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Recent Changes in Cervical Cancer Screening Guidelines: U.S. Women's Willingness for HPV Testing Instead of Pap Testing

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Abstract

Cervical cancer screening guidelines in the United States were revised in 2018 to include the option of primary human papillomavirus (HPV) testing. The transition to this screening method may face difficulties as Pap testing has been the primary screening modality in the United States. The objective of this study is to assess information, motivation, and behavioral skills associated with willingness to receive an HPV test instead of a Pap test among women. The sample included U.S. 812 women, ages 30 to 65 years. Participants completed an online survey in 2018. The Information, Motivation, and Behavioral Skills (IMB) model was used to measure predictors of willingness for HPV testing. The outcome variables were willingness to receive the HPV test instead of the Pap test, with and without time interval details. Logistic regression modeling was used with SAS 9.4. Over half of the sample (55%) were willing to receive the HPV test. For the information domain, HPV knowledge was significantly associated with willingness for HPV testing (OR=1.08, 95%CI 1.04-1.13). Significant motivating factors included: positive attitudes, social norms, perceived benefits, worry about cervical cancer, and worry about abnormal HPV tests. For behavioral skills, women were significantly more willing to get the HPV test if a provider recommended it (OR=2.43, 95%CI 1.53-3.87) and currently up-to-date on cervical cancer screening guidelines (OR=1.52, 95%CI 1.52-2.26). Addressing barriers and facilitators to willingness to transition to primary HPV testing over Pap testing is needed as the United States has updated guidelines for cervical cancer screening.

Keywords: human papillomavirus (HPV); cervical cancer; screening; women; guidelines

Introduction

Human papillomavirus (HPV) is the most common sexually transmitted infection in the United States.¹ Moreover, HPV causes >99% of cervical cancer cases.² Cervical cancer rates among U.S. women have declined by over 50% since the implementation of routine Papanicolaou (i.e., Pap testing) cervical cancer screening in the 1950s.³ In 2006, a new tool for primary prevention became available with the introduction of HPV vaccination; presently, the Advisory Committee on Immunization Practices recommends the nonavalent HPV vaccine series for females and males ages 11-12 until age 26.⁴⁻⁷ Following the sharp decrease in cervical cancer trends due to Pap testing screening advancements, cervical cancer incidence has remained largely unchanged due to screening, with approximately 13,170 new diagnoses of cervical cancer among U.S. women projected for 2019.⁸ The existence of primary HPV prevention does not eliminate the necessity of routine cervical cancer screening.⁶

Most recently, cervical cancer prevention has shifted toward alternative secondary prevention approaches using primary HPV DNA testing (i.e., HPV test). Previous United States Preventive Services Task Force (USPSTF) guidelines from 2012 recommended routine cytology every 3 years to screen for cervical cancer among women ages 21 to 65 years and the option of co-testing with cytology and HPV testing every 5 years for women ages 30-65 years.⁹ In 2018, the USPSTF guidelines changed to include the *option of primary HPV testing every 5 years* for women ages 30-65 years, co-testing every 5 years, or Pap testing every 3 years.¹⁰

When compared with Pap testing, primary HPV testing every 5 years was more efficacious at detecting cervical cancer for average risk women ages 30-65: Pap testing alone was less sensitive in detecting cervical intraepithelial neoplasias (CIN) 2 and 3.¹¹⁻¹³ Because of improved screening sensitivity, primary HPV testing at 5-year intervals reduced cervical cancer deaths and reduced number of colposcopies per gained life-year when compared with Pap testing alone.^{11,12,14} Unlike Pap testing, samples for HPV testing can be collected by women and mailed for processing (i.e., self-sampling), serving as a potential strategy for increasing screening rates in under-screened populations.¹⁰

Other countries, such as Australia, have already transitioned to primary HPV testing for their national cervical cancer screening program. However, Australia, a country that has led the way in cervical cancer prevention,¹⁵⁻¹⁷ faced difficulties in transitioning to HPV testing from Pap testing because of variations in HPV testing intentions, uptake, and willingness (i.e., acceptability¹⁸). Thus, there is a need to examine the acceptability of primary HPV testing in the U.S. with new guideline changes. Numerous studies have evaluated possible facilitators and barriers for acceptability of HPV testing. One of the identified barriers to HPV testing

acceptability was a negative attitude toward the timing of screening intervals.¹⁹ A U.S. study revealed primary HPV testing every 3 years was the least acceptable, whereas annual Pap testing was most acceptable to women.²⁰ Similarly, in a sample of Canadian women, willingness to attend primary HPV testing cervical cancer screening decreased from 84.2% to 54.2% when coupled with the extending of the screening interval to 4 years.²¹ In an Australian study, almost half of women aged 18-70 preferred having Pap tests annually, despite over 85% wanting concurrent HPV testing.²² Thus, the change in cervical cancer screening modality and interval in the United States must be further assessed with this changing USPSTF guidelines recommendation.

In light of the newest guidelines, the aim of this study is to build on current primary HPV testing acceptability research by focusing on U.S. women aged 30-65 and their willingness to undergo primary HPV testing instead of Pap testing. Specifically, there is a need to explore how the change in type of test (i.e., Pap to HPV testing) and change in testing intervals (i.e., 3 to 5 years) influences women's willingness for HPV testing. This study aims to identify barriers and facilitators to 1) *willingness to receive the HPV test instead of the Pap test* and 2) *willingness to receive the HPV test every 5 years instead of the Pap test every 3 years* by assessing knowledge, motivation, and behavioral skills, the theoretical components of the Information-Motivation-Behavioral Skills Model.

Methods

Sample

The target population for this study were women who would meet the guideline recommendation criteria for cervical cancer screening with HPV testing: inclusion criteria were women aged 30-65 years, and the exclusion criterion was having a hysterectomy. Women were sampled utilizing Qualtrics Online Panels, which recruits participants across the U.S. and provides respondents with small amounts of compensation (e.g., points, monetary). The sampling strategy oversampled for African American and Hispanic women due to the higher burden of cervical cancer among these populations.²³ Participants were recruited in May-June of 2018 resulting in a total sample size of 812 participants. This study was exempt from the [BLIND] Institutional Review Board, and eligible women assented to participation after reading a consent document online.

Measures

The survey items were developed using the Information, Motivation, and Behavioral Skills (IMB) Model.^{24,25} The IMB Model identifies information, motivational issues, and behavioral skills to be implicated for a target population's adoption of preventative behavior.²⁴ The IMB Model has been previously used to examine HPV vaccination among young adult women.^{26,27} The items on the survey were pilot tested with four women meeting the study inclusion/exclusion criteria.

During the survey, participants first responded to eligibility questions and knowledge questions about HPV. Once participants had completed the knowledge items, they were shown a diagram explaining the USPSTF recommendations for cervical cancer screening in 2012 and the draft recommendations for 2018. Additionally, participants were provided with a table comparing an HPV test and a Pap test based on a description from the draft 2018 recommendations (see Supplementary Material).²⁸ The purpose of providing women with this information was to ensure all participants were aware of the difference between the two tests. Similar methodology has been used in previous studies.²⁹⁻³¹ This approach was especially needed for this topic as previous studies have reported many misconceptions regarding the purpose of the Pap test; many women incorrectly thought that Pap tests detected HPV and did not know that Pap tests screened for cervical cancer.³²

Two outcomes were assessed. One outcome compared the two tests, regardless of testing intervals: *willingness to receive the HPV test instead of the Pap test*. The second outcome included testing intervals: *willingness to receive the HPV test every 5 years instead of the Pap test every 3 years*. Participants responded with a Likert scale of very willing, somewhat willing, neutral, somewhat unwilling, and not willing. Both variables were operationalized as willing (very willing and somewhat willing) and unwilling (neutral, somewhat unwilling, and not willing).

Predictor variables selected for the analysis were derived from the IMB Model and the current body of research regarding women's HPV testing acceptability. Within the Information domain, *HPV knowledge* was assessed using a 16-item true, false, and don't know scale,³¹ which has been validated among a sample of Canadian parents.²⁹ Response options were recoded as correct and incorrect (inclusive of don't know). Correct responses were summed for the 16-items for a total HPV knowledge scale score ($\alpha=0.886$).

Motivation variables included an HPV testing attitude scale, social norms, HPV testing benefit of less time at a doctor's office, HPV testing benefit of less frequent discomfort, worry about cervical cancer, and what is most worrisome for testing outcomes. The 4-item *HPV testing attitude scale* was adapted³³; "Having an HPV test to screen for cervical cancer every 5

years and after age 30 instead of a Pap smear every 3 years would be: accurate/safe/protect my health/acceptable.” There were 7-Likert response options of strongly agree to strongly disagree aggregated to produce a sum score ($\alpha=0.946$). A *subjective norms* question was adapted³³; “If national guidelines recommended having an HPV test to screen for cervical cancer instead of a Pap smear, most people who are important to me would think I should/expect me to have an HPV test instead of a Pap smear.” The 7-response Likert scale was operationalized as agree (strongly agree, agree, and somewhat agree), neither agree nor disagree, and disagree (strongly disagree, disagree, and somewhat disagree) due to the bimodal distribution of the variable. A question adapted from Gerend et al.³⁴ asked “For you personally, what would be the main benefits (good things) of getting an HPV test every 5 years instead of a Pap test every 3 years?” Variables assessing two *HPV testing benefits*, less frequent discomfort and less time at the doctor’s office (response options yes, no), were included in a list of benefits.³⁴ *Worry about cervical cancer* was adapted³⁵ asking “How worried are you about developing cervical cancer?”. Five response options ranging from not worried at all to very worried were operationalized into three categories: not worried, slightly/somewhat worried, and quite/very worried. To assess which testing outcomes would be *more worrisome*,³⁶ participants were asked “What would worry you more?": an abnormal Pap test, an abnormal HPV test, equally worrying, and neither.

Behavioral skill variables included facilitators of the decision/skill, barriers to the decision/skill, and current adherence to cervical cancer screening guidelines. Variables to assess *provider recommendation as a facilitator* and *stigma about having HPV as a barrier* were adapted from a list of barriers and facilitators by Jayasinghe et al.¹⁹, asking “What would make deciding to have an HPV test instead of a Pap test easier for you?” and “What would make deciding to have an HPV test instead of a Pap test harder for you?”, respectively. The items for this analysis were selected based on the salience from previous literature on HPV testing.¹⁸ Response options were yes and no. *Adherence to cervical screening guidelines* was assessed based on the 2012 USPSTF recommendations. Women who had Pap testing in the last 3 years (without co-testing) or women who had co-testing in the last 5 years were considered adherent to screening guidelines, otherwise they were considered non-adherent.

For participant demographics, *education attainment* categories included less than high school, high school, some college or technical school, and college. *Marital status* categories included single, married, or other (e.g., widowed, divorced, etc.). *Age* was categorized by decade. *Race* was operationalized as Black, White or Caucasian, and Other categories, and *Hispanic* ethnicity as yes or no.

Data Analysis

Aggregate data were received from Qualtrics Panels, and all analyses were conducted in SAS 9.4. Univariate and bivariate statistics analyses were performed for each binary outcome HPV testing willingness and HPV testing willingness with time component, respectively. Using predictor variables from the IMB model and demographic variables (see Measures), multivariable binary logistic regression models were estimated for both outcomes. No evidence of multicollinearity was observed (variance inflation factor < 5). Adjusted odds ratios (aOR) and 95% confidence intervals (CI) were reported.

Results

Sample Description

Of the 812 women in this sample, 55% of the respondents were willing to get the HPV test instead of the Pap test and 57% of the respondents were willing to get the HPV test every 5 years instead of the Pap test every 3 years (Table 1). Overall, most respondents were White (68.1%), Non-Hispanic (81.4%), and married (49.8%). Most women fell between the ages of 30 and 39 (39.8%) and had some college or technical school education (36.5%). Over half of women (54.3%) were slightly or somewhat worried about getting cervical cancer, and most women (71.4%) were adherent to the 2012 USPSTF cervical cancer screening guidelines. When asked what result would worry them more, most respondents reported that an abnormal HPV test and an abnormal Pap test were equally worrying (60.2%). Additionally, most women (63.6%) did not report HPV stigma as a barrier to HPV testing. Moreover, most participants identified less time in the doctor's office (73.5%) and less frequent discomfort (70.3%) as a main benefit of HPV testing. In fact, most women (75.4%) reported that having a provider recommendation would facilitate selecting HPV testing over Pap testing.

Willingness for HPV Test Compared to Pap Test

In multivariable analysis, a one-unit increase in knowledge score was associated with higher odds (aOR=1.08; 95%CI 1.04-1.13) of willingness to receive the HPV test instead of the Pap test. With regard to attitudes, women with more positive HPV testing attitudes (aOR=1.14, 95%CI 1.10-1.19) and positive social norms for HPV testing (agree: aOR=2.01, 95%CI 1.37-2.95) had higher odds of willingness for HPV testing. Additionally, women who perceived a benefit of less time in the doctor's office and less frequent discomfort had higher odds to get the HPV test instead of the Pap test. Women who were very/quite worried about cervical cancer

had more than twice the odds ($aOR=2.58$; 95%CI 1.48-4.51) of being willing to receive the HPV test. Similarly, women who reported an abnormal HPV test worries them more, compared to the two tests being equally worrying, were more willing to receive the HPV test.

Regarding behavioral skills, we examined potential facilitators and barriers for deciding about an HPV test instead of a Pap test. Women reporting that a provider recommendation would make it easier to decide were more willing to receive the HPV test ($aOR=2.43$; 95%CI 1.53-3.87). Women who were currently adherent to cervical cancer screening guidelines were more willing to receive an HPV test instead of a Pap test ($aOR=1.52$, 95%CI 1.02-2.26). For demographic characteristics, women with a college degree were less willing to receive an HPV test ($aOR=0.58$, 95%CI 0.35-0.94) compared to women with a high school degree.

Willingness for HPV Test Every 5 Years Compared to Pap Test Every 3 Years

Similar results were observed in the multivariable model for the outcome of willingness for HPV testing every 5 years compared to Pap testing every 3 years. In this model, less time at a doctor's office as a perceived benefit, worry about the type of abnormal test, and educational attainment were no longer statistically significant. The strongest effect observed was that, compared to those not worried about cervical cancer, women who were worried about cervical cancer had twice the odds of being willing to endorse HPV testing every 5 years compared to Pap testing every 3 years ($aOR=2.01$, 95%CI 1.17-3.43).

Discussion

Given the recent transition of U.S. cervical cancer screening guidelines to include primary HPV testing, there is a need to examine women's willingness to engage in this prevention behavior. Australia has recently faced resistance from women when the cervical cancer screening program transitioned from Pap testing to primary HPV testing.¹⁷ In the present study we found that more than half of the sample was willing to have primary HPV testing instead of Pap testing as a mode for cervical cancer screening.

Using the IMB Model as a framework, knowledge of HPV was significantly associated with willingness to use HPV testing. Burger et al., (2014) also reported that increased HPV knowledge was associated with increased HPV test acceptability among Norwegian women.³⁵ In this study, motivating factors, i.e., positive attitudes and social norms about HPV testing, were significantly related to willingness for primary HPV testing. Similar findings were reported for positive attitudes and indirect subjective norms (e.g., physician, friends, partner, cancer agency) being significantly associated with willingness to have an HPV test after the age of 25 and every

4 years among Canadian women.^{21,33} In this study, women's beliefs for perceived benefits for less time in a doctor's office and less frequent discomfort were also found to be significant factors associated with HPV testing. These perceived benefits may be similar to beliefs regarding lengthened Pap testing intervals. Gerend et al. (2017) described the most commonly reported potential benefits of less frequent Pap testing to be reduced cost, dislike of annual Pap tests, and more convenience in a US sample of women ages 21-65 years.³⁴ In contrast, less frequent visits were reported qualitatively as a past concern for implementing widened screening intervals, as women have often preferred annual cervical cancer screening.²¹

Additionally, a concern regarding the transition to HPV testing has been women's negative emotional reactions to a positive HPV test compared to an abnormal Pap test, as seen in a qualitative study with Hispanic women.³⁷ Similar findings among young women of reproductive age were found in a mixed-methods study assessing psychosocial effects of HPV test results and abnormal Pap smears. Women reported a sense of stigma and shame related to the diagnosis of HPV that was compounded by the fear of cervical cancer stemming from abnormal Pap results.^{38,39} Women in this study were more willing to receive the HPV test if they reported that beliefs that they were worried about cervical cancer and more worried about an abnormal HPV test.

Women who were adherent to 2012 cervical cancer screening guidelines were more willing to receive an HPV test compared to Pap test. The key facilitator to this decision may ultimately rely on a provider recommendation. Women in the sample had more than two times the odds of being willing to receive an HPV test compared to a Pap because a provider recommendation would make that decision easier. The importance of provider recommendation is noted in another study among US women, where over two-thirds were willing to undergo less frequent screening (screening every 3 to 5 years versus annually) if it was recommended by their provider.³⁴ The US Community Preventive Services Task Force recommends one-on-one patient-provider education to increase cervical cancer screening,⁴⁰ so this finding aligns with this evidence-based recommendation. However, previous research has found providers are more likely to recommend more frequent screening, some of which stems from patient requests.^{41,42} Additionally, in the US, 23-43% of healthcare providers were not providing HPV tests to women ages 30-65 years old.^{43,44} Providers must also manage the multiplicity of clinical guidelines for cervical cancer screening from various professional organizations⁴⁵ and stay abreast of changes in these guidelines.⁴⁶ Thus, additional research is needed in the area of provider recommendation for cervical cancer screening and shared decision-making between patients and providers, especially in light of recent guidelines changes.

Overall, demographic characteristics were not associated with willingness for an HPV test, with the exception of educational attainment. Women with a college education were least likely to be willing to receive the HPV test instead of the Pap test compared to women with a high school degree; yet, this difference was not observed when the time interval was added to the outcome variable. This may be the result of knowledge or attitudes regarding preventive health practices varying by educational attainment. For example, those with a college education may desire to continue with a Pap test, but not necessarily if this means less frequent screening intervals. A previous study among a national sample of women found that women's knowledge about HPV also varied by educational attainment,⁴⁷ which may need to be considered when developing strategies to promote HPV testing.

The study findings should be considered in the context of the limitations. First, the sampling frame for this study is derived from an online panel of English speakers and may not be completely generalizable to U.S. women. The exclusion criteria for this study were women who had a hysterectomy; however, we did not exclude women who were diagnosed with cervical abnormalities due to the concern of self-report status of this criterion. Additionally, at the time of survey distribution, the cervical cancer screening guidelines were in a draft form on the taskforce website.²⁸ The draft guidelines had the option of primary HPV testing or Pap testing only (a change from Pap testing only or co-testing); however, the finalized guidelines released in September 2018 also included the option of co-testing. Therefore, the data gathered for this study did not include the co-testing option. Finally, these data are self-reported, so items such as past cervical cancer screening behavior may be misclassified due to retrospective bias.

Conclusion

Recognizing barriers and facilitators to willingness to transition to primary HPV testing over Pap testing is needed as the United States has updated guidelines for cervical cancer screening. Emphasizing positive attributes of HPV testing compared to Pap testing and provider recommendations may promote the use of this screening technique as this guideline transition takes place. It is particularly promising that over half of the women in this study are willing to get the HPV test instead of the Pap test and more than half of the respondents were willing to get the HPV test every 5 years instead of the Pap test every 3 years, given that studies from only a decade ago found strongly negative emotional expressions among women who received an HPV positive test result. These study findings do not preclude continued educational efforts aimed at reassuring women that the majority of HPV infections are transitory, as any test result with potentially fearful consequences require education and reassurance. However, our study

indicates a possible positive trend in women choosing a prevention strategy that might previously have been untenable. Future research should utilize dissemination and implementation science approaches to promote cervical cancer screening guidelines transitions in practice. With improved sensitivity of HPV testing, adoption of this guideline change has the potential to reduce cervical cancer cases nationally.

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Table 1. Frequencies and adjusted odds of willingness for HPV testing among US women (n=812)

	Willingness for HPV Test instead of Pap Test			Willingness for HPV Test Every 5 Years instead of Pap Test Every 3 Years		
	Willing, n (%) 447 (55.0)	Not Willing, n (%) 365 (45.0)	aOR (95% CI)	Willing, n (%) 465 (57.0)	Not Willing, n (%) 347 (43.0)	aOR (95% CI)
Information						
HPV Knowledge Scale ^{a,b}	9.0 (4.2)	7.0 (4.8)	1.08 (1.04, 1.13)	9.0 (4.2)	6.9 (4.9)	1.08 (1.04, 1.13)
Motivation						
HPV Testing Attitude Scale ^{a,c}	23.0 (4.7)	18.2 (5.3)	1.14 (1.10, 1.19)	22.9 (4.6)	18.1 (5.5)	1.15 (1.11, 1.20)
Social Norms (People important to me think I should have the HPV test instead of the Pap test)						
Agree	320 (71.6)	125 (34.3)	2.01 (1.37, 2.95)	320 (68.8)	125 (36.0)	1.76 (1.20, 2.57)
Neither Agree/Disagree	115 (25.7)	188 (51.5)	1 (Referent)	126 (27.1)	177 (51.0)	1 (Referent)
Disagree	12 (2.7)	52 (14.3)	0.34 (0.16, 0.74)	19 (4.1)	45 (13.0)	0.62 (0.31, 1.24)
HPV Test Benefit: Less time at doctor's office						
Yes	380 (85.0)	217 (59.5)	1.81 (1.13, 2.91)	386 (83.0)	211 (60.8)	1.36 (0.86, 2.16)
No	67 (15.0)	148 (40.6)	1 (Referent)	79 (17.0)	136 (39.2)	1 (Referent)
HPV Test Benefit: Less frequent discomfort						
Yes	368 (82.3)	203 (55.6)	1.61 (1.01, 2.58)	376 (80.9)	195 (56.2)	1.61 (1.02, 2.54)
No	79 (17.7)	162 (44.4)	1 (Referent)	89 (19.1)	152 (43.8)	1 (Referent)
Worried about Cervical Cancer						
Very/Quite	103 (23.0)	58 (15.9)	2.58 (1.48, 4.51)	101 (21.7)	60 (17.3)	2.01 (1.17, 3.43)
Somewhat/Slightly	248 (55.5)	193 (52.9)	1.55 (1.01, 2.38)	263 (56.6)	178 (51.3)	1.59 (1.05, 2.41)
Not	96 (21.5)	114 (31.2)	1 (Referent)	101 (21.7)	109 (31.4)	1 (Referent)
What Worries You More						
Abnormal HPV Test	65 (14.5)	25 (6.9)	2.21 (1.21, 4.02)	60 (12.9)	30 (8.7)	1.22 (0.70, 2.13)
Abnormal Pap test	68 (15.2)	46 (12.6)	1.09 (0.66, 1.80)	74 (15.9)	40 (11.5)	1.21 (0.73, 2.00)
Equally Worrying	279 (62.4)	210 (57.5)	1 (Referent)	292 (62.8)	197 (56.8)	1 (Referent)
Neither	35 (7.8)	84 (23.0)	0.84 (0.48, 1.50)	39 (8.4)	80 (23.1)	0.87 (0.50, 1.51)
Behavioral Skills						
Easier to Decide: Provider Recommendation						
Yes	394 (88.1)	218 (59.7)	2.43 (1.53, 3.87)	400 (86.0)	212 (61.1)	1.71 (1.10, 2.67)
No	53 (11.9)	147 (40.3)	1 (Referent)	65 (14.0)	135 (38.9)	1 (Referent)
Harder to Decide: Stigma at having HPV						
Yes	180 (40.3)	116 (31.8)	0.69 (0.47, 1.02)	184 (39.6)	112 (32.3)	0.77 (0.53, 1.12)
No	267 (59.7)	249 (68.2)	1 (Referent)	281 (60.4)	235 (67.7)	1 (Referent)
Follows Cervical Cancer Screening Guidelines						
Yes	345 (77.2)	235 (64.4)	1.52 (1.02, 2.26)	362 (77.9)	218 (62.8)	1.73 (1.18, 2.54)
No	102 (22.8)	130 (35.6)	1 (Referent)	103 (22.2)	129 (37.2)	1 (Referent)
Demographics						
Educational Attainment						
Less than high school	20 (4.5)	26 (7.1)	0.60 (0.27, 1.37)	22 (4.7)	24 (6.9)	0.82 (0.37, 1.80)

High school	129 (28.9)	95 (26.0)	1 (Referent)	130 (28.0)	94 (27.1)	1 (Referent)
Some college/technical school	164 (36.7)	132 (36.2)	0.79 (0.50, 1.25)	162 (34.8)	134 (38.6)	0.71 (0.46, 1.11)
College	134 (30.0)	112 (30.7)	0.58 (0.35, 0.94)	151 (32.5)	95 (27.4)	0.88 (0.55, 1.41)
Marital Status						
Single	116 (26.0)	114 (31.2)	0.73 (0.48, 1.13)	124 (26.7)	106 (30.6)	0.89 (0.59, 1.36)
Married	235 (52.6)	169 (46.3)	1 (Referent)	238 (51.2)	166 (47.8)	1 (Referent)
Other	96 (21.5)	82 (22.5)	1.05 (0.66, 1.67)	103 (22.2)	75 (21.6)	1.27 (0.81, 2.00)
Age						
30-39 years	179 (40.0)	144 (39.5)	1 (Referent)	181 (38.9)	142 (40.9)	1 (Referent)
40-49 years	111 (24.8)	80 (21.9)	1.23 (0.77, 1.96)	120 (25.8)	71 (20.5)	1.56 (0.99, 2.47)
50-59 years	103 (23.0)	88 (24.1)	1.02 (0.63, 1.65)	108 (23.2)	83 (23.9)	1.15 (0.73, 1.82)
60-65 years	54 (12.1)	53 (14.5)	0.96 (0.53, 1.72)	56 (12.0)	51 (14.7)	1.08 (0.61, 1.91)
Hispanic or Latina						
Yes	87 (19.5)	64 (17.5)	0.73 (0.45, 1.18)	95 (20.4)	56 (16.1)	0.95 (0.59, 1.53)
No	360 (80.5)	301 (82.5)	1 (Referent)	370 (79.6)	291 (83.9)	1 (Referent)
Race						
Black/African American	102 (22.8)	85 (23.3)	0.80 (0.51, 1.25)	106 (22.8)	81 (23.3)	0.84 (0.54, 1.30)
Other	39 (8.7)	33 (9.0)	0.64 (0.34, 1.22)	40 (8.6)	32 (9.2)	0.66 (0.35, 1.24)
White or Caucasian	306 (68.5)	247 (67.7)	1 (Referent)	319 (68.6)	234 (67.4)	1 (Referent)
^a Scale values in these rows are displayed as <i>mean (standard deviation)</i> instead of <i>n (%)</i> . ^b Knowledge scale range 0-16. ^c Attitude scale range 4-28.						

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References Cited

1. Satterwhite CL, Torrone E, Meites E, et al. Sexually transmitted infections among US women and men: prevalence and incidence estimates, 2008. *Sexually transmitted diseases*. 2013;40(3):187-193.
2. Forman D, de Martel C, Lacey CJ, et al. Global burden of human papillomavirus and related diseases. *Vaccine*. 2012;30 Suppl 5:F12-23.
3. Sherman ME, Wang SS, Carreon J, Devesa SS. Mortality trends for cervical squamous and adenocarcinoma in the United States: relation to incidence and survival. *J Cancer: Interdisciplinary International Journal of the American Cancer Society*. 2005;103(6):1258-1264.
4. Markowitz L, Dunne E, Saraiya M, et al. Human papillomavirus vaccination: recommendations of the Advisory Committee on Immunization Practices (ACIP). *Methods*. 2014;12:15.
5. Markowitz L, Dunne E, Saraiya M, Lawson H, Chesson H, Unger E. Quadrivalent Human Papillomavirus Vaccine: Recommendations of the Advisory Committee on Immunization Practices (ACIP). *MMWR Recommendations and reports : Morbidity and mortality weekly report Recommendations and reports / Centers for Disease Control*. 2007;56(RR-2):1-24.
6. Petrosky E, Bocchini JJ, Hariri S, et al. Use of 9-valent human papillomavirus (HPV) vaccine: updated HPV vaccination recommendations of the Advisory Committee on Immunization Practices. *MMWR Morbidity mortality weekly report*. 2015;64(11):300-304.
7. Meites E, Szilagyi PG, Chesson HW, Unger ER, Romero JR, Markowitz LE. Human Papillomavirus Vaccination for Adults: Updated Recommendations of the Advisory Committee on Immunization Practices. *MMWR Morbidity and mortality weekly report*. 2019;68(32):698-702.
8. American Cancer Society. Key Statistics for Cervical Cancer. 2019; <https://www.cancer.org/cancer/cervical-cancer/about/key-statistics.html>. Accessed April 21, 2019.
9. Moyer VA. Screening for cervical cancer: US Preventive Services Task Force recommendation statement. *J Annals of internal medicine*. 2012;156(12):880-891.
10. Curry SJ, Krist AH, Owens DK, et al. Screening for cervical cancer: US Preventive Services Task Force Recommendation Statement. *JAMA*. 2018;320(7):674-686.
11. Kim JJ, Burger EA, Regan C, Sy S. Screening for cervical cancer in primary care: A decision analysis for the us preventive services task force. *JAMA*. 2018;320(7):706-714.
12. Melnikow J, Henderson JT, Burda BU, Senger CA, Durbin S, Soulsby MA. Screening for Cervical Cancer With High-Risk Human Papillomavirus Testing: A Systematic Evidence Review for the U.S. Preventive Services Task Force. *Agency for Healthcare Research and Quality (US)*. 2018;Evidence Synthesis.
13. Ogilvie GS, Krajden M, van Niekerk D, et al. HPV for cervical cancer screening (HPV FOCAL): Complete Round 1 results of a randomized trial comparing HPV-based primary screening to liquid-based cytology for cervical cancer. *International journal of cancer*. 2017;140(2):440-448.
14. Dijkstra MG, van Zummeren M, Rozendaal L, et al. Safety of extending screening intervals beyond five years in cervical screening programmes with testing for high risk human papillomavirus: 14 year follow-up of population based randomised cohort in the Netherlands. *BMJ (Clinical research ed)*. 2016;355:i4924.

15. Foran T. Five myths about the new cervical screening program that refuse to die. 2017; [https:// theconversation.com/five-myths-about-the-new-cervical-screening-program-thatrefuse-to-die-74077](https://theconversation.com/five-myths-about-the-new-cervical-screening-program-thatrefuse-to-die-74077), 2018.
16. Hall MT, Simms KT, Lew JB, et al. The projected timeframe until cervical cancer elimination in Australia: a modelling study. *The Lancet Public health*. 2018.
17. Australian Government Department of Health. National Cervical Screening Program. 2017; <http://www.cancerscreening.gov.au/internet/screening/publishing.nsf/Content/cervical-screening-1>, 2018.
18. Tatar O, Thompson E, Naz A, et al. Factors associated with human papillomavirus (HPV) test acceptability in primary screening for cervical cancer: A mixed methods research synthesis. *Prev Med*. 2018;116:40-50.
19. Jayasinghe Y, Rangiah C, Gorelik A, et al. Primary HPV DNA based cervical cancer screening at 25 years: Views of young Australian women aged 16–28 years. *Journal of Clinical Virology*. 2016;76:S74-S80.
20. Saraiya M, Kwan A, Cooper CP. Primary HPV testing: U.S. women's awareness and acceptance of an emerging screening modality. *Prev Med*. 2018;108:111-114.
21. Ogilvie GS, Smith LW, van Niekerk D, et al. Correlates of women's intentions to be screened for human papillomavirus for cervical cancer screening with an extended interval. *BMC Public Health*. 2016;16:213.
22. Dieng M, Trevena L, Turner RM, Wadolowski M, McCaffery K. What Australian women want and when they want it: cervical screening testing preferences, decision-making styles and information needs. *Health Expectations*. 2013;16(2):177-188.
23. Cronin KA, Lake AJ, Scott S, et al. Annual Report to the Nation on the Status of Cancer, part I: National cancer statistics. *Cancer*. 2018;124(13):2785-2800.
24. Fisher JD, Fisher WA. Changing AIDS-risk behavior. *Psychological bulletin*. 1992;111(3):455.
25. Fisher JD, Fisher WA, Bryan AD, Misovich SJ. Information-motivation-behavioral skills model-based HIV risk behavior change intervention for inner-city high school youth. *Health Psychology*. 2002;21(2):177.
26. Fisher WA. Understanding Human Papillomavirus Vaccine Uptake. *Vaccine*. 2012;30:F149-F156.
27. Thompson EL, Vamos CA, Straub DM, Sappenfield WM, Daley EM. Human papillomavirus vaccine information, motivation, and behavioral skills among young adult US women. *Journal of health psychology*. 2018;23(14):1832-1841.
28. United States Preventive Services Task Force. Draft Recommendation Statement: Cervical Cancer: Screening. 2018; <https://www.uspreventiveservicestaskforce.org/Page/Document/draft-recommendation-statement/cervical-cancer-screening2> Accessed January 1, 2019.
29. Perez S, Tatar O, Ostini R, et al. Extending and validating a human papillomavirus (HPV) knowledge measure in a national sample of Canadian parents of boys. *Preventive medicine*. 2016;91:43-49.
30. Perez S, Tatar O, Shapiro GK, et al. Psychosocial determinants of parental human papillomavirus (HPV) vaccine decision-making for sons: methodological challenges and initial results of a pan-Canadian longitudinal study. *BMC public health*. 2016;16(1):1223.
31. Waller J, Ostini R, Marlow LAV, McCaffery K, Zimet G. Validation of a measure of knowledge about human papillomavirus (HPV) using item response theory and classical test theory. *Preventive Medicine*. 2013;56(1):35-40.
32. Daley E, Perrin K, Vamos C, et al. Confusion about Pap smears: lack of knowledge among high-risk women. *Journal of women's health*. 2013;22(1):67-74.

33. Ogilvie GS, Smith LW, van Niekerk DJ, et al. Women's intentions to receive cervical cancer screening with primary human papillomavirus testing. *International journal of cancer*. 2013;133(12):2934-2943.
34. Gerend MA, Shepherd MA, Kaltz EA, Davis WJ, Shepherd JE. Understanding women's hesitancy to undergo less frequent cervical cancer screening. *Prev Med*. 2017;95:96-102.
35. Burger EA, Nygård M, Gyrd-Hansen D, Moger TA, Kristiansen IS. Does the primary screening test influence women's anxiety and intention to screen for cervical cancer? A randomized survey of Norwegian women. *J BMC public health*. 2014;14(1):360.
36. Silver MI, Rositch AF, Burke AE, Chang K, Viscidi R, Gravitt PE. Patient concerns about human papillomavirus testing and 5-year intervals in routine cervical cancer screening. *Obstetrics and Gynecology*. 2015;125(2):317-329.
37. Vanslyke JG, Baum J, Plaza V, Otero M, Wheeler C, Helitzer DL. HPV and Cervical Cancer Testing and Prevention: Knowledge, Beliefs, and Attitudes Among Hispanic Women. *Qualitative health research*. 2008;18(5):584-596.
38. Daley EM, Perrin KM, McDermott RJ, et al. The psychosocial burden of HPV: a mixed-method study of knowledge, attitudes and behaviors among HPV+ women. *Journal of health psychology*. 2010;15(2):279-290.
39. Perrin KK, Daley EM, Naom SF, et al. Women's reactions to HPV diagnosis: insights from in-depth interviews. *Women & health*. 2006;43(2):93-110.
40. Community Preventive Services Task Force. Updated recommendations for client-and provider-oriented interventions to increase breast, cervical, and colorectal cancer screening. *American Journal of Preventive Medicine*. 2012;43(1):92-96.
41. Cooper CP, Saraiya M. Primary HPV testing recommendations of US providers, 2015. *Prev Med*. 2017;105:372-377.
42. Haas JS, Sprague BL, Klabunde CN, et al. Provider Attitudes and Screening Practices Following Changes in Breast and Cervical Cancer Screening Guidelines. *J Gen Intern Med*. 2016;31(1):52-59.
43. Perkins RB, Anderson BL, Gorin SS, Schulkin JA. Challenges in cervical cancer prevention: a survey of U.S. obstetrician-gynecologists. *American journal of preventive medicine*. 2013;45(2):175-181.
44. Saraiya M, Berkowitz Z, Yabroff KR, Wideroff L, Kobrin S, Benard V. Cervical cancer screening with both human papillomavirus and Papanicolaou testing vs Papanicolaou testing alone: what screening intervals are physicians recommending? *Archives of internal medicine*. 2010;170(11):977-985.
45. Han PK, Klabunde CN, Breen N, et al. Multiple clinical practice guidelines for breast and cervical cancer screening: perceptions of US primary care physicians. *Medical care*. 2011;49(2):139-148.
46. Tatar O, Wade K, McBride E, et al. Are Health Care Professionals Prepared to Implement Human Papillomavirus Testing? A Review of Psychosocial Determinants of Human Papillomavirus Test Acceptability in Primary Cervical Cancer Screening. *Journal of women's health (2002)*. 2019.
47. Vázquez-Otero C, Vamos CA, Thompson EL, et al. Assessing dentists' human papillomavirus-related health literacy for oropharyngeal cancer prevention. *J Am Dent Assoc*. 2018;149(1):9-17.

Highlights

- Most women were willing to receive an HPV test for cervical cancer screening.
- Information and motivation factors increased women's willingness for an HPV test.
- Provider recommendation may be a critical facilitator for HPV testing uptake.

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