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# Knowledge of cervical cancer prevention and human papillomavirus among women with HIV

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## Abstract

**Objective—**To assess knowledge of and attitudes towards human papillomavirus (HPV), Pap testing, and the HPV vaccine.

**Methods—**In a multicenter U.S. cohort study, women with the human immunodeficiency virus (HIV) and at-risk comparison women completed 44-item standardized self-report questionnaires exploring their knowledge of cervical cancer prevention, HPV, and HPV vaccination. Results were correlated with demographic variables, measures of education and attention, and medical factors. Data were clustered using principal component analysis. Significant associations were assessed in multivariable models.

**Results—**Among 1588 women, HIV seropositive women better understood facts about cervical cancer prevention and HPV than seronegative women, but both had substantial knowledge deficits. Almost all women considered Pap testing important, although 53% of HIV seropositive and 48% of seronegative women considered cervical cancer not preventable ($P$=0.21). Only 44% of HIV seropositive women knew Paps assess the cervix, versus 42% of HIV seronegative women



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The authors declare that there are no conflicts of interest.

(*P*=0.57). Both groups understood that HPV causes genital warts and cervical cancer (67% of HIV seropositive vs. 55% of seronegative women, *P*=0.002). About half of both groups considered HPV vaccination extremely important for cervical cancer prevention. HIV seronegative women were more likely to report learning of HPV vaccination through advertising than from clinicians (81% vs. 64%, *P*<0.0001).

**Conclusion—**High risk women need effective education about cervical cancer prevention, HPV, and HPV vaccination.

### Keywords

HPV; Cervical cancer prevention; Pap test; Health education; HIV in women

## Introduction

Women infected with the human immunodeficiency virus (HIV) have high rates of coinfection with human papillomavirus (HPV) [1]. Persistent infection with carcinogenic types of HPV can lead to the development of cervical intraepithelial lesions (CIN) and cervical cancer, and women with HIV face a high risk of abnormal Pap test results and CIN [2–4]. Population based registry studies have shown that women with HIV are at higher risk for invasive cervical cancer than HIV-uninfected women [5,6], though their risk approaches that of the general population when they participate in regular cervical cancer screening and prevention programs [7].

Such participation may be enhanced when women consider themselves at risk for cervical cancer and when they understand the course of HPV infection and the cervical cancer prevention process. Understanding cervical oncogenesis can be difficult, since it involves multistep carcinogenesis, beginning with sexual acquisition of HPV infection, failure of immune-mediated HPV clearance, and the progression of preinvasive lesions to cancer. The mechanics of cervical cancer prevention can be similarly confusing, requiring an often arduous program of cytologic screening, colposcopy triage, and treatment. Among women with HIV, failure rates for treatment of cancer precursors are high [8]. For these women, prevention may involve rounds of cytology, colposcopy, and treatment, with multiple opportunities for discouragement and default that may allow cancer precursors to progress. Some 35% of women with HIV default from colposcopy referral [9]. In other populations, educational interventions to address misunderstandings about cervical cancer prevention have improved compliance with follow-up [10–13]. These have not been tested in HIV-infected individuals, and understanding what HIV infected women know about cervical cancer and what contributes to misunderstanding might help guide effective interventions.

Among U.S. women, knowledge of HPV and its consequences is quite limited [14–21]. Women least likely to know about HPV and its relationship to cervical cancer are those from lower socio-economic strata, those with lower educational attainment, and those who do not obtain regular Pap testing [15,16,19]. These in turn are risks for cervical cancer [22].

Despite the particular threat of cervical cancer for women with HIV, little is known about what HIV-infected women understand about HPV and cervical disease. To provide a more complete understanding, we administered a questionnaire to women with HIV and to comparison women uninfected with HIV. We inquired about their knowledge of HPV, HPV vaccination, and the cervical cancer prevention process. We asked about women's sources for knowledge about HPV vaccination. We attempted to identify characteristics of women who knew little about these areas as a basis for interventions.

## Methods

This investigation was part of the Women's Interagency HIV Study (WIHS), an ongoing multicenter prospective cohort study of the natural history of HIV infection and related health conditions among HIV seropositive women and at-risk HIV uninfected comparison women. The protocols, recruitment processes, procedures, and baseline results of the WIHS have been described [23,24]; seropositive WIHS participants are representative of U.S. women with HIV [23]. Enrollment began with 2,623 women in 1994 at 6 study consortia (Bronx, Brooklyn, Chicago, Los Angeles, San Francisco, and Washington, D.C.). The cohort was expanded to 3,766 women during 2001–2002 to recruit younger, AIDS-free, and therapy naïve HIV seropositive women, along with HIV-uninfected women with similar socio-demographic and sexual risk characteristics [24]. Comparisons by WIHS administrators to statistics from the Centers for Disease Control and Prevention have shown that the demographics and HIV risk characteristics of the cohort are broadly similar to those of U.S. women with HIV, though WIHS does not include Southern women and so has marginally greater representation of Latinas from the New York and Los Angeles areas than the U.S. population. Adolescents and young women are also underrepresented. Written informed consent was obtained after local human subjects committees approval. Follow up continues, but this analysis reports information from a cross sectional questionnaire on knowledge of and attitudes toward cervical cancer prevention and HPV administered between April and September, 2006. Reading level and a neuropsychological screen for attention and cognitive dysfunction were assessed between October 2004 and September 2005. HIV status was determined by Western blot at study entry for all participants and annually thereafter for those initially seronegative. Ethnicity and years of education were self-reported.

The English version of this questionnaire has been previously described [16]; it was translated into Spanish for this study. Questions asked about HPV, Pap tests, cancer risks, and HPV vaccination. The WIHS National Community Advisory Board reviewed a draft of the questionnaire and provided feedback prior to field implementation. Multiple choice questions and response options were read by participants or to participants by trained interviewers, and responses were recorded. Interviewers were instructed to clarify questions as needed but to defer requests for information until after the questionnaires had been completed. On completion, participants were given written explanations of the correct answers with background, and further information was supplied if requested.

Responses to the 44-item questionnaire were tabulated and compared by HIV status using a global chi-square test. Responses then were coded as correct or incorrect where applicable and subjected to a principal component analysis for item reduction. The principal axis method was used to extract the components, and this was followed by a varimax (orthogonal) rotation [25]. A single summary factor-based score was computed for each subject based on the remaining 26 questionnaire items from the principal component analysis (Chronbach's alpha=0.88). It included items related to knowledge of HPV, risk factors for cervical cancer, the HPV vaccine, and care following abnormal Pap smears.

Scores were correlated with demographic variables, including age at questionnaire administration, ethnicity, education attained by study entry, reading level, and household income; medical factors, including HIV serostatus, abnormal Pap history, prior colposcopy, and cervical disease treatment; and measures of attention, depressive symptoms, and reading level as a proxy for educational attainment. To explore links between study responses and general cognition, we used information gathered during the Neurocognition Substudy in WIHS. The Wide Range Achievement Test-Version 3 (WRAT) for English speakers and the Word Accentuation Test for Spanish Speakers [26,27] were used to assess basic academic

skills. A cognitive task, the Symbol Digit Modalities Test, was used to assess information processing and attentiveness, including visual scanning and mental and motor speed, and immediate paired recall of the same test was used to assess short-term memory [28]. Clinically significant depressive symptoms were screened for using the Center for Epidemiologic Studies Depression (CES-D) scale, with a cutoff score of 16 considered as positive [29].

Multivariable analysis was carried out with the knowledge factor-based score as the outcome. Linear regression was used to assess characteristics associated with knowledge score. For the initial model, each independent variable was evaluated for fit using the Type III SS value and *P*-value and were included in the analyses if they had a *P*-value <0.05. Raw Symbol Digit and WRAT score were added to subsequent models. Due to minor but potentially confounding connotative differences between English and Spanish speakers, 137 women who completed their questionnaires in Spanish were excluded from multivariable analyses. All final regression models were created using the PROC Generalized Linear Models (GLM) procedure in SAS software [30].

## Results

Of the 2,091 women seen at WIHS visit 26, a total of 1,597 (76%) completed questionnaires on cervical cancer and HPV, while 156 (7%) did not receive questionnaires, 167 (8%) refused or did not return questionnaires, and 171 (8%) returned substantially incomplete questionnaires. No significant differences were seen between those who were excluded because of missing data from questionnaire and those who were not except for site and age; those missing data were slightly older 44.5 vs. 43.1 (*P*=0.05) and more likely to be from the Washington, Los Angeles, and Chicago sites compared to other sites. Nine additional women were excluded because of HIV seroconversion during the years of study, a group too small for analysis. This left 1588 women for analysis. Women who were excluded were more likely to come from the District of Columbia, Los Angeles, and Chicago sites and were marginally older (44.5 vs. 43.1 years, *P*=0.05). There were no differences between included and excluded women by CES-D score; HIV serostatus income; alcohol, smoking and drug use; ethnicity; education level; history of abnormal Pap, or most recent Pap grade.

As shown in Table 1, when compared to HIV seronegative women, HIV seropositive women in our study group were older (median age 43.9 vs. 40.5 years, *P*<0.0001 by Wilcoxon two-sample test) and less likely to use alcohol and tobacco currently but more likely to have a history of injected drug use. There were also differences between HIV seropositive and seronegative women by site and income, though not in overall depressive symptoms or reading level achieved. Table 2 shows that HIV seropositive women were more likely than seronegative women to have prior abnormal Paps, more severe abnormalities, and more colposcopies and cervical disease treatments.

Tables 3–6 present questionnaire results. As shown in Table 3, a minority of women were knowledgeable about cervical cancer prevention processes. In most cases where differences were significant, HIV seropositive women had a better understanding of facts about cervical cancer prevention. Tables 4 and 5 similarly show that HIV seropositive women understood aspects of HPV infection and vaccination better than HIV seronegative women, although substantial minorities in both groups were unaware of facts concerning HPV and vaccination.

Table 6 shows how women differed in their attitudes toward Pap testing and HPV vaccination. Although many women had responded that cervical cancer is not preventable, almost all women surveyed considered Pap testing at least somewhat important. Despite lack

of knowledge about many aspects of HPV, about half the women studied considered HPV vaccination extremely important for cervical cancer prevention, and more than half would recommend vaccination to female relatives and friends, though 30% of HIV seropositive women and 37% of seronegative women believed they needed additional information before doing so.

We surveyed women to learn where they had received information about HPV vaccination. Among women who had heard about it, 19% had learned of it from doctors, 11% from nurses, 17% from WIHS staff, 61% from news reports, and 68% through advertising, while 8% could not remember their source of information. HIV seronegative women were more likely to report learning of HPV vaccination through advertising than from clinicians (81% vs. 64%, $P<0.0001$), but other sources of information did not differ by serostatus.

The factor-based score computed using the final 26 items ranged from −1.98 to 1.78 (median=0.27), with negative scores showing worse knowledge and increasing positive scores showing greater knowledge. HIV seropositive women had a higher median knowledge score than seronegative women (0.37 vs. −0.03, Two independent sample *t*-test $P<0.0001$). Results of our main multivariable models are presented in Table 7, which show correlates of the factor-based score across all knowledge fields. In the first model, better knowledge was associated with being HIV seropositive and of white or other ethnicity, as well as with having more education, higher income, and a prior abnormal Pap, while depressive symptoms were associated with lower knowledge score. The second model included a measure of sustained attention and perceptual speed by adding the Symbol Digit Modalities Test score; this increased the model's predictive value ($R^2$) and demonstrated that greater attentiveness was linked to better scores, displacing age and Hispanic ethnicity. In the third model, controlling for reading achievement as a proxy for educational attainment in addition to number of years of education by adding the WRAT reading recognition score further improved predictive value, while screening positively for depressive symptoms became nonsignificant.

## Discussion

For many women with HIV and their HIV uninfected peers, knowledge gaps can pose a barrier to engaging in cervical cancer prevention programs. Most women in our study did not know correct answers to questions about several fundamental aspects of cervical cancer prevention, including the concept that Pap testing evaluates the cervix. This result was unanticipated. On the one hand, our participants came predominantly from lower socioeconomic and educational backgrounds [23], factors that have predicted lower awareness of HPV and cervical cancer prevention processes [15,16,19]. On the other hand, WIHS participants had personal experience of semiannual Pap testing. Most had abnormal Pap results. All had opportunities to learn about HPV and cervical cancer prevention through newsletters, peer education, and staff contact after abnormal Pap results. Women with prior abnormal Pap tests knew more about cervical cancer prevention, but only marginally so. In high-risk populations like ours, unstructured encounter-based education may be insufficient to raise understanding of cervical cancer risks and prevention strategies. Culturally tailored educational interventions designed to improve compliance with screening, treatment, and vaccination among women like those we studied will need to incorporate basic information about genital anatomy and the natural history of cervical disease. Women with less than a high school education have the greatest knowledge deficits and merit particular outreach.

Most participants learned about HPV vaccination from advertising and news, not WIHS researchers or clinicians, but the substantial knowledge gaps we found suggest that media

may communicate messages incorrectly or incompletely to low-income women of color. The importance of ethnicity, income, and quality of education in predicting knowledge suggests that educational messages should be culturally specific. Research is needed to determine whether more tailored education from clinicians, such as multimedia approaches incorporating visual and auditory aids, might improve women's understanding of cancer prevention and if so whether better understanding leads to better compliance.

Our study was novel in incorporating psychometric assessments. These included measures of sustained attention, mental speed, reading as a proxy for education, and depressive symptoms. Multivariable analysis showed that all but depressive symptoms were significant contributors to the level of knowledge about cervical cancer prevention and HPV, and future studies in these areas should incorporate them. Unfortunately, models combining these factors with nominal years of education and proxies for cultural factors like income and ethnicity failed to explain much of the variability in knowledge. Unmeasured factors, such as the perceived reliability of the information source, may be important and deserve further exploration. Nevertheless, some women, such as those who do not know what a cervix, a cell, or a cancer is, may have knowledge deficits that cannot be addressed readily in brief clinical encounters or educational campaigns. In fact such efforts may be counterproductive if exposing knowledge deficits erodes women's self-worth and desire to pursue cancer prevention. For these women, efforts focused on developing trust may be more effective in improving compliance with prevention measures than educational outreach. Appropriately educated HIV seropositive women may make effective peer counselors for women needing such support, as participants frequently indicated that they considered HPV vaccination an important measure against cervical cancer and would recommend vaccination to female relatives and friends. Whether vaccination is safe or effective for HIV-infected women is the subject of ongoing trials.

Results from our study were broadly congruent with recent research on knowledge and attitudes regarding cervical cancer prevention, HPV, and HPV vaccination. For example, a recent review found that 8–68% of women asked closed-ended questions could identify the link between HPV and cervical cancer [22]. A focus group study conducted by the Centers for Disease Control in 2002–3 found that women preferred to receive information about HPV from sources that were trustworthy, accessible, convenient, and confidential; while they preferred clinicians as information sources, we found that many of our participants had received their information from media and advertising [31].

Our study was limited by several factors. First, women from similar socioeconomic backgrounds but irregularly screened may have even lower levels of understanding of cervical cancer prevention, HPV, and HPV vaccination than our participants. Second, since this study was nested in a larger study of other health outcomes, restricting time availability, we used multiple choice testing. Knowledge may be lower when measured without prompting [21] and using open-ended questions [20]. Third, because WIHS is a comprehensive study of multiple health outcomes with limited time at each visit, measures of vocabulary and cognitive function were administered at different visits, potentially limiting the strength of correlations. Fourth, because we excluded women who spoke only Spanish from analyses, conclusions may not apply to less acculturated Latina women. Fifth, our findings may not reflect those of young women or those from the South, who are underrepresented in WIHS. Finally, our study was conducted as HPV vaccine marketing was initiated; ongoing marketing of HPV vaccines has likely increased awareness of HPV and cervical cancer prevention [32], and we recently completed a follow-up survey to assess how knowledge is evolving.

In addition to education about cervical cancer prevention processes, HPV education is important because an HPV diagnosis can induce feelings of anxiety, shame, and stigmatization, which actually may be stronger among women who are knowledgeable about HPV [33]. Understanding the near-ubiquity of HPV infection may reduce these reactions [33]. However, improving knowledge may not lead to behavior change. For example, among parents with vaccine-eligible daughters, an HPV education sheet improved knowledge about HPV but did not alter willingness to consider vaccination [34]. We plan follow-up studies to assess the impact of an HPV-related educational intervention on knowledge scores and colposcopy compliance among women with abnormal Pap tests.

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## Table 1

Demographic and medical characteristics of women who completed questionnaire (*n*=1588). *N* (%).

| | HIV+ *N*=1123 | HIV− *N*=465 | *P*-value[a] |
|---|---|---|---|
| Age at interview (years) | | | |
| <30 | 58 (5.2) | 79 (17.0) | <0.0001 |
| 30–39 | 310 (27.6) | 147 (31.6) | |
| 40–49 | 476 (42.4) | 155 (33.3) | |
| 50+ | 279 (24.8) | 84 (18.1) | |
| Ethnicity | | | |
| Non-Hispanic African-American | 628 (55.9) | 282 (60.7) | 0.07 |
| Hispanic | 308 (27.4) | 116 (24.9) | |
| Non-Hispanic White | 147 (13.1) | 44 (9.5) | |
| Other | 40 (3.6) | 23 (4.9) | |
| Average household income | | | |
| ≤ =$6,000 | 185 (18.0) | 102 (24.2) | 0.009 |
| $6,001–$12,000 | 323 (31.5) | 102 (24.2) | |
| $12,001–$18,000 | 146 (14.2) | 56 (13.3) | |
| $18,001+ (missing=140) | 373 (36.3) | 161 (38.3) | |
| Education level | | | |
| Less than high school | 424 (37.8) | 164 (35.3) | 0.40 |
| Completed high school | 323 (28.8) | 149 (32.1) | |
| Some college/college degree (missing=3) | 374 (33.4) | 151 (32.5) | |
| Site/location | | | |
| Bronx | 168 (15.0) | 91 (19.6) | 0.03 |
| Brooklyn | 272 (24.2) | 110 (23.6) | |
| DC | 169 (15.0) | 61 (13.1) | |
| Los Angeles | 219 (19.5) | 78 (16.8) | |
| San Francisco | 147 (13.1) | 78 (16.8) | |
| Chicago | 148 (13.2) | 47 (10.1) | |
| Alcohol use | | | |
| Abstainer | 716 (63.8) | 230 (49.5) | <0.0001 |
| Light (<3 drinks/week) | 294 (26.2) | 147 (31.6) | |
| Moderate/heavy (3+ drinks/week) | 113 (10.0) | 88 (18.9) | |
| Current smoker | 441 (39.3) | 225 (48.4) | 0.0008 |
| Injection drug use status | | | |
| Current user | 19 (1.7) | 11 (2.4) | 0.01 |
| Former user | 258 (23.0) | 77 (16.5) | |
| Never | 846 (75.3) | 377 (81.1) | |
| Non-injection drug use status | | | |
| Current user | 222 (19.8) | 147 (31.6) | <0.0001 |
| Former user | 535 (47.6) | 226 (48.6) | |
| Never | 366 (32.6) | 92 (19.8) | |

| | HIV+ *N*=1123 | HIV− *N*=465 | *P*-value[a] |
|---|---|---|---|
| CES-D score | | | |
| Mean | 13.9 | 12.7 | 0.06[b] |
| Median | 11.0 | 9.0 | 0.07[c] |
| Range | 0–58 | 0–53 | |
| Depressive symptoms based on CES-D score (16+) (missing=5) | 436 (38.9) | 162 (35.1) | 0.15 |
| English WRAT score (number of words pronounced correctly) | | | |
| Mean | 28.8 | 28.7 | 0.77[b] |
| Median | 31.0 | 29.0 | 0.43[c] |
| Range | 3–42 | 8–42 | |
| Spanish WAT score (number of words pronounced correctly) | | | |
| Mean | 23.3 | 19.3 | 0.14[b] |
| Median | 26.0 | 19.0 | 0.21[c] |
| Range | 0–30 | 4–30 | |
| Lifetime nadir CD4 lymphocyte count (cells/cmm) | | | |
| <200 | 514 (45.8) | | |
| 200–500 | 529 (47.1) | | |
| >500 | 80 (7.1) | | |
| CD4 lymphocyte count (cells/cmm) at visit | | | |
| <200 | 157 (14.0) | | |
| 200–500 | 443 (39.4) | | |
| >500 | 523 (46.6) | | |
| Viral load at visit | | | |
| Mean | 16,158.0 | | |
| Median | 80 | | |
| Range (missing=12) | 80–2,100,000 | | |
| HAART[d] use at visit For questionnaire | 740 (65.9) | | |

[a] *P*-value obtained by using the chi-square test unless otherwise specified.

[b] *P*-value obtained by using the t-test for means.

[c] *P*-value obtained using the Wilcoxon two-sample test.

[d] Highly active antiretroviral therapy.

## Table 2

Antecedent Pap test results and cervical cancer prevention procedures among women completing questionnaires (*n*=1588). *N* (%).

| | HIV+ *N*=1123 | HIV− *N*=465 | *P*-value[a] |
|---|---|---|---|
| Total count of abnormal Pap results per patient | | | |
| Median | 3.0 | 1.0 | <0.0001[b] |
| Ever had abnormal Pap result | 878 (78.2) | 268 (57.6) | <0.0001 |
| Grade of last Pap result | | | |
| Negative | 858 (76.4) | 419 (90.1) | <0.0001 |
| ASCUS[c] | 183 (16.3) | 36 (7.8) | |
| LGSIL[d] | 66 (5.9) | 7 (1.5) | |
| HGSIL[e] | 16 (1.4) | 2 (0.4) | |
| Squamous cancer | 0 (0) | 1 (0.2) | |
| Grade of worst Pap test | | | |
| Normal | 246 (21.9) | 198 (42.6) | <0.0001 |
| ASCUS | 376 (33.5) | 195 (41.9) | |
| LGSIL | 423 (37.7) | 62 (13.3) | |
| HGSIL | 78 (6.9) | 9 (2.0) | |
| Squamous cancer | 0 (0) | 1 (0.2) | |
| Total WIHS colposcopies per patient | | | |
| Median | 2.0 | 1.0 | <0.0001[b] |

[a] *P*-value obtained by using the chi-square test unless otherwise specified.

[b] *P*-value obtained using the Wilcoxon two-sample test.

[c] Atypical squamous cells of undetermined significance.

[d] Low grade squamous intraepithelial lesion.

[e] High grade squamous intraepithelial lesion.

## Table 3

Distribution of responses to questions about cervical cancer prevention. Correct responses are in bold type.

| Question | HIV positive, *N*=1123 | HIV negative, *N*=465 | *P*-value |
|---|---|---|---|
| What part of body does Pap test check? | | | |
| Vagina | 304 (27.1) | 138 (29.7) | 0.57 |
| **Cervix (mouth of the womb)** | **499 (44.4)** | **198 (42.6)** | |
| Uterus (womb) | 121 (10.8) | 55 (11.8) | |
| Don't know | 199 (17.7) | 74 (15.9) | |
| How often should Pap test be done for a woman who does not have HIV? | | | |
| Every 6 months | 571 (50.8) | 321 (69.0) | <0.0001 |
| **Every 1–3 years** | **451 (40.2)** | **114 (24.5)** | |
| Every 4–5 years | 5 (0.5) | 0 (0) | |
| When a woman has a discharge | 6 (0.5) | 0 (0) | |
| Don't know | 90 (8.0) | 30 (6.5) | |
| Women in WIHS have Pap tests every visit. Outside a study, how often should a Pap test be done for a woman with HIV? | | | |
| **Every year, once two tests are normal** | **900 (80.1)** | **282 (60.6)** | <0.0001 |
| Every 3 years | 9 (0.8) | 8 (1.7) | |
| Every 4–5 years | 4 (0.4) | 4 (0.9) | |
| When a woman has a discharge | 40 (3.6) | 13 (2.8) | |
| Don't know | 170 (15.1) | 158 (34.0) | |
| What is the purpose of a Pap test? | | | |
| To check for a yeast infection | 50 (4.4) | 21 (4.5) | 0.0002 |
| To look inside the vagina | 107 (9.5) | 83 (17.9) | |
| **To check for cervical cancer or precancerous cells** | **861 (76.7)** | **320 (68.8)** | |
| To see why a woman has painful periods | 17 (1.5) | 8 (1.7) | |
| To treat cancer | 5 (0.5) | 0 (0) | |
| Don't know | 83 (7.4) | 33 (7.1) | |
| What does it mean if you have an abnormal Pap test? | | | |
| It means the female organs look bad | 50 (4.4) | 21 (4.5) | 0.07 |
| It means you have cancer | 21 (1.9) | 3 (0.6) | |
| It means you have a STD and need antibiotics | 48 (4.3) | 30 (6.5) | |
| It means you have a yeast infection | 29 (2.6) | 14 (3.0) | |
| **It means you have abnormal cells that can turn into cancer** | **834 (74.3)** | **324 (69.7)** | |
| Don't know | 141 (12.5) | 73 (15.7) | |
| After an abnormal Pap test, follow-up may include: | | | |
| A blood test | | | |
| True | 370 (33.0) | 221 (47.5) | <0.0001 |
| **False** | **446 (39.7)** | **114 (24.5)** | |
| Don't know | 307 (27.3) | 130 (28.0) | |
| A biopsy | | | |
| **True** | **833 (74.2)** | **300 (64.5)** | 0.0003 |
| False | 105 (9.3) | 67 (14.4) | |

| Question | HIV positive, *N*=1123 | HIV negative, *N*=465 | *P*-value |
|---|---|---|---|
| Don't know | 185 (16.5) | 98 (21.1) | |
| Another Pap test | | | |
| **True** | **769 (68.5)** | **337 (72.5)** | 0.20 |
| False | 146 (13.0) | 47 (10.1) | |
| Don't know | 208 (18.5) | 81 (17.4) | |
| Colposcopy | | | |
| **True** | **742 (66.1)** | **228 (49.0)** | <0.0001 |
| False | 129 (11.5) | 66 (14.2) | |
| Don't know | 252 (22.4) | 171 (36.8) | |
| Testing for HPV | | | |
| **True** | **647 (57.6)** | **261 (56.1)** | 0.81 |
| False | 123 (11.0) | 50 (10.8) | |
| Don't know | 353 (31.4) | 154 (33.1) | |
| Nothing | | | |
| True | 58 (5.2) | 31 (6.7) | 0.48 |
| **False** | **735 (65.4)** | **302 (64.9)** | |
| Don't know | 330 (29.4) | 132 (28.4) | |
| What makes a woman more likely to get cervical cancer? | | | |
| Others in the family have it | | | |
| **True** | **603 (53.7)** | **267 (57.4)** | 0.25 |
| False | 263 (23.4) | 92 (19.8) | |
| Don't know | 257 (22.9) | 106 (22.8) | |
| Multiple sex partners | | | |
| **True** | **518 (46.1)** | **204 (43.9)** | 0.62 |
| False | 306 (27.3) | 137 (29.4) | |
| Don't know | 299 (26.6) | 124 (26.7) | |
| Not getting a Pap test done | | | |
| **True** | **610 (54.3)** | **230 (49.5)** | 0.18 |
| False | 308 (27.4) | 146 (31.4) | |
| Don't know | 205 (18.3) | 89 (19.1) | |
| Using illegal drugs | | | |
| True | 168 (15.0) | 61 (13.1) | 0.63 |
| **False** | **606 (53.9)** | **255 (54.9)** | |
| Don't know | 349 (31.1) | 149 (32.0) | |
| Smoking | | | |
| **True** | **302 (26.9)** | **134 (28.8)** | 0.67 |
| False | 485 (43.2) | 191 (41.1) | |
| Don't know | 336 (29.9) | 140 (30.1) | |
| Sex without a condom | | | |
| True | 524 (46.7) | 154 (33.1) | 0.04 |
| **False** | **336 (29.9)** | **154 (33.1)** | |
| Don't know | 263 (23.4) | 126 (27.1) | |

| Question | HIV positive, *N*=1123 | HIV negative, *N*=465 | *P*-value |
|---|---|---|---|
| Wrong diet | | | |
| True | 133 (11.8) | 56 (12.0) | 0.98 |
| **False** | **656 (58.4)** | **269 (57.9)** | |
| Don't know | 334 (29.8) | 140 (30.1) | |
| Sex early in life | | | |
| **True** | **345 (30.7)** | **99 (21.3)** | 0.0006 |
| False | 416 (37.1) | 203 (43.7) | |
| Don't know | 362 (32.2) | 163 (35.0) | |
| Weighing too much | | | |
| True | 80 (7.1) | 34 (7.3) | 0.99 |
| **False** | **674 (60.0)** | **279 (60.0)** | |
| Don't know | 369 (32.9) | 152 (32.7) | |
| Viral infection | | | |
| **True** | **535 (47.6)** | **244 (52.5)** | 0.15 |
| False | 232 (20.7) | 80 (17.2) | |
| Don't know | 356 (31.7) | 141 (30.3) | |
| Sexually transmitted diseases | | | |
| **True** | **636 (56.6)** | **258 (55.5)** | 0.90 |
| False | 171 (15.2) | 74 (15.9) | |
| Don't know | 316 (28.1) | 133 (28.6) | |
| Drinking too much alcohol | | | |
| True | 111 (9.9) | 50 (10.7) | 0.54 |
| **False** | **657 (58.5)** | **258 (55.5)** | |
| Don't know | 355 (31.6) | 157 (33.8) | |
| Oral sex | | | |
| True | 132 (11.8) | 48 (10.3) | 0.71 |
| **False** | **629 (56.0)** | **265 (57.0)** | |
| Don't know | 362 (32.2) | 152 (32.7) | |
| Abortions | | | |
| True | 235 (20.9) | 98 (21.1) | 0.36 |
| **False** | **465 (41.4)** | **176 (37.8)** | |
| Don't know | 423 (37.7) | 191 (41.1) | |
| HIV | | | |
| **True** | **582 (51.8)** | **174 (37.4)** | <0.0001 |
| False | 211 (18.8) | 85 (18.3) | |
| Don't know | 330 (29.4) | 206 (44.3) | |
| Can cervical cancer be prevented? | | | |
| **Yes** | **594 (52.9)** | **225 (48.4)** | 0.21 |
| No | 129 (11.5) | 64 (13.8) | |
| Don't know | 400 (35.6) | 176 (37.8) | |

* T-test.

* Kruskal–Wallis test.

## Table 4

Distribution of responses to questions about human papillomavirus (HPV). Correct responses are in bold type.

| Question | HIV positive, *N*=1123 | HIV negative, *N*=465 | *P*-value |
|---|---|---|---|
| What is the human papillomavirus (HPV)? | | | |
| **Virus acquired from sex that causes warts and cancer** | **749 (66.7)** | **266 (57.2)** | 0.002 |
| Virus acquired from mosquito bite that makes people sick | 19 (1.7) | 6 (1.3) | |
| Virus that makes people unable to have children | 21 (1.9) | 9 (1.9) | |
| Don't know | 334 (29.7) | 184 (39.6) | |
| Is statement true or false about people with HPV? | | | |
| They are at higher risk for cervical cancer | | | |
| **True** | **789 (70.3)** | **273 (58.7)** | <0.0001 |
| False | 43 (3.8) | 22 (4.7) | |
| Don't know | 291 (25.9) | 170 (36.6) | |
| They can be cured with medication | | | |
| True | 289 (25.7) | 150 (32.3) | 0.002 |
| **False** | **354 (31.5)** | **110 (23.7)** | |
| Don't know | 480 (42.7) | 205 (44.1) | |
| They are at higher risk for genital warts | | | |
| **True** | **577 (51.4)** | **190 (40.9)** | 0.0006 |
| False | 97 (8.6) | 52 (11.2) | |
| Don't know | 449 (40.0) | 223 (47.9) | |
| They usually can tell they have it | | | |
| True | 137 (12.2) | 59 (12.7) | 0.65 |
| **False** | **560 (49.9)** | **220 (47.3)** | |
| Don't know | 426 (37.9) | 186 (40.0) | |
| Condoms will keep it from spreading | | | |
| **True** | **494 (44.0)** | **176 (37.8)** | 0.07 |
| False | 252 (22.4) | 111 (23.9) | |
| Don't know | 377 (33.6) | 178 (38.3) | |

## Table 5

Distribution of responses to questions about vaccination against the human papillomavirus. Correct responses are in bold type.

| Question | HIV positive, *N*=1123 | HIV negative, *N*=465 | *P*-value |
|---|---|---|---|
| Have you heard about an HPV vaccine called Gardasil? | | | |
| Yes | 531 (47.3) | 172 (37.0) | 0.0006 |
| No | 428 (38.1) | 219 (47.1) | |
| Not sure | 164 (14.6) | 74 (15.9) | |
| What do you think the vaccine is meant to prevent? | | | |
| Abnormal Pap tests, cervical cancer and precancer | | | |
| **True** | **725 (64.6)** | **270 (58.0)** | 0.05 |
| False | 81 (7.2) | 38 (8.2) | |
| Don't know | 317 (28.2) | 157 (33.8) | |
| Lung infections | | | |
| True | 56 (5.0) | 17 (3.6) | 0.003 |
| **False** | **704 (62.7)** | **257 (55.3)** | |
| Don't know | 363 (32.3) | 191 (41.1) | |
| Urine infections | | | |
| True | 136 (12.1) | 66 (14.2) | 0.01 |
| **False** | **605 (53.9)** | **212 (45.6)** | |
| Don't know | 382 (34.0) | 187 (40.2) | |
| Warts around the genitals and anus | | | |
| **True** | **397 (35.4)** | **142 (30.5)** | 0.06 |
| False | 298 (26.5) | 117 (25.2) | |
| Don't know | 428 (38.1) | 206 (44.3) | |
| Genital herpes | | | |
| True | 262 (23.3) | 101 (21.7) | 0.17 |
| **False** | **416 (37.1)** | **156 (33.6)** | |
| Don't know | 445 (39.6) | 208 (44.7) | |
| For women with HIV, what are recommendations for HPV vaccination? | | | |
| All should be vaccinated | 288 (25.7) | 114 (24.5) | 0.89 |
| None should be vaccinated | 20 (1.8) | 7 (1.5) | |
| **Unclear. Women should talk to their doctors about risks and benefits, then decide** | **810 (72.1)** | **341 (73.3)** | |
| Don't know | 5 (0.4) | 3 (0.7) | |
| Among women without HIV, who should get the HPV vaccine? | | | |
| **Girls as young as 9 years of age** | | | |
| **True** | **330 (29.4)** | **115 (24.7)** | 0.15 |
| False | 375 (33.4) | 160 (34.4) | |
| Don't know | 418 (37.2) | 190 (40.9) | |
| Teenage and young adult women | | | |
| **True** | **745 (66.3)** | **293 (63.0)** | 0.36 |
| False | 75 (6.7) | 30 (6.5) | |

| Question | HIV positive, *N*=1123 | HIV negative, *N*=465 | *P*-value |
|---|---|---|---|
| Don't know | 303 (27.0) | 142 (30.5) | |
| Women over 25 years who are at high risk | | | |
| True | 659 (58.7) | 275 (59.1) | 0.45 |
| **False** | **114 (10.1)** | **38 (8.2)** | |
| Don't know | 350 (31.2) | 152 (32.7) | |
| Women 50 years of age and older | | | |
| True | 432 (38.5) | 172 (37.0) | 0.85 |
| **False** | **237 (21.1)** | **99 (21.3)** | |
| Don't know | 454 (40.4) | 194 (41.7) | |

## Table 6

Distribution of responses to attitude questions about Pap tests and vaccination against the human papillomavirus.

| Question | HIV positive, *N*=1123 | HIV negative, *N*=465 | *P*-value |
|---|---|---|---|
| How important is it for women with HIV to have regular Pap tests? | | | |
| Extremely important | 925 (82.4) | 352 (75.7) | 0.0007 |
| Very important | 137 (12.2) | 61 (13.1) | |
| Somewhat important | 9 (0.8) | 5 (1.1) | |
| Not at all important | 1 (0.1) | 0 (0) | |
| Not sure | 51 (4.5) | 47 (10.1) | |
| How important is it for women without HIV to have regular Pap tests? | | | |
| Extremely important | 747 (66.5) | 323 (69.5) | 0.71 |
| Very important | 282 (25.1) | 105 (22.6) | |
| Somewhat important | 37 (3.3) | 15 (3.2) | |
| Not at all important | 2 (0.2) | 0 (0) | |
| Not sure | 55 (4.9) | 22 (4.7) | |
| How important do you think the HPV vaccine is for preventing cervical cancer? | | | |
| Extremely important | 586 (52.2) | 224 (48.2) | 0.20 |
| Very important | 208 (18.5) | 89 (19.1) | |
| Somewhat important | 48 (4.3) | 22 (4.7) | |
| Not at all important | 1 (0.1) | 3 (0.7) | |
| Not sure | 280 (24.9) | 127 (27.3) | |
| How likely would you be to recommend the HPV vaccine to female relatives and friends? | | | |
| Extremely likely | 467 (41.6) | 171 (36.8) | 0.09 |
| Very likely | 222 (19.8) | 86 (18.5) | |
| Somewhat likely | 70 (6.2) | 32 (6.8) | |
| Not at all likely | 22 (2.0) | 5 (1.1) | |
| Not sure/need more information | 342 (30.4) | 171 (36.8) | |

## Table 7

Regression coefficients and 95% confidence intervals for final linear regression models among survey participants who completed the survey in English.

| | **Model 1, *N*=1451** | **Model 2, *N*=1356** | **Model 3, *N*=1149** |
|---|---|---|---|
| Adjusted $R^2$ | 0.16 | 0.17 | 0.19 |
| F-Value | 31.2*** | 26.8*** | 24.4*** |
| Predictor variables | | | |
| HIV seropositive (vs. negative) | 0.21 (0.11, 0.31) *** | 0.21 | 0.22 |
| Age at visit | −0.01 (−0.01, −0.002) ** | −0.003 (−0.008, 0.003) | −0.003 (−0.009, 0.002) |
| Ethnicity (vs. Non-Hisp Blacks) | | | |
| Hispanic | 0.11 (−0.01, 0.22) | 0.07 (−0.05, 0.20) | 0.03 (0.10, 0.16) |
| White/Other | 0.38 (0.25, 0.51) *** | 0.28 (0.15, 0.42) *** | 0.21 (0.06, 0.37) ** |
| Education (vs. less than High school) | | | |
| High school | 0.28 (0.17, 0.40) *** | 0.23 (0.11, 0.35) *** | 0.13 (−0.002, 0.26) * |
| College | 0.59 (0.47, 0.71) *** | 0.49 (0.36, 0.61) *** | 0.27 (0.13, 0.41) *** |
| Income > $18,000 (vs. <$18,000) | 0.24 (0.14, 0.34) *** | 0.21 (0.10, 0.31) *** | 0.20 (0.08, 0.31) *** |
| Depressed (yes/no) | −0.13 (−0.23, −0.03) ** | −0.11 (−0.21, −0.006) * | −0.00002 (−0.11, 0.11) |
| Ever had an abnormal Pap smear | 0.14 (0.04, 0.25) ** | 0.14 (0.04, 0.25) ** | 0.19 (0.07, 0.30) ** |
| Symbol Digit Modalities Test | | 0.01 (0.006, 0.02) *** | 0.01 (0.003, 0.01) ** |
| WRAT (English) | | | 0.03 (0.02, 0.03) *** |

* $P \leq 0.05$.

** $P \leq 0.01$.

*** $P \leq 0.001$.