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Risk Perceptions after Human Papillomavirus Vaccination in HIV-Infected Adolescent and Young Adult Women

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Abstract

Purpose—To examine risk perceptions (perceived risk of HPV, perceived risk of other sexually transmitted infections (STIs), and need for safer sexual behaviors) and to determine factors associated with these risk perceptions after human papillomavirus (HPV) vaccination.

Methods—Data were collected at the baseline visit of an HPV-6, -11, -16, -18 vaccine clinical trial in 16- to 23-year-old HIV-infected young women (N=99). Immediately after receiving the first vaccine dose, participants completed a confidential questionnaire that included three 5-item scales measuring perceived risk of HPV, perceived risk of other STIs, and need for safer sexual behaviors. Linear and logistic regression models were used to examine associations between baseline characteristics (demographic characteristics; CD4+ count; HIV viral load; knowledge about HPV and HPV vaccines; sexual behaviors; and STI diagnosis) and each measure of risk perceptions.

Results—Most participants perceived themselves to be at lower risk for HPV (mean scale score 19.5/50), most perceived that they were *not* at lower risk for other STIs (mean 31.2/50), and the vast majority reported that there was still a need for safer sexual behaviors after vaccination (mean 43.1/50). Multivariable analyses indicated that knowledge about HPV and HPV vaccines was associated with perceived need for safer sexual behaviors (OR 1.05, 95% CI 1.0-1.1).

Conclusions—Although almost all young women in this study believed that safer sexual behaviors were still important after HPV vaccination, a subset believed they were at less risk for

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Conflicts of Interest Vaccine and HPV Mean Geometric Titers were provided through the Investigator-Initiated Studies Program of Merck & Co., Inc. Gregory D. Zimet is an investigator on other behavioral research studies related to HPV vaccination that are funded by Merck & Co. Inc. Investigator-Initiated Studies Program. For the remaining authors no other conflicts were declared.
The opinions expressed in this paper are those of the authors and do not necessarily represent those of Merck & Co., Inc.

STIs other than HPV. Educational interventions are needed to prevent misperceptions and promote healthy behaviors after vaccination.

Keywords

human papillomavirus; vaccine; HIV; adolescent; risk perceptions

Introduction

Human papillomavirus (HPV) is a highly prevalent sexually transmitted infection (STI) that is causally associated with anogenital cancers, conditions responsible for substantial morbidity, mortality, and expense worldwide. HIV-infected individuals are at increased risk for both infection and progression to HPV-related malignancies.[1] Two prophylactic HPV vaccines are now licensed for use, and the U.S. Advisory Committee on Immunization Practices (ACIP) recommends universal HPV vaccination for all 11-12 year-old girls and vaccination of all previously unvaccinated 13-26 year-old girls and women.[2] HPV vaccination could have a substantial public health impact globally. However, concerns have been raised about risk compensation after vaccination; that is, the possibility that adolescents who are vaccinated will practice riskier sexual behaviors.[3-8] It is unknown whether HPV vaccination will affect sexual behaviors, but some previous studies suggest that investigational HIV vaccines as well as highly active antiretroviral treatment (HAART) and effective post-exposure prophylaxis for HIV may lead to an increase in risky sexual behaviors or STI in some individuals.[9-13] In contrast, other studies show no increase in risky behaviors after HIV vaccination.[14]

If HPV vaccination does affect sexual behaviors, adolescent attitudes post-vaccination are likely to play a key role. Studies examining the impact of investigational HIV vaccines or HAART therapy on sexual behaviors suggest that the most important attitudes driving behaviors are risk perceptions.[12,13,15-22] For example, the strongest predictor of sexual risk behaviors in a study of HIV-positive men was whether the participants perceived that they were at less risk for HIV because of better HIV treatment options.[17] Among men who had sex with men participating in an HIV vaccine trial, perceived assignment to vaccine compared to placebo was associated with increased probability of unprotected anal sex during the trial.[13] Finally, in a longitudinal study of men who have sex with men, those who perceived less HIV/AIDS threat and less need for safer sexual behaviors since HAART became available were more likely to be positive for STIs other than HIV.[21]

The lack of data about the impact of HPV vaccination on adolescent risk perceptions and behaviors is problematic because less protective sexual behaviors post-vaccination could increase the risk of HPV-related disease caused by non-vaccine type HPVs, and could lead to increased rates of other STI. Less protective sexual behaviors are of particular concern in HIV-infected young women because of the risk of HIV transmission to their sexual partners. In addition, concerns about risk compensation after vaccination may adversely affect provider willingness to recommend HPV vaccines and parental agreement for their child to be vaccinated.[3,4,7,8] These concerns have also been noted in arguments against mandated immunization[5] and have been frequently cited in the media. Examination of risk perceptions after vaccination, as well as identification of modifiable factors that are associated with any misperceptions, will be critical in order to guide the development of evidence-based educational interventions that maximize the effectiveness of vaccination in preventing HPV-related disease. The findings may also have implications for the design of future HIV vaccine clinical trials.

Thus, we designed a study to examine risk perceptions after HPV vaccination in a cohort of HIV-infected adolescent and young adult women participating in an HPV vaccine trial. The aims of the study were 1) to determine whether perceived risk of HPV and other STI and perceived need for safer sexual behaviors changed as a result of vaccination, and 2) to determine whether baseline characteristics, knowledge and sexual behaviors were associated with perceived risk of HPV and other STI and perceived need for safer sexual behaviors. The hypotheses were: 1) immediately after HPV vaccination, most HIV-infected young women would report that safer sexual behaviors were still needed after vaccination, and 2) higher knowledge about HPV and HPV vaccines as well as less risky sexual behaviors at baseline would be associated with this perception.

Methods

Data for this study were collected at the baseline visit of a phase II, open-label, multi-center trial to evaluate the immunogenicity, safety, tolerability and behavioral impact of an HPV-6, -11, -16, -18 vaccine (Gardasil®) in 16- to 23-year-old HIV-infected young women. This trial was conducted by the Adolescent Medicine Trials Network for HIV/AIDS Interventions (ATN), and young women were recruited from 14 sites across the U.S. and Puerto Rico. These sites provide clinical care to HIV-infected individuals, and STI prevention resources are readily available. The trial took place between July 2008 and February 2011. Three doses of the vaccine were administered at day 0, week 8, and week 24. Immediately after the first vaccine dose was administered, participants completed a paper-and-pencil, self-administered, confidential questionnaire (sealed in an envelope by the participant to protect privacy) that assessed sociodemographic characteristics, knowledge, risk perceptions and sexual behaviors. The knowledge scale was developed by the investigators. Versions of the scale have been used in a number of different studies involving participants who were similar demographically to this population, including a series of studies designed to measure changes in knowledge after an HPV educational intervention.[23-25] Participants also underwent testing for CD4+ count and HIV viral load as well as trichomonas, gonorrhea and Chlamydia. Basic information about HPV and HPV vaccines was provided to participants as part of the informed consent process. The informed consent and assent noted that HPV is sexually transmitted, that there are multiple types of HPV, and that the available vaccines prevent only some types of HPV. The Institutional Review Board for each participating site approved the study.

Perceived susceptibility to HPV and other STIs and need for safer sexual behaviors after vaccination were assessed using three 5-item scales, adapted from previous studies (Cronbach's alpha 0.72-0.93).[17,19,21] Responses were on 11-point continuous scales where 0=strongly disagree and 10=strongly agree. Responses were summed to create three separate scale scores. Based on the distribution of responses, scales measuring perceived risk of HPV and other STIs were analyzed as continuous variables, and the scale measuring perceived need for safer sexual behaviors was analyzed as a dichotomous variable (≥ median scale score vs. < median scale score).

Unadjusted linear and logistic regression models were used to examine associations between baseline characteristics (including demographic characteristics; CD4+ count and viral load; knowledge about HPV and HPV vaccines; sexual behaviors; and STI diagnosis) and the three outcome variables: perceived risk of HPV, perceived risk of other STIs, and perceived need for safer sexual behaviors after vaccination. Variables associated with each of the three outcomes at $p < 0.25$ were eligible for inclusion in the multivariable regression models. A backward model selection approach was used to determine variables associated with the three outcomes.

Results

The mean age of participants was 21.4 years, and the majority was non-Hispanic black (Table 1). More than 85% of participants had a CD4+ count > 350 cells/mm^3, 40% had an HIV viral load of < 400 copies/mL, and 30% were taking HAART. The CD4+ count and HIV viral load data indicate that the majority of participants were not substantially immunosuppressed. More than one-third of participants reported ≥ 10 lifetime male sexual partners, 40% reported having had sex without a condom in the previous 90 days, and 13% were positive at baseline for trichomonas, gonorrhea, and/or Chlamydia.

Knowledge about HPV and HPV vaccines was generally poor: the mean percentage of correctly answered items was less than 50% (Table 2). More than half of women incorrectly believed that women who receive an HPV vaccine are protected 100% against cervical cancer and almost 20% believed that women who had been vaccinated no longer needed Pap tests.

Responses to the five individual items comprising the HPV risk perception scale (higher scores indicate higher perceived risk) ranged from 3.1 to 4.7 out of a possible 10 (Table 2). These were lower than responses to the five items comprising the STI risk perception scale (range 5.5 to 7.1) and the five items comprising the scale measuring need for safer sexual behaviors (range 8.5 to 9.4; higher scores indicate a stronger belief that safer sexual behaviors are still needed after vaccination). Most participants believed that they were at lower risk for HPV after vaccination (mean total scale score = 19.5 (SD: 12.5) out of a possible 50, median = 18). In contrast, most participants believed that they were *not* at lower risk for STIs other than HPV after vaccination (mean scale score = 31.2 (SD: 12.0), median = 32), and the vast majority of participants believed that there was still a need for safer sexual behaviors after vaccination (mean scale score = 43.1 (SD: 8.8), median = 47.5). A box plot demonstrating the mean scores for the 15 individual items and each of the three subscales is shown in the Figure. The maximum score, 75^{th} percentile, median, 25^{th} percentile, and minimum score for each item and subscale are also shown.

In unadjusted linear regression models (data not shown), higher number of lifetime male sexual partners was significantly ($p = .049$) associated with higher perceived risk of HPV after vaccination. In addition to number of lifetime male sexual partners, variables entered into the multivariable linear regression model (associated with the outcome at $p < 0.25$) included Hispanic origin, knowledge about HPV and HPV vaccines, CD4 count, and trichomonas infection at baseline. None of these covariates was retained in the final model at an alpha level of 0.05. In unadjusted linear regression models (data not shown), no variables were significantly associated with higher perceived risk of other STIs after vaccination, though knowledge about HPV and HPV vaccines was marginally associated with the outcome variable ($p = .086$).

Additional variables entered into the multivariable model (associated with the outcome at $p < 0.25$) included detectable HIV viral load, number of male sexual partners in the past 90 days, and frequency of vaginal sexual intercourse in the past 90 days. None of these covariates was retained in the final model at an alpha level of 0.05.

In unadjusted logistic regression models (Table 3), the two factors significantly associated with perceived need for safer sexual behaviors after HPV vaccination were higher knowledge about HPV and HPV vaccines and number of times (2-10 vs. 0) the participant had vaginal intercourse during the past 90 days. Additional variables entered into the multivariable linear regression model (associated with the outcome at $p < 0.25$) included age, CD4+ count, number of lifetime male sex partners, number of male sexual partners in the past 90 days, number of times the participant had vaginal sex during the previous 90

days without a condom, number of casual sex partners, condom use at last sex, and Chlamydia infection. The multivariable analyses indicated that only knowledge about HPV and HPV vaccines was associated with perceived need for safer sexual behaviors (OR 1.05, 95% CI 1.0-1.1). The results indicate that every 1-point increase on the knowledge scale score was associated with 5% greater odds of having a perceived need for safer sexual behaviors score ≥ the median scale score (vs. < the median scale score).

Discussion

In this sample of HIV-infected adolescent and young adult women receiving their first HPV vaccine dose in the context of a clinical trial, most participants believed that they were at lower risk for HPV but were still at risk for STIs other than HPV. These perceptions are appropriate, given that these young women had just received an HPV vaccine. However, a subset of participants incorrectly believed that they were at lower risk for STIs other than HPV after vaccination. It is not surprising that young women would have misperceptions about the outcomes of HPV vaccination, given the generally limited understanding about HPV infection and HPV vaccines in both adolescents and adults.[26] Even in this cohort of young women who were actively engaged in care and enrolled in a study of an HPV vaccine, knowledge about HPV and HPV vaccines was poor. In fact, better knowledge about HPV and HPV vaccines was marginally associated with young women's perception that they were still at risk for STIs other than HPV after vaccination. It is a significant challenge to provide accurate, comprehensive and developmentally-appropriate information about complex topics such as HPV infection and the impact of HPV vaccination during brief office visits. Office-or school-based educational interventions and public health initiatives are needed that clearly and effectively convey the specific benefits and limitations of HPV vaccination.[27]

Contrary to the concerns about riskier sexual behaviors after vaccination that have been noted by both clinicians and parents as barriers to vaccination[3,4,7,8] and that have figured prominently in the media, the vast majority of young women in this study believed that it was still important to practice safer sexual behaviors after vaccination. Communicating these reassuring findings to clinicians and parents may increase HPV vaccine acceptability, facilitate adolescent vaccination, and inform discussions about mandated HPV vaccination. It also may be helpful to communicate to clinicians that the potential for risk compensation among a very small percentage of individuals is not a justification to withhold vaccination, but instead suggests the need for appropriate education and counseling.

Higher knowledge about HPV and HPV vaccines was associated with perceived need for safer sexual behaviors in the multivariable model, consistent with the original hypothesis. This finding suggests that education may be an important strategy to promote safer sexual behaviors after vaccination. However, the finding that no demographic or behavioral factors were associated with perceived need for safer sexual behaviors demonstrates that in this study sample, the small subgroup of girls who believe they can practice riskier behaviors are not readily identifiable based on their characteristics. Similarly, no demographic or behavioral factors were associated with perceived risk of STIs after vaccination. These findings imply that effective counseling about STI prevention is important for all young women receiving the vaccine. Additional research is warranted to examine whether predictors of perceived need for safer sexual behaviors after vaccination can be identified in other groups of young women.

There are several limitations to this study. Although participants were recruited from across the U.S. and Puerto Rico, the study sample was small: the modest sample size may have limited the power of these analyses to detect associations between participant characteristics

and risk perceptions. In addition, participants were recruited in the context of an HPV vaccine clinical trial, engaged in care at sites that provide services to HIV-infected individuals, and had STI prevention resources available to them in these settings. Young women who are motivated to participate in research and who are receiving care in such settings may have different risk perceptions than other women. In addition, participants were recruited in the context of an HPV vaccine clinical trial and engaged in care: the relevance of these findings for young women receiving HPV vaccines in other clinical settings may be limited. Because participants were all HIV-infected, which may impact their baseline STI risk perceptions, the findings may not be generalizable to HIV-uninfected young women. Finally, the responses to items about perceived risk of STIs and perceived need for safer sexual practices after vaccination may be subject to social desirability bias, possibly leading to an underestimation of misperceptions after vaccination.

Despite these limitations, this study provides novel data regarding risk perceptions after HPV vaccination in young women, and has implications for the design of educational interventions in clinical settings as well as for future clinical trials of HIV and other STI vaccines. Further analyses will examine the impact of risk perceptions after vaccination on future sexual behaviors and STI acquisition, and facilitate the development of frameworks for understanding how attitudes about STI vaccines affect health-related behaviors after vaccination.

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Implications and Contribution

This study provides novel data regarding risk perceptions after HPV vaccination in young women. The vast majority of participants appropriately believed it was still important to practice safer sexual behaviors after vaccination, but educational interventions are needed for the subset that held misperceptions about protection against other sexually transmitted infections.

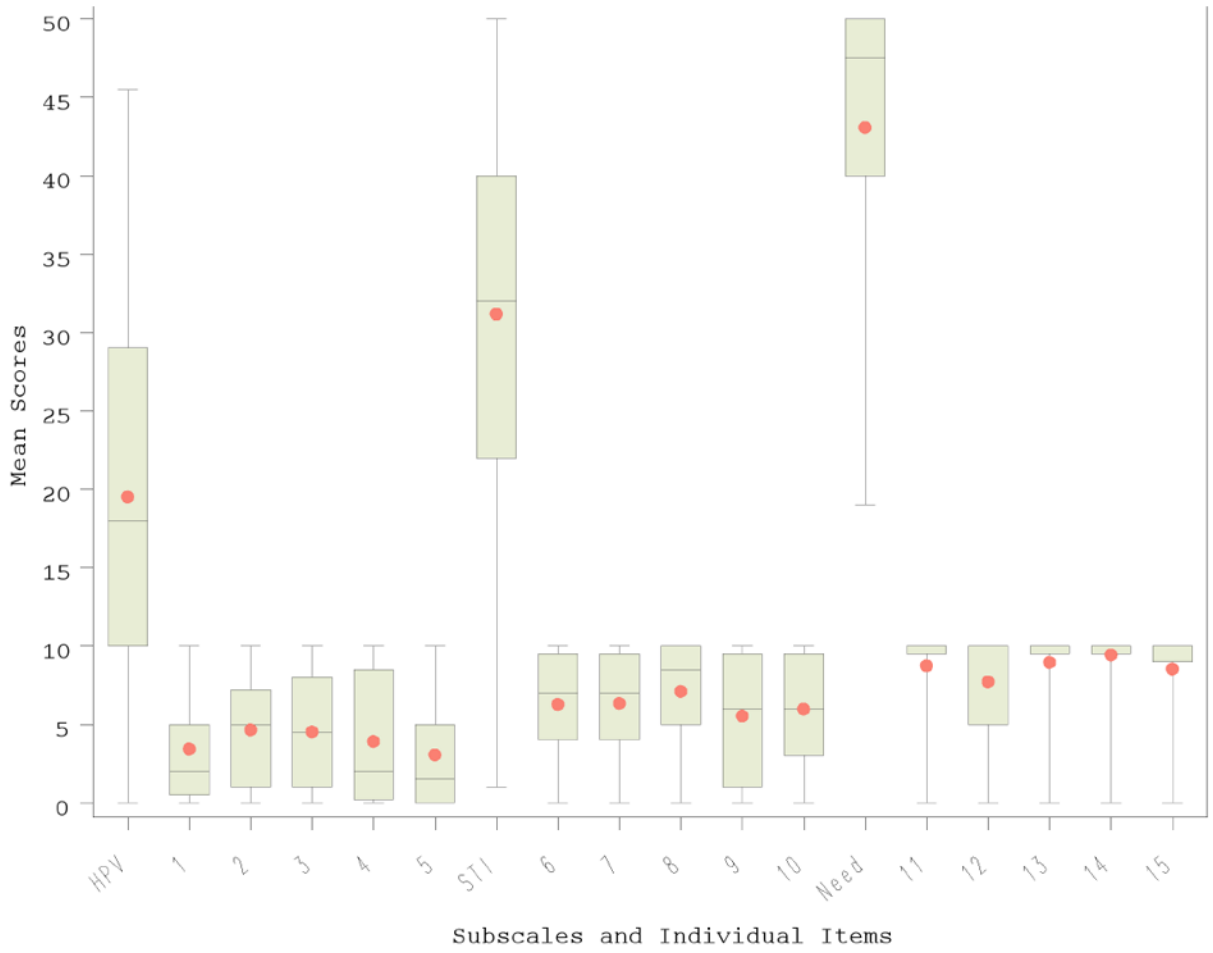

Figure 1.

Box plot demonstrating mean scores (circles), maximum score, 75th percentile, median, 25th percentile, and minimum score for the 15 individual items and each of the three subscales. The score range for each individual item is 0 to 10, and the items corresponding to each number are found in Table 2. The score range of each scale is 0 to 50, and each subscale score was computed by summing the scores of the five individual items comprising the subscale. The three subscales included: HPV (perceived risk of HPV infection after vaccination), STI (perceived risk of sexually transmitted infections other than HPV after vaccination), and Need (perceived need for safer sexual behaviors after vaccination).

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Table 1

Demographic and viral characteristics, sexual behaviors, and sexually transmitted infections in study participants (N=99)

	Mean (SD)	N (%)
Demographic and viral characteristics		
Age (years)	21.4 (2.0)	
Racial background		
Black/African American		79 (79.8)
White		10 (10.1)
Other/Mixed race		6 (6.1)
Unknown		4 (4.0)
Hispanic origin		
Non-Hispanic		83 (83.8)
Hispanic		16 (16.2)
CD4+ count (cells/mm^3), numeric	613.3 (271.1)	
CD4+ count (cells/mm^3), categorical		
<200		1 (1.0)
200-349		13 (13.1)
≥350		85 (85.9)
HIV viral load (copies/mL), numeric [1]	13284.9 (53207.9)	
HIV viral load (copies/mL), categorical		
<400		40 (40.4)
≥400		59 (59.6)
Sexual behaviors		
Number of male sexual partners, lifetime		
0-5		29 (30.2)
6-10		31 (32.3)
11+		36 (37.5)
Number of male sexual partners, past 90 days		
0		22 (22.4)
1		60 (61.2)
2+		16 (16.3)

	Mean (SD)	N (%)
Number of times had vaginal sex with male partner, past 90 days		
0		17 (18.5)
1		16 (17.4)
2-10		33 (35.9)
11+		26 (28.3)
Number of times had vaginal sex with male partner without a condom, past 90 days		
0		51 (52.6)
1		14 (14.4)
2-10		19 (19.6)
11+		13 (13.4)
Number of male vaginal sexual partners who did not use a condom, past 90 days		
0		58 (59.8)
1+		39 (40.2)
Number of main sexual partners, past 90 days		
0-1		92 (93.9)
2+		6 (6.1)
Number of casual sexual partners, past 90 days		
0-1		91 (92.9)
2+		7 (7.1)
Used condom during last sex with main partner		
Yes		72 (72.7)
No		23 (23.2)
Not applicable: main partner is female		4 (4.0)
Sexually transmitted infections		
Trichomonas		9 (9.3)
Gonorrhea		0 (0.0)
Chlamydia		5 (5.1)
At least one STI diagnosis positive		13 (13.1)

[1]Subjects with viral loads below detectable levels were not included in this calculation. Based on HIV-1 RNA viral load assays, the below detectable level varies, e.g. Abbott Real Time (<40 copies/mL), Roche Ultrasensitive (<50 copies/mL), and COBAS ® Amplipre (<48 copies/mL).

Table 2

Knowledge and risk perceptions of study participants (N=99)

	Mean (SD)	N (%)
Knowledge about HPV and HPV vaccines (percent correct responses)		
A person may be infected with HPV and not know it		94 (94.9)
HPV infection is often found or detected by a Pap test		83 (83.8)
Women who have received an HPV vaccine do not need Pap tests anymore		82 (82.8)
Women with HPV may need to get Pap tests more often than those without HPV		65 (65.7)
If a woman's male sexual partners use condoms, she is completely protected against HPV		46 (46.5)
Women who receive an HPV vaccine are protected 100% against cervical cancer		44 (44.4)
Cigarette smoking increases a woman's chance of getting cervical cancer if she has HPV		41 (41.4)
Genital warts always go away permanently if a woman gets the right treatment		39 (39.4)
HPV can be spread from person to person just by skin to skin genital contact		34 (34.3)
HPV can sometimes be cured with antibiotics		33 (33.3)
Most women with HPV have problems with their menstrual periods		16 (16.2)
HPV can cause problems getting pregnant		8 (8.1)
Knowledge scale score (mean percentage of items answered correctly)	49.2 (17.4)	
Risk Perceptions		
HPV risk perception total scale score (Cronbach's alpha 0.75) *1,2*	19.5 (12.5)	
After getting vaccinated against HPV:		
1 I am less worried about getting HPV (R)	3.4 (3.4)	
2 I am still just as concerned about getting HPV	4.7 (3.4)	
3 I think getting HPV will be less of a problem (R)	4.5 (3.6)	
4 I am less worried that one of my sex partners could get HPV from me (R)	3.9 (3.9)	
5 There is less of a chance that I will get HPV than there used to be (R)	3.1 (3.3)	
STI risk perception total scale score (Cronbach's alpha 0.72) *1,2*	31.2 (12.0)	
After getting vaccinated against HPV:		
6 I am less worried about getting an STI or STD other than HPV (R)	6.3 (3.4)	
7 I am still just as concerned about getting an STI or STD other than HPV	6.3 (3.5)	
8 I think getting an STI or STD other than HPV will be less of a problem (R)	7.1 (3.2)	
9 I am less worried that one of my sex partners could get an STI or STD other than HPV from me (R)	5.5 (4.0)	

	Mean (SD)	N (%)
10 There is less of a chance that will get an STI or STD other than HPV than there used to be (R)	6.0 (3.6)	
Need for safer sexual behaviors total scale score (Cronbach's alpha 0.64) [1,2]	43.1 (8.8)	
After getting vaccinated against HPV:		
11 I feel that condom use during sex is less necessary (R)	8.7 (2.6)	
12 I feel it is just as important to have as few sexual partners as possible	7.7 (3.7)	
13 I feel it is not as important to talk to my sex partners about safe sex (R)	9.0 (2.3)	
14 I think it is still just as important to use a condom every time I have sex.	9.4 (1.4)	
15 I will be less worried about having unprotected sex (R)	8.5 (2.9)	

[1]The possible score range for each subscale is 0 to 50.

[2]"R" following an item indicates that this item has been reversed before calculation. A higher scale score indicates a higher perceived risk of HPV, higher perceived risk of STIs other than HPV, or a greater perceived need for safer sexual behavior after vaccination.

Table 3

Associations between participant characteristics and perceived need for safer sexual behaviors: results of unadjusted logistic regression models

	NSSB Scale Score <47.5[1] n (%)	NSSB Scale Score ≥47.5[1] n (%)	OR (95% CI) [2]	p-value[2]
Age (years)[3]	47 (47.5)	52 (52.5)	1.14 (0.9 -1.4)	0.1979
Racial background				
Black/African American	38 (48.1)	41 (51.9)	0.72 (0.2 - 2.7)	0.6298
Other/Mixed race and Unknown	5 (50.0)	5 (50.0)	0.67 (0.1 - 3.9)	0.6537
White	4 (40.0)	6 (60.0)	1.00	
Hispanic origin				
Hispanic	8 (50.0)	8 (50.0)	0.89 (0.3 - 2.6)	0.8250
Non-Hispanic	39 (47.0)	44 (53.0)	1.00	
Knowledge about HPV and HPV vaccine[4]	47 (47.5)	52 (52.5)	1.05 (1.0 - 1.1)	**0.0012**
CD4+ Count (cells/mm^3)				
<350	4 (28.6)	10 (71.4)	2.56 (0.7 - 8.8)	0.1358
≥350	43 (50.6)	42 (49.4)	1.00	
HIV viral load (copies/mL)				
≥400	29 (49.2)	30 (50.8)	0.85 (0.4 - 1.9)	0.6848
<400	18 (45.0)	22 (55.0)	1.00	
Number of male sex partners, lifetime				
11+	18 (50.0)	18 (50.0)	1.23 (0.5 - 3.3)	0.6783
6-10	12 (38.7)	19 (61.3)	1.95 (0.7 - 5.5)	0.2036
0-5	16 (55.2)	13 (44.8)	1.00	
Number of male sex partners, past 90 days				
2+	6 (37.5)	10 (62.5)	2.41 (0.6 - 9.0)	0.1926
1	28 (46.7)	32 (53.3)	1.65 (0.6 - 4.4)	0.3209
0	13 (59.1)	9 (40.9)	1.00	
Number of times had vaginal sex with male partner, past 90 days				
11+	13 (50.0)	13 (50.0)	1.83 (0.5 - 6.4)	0.3447
2-10	11 (33.3)	22 (66.7)	3.67 (1.1 - 12.5)	**0.0385**
1	9 (56.3)	7 (43.8)	1.43 (0.4 - 5.8)	0.6199

	NSSB Scale Score <47.5[1] n (%)	NSSB Scale Score ≥47.5[1] n (%)	OR (95% CI) [2]	p-value[2]
0	11 (64.7)	6 (35.3)	1.00	
Number of times had vaginal sex with male partner without a condom, past 90 days				
11+	3 (23.1)	10 (76.9)	2.96 (0.7 - 12.0)	0.1290
2-10	11 (57.9)	8 (42.1)	0.65 (0.2 - 1.9)	0.4216
1	8 (57.1)	6 (42.9)	0.67 (0.2 - 2.2)	0.5053
0	24 (47.1)	27 (52.9)	1.00	
Number of male vaginal sex partners who did not use a condom, past 90 days				
1+	20 (51.3)	19 (48.7)	0.83 (0.4 - 1.9)	0.6478
0	27 (46.6)	31 (53.4)	1.00	
Number of main sex partners, past 90 days				
2+	4 (66.7)	2 (33.3)	0.42 (0.1 - 2.4)	0.3303
0-1	42 (45.7)	50 (54.3)	1.00	
Number of casual sex partners, past 90 days				
2+	5 (71.4)	2 (28.6)	0.33 (0.1 - 1.8)	0.1965
0-1	41 (45.1)	50 (54.9)	1.00	
Used condom during last sex with main partner				
No	9 (33.3)	18 (66.7)	2.24 (0.9 - 5.6)	0.0881
Yes	38 (52.8)	34 (47.2)	1.00	
Trichomonas				
Positive	3 (33.3)	6 (66.7)	1.83 (0.4 - 7.8)	0.4150
Negative	42 (47.7)	46 (52.3)	1.00	
Chlamydia				
Positive	4 (80.0)	1 (20.0)	0.21 (0.0 - 2.0)	0.1709
Negative	43 (45.7)	51 (54.3)	1.00	
At least one STI diagnosis positive				
Yes (≥1 STI positive)	6 (46.2)	7 (53.8)	1.06 (0.3 - 3.4)	0.9186
No (all STI negative)	41 (47.7)	45 (52.3)	1.00	

[1] NSSB = need for safer sexual behaviors; 47.5 is the median of the summary score.

[2] The probability modeled is an NSSB score of 47.5 or greater.

[3] Mean age for those with an NSSB score < 47.5 = 20.6 years; mean age for those with an NSSB score ≥ 47.5 = 21.2 years.

[4] Mean percentage of knowledge items answered correctly for those with an NSSB score < 47.5 = 42.9%; mean percentage for those with an NSSB score ≥ 47.5 = 55.0%.