Title

HIV-Infected Young Men Demonstrate Appropriate Risk Perceptions and Beliefs about Safer Sexual Behaviors after Human Papillomavirus Vaccination

Journal

AIDS and Behavior, 22(6)

ISSN

1090-7165

Authors

Kahn, Jessica A
Lee, Jeannette
Belzer, Marvin
et al.

Publication Date

2018-06-01

DOI

10.1007/s10461-017-1710-0

Peer reviewed

HHS Public Access

Author manuscript

AIDS Behav. Author manuscript; available in PMC 2019 June 01.

Published in final edited form as:

AIDS Behav. 2018 June ; 22(6): 1826–1834. doi:10.1007/s10461-017-1710-0.

HIV-Infected Young Men Demonstrate Appropriate Risk Perceptions and Beliefs about Safer Sexual Behaviors after Human Papillomavirus Vaccination

Jessica A. Kahn[1], **Jeannette Lee**[2], **Marvin Belzer**[3], and **Joel M. Palefsky**[4] **for the AIDS Malignancy Consortium and Adolescent Medicine Trials Network for HIV/AIDS Interventions**

[1]Department of Pediatrics, Cincinnati Children's Hospital Medical Center and the University of Cincinnati College of Medicine, Cincinnati, OH

[2]Department of Biostatistics, University of Arkansas for Medical Sciences, Little Rock, AR

[3]Department of Pediatrics, University of Southern California, Los Angeles, CA

[4]Department of Medicine, University of California San Francisco, San Francisco, CA

Abstract

The aim of this study was to identify risk perceptions after human papillomavirus (HPV) vaccination among HIV-infected young men who have sex with men. On average, participants appropriately perceived themselves to be at lower than neutral risk for HPV (mean subscale score 4.2/10), at higher than neutral risk for other sexually transmitted infections (7.0/10), and that safer sexual behaviors were still important (8.5/10). Higher perceived risk of HPV was associated with African-American race (p=.03); higher perceived risk of other sexually transmitted infections with White race (p=.01) and higher knowledge about HPV (p=.001); and higher perceived need for safer sexual behaviors with consistent condom use (p=.02). The study provides reassuring data that HIV-infected young men who have sex with men generally have appropriate risk perceptions and believe that safer sexual behaviors after vaccination are still important. These findings mirror the results of studies in HIV-infected young women and HIV-uninfected adolescents.

Keywords

human papillomavirus; vaccine; HIV; adolescent; risk perceptions

Corresponding Author: Jessica A. Kahn, MD MPH, Division of Adolescent Medicine, MLC 4000, Cincinnati Children's Hospital Medical Center, 3333 Burnet Avenue, Cincinnati, OH 45229, Phone (513) 636-2970, Fax (513) 636-1129, jessica.kahn@cchmc.org.

Disclosure of potential conflicts of interest. Dr. Kahn has received research funding from Merck & Co. for clinical trials of the quadrivalent HPV vaccine in HIV-infected men and women; the trials were NIH-funded and Merck & Co. provided vaccine and immunogenicity testing. Dr. Belzer received research funding from ViiV Healthcare. Dr. Palefsky has received travel support and research support from Merck & Co. and serves on the scientific advisory boards for Agenovir Corporation, Antiva Biosciences, and The Vax. Dr. Lee reports has no conflict of interest.

Ethical approval. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. This article does not contain any studies with animals performed by any of the authors.

Introduction

Human papillomavirus (HPV) is a common sexually transmitted infection (STI) that may cause oral and anogenital cancers in both women and men. In men living in developed countries, the combined prevalence of HPV-associated oral, penile, and anal cancers is similar to that of cervical cancer in women.(1) HIV-infected men who have sex with men (MSM) are at substantially higher risk than HIV-uninfected men for anogenital HPV infection and progression to anal cancer.(2, 3) Two prophylactic HPV vaccines that protect against the HPV types most commonly associated with male anogenital cancers are now licensed for use in men, and the U.S. Advisory Committee on Immunization Practices (ACIP) recommends routine HPV vaccination at age 11 or 12 years, with catch-up vaccination for men 13 through 21 years who have not been vaccinated previously, and vaccination for men at high risk for HPV, including MSM and HIV-infected men, 22 through 26 years.(4, 5)

HPV vaccination could substantially decrease anogenital cancer prevalence and mortality in HIV-infected men and MSM. However, risk compensation after vaccination; i.e., the practice of riskier sexual behaviors among vaccinated men due to a perception of decreased risk, could diminish the health benefits of vaccination. Studies of risk compensation after HPV vaccination in women have not demonstrated a change in sexual behaviors or biological outcomes such as STI diagnosis after HPV vaccination, as summarized recently by Kasting et al.(6) However, several previous studies conducted primarily in men have demonstrated that HIV prevention methods such as investigational HIV vaccines, antiretroviral therapy, male circumcision, and post-exposure prophylaxis for HIV may lead to an increase in risky sexual behaviors or STIs.(7–12) Findings are inconsistent: other studies show no changes in behaviors after these interventions.(13, 14) Studies that have examined the effect of investigational HIV vaccines or antiretroviral therapy on sexual behaviors suggest that risk perceptions; that is, perceived risk of HIV, mediated the effect on behaviors.(8–11, 15–19)

If HIV-infected men inappropriately perceive a lower risk of STIs other than HPV or a reduced need for safer sexual behaviors after HPV vaccination, and if these risk perceptions lead to less safe sexual behaviors, this could increase the risk of HPV-related disease caused by non-vaccine type HPVs or other STIs. Concerns about risk compensation after vaccination may also impact provider recommendations for HPV vaccines and parental acceptability of vaccination.(20–23) Examination of risk perceptions after vaccination and identification of any factors associated with misperceptions are important for the development of educational and public health messages to prevent riskier behaviors after vaccination.

We therefore conducted a study to examine risk perceptions after HPV vaccination in a cohort of young HIV-infected MSM participating in an HPV vaccine clinical trial. The aim of the study was to characterize young men’s risk perceptions after the first HPV vaccine dose and to determine whether risk perceptions were associated with sociodemographic characteristics, knowledge, sexual behaviors, STI diagnosis, CD4+ T-cell count, and HIV viral load.

Methods

Data for this study were collected at the baseline visit of a phase II, open-label, multi-center trial of the quadrivalent HPV (6, 11, 16, 18) vaccine in 13- to 26-year-old HIV-infected MSM. This trial was conducted by the AIDS Malignancy Consortium (AMC) in collaboration with the Adolescent Medicine Trials Network for HIV/AIDS Interventions (ATN). Young men were recruited from 15 U.S. sites between 2012 and 2015. A self-administered, paper-and-pencil questionnaire was completed by all participants after the first vaccine dose that measured sociodemographic characteristics, knowledge about HPV and HPV vaccines, smoking, condom use, and risk perceptions. The 5-item knowledge scale was adapted from previous scales developed by the investigators that have been used in several studies.(24–26) The 15-item risk perception scale was comprised of three 5-item subscales that assessed changes in perceived susceptibility to HPV, perceived susceptibility to other STIs, and need for safer sexual behaviors after HPV vaccination. Each of the scale items was preceded by the following stem: “After getting vaccinated against HPV …” For example, “After getting vaccinated against HPV, I am still just as concerned about getting HPV” or “After getting vaccinated against HPV, there is less of a chance that I will get an STI or STD other than HPV than there used to be.” In this way, the items assessed whether the participants’ self-reported risk perceptions or need for safer sexual behaviors had changed after vaccination. The subscales and items were originally adapted from the literature on HIV risk perceptions after the introduction of antiretroviral therapy or an investigational HIV vaccine,(9, 16, 18) and were used in several previous studies of HPV vaccines, including in HIV-infected young women.(27–30) Responses to each item were on 11-point continuous scales (0=strongly disagree, 5=neither agree nor disagree, and 10=strongly agree) and the mean of the responses for each of the five items within each subscale was calculated to create three separate mean subscale scores, which were analyzed as continuous variables. Some items were reverse-scored because of the direction in which they were worded, so that higher scores indicated higher perceived risk and lower scores indicated lower perceived risk. Summary subscale scores were also calculated (representing the mean of the sum of the individual items) so that subscale scores could be compared to previous studies in other populations. Participants also underwent testing for CD4+ count, HIV viral load, gonorrhea and Chlamydia. The Institutional Review Board for each participating site approved the study.

One-way analysis of variance (ANOVA) was used to determine if each of the three risk perception subscales (perceived risk of HPV, perceived risk of other STIs, and perceived need for safer sexual behaviors after vaccination) was associated with sociodemographic factors, smoking, sexual behaviors (number of male and female sexual partners, frequency of condom use), STI diagnosis, HIV viral load and CD4 T-cell count. A generalized linear model was used to determine whether each of the three risk perception subscales was associated with knowledge. The parameter estimate and standard error were derived from this generalized linear model; a significant association was detected if the slope for the independent variable of knowledge was significantly different from zero.

In order to determine if the mean scores for each subscale differed significantly from 5, which is the neutral score for each of the subscales, one-sample t-tests were used to compare

the mean subscale scores for each of the three subscales to 5. This was done for each of the covariates.

Results

The mean age of the 142 participants was 23.0 years (standard deviation or SD 2.0), 83 (56.5%) were Black, and 36 (24.5%) were Latino; race and ethnicity were assessed using separate items. Sixty-three (44.3%) reported smoking during the previous month and 75 (51.0%) reported more than one male sexual partner in the previous 6 months. The CD4+ T cell count was at least 350 cells/mm^3 in 59 (40.1%) of participants, and the HIV viral load was less than 400 in 131 (89.1%) of participants. Urine specimens were positive for Gonorrhea in 1 (0.7%) participant and for Chlamydia in 6 (4.1%) participants.

The proportion of correct responses to questions assessing knowledge about HPV and HPV vaccines ranged from 40% to 98%. Almost all participants (98%) responded correctly that HPV infection may be asymptomatic, while 70% responded correctly that HPV could be transmitted by skin-to-skin genital contact, 65% responded correctly that condom use does not completely protect against HPV acquisition, 61% responded correctly that genital warts may not resolve permanently after treatment, and 40% responded correctly that HPV infection cannot be cured with antibiotics. The mean knowledge scale score was 3.3 (SD 1.3) out of a possible 5.0. Cronbach's alpha values for the risk perception subscales were as follows (Table 1): 0.72 for the HPV risk perception subscale, 0.75 for the STI risk perception subscale, and 0.64 for the need for safer sexual behavior subscale. The mean responses to the five individual items comprising the HPV risk perception subscale ranged from 3.5 to 5.2 out of a possible 10. These were lower than responses to the five items comprising the STI risk perception subscale (range of means 6.3 to 7.7): higher scores on both subscales indicated higher perceived risk. Scores were even higher for the five items comprising the subscale measuring need for safer sexual behaviors (range of means 7.5 to 9.1): higher scores indicated a stronger belief that safer sexual behaviors are still needed after vaccination. The finding that the range of scores was narrow demonstrated that there was not wide variation in the way in which participants responded to the items within each subscale. The mean score for the subscale measuring perceived risk for HPV after vaccination was 4.2 out of a possible 10; a mean score less than 5 indicated lower perceived risk on average. In contrast, the mean score for the subscale measuring perceived risk for STIs other than HPV after vaccination was 7.0; a mean score greater than 5 indicated higher perceived risk on average. These results suggest that on average, participants perceived themselves to be at lower risk for HPV, but did not perceive themselves to be at lower risk for other STIs. A paired t-test was used to compare the mean scale scores for perceived risk of HPV vs. perceived risk of other STIs: the mean difference was −2.8 ($p < .001$), indicating that the perceived risk of other STIs was significantly higher than the perceived risk of HPV. The mean score for the subscale measuring need for safer sexual behaviors after vaccination was 8.5; a mean score greater than 5 indicates a higher perceived need for safer sexual behaviors. We also calculated summary mean subscale scores (i.e. the mean of the sum of the subscale items) so that the results could be compared to the results of previous studies that calculated subscale scores in this way, and summary subscale scores and standard errors

were as follows: perceived risk of HPV (score 21.1/50), perceived risk of other STIs (score 34.4/50), and perceived need for safer sexual behaviors (score 42.1/50).

ANOVA demonstrated that higher perceived risk of HPV was associated with African-American race (p=.03), higher perceived risk of other STIs with White race (p=.01), and higher perceived need for safer sexual behaviors with consistent condom use (p=.02) (Table 2). Generalized linear models demonstrated that the only risk perception subscale significantly associated with higher knowledge was higher perceived risk of other STIs (parameter estimate 0.48, standard error 0.15, p = .001). Multivariable modeling was not conducted because only one variable was associated with two of the three outcomes in the univariable analyses.

The results of the one-sample t-tests to compare the mean subscale scores for each of the three subscales to 5, in order to determine if the mean scores for each subscale differed significantly from the neutral score, are shown in Table 3. For all covariates, the mean minus 5 for perceived risk of HPV was negative, indicating a lower perceived risk of HPV on average. In contrast, the mean minus 5 for perceived risk of other STIs and perceived need for safer sexual behaviors was positive, indicating a higher perceived risk of STIs and a higher perceived need for safer sexual behaviors on average. The mean subscale scores generally differed significantly from neutral scores, with a few exceptions (10/66 or 15% of all comparisons): 7 of these exceptions were comparisons involving the perceived risk of HPV subscale, and the other 3 were comparisons involving the perceived risk of other STIs subscale. All comparisons involving the need for safer sexual behaviors subscale were significant.

Discussion

In this study, we characterized young men's risk perceptions after HPV vaccination and determined whether sociodemographic factors, knowledge, behaviors, STI diagnosis, HIV viral load and CD4 T-cell count were associated with risk perceptions. To our knowledge, this is the first study of risk perceptions after HPV vaccination in young HIV-infected MSM.

Participants appropriately perceived themselves to be at lower than neutral risk for HPV and at higher than neutral risk for other sexually transmitted infections, on average. These findings are similar to those of previous studies utilizing the same subscales, among 16–23 year-old HIV-infected young women participating in a clinical trial of the quadrivalent HPV vaccine and 13–21 year-old HIV-uninfected women recruited from clinical settings. The summary scale score was actually higher (34.4/50) in HIV-infected young MSM compared with HIV-infected young women (31.2/50)(27) and HIV-uninfected young women (30.5/50),(28) suggesting that young men had slightly more appropriate perceptions of risk about other STIs overall. However, some participants in this study, as in previous studies, believed that they were at lower risk for other STIs after HPV vaccination. Although previous literature is not consistent, some studies suggest that other prevention modalities such as HIV vaccines, antiretroviral therapy and post-exposure prophylaxis for HIV may lead to an increase in risky sexual behaviors or STIs,(7–12) and that risk perceptions mediate the effect on behavioral changes.(8–11, 15–19) Our findings, in combination with those of previous

studies, support the importance of educational interventions to provide accurate information about the limits of HPV vaccine effectiveness. Misperceptions about protection against other STIs could lead to behaviors that would increase the risk of HPV-related disease caused by non-vaccine type HPVs or other STIs, though it is encouraging that in a recent longitudinal study of young women, lower perceived risk of other STIs was not associated with less consistent condom use, higher number of sexual partners, or STI diagnosis over the 30 months following vaccination.(30) The importance of education at the time of vaccination is underscored by results demonstrating a positive association between higher knowledge about HPV and more appropriate risk perceptions about STIs other than HPV.

Participants generally perceived that safer sexual behaviors were still important after HPV vaccination. This finding is reassuring and is consistent with the results of previous studies conducted in HIV-infected women and others.(6, 27–29, 31) The summary scale score measuring perceived need for safer sexual behaviors in young HIV-infected MSM (42.1/50) was almost identical to the scores in HIV-infected young women (43.1/50)(27) and HIV-uninfected young women (42.5/50).(28) Communicating this finding to clinicians may improve their ability to reassure parents and may enhance the strength of their vaccine recommendations, and communicating this finding to parents may increase HPV vaccine acceptability and rates of uptake. Not surprisingly, perceived need for safer sexual behaviors was associated with condom use in young men.(32) The fact that no demographic or other factors were associated with perceived need for safer sexual behaviors is similar to the findings of previous studies, and demonstrates that the small group of young men who do not believe that safer sexual behaviors are as important after vaccination are not readily identifiable based on their characteristics; thus, effective counseling about safer sexual behaviors is important for all young men. Although knowledge about HPV was not associated with perceived need for safer sexual behaviors, the knowledge scale did not measure knowledge about the need for safer sexual behaviors after vaccination. Therefore, the lack of an association does not preclude the importance of educational strategies to encourage safer sexual behaviors after vaccination. Strategies to target those young men who perceive less of a need for safer sexual behaviors after vaccination could include a direct assessment of this perception at the time of vaccination, and enhanced counseling of those men who endorse this belief.

There are several limitations to this study. Participants were recruited from sites across the U.S., but the study sample was small which limits the power to detect associations between risk perceptions and outcome variables. Therefore, caution should be exercised in interpreting univariable associations for which there are a small number of participants in specific categories. Participants were HIV-infected MSM with relatively low HIV viral load and relatively high CD4+ T-cell count who were willing to participate in a clinical trial; therefore, their risk perceptions may differ from those of other men, limiting generalizability. However, the fact that findings were very similar to those in studies enrolling other populations suggests that the findings may be generalizable. As with all studies assessing need for safer sexual practices after vaccination, social desirability bias may lead to an underestimate of misperceptions after vaccination. Finally, we did not assess whether the use of biomedical HIV prevention strategies such as pre-exposure prophylaxis

influence perceptions of risk and need for safer sexual behaviors after HPV vaccination, an important area for future research.

In conclusion, this study provides novel data about risk perceptions after the first HPV vaccine dose in young HIV-infected men who have sex with men. The study provides reassuring data that young men generally believe that safer sexual behaviors after vaccination are still important. However, the finding that a subset of participants believe that HPV vaccination protects against other STIs – and that there was a positive association between appropriate perception of risk about protection against other STIs and knowledge about HPV – underscores the importance of educational interventions in clinical settings and in clinical trials of HIV and other STI vaccines.

Acknowledgments

This study was supported by the AIDS Malignancies Consortium (AMC) from the National Cancer Institute (UM1CA121974). The following AMC sites participated in this study: Boston Medical Center (E. Stier), Washington University School of Medicine (L. Ratner, G. Bucher), UCSD Moores Cancer Center (W. Wachsman, E. Cachay, A. Sitapati), Laser Surgery Center (S. Goldstone, D. Worrall), UCSF Medical Center Mount Zion (L. Kaplan, M. Berry, N. Jay, J. Palefsky, M. Rubin), Thomas Street Clinic (E. Chiao), Wake Forest University Health Sciences (L. Barroso, L. Bachmann), and University of Puerto Rico (M. Tirado-Gomez, H. Guiot). This work was also supported by The Adolescent Trials Network for HIV/AIDS Interventions (ATN) from the National Institutes of Health [U01 HD 040533 and U01 HD 040474] through the National Institute of Child Health and Human Development (B. Kapogiannis, L. Serchuck), with supplemental funding from the National Institutes on Drug Abuse (N. Borek) and Mental Health (P. Brouwers, S. Allison). The study was scientifically reviewed by the ATN's Therapeutic Leadership Group. Network, scientific and logistical support was provided by the ATN Coordinating Center (C. Wilson, C. Partlow) at The University of Alabama at Birmingham. Network operations and analytic support was provided by the ATN Data and Operations Center at Westat, Inc. (J. Korelitz, B. Driver). The following ATN sites participated in this study: John H. Stroger Jr. Hospital of Cook County (Martinez, Bojan), Montefiore Medical Center (Futterman, Campos), St. Jude's Children's Research Hospital (Flynn, Dillard), Children's Hospital of Los Angeles (Belzer, Tucker), Baylor College of Medicine (Paul, Head), The Fenway Institute (Mayer, Dormitzer), and the University of Colorado, Denver (Reirden, Chambers). The investigators are grateful to the members of the local youth Community Advisory Boards for their insight and counsel and are indebted to the youth who participated in this study. The comments and views of the authors do not necessarily represent the views of the Eunice Kennedy Shriver National Institute of Child Health and Human Development. Vaccine and HPV Mean Geometric Titers were provided through the Investigator-Initiated Studies Program of Merck & Co., Inc. The opinions expressed in this paper are those of the authors and do not necessarily represent those of Merck & Co., Inc.

Funding. This study was funded by the AIDS Malignancies Consortium (AMC) from the National Cancer Institute (UM1CA121974). This work was also supported by The Adolescent Trials Network for HIV/AIDS Interventions (ATN) from the National Institutes of Health (U01 HD 040533 and U01 HD 040474) through the National Institute of Child Health and Human Development. Vaccine and HPV Mean Geometric Titers were provided through the Investigator-Initiated Studies Program of Merck & Co., Inc.

References

1. Palefsky JM. Human papillomavirus-related disease in men: not just a women's issue. J Adolesc Health. 2010; 46(4 Suppl):S12–9. [PubMed: 20307839]
2. Piketty C, Selinger-Leneman H, Grabar S, Duvivier C, Bonmarchand M, Abramowitz L, et al. Marked increase in the incidence of invasive anal cancer among HIV-infected patients despite treatment with combination antiretroviral therapy. AIDS. 2008; 22(10):1203–11. [PubMed: 18525266]
3. D'Souza G, Wiley DJ, Li X, Chmiel JS, Margolick JB, Cranston RD, et al. Incidence and epidemiology of anal cancer in the multicenter AIDS cohort study. J Acquir Immune Defic Syndr. 2008; 48(4):491–9. [PubMed: 18614927]
4. Markowitz LE, Dunne EF, Saraiya M, Chesson HW, Curtis CR, Gee J, et al. Human papillomavirus vaccination: 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. 2014; 63(RR-05):1–30.

5. Petrosky E, Bocchini JA Jr, Hariri S, Chesson H, Curtis CR, Saraiya M, et al. Use of 9-valent human papillomavirus (HPV) vaccine: updated HPV vaccination recommendations of the advisory committee on immunization practices. MMWR Morb Mortal Wkly Rep. 2015; 64(11):300–4. [PubMed: 25811679]
6. Kasting ML, Shapiro GK, Rosberger Z, Kahn JA, Zimet GD. Tempest in a teapot: A systematic review of HPV vaccination and risk compensation research. Human vaccines & immunotherapeutics. 2016; 12(6):1435–50. [PubMed: 26864126]
7. Chesney MA, Chambers DB, Kahn JO. Risk behavior for HIV infection in participants in preventive HIV vaccine trials: a cautionary note. Journal of acquired immune deficiency syndromes and human retrovirology : official publication of the International Retrovirology Association. 1997; 16(4):266–71.
8. Stolte G, Dukers NH, de Wit JB, Fennema H, Coutinho RA. A summary report from Amsterdam: increase in sexually transmitted diseases and risky sexual behaviour among homosexual men in relation to the introduction of new anti-HIV drugs. Euro Surveill. 2002; 7(2):19–22.
9. Stolte IG, Dukers NH, Geskus RB, Coutinho RA, de Wit JB. Homosexual men change to risky sex when perceiving less threat of HIV/AIDS since availability of highly active antiretroviral therapy: a longitudinal study. Aids. 2004; 18(2):303–9. [PubMed: 15075549]
10. Wilson TE, Gore ME, Greenblatt R, Cohen M, Minkoff H, Silver S, et al. Changes in sexual behavior among HIV-infected women after initiation of HAART. Am J Public Health. 2004; 94(7): 1141–6. [PubMed: 15226134]
11. Bartholow BN, Buchbinder S, Celum C, Goli V, Koblin B, Para M, et al. HIV sexual risk behavior over 36 months of follow-up in the world's first HIV vaccine efficacy trial. J Acquir Immune Defic Syndr. 2005; 39(1):90–101. [PubMed: 15851919]
12. Kibira SP, Nansubuga E, Tumwesigye NM, Atuyambe LM, Makumbi F. Differences in risky sexual behaviors and HIV prevalence of circumcised and uncircumcised men in Uganda: evidence from a 2011 cross-sectional national survey. Reproductive health. 2014; 11(1):25. [PubMed: 24656204]
13. Lampinen TM, Chan K, Remis RS, Merid MF, Rusch M, Vincelette J, et al. Sexual risk behaviour of Canadian participants in the first efficacy trial of a preventive HIV-1 vaccine. CMAJ. 2005; 172(4):479–83. [PubMed: 15710939]
14. Westercamp N, Agot K, Jaoko W, Bailey RC. Risk compensation following male circumcision: results from a two-year prospective cohort study of recently circumcised and uncircumcised men in Nyanza Province, Kenya. AIDS and behavior. 2014; 18(9):1764–75. [PubMed: 25047688]
15. Ostrow DE, Fox KJ, Chmiel JS, Silvestre A, Visscher BR, Vanable PA, et al. Attitudes towards highly active antiretroviral therapy are associated with sexual risk taking among HIV-infected and uninfected homosexual men. Aids. 2002; 16(5):775–80. [PubMed: 11964534]
16. Vanable PA, Ostrow DG, McKirnan DJ. Viral load and HIV treatment attitudes as correlates of sexual risk behavior among HIV-positive gay men. J Psychosom Res. 2003; 54(3):263–9. [PubMed: 12614836]
17. Stolte IG, de Wit JB, van Eeden A, Coutinho RA, Dukers NH. Perceived viral load, but not actual HIV-1-RNA load, is associated with sexual risk behaviour among HIV-infected homosexual men. Aids. 2004; 18(14):1943–9. [PubMed: 15353980]
18. van der Snoek EM, de Wit JB, Mulder PG, van der Meijden WI. Incidence of sexually transmitted diseases and HIV infection related to perceived HIV/AIDS threat since highly active antiretroviral therapy availability in men who have sex with men. Sex Transm Dis. 2005; 32(3):170–5. [PubMed: 15729154]
19. Elford J. Changing patterns of sexual behaviour in the era of highly active antiretroviral therapy. Curr Opin Infect Dis. 2006; 19(1):26–32. [PubMed: 16374214]
20. Davis K, Dickman ED, Ferris D, Dias JK. Human papillomavirus vaccine acceptability among parents of 10- to 15-year-old adolescents. J Low Genit Tract Dis. 2004; 8(3):188–94. [PubMed: 15874862]

21. Kahn JA, Zimet GD, Bernstein DI, Riedesel JM, Lan D, Huang B, et al. Pediatricians' intention to administer human papillomavirus vaccine: the role of practice characteristics, knowledge, and attitudes. J Adolesc Health. 2005; 37(6):502–10. [PubMed: 16310128]
22. Kahn JA, Ding L, Huang B, Zimet GD, Rosenthal SL, Frazier AL. Mothers' intention for their daughters and themselves to receive the human papillomavirus vaccine: a national study of nurses. Pediatrics. 2009; 123(6):1439–45. [PubMed: 19482752]
23. Kahn JA, Cooper HP, Vadaparampil ST, Pence BC, Weinberg AD, LoCoco SJ, et al. Human papillomavirus vaccine recommendations and agreement with mandated human papillomavirus vaccination for 11-to-12-year-old girls: a statewide survey of Texas physicians. Cancer Epidemiol Biomarkers Prev. 2009; 18(8):2325–32. [PubMed: 19661092]
24. Wetzel C, Tissot A, Kollar LM, Hillard PA, Stone R, Kahn JA. Development of an HPV Educational Protocol for Adolescents. J Pediatr Adolesc Gynecol. 2007; 20(5):281–7. [PubMed: 17868894]
25. Kahn JA, Rosenthal SL, Jin Y, Huang B, Namakydoust A, Zimet GD. Rates of human papillomavirus vaccination, attitudes about vaccination, and human papillomavirus prevalence in young women. Obstet Gynecol. 2008; 111(5):1103–10. [PubMed: 18448742]
26. Conroy K, Rosenthal SL, Zimet GD, Jin Y, Bernstein DI, Glynn S, et al. Human papillomavirus vaccine uptake, predictors of vaccination, and self-reported barriers to vaccination. J Womens Health (Larchmt). 2009; 18(10):1679–86. [PubMed: 19785564]
27. Kahn JA, Xu J, Zimet GD, Liu N, Gonin R, Dillard ME, et al. Risk perceptions after human papillomavirus vaccination in HIV-infected adolescents and young adult women. J Adolesc Health. 2012; 50(5):464–70. [PubMed: 22525109]
28. Mullins TL, Zimet GD, Rosenthal SL, Morrow C, Ding L, Shew M, et al. Adolescent perceptions of risk and need for safer sexual behaviors after first human papillomavirus vaccination. Arch Pediatr Adolesc Med. 2012; 166(1):82–8. [PubMed: 22213755]
29. Mayhew A, Mullins TL, Ding L, Rosenthal SL, Zimet GD, Morrow C, et al. Risk perceptions and subsequent sexual behaviors after HPV vaccination in adolescents. Pediatrics. 2014; 133(3):404–11. [PubMed: 24488747]
30. Mullins TL, Zimet GD, Rosenthal SL, Morrow C, Ding L, Huang B, et al. Human papillomavirus vaccine-related risk perceptions and subsequent sexual behaviors and sexually transmitted infections among vaccinated adolescent women. Vaccine. 2016
31. Mullins TL, Widdice LE, Rosenthal SL, Zimet GD, Kahn JA. Risk perceptions, sexual attitudes, and sexual behavior after HPV vaccination in 11-12 year-old girls. Vaccine. 2015; 33(32):3907–12. [PubMed: 26116249]
32. Johnson WD, Diaz RM, Flanders WD, Goodman M, Hill AN, Holtgrave D, et al. Behavioral interventions to reduce risk for sexual transmission of HIV among men who have sex with men. The Cochrane database of systematic reviews. 2008; (3):CD001230. [PubMed: 18646068]

Table 1

Descriptive data for three subscales and 15 items measuring perceived risk of human papillomavirus (HPV), perceived risk of sexually transmitted infections (STIs) other than HPV, and perceived need for safer sexual behaviors, after HPV vaccination

Subscales and items	Mean subscale score[a, b] (SE[c])	Total subscale score[d] (SD)[e]	Cronbach's alpha	Mean item score[a, b]
Perceived risk of HPV	4.2 (2.3)	21.1 (11.3)	0.72	
After getting vaccinated against HPV…				
I am less worried about getting HPV				3.5 (3.0)
I am still just as concerned about getting HPV				5.2 (3.3)
I think getting HPV will be less of a problem				4.6 (3.6)
I am less worried that one of my sex partners could get HPV from me				4.3 (3.4)
There is less of a chance that I will get HPV than there used to be				3.5 (3.1)
Perceived risk of STIs other than HPV	7.0 (2.2)	34.4 (11.5)	0.75	
After getting vaccinated against HPV…				
I am less worried about getting an STI or STD other than HPV				7.0 (3.3)
I am still just as concerned about getting an STI or STD other than HPV				7.7 (2.8)
I think getting an STI or STD other than HPV will be less of a problem				7.2 (3.1)
I am less worried that one of my sex partners could get an STI or STD other than HPV from me				6.3 (3.5)
There is less of a chance that I will get an STI or STD other than HPV than there used to be				6.5 (3.3)
Perceived need for safer sexual behaviors	8.5 (1.7)	42.1 (8.8)	0.64	
After getting vaccinated against HPV…				
I feel that condom use during sex is less necessary				8.7 (2.5)
I feel it is still just as important to have as few sexual partners as possible				7.5 (3.4)
I feel it is not as important to talk to my sex partners about safe sex				8.7 (2.7)
I think it is still just as important to use a condom every time I have sex				9.1 (2.2)
I will be less worried about having unprotected sex				8.3 (2.8)

[a] Out of a possible 10

[b] Reverse-scored if appropriate: higher scores on subscales and items indicate higher perceived risk or higher perceived need for safer sexual behaviors

[c] SE = standard error

[d] Out of a possible 50

[e] SD = standard deviation

AIDS Behav. Author manuscript; available in PMC 2019 June 01.

Table 2

Associations between risk perceptions and other variables: univariable analyses

	Perceived risk of HPV	P value[c]	Perceived risk of other STIs	P value	Perceived need safer sexual behaviors	P value
Age (years) – *mean*[a] *(SD)*[b]						
≤ 21 years (n=30)	4.8 (1.8)	.09	7.3 (2.2)	.38	9.0 (1.4)	.07
> 21 years (n=112)	4.0 (2.3)		6.9 (2.3)		8.3 (1.8)	
Race – *mean (SD)*						
Black/African American (n=80)	4.6 (2.5)	**.03**	6.6 (2.4)	**.01**	8.6 (1.7)	.19
White/Other (n=62)	3.7 (1.9)		7.5 (2.0)		8.3 (1.8)	
Hispanic origin – *mean (SD)*						
Hispanic (n=36)	3.8 (2.0)	.20	7.2 (2.1)	.60	8.7 (1.5)	.31
Non-Hispanic (n=106)	4.4 (2.3)		6.9 (2.4)		8.4 (1.8)	
CD4+ Count (cells/mm^3) – *mean (SD)*						
< 200 (n=18)	4.9 (2.6)	.21	6.3 (2.4)	.42	8.2 (1.8)	.75
201–349 (n=62)	3.9 (2.1)		7.0 (2.2)		8.6 (1.8)	
≥ 350 (n=58)	4.4 (2.3)		7.1 (2.4)		8.4 (1.7)	
HIV viral load (copies/mL) – *mean (SD)*						
≥400 (n=14)	3.7 (2.4)	.33	6.1 (2.7)	.14	7.7 (2.4)	.08
<400 (n=128)	4.3 (2.2)		7.1 (2.3)		8.6 (1.6)	
STI[d] (Chlamydia or gonorrhea) – *mean (SD)*						
Yes (n=6)	3.5 (2.8)	.47	6.3 (4.0)	.43	8.9 (1.5)	.52
No (n=133)	4.2 (2.2)		7.0 (2.2)		8.5 (1.7)	
Male sexual partners, lifetime – *mean (SD)*						
1 (n=54)	4.3 (2.2)	.71	6.6(2.5)	.15	8.6 (1.6)	.64
2–5 (n=55)	4.0 (2.1)		7.5 (2.0)		8.4 (1.9)	
6+ (n=22)	4.5 (2.2)		7.3 (1.9)		8.2 (1.8)	
Female sexual partners, past 6 months – *mean (SD)*						
Yes (n=8)	4.2 (2.7)	.95	5.7 (3.0)	.10	9.5 (1.5)	.09
No (n=132)	4.2 (2.2)		7.1 (2.2)		8.4 (1.7)	
Condom use – *mean (SD)*						
Always (n=57)	4.0 (2.2)	.39	6.7 (2.6)	.20	8.9 (1.5)	**.02**

	Perceived risk of HPV	P value[c]	Perceived risk of other STIs	P value	Perceived need safer sexual behaviors	P value
Sometimes/never (n=85)	4.3 (2.3)		7.2 (2.0)		8.2 (1.8)	
Smoked past 30 days – *mean (SD)*						
Yes (n=63)	4.4 (2.2)	.39	7.0 (2.3)	1.0	8.3 (1.9)	.20
No (n=79)	4.1 (2.3)		7.0 (2.3)		8.6 (1.6)	
Knowledge about HPV –*parameter estimate (standard error)*[e]	−0.11 (.15)	.46	0.48 (.15)	**.001**	.06 (.11)	.60

Statistical note: degrees of freedom were 1 for all comparisons with the exception of the CD4 T cell count category and number of male sexual partner category, for which the degrees of freedom were 2

[a] Mean refers to mean subscale score

[b] SD = standard deviation

[c] One-way analysis of variance (ANOVA) was used to determine if each of the three risk perception subscales was associated with each independent variable except knowledge scale score

[d] STI = sexually transmitted infection

[e] A generalized linear model was used to determine whether each of the three risk perception subscales was associated with knowledge. The parameter estimate and standard error were derived from this generalized linear model; a significant association was detected if the slope for the independent variable of knowledge was significantly different from zero. Higher knowledge about HPV was significantly associated with higher perceived risk of other STIs.

Table 3

Comparison of mean subscale scores for each of the three subscales to 5, the neutral score for each subscale[a]

	Perceived risk of HPV: mean minus 5	P value	Perceived risk of other STIs: mean minus 5	P value	Perceived safer sexual mean	P value
Age (years)						
≤ 21 years (n=30)	−0.18	0.60	2.31	<.0001	3.97	<.0001
> 21 years (n=112)	−0.96	<.0001	1.90	<.0001	3.33	<.0001
Race						
Black/African American (n=80)	−0.42	0.13	1.57	<.0001	3.63	<.0001
White/Other (n=62)	−1.27	<.0001	2.53	<.0001	3.25	<.0001
Hispanic origin						
Hispanic (n=36)	−1.21	.001	2.16	<.0001	3.72	<.0001
Non-Hispanic (n=106)	−0.65	.005	1.93	<.0001	3.3	<.0001
CD4+ Count (cells/mm^3)						
< 200 (n=18)	−0.083	0.89	1.29	.04	3.22	<.0001
201–349 (n=62)	−1.10	<.0001	2.03	<.0001	3.55	<.0001
≥ 350 (n=58)	−0.63	.046	2.08	<.0001	3.38	<.0001
HIV viral load (copies/mL)						
≥400 (n=14)	−1.35	.055	1.14	0.07	2.70	.0009
<400 (n=128)	−0.73	.0003	2.08	<.0001	3.55	<.0001
STI[b] (Chlamydia or gonorrhea)						
Yes (n=6)	−1.47	0.26	1.27	0.47	3.93	.001
No (n=133)	−0.78	<.0001	2.02	<.0001	3.47	<.0001
Male sexual partners, lifetime						
1 (n=54)	−0.74	.02	1.64	<.0001	3.57	<.0001
2–5 (n=55)	−0.97	.002	2.46	<.0001	3.39	<.0001
6+ (n=22)	−0.53	.27	2.31	<.0001	3.15	<.0001
Female sexual partners, past 6 months						
Yes (n=8)	−0.83	0.41	0.70	0.54	4.45	<.0001
No (n=132)	−0.78	.0001	2.05	<.0001	3.39	<.0001
Condom use						
Always (n=57)	−0.99	.001	1.69	<.0001	3.89	<.0001

	Perceived risk of HPV: mean minus 5	P value	Perceived risk of other STIs: mean minus 5	P value	Perceived safer sexual mean	P value
Sometimes/never (n=85)	−0.66	.009	2.19	<.0001	3.18	<.0001
Smoked past 30 days						
Yes (n=63)	−0.61	.03	1.99	<.0001	3.26	<.0001
No (n=79)	−0.94	.0005	1.99	<.0001	3.63	<.0001

[a]Differences calculated using a one-sample t-test

[b]STI = sexually transmitted infection