



Contents lists available at ScienceDirect

Vaccine

journal homepage: www.elsevier.com/locate/vaccine

Human papillomavirus vaccine-related risk perceptions and subsequent sexual behaviors and sexually transmitted infections among vaccinated adolescent women

Tanya L. Kowalczyk Mullins^{a,b,*}, Gregory D. Zimet^c, Susan L. Rosenthal^d, Charlene Morrow^a, Lili Ding^e, Bin Huang^e, Jessica A. Kahn^{a,b}

^a Division of Adolescent and Transition Medicine, Department of Pediatrics, Cincinnati Children's Hospital Medical Center, 3333 Burnet Ave MLC 4000, Cincinnati, OH 45229, USA

^b University of Cincinnati College of Medicine, 231 Albert Sabin Way, Cincinnati, OH 45267, USA

^c Division of Adolescent Medicine, Indiana University, 410 West 10th Street, HS 1001, Indianapolis, IN 46202, USA

^d Departments of Pediatrics and Psychiatry, Columbia University and New York Presbyterian Morgan Stanley Children's Hospital, 622 West 168 Street, Vanderbilt Clinic 4th Floor – Room 402, New York, NY 10032, USA

^e Division of Biostatistics and Epidemiology, Cincinnati Children's Hospital Medical Center, 3333 Burnet Ave MLC 5041, Cincinnati, OH 45229, USA

ARTICLE INFO

Article history:

Received 15 March 2016

Received in revised form 27 May 2016

Accepted 3 June 2016

Available online xxxxx

Keywords:

Papillomavirus vaccines

Adolescent

Sexual behavior

Longitudinal study

Survey study

Sexually transmitted infections (STIs)

ABSTRACT

Objective: To examine the association between risk perceptions after human papillomavirus (HPV) vaccination and sexual behaviors and sexually transmitted infection (STI) diagnosis over 30 months following vaccination.

Methods: Participants included 112 sexually experienced girls aged 13–21 years who were enrolled at the time of first HPV vaccination and completed ≥ 2 of 4 follow-up visits at 2, 6, 18, 30 months and including 30 months. At each visit, participants completed surveys assessing risk perceptions (perceived need for safer sexual behaviors, perceived risk of STIs other than HPV) and sexual behaviors. STI testing was done at 6, 18, and 30 months. Outcomes were condom use at last intercourse with main male partner, number of sexual partners since last study visit, and STI diagnosis. Associations between risk perceptions and sexual behaviors/STIs were examined using generalized linear mixed models.

Results: Mean age was 17.9 years; 88% were Black; 49% had a history of STI at baseline. Scale scores for perceived need for safer sexual behaviors did not change significantly over time. Scale scores for perceived risk of STIs other than HPV significantly changed ($p = 0.027$), indicating that girls perceived themselves to be more at risk of STIs other than HPV over 30 months following vaccination. Multivariable models demonstrated that greater perceived need for safer sexual behaviors following vaccination was associated with condom use ($p = 0.002$) but not with number of partners or STI diagnosis. Perceived risk of STIs other than HPV was not associated with the three outcomes.

Conclusions: The finding that perceived risk for STIs other than HPV was not associated with subsequent sexual behaviors or STI diagnosis is reassuring. The association between perceived need for safer sexual behaviors and subsequent condom use suggests that the HPV vaccination visit is an important opportunity to reiterate the importance of safer sexual behaviors to sexually experienced girls.

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1. Introduction

Despite published Advisory Committee on Immunization Practices (ACIP) recommendations for routine prophylactic vaccination against human papillomavirus (HPV) for girls since 2007 [1], overall uptake remains suboptimal [2]. One contributing factor may be concern about the impact of vaccination on sexual behaviors. Concerns have been raised by parents [3–7] and clinicians [8,9] that some girls who received the HPV vaccine may incorrectly perceive

Abbreviations: ACIP, Advisory Committee on Immunization Practices; HPV, human papillomavirus; STIs, sexually transmitted infections.

* Corresponding author at: Division of Adolescent and Transition Medicine, MLC 4000, Cincinnati Children's Hospital Medical Center, 3333 Burnet Ave, Cincinnati, OH 45229, USA.

E-mail address: tanya.mullins@cchmc.org (T.L.K. Mullins).

<http://dx.doi.org/10.1016/j.vaccine.2016.06.026>

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themselves to be at less risk of sexually transmitted infections (STIs) other than HPV and thus may engage in riskier sexual behaviors.

Risk homeostasis theory proposes that individuals adjust their behavior based on their perceived level of risk of an outcome (risk perceptions) and the level of risk that they are willing to assume [10,11]. This theory has been used to examine sexual behaviors among people who are at risk of STIs and human immunodeficiency virus (HIV) infection. The theory posits that individuals who perceive that their risk of a negative outcome is low (for example, after receiving a preventive intervention like HPV vaccination) may participate in less safe behaviors [12,13]. Studies have shown that risk perceptions play an important role in sexual behaviors [14–16], although studies of sexual behaviors following primary HIV prevention interventions have generally not demonstrated an increase in risky behaviors [16,17]. Because risk perceptions may influence behavior, it is critical to understand HPV vaccine-related risk perceptions and whether these perceptions impact behavior among adolescent girls who have been vaccinated against HPV.

To our knowledge, no studies have examined longitudinally the association between adolescent risk perceptions at the time of HPV vaccination and subsequent sexual behaviors and STI diagnosis. Data demonstrating that risk perceptions influence subsequent sexual behaviors or STI diagnoses may provide guidance for educational interventions that can be provided at the time of HPV vaccination. Therefore, the aim of the current study was to examine the associations between HPV vaccine-related risk perceptions and subsequent sexual behaviors and STI diagnosis over the 30 months following the first HPV vaccine dose among sexually experienced 13–21 year-old girls. We hypothesized that greater perceived need for safer sexual behaviors and greater perceived risk of STIs other than HPV would be associated with condom use at last sexual intercourse, fewer sexual partners, and fewer STI diagnoses.

2. Methods

Data for this analysis were drawn from a longitudinal study of 339 13–21 year-old girls, consecutively recruited from an urban, hospital-based adolescent primary care office within 2 days of receipt of their first HPV vaccine dose. Recruitment took place from 2008 to 2010, and participants were followed longitudinally until 2013. Consent was obtained from girls who were 18 years of age or older, and parental permission (in person or by phone) and assent from the girl was obtained for younger girls. Study staff contacted mothers or female legal guardians of all participants to invite them to enroll in the study; mothers provided consent for their participation. The study received approval from the hospital's institutional review board.

Overall, 195 girls were sexually experienced at the baseline visit. Participants eligible for this analysis were the 112 sexually experienced girls who completed the baseline visit, the final 30-month visit, and at least 1 of the 3 intervening visits at 2, 6, and 18 months (i.e. completed at least 3 of 5 study visits, including the first and last study visits). Girls who were eligible for and included in this analysis differed from girls who were not eligible for this analysis by race (fewer white girls [8.0% of girls who were eligible for analysis vs. 15.7% of girls who were not eligible]; more black girls [88.4% of girls who were eligible for the analysis vs. 72.3% who were not eligible]; $p = 0.012$) and reported number of lifetime sexual partners (28% of girls eligible for analysis vs. 14% of girls not eligible for analysis reported 0–1 sexual partner; $p = 0.02$); there were no significant differences in age, insurance status, reported condom use at last sexual intercourse with main male partner, smoking in the past month, lifetime alcohol use, or

reported history of HPV or other STI. At each visit, girls completed self-administered surveys assessing HPV vaccine-related risk perceptions (perceived need for safer sexual behaviors, perceived risk of STIs other than HPV) and interim sexual behaviors. Sixty-two mothers completed surveys in person or by phone at baseline only. Survey constructs were derived from models of health behavior, including the Theory of Planned Behavior [18] and the Health Belief Model [19]. Specific items and scales assessing knowledge and attitudes were adapted from previously validated surveys in similar populations [20]. Primary predictor variables (HPV vaccine-related risk perceptions) were perceived risk of STIs other than HPV and perceived need for safer sexual behaviors, each of which was measured with a scale comprised of 5 items. Risk perceptions scales were adapted from scales measuring HIV/AIDS risk perceptions and HIV treatment attitudes [21–23]. In order to capture risk perceptions related to HPV vaccination, each item was presented in the context of “getting vaccinated (the shot) against HPV” (see Table 1, footnotes e and f). Responses to each of the 5 items were measured using a 10-point visual analog scale ranging from “strongly disagree” to “strongly agree”, with a neutral option in the middle of the scale. The mean response to all scale items was calculated, yielding a scale score which could range from 0 to 10. Higher scale scores indicated lower perceived risk of STIs and less perceived need for safer sexual behaviors; some scale items were reverse scored to maintain this interpretation. Mean scale scores were dichotomized for analysis into top tertile (lowest perceived risk of STIs, lowest perceived need for safer sexual behaviors) vs. lower two tertiles (greater perceived risk of STIs, greater perceived need for safer sexual behaviors) in order to examine the impact of the most risky attitudes on sexual behavior and STI diagnoses. Covariates included participant demographics, substance use (alcohol, marijuana, tobacco), HPV and HPV vaccine knowledge (10 items assessing knowledge of HPV [24] and three items assessing knowledge about the HPV vaccine), and patient reported lifetime history of HPV (including genital warts) or other STI at baseline. Maternal factors that were associated with perceived need for safer sexual behaviors among girls at baseline were entered as covariates as well. These were maternal knowledge about HPV and the HPV vaccine and maternal report of the source of HPV vaccine information (i.e., where mother obtained information about the HPV vaccine) and communication with the daughter about the HPV vaccine [20]. Outcomes were sexual behaviors and laboratory diagnosis of STIs over the 30 months following HPV vaccination, specifically: (1) condom use at last intercourse with main male partner (“condom use”) [25]; (2) number of sexual partners since last study visit (“sexual partners”); and (3) laboratory diagnosis of gonorrhea, chlamydia, and/or trichomonas at any visit (“positive STI testing”). Girls were tested for *Neisseria gonorrhoeae*, *Chlamydia trachomatis*, and *Trichomonas vaginalis* at the 6, 18, and 30 month visits.

Descriptive analyses were performed to examine participant characteristics, HPV vaccine-related risk perceptions, sexual behaviors, and STI diagnosis. Linear mixed effects models examined changes in HPV vaccine-related risk perceptions (perceived risk of STIs other than HPV and perceived need for safer sexual behaviors after vaccination) over the 30 months of the study. The associations between predictor variables (i.e. perceived risk of STIs other than HPV, perceived need for safer sexual behaviors), covariates, and sexual behaviors/STI outcomes were examined using generalized linear mixed effects models, which account for time-varying covariates. We examined separate univariable and multivariable models for each of the three outcomes (condom use, number of sexual partners, and positive STI testing). Predictors or covariates that were associated with an outcome at $p < 0.10$ in univariable analyses were included in the multivariable mixed

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