Risk Perceptions and Subsequent Sexual Behaviors After HPV Vaccination in Adolescents
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Risk Perceptions and Subsequent Sexual Behaviors After HPV Vaccination in Adolescents

WHAT’S KNOWN ON THIS SUBJECT: Concerns have been raised that human papillomavirus (HPV) vaccination could lead to riskier behaviors in vaccinated adolescents, but it is unknown whether changes in risk perceptions after vaccination lead to riskier sexual behaviors.

WHAT THIS STUDY ADDS: Risk perceptions following HPV vaccination were not associated with subsequent riskier sexual behaviors in sexually experienced and inexperienced young women. These data contribute to the growing evidence that HPV vaccination does not lead to changes in sexual behaviors among adolescents.

OBJECTIVES: Concerns have been raised that human papillomavirus (HPV) vaccination could lead to altered risk perceptions and an increase in risky sexual behaviors among adolescents. The aim of this study was to assess whether adolescent risk perceptions after the first vaccine dose predicted subsequent sexual behaviors.

METHODS: Young women 13 to 21 years of age (N = 339) completed questionnaires immediately after HPV vaccination, and 2 and 6 months later, assessing demographic characteristics, knowledge/attitudes about HPV vaccination, risk perceptions, and sexual behaviors. Risk perceptions were measured by using 2 5-item scales assessing: (1) perceived risk of sexually transmitted infections (STI) other than HPV, and (2) perceived need for safer sexual behaviors after HPV vaccination. We assessed associations between risk perceptions at baseline and sexual behaviors over the next 6 months by using logistic regression, stratifying participants by sexual experience at baseline and age (13–15 vs 16–21 years).

RESULTS: Among all sexually inexperienced participants (42.5%), baseline risk perceptions were not associated with subsequent sexual initiation; in age-stratified analyses, girls 16 to 21 years of age who reported lower perceived risk for other STI (an inappropriate perception) were less likely to initiate sex (odds ratio [OR] 0.13, 95% confidence interval [CI] 0.03–0.69). Among all sexually experienced participants (57.5%) and in age-stratified analyses, baseline risk perceptions were not associated with subsequent number of sexual partners or condom use.

CONCLUSIONS: Risk perceptions after HPV vaccination were not associated with riskier sexual behaviors over the subsequent 6 months in this study sample. Pediatrics 2014;133:1–8
Human papillomavirus (HPV) infection is extremely common, affecting an estimated 7.5 million females between the ages of 14 and 24 years in the United States, with a peak prevalence of 44.8% among 20- to 24-year-olds. Two prophylactic HPV vaccines are widely available: a bivalent and a quadrivalent vaccine. Both prevent the 2 HPV types (HPV-16 and -18) that cause ∼70% of cervical cancers, and the quadrivalent vaccine prevents 2 types (HPV-6 and -11) that cause ∼80% of anogenital warts. The US Advisory Committee on Immunization Practices (ACIP) currently recommends the bivalent and quadrivalent vaccines for girls and women 11 to 26 years of age, and recommends the quadrivalent vaccine for all boys 11 to 21 years of age and men 22 to 26 years of age who are at high risk for HPV.

Despite the known effectiveness of HPV vaccines, concerns have been raised among parents and clinicians that HPV vaccination of adolescents could lead to riskier sexual behaviors, placing adolescents at higher risk for acquiring non-vaccine type HPVs and other sexually transmitted infections (STIs), and in turn diminishing the positive public health benefits of vaccination. These concerns are consistent with risk homeostasis theory, which suggests that individuals maintain a desired level of health risk by continually evaluating and adjusting their risk perceptions and risk behaviors. Concerns about riskier behaviors after HPV vaccination may derive in part from previous studies of HIV-infected individuals that suggested receipt of an experimental HIV vaccine or initiation of highly active antiretroviral therapy impacted subsequent sexual behaviors or STI diagnosis. Decreased perceived risk for acquiring or transmitting HIV appeared to be a significant factor driving these associations. However, the evidence supporting risk homeostasis theory has been mixed overall, and whether it applies in any given circumstance likely depends on the disease, the nature of the health behavior, the characteristics of the population, and the perceptions of personal risk.

We previously examined risk perceptions after HPV vaccination and found that although few adolescent girls reported less need for safer sexual behaviors after receipt of their first vaccine dose, 23.6% reported decreased perceived risk for acquiring STIs other than HPV. To our knowledge, no longitudinal studies have examined whether risk perceptions after HPV vaccination are associated with a change in sexual behaviors. Further understanding of this association is important to address parental and clinician concerns and enable clinicians to provide tailored counseling to patients receiving the vaccine, to maximize the positive health impact of this intervention. Thus, the aim of this study was to examine whether adolescent risk perceptions at the time of first HPV vaccine dose predicted sexual behaviors 2 and 6 months after vaccination. We hypothesized that adolescent perceptions of less need to practice safer sexual behaviors and reduced susceptibility to STIs other than HPV as a result of vaccination would be associated with riskier sexual behaviors.

**METHODS**

**Participants**

Girls 13 to 21 years of age receiving care at a hospital-based adolescent primary care center, who had received the first HPV vaccine dose within the previous 2 days, were eligible to participate in this longitudinal study. For participants ≥18 years of age, we obtained consent to participate, and for those <18 years of age, we obtained participant assent and parental permission to participate. All participants received $15 for participation in the baseline study visit and $25 for the 2- and 6-month visits. This study was reviewed and approved by the hospital’s Institutional Review Board.

**Procedures**

Before vaccination, participants were given standard written information and recommendations regarding HPV and HPV vaccines by clinicians, and vaccines were administered based on the clinic protocol. After vaccination, participants completed previously validated paper-and-pencil surveys assessing demographic characteristics, knowledge and attitudes regarding HPV and HPV vaccination, risk perceptions, and sexual behaviors. Participants returned 2 and 6 months after the initial vaccine dose to complete follow-up surveys and receive the second and third doses of the HPV vaccine, per vaccination guidelines.

**Measures**

Sexual experience was assessed by using the following item: “Have you ever had sex with a male or female (by sex we mean vaginal or anal sex)?” Participants were stratified for analysis based on self-reported sexual experience at baseline. The primary independent variables for this analysis were two 5-item risk perceptions scales measured at baseline: (1) perceived risk for STIs other than HPV after vaccination, and (2) perceived need for safer sexual behaviors after vaccination. To assess risk perceptions using these scales, participants were asked to respond to statements on a 10-point continuous scale where 0 indicated that the participant strongly disagreed with the statement and 10 indicated that she strongly agreed with the statement. Some items were reverse-scored so that lower scores indicated more appropriate risk perceptions.
(ie, perception that there is still a risk for STIs other than HPV after vaccination, and perception that safer sexual behaviors are still important after vaccination). Mean and median scale scores were calculated for each of the risk perception subscales, and sub-scales were dichotomized for analysis into the top tertile versus the lower 2 tertiles. Other independent variables included age, self-reported race and ethnicity, insurance coverage, smoking, substance use, and HPV knowledge. Dependent variables were sexual behaviors measured at 2 and 6 months. For participants who were sexually in-experienced at baseline, the dependent variable was sexual initiation as reported at 2 and 6 months, dichotomized for analysis into those who initiated versus did not initiate sex. For participants who identified as sexually experienced at baseline, the dependent variables included number of sexual partners and condom use at last sexual intercourse as reported at 2 and 6 months. Both were dichotomized for analysis: number of sexual partners was dichotomized as ≥2 versus <2, and condom use at last sexual intercourse was dichotomized as no versus yes.

Analysis
Descriptive analyses were performed to examine participant characteristics, risk perceptions, and sexual behaviors. Univariable logistic regression was used to assess associations between independent variables (participant characteristics and risk perceptions) assessed at baseline and sexual behaviors assessed at 2 and 6 months. For logistic regression analyses, participants were stratified by sexual experience at baseline and by age (13–15 and 16–21 years).

RESULTS
A total of 339 young women were recruited for the study. Of those, 280 (82.6%) returned for the 2-month follow-up visit and 258 (76.1%) returned for the 6-month follow-up visit. Compared with those who did not return at 2 and 6 months, those who did return differed only in terms of insurance status: those who returned were more likely than those who did not to have health insurance (86.4% vs 74.6% at 2 months and 86.4% vs 77% at 6 months, \( P < .05 \) for both comparisons). Those who returned at 2 and 6 months did not differ from those who did not return in terms of race, ethnicity, sexual behaviors, or risk perceptions.

Participants’ demographic characteristics, substance use, and knowledge about HPV and HPV vaccines are shown in Table 1, and participants’ sexual behaviors are shown in Table 2. Seventy-five percent reported that they were black, 17% white (including 4% of Appalachian descent), and 3% Hispanic. At baseline, 195 participants (57.5%) were sexually experienced, and of those, the majority of participants (74.8%) reported ≥1 lifetime male partner. Of the remaining 144 participants (42.5%) who were sexually inexperienced, few (8.3%) reported previous sexual contact (ie, genital, skin-to-skin contact only). The mean age of participants was 16.8 years, and those who were sexually experienced were significantly older than those who were sexually inexperienced. Sexually experienced compared with inexperienced participants also had significantly greater knowledge about HPV and HPV vaccines, and were significantly more likely to report tobacco, alcohol, and marijuana use. Among sexually experienced participants, age was positively associated with lifetime number of sexual partners (\( P < .0001 \)) and inversely associated with report of condom use at baseline (\( P = .004 \)) and 6 months (\( P = .008 \) (data not shown). Age was positively associated with report of alcohol use at baseline (\( P = .02 \)).

Marijuana use, alcohol use, and smoking frequency during the past 30 days were positively associated with lifetime number of sexual partners reported at baseline (\( P = .006, 0.002, \) and 0.049, respectively), and marijuana use at baseline was associated with number of recent sexual partners reported at baseline (\( P = .02 \)) and 6 months (\( P = .03 \)).

As described in a previous manuscript, immediately after vaccination the majority of participants did not perceive decreased risk for STIs other than HPV and did not perceive less need for safer sexual behaviors. We found no significant differences in mean scale scores for perceived risk for other STIs or perceived need for safer sexual behaviors. We found no significant differences in mean scale scores for perceived risk for other STIs or perceived need for safer sexual behaviors after vaccination among sexually experienced versus sexually inexperienced participants (Table 3). Age was not associated with perceived risk for other STIs or perceived need for safer sexual behaviors.

The primary outcome measures for this study were sexual risk behaviors at 2 and 6 months. Of those who were sexually inexperienced at baseline, 20.2% (20/99) initiated sex during the 6-month study period: 6.9% (8/116) between 0 and 2 months and 12.1% (12/99) between 2 and 6 months. Missing data account for the variation in denominators. Among sexually experienced participants at baseline, most (61.8% at 2 months and 62.7% at 6 months) reported having used a condom at last intercourse and a minority (21.8% at 2 months and 34.8% at 6 months) reported 2 or more partners since the last study visit.

Univariable analyses demonstrated that there were no significant associations between risk perceptions and subsequent sexual behaviors among all sexually inexperienced and all sexually experienced participants (Table 4). Among participants who were sexually
### TABLE 1 Demographic Characteristics, Substance Use, and Knowledge at Baseline Among Study Participants

<table>
<thead>
<tr>
<th>Demographic characteristics</th>
<th>All (n = 339)</th>
<th>Sexually Experienced at Baseline (n = 195)</th>
<th>Sexually Inexperienced at Baseline (n = 144)</th>
<th>P value*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N (%)</td>
<td>Mean (SD)</td>
<td>N (%)</td>
<td>Mean (SD)</td>
</tr>
<tr>
<td>Age</td>
<td>16.8 (2.5)</td>
<td>18.1 (2.2)</td>
<td>15.0 (1.4)</td>
<td>&lt; 0.0001</td>
</tr>
<tr>
<td>Race</td>
<td>C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>56339 (16.5)</td>
<td>22195 (11.3)</td>
<td>34144 (23.6)</td>
<td>&lt; 0.0001</td>
</tr>
<tr>
<td>Black</td>
<td>259339 (76.4)</td>
<td>159195 (81.5)</td>
<td>100144 (69.4)</td>
<td>&lt; 0.0001</td>
</tr>
<tr>
<td>Other</td>
<td>24339 (7.1)</td>
<td>14195 (7.2)</td>
<td>10144 (6.9)</td>
<td>&lt; 0.0001</td>
</tr>
<tr>
<td>Hispanic</td>
<td>11339 (3.2)</td>
<td>10195 (5.1)</td>
<td>1144 (0.7)</td>
<td>&lt; 0.0001</td>
</tr>
<tr>
<td>Appalachian descent</td>
<td>13339 (3.8)</td>
<td>4195 (2.1)</td>
<td>9144 (6.3)</td>
<td>&lt; 0.0001</td>
</tr>
<tr>
<td>Have health insurance</td>
<td>286339 (84.4)</td>
<td>162195 (83.1)</td>
<td>124144 (86.1)</td>
<td>&lt; 0.0001</td>
</tr>
<tr>
<td>Substance use</td>
<td>C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ever smoked &gt;100 cigarettes</td>
<td>34339 (10.0)</td>
<td>30195 (15.4)</td>
<td>4144 (2.8)</td>
<td>&lt; 0.0001</td>
</tr>
<tr>
<td>smoked &gt;1 d in past month</td>
<td>40339 (11.8)</td>
<td>36195 (18.5)</td>
<td>4144 (2.8)</td>
<td>&lt; 0.0001</td>
</tr>
<tr>
<td>Alcohol: ever used</td>
<td>170339 (50.2)</td>
<td>125195 (64.1)</td>
<td>45144 (51.3)</td>
<td>&lt; 0.0001</td>
</tr>
<tr>
<td>Marijuana: ever used</td>
<td>69339 (20.4)</td>
<td>65195 (33.3)</td>
<td>4144 (2.8)</td>
<td>&lt; 0.0001</td>
</tr>
<tr>
<td>Knowledge about HPV and HPV vaccines</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Knowledge (12-item scale)</td>
<td>5.3 (2.6)</td>
<td>5.6 (2.7)</td>
<td>4.9 (2.4)</td>
<td>0.02</td>
</tr>
</tbody>
</table>

*P value represents the comparison between sexually experienced and sexually inexperienced participants; a χ² or Fisher’s Exact test was used to compare proportions and a Wilcoxon or t test to compare means.

### TABLE 2 Sexual Behaviors Among Study Participants at Baseline, 2 Months, and 6 Months

<table>
<thead>
<tr>
<th>Sexual Behaviors</th>
<th>All (n = 339)</th>
<th>Sexually Experienced at Baseline (n = 195)</th>
<th>Sexually Inexperienced at Baseline (n = 144)</th>
<th>P valueb</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N (%)</td>
<td>Mean (SD)</td>
<td>N (%)</td>
<td>Mean (SD)</td>
</tr>
<tr>
<td>Sexual Behaviors</td>
<td>C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>At baseline</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ever had sexual contact</td>
<td>207339 (61.1)</td>
<td>195195 (100)</td>
<td>12144 (8.3)</td>
<td>&lt; 0.0001</td>
</tr>
<tr>
<td>Ever had sexual intercourse</td>
<td>195339 (57.5)</td>
<td>195195 (100)</td>
<td>0144 (0)</td>
<td>N/A</td>
</tr>
<tr>
<td>Number of male partners, lifetime</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤1</td>
<td>42189 (22.2)</td>
<td>42189 (22.2)</td>
<td>0144 (0)</td>
<td>N/A</td>
</tr>
<tr>
<td>&gt;1 to &lt;5</td>
<td>72189 (38.1)</td>
<td>72189 (38.1)</td>
<td>0144 (0)</td>
<td>N/A</td>
</tr>
<tr>
<td>≥5</td>
<td>75189 (39.7)</td>
<td>75189 (39.7)</td>
<td>0144 (0)</td>
<td>N/A</td>
</tr>
<tr>
<td>Number of male partners, past 3 mo[4]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥2</td>
<td>49194 (25.3)</td>
<td>49194 (25.3)</td>
<td>0144 (0)</td>
<td>N/A</td>
</tr>
<tr>
<td>Condom use at last intercourse</td>
<td>114193 (59.1)</td>
<td>114193 (59.1)</td>
<td>0144 (0)</td>
<td>N/A</td>
</tr>
<tr>
<td>At 2 mo</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Had sexual intercourse for the first time</td>
<td>8116 (6.9)</td>
<td>0195 (0)</td>
<td>8116 (6.9)</td>
<td>N/A</td>
</tr>
<tr>
<td>Number of male partners (0-2 mo)[5]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥2</td>
<td>23117 (19.7)</td>
<td>22110 (20.0)</td>
<td>17 (14.3)</td>
<td>1.00</td>
</tr>
<tr>
<td>Condom use at last intercourse</td>
<td>75161 (64.1)</td>
<td>68110 (61.8)</td>
<td>77 (100)</td>
<td>0.05</td>
</tr>
<tr>
<td>At 6 mo</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Had sexual intercourse for the first time</td>
<td>1299 (12.1)</td>
<td>0195 (0)</td>
<td>1299 (12.1)</td>
<td>N/A</td>
</tr>
<tr>
<td>Had sexual intercourse during the study (0-6 mo)</td>
<td>2099 (20.2)</td>
<td>0195 (0)</td>
<td>2099 (20.2)</td>
<td>N/A</td>
</tr>
<tr>
<td>Number of male partners (2-6 mo)[5]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥2</td>
<td>42137 (30.7)</td>
<td>40118 (33.9)</td>
<td>219 (10.5)</td>
<td>0.04</td>
</tr>
<tr>
<td>Condom use at last intercourse</td>
<td>88137 (64.2)</td>
<td>74118 (62.7)</td>
<td>1419 (73.7)</td>
<td>0.35</td>
</tr>
</tbody>
</table>

* The denominator represents the total number of subjects who were asked to respond to this survey item.

* P value represents the comparison between sexually experienced and sexually inexperienced participants; a χ² or Fisher’s Exact test was used to compare proportions and a Wilcoxon or t test to compare means.

* N/A, not applicable.

* Number of sexual partners for the past 3 mo was assessed at baseline, number of sexual partners between 0 and 2 mo was assessed at the 2-mo visit (ie, between the baseline and the 2-mo visits), and number of sexual partners between 2 and 6 mo was assessed at the 6-mo visit (ie, between the 2 mo and the 6 mo visits). In this way, we were able to assess the number of partners from 3 mo before enrollment until 6 mo after enrollment.
Inexperienced at baseline, risk perceptions (perceived risk for STIs other than HPV and perceived need for safer sexual behaviors) were not associated with sexual initiation at 2 or 6 months. In contrast, in age-stratified analyses, girls 16 to 21 years of age with higher scores on the scale measuring perceived risk for STIs other than HPV, indicating lower perceived risk for other STI (an inappropriate perception) were less likely to initiate sex over the next 6 months (OR, 0.13; 95% CI, 0.03–0.69). Among participants who were sexually experienced at baseline, neither perceived risk for other STIs nor perceived need for safer sexual behaviors was associated with sexual behaviors (number of sexual partners and condom use) at 2 or 6 months. Similarly, these 2 measures of perceived risk were not associated with sexual behaviors when participants were stratified by age (13–15 vs 16–21 years).

**DISCUSSION**

In this study, we examined the relationship between risk perceptions immediately after HPV vaccination and sexual behaviors 2 and 6 months later. To our knowledge, this is the first study to assess longitudinally the association between risk perceptions and sexual behaviors after HPV vaccination, and it provides additional support to the growing literature suggesting that HPV vaccination does not lead to sexual behavior change among adolescents.

We previously published the findings that at baseline, most participants in this study did not perceive that they had a lower risk for STIs other than HPV and most believed that safer sexual behaviors were still important. In this study, we further demonstrated that baseline risk perceptions did not differ between sexually experienced and sexually inexperienced participants, despite the finding that sexually inexperienced participants had lower knowledge of HPV and HPV vaccines.

We found no correlation between risk perceptions immediately after vaccination and sexual risk behaviors over the subsequent 6 months among all sexually inexperienced participants and those 13 to 15 years of age. Similarly, we found no correlation among all sexually experienced participants and those 13 to 15 and 16 to 21 years of age. The only significant association we found was in age-stratified analyses of sexually inexperienced participants: those 16 to 21 years of age who had higher scores on the scale measuring perceived risk for STIs other than HPV, indicating lower perceived risk for other STI (an inappropriate perception) were less likely to initiate sex over the next 6 months, contrary to our initial hypothesis. A possible explanation for this finding is that those young women

**TABLE 3 Risk Perceptions Among Study Participants**

<table>
<thead>
<tr>
<th>Risk perceptions (5-item subscales)</th>
<th>All (n = 339)</th>
<th>Sexually Experienced at Baseline (n = 195)</th>
<th>Sexually Inexperienced at Baseline (n = 144)</th>
<th>P valuea</th>
</tr>
</thead>
<tbody>
<tr>
<td>Need for safer sexual behaviorsb</td>
<td>1.6 (1.6)</td>
<td>1.6 (1.7)</td>
<td>1.5 (1.4)</td>
<td>0.59</td>
</tr>
<tr>
<td>STI risk perceptionsc</td>
<td>3.9 (2.0)</td>
<td>3.7 (2.1)</td>
<td>4.0 (2.0)</td>
<td>0.18</td>
</tr>
</tbody>
</table>

*a P value represents the comparison between sexually experienced and sexually inexperienced participants; a Wilcoxon test was used to compare means.

*b Need for safer sexual behaviors was measured by using a 5-item scale comprised of the following items: After getting vaccinated against HPV … (1) I think that condom use during sex is less necessary, (2) I feel it is just as important to have as few sexual partners as possible, (3) I feel it is not as important to talk to my sex partners about safe sex, (4) I think it is still just as important to use a condom every time I have sex, and (5) I will be less worried about having unprotected sex.

*c STI risk perceptions were measured using a 5-item scale comprised of the following items: After getting vaccinated against HPV … (1) I am less worried about getting an STI or STD other than HPV, (2) I am still as concerned about getting an STI or STD other than HPV will be less of a problem, (4) I am less worried that one of my sex partners could get an STI or STD other than HPV from me, and (5) There is less of a chance that I will get an STI or STD other than HPV than there used to be. Responses were on a scale ranging from 0 to 10. Some items were reverse-scored so that lower scores indicated more appropriate risk perceptions (ie, perception that safer sexual behaviors are still important after vaccination). Median scale score was 0 and range was 0 to 6.9.

**TABLE 4 Associations Between Risk Perceptions at Baseline and Sexual Behaviors Over the Subsequent 6 Months Among Sexually Inexperienced and Sexually Experienced Participants**

<table>
<thead>
<tr>
<th>Risk Perceptions at Baseline</th>
<th>Sexual Behaviors</th>
<th>Odds Ratio (95% CI)a</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sexually inexperienced at baseline</td>
<td>Initiated sex between 0 and 2 mo</td>
<td>0.22 (0.03–1.82)</td>
<td>0.16</td>
</tr>
<tr>
<td>Perceived risk for other STI</td>
<td>Initiated sex between 2 and 6 mo</td>
<td>0.74 (0.21–2.66)</td>
<td>0.65</td>
</tr>
<tr>
<td></td>
<td>Initiated sex between 0 and 6 mo</td>
<td>0.44 (0.15–1.33)</td>
<td>0.15</td>
</tr>
<tr>
<td>Perceived need for safer sexual behaviors</td>
<td>Initiated sex between 0 and 2 mo</td>
<td>0.42 (0.08–2.16)</td>
<td>0.30</td>
</tr>
<tr>
<td></td>
<td>Initiated sex between 2 and 6 mo</td>
<td>1.42 (0.42–4.75)</td>
<td>0.57</td>
</tr>
<tr>
<td></td>
<td>Initiated sex between 0 and 6 mo</td>
<td>0.88 (0.32–2.40)</td>
<td>0.81</td>
</tr>
<tr>
<td>Sexually experienced at baseline</td>
<td>≥2 partners between 0 and 2 mo</td>
<td>1.31 (0.51–3.37)</td>
<td>0.57</td>
</tr>
<tr>
<td>Perceived risk for other STI</td>
<td>≥2 partners between 2 and 6 mo</td>
<td>1.91 (0.57–6.19)</td>
<td>0.11</td>
</tr>
<tr>
<td></td>
<td>Condom use at last sex at 2 mo</td>
<td>1.14 (0.50–2.60)</td>
<td>0.76</td>
</tr>
<tr>
<td></td>
<td>Condom use at last sex at 6 mo</td>
<td>0.96 (0.40–2.26)</td>
<td>0.70</td>
</tr>
<tr>
<td>Perceived need for safer sexual behaviors</td>
<td>≥2 partners between 0 and 2 mo</td>
<td>1.23 (0.50–3.07)</td>
<td>0.65</td>
</tr>
<tr>
<td></td>
<td>≥2 partners between 2 and 6 mo</td>
<td>0.99 (0.46–2.18)</td>
<td>0.98</td>
</tr>
<tr>
<td></td>
<td>Condom use at last sex at 2 mo</td>
<td>0.80 (0.37–1.74)</td>
<td>0.57</td>
</tr>
<tr>
<td></td>
<td>Condom use at last sex at 6 mo</td>
<td>0.91 (0.43–1.84)</td>
<td>0.82</td>
</tr>
</tbody>
</table>

*a Logistic regression analyses were conducted to compare outcomes in participants who had high- versus low-risk perception scale scores (upper tertile versus lower 2 tertiles) after vaccination.
adolescent are not a salient enough factor in an
tween risk perceptions and sexual
tion may have incorrect risk percep-
tions because they are simply not
they may put them at less risk for STIs.
Overall, we did not find support for the
tory that some of these characteristics may alter the
are numerous contributing factors to
research has demonstrated that there
clude individual factors such as ad-
textual factors such as family struc-
table of risk in adolescents.26,27
Although it is currently unknown what
each of these factors may have on the overall perception of risk by
adolescents, it is possible that any of
these characteristics may alter the
way in which adolescents perceive
risk, view negative health outcomes,
and evaluate their degree of partici-
participation in risky behavior.
These findings contribute to the growing
literature suggesting that HPV
vaccination is unlikely to alter sexual
risk behaviors in young women. Some
investigators have reported that ado-
lescents anticipate their sexual behav-
iors will change after receiving the HPV
vaccine;28 in 1 study, 16.9% of adoles-
cent girls reported that they would be
more likely to have sex after HPV vac-
cination, and 8.4% reported that they
would be more likely to have un-
protected sex.28 However, despite these
predicted changes in sexual behaviors,
likely influenced by risk perceptions,
studies have shown no change in ac-
tual sexual behaviors after HPV vacci-
nation.13,18,29,31 A recent longitudinal
study examining behaviors after HPV
vaccination found that vaccinated,
compared with unvaccinated, adoles-
cents were not more likely to initiate
sex or participate in risky sexual
behaviors after vaccination.29 In addi-
tion, a large retrospective study using
electronic medical records demon-
strated no significant increase in preg-
nancy, STI testing or diagnosis, or
contraceptive counseling among HPV-
vaccinated young women.30
Our finding that inappropriate risk
perceptions are not associated with
sexual behaviors after HPV vaccination,
combined with previous evidence that
sexual behaviors do not change after
HPV vaccination, has important clinical
implications. Current HPV vaccination
uptake rates are suboptimal: from 2010
to 2012, HPV vaccination coverage
among 13- to 17-year-old girls increased
from only 48.7% to 53.8% for at least 1
dose, and from only 32.0% to 33.4% for
at least 3 doses.31 One contributing
factor to these relatively low vaccina-
tion rates is parental or clinician con-
cern that vaccination may lead to
changes in risk perceptions and riskier
sexual behaviors.9,28,32,33 Beliefs among
providers and parents that adoles-
cents who are vaccinated may practice
riskier sexual behaviors may adversely
impact provider recommendations for
HPV vaccines and parental agreement
for their child to be vaccinated, both
key factors driving vaccine uptake. In
a survey conducted among parents of
10- to 15-year-olds, 24% of parents op-
posed to the HPV vaccine believed it
would promote earlier sexual initia-
tion, compared with 9% of parents
supportive of vaccination (P = .003).34
Parental concerns may also present
a barrier to clinician recommenda-
tions. A substantial proportion of
pediatricians and family physicians
who participated in 2 national survey
studies and a qualitative study we
carried out believed parents would be
concerned about riskier sexual behav-
iors in vaccinated adolescents, and
further reported that parental con-
cerns would represent a barrier to their
recommendation of HPV vaccines.35,36
In another study conducted among
Texas physicians, 46% reported that
parental concern that HPV vaccination
would lead to riskier sexual behaviors
was a barrier to recommending the
vaccine.37 Data demonstrating that HPV
vaccination does not lead to riskier
behaviors may allow clinicians to pro-
vide accurate, evidence-based infor-
mation to address parental concerns
and thereby increase vaccination rates.
This study had several limitations,
including the possibility that there was
not sufficient power to detect associa-
tions of a smaller magnitude between
risk perceptions and behaviors. Sexual
behaviors were self-reported, possibly
limiting their validity. Although those who returned at 2 and 6 months did not differ from those who did not return in terms of race, ethnicity, sexual behaviors, and risk perceptions, we cannot exclude the possibility that those who did not return may have practiced riskier behaviors. Given that the study was intentionally designed to be conducted in the context of a real-world clinical setting, it is not possible for us to determine the impact of specific prevention messages on risk perceptions and subsequent behaviors. Another limitation is that we did not assess oral sexual behaviors after vaccination; thus, we were unable to assess whether oral sexual behaviors changed after vaccination because sex was defined as vaginal or anal. Finally, the study was conducted in a study population comprised predominantly of low-income adolescents, the majority of whom were black, which could limit generalizability.

CONCLUSIONS

Education to prevent misperceptions about risk after HPV vaccination is important and may promote safer sexual behaviors. However, this study provides reassuring evidence that changes in risk perceptions after vaccination are not associated with riskier sexual behaviors, providing additional support for the increasing evidence that HPV vaccination does not lead to changes in sexual behaviors among adolescents.

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# Risk Perceptions and Subsequent Sexual Behaviors After HPV Vaccination in Adolescents

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