Human Papillomavirus Vaccine and Sexual Behavior Among Adolescent and Young Women

Nicole C. Liddon, PhD, Jami S. Leichliter, PhD, Lauri E. Markowitz, MD

Background: Vaccines to prevent certain types of human papillomavirus (HPV) and associated cancers are recommended for routine use among young women. Nationally representative reports of vaccine uptake have not explored the relationship between HPV vaccine initiation and various sexual behaviors.

Purpose: Explore sexual behavior and demographic correlates of HPV vaccine initiation from a nationally representative survey of adolescent and young adult women.

Methods: In 2007–2008, a total of 1243 girls/women aged 15–24 years responded to questions about receiving HPV vaccine in the National Survey of Family Growth (NSFG). In 2010, demographic and sexual behavior correlates were evaluated in bivariate and multivariate analyses by age.

Results: HPV vaccine initiation was higher among those aged 15–19 years than those aged 20–24 years (30.3% vs 15.9%, $p<0.001$). No differences existed by race/ethnicity for those aged 15–19 years, but among women aged 20–24 years, non-Hispanic blacks were less likely than non-Hispanic whites to have received the HPV vaccine (AOR=0.15). HPV vaccine initiation was greater for those with insurance regardless of age. HPV vaccination was not associated with being sexually active or number of sex partners at either age. Among sexually active adolescents aged 15–19 years, those who received HPV vaccine were more likely to always wear a condom (AOR=3.0).

Conclusions: This study highlights disparities in HPV vaccine initiation by insurance status among girls/women aged 15–24 years and by race/ethnicity among women aged >19 years. No association was found between HPV vaccination and risky sexual behavior.
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Introduction

Human papillomavirus (HPV) infection is the most common sexually transmitted infection in the U.S., with an estimated 6.2 million new infections annually and prevalence among women estimated at 24.5% for those aged 14–19 years and 44.8% for those aged 20–24 years.[1] HPV is linked to various cancers, including cervical, vaginal, vulvar, anal, penile, and oropharyngeal.[2] HPV types 16 and 18 account for 70% of all cervical cancers, and HPV types 6 and 11 are associated with 90% of anogenital warts.[3–6] Two prophylactic HPV vaccines have been licensed by the U.S. Food and Drug Administration (FDA) for use in girls/women. A quadrivalent vaccine to protect against HPV types 6, 11, 16, and 18 was licensed for use in girls/women aged 9–26 years in 2006 and a bivalent vaccine directed against HPV types 16 and 18 was licensed in 2009. Either vaccine is recommended for routine vaccination for girls aged 11 or 12 years, with catch-up vaccination for girls/women through age 26 years.[7]

Monitoring HPV vaccine uptake is important to determine progress of vaccination programs and to identify any disparities in vaccine coverage. National as well as state and facility-specific vaccine coverage data have been reported.[8–13] The National Immunization Survey - Teen (NIS-Teen), which uses provider-verified records, found that the percentage of girls aged 13–17 years who had received at least one dose of HPV vaccine increased from 25% in 2007[8] to 44.3% in 2009.[9] In 2008, receipt of at least one dose of HPV vaccine was higher among Hispanic girls/women (44%) than among whites (35%), but this

relationship was not apparent in 2009.[8,9] In both 2008 and 2009, the NIS-Teen also found that having received at least one dose was higher for those living below the poverty line than those above it.

Data from the National Health and Nutrition Examination Survey (NHANES) 2007–2008[11] showed that vaccine initiation was 21.6% among girls aged 14–18 years and 11% among those aged 19–26 years. Reports from the National Health Interview Survey (NHIS) showed that less than one quarter of girls aged 9–17 years had initiated HPV vaccination by the end of 2008[13] and that uptake of at least one dose in women aged 19–26 years was at 10.5%.[12] The latter was reported to have increased to 17.1% in 2009.[12]

Some findings from national surveys vary perhaps because of the timing of survey relative to vaccine implementation and/or different methodologies employed (self- vs parent-report/physician verified, and telephone vs face-to-face administration). There are few data on receipt of HPV vaccine and sexual behavior. The purpose of the present study is to examine associations between receipt of at least one dose of HPV vaccine and various demographic and sexual behavior data.

Methods

Data came from the National Survey of Family Growth (NSFG) 2006–2008, a continuously administered national probability sample of the U.S. household population aged 15–44 years.[14] NSFG 2006–2008 used a multistage sampling design, was conducted at the household level, and included oversamples of blacks/African Americans, Hispanics/Latinos, and adolescents (aged 15–19 years).[14] The survey was approved by the IRB at the National Center for Health Statistics (NCHS), at the CDC.

All respondents aged ≥18 years provided informed consent and adolescents provided assent after parental consent was obtained.[15] A total of 7356 women were interviewed from June 2006 through December 2008 with a response rate of 76%.[16] All respondents completed an interviewer-administered computer-assisted personal interview (CAPI) that was conducted in English or Spanish. Detailed information about the survey design, sample weighting, and calculation of response rates has been published previously.[14,15]

Outcome Measures

In July 2007, a series of questions focusing on HPV and receipt of HPV vaccine was added to the female CAPI survey of the NSFG 2006–2008. All female respondents were asked separate questions to determine if they had ever heard of HPV and the HPV vaccine (defined as "the cervical cancer vaccine, HPV shot, or Gardasil"). Respondents aged <25 years who had heard of the vaccine were asked if they had received at least one dose. Although the ACIP recommendations for the "catch-up" vaccine include women aged ≤26 years, the NSFG previously employed special skip patterns that included girls/women aged ≤24 years; therefore, questions about receipt of HPV vaccine are limited to this age group.

Statistical Analyses

In 2010, statistical analyses were limited to the 4283 women aged 15–44 years who were interviewed from July 2007 through December 2008, after the HPV vaccine questions were included in the survey. SAS (version 9.2) and SAS-callable SUDAAN (version 10.0) were used to account for the multistage sampling, and the data were weighted to represent the U.S. female population. For questions related to receipt of HPV vaccine, analyses were limited to the 1243 girls/women who were aged 15–24 years and reported that they had heard of the HPV vaccine (83% of all girls/women aged 15–24 years).

Analyses were run separately for those aged 15–19 years and 20–24 years to observe any potential differences in demographic subgroups that may have been influenced by the Vaccines for Children (VFC) program. This federally funded program provides vaccines at no cost for children aged ≤18 years who are uninsured; eligible for Medicaid; American Indian or Alaska Native (AI/AN); or covered by private health insurance that does not cover the costs of all recommended vaccines ("underinsured). Because data here were reported retrospectively for the previous years in which the vaccine had been licensed, it is assumed that most 19-year-olds would have been in the population potentially covered by VFC funding.

Chi-square tests were used to examine differences in receipt of HPV vaccine by several demographic factors, parental communication regarding relevant sexual health topics, and whether or not the girl/woman ever had vaginal sex. Demographics include marital status (never married, other); race/ethnicity (Hispanic, non-Hispanic white, non-Hispanic black, non-Hispanic other); religion (Catholic, other religion, no religion); had medical insurance (yes, no); education (<high school/GED, high school/GED or higher); and poverty income level (household income less than 150% of the poverty level, household income 150% of the poverty level or higher). For the younger age group, parental communication about sexual health topics related to receipt of HPV vaccine were included. Specifically, whether or not the female respondent had talked to a parent/guardian about sexually transmitted diseases (STDs); birth control methods; saying no to sex or how to use a condom were examined separately. Estimates where the relative SE (RSE) was >30% or the denominator sample size was <50 were considered unstable. All variables significant at $p < 0.10$ in bivariate analyses were included in separate multiple logistic regression models.

Finally, to observe any differences in sexual behaviors by receipt of HPV vaccine, only the subset of women who reported that they had ever engaged in vaginal sex (referred to as sexually experienced) were analyzed ($n = 833$). In addition to the demographic variables listed above, sexual behavior variables were examined based on findings from an earlier analysis of sexual activity and condom use among teens.[17] Variables used in this analysis included age at first sex (<15 years, ≥15 years); lifetime number of sex partners (1, 2–3, ≥4); and consistent condom use in the past 4 weeks, a composite variable that calculated the percentage of vaginal sex acts where a condom was used (recoded into "never" or 0%, "inconsistent" or 1%–99%, and "consistent" or 100%) for respondents who reported vaginal sex in that time frame. As a measure of access to reproductive health care, whether the respondent received a Papanicolaou test (Pap) in the past year and whether she received an STD service (e.g., counseling, testing, or treatment) in the same time frame also were studied. Similar to analyses with the

full sample, bivariate associations were tested using chi-square tests and included variables significant at $p < 0.10$ in separate multiple logistic regression models.

Results

Sample

Table 1 shows the weighted percentages of demographic and other variables by age. There were no differences between the two age groups by race/ethnicity, religion, or poverty level. As might be expected, the older age group was significantly more likely to be married, not have insurance, have graduated high school or received a GED, had a Pap in the past year, received an STD service in the past year and ever had sex. Among sexually active women, the younger age group had fewer lifetime partners ($p < 0.05$). There were no significant differences by age in consistent condom use in the past 4 weeks.

Overall, 23.1% (95% CI=18.9, 27.9) of women aged 15–24 years reported receipt of at least one dose of HPV vaccine. Receipt of HPV vaccine was significantly higher among those aged 15–19 years, 30.3% (95% CI=24.9, 36.2), compared with those aged 20–24 years, 15.9% (95% CI=10.6, 23.0; $p < 0.001$).

Bivariate and Multivariate Results: Adolescents Aged 15–19 Years

For the entire sample of those aged 15–19 years, there were no differences in receipt of HPV vaccine by race/ethnicity, education, or poverty (Table 2). Respondents with some form of insurance were more likely to have received HPV vaccine compared with uninsured individuals (AOR=3.2, CI=1.4, 7.4). Compared with Catholic young women, those of other religions were less likely to have received the HPV vaccine (AOR=0.5, CI=0.3, 0.8). Having talked to parent about birth control and living above the poverty level were positively related to receipt of HPV vaccine in bivariate analyses, but neither retained significance in the multivariable model. Having had vaginal sex, other parental communication variables, and receiving an STD service or Pap in the past year were unrelated to receipt of HPV vaccine in bivariate analyses.

Among those aged 15–19 years who were sexually active (Table 3), no demographic variables were related to receipt of HPV vaccine in the multivariable model. Although having insurance was related to being vaccinated in bivariate analyses, it did not retain significance in the multivariable model. In bivariate analysis, a higher percentage of those who reported always or inconsistently using condoms reported being vaccinated (38.9% and 42.0%) than those who never use condoms (17.9%). In the multivariable model, compared with those who reported never using a condom, girls/women always using a condom were more likely to report receipt of HPV vaccine

(AOR=3.0, CI=1.1, 7.9). None of the other sexual behavior variables were related to receipt of HPV vaccine.

Bivariate and Multivariate Results for Those Aged 20–24 Years

Non-Hispanic black women in this age group were less likely than non-Hispanic white women to have received the HPV vaccine (AOR=0.2, CI=0.1, 0.4; Table 2). Women with less education were less likely to have received the vaccine in bivariate analyses, but this relationship did not retain significance in the multivariable model. Those with insurance were more likely to have received at least one dose of the vaccine than those without insurance (AOR=5.0, CI=2.4, 10.8). Never married women were more likely to have received the vaccine (AOR=2.5, CI=1.4, 5.4) than women of other marital status. There were no differences in receipt of HPV vaccine by religion, poverty, having had sex, or receiving an STD service or Pap in the past year.

Among the sexually active in the sample aged 20–24 years, the same demographic differences described above as significant were again significantly related to receipt of HPV vaccine (Table 3). Two sexual behavior variables were associated with receipt of HPV vaccine in the bivariable model (age of first sex and having had a Pap in the past year) but not in the multivariable model. Lifetime sex partners, consistent condom use in the past month, and having received an STD service in the past year were unrelated to receipt of HPV vaccine.

Discussion

Findings indicate that within the first years following vaccine licensure and ACIP recommendations, receipt of at least one dose of HPV vaccine was 23.1% in girls/women aged 15–24 years and was higher among younger women. About twice as many of those aged 15–19 years received the vaccine compared with those aged 20–24 years. Data from the National Health and Nutrition Examination Survey (NHANES) also found that receipt of HPV vaccine was higher for those aged 14–18 years (21.6%) than those aged 19–26 years (11%).[11]

Receipt of HPV vaccine was higher among those with insurance in both age groups. This finding was more pronounced among the women aged 20–24 years. Because uninsured girls aged <18 years are VFC eligible, these findings of greater disparity by insurance coverage among the older age group may reflect the absence of VFC coverage among that group. However, although not as pronounced, the significant finding among the younger age group suggests that not all VFC-eligible young women are accessing this program or that uninsured girls/women are less likely to access the healthcare

Table 1. Sample HPV vaccine initiation, sexual behavior, and sexual and reproductive health services, NSFG 2006–2008

Variable	Aged 15–19 years (n=630)	Aged 20–24 years (n=613)
DEMOGRAPHICS		
Race/ethnicity		
Hispanic	115 (12.8)	105 (12.2)
Non-Hispanic white	385 (70.2)	362 (69.3)
Non-Hispanic black	103 (12.2)	127 (15.2)
Non-Hispanic other	27 (4.8)	19 (3.4)
Marital status*		
Never married	591 (95.0)	398 (61.0)
Other	39 (5.0)	215 (39.0)
Religion		
Catholic	142 (20.9)	143 (21.5)
Other religion	356 (58.4)	332 (58.3)
None	132 (20.7)	138 (20.2)
Insurance*		
Yes	570 (90.0)	471 (75.4)
No	60 (10.0)	142 (24.6)
Education*		
< high school/GED	426 (67.1)	86 (14.3)
≥ high school/GED	204 (33.0)	527 (85.7)
Poverty (%)		
<150	253 (35.4)	245 (36.6)
≥150	377 (64.7)	368 (63.4)
HPV vaccination*		
Vaccinated	192 (30.3)	87 (15.9)
Unvaccinated	438 (69.7)	526 (84.2)
SEXUAL BEHAVIORS		
Ever had sex		
Yes	298 (43.7)	533 (84.5)
No	332 (56.4)	80 (15.5)
Age at first sex (years)[a],*		
<15	86 (27.1)	87 (13.4)
≥15	212 (72.9)	446 (86.6)
Lifetime partners*	332 (56.4)	80 (15.5)
None		
1	94 (14.3)	111 (21.5)
2–3	94 (13.3)	147 (24.2)
≥4	110 (16.1)	275 (38.8)

(continued)

Table 1. (*continued*)

Variable	Aged 15–19 years (n=630)	Aged 20–24 years (n=613)
Consistent condom use in past 4 weeks[b]		
Never	75 (38.0)	203 (49.9)
Inconsistent	25 (10.5)	43 (11.5)
Always	89 (51.5)	122 (38.6)
REPRODUCTIVE HEALTHCARE ACCESS		
Pap in past year*		
Yes	189 (26.8)	431 (69.8)
No	440 (73.2)	182 (30.2)
STD service in past year*		
Yes	110 (14.5)	181 (30.7)
No	519 (85.5)	432 (69.3)

Note: Values are *n* (%).
[a]Sexually active women only
[b]Includes only those who had vaginal sex in the past 4 weeks
*Significant differences between age groups at *p*<0.05
GED, General Educational Development test; HPV, human papillomavirus; NSFG, National Survey of Family Growth; STD, sexually transmitted disease

system where they would receive the vaccine. Differences in vaccine initiation by insurance status also were found in other surveys.[11–13]

The current analyses found no differences in receipt of HPV vaccine by either race/ethnicity or poverty level among those aged 15–19 years. However, among women aged 20–24 years, non-Hispanic blacks were less likely than non-Hispanic whites to have received HPV vaccine. As more girls/women are vaccinated at younger ages, this disparity may diminish over time. Considering the higher rates of cervical cancer as well as cervical cancer mortality among non-Hispanic blacks compared with non-Hispanic whites, efforts should be made to ensure that differences in vaccine uptake do not increase these inequities.

The absence of differences by race/ethnicity and poverty status among the younger age group is reassuring. Some previous national studies describe varying differences in vaccine initiation by both race/ethnicity and poverty level, but when differences were found, uptake was higher among Hispanics than non-Hispanic whites and for those living below the poverty level than those above.[9] NIS-Teen reported differences in HPV vaccine initiation by ethnicity in 2008 but not in 2009,[10] and differences by poverty level were found in both years. NHANES data from 2008 showed no differences in vaccine initiation by race or poverty level,[11] and the NHIS

Table 2. Associations between selected characteristics and receipt of HPV vaccine, NSFG, 2006–2008

Variable	Aged 15–19 years (n=630)		Aged 20–24 years (n=613)	
	% (95% CI)[a]	AOR (95% CI)[b]	% (95% CI)[a]	AOR (95% CI)[b]
Race/ethnicity				
Hispanic	26.6 (19.1, 35.8)	—	8.9 (2.8, 24.7)[c]	0.7 (0.3, 1.7)
Non-Hispanic white	33.1 (26.3, 40.7)	—	19.9 (13.1, 29.0)	1.0
Non-Hispanic black	19.5 (11.2, 31.7)	—	4.2 (2.1, 8.4)[c]	**0.2 (0.1, 0.4)**
Non-Hispanic other	26.0 (20.6, 41.3)[c]	—	11.2 (4.2, 26.4)[c]	0.4 (0.9, 1.4)
Marital status[d]				
Never married	—	—	20.5 (13.7, 29.4)	**2.7 (1.4, 5.4)**
Other	—	—	8.6 (4.7, 15.2)	1.0
Religion				
Catholic	41.4 (32.2, 51.3)	1.0	14.8 (8.1, 25.3)	—
Other	26.9 (20.2, 33.8)	**0.5 (0.3, 0.8)**	14.8 (9.2, 23.1)	—
None	30.0 (20.6, 41.3)	0.6 (.3, 1.2)	20.0 (10.2, 35.5)[c]	—
Insurance				
Yes	32.3 (26.9, 38.3)	**3.2 (1.4, 7.4)**	19.7 (13.5, 27.8)	**5.0 (2.4, 10.8)**
No	11.9 (5.9, 22.9)[c]	1.0	4.1 (1.7, 9.7)[c]	1.0
Education[d]				
< high school/GED	—	—	6.2 (1.4, 18.2)[c]	1.0
≥ high school/GED	—	—	17.5 (11.7, 25.3)	1.4 (0.4, 4.7)
Poverty (%)				
<150	24.5 (18.7, 31.4)	1.0	14.5 (6.3, 29.9)[c]	—
≥150	33.4 (27.1, 40.5)	1.5 (0.9, 2.2)	16.7 (12.6, 21.8)	—
Ever had sex				
Yes	33.7 (25.5, 43.0)	—	15.4 (9.4, 24.3)	—
No	27.6 (21.3, 35.0)	—	18.1 (9.4, 32.3)[c]	—
Talked to parent about saying no to sex[e]				
Yes	29.9 (22.9, 38.1)	—	—	—
No	30.9 (24.0, 38.8)	—	—	—
Talked to parent about birth control[e]				
Yes	36.3 (27.5, 46.2)	1.8 (0.9, 3.4)	—	—
No	23.4 (16.5, 32.0)	1.0	—	—
Talked to parent about using condom[e]				
Yes	30.5 (19.8, 43.8)	—	—	—
No	30.2 (24.9, 36.1)	—	—	—
Talked to parent about STDs[e]				
Yes	30.2 (22.4, 39.4)	—	—	—
No	30.3 (23.1, 38.7)	—	—	—

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Table 2. (*continued*)

Variable	Aged 15–19 years (*n*=630)		Aged 20–24 years (*n*=613)	
	% (95% CI)[a]	AOR (95% CI)[b]	% (95% CI)[a]	AOR (95% CI)[b]
Talked to parent about preventing HIV[e]				
Yes	30.9 (21.9, 41.5)	—	—	—
No	29.8 (23.3, 37.3)	—	—	—
STD service in past year[e]				
Yes	38.7 (27.7, 51.0)	—	18.5 (9.3, 33.2)	—
No	28.9 (23.3, 35.2)	—	14.7 (10.0, 21.2)[c]	—
Pap in past year[e]				
Yes	35.67 (25.8, 47.0)	—	17.9 (10.7, 28.4)	—
No	28.34 (23.0, 34.4)	—	11.1 (5.4, 21.4)[c]	—

[a]Percentage reporting having received at least one dose of HPV vaccine
[b]Factors with $p<0.10$ in bivariate analyses were included in the multivariate model.
[c]Estimates are unstable as relative SE (RSE) >30% and/or $n_{denominator}$ <50.
[d]Variables not analyzed for those aged 15–19 years because of skewness
[e]Variables analyzed only for those aged 15–19 years because they are considered more relevant for this age group
HPV, human papillomavirus; NSFG, National Survey of Family Growth; STD, sexually transmitted disease

reported congruent increases in having received at least one dose from 2008 to 2009 across racial and ethnic groups.[12]

In this analysis, receipt of HPV vaccine was not related to having received sexual and reproductive health care in the previous year, suggesting that these visits are not being used for HPV vaccine provision. However, because the exact date of vaccination is unknown, it is not clear whether such visits prior to the previous year were used for administering HPV vaccine. If any relationship between sexual and reproductive healthcare utilization and HPV vaccination did exist, it likely would be confounded by the relationship of both to onset of sexual activity. The complexity of these relationships should be considered further. Studies should specifically assess if HPV vaccination is taking place at sexual and reproductive healthcare visits and the timing of such visits to vaccination. The feasibility of using these visits for HPV vaccination also should be explored in order to improve vaccination uptake among those who might otherwise be missed.

A main goal of this NSFG analysis was to explore any association between sexual behaviors and receipt of HPV vaccine. Results do not indicate a difference in sexual experience by HPV vaccine status. While an association was found in another national survey, neither that survey[11] nor NSFG had data on age at vaccination that would allow further exploration of the findings. Therefore, neither survey could assess the temporal relationship between vaccine and sexual initiation. Such data will be available in future surveys.

Ascertaining the timing of receipt of HPV vaccine in relation to initiation of sexual activity would allow researchers to determine what percentage of girls/women are getting vaccinated before onset of sexual activity. This is important considering the prophylactic nature of the vaccines and the rapid acquisition of HPV soon after sexual initiation.[18] However, ascertaining timing of vaccination to sexual activity would not be sufficient to address concerns that receipt of HPV vaccine might promote earlier sexual initiation and riskier sexual behaviors.[19,20] If there was an association and vaccination preceded initiation of sexual activity, it still could not be concluded that the sexual activity was due to a perceived lack of risk. Other explanations include provider likelihood to recommend to older adolescents[21] who are more likely to initiate sex or that vaccine is sought by girls/women who were planning initiation of sexual activity. More detailed research on the cognitive processes of adolescents would be needed to suggest that disinhibition occurs.

Among sexually active women, a significant difference was found between vaccinated and unvaccinated women in reported consistency of condom use; sexually active young women who had received the vaccine were more likely to report always using a condom in the past 4 weeks than sexually active young women who had not received the vaccine. This finding could be due to girls/women who are more concerned about safer sex also being more likely to receive the vaccine, or that receipt of HPV vaccine (possibly through education about HPV or other

Table 3. Associations between selected characteristics, sexual behavior, and receipt of HPV vaccine among those who are sexually active, NSFG, 2006–2008

	Aged 15–19 years (*n*=298)		Aged 20–24 years (*n*=533)	
Variable	% (95% CI)[a]	AOR (95% CI)[b]	% (95% CI)[a]	AOR (95% CI)[b]
Race/ethnicity				
Hispanic	30.3 (18.4, 45.6)	—	8.5 (2.4, 25.5)[c]	0.7 (0.2, 1.8)
Non-Hispanic white	37.9 (26.8, 50.5)	—	19.5 (11.6, 31.0)	1.0
Non-Hispanic black	20.3 (12.1, 32.1)	—	4.7 (2.3, 9.5)[c]	**0.2 (0.1, 0.5)**
Non-Hispanic other	28.5 (5.6, 72.9)[c]	—	13.8 (4.9, 32.9)[c]	0.5 (0.1, 3.0)
Marital status[d]				
Never married	—	—	21.0 (12.7, 32.7)	**3.0 (1.4, 6.4)**
Other	—	—	8.8 (4.8, 15.5)	1.0
Religion				
Catholic	45.0 (24.2, 68.8)	—	14.1 (7.3, 25.3)[c]	—
Other	30.3 (20.8, 41.8)	—	14.0 (7.2, 25.6)[c]	—
None	34.6 (24.5, 46.3)[c]	—	20.3 (10.0, 36.7)[c]	—
Insurance				
Yes	36.4 (27.5, 46.4)	2.8 (0.7, 10.8)	19.2 (11.9, 29.6)	**3.1 (1.4. 7.1)**
No	12.3 (3.8, 33.0)[c]	1.0	4.6 (1.9, 10.7)[c]	1.0
Education[d]				
< high school/GED	—	—	6.2 (1.9, 18.2)[c]	1.0
≥ high school/GED	—	—	17.3 (10.4, 27.4)	1.5 (0.4, 6.1)
Poverty (%)				
<150	31.6 (20.6, 45.2)	—	12.5 (4.3, 31.2)[c]	—
≥150	34.8 (25.1, 46.0)	—	17.3 (12.5, 23.4)	—
Age at first sex (years)				
<15	30.2 (20.0, 42.8)	—	7.9 (2.7, 21.0)[c]	0.7 (0.2, 2.7)
≥15	35.0 (25.8, 45.4)	—	16.6 (10.1, 26.0)	1.0
Lifetime sex partners				
1	26.3 (16.4, 39.6)	—	11.6 (6.0, 21.2)[c]	—
2–3	42.7 (27.4, 59.6)	—	15.0 (6.5, 31.3)[c]	—
≥4	32.7 (24.0, 42.7)	—	17.8 (9.4, 31.2)	—
Consistent condom use past 4 weeks[e]				
Never	17.9 (8.8, 32.9)[c]	1.0	14.8 (6.9, 28.8)[c]	—
Inconsistent	42.0 (19.4, 68.5)[c]	3.5 (0.7, 17.1)	5.1 (1.4, 17.0)[c]	—
Always	38.9 (25.7, 54.0)	**3.0 (1.1, 7.9)**	17.3 (9.0, 30.6)	—
Pap in past year				
Yes	36.1 (25.5, 48.2)	—	18.2 (10.7, 29.1)[c]	1.0
No	30.6 (21.6, 41.5)	—	6.2 (2.5, 14.7)[c]	0.3 (0.1, 1.1)

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Table 3. (*continued*)

Variable	Aged 15–19 years (*n*=298)		Aged 20–24 years (*n*=533)	
	% (95% CI)[a]	AOR (95% CI)[b]	% (95% CI)[a]	AOR (95% CI)[b]
STD service in past year				
Yes	36.6 (25.3, 49.6)	—	18.3 (9.1, 33.2)[c]	—
No	32.3 (23.5, 42.5)	—	13.8 (8.2, 22.3)	—

[a]Percentage reporting having received at least one dose of HPV vaccine
[b]Factors with $p<0.10$ in bivariate analyses were included in the multivariate model. Adjusted analyses for those aged 15–19 years were limited to women who had vaginal sex in the past 4 weeks.
[c]Estimates are unstable as relative SE (RSE) $>30\%$ and/or $n_{denominator}<50$.
[d]Variables not analyzed for those aged 15–19 years because of skewness
[e]Includes only those who had vaginal sex in the past 4 weeks
GED, General Educational Development test; HPV, human papillomavirus; NSFG, National Survey of Family Growth; STD, sexually transmitted disease

STDs at the time of vaccination) leads to safer sex. Regardless, data do not suggest that receipt of HPV vaccine causes disinhibition or perceived lessened risk and thus more sexually risky behavior. However, these simple analyses do not speak to the psychological processes adolescents or young women take to evaluate risk and determine behavior. More-detailed research would more definitively dispel or support notions of sexual disinhibition as it relates to HPV vaccination.

These analyses have several limitations. As stated previously, lack of data on age at vaccination limited ability to test for temporal associations between receipt of vaccine and initiation of sexual behavior. Further complicating this timing issue is the fact that the vaccine was FDA approved in 2006 and widely available in 2007, around the same time of data collection. Some of the sexual behavior data reported here (e.g., number of lifetime partners) may have occurred prior to either FDA approval or availability of the vaccine. Also, data were self-reported and possibly subject to reporting bias. However, the short duration between HPV vaccine availability and NSFG data collection would reduce recall bias. In addition, data from other national samples, including provider-verified NIS-Teen data, yielded similar results. Finally, the measure of receipt of HPV vaccine is restricted to having received an initial dose of the three-part vaccine series and does not allow a thorough look at vaccine series completion, which may be related to factors other than those found here. Finally, in some instances, sample sizes were too small to produce stable estimates.

Despite these limitations, the present study contributes to the literature in several ways. It is a national survey conducted within a few years after HPV vaccine introduction that provides additional information on HPV vaccine coverage and associated demographic and sexual behavior in girls/women aged 15–24 years. The study highlights some potentially troubling disparities in HPV vaccination by insurance coverage among girls/women aged 15–24 years and by race ethnicity among women aged >19 years. Both of these findings should be further investigated in other national as well as local and in-depth studies. The lack of association between receipt of HPV vaccine and initiation or increased frequency of sexual behaviors should assuage some concern for a causal link between the two.

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