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Human papillomavirus (HPV) vaccine initiation and HPV and vaccine awareness among men 18–26 years in the United States, 2010

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Abstract

Background—In 2009, the quadrivalent Human Papillomavirus (HPV) vaccine was licensed by the Food and Drug Administration (FDA) for use in males 9 through 26 years. In 2009, the Advisory Committee on Immunization Practices (ACIP) provided a permissive recommendation allowing the administration of HPV vaccine to males 9 through 26 years.

Purpose—To assess HPV vaccination coverage, evaluate awareness of HPV and HPV vaccine, and identify factors independently associated with awareness of HPV and HPV vaccine among men 18-26 years.

Methods—We analyzed data from the 2010 National Health Interview Survey (NHIS), to evaluate initiation of HPV vaccination, assess awareness of HPV and the HPV vaccine, and identify factors associated with awareness of HPV and the HPV vaccine among men 18–26 years.

Results—In 2010, HPV vaccination initiation among men 18-26 years was 1.1%. Among the 1,741 men 18-26 years interviewed, nearly half had heard of HPV (51.8%). Overall, about one third of men 18-26 years had heard of the HPV vaccine (34.8%). Factors independently associated with a higher likelihood of awareness of both HPV and HPV vaccine among men 18-26 years included non-Hispanic white race/ethnicity, higher education, birth in the United States, a greater number of physician contacts, private health insurance, receipt of other vaccines, and reporting risk behaviors related to sexually transmitted diseases, including HIV.

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Conclusions—HPV vaccination initiation among men 18-26 years in 2010 was low. HPV and HPV vaccine awareness were also low and communication messages directed to men are needed. Since ACIP published a recommendation for routine use of HPV4 among males in December 2011, continued monitoring of HPV vaccination uptake among men 18-26 years is useful for evaluating the vaccination campaigns and for planning and implementing strategies for increasing vaccination coverage.

Keywords

human papillomavirus; human papillomavirus vaccine; adult vaccination; vaccination coverage

Introduction

Human papillomavirus (HPV) is the most common sexually transmitted infection in the United States; an estimated 6.2 million persons 14-44 years are newly infected every year [1, 2]. Of these new infections, 74% occur among persons 15-24 years[1]. More than 50% of sexually active men and women will acquire HPV infection in their lifetime[3]. HPV-related cancers in males include some anal, penile, and oropharyngeal cancers caused primarily by HPV type 16 [4-8]; approximately 7,000 HPV type 16- and 18-related cancers occur among males each year[4]. Studies indicate that incidence of oropharyngeal and anal cancers in men are increasing[4, 7, 8]; an evaluation of data from 1973–2007 found increases of 1% per year for oropharyngeal cancers and 3% per year for anal cancers[8]. Additionally, approximately 250,000 cases of genital warts occur each year in the United States among sexually active males [9, 10].

In June 2006, HPV vaccine (HPV4; Gardasil, Merck & Co. Inc.), directed against HPV types 6, 11, 16, and 18, was licensed by the Food and Drug Administration (FDA) for use in females[1]. In October 2009, the quadrivalent HPV vaccine was licensed by the Food and Drug Administration (FDA) for use in males 9 through 26 years for prevention of genital warts caused by HPV. Also in October 2009, the Advisory Committee on Immunization Practices (ACIP) voted and provided guidance that the HPV4 vaccine may be given to males 9 through 26 years noting that men who have sex with men (MSM) are particularly at risk for conditions associated with HPV infection, and this guidance was officially published in May 2010[11, 12]. The committee did not recommend routine use for males at that time[12]. In October, 2011, ACIP recommended routine use of HPV4 among males 11 or 12 years and recommended HPV4 for males through 21 years who have not been vaccinated previously or who have not completed the 3-dose series. Men 22 through 26 years may also be vaccinated. HPV vaccination is recommended through 26 years for men who have sex with men and men who are immunocompromised (such as those with human immunodeficiency (HIV) infection) who had not been previously vaccinated[4]. Optimal use of vaccination strategies could potentially reduce burden of HPV-related disease among males[11, 12]. Monitoring HPV vaccine initiation after vaccine licensure is important for evaluating the vaccination campaigns and for planning and implementing strategies for increasing vaccination coverage.

Limited studies evaluated and discussed HPV uptake and awareness of HPV and HPV vaccine among male adolescents[13, 14]. Little is known regarding national level of HPV vaccination uptake and awareness of HPV and HPV vaccine among younger US male adult. The purpose of this study is to address and examine the following questions using the 2010 National Health Interview Survey (NHIS): (1) What is HPV vaccination initiation for men 18–26 years within 3 to 14 months after HPV4 was first licensed for males? (2) What are awareness levels of HPV and HPV vaccine among men 18-26 years? (3) What factors are independently associated with awareness of HPV and HPV vaccine among men 18-26 years? This study provides an opportunity to establish baseline indicators from which the impact of universal/routine recommendation can be determined. This study also identifies opportunities for future intervention focused on addressing low levels of awareness and HPV vaccination among males.

Methods

The NHIS is an annual household survey conducted by the National Center for Health Statistics of the Centers for Disease Control and Prevention [15]. The NHIS sample is selected through the use of complex sampling design. Face to face interviews were conducted. In the sample adult core, one adult per sampled family was randomly selected and asked to complete the sample adult questionnaire[15]. In 2010, the final response rate for the sample adult core was 60.8%[15].

To determine awareness of HPV respondents were asked: “Have you ever heard of HPV? HPV stands for human papillomavirus?” To determine awareness of HPV vaccine respondents were asked: “Have you ever heard of HPV vaccines or shots?” Finally, to determine HPV vaccine uptake, respondents were asked: “Have you ever received an HPV shot or vaccine?” Those who answered “yes” were asked: “How many HPV shots did you receive?”

SUDAAN statistical software (Research Triangle Institute, Research Triangle Park, NC) was used to calculate point estimates and 95% confidence intervals (CIs) for vaccine uptake and awareness of HPV and HPV vaccine [16]. All analyses were weighted to reflect the U.S. non-institutionalized, civilian population. Bi-variable analysis was conducted and T-tests were used to test for difference in vaccine uptake and awareness of HPV and HPV vaccine for each variable. Due to the low levels of HPV vaccine initiation, we were unable to conduct a multivariable analysis to further assess factors independently associated with HPV vaccine initiation. Multivariable logistic regression model was conducted to identify factors independently associated with awareness of HPV and the HPV vaccine using adjusted prevalence ratio among men 18-26 years.

Results

The 2010 NHIS surveyed 1,741 men 18-26 years. Men 18-26 years were mostly non-Hispanic white (60.7%), not married status (86.4%), had private health insurance (54.2%), and employed (64.1%). Most of men 18-26 years lived at or above the federal poverty line

(76.2%), were born in the United States (86.3%), not hospitalized within past year (95.9%), and had a regular physician (64.3%) (Table 1).

HPV vaccine initiation (≥1 dose)

HPV vaccine initiation (≥1 dose) is shown in Table 2. Overall, 1.1% (N=1741; 95% CI=0.6%-2.2%) of men 18-26 years reported receiving ≥1 dose of HPV vaccine. Approximately 0.1% (95% CI=0.0%-0.5%) of men 18-26 years reported receiving 3 doses of vaccine (series completion) (Data not shown).

HPV vaccine initiation was significantly higher among those living below the poverty level and those with awareness of HPV and HPV vaccine ($p<0.05$). Due to the low levels of HPV vaccine initiation, we were unable to conduct a multivariable analysis to further assess factors independently associated with HPV vaccine initiation.

Awareness of HPV and the HPV vaccine

Overall, 51.8% men 18-26 years had ever heard of HPV, and 34.8% men 18-26 years had ever heard of HPV vaccine (Table 3).

In bivariable analyses, among men 18-26 years, the following characteristics were significantly associated with ever having heard of HPV and the HPV vaccine: non-Hispanic white race, higher educational level, higher income, birth in the United States, increasing number of physician contacts, private insurance, past receipt of other recommended vaccinations, and reported STD/HIV related high risk behaviors (Table 3).

Additionally, of those interviews conducted during January through May 2010, about 54% had ever heard of HPV, and 35% had ever heard of HPV vaccine among men 18-26 years. Of those interviews conducted during June through December 2010 (approximately one year after vaccine licensure), about 50% had ever heard of HPV, and 34% had ever heard of HPV vaccine among men 18-26 years. Awareness of HPV and HPV vaccine were not statistically significant between those who were interviewed during January through May 2010 and those who were interviewed during June through December 2010 (Table 3).

In multivariable analysis, among men 18-26 years, HPV awareness was lower among Hispanics and Asians compared to non-Hispanic whites (Adjusted Prevalence Ratios 0.7, 0.6, respectively, *P*-values<0.05). HPV awareness was significantly lower among non-Hispanic blacks compared with non-Hispanic whites in bivariate analysis (*P*-value<0.05) but the result did not hold after controlling other factors. Awareness was higher among men with some college education and education beyond college compared to men with less than high school education (Adjusted Prevalence Ratios 1.6, 1.6, respectively, *P*-values<0.05) (Table 3). Among men 18-26 years, awareness of HPV vaccine was lower among Hispanic and Asian men compared to non-Hispanic white men (Adjusted Prevalence Ratios 0.7, 0.8, respectively, *P*-values<0.05). Awareness was higher among men with some college education, and with education beyond college compared to men with less than high school education (Adjusted Prevalence Ratios 1.4, 1.6, respectively, *P*-values<0.05) (Table 3). Other characteristics independently associated with a higher likelihood of awareness of both HPV and HPV vaccine among men 18-26 years included birth in the United States, a greater

number of physician contacts, private health insurance, receipt of other vaccines, and reported of STD/HIV related high risk behaviors (Table 3).

Discussion

Our study presents an important source of baseline data when monitoring HPV vaccination initiation and HPV awareness among males. The timing of this analysis post-licensure for HPV vaccine in males is critical given that the ACIP has issued a routine recommendation subsequently[4]. In this national assessment of interviews conducted about 3 to 14 months after the quadrivalent HPV vaccine was first licensed in males and after ACIP provided guidance on the use of the vaccine in males, awareness of HPV and HPV vaccine in males 18-26 years was 52%, and 35%, respectively. Only 1.1% of men 18–26 years had initiated HPV vaccination. The result from our study is not surprising because although the vaccine was licensed, ACIP only recommended that the HPV vaccine may be used in males 9 through 26 years at the time of the survey. HPV vaccination coverage might increase in the next several years since ACIP published a recommendation for routine use of HPV4 among males in December 2011[4].

Awareness of HPV and HPV affect vaccination coverage[17]. Assessing awareness of HPV and HPV vaccine is important for developing tailored intervention programs to improve HPV-related knowledge and vaccine uptake. In contrast to the findings from surveys of females one year after vaccine licensure that describe the awareness of both HPV and HPV vaccine as >80%[17], our study found men had lower HPV and HPV vaccine awareness (51.8%, and 34.8%, respectively, 3-14 months after vaccine licensure; 50.0%, and 34.18%, respectively, about one year after vaccine licensure). One of the possible reasons may be that women are more concerned about cervical cancer and thus may have comparatively better knowledge on HPV and the HPV vaccine [18, 19]. Another reason is that there was marketing about HPV disease (pre-vaccine licensure) and marketing about the vaccine (post-licensure) specifically directed at women[20-32]. In addition, routine vaccination for females was recommended by ACIP after vaccine licensure, however, ACIP only provided guidance that the HPV4 vaccine may be given to males 9 through 26 years and vaccination was not routinely recommended for males after vaccine licensure[1, 12]. This difference in recommendation may affect awareness of HPV and HPV vaccine between females and males. This difference in recommendation may confuse people and affect vaccine initiation for males. Other studies have similar findings and report that females had more HPV-related knowledge than males[18, 19, 21].

Several characteristics were independently associated with higher awareness of HPV and the HPV vaccine. Racial and ethnic disparities were noted with non-Hispanic white men having significantly higher HPV and HPV vaccine awareness compared to Hispanic, non-Hispanic Asian, and non-Hispanic black men 18-26 years, though the disparity for non-Hispanic black men was no longer apparent after controlling for other factors. Higher education was also associated with higher HPV and HPV vaccine awareness among this age group, consistent with other studies[17, 22]. Education programs, materials, and information about HPV and the vaccine have been disseminated and provided to providers, patients/parent, and the general public [4, 23-27]. Information about HPV and the vaccine may improve HPV and

HPV vaccine knowledge for diverse racial/ethnic groups and all educational levels[28, 29]. Educating men about HPV and HPV vaccination is particularly important because the HPV vaccine has been targeted toward women, mothers and adolescent girls with a focus on prevention of cervical cancer [23-27]. With the addition of males in vaccine recommendations, newer materials need to address the issues and concerns of men.

Men with a greater number of physician contacts had higher awareness of HPV and HPV vaccine. Persons who have more frequent physician contact have more opportunities to discuss their health status and thus may know or understand more about vaccination. Studies showed that a doctor's recommendation is a key determinant of HPV vaccine acceptability and uptake among females[33, 34]. Healthcare providers are one of the main sources of HPV vaccine information among females[35], and may play an important role in vaccine uptake among males. Future interventions targeting healthcare providers might help increase HPV vaccine uptake among males. For example, physician vaccination reminder systems may help increase vaccination coverage but are underused by healthcare providers[36, 37].

Lack of medical insurance has been associated with low adult vaccination[17, 38-45]. Our study indicated that approximately 36% males 18-26 years had no medical insurance. For uninsured individuals, there are limited opportunities to access a medical home or usual sources of care, which have been associated with lower vaccination coverage [46-48]. Vaccination may need to be paid out of pocket for those without medical insurance and for some with medical insurance that does not cover the cost of the vaccine. The vaccine manufacturer has implemented a program (Merck Vaccine Patient Assistance Program), which provides free vaccines including the HPV vaccine to all adults who are uninsured and poor (household income less than $20,800 for individuals, $28,000 for couples, or $42,400 for a family of four)[49]. The CDC's Section 317 Grants Program provides the immunization infrastructure to deliver vaccines to underinsured children, and uninsured and underinsured adults[50]. This program might help improve vaccination coverage among uninsured and poor adult population, however, variation by state in how funds are used for HPV vaccination may affect vaccination coverage. Such resources are important for uninsured and underinsured individuals, but these funds are often insufficient for demand. Although these programs help provide for vaccines for adults, there is a recognized gap in coverage for adult immunizations [39-45, 51]. The Affordable Care Act may help improve vaccination coverage since the expanded enrollment in public and private insurance programs expected from provisions of the Affordable Care Act is likely to improve access to health care services, including vaccination [52]. Federal, state, and local partners should continue to build support for adult immunizations and address areas of need for uninsured populations.

The findings in this study are subject to limitations. Data for this study were collected by self report and vaccination was not verified by medical records. Previous studies have found that self-report of pneumococcal vaccination by adults was moderately or highly sensitive and moderately specific compared with reviews of medical records[53, 54], and self-report of influenza vaccination by adults also has been shown to have high sensitivity and moderate specificity[53]. Validity studies regarding self-reported HPV vaccination compared with medical records among adults have not been reported, however, one study showed that parent-reported HPV vaccination was highly sensitive and specific compared with provider

report[55]. Additionally, few men reported HPV vaccine initiation, precluding further evaluation of predictors of HPV vaccine initiation.

In conclusion, soon after the vaccine was licensed, only 1.1% of men 18–26 years had initiated HPV vaccination and awareness of HPV and HPV vaccine among men were low. HPV vaccination coverage might increase in the next several years since ACIP published a recommendation for routine use of HPV4 among males in December 2011[4]. Efforts should be directed to provide comprehensive, accessible, and appropriate communication messages on HPV and HPV vaccine directed to men. Greater use of strategies demonstrated to improve vaccination coverage are needed, including use of implementation of standing orders programs, use of media promotions and educational programs, and financing to reduce client out-of-pocket expenses [35, 56].

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TABLE 1

Characteristics of Men 18-26 years in the United States, by Demographic and Health Care Variables–The 2010 National Health Interview Survey (NHIS 2010)

Characteristic	Sample size (n)	%
Total	1,741	100
Race/Ethnicity		
Non-Hispanic White	881	60.7
Non-Hispanic Black	243	14.1
Hispanic	469	19.5
No n-Hispanic Asian	101	3.4
Other	47	2.3
Marital status		
Married	221	13.6
Not married	1,517	86.4
Education		
Less than High School	274	15.8
High School Graduate	531	32.1
Some College	674	40.0
≥College Graduate	257	12.2
Employment status		
Currently Employed	1,133	64.1
Not employed	607	35.9
Poverty level *		
300%+	444	36.5
2 00% to <300%	242	16.3
100% to <200%	388	23.5
<100%	468	23.8
Immigration status		
Born in U.S.	1,406	86.3
Born outside U.S. and Stayed in the US ≤10 Years	196	7.1
Born outside U.S. and Stayed in the US >10 Years	139	6.6
Hospitalization within past year		
Yes	64	4.1
No	1,677	95.9
Physician contacts within past year		
None	759	42.2
1	383	21.3
2–3	335	20.3
4–9	190	12.9
>10	55	3.3
Health insurance		
Private	902	54.2

Characteristic	Sample size (n)	%
Public	176	10.1
None	650	35.7
Having a regular physician for health care		
Yes	1,038	64.3
No	692	35.7
One/more recommended vaccines in life time†		
Yes	1,311	78.0
No	410	22.0
Cigarette use		
Current Smoker	408	24.4
Former Smoker	157	8.5
Never Smoked	1,172	67.1
Month of interview		
January–May	691	39.0
June–December	1,050	61.0
STD/HIV related high risk behavior‡		
Yes	140	6.6
No	1,574	93.4
Household with a female adolescent		
Yes	132	10.5
No	1,609	89.5
Ever heard of HPV		
Yes	830	51.8
No	803	48.2
Ever heard of HPV vaccine		
Yes	546	34.8
No	1,086	65.2

*Poverty level is determined by the US Census Bureau based on household income and the number of persons living in the household.

†Persons reported ever receiving hepatitis A (HepA), Hepatitis B (HepB), pneumococcal polysaccharide vaccine (PPV) or tetanus–diphtheria, tetanus–diphtheria–acellular pertussis (Td/Tdap) vaccines.

‡Includes persons who considered themselves at high risk for HIV infection, persons who reported having a sexually transmitted disease other than HIV/AIDS during the previous 5 years, and persons who reported any one of the following risk factors: hemophilia with receipt of clotting factor concentrates, men who have sex with men, injecting street drugs, trading sex for money or drugs, testing positive for HIV, or having sex with someone with any of these risk factors.

TABLE 2

Initiation of Human Papillomavirus (HPV) (≥1 dose) among Men 18–26 years in the United States, by Demographic and Health Care Variables–The 2010 National Health Interview Survey (NHIS 2010)

		HPV vaccination coverage (≥1 dose)		
Characteristic	**Sample size**	**%**	**95% CI**	**p-value**
Total	1,741	1.1	(0.6, 2.2)	
Race/Ethnicity				
Non-Hispanic White *	881	0.9	(0.3, 2.3)	
Non-Hispanic Black	243	1.0	(0.3, 3.4)	0.921
Hispanic	469	1.9	(0.5, 6.7)	0.488
Marital status				
Married *	221	0.9	(0.2, 3.7)	
Not married	1,517	1.2	(0.5, 2.5)	0.776
Education				
Less than High School *	274	2.4	(0.7, 8.1)	
High School Graduate	531	1.2	(0.3, 4.4)	0.446
Some College	674	0.6	(0.3, 1.3)	0.207
≥College Graduate	257	1.1	(0.3, 3.7)	0.430
Employment status				
Currently Employed	1,133	1.0	(0.4, 2.4)	0.709
Not employed *	607	1.3	(0.5, 3.7)	
Poverty level †				
300%+	444	0.8	(0.1, 5.3)	0.197
200% to <300%	242	0.7	(0.2, 2.9)	0.110
100% to <200%	388	0.4	(0.1, 1.7)	0.025‡
<100% *	468	2.1	(1.1, 4.1)	
Health insurance				
Private	902	1.4	(0.6, 3.5)	0.210
Public	176	1.8	(0.7, 4.5)	0.181
None *	650	0.6	(0.2, 1.6)	
Having a regular physician for health care				
Yes	1,038	1.5	(0.7, 3.2)	0.125
No *	692	0.5	(0.2, 1.5)	
Month of interview				
January-May *	691	1.1	(0.5, 2.1)	
June-December	1,050	1.1	(0.4, 3.2)	0.922
STD/HIV related high risk behavior§				
Yes	140	1.4	(0.3, 6.0)	0.809
No *	1,574	1.1	(0.5, 2.3)	
Household with a female adolescent				

		HPV vaccination coverage (≥1 dose)		
Characteristic	**Sample size**	**%**	**95% CI**	**p-value**
Yes	132	0.0	//	N/A
No *	1,609	1.2	(0.6, 2.5)	
Ever heard of HPV				
Yes	830	2.0	(1.0, 4.2)	0.018‡
No *	803	0.2	(0.0, 0.9)	
Ever heard of HPV vaccine				
Yes	546	2.8	(1.3, 5.9)	0.020‡
No *	1,086	0.2	(0.1, 0.8)	

* Reference level.

† Poverty level is determined by the US Census Bureau based on household income and the number of persons living in the household.

‡ $p<0.05$ by T test for comparisons within each variable with the indicated reference level.

§ Includes persons who considered themselves at high risk for HIV infection, persons who reported having a sexually transmitted disease other than factors: hemophilia with receipt of clotting factor concentrates, men who have sex with men, injecting street drugs, trading sex for money or drugs, testing positive for HIV, or having sex with someone with any of these risk factors.

// No respondents receiving vaccination in this group.

N/A: Not applicable.

TABLE 3

Awareness of Human Papillomavirus and Human Papillomavirus vaccine among Men 18-26 years, by Demographic and Health Care Variables –The 2010 National Health Interview Survey (NHIS 2010)

	Percentage of Awareness of Human Papillomavirus	Prevalence Ratio (adjusted)	Percentage of Awareness of Human Papillomavirus vaccine	Prevalence Ratio (adjusted)
Characteristic	**% (95% CI)**	**% (95% CI)**	**% (95% CI)**	**% (95% CI)**
Total	51.8 (48.7, 54.8)		34.8 (31.7, 38.0)	
Race/Ethnicity				
Non-Hispanic White *	60.0 (55.8, 64.1)	Referent	40.0 (35.7, 44.4)	Referent
Non-Hispanic Black	46.1 (37.9, 54.4) †	1.0 (0.8–1.2)	33.1 (26.1, 40.9)	1.0 (0.8–1.3)
Hispanic	31.6 (26.8, 36.9) †	0.7 (0.6–0.9) †	21.4 (16.7, 27.0) †	0.7 (0.6–1.0) †
Non-Hispanic Asian	31.9 (19.8, 47.2) †	0.6 (0.4–0.9) †	24.5 (15.0, 37.5) †	0.8 (0.5–1.3)
Other	70.2 (48.0, 85.7)	1.4 (1.1–1.7)	37.4 (21.8, 56.1)	1.1 (0.7–1.7)
Marital status				
Married *	45.9 (38.1, 53.9)	Referent	28.4 (22.0, 36.0)	Referent
Not married	52.7 (49.4, 56.1)	1.1 (0.9–1.3)	35.8 (32.5, 39.3)	1.1 (0.9–1.4)
Education				
Less than High School *	32.4 (25.6, 40.1)	Referent	22.4 (16.7, 29.4)	Referent
High School Graduate	45.6 (40.1, 51.2) †	1.3 (1.0–1.6)	26.0 (21.1, 31.4)	1.0 (0.7–1.4)
Some College	60.9 (55.9, 65.6) †	1.6 (1.2–2.0) †	43.0 (37.9, 48.3) †	1.4 (1.0–1.9) †
≥College Graduate	65.0 (57.4, 71.9) †	1.6 (1.3–2.1) †	48.8 (39.8, 57.8) †	1.6 (1.1–2.2) †
Employment status				
Currently Employed *	52.4 (48.5, 56.4)	Referent	37.1 (33.3, 41.2)	Referent
Not employed	50.7 (45.8, 55.5)	1.0 (0.9–1.2)	30.7 (26.2, 35.6) †	0.8 (0.7–1.0)
Poverty level §				
300%+	59.4 (53.5, 65.2) †	1.1 (0.9–1.3)	42.9 (36.7, 49.3) †	1.2 (0.9–1.5)
200% to <300%	51.1 (43.3, 58.8)	1.1 (0.9–1.3)	38.2 (31.1, 46.0) †	1.2 (1.0–1.6)
100% to <200%	45.7 (39.5, 52.0)	1.1 (0.9–1.2)	30.1 (25.1, 35.6)	1.0 (0.8–1.3)
<100% ‡	43.6 (37.6, 49.9)	Referent	27.4 (22.7, 32.7)	Referent
Immigration status				
Born in U.S. *	55.0 (51.5, 58.5)	Referent	37.4 (34.0, 41.0)	Referent
Born outside U.S. and stayed in the US ≤10 years	19.0 (13.7, 25.7) †	0.6 (0.5–0.9) †	9.6 (5.7, 15.7) †	0.5 (0.3–0.8) †
Born outside U.S. and stayed in the US >10 years	44.6 (34.2, 55.4)	1.1 (0.9–1.4)	27.3 (18.0, 39.2)	0.9 (0.6–1.3)
Hospitalization within past year				
Yes	61.4 (45.3, 75.4)	0.9 (0.6–1.2)	36.8 (22.9, 53.4)	1.0 (0.6–1.5)
No *	51.4 (48.2, 54.5)	Referent	34.7 (31.5, 38.0)	Referent

Characteristic	Percentage of Awareness of Human Papillomavirus % (95% CI)	Prevalence Ratio (adjusted) % (95% CI)	Percentage of Awareness of Human Papillomavirus vaccine % (95% CI)	Prevalence Ratio (adjusted) % (95% CI)
Physician contacts within past year				
None *	43.2 (38.6, 47.9)	Referent	27.4 (23.5, 31.8)	Referent
1	51.7 (44.4, 58.9)	1.1 (0.9–1.3)	32.5 (26.3, 39.3)	1.1 (0.9–1.4)
2–3	59.0 (52.2, 65.4) †	1.2 (1.0–1.4) †	46.0 (39.4, 52.7) †	1.4 (1.2–1.8) †
4–9	66.4 (58.3, 73.6) †	1.3 (1.1–1.6) †	46.9 (37.8, 56.1) †	1.3 (1.0–1.7) †
>10	66.1 (48.8, 80.0) †	1.4 (1.0–1.8)	31.8 (18.6, 48.7)	1.1 (0.7–1.8)
Health insurance				
Private	61.4 (57.1, 65.6) †	1.3 (1.1–1.6) †	43.4 (38.8, 48.2) †	1.4 (1.1–1.7) †
Public	40.4 (32.1, 49.3)	1.0 (0.8–1.3)	24.0 (17.4, 32.1)	1.1 (0.8–1.5)
None *	40.7 (35.9, 45.7)	Referent	24.6 (20.5, 29.3)	Referent
Having a regular physician for health care				
Yes *	53.8 (49.8, 57.8)	Referent	36.4 (32.5, 40.4)	Referent
No	48.3 (43.4, 53.1)	0.9 (0.8–1.0) †	32.1 (27.8, 36.7)	0.8 (0.7–1.0) †
One/more recommended vaccines in life time§				
Yes	56.0 (52.6, 59.5) †	1.3 (1.1–1.5) †	37.4 (34.0, 41.0) †	1.3 (1.0–1.6) †
No *	36.5 (30.5, 43.0)	Referent	25.2 (19.4, 32.0)	Referent
Cigarette use				
Current Smoker *	52.6 (46.7, 58.5)	Referent	33.1 (27.1, 39.6)	Referent
Former Smoker	61.0 (51.8, 69.4)	1.0 (0.8–1.2)	32.3 (23.8, 42.1)	0.8 (0.6–1.2)
Never Smoked	50.3 (46.3, 54.3)	0.9 (0.8–1.0)	35.8 (32.0, 39.7)	1.0 (0.8–1.3)
Month of interview				
January–May *	54.4 (50.0, 59.3)	Referent	35.2 (30.3, 40.3)	Referent
June–December	50.0 (45.8, 54.3)	0.9 (0.8–1.0)	34.1 (30.1, 38.4)	1.0 (0.8–1.2)
STD/HIV related high risk behavior‖				
Yes	62.5 (52.9, 71.3) †	1.3 (1.1–1.5) †	45.6 (36.0, 55.4) ‡	1.3 (1.0–1.7) †
No *	51.0 (47.8, 54.2)	Referent	34.0 (30.8, 37.4)	Referent
Household with a female adolescent				
Yes	45.4 (34.8, 56.3)	1.0 (0.8–1.3)	34.3 (24.7, 45.3)	1.2 (0.9–1.6)
No *	52.5 (49.3, 55.7)	Referent	34.5 (31.3, 37.9)	Referent

* Reference level for comparison of percentage of awareness of Human Papillomavirus and Human Papillomavirus vaccine from bivariable analysis.

† $p<0.05$ by T test for comparisons within each variable with the indicated reference level.

[‡] Poverty level is determined by the US Census Bureau based on household income and the number of persons living in the household.

[§] Persons reported ever receiving hepatitis A (HepA), Hepatitis B (HepB), pneumococcal polysaccharide vaccine (PPV) or tetanus–diphtheria, tetanus–diphtheria–acellular pertussis (Td/Tdap) vaccines.

[‖] Includes persons who considered themselves at high risk for HIV infection, persons who reported having a sexually transmitted disease other than HIV/AIDS during the previous 5 years, and persons who reported any one of the following risk factors: hemophilia with receipt of clotting factor concentrates, men who have sex with men, injecting street drugs, trading sex for money or drugs, testing positive for HIV, or having sex with someone with any of these risk factors.