HHS Public Access

Author manuscript

Vaccine. Author manuscript; available in PMC 2022 April 01.

Published in final edited form as:

Vaccine. 2013 June 19; 31(28): 2937–2946. doi:10.1016/j.vaccine.2013.04.041.

Factors associated with human papillomavirus vaccination among young adult women in the United States

Walter W. Williams[a,*], **Peng-Jun Lu**[a], **Mona Saraiya**[b], **David Yankey**[a], **Christina Dorell**[a], **Juan L. Rodriguez**[b], **Deanna Kepka**[c], **Lauri E. Markowitz**[d]

[a]Immunization Services Division, National Center for Immunization and Respiratory Diseases, Centers for Disease Control and Prevention, 1600 Clifton Road, NE, Atlanta, GA 30333, United States

[b]Division of Cancer Prevention and Control, National Center for Chronic Disease Prevention & Health Promotion, Centers for Disease Control and Prevention, 1600 Clifton Road, NE, Atlanta, GA 30333, United States

[c]College of Nursing & Huntsman Cancer Institute, University of Utah, Huntsman Cancer Institute, 2000 Circle of Hope, Room 4144, Salt Lake City, UT 84112, United States

[d]Division of Sexually Transmitted Disease Prevention, National Center for HIV/AIDS, Viral Hepatitis, STD, & TB Prevention, Centers for Disease Control and Prevention, 1600 Clifton Road, NE, Atlanta, GA 30333, United States

Abstract

Background: Human papillomavirus (HPV) vaccination is recommended to protect against HPV-related diseases.

Objective: To estimate HPV vaccine coverage and assess factors associated with vaccine awareness, initiation and receipt of 3 doses among women age 18–30 years.

Methods: Data from the 2010 National Health Interview Survey were analyzed to assess associations of HPV vaccination among women age 18–26 (n = 1866) and 27–30 years (n = 1028) with previous HPV exposure, cervical cancer screening and selected demographic, health care and behavioral characteristics using bivariate analysis and multivariable logistic regression.

Results: Overall, 23.2% of women age 18–26 and 6.7% of women age 27–30 years reported receiving at least 1 dose of HPV vaccine. In multivariable analyses among women age 18–26 years, not being married, having a regular physician, seeing a physician or obstetrician/gynecologist in the past year, influenza vaccination in the past year, and receipt of other recommended vaccines were associated with HPV vaccination. One-third of unvaccinated women age 18–26 years (n = 490) were interested in receiving HPV vaccine. Among women who were not interested in receiving HPV vaccine (n = 920), the main reasons reported included: not needing the vaccine (41.3%); concerns about safety of the vaccine (12.5%); not knowing enough about the vaccine (11.9%); not being sexually active (8.2%); a doctor not recommending

*Corresponding author at: National Center for Immunization and Respiratory Diseases, Centers for Disease Control and Prevention, 1600 Clifton Road, NE, Mail Stop A-19, Atlanta, GA 30333, United States. Tel.: +1 404 718 8734; fax: +1 404 235 1751. www.1@cdc.gov (W.W. Williams).

the vaccine (7.6%); and already having HPV (2.7%). Among women with health insurance, 10 or more physician contacts within the past year and no contraindications, 74.5% reported not receiving HPV vaccine.

Conclusions: HPV vaccination coverage among women age 18–26 years remains low. Opportunities to vaccinate are missed. Healthcare providers can play an important role in educating young women about HPV and encouraging vaccination. Successful public health and educational interventions will need to address physician attitudes and practice patterns and other factors that influence vaccination behaviors.

Keywords

Human papillomavirus; HPV vaccine; Cervical cancer; Pap smear; Vaccination; Adult vaccination

1. Introduction

Genital human papillomavirus (HPV) is the most common sexually transmitted infection in the United States and can cause cervical cancer, genital warts and other anogenital cancers. Quadrivalent and bivalent HPV vaccines were licensed for use in the United States in 2006 and 2009, respectively, and recommended for prevention of vaccine HPV-type-related cervical cancers and cancer precursors [1,2]. Routine HPV vaccination of females age 11 or 12 years is recommended [2] and vaccination of females age 13–26 years who have not been previously vaccinated [1,2]. Routine cervical cancer screening is generally recommended at age 21 to age 65 years for adult women, regardless of HPV vaccination status, although guidelines may differ from one another with regards to when to start, stop, how often to screen, and use of the conventional Pap test or liquid-based cytology [1,3–6].

Since HPV vaccine was recommended for use in females, estimates of vaccine coverage among young women have been published [7–12]. In previous reports factors associated with HPV vaccination in adult women (≥18) have included white race, higher education and income, having insurance, discussions with a healthcare provider about HPV vaccine, history of sexual activity, and receipt of other vaccines [7–11]. Concern about vaccine safety, doctors not recommending vaccination and cost have been barriers to HPV vaccination [8,12].

This study at four years following first licensure of HPV vaccine uses national data to update information among age-eligible adult women on associations of initiation and receipt of the complete three dose series.

2. Methods

We analyzed data from the 2010 National Health Interview Survey (NHIS) which collected data throughout the year using a design oversampling for Hispanics, blacks, and Asians to produce nationally representative samples. The 2010 NHIS sample adult core included questions about HPV infection, Pap testing, and HPV vaccination. The NHIS protocol was approved by the National Center for Health Statistics Research Ethics Review Board (ERB # 2009–16). Additional details about the 2010 NHIS

are located at ftp://ftp.cdc.gov/pub/Health_Statistics/NCHS/Dataset_Documentation/NHIS/2010/srvydesc.pdf. The study sample consisted of adult women age 18–26 years (n = 1866) and women age 27–30 years at the time of the survey (n = 1028) who were eligible for vaccination at the time of vaccine licensure. HPV vaccination was self-reported.

We selected covariates from coded survey questions to measure associations among previous HPV exposure, HPV vaccination, cervical cancer screening, and selected demographic, health care access and behavior characteristics. Below poverty was defined as a total family income of less than $22,314 for a family of four as identified by the U.S. Census Bureau [http://www.census.gov/hhes/www/poverty/data/threshld/thresh09.html.]

Weighted data were used to produce national estimates. SUDAAN was used to calculate point estimates and 95% confidence intervals (CIs) accounting for the complex sample design [13]. Respondents who answered “Don’t Know” or who refused to answer any question were excluded from the analysis. Chi-square tests were used to examine population distributions between age groups and T-tests were used to determine significance within strata with multiple levels. Statistical significance was defined as $p < 0.05$. Logistic regression was used to determine adjusted prevalence ratios (Risk Ratio) of ever having received HPV vaccination by selected demographic, access to care, and health behavior covariates. All variables selected were included in the multivariable model.

3. Results

3.1. Ever told had HPV, cervical cancer screening and awareness of HPV vaccine

Overall, women age 27–30 years were more likely to have been told they had HPV (12.3%) than were women age 18–26 years (8.5%) ($p < 0.05$). These women were more likely to have ever heard of HPV vaccine (91.4%) and to have received at least one dose of HPV vaccine (30.2%) than women who had not been told they had HPV (84.7% and 19.9%, respectively) ($p < 0.05$). Women age 18–26 and 27–30 years had similar likelihood of awareness of HPV vaccine (Table 1).

Among respondents age 18–20 years, 21–26 years, 18–26 years overall, and 27–30 years, 76.9%, 70.8%, 72.2% and 67.1%, respectively, reported a year or less since their most recent Pap test. Women age 27–30 years were more likely to have been screened for cervical cancer during the previous three years (86.8%) compared with women age 18–26 years (72.2%) ($p < 0.05$) (Table 1).

Ever having had cervical cancer screening (76.2%) and having had cervical cancer screening in ≤3 years (77.3%) were associated with awareness of HPV vaccine ($p < 0.05$). Non-Hispanic white women were more likely to have heard of HPV vaccine (81.3%) than were non-Hispanic black (65.8%), non-Hispanic Asian (60.6%), and Hispanic women (52.0%) ($p < 0.05$) (Table 1).

3.2. HPV vaccine initiation

Vaccine initiation (receipt of ≥1 HPV vaccine dose) and receipt of 3 doses by age group by a variety of characteristics are shown in Table 2. Overall, HPV vaccine initiation was

higher in younger than in older age groups with 34.9% of women age 18–20 years, 17.5% of women age 21–26 years (23.2% of women age 18–26), and 6.7% of women age 27–30 years reporting receipt of at least 1 dose of HPV vaccine (Table 2). Only 1.3% of women ≥27 years reported having ever had at least 1 HPV vaccine dose. In bivariate analyses characteristics associated with receipt of at least 1 dose of HPV vaccine varied by age group. Characteristics associated with vaccine initiation among women age 18–20 and 21–26 years included non-Hispanic ethnicity, having private health insurance, having a regular physician, seeing a physician or obstetrician/gynecologist in the past year, and receipt of influenza and other recommended vaccines (Table 2). Among women age 18–26 years overall, other factors associated with receipt of at least 1 vaccine dose included not currently being married, income at or above 300% of the poverty level, and having either public or private health insurance (Table 2).

Women age 18–26 years reporting >3 years since the last Pap test were less likely to have received at least 1 dose of HPV vaccine (4.2%) compared with women never tested (24.2%) or tested in ≤3 years (23.9%) ($p < 0.05$)(Table 2). Women age 21–26 years reporting having ever had a Pap test or ≤3 years since their last Pap test were more likely to have received at least 1 dose of HPV vaccine (19.3% and 20.3%, respectively) compared with women never tested (5.3%) ($p < 0.05$). Women age 18–26 years who were born outside the United States and had stayed in the United States ≤10 years (49.5% Hispanic, 23.4% non-Hispanic white, 17.8% non-Hispanic Asian, 8.7% non-Hispanic black) were less likely to have received at least 1 dose of HPV vaccine (9.9%) compared with women born in the United States (24.4%) or born outside the United States and residing in the United States >10 years (19.4%) (Table 2).

Among women age 27–30 years, having ever been told they had HPV and not currently being married were associated with receipt of at least 1 dose of HPV vaccine (Table 2). Non-Hispanic black and Hispanic women age 27–30 years were less likely to have received at least 1 dose of HPV vaccine (4.0% and 2.7%, respectively) compared with non-Hispanic white women (8.5%) ($p < 0.05$).

In multivariable analyses among women age 18–26 years, not currently being married, having a regular physician, seeing a physician or obstetrician/gynecologist in the past year, influenza vaccination in the past year, and receipt of other recommended vaccines were associated with receipt of at least 1 dose of HPV vaccine (Table 3).

3.3. Receipt of 3 HPV vaccine doses

Among women age 18–26 years overall, 13.2% reported receipt of 3 HPV vaccine doses, including 21.1% of women age 18–20 and 9.3% of women 21–26. Only 4.2% of women 27–30 years reported receipt of 3 HPV vaccine doses (Table 2). Overall, 57.1% of those who initiated the series reported receipt of 3 HPV vaccine doses. Characteristics associated with receipt of 3 HPV vaccine doses for each age group are similar to those of women who initiated HPV vaccination. Among women age 18–26 years, black non-Hispanic women (7.5%) and Hispanic women (9.6%) were less likely to receive 3 doses of HPV vaccine compared with white non-Hispanic women (15.4%) ($p < 0.05$). Examination of age at last

HPV vaccine dose among women who received 3 doses indicated that women in more recent age cohorts were getting the third dose at younger ages (data not shown).

3.4. Impact of insurance, having a regular doctor, and doctor visits on HPV vaccination

Among women age 18–26 years, those who had health insurance were more likely to have a regular physician (86.4%) than those without health insurance (53.3%) ($p < 0.05$) (Table 4). Those with a regular physician were more likely to be vaccinated than those who did not have a regular physician whether or not they had (28.7% versus 14.0%) or did not have health insurance (17.6% versus 8.4%) ($p < 0.05$) (Table 4).

HPV vaccination was higher among women age 18–26 years who had health insurance and 2–3 (28.4%) or 4–9 physician contacts within the past year (33.3%) compared with women with health insurance and no physician contacts within the past year (15.9%) ($p < 0.05$) (Table 4). However, vaccination was lower among women without health insurance compared to those with insurance, regardless of the number of physician contacts within the past year. Among women age 18–26 who had 10 or more physician visits ($n = 271$), 37 (13.6%) were pregnant, a group for whom HPV vaccination is not recommended. Most (65.9%) of the remaining women reported no chronic health condition; the others reported chronic illnesses that are not contraindications for HPV vaccination, including asthma (6.5%), heart disease (6.5%), cancer (2.3%), liver disease (2.0%), diabetes (1.6%) and kidney disease (1.6%). Among those women for whom HPV vaccination is indicated who had health insurance and 10 or more physician contacts within the past year, 74.5% reported not receiving HPV vaccine (Table 4).

3.5. Interest in HPV vaccination

Among women age 18–26 years who had never had HPV vaccine or did not know or refused to provide this information ($n = 1484$), 33.0% said they would be interested in getting HPV vaccine ($n = 490$) and 62.0% said they would not be interested ($n = 920$). Among those who were interested in getting HPV vaccine, most (76.2–85.5%) indicated they would not get the vaccine if they had to pay full price (Table 4). Among women who were not interested in getting HPV vaccine, the main reasons reported included: not needing it (41.3%); concerns about vaccine safety (12.5%); not knowing enough about the vaccine (11.9%); not being sexually active (8.2%); the doctor not recommending the vaccine (7.6%); and already having HPV (2.7%). Of women not interested in HPV vaccination, only 2.6% cited the vaccine being too expensive as the primary reason; 2.3% indicated they were too old, 0.7% reported their spouse or family was against it, and 0.3% did not know where to get the vaccine. Reasons other than those cited here were reported by 10% of respondents. Nearly all of those unwilling to pay full price for HPV vaccination (97.7–98.2%) reported that they would get the vaccine if it were free or available at lower cost (Table 4).

4. Discussion

The findings of this study indicate that 4 years following the recommendation for routine vaccination at age 11 or 12 years and through age 26 for those not previously vaccinated, HPV vaccination remains low with initiation highest among women age 18–20 years. The

finding of higher initiation levels at younger ages has been reported [8,9,11,14] and might reflect the knowledge, attitude and practices of the healthcare providers of young adult women [9], the social norms of young women and the perceptions and vaccine intentions of peers or significant others [15] or receipt of vaccine when eligible for the Vaccines for Children (VFC) Program (≤18) [9–11] but 18 or older at the time of the survey. Few women age 27–30 years at the time of the survey (age 24–26 years when HPV vaccine was licensed) or age ≥27 reported receiving at least 1 dose, indicating HPV vaccine initiation was low within 1–3 years after vaccine licensure and limited off-label use.

Our multivariable model was used mainly to control for confounding rather than to test a specific hypothesis or underlying causal model developed a prior. Findings from the model should be interpreted along with those from bivariate analyses. Women who had been told by a provider they had HPV were more likely to have ever heard of and received at least 1 HPV vaccine dose than women who had not been told they had HPV. This observation suggests that a discussion with a healthcare provider about HPV might have facilitated a conversation about HPV vaccine and the decision to vaccinate. As reported elsewhere [7–12,14,16], awareness of HPV vaccine and HPV vaccination were also associated with having health insurance, having a regular physician, seeing a physician or obstetrician/gynecologist in the past year, and receipt of influenza and other recommended vaccines. These findings are consistent with previous reports indicating that persons who have insurance coverage, a usual place for health care or medical home, and who seek medical care one or more times during the year are more likely to be vaccinated against influenza and receive other preventive services, compared with those who are uninsured and are without a usual place for healthcare [17,18]. Having a regular physician and seeing a physician provide opportunities for education about HPV, HPV vaccination and other prevention services [8,10–12,14,16].

The association of HPV vaccination with not currently being married might be related to a perception of greater risk for HPV infection among unmarried women, particularly those engaging in sexual activity [7,10,12]. The perception of greater risk is also likely among women who have had HPV infection. The perception of risk for HPV infection is important in gaining acceptance of HPV vaccination as well as allaying undue concerns about vaccination side effects [12]. Tailoring educational initiatives among women to increase their understanding of the risk of acquiring HPV infection and the safety of HPV vaccine might improve vaccine acceptance. The association of HPV vaccination with receipt of influenza or other recommended vaccines was a predictor of HPV vaccination in this and other studies [7,10,12,14]. This finding might indicate a positive attitude about preventive measures playing an important role in women's decisions about HPV vaccination, the quality of their medical care or having providers who are more likely to vaccinate adults [7,11,12,14]. Recent Pap testing (≤3 years) was associated with initiating HPV vaccination and receiving 3 doses. The relationship of vaccine initiation with Pap testing in other studies has been mixed, with reports of no association of HPV vaccine initiation with recent Pap testing [8,10] and in another study cervical cancer screening and having abnormal Pap results being positive correlates of HPV vaccine initiation [14].

HPV vaccination was lower among women age 18–26 years without health insurance, illustrating the importance of insurance in the receipt of preventive services. Lack of medical insurance has been an important predictor of low adult vaccination [7–12]. While many health plans are providing coverage for HPV vaccination, the availability or the level of coverage can vary (http://www.cdc.gov/std/hpv/stdfact-hpv-vaccine-young-women.htm) The expanded enrollment in public and private insurance programs expected from provisions of the Affordable Care Act might improve access to health care services, including vaccination, for persons who were previously uninsured [19]. Health insurance coverage, however, although beneficial in improving access to health care services, might not be sufficient in itself to achieve optimal HPV vaccination. In this report, even among those with health insurance, 10 or more contacts with physicians within the past year and no contraindications, HPV vaccination was not optimal-as many as 74.5% reported not receiving HPV vaccine. Provider attitudes and practice patterns might be playing a role in determining which women are offered HPV vaccine [7,8,14]. Providers may not be knowledgeable about HPV vaccine recommendations, offering vaccination to eligible women in their practice, and may not be discussing topics such as health risks related to sexual behavior with their young female patients.

Similar to other reports [7,9–12,14,16,20], in our bivariate analysis we found that black race and Hispanic ethnicity were negative correlates of HPV vaccination among women age 18–26 and 27–30 years. Numerous factors might play a role in these racial and ethnic disparities, including differences in attitudes toward vaccination and preventive care, propensity to seek and accept vaccination, variations in likelihood that providers recommend vaccination, regional factors, and differences in quality of care received by racial/ethnic populations [11,14,21–31]. Differences in HPV vaccination coverage by race or ethnicity among women 18–30 years of age differ from those among girls 13–17 years of age. In 2011, HPV initiation was higher for black and Hispanic girls, 13–17 years of age, compared to whites; coverage with three HPV doses was higher for Hispanics compared to whites [32]. Increased vaccine access through the VFC program or risk-based approaches that base provider recommendations for HPV on the perceived level of the patient's risk for cervical cancer might contribute to higher HPV initiation rates among blacks and Hispanics [33].

As reported here, the main reasons reported among women age 18–26 years who were not interested in getting HPV vaccine included not believing it was needed, concerns about vaccine safety, not knowing enough about the vaccine, and the doctor not recommending the vaccine, all factors amenable to changes in physician practice. Increasing activities to inform providers of their critical role in influencing vaccination is important. Efforts to decrease out of pocket expenses to pay for HPV vaccination are also important [10,34–36].

This study has limitations. First, vaccination in NHIS is self-reported and not validated by medical records so is subject to recall bias. Adult self-reported influenza and pneumococcal vaccination, however, have been shown to be sensitive and specific [37–40]. Validity studies of self-reported HPV vaccination among adult women have not been reported. Among adolescent girls, however, high levels of inaccuracy between actual HPV vaccination and self-report of vaccine receipt has been reported [41]. Second, multiple comparisons and a large number of statistical tests were performed. Without correction for multiple

comparisons, an unidentifiable proportion of significant results might be spurious. Third, the vaccination status and characteristics of women not included in the NHIS are not known. Women not included are those who at the time of the survey were not living at home, such as those in the military or incarcerated.

HPV vaccination can reduce the burden of HPV-associated disease through primary prevention of HPV infection but coverage is suboptimal. Vaccination would be most effective when given before exposure to HPV through sexual contact. Healthcare providers have an important role to play in educating young women about HPV and encouraging vaccination. Successful interventions will need to address physician attitudes and practice patterns. Greater use of strategies demonstrated to improve vaccination coverage is important [21,22,35,36,42].

References

[1]. Centers for Disease Control and Prevention (CDC). Quadrivalent Human Papillomavirus Vaccine: Recommendations of the Advisory Committee on Immunization Practices (ACIP). MMWR 2007;56(RR–2):1–24.

[2]. Centers for Disease Control and Prevention (CDC). FDA Licensure of Bivalent Human Papillomavirus Vaccine (HPV2, Cervarix) for Use in Females and Updated HPV Vaccination Recommendations from the Advisory Committee on Immunization Practices (ACIP). MMWR 2010;59(20):626–9. [PubMed: 20508593]

[3]. Feldman S Making sense of the new cervical-cancer screening guidelines. N Engl J Med 2011;365:2145–7. [PubMed: 22111669]

[4]. Vesco KK, Whitlock EP, Eder M, et al. Risk factors and other epidemiologic considerations for cervical cancer screening: a narrative review for the U.S. Preventive Services Task Force. Ann Intern Med 2011;155:698–705. [PubMed: 22006929]

[5]. Saslow D, Solomon D, Lawson HW, et al. American Cancer Society, American Society for Colposcopy and Cervical Pathology, and American Society for Clinical Pathology screening guidelines for the prevention and early detection of cervical cancer. Am J Clin Pathol 2012;137:516–42. [PubMed: 22431528]

[6]. Moyer (on behalf of the U.S. Preventive Services Task Force) VA. Screening of cervical cancer: U.S. Preventive Services Task Force recommendation statement. Ann Intern Med 2012;156:880–91. [PubMed: 22711081]

[7]. Jain N, Euler GL, Shefer A, Lu P, Yankey D, Markowitz L. Human papillomavirus (HPV) awareness and vaccination initiation among women in the United States, National Immunization Survey-Adult 2007. Prev Med 2009;48:426–31. [PubMed: 19100762]

[8]. Caskey R, Lindau ST, Alexander GC. Knowledge and early adoption of the HPV vaccine among girls and young women: results of a national survey. J Adolesc Health 2009;45:453–62. [PubMed: 19837351]

[9]. Taylor LD, Hariri S, Sternberg M, Dunne EF, Markowitz LE. Human papillomavirus vaccine coverage in the United States, National Health and Nutrition Examination Survey, 2007–2008. Prev Med 2011;52:398–400. [PubMed: 21108962]

[10]. Anhang Price R, Tiro JA, Saraiya M, Meissner H, Breen N. Use of human papillomavirus vaccines among young adult women in the United States: an analysis of the 2008 National Health Interview Survey. Cancer 2011;17:5560–8.

[11]. Dempsey A, Cohn L, Dalton V, Ruffin M. Worsening disparities in HPV vaccine utilization among 19–26 year old women. Vaccine 2011;29:528–34. [PubMed: 21050904]

[12]. Bednarczyk RA, Birkhead GS, Morse DL, Doleyres H, McNutt LA. Human papillomavirus vaccine uptake and barriers: association with perceived risk, actual risk and race/ethnicity among female students at a New York State university, 2010. Vaccine 2011;29:3138–43. [PubMed: 21376797]

[13]. Shah B, Barnwell B, Bieier G. SUDAAN User's Manual, Release 10.1. Research Triangle Park, NC: Research Triangle Institute; 2010.

[14]. Chao C, Velicer C, Slezak JM, Jacobsen SJ. Correlates for human papillomavirus vaccination of adolescent girls and young women in a managed care organization. Am J Epidemiol 2010;171:357–67. [PubMed: 20047978]

[15]. Allen JD, Mohllajee AP, Shelton RC, et al. Stage of adoption of the human papillomavirus vaccine among college women. Prev Med 2009;48:420–5. [PubMed: 19133288]

[16]. Dempsey A, Cohn L, Dalton VA, Ruffin M. Patient and clinic factors associated with adolescent human papillomavirus vaccine utilization within a university-based health system. Vaccine 2010;28:989–95. [PubMed: 19925899]

[17]. Sudano JJ, Baker DW. Intermittent lack of health insurance coverage and use of preventive services. Am J Public Health 2003;93:130–7. [PubMed: 12511402]

[18]. Beal AC, Doty MM, Hernandez SE, et al. Closing the divide: how medical homes promote equity in health care – results from the Commonwealth Fund 2006 Health Care Quality Survey. The Commonwealth Fund, New York, NY. http://www.commonwealthfund.org/Publications/Fund-Reports/2007/Jun/Closing-the-Divide-How-Medical-Homes-Promote-Equity-in-Health-Care-Results-From-The-Commonwealth-F.aspx; [accessed 05.04.12].

[19]. 111th Congress. Public Law 111–148–March. 23, 2010. 124 STAT. 119 (H.R. 3590). An Act Entitled: The Patient Protection and Affordable Care Act. http://www.gpo.gov/fdsys/pkg/PLAW-111publ148/pdf/PLAW-111publ148.pdf; [accessed 24.05.11].

[20]. Rosenthal SL, Weiss TW, Zimet GD, et al. Predictors of HPV vaccine uptake among women age 19–26: importance of a physician's recommendation. Vaccine 2011;29:890–5. [PubMed: 20056186]

[21]. Singleton JA, Santibanez TA, Wortley PM. Influenza and pneumococcal vaccination of adults age ≥65: racial/ethnic differences. Am J Prev Med 2005;29:412–20. [PubMed: 16376704]

[22]. Walker FJ, Singleton JA, Lu P-J, et al. Influenza vaccination of health care workers in the United States, 1989–2002. Infect Control Hosp Epidemiol 2006;27:257–65. [PubMed: 16532413]

[23]. Lindley MC, Wortley PM, Winston CA, Bardenheier BH. The role of attitudes in understanding disparities in adult influenza vaccination. Am J Prev Med 2006;31:281–5. [PubMed: 16979451]

[24]. Singleton JA, Greby SM, Wooten KG, et al. Influenza, pneumococcal, and tetanus toxoid vaccination of adults–United States, 1993–1997. MMWR 2000;49:39–50. [PubMed: 11016877]

[25]. Link MW, Ahluwalia IB, Euler GL, et al. Racial and ethnic disparities in influenza vaccination coverage among adults during the 2004–2005 season. Am J Epidemiol 2006;163:571–8 [PubMed: 16443801]

[26]. Bach PB, Pham HH, Schrag D, Tate RC, Hargraves JL. Primary care physicians who treat blacks and whites. N Engl J Med 2004;351:575–84. [PubMed: 15295050]

[27]. Schneider EC, Zaslavsky AM, Epstein AM. Racial disparities in the quality of care for enrollees in medicare manage care. JAMA 2002;287:1288–94. [PubMed: 11886320]

[28]. Gemson DH, Elinson J, Messeri P. Differences in physician prevention practice patterns for white and minority patients. Community Health (Bristol) 1988;13:53–64.

[29]. C.D.C. Reasons reported by medicare beneficiaries for not receiving influenza and pneumococcal vaccinations-United States, 1996. MMWR 1999;48: 886–90. [PubMed: 10550040]

[30]. Agency for Healthcare Research and Quality. National healthcare disparities report. Rockville, MD: Agency for Healthcare Research and Quality; 2011. Publication no. 11–0005. Available at http://www.ahrq.gov/qual/qrdr10.htm; [accessed 30.03.12].

[31]. Wei F, Moore PC, Green AL Geographic variability in human papillomavirus vaccination among U.S. young women. Am J Prev Med 2013;44:154–7. [PubMed: 23332332]

[32]. CDC. National and state vaccination coverage among adolescents aged 13–17 years - United States, 2011. MMWR 2012; 61:671–7. [PubMed: 22932301]

[33]. Hughes CC, Jones AL, Feemster KA, Fiks AG. HPV vaccine decision making in pediatric primary care: a semi-structured interview study. BMC Pediatrics 2011;11:74–82. [PubMed: 21878128]

[34]. Merck Vaccine Patient Assistance Program. Available at: http://www.merck.com/merckhelps/vaccines/qualify.html; [accessed 06.02.12].

[35]. Briss PA, Rodewald LE, Hinman AR, Shefer AM, Strikas RA, Bernier RR, et al. Reviews of evidence regarding interventions to improve vaccination coverage in children, adolescents, and adults. The Task Force on Community Preventive Services. Am J Prev Med 2000;18(Suppl.):97–140.

[36]. Task Force on Community Prevention Services. The guide to community preventive services. New York, NY: Oxford University Press. Available at http://www.thecommunityguide.org/library/book/index.html; 2005 [accessed 30.03.12].

[37]. Donald RM, Baken L, Nelson A, Nichol KL. Validation of self-report of influenza and pneumococcal vaccination status in elderly outpatients. Am J Prev Med 1999;16:173–7. [PubMed: 10198654]

[38]. Mangtani P, Shah A, Roberts JA. Validation of influenza and pneumococcal vaccine status in adults based on self-report. Epidemiol Infect 2007;135:139–43. [PubMed: 16740194]

[39]. Zimmerman RK, Raymund M, Janosky JE, et al. Sensitivity and specificity of patient self-report of influenza and pneumococcal polysaccharide vaccinations among elderly outpatients in diverse patient care strata. Vaccine 2003;21:1486–91. [PubMed: 12615445]

[40]. Shenson D, DiMartino D, Bolen J, Campbell M, Lu PJ, Singleton JA. Validation of self-reported pneumococcal vaccination in behavioral risk factor surveillance surveys: experience from the sickness prevention achieved through regional collaboration (SPARC) program. Vaccine 2005;23:1015–20. [PubMed: 15620474]

[41]. Stupiansky NW, Zimet GD, Cummings T, Fortenberry JD, Shew M. Accuracy of self-reported human papillomavirus vaccine receipt among adolescent girls and their mothers. J Adolesc Health 2012;50:103–5. [PubMed: 22188843]

[42]. Poland GA, Shefer AM, McCauley M, Webster PS, Whitely-Williams PN, Peter G, et al. Standards for adult immunization practice. Am J Prev Med 2003;25(2): 144–50. [PubMed: 12880883]

Table 1.

Demographic characteristics, health care access, and health behavior among women in the United States by awareness of HPV vaccine and receipt of at least one HPV vaccine dose – NHIS 2010.

Characteristic	Age group								Ever heard of HPV vaccine		Ever had at least 1 HPV vaccine dose	
	18–20 years		21–26 years		18–26 years		27–30 years					
	n	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
Total									2894	72.8	2894	18.0
Age												
18–20[a]	492	22.6							492	74.1	492	34.9
21–26			1374	46.2					1374	74.3	1374	17.5[b]
18–26					1866	68.8			1866	74.2	1866	23.2[b]
27–30							1028	31.3[c]	1028	69.7	1028	6.7[b]
Previous HPV exposure Ever been told had HPV												
Yes	*d*	*d*	116	10.8	134	8.5	90	12.3[c]	224	91.4[b]	224	30.2[b]
No[a]	360	96.4	969	89.2	1329	91.5	679	87.7	2008	84.7	2008	19.9
Cervical CA screening Never had PAP test[a]	207	46.7	180	13.1	387	24.2	74	5.9	461	58.5	461	21.8
Ever had PAP test Time since last PAP	285	53.3	1186	86.9	1471	75.8	950	94.1	2421	76.2[b]	2421	17.2
≤3y	278	52.2	1121	82.1	1399	72.2	875	86.8[c]	2274	77.3[b]	2274	18.1
>3y	*d*	*d*	53	4.0	60	3.1	57	5.8	117	62.3	117	4.2[b]
Doctor recommended												
Yes	304	67.6	664	48.7	968	55.0	459	43.8[c]	1427	71.2	1427	19.8
No[a]	187	32.4	680	51.3	867	45.0	551	56.2	1418	74.9	1418	16.4
Race/Ethnicity												
Non-Hispanic white[a]	240	61.8	664	60.5	904	60.9	472	62.1	1376	81.3	1376	20.3
Non-Hispanic black	89	14.5	254	14.4	343	14.4	182	12.7	525	65.8[b]	525	16.5
Hispanic	125	17.7	323	17.7	448	17.7	275	17.3	723	52.0[b]	723	12.4[b]

Characteristic	Age group								Ever heard of HPV vaccine		Ever had at least 1 HPV vaccine dose	
	18–20 years		21–26 years		18–26 years		27–30 years					
	n	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
Non-Hispanic Asian	*d*	*d*	95	4.8	116	4.1	78	6.1	194	60.6[b]	194	15.9
Other	*d*	*d*	38	2.6	55	2.9	21	1.9	76	71.7	76	15.7
Marital status												
Married[a]	*d*	*d*	329	27.1	358	20.6	426	51.1[c]	784	69.5	784	7.6
Other	462	92.7	1043	73.0	1505	79.4	600	48.9	2105	74.2[b]	2105	22.6[b]
Education												
Less than HS[a]	121	24.6	167	10.2	288	14.9	133	11.1[c]	421	54.4	421	15.8
HS Grad/GED	146	28.2	313	22.3	459	24.3	211	20.6	670	62.8[b]	670	15.2
Some college	222	47.1	551	40.6	773	42.7	344	32.1	1117	78.3[b]	1117	20.9
College graduate	*d*	*d*	341	26.9	343	18.1	337	36.2	680	84.3[b]	680	17.4
Employment status												
Employed	233	50.4	863	66.0	1096	60.9	691	68.0[c]	1787	76.9[b]	1787	18.1
Not employed[a]	259	49.6	511	34.0	770	39.1	337	32.0	1107	65.8	1107	18.0
Poverty level												
300%+	76	29.2	307	32.7	383	31.6	353	44.9[c]	736	83.4[b]	736	21.6
200% to <300%	60	17.6	208	18.8	268	18.4	151	16.4	419	78.3[b]	419	16.2
100% to <200%	102	21.9	289	22.0	391	21.9	210	21.4	601	62.8	601	13.0
<100%[a]	192	31.4	443	26.5	635	28.1	230	17.3	865	65.3	865	18.2
Immigration status												
Born in U.S.[a]	432	90.0	1145	86.3	1577	87.5	771	81.3[c]	2348	78.0	2348	19.3
Born outside U.S. and stayed	*d*	*d*	126	7.4	152	6.4	128	9.7	280	34.1[b]	280	7.5[b]
in the US <10 years Born outside U.S. and stayed in the US >10 years	34	5.7	103	6.3	137	6.1	129	9.0	266	50.2[b]	266	14.2
Health insurance												

Characteristic	Age group								Ever heard of HPV vaccine		Ever had at least 1 HPV vaccine dose	
	18–20 years		21–26 years		18–26 years		27–30 years					
	n	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
Private	237	53.6	649	52.1	886	52.6	554	60.0[c]	1440	81.3[b]	1440	21.2[b]
Public	137	24.3	342	20.6	479	21.8	227	18.7	706	62.2	706	18.1[b]
None[a]	115	22.1	378	27.4	493	25.6	242	21.3	735	63.2	735	11.0
Regular physician												
Yes	392	82.3	1036	75.9	1428	78.0	810	79.6[c]	2238	74.3[b]	2238	20.6[b]
No[a]	100	17.7	338	24.1	438	22.0	217	20.4	655	67.7	655	8.9
Seen physician or OB/GYN in past year												
Yes	360	76.8	1061	78.0	1421	77.6	820	81.1	2241	76.6[b]	2241	20.4[b]
No[a]	132	23.2	311	22.0	443	22.4	208	18.9	651	58.9	651	9.5
Other vaccination behavior One/more recommended lifetime vaccines												
Yes	401	85.2	1096	80.7	1497	82.2	765	77.8[c]	2262	77.2[b]	2262	20.7[b]
No[a]	86	14.8	268	19.3	354	17.8	254	22.2	608	54.0	608	6.7
Influenza vaccine in past year												
Yes	61	23.6	186	23.8	247	23.7	161	28.6	408	80.9[b]	408	29.2[b]
No[a]	240	76.4	627	76.2	867	76.3	466	71.4	1333	67.7	1333	12.0
Cigarette use												
Current smoker[a]	72	15.8	269	19.0	341	17.9	217	22.5[c]	558	74.1	558	15.4
Formersmoker	*d*	*d*	106	8.1	119	6.1	105	12.5	224	79.8	224	12.1
Never smoked	407	82.2	999	72.9	1406	76.0	706	64.9	2112	71.7	2112	19.4

[a] Reference level.

[b] p <0.05 by T test forcomparisons within each variable with the indicated reference level.

[c] Significant difference between persons aged 27–30 years and persons aged 18–26 years (by chi-square test, p <0.05).

[d] Estimates are not reliable due to small sample size (n <30) or relative standard error (RSE) is >0.3.

Table 2

Receipt of at least one HPV vaccine dose and receipt of three doses among women in the United States, by age and selected characteristics – NHIS 2010.

Characteristic	Age 18–20 Years		Age 21–26 Years		Age 18–26 Years		Age 27–30 Years	
	Number HPV doses							
	At least 1 dose % (95% CI)	3 Doses[a] % (95% CI)	At least 1 dose % (95% CI)	3 Doses[a] % (95% CI)	At least 1 dose % (95% CI)	3 Doses[a] % (95% CI)	At least 1 dose % (95% CI)	3 Doses[a] % (95% CI)
Total	34.9 (29.8, 40.3)	21.1 (17.0, 25.9)	17.5 (15.0, 20.3)	9.3 (7.4, 11.5)	23.2 (20.8, 25.8)	13.2 (11.2, 15.4)	6.7 (5.3, 8.4)	4.2 (3.2, 5.6)
Ever been told had HPV								
Yes	*b*	*b*	31.8 (21.9, 43.6)[c]	18.9 (11.0, 30.5)	34.1 (24.9, 44.8)	21.7 (13.7, 32.5)	24.0 (15.5, 35.2)[c]	18.6 (11.2, 29.3)[c]
No[d]	40.5 (34.5, 46.7)	24.8 (19.7, 30.8)	18.7 (15.5, 22.3)	9.6 (7.5, 12.2)	26.0 (23.0, 29.2)	14.7 (12.2, 17.6)	5.8 (4.3, 7.7)	3.5 (2.4, 5.3)
Cervical CA screening								
Never had PAP test[d]	34.9 (27.0, 43.9)	19.9 (13.6, 28.1)	5.3 (2.9, 9.7)	2.5 (1.0, 6.5)	24.2 (18.7, 30.6)	13.6 (9.5, 19.2)	*b*	*b*
Ever had PAP test	34.9 (28.4, 41.9)	22.2 (16.9, 28.5)	19.3 (16.4, 22.6)[c]	10.2 (8.2, 12.7)[c]	22.9 (20.1, 26.0)	13.0 (10.9, 15.4)	7.0 (5.6, 8.9)	4.5 (3.3, 6.0)
Time since last PAP								
≤3y	35.3 (28.8, 42.4)	22.3 (17.0, 28.7)	20.3 (17.3, 23.7)[c]	10.7 (8.6, 13.4)[c]	23.9 (21.0, 27.0)	13.5 (11.3, 16.0)	7.4 (5.8, 9.4)	4.7 (3.5, 6.2)
>3y	*b*	*b*	2.8 (0.7, 9.9)	1.8 (0.3, 9.2)	4.2 (1.3, 12.4)[c]	3.3 (0.9, 11.8)[c]	*b*	*b*
Doctor recommended								
Yes	36.7 (30.2, 43.8)	21.8 (16.5, 28.2)	16.6 (13.1, 20.8)	9.1 (6.5, 12.6)	24.8 (21.3, 28.8)	14.3 (11.4, 17.8)	5.9 (3.9, 8.7)	3.2 (1.9, 5.2)
No[d]	31.2 (23.6, 39.9)	19.8 (13.7, 27.6)	18.5 (14.9, 22.7)	9.2 (6.7, 12.5)	21.5 (18.1, 25.5)	11.7 (9.1, 14.9)	7.3 (5.4, 9.9)	5.1 (3.4, 7.4)
Race/Ethnicity								
Non-Hispanic white[d]	38.0 (31.3, 45.2)	22.9 (17.5, 29.3)	19.6 (16.0, 23.7)	11.6 (8.8, 15.2)	25.7 (22.4, 29.3)	15.4 (12.5, 18.8)	8.5 (6.5, 11.0)	5.3 (3.8, 7.3)
Non-Hispanic black	33.8 (22.0, 47.9)	16.2 (8.8, 27.8)	15.5 (10.3, 22.6)	3.2 (1.7, 6.1)[c]	21.5 (16.0, 28.3)	7.5 (4.6, 11.9)[c]	4.0 (1.8, 8.7)[c]	2.6 (0.9, 7.1)
Hispanic	24.9 (17.2, 34.7)[c]	16.0 (9.5, 25.6)	12.7 (9.1, 17.5)[c]	6.4 (4.2, 9.7)[c]	16.7 (13.1, 21.1)[c]	9.6 (6.7, 13.5)[c]	2.7 (1.4, 5.0)[c]	1.6 (0.7, 3.8)[c]
Non-Hispanic Asian	*b*	*b*	*b*	*b*	22.9 (13.9, 35.2)	17.4 (9.9, 28.7)	*b*	*b*
Other	*b*	*b*	*b*	*b*	19.0 (10.2, 32.9)	*b*	*b*	*b*
Marital status								
Married[d]	*b*	*b*	10.7 (7.7, 14.6)	5.7 (3.6, 9.0)	11.4 (8.2, 15.7)	5.2 (3.2, 8.1)	4.2 (2.6, 6.6)	*b*

Characteristic	Age 18–20 Years		Age 21–26 Years		Age 18–26 Years		Age 27–30 Years	
	Number HPV doses							
	At least 1 dose % (95% CI)	3 Doses[a] % (95% CI)	At least 1 dose % (95% CI)	3 Doses[a] % (95% CI)	At least 1 dose % (95% CI)	3 Doses[a] % (95% CI)	At least 1 dose % (95% CI)	3 Doses[a] % (95% CI)
Other	36.4 (31.1, 42.0)	22.7 (18.4, 27.8)[c]	20.0 (16.8, 23.6)[c]	10.6 (8.3, 13.4)[c]	26.3 (23.4, 29.4)[c]	15.2 (12.9, 17.9)[c]	9.3 (7.0, 12.1)[c]	6.7 (4.8, 9.2)
Education								
Less than HS[d]	29.2 (19.7, 40.8)	14.0 (7.4, 25.0)	10.6 (5.7, 18.7)	2.8 (1.2, 6.5)	20.7 (14.9, 27.9)	8.9 (5.0, 15.2)	*b*	*b*
HS Grad/GED	33.9 (24.0, 45.4)	18.7 (11.5, 28.9)	10.4 (7.2, 14.6)	5.0 (3.0, 8.2)	19.3 (15.0, 24.6)	10.2 (7.1, 14.7)	4.5 (2.2, 9.0)	3.7 (1.7, 8.1)[c]
Some college	38.6 (31.0, 46.8)	26.2 (19.9, 33.8)[c]	17.8 (13.9, 22.5)	8.1 (5.6, 11.4)[c]	25.3 (21.5, 29.6)	14.7 (11.8, 18.1)[c]	8.0 (5.4, 11.5)[c]	4.1 (2.3, 7.2)[c]
College graduate	*b*	*b*	25.7 (19.9, 32.5)[c]	17.1 (12.3, 23.2)[c]	25.7 (19.9, 32.4)	17.1 (12.4, 23.2)[c]	8.4 (5.9, 11.9)[c]	6.0 (4.0, 8.9)[c]
Employment status								
Employed	35.5 (28.0, 43.9)	20.9 (15.1, 28.1)	19.0 (15.9, 22.5)	10.8 (8.5, 13.6)[c]	23.5 (20.2, 27.1)	13.6 (11.0, 16.6)	7.4 (5.6, 9.7)	5.4 (3.9, 7.4)
Not employed[d]	34.3 (27.7, 41.5)	21.3 (15.7, 28.1)	14.6 (10.8, 19.5)	6.3 (3.8, 10.2)	22.8 (19.5, 26.6)	12.5 (9.8, 15.9)	5.1 (3.1, 8.1)	*b*
Poverty level								
300%+	54.4 (41.6, 66.6)[c]	33.0 (22.1, 46.1)[c]	21.3 (16.5, 27.0)	14.5 (10.1, 20.6)[c]	31.1 (25.6, 37.2)[c]	20.1 (14.9, 26.5)[c]	7.2 (4.9, 10.5)	4.1 (2.5, 6.7)
200% to <300%	24.5 (13.4, 40.4)	15.1 (7.1, 29.4)	18.2 (12.2, 26.3)	6.6 (4.1, 10.7)	20.1 (14.5, 27.2)	9.2 (5.9, 14.1)	6.7 (3.5, 12.4)	4.0 (1.7, 9.1)
100% to <200%	26.4 (18.2, 36.7)	17.7 (10.8, 27.8)	11.7 (8.0, 16.7)	5.3 (3.3, 8.5)	16.4 (12.6, 21.2)	9.3 (6.5, 13.1)	5.6 (2.9, 10.6)	4.5 (2.1, 9.4)
<100%[d]	32.3 (24.2, 41.7)	16.8 (11.5, 23.9)	15.0 (11.4, 19.5)	6.7 (4.5, 10.0)	21.2 (17.3, 25.8)	10.4 (7.7, 13.7)	7.4 (4.1, 12.9)	4.3 (1.8, 9.7)
Immigration status								
Born in U.S.[d]	35.9 (30.5, 41.6)	22.5 (18.0, 27.6)	18.6 (15.7, 21.9)	10.0 (8.0, 12.5)	24.4 (21.8, 27.3)	14.2 (12.1, 16.7)	7.0 (5.4, 9.0)	4.5 (3.3, 6.2)
Born outside U.S. and stayed in the US ≤10 years	*b*	*b*	*b*	*b*	9.9 (4.0, 22.6)[c]	2.0 (0.9, 4.3)[c]	*b*	*b*
Born outside U.S. and stayed in the US >10 years	24.4 (9.4, 50.1)	11.9 (2.9, 37.4)	17.3 (10.1, 27.8)	8.3 (4.3, 15.6)	19.4 (12.6, 28.8)	9.4 (5.5, 15.7)	*b*	*b*
Health insurance								
Private	42.3 (34.9, 50.2)[c]	25.6 (19.5, 32.8)[c]	21.8 (18.1, 26.1)[c]	13.4 (10.4, 17.0)[c]	28.7 (25.0, 32.8)[c]	17.5 (14.3, 21.2)[c]	6.7 (4.9, 9.1)	4.4 (3.1, 6.3)
Public	33.5 (24.0, 44.5)[c]	23.5 (15.9, 33.2)[c]	15.0 (10.1, 21.6)	6.0 (2.9, 12.0)	21.8 (17.0, 27.5)[c]	12.5 (8.7, 17.5)[c]	8.7 (5.2, 14.1)	5.5 (2.8, 10.4)
None[d]	18.2 (10.7, 29.4)	7.6 (4.1, 13.8)	11.4 (7.7, 16.5)	4.0 (2.5, 6.2)	13.3 (9.6, 18.2)	5.0 (3.5, 7.2)	4.9 (2.5, 9.4)	*b*

Characteristic	Age 18–20 Years		Age 21–26 Years		Age 18–26 Years		Age 27–30 Years	
	Number HPV doses							
	At least 1 dose % (95% CI)	3 Doses[a] % (95% CI)	At least 1 dose % (95% CI)	3 Doses[a] % (95% CI)	At least 1 dose % (95% CI)	3 Doses[a] % (95% CI)	At least 1 dose % (95% CI)	3 Doses[a] % (95% CI)
Regular physician								
Yes	39.0 (33.4, 44.9)[c]	24.7 (20.0, 30.1)[c]	20.2 (17.2, 23.6)[c]	10.6 (8.4, 13.3)[c]	26.7 (24.0, 29.6)[c]	15.5 (13.2, 18.2)[c]	7.3 (5.6, 9.3)	4.4 (3.2, 6.0)
No[d]	16.0 (8.9, 27.0)	4.5 (1.9, 10.0)	8.9 (6.1, 12.8)	5.0 (3.1, 7.9)	10.8 (7.8, 14.7)	4.9 (3.2, 7.3)	4.3 (2.1, 8.7)	3.5 (1.6, 7.9)
Seen physician or OB/GYN in past year								
Yes	38.5 (32.5, 45.0)[c]	24.0 (19.1, 29.8)[c]	20.7 (17.7, 24.2)[c]	10.9 (8.7, 13.6)[c]	26.5 (23.6, 29.7)[c]	15.2 (12.8, 18.0)[c]	7.4 (5.7, 9.4)[c]	4.7 (3.4, 6.4)
No[d]	22.8 (14.6, 33.8)	11.4 (6.0, 20.4)	6.0 (4.0, 9.0)	3.5 (2.0, 6.1)	11.8 (8.4, 16.1)	6.2 (3.9, 9.5)	3.7 (1.9, 7.1)	2.4 (1.1, 5.2)
Other vaccination behavior One/more recommended lifetime vaccines								
Yes	39.7 (34.0, 45.7)[c]	23.8 (19.2, 29.2)[c]	19.6 (16.5, 23.0)[c]	10.7 (8.5, 13.3)[c]	26.4 (23.6, 29.5)[c]	15.1 (12.8, 17.8)[c]	7.5 (5.9, 9.6)[c]	4.5 (3.4, 6.1)
No[d]	7.2 (33, 15.1)	5.0 (2.0, 12.2)	8.7 (5.7, 13.1)	3.4 (1.7, 6.6)	8.3 (5.6, 12.2)	3.9 (2.3, 6.5)	3.9 (1.8, 8.0)	3.4 (1.4, 8.1)
Influenza vaccine in past year								
Yes	65.4 (49.5, 78.5)[c]	37.6 (23.9, 53.7)[c]	28.3 (20.0, 38.3)[c]	15.7 (9.3, 25.3)[c]	40.8 (32.6, 49.5)[c]	23.1 (16.1, 31.9)[c]	8.1 (4.4, 14.5)	3.8 (1.4, 9.8)
No[d]	23.6(17.8, 30.7)	15.6 (10.8. 21.9)	10.5 (7.9, 13.9)	6.2 (4.4, 8.7)	15.0 (12.3, 18.1)	9.4 (7.3, 11.9)	5.0 (3.3, 7.6)	3.3 (2.0, 5.5)
Cigarette use								
Current smoke[d]	40.3 (27.5, 54.6)	19.5 (11.0, 32.2)	12.7 (8.8, 18.0)	4.4 (2.5, 7.6)	20.7 (15.6, 26.9)	8.7 (5.8, 13.0)	6.2 (3.6, 10.4)	3.5 (1.6, 7.6)
Former smoker	*b*	*b*	12.6 (7.5, 20.4)	*b*	15.4 (9.7, 23.7)	8.7 (4.5, 16.1)	8.5 (4.3, 16.2)	5.1 (2.2, 11.1)
Never smoked	33.8 (28.3, 39.7)	21.3 (16.8, 26.6)	19.3 (16.2, 22.7)	10.8 (8.5, 13.6)[c]	24.4 (21.7, 27.4)	14.6 (12.2, 17.3)[c]	6.5 (4.8, 8.6)	4.3 (3.0, 6.2)

[a] A small number may have received more than 3 doses.

[b] Estimates are not reliable due to small sample size ($n < 30$) or relative standard error (RSE) is >0.3.

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

[d] Reference level.

Table 3

Multivariable logistic regression and predictive marginal prevalence of women aged 18–26 years ($n = 1866$) who reported having ever received HPV vaccination, United States, by demographic and access-to-care variables, NHIS 2010.

Characteristic	Adjusted vaccination coverage % (95% CI)	Prevalence ratio (Risk Ratio) (adjusted) % (95% CI)	*p*-Value[a]
Previous HPV exposure Ever been told had HPV			
Yes	20.9 (10.0, 31.8)	0.9 (0.5–1.5)	0.555
No[b]	24.5 (20.4, 28.6)	Referent	
Cervical CA screening			
Ever had PAP test	23.6 (19.1, 28.1)	1.3 (1.0–1.9)	0.584
Never had PAP test[b]	26.4 (17.6, 35.2)	Referent	
Doctor recommended			
Yes	24.3 (18.7,30.0)	1.0 (0.7–1.4)	0.961
No[b]	24.1 (18.5, 29.8)	Referent	
Race/Ethnicity			
Non-Hispanic white[b]	23.0 (18.0, 28.1)	Referent	
Non-Hispanic black	24.9 (16.1, 33.8)	1.1 (0.7–1.6)	0.713
Hispanic	30.7 (22.4, 38.9)	1.3 (0.9–1.9)	0.112
Other	24.5 (13.3, 35.7)	1.1 (0.6–1.8)	0.811
Marital status			
Married[b]	11.2 (5.5, 16.9)	Referent	
Other	27.3 (22.8, 31.8)	2.4 (1.4–4.2)	<0.001
Education			
Less than HS[b]	26.8 (16.1, 37.5)	Referent	
HS Grad/GED	23.4 (15.2, 31.6)	0.9 (0.5–1.5)	0.615
Some college	25.0 (19.7,30.3)	0.9 (0.6–1.5)	0.762
College graduate	21.5 (13.2, 29.8)	0.8 (0.5–1.4)	0.459
Immigration status			
Born in U.S.[b]	24.0 (20.0, 28.0)	Referent	

Characteristic	Adjusted vaccination coverage % (95% CI)	Prevalence ratio (Risk Ratio) (adjusted) % (95% CI)	*p*-Value[a]
Born outside U.S. and stayed in the US ≤10 years	11.9 (−0.5, 24.2)	0.5 (0.2–1.4)	0.143
Born outside U.S. and stayed in the US >10 years	33.6 (21.0, 46.1)	1.4 (1.0–2.1)	0.115
Health insurance			
Private	27.8 (22.5, 33.0)	1.7 (1.0–3.0)	0.059
Public	20.8 (12.7, 28.8)	1.3 (0.7–2.3)	0.435
None[b]	16.4 (8.0, 24.8)	Referent	
Regular physician			
Yes	26.2 (22.0, 30.4)	1.9 (1.2–3.1)	0.005
No[b]	13.7 (7.2, 20.3)	Referent	
Seen physician or OB/GYN in past year			
Yes	25.4 (21.2, 29.6)	1.6 (1.0–2.7)	0.050
No[b]	15.8 (7.9, 23.7)	Referent	
Other vaccination behavior One/more recommended lifetime vaccines			
Yes	26.3 (22.1, 30.4)	2.7 (1.4–5.1)	<0.001
No[b]	9.7 (3.7, 15.8)	Referent	
Influenza vaccine in past year			
Yes	40.0 (31.6, 48.4)	2.2 (1.6–2.9)	<0.001
No[b]	18.3 (14.4, 22.1)	Referent	
Cigarette use			
Current smoker[b]	24.7 (16.4, 33.0)	Referent	
Former smoker	20.1 (10.9, 29.2)	0.8 (0.5–1.4)	0.440
Never smoked	24.6 (19.9, 29.2)	1.0 (0.7–1.5)	0.976

[a] p <0.05 by T test for comparisons within each variable with the indicated reference level. All the variables in the table were included in the model.

[b] Reference level.

Table 4

Association of health insurance, having a regular doctor, doctor visit, and vaccine cost with HPV vaccination among U.S. women aged 18–26 – NHIS 2010.

Characteristic			HPV vaccination[a] n	% (95% CI)	% (95% CI)
Health insurance					
Yes[b]					
	Regular physician				
		Yes[b]	1247	86.4 (84.1, 88.5)	28.7 (25.4, 32.2)
		No	210	13.6 (11.5, 15.9)[c]	14.0 (9.2, 20.8)[c]
No					
	Regular physician				
		Yes[b]	271	53.3 (47.9, 58.6)[d]	17.6 (11.7, 25.6)[d]
		No	258	46.7 (41.4, 52.1)[d]	8.4 (5.3, 13.0)[c]
Yes[b]					
	Physician contacts within past year				
		None[b]	198	11.4 (9.5, 13.6)	15.9 (9.7, 24.9)
		1	211	14.7 (12.8, 16.9)	20.8 (14.4, 29.2)
		2–3	405	28.2 (25.2, 31.3)[c]	28.4 (23.3, 34.2)[c]
		4–9	402	29.1 (26.1, 32.2)[c]	33.3 (27.3, 39.9)[c]
		≥10	231	16.6 (14.2, 19.4)	24.9 (17.2, 34.6)
No					
	Physician contacts within past year				
		None[b]	198	37.8 (32.9, 43.0)[d]	4.9 (2.6, 9.3)[d]
		1	86	16.2 (12.7, 20.4)[c]	24.7 (13.0, 41.8)[c]
		2–3	126	22.8 (18.6, 27.6)	16.7 (10.1, 26.5)[c,d]
		4–9	77	15.4 (11.8, 19.7)[c,d]	[e]

Characteristic			HPV vaccination[a] n	% (95% CI)	% (95% CI)
		≥10	40	7.8 (5.2, 11.7)[c,d]	*e*
Health insurance (Unvaccinated women interested in getting HPV vaccine)					
Yes[b]					
	Would get vaccine ifhad to pay $360–500				
		Yes[b]	73	23.8 (18.6, 29.9)	*f*
		No	258	76.2 (70.1, 81.4)[c]	*f*
No					
	Would get vaccine ifhad to pay $360–500				
		Yes[b]	*e*	*e*	*f*
		No	125	85.5 (78.6, 90.5)[c]	*f*
Health insurance (Unvaccinated women who would not pay $360–500 forthe HPV vaccine or for whom the main reason for not getting HPV vaccine was cost)					
Yes[b]					
	Would get vaccine iffreeor lower cost				
		Yes[b]	259	97.7 (95.2, 98.9)	*f*
		No	*e*	*e*	*f*
No					
	Would get vaccine iffreeor lower cost				
		Yes[b]	133	98.2 (93.1, 99.6)	*f*
		No	*e*	*e*	*f*

[a] Estimates based on the responses of participants in the respective categories who answered affirmatively to the question, “Have you ever received an HPV shot or vaccine?”

[b] Reference level.

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

[d] $p < 0.05$ by T test for comparison with the same level of the variable within the “Health insurance = Yes” category.

[e] Estimates are not reliable due to small sample size (n <30) or relative standard error (RSE) is >0.3.

[f] Data not applicable. Includes unvaccinated women.