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## Providers' beliefs about the effectiveness of the HPV vaccine in preventing cancer and their recommended age groups for vaccination: Findings from a provider survey, 2012

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### Abstract

**Background**—The human papillomavirus (HPV) vaccine was recommended in 2007 by the Advisory Committee on Immunization Practices (ACIP) to preadolescent and adolescent girls. Vaccination initiation was recommended at age 11–12 years with the option to start at age 9. Catchup vaccination was recommended to females aged 13–26 previously not vaccinated. However, vaccination coverage remains low. Studies show that the HPV vaccine can prevent cervical, vulvar, vaginal, anal and some oropharyngeal cancers and that provider recommendation of vaccines can improve low vaccination rates.

**Methods**—Using data from 2012 DocStyles, an annual, web-based survey of U.S. healthcare professionals including physicians and nurse practitioners ( $n = 1753$ ), we examined providers' knowledge about the effectiveness of the HPV vaccine in preventing cancer and their vaccine recommendation to all age-eligible females (9–26 years). Descriptive statistics and Chi-square tests were used to assess differences across specialties.

**Results**—Knowledge about HPV vaccine effectiveness in preventing cervical cancer was highly prevalent (96.9%), but less so for anal, vaginal, vulvar and oropharyngeal cancers. Only 14.5% of providers recommended the vaccine to all age-eligible females and 20.2% recommended it to females aged 11–26 years. Knowledge assessment of cancers associated with HPV and vaccination recommendations varied significantly among providers ( $p < 0.01$ ). Providers more frequently recommended the vaccine to girls older than 11–12 years.

**Conclusions**—Improving providers' knowledge about HPV-associated cancers and the age for vaccination initiation, communicating messages focusing on the vaccine safety and benefits in

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Conflict of interest

The authors declare that there are no conflicts of interests.

Disclaimer

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

cancer prevention and on the importance of its delivery prior to sexual onset, may improve HPV vaccine coverage.

### Keywords

HPV vaccine recommendations; Cervical, anal, vaginal, vulvar and cancers; Vaccine initiation; HPV vaccine knowledge

## Introduction

In 2007, the human papillomavirus (HPV) vaccine was first recommended by the Advisory Committee on Immunization Practices (ACIP) for routine vaccination of preadolescent and adolescent girls (Markowitz et al., 2014); (Markowitz et al., 2007). ACIP recommended a 3-dose series of the vaccine targeted to girls aged 11–12 years. However, the recommendation also pointed out that the vaccine could be administered to girls starting at age 9 years. Catch-up vaccination was recommended to females aged 13–26 years who had not been vaccinated. In 2011, the vaccine was also recommended for males aged 13 to 21 years who had not been previously vaccinated or who had not completed the 3-dose series. The ACIP also recommended that males aged 22 to 26 years may be vaccinated (Centers for Disease Control and Prevention, 2011).

HPV vaccine coverage remains low in the U.S. In 2013, complete (three doses) of vaccine uptake was estimated at 37.6% among females aged 13–17 years (Dunne et al., 2014). Even with a low HPV vaccination coverage, there has been a 56% reduction in vaccine-specific HPV infections among females aged 14–19 years in the US from 2003–2006, the period before vaccine initiation, to 2007–2010, the period after initiation. Provider recommendation of the vaccine has repeatedly been associated with much greater odds of vaccination uptake (Reiter et al., 2009); (Daley et al., 2010); (Brewer et al., 2011); (Rosenthal et al., 2011); (Lau et al., 2012); (Gargano et al., 2013); (Ylitalo et al., 2013). Providers with knowledge and understanding of the burden of disease may be more likely to recommend the vaccine, consistent with guidelines (Daley et al., 2010).

HPV can cause cancers of the cervix, vulva, vagina, penis, or anus. It can also cause cancer of the back of the throat, including the base of the tongue and tonsils (Saraiya et al., 2015). Information on HPV associated cancers, which physicians believed the HPV vaccine can prevent, had been published previously (Saraiya et al., 2012). However, to our knowledge, no previous studies have assessed the full spectrum of the age range for which HPV vaccination was recommended. Our study examined more current data on providers' beliefs about the effectiveness of the HPV vaccine in preventing cancer and their recommended age groups for vaccinating females aged 9–26 years, by provider specialty, to identify measures which may increase vaccine uptake.

## Materials and methods

### Data source

DocStyles is an annual web-based survey of U.S. healthcare professionals that investigates provider attitudes and practices related to various health issues. The survey was administered

online by Porter Novelli Public Services (Porter Novelli, Washington, DC) with guidance provided by federal public health agencies and other clients. Quota sampling is used to warrant the adequate representation of targeted provider specialties.

Participants were recruited from the Epocrates Honors Panel, a market research panel comprised of over 275,000 medical practitioners and 750,000 allied health professionals. Physicians' verification was completed at the time of panel registration and was achieved by checking each physician's name, date of birth, medical school, and graduation date against the American Medical Association's (AMA) Masterfile, an inventory of licensed U.S. physicians. A random sample of physicians was then selected to match the AMA file proportion for age, gender and region. The sample of nurse practitioners was drawn from a list of 78,668 nurse practitioners in the Epocrates Allied Health Panel but no verification of identities or demographic thresholds was performed. Providers were eligible to participate in the 2012 DocStyles survey if they actively saw patients, worked in an individual, group, or hospital practice, and actively practiced medicine for a minimum of 3 years in the U.S.

The Centers for Disease Control and Prevention (CDC) licensed items on the 2012 DocStyles survey to monitor knowledge of gynecologic cancer screening and prevention practices among health-care providers. Therefore, this survey assessed provider beliefs on HPV vaccination only in females. This project was exempt from CDC IRB because personal identifiers were not included in the data file. A variety of provider groups were recruited, but responses to all items analyzed in our study were limited to family medicine/general practitioners (fm/GPs), internists, nurse practitioners (NPs), pediatricians, and obstetrician/gynecologists (OB/GYNs). A randomly selected sample of providers was invited to participate in the survey. Sampling quotas were set to reach 1000 fm/GPs and internists and 250 of each of the other specialties. In July 2012, an email invitation to participate in the DocStyles survey was sent to 2175 fm/GPs and internists, 456 NPs, 518 pediatricians and 489 OB/GYNs. Completed responses were obtained from 1753 providers, with an overall response rate of 52.2%. Specialty response rates were 49.9% for fm/GPs and internists (only aggregate number was provided), 65.4% for NPs, 53.5% for pediatricians and 55.2% for OB/GYNs. Providers who did not meet the screening criteria ( $n = 71$ ) and those who did not complete the survey ( $n = 75$ ) were excluded. The remaining providers were removed when the quota was filled.

## Analysis

Our outcomes of interest included: 1) HPV vaccination recommendations, and 2) provider knowledge of HPV vaccine effectiveness in cancer prevention. The first outcome was measured with the question "To which age groups of female patients do you typically recommend the HPV vaccine? Select all that apply". Answer choices included 8 years and younger, 9–10 years, 11–12 years, 13–17 years, 18–26 years, 27–30 years, 31 years and older, and I do not recommend the HPV vaccine. The second outcome was measured with the question "The HPV vaccine is effective in preventing which of the following? Select all that apply." Choices included cancers associated with HPV (cervical cancer, vulvar cancer, vaginal cancer, anal cancer, and oropharyngeal cancer), and cancers not associated with HPV (ovarian cancer, uterine cancer and skin cancer), and none of these. Other variables of

interest included demographic characteristics (gender, race/ethnicity, and number of years in practice), practice characteristics (practice setting, number of providers in the practice, and geographic region), and patient characteristics (number of patients seen weekly, seeing patients < 18 years, and percent of female patients ages 18–26). All five provider specialties were asked the questions about HPV vaccine knowledge and beliefs. The responses to these questions may reflect not only the age groups providers see in their practice but what they might recommend to parents with children at eligible HPV vaccination age.

Descriptive statistics were conducted to assess the distributions of demographic, practice and patient characteristics and were stratified by provider specialty. We also calculated percentages of physicians in each specialty selecting the specified age groups, the cancers associated with HPV, and the percentages of mutually exclusive combinations of these selections. Chi-square tests were used to examine differences across specialties. All analyses were conducted using SAS 9.3 (SAS Institute, Cary, NC). A p-value < 0.05 was considered significant.

## Results

Most provider and practice characteristics varied significantly by provider type (Table 1). The majority of respondents were male (60.1%), non-Hispanic white (74.2%), in a group outpatient work setting (73.8%), working with 2 or more practitioners (84.7%), and except for NPs, more than 50% saw 100 or more patients a week.

Across all specialties, 54.9% of providers recommended the HPV vaccine to females aged 11–12 years (Fig. 1). Specialty responses ranged from 30.4% among internists to 74.0% among pediatricians ( $p < 0.001$ ). Providers more frequently recommended HPV vaccination for females aged 13–17 years (66.9%) with percentages ranging from 46.1% among internists to 78.4% among pediatricians ( $p < 0.001$ ). The percentage of providers who recommended the vaccine to females aged 18–26 years was 63.3% and ranged from 54.7% and 55.6% among internists and pediatricians respectively to 78.4% among OB/GYNs ( $p < 0.001$ ). Overall recommendations to females aged 9–10 years was 22.6%, of which OB/GYNs had the highest percentage (38.0%,  $p < 0.001$ ). Nearly 2% of providers recommended the vaccine to females younger than 9 years and 15.5% recommended it to females older than 26 years.

Table 2 describes the patterns of mutually exclusive age groups to which providers recommended the HPV vaccine. Among providers recommending the vaccine within the age-eligible range, 14.5% recommended it to females 9–26 years old, 20% recommended it to females 11–26 years, and 42% recommended the vaccine to females in various subsets of age groups within the eligible age range. Vaccination recommendations differed significantly ( $p < 0.001$ ) among the 5 types of providers. OB/GYNs had the highest percentage of their specialty recommending the vaccine to females aged 9–26 (29.2%), pediatricians most frequently recommended the vaccine to females aged 11–26 (32.4%) and internist most often (18.7%) recommended the vaccine to females aged 18–26 years.

Twelve percent of providers recommended combinations of age groups outside the age-eligible range, with the largest percentages being among fm/GPs, OB/GYNs and internists (15.5%, 13.6% and 13.4% respectively). More than 11.0% did not recommend the vaccine to any age group. Internist comprised the largest percentage (23.9%) of providers who did not recommend the vaccine.

Almost all providers were aware that the HPV vaccine was effective in preventing cervical cancer (96.9%), with responses ranging from 94.8% among NPs to 99.2% among both pediatricians and OB/GYNs ( $p = 0.001$ ; Fig. 2). However, their awareness of the vaccine's effectiveness of anal, oropharyngeal, vulvar, and vaginal cancers was lower and varied between specialties ( $p < 0.001$  for each cancer type respectively). OB/GYNs had the highest percentage of knowledge about the vaccine's potential effectiveness for anal, vulvar, and vaginal cancers (63.2%, 56.4% and 45.2% respectively) and internists had the lowest (40.5%, 20.5%, and 17.0% respectively). The percentage of physicians reporting that HPV is effective in preventing oropharyngeal cancer was highest among pediatricians (38%) with a slightly lower response by OB/GYNs (34%), and the lowest among internists (20.3%). Less than 4% of providers selected the choices of uterine, ovarian, and skin cancers, and none of these cancers.

Patterns of beliefs about the effectiveness of the HPV vaccine in preventing various combinations of cancers varied by specialty (Table 3). Among the mutually exclusive combination choices which were analyzed, only 6.4% of all providers selected anal, cervical, vaginal and vulvar cancers without selecting any other cancer. OB/GYNs were more likely to select this combination than any other specialty (12.4%,  $P < 0.001$ ). The largest group of providers (39.9%) selected cervical cancer as the only cancer prevented by the HPV vaccine with internists having the largest proportion of their specialty selecting it (46.8%). The selection of cervical cancer in various combinations with anal, vaginal and vulvar cancers, comprised 21.4% and ranged from 20.9% among internists to 27.6% among OB/GYNs ( $p < 0.001$ ). Ten percent of providers selected anal, cervical, vaginal, vulvar and oropharyngeal cancers. OB/GYNs had the highest percentage (22.4%) and internists the lowest (5.0%,  $p < 0.001$ ). Combinations of cervical cancer with anal, vaginal, vulvar and oropharyngeal cancers were selected by 13.5% of providers with pediatricians having the highest percentage (23.2%). Finally, nearly 9% of providers selected answers with one or more cancer (skin, uterine and ovarian cancers), which are not considered to be caused by HPV, or with none of these cancers. Among those, NPs had the highest percentage (15.9%) of selection and OB/GYNs the lowest (2.8%).

## Discussion

Our study identified the range of age groups of females for whom providers recommended HPV vaccination, and provider knowledge of which cancers can be prevented with the HPV vaccine—characteristics that might shed light on the low vaccination rate among females aged 11–26 years.

Consistent with previous studies, our findings show that providers more often recommended the vaccine to females aged 13–17 years and 18–26 years than to females aged 11–12 years,

the target age for vaccination initiation (Reiter et al., 2009); (Daley et al., 2010); (Rahman et al., 2015). Only one out of 5 providers recommended vaccination to females in the age range of 11–26 years. An additional 14.5% recommended it to those aged 9–26 years, the full age spectrum of age-eligible groups. A barrier contributing to the lower vaccination proportion of preadolescents might be the 11% of providers who did not recommend the HPV vaccine at all. Further examination of these providers' beliefs about the vaccine is warranted. An additional area of improvement is related to providers' knowledge of the age-group eligible for HPV vaccination. Many providers selected ages younger or older than the ages recommended by the ACIP. Education and messages targeting providers about the recommended ages of initiation and catchup vaccination would be beneficial.

Our findings were also consistent with findings of a previous DocStyles study conducted in 2009, which included only the 4 physician specialty groups (Saraiya et al., 2012). In both studies, a very high percentage of providers recognized that the HPV vaccine is effective in preventing cervical cancer. However, in 2012, after the anal efficacy trial was published (Palefsky et al., 2011); (Giuliano et al., 2011) recognition of the vaccine in preventing anal cancer doubled among all physicians. A similar increase occurred for the selection of oropharyngeal cancer, albeit with smaller percentages. This finding is interesting, given that there is no clinical trial showing prevention of oropharyngeal cancer. The potential of the vaccine role in preventing oropharyngeal cancer is based on epidemiological research, which has shown that certain types of oropharyngeal cancer are attributable to HPV infection (especially HPV 16) and on indirect evidence suggesting prevention of oral HPV infection (Herrero et al., 2013). A much more modest increase (between < 1% to 4%) among the 4 physician groups occurred for the selection of vulvar cancer, and the change for vaginal cancer selection was not consistent.

Our study suggests that much improvement could be made in providers' knowledge of HPV vaccine, and its potential role in preventing anal, vaginal, vulvar and oropharyngeal cancers in addition to cervical cancer, the only familiar site to all providers. Furthermore, knowledge about the association of HPV with both anal and oropharyngeal cancer can potentially promote the vaccine to males, who currently have a much lower uptake than females (Elam-Evans et al., 2014); (Committee on Infectious Diseases, 2012); (McRee et al., 2014). A recent study addressing gaps in physicians' knowledge about the HPV vaccine and its applications found that a brief educational intervention using structured presentations increased providers' HPV vaccine knowledge among a variety of healthcare providers (Berenson et al., 2015).

Adolescent vaccination coverage of HPV vaccine is generally lower than that of other recommended adolescent vaccines (Elam-Evans et al., 2014); (Schwartz and Easterling, 2015) namely tetanus and meningococcal, and much lower than vaccination coverage of children and infants (Elam-Evans et al., 2014). Unlike younger age groups, this group does not have preventive visits as often as when vaccinations are most commonly given, thus reducing opportunities for immunizations (Rand et al., 2007); (Committee on Infectious Diseases, 2012); (The president cancer panel, 2014). Bundling the HPV vaccine with other vaccines administered to preadolescent and young adolescents can potentially increase vaccine initiation substantially, as was previously recommended by the 2012–2013



President's Cancer Panel and currently by the CDC (The president cancer panel, 2014); (Dunne et al., 2014). A study based on the National Immunization-Teen Survey found that provider recommendation to co-administer the HPV and meningococcal vaccines increased the odds of HPV vaccination by 3-folds among girls who received meningococcal vaccination and reduced missed opportunities to initiate the HPV vaccine series (Perkins et al., 2015).

The lower percentage of vaccine recommendations to females aged 11–12, the age of vaccine initiation, may result in a delay in vaccine initiation and may explain the low rate of vaccination completion at ages 13–17 years (Williams et al., 2015). Reluctance to recommend the HPV vaccine to preadolescent girls may be associated with the perception that young girls are at low risk of HPV infection, which is a sexually transmitted infection, and the hesitation to discuss sexual health-related issues with them and their parents (Committee on Infectious Diseases, 2012); (Daley et al., 2010); (Kahn et al., 2005). In a survey of U.S. physicians 18 months after the HPV vaccine licensure, Daley et al. observed that physicians' reluctance to recommend the vaccine stemmed also from the time it takes to discuss vaccination, and reports that parents of 11–12 years old female patients are more likely to refuse vaccination than those of older patients. However, physicians who did not intend to defer vaccination to an older age and those with a high load of publicly insured patients were more likely to strongly recommend the vaccine to this age group. Additionally, if the discussion about the HPV vaccine emphasized cancer prevention at the time children are coming for scheduled immunization, and occurred before sexual onset, the first uptake of the vaccine might increase substantially (Kahn et al., 2005); (Rand et al., 2007); (Shefer et al., 2008).

OB/GYNs had the highest percentage of knowledge about the benefits of the HPV vaccine in preventing cancer. Knowledge about the burden of disease is a factor in improving vaccination uptake. Following the example of advocacy by the American College of Obstetricians and Gynecologists (ACOG) to their constituency (Committee on Adolescent Health Care of the American College of Obstetricians and Gynecologists and Immunization Expert Work Group of the American College of Obstetricians and Gynecologists, 2014), priming parents of children ages younger than 11 about the vaccine benefits to preadolescent girls and its safety (Schwarz et al., 2012) may decrease parents' anxiety and help increase vaccination initiation substantially. This approach may also work for other provider specialties who may not care directly for adolescents but may have the opportunity to educate parents about the benefits of the HPV vaccine for younger patients. Targeting at a younger age is a more useful strategy than giving the vaccine at ages 21 to 26, when most females are already exposed to HPV (Joura et al., 2015).

There are a number of limitations to our findings. First, the method of recruitment may introduce some bias. Responses to e-mail invitations were collected on a first-come, first-served basis, turning away respondents after the quota for their specialty had been filled. However, the ability to answer the survey over three weeks helped achieve above-average response rates ranging from 50% to 65% for all specialties. Additionally, an analysis performed by Porter Novelli comparing demographic variables of participants in 2012 DocStyles with physicians in the AMA Masterfile found that, although the percentages of

pediatricians and OB/GYN who responded were higher than expected, the percentages of fm/GPs and internists, participants' ages, and regions distributions were fairly comparable. Focusing on female vaccination is another limitation. Assessment of male recommendations was excluded because the survey items were part of a project focused on gynecological cancer. An important limitation of the study is the inclusion of providers who did not care for children aged < 18 or 9–10 year olds. Some of these providers' recommendations might have focused on their patient population and less on the age range for vaccination. However, asking all providers about the ages for whom they recommend the HPV vaccine, including age groups which are not part of their patient population, may be part of preventive messages the clinicians are giving to parents or grandparents. The inclusion of only 2 items related to HPV vaccination in the survey is another limitation. However, the questions about physician's knowledge may point out the gap in knowledge about the burden of disease, which had been shown to have an impact on vaccine recommendations. Lastly, there were no questions regarding provider attitudes about the HPV vaccine.

## Conclusions

Our study revealed that a relatively small percentage of providers recommended the full age range of vaccination. Moreover, providers more often recommended the vaccine to females at ages older than the target age for the HPV vaccine initiation (11–12 years). Additionally, providers were most familiar with the potential benefits of the HPV vaccine in preventing cervical cancer but were found to have gaps in knowledge about the other HPV associated cancers. These age groups preferences and the gap in providers' knowledge about the ACIP guidelines may delay vaccination initiation and suggest that a large number of eligible females in the U.S. may not receive appropriate recommendations for the HPV vaccine. Bundling the vaccine with other early adolescent immunizations, improving provider knowledge about HPV-associated cancers and the eligible age for vaccination, communicating messages that focus on the vaccine safety and benefits in cancer prevention and on the importance of its delivery prior to sexual onset, (American Academy of Pediatrics, 2015) may lead to a substantial improvement in HPV vaccine coverage.

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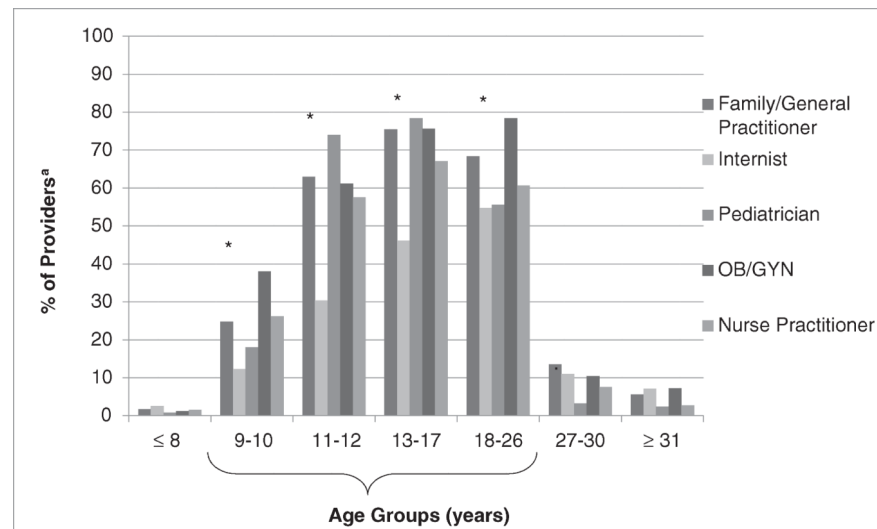
## References

- American Academy of Pediatrics, 2015 Immunizations. Human papillomavirus (HPV). <https://www2.aap.org/immunization/illnesses/hpv/hpv.html> (Accessed July 31,2015).
- Berenson AB, Rahman M, Hirth JM, Rupp RE, Sarpong KO, 2015 A brief educational intervention increases providers' human papillomavirus vaccine knowledge. *Hum. Vaccin. immunotherapeutics* 11,1331–1336.



- Brewer NT, Gottlieb SL, Reiter PL, et al., 2011 Longitudinal predictors of human papillomavirus vaccine initiation among adolescent girls in a high-risk geographic area. *Sex. Transm. Dis* 38,197–204. [PubMed: 20838362]
- Centers for Disease Control and Prevention, 2011 Recommendations on the use of quadrivalent human papillomavirus vaccine in males—Advisory Committee on Immunization Practices (ACIP), 2011. *MMWR Morb. Mortal. Wkly Rep* 60, 1705–1708. [PubMed: 22189893]
- Committee on Adolescent Health Care of the American College of Obstetricians and Gynecologists, Immunization Expert Work Group of the American College of Obstetricians and Gynecologists, 2014 Committee opinion no. 588: human papillomavirus vaccination. *Obstet. Gynecol* 123, 712–718. [PubMed: 24553168]
- Committee on Infectious Diseases, 2012 HPV vaccine recommendations. *Pediatrics* 129, 602–605. [PubMed: 22371460]
- Daley MF, Crane LA, Markowitz LE, et al., 2010 Human papillomavirus vaccination practices: a survey of US physicians 18 months after licensure. *Pediatrics* 126,425–433. [PubMed: 20679306]
- Dunne EF, Markowitz LE, Saraiya M, et al., 2014 CDC grand rounds: reducing the burden of HPV-associated cancer and disease. *MMWR Morb. Mortal. Wkly Rep* 63, 69–72. [PubMed: 24476977]
- Elam-Evans LD, Yankey D, Jeyarajah J, et al., 2014 National, regional, state, and selected local area vaccination coverage among adolescents aged 13–17 years—United States, 2013. *MMWR Morb. Mortal. Wkly Rep* 63, 625–633. [PubMed: 25055186]
- Gargano LM, Herbert NL, Painter JE, et al., 2013 Impact of a physician recommendation and parental immunization attitudes on receipt or intention to receive adolescent vaccines. *Hum. Vaccin. immunotherapeutics* 9, 2627–2633.
- Giuliano AR, Palefsky JM, Goldstone S, et al., 2011 Efficacy of quadrivalent HPV vaccine against HPV Infection and disease in males. *N. Engl.J. Med* 364,401–411. [PubMed: 21288094]
- Herrero R, Quint W, Hildesheim A, et al., 2013 Reduced prevalence of oral human papillomavirus (HPV) 4 years after bivalent HPV vaccination in a randomized clinical trial in Costa Rica. *PLoS One* 8, e68329. [PubMed: 23873171]
- Joura EA, Giuliano AR, Iversen OE, et al., 2015 A 9-valent HPV vaccine against infection and intraepithelial neoplasia in women. *N. Engl.J. Med.* 372, 711–723. [PubMed: 25693011]
- Kahn JA, Zimet GD, Bernstein DI, et al., 2005 Pediatricians' intention to administer human papillomavirus vaccine: the role of practice characteristics, knowledge, and attitudes.*J. Adolesc. Health: Off. Publ. Soc. Adolesc. Med* 37,502–510.
- Lau M, Lin H, Flores G, 2012 Factors associated with human papillomavirus vaccine-series initiation and healthcare provider recommendation in US adolescent females: 2007 National Survey of Children's Health. *Vaccine* 30, 3112–3118. [PubMed: 22425179]
- Markowitz LE, Dunne EF, Saraiya M, et al., 2007 Quadrivalent human papillomavirus vaccine: recommendations of the advisory committee on immunization practices (ACIP). *MMWR. Recommendations and reports: Morbidity and mortality weekly report. Recommendations and reports / Centers for Disease Control and prevention.* 56 pp. 1–24.
- Markowitz LE, Dunne EF, Saraiya M, et al., 2014 Human papillomavirus vaccination: recommendations of the Advisory Committee on Immunization Practices (ACIP). *MMWR. Recommendations and reports: Morbidity and mortality weekly report. Recommendations and reports / Centers for Disease Control.* 63 pp. 1–30.
- McRee AL, Gilkey MB, Dempsey AF, 2014 HPV vaccine hesitancy: findings from a statewide survey of health care providers. *J. Pediatr. Health Care: Off. Public. Natl. Assoc. Pediatr. Nurs. Associates Practitioners* 28, 541–549.
- Palefsky JM, Giuliano AR, Goldstone S, et al., 2011 HPV vaccine against anal HPV infection and anal intraepithelial neoplasia. *N. Engl. J. Med.* 365, 1576–1585. [PubMed: 22029979]
- Perkins RB, Lin M, Silliman RA, Clark JA, Hanchate A, 2015 Why are U.S. girls getting meningococcal but not human papilloma virus vaccines? Comparison of factors associated with human papilloma virus and meningococcal vaccination among adolescent girls 2008 to 2012. *Women's health issues: official publication of the Jacobs Institute of Women's Health.* 25 pp. 97–104.

- Rahman M, McGrath CJ, Hirth JM, Berenson AB, 2015 Age at HPV vaccine initiation and completion among US adolescent girls: trend from 2008 to 2012. *Vaccine* 33, 585–587. [PubMed: 25529289]
- Rand CM, Shone LP, Albertin C, Auinger P, Klein JD, Szilagyi PG, 2007 National health care visit patterns of adolescents: implications for delivery of new adolescent vaccines. *Arch. Pediatr. Adolesc. Med* 161, 252–259. [PubMed: 17339506]
- Reiter PL, Brewer NT, Gottlieb SL, McRee AL, Smith JS, 2009 Parents' health beliefs and HPV vaccination of their adolescent daughters. *Soc. Sci. Med* 69, 475–480. [PubMed: 19540642]
- Rosenthal SL, Weiss TW, Zimet GD, Ma L, Good MB, Vichnin MD, 2011 Predictors of HPV vaccine uptake among women aged 19–26: importance of a physician's recommendation. *Vaccine* 29, 890–895. [PubMed: 20056186]
- Saraiya M, Rosser JI, Cooper CP, 2012 Cancers that U.S. physicians believe the HPV vaccine prevents: findings from a physician survey, 2009. *J. Women's Health* 21, 111–117.
- Saraiya M, Unger ER, Thompson TD, et al., 2015 US assessment of HPV types in cancers: implications for current and 9-valent HPV vaccines. *J. Natl. Cancer Inst* 107, djv086. [PubMed: 25925419]
- Schwartz JL, Easterling LA, 2015 State vaccination requirements for HPV and other vaccines for adolescents, 1990–2015. *JAMA* 314, 185–186. [PubMed: 26172898]
- Schwarz TF, Huang LM, Medina DM, et al., 2012 Four-year follow-up of the immunogenicity and safety of the HPV-16/18 AS04-adjuvanted vaccine when administered to adolescent girls aged 10–14 years. *J. Adolesc. Health: Off. Publ. Soc. Adolesc. Med* 50, 187–194.
- Shefer A, Markowitz L, Deeks S, et al., 2008 Early experience with human papillomavirus vaccine introduction in the United States, Canada and Australia. *Vaccine* 26 (Suppl. 10), K68–K75. [PubMed: 18847559]
- The president cancer panel, 2014 Accelerating HPV Vaccine Uptake: Urgency for Action to Prevent Cancer. National Cancer Institute, Bethesda, MD ([http://deainfo.nci.nih.gov/advisory/pcp/annualReports/HPV/PDF/PCP\\_Annual\\_Report\\_2012-2013.pdf](http://deainfo.nci.nih.gov/advisory/pcp/annualReports/HPV/PDF/PCP_Annual_Report_2012-2013.pdf)).
- Williams WW, Lu PJ, O'Halloran A, et al., 2015 Vaccination coverage among adults, excluding influenza vaccination—United States, 2013. *MMWR Morb. Mortal. Wkly Rep* 64, 95–102. [PubMed: 25654611]
- Ylitalo KR, Lee H, Mehta NK, 2013 Health care provider recommendation, human papillomavirus vaccination, and race/ethnicity in the US National Immunization Survey. *Am. J. Public Health* 103, 164–169. [PubMed: 22698055]

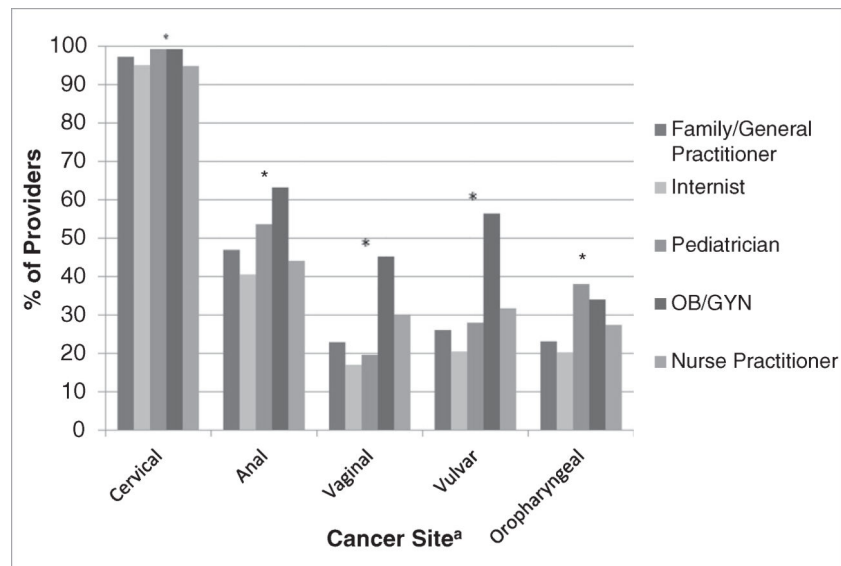


**Fig. 1.**

Age groups of females to which providers typically recommended the HPV vaccine, by provider specialty, DocStyles survey 2012 (N = 1753).

<sup>a</sup>Percentages do not include providers who did not recommend the vaccine to females.

\*Significant differences ( $p < 0.001$ ) by physician specialty for each age group included in the age-eligible range. Percentage differences were assessed with chi-square tests.



**Fig. 2.**

Cancers which providers believed are prevented by the HPV vaccine, by provider specialty, DocStyles survey 2012 (N = 1753)<sup>a</sup>.

<sup>a</sup>Three cancer types not associated with HPV were also available to select including ovarian, skin, uterine cancers and none of the above. However responses to these cancers were selected by < 9% of physicians of any specialty. \*Significant differences ( $p < 0.01$ ) by provider specialty for each cancer site. Percentage differences were assessed with Chi-square tests.

**Table 1**

Provider and practice characteristics, by provider specialty, DocStyles survey 2012.

	Family/general practitioner (n = 537)	Internist (n = 464)	Pediatrician (n = 250)	OB/GYN (n = 250)	Nurse practitioner (n = 252)	Total (n = 1753)
<i>Demographic characteristics</i>						
Gender**						
Male	70.0	72.6	56.0	67.2	12.7	60.1
Female	30.0	27.4	44.0	32.8	87.3	39.9
Number of years in practice**						
10 years	34.8	31.9	28.4	16.8	40.1	31.3
11–20 years	33.5	37.9	39.6	46.8	45.6	39.2
>20 years	31.7	30.2	32.0	36.4	14.3	29.5
Race/ethnicity**						
White	76.7	58.2	77.2	77.6	92.1	74.2
Black	3.3	4.3	4.0	5.2	2.0	3.8
Asian	10.6	24.4	9.2	9.2	2.0	12.6
Hispanic	5.4	4.1	5.6	4.8	2.0	4.5
Other	3.9	9.0	4.0	3.2	2.0	4.9
<i>Practice characteristics</i>						
Practice setting**						
Individual outpatient	19.5	15.7	11.6	25.2	16.7	17.8
Group outpatient	78.2	64.0	76.4	74.0	79.8	73.8
Inpatient	2.2	20.3	12.0	0.8	3.6	8.4
Number of providers in practice**						
Sole practice	16.4	10.3	8.8	22.8	21.0	15.3
2–5 practitioners	38.0	33.4	39.2	39.6	48.0	38.6
6 practitioners	45.6	56.2	52.0	37.6	30.9	46.1
Geographic region						
Northeast	26.3	28.7	24.8	24.8	26.6	26.5
South	21.8	21.8	24.0	23.6	23.4	22.6
Midwest	24.2	24.2	23.2	22.0	25.8	23.8

	Family/general practitioner (n = 537)	Internist (n = 464)	Pediatrician (n = 250)	OB/GYN (n = 250)	Nurse practitioner (n = 252)	Total (n = 1753)
West	27.7	27.7	28.0	29.6	24.2	27.1
<i>Patient characteristics</i>						
Number of patients seen weekly **						
<75	16.0	20.9	24.4	14.0	30.9	20.4
75–99	19.2	19.2	20.4	22.0	24.2	20.5
100–124	38.9	32.1	31.6	36.0	29.8	34.3
125+	25.9	27.8	23.6	28.0	15.1	24.8
See Patients < 18 years **						
Yes	94.2	36.0	99.6	85.2	75.4	75.6
No	5.8	64.0	0.4	14.8	24.6	24.4
% patients female ages 18–26						
0	0.2	2.4	21.2	0.0	3.6	4.2
1–24	85.8	84.3	76.4	30.4	59.1	72.3
25	14.0	13.4	2.4	69.6	37.3	23.4

Note: n = sample size. OB/GYN = Obstetricians/gynecologists. Distributions by provider specialty are presented as a percent of column total. Chi-square tests were used to determine differences across specialty

\*\* The difference between provider types is significant with a p value < .001



Table 2

Number and percent of providers recommending HPV vaccination, by provider specialty, DocStyles survey 2012.

Age group <sup>a</sup> (years)	Family/general practitioner (n = 537)	Internist (n = 464)	Pediatrician (n = 250)	OB/GYN (n = 250)	Nurse practitioner (n = 252)	Total (n = 1753)
	n (%) <sup>b</sup>	n (%) <sup>b</sup>	n (%) <sup>b</sup>	n (%) <sup>b</sup>	n (%) <sup>b</sup>	n (%) <sup>b</sup>
<i>Within the age-eligible groups</i>						
Full age-eligible range (9–26)	85 (15.8)	27 (5.8)	28 (11.2)	73 (29.2)	41 (16.3)	254 (14.5)
Guideline recommended age range (11–26)	138 (25.7)	43 (9.3)	81 (32.4)	41 (16.4)	51 (20.2)	354 (20.2)
<i>Partial age ranges</i>						
13–26	42 (7.8)	42 (9.1)	18 (7.2)	28 (11.2)	20 (7.9)	150 (8.6)
18–26	28 (5.2)	87 (18.7)	2 (0.8)	27 (10.8)	21 (8.3)	165 (9.4)
9–17	6 (1.1)	4 (0.9)	6 (2.4)	4 (1.6)	5 (2.0)	25 (1.4)
11–17	19 (3.5)	9 (1.9)	25 (10.0)	5 (2.0)	7 (2.8)	65 (3.7)
13–17	47 (8.8)	43 (9.3)	28 (11.2)	11 (4.4)	25 (9.9)	154 (8.8)
11–12	38 (7.1)	27 (5.8)	35 (14.0)	11 (4.4)	21 (8.3)	132 (7.5)
9–10	14 (2.6)	7 (1.5)	6 (2.4)	5 (2.0)	4 (1.6)	36 (2.1)
Other age group combinations	4 (0.7)	2 (0.4)	1 (0.4)	1 (0.4)	1 (0.4)	9 (0.5)
Sub total	421 (78.4)	291 (62.7)	230 (92.0)	206 (82.4)	196 (77.8)	1344 (76.7)
<i>Ranges of ages including outside age-eligible groups</i>						
Combinations with ages 8, 27–30 or 31 +	82 (15.3)	62 (13.4)	10 (4.0)	34 (13.6)	23 (9.1)	211 (12.0)
<i>Not recommending the HPV vaccine</i>						
	34 (6.3)	111 (23.9)	10 (4.0)	10 (4.0)	33 (13.1)	198 (11.3)

Note: n = sample size. OB/GYN = Obstetrician/gynecologist.

<sup>a</sup> Age groups are mutually exclusive.

<sup>b</sup> Percentages sum to 100 per column; percentages are rounded to the closest integer.

Table 3

Number and percent of providers believing that HPV vaccine is effective in preventing various combinations of cancers, by provider type, DocStyles survey 2012.

Types of cancer <sup>a</sup>	Family/general practitioner (n = 537)	Internist (n = 464)	Pediatrician (n = 250)	OB/GYN (n = 250)	Nurse practitioner (n = 252)	Total (n = 1753)
	n (%) <sup>b</sup>	n (%) <sup>b</sup>	n (%) <sup>b</sup>	n (%) <sup>b</sup>	n (%) <sup>b</sup>	n (%) <sup>b</sup>
<i>Combinations of anal, cervical, vaginal, and vulvar cancer</i>						
Cervical, vulvar, vaginal, anal cancers only	33 (6.1)	21 (4.5)	10 (4.0)	31 (12.4)	17 (6.7)	112 (6.4)
Cervical cancer only	230 (42.8)	217 (46.8)	85 (34.0)	60 (24.0)	108 (42.9)	700 (39.9)
Partial combinations of cervical cancer with vulvar, vaginal and anal cancers	125 (23.3)	97 (20.9)	54 (21.6)	69 (27.6)	31 (12.3)	376 (21.4)
<i>Combinations of anal, cervical, vaginal, and vulvar, and oropharyngeal cancer</i>						
Cervical, vulvar, vaginal, anal and oropharyngeal cancers only	46 (8.6)	23 (5.0)	23 (9.2)	56 (22.4)	28 (11.1)	176 (10.0)
Partial combinations of cervical, vulvar, vaginal, anal and oropharyngeal cancers	61 (11.4)	63 (13.6)	58 (23.2)	27 (10.8)	28 (11.1)	237 (13.5%)
<i>All other combinations including 1 wrong cancer<sup>c</sup></i>	42 (7.8)	43 (9.3)	20 (8.0)	7 (2.8)	40 (15.9)	152 (8.7)

n = sample size; OB/GYN = Obstetrician/gynecologist.

<sup>a</sup>Cancer categories are mutually exclusive.

<sup>b</sup>Percentages sum to 100 per column; percentages are rounded to the closest integer.

<sup>c</sup>Nine possible responses were included: anal cancer, cervical cancer, ovarian cancer, oropharyngeal cancer, skin cancer, uterine cancer, vaginal cancer, vulvar cancer, and the option, and none of these.