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Missed Clinical Opportunities: Provider Recommendations for HPV Vaccination for 11-12 Year Old Girls is Limited

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Abstract

Objective—The purpose of this study was to determine the prevalence of physician recommendation of human papillomavirus (HPV) vaccination in early (ages 11-12), middle

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(13-17), and late adolescent/young adult (18-26) female patients by physician specialty, and to identify factors associated with recommendation in early adolescents.

Methods—A 38-item survey was conducted April 2009 through August 2009 among a nationally representative random sample of 1,538 Family Physicians, Pediatricians, and Obstetricians and Gynecologists obtained from the American Medical Association Physician Masterfile. A multivariable model was used to assess factors associated with frequency of physician recommendation of HPV vaccination (“always”=76-100% of the time vs. other=0-75%) within the past 12 months.

Results—Completed surveys were received from 1,013 physicians, including 500 Family Physicians, 287 Pediatricians, and 226 Obstetricians and Gynecologists (response rate = 67.8%). Across the specialties, 34.6% of physicians reported they “always” recommend the HPV vaccine to early adolescents, 52.7% to middle adolescents, and 50.2% to late adolescents/young adults. The likelihood of “always” recommending the HPV vaccine was highest among Pediatricians for all age groups ($P < .001$). Physician specialty, age, ethnicity, reported barriers, and Vaccines for Children provider status were significantly associated with “always” recommending HPV vaccination for early adolescents.

Conclusions—Findings suggest missed clinical opportunities for HPV vaccination, and perceived barriers to vaccination may drive decisions about recommendation. Results suggest the need for age and specialty targeted practice and policy level interventions to increase HPV vaccination among US females.

Keywords

human papillomavirus; HPV vaccine; cancer vaccine; cervix cancer; physician

1. Introduction¹

In June 2006, the Food and Drug Administration (FDA) approved a quadrivalent human papillomavirus (HPV) vaccine for 9-26-year-old females. The Centers for Disease Control and Prevention’s Advisory Committee on Immunization Practices (ACIP) subsequently recommended routine vaccination of females aged 11-12 years, as well as catch-up vaccination for females aged 13-26 years and vaccination of ages 9-10 years at the provider’s discretion [1,2]. Despite these recommendations, HPV vaccination rates remain suboptimal, with only 44.3% of 13-17-year-olds receiving at least one dose in 2009 [3]. Data from the 2008 National Health Interview Survey indicated 14.7% of 11-12-year-olds and 25.4% of 13-17-year-olds received at least one dose of the HPV vaccine, and only 5.5% of 11-12-year-olds and 10.7% of 13-17-year-olds received all 3 doses [4]. Although patient factors including concerns about vaccine safety [5], moral or ethical concerns [6,7], and insurance/access to care issues [8] have been cited, another equally important factor with regard to vaccine uptake among children [9-12] and adults [13-19] is physician recommendation [20].

Three physician specialties typically provide preventive care for females between the ages of 9 and 26: Pediatricians (Peds), Family Physicians (FPs), and Obstetricians/Gynecologists (OBGYNs) [21]. Studies conducted predominantly prior to availability of the HPV vaccine demonstrated variability in intention to recommend HPV vaccination across these specialties [22-24]. Understanding provider recommendation among a representative sample of

¹Abbreviations: FDA—Food and Drug Administration, HPV—human papillomavirus, ACIP—Advisory Committee on Immunization Practices, Peds—Pediatricians, FPs—Family Physicians, OBGYNs—Obstetricians/Gynecologists, AMA—American Medical Association, SE—standard error, OR—odds ratio, CI—confidence interval, VFC—Vaccines for Children

physicians from the 3 specialties is an important first step in promoting optimal utilization of HPV vaccination. The primary aim of this study was to determine the prevalence of physician recommendation of HPV vaccination in early (ages 11-12), middle (ages 13-17), and late adolescent/young adult (ages 18-26) female patients by specialty among a nationally representative sample of US physicians. Given that females aged 11-12 years are the primary target group for routine vaccination [1,2], a second aim was to identify factors associated with recommendation of vaccination for early adolescents.

2. Methods and materials

2.1. Sample

A nationally representative sample of FPs, Peds, and OBGYNs was randomly selected from the American Medical Association (AMA) Physician Masterfile, a database of all licensed US physicians irrespective of membership in the AMA or any other elective organization [25]. FPs, Peds, and OBGYNs were sampled based on their proportional representation in the US physician primary care workforce. The sampling frame excluded physicians who were: 1) trainees, 2) locum tenens, 3) *primarily* conducting non-patient care related professional activity, 4) OBGYNs who solely practiced obstetrics, 5) from the same practice, 6) > age 65 years (likely to be retired), and 7) listed a post office box for their address (precluding our ability to mail surveys via Federal Express). The survey was mailed to 1,538 physicians: 818 FPs, 393 Peds, and 327 OBGYNs. Of those surveys, 33 were undeliverable and 10 participants were identified as ineligible. Completed surveys were received from 1,013 physicians, including 500 FPs, 287 Peds, and 226 OBGYNs, for an overall response rate of 67.8%. The specialty-specific response rates were 63.6% for FPs, 74.6% for Peds, and 69.8% for OBGYNs.

2.2. Instrument

The survey was developed using the Competing Demands Model which proposes that patient, physician, and practice level factors impact a physician's decision to provide a preventive service (e.g., HPV vaccination) [26]. Where possible, items were used from previous surveys of physician recommendation of HPV vaccination [22,23,27,28]. Face validity was established through 2 rounds of expert panel review with HPV researchers and clinicians, qualitative interviews with academic and community physicians (n=7), and a pilot study with physicians (n=16) randomly selected using online medical association directories. The final 38-item survey included sections assessing demographic and practice characteristics, HPV knowledge, perceived barriers related to HPV vaccination, vaccine practices, and vaccine recommendation. The survey instructions specified that the questions pertained to the quadrivalent HPV vaccine.

HPV knowledge was measured using 6 items designed to ascertain participants' knowledge regarding HPV infection and HPV vaccination. Response options included "true," "false," or "don't know." Correct responses were summed to create a total knowledge score (range: 0-6), which was dichotomized into "high knowledge" (≥ 5 correct responses) and "low knowledge" (≤ 4 correct responses) based on a median split.

Perceived barriers to HPV vaccination were measured using 14 items pertaining to concerns about: vaccine safety and efficacy, discussing sexuality, vaccinated teens practicing riskier sexual behaviors, cost and reimbursement, ensuring 3-dose series completion, and school attendance requirements linked to HPV vaccination. Response options were on a 5-point Likert scale (1=strongly disagree to 5=strongly agree). Items were summed and averaged to create a mean barrier score. Scores for the sample were divided into thirds to classify participants reporting low, medium, and high barriers.

Participants were asked to identify strategies used to ensure 3-dose series completion: providing a paper-based reminder card to the patient, reminder letters or telephone calls, flagging patient charts, scheduling patients for the next dose during their current office visit, using a computerized immunization database or registry, or another strategy. Participants could select all options that applied. Responses were classified into 3 groups: no strategies, 1 strategy, or 2 or more strategies.

HPV vaccine recommendation for females was assessed using the following question: “In the past 12 months, how often did you *recommend* the HPV vaccine to your female patients?” Physicians reported their recommendation practices separately for early, middle, and late adolescents/young adults. Response options included a qualitative descriptor and quantitative estimate: “never” (0%), “rarely” (1-25%), “sometimes” (26-50%), “often” (51-75%), or “always” (>75%).

2.3. Data collection

After Institutional Review Board approval, a multiphase recruitment approach was used based on the Dillman method [29]. First, participants were mailed a postcard to inform them about the survey. Two weeks later, physicians were sent a Federal Express packet that included a cover letter, scannable survey, prepaid return envelope, pen, USB drive, and \$25 cash incentive. A reminder card was mailed 1 week later, followed by another survey, another reminder card, and a final survey. Data collection took place between April and August 2009. Ten percent of the surveys were randomly selected and verified to check for errors that may have occurred during scanning.

2.4. Data analysis

Pearson Chi-square or Fisher’s Exact tests were conducted to investigate differences between specialty and variables of interest. The primary response variable, physician recommendation of HPV vaccination, was dichotomized into “always” (>75% of the time) or “other.” This comparison was selected as “always” as it most closely reflects recommendation practices based on ACIP guidelines for routine vaccination of females [1,2]. Prevalence of recommendation was also summarized by patient age group and physician specialty. Respondents who reported they do not see patients in an age group were excluded from those age-specific analyses. Additionally, weighted specialty-specific prevalence estimates and their standard errors (SE) were calculated using the reciprocal of actual respondents to the total number of physicians for each specialty.

Simple logistic regression models were used to determine factors independently associated with “always” recommending the HPV vaccine for early adolescents. Multivariable logistic regression models were then fitted. The final model was selected empirically and based on the backward elimination approach (significance level of stay = 0.05); however, physician specialty was included as a design variable in the final model. Odds ratios (OR) and their 95% confidence interval (CI) were estimated from the logistic regression model. All analyses used two-tailed tests of significance with the significance level set at $P < 0.05$, and were performed using the SAS® 9.2 statistical software package (SAS Institute Inc, Cary, North Carolina).

3. Results

Table 1 describes the final study sample. Statistically significant differences were observed for nearly every variable by specialty. Compared to FPs (38.5%), a significantly higher proportion of Peds (55.4%) and OBGYNs (51.8%) were female, and these 2 groups saw a significantly higher number of patients per day. FPs (24.7%) were more commonly located

in rural regions of the US (Peds = 8.7%, OBGYNs = 15.3%) and had the lowest percentage of patients who used private insurance as their primary payment method (46.1% vs. 55.4% of Peds and 62.2% of OBGYNs). Peds had the highest proportion of Vaccines for Children (VFC) providers (71.1% vs. 37.9% of FPs and 5.4% of OBGYNs). Relative to Peds (36.9%), more FPs (59.1%) and OBGYNs (63.5%) referred uninsured patients to federally qualified health centers, health departments, or other locations for HPV vaccination. A lower proportion of Peds (64.5%) saw non-Hispanic White patients compared to FPs (75.0%) and OBGYNs (79.3%). A higher proportion of FPs (43.5%) reported high overall perceived barriers to HPV vaccination relative to Peds (28.2%) and OBGYNs (26.6%).

Overall, 34.6% of physicians reported they “always” recommend the HPV vaccine to early, 52.7% to middle, and 50.2% to late adolescents/young adults (Figure 1). FPs were the least likely to report recommending HPV vaccination, regardless of age group considered. In contrast, Peds were most likely to recommend vaccination. Compared to FPs, there was a 2.6- (95% CI, 1.9-3.7), 4.7- (95% CI, 3.4-6.6), and 5.3- (95% CI, 3.6-7.7) fold greater odds of Peds “always” recommending vaccination for early adolescents, middle adolescents, and late adolescents/young adults, respectively (Table 2). Similarly, there was a 2.7- (95% CI, 1.9-3.8) and 2.5- (95% CI, 1.8-3.6) fold greater odds of OBGYNs “always” recommending vaccination compared to FPs for middle adolescents and late adolescents/young adults, respectively.

Survey weights were used to approximate the prevalence of HPV vaccine recommendation among the national physician population. Regarding early adolescents, 33.7% (SE = 1.8) of physicians reported “always” recommending HPV vaccination; that 33.7% was comprised of 12.3% Peds, 13.7% FPs, and 7.7% OBGYNs. For middle adolescents, 50.9% (SE = 1.7) “always” recommended HPV vaccination, of which 18.7% were Peds, 19.3% FPs, and 12.9% OBGYNs. Of the 50.3% (SE = 1.7) who “always” recommended HPV vaccination to ages late adolescents/young adults, 19.1% were Peds, 18.9% FPs, and 12.4% OBGYNs.

In bivariate analyses, physician age, gender, race, ethnicity, specialty, practice type, VFC provider status, referring uninsured patients for HPV vaccination, perceived barriers related to HPV vaccination, and patient race were significantly associated with vaccine recommendation for early adolescents (Table 3). Factors independently associated with recommendation of HPV vaccination for early adolescents in a multivariable model are presented in Table 4. Compared to FPs, Peds had a 2.1-fold (95% CI, 1.5-3.0) greater odds of “always” recommending vaccination. Physicians aged 40 to 49, compared to those > 50 years, had a 1.8-fold (95% CI, 1.3-2.7) greater odds of recommending. Hispanic or Latino physicians, compared to non-Hispanic physicians, had a 2.4-fold (95% CI, 1.3-4.4) greater odds of recommending vaccination. Those who reported a low, vs. high, level of barriers to vaccination had a greater odds of recommending (OR, 1.8; 95% CI, 1.2-2.6). Physicians who were not VFC providers, compared to those who were, had a lower odds of recommending vaccination (OR, 0.5; 95% CI, 0.4-0.8).

4. Discussion

Across the main specialties involved in HPV vaccination, the prevalence of “always” recommending vaccination was lowest for early adolescents (34.6%) and increased slightly to ~50% for middle (52.7%) and late adolescents/young adults (50.2%). This practice is not in compliance with ACIP recommendations which designates girls aged 11-12 years as the primary target, ideal age group for routine vaccination [1,2]. The lower prevalence of recommendation for this age group is consistent with findings from previous studies [30,31], and is lower than rates reported for middle adolescents which ranged from 36% to 64% in

other studies [30,31]. These results point to the need to intervene with physicians as one approach to increase dissemination of HPV vaccination in females.

The rationale for targeting early adolescents is to deliver the vaccine prior to sexual debut and first HPV exposure [21,32]. In a recent analysis of the Youth Risk Behavioral Surveillance data, 5.9% of students reported engaging in sexual intercourse before age 13 [33]. Additionally, younger age groups are ideal to target for HPV vaccination given the frequency of preventive care physician visits and that providers who see this age group are most experienced in delivering vaccines [34]. Thus, the results indicate that less frequent recommendation to younger females represents a missed clinical opportunity to provide both individual and population level benefits of HPV vaccination.

Despite consistent recommendations across professional organizations of each specialty [35-37], vaccine recommendation rates varied by provider specialty. Peds were significantly more likely than FPs and OBGYNs to “always” recommend HPV vaccination for almost all female age groups. In a study of factors associated with HPV vaccine series initiation and completion among adolescent females ages 9-18, there were no differences in series initiation between Peds and FPs [38]. However, in our study FPs were least likely to recommend HPV vaccination. Differences in results across physician studies may reflect variability in survey question design or other interventions in place at the time of the survey. For example, Dempsey et al. [5] observed that “visit type” was most strongly associated with HPV vaccination. In the current study, vaccination recommendation was not evaluated by visit type and may account for some of the specialty specific differences in our study given that FPs are 50% less likely to see adolescents for preventive care visits compared to Peds [34]. Additionally, during 6 of the 15 months of the Dempsey et al. study, Family Medicine clinics (but none of the other specialties) participated in an intervention that provided automated computer reminders about HPV vaccination [38].

Older adolescent and young adult visits tend to shift from the Peds care setting to that of FPs and OBGYNs [34]. Our study found that OBGYNs were more likely than FPs to recommend vaccination to middle and late adolescent/young adult patients. This may also reflect the nature of visits to FPs versus OBGYNs. An analysis of National Ambulatory Medical Care Survey and National Hospital Ambulatory Medical Care Survey data conducted prior to HPV vaccine availability indicated that 35% of preventive visits made by females ages 18-21 were to OBGYNs; the same report found only 1-3% of immunizations were received from OBGYNs (or other subspecialists) [34]. However, if the pattern of visit type by specialty remained consistent (i.e., FPs for problem-focused and OBGYN for preventive visits) since HPV vaccine availability, then perhaps the clinical opportunity to recommend HPV vaccination for late adolescent females is more likely to occur in OBGYN visits.

In addition to specialty, physician demographic characteristics including age and ethnicity were significantly associated with vaccine recommendation. Physicians aged 40-49 years were more likely to recommend HPV vaccination than physicians in younger or older age groups. It is possible that providers in this age group have achieved a sufficient level of clinical autonomy, but are still open to the adoption of new innovations and technologies in their clinical practice. Physicians who self-identified as Hispanic/Latino were more likely than non Hispanic/Latino providers to always recommend HPV vaccination to early adolescents. Given that Hispanic women have higher rates of cervical cancer incidence compared to other races/ethnicities [39] and Hispanic physicians are more likely to provide care to Hispanic patients [40], they may be more sensitized to the importance of vaccines for cervical cancer prevention.

Compared to physicians who reported high perceived barriers to vaccination, those who reported low perceived barriers were more likely to recommend vaccination to early adolescents. This finding is aligned with previous research that found several individual barriers, including concerns about adding another vaccine to the vaccine schedule and the time needed to discuss HPV vaccination with parents, were significantly associated with physicians not strongly recommending vaccination of girls aged 11-12 [41].

Policy-level factors that impact physician recommendation of HPV vaccination include state vaccine financing programs' coverage of immunization [42]. In the current study, VFC provider status was examined as a means for assessing the impact of state vaccine financing on physician recommendation of HPV vaccine, and results indicate VFC providers were more likely than non-VFC providers to report always recommending HPV vaccine to early adolescent patients. The VFC program provides ACIP-recommended vaccines to eligible children up to age 18, who meet at least one of the following criteria: Medicaid eligible, uninsured, underinsured, or American Indian or Alaska Native [43]. VFC states (n=36) provide vaccines only for VFC providers choosing to enroll. Physicians who enroll as VFC providers may be responsible for maintaining separate vaccine stocks for VFC-eligible and non-eligible patients. Thus, providers willing to take on this additional responsibility may represent those groups with greater motivation to recommend vaccination [42]. It is plausible that an intervention to increase physicians' participation in the VFC program will increase physician recommendation of HPV vaccine.

Finally, it should be noted that the FDA approved the HPV vaccine for use in males after the current study was conducted [44]. Prior to FDA approval, Weiss and colleagues [45] surveyed FPs and Peds about their attitudes and perceptions of vaccinating males against HPV. Physicians were asked the frequency with which they recommended HPV vaccine to their female patients and if they would recommend the vaccine to males if recommended by the ACIP and covered by insurance. Results suggest that more physicians would "often" or "always" recommend the vaccine for males (24.1%) than females (18.1%) aged 9-10 years ($P < 0.001$), but more physicians would recommend the vaccine to females than males for the 11-12 and 13-18 age groups ($P < 0.001$). For ages 19-26, no statistically significance by patient gender was observed. Further research examining physicians' actual recommendation of HPV vaccine to their male patients is needed.

To our knowledge, this is the first nationally representative survey of US provider recommendation of HPV vaccination. There are notable strengths in the present study. First, our study population is based on a sample of all US licensed physicians. Previous physician studies of actual vaccination practices have been limited by geography and/or membership to a particular professional organization or society [30,31]. Second, our survey response rate (~68%) exceeds any previous study of actual physician recommendation of HPV vaccination yielding response rates below 20% [30,31]. This response rate among a nationally representative sample of physicians enhances the generalizability of our findings to all US physicians practicing in the specialties studied. Third, we were able to make important comparisons of recommendation practices by both patient age group and provider specialty, allowing for a more precise estimate of HPV vaccination recommendation. Additionally, these data serve as an important baseline measure of recommendation of HPV vaccination to evaluate time trends post-vaccine licensure.

This study also has limitations. The initial sampling frame may not have included all eligible physicians. However, the AMA Masterfile [25] contains data on 100% of allopathic and 93% of osteopathic physicians, irrespective of membership to the AMA or any other professional organization [46]. Since ~32% of physicians did not respond to the survey, results may be more representative of physicians with stronger opinions about HPV

vaccination. However, our overall response rate far exceeds any previous national or population-based study of HPV vaccine recommendation to date. We did not observe whether physicians actually recommended vaccination to their patients and it is possible that respondents reported socially desirable responses with respect to practice behaviors. However, the anonymity of the survey likely reduced this bias. There is further evidence that bias was unlikely given the range of responses on our primary outcome variable of interest. Our survey was conducted prior to the availability of the bivalent HPV vaccine. Thus, it is possible that responses to certain questions (e.g., barriers associated with vaccination) may differ based on the type of vaccine a provider elects to provide to their patients. Finally, we used “always” to group physicians who reported recommending vaccination >75%-100% of the time.

5. Conclusion

Despite national guidelines recommending vaccination to all females 11-26 years of age, the proportion of physicians who reported they always recommended HPV vaccination to this population ranged between 25.8% and 74.5%, depending on age group and physician specialty. Our findings suggest that there are numerous missed clinical opportunities for HPV vaccination, particularly for early adolescent females, and that perceived barriers to vaccination may drive decisions about recommending the vaccine. Physician recommendation is an important and consistent predictor of vaccine uptake. Thus, interventions are needed to address barriers to vaccination and promote HPV vaccination of early adolescents. Our findings suggest these interventions may need to be targeted by provider age and specialty.

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Highlights

- We surveyed a nationally representative sample of physicians about HPV vaccination.
- Almost 35% of physicians reported they “always” recommend HPV vaccine to ages 11-12.
- Age and specialty targeted interventions may increase HPV vaccination among females.

Figure 1.

Unweighted percentage of physicians who “always”^a recommend the HPV vaccine, by specialty and patient age group^b

^a Defined as 76-100% of the time.

^bNote: Peds seeing 11-12 year olds n = 265; 13-17 year olds n = 267; 18-26 year olds n = 196. FPs seeing 11-12 year olds n = 415; 13-17 year olds n = 426; 18-26 year olds n = 439. OB/GYNs seeing 11-12 year olds n = 83; 13-17 year olds n = 197; 18-26 year olds n = 211.

Demographic, practice, and, patient characteristics, knowledge, perceived barriers, and vaccine practices by provider specialty^a (N = 1008)

Table 1

	Total (N=1008) n (%)	FPs (N=499) n (%)	Peds (N=287) n (%)	OBGYNs (N=222) n (%)	P Value
Demographic characteristics					
Age (yr)					.20
25-39	239 (23.7)	127 (25.5)	67 (23.3)	45 (20.3)	
40-49	327 (32.4)	149 (29.9)	92 (32.1)	86 (38.7)	
50+	422 (41.9)	214 (42.9)	121 (42.2)	87 (39.2)	
Gender					<.001
Male	528 (52.4)	302 (60.5)	122 (42.5)	104 (46.9)	
Female	466 (46.2)	192 (38.5)	159 (55.4)	115 (51.8)	
Race					.02
White/Caucasian	737 (73.1)	380 (76.2)	190 (66.2)	167 (75.2)	
Other	252 (25.0)	111 (22.2)	88 (30.7)	53 (23.9)	
Ethnicity					.04
Hispanic or Latino	62 (6.2)	24 (4.8)	26 (9.1)	12 (5.4)	
Not Hispanic or Latino	920 (91.3)	464 (93.0)	250 (87.1)	206 (92.8)	
Practice characteristics					
No. of physicians					.002
1	170 (16.9)	102 (20.4)	31 (10.8)	37 (16.7)	
2-15	695 (69.0)	316 (63.3)	221 (77.0)	158 (71.2)	
16+	132 (13.1)	72 (14.4)	33 (11.5)	27 (12.2)	
No. of specialties					.04
Single	702 (69.6)	334 (66.9)	197 (68.6)	171 (77.0)	
Multiple	248 (24.6)	135 (27.1)	67 (23.3)	46 (20.7)	
Other	43 (4.3)	20 (4.0)	18 (6.3)	5 (2.3)	
Type					.003
Private practice	728 (72.2)	336 (67.3)	215 (74.9)	177 (79.7)	
Other	267 (26.5)	155 (31.1)	67 (23.3)	45 (20.3)	
Arrangement					<.001

	Total (N=1008) n (%)	FPs (N=499) n (%)	Peds (N=287) n (%)	OBGYNs (N=222) n (%)	P Value
Full/part-owner physician practice	472 (46.8)	206 (41.3)	134 (46.7)	132 (59.5)	
Other	522 (51.8)	285 (57.1)	147 (51.2)	90 (40.5)	
No. of patients/day					<.001
0-19	258 (25.6)	152 (30.5)	66 (23.0)	40 (18.0)	
20-29	500 (49.6)	245 (49.1)	141 (49.1)	114 (51.4)	
30+	232 (23.0)	91 (18.2)	75 (26.1)	66 (29.7)	
Location					<.001 ^b
Urban	289 (28.7)	119 (23.9)	99 (34.5)	71 (32.0)	
Suburban	506 (50.2)	247 (49.5)	147 (51.2)	112 (50.5)	
Rural	182 (18.1)	123 (24.7)	25 (8.7)	34 (15.3)	
Other	7 (0.7)	1 (0.2)	5 (1.7)	1 (0.5)	
Region					.06
Northeast	194 (19.3)	79 (15.8)	70 (24.4)	45 (20.3)	
Midwest	247 (24.5)	136 (27.3)	62 (21.6)	49 (22.1)	
South	334 (33.1)	161 (32.3)	97 (33.8)	76 (34.2)	
West	210 (20.8)	112 (22.4)	52 (18.1)	46 (20.7)	
VFC provider					<.001
Yes	405 (40.2)	189 (37.9)	204 (71.1)	12 (5.4)	
No	475 (47.1)	221 (44.3)	59 (20.6)	195 (87.8)	
Don't know	112 (11.1)	78 (15.6)	20 (7.0)	14 (6.3)	
Refer uninsured patients for vaccine					<.001
No	466 (46.2)	204 (40.9)	181 (63.1)	81 (36.5)	
Yes, to federally qualified health center/health department/other	542 (53.8)	295 (59.1)	106 (36.9)	141 (63.5)	
Refer underinsured patients for vaccine					<.001
No	489 (48.5)	216 (43.3)	179 (62.4)	94 (42.3)	
Yes, to federally qualified health center/health department/other	519 (51.5)	283 (56.7)	108 (37.6)	128 (57.7)	
Patient characteristics					
Patient payment method					<.001
Private insurance					

	Total (N=1008) n (%)	FPs (N=499) n (%)	Peds (N=287) n (%)	OBGYNs (N=222) n (%)	P Value
0-50% of patients	427 (42.4)	242 (48.5)	113 (39.4)	72 (32.4)	
51-100% of patients	527 (52.3)	230 (46.1)	159 (55.4)	138 (62.2)	
Patient race (majority)					<.001
Non-Hispanic White	735 (72.9)	374 (75.0)	185 (64.5)	176 (79.3)	
Other	256 (25.4)	117 (23.5)	95 (33.1)	44 (19.8)	
HPV knowledge					<.001
Low (0-4 correct answers)	380 (37.7)	206 (41.3)	154 (53.7)	20 (9.0)	
High (5-6 correct answers)	628 (62.3)	293 (58.7)	133 (46.3)	202 (91.0)	
Perceived barriers related to HPV vaccination					
Overall					<.001
Low	347 (34.4)	129 (25.9)	119 (41.5)	99 (44.6)	
Medium	281 (27.9)	145 (29.1)	79 (27.5)	57 (25.7)	
High	357 (35.4)	217 (43.5)	81 (28.2)	59 (26.6)	
Individual (% somewhat/strongly agree is a barrier)					
Vaccine safety	719 (71.3)	353 (70.7)	210 (73.2)	156 (70.3)	.49
Vaccine efficacy	715 (70.9)	361 (72.3)	201 (70.0)	153 (68.9)	.79
Discussing sexuality/STIs	669 (66.4)	351 (70.3)	172 (59.9)	146 (65.8)	.009
Teens practicing riskier sexual behaviors	476 (47.2)	260 (52.1)	120 (41.8)	96 (43.2)	.01
Administering new vaccine with limited track record of safety	527 (52.3)	282 (56.5)	162 (56.5)	83 (37.4)	<.001
Adding another vaccine to schedule	372 (36.9)	219 (43.9)	104 (36.2)	49 (22.1)	<.001
Lack of information about vaccine	210 (20.8)	124 (24.9)	49 (17.1)	37 (16.7)	.01
Up front cost of purchasing vaccine	531 (52.7)	297 (59.5)	141 (49.1)	93 (41.9)	<.001
Cost of stocking vaccine	509 (50.5)	289 (57.9)	128 (44.6)	92 (41.4)	<.001
Lack of adequate reimbursement	519 (51.5)	278 (55.7)	138 (48.1)	103 (46.4)	.05
Some insurance does not cover vaccine	651 (64.6)	346 (69.3)	168 (58.5)	137 (61.7)	.009
Time to discuss vaccination with patients/parents	272 (27.0)	158 (31.7)	70 (24.4)	44 (19.8)	.004
Difficulty ensuring completion of series	434 (43.1)	238 (47.7)	99 (34.5)	97 (43.7)	.001
Vaccine not required for school	295 (29.3)	162 (32.5)	78 (27.2)	55 (24.8)	.08

	Total (N=1008) n (%)	FPs (N=499) n (%)	Peds (N=287) n (%)	OBGYNs (N=222) n (%)	P Value
Vaccine practices					
Strategies to ensure HPV vaccine completion					<.001
0	121 (12.0)	67 (13.4)	24 (8.4)	30 (13.5)	
1	163 (16.2)	76 (15.2)	66 (23.0)	21 (9.5)	
2+	662 (65.7)	311 (62.3)	180 (62.7)	171 (77.0)	

^a Percentages may not add up to 100% due to missing data.

^b For location, Fisher's Exact Test was used instead of the Pearson's Chi-square test due to small cell size.

Table 2

Likelihood of “always” recommending HPV vaccination to females by provider specialty and age group

Specialty	Age Group		
	11-12	13-17	18-26
	OR (95% CI)	OR (95% CI)	OR (95% CI)
FPs	1.0 (Reference)	1.0 (Reference)	1.0 (Reference)
Peds	2.6 (1.9-3.7)	4.7 (3.4-6.6)	5.3 (3.6-7.7)
OBGYNs	1.6 (1.0-2.7)	2.7 (1.9-3.8)	2.5 (1.8-3.6)

Table 3

Physician demographic, practice, and patient characteristics; knowledge; perceived barriers; and vaccine practices by HPV vaccine recommendation (“always” vs. other) for early adolescents (N = 763)

	N	OR (95% CI)
Demographic characteristics		
Age (yr)		
50+	306	1.0 (Reference)
40-49	244	1.8 (1.2-2.5)
25-39	200	1.3 (0.9-1.8)
Gender		
Male	393	1.0 (Reference)
Female	361	1.4 (1.0-1.9)
Race		
White/Caucasian	560	1.0 (Reference)
Other	188	1.5 (1.1-2.1)
Ethnicity		
Not Hispanic or Latino	694	1.0 (Reference)
Hispanic or Latino	49	2.7 (1.5-4.8)
Practice characteristics		
Specialty		
FP	415	1.0 (Reference)
Peds	265	2.7 (1.9-3.7)
OBGYN	83	1.6 (1.0-2.7)
No. of physicians		
2-15	534	1.0 (Reference)
1	126	0.9 (0.6-1.3)
16+	96	1.4 (0.9-2.1)
No. of specialties		
Single	536	1.0 (Reference)
Multiple	192	1.4 (1.0-2.0)
Other	24	1.0 (0.4-2.4)
Type		
Private practice	583	1.0 (Reference)
Other	170	1.1 (0.8-1.6)
Arrangement		
Other	390	1.0 (Reference)
Full/part-owner physician practice	364	1.0 (0.7-1.4)
No. of patients/day		
30+	182	1.0 (Reference)
20-29	389	0.9 (0.6-1.3)
0-19	183	0.8 (0.5-1.2)
Location		
Suburban	405	1.0 (Reference)

	N	OR (95% CI)
Urban	192	1.3 (0.9-1.9)
Rural	145	1.0 (0.6-1.4)
Other	6	2.0 (0.4-10.0)
Region		
West	162	1.0 (Reference)
Northeast	149	0.7 (0.4-1.1)
Midwest	185	0.6 (0.4-0.9)
South	251	0.6 (0.4-0.9)
VFC provider		
No	279	1.0 (Reference)
Yes	382	1.9 (1.4-2.7)
Don't know	93	1.2 (0.7-1.9)
Refer uninsured patients for vaccine		
No	355	1.0 (Reference)
Yes, to federally qualified health center/ health department/other	408	0.7 (0.5-1.0)
Refer underinsured patients for vaccine		
No	369	1.0 (Reference)
Yes, to federally qualified health center/ health department/other	394	0.8 (0.6-1.0)
Patient characteristics		
Patient payment method		
Private insurance		
51-100% of patients	407	1.0 (Reference)
0-50% of patients	324	1.2 (0.9-1.6)
Patient race (majority)		
Non-Hispanic White	558	1.0 (Reference)
Other	194	1.5 (1.1-2.1)
HPV knowledge		
High (5-6 correct answers)	458	1.0 (Reference)
Low (0-4 correct answers)	305	1.0 (0.8-1.4)
Perceived barriers related to HPV vaccination		
High	263	1.0 (Reference)
Medium	216	1.1 (0.7-1.6)
Low	271	2.1 (1.5-3.0)
Vaccine practices		
Strategies to ensure HPV vaccine completion		
2+	536	1.0 (Reference)
1	146	0.8 (0.6-1.2)
0	81	0.5 (0.3-0.9)

Table 4Logistic regression for HPV vaccine recommendation for early adolescents (“always” vs. other)^a

Predictor	OR (95% CI) ^b
Specialty	
FP	1.0 (Reference)
Peds	2.1 (1.5-3.0)
OBGYN	1.6 (0.9-2.9)
Age	
50+	1.0 (Reference)
40-49	1.8 (1.3-2.7)
25-39	1.4 (0.9-2.1)
Ethnicity	
Not Hispanic or Latino	1.0 (Reference)
Hispanic or Latino	2.4 (1.3-4.4)
Perceived barriers related to HPV vaccination	
High	1.0 (Reference)
Medium	1.0 (0.7-1.6)
Low	1.8 (1.2-2.6)
VFC Provider	
Yes	1.0 (Reference)
No	0.5 (0.4-0.8)
Don't know	0.7 (0.4-1.2)

^aNote: Specialty was forced into the model; other variables were selected through backward selection at the level of stay alpha = .05.^bORs were adjusted for all variables listed in the table.