Published in final edited form as:
Cancer. 2013 February 1; 119(3): 621–628. doi:10.1002/cncr.27735.

Provider Factors Associated with Disparities in HPV Vaccination among Low-Income 9–17-Year-Old Girls

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Abstract

Background—Many women who develop cervical cancer are eligible for or are participants of Medicaid. Providing human papillomavirus (HPV) vaccination to girls enrolled in Medicaid may reduce cervical cancer disparities in low-income and minority women. This study evaluated provider characteristics associated with HPV vaccination among 9–17-year-old female Medicaid enrollees.

Methods—A random sample of 800 providers from the Florida Medicaid Master Provider File was mailed a survey in October 2009 that evaluated demographic and practice characteristics, HPV information and knowledge, barriers to HPV vaccination, vaccine practices, and vaccine recommendation practices. To measure HPV vaccination, Medicaid claims data were used to calculate the proportion of eligible patients who received at least one dose of the vaccine from participating providers within the study period. Provider factors associated with vaccination at the bivariate level were evaluated in a multiple linear regression model.

Results—The response rate was 68.3% (N = 485). After excluding ineligible respondents, the current analysis included 433 providers. HPV vaccination prevalence ranged from 0% to 61.9% (M = 20.4, SD = 14.5). HPV vaccination rates were higher among providers who: were Pediatricians, had a private practice, practiced in a single specialty setting, were VFC providers, saw primarily non-Hispanic White patients, used ≥2 strategies for vaccine series completion, and did not refer out for HPV vaccination.

Conclusions—Despite financial coverage for Medicaid-eligible girls, HPV vaccination rates are low. Study findings can be used to target health services interventions to providers least likely to administer HPV vaccine to female Medicaid enrollees.

Keywords

human papillomavirus; HPV vaccine; cancer vaccine; cervix cancer; low-income population; Medicaid; physician

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Financial disclosures: Dr. Giuliano has received funding from Merck for consultancy and lectures.

Background

A strong causal relationship has been established between the most common sexually transmitted infection, human papillomavirus (HPV), and cervical cancer.[1] There are over 100 types of HPV, of which types 16 and 18 cause 70% of all cervical cancer cases.[2] In 2011, an estimated 12,710 women were diagnosed with cervical cancer and 4,290 died from the disease.[3]

One developmental goal of *Healthy People 2020* is to "reduce the proportion of females with [HPV] infection."[4] Gardasil® is a quadravalent HPV vaccine approved by the US Food and Drug Administration in June 2006. This vaccine confers immunity against HPV 6, 11, 16, and 18. Another vaccine, Cervarix®, confers immunity against HPV 16 and 18 and was approved in 2009. In 2006, the Advisory Committee on Immunization Practices (ACIP) recommended HPV vaccine for girls aged 11–12, catch-up vaccination for females aged 13–26, and vaccination of ages 9 and 10 at the provider's discretion.[5]

Low-income and minority women bear a disproportionate burden of cervical cancer morbidity and mortality,[6–9] yet low-income, Black, and Hispanic females are less likely to complete the HPV vaccination series.[10] Despite availability at no cost through programs such as Vaccines for Children (VFC), vaccination uptake in low-income and minority populations remains low.[10–13] This low uptake may be due, in part, to limited understanding about HPV infection and prevention among adult and adolescent females.[14–22] In general, the majority of patients identify health care providers as the best or most trusted source of information about HPV.[22, 23] The strength of a provider's role in vaccine uptake is evidenced by research indicating that the combination of physician discussion and recommendation was associated with a 93-fold increase in the odds of initiating the HPV vaccine series among a sample of women aged 19–26 years.[24] Given that providers play a critical role in vaccine dissemination in low-income and minority populations,[25, 26] the primary aim of this study was to evaluate provider characteristics associated with HPV vaccination of 9–17-year-old female Medicaid enrollees.

Methods

Sample

A sample of 800 providers who had: a physical address in Florida, billed claims or had an assigned panel that included 25 or more 9–17-year-old girls in the past year, and a primary care specialty (i.e., Pediatrics, Obstetrics and Gynecology, Family Medicine, Internal Medicine, General Practice, or Preventive Medicine) was randomly selected from the Florida Medicaid Master Provider File.

Measures

A 27-item survey in October 2009 was used to evaluate factors related to HPV vaccination, including: 1) demographic and practice characteristics, 2) HPV information and knowledge, 3) barriers to HPV vaccination, 4) HPV vaccine practices, and 5) HPV vaccine recommendation practices. The survey was adapted from a previous national study of HPV vaccination among physicians.[27]

The survey contained six items to measure participants' knowledge about HPV infection (e.g., "most HPV infections resolve without medical intervention") and vaccination (e.g., "females who have been diagnosed with HPV infection should not be given the HPV vaccine"). Response options included "true," "false," or "unsure." Composite HPV knowledge was determined by summing the correct responses (range: 0–6) and then

dichotomizing into “more knowledge” (≥5 correct responses) and “less knowledge” (≤4 correct responses) based on a median split.

Thirteen items assessed physicians’ level of agreement about factors that may serve as barriers to HPV vaccination: 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 presented on a 5-point Likert scale ranging from “strongly disagree” to “strongly agree.” A mean barrier score was obtained by summing and averaging the items. These scores were then divided into thirds to create “low,” “medium,” and “high” barriers categories.

To measure the outcome variable, HPV vaccination, Medicaid claims data were used to calculate the proportion of eligible patients who received at least one dose of the vaccine from sampled providers within the survey period of November 2008 to October 2009. Eligible patients were calculated as the number of girls aged 9–17 years who had claims with the provider or selected the provider as her primary care provider and were enrolled at least 10 months during the survey period minus those girls who had at least 3 claims for the HPV vaccine between June 2006 and October 2008 (indicating she was already fully vaccinated and not eligible for more doses). Vaccination receipt was determined by calculating the number of girls with at least one claim for the HPV vaccine with the provider as the treating provider during the survey period. The proportion of eligible patients who received at least one dose of the vaccine was calculated by dividing vaccination receipt by the number of eligible patients.

Data collection

Upon Institutional Review Board (IRB) approval from the Universities of South Florida and Florida, data collection occurred between October 2009 and April 2010. A multiphase recruitment approach was based on the Dillman[28] method. First, a postcard was mailed to the physicians informing them about the survey, followed in two weeks by a Federal Express mailing that contained a cover letter, scannable survey, prepaid return envelope, and $15 cash incentive. A reminder card was mailed two weeks later, followed by another copy of the survey to prompt non-responders to complete the survey. Three weeks following the second survey packet, a third survey packet was sent to all who received the second mailing because of a clerical error discovered in the cover letter suggesting $15 was included. The third survey packet was sent via Federal Express and contained a cover letter explaining the mistake, a scannable survey, prepaid return envelope, and $15 cash incentive. The IRB approved the use of the introductory letter as informed consent and granted a waiver of informed consent documentation.

Data analysis

Data were analyzed using SAS® 9.1 (SAS Institute Inc, Cary, North Carolina). All analyses used two-tailed tests of significance with a statistical significance level set at $p < 0.05$. The associations between provider factors and HPV vaccination were assessed using an analysis of variance (ANOVA). Provider factors that were significantly associated with HPV vaccination at the bivariate level were evaluated simultaneously in a multiple linear regression model with HPV vaccination as the outcome variable. Participants with complete data for the variables of interest were included in this multivariable analysis.

Results

The overall response rate was 68.3% (n = 485). After excluding respondents who identified themselves as unlikely to be involved in vaccination (e.g., hospice, emergency care providers; n = 23), reported a specialty other than those targeted (n = 23), or had no Medicaid enrollees during the study period (n = 6), the current analysis included 433 providers. The final study sample is described in Table 1. In summary, ~50% of physicians were aged 50 or older (48.0%), male (53.8%), and White/Caucasian (47.6%). The majority (65.4%) were non-Hispanic/Latino. Over half worked in a practice setting where they were full or part owner (63.3%), single specialty (80.6%) or private (83.1%), and included 2 to 15 physicians (62.6%). The majority (79.2%) reported being VFC providers. The largest proportion (41.8%) indicated seeing 20 or more patients each day, with the majority (77.6%) of these patients being a race other than non-Hispanic White. Regarding HPV vaccination, 77.4% did not refer patients to another location for vaccination and 73.2% used two or more strategies to ensure HPV vaccine completion.

The prevalence of HPV vaccination ranged from 0–61.9% ($M = 20.4$, SD = 14.5). At the bivariate level, provider factors significantly associated with HPV vaccination included physician ethnicity, specialty, single vs. multispecialty practice, private vs. other practice, VFC provider status, referring out for HPV vaccination, patient race, and number of strategies used to ensure vaccine completion (Table 2); these factors were subsequently included in a multiple linear regression model.

The multiple linear regression model explained approximately 32% of the variance in HPV vaccine administration, $F(12, 393) = 15.35$, $p < .0001$, adjusted $R^2 = 0.30$. After controlling for other variables, HPV vaccination rates were increased among providers who: were Pediatricians (vs. Family Physicians), had a private practice (vs. another practice type), practiced in a single specialty practice (vs. multispecialty), were VFC providers (vs. non-VFC providers or those who did not know their status), saw primarily patients who were not non-Hispanic White, used two or more strategies to ensure vaccine series completion (vs. no strategies), and did not refer out for HPV vaccination (vs. those who refer patients; Table 3). Private vs. other practice (e.g., ambulatory care clinic of hospital or medical center, urgent care clinic, community health center) was the strongest predictor of HPV vaccination ($\beta = 0.28$, $p < .0001$).

Discussion

Despite financial coverage of the HPV vaccine for Medicaid-eligible girls, the average vaccination rates are low. Results of the current study can be used to target health services interventions to providers least likely to administer HPV vaccine to female Medicaid enrollees.

On average, sampled providers administered at least one dose of HPV vaccine to about 20% of eligible patients during the study period. This study is consistent with a prior study of Florida Medicaid patients' HPV vaccine uptake among ages 11–17 girls (~19% in 2008).[11] However, these Florida-based estimates of participants in the Medicaid program appear to be lower than other studies of both vaccine initiation and series completion in the state. The current study focused on physicians caring for Medicaid patients; these patients are eligible for the federal VFC program, which offers routinely recommended immunization free of charge to children aged 18 or younger who are Medicaid-eligible, Native American or Alaska native, or uninsured. Additionally, underinsured children may receive free vaccinations at a federally qualified health center or rural health clinic. When comparing VFC-eligible to non-VFC-eligible children in Florida, NIS-Teen data for 2009 suggest

44.1% and 36.1%, respectively, received ≥1 dose of HPV vaccine and 26.3% and 23.4%, respectively, received ≥3 doses.[29] The lower vaccination rate observed in the current study may be partly attributed to the ages studied; NIS-Teen data are reported for ages 13–17 whereas the current study examined ages 9–17 to include the youngest age for which the vaccine is approved for administration. Previous research has shown that younger patients (ages 9–12) are less likely to initiate the vaccine series than their older counterparts.[26, 30, 31] Additionally, the current study included only Medicaid patients whereas the NIS-Teen data included all VFC-eligible patients.

The strongest predictor of HPV vaccination was practice type, with private practice physicians reporting higher vaccination rates than those in another type of practice (e.g., ambulatory care clinic of hospital or medical center, urgent care clinic). The higher vaccination rates among private practice physicians compared to those in other practices may be due to private physicians' increased focus on well-child visits, of which immunizations are an important component.[32] Furthermore, there has been some concern that administering immunizations at sick visits decreases attendance at well-child visits and, consequently, children may miss out on preventive care.[33] Therefore, physicians working in settings where well-child visits are not the focus may be less likely to administer HPV vaccine. Additionally, given that the cost of stocking HPV vaccine has been cited as a barrier to physicians,[27] it is possible that a stock of HPV vaccine may not be maintained in practice settings where vaccination is not routine.

Family physicians had a lower HPV vaccination prevalence than Pediatricians. This finding is consistent with previous studies of HPV vaccination by physician specialty.[27] Family Medicine physicians are about half as likely to provide preventive care for adolescents compared to Pediatricians,[34] which may account for a lower prevalence of HPV vaccination in this group. This explanation is also supported by a study that found significantly more Pediatricians than Family Physicians reported that ≥75% of their adolescent patients were up-to-date on other vaccinations such as tetanus/diphtheria (75% of Pediatricians vs. 62% of Family Physicians), hepatitis B (34% vs. 19%), and varicella (42% vs. 19%).[35]

Physicians practicing in a multispecialty practice were less likely to vaccinate than those in a single specialty practice. Prevailing policies about the type of care delivered (e.g., vaccinations) and resources available (e.g., vaccine storage systems) in a multispecialty practice may impact HPV vaccination rates in this setting. In addition, providers using two or more strategies to ensure HPV vaccine series completion were more likely to vaccinate patients against HPV than those using no strategies. Physicians using multiple strategies to ensure series completion represent those who are more proactive in vaccinating patients and have the necessary mechanisms in place to provide the vaccine. It should be noted that physicians were asked about their strategies to ensure vaccine completion whereas the claims data used to calculate HPV vaccination included girls who received at least one dose of the vaccine and therefore could represent girls initiating or continuing vaccination. Strategies physicians use to prompt HPV vaccine initiation, such as vaccine recommendation during other health visits, could differ from those used to ensure vaccine completion (e.g., using reminder/recall systems). On the other hand, mechanisms in place to ensure vaccine completion, such as using a computerized database or registry to track when vaccinations are due, also may be used to identify and prompt patients to initiate the vaccine series. More research is needed to identify potential differences in strategies to encourage vaccine initiation and ensure series completion.

VFC providers in the current study were more likely to vaccinate than physicians who were non-VFC providers or unaware of their VFC status. These results are similar to those from a national survey of physicians specializing in Family Medicine, Pediatrics, and Obstetrics

and Gynecology.[27] The VFC program reduces the patient's cost barrier to vaccination by providing free HPV vaccine to children up to age 18 years who are enrolled in Medicaid.[36] During the time the survey was conducted in 2009, Florida's childhood vaccine supply policy was VFC-only, whereby all routinely recommended pediatric vaccines are supplied to private providers enrolled in the VFC program to administer to VFC-eligible children.

Physicians who reported caring primarily for patients other than non-Hispanic Whites had a higher vaccination average than those who care for primarily non-Hispanic White patients. This "other" group was comprised of mostly Black (28%) and Hispanic (35%) patients. Given that Black and Hispanic women have higher rates of cervical cancer incidence and mortality compared to their White counterparts,[37] physicians may be more sensitized to the importance of vaccinating these women against cervical cancer. Furthermore, these findings are consistent with higher HPV vaccine initiation rates among Hispanic adolescents compared to non-Hispanic adolescents.[11]

An interesting finding was that vaccination was relatively low in light of patients' eligibility for free vaccinations through the VFC program and their ability to access health care, given that vaccine cost and inability to access preventive services may serve as barriers to vaccination. It appears that other factors may have impeded HPV vaccination and perhaps included disruption of the provider's vaccine supply or patient refusal. Further research is needed to investigate these other factors and identify targets for interventions to decrease barriers to vaccination.

Finally, it should be noted that HPV vaccine was approved for administration to males after data collection for the current study commenced.[38] Physicians' recommendation and administration practices for HPV vaccine may differ for male patients compared to female patients. Some research regarding attitudes and perceptions of vaccinating males against HPV was conducted prior to FDA approval.[39] A sample of Family Physicians and Pediatricians was surveyed about recommending HPV vaccination to their female patients and if they would recommend the vaccine to males if recommended by the ACIP and covered by insurance. More physicians reported they would "often" or "always" recommend the vaccine for males (24.1%) compared to females (18.1%) aged 9–10 years ($p < 0.001$); however, more physicians would recommend the vaccine to females than males for the 11–12 and 13–18 age groups ($p < 0.001$). Following this study, the ACIP issued a permissive recommendation for quadrivalent HPV vaccine administration to boys in 2009, which was replaced in 2011 with recommendation for routine use of HPV vaccine in males aged 11–12 years.[40] Additional research is needed to examine physicians' administration of HPV vaccine to their male patients.

There are several limitations of this study. First, the use of self-reported data may introduce social desirability effects. Second, selection bias may be present (e.g., providers may have self-selected to participate based on strong HPV vaccination opinions). Third, Medicaid claims data do not include vaccinations received outside of the Medicaid system (e.g., state health department), and, therefore, the number of girls deemed eligible for vaccine doses may be an overestimate. Eligibility overestimates may subsequently underestimate the provider's clinic population vaccination rate, especially among those regularly referring out for vaccination. Yet, the influence of outside vaccination is likely small because most providers (77%) in our study reported they did not refer out for vaccinations.

These limitations should be viewed in light of this study's strengths. This study accessed claims data to ascertain physician administration of HPV vaccination. These data may yield more precise identifiers compared to that of self-report. Additionally, a response rate of nearly 70% from a random sample of Medicaid providers enhances generalizability to all

Florida Medicaid providers. Finally, this study complemented claims data with a survey to gain a more in-depth understanding of issues surrounding HPV vaccine administration.

Taken together, study findings suggest HPV vaccination disparities in low-income females, even in the absence of vaccine cost to the patient. Targeted interventions to increase vaccination among this underserved population may focus on Family Physician specialty and physicians who: practice in a location other than a private practice, practice in a multispecialty setting, are not a VFC provider or do not know their status, see primarily non-Hispanic White patients, use no strategies to ensure vaccine series completion, and refer out for HPV vaccination. The most effective target for increasing HPV vaccine initiation may be focusing on improving vaccination among non-private practices.

Acknowledgments

Funding: This research was supported by a grant from the University of Florida [UF09035].

The work contained within this publication was supported in part by the Survey Methods Core Facility at the Moffitt Cancer Center. The authors would like to thank Deepa Ranka, M.S., and the Medicaid programming team at the Institute for Child Health Policy for sample selection and data management.

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Table 1

Demographic, practice, and, patient characteristics, knowledge, perceived barriers, and vaccine practices by provider specialty[a] (N = 433)

	Total (N = 433) n (%)	Pediatricians (n = 319) n (%)	Family Physicians (n = 57) n (%)	Obstetricians/ Gynecologists (n = 57) n (%)
Demographic characteristics				
Age (yr)				
25–39	63 (14.6)	43 (13.5)	7 (12.3)	13 (22.8)
40–49	143 (33.0)	115 (36.1)	11 (19.3)	17 (29.8)
50+	208 (48.0)	148 (46.4)	38 (66.7)	22 (38.6)
Gender				
Male	233 (53.8)	162 (50.8)	35 (61.4)	36 (63.2)
Female	193 (44.6)	151 (47.3)	22 (38.6)	20 (35.1)
Race				
White/Caucasian	206 (47.6)	155 (48.6)	23 (40.4)	28 (49.1)
Other	200 (46.2)	142 (44.5)	32 (56.1)	26 (45.6)
Ethnicity				
Hispanic or Latino	141 (32.6)	109 (34.2)	15 (26.3)	17 (29.8)
Not Hispanic or Latino	283 (65.4)	202 (63.3)	41 (71.9)	40 (70.2)
Practice characteristics				
No. of physicians				
1	132 (30.5)	89 (27.9)	30 (52.6)	13 (22.8)
2–15	271 (62.6)	205 (64.3)	25 (43.9)	41 (71.9)
16+	26 (6.0)	21 (6.6)	2 (3.5)	3 (5.3)
No. of specialties				
Single	349 (80.6)	268 (84.0)	34 (59.7)	47 (82.5)
Multiple	64 (14.8)	41 (12.9)	17 (29.8)	6 (10.5)
Other	18 (4.2)	9 (2.8)	5 (8.8)	4 (7.0)
Type				
Private practice	360 (83.1)	279 (87.5)	35 (61.4)	46 (80.7)
Other	63 (14.6)	36 (11.3)	17 (29.8)	10 (17.5)
Arrangement				
Full/part-owner physician practice	274 (63.3)	214 (67.1)	29 (50.9)	31 (54.4)
Other	151 (34.9)	100 (31.4)	25 (43.9)	26 (45.6)
No. of patients/day				
≤14	105 (24.3)	67 (21.0)	19 (33.3)	19 (33.3)
15–19	135 (31.2)	103 (32.3)	20 (35.1)	12 (21.1)
≥20	181 (41.8)	139 (43.6)	17 (29.8)	25 (43.9)
VFC provider				
Yes	343 (79.2)	300 (94.0)	36 (63.2)	7 (12.3)
No	73 (16.9)	13 (4.1)	16 (28.1)	44 (77.2)
Don’t know	12 (2.8)	3 (0.9)	3 (5.3)	6 (10.5)

	Total (N = 433) n (%)	Pediatricians (n = 319) n (%)	Family Physicians (n = 57) n (%)	Obstetricians/ Gynecologists (n = 57) n (%)
Refer patients for vaccine				
No	335 (77.4)	284 (89.0)	36 (63.2)	15 (26.3)
Yes, to federally qualified health center/ health department/other	98 (22.6)	35 (11.0)	21 (36.8)	42 (73.7)
Patient characteristics				
Patient race (majority)				
Non-Hispanic White	87 (20.1)	60 (18.8)	13 (22.8)	14 (24.6)
Other	336 (77.6)	253 (79.3)	40 (70.2)	43 (75.4)
HPV knowledge				
Less (0–4 correct answers)	224 (51.7)	185 (58.0)	30 (52.6)	9 (15.8)
More (5–6 correct answers)	209 (48.3)	134 (42.0)	27 (47.4)	48 (84.2)
Perceived barriers related to HPV vaccination				
Overall				
Low	139 (32.1)	105 (32.9)	12 (21.1)	22 (38.6)
Medium	130 (30.0)	98 (30.7)	13 (22.8)	19 (33.3)
High	162 (37.4)	115 (36.1)	32 (56.1)	15 (26.3)
Vaccine practices				
Strategies to ensure HPV vaccine completion				
0	51 (11.8)	30 (9.4)	13 (22.8)	8 (14.0)
1	65 (15.0)	53 (16.6)	7 (12.3)	5 (8.8)
2+	317 (73.2)	236 (74.0)	37 (64.9)	44 (77.2)

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

Abbreviations: HPV, human papillomavirus; VFC, Vaccines for Children.

Table 2

Association between provider factors and percentage of eligible females vaccinated for HPV (N = 433)

	n	Mean (SD)	*F*	p
Demographic characteristics				
Age (yr)				
25–39	62	19.92 (14.50)	2.30	.1017
40–49	143	22.57 (15.15)		
50+	208	19.25 (13.98)		
Gender				
Male	232	20.60 (14.41)	0.14	.7048
Female	193	20.07 (14.48)		
Race				
White/Caucasian	205	20.99 (14.35)	0.56	.4555
Other	200	19.91 (14.82)		
Ethnicity				
Hispanic or Latino	140	22.61 (14.80)	5.36	.0211
Not Hispanic or Latino	283	19.17 (14.12)		
Practice characteristics				
Specialty				
Pediatricians	319	22.53 (14.11)	31.80	<.0001
Family Physicians	57	11.59 (13.58)		
Obstetricians/Gynecologists	56	11.84 (9.45)		
No. of physicians				
1	132	19.84 (14.75)	0.92	.3983
2–15	270	20.30 (14.27)		
16+	26	24.04 (15.66)		
No. of specialties				
Single	348	21.97 (14.56)	9.94	<.0001
Multiple	64	14.95 (12.71)		
Other	18	12.14 (10.49)		
Type				
Private practice	360	22.28 (14.07)	40.62	<.0001
Other	62	10.08 (13.06)		
Arrangement				
Full/part-owner physician practice	274	21.05 (14.09)	1.70	.1928
Other	150	19.13 (15.22)		
No. of patients/day				
≤14	105	19.13 (14.21)	1.54	.2151
15–19	134	19.48 (14.16)		
≥20	181	21.79 (14.52)		
VFC provider				
Yes	343	22.82 (14.48)	27.73	<.0001

	n	Mean (SD)	*F*	p
No	72	10.58 (9.41)		
Don't know	12	9.77 (8.72)		
Refer patients for vaccine				
No	335	23.09 (14.59)	56.48	<.0001
Yes, to federally qualified health center/health department/other	97	11.29 (9.48)		
Patient characteristics				
Patient race (majority)				
Non-Hispanic White	87	16.32 (12.15)	8.44	.0039
Other	335	21.33 (14.82)		
HPV knowledge				
Less (0–4 correct answers)	224	20.81 (14.03)	0.30	.5832
More (5–6 correct answers)	208	20.04 (14.94)		
Perceived barriers related to HPV vaccination				
Overall				
Low	139	20.99 (14.24)	0.66	.5181
Medium	129	21.12 (14.51)		
High	162	19.41 (14.63)		
Vaccine practices				
Strategies to ensure HPV vaccine completion				
0	50	12.73 (12.13)	8.43	.0003
1	65	22.21 (15.34)		
2+	317	21.29 (14.29)		

Abbreviations: HPV, human papillomavirus; VFC, Vaccines for Children.

Table 3

Predicting HPV vaccination (N = 406) with significant bivariate provider factors

Predictor	*B*	*SE B*	β	*t*	*p*
Physician ethnicity (non-Hispanic/Latino vs. Hispanic/Latino)	−1.69	1.32	−0.06	−1.28	.2015
Family Physician specialty (vs. Pediatrics)	−4.98	2.11	−0.11	−2.36	.0188
OBGYN specialty (vs. Pediatrics)	−1.06	2.66	−0.03	−0.40	.6902
Multispecialty practice (vs. single specialty)	−4.28	1.89	−0.10	−2.26	.0242
Practice other than single or multispecialty (vs. single specialty)	−3.54	3.06	−0.05	−1.16	.2473
Practice location (private vs. other)	11.46	1.95	0.28	5.89	<.0001
VFC provider status (no vs. yes)	−5.83	2.87	−0.15	−2.03	.0430
VFC provider status (don't know vs. yes)	−10.16	4.00	−0.12	−2.54	.0114
Refer out for HPV vaccination (no vs. yes)	6.00	2.14	0.17	2.80	.0053
Patient race (non-Hispanic White vs. other)	−3.97	1.55	−0.11	−2.56	.0109
No strategies used to ensure vaccine completion (vs. 2+ strategies)	−5.28	2.17	−0.11	−2.43	.0156
One strategy used to ensure vaccine completion (vs. 2+ strategies)	2.47	1.72	0.06	1.44	.1514
R^2			0.32		<.0001

Abbreviations: HPV, human papillomavirus; OBGYN, Obstetrics and Gynecology; VFC, Vaccines for Children.