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Association of Both Consistency and Strength of Self-Reported Clinician Recommendation for HPV Vaccination and HPV Vaccine Uptake among 11- to 12-Year-Old Children

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Abstract

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PURPOSE—We tested the hypotheses that consistency and strength of clinician recommendation of the human papillomavirus (HPV) vaccination would be associated with vaccine deliveryrates.

METHODS—From October 2015 through January 2016, we conducted a survey of primary care clinicians (n=227) in Southeastern Minnesota to evaluate clinician behaviors regarding HPV vaccination. The survey response rate was 41.0% (51clinical sites). We used the Rochester Epidemiology Project, a clinical data linkage infrastructure, to ascertain clinical site-level HPV vaccination rates. We examined associations of clinician self-reports of both the consistency and strength of their recommendations for HPV vaccination for patients aged 11 to 12 years (n=14,406) with site-level vaccination rates.

RESULTS—The majority of clinicians reported consistently (always or usually) recommending the HPV vaccine to females (79.0%) and to males (62.2%); 71.9% of clinicians reported strongly recommending the vaccine to females while 58.6% reported strongly recommending to males. Consistency and strength of recommending the HPV vaccine was significantly higher among those practicing in pediatrics and board certified in pediatrics compared to family medicine. Higher rates of initiation (1 dose) [Incident Rate Ratio (IRR)=1.05; 95% CI (1.01–1.09)] and completion (3 doses) [IRR=1.08; 95% CI (1.02–1.13)] were observed among clinical sites where, on average, clinicians more frequently reported always or usually recommending the vaccine for females compared to sites where, on average, clinicians reported recommending the vaccine less frequently. Similarly, higher rates of initiation [IRR=1.03; 95% CI (1.00–1.06)] and completion [IRR=1.04; CI (1.00, 1.08)] were observed among sites where clinicians reported strongly recommending the vaccine to females more frequently compared to sites where, on average, clinicians reported strongly recommending the HPV vaccine less frequently; similar associations were observed for male initiation [IRR=1.05; CI (1.02,1.08)] and completion [IRR=1.05; 95% CI (1.01, 1.09)].

CONCLUSIONS—Consistency and strength of HPV vaccination recommendation was associated with higher vaccination rates.

Keywords

GUIDELINE ADHERENCE; PROFESSIONAL PRACTICE; PAPILLOMAVIRUS VACCINES HEALTH KNOWLEDGE; ATTITUDES; PRACTICE; PATIENT ACCEPTANCE OF HEALTH CARE; VACCINATION; VACCINATION REFUSAL

INTRODUCTION[1]

Each year in the United States over 38,000 new cases of human papillomavirus (HPV) associated cancers occur in males and females.[1] Recommendations for universal vaccination of females, 11–12 years of age, were first published by the Advisory Committee on Immunization Practices (ACIP) in 2007[2]. ACIP recommendations for universal HPV vaccination of males were published in 2011[3]. Despite the availability of safe and effective

[1]Abbreviations: ACIP, Advisory Committee on Immunization Practices; CASE, Corroborate, About Me, Science, Explain/Advise; CI, Confidence Intervals; clinician barriers, clinician perceived barriers to delivering the HPV vaccine; clinician knowledge, clinician knowledge about HPV and the HPV vaccination; completion, receipt of three valid HPV vaccine doses; HPV, Human Papillomavirus; initiation, at least one valid HPV vaccine dose; IRR, Incidence Rate Ratio; perceived parental barriers, parental barriers related to the HPV vaccination; REP, Rochester Epidemiology Project

vaccines with ACIP recommendations for use, national rates of HPV vaccination in the U.S. remain low and lag behind other recommended vaccinations for adolescents [4]. According to recent data from the US National Immunization Survey (NIS-Teen), only 62.8% of females aged 13–17 years have received the 1st dose in the 3-dose HPV vaccine series, and 41.9% received 3 or more doses[4]. Perhaps reflecting in part the lag in recommendations for HPV vaccinations in males, only 49.8% of males aged 13–17 received the 1st dose and 28.1% received 3 or more doses [4]. These rates are far below the national Healthy People 2020 goals of 80% uptake among both males and females 13 to 15 years of age.(Ref: https://www.healthypeople.gov/2020/topics-objectives/topic/immunization-and-infectious-diseases/objectives).

Frequently identified barriers to HPV vaccination among health care professionals include parental attitudes and financial concerns [5, 6]. Barriers commonly cited by parents include lack of physician recommendation, lack of information, inconsistent use of preventive services, cost, low-perceived risk of HPV infection, and potential impact on sexual behavior [5]. Notably, lack of physician recommendation is frequently cited as the primary reason for not vaccinating[5, 7–11]. Evidence supports the importance of clinician recommendation for HPV vaccination; most adolescents who receive a clinician recommendation follow through with vaccination [8, 10, 11]. NIS-Teen data from 2010–2013 documents parental reports of low clinician recommendation rates for the vaccine, especially for boys [10, 11]. Improvement is seen in 2014 NIS-Teen data with 72.6% of girls and 51.8% of boys receiving clinician recommendation for HPV vaccination per parental report.[12] Prior research demonstrates a consistent association between clinician recommendation and higher rates of HPV vaccine initiation and completion [5, 13–19]; however, further research is needed to understand how the nature of clinician recommendation influences HPV vaccination.

Study Objectives

Given the frequency with which parents identify lack of recommendation as a barrier to HPV vaccination, it is important to understand how the consistency and strength with which clinicians recommend the vaccine to patients might be associated with actual vaccination rates. Using population-based clinical billing data to ascertain associations between clinician self-reported behavior and incident rates of HPV vaccination, we tested the hypothesis that clinician self-report of both the consistency and the strength of recommendation for the HPV vaccination would be associated with rates of vaccine delivery at the practice-site level, and may differ by sex. ACIP recommends universal vaccination of children ages 11–12 years; thus, we focused our analyses on this age group.

METHODS

We conducted a survey of primary care clinicians in a 27-county geographic region captured by the Rochester Epidemiology Project (REP) using a validated instrument to assess clinician knowledge, attitudes, and behaviors related to HPV vaccination[20–23]. The REP is a research infrastructure that links medical records from the majority of clinical practices across the 27 counties to individuals residing in the community and maintains an electronic

index of medical record information, including clinical diagnoses, procedure codes, drug prescriptions, office visits, emergency room visits, and hospitalizations.[24] The REP, which has captured virtually all health care delivered in Olmsted County, Minnesota since 1966 was expanded to include an additional 26 contiguous counties in southeast Minnesota and western Wisconsin.[25–27] To evaluate associations between self-reported frequency and strength of recommendation for HPV vaccination and actual HPV vaccination delivery rates at the site level, we integrated clinician survey data with clinical data from the REP. The survey component of the reported research was deemed to be exempt by the Mayo Clinic Institutional Review Board (IRB). Integration of the survey data with the clinical data in the REP was reviewed and approved by the Mayo Clinic and Olmsted Medical Center IRBs.

Data Collection Procedures

Survey data—We obtained a comprehensive list of primary care clinicians and additional information such as clinical specialty, mailing address, and email address within the clinical practices within our defined geographic region. Survey data were collected from October 2015 to January 2016 using two modes of data collection including a mailed survey and web-based survey (sent via email). We conducted an embedded experiment wherein our sample was randomized to one of four experimental arms to compare response rate, non-response bias, and item non-response for two mixed-mode designs and two single mode designs. Results of the embedded experiment will be published separately.

HPV vaccination data—Our study cohort (n=14,406) was obtained through electronic extraction of data for all visits among children ages 11–12 years at participating sites from January 1, 2014 through December 31, 2015. Using current procedural terminology codes (90649, 90650, 90651) for the three specific licensed HPV vaccines, electronic indices of the REP were searched to identify all HPV vaccinations from January 1, 2009 through December 31, 2015. Each clinical site included in our analysis has had the HPV vaccine available for their patients since 2006. We assigned patients to the clinical site where they made their visits. For those patients with visits at more than one site, assignment was made to the site they visited most frequently from January 2014 through December 2015. In cases of a tie with frequency of visits at sites, assignment was made to the most recently visited site.

Survey Instrument

The Hearing Physicians Views – HPV Immunization National Trends Survey, previously developed by one of the coauthors (STV), was slightly modified for our study. [20, 21, 23] The survey included questions to assess clinicians' knowledge, attitudes, and behaviors related to HPV and HPV vaccination. Clinicians were asked to rate the frequency with which they recommended the HPV vaccine separately for their female and male patients: *In the past 12 months, how often did you recommend the HPV vaccine to your female [male] patients?* Response options included "never/almost never (<10%)," "occasionally (10%–39%)," "About half the time (40%–59%)," "usually (60%–90%),", and "always/almost always (>90%)." For our analyses, we dichotomized the responses combining the "usually" and "always/almost always" responses versus all other responses. Clinicians were also asked to rate the strength of their recommendation: *In the past 12 months, how strongly did you*

recommend HPV vaccine to your female [male] patients? Responses included the following: "I recommend against," "I do not recommend for or against," I recommend, but not strongly," and "I strongly recommend." We dichotomized responses to this item as "I strongly recommend" versus all other responses.

Data Preparation and Analysis

Demographic, occupational and professional characteristics of primary care clinicians were compared overall and by their categorized responses regarding consistency and strength of HPV vaccine recommendations for both female and male patients. These responses were compared across each characteristic separately by patient sex using chi-square tests. McNemar's tests were used to assess whether a clinician was more likely to consistently or frequently recommend the HPV vaccine to their female patients relative to their male patients.

Associations between HPV vaccination initiation and completion rates at the practice-site level and aggregated clinician consistency and strength of HPV vaccine recommendations were examined. Initiation was defined as having a first dose of the HPV vaccination. Appropriate spacing was defined according to recommendations from ACIP that were in place during our study period. [28, 29] Valid receipt of the second and third doses required the second dose to occur at least 24 days after the first dose and the third dose at least 80 days after the second dose and at least 164 days after the first dose.[30] We allowed a 4-day grace period at each dose.[3] Rates of incident initiation (1 dose) and completion (3 valid doses) of the HPV vaccine series for 11–12 year olds from 2014–2015 were determined for each clinic site. Prevalent cases of initiation or completion from January 1, 2009 to December 31, 2013 were excluded. The rate of initiation was determined by dividing the number of patients ages 11–12 assigned to the site who initiated the vaccination from 2014–2015 by the number eligible for initiation (those assigned to the site minus those who initiated the vaccine from 2009–2013). The rate of completion of three valid doses was obtained by dividing the number of patients ages 11–12 assigned to a site who completed the 3-dose vaccination series by the number eligible to complete the series (those assigned to the site in 2014–2015 minus the number who completed the 3-dose series from 2009–2013).

The association between site-level clinician consistency and strength of HPV vaccine recommendation and rates of HPV initiation and completion were modeled using Poisson regression. The outcome was the count of the number who initiated (or completed) the 3-dose HPV vaccine series at the site level. An offset of the eligible population at each site was used to change the scale of the outcome from a mean count to a case rate per person for interpretation purposes. To measure clinical consistency at the site level, the number of clinicians who reported that they consistently or strongly recommended HPV vaccination was aggregated into a proportion per site. The scores were rescaled so that a one unit difference corresponded to a quartile increase across the range of the score; therefore the results can be interpreted as an increased rate of HPV initiation (or completion) per 25% increase in the proportion of clinicians who consistently or strongly recommended the HPV vaccination. Multivariable models were used to adjust for site level patient demographics, including the percentages of females, whites, ages 9–13 and those using government

insurance or self-paying their medical bills. Results are presented as Incident Rate Ratios (IRR) and 95% confidence intervals.

RESULTS

Of the 685 clinicians who were sent the survey, 280 completed and returned the survey (response rate= 41.0%). A total of 51 clinical sites were represented. Using administrative data, we assessed whether there were any significant differences between survey responders and non-responders by medical specialty and geographic region. No differences were observed by medical specialty (P=0.30). Response rates were higher in the Rochester area and lower in the southeastern Minnesota region (P=0.003). We excluded from analysis the responses of 53 clinicians who indicated they did not see patients 11–12 years of age, as the ACIP recommendations for universal HPV vaccination targets this particular age group. Characteristics of the remaining 227 primary care clinicians who completed the survey are summarized in Table 1. The majority of clinicians who responded were practicing in family medicine and board certified in family medicine. The majority of respondents were physicians with a sizable minority of nurse practitioners and physician assistants.

Table 2 summarizes the consistency and strength of recommendation of the HPV vaccine by clinician characteristics. Clinicians were more likely to consistently and strongly recommend the HPV vaccine to their female patients (79% and 72%, respectively) relative to their male patients (62% and 59%, respectively; McNemar's chi square $p<0.001$ for both). For both female and male patients, consistency of recommending the HPV vaccine was significantly higher among those practicing in pediatrics and board certified in pediatrics compared to those practicing in and certified in other primary care specialties. A similar pattern was observed for strength of recommendation to both females and males wherein clinicians practicing in pediatrics and board certified in pediatrics reported strongly recommending the vaccine more frequently than those practicing in and certified in family medicine or other primary care specialties.

Table 3 summarizes the results of Poisson regression analyses examining the association between consistency and strength of HPV recommendations separately for female and male patients. Both consistency and strength of recommendation of HPV vaccination at the site level was associated with higher rates of HPV vaccination initiation and completion in the adjusted analysis. Specifically, higher rates of initiation (1 dose) [Incident Rate Ratio (IRR)=1.05; 95% CI (1.01, 1.09)] and completion (3 doses) [IRR=1.08; 95% CI (1.02, 1.13)] were observed among clinical sites where, on average, a higher percentage of clinicians more frequently reported always or usually recommending the vaccine for females compared to sites where, on average, clinicians reported recommending the vaccine less frequently; a similar association was observed for males for the completion of 3 doses [IRR=1.04; 95% CI (1.0, 1.08)]. Similarly, higher rates of completion of 3 doses [IRR=1.04; CI (1.00, 1.08)] were observed among sites where a higher percentage of clinicians reported strongly recommending the vaccine to females more frequently compared to sites where, on average, clinicians reported strongly recommending the HPV vaccine less frequently; similar associations were observed for males for both 1 dose [IRR=1.05; CI (1.02,1.08)] and 3 doses [IRR=1.05; 95% CI (1.01, 1.09)].

DISCUSSION

HPV vaccination rates are increasing more slowly than other vaccines licensed and recommended for adolescents within the same timeframe as the HPV vaccine.[4] Lack of clinician recommendation has been identified as a primary barrier to vaccination. We examined the association of clinicians' reported consistency and strength of HPV vaccine recommendation with incident HPV vaccination rates at the clinical site level among 11–12 year olds.

We found that the majority of clinicians reported consistently (always or usually) recommending the HPV vaccine to both their female and male patients. We observed a higher percentage of clinicians offering strong recommendations to their female patients compared to their male patients. Rates of HPV vaccination among males are considerably lower than among females.[4] As previously mentioned, recommendations for universal vaccination of females, 11–12 years of age, were first published by the ACIP in 2007 [2] with recommendations for universal HPV vaccination of males published in 2011.[3] Thus, initial efforts to raise public awareness of the vaccine were focused on females and emphasized protection against cervical cancer. Low rates of vaccination among males coupled with our data demonstrating lower consistency and strength of recommendation of the HPV vaccine to male patients underscore the need to elevate public awareness of the cancers associated with HPV in both males and females and among clinicians, to emphasize the importance of recommending HPV vaccination to males.

Consistent with published research, [23] we found that consistency and strength of recommending the HPV vaccine was significantly higher among clinicians practicing in and board certified in pediatrics compared to those practicing in and board certified in family medicine. Compared with clinicians in pediatric practice, those in family medicine are about half as likely to provide preventive care to adolescents, [14] which may contribute to the lower rates of incident HPV vaccination observed in this group. In the majority of practices from which our HPV rates were drawn, nurse practitioners and physician assistants practice fairly independently and maintain their own panels of patients. Despite the independence of nurse practitioners and physician assistants, they adhere to the same organizational schedule of recommended vaccines as physicians. Thus, it is not surprising that no differences in consistency and strength of recommendation were observed when compared to physicians.

Controlling for site-level characteristics, including the percentages of patients cared for at the site who are female, white, ages 9–13 years and those using government insurance or self-paying their medical bills, we found that both consistency and strength of recommendation of HPV vaccination was associated with higher site-level rates of HPV vaccination initiation and completion. These findings underscore the crucial role of the clinician recommendation in improving HPV vaccination rates and are consistent with the body of evidence demonstrating an association between physician recommendation and higher rates of HPV vaccine initiation and completion.[5, 13–19] In a survey of parents of male and female adolescents, the quality of the clinician recommendation for HPV vaccination as defined by strength of recommendation, inclusion of a cancer prevention message and support for same day vaccination had a significant association with vaccine

initiation and completion.[31] Furthermore, results of a survey of young women who recently received an HPV vaccine revealed that strength of the physician's recommendation was a significant factor in their decision to be vaccinated with those receiving a strong recommendation having a four-fold greater likelihood of vaccination over those who received a recommendation that was not strong.[32] Our findings extend this prior research to a population-level across both sexes and several provider specialties, and link self-reported clinician behavior to actual vaccination rates.

Our results, coupled with prior research, emphasize the need to offer training to clinicians to strengthen their ability to consistently offer strong recommendations for HPV vaccination. [31] Clinicians may tend to couch their recommendations in weaker language or even fail to recommend the vaccine when they anticipate parents will question or refuse their recommendations. Indeed, clinicians may over-estimate the degree of parental hesitancy and fail to make clear or strong recommendations leading to parental hesitancy as a result.[6] An empirical approach to improving the strength of the clinician's recommendation of vaccination in the clinical setting is to use presumptive rather than participatory language when presenting the recommendation to vaccinate.[6, 33, 34]

As for addressing vaccine hesitancy, we recommend the C.A.S.E. method (corroborate, about me, science, and explain/advise).[35, 36] This approach to addressing vaccine hesitancy acknowledges patient concerns (corroborate), confirms the clinician's professional standing and expertise (about me), summarizes relevant scientific evidence (science), and offers a strong recommendation as a conclusion of addressing that parental concern (explain/advise). Evidence suggests that attempting to counter political misperceptions about the HPV vaccines may actually lead to greater vaccine hesitancy or resistance to vaccination. [37] Offering novel scientific evidence to influence parents' attitudes appears to be a more effective strategy [38] For example, with the rising incidence of oropharyngeal cancers [39], research has shown that emphasizing male-specific benefits of the vaccine is more effective than emphasizing altruistic motives among male patients. [40] Additionally, clinicians may benefit from training to support their summarization of the scientific evidence to highlight information that may be novel to parents including evidence about the enhanced immune response and lifetime of protection associated with early vaccination. [41] [42, 43]

Strengths and Limitations

A unique strength of our analysis is the ability to link clinician survey data to population-based clinical billing data to ascertain associations between clinician self-reported behavior and incident rates of HPV vaccination. Another distinct strength of our study stems from the inclusion of both family medicine and pediatric practices and a diversity of non-academic community practice sites. Clinicians other than physicians, such as nurse practitioners and physician assistants often engage with patients in conversations about vaccination. Therefore, it is important to ascertain self-reported behavior of clinicians other than physicians when attempting to understand vaccine-related clinical practice. Our collection of survey data among nurse practitioners and physician assistants in addition to physicians is also a novel contribution.

A limitation of our study stems from the cross sectional design which precludes drawing conclusions about causal associations. Additionally, evaluation of consistency and strength of HPV vaccination recommendations is challenging, particularly for clinicians seeing large numbers of patients; moreover, clinician self-reported behavior may suffer from recall or social desirability bias. We were also limited in the number of site-level variables to characterize the population and the clinical practice that we were able to control for in our analysis of the association of consistency and strength of HPV recommendations with incident HPV rates. Finally, use of clinical data to obtain population estimates of incident vaccine rates excluded patients who were vaccinated in other non-REP locations. While this may result in underestimation of vaccination rates, the population coverage of REP data in these counties is high, lending assurance that our data capture most vaccinations.

Another potential study limitation is the low survey response rate which may limit the generalizability of our findings. However, the response rate of our survey is consistent with those reported for other surveys of health professionals.[44] A related potential limitation is that the observed response rate among clinicians in Rochester, Minnesota was higher compared to other geographic regions. Additionally, the response rate observed among family medicine clinicians was higher than that of pediatric clinicians. Our findings may therefore be more characteristic of the Rochester region and family medicine practices than the outlying geographic area and pediatric practices, respectively.

Finally, we excluded prevalent cases of vaccine initiation from our analyses. We note that this exclusion may underestimate the actual impact of strong provider recommendations on HPV vaccination initiation and completion rates. This bias to the null may occur because providers that have routinely strongly recommended the vaccine may have already depleted the pool of the more compliant patient population, leaving only the more vaccine hesitant population at the time of the study. Therefore, it is possible that the associations we observed between strength of the provider recommendation and vaccination rates are underestimates of the true association.

CONCLUSIONS

Consistent with our hypothesis, we observed an association between the consistency and the strength of self-reported clinician recommendation of the HPV vaccine and incident rates of HPV vaccination at the site level. We also observed differences in consistency and strength of recommendation by patient sex and between pediatric and family medicine practices. Identification of inconsistences in recommendation of HPV vaccination by patient and provider characteristics will guide efforts to target interventions to improve uniform and effective HPV vaccine delivery across patients and settings.

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Table 1

Demographic, Occupational and Professional Characteristics of Primary Care Clinicians

Characteristics	N[1]	%
Total	227	
Race/Ethnicity		
White	198	87.2%
Non-white	29	12.8%
p-value[2]		<0.0001
Primary Clinical Specialty		
Pediatrics	43	19.1%
Family Medicine	177	78.7%
Other[3]	5	2.2%
p-value[2]		<0.0001
Medical Degree		
MBBS/MD/DO	160	72.1%
NP/PA	62	27.9%
p-value[2]		<0.0001
Board Certification		
Pediatrics	39	19.6%
Family Medicine	160	80.4%
p-value[2]		<0.0001
Years since Residency		
0–4	62	27.3%
5–9	36	15.9%
10–19	53	23.4%
20+	76	33.5%
p-value[2]		0.0019
Age in years		
<=35	58	26.6%
36–45	54	24.8%
46–55	56	25.7%

Characteristics	N[1]	%
56+	50	22.9%
p-value[2]		0.8867
Sex		
Males	90	39.7%
Females	137	60.3%
p-value[2]		0.0018

[1]Total N=227, not all measures sum to 227 due to missing values

[2]Chi-square p-values in the table are comparing the n, % across each characteristic

[3]Obstetrics/Gynecology/Other/Internal Medicine

Table 2

Consistency and Strength of HPV Recommendations by Characteristics of Primary Care Clinicians

Characteristics	Always or Usually Recommend for Females	Always or Usually Recommend for Males	Strongly Recommend for Females	Strongly Recommend for Males
	N[1], %	N[1], %	N[1], %	N[1], %
Total	177, 79.0%	138, 62.2%	156, 71.9%	129, 58.6%
p-value[2]	<0.0001		<0.0001	
Race/Ethnicity				
White	154, 79.4%	119, 61.7%	140, 73.7%	113, 59.2%
Non-white	22, 75.9%	19, 65.5%	16, 59.3%	16, 55.2%
p-value[3]	0.6647	0.6895	0.1187	0.6844
Primary Clinical Specialty				
Pediatrics	42, 97.7%	40, 93%	40, 95.2%	38, 88.4%
Family Medicine	132, 76.3%	98, 56.7%	113, 66.9%	90, 52.3%
Other[4]	1, 20.0%	0	2,50.0%	1, 25.0%
p-value[3]	<0.0001	<0.0001	0.0007	<0.0001
Medical Degree				
MBBS/MD/DO	125, 79.6%	102 65.4%	110, 71.9%	92, 59.4%
NP/PA	47, 77.1%	35, 57.4%	43, 72.9%	36, 60.0%
p-value[2]	0.6765	0.2717	0.8859	0.9311
Board Certification				
Pediatrics	38, 97.4%	37, 94.9%	36, 94.7%	34, 87.2%
Family Medicine	117, 75%	85, 54.5%	103, 67.3%	81, 52.6%
p-value[3]	0.0019	<0.0001	0.0007	<0.0001
Years since Residency				
0–4	46, 76.7%	41, 66.1%	47, 79.7%	40, 65.6%
5–9	29, 80.6%	20, 58.8%	24, 70.6%	20, 58.8%
10–19	43, 82.7%	35, 66.0%	37, 74.0%	32, 60.4%
20+	58, 77.3%	42, 57.5%	48, 64.9%	37, 51.4%
p-value[3]	0.8496	0.6641	0.2947	0.4175

Characteristics	Always or Usually Recommend for Females	Always or Usually Recommend for Males	Strongly Recommend for Females	Strongly Recommend for Males
	N[1], %	N[1], %	N[1], %	N[1], %
Age in years				
<=35	44, 77.2%	38, 66.7%	44, 80.0%	36, 64.3%
36–45	46, 86.8%	37, 69.8%	40, 78.4%	36, 67.9%
46–55	44, 80%	34, 63.0%	37, 68.5%	30, 56.6%
56+	37, 74.0%	26, 53.1%	31, 64.6%	24, 49.0%
p-value[3]	0.4144	0.3258	0.2201	0.2095
Sex				
Female	89, 65.9%	62, 47.0%	95, 72.5%	79, 60.8%
Male	49, 55.7%	34, 37.8%	61, 70.9%	50, 55.6%
p-value[3]	0.1237	0.1747	0.7990	0.4401

[1]Total N=227, not all measures sum to 227 due to missing values

[2]Comparison of responses for females versus males using McNemar's test. Difference in Always or Usually Recommend: p=0.xx, Difference in How Strongly Recommend: p=0.xx.

[3]Chi-square p-values in the table are comparing the n, % across each characteristic separately for females and males.

[4]Obstetrics/Gynecology/Other/Internal Medicine

Table 3

Association of Consistency and Strength of HPV Recommendations with Incident HPV Rates (Bold italics represent statistically significant associations)

	1 Dose		2 Doses		3-Doses	
Site-level characteristics	**Unadjusted Model**	**Adjusted Model[1]**	**Unadjusted Model**	**Adjusted Model[1]**	**Unadjusted Model**	**Adjusted Model[1]**
	Incident Rate Ratio (95% CI)	**Incident Rate Ratio (95% CI)**	**Incident Rate Ratio (95% CI)**	**Incident Rate Ratio (95% CI)**	**Incident Rate Ratio (95% CI)**	**Incident Rate Ratio (95% CI)**
Often recommend for Males Aged 11–12 Years[2]	***1.05 (1.03,1.08)***	1.00 (0.98,1.03)	***1.05 (1.01,1.09)***	0.99 (0.95,1.04)	***1.15 (1.12,1.19)***	***1.04 (1.00,1.08)***
P value	***<0.0001***	0.7473	***0.0083***	0.7801	***<0.0001***	***0.0307***
Often recommend for Females Aged 11–12 Years[2]	***1.13 (1.10,1.17)***	***1.05 (1.01,1.09)***	***1.13(1.07,1.19)***	***1.07 (1.00,1.14)***	***1.18 (1.13,1.24)***	***1.08 (1.02,1.13)***
P value	***<0.0001***	***0.0203***	***<0.0001***	***0.0360***	***<0.0001***	***0.0064***
Strongly Recommend for Males Aged 11–12 Years[2]	***1.09 (1.06, 1.12)***	***1.05 (1.02, 1.08)***	***1.04 (1.00, 1.09)***	1.00 (0.95, 1.04)	***1.14 (1.11, 1.18)***	***1.05 (1.01, 1.09)***
P value	***<0.0001***	***0.0006***	***0.0349***	0.8583	***<0.0001***	***0.0099***
Strongly Recommend for Females Aged 11–12 Years[2]	***1.09 (1.06, 1.12)***	1.03 (1.00, 1.06)	***1.06 (1.02, 1.10)***	1.00 (0.96, 1.05)	***1.14 (1.10, 1.18)***	***1.04 (1.00, 1.08)***
P value	***<0.0001***	0.0592	***0.0038***	0.9499	***<0.0001***	***0.033***

[1] Adjusted for percent white, percent female, percent ages 9–13 and percent with government insurance or self-pay at each site.

[2] Poisson regression was used to estimate incident rate ratio per quartile increase in the measure