Published in final edited form as:

J Pediatr Adolesc Gynecol. 2011 June ; 24(3): 166–171. doi:10.1016/j.jpag.2011.01.004.

Factors associated with intention to vaccinate a daughter against HPV: a statewide survey in Alabama

Allison G. Litton, DrPH,

Division of Preventive Medicine, School of Medicine, University of Alabama at Birmingham

Renee A. Desmond, DVM, PhD,

Division of Preventive Medicine, School of Medicine, University of Alabama at Birmingham

Janice Gilliland, PhD,

Department of Pediatrics, University of Utah

Warner K. Huh, MD, and

Division of Gynecologic Oncology, School of Medicine, University of Alabama at Birmingham

Frank A. Franklin, MD, PhD

Department of Health Behavior, School of Public Health, University of Alabama at Birmingham

Abstract

Purpose—Human papillomavirus (HPV) is the most common sexually transmitted infection in the United States. Adolescent and young adults aged 15–24 were estimated to account for three quarters of new infections in 2000. Two HPV vaccines are currently available. The vaccine is recommended for girls aged 11–12 years. Previous research has indicated that African- American and Asian-American parents are less likely to vaccinate their daughters than Caucasians. This investigation examines the relationship between demographic, medical, and behavioral risk factors for HPV vaccine acceptability among Alabama residents.

Methods—The cross sectional survey was conducted using random digit dialing. Eligible participants were female caregivers of adolescent girls between the ages of 10 and 14 years. Factors related to intention to vaccinate a daughter within the next 6 months were examined using chi-square and logistic regression.

Results—Caregivers who were informed about HPV vaccination from a health care provider were more likely to intend to vaccinate their daughter within the next 6 months compared to caregivers who did not report this source of information (OR=3.59 , 95% CI= 1.52, 8.45). Race, education, county of residence, child's age, religious attendance, knowledge and history of HPV, perceived susceptibility and severity of infection were not significantly related to intention to vaccinate against HPV.

Conclusion—Caregivers who were informed of the vaccine by their health care provider were more likely to vaccinate their adolescent daughters. Provider attitudes and caregiver education is an essential link to improvement of HPV vaccination uptake in Alabama.

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Correspondence and request for reprints should be addressed to: Dr. Allison Litton, Division of Preventive Medicine, School of Medicine, University of Alabama at Birmingham, 1530 3rd Ave South, MT 415, Birmingham, AL 35294-4410.

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Keywords

Human papillomavirus; HPV vaccine; parental attitudes; adolescents

Introduction

Acquisition of HPV is primarily related to sexual activity, however, the clearance of HPV infection and disease regression or progression is determined by the host immune response (1). The most important factor for developing cervical cancer is persistent infection with high risk HPV types(2). Adolescent and young adults aged 15–24 years were estimated to account for three quarters of new HPV infections in 2000 (3). An estimated 4.6 million new HPV infections occur each year among persons aged 15–24 years, which will result in an estimated direct medical lifetime cost of \$2.9 billion(4). Several studies have estimated the prevalence of HPV infection in adolescents, data from the National Health and Nutrition Examination Survey (NHANES), United States, from 2003–2004, provide the best available prevalence and incidence statistics. Rates of sexually transmitted infections (STI) vary by region. The southern United States continues to experience increasing rates of STIs (5). Several studies found that HPV is the most prevalent STI among female adolescents (aged 14–19 yrs) in the United States (6,7). Racial disparities exist in STI rates. African American adolescent girls have an overall STI prevalence of 48% compared to 20% among Caucasians and Mexican Americans in the United States (7).

In 2006, the first vaccine to prevent certain types of HPV became available. Merck's Gardasil was approved by the FDA in June 2006 and targets HPV types 6,11,16, 18. A bivalent vaccine made by Glaxo Smith Kline, Cervarix, was approved by the FDA in October 2009 and prevents HPV types 16 and 18, which are responsible for greater than 70% of cervical cancer cases. Low risk HPV types 6 and 11 cause genital warts, low grade cervical dysplastic lesions and respiratory papillomatosis. The Advisory Committee on Immunization Practices (ACIP) recommends vaccination against HPV for 11–12 year old girls but it can be administered as young as age nine years and up to age 26 (8). Both the quadrivalent and bivalent vaccines are administered in 3 doses over a period of 6 months. Ideally the vaccine should be given before the onset of sexual activity. Clinical studies of the HPV vaccine demonstrated nearly 100% efficacy in preventing infection and disease associated with types included in the vaccine (HPV types 6, 11,16,18) (6).

Because the vaccine targets an STI, there is some resistance among caregivers to vaccinate young girls (9,10,11,12). However, it is important to recognize that nationally, 33% of ninth grade students report having had sexual intercourse with the rate increasing to 62% of students by the 12th grade (5). Many caregivers believe their children are not at risk of a sexually transmitted infection like HPV. According to the 2009 Youth Risk Behavioral Survey, 56% of Alabama high school students have had sexual intercourse, 10% of which had their first sexual intercourse before age 13 (7). The risk of contracting HPV increases after initiation of sexual activity. Previous estimates of HPV infection after first vaginal intercourse are 30% and increases to 50% after 3 years (14,15). This highlights the need to vaccinate young adolescents at an early age before sexual debut. In 2007, initiation of HPV vaccination in the United States was 25% (16), however, the following year uptake was reported as 32.8% among 13–17 year old adolescents in Alabama. This number was lower than the national average of 37.2%.

The HPV vaccine is targeted at young adolescents, therefore parental intention to vaccinate against HPV is an important consideration in whether an adolescent daughter actually receives the vaccine. Several studies examined parental attitudes toward the HPV vaccine

prior to the vaccine approval in June 2006. This study examined parental attitudes in Alabama since the vaccine approval. The primary aim of this study was to estimate female caregivers' intention to vaccinate a daughter against HPV in Alabama. The secondary aim was to compare characteristics of groups of caregivers with an intention to vaccinate with those who do not.

Survey methods and design

This statewide population survey examined female caregiver's intention to vaccinate their daughters against HPV within the targeted 10–14 years age range of vaccination. The age range of 10–14 years was chosen specifically to examine the ACIP recommended age of HPV vaccination (11–12 years). It also included daughters a year younger and two years older than the recommendation. This age range was widened to be more inclusive of pre-adolescents and adolescents on a different schedule than recommended by the ACIP, recognizing that this age group is difficult to access for preventive health services (17).

The cross-sectional research study employed a random digit dial phone survey conducted through the Survey Research Unit at the University of Alabama at Birmingham (UAB). Participants were limited to English speakers. Participants were female caregivers of female adolescents, ages 10–14 years. Due to financial and time restraints, the survey was not offered in any other language. They included mothers, grandmothers and legal guardians. Primary caregivers were defined as the female who was responsible for parenting and knowledgeable about the child's health care. Names of participants were not recorded and confidentiality was maintained for all data regarding the child. The survey was pilot tested for feasibility by the UAB Survey Research Unit before data collection. The study was approved by the Institutional Review Board at the University of Alabama at Birmingham.

Target population

The original sample was straight random digit dialing within the state of Alabama and included both listed and unlisted numbers. However, the number of ineligible households made data collection with that sample ineffective and jeopardized meeting completion deadlines. As a result, a second subsample consisted of listed telephone numbers of households in the state of Alabama identified as having children living in the home was added to the calling queue 2 months after data collection started. We believe it enriched the original sample. Cell phone numbers were eligible to be included in the survey as well. Trained African American and Caucasian women interviewers conducted the phone surveys between December 2008 and April 2009. Calls were made from 10:00 a.m. to 3:00 p.m. and 4:00 p.m. to 9:00 p.m. everyday except Sunday. A total of 5,798 phone numbers were called. The average time to complete a survey was 12 minutes. A modified version of a caregiver survey regarding HPV vaccine acceptability was used for this study. It combined elements of two published surveys (18,19) including knowledge, attitudes and beliefs about HPV and the vaccine incorporating components of the health belief model and theory of planned behavior (20,21).

Sample size

The sample size calculated to estimate prevalence of intention to vaccinate a daughter aged 10–14 years was 400 with an error rate of $\pm 3\%$. This rate is probably an underestimation of intention but it provided the best available estimation to calculate sample size at the time. We believe that parental intention to vaccinate a daughter against HPV is higher than actual vaccination against the disease. For secondary analyses, we expected that our population would have a 4:1 distribution of intention to vaccinate based on the null hypothesis. Therefore, a two group X^2 test with a 0.05 two-sided significance level will have 80% power

to detect the difference between a Group 1 proportion of 0.5 and a Group 2 proportion, of 0.7 when the sample sizes are 57 and 226, respectively (a total sample size of 282).

Statistical analyses

The descriptive characteristics of the population are presented as frequency data for nominal variables and means (sd) for continuous variables. Intention to vaccinate a daughter against HPV was calculated as a dichotomous variable (1 = I don't want her to get the vaccine= **NO** vs. 2= I do want her to get the vaccine= **YES**). The exact 95% confidence intervals were computed. Cross tabulations and Chi-square statistics were used to assess race/ethnicity and other subgroup differences. Subgroups with fewer than 25 caregivers were collapsed into "other" categories. Asians and Hispanics were collapsed into an "other" category because very few were represented in the sample. Girls who have already been vaccinated were excluded in the final analyses but were included in the study to examine demographics. The relationships between predictors of intention to vaccinate were examined in univariate models. The variables significantly associated with intention to vaccinate against HPV were examined in logistic regression models in a stepwise model. For all analyses p-values of < 0.05 were deemed statistically significant. Quantitative analyses were performed using SAS 9.1 (22).

Results

Descriptive statistics

There were 421 respondents in the telephone survey. Eighteen respondents did not complete the survey, resulting in a sample size of 403. The cooperation response rate was 47%.

The majority of the study population was white, non Hispanic (89.8%) and African Americans were the next largest group (9%). The majority of the study population was between 40–49 years (57.7%) followed by the 30–39 years age group (23.3%). Most study participants lived in urban areas of the state (71.1% urban vs. 28.9% rural). Most of the study population had attended and/or graduated from college (74%). A majority of the study population was married (91.6%), had private health insurance (85%), consisted of 4–6 family members (80.3%) and identified themselves as belonging to one of several Christian denominations (89.7%).

Female caregivers answered questions regarding their knowledge and beliefs about HPV and the HPV vaccine. A majority of the women were aware of HPV (91.8%) and knew that it caused cervical cancer (76.7%). A substantial percentage of women did not understand the mode of transmission and did not believe that HPV was sexually transmitted (17% and 24.3%, respectively). In addition, women had low knowledge that HPV could go away without treatment (3%) or cause genital warts (41.4%). Most women in this study were aware of the HPV vaccine (96%) and their most common source of information was from a drug company advertisement (91.5%) followed by a health care provider (67.2%).

Only 45.2% of women reported that their health care provider had recommended the HPV vaccine for their daughter and only 19.5% had discussed the vaccine with their daughter's provider. Approximately one quarter of women reported their daughter had started the HPV vaccine 3 dose series (26%) and 63.8% of those who reported starting the series had completed it. Although more than one-third of women reported their intention to have their daughters vaccinated against HPV (37.3%), the majority was still undecided (44.6%). Of those participants who intended to have their daughters vaccinated, 6.7% reported they would do so in the next month, 14.4% in the next 6 months, 14.4% in the next year, 28.2% by her 15th birthday, and 29.9% were unsure. Interestingly, more than half of caregivers would vaccinate a son if the vaccine was available to them (51.6%).

Predictors of intention

Table 1 displays the results of the bivariate analyses of vaccine intention by demographic factors of caregivers whose daughters have not already started the HPV vaccine series. Factors that were associated with caregivers being less likely to intend to vaccinate a daughter against HPV were African American, having a total family household income between \$41,000–60,000 a year, having a 13 year old daughter, Baptist religious affiliation, attending religious services more than once a week, and perceiving a low likelihood of HPV infection. Several health beliefs were also associated with being less likely to intend to vaccinate a daughter; the vaccine is too new, causes lasting health problems, daughter is too young and the vaccine is unsafe.

Factors that were associated with caregivers being more likely to intend to vaccinate a daughter against HPV were family, friends and health care providers as the source of HPV vaccine information, a total family household income over \$80,000 a year, having an 11 year old daughter, Methodist religious affiliation, attending religious services once a week, supporting mandatory vaccination of boys and girls, perceiving moderate likelihood of HPV infection and believing it is not hard to find a provider without a long wait. Two health beliefs were associated with being more likely to intend to vaccinate a daughter against HPV; belief that HPV causes abnormal Pap smears and that HPV cannot clear without treatment.

Table 2 displays caregivers' knowledge, attitudes and beliefs related to intention to vaccinate a daughter against HPV. Health belief about vaccine safety was associated with intention to vaccinate a daughter against HPV in the bivariate analyses. Caregivers who believed the HPV vaccine is too new were still undecided about vaccinating their daughter ($p<0.0001$). In addition, caregivers who believed the HPV vaccine might cause lasting health problems were less likely to vaccinate their daughter against HPV (57.1%, $p<0.0001$). Caregivers who believed the HPV vaccine is unsafe were less likely to vaccinate their daughter, whereas caregivers who didn't know if the vaccine was unsafe were still undecided about vaccination (72.6%, $p<0.0001$). Caregivers who believed their daughter is too young for a vaccine against a sexually transmitted infection were undecided about vaccination (58.8%, $p<0.0001$). These findings seem to suggest a lingering concern about general vaccine safety among parents.

Caregivers who intended to vaccinate their daughters would also vaccinate their sons if available (66.7%, $p<0.0001$). Caregivers who perceived a moderate to high likelihood of their daughter getting an HPV infection were more likely to intend to vaccinate their daughter ($p<0.0001$). Perceived susceptibility of HPV infection and vaccination of boys have previously been reported in the literature to be associated with intention to vaccinate a daughter (23,24).

Multivariable model—The results of the logistic regression are presented in Table 3 as multivariate analyses of factors predictive of intention to vaccinate an adolescent daughter against HPV. Table 3 displays the results from the 3 step model of factors. All of these factors were significant in the bivariate analyses. Some factors were not included in the final model because of missing values, which reduced sample size and power. The first model predicting intention to vaccinate against HPV included demographics (education, religious attendance, age, child's age, race and county). No factors were significant in this model. The second model predicting intention included demographics, knowledge and beliefs about HPV. Ultimately only two factors remained in the model, a health care provider as source of HPV vaccine information and discussing sex with their daughter, after other factors were dropped due to missing values. The only factor that was significant was the health care provider as the source of HPV vaccine information (OR =4.20). The third model included

demographics, knowledge and beliefs about HPV and barriers to vaccination. Only one barrier (not waiting long for an appointment) remained in the model after frequencies were examined. The only significant factor predicting intention to vaccinate was the health care provider as the source of HPV vaccine information (OR=3.59).

Discussion

The results of this study suggest that overall rates of HPV awareness were high (91.8%), however intention to vaccinate a daughter against HPV remained low (37%). Previous research suggested that knowledge of HPV was not predictive of HPV vaccine acceptance (19,23). Almost half of female caregivers in this Alabama study were undecided as to whether or not they intended to vaccinate their daughter against HPV (44.6%).

Several factors that were not associated with intention to vaccinate a daughter against HPV in the bivariate analyses were age, marital status, education, insurance status, urban/ rural location and child's vaccination history. African Americans were less likely to vaccinate their daughter against HPV than non-Hispanic whites in this study population (18.5% vs. 40.2%, $p=0.02$). Race was not a predictor in the logistic regression model. In regards to income, caregivers with household income over \$80,000 a year were more likely to vaccinate a daughter against HPV than other income levels (47.4%, $p=0.02$); however, this difference was not significant when intention and undecided groups were evaluated in a 2x2 table.

A history of cervical cancer was associated with intention to vaccinate a daughter against HPV (100%, $p=0.03$) even though the numbers were small. Also a history of HPV infection (47.1%, $p=0.08$) tended to be associated with intention to vaccinate a daughter against HPV, although it did not reach statistical significance. This finding confirms earlier studies that women's personal history of HPV infection is associated with intention to vaccinate their daughters (18,20,23).

Two institutional factors were associated with intention to vaccinate a daughter against HPV. Caregivers who believed that all girls should get the HPV vaccine were more likely to intend to vaccinate their own daughter (79.7%, $p<0.0001$). Interestingly, cost did not seem to be factor with intention to vaccinate a daughter against HPV. Caregivers who did not intend to vaccinate their daughter still would not vaccinate even if it were free (80%, $p<0.0001$).

In conclusion, only 16.8% of female caregivers in this study said they did not intend to vaccinate their daughter against HPV, whereas 44.6% were still undecided. This can be viewed as an opportunity to intervene with health promotion and education strategies toward vaccine acceptance. The health care provider should take advantage of this opportunity to address concerns with parents and improve HPV vaccine intentions. This research study examined factors influencing caregiver intention to vaccinate a daughter against HPV. Caregiver intention to vaccinate a daughter against HPV is believed to be influenced by institutional factors, social and environmental factors, and their subsequent interface with the health care system. Institutional factors refer to guidelines regarding vaccination and professional group recommendations such as the American Academy of Pediatrics. Social and environmental factors included cultural attitudes, media coverage, and subjective norms. Caregivers' interface with the health care system includes physician recommendations, access to care and insurance status. All of these factors interact with and impact caregivers' personal beliefs about vaccines, sexually transmitted infections and the subsequent decision of whether to vaccinate a daughter against HPV. The physical environment in the conceptual

model includes the prevalence of HPV in the community and the history of public health efforts. It is the broad backdrop for individual decisions.

One of the major strengths of this study was the ability to collect statewide data using random digit dialing (RDD) for female caregivers regarding intention to vaccinate their daughters against HPV. Another strength of the study was the specific age range of daughters (10–14 years). This age range provided timely information on the targeted range of adolescents that are currently recommended for HPV vaccination. We designed our study to utilize random digit dialing, providing all female caregivers with a daughter in the specific age range an opportunity to participate if they had access to a landline or cell phone. However, we were unable to recruit a demographically representative sample of the state of Alabama. Minorities and female caregivers with low education income were underrepresented in this study population, limiting the generalizability of the results.

Conclusions

This study confirmed earlier studies regarding factors associated with parental acceptance of HPV vaccination. Previous research suggested that certain health beliefs were associated with being less likely to vaccinate a daughter against HPV. Those factors that were confirmed in this study as being less likely were race (African Americans), and parents who had concerns about vaccine safety and effectiveness. Cost was confirmed in this study as not being associated with intention to vaccinate a daughter against HPV. New factors to be reported in the literature that were associated in the bivariate analyses in this study as being more likely to vaccinate a daughter against HPV were religious affiliation (Methodists), and sources of HPV vaccine information (from the health care provider). The health care provider as the source of HPV vaccine information was the only predictor in the logistic regression model. This confirms the important role that providers play in parental acceptance of childhood immunizations (25). Our study indicated that HPV vaccine information provided at a health care visit was more important for a caregiver's intention to vaccinate a daughter against HPV than provider recommendation alone. Further study is needed on what type of information needs to be provided to parents/ patients and by whom (physician vs. nurse).

Acknowledgments

This dissertation research study was supported by NCI grant 5R25CA047888.

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Table 1

Demographic factors of female caregivers' intention to vaccinate a daughter against HPV

	No intention	Intention	Undecided	p value
Total	16.8	37.3	44.6	
Age group				
30–39	16.7	38.9	44.4	0.09
40–49	14	38.5	47.5	
50–59	27.3	27.3	45.5	
60 +	0	100	0	
Marital status				
Married	17.8	38.3	43.8	0.35
Divorced/ separated	9.6	23.8	66.6	
Widowed	0	50	50	
Single/ never married	0	100	0	
Race				
White	17	40.2	42.8	0.02
Black	11.1	18.5	70.4	
Other	2	0	0	
History of HPV				
Yes	11.8	47.1	41.2	0.08
No	16.9	37.5	45.6	
Income				
< \$20,000	12	40	48	0.02
\$21,000–40,000	10.5	47.4	42.1	
\$41,000–60,000	34.1	25	40.9	
\$61,000–80,000	18	26	56	
> \$80,000	13.5	47.2	39.3	
Education				
Less than high school	25	50	25	0.09
High school graduate	18.7	33.3	48	
Some college	25.3	28	46.7	
College graduate	11.4	45	43.6	
Child's age				
10	22.2	50	27.8	0.008
11	13	42	45	
12	25.8	28.8	45.4	
13	11.4	27.1	61.4	
14	12.5	47.9	39.6	

Table 2

Knowledge, attitudes, beliefs of female caregivers' regarding HPV vaccine

	No intention	Intention	Undecided	
HPV vaccine is too new				
Strongly agree	24.4	13.3	62.2	<0.0001
Somewhat agree	11.6	36.2	52.2	
Somewhat disagree	5.9	88.2	5.9	
Strongly disagree	11.9	85.7	2.4	
Don't know	7.7	15.4	76.9	
HPV vaccine is unsafe				
Strongly agree	80	15	5	<0.0001
Somewhat agree	31.9	12.8	55.3	
Somewhat disagree	10.4	56.3	33.3	
Strongly disagree	6.1	81.8	12.1	
Don't know	8.8	18.6	72.6	
Vaccine might cause lasting health problems				
Strongly agree	57.1	9.5	33.3	<0.0001
Somewhat agree	28.6	4.8	66.7	
Somewhat disagree	8.1	70.3	21.6	
Strongly disagree	8	76	16	
Don't know	12.2	30	56.9	
Daughter is too young for an STI vaccine				
Strongly agree	36.4	18.2	45.5	<0.0001
Somewhat agree	8.8	32.6	58.8	
Somewhat disagree	10.4	56.3	33.3	
Strongly disagree	6.1	81.8	12.1	
Don't know	8.8	18.6	72.6	
Boys should receive vaccine				
Strongly agree	6.2	66.7	27.2	<0.0001
Somewhat agree	4.4	60.9	34.8	
Somewhat disagree	20	0	80	
Strongly disagree	62.5	12.5	25	
Don't know	8.6	22.6	68.8	
Perceived likelihood of HPV infection				
None	30	15	55	<0.0001
Low	26.3	27.4	46.3	
Moderate	3.7	60.5	35.8	
High	5.9	58.8	35.3	
Don't know	18.5	28.4	53.1	
HPV causes cervical cancer				
Yes	14.5	43	42.5	0.03
No	0	50	50	

	No intention	Intention	Undecided	
Don't know	28.6	27	44.4	
HPV causes abnormal Pap smears				
Yes	14.4	40.6	45	0.04
No	60	20	20	
Don't know	24.6	36.8	38.6	
HPV can clear without treatment				
Yes	27.3	45.5	27.3	<0.0001
No	12.2	44.3	43.4	
Don't know	40.5	10.8	48.7	
HPV mandate endorsement				
Strongly agree	5	79.7	15.3	<0.0001
Somewhat agree	0	76.7	23.3	
Somewhat disagree	16.2	24.3	59.5	
Strongly disagree	46.4	12.6	33.3	
Don't know	10.5	9.3	80.2	
HPV vaccinate if free				
Definitely won't	80	8.9	11.1	<0.0001
Probably won't	28.6	4.8	66.7	
Probably will	2.1	25	72.9	
Definitely will	1.9	80.4	17.8	
Don't know	4.5	7.5	88	
Discussed HPV vaccine with provider				
Yes	24.2	42.4	33.3	0.31
No	16.9	31.3	51.8	
Provider recommended vaccine				
Yes	14.9	47.8	37.2	0.13
No	18.1	33.2	48.7	
Family or friend as source of HPV vaccine information				
Yes	19.1	46	34.9	0.02
No	14.9	33.8	51.3	
Health care provider as source of HPV vaccine information				
Yes	13.2	47.9	38.9	0.006
No	22.3	26.8	50.9	

Table 3

Multivariate logistic regression of factors predictive of intention to vaccinate adolescent daughter against HPV in Alabama, 2009 (n=161)

Factor	Demographics Model 1 OR (95% CI)	Demographics +Knowledge + Beliefs Model 2	Demographics+ Knowledge + Beliefs + Barriers Model 3
Education	1.59 (0.69, 3.68)	1.57 (0.61, 4.02)	1.71 (0.65, 4.48)
Religious Attendance	0.31 (0.08, 1.17)	0.32 (0.08, 1.25)	0.23 (0.04, 1.12)
Age	1.03 (0.60, 1.77)	1.00 (0.56, 1.81)	0.97 (0.53, 1.77)
Child's age	0.98 (0.75, 1.29)	0.84 (0.61, 1.15)	0.86 (0.63, 1.18)
Race	0.57 (0.12, 2.60)	0.63 (0.10, 3.89)	1.40 (0.12, 15.60)
County	1.23 (0.56, 2.70)	0.98 (0.40, 2.37)	0.96 (0.39, 2.38)
Health care provider as sources of HPV vaccine information		4.20 (1.82, 9.68)	3.59 (1.52, 8.45)
Discussed sex with daughter		1.24 (0.22, 6.93)	0.76 (0.10, 5.46)
Not waiting long for an appointment			0.93 (0.40, 2.17)