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HPV Vaccine and Health Decision Making Behaviors among University Undergraduates

By

Kathleen Renée Ragan
Master of Science in Public Health

Global Epidemiology

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Robert A. Bednarczyk, Ph.D., M.S.
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Kathleen Renée Ragan

B.S.
Georgia College and State University
2010

Thesis Committee Chair: Robert A. Bednarczyk, Ph.D., M.S.
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An abstract of
A thesis submitted to the Faculty of the
Rollins School of Public Health of Emory University
in partial fulfillment of the requirements for the degree of
Master of Science in Public Health
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2015

Abstract

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By Kathleen Renée Ragan

Background

Genital human papillomavirus (HPV) is the most common sexually transmitted infection. Even though vaccines are recommended for adolescents, coverage rates in the U.S. are much lower than other developed countries. Low rates in the U.S. demonstrate a need to focus on effective catch-up vaccination strategies for 13 to 26 year-olds. When teens enter college, many move away from their parents/guardians who may have had roles in influencing their health care decisions. Determining which modifiable or influencing factors lead some young adults to get vaccinated while others do not is a sizable gap in current literature. We sought to identify influencing factors regarding HPV vaccine decision making among 18 to 26 year old college students. Identifying when this population begins to take control of their own decision making and to the extent to which they rely on others to influence these decisions is crucial for effective public health interventions.

Methods

This cross-sectional study utilized an HPV Vaccine and Decision Making Behaviors Survey that was distributed to a sample of male and female students at two universities. We targeted introductory level courses to investigate the continuum of decision making practices from adolescents to young adults.

Results

A total of 527 students participated (response proportion = 93.1%). Overall, 54.5% of participants received the HPV vaccine; most recipients (92.3%) reported that someone encouraged them. Encouraging conversations with doctors and/or parents/guardians were identified as one of the most influential factors to increase vaccine uptake. Campaigns about cancer prevention were viewed as more influential than those that focus on preventing genital warts. Approximately one-third of both men and women indicated they didn't know where to get the HPV vaccine. Women were more likely to report that their parents would not let them get the HPV vaccine compared to men (26.7% vs. 2.3%). The majority of students (77.2%) indicated their parents were sometimes, equally, or mostly involved in making decisions about receiving vaccines (other than flu).

Conclusions

Student's decision making is greatly influenced by their parents, therefore, interventions for this population should work to increase students' control over decision making while also addressing parental concerns.

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HPV Vaccine and Health Decision Making Behaviors among University Undergraduates

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Summary: In a cross-sectional study of 527 college students, we identified that their healthcare decision making is largely influenced by their parents. Targeted interventions which address parental barriers are needed in order to increase HPV vaccine uptake in this population.

Abstract

Background

Genital human papillomavirus (HPV) is the most common sexually transmitted infection. Even though vaccines are recommended for adolescents, coverage rates in the U.S. are much lower than other developed countries. Determining which influencing factors lead some young adults to get vaccinated while others do not is a sizable gap in current literature.

Methods

This cross-sectional study utilized an HPV Vaccine and Decision Making Behaviors Survey that was distributed to a sample of male and female students at two universities. We targeted introductory level courses to investigate the continuum of decision making practices from adolescents to young adults.

Results

A total of 527 students participated (response proportion = 93.1%). Overall, 54.5% of participants received the HPV vaccine; most recipients (92.3%) reported that someone encouraged them. Encouraging conversations with doctors and/or parents/guardians were identified as one of the most influential factors to increase vaccine uptake. Campaigns about cancer prevention were viewed as more influential than those that focus on preventing genital warts. Approximately one-third of both men and women indicated they didn't know where to get the HPV vaccine. Women were more likely to report that their parents would not let them get the HPV vaccine compared to men (26.7% vs. 2.3%). The majority of students (77.2%) indicated their parents were sometimes, equally, or mostly involved in making decisions about receiving vaccines (other than flu).

Conclusions

Student's decision making is greatly influenced by their parents, therefore, interventions for this population should work to increase students' control over decision making while also addressing parental concerns.

Background

Genital human papillomavirus (HPV) is the most common sexually transmitted infection with about 79 million Americans currently infected and about 14 million becoming infected each year [1]. Half of U.S. adolescents and young women acquire HPV within 3 years of first sexual intercourse [2, 3]. HPV can cause genital warts, and HPV-associated cancers (such as cervical, vulvar, vaginal, penile, anal, and oropharyngeal) are estimated to contribute to ~4.8% of all cancers in the United States. [4]. HPV vaccines are recommended for males and females from age 11 or 12 through age 26 [5].

Adolescent HPV vaccine coverage is much lower in the United States when compared to other recommended vaccines (such as tetanus-diphtheria-acellular pertussis [Tdap] and meningococcal conjugate vaccine [MCV4]) [6]. In 2013, HPV vaccine series initiation among girls was 57% compared to 35% among boys [7]. HPV vaccine coverage in the United States lags that of other countries, with 82% of female adolescents in Australia having received at least one dose [8] and HPV series completion in the United Kingdom of 86% [9]. Low rates in the U.S. demonstrate a need to focus on effective catch-up vaccination strategies which are encouraged for individuals over age 13 who are outside of the primary recommended schedule. Sexual onset and activity often increases once teenagers enter college which places them at higher risk for acquiring HPV. Although HPV prevalence among U.S. women ages 20-24 is about 50%, research suggests that catch-up vaccination programs can be cost-effective and beneficial [10-12].

Many studies have sought to predict vaccination behaviors by focusing on knowledge constructs and exploring HPV vaccine knowledge, attitudes, and practices of

college students in addition to vaccine acceptance and uptake [12-17]. Studies have also explored parental and/or physician attitudes and knowledge, however, many studies have focused only on females [12, 14, 18-22]. Although some barriers to HPV vaccination have been identified, research on the level of autonomy and control over decision making is still limited. When teens enter college, many move away from their parents/guardians who may have had roles in influencing their health care decisions. Determining which modifiable or influencing factors lead some young adults to get vaccinated while others do not is a sizable gap in current literature [20].

We sought to identify key barriers and influencing factors regarding the HPV vaccine decision making process among 18 to 26 year old college students. Specifically, we wanted to assess whether the rationale for students' vaccine decisions changed as they aged and entered college. Identifying when this population begins to take control of their own decision making and to the extent to which they rely on others to influence these decisions is crucial for effective public health interventions. Health promotion and message framing topics were also explored.

Methods

Survey

This cross-sectional study utilized a self-administered HPV Vaccine and Decision Making Behaviors Survey in classroom settings at two universities. Each university's Institutional Review Board approved the survey, and data collection occurred between October and November 2014. The survey was anonymous and no personally identifiable information was collected. As written documentation of consent would have compromised confidentiality by allowing responses to be traced back to students, we

acquired a waiver of signed informed consent. Study participants did not receive any school credit and were not monetarily compensated. Participants received a stress ball as a thank you gift for assisting with the study.

Some items on the questionnaire were based upon commonly used theories and models, including the Health Belief Model, the Transtheoretical Model, and the Theory of Planned Behavior. Additional items were developed based on message framing concepts. The 50 item questionnaire focused primarily on the topic of HPV vaccine, but also included items relating to personal health history and behaviors (such as vaccination history), sexual health history and behaviors, and factors associated with healthcare decision making. Demographic items such as class status (e.g., Freshman), age, race/ethnicity, and income level were also included.

The questionnaire was pilot tested to ensure content was appropriate and understandable for the target population. The group consisted of 6 females and 4 males and had an average age of 23 years (range: 18 to 27 years). Participants took an average of 15.3 minutes to complete the questionnaire (range: 10.5 to 21 minutes). Participant feedback was very positive with only minor changes requested. No survey data was collected from pilot test participants.

Study population

The study population primarily consisted of undergraduates attending college at an urban private religious-affiliated university or a rural public university in Georgia. To be included in the study, participants had to be at least 18 years of age, a currently enrolled student at the institution being studied, and able to read and understand English.

After obtaining a list of courses at each university, we contacted a sample of professors of courses with more than 50 students and asked if they would allow time during their course for students to complete the questionnaire. Enrollment was not limited to a specific ethnic or racial group, and there were no plans to monitor equitable recruitment of subjects. During regularly scheduled class times, research personnel verbally described informed consent guidelines, distributed surveys to students, and promptly collected them via a drop box. Paper copies of informed consent information were also distributed for students to review prior to beginning the survey. To investigate the continuum of decision making practices from teens to young adults, we targeted introductory level courses. Courses were selected from a variety of subjects including mathematics, linguistics, sociology, psychology, biology, religion, and political science.

Statistical analysis

The total number of completed surveys needed was 402 based on computations utilizing a response proportion of 50% with a 95% confidence interval of +/- 5% with 80% power. Since the most conservative response proportion of 50% was used, a sample size of 402 is sufficient to evaluate any response proportion more extreme than 50%.

Data was entered into and analyzed using IBM SPSS Statistics for Windows, Version 22.0 (Armonk, NY) and SAS 9.4 (SAS Institute, Cary NC). Categorical data comparisons were done using Chi-square and Fisher's Exact tests. Multivariate Poisson regression was used to model initiation of HPV vaccine while controlling for key influential covariates at the 0.05 alpha level.

Results

Study sample

Data were collected from students in five courses at each university for a total of ten courses sampled and 527 participants. Among students present on the day of data collection, there was a 97.4% response rate at the public university and an 89.2% response rate at the private university (overall response rate: 93.1%). Class sizes ranged from 21 to 117 students in attendance at the time of survey implementation.

Comparison by university

Public university participants were younger and more likely to be Caucasian compared to those from the private university (Table 1). While most public university students relied on their parents' insurance plan (94.7%), private university students were more likely to be covered by a school or individual plan. Average yearly family income differed significantly by institution. The most common family income bracket at the private university was more than $200,000 (43.4%) compared to the most common for the public university, where 40.6% reported their family income was between $75,000 and $149,000. Participants reporting ever having sexual intercourse did not differ by school.

Vaccine coverage

A little more than half (54.5%) of participants reported receiving at least one dose of HPV vaccine, with 81.5% of initiators completing the three dose series. Among the participants who did not receive the HPV vaccine, only 4.4% reported they were planning

to get it within the next year, while 48.5% reported they did not plan to get it and 44.1% were undecided. HPV vaccine initiation did not differ by institution (Table 1).

Significantly more women reported having received the vaccine compared to men (62.9% vs. 42.3%, PR=1.49, CI=1.22-1.81). For both men and women, younger students were generally more likely to have received the vaccine (Table 2). Vaccine initiation did not differ by family income. Initiation of sexual intercourse was not significantly associated with vaccine uptake for men or women after adjusting for other factors. Students who received either the meningitis or Tdap vaccine were a little more likely to have also received the HPV vaccine, although this association was reduced after controlling for relevant covariates.

Decision making

When students were asked about who usually makes decisions regarding getting vaccines (other than flu), 20.7% (N=108) indicated they made their own decisions while 77.2% (N=403) indicated their parents were sometimes, equally, or mostly involved in making the decisions. Students tended to be more autonomous when asked about making a decision regarding the flu vaccine, with 36.2% (N=189) indicating they made their own decisions and 62.3% (N=325) indicating their decisions involved their parents in some form. More than a quarter (26.4%) of students reported that their parents mostly made decisions regarding getting the flu vaccine while over a third (35.2%) indicated the same regarding other vaccine decisions. When stratified by HPV vaccine series initiation, there were no significant differences between HPV vaccine initiators and non-initiators in terms of who made decisions relating to getting the flu vaccine or vaccines in general (Table 3).

Among HPV vaccine initiators, self-reported factors that were significantly associated with being more likely to receive the vaccine included the following: encouragement from a doctor, parent/guardian, or friend; recommendation from CDC guidelines; talking to someone who had a good experience with the vaccine; having an HPV awareness program on campus; and television, radio, or print campaigns focused on preventing cancer (Table 4). HPV vaccine initiators perceived doctor or parental encouragement to be much more influential in their decision making than non-initiators. Campaigns and targeted messages focusing on cancer prevention were viewed as more influential by students, independent of HPV vaccine initiation, than those that focus on preventing genital warts. Among all students, talking to someone who had a bad side effect from the vaccine was the primary negative influential factor that would make them much less likely to get vaccinated.

Students who were encouraged by someone were significantly more likely to receive the HPV vaccine. The majority of students (83.5%) who received encouragement reported receiving the vaccine, however, only a small proportion (12.6%) of students who were not encouraged reported receiving the vaccine (PR=6.65, CI=4.48-9.85). Parental encouragement was identified as a key influential factor, with 62.5% of vaccine initiators reporting they were encouraged by a parent ($p<0.001$). When students were encouraged by both a doctor and a parent, 95.8% received the vaccine. However, when students were encouraged by a doctor but discouraged by a parent, only 29.6% received the vaccine. When encouragement by a doctor was considered independent of encouragement from other persons, no differences in vaccine initiation existed. Students who reported they were discouraged by someone were significantly less likely to receive the vaccine than

students who were not discouraged (PR=0.44, CI=0.29-0.67). Among those who were discouraged, 72.1% did not receive the vaccine. Parental discouragement was a strong indicator of declining vaccination, given that 80.9% of students who were discouraged by a parent reported not receiving the vaccine.

Only 68.6% of all students indicated they had held a conversation with a doctor or nurse about HPV vaccine and they were almost equally as likely to have held conversations with their parents (67.9%). Of these students, 53.4% indicated that they trust their doctor/nurse "a lot" or "very much" while 50.4% indicated the same regarding their parent/guardian. Among students who had not had a conversation with a doctor/nurse, 78.0% did not receive the vaccine. Similarly, students who had not had discussions with their parent/guardian were significantly less likely to have received the vaccine than students who reported having discussions.

Barriers to initiation and series completion

Among participants who reported they did not plan to get the HPV vaccine, the most common reason for females was that they didn't have sex and didn't need it (58.3%), while the most common reason for males was that their doctor did not talk to them about getting it (41.9%) (Supplementary Table 1). While 38.3% of women indicated hearing the vaccine has too many side effects, only 7.0% of men indicated this as a barrier. According to 26.7% of women but only 2.3% of men, they did not plan to get the vaccine because their parents would not let them get it. A small subset of women (8.3%) reported the vaccine goes against their religious beliefs.

Among students undecided about getting the vaccine, women reported the top reasons were because they weren't having sex and didn't need it (42.1%) and the doctor

not talking to them about getting it (42.1%), compared to 17.9% and 48.7% of men, respectively (Supplementary Table 1). Almost a third of men and women who were undecided reported they didn't know where to go to get it. Of those participants who indicated they had received at least one dose but had not completed the series, 34% don't plan to get it, 41.5% intend to get it, and 24.5% have scheduled an appointment to get the next dose (Supplementary Table 2). Half of those who don't plan to get it indicated it was because it was too much trouble to schedule appointments. A primary barrier for roughly 45% of students who didn't complete the series was having their doctor's office located in another town (Supplementary Table 3).

Discussion

College students' healthcare decision making is still greatly influenced by their parents, and encouragement by parents and doctors was strongly associated with HPV vaccine initiation. Given that over 40% of students who were undecided about the vaccine indicated their doctor did not discuss it with them, there is potential for greatly increasing uptake via more routine physician discussion and recommendation about HPV vaccination, especially among student health providers. Since physicians are often more likely to strongly recommend vaccination to older adolescents instead of 11-12 year-olds, it is imperative for physicians to switch their focus to emphasizing the primary schedule instead of relying on catch-up vaccination to occur [23]. Our results suggest that encouragement has more influence on initiation than discouragement, especially when received by both a parent and a doctor.

Female students were more likely to report that their parents would not let them get the vaccine. The lack of support from parents for vaccinating their daughters may

stem from unvalidated concerns about the vaccine increasing sexual activity [14, 24-27]. Some parents may believe that the vaccine isn't needed because pap smears can provide protection by detecting abnormal cervical cells, however, guidelines recommend that women receive their first screening at age 21 which may be several years after they become sexually active [28, 29].

Our results support research that suggests women's intentions to receive the vaccine are higher when messages are framed around preventing cervical cancer compared to mixed messages that frame the vaccine as a prevention method for sexually transmitted infections or genital warts [24]. Targeted messages that provide details about insurance coverage and ease of access are also needed, as approximately one-third of both men and women indicated they didn't know where to get the vaccine.

For those who haven't completed the HPV series, 40% indicated their doctor's office is in another town. The private university's student health center offers the HPV vaccine, but it is not available at the public university. However, many retail and grocery store chains now offer vaccines via their in-store pharmacies. Students who are on their parent's insurance and are not attending college near home may experience issues with coverage of vaccines depending on how their plan's pharmacy vaccine network aligns with the in-network guidelines of the Affordable Care Act [30].

Communication campaigns that help students understand the policies of HPV vaccination (such as being able to get the vaccine at providers outside of the one which administered the first shot) could also help greatly increase vaccine uptake and/or series completion. The adoption of a reduced dosing schedule is also being considered as a

means of making vaccination more convenient for providers, parents, and students by reducing logistical challenges and resource needs [31].

The most important limitation is that information was self-reported by students in a classroom setting among their regular instructor(s) and peers, thus suggesting possible self-report bias. Since classes were randomly selected and students were not directly enrolled, the study sample may not be a true representation of the university population. Next steps would include implementing the survey instrument in a more diverse student population to determine if trends in decision making behaviors differ among college cohorts.

Conclusion

We sought to explore influential factors in hopes of providing important insight into interventions that may increase HPV vaccine uptake among students who didn't receive the vaccine before entering college. We discovered that even though there are some modifiable barriers that can be addressed (such as increasing awareness about the importance of the vaccine even if you are not sexually active), students' decision making is not independent and parental factors that influenced them in their teenage years are still highly impactful. Although young adults often appear to yearn for independence and stray from parental guidance, our results suggest that they tend to rely on parents for important healthcare decisions. More information is needed regarding parents' awareness of the influence they may have and why students' sense of independence decreases when healthcare is involved. Since students' primary care providers often change once they enter college, student health physicians also have a critical role in bridging the gap in vaccine initiation and series completion. Increasing students' feelings of autonomy and

self-control concerning their own health is crucial to address early on, as these learned behaviors will continue to benefit them as they age and begin thinking of starting a family, for whom they will then have an important decision-making role.

Table 1. Demographic characteristic comparisons of students at two universities (N=527)

Characteristic	Urban Private (N=263)		Rural Public (N=264)		p-value
	No.	%	No.	%	
Gender					
Man	93	37.5%	75	28.5%	0.031
Woman	155	62.5%	188	71.5%	
Missing	15		1		
Age (years)					
18	86	35.2%	97	37.0%	0.005
19	81	33.2%	100	38.2%	
20	35	14.3%	48	18.3%	
21	32	13.1%	13	5.0%	
22 and older	10	4.1%	4	1.5%	
Missing	19		2		
Class Level					
Freshman	119	48.0%	122	46.4%	0.001^
Sophomore	67	27.0%	102	38.8%	
Junior	35	14.1%	29	11.0%	
Senior	26	10.5%	8	3.0%	
Other	1	0.4%	2	0.8%	
Missing	15		1		
Race[a]					
White/Caucasian	123	50.0%	239	91.2%	<0.001
Asian/Asian American	69	28.0%	6	2.3%	
Black/African American	27	11.0%	10	3.8%	
Mixed	15	6.1%	2	0.8%	
Other	12	4.9%	5	1.9%	
Missing	17		2		

Hispanic Ethnicity					
Yes	23	9.5%	13	5.0%	0.049
Missing	21		3		
Insurance Coverage					
None	3	1.1%	3	1.1%	<0.001^
Parent's plan	184	70.0%	249	94.7%	
School plan	46	17.5%	5	1.9%	
Own plan	19	7.2%	4	1.5%	
Dual plans	7	2.7%	1	0.4%	
Other	4	1.5%	1	0.4%	
Missing	0		1		
Financial Status					
Independent	20	8.1%	21	8.0%	0.963
Dependent	227	91.9%	242	92.0%	
Missing	16		1		
Family Income					
Less than $30,000	23	9.8%	11	4.4%	<0.001
$30,000 to $74,999	33	14.0%	63	25.1%	
$75,000 to $149,999	45	19.1%	102	40.6%	
$150,000 to $199,999	32	13.6%	44	17.5%	
More than $200,000	102	43.4%	31	12.4%	
Missing	28		13		
Ever had sexual intercourse					
Yes	117	48.0%	138	53.1%	0.250
No	127	52.0%	122	46.9%	
Missing	19		4		
Received HPV vaccine[b]					
Yes	151	59.7%	136	52.1%	0.084

No	102	40.3%	125	47.9%	
Missing	10				
Received meningitis vaccine					
Yes	179	68.3%	127	48.5%	<0.001
No	13	5.0%	33	12.6%	
Don't know	70	26.7%	102	38.9%	
Missing	1		2		
Received Tdap vaccine					
Yes	176	67.2%	115	43.9%	<0.001
No	11	4.2%	37	14.1%	
Don't know	75	28.6%	110	42.0%	
Missing	1		2		

^Fisher's Exact Test; Else values are X^2 p-values

[a]Mixed includes participants who indicated two or more races

[b]Reported receiving at least one dose of HPV vaccine

Table 2. HPV vaccine initiation and bivariate and multivariate predictors among students at two universities (N=527).

	Men		
	Received HPV Vaccine	Bivariate Analysis	Multivariate Analysis
	N (%)	PR (95% CI)	aPR (95% CI)
Overall Men (n=163)	69 (42.3)	N/A	N/A
Age			
18 (n=46)	24 (52.2)	Referent	Referent
19 (n=60)	22 (36.7)	0.70 (0.46, 1.08)	0.78 (0.42, 1.43)
20 (n=25)	12 (48.0)	0.92 (0.56, 1.51)	0.97 (0.45, 2.09)
21 and older (n=32)	11 (34.4)	0.66 (0.38, 1.15)	0.70 (0.33, 1.51)
Race			
White/Caucasian (n=110)	49 (44.6)	Referent	Referent
Asian/Asian American (n=28)	11 (39.3)	0.88 (0.53, 1.46)	0.93 (0.45, 1.94)
Black/African American (n=8)	2 (25.0)	0.56 (0.17, 1.90)	0.77 (0.17, 3.41)
Mixed/Other (n=17)	7 (41.2)	0.92 (0.50, 1.69)	0.70 (0.25, 1.96)
Hispanic Ethnicity			
Yes (n=14)	7 (50.0)	1.19 (0.68, 2.07)	1.86 (0.69, 5.07)
No (n=147)	62 (42.2)	Referent	Referent
Family Income			
Less than $74,999 (n=38)	10 (26.3)	0.51 (0.28, 0.94)	0.58 (0.26, 1.33)
$75,000 to $149,999 (n=47)	16 (34.0)	0.67 (0.41, 1.09)	0.80 (0.39, 1.63)
$150,000 to $199,999 (n=27)	19 (70.4)	1.38 (0.95, 2.01)	1.37 (0.70, 2.69)
More than $200,000 (n=45)	23 (51.1)	Referent	Referent
Had sexual intercourse			
Yes (n=103)	46 (44.7)	1.17 (0.78, 1.74)	1.15 (0.67, 1.95)
No (n=55)	21 (38.2)	Referent	Referent
Received the meningitis vaccine			
Yes (n=84)	46 (54.8)	1.57 (1.06, 2.31)	1.15 (0.64, 2.05)
No (n=16)	1 (6.3)	0.18 (0.03, 1.23)	0.20 (0.03,1.54)
Don't know (n=63)	22 (34.9)	Referent	Referent
Received the Tdap vaccine			
Yes (n=85)	44 (51.8)	1.50 (1.01, 2.25)	1.20 (0.66, 2.17)
No (n=17)	4 (23.5)	0.68 (0.27, 1.72)	0.80 (0.26, 2.46)
Don't know (n=61)	21 (34.4)	Referent	Referent
University			
Private (n=88)	44 (50.0)	1.50 (1.02, 2.20)	1.38 (0.75, 2.50)
Public (n=75)	25 (33.3)	Referent	Referent

Table 2 (continued).

	Women		
	Received HPV Vaccine	Bivariate Analysis	Multivariate Analysis
	N (%)	PR (95% CI)	aPR (95% CI)
Overall Women (n=337)	212 (62.9)	N/A	N/A
Age			
18 (n=134)	88 (65.7)	Referent	Referent
19 (n=116)	74 (63.8)	0.97 (0.81, 1.17)	0.97 (0.69, 1.36)
20 (n=58)	35 (60.3)	0.92 (0.72, 1.17)	0.90 (0.59, 1.37)
21 and older (n=25)	12 (48.0)	0.73 (0.48, 1.12)	0.69 (0.37, 1.27)
Race			
White/Caucasian (n=247)	167 (67.6)	Referent	Referent
Asian/Asian American (n=43)	25 (58.1)	0.86 (0.66, 1.12)	0.80 (0.49, 1.29)
Black/African American (n=27)	9 (33.3)	0.49 (0.29, 0.85)	0.64 (0.31, 1.31)
Mixed/Other (n=17)	8 (47.1)	0.70 (0.42, 1.16)	0.66 (0.31, 1.41)
Hispanic Ethnicity			
Yes (n=20)	13 (65.0)	1.03 (0.74, 1.44)	1.08 (0.59, 2.02)
No (n=310)	195 (62.9)	Referent	Referent
Family Income			
Less than $74,999 (n=89)	52 (58.4)	0.81 (0.65, 1.01)	0.93 (0.60, 1.44)
$75,000 to $149,999 (n=96)	52 (54.2)	0.75 (0.60, 0.95)	0.87 (0.58, 1.30)
$150,000 to $199,999 (n=49)	36 (73.5)	1.02 (0.83, 1.27)	1.09 (0.70, 1.70)
More than $200,000 (n=85)	61 (71.8)	Referent	Referent
Had sexual intercourse			
Yes (n=145)	105 (72.4)	1.30 (1.10, 1.52)	1.28 (0.95, 1.71)
No (n=188)	105 (55.9)	Referent	Referent
Received the meningitis vaccine			
Yes (n=208)	147 (70.7)	1.26 (1.04, 1.53)	1.30 (0.91, 1.86)
No (n=28)	7 (25.0)	0.45 (0.23, 0.87)	0.45 (0.18, 1.10)
Don't know (n=98)	55 (56.1)	Referent	Referent
Received the Tdap vaccine			
Yes (n=191)	127 (66.5)	1.11 (0.93, 1.34)	1.07(0.76, 1.51)
No (n=29)	14 (48.3)	0.81 (0.54, 1.21)	1.12 (0.60, 2.06)
Don't know (n=114)	68 (59.7)	Referent	Referent
University			
Private (n=152)	102 (67.1)	1.13 (0.96, 1.33)	1.20 (0.83, 1.75)
Public (n=185)	110 (59.5)	Referent	Referent

Table 3. Primary decision makers for receiving vaccines by HPV vaccine initiation (N=527).

	Received HPV vaccine?	You		Primarily You, Sometimes Parents		Equally You and Your Parents		Mostly Parents		Others[a]		p-value
		No.	%	No.	%	No.	%	No.	%	No.	%	
Making a decision about getting the flu vaccine?	Yes (N=284)	101	35.6%	38	13.4%	66	23.2%	76	26.8%	3	1.1%	0.656^
	No (N=226)	83	36.7%	36	15.9%	45	19.9%	57	25.2%	5	2.2%	
Making a decision about getting vaccines? (other than flu)	Yes (N=284)	54	19.0%	46	16.2%	76	26.8%	102	35.9%	6	2.1%	0.903^
	No (N=226)	51	22.6%	34	15.0%	57	25.2%	79	35.0%	5	2.2%	

[a]Includes: Primarily You, Sometimes Partner/Friend; Mostly Partner/Friend; Others

^Fisher's Exact Test

Table 4. Influential factors in HPV vaccine decision making among students at two universities (N=527).

	Received HPV vaccine?	More Likely		No Change		Less Likely		Don't Know		p-value
		No.	%	No.	%	No.	%	No.	%	
If a doctor encouraged you to?	Yes (N=281)	264	94.0%	6	2.1%	2	0.7%	9	3.2%	<0.001
	No (N=217)	154	71.0%	32	14.7%	13	6.0%	18	8.3%	
If a parent/guardian encouraged you to?	Yes (N=282)	259	91.8%	15	5.3%	6	2.1%	2	0.7%	<0.001^
	No (N=216)	163	75.5%	30	13.9%	14	6.5%	9	4.2%	
If the CDC guidelines recommended you to?	Yes (N=280)	219	78.2%	45	16.1%	13	4.6%	3	1.1%	<0.001
	No (N=217)	130	59.9%	60	27.6%	12	5.5%	15	6.9%	
If your partner/significant other encouraged you to?	Yes (N=280)	215	76.8%	43	15.4%	11	3.9%	11	3.9%	0.056
	No (N=217)	143	65.9%	52	24.0%	12	5.5%	10	4.6%	
If the HPV vaccine was free?	Yes (N=280)	189	67.5%	65	23.2%	15	5.4%	11	3.9%	0.054
	No (N=214)	119	55.6%	67	31.3%	14	6.5%	14	6.5%	
Talking to someone who had a good experience with the vaccine?	Yes (N=280)	187	66.8%	75	26.8%	11	3.9%	7	2.5%	0.003
	No (N=217)	110	50.7%	80	36.9%	15	6.9%	12	5.5%	
If a friend encouraged you to?	Yes (N=281)	186	66.2%	67	23.8%	25	8.9%	3	1.1%	0.014
	No (N=215)	120	55.8%	67	31.2%	18	8.4%	10	4.7%	
If the HPV vaccine was offered on campus?	Yes (N=280)	161	57.5%	88	31.4%	22	7.9%	9	3.2%	0.259
	No (N=214)	105	49.1%	80	37.4%	18	8.4%	11	5.1%	

An HPV awareness program on campus?	Yes (N=281)	156	55.5%	91	32.4%	29	10.3%	5	1.8%	<0.001
	No (N=215)	84	39.1%	101	47.0%	19	8.8%	11	5.1%	
TV/Radio/Print campaigns focused on preventing cancer?	Yes (N=281)	150	53.4%	89	31.7%	38	13.5%	4	1.4%	0.030
	No (N=216)	92	42.6%	82	38.0%	32	14.8%	10	4.6%	
Social media/app campaigns focused on preventing cancer?	Yes (N=277)	135	48.7%	95	34.3%	41	14.8%	6	2.2%	0.116
	No (N=215)	87	40.5%	89	41.4%	29	13.5%	10	4.7%	
TV/Radio/Print campaigns focused on preventing genital warts?	Yes (N=280)	111	39.6%	116	41.4%	47	16.8%	6	2.1%	0.256
	No (N=215)	71	33.0%	101	47.0%	34	15.8%	9	4.2%	
Social media/app campaigns focused on preventing genital warts?	Yes (N=280)	98	35.0%	128	45.7%	49	17.5%	5	1.8%	0.153
	No (N=216)	65	30.1%	109	50.5%	32	14.8%	10	4.6%	
Talking to someone who had a bad side effect from the vaccine?	Yes (N=281)	58	20.6%	67	23.8%	146	52.0%	10	3.6%	0.744
	No (N=217)	45	20.7%	48	22.1%	112	51.6%	12	5.5%	

^Fisher's Exact Test; Else other values are Chi-Square

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Supplementary Table 1. Reasons for not initiating the HPV vaccine series, by intent to receive the HPV vaccine in the next year among students at two universities.

Reason for not getting HPV Vaccine	Don't Plan to Get (N=110)				Plan to Get (N=10)				Undecided (N=100)			
	Male (N=46)		Female (N=60)		Male (N=6)		Female (N=4)		Male (N=40)		Female (N=58)	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
I don’t have sex and don’t need it	15	34.9%	35	58.3%	1	16.7%	2	50.0%	7	17.9%	24	42.1%
My doctor did not talk to me about getting it	18	41.9%	16	26.7%	2	33.3%	0	0.0%	19	48.7%	24	42.1%
I heard it has too many side effects	3	7.0%	23	38.3%	0	0.0%	1	25.0%	2	5.1%	8	14.0%
Other	9	20.9%	11	18.3%	1	16.7%	2	50.0%	15	38.5%	15	26.3%
My parents would not let me get it	1	2.3%	16	26.7%	0	0.0%	0	0.0%	1	2.6%	12	21.1%
My doctor doesn’t think I need the vaccine	7	16.3%	5	8.3%	2	33.3%	0	0.0%	3	7.7%	6	10.5%
I don’t know where to go to get it	6	14.0%	4	6.7%	2	33.3%	1	25.0%	11	28.2%	17	29.8%

Someone I know had a bad side effect	2	4.7%	8	13.3%	0	0.0%	1	25.0%	3	7.7%	2	3.5%
The vaccine is too expensive	2	4.7%	6	10.0%	0	0.0%	0	0.0%	3	7.7%	7	12.3%
I was worried it doesn't work	1	2.3%	4	6.7%	0	0.0%	0	0.0%	1	2.6%	3	5.3%
It goes against my religious beliefs	0	0.0%	5	8.3%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Problems with insurance coverage	2	4.7%	3	5.0%	1	16.7%	0	0.0%	0	0.0%	4	7.0%
I don't have access to a doctor that supplies the vaccine	2	4.7%	1	1.7%	2	33.3%	0	0.0%	3	7.7%	3	5.3%
Outside recommended age range	3	7.0%	0	0.0%	0	0.0%	1	25.0%	1	2.6%	2	3.5%
My doctor does not have the vaccine at his/her practice	1	2.3%	0	0.0%	1	16.7%	0	0.0%	1	2.6%	0	0.0%

Supplementary Table 2. Reasons given by HPV vaccine series initiators for not completing the HPV vaccine series, by intent to complete the series.

Reason for not getting HPV vaccine	Don't plan to get (N=18)		Intend to get (N=22)		Scheduled Apt. (N=13)	
	No.	%	No.	%	No.	%
Too much trouble to schedule appointments	9	50.0%	6	27.3%	15	28.3%
Doctor's office is in another town	8	44.4%	9	40.9%	6	46.2%
Problem’s getting to facility/appointment	5	27.8%	4	18.2%	0	0.0%
Don’t know where to go to get the next shot	4	22.2%	2	9.1%	1	7.7%
Other	4	23.5%	0	0.0%	0	0.0%
I just started the shots recently (within the past 6 months)	3	16.7%	14	63.6%	12	92.3%
The shots are too expensive	3	16.7%	0	0.0%	0	0.0%
I know someone who had a bad side effect from the vaccine	2	11.1%	0	0.0%	0	0.0%
I had a bad side effect from a previous vaccine dose	1	5.6%	0	0.0%	0	0.0%

Problem with insurance coverage	1	5.6%	0	0.0%	0	0.0%
Doctor's office has not called to schedule appointment	0	0.0%	1	4.5%	0	0.0%

Supplementary Table 3. Reasons given by HPV series initiators for not completing the HPV vaccine series.

Reason	N	%
I just started the shots recently (within the past 6 months)	30	53.6
Doctor's office is in another town	25	44.6
Too much trouble to schedule appointments	17	30.4
Problem’s getting to facility/appointment	10	17.9
Don’t know where to go to get the next shot	8	14.3
Other	8	14.5
The shots are too expensive	4	7.1
I know someone who had a bad side effect from the vaccine	2	3.6
I had a bad side effect from a previous vaccine dose	1	1.8
Problem with insurance coverage	1	1.8
Doctor's office has not called to schedule appointment	1	1.8