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HPV catch-up vaccination among a community sample of young adult women

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Abstract

Objectives—Despite the high efficacy of the human papillomavirus (HPV) vaccine, uptake has been slow and little data on psychosocial barriers to vaccination exist.

Methods—A community sample of 428 women enrolled in a longitudinal study of social development in the Seattle WA metropolitan area were interviewed about HPV vaccine status, attitudes, and barriers to HPV vaccination in spring 2008 or 2009 at ~age 22.

Results—Nineteen percent of women had initiated vaccination, 10% had completed the series, and ~40% of unvaccinated women intended to get vaccinated. Peer approval was associated with vaccine initiation (Adjusted Prevalence Ratio (APR) 2.1; 95% Confidence Interval 1.4–3.2) and intention to vaccinate (APR 1.4; 1.1–1.9). Belief the vaccine is < 75% effective was associated with less initiation (APR 0.6; 0.4–0.9) or intention to vaccinate (APR 0.5; 0.4–0.7). Vaccine initiation was also less likely among cigarette smokers and illegal drug users, whereas intention to vaccinate was more common among women currently attending school or with > 5 lifetime sex partners, but less common among women perceiving low susceptibility to HPV (APR 0.6; 0.5–0.9).

Conclusions—HPV vaccination uptake was low in this community sample of young adult women. Increasing awareness of susceptibility to HPV and the high efficacy of the vaccine, along with peer interventions to increase acceptability, may be most effective.

Introduction

Despite declines in mortality over the past 30 years, the death rate for cervical cancer in the U.S. is still 2.42 per 100,000 women [1]. Unlike most cancers, however, cervical cancer can be prevented through vaccination. Human papillomavirus (HPV) types 16 and 18 are responsible for 70% of cervical cancers and 2 HPV vaccines are currently approved by the U. S. Food and Drug Administration (FDA). Cervarix® (GlaxoSmithKline) protects against

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HPV 16/18, as does Gardasil® which provides additional protection against HPV 6/11, the 2 types most commonly associated with genital warts. When administered prior to initial exposure, these vaccines are 99% – 100% effective in preventing persistent infection and high-grade HPV16/18 associated lesions [2, 3]. Both vaccines follow a similar schedule, requiring 3 injections to complete the series (at baseline, 2 months, and 6 months), and in 2007, the U.S. Advisory Committee on Immunization Practices (ACIP) recommended routine vaccination of females 11 – 12 years of age. “Catch-up vaccination” is recommended for females 13 – 26 years old who have not been previously vaccinated or have not yet completed the series [4, 5].

Since FDA approval of the first HPV vaccine in 2006, overall coverage of the target age group remains low. In 2009, HPV vaccination coverage for U.S. adolescents 13 – 17 years of age was 44.3%, ranging from a low of 22.9% for Mississippi teens, to a high of 69% in Massachusetts [6]. Although national-level data on catch-up vaccination among young adult women are limited, coverage in selected populations ranges from 8% among 16 – 18 year olds on Medicare to 44% among college women [7–12]. Such low coverage suggests the need to identify correlates and barriers to vaccination for young females to inform efforts to increase vaccine uptake.

Early research on vaccine acceptability focused on parental and provider attitudes, even before vaccine licensure [13]. More recently, data have emerged on attitudes of young women themselves toward HPV vaccination [14–17]. Actual uptake of the vaccine has primarily been studied among clinic and university populations [8, 9, 11, 12, 18, 19]. The few data available on vaccine completion come almost exclusively from administrative databases or clinic-based populations [20–22], the latter of which likely have different health behaviors than the general population. Even managed-care populations, which can be quite representative in some cases, include only insured individuals who are engaged in the health care system and may have different vaccine uptake patterns. The National Immunization Survey provides the only population-based data available to date on vaccine uptake and completion rates [6], but consists of a random digit dial telephone survey of teens that requires parental consent, limiting somewhat its generalizability. Very little data exist on catch-up vaccination in community samples [8]. Most available studies have focused on characteristics of the medical setting (e.g., type of insurance, type of provider) [7, 8, 11, 18, 21], rather than psychosocial motivators for vaccination.

To further investigate acceptability, initiation, and completion of HPV catch-up vaccination in the general population, we conducted a cross-sectional study among a community sample of young women participating in the Raising Healthy Children (RHC) project, a longitudinal study of social development. We assessed vaccination initiation and completion, barriers and attitudes to vaccination, and characteristics associated with intention to vaccinate. We based our approach on the Health Belief Model which suggests that the uptake of preventive behaviors such as vaccination are motivated by perceived susceptibility to the disease, perceived severity of the disease, perceived benefits of the preventive intervention, and perceived barriers to accessing it [23]. We also considered perceptions of peers (as psychosocial benefits and/or barriers), sociodemographic characteristics (possibly related to access), patterns of substance use (potentially related to risk taking), and sexual behavior and STD history.

Methods

Design and Sample

The RHC project is a longitudinal study of individuals enrolled as students from 10 public schools in a suburban Washington State school district that was in metropolitan area of

Seattle. In 1993 and 1994, families with students in first (younger cohort) and second grade (older cohort) were invited to participate. About 76% of eligible families consented and 1040 (47% female) students were enrolled. At time of recruitment, 52% were in first and 48% were in second grade. Nested within the RHC project is a randomized test of an intervention designed to reduce drug use and other problem behaviors [24, 25], consisting of parenting workshops; case management home visits for high-risk students; instructional staff development for teachers; social, emotional, and cognitive skills training for students; and short booster sessions for families when participants were experiencing developmental transitions in adolescence. Parents provided written consent prior to baseline data collection. After participants turned 18, they provided their own written consent for subsequent data collection.

Surveys were completed annually every spring, with 2 additional fall time points at ages 18 – 20 years. In 2008, members of the older cohort were asked HPV-related questions in face-to-face or web-based interviews, followed by the younger cohort in 2009. In the face-to-face interview, the computer was turned over to the subject for sensitive sexual behavior and drug use questions, making their responses completely confidential. Previous analyses revealed no differences by mode of survey administration [26]. All participants received a \$60 incentive. Study procedures were approved by the University of Washington Institutional Review Board.

Measures

Vaccine initiation was defined as having received at least one dose of the 3-dose series. Vaccine completion was defined as having received all 3 doses. Participants who reported that they had not received any shots were asked: “Are you thinking about getting the HPV vaccine?” (intent to vaccinate).

HPV-related beliefs were assessed using 5-point Likert scales based on the Health Belief Model [23]. Questions addressed personal views of susceptibility to HPV (‘How likely do you think it is that you will get HPV’); severity of HPV (‘If you got HPV, how bad do you think it would be for your health’); benefit of the HPV vaccine (‘How effective do you think the HPV vaccine is in protecting women from getting HPV’); and, for participants who had not initiated vaccination, barriers to starting the vaccine series (‘Why have you not gotten the HPV vaccine?’). Additionally, participants were asked ‘How do most people your age feel about getting the HPV vaccine’ to gauge peer acceptability.

History of HPV-related conditions was defined as a clinical diagnosis of genital warts, cervical cancer, or HPV. Sexual health and behaviors assessed included Pap smear history, sexual activity, lifetime number of sexual partners, marital status, history of sexually transmitted disease (STD), and condom use. History of STD was defined as a clinician diagnosis of chlamydia, gonorrhea, syphilis, genital herpes, HIV/AIDS, or other (trichomoniasis, vaginitis, bacterial vaginosis, pelvic inflammatory disease, cervicitis, nongonococcal urethritis).

A “current daily smoker” was defined as smoking ≥ 1 cigarettes per day in the last 30 days. Binge drinking was defined as ≥ 4 drinks at one time during the past year [27]. Health status was assessed by asking: “How many days during the past 30 days was your physical health not good?”

Analysis

In bivariate analyses, Pearson’s chi-square and Fisher’s exact tests compared characteristics of women who had and had not initiated HPV vaccination, who had and had not completed HPV vaccination, and who intended and did not intend to initiate vaccination. Because these

outcomes were common ($> 10\%$), making the odds ratio an overestimate of relative risk [28], we used Poisson regression with robust standard errors in multivariable analyses to estimate adjusted prevalence ratios (APR) and 95% confidence intervals (CI).

Variables considered in the final multivariable model included sociodemographic characteristics (education, ethnicity, income, religious preference, marital status, school status), sexual behaviors (sex in past 3 months, lifetime number of sexual partners, HPV-related conditions, STD, condom use), substance use (daily smoking, binge drinking, illegal drug use), general health (number of days physically unhealthy), cohort (older=interviewed in 2008 or younger=interviewed in 2009), and all HPV- and vaccine-related attitudinal scales. Characteristics that were statistically significant at $p < 0.05$ were retained. Neither the intervention condition, nor interactions of intervention with the correlates were significantly associated with the outcomes we evaluated; therefore data from participants in both groups were combined in all analyses.

Results

Of the 1040 students enrolled in the project, 492 were female, of whom 434 completed their age 22 survey and 428 (87%) answered HPV-related questions. The 64 women who did not complete the age 22 survey did not differ from those in the original sample with respect to ethnicity/race or low-income status at baseline; however, a higher percentage of the women who did not complete the age 22 survey were in the intervention condition (18.0% versus 7.6%, $p < 0.001$).

Women in these analyses were primarily white (82%), and over two thirds earned $< \$21,000$ annually (Table 1). All were approximately 22 years of age (range 21 – 23). Half of their parents had completed an associate's or bachelor's degree and 41% of these women were currently enrolled in school. Most (72%) were single and had grown up in a protestant or nonreligious household. Women reported overall good physical health, yet 26% were smokers and 71% reported binge drinking in the past year. Illegal drug use other than marijuana was practiced by 10.1%.

Relatively few women (19%) had initiated vaccination and an even smaller proportion (10%) had completed the series (Table 2). Nevertheless, vaccine initiation was higher among women in the younger cohort (23% vs. 13%, $p=0.008$), surveyed just one year later. Of the women who had not yet initiated vaccination, 136 (39%) were considering getting the vaccine, most of whom said they would do so in the next 1 – 6 months. Only half believed the vaccination series should be started before becoming sexually active, but the vast majority felt the vaccine would have no influence over whether they decided to start having sex (87%). While over half had a pelvic exam within the past year, 14% had experienced HPV-related conditions and 12% reported an abnormal Pap smear. Most were sexually active in the past 3 months (79%), and 46% had > 5 lifetime sexual partners. Condom use at first intercourse with the current partner was 65%.

Half of women believed their peers approved of the vaccine, and most (82%) believed HPV would be bad to some degree for their health (Table 3). Despite this, almost 70% of women felt low susceptibility to acquiring HPV (slightly to not at all likely), and only 25% believed the vaccine was highly effective (90% – 100% of the time).

Vaccine initiation

In bivariate analyses, vaccine initiation was more common among women in the younger cohort, those currently attending school and those who used a condom at first intercourse with their current partner ($p < 0.05$ for all; Table 3). In contrast, vaccine initiation was less

common among women who were sexually active in the past 3 months, were daily smokers, or who had used illegal drugs in the past year ($p < 0.05$ for all). Although none of the black or Native American women had initiated vaccination, the numbers were small and these results should be interpreted with caution.

Vaccine initiation was significantly associated with peer approval of the vaccine, perceived susceptibility to acquiring HPV, and beliefs about vaccine effectiveness ($p \leq 0.01$ for all), but not with concerns about severity of HPV infection (Table 3). Nearly 50% of women who had initiated the series reported strong peer approval of the vaccine, compared to only 21% of unvaccinated women. Women who felt very susceptible or only slightly susceptible were more likely to have initiated the vaccine series than women who felt either more or less likely to acquire HPV ($p = 0.02$), yet vaccine initiators were more likely to believe the vaccine was effective. Among women who had not initiated vaccination, the primary reason was not knowing what the vaccine was for (32%); parental approval was not a factor in catch-up vaccine initiation.

Vaccination completion

Among the 77 women who had initiated vaccination, 56% reported completing the series ($n = 43$). Although women in the younger cohort were more likely to have completed vaccination than those in the older cohort, this was not statistically significant (61.5% vs. 45.8%, $p=0.20$). Compared to women who had only initiated the series, those who completed vaccination were somewhat more likely to have education beyond high school (61% vs. 50%), but less likely to have an associate's or bachelor's degree (7% vs. 26%, $p = 0.07$). They were also significantly more likely to report smoking marijuana in the past month (30% vs. 9%, $p = 0.03$), and slightly more likely to have been sexually active in the past 3 months (79% vs. 59%, $p = 0.06$). Being a virgin was not associated with vaccine completion, nor was peer approval or any of the components of the Health Belief Model (perceived susceptibility, severity, barriers, and benefits). Given the small number of women completing vaccination, we did not perform multivariate analyses.

Intent to vaccinate

Among those who had not yet initiated the vaccine series, 39% were considering vaccination (Table 3). Although cohort was not associated with intention to vaccinate, young women who were currently attending school, those who grew up in either a nonreligious or protestant family, or who had a history of HPV-related conditions were more likely to report thinking about getting the vaccine ($p < 0.05$ for all). Higher risk behaviors were also significantly associated with intention to vaccinate (e.g., more lifetime sex partners, binge drinking, marijuana use), as was poorer physical health ($p < 0.05$ for all).

Like vaccine initiation, intention to vaccinate was associated with peer approval, susceptibility to acquiring HPV, and perceived vaccine effectiveness ($p \leq 0.001$ for all), but not perceived severity of HPV infection. The majority of women not considering vaccination did not believe they were susceptible to HPV (55%), and were less likely to believe the vaccine was effective. Barriers associated with not intending to get vaccinated included not knowing what the vaccine was for, cost, and lack of time to get vaccinated ($p < 0.01$ for all).

Multivariable analyses

In multivariable analyses, vaccine initiation was 50 – 70% less common among smokers and illegal drug users, and 40% less common among those who did not believe that the vaccine was highly effective (APR 0.6; 0.40 – 0.96) (Table 4). In contrast, vaccine initiation was approximately twice as common among women who reported a pelvic exam in the past year

(APR 2.3; 1.32 – 4.12), whose peers strongly approved of the vaccine (APR 2.1; 1.42 – 3.18), or who were part of the younger cohort (APR 1.7; 1.15–2.64). Intention to vaccinate was also more common among women whose peers strongly approved of the vaccine, although to a somewhat lesser degree (APR 1.4; 1.11 – 1.87), and was 30 – 40% more common among women currently in school and those who had > 5 lifetime sex partners. In contrast, intention to vaccinate was less common among women with low perceived susceptibility to HPV (APR 0.6; 0.48 – 0.85) or who believed the vaccine was < 75% effective (APR 0.5; 0.39 – 0.71).

Discussion

Catch-up vaccine initiation and completion were low among these 22-year-old women in Washington State. Only 19% had initiated HPV catch-up vaccination, and only half of the initiators had completed the 3-dose series, making overall vaccine completion ~10%. Peer approval of the vaccine was strongly associated with both vaccine initiation and intent to vaccinate, while having a pelvic exam in the past year was only associated with vaccine initiation. Belief that the vaccine was less effective than it truly is was a deterrent to both vaccine initiation and intent to vaccinate. The younger cohort, interviewed just one year later than the older cohort, were more likely to have both initiated and completed vaccination.

Knowledge of the HPV vaccine in this population was relatively poor, highlighted by the fact that the primary barrier against vaccination was ‘not knowing what the vaccine was for’ and the belief by half of women that the vaccine can be given any time, irrespective of sexual debut. The majority also underestimated the efficacy of the vaccine, with only 25% correctly reporting that it was effective 90% – 100% of the time. It is especially concerning that so few women felt susceptible to HPV infection, given that the cumulative incidence of HPV infection is 29% one year after sexual debut and nearly 50% 3 years after sexual debut among young women with their first male sex partner [29]. However, despite concerns that vaccination will encourage early sexual debut [30], when asked directly, these young women did not feel that vaccination would affect their decision to start having sex.

Our estimate of 19% catch-up vaccination initiation was higher than the 10% among women 18 – 49 years in the 2007 National Immunization Survey-Adult [31] and the 9% in a representative cross-section of 18 to 26-year-old U.S. women [8]. While some of the differences between these studies and our own may be due to differences in age range, the higher proportion we observed may also reflect the nearly 2-year gap between data collection in these studies and our own, providing more time to accrue initiators. This is supported by the higher vaccine initiation we observed in the younger cohort of women who had an additional year to be vaccinated. Nevertheless, 19% is still quite low and may be partly due to a belief that women past their sexual debut will not benefit from vaccination. Nearly 50% recognized that the vaccine should be administered prior to sexual debut and only a very small proportion of these women had not initiated sexual activity. Young adult women may also be less likely to adopt vaccination for reasons related to their stage of life. Their parents no longer direct their health care, many lack health insurance, and many are highly mobile, all of which may reduce access to and frequency of routine health care visits that would otherwise provide an opportunity for vaccination.

Vaccine initiation was strongly influenced by perceived peer approval and perceived effectiveness of the vaccine. It was also strongly associated with interaction with the health care system and reproductive health care (e.g., history of a pelvic exam). However, among these women, as well as among university women [12], risk perception was not significantly associated with uptake of the vaccine and most failed to recognize the risk of acquiring HPV. In clinical settings, vaccine initiation has been associated with history of an abnormal

Pap smear [9], discussing the vaccine with family or a health care provider [8], age, and type of insurance, visit, or provider [21]. We observed no association with abnormal Pap smears or age (although this age range was narrow) and we did not measure characteristics of a health care visit. Racial disparities in HPV vaccine uptake have been observed in other settings [10, 12], but we were unable to adequately evaluate this.

Vaccine completion has been measured less often and mostly in clinical settings among women who received an initial dose. In university clinical practices and managed health care organizations, vaccine completion ranged from 47% – 58% [20, 22], similar to the 56% completion in our community sample. In contrast, 75% of vaccine initiators in a Michigan university-based health system completed the series [21]; however, this group included younger women (ages 9 – 18), some of whom were eligible for regular rather than catch-up vaccination. Although previous studies observed a relationship between ethnicity and vaccine completion [20–22], we were unable to evaluate this. Type of insurance has been a strong predictor of vaccine completion in clinic-based studies [20–22], but we did not measure this. The association of vaccine completion with marijuana use and being sexually active suggests higher risk individuals have greater desire to complete the vaccination series. Although neighborhood levels of education were associated with vaccine completion among women in a managed care organization [20], we found no association between education levels and vaccine completion in multivariate analyses, despite the borderline association in bivariate results.

Almost 40% of unvaccinated women were considering getting the vaccine and social norms and/or peer approval have been consistently associated with intention to adopt catch-up vaccination. This was true in these women, as well as in primary care clinic attendees [17] and university women [14]. However, we found no association between perceived severity of HPV and intention to vaccinate, whereas this was linked in young women attending primary care clinics [17]. Similar to vaccine initiation, the belief that the vaccine was less effective than it actually is was associated with not intending to get vaccinated. Given that women make vaccine-related decisions based on perceived degree of protection conferred [32], greater publicity about the high vaccine efficacy may be a worthwhile investment, as would greater dissemination of information about the relatively high risk of HPV acquisition. The association between intention to vaccinate and more lifetime sex partners may be a marker of subconscious perceived risk.

This study is characterized by a number of strengths and limitations. Not all women seek health care and these community-based data provide an additional perspective to the largely clinic-based data available on HPV catch-up vaccination. This population was socioeconomically diverse and included a balance of college and non-college youth. Nevertheless, women were all approximately the same age, were drawn from one suburban school district, participated in a longitudinal study that included an evaluation of a preventive intervention, and more women in the control group were captured than in the intervention group at this time point, all of which may limit the generalizability of our findings. We assessed vaccination status and history of STD by self-report and these data may be subject to some social desirability bias, potentially resulting in under-reporting of both of these factors. However, these women have been answering survey questions annually since first and second grade, which may have reduced some of the social desirability bias. This was a predominantly white population; thus we were not able to carefully explore racial disparities. Additionally, we did not measure several key factors for HPV vaccine uptake (insurance coverage, discussion of vaccination with significant individuals), or where vaccinated women had received the vaccine and thus were unable to evaluate them. Finally, the cross-sectional study design precludes conclusions about causality.

The HPV vaccine has great potential to prevent cervical and other anogenital cancers. However, current vaccine coverage estimates are substantially below those required to see population-level effects on HPV-related morbidity and mortality [33], and much remains to be done to increase HPV vaccine uptake and completion. Focusing efforts on increasing knowledge about the widespread nature of HPV infection and the high levels of vaccine efficacy, along with peer interventions, may be most effective.

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Table 1

Sociodemographic and behavioral characteristics of 428 young women who participated in the Raising Healthy Children (RHC) young adult survey during 2008 and 2009.

	N (%)
Year of survey	
2008	192 (49.9)
2009	236 (55.1)
Ethnic group	
Asian	29 (6.8)
Black	17 (4.0)
Hispanic	18 (4.2)
Native American	12 (2.8)
White	352 (82.2)
Income	
Less than \$10,999/year	210 (53.4)
\$11,000 – 20,999/year	96 (24.4)
\$21,000 – 30,999/year	57 (14.5)
More than \$31,000/year	30 (7.6)
Highest level of schooling completed	
High school or less	152 (35.5)
Some college/trade/business school	217 (50.7)
Bachelor's or associate's degree	59 (13.8)
Currently attending school	175 (40.9)
Parents' education level	
High school or less	45 (11.6)
Some college/trade/business school	142 (36.7)
Bachelor's or associate's degree	141 (36.4)
Graduate or professional degree	59 (15.3)
Marital Status	
Single	307 (71.7)
Married/engaged	115 (26.9)
Divorced/separated	6 (1.4)
Family's religious preference growing up*	
No religion	150 (35.6)
Roman Catholic	60 (14.2)
Protestant	171 (40.5)
Other	41 (9.7)
Number days physically unhealthy	
0 days	232 (54.6)
1–4 days	95 (21.7)
5 or more days	101 (23.8)
Daily smoker (past month)†	112 (26.2)

	N (%)
Used any illegal drugs excluding marijuana (past year)	43 (10.1)
Marijuana use (past month)	92 (21.6)
Binge drinking (past year) [‡]	304 (71.0)

* 'Other' includes: Orthodox, Non-Chalcedonian Orthodox, Jewish, Islamic/Muslim, Hindu, Buddhist, Taoist, Shinto, Wiccan (or other ritual magic), Mormon, and self described 'other' religion.

[†] Current daily smoker is defined as smoking ≥ 1 cigarette a day during the past month.

[‡] Binge drinking defined as consuming 4 or more drinks at one time during the past year.

Table 2

Human papillomavirus (HPV) vaccine-related questions asked of 428 young women who participated in the Raising Healthy Children (RHC) young adult survey during 2008 and 2009.

	N (%)
Vaccination	
Received the HPV vaccine	82 (18.9)
Number of shots received*	
1	20/77 (26.0)
2	14/77 (18.2)
3	43/77 (55.8)
Considering getting the HPV vaccine [†]	136 (39.2)
When might get the HPV vaccine [‡]	
In the next month	21/135 (15.6)
In the next 6 months	64/135 (47.4)
In the next year	42/135 (31.1)
> 1 year from now	8/135 (5.9)
When a person should get vaccinated	
Any time	194 (47.2)
Before start having sexual intercourse	204 (49.6)
After start having sexual intercourse	13 (3.2)
Influence of vaccination on starting to have sex [§]	
More likely to start having sex	1/33 (3.3)
Less likely to start having sex	3/33 (10.0)
Would not affect my decision about starting to have sex	26/33 (86.7)
Sexual Health	
History of any HPV related conditions	56 (13.8)
When was last pelvic exam	
Within past year	275 (64.6)
> 1 year ago	81 (19.0)
Never	70 (16.4)
Pap smear at last pelvic exam	315 (88.5)
Abnormal pap smear at last pelvic exam	38/315 (12.1)
Had sex past 3 months	336 (79.4)
Condom use first intercourse with current partner	217 (65.0)
Lifetime number of sexual partners	
0	32 (7.7)
1	69 (16.6)
2 – 5	125 (30.1)
> 5	189 (45.5)

* Although 82 women reported having received the vaccine, 4 of the women reported 0 shots and 1 refused to report number of shots. Therefore, 77 women provided data on the number of shots they had received.

[†] Only asked of participants who answered 'No' to 'Have you had the HPV vaccine' (n = 347)

[‡] Only asked of participants who answered 'Yes' to 'Are you thinking about getting the HPV vaccine' (n = 135); one participant did not respond.

[§] Only asked of young women who were not sexually active yet (i.e., had 0 lifetime sexual partners) (n = 33)

^{||} Includes: cervical cancer, genital warts, and HPV.

Sociodemographic characteristics, attitudes and beliefs associated with HPV vaccine initiation and intention to vaccinate among 428 young women who participated in the Raising Healthy Children (RHC) young adult survey during 2008 and 2009.

Table 3

Characteristics	Vaccine Initiation				Intention to Vaccinate (N = 349) *			
	Total N = 428 N (%)	≥1 dose N = 77 N (%)	Not vaccinated N = 351 N (%)	p-value [†]	Yes N = 136 N (%)	No N = 213 N (%)	p-value [‡]	
Year of survey				0.008			0.95	
2008	192 (44.9)	24 (12.5)	168 (87.5)		71 (28.8)	112 (61.2)		
2009	236 (55.1)	53 (22.5)	183 (77.5)		65 (39.2)	101 (60.8)		
Currently attending school	175 (40.9)	41 (53.2)	134 (38.2)	.01	61 (44.9)	73 (34.3)	.04	
Education				.37			.56	
High school or less	152 (35.5)	22 (28.6)	130 (37.0)		48 (35.3)	81 (38.0)		
Some college/trade/business	217 (50.7)	43 (55.8)	174 (49.6)		72 (52.9)	101 (47.4)		
Bachelor's or associate's degree	59 (13.8)	12 (15.6)	47 (13.4)		16 (11.8)	31 (14.6)		
Ethnic group				.08			.36	
Asian	29 (6.8)	7 (9.1)	22 (6.3)		7 (5.1)	14 (6.6)		
Black	17 (4.0)	0 (0.0)	17 (4.8)		5 (3.7)	11 (5.2)		
Hispanic	18 (4.2)	2 (2.6)	16 (4.6)		3 (2.2)	13 (6.1)		
Native American	12 (2.8)	0 (0.0)	12 (3.4)		6 (4.4)	6 (2.8)		
White	352 (82.2)	68 (88.3)	284 (80.9)		115 (84.6)	169 (79.3)		
Income				.96			.75	
Less than \$21,000/year	306 (77.9)	57 (78.1)	249 (77.8)		94 (77.0)	154 (78.6)		
More than \$21,000/year	87 (22.1)	16 (21.9)	71 (22.2)		28 (23.0)	42 (21.4)		
Family's religious preference growing up				.32			.03	
No religion	150 (35.5)	22 (28.9)	128 (37.0)		55 (40.7)	71 (34.1)		
Roman Catholic	60 (14.2)	14 (18.4)	46 (13.3)		17 (12.6)	29 (13.9)		
Protestant	171 (40.5)	30 (39.5)	141 (40.8)		58 (43.0)	82 (39.4)		
Other [§]	41 (9.7)	10 (13.2)	31 (9.0)		5 (3.7)	26 (12.5)		
Marital Status				.11			.09	
Single/divorced/separated	313 (73.1)	62 (80.5)	251 (71.5)		104 (76.5)	145 (68.1)		
Married/engaged	115 (26.9)	15 (19.5)	100 (28.5)		32 (23.5)	68 (31.9)		

Characteristics	Vaccine Initiation				Intention to Vaccinate (N = 349) *		
	Total N = 428 N (%)	≥1 dose N = 77 N (%)	Not vaccinated N = 351 N (%)	p-value [†]	Yes N = 136 N (%)	No N = 213 N (%)	p-value [‡]
Had sex past 3 months	336 (79.4)	53 (70.7)	283 (81.3)	.03	108 (80.6)	173 (81.6)	.81
Number of lifetime sexual partners				.92			.006
0	32 (7.7)	5 (6.7)	27 (7.9)		6 (4.7)	21 (10.0)	
1–5	194 (46.7)	36 (48.0)	158 (46.5)		51 (39.8)	108 (51.4)	
> 5	189 (45.5)	34 (45.3)	155 (45.6)		71 (55.5)	81 (38.6)	
History of HPV related conditions [§]	56 (13.8)	13 (18.6)	43 (12.8)	.20	24 (18.3)	18 (8.9)	.01
Condom 1 st intercourse (current partner)	217 (65.0)	46 (76.7)	171 (62.4)	.03	69 (63.9)	102 (62.2)	.78
Current daily smoker	112 (26.2)	12 (15.6)	100 (28.5)	.02	43 (31.6)	56 (26.3)	.28
Binge drinker [¶]	304 (71.0)	59 (76.6)	245 (69.8)	.23	108 (79.4)	134 (62.9)	.001
Used illegal drugs ≥ once past yr ^{**}	43 (10.0)	2 (2.6)	41 (11.7)	.01 ^{††}	16 (11.8)	25 (11.7)	.99
Ever smoked marijuana (past month)	92 (21.5)	16 (20.8)	76 (21.7)	.85	40 (29.6)	35 (16.4)	.004
Number of days physically unhealthy				.61			.02
0 days	232 (54.6)	45 (58.4)	187 (53.7)		62 (46.3)	125 (59.0)	
1–4 days	92 (21.6)	17 (22.1)	75 (21.6)		30 (22.4)	46 (21.7)	
5 or more days	101 (23.8)	15 (19.5)	86 (24.7)		42 (31.3)	41 (19.3)	
Attitudes and beliefs							
Peer approval of HPV vaccine				< .001			< .001
Strongly approve	106 (26.0)	37 (48.7)	69 (20.8)		42 (31.8)	26 (13.3)	
Moderately approve	99 (24.3)	20 (26.3)	79 (23.9)		34 (25.8)	44 (22.6)	
Neither approve nor disapprove	183 (45.0)	17 (22.4)	166 (50.2)		51 (38.6)	113 (57.9)	
Moderately disapprove	8 (2.0)	2 (2.6)	6 (1.8)		2 (1.5)	4 (2.1)	
Strongly disapprove	11 (2.7)	0 (0.0)	11 (3.3)		3 (2.3)	8 (4.1)	
Susceptibility to acquiring HPV				.02			< .001
Very likely	42 (10.2)	9 (11.8)	33 (9.9)		21 (15.7)	11 (5.6)	
Moderately likely	27 (6.6)	2 (2.6)	25 (7.5)		10 (7.5)	15 (7.6)	
Somewhat likely	58 (14.1)	5 (6.6)	53 (15.8)		32 (23.9)	20 (10.1)	
Slightly likely	106 (25.8)	29 (38.2)	77 (23.0)		32 (23.9)	44 (22.2)	
Not at all likely	178 (43.3)	31 (40.8)	147 (43.9)		39 (29.1)	108 (54.5)	

Characteristics	Vaccine Initiation			Intention to Vaccinate (N = 349)*		
	Total N = 428 N (%)	≥1 dose N = 77 N (%)	Not vaccinated N = 351 N (%)	p-value [†]	Yes N = 136 N (%)	No N = 213 N (%)
Severity of HPV for health				.25		
Very bad	134 (32.6)	25 (32.9)	108 (32.2)		48 (35.8)	59 (29.9)
Moderately bad	108 (26.1)	26 (34.3)	81 (24.2)		31 (23.1)	48 (24.4)
Somewhat bad	96 (23.2)	14 (18.4)	82 (24.5)		34 (25.4)	47 (23.9)
Slightly bad	42 (10.1)	8 (10.5)	34 (10.1)		14 (10.4)	20 (10.2)
Would have no bad effect	33 (8.0)	3 (3.9)	30 (9.0)		7 (5.2)	23 (11.7)
Effectiveness of HPV vaccine				.007		
Not very effective	26 (6.4)	3 (3.9)	23 (7.0)		2 (1.5)	21 (10.9)
Somewhat effective	96 (23.6)	11 (14.3)	85 (25.8)		27 (20.5)	55 (28.5)
Effective about ½ of the time	67 (16.5)	9 (11.7)	58 (17.6)		15 (11.4)	43 (22.3)
Effective about ¾ of the time	114 (28.1)	23 (29.9)	91 (27.7)		46 (34.8)	44 (22.8)
Extremely effective (90–100%)	103 (25.4)	31 (40.3)	72 (21.9)		42 (31.8)	30 (15.5)

* 2 individuals did not provide data on intention to vaccinate.

[†] p-value is for Pearson's chi square test, unless otherwise specified.

[‡] 'Other' includes: Orthodox, Non-Chalcedonian Orthodox, Jewish, Islamic/Muslim, Hindu, Buddhist, Taoist, Shinto, Wiccan (or other ritual magic), Mormon, and self described 'other' religion.

[§] Includes: cervical cancer, genital warts, and HPV.

^{||} Current daily smoker defined as smoking ≥ 1 cigarette a day during the past month.

[¶] 'Binge drinking' defined as consuming 4 or more drinks at one time during the past year.

** Excluding marijuana.

^{††} Fisher's Exact test.

Table 4

Multivariable analyses of characteristics independently associated with vaccine initiation and intention to vaccinate among 428 young women who participated in the Raising Healthy Children (RHC) young adult survey during 2008 and 2009.

	Vaccine Initiation		Intention to Vaccinate	
	APR (95% CI)*	p-value	APR (95% CI)*	p-value
Daily smoker	0.5 (0.29–0.87)	0.01	-	-
Illegal drug use [†]	0.3 (0.07–1.00.)	0.05	-	-
Surveyed in 2009	1.7 (1.15–2.64)	0.008	-	-
Pelvic exam in the past year	2.3 (1.32–4.12)	0.003	-	-
Belief vaccine is < 75% effective	0.6 (0.40–0.96)	0.03	0.5 (0.39–0.71)	< 0.001
Peers strongly approve of vaccine	2.1 (1.42–3.18)	< 0.001	1.4 (1.11–1.87)	0.006
Currently attending school	-	-	1.3 (1.01–1.70)	0.04
Greater than 5 sex partners	-	-	1.4 (1.08–1.82)	0.01
Low perceived susceptibility to HPV	-	-	0.6 (0.48–0.85)	0.002

* APR (95% CI) = adjusted prevalence ratio and 95% confidence interval from Poisson regression with robust standard errors; adjusted for all characteristics listed in table. Further adjustment for the following characteristics made no appreciable difference in the estimates and were not included: race, education (self or parent), marital status, income, sexually active in the past 3 months, lifetime number of sex partners, condom use, history of HPV-related conditions, history of STD, religious preferences, physical health, mental health, binge drinking, and severity of or susceptibility to HPV infection.

[†] Excluding marijuana use.