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HPV vaccination among lesbian and bisexual women: Findings from a national survey of young adults

Annie-Laurie McRee, DrPH^{a,b}, Mira L. Katz, PhD^{a,b,c}, Electra D. Paskett, PhD^{a,b,c}, and Paul L. Reiter, PhD^{a,b,c}

^aCollege of Public Health, The Ohio State University, 1841 Neil Ave, Columbus, OH 43210, USA

^bComprehensive Cancer Center, The Ohio State University, Columbus, OH 43210, USA

^cDivision of Cancer Prevention and Control, College of Medicine, The Ohio State University, Columbus, OH 43210, USA

Abstract

Background—Human papillomavirus (HPV) infection and associated cervical disease are common among all women, regardless of sexual identity, yet limited research has examined HPV vaccination among lesbian and bisexual women.

Methods—A national sample of lesbian and bisexual women ages 18–26 ($n=543$) completed our online survey during Fall 2013. We used multivariable logistic regression to identify correlates of HPV vaccine initiation (receipt of at least 1 dose) and completion (receipt of all 3 recommended doses among initiators).

Results—Overall, 45% of respondents had initiated HPV vaccine, and 70% of initiators reported completing the series. HPV vaccine initiation was higher among respondents who: were students, had received a healthcare provider's recommendation, perceived greater positive social vaccination norms, or anticipated greater regret if they did not get vaccinated and later got HPV. Initiation was lower among those who perceived greater HPV vaccine harms or greater barriers to getting the vaccine (all $p<.05$). HPV vaccine completion was higher among initiators who had a college degree while it was lower among those who perceived a greater likelihood of acquiring HPV or who anticipated greater regret if they got the vaccine and fainted (all $p<.05$). Among HPV vaccine initiators who had not yet completed the series, about half (47%) intended to get the remaining doses.

Conclusions—Many lesbian and bisexual women are not getting vaccinated against HPV. Healthcare provider recommendations and women's health beliefs may be important leverage points for increasing vaccination among this population.

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Correspondence to: Annie-Laurie McRee, Division of Health Behavior and Health Promotion; College of Public Health, The Ohio State University, 354 Cunz Hall, 1841 Neil Ave, Columbus, OH 43210, USA; almcrec@cph.osu.edu; Phone: (614)292-4216.

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Keywords

human papillomavirus; vaccination; HPV vaccine; young adults; lesbian and bisexual women

1. Introduction

Human papillomavirus (HPV) infection is widespread among women in the United States (US) and is most prevalent among young adults, with an estimated 50% or more of females ages 20-24 infected [1]. Vaccines are available that confer protection against types of HPV that cause up to 90% of genital warts and most cases of cervical and anal cancer as well as many cases of vaginal, vulvar, and other cancers [2-4]. HPV vaccine is currently administered in 3 doses over the course of 6 months. Advisory Committee on Immunization Practices' (ACIP) guidelines recommend routine administration of HPV vaccine to adolescents ages 11-12 with “catch-up” vaccination to age 26 [5, 6]. Despite recommendations, vaccination among females in the US is suboptimal with an estimated 53% of 13-17 year olds having received at least 1 dose (i.e., vaccine initiation) and only 33% having completed the 3-dose HPV vaccine series as of 2012 [7]. Coverage is even lower among young adults 18-26 years old with estimates of HPV vaccine initiation among young adult women ranging from just 23% to 45% [8, 9].

Lesbian and bisexual women are an often overlooked group at risk for HPV infection, even though the virus can be transmitted between female sex partners [10] and many lesbians may have past male partners from whom they could have acquired HPV [11, 12]. Up to 30% of sexual minority (i.e., lesbian and bisexual) women have current genital HPV infections [10, 13] and about 12% report a history of genital warts [14]. Furthermore, about 25% of lesbian and bisexual women report a history of cervical abnormalities [15], many of which are caused by HPV infection. Despite a similar prevalence of HPV infection among sexual minority and heterosexual women, previous research suggests that they may view their risk of HPV as low and may perceive themselves as less likely to acquire an HPV infection compared to all women [15, 16]. Sexual minority women may also be less likely to receive recommended cervical cancer screening [17], making HPV vaccine an important strategy for preventing HPV-related disease among lesbian and bisexual women.

Improving the health of lesbian, gay, bisexual and transgender (LGBT) individuals is a public health priority [18, 19], yet limited research has examined HPV vaccination among these populations [20, 21]. To our knowledge, only one study provides an estimate of HPV vaccine uptake among sexual minority women. Using data from 2010, Bernat et al. [8] found that 45% of lesbian and bisexual women ages 18-24 had received at least 1 dose of HPV vaccine, compared to 51% of heterosexual women. The purpose of the present study was to examine HPV vaccination among young adult lesbian and bisexual women. By identifying correlates of vaccine initiation and series completion, this study addresses a gap in the literature and aims to inform the development of targeted strategies to increase HPV vaccine uptake.

2. Methods

2.1 Study design

We surveyed a national sample of young adults (ages 18-26 years) who self-identified as LGBT [20]. Participants were members of an LGBT specialty subset of the Harris Interactive Online Panel, a voluntary research panel constructed through online and offline recruitment strategies [22]. Panel members complete multiple online surveys each month in exchange for points that can later be redeemed for rewards. The Institutional Review Board at The Ohio State University approved the study.

In October and November 2013, 1,005 of 2,014 (50%) panel members who were confirmed eligible to participate provided informed consent and took our cross-sectional, online survey. In the present study, we report data from female respondents who self-identified as lesbian or bisexual ($n=543$). We do not report data from males ($n=428$) or transgender individuals ($n=34$) since it is possible that factors related to HPV vaccination differ greatly between these populations. Most women in this study identified as bisexual (74%), were between 22-26 years of age (67%), non-Hispanic white (68%), and reported an income of less than \$50,000 (65%; Table 1).

2.2 Measures

We developed survey items based on the literature [21, 23-25]. Statements throughout the survey provided all respondents with information about HPV and HPV vaccine [25]. The survey took about 17 minutes to complete.

HPV vaccination—We examined 2 primary outcomes: (a) HPV vaccine initiation (i.e., receipt of at least 1 dose of HPV vaccine) and (b) HPV vaccine series completion (i.e., receipt of all 3 doses among initiators). The survey assessed HPV vaccine initiation with a single survey item asking if respondents had ever received any dose of HPV vaccine. For respondents who had initiated the vaccine series, subsequent items assessed their main reasons for initiating HPV vaccine and the number of doses they had received. We classified respondents who had received all 3 doses as having completed the vaccine series. Although the World Health Organization recently recommended a change to a 2-dose HPV vaccine series for girls ages 15 and younger [26], our definition of completion is aligned with current US recommendations for all age-eligible females. For respondents who had initiated, but had not yet completed the series, survey questions assessed whether they intended on getting the remaining shots (yes/no/don't know); among those who indicated that they did not know or did not intend to complete the vaccine series, the survey also assessed main reasons for potentially not doing so.

For unvaccinated respondents, survey items assessed willingness to get the vaccine under two conditions: (a) if it were free, and (b) if it cost \$400 out-of-pocket (1=“definitely not willing” to 5=“definitely willing”). At the time of the survey, the 3-dose series cost about \$400 without health insurance coverage of the vaccine [27]. Unvaccinated respondents also indicated the main reasons why they had not yet gotten any HPV vaccine shots.

Knowledge, attitudes and beliefs—Survey questions assessed a wide range of knowledge, attitudes and beliefs about HPV and HPV vaccine as potential correlates of HPV vaccination. We classified respondents as having either low or high knowledge of HPV based on the number of correct responses to 6 true/false statements (3 or fewer =low knowledge, 4 or more =high knowledge). We used items from a previously validated scale [25] to assess respondents' perceptions of HPV vaccine effectiveness (3 items, $\alpha=0.81$) potential HPV vaccine harms (4 items, $\alpha=0.68$), and barriers to getting HPV vaccine (2 items, $\alpha=0.72$). Survey items also examined: perceived positive social/community norms (i.e., if other people in the LGBT community are getting HPV vaccine); worry about getting HPV-related disease; perceived severity of HPV-related disease; and perceived likelihood of getting HPV-related disease (4 items, $\alpha=0.81$). Questions asked whether respondents perceived a lower risk of cervical cancer compared to heterosexual women, and assessed their anticipated regret (a) if they received HPV vaccine and fainted and (b) if they did not get vaccinated and later developed an HPV infection that could lead to health problems. Continuous variables were coded so that higher values indicate greater levels of that construct.

Demographics and healthcare-related characteristics—The survey collected information on a range of demographic, sexual behavior, and health-related characteristics including: health insurance, receiving a routine check-up in past year, and receiving a provider's HPV vaccine recommendation. Survey items assessed age at sexual debut and number of lifetime sexual partners, as sexual behavior has been found to be associated with both objective and perceived risk of HPV infection [28, 29]. Questions also asked whether respondents had disclosed their sexual orientation to their healthcare provider, or if they thought they had ever been discriminated against by a provider because of their sexual orientation [30] as these constructs may be related to healthcare access and quality [18].

2.3. Data analysis

We conducted parallel analyses examining: (a) HPV vaccine initiation, and (b) HPV vaccine series completion among initiators. For each outcome, we first used logistic regression to identify bivariate correlates and then constructed multivariable logistic regression models that included all variables associated ($p<.05$) in bivariate analyses. Among unvaccinated respondents, we used a paired *t*-test to compare vaccination willingness if HPV vaccine were free and if it cost \$400 out of pocket. We conducted analyses in Stata IC version 13 (Statacorp, College Station, TX) using two-tailed tests and a critical alpha of 0.05.

3. Results

3.1 HPV vaccine initiation

Overall, 45% (247/543) of respondents had received at least 1 dose of HPV vaccine. The most common main reasons for vaccination were because a doctor said to get vaccinated (43%), because a parent said to get vaccinated (26%), and to protect against cancer (24%).

In multivariable analyses (Table 2), respondents were more likely to have initiated the HPV vaccine series if they were students (OR=2.25, 95% CI: 1.16-4.37) or had received a

healthcare provider's recommendation for vaccination (OR=6.50, 95% CI: 3.78-11.19). Several HPV attitudes and beliefs were also correlates of HPV vaccine initiation (Table 3). Respondents were less likely to report initiation if they perceived greater HPV vaccine harms (OR=0.59, 95% CI: 0.39-0.90) or greater barriers to getting the vaccine (OR=0.24, 95% CI: 0.17-0.34). Conversely, respondents were more likely to have initiated the vaccine series if they perceived positive LGBT community vaccination norms (OR=1.72, 95% CI: 1.19-2.48) or anticipated greater levels of regret if they did not get HPV vaccine but later got an HPV infection (OR=1.69, 95% CI: 1.14-2.50).

3.2 HPV vaccine series completion

One-third of all respondents (32%, 172/543) had received all 3 doses of HPV vaccine, meaning 70% (172/247) of initiators had completed the vaccine series. In multivariable analyses conducted among respondents who had initiated the HPV vaccine series, completion was more common among those who had a college degree (OR=2.43, 95% CI: 1.04-5.69; Table 4). Completion was lower among initiators who perceived a greater likelihood of getting HPV-related disease (OR=0.46, 95% CI: 0.22-0.96) or anticipated greater regret if they got the vaccine and fainted (OR=0.64, 95% CI: 0.43-0.96).

Among respondents who had initiated, but not yet completed, the HPV vaccine series, almost half (47%) indicated that they intended to get the remaining doses. Almost one-third (31%) reported that they did not plan to complete the series and many (22%) did not know. The majority of respondents who did not plan or who were not sure if they would receive the remaining doses endorsed the response they had waited too long since their last HPV vaccine shot (78%) as the main reason they might not complete the vaccine series.

3.3 Reasons for not vaccinating and willingness to get vaccinated

Among unvaccinated respondents ($n=296$), the most common main reasons for not getting vaccinated were: having only 1 sexual partner who does not have HPV (21%); not being sexually active (12%); not having been to a doctor recently (10%); concern that the vaccine might not be safe (9%); and not receiving a healthcare provider recommendation for the vaccine (9%). Fewer respondents endorsed cost (5%), already having HPV (5%), or only having sex with women (3%) as their main reason for not vaccinating.

About two-thirds of unvaccinated respondents (64%) indicated that they were definitely or probably willing to get HPV vaccine if the vaccine were free (mean=3.70, SD=1.27). However, respondents were much less willing if the vaccine cost \$400 out-of-pocket, with just 3% indicating that they were definitely or probably willing to get vaccinated (mean=1.49, SD=0.82; paired $t=30.81$, $p<.001$).

4. Discussion

4.1 Findings

In this national sample of young adult sexual minority women in the US, we found that fewer than half of women had received at least 1 dose of HPV vaccine and more than a quarter of women who initiated vaccination had not yet received all 3 recommended doses.

A study using data from 2010 [8] reported the same vaccine initiation prevalence among lesbian and bisexual young adult women as we found in this more recent sample. The lower age range (ages 18-24) and higher educational attainment of respondents in the previous study may explain this pattern of findings, as both age and education have been shown to be associated with vaccine uptake among young adults [8, 31]. Interestingly, vaccine initiation in our study was lower than that reported among adolescent females ages 13-17 years in 2012 (45% vs. 54%), but the level of completion among initiators was similar (70% vs. 67%) [7].

To our knowledge, this is the first study to examine correlates of HPV vaccination among young adult lesbian and bisexual women. Consistent with research in other populations, including young adult sexual minority men [20, 24, 32, 33], receiving a healthcare provider's recommendation was the strongest correlate of HPV vaccine initiation among women in our study. However, young adults may have fewer opportunities to receive a provider's recommendation due to lower healthcare use than other age groups [34]. As family planning services are a key driver for accessing care among young adult women [35], lesbian and bisexual young adults may use healthcare at even lower levels [36, 37]. Given this lower healthcare utilization, it becomes especially important for providers to use each clinical encounter to assess vaccination status and recommend HPV vaccine, as indicated.

HPV vaccine initiation was lower among women who perceived greater barriers to vaccination, similar to previous research [20, 32]. Cost may be a particularly salient barrier for young adults who historically have lower incomes and lower levels of insurance coverage than other groups [38]. Increased insurance coverage due to the Affordable Care Act (ACA) may increase routine healthcare and, thus, opportunities for vaccination in this population. However, increasing access alone may not be sufficient to substantially change vaccination coverage. Indeed, 80% of the unvaccinated women in our study who had a recent routine healthcare visit reported never receiving a providers' recommendation for HPV vaccine. Two factors in particular may contribute to high missed opportunities during clinical visits among this population. First, previous research suggests that pediatricians are more likely to recommend HPV vaccine than other types of providers who may see a greater proportion of adult patients [39]. Second, sexual minority women and their healthcare providers may make assumptions that women who have sex with women have a lower risk of sexually-transmitted infections [13, 15] which could affect HPV vaccine recommendations.

Our study identifies a number of health beliefs that may be modifiable targets for future interventions for sexual minority women. For example, normalizing HPV vaccination among young adults and sexual minority populations, and reducing concerns about the potential harms of HPV vaccination may help increase vaccine uptake among lesbian and bisexual women, similar to findings from other research with adolescents and young adults, including gay and bisexual men [20, 40-42]. Women's reasons for not yet getting vaccinated point to information gaps that can also be addressed in future interventions. The most commonly endorsed reasons were related to potential misconceptions about low perceived risk, thus it may be important to educate lesbian and bisexual young adults about HPV infection and transmission. Sexual minority women may specifically need to know that HPV

can be transmitted between female partners [10] and that sexual partners could be infected with HPV but not show symptoms. As the majority of young adults over 18 years of age have already initiated sexual activity [12], education for this age group should include the potential benefits of HPV vaccination for those who have already had sex while still emphasizing that the vaccine is most effective before sexual debut [6].

Although health behavior theory [43] posits that vaccination should be higher among those with a greater perceived likelihood of disease we found the inverse relationship with HPV vaccine completion. That is, women in our study who perceived a greater likelihood of disease had *lower* odds of having completed the 3-dose series. This finding is consistent with previous research [32, 44] and likely reflects our study's cross-sectional design; having completed the HPV vaccine series lowers the objective likelihood of acquiring HPV-related disease, thus likely lowering women's perceived likelihood as well [45]. It may also reflect our use of perceived likelihood questions that were conditioned on vaccination status (i.e., that remind respondents whether they have received HPV vaccine), which we believe is a necessary step toward yielding interpretable findings in studies of behaviors that are expected to change objective risk [44].

HPV vaccine initiation and completion showed different patterns of correlates in our analyses, suggesting that increasing adherence and completion of the 3-dose series may require different strategies. For example, increasing healthcare providers' HPV vaccine recommendations is a critical strategy for vaccine initiation [32, 33, 41]. However, as provider recommendation was not associated with vaccine completion, efforts to increase follow-through with receiving all doses may need to employ other provider and systems-based strategies as well. Recall/reminder systems [46] may be particularly useful for young adults, who are likely to experience life transitions that could interrupt the vaccination schedule (e.g., moving away from home). It is concerning that only about half of women who had initiated, but not yet completed, the vaccine series intended to receive all 3 doses, particularly as the main reason for not intending to do so was the belief that they had waited too long since their last shot. Young adults may also need to know that, while it is important to stay on the recommended dosing schedule, they can still receive their next dose without restarting the vaccine series, even if they have waited longer than the recommended interval between shots [6].

4.2 Strengths and limitations

Study strengths include a national sample of age-eligible young adult women in a population at risk for health disparities, and an examination of HPV vaccine series completion, in addition to the more commonly assessed measure of initiation. Limitations include a cross-sectional design, a modest response rate, and a lack of data on non-respondents. However, respondents were members of an online survey panel that is similar in composition to the US population on several demographic characteristics [22] and the distribution of lesbian and bisexual women in our sample is comparable to other national data [12]. Our sample was limited to lesbian and bisexual women based on their sexual identity (vs. sexual behavior) and did not include a heterosexual comparison group. The survey did not assess the gender of women's sexual partners which could be associated with their risk of HPV infection [47].

We assessed vaccination status through self-report which may be subject to recall bias; however, previous research supports the validity HPV vaccine recall among adults [48]. Further, the survey did not include information about the timing of doses received, thus we were unable to assess adherence to the recommended vaccination schedule among initiators.

4.3 Conclusion

This study represents the most comprehensive study to date of HPV vaccination among young adult lesbian and bisexual women. Less than half of women in this national sample had received any doses of HPV vaccine and over a quarter who initiated had not yet completed the series. Our findings suggest that programs designed to increase HPV vaccination among women in this population should focus on healthcare provider recommendations, perceived barriers, and other modifiable health beliefs. Future research is needed to monitor HPV vaccine coverage among age-eligible sexual minority adults and to identify effective interventions to increase vaccine initiation and series completion in this population.

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Abbreviations

HPV	human papillomavirus
LGBT	lesbian, gay, bisexual and transgender

Highlights

- We examined HPV vaccination among a national sample of young adult lesbian and bisexual women
- Many women had not initiated HPV vaccine and fewer had completed the 3-dose series
- Vaccine initiation was associated with healthcare provider recommendation and positive social norms

Table 1

Sample characteristics, $n=543$

	<i>n</i>	(%)
Sexual identity		
Bisexual	401	(73.9)
Lesbian	142	(26.2)
Age		
18-21	180	(33.2)
22-26	363	(66.9)
Race / Ethnicity		
Non-Hispanic White	368	(67.8)
Non-Hispanic Black	56	(10.3)
Hispanic	74	(13.6)
Other race/ethnicity	45	(8.3)
Education		
Less than college	116	(21.4)
Some college	204	(37.6)
College degree or more	223	(41.1)
Relationship status		
Never married, divorced, widowed, separated	352	(64.8)
Married, civil union, living with a partner	191	(35.2)
Employment status		
Currently employed	266	(49.0)
Not employed	109	(20.1)
Student	168	(30.9)
Annual household income		
<\$50,000	355	(65.4)
\$50,000	142	(26.2)
Not reported	46	(8.5)
Urbanicity		
Rural	110	(20.3)
Suburban	208	(41.4)
Urban	225	(38.3)
Region of residence		
East	149	(27.4)
Midwest	124	(22.8)
South	147	(27.1)
West	123	(22.7)

Note. Percentages may not sum to 100 due to rounding.

Table 2
Correlates of HPV vaccine initiation among lesbian and bisexual women (categorical variables), n=543

Demographic characteristics	No who initiated HPV vaccine / Total in Category (%)		Bivariate		Multivariable	
	n/N	(%)	OR	(95% CI)	OR	(95% CI)
Sexual identity						
Bisexual	182/401	(45.4)	ref		--	
Lesbian	65/142	(45.8)	1.02	(0.69-1.49)	--	
Age (in years)						
18-21	95/180	(52.8)	ref		ref	
22-26	152/363	(41.9)	0.64	(0.45-0.93)*	1.02	(0.53-1.96)
Race / Ethnicity						
Non-Hispanic White	172/368	(46.7)	ref		ref	
Non-Hispanic Black	14/56	(25.0)	0.38	(0.20-0.72)**	0.53	(0.20-1.40)
Hispanic	38/74	(51.4)	1.20	(0.73-1.98)	2.01	(0.95-4.30)
Other race/ethnicity	23/45	(51.1)	1.19	(0.64-2.21)	1.47	(0.58-3.7)
Education						
Less than college	45/116	(38.8)	ref		--	
Some college	96/204	(47.1)	1.40	(0.88-2.23)	--	
College degree or more	106/223	(47.5)	1.43	(0.91-2.26)	--	
Relationship status						
Never married, divorced, widowed, separated	173/352	(49.2)	ref		ref	
Married, civil union, living with a partner	74/191	(45.5)	0.65	(0.46-0.94)*	0.64	(0.36-1.14)
Employment status						
Currently employed	110/266	(41.4)	ref		ref	
Not employed	34/109	(31.2)	0.64	(0.40-1.03)	1.38	(0.67-2.85)
Student	103/168	(61.3)	2.25	(1.51-3.34)***	2.25	(1.16-4.37)*
Annual household income						
<\$50,000	161/355	(45.4)	ref		--	
\$50,000	66/142	(46.5)	1.05	(0.71-1.55)	--	
Not reported	20/46	(43.5)	0.93	(0.50-1.72)	--	

	No who initiated HPV vaccine / Total in Category (%)		Bivariate		Multivariable	
	n/N	(%)	OR	(95% CI)	OR	(95% CI)
Urbanicity						
Rural	46/110	(41.8)	ref		--	
Suburban	98/208	(47.1)	1.17	(0.74-1.86)	--	
Urban	103/225	(45.8)	1.24	(0.78-.98)	--	
Region of residence						
East	83/149	(55.7)	ref		ref	
Midwest	58/124	(46.8)	0.70	(0.43-1.13)	0.93	(0.44-1.95)
South	52/147	(35.4)	0.44	(0.27-0.69)***	0.63	(0.31-1.26)
West	54/123	(43.9)	0.62	(0.38-1.01)	0.70	(0.34-1.45)
Sexual behavior						
Age at sexual debut (in years) ^a						
17 or younger	148/318	(46.5)	ref		--	
18 or older	99/225	(44.0)	0.90	(0.64-1.27)	--	
Number of sexual partners in lifetime						
4 or fewer	130/281	(46.3)	ref		--	
5 or more	117/262	(44.7)	0.94	(0.67-1.31)	--	
HPV and HPV vaccine						
HPV knowledge ^b						
Low knowledge	154/352	(43.8)	ref		--	
High knowledge	93/191	(48.7)	1.22	(0.86-1.74)	--	
Healthcare provider ever recommended HPV vaccine						
No	81/333	(24.3)	ref		ref	
Yes	166/210	(79.1)	11.74	(7.74-17.79)***	6.50	(3.78-11.19)***
Health care						
Insurance status						
No health insurance	35/112	(29.5)	ref		ref	
Insures self (work, school, etc.)	87/197	(44.2)	1.89	(1.16-3.10)*	1.02	(0.47-2.21)
Insured through parent's plan	127/234	(54.3)	2.84	(1.76-4.60)***	0.88	(0.41-1.91)
Had a routine check-up in past year						

	No who initiated HPV vaccine / Total in Category (%)		Bivariate		Multivariable	
	n/N	(%)	OR	(95% CI)	OR	(95% CI)
No	107/269	(39.8)	ref		ref	
Yes	140/274	(51.1)	1.58	(1.13-2.22)**	0.63	(0.37-.1.14)
Disclosed sexual orientation to healthcare provider						
No	138/317	(43.5)	ref		--	
Somewhat	33/70	(47.1)	1.15	(0.69-1.94)	--	
Yes	76/156	(48.7)	1.23	(0.83-1.81)	--	
Discriminated against by healthcare provider						
No	207/449	(46.1)	ref		--	
Yes	21/44	(47.7)	1.07	(0.57-1.98)	--	
Don't know	19/50	(38.0)	0.72	(0.39-1.31)	--	

Note. Multivariable model included all categorical and continuous variables associated at $p<.05$ in bivariate analyses.
HPV=human papillomavirus; OR=odds ratio; CI=confidence interval; ref=reference group.

^a Age at first vaginal, anal or oral sex

^b Low knowledge was defined as 3 knowledge items (out of 6 total items) and high knowledge was defined as 4 correct items.

* $p<.05$;
** $p<.01$;
*** $p<.001$

Table 3
Correlates of HPV vaccine initiation among lesbian and bisexual women (continuous variables), *n*=543

	Mean (SD)		Bivariate		Multivariable	
	Vaccinated (<i>n</i> =247)	Unvaccinated (<i>n</i> =296)	OR	(95% CI)	OR	(95% CI)
Perceived effectiveness of HPV vaccine ^a	3.03 (0.65)	2.72 (0.85)	1.69	(1.34-2.12)***	0.93	(0.44-1.95)
Perceived harms of HPV vaccine ^b	2.63 (0.73)	3.06 (0.60)	0.36	(0.27-0.49)***	0.59	(0.39-0.90)*
Perceived barriers to getting HPV vaccine ^c	1.63 (0.76)	2.80 (0.91)	0.20	(0.15-0.27)***	0.24	(0.17-0.34)***
Perceived LGBT community vaccination norms ^d	3.71 (0.79)	3.30 (0.71)	2.07	(1.63-2.63)***	1.72	(1.19-2.48)**
Worry about getting HPV-related disease ^e	1.91 (0.88)	1.70 (0.82)	1.33	(1.09-1.63)**	1.22	(0.88-1.68)
Perceived severity of HPV-related disease ^f	3.65 (0.59)	3.55 (0.69)	1.26	(0.96-1.65)	--	--
Perceived likelihood of HPV-related disease ^g	1.96 (0.44)	1.99 (0.51)	0.87	(0.61-1.25)	--	--
Perceived lower risk of cervical cancer compared to heterosexual women ^d	2.35 (1.02)	2.65 (0.96)	0.74	(0.63-0.88)**	1.18	(0.90-1.55)
Anticipated regret if got HPV vaccine and fainted ^e	1.72 (0.79)	2.27 (0.95)	0.49	(0.40-0.60)***	0.77	(0.56-1.05)
Anticipated regret if did <u>not</u> get HPV vaccine and later got HPV infection ^e	3.50 (0.81)	3.25 (0.92)	2.92	(2.17-3.92)***	1.69	(1.14-2.50)**

Note. Multivariable model included all categorical and continuous variables associated at $p < .05$ in bivariate analyses. HPV=human papillomavirus; SD=standard deviation; OR=odds ratio; CI=confidence interval; LGBT=lesbian, gay, bisexual, or transgender

^a 3 item scale; each item had a 4-point response scale ranging from 1="not at all" to 4="a lot"

^b 4 item scale; each item had a 5-point response scale ranging from 1="strongly disagree" to 5="strongly agree"

^c 2 item scale; each item had a 5-point response scale ranging from 1="strongly disagree" to 5="strongly agree"

^d 5-point response scale ranging from 1="strongly disagree" to 5="strongly agree"

^e 4-point response scale ranging from 1="not at all" to 4="a lot"

^f 4-point response scale ranging from 1="not at all" to 4="very"

^g 4 item scale; each item had a 4-point response scale ranging from 1="no chance" to 4="high chance"

* $p < .05$;

** $p < .01$;

*** $p < .001$

Table 4
Correlates of HPV vaccine series completion among lesbian and bisexual women, *n*=247

	Bivariate		Multivariable	
	OR	(95% CI)	OR	(95% CI)
Demographics				
Education				
Less than college	ref		ref	
Some college	2.36	(1.13-4.93)*	2.29	(0.99-5.28)
College degree or more	2.44	(1.18-5.05)*	2.43	(1.04-5.69)*
HPV vaccine				
Healthcare provider ever recommended HPV vaccine				
No	ref		ref	
Yes	2.03	(1.15-3.57)*	1.78	(0.94-3.38)
Health care				
Disclosed sexual orientation to healthcare provider				
No	ref		ref	
Somewhat	3.39	(1.12-10.25)*	2.92	(0.90-8.92)
Yes	0.85	(0.47-1.53)	0.74	(0.38-1.47)
Attitudes and beliefs				
Perceived harms of HPV vaccine ^a	0.68	(0.47-0.99)*	1.11	(0.70-1.74)
Perceived barriers to getting HPV vaccine ^b	0.50	(0.35-0.73)***	0.66	(0.43-1.01)
Perceived likelihood of HPV-related disease ^c	0.42	(0.22-0.81)**	0.46	(0.22-0.96)*
Perceived lower risk of cervical cancer compared to heterosexual women ^d	0.73	(0.57-0.95)*	0.87	(0.65-1.17)
Anticipated regret if got HPV vaccine and fainted ^e	0.53	(0.38-0.76)***	0.64	(0.43-0.96)*
Anticipated regret if did <u>not</u> get HPV vaccine and later got HPV infection ^e	1.83	(1.12-3.01)*	1.31	(0.73-2.33)

Note. Table shows variables associated at $p < .05$ in bivariate models and, therefore, included in the multivariable model. Other variables examined as potential correlates included: all demographics; age at sexual debut; number of sexual partners in lifetime; HPV knowledge; health insurance; receipt of a recent routine check-up; perceived discrimination; HPV vaccine effectiveness; LGBT community vaccination norms; worry about getting HPV-related disease; and perceived severity of HPV-related disease, none of which were associated at $p < .05$ in bivariate analyses.

HPV=human papillomavirus; OR=odds ratio; CI=confidence interval; ref=reference group

^a 4 item scale; each item had a 5-point response scale ranging from 1="strongly disagree" to 5="strongly agree"

^b 2 item scale; each item had a 5-point response scale ranging from 1="strongly disagree" to 5="strongly agree"

^c 4 item scale; each item had a 4-point response scale ranging from 1="no chance" to 4="high chance"

^d 5-point response scale ranging from 1="strongly disagree" to 5="strongly agree"

^e 4-point response scale ranging from 1="not at all" to 4="a lot"

* $p < .05$;

** $p < .01$;

 $p < .001$