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RATES AND PREDICTORS OF HUMAN PAPILLOMAVIRUS VACCINATION AMONG YOUNG MEN RECRUITED FROM URBAN CLINICAL AND COMMUNITY SETTINGS

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ABSTRACT

Background and Objective

Human papillomavirus (HPV) vaccination rates are suboptimal in young men, representing a missed opportunity to prevent cancers caused by HPV. Data about factors associated with vaccination over time are important to design interventions that improve vaccination rates. The aims of this study were to determine HPV vaccine initiation and completion rates in young men 13–26 years of age recruited from clinical and community settings from 2013-2014 and 2016-2017, and to determine factors associated with vaccination.

Material and Methods

Men (N=747) were recruited from a hospital-based teen health center (THC), health department sexually transmitted disease clinic (HDSTD) and the general community. Participants completed a self-administered survey assessing demographic and behavioural factors. Vaccination status was determined using the electronic medical record and a statewide immunization registry. We determined vaccine initiation and completion rates, by recruitment site and year. We determined factors independently associated with vaccine initiation and completion, overall and stratified by recruitment year, using multivariable logistic regression.

Results

Mean age was 21.2 years, 258 (34.5%) had initiated the vaccine series and 154 (20.8%) had completed it. Those recruited from the THC (vs. community and HDSTD) were more likely to initiate (71.3%, 23.2%, and 19.5%, respectively, p<.0001) and complete (50.7%, 11.7%, and 8.3%, p<.0001) the series. In multivariable analysis, variables associated with vaccine initiation were younger age (13–17 vs. 22–26 years: AOR 5.31),

insurance plan (Private vs. Medicaid: OR 0.39; Medicaid vs. others: AOR 2.22), no cigarette smoking (no vs. yes: AOR 1.78) and recruitment site (THC vs. HDSTD: AOR 3.74; THC vs. community: AOR 3.01). Variables associated with vaccine completion were younger age (13–17 vs. 22-26 years: AOR 3.55; 18–21 vs. 22–26 years: AOR 4.26), insurance plan (Private vs. Medicaid: AOR 0.51; Medicaid vs. others: AOR 2.62), fewer lifetime female partners (1 vs. 2–10: AOR 2.55; 1 vs. 11+: AOR 2.23) and recruitment site (THC vs. HDSTD: AOR 4.99; THC vs. community: AOR 3.95).

Conclusion

HPV vaccine initiation and completion rates were low among young men over the 6 years after vaccine recommendations for men. Men who reported behaviours that have been associated with a higher risk for HPV were less likely to be vaccinated. Interventions that improve access to a primary care medical home and insurance programs that cover vaccination costs may increase HPV vaccination rates in young men.

Key words: *human papillomavirus; vaccination; adolescent; young men; urban*

Human papillomavirus (HPV) is a common sexually transmitted infection that can cause penile, anal, and oropharyngeal cancers as well as genital warts in men. There are approximately 14 million new HPV infections transmitted each year, half of which are estimated to occur among those between the ages of 15 and 24 years.[1] In 2011, the U.S. Advisory Committee on Immunization Practices (ACIP) recommended routine vaccination with the 4-valent HPV vaccine for 11- to 12-year-old boys, for young men 13–21 who had not initiated or previously completed the vaccine series, and for men 22–26 years of age at high risk for HPV-related disease.[2] In 2016, the recommendation for a 3-dose vaccine series was updated: a 2-dose schedule was recommended for young men initiating the vaccine prior to age 15 years.[3] Although the HPV vaccine has been recommended for young men since 2011, vaccine uptake has been lower than expected. In 2016, only 56.0% of young men 13–17 years of age had received at least one dose and only 37.5% had received all recommended doses.[4] Among young adult men 19–26 years of age, vaccination rates are even lower: in one study, only 15.7% of young men 19–21 years of age and 7.3% of those 22–26 years of age had received at least one vaccine dose.[5]

Previously published research on rates and predictors of HPV vaccination in males has primarily been conducted between 2009 when HPV vaccines were first licensed for men, and 2011, when HPV vaccination was recommended routinely for men 11–21 years of age.[6–8] Little is known about recent rates and predictors of vaccination, especially in men older than 21 years of age.[9–11] In order to design clinic-based interventions to improve HPV vaccination rates in young men, it is imperative that studies are conducted to determine recent HPV vaccination rates and predictors of vaccination in men across a wider age range, given the persistently low HPV vaccine uptake in young men.

Therefore, we designed a study to examine rates and predictors of HPV vaccination in young men 13 to 26 years of age, recruited from 3 different clinical and community settings, over the 6 years after the routine recommendation for HPV vaccination in men. The primary aims of this study were to: (1) determine HPV vaccine initiation and completion rates in young men recruited from these settings (2 clinical and one community) during 2 time periods (2013-2015 and 2016-2017), and (2) determine whether demographic factors, sexual behaviours, knowledge of HPV, and recruitment site were associated with HPV vaccination. This study extends the findings of a previous study which examined vaccination rates during the first time period.[12] We hypothesized the vaccination rates would be significantly lower during the first versus the second time period; vaccine initiation rates in young men recruited from the health department would be lower than those from a hospital teen clinic and community setting; and that higher number of sexual partners, lower knowledge, older age, and no health insurance would be associated with not receiving the HPV vaccine.

METHODS

We recruited 747 adolescent and young adult males 13–26 years of age to participate in an HPV epidemiologic study. Data were collected in 2 waves, from 2013-2015 and from 2016-2017. Details about participant recruitment and study procedures are provided in previous manuscripts.[12,13] Briefly, 3 groups of participants were recruited: from an urban hospital-based teen health center (THC), a health department sexually transmitted disease clinic (HDSTD) and the general community in Cincinnati, Ohio. The participants from the general community were recruited by email through the hospital's employee database, newspaper advertising, and advertising at a local college. Young men who had had sexual contact (genital-oral or genital-genital sex with a male or female partner) were eligible to participate. Participants who enrolled during the first wave of the study were not eligible to participate in the second wave to maintain the independence of the study samples. The research study was approved by both the hospital and health department Institutional Review Boards. A waiver of parental consent was granted for participants who were <18 years of age to preserve confidentiality, given the inclusion criterion of sexual contact. Written informed consent was obtained from each participant prior to enrollment into the study.

Young men who enrolled in the study completed a self-administered paper-and-pencil survey instrument during a one-time study visit and received a gift card as an incentive for their time. The survey assessed sociodemographic factors, health history, knowledge of HPV and HPV vaccines, HPV vaccination history, and sexual behaviours. Survey items and scales assessing knowledge and sexual behaviours were developed and validated in populations that were demographically similar to those in this study.[12,14,15]

Independent variables for this study included age, race, ethnicity, marital status, insurance status, health history, sexual behaviours, knowledge of HPV and HPV vaccines, study wave, and recruitment site. The primary outcome variables were HPV vaccine series initiation and completion. Vaccination status was assessed in the survey instrument and also validated using the electronic medical record (EMR) and statewide immunization registry. If there were no HPV immunization data listed in either system, we used the self-reported information. Of the 747 HPV immunization records, 114 (15%) had no EMR registry data available, which resulted in 16 (14%) records using the self-reported immunization data. Vaccine initiation was defined as having received ≥1 dose. Vaccine completion was defined as having received (1) ≥3 doses prior to October 19, 2016 (the date of new ACIP reduced-dosing vaccine guidelines), (2) ≥ 3 doses in males ≥ 15 years of age after the new vaccine guidelines, or (3) ≥ 2 doses in males <15 years of age after the new vaccine guidelines.

Descriptive analyses were conducted to generate the mean, standard deviation, median, range for all continuous - and the frequency and percentage for all categorical - independent and dependent variables. We first examined vaccine initiation and completion rates for all participants, and stratified by study wave and recruitment site. We then examined whether recruitment site, demographic factors, sexual behaviours and HPV knowledge were associated with HPV vaccine initiation and completion rates overall, in 2013-15, and in 2016-17, using univariable methods: a Chi-square or Fisher's exact test when the independent variable was categorical and a t-test or Wilcoxon rank-sum test when it was continuous. Variables associated with the outcomes at $p < .10$ were examined for multicollinearity, some were removed when necessary, and the rest were entered into multivariable logistic regression models to determine which variables were independently associated with HPV initiation and completion overall, in 2013-15, and in 2016-17. A final model was built by stepwise variable selection where only independent variables with a p-value of <0.05 were retained in the model.

RESULTS

Overall, 876 adolescent and young adult men were approached for enrollment, and 747 (85.3%) agreed to participate and completed the study. As shown in Table 1, the majority of participants were Black (67.3%), recruited from the HDSTD clinic (57%), and had health insurance (67.7%). The mean age of participants was 21.2 years with a range of 13–26 years.

TABLE 1 Characteristics of Male Participants 13–26 Years of Age, Recruited from 2013–2014 and 2016–2017 (N=747)

Participant Characteristics	N (%)	Mean (SD)	Median (Range)
Recruitment Site			
Teen Health Center	209 (28.0)		
Health Department STD	426 (57.0)		
Community	112 (15.0)		
Age		21.2 (3.1)	21 (13–26)
13–17	99 (13.3)		
18–21	289 (38.7)		
22–26	359 (48.1)		
Race			
White	187 (25.0)		
Black	503 (67.3)		
Asian	4 (0.54)		
Native American	2 (0.27)		
Multiracial	50 (6.7)		
Other	1 (0.13)		
Ethnicity			
Hispanic	26 (3.5)		
Non-Hispanic	721 (96.5)		
Appalachian Descent			
Yes	18 (2.4)		
No	729 (97.6)		
Marital Status			
Never Married	721 (96.5)		
Divorced/Separated/Widowed	3 (0.40)		
Married Now	23 (3.1)		
Insurance			
Yes	506 (67.7)		
No	178 (23.8)		
Not Sure	63 (8.4)		
Insurance Plan			
Private	207 (27.7)		
Medicaid/CareSource	251 (33.6)		
None/Not Sure	289 (38.7)		

TABLE 1 Characteristics of Male Participants 13–26 Years of Age, Recruited from 2013–2014 and 2016–2017 (N=747) (*Continued*)

Participant Characteristics	N (%)	Mean (SD)	Median (Range)
Ever had sex with a female			
Yes	680 (91.0)		
No	67 (9.0)		
Last time had sex with a female			
Within 24 hours	68 (9.1)		
More than 24 hours ago	615 (82.3)		
Not Applicable (no sex with female)	64 (8.6)		
Age of first sexual intercourse with a female		15.5 (2.3)	15 (6–25)
≤ 14 years	244 (32.7)		
15–17 years	315 (42.2)		
≥ 18 years	124 (16.6)		
Never had sex with a female	64 (8.6)		
Number of female partners, lifetime		19.2 (50.0)	10.0 (1–1000)
0	64 (8.6)		
1	59 (7.9)		
2–10	345 (46.4)		
11+	275 (37.0)		
Number of female partners, past 3 months		2.0 (2.0)	1 (0–20)
0	77 (10.3)		
1	292 (39.1)		
≥ 2	313 (41.9)		
Number of new female partners, past 3 months		1.0 (1.7)	1 (0–18)
0	336 (44.9)		
1	202 (27.0)		
≥ 2	145 (19.4)		
Number of female partners, past 12 months		3.8 (5.6)	2 (0–70)
0	32 (4.3)		
1	199 (26.7)		
≥ 2	451 (60.5)		
Number of new female partners, past 12 months		2.4 (4.6)	1 (0–67)
0	192 (25.7)		
1	194 (26.0)		
≥ 2	296 (39.7)		

TABLE 1 Characteristics of Male Participants 13–26 Years of Age, Recruited from 2013–2014 and 2016–2017 (N=747) (*Continued*)

Participant Characteristics	N (%)	Mean (SD)	Median (Range)
Ever had anal sex with female, lifetime			
Yes	228 (30.5)		
No	519 (69.5)		
Ever had anal sex with a male			
Yes	96 (12.9)		
No	651 (87.2)		
Last time had anal sex with a male			
Within the last 24 hours	12 (1.6)		
More than 24 hours ago	84 (11.2)		
Not Applicable (no sex with male)	651 (87.2)		
Age of first anal sexual intercourse with a male		17.1 (3.0)	17 (5–25)
≤ 14 years	14 (1.9)		
15–17 years	37 (4.9)		
≥ 18 years	45 (6.0)		
Never had anal sex with a male	651 (87.2)		
Number of male partners had anal sex, lifetime		17.5 (29.7)	7 (1–200)
1–10	60 (8.0)		
11+	35 (4.7)		
Never had anal sex with a male	651 (87.2)		
Number of male partners had anal sex, past 3 months		2.1 (2.2)	1 (0–12)
0	13 (1.7)		
1	39 (5.2)		
≥ 2	44 (5.9)		
Number of new male partners, past 3 months		1.22 (1.9)	1 (0–12)
0	44 (5.9)		
1	24 (3.2)		
≥ 2	28 (3.8)		
Number of male partners had anal sex, past 12 months		4.6 (6.1)	2 (0–40)
0	8 (1.1)		
1	24 (3.2)		
≥ 2	64 (8.6)		

TABLE 1 Characteristics of Male Participants 13–26 Years of Age, Recruited from 2013–2014 and 2016–2017 (N=747) (*Continued*)

Participant Characteristics	N (%)	Mean (SD)	Median (Range)
Number of new male partners, past 12 months		3.6 (5.8)	2 (0–40)
0	23 (3.1)		
1	22 (2.9)		
≥ 2	51 (6.8)		
Ever had sex with more than one person during the same time period			
Yes	349 (46.7)		
No	368 (49.3)		
Don't remember/Don't know	30 (4.0)		
Ever had an STI			
Chlamydia	242 (32.4)		
Gonorrhea	144 (19.3)		
Trichomonas	50 (6.7)		
Pubic Lice	9 (1.2)		
Genital Warts	14 (1.9)		
Herpes	16 (2.1)		
HIV (AIDS)	13 (1.7)		
Syphilis	21 (2.8)		
Any STI (≥1 STI)	327 (43.8)		
Last time washed genital area			
Today	532 (71.2)		
Yesterday	206 (27.6)		
Before Yesterday	9 (1.2)		
Smoked at least 100 cigarettes (5 packs), lifetime			
Yes	218 (29.2)		
No	514 (68.8)		
Not sure	15 (2.0)		
Number of days smoked cigarettes, past 30 days			
0 days	495 (66.3)		
1 or 2 days	42 (5.6)		
3 to 5 days	43 (5.8)		
6 to 9 days	17 (2.3)		
10 to 19 days	41 (5.5)		
20 to 29 days	31 (4.2)		
All 30 days	78 (10.4)		

TABLE 1 Characteristics of Male Participants 13–26 Years of Age, Recruited from 2013–2014 and 2016–2017 (N=747) (*Continued*)

Participant Characteristics	N (%)	Mean (SD)	Median (Range)
Ever smoked marijuana			
Yes	585 (78.3)		
No	161 (21.6)		
Not sure	1 (0.13)		
Number of days smoked marijuana			
0 days	187 (25.0)		
1 or 2 days	100 (13.4)		
3 to 5 days	47 (6.3)		
6 to 9 days	32 (4.3)		
10 to 19 days	61 (8.2)		
20 to 29 days	52 (6.9)		
All 30 days	114 (15.3)		
Not Applicable	154 (20.6)		
HPV and HPV vaccine knowledge (scale score; mean correct responses)			
HPV knowledge (scale range 0–8)		3.5 (2.0)	
HPV vaccine knowledge (scale range 0–2)		0.78 (0.90)	
HPV and HPV vaccine knowledge (scale range 0–10)		4.3 (2.5)	

HPV = human papillomavirus; SD = standard deviation; STD = sexually transmitted disease clinic; STI = sexually transmitted infection.

The mean age of first sexual intercourse with a female partner was 15.5 years (standard deviation 2.3 years), and the mean age of first anal sex with a male partner was 17.1 years (standard deviation 3.0 years). Among all participants, 43.8% reported a history of having any STIs, 29.2% had smoked at least 5 packs of cigarettes in their lifetime, and 78.3% reported a history of smoking marijuana. The mean number of items answered correctly on the scale measuring HPV and HPV vaccine knowledge was 4.32 (scale range 0–10).

HPV vaccination initiation and completion rates by study time period (wave) and recruitment site are presented in **Table 2** and **Figures 1** and **2**. Overall, 34.5% of participants had initiated and 20.8% completed the vaccine series. A substantially higher proportion of participants recruited from the THC had initiated the HPV series (71.3%) than those recruited from the HDSTD (19.5%) and the community (23.2%; $p < .0001$). Similarly, a higher proportion of participants recruited from the THC had completed the HPV vaccine series (50.7%) than those recruited from the HDSTD (8.3%) and the community (11.7%; $p < .0001$). Across study waves (**Table 2, Figure 1**), there was a statistically significant increase in HPV vaccine initiation, from 23.3% to 47.6% ($p < .0001$), and HPV vaccine completion, from 11.1% to 31.9% ($p < .0001$). At each recruitment site (**Figure 2**), there was a statistically significant increase in HPV vaccine initiation from 2013-15 to 2016-17: THC 54.6% to 85.7% ($p < .0001$), HDSTD 13.5% to 29.4% ($p < .0001$), and the community 10.8% to 29.3% ($p = .029$). There was a statistically significant increase from 2013-15 to 2016-17 in HPV vaccine series completion at both the THC (29.9% to 68.7%, $p < .0001$) and the HDSTD (4.9% to 13.8%, $p = .0013$), but not the community (**Figure 3**).

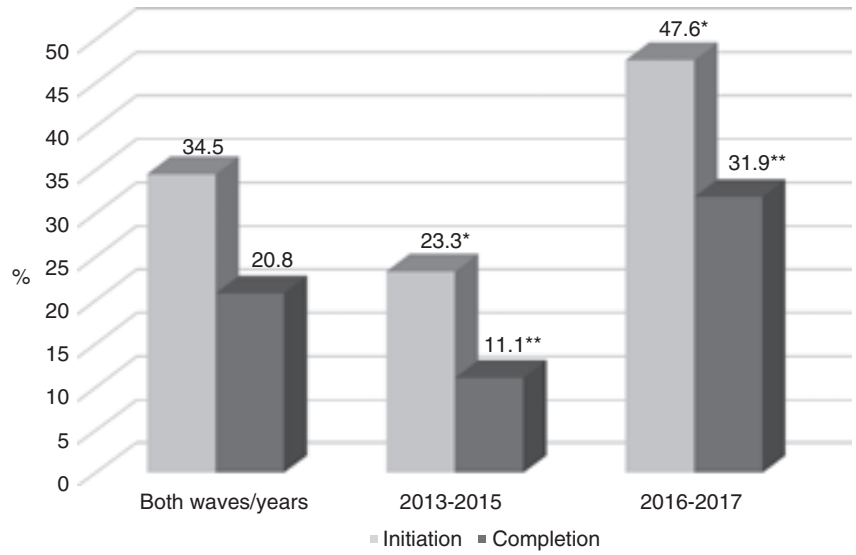
In univariable analysis, the following variables were associated with HPV vaccine initiation among

TABLE 2 HPV Vaccination Status among Young Men by Study Wave and Recruitment Site

	Study Wave N (%)				Recruitment Site N (%)				
	All participants	2013–2015	2016–2017	P value*	All sites	Teen Health Center	Health Department STD Clinic	Community	P value**
Initiation	258 (34.5)	93 (23.3)	165 (47.6)	< .0001	258 (34.5)	149 (71.3)	83 (19.5)	26 (23.2)	< .0001
Completion	154 (20.8)	44 (11.1)	110 (31.9)	< .0001	154 (20.8)	106 (50.7)	35 (8.3)	13 (11.7)	< .0001

**P value represents comparison of recruitment years: 2013–2015 and 2016–2017.*
***P value represents comparison of recruitment sites: Teen Health Center, Health Department STD clinic, and community.*
HPV = human papillomavirus; STD = sexually transmitted disease.

FIG. 1 Human papillomavirus vaccine initiation and completion status.

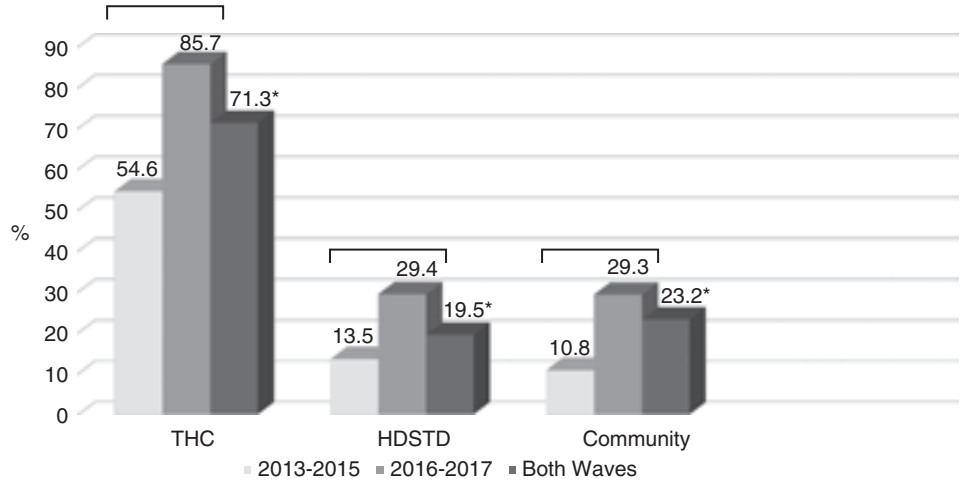


** Indicates a statistically significant increase in HPV vaccine initiation between 2013-2015 and 2016-2017 (p < .0001).*
*** Indicates a statistically significant increase in HPV vaccine completion between 2013-2015 and 2016-2017 (p < .0001).*

all participants at a significance level of p < .10 (the threshold for inclusion in multivariable models): age, race, insurance, insurance plan, age of first sexual intercourse with a female, number of lifetime female partners, lifetime anal sex with a female, lifetime anal sex with a male, sex with more than one person during same period of time, having any STI, lifetime cigarette smoking, number of days smoking cigarettes, marijuana smoking, and recruitment site. Variables associated with HPV vaccine completion among all participants included: age, race, insurance, insurance plan, lifetime female partners, lifetime anal sex with a female, age of first anal sex with a male, sex with more than one person during the same time period, having any STI, lifetime cigarette smoking, number of days smoking cigarettes, and recruitment site.

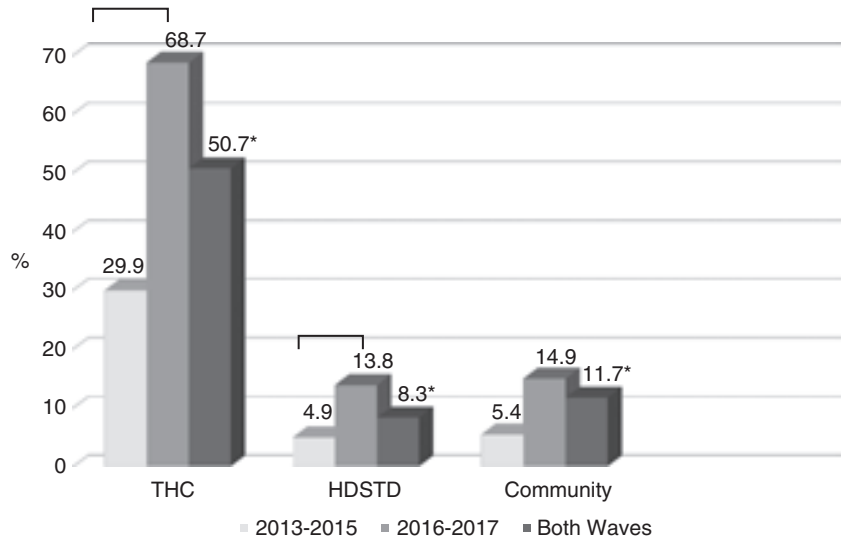
In multivariable analysis (**Table 3**), among all participants, variables independently associated with HPV vaccine initiation included age (13–17 vs. 22–26 years: AOR 5.31), insurance plan (Medicaid

FIG. 2 Human papillomavirus vaccine initiation by recruitment site.



— *Indicates a statistically significant increase in HPV vaccine initiation from 2013–2015 to 2016–2017 in the THC (p < .0001), the STD clinic (p <.0001) and the Community setting (p= .029).*
** Indicates a statistically significant increase in vaccine initiation rates between sites for both waves combined (p < .0001).*

FIG. 3 Human papillomavirus vaccine completion by recruitment site



— *Indicates a statistically significant increase in HPV vaccine completion from 2013–2015 to 2016–2017 in the THC (p < .0001) and the STD clinic (p = .0013).*
** Indicates a statistically significant increase in vaccine completion rates between sites in both waves combined (p < .0001).*

vs. others: AOR 2.22), cigarette smoking (no vs. yes: AOR 1.78) and recruitment site (THC vs. HDSTD: AOR 3.74 and THC vs. community: AOR 3.01). In stratified analyses, variables associated with vaccine initiation in 2013-2015 included younger age (13–17 vs. 22–26 years: AOR 11.03; 18–21 vs. 22–26 years: AOR 7.6), recruitment site (THC vs. HDSTD: AOR 3.17; THC vs. community: AOR 4.07), fewer anal sex partners (1–10 vs. 11+: AOR 7.97), and no recent cigarette smoking (AOR 2.22). Variables associated with vaccine initiation in 2016-2017 included younger age (13–17 vs. 22-26 years: AOR 5.85; 18–21 vs. 22–26 years: AOR 5.69), recruitment site (THC vs. HDSTD: AOR 5.39; THC vs. community: AOR 5.68), and race (White vs. multiracial: AOR 0.25). Variables independently associated with HPV vaccine completion

TABLE 3 Variables Independently Associated with HPV Vaccine Initiation and Completion, In All Participants and By Study Wave: Results of Multivariable Logistic Regression (N=747)

All Participants			2013–2015		2016–2017	
Variable	**AOR**	**95% CI**	**AOR**	**95% CI**	**AOR**	**95% CI**
HPV Vaccine Initiation						
Age (years)						
13–17 vs. 18–21	1.12	0.64–1.96	1.45	0.70–3.01	1.03	0.41–2.59
13–17 vs. 22–26	5.31	2.76–10.22	11.03	4.31–28.21	5.85	2.16–16.18
18–21 vs. 22–26	4.75	3.06 – 7.39	7.60	3.56–16.25	5.69	3.10–10.46
Insurance plan						
Private vs. Medicaid	0.39	0.23–0.66	-	-	-	-
Private vs. others	0.87	0.51–1.48	-	-	-	-
Medicaid vs. others	2.22	1.44–3.44	-	-	-	-
Smoked at least 100 cigarettes, lifetime						
No vs. yes	1.78	1.14–2.80	-	-	-	-
Recruitment site						
THC vs. HDSTD	3.74	2.35–5.94	3.17	1.68–6.00	5.39	2.55–11.43
THC vs. community	3.01	1.61–5.64	4.07	1.19–13.89	5.68	2.37–13.60
HDSTD vs. community	0.81	0.45–1.45	1.28	0.38–4.34	1.05	0.50–2.21
Number of male anal sex partners, lifetime						
1–10 vs. 11+	-	-	7.97	1.13–56.01	-	-
1–10 vs. did not have anal sex	-	-	4.92	1.69–14.34	-	-
11+ vs. did not have anal sex	-	-	0.62	0.11–3.34	-	-
Number of days smoked cigarettes, past 30 days						
0 vs. 1–30	-	-	2.22	1.14–4.34	-	-
Race						
White vs. Black	-	-	-	-	0.52	0.26–1.02
White vs. multiracial	-	-	-	-	0.25	0.08–0.81
Black vs. multiracial					0.49	0.16–1.49

TABLE 3 Variables Independently Associated with HPV Vaccine Initiation and Completion, In All Participants and By Study Wave: Results of Multivariable Logistic Regression (N=747) (*Continued*)

All Participants			2013–2015		2016–2017	
Variable	**AOR**	**95% CI**	**AOR**	**95% CI**	**AOR**	**95% CI**
HPV Vaccine Completion						
Age (years)						
13–17 vs. 18–21	0.83	0.48–1.45	1.03	0.46–2.31	0.61	0.28–1.35
13–17 vs. 22–26	3.55	1.67–7.55	8.03	2.19–29.47	2.61	0.95–7.19
18–21 vs. 22–26	4.26	2.36–7.68	7.81	2.42–25.10	4.26	2.05–8.87
Insurance plan						
Private vs. Medicaid	0.51	0.28–0.94	-	-	-	-
Private vs. others	1.33	0.68–2.59	-	-	-	-
Medicaid vs. others	2.62	1.58–4.34	-	-	-	-
Number of female partners, lifetime						
1 vs. 2–10	2.55	1.28–5.07	-	-	-	-
1 vs. 11+	2.23	1.05–4.76	-	-	-	-
Recruitment site						
THC vs. HDSTD	4.99	2.94–8.46	4.31	1.94–9.59	7.22	3.46–15.07
THC vs. community	3.95	1.87–8.31	2.86	0.60–13.70	11.19	4.76–26.36
HDSTD vs. community	0.79	0.37–1.71	0.66	0.13–3.30	1.55	0.66–3.65
Appalachian descent						
Yes vs. no	-	-	11.90	1.30–111.11	-	-
Number of days smoked marijuana						
Never vs. 1–30 of past 30 days	-	-	-	-	2.26	1.10–4.65

AOR = adjusted odds ratio; dash indicates an independent variable not retained in the final model due to a p value > .05; CI = confidence interval; HDSTD= health department sexually transmitted disease clinic; HPV = human papillomavirus; THC = teen health center.

among all participants included age (13-17 vs. 22–26 years: AOR 3.55, 18–21 vs. 22–26 years: AOR 4.26), insurance plan (Medicaid vs. others: AOR 2.62; Private vs. Medicaid: AOR 0.51), and recruitment site (THC vs. HDSTD: AOR 4.99; THC vs. community: AOR 3.95). In stratified analyses, variables associated with vaccine completion in 2013-2015 included: younger age (13–17 vs. 22-26 years: AOR 8.03; 18-21 vs. 22–26 years: AOR 7.81), recruitment site (THC vs. HDSTD: AOR 4.31), and Appalachian descent (AOR 11.9). Variables associated with vaccine completion in 2016-2017 included: younger age (18-21 vs. 22-26 years: AOR 4.26), recruitment site (THC vs. HDSTD: AOR 7.22; THC vs. community: AOR 11.19), and never having smoked marijuana (AOR 2.26).

DISCUSSION

In this study, we examined rates and factors associated with HPV vaccine initiation and completion among adolescent and young adult men age 13–26 years of age across 3 clinical and community settings from 2013-2017, extending the findings of a previous study conducted from 2013-2015.[12] Rates of HPV vaccine initiation (34.5%) and completion (20.8%) were low among all young men, but differed by age. A substantially higher proportion of young men 13- to 17-years-of-age initiated the vaccine series (68.7%) compared to those 18–21 (52.3%) and 22- to 26-years-of-age (10.9%). Similarly, the proportion of young men who completed the vaccine series differed by age: 41.4% of 13- to 17-year-olds, 32.9% of 18- of 21-year-olds, and 5.1% of 22- to 26-year-olds. Compared to 13- to 17-year-old young men in Ohio, initiation rates were higher (68.7% in this study vs. 55.0% in Ohio) and completion rates were the same (41.4% in this study vs. 41.1% in Ohio).[4] The higher rates among younger vs. older men are reflected in national data as well.[4] One of the reasons why rates may be higher in younger versus older men is that they are more likely to access primary care: studies have shown that young men who are seen in a primary care setting are more likely to benefit from providers who give strong recommendations for vaccination and to have insurance coverage for vaccination.[16,17] In our study, the 13- to 17-year-olds enrolled were largely being seen for care in the THC, a primary care medical home largely staffed by pediatricians and nurse practitioners with adolescent medicine training. Ensuring that young men have access to primary care providers, or to alternative providers of vaccination such as school-based programs or pharmacies, is vital for health promotion and disease prevention efforts including HPV vaccination.

We demonstrated in this study that HPV vaccine initiation rates doubled across the 2 data collection waves (23.3% to 47.6%), and completion rates almost tripled (11.1% to 31.9%), mirroring an increase in Ohio and nationally. In this study, however, initiation rates among 13- to 17-year-olds were higher (56.9% in 2013-2015, 81.3% in 2016-2017) than in Ohio during approximately the same time period (26.5% in 2013 and 55.0% in 2016).[4,18] These higher initiation rates in our study may be a function of the setting in which most 13–17 year-old young men were recruited: a primary care practice in which providers routinely give strong recommendations for vaccination, vaccines are updated at every visit, and alerts are embedded in the electronic health record to remind clinicians at each visit when vaccines are due.

The factors that were most consistently associated with vaccine initiation and completion in this study were younger age, Medicaid insurance status, and recruitment from the THC. These 3 factors were associated with both HPV vaccine initiation and completion among all participants, and younger age and recruitment from the THC were associated with both vaccine initiation and completion in analyses stratified by year (2013-2015 and 2016-2017). Among young men who were insured, those with Medicaid were more likely to be vaccinated than those who had private or other insurance. Age, insurance, and recruitment site are related in ways that have implications for interventions to improve HPV vaccination rates. Eligibility for vaccination through Medicaid may be restricted by age, and younger versus older men are more likely to access primary care sites that provide vaccination such as the THC. A study conducted in 2015, which utilized National Immunization Survey-Teen data, also demonstrated that adolescents with Medicaid insurance had significantly higher HPV vaccination rates compared to those with private insurance or who were uninsured.[17] Among insured adolescents in that study, HPV vaccination coverage among males (at least one

dose and all 3 doses) was significantly higher among those with Medicaid compared with those with private health insurance. In contrast, vaccination coverage did not significantly differ by type of health insurance for tetanus, diphtheria, or meningococcal conjugate vaccines. Furthermore, adolescent and young adult men who have a primary care provider may be more likely to benefit from the Vaccines for Children assistance program. This program provides free or discounted vaccines to those who are underinsured, uninsured and those who are eligible for Medicaid.

In addition to age, insurance status, and recruitment site, we identified a set of behavioural factors associated with vaccine initiation and completion. No history of cigarette smoking was associated with vaccine initiation among all participants and those recruited in 2013-2015, no marijuana use with vaccine completion in 2016-2017, fewer anal sex partners with vaccine initiation in 2013-2015, and fewer lifetime female partners with vaccine completion among all participants. These findings are notable in that behaviours linked to lower risk for HPV were associated with vaccine initiation and completion; therefore, those at higher risk for HPV may be less likely to be vaccinated. Research is needed to determine why those at higher risk for HPV are less likely to be vaccinated. It is possible that those practicing riskier behaviours are more likely to present for urgent or ill visits at which they are not offered routine vaccinations, or that they are more likely to refuse preventive health care recommendations such as vaccination. It is also possible that clinicians have not discussed behaviours related to substance use or sexual behaviours with patients, or that young men are not comfortable disclosing these behaviours with clinicians due to fear of stigma so that clinicians are not aware that they are at higher risk for HPV. Regardless, this is a concerning finding and implies that clinicians should consider eliciting these behaviours during clinic visits and outreach to those patients at higher risk for HPV to encourage vaccination and that improved access in alternative settings is needed.

This study has several strengths, including recruitment from clinical sites and the community, a racially diverse study population, recruitment over 2 time periods which enabled comparison in vaccination rates over time, and a validated measure of HPV vaccination status. However, the study also had limitations. The study was conducted predominantly among Black men with public health insurance, so the findings may not be generalizable to the U.S. population. We only recruited young men who had had sexual contact: HPV vaccine initiation and completion rates may differ in a population inclusive of all young men. Finally, our study relied on self-reported information regarding insurance status and sexual behaviours, which may limit the validity of the data collected.

CONCLUSION

We found that HPV vaccine initiation and completion rates for the young men 13–26 years of age enrolled in this study were suboptimal 2 and 5 years after vaccine introduction, and far below the Healthy People 2020 goal of 80%. Factors associated with vaccination including being seen in a primary care clinic, younger age, and Medicaid insurance. Interventions to increase HPV vaccination could include improving access to a primary care medical home, ensuring access to insurance or federal programs that cover the cost of vaccination, and ensuring that HPV vaccination is available in multiple settings including STD clinics and alternative settings such as pharmacies or schools. Interventions should focus on the sexually active young men at highest risk for HPV, recognizing that such discussions may require extra sensitivity.

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