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Original Research Article

Provider facility type and HPV vaccination rate among African American teenagers in the United States

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ABSTRACT

Background: The Human Papilloma Virus vaccine is one of the most efficient preventive vaccinations on the market to prevent HPV infection and has made significant advances in human vaccination. This study aimed to examine the relationship between the provider facility type and HPV vaccination rates, among African American teenagers. By exploring the potential relation of the two, we hope to inform programs and further studies into boosting HPV vaccination rates by targeted provider-based interventions.
Methods: This cross-sectional study was conducted using data from the National Immunization Survey for Teen (NIS-TEEN) for the year 2021. This study focused on African American teenagers, aged 13 to 17 years, living in non-institutionalized households in
the United States in 2021. Data was collected in two phases -the household interview phase and the provider data collection phase. Statistical analysis was conducted using weighted provider data, and all analysis was done using SAS Studio 3.81.
Results: Provider facility type was significantly associated with HPV vaccination status ($p \leq 0.0001$). Specifically, respondents who used hospital facilities and public facilities had higher odds of having received at least one dose of the HPV vaccine when compared to those who used private facilities (OR=1.86; 95%CI; 1.84,1.89) and (OR=1.72; 95% CI; 1.70, 1.74) respectively.
Conclusions: Results of this study suggest that provider facility type is associated with HPV vaccination status among African American teens in the US. There is however a need for definitive longitudinal studies to establish the relationship between provider type and HPV vaccination rates in African American teens.

Keywords: HPV Vaccination, African American research, Health-provider facility, Vaccination predictors, NIS-Teen

INTRODUCTION

Human Papilloma Virus (HPV) infection is the most common Sexually Transmitted Infection (STI) in the United States (US), and every year, approximately 26,000 new cancers are diagnosed in women and men as a result of oncogenic HPV infection. Recent US population-based studies conducted by the Centers for Disease Control and Prevention (CDC) show that 66% of cervical cancers, 55% of vaginal cancers, 79% of anal cancers, and 62% of oropharyngeal cancers are attributable to oncogenic HPV types 16 or 18.[1] According to data from 2003 to 2006, prior

to the development of effective vaccines for HPV, an estimated 79 million people in the United States were infected with HPV. Each year, there are about 14 million new HPV infections, with those between the ages of 15 and 24 accounting for about half of these cases. In the United States, men aged 18 to 59 years old had genital prevalence of any of the 37 HPV types tested at 45.2%, and high-risk HPV types at 25.1% in 2013-2014. Additionally, during this time, American women in the same age group had genital prevalence rates of 39.9% for any of the 37 HPV types that had been tested and 20.4% for high-risk HPV types. After the quadrivalent HPV vaccine was made available in the United States in 2006, the prevalence of HPV types 6, 11, 16, and 18 fell by 86% among females aged 14 through 19 years and decreased 71% among females aged 20 through 24 years.[2] The HPV vaccine is one of the most efficient preventive vaccinations on the market and has made significant advances in human vaccination. They are the first vaccines to do so without specifically inducing mucosal immunity, making them effective against sexually transmitted infectious agents having mucosatropic properties. Additionally, these are the first subunit vaccinations that reliably cause persistent, long-lasting serum antibody responses (lasting more than ten years). Without requiring a further booster shot, HPV vaccinations seem to establish sterilizing immunity from the initial infection for at least ten years.[3] Two companies, GlaxoSmithKline Biologicals (GSK) and Merck & Co., undertook the initial commercial development of HPV vaccinations. HPV-16 and HPV-18 were combined to create Cervarix, a bivalent vaccine made by GSK. With HPV-16 and HPV-18 as well as HPV-6 and HPV-11 VLPs, Merck created the quadrivalent vaccination Gardasil. The adjuvants and the viral L1 protein production cells are other distinctions between the two vaccinations. Later, Merck created a nonavalent vaccine called Gardasil 9, which is similar to Gardasil but contains L1 VLPs of five more HPV oncogenic types: 31, 33, 45, 52, and 58. This vaccination has the potential to provide type-specific protection against 90% of cervical malignancies worldwide.[4] A top public health priority in the US is enhancing the administration of the HPV vaccine. Even though there are national recommendations for the routine administration of the HPV vaccine to teenagers between the ages of 11 and 12, only 40% of girls and 22% of boys finished the 3-dose series in 2014. Research into factors affecting HPV vaccination has expanded quickly as a result of the continually low levels of coverage, and studies have repeatedly shown the significant impact of healthcare professionals' communication on vaccination rates. Specifically, teenagers who were advised by their providers were more likely to start the vaccination process than those who did not.[5] HPV vaccination decisions were additionally hindered by a lack of understanding about HPV and HPV vaccines, access issues, insurance coverage issues, logistical issues (cost and a lack of alternate locations), and a lack of provider recommendations.[6] Generally, vaccine coverage studies have found that vaccination rates tend to rise as the number of contacts with healthcare professionals increases, with rates being greater for children who had a well-child visit with their providers and had insurance coverage.[7] While there are studies investigating the general factors that promote HPV vaccination hesitancy amongst teenagers as well as studies linking provider visit to increased vaccination rates, to our knowledge there are no studies which have looked into associating HPV vaccination rates with the "type" of provider facility utilized by the teens. Moreover, there are limited studies looking into this association among African American teenagers, who are underrepresented in research. This study aimed to fill this literature gap by examining the relationship between the provider facility type and provider reported reception of at least one dose of HPV vaccination, among African American teenagers. By exploring the potential relation of the two, we hope to inform programs and further studies into boosting HPV vaccination rates by targeted provider-based interventions.

METHODS

Data source

This study was conducted using the National Immunization Survey for Teen (NIS-TEEN) database for the year 2021. The NIS-TEEN surveys are conducted by the National Opinion Research Center (NORC) and sponsored by the Centers for Disease Control and Prevention, National Center for Immunization and Respiratory Diseases (CDC, NCIRD).They are a group of yearly random-digit-dialed telephone surveys used to track routine adolescent vaccination coverage in the US for the following routine adolescent vaccines: tetanus, diphtheria, acellular pertussis (TDaP), meningococcal conjugate (MenACWY), HPV and Influenza vaccine (flu). The NIS-TEEN started in 2006 and currently uses a single-frame sample of cell phone lines to reach participants in the US. The 2021 National Immunization Survey for Teen (NIS-TEEN) Public Use Data is de-identified. Hence, this study was not submitted for research ethics approval as the activities described use de-identified data.

Study design

This study used a cross-sectional observational design. The NIS-TEEN 2021 is a nationally representative public health survey of a stratified, probability sample of households in the US. The NIS-TEEN 2021 household interviews began on January 7, 2021 and ended on 3 February 2022.[8]

Study population

Our study population was African American teenagers, aged 13 to 17 years, living in non-institutionalized households in the US in 2021. We utilized data for teens living in 59 geographical stata which included the 50 states of the US but did not use data for the US territories. Participants who were living in the US territories and were younger than 13 or older than 17, were excluded from this

study. We also excluded non-African-American teens and teens who did not consent to provider data collection.

Data collection

Data was collected in two phases from the national probability sample: The household interview phase and the provider data collection phase.[8]

Phase one: Data was collected through telephone interviews with parents/guardians of teens in the estimation areas. Cell phone numbers were randomly selected from a single frame sample provided by the Marketing Systems Group (MSG), called and the receivers were screened for age-eligible teens in their households. Age-eligible teens from each household were enrolled and the person most knowledgeable about their vaccination history was interviewed. The names and location of their vaccination provider(s) were collected, and consent was gotten to contact them and use their data. This phase lasted four weeks. The sample frame had 12.1 million phone numbers and 724,820 households were successfully screened. 63,723 households had age-eligible teens and interviews were completed for 45,036 teens. Phase two: A questionnaire was then mailed to each enrollee's vaccination provider(s) to collect information on their vaccination history.

Information collected included the types of vaccination, number of doses and dates of administration of the vaccine, as well as information about the vaccination providers. The Advisory Committee on Immunization Practices (ACIP) guidelines were then used to classify the enrolled teens as being up to date or not based on the recommended number of doses for each vaccine. Consent was gotten from enrollees to contact their vaccination provider(s) and 18,352 of them had adequate provider data.

Statistical analysis

The primary outcome of interest for this study was the HPV vaccination status of the respondents. Weighted provider data was utilized to account for the respondents who did not grant access to provider interviews. The vaccination status responses were dichotomized, (i.e., given a value of 0 or 1) for the analysis with '0' representing having received any dose of HPV vaccination and '1' representing not having received at least one dose of HPV vaccination. Categorical variables were compared using the Pearson Chi Square to identify significant univariate associations and differences between groups in the outcomes were reported as percentages. Crude and Insurance status adjusted Odds ratios of the baseline demographic variables by outcome was analyzed, with all variables included in the multivariate logistic regression model to test the relationship between provider facility type and HPV vaccination status. The statistical analysis was done using the SAS Studio 3.81. A two-sided p value <0.05 was considered statistically significant for all analysis.

RESULTS

Table 1 shows the characteristics of the NIS-TEEN 2021 that received at least one dose of the HPV vaccine in comparison to those who had not received a dose of HPV vaccine. Most of the survey respondents were females in both groups and the majority had mothers between the ages of 35-44 yrs. Majority of the respondents that had received at least one dose of HPV vaccine, were aged 13 years while the majority in the group that had not received at least one dose of HPV vaccine were aged 15 years. Focusing on the provider facility type, most respondents in both groups assessed care from private facilities (58.3% and 52.6%) and had attended a well child exam at age 11 (50.9% and 54.6%). Both groups differed at a statistically significant level in terms of the baseline demographic variables. Table 2 shows the crude and Insurance-Adjusted Associations for participants that have received at least one dose of HPV Vaccine.

Crude analysis revealed that compared to female respondents, male respondents had 0.96 times the odds of receiving a dose of HPV vaccine (95%CI, 0.96, 0.97) and after insurance adjustments the odds was 0.92 (95%CI 0.91, 0.92). Similarly, participants who had not attended a well child exam at age 11 had 0.87 times the odds of receiving a dose of HPV vaccine (95%CI 0.86, 0.87) and after insurance adjustments the odds was 0.83 (95%CI 0.83, 0.84). Confounding by insurance status was noted amongst some of the baseline characteristic variables. Specifically, most of the crude odd's ratios in the relationship between HPV vaccination status and respondents' mothers age, teens age, income, mothers' education, provider facility type differed significantly from the odds ratios calculated after insurance adjustment. Looking at the provider facility type, crude analysis showed that compared to the teenagers that utilized private facilities, those who used hospitals facilities (OR=1.83; 95%CI 1.81, 1.85) and public facilities (OR=1.68; 95%CI 1.66, 1.70) had higher odds of receiving at least a dose of the HPV vaccine. Following insurance adjustments, the odds ratios changed significantly to (OR=1.64; 95%CI 1.62, 1.66) and (OR=1.43, 95%CI 1.41, 1.44) for hospital and public facilities respectively. Also, crude analysis for those who used a mixture of facility types (OR=0.94, 95%CI 0.94, 0.95) revealed lower odds when compared to those that used private facilities. After insurance adjustments the odds of receiving at least one dose of the HPV vaccine was now (OR=0.80, 95%CI 0.80, 0.81) for teenagers that used mixed facility types.

Table 3 shows the multivariable adjusted Odds Ratios for select characteristics for participants that have received at least one dose of HPV Vaccine. Overall, all characteristics included in the model were associated with HPV vaccination status with statistically significant p values <0.05. Following adjustments of all other variables in the model, when compared to the female respondents, male respondents had less odds of receiving the HPV vaccine (OR=0.93, 95%CI 0.93, 0.94).

Table 1: Characteristics of NIS-TEEN 2021 participants that have received at least one dose of HPV vaccine compared to participants that have not.

Parameters	Provider validated HPV Vaccination status				Chi-square (p value)
	Have not received a dose		Have received a dose		
	N	%	N	%	
Sex					
Male	237712	49.9	930032	49.0	140.9 (<0.0001)
Female	238426	50.1	969424	51.0	
Age (mother's age) (years)					1284.8 (<0.0001)
≤34	35625	7.5	172842	9.1	
35-44	247191	51.9	959694	50.5	
≥45	193322	40.6	766920	40.38	
Age (teen's age) (years)					29050.5 (<0.0001)
13	126849	26.6	363578	19.1	
14	102979	21.6	409712	21.6	
15	73005	15.3	433248	22.8	
16	106590	22.4	339411	17.9	
17	66714	14.0	353507	18.6	
Well child exam					
Yes	242521	50.9	1037198	54.6	2063.4 (<0.0001)
No	233617	49.1	862258	45.4	
Income					
<35K	103327	21.7	637571	33.6	
35K-75K	153482	32.2	486081	25.6	26048.8 (<0.0001)
>75K	184993	38.9	646274	34.0	
Unknown	34336	7.2	129530	6.8	
Mother's education					
≤12 years	153944	32.3	681849	35.9	3122.7 (<0.0001)
>12 but not college grad	142614	30.0	501907	26.4	
College grad	179580	37.7	715700	37.7	
Provider facility					
Public facilities	49973	10.5	302166	15.9	
Hospital facilities	35980	7.6	236519	12.5	23673.2 (<0.0001)
Private facilities	277427	58.3	998435	52.6	
Others	19344	4.0	45032	2.4	
Mixed	93414	19.6	317305	16.7	
Insurance status					
Private only	278954	58.6	769902	40.5	
Any Medicaid	147669	31.0	974580	51.3	70088.5 (<0.0001)
Other	31867.0	6.7	69436	3.7	
Uninsured	17648	3.7	85536	4.5	

[a]This includes school/teen clinics; [b]Insurance continuity since age 11.

Table 2: Crude and insurance-adjusted associations for participants that have received at least one dose of HPV vaccine.

Characteristic	Odds Ratio	Crude 95% CI	Odds Ratio	Insurance Adjusted* 95% CI
Sex				
Male	0.96	(0.96-0.97)	0.92	(0.91-0.92)
Female	1.00		1.00	
Age (Mother's age) (years)				
≤34	1.22	(1.21-1.24)	1.02	(1.00-1.03)
35-44	0.98	(0.97-0.99)	0.87	(0.86-0.88)
≥45	1.00	-	1.00	-
Age (Teen's age) (years)				

Continued.

Characteristic	Odds Ratio	Crude 95% CI	Odds Ratio	Insurance Adjusted* 95% CI
13	0.54	(0.54-0.55)	0.63	(0.63-0.64)
14	0.75	(0.74-0.76)	0.85	(0.84-0.85)
15	1.12	(1.11-1.13)	1.27	(1.26-1.29)
16	0.60	(0.60-0.61)	0.64	(0.63-0.64)
17	1.00	-	1.00	-
Well child exam				
Yes	1.00	(0.86-0.87)	1.00	(0.83-0.84)
No	0.86		0.83	
Income				
<35K	1.77	(1.75-1.78)	1.08	(1.07-1.10)
35K-75K	0.91	(0.90-0.91)	0.54	(0.53-0.54)
>75K	1.00		1.00	
Unknown	1.07	(1.07-1.09)	0.76	(0.75-0.77)
Mother's education				
≤12 years	1.11	(1.10-1.12)	0.74	(0.73-0.75)
>12 but not college grad	0.88	(0.88-0.89)	0.69	(0.69-0.70)
College grad	1.00	-	1.00	-
Provider facility				
Public facilities	1.68	(1.66-1.70)	1.43	(1.41-1.44)
Hospital facilities	1.83	(1.81-1.85)	1.64	(1.62-1.66)
Private facilities	1.00	-	1.00	-
Othersa	0.65	(0.64-0.66)	0.62	(0.61-0.64)
Mixed	0.94	(0.94-0.95)	0.80	(0.80-0.81)
Insurance status				
Private only	0.57	(0.56-0.58)	-	-
Any medicaid	1.36	(1.34-1.39)	-	-
Otherb	0.45	(0.44-0.46)	-	-
Uninsured	1.00	-	1.00	-

Table 3: Multivariable adjusted Odds Ratios for select characteristics for participants that have received at least one dose of HPV vaccine (n=1566).

Characteristic	% of total cases or mean*	Odds Ratio	95% CI	P value
Sex				
Male	49.20	0.93	(0.93-0.94)	<0.0001
Female	50.80			
Age (Mother's age) (years)				
≤34	8.78	1.20	(1.19-1.21)	<0.0001
35-44	50.85	0.92	(0.91-0.92)	
≥45	40.37			
Teen's age	14.91	1.11	(1.11-1.11)	<0.0001
Well child Exam				
Yes	53.83	0.75	(0.74-0.75)	<0.0001
No	46.17			
Income				
<35K	31.22	0.94	(0.93-0.95)	<0.0001
35K-75K	26.95	0.61	(0.60-0.61)	
>75K	35.02			
Unknown	6.82	0.74	(0.73-0.75)	
Mother's education				
≤12 years	35.13	0.63	(0.62-0.64)	<0.0001
>12 but not college grad	27.15	0.65	(0.65-0.66)	
College grad	37.72	-	-	
Provider facility				
Public facilities	14.84	1.72	(1.70-1.74)	<0.0001
Hospital facilities	11.48	1.86	(1.84-1.89)	

Continued.

Characteristic	% of total cases or mean*	Odds Ratio	95% CI	P value
Private facilities	53.75	-	-	
Othersa	2.62	0.73	(0.72-0.75)	
Mixed	17.30	0.84	(0.84-0.84)	
Insurance status				
Private only	44.19	0.44	(0.43-0.45)	
Any medicaid	47.28	1.32	(1.30-1.35)	<0.0001
Otherb	4.18	0.43	0.41-0.43)	
Uninsured	4.35	-	-	

Also, after adjustment, participants who had not attended a well child exam at age 11 had less odds (OR=0.74, 95%CI 0.74, 0.75) of receiving at least one dose of HPV vaccine when compared to those who had a well child exam. For the provider facility types, after controlling for all other variables in the model, respondents who used hospital facilities (OR=1.86, 95%CI 1.84, 1.89) and public facilities (OR=1.72, 95%CI 1.70, 1.74) had higher odds of receiving the HPV vaccine when compared to those who used private facilities while those who used mixed facilities had lower odds (OR=0.84, 95%CI 0.84, 0.84) when compared to private facility users. Additionally, after adjustments, when compared to the uninsured, respondents who used any MEDICAID had higher odds (OR=1.32, 95% CI 1.30, 1.35) of receiving the HPV vaccine.

DISCUSSION

Current study looked at HPV vaccination rates among African Americans teenagers and provider facility type. Identifying factors that affect HPV vaccination rates is crucial in implementing interventions that could improve the vaccination rates. Our study found that provider facility type was associated with HPV Vaccination rate. Respondents who used hospital facilities and public facilities had higher odds when compared to private facilities users of having received at least one dose of the HPV vaccine.

While there is no clear-cut reason for this, a prior study looking into the influence of public health systems on childhood vaccination rates revealed that more children attending private clinics had delays in receiving vaccines scheduled for the first 2 years of life, compared to those who attended the public clinic.[9] However, another study found no significant differences in the vaccinate rates for public and private providers.[10] Attendance of a well child examination at age 11 was significantly associated with HPV vaccination rates. Teenagers that had not undergone a well-child exam had less odds of having received at least one dose of the HPV vaccine when compared with those who attended the well-child exam. We think this may be due to the opportunity for provider education and promotion of vaccination which the well child visit provides. Another possible cause for the lower odds may be better health seeking behavior, adherence practices and perceptions among the caregivers who adhered to well child visits. If they are more likely to adhere to well child examinations, they may be more likely to initiate and complete HPV vaccinations. Moreover, the well child exam which serves to ascertain if a child's needs, specific to his age, are being met is an invaluable opportunity for parent-teenager health education.[11-13]

Parental knowledge of HPV is an important predictor of HPV vaccination and was found to be the factor most strongly associated with adolescent vaccination status in the US, Australia, and the UK.[14] A prior study found that parents knowledgeable on HPV vaccination were more likely to indicate to have their children vaccinated, in comparison to those who were not, and most of the parents included in the study had reported prior attendance of a well child examination.[15] Our study additionally found that insurance status was significantly associated with HPV vaccination rate. Teenagers who were medically insured using Medicaid had higher odds of having received one dose of the HPV vaccine when compared to teenagers without insurance. As seen in multiple studies, having health insurance leads to higher odds of receiving essential vaccines, and evidence shows that vaccination coverage was increased (at least doubled) as the population with insurance coverage increased.[16-19] Males were found to have lower odds of receiving the HPV vaccination. This may be due to the more popular knowledge of the strong association of HPV with cervical cancer.[20] This may create the perception especially among parents with little formal education that males may not need the HPV vaccination as much as the females do. The lack of provider recommendation may also have a role to play. Over half of the parents of males in one study did not receive HPV vaccine recommendations from their provider, in comparison to a third in their female counterparts. The same study also found that the reasons parents of males would not vaccinate their sons were majorly lack of recommendation and presumption of it not being necessary.[21] This disparity exists despite the increase in oropharyngeal HPV associated cancers among men for which the HPV vaccination has also been recommended.[22] From 2014-2018 there have been 46,143 new cases of oropharyngeal HPV associated cancers, of which males accounted for 20,424 cases.[23] This calls for more health information to be shared with the African American community on the importance of HPV vaccination for male teenagers. Although strengthened by the large sample size, this study is however not without limitations. The NIS TEEN 2021 database utilized in this study, is based on a cross sectional study design, hence we are unable to

establish causality or examine for temporality in the relationship between provider facility type and HPV vaccination rates. Furthermore, having relied on surveys, the responses may be subject to recall bias and non-response bias. We were, however, able to counterbalance these limitations by using provider validated data to reduce recall bias in ascertaining HPV vaccination rates and provider facility type. We also used provider weighted variables provided by the NIS-TEEN 2021 statistical team to account for the responders who declined access to provider verification of data, thereby reducing non-response bias.

CONCLUSION

Results of the study indicate that provider facility type is associated with HPV vaccination rates among African American teenagers in the US. The odds of receiving at least one dose of HPV vaccine are higher in teens who used hospital facilities and public facilities when compared to those that used private facilities. Teens who had undergone a well child exam also had higher odds of receiving one dose of the HPV vaccine. While suggestive, there is a need for further longitudinal studies to adequately define the relationship between provider type and HPV vaccination rates in African American teens in the US and ascertain why differences exist among different facility types. In the meantime, results from this study emphasize the need to direct provider-based vaccination interventions to private provider facilities, and the need to promote awareness and attendance of well child examinations at age 11.

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