Published in final edited form as:

Clin Pediatr (Phila). 2015 December ; 54(14): 1328–1333. doi:10.1177/0009922815579687.

Correlates of human papillomavirus vaccine completion among adolescent girl initiators

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Abstract

OBJECTIVE—To examine correlates of vaccine series completion among young adolescent US girls who initiated the human papillomavirus (HPV) vaccine.

METHODS—We analyzed National Immunization Survey-Teens 2012 provider-verified data to examine correlates of HPV vaccine completion among 13-17 year old girls who initiated HPV vaccine in 2012 (N=4,548).

RESULTS—The weighted vaccine series completion rate among 13-17 year old girl initiators was 66.7% (95% confidence interval (CI), 64.0-69.3). Adolescent girls who were older, residents of the Northeast (adjusted prevalence ratio (aPR) 1.36, 95% CI 1.07-1.73), and had provider-verified seasonal influenza vaccination in the past year (aPR 1.67, 95% CI 1.32-2.11) and provider recommendation (aPR 1.40, 95% CI 1.10-1.77) were more likely to complete the 3-dose vaccine series.

CONCLUSIONS—Parents of younger adolescent girls need to be educated about the importance of completing the 3-dose HPV vaccine series. Provider recommendation for the vaccine would also facilitate series completion.

Keywords

Human papillomavirus (HPV) vaccine; vaccine initiation; vaccine completion; correlates; adolescent girls

INTRODUCTION

Human papillomavirus (HPV) is the most prevalent sexually transmitted infection in the USA.¹ Although research has demonstrated high HPV vaccine efficacy (90-100%) in preventing HPV vaccine type-related infections and precancerous lesions among sexually

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Conflict of interest: None

Financial disclosure: None of the authors has any financial disclosure

active adolescents and young women,²⁻⁶ a recent national study based on 13-17 year old girls observed low vaccine uptake (53% initiation and 35% completion)⁷. Thus, among adolescent girls who initiated the vaccine, almost one-third did not complete the vaccine series and may not be adequately protected.⁸ This situation is inefficient for the patient and the health care system.

Several studies,⁹⁻¹⁵ including our earlier study,⁷ have examined the correlates of completion among adolescent girls based on parental report or provider-verified HPV vaccine information. It is important, however, to understand why women who initiate the vaccine do not complete the series as barriers to HPV vaccine initiation, overall completion and completion among initiators are reported to differ.¹⁶ To date, few studies using a nationally representative sample of adolescent girls have examined correlates of HPV vaccination among initiators.^{9,10} These estimates were either based on provider-verified vaccination information⁹ or self-reported responses¹⁰. The one study using provider-verified vaccination information was based on 2008-2009 data, when the HPV vaccine was new and uptake was very low. Further studies are needed to examine correlates among adolescent girls, using the most recently available provider-verified HPV vaccination data. The objective of this study was to examine correlates of HPV vaccine series completion among 13-17 year old adolescent girl initiators using data from the 2012 National Immunization Survey–Teen (NIS-Teen).

METHODS

Study Population

The Centers for Disease Control and Prevention conducts the NIS-Teen study every year to obtain vaccination information on adolescents aged 13–17 year from parents or household members based on a stratified national probability sample of households in the US using two phases of data collection: (1) a random-digit-dialed telephone survey and (2) a mailed survey to adolescents' immunization providers identified by the parents/guardians during the telephone survey.¹⁷ Unlike data collected in earlier years, starting in 2011, NIS-Teen collected data from both landline and cellphone household samples. Details of NIS-Teen methodology have been reported elsewhere.¹⁸ This study did not require approval by the UTMB Institutional Review Board as we used NIS-Teen publicly available de-identified database.

Data

Household interviews for 15,625 adolescent girls were conducted; of whom 9,320 had provider-verified HPV vaccination information and 4,972 initiated the HPV vaccine in 2012. We excluded 359 respondents as they did not have enough time (24 weeks) to complete the series within 2012. Finally, 65 observations from U.S. Virgin Islands who had provider-verified HPV vaccination were excluded. Thus, 4,548 observations were used for the final analyses. We considered provider-verified HPV vaccine completion (3 doses) among initiators (1 dose) as the primary outcome variable. Predictor variables included socio-demographic characteristics, parental report of receiving a provider recommendation for the HPV vaccine, healthcare utilization variables, and region of residence. Information on

whether the participant had provider recommendation for the HPV vaccine was obtained from parents using the following question, “Had or has doctor or other health care professional ever recommended that teen receive HPV shots?” The response options were “yes”, “no”, “don’t know” and “refused”. Socio-demographic characteristics included information about the teen, mother, and household. Respondents provided data on their age as well as their relationship to the adolescent (mother, father, other) and the adolescent’s age at interview, race/ethnicity, provider-verified seasonal influenza vaccination in the past year, and health care coverage. Data from all states were categorized into four distinct regions: Northeast, Midwest, West and South after excluding observations from the US Virgin Islands.¹⁹

Analysis

STATA 12 *svy* commands, incorporating probability sampling weighting, were used for data analysis. Chi square tests and log-binomial regression models were used for bivariate and multivariable comparisons, respectively. Adjusted prevalence ratios (aPR) and 95% confidence intervals (CI) were reported for each of the correlates. Any variables that were unevenly distributed by HPV vaccine series completion status were controlled for in the multivariable model. Candidate variables with $P \leq 0.20$ were included in the initial multivariable model while variables with $P > 0.20$ were excluded from the final model.

RESULTS

Overall, 4,548 adolescent girls initiated the HPV vaccine and were eligible to complete the 3-dose vaccine series in 2012; of whom 3,245 completed the 3-dose series. The weighted vaccine series completion rate among those who initiated the vaccine was 66.7% (95% CI, 64.0-69.3). In bivariate analysis, girls who were older, non-Hispanic whites, residents of Northeastern states, whose mother was married or a college graduate, and had higher family income, health care coverage, provider recommendation for HPV vaccine, and seasonal influenza vaccination in the past year were more likely to complete the 3-dose series (Table 1).

All socio-demographic characteristics and healthcare utilization variables (Table 1) were included in the initial multivariable model. Variables with $P > 0.20$ were excluded from the final model. In multivariable analysis (Table 2), the following characteristics were associated with higher HPV vaccine completion among initiators: older age of the adolescent girl, provider-verified seasonal influenza vaccination in the past year (aPR 1.67, 95% CI 1.32-2.11, $P < .001$) and provider recommendation for the HPV vaccine (aPR 1.40, 95% CI 1.10-1.77, $P = .006$). Residents of the Northeast also had higher odds of completing the series (aPR 1.36, 95% CI 1.07-1.73, $P = .013$) compared to the other regions of the US.

DISCUSSION

In this study, we observed a substantial increase (66.7%) in HPV vaccine series completion among adolescent girl initiators compared to a similar study based on NIS-Teen 2008-2009 data (53.3%).⁹ In addition to age, race/ethnicity and provider recommendation, we also observed that history of seasonal influenza vaccination in the past year and region were

correlates of HPV vaccine series completion among initiators. Authors of the previous study observed that non-Hispanic blacks and Hispanics adolescent girls were less likely to complete while girls aged 16 years were more likely to complete the series. However, in this study we observed that only Hispanic girls were less likely to complete and compared to 13 year old girls, 14-17 year old girls were more likely to complete the series. The differences between these two studies could be explained by higher vaccine series completion observed in our study and study year.

We observed that older adolescent girls were more likely to complete the vaccine series compared to younger girls. As the prevalence of HPV infection increases with each increasing year between 14 and 24 years of age,²⁰ HPV vaccine series completion at a young age is critical. Moreover, HPV vaccine efficacy is highest among HPV-naïve adolescent girls. Thus, adolescent girls who had <3 doses of HPV vaccine may not be adequately protected.⁸ A notable improvement in the mean of age of HPV vaccine completion was observed during 2008-2012 (from 14.7 years to 13.1 years).²¹ Intervention programs to improve HPV vaccine series completion during early adolescence are warranted to ensure adequate protection against HPV-related diseases.

Similar to results in this study, other studies have observed higher HPV vaccine initiation and completion rates among adolescent girls who have been vaccinated against influenza in the past season.²² This association likely reflects the overall attitude of people regarding preventive health services and suggests that those who follow prevention guidelines may be a good population to target for assistance in obtaining follow-up HPV injections. It is important to reinforce providers that all visits for preventive healthcare provide an excellent opportunity to discuss the importance of initiating and completing the HPV vaccine series.

Provider recommendation has been reported to be the most important facilitator to increasing HPV vaccine initiation among adolescent children,^{9,23-25} although only 59% of parents reported that they had ever received a provider recommendation to vaccinate their adolescent daughters.²⁶ Similarly, we also observed that provider recommendation was a significant predictor of vaccine series completion. Together, these studies suggest that provider recommendation is not only important for HPV vaccine initiation, but it is also crucial for completing the series. Future studies are also needed to better understand why physicians may not provide a recommendation for the HPV vaccine, as well as, to identify strategies to improve the provider's ability to effectively communicate their recommendation.

HPV vaccine initiation has been reported to be lower in Southern states than other regions of the US.⁷ We also observed that HPV vaccine completion among initiators was lower in the South and West/Mid-Western states as compared to Northeastern states. As the incidence of cervical cancer is highest in the South,²⁷ a lower rate of HPV vaccine initiation and completion among initiators in the South, may contribute to a continued higher cervical cancer burden in this region. Thus, additional efforts are needed to increase completion of HPV vaccination in this region.

The strengths of this study include data from a large nationally representative sample of adolescent girls in the US, provider-verified vaccination information, and a sampling frame including both landlines and cellphones. It should be noted, however, that correlates based on telephone surveys may be subject to recall bias as they are self-reported. In addition, nonresponse bias may have remained even after using sampling weights in the analyses.

This study provides important information about the correlates of HPV vaccine completion among initiators using provider-verified vaccination status. Overall, families with an adolescent girl who had initiated the HPV vaccine may need additional support or reminders to complete the 3-dose series.

Acknowledgments

Funding: Dr. McGrath is supported by a research career development award (K12HD052023: Building Interdisciplinary Research Careers in Women's Health Program –BIRCWH, PI: Berenson) from the Office of Research on Women's Health (ORWH), the Office of the Director (OD), the National Institute of Allergy and Infectious Diseases (NIAID), and NICHD at the National Institutes of Health.

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Table 1

Characteristics of 13-17 year old adolescent girls by HPV vaccine completion among initiators (1 dose)

Characteristics	Total (N=4,548)	Completed 3-dose series	
		% (95% CI)	P value
Age of girls, years			<.001
13	727	49.9 (43.6-56.3)	
14	815	64.4 (57.2-71.0)	
15	981	68.9 (63.5-73.9)	
16	1050	73.1 (68.2-77.6)	
17	975	72.4 (65.9-78.0)	
Age of mothers, years			.175
34	376	62.3 (53.4-70.4)	
35-44	1852	65.1 (60.9-69.1)	
45	2320	69.5 (65.6-73.1)	
Girls' race/ethnicity			.003
Non-Hispanic white	2906	71.8 (69.0-74.4)	
Non-Hispanic black	458	63.7 (56.3-70.6)	
Hispanic	715	59.3 (52.3-66.0)	
Non-Hispanic other ^a	469	64.1 (54.4-72.7)	
Marital status of the respondent			.010
Married	3220	69.6 (66.5-72.5)	
Not married	1328	62.2 (57.2-66.9)	
Mother' education level			.003
<HS	540	62.8 (54.6-70.4)	
HS graduate	900	61.4 (55.3-67.2)	
Some college hours	1213	65.4 (60.8-69.8)	
College graduate	1895	74.1 (70.5-77.5)	
Family income (% of the federal poverty line)			.004
<100%	874	60.7 (54.8-66.3)	
100% to <200%	722	66.9 (61.0-72.3)	
200%	2723	71.1 (67.9-74.1)	
Having healthcare coverage			.031
No	263	56.2 (45.6-66.3)	
Yes	4285	67.6 (64.8-70.3)	
Respondent's relation to the girl			.989
Mother	3596	66.8 (63.7-69.7)	
Father, grandparent, other	951	66.7 (61.3-71.7)	
Provider-confirmed seasonal influenza vaccination in the past year			<.001
No	3180	63.1 (59.8-66.3)	
Yes ^b	1368	75.5 (71.0-79.5)	
Had a physician (or other healthcare			.355

Characteristics	Total (N=4,548)	Completed 3-dose series	
		% (95% CI)	P value
provider) visit in the past 12 months			
No	566	63.7 (55.8-70.8)	
Yes	3950	67.4 (64.5-70.2)	
Had provider recommendation			<.001
No	813	56.8 (50.7-62.6)	
Yes	3524	65.3 (67.3-73.1)	
Region			<.001
Northeast	942	75.0 (70.3-79.1)	
Midwest/South/West ^c	3606	64.9 (61.7-67.9)	

Numbers may not sum up due to missing data

All values are weighted; HS= High School; HPV=Human papillomavirus

^aAlso Included multiracial

^bIncluded those who had provider-verified seasonal flu vaccination in 2011

^cAs completion rate in the South, Midwest and West was similar, they were combined.

Table 2

Correlates of HPV vaccine series completion among 13-17 year old US adolescent girls

Characteristics	Completed 3-dose series among initiators	
	Adjusted prevalence ratio (95% CI) ^{a,b}	P value
Age of girls, years		
13	Reference	
14	1.71 (1.28-2.29)	<.001
15	1.83 (1.37-2.45)	<.001
16	2.16 (1.63-2.87)	<.001
17	2.39 (1.71-3.34)	<.001
Girls' race/ethnicity		
Non-Hispanic white	Reference	
Non-Hispanic black	0.83 (0.62-1.11)	.211
Hispanic	0.72 (0.55-0.94)	.017
Non-Hispanic other ^c	0.78 (0.55-1.12)	.174
Mother' education level		
<HS	Reference	
HS graduate	0.74 (0.52-1.05)	.092
Some college hours	0.75 (0.54-1.05)	.098
College graduate	1.00 (0.71-1.40)	.991
Provider-confirmed seasonal influenza vaccination in the past year		
No	Reference	
Yes ^d	1.67 (1.32-2.11)	<.001
Had provider recommendation for the HPV vaccine		
No	Reference	
Yes	1.40 (1.10-1.77)	.006
Region		
Midwest/South/West ^e	Reference	
Northeast	1.36 (1.07-1.73)	.013

CI=Confidence interval

^aLog-binomial regression model was used to examine correlates of HPV vaccine completion among initiators. All characteristics were included in an initial multivariable model. Variables with $P>0.20$ were excluded from the final model.

^bAdjusted by the variables listed in this Table.

^cAlso includes multiple races

^dIncluded those who had provider-verified seasonal flu vaccination in 2011

^eAs completion rate in the South, Midwest and West was similar, they were combined.