Correlates of HPV Vaccination among Adolescent Females from Appalachia and Reasons Why Their Parents Do Not Intend to Vaccinate

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Abstract

Limited research has examined HPV vaccination in Appalachia, a region with cervical cancer disparities. We analyzed 2008–2010 National Immunization Survey-Teen data for adolescent females ages 13–17 from Appalachia (n=1,951) to identify correlates of HPV vaccination and reasons why their parents do not intend to vaccinate. HPV vaccine initiation was 40.8%, completion was 27.7%, and follow-through was 67.8%. Vaccination outcomes tended to be higher among females who were older, had visited their healthcare provider in the last year, or whose parents reported receiving a provider recommendation to vaccinate. Only 41.0% of parents with unvaccinated daughters intended to vaccinate in the next year. The most common reasons for not intending to vaccinate were believing vaccination is not needed or not necessary (21.5%) and lack of knowledge (18.5%). Efforts to reduce missed opportunities for vaccination at healthcare visits and address reasons why parents are not vaccinating may help increase HPV vaccination in Appalachia.

Keywords

Human papillomavirus; HPV vaccine; Appalachia; Cancer; NIS-Teen

Introduction

Several populations in the U.S. continue to suffer from cervical cancer disparities, including females from Appalachia. Appalachia is a 13-state region (from New York to Mississippi) containing about 8% of the U.S. population [1]. Parts of Appalachia have among the highest cervical cancer incidence and mortality rates in the country [2,3]. Human papillomavirus (HPV) vaccination offers a strategy for reducing these disparities. Guidelines currently

recommend that all females ages 11–12 receive three doses of HPV vaccine, with catch-up vaccination for ages 13–26 [4].

Most healthcare facilities in Appalachia have HPV vaccine available [5], and vaccine acceptability is fairly high among Appalachian adults [6,7]. We previously found that HPV vaccine uptake among adolescent females from Appalachia was generally comparable to the rest of the U.S. [8]. Although several studies have identified correlates of HPV vaccination [9], none have done so among adolescent females from Appalachia or identified reasons why Appalachian parents do not intend to vaccinate. Such information will be useful to future efforts to increase HPV vaccination in Appalachia.

Materials and Methods

Study Design

We analyzed data from the National Immunization Survey-Teen (NIS-Teen), an annual survey conducted by the Centers for Disease Control and Prevention (CDC) that monitors adolescent vaccination among 13–17 year-olds in the U.S. [10]. The NIS-Teen collects data using a random-digit-dialed telephone survey with parents/guardians (referred to as "parents") of adolescents ages 13–17 and a mailed survey to adolescents' healthcare providers. We report NIS-Teen data from 2008–2010 (all publicly available years at the time of analysis) on 1,951 adolescent females from Appalachia with provider-verified vaccination records. Appalachian residence was established using county of residence and the Appalachian Regional Commission's county classification scheme [11].

Data collection for the NIS-Teen was approved by the National Center for Health Statistics (NCHS) Research Ethics Review Board (ERB). Analysis of deidentified data from the survey is exempt from the federal regulations for the protection of human research participants. We accessed restricted data through the NCHS Research Data Center (RDC), including data on county of residence and parents' intent to vaccinate. Analysis of restricted data through the RDC is approved by the NCHS ERB. The Institutional Review Board at The Ohio State University determined this study was exempt from review.

Measures

We examined three dichotomous (yes or no) HPV vaccination outcomes: 1) initiation: receipt of at least one dose; 2) completion: receipt of three doses; and 3) follow-through: completion among initiators. Among parents with unvaccinated daughters, we examined intent to vaccinate their daughters in the next year. Surveys asked these parents. "How likely is it that [TEEN] will receive HPV shots in the next 12 months?" Response options included "very likely," "somewhat likely," "not sure/don't know," "not too likely," and "not likely at all." Parents who indicated one of the latter three responses were asked, "What is the main reason [TEEN] will not receive HPV shots in the next 12 months?" This open-ended survey item allowed parents to indicate multiple reasons, with the CDC coding responses into categories.

Parent surveys collected data on several characteristics (Table 1). We used county of residence to determine which Appalachian subregion adolescent females resided in. Appalachia can be divided into five subregions (Northern, North Central, Central, South Central, and Southern)[11], which are contiguous areas within Appalachia with similar characteristics (e.g., demographics, etc.).

Data Analysis

For each HPV vaccination outcome, we used logistic regression to first identify variables with $p<0.15$ in univariable analyses. We then entered these variables into a multivariable logistic regression model to produce adjusted odds ratios (ORs) and 95% confidence intervals (CIs). Analyses applied sampling weights, accounted for the complex design of the NIS-Teen, and combined data from multiple survey years using recommended methods [12]. Frequencies are not weighted. Statistical tests using SAS Version 9.2 (Cary, NC) were two-tailed with a critical alpha of 0.05.

Results

Initiation

About 40.8% (743/1951) of adolescent females had initiated the HPV vaccine regimen (Table 2). Initiation increased from 32.4% in 2008 to 45.4% in 2010. In multivariable analyses, initiation was more common among adolescent females who had visited their healthcare provider in the last year (OR=2.17, 95% CI: 1.42–3.34), whose parents had heard of HPV vaccine (OR=2.53, 95% CI: 1.14–5.63), or whose parents reported receiving a provider recommendation for vaccination (OR=4.07, 95% CI: 3.06–5.43). Initiation was lower among adolescent females from the Central (OR=0.47, 95% CI: 0.28–0.78) or Southern (OR=0.67, 95% CI: 0.47–0.95) subregions.

Completion

Overall, 27.7% (482/1951) of adolescent females had completed the HPV vaccine regimen (increasing from 19.2% in 2008 to 34.5% in 2010; Table 2). Adolescent females who were 17 years old (OR=2.04, 95% CI: 1.26–3.31), had visited their healthcare provider in the last year (OR=1.65, 95% CI: 1.00–2.72), had healthcare coverage other than through their parents' employer or union (OR=3.67, 95% CI: 1.32–10.20), or whose parents reported receiving a provider recommendation for vaccination (OR=2.71, 95% CI: 1.99–3.70) were more likely to have completed the vaccine regimen, in multivariable analyses. Completion was less common among adolescent females from the North Central (OR=0.54, 95% CI: 0.32–0.91), Central (OR=0.33, 95% CI: 0.19–0.57), or Southern (OR=0.48, 95% CI: 0.34–0.69) subregions.

Follow-Through

Most Appalachian females who initiated the HPV vaccine regimen received all three doses (67.8% [482/743]; Table 2). Follow-through increased from 59.4% in 2008 to 76.1% in 2010. In multivariable analyses, follow-through was more common among adolescent females who were 17 years old (OR=3.01, 95% CI: 1.48–6.11), had healthcare coverage other than through their parents' employer or union (OR=3.83, 95% CI: 1.04–14.09), or whose parents had heard of HPV (OR=2.33, 95% CI: 1.28–4.24). Follow-through was lower among adolescent females from the Central (OR=0.36, 95% CI: 0.17–0.75) or Southern (OR=0.36, 95% CI: 0.22– 0.61) subregions.

Intent and Reasons for Not Intending to Vaccinate

About 41.0% of parents with unvaccinated daughters indicated their daughters were "somewhat likely" or "very likely" to receive HPV vaccine in the next year. Just over half (50.3%) said their daughters were "not too likely" or "not likely at all" to receive the vaccine in the next year, while 8.7% were not sure. The most common main reasons for not intending to vaccinate were believing vaccination is not needed or not necessary (21.5%), lack of knowledge (18.5%), indicating daughters were not sexually active (17.1%), and concerns about vaccine safety or side effects (12.3%)(Table 3).

Discussion

Our results identify key leverage points for increasing HPV vaccination in Appalachia. Correlates were similar across vaccination outcomes and to those identified among other U.S. populations [9]. Initiation and completion were higher among daughters who had visited their healthcare provider in the last year or whose parents had received a provider recommendation for vaccination. These results continue to demonstrate the important role that contact with the healthcare system plays in HPV vaccination [13]. Although about 85% of daughters had a healthcare visit within the last year, only about half of parents reported receiving a provider recommendation for vaccination. Thus, there are still many missed opportunities for vaccination. Interventions targeting providers may help reduce missed opportunities and increase HPV vaccination in Appalachia.

Older adolescents had better rates of completion and follow-through, likely due to having more time and opportunities to receive all three doses. Adolescent females without healthcare coverage had lower rates of completion and follow-through. The Vaccines for Children (VFC) Program offers vaccines at no cost to certain children, including those without healthcare coverage [14]. However, some parents may not know their children are eligible for the VFC program and struggle to pay for three doses of HPV vaccine.

Vaccination outcomes tended to be lower in the Central and Southern subregions of Appalachia. As discussed previously [8], differences may be due to these subregions having fewer healthcare providers and higher levels of poverty [1,15]. These subregions also contain states in the U.S. "Bible Belt", many of which are among the most religious and politically conservative states [16]. Conservative political views and religious beliefs have been associated with lower HPV vaccine acceptability and uptake [17–19].

Over half of parents with unvaccinated daughters indicated they were unsure or not likely to vaccinate their daughters in the next year, which is somewhat discouraging. To increase HPV vaccination in Appalachia, efforts are needed to address reasons why Appalachian parents are not intending to vaccinate. Brief education sessions for parents may help address several of these reasons (e.g., lack of knowledge, concerns about vaccine safety, etc.), as such sessions have been successful in improving knowledge and beliefs about HPV vaccine [20].

Study strengths include a large sample from throughout the entire Appalachian region and provider-verified vaccination data. The NIS-Teen was limited to households with landline telephones, though our sample was demographically similar (race, education, etc.) to the larger Appalachian population [1]. It is also possible that provider vaccination records may be incomplete. We did not have data on community-level or state-level factors that might influence HPV vaccination. Despite these limitations, we believe our results will be highly useful to future efforts to increase HPV vaccination in Appalachia.

Acknowledgments

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Table 1

Characteristics of parents and adolescent daughters from Appalachia (n=1951)

	n (weighted %)
Year	
2008	667 (32.9)
2009	630 (34.9)
2010	654 (32.2)
Daughter characteristics	
Age	
13 yr	424 (20.7)
14 yr	382 (18.7)
15 yr	401 (20.7)
16 yr	393 (19.8)
17 yr	351 (20.1)
Race/ethnicity	
White, non-Hispanic	1664 (80.6)
Black, non-Hispanic	163 (12.1)
Other	124 (7.3)
Visited healthcare provider in last year	
No	244 (14.6)
Yes	1699 (85.4)
Healthcare coverage	
Through parent employer or union	1296 (63.3)
Other insurance	559 (31.3)
No insurance	93 (5.4)
Parent characteristics	
Mother's age	
<35 yr	179 (9.9)
35–44 yr	957 (50.7)
45+ yr	815 (39.4)
Mother's education	
High school or less	684 (44.3)
Some college	597 (27.0)
College graduate	670 (28.7)
Mother's marital status	
Married	1457 (74.3)
Other	494 (25.7)
Heard of HPV	
No	304 (16.4)
Yes	1623 (83.6)
Heard of HPV vaccine	
No	101 (5.0)

	n (weighted %)
Yes	1835 (95.0)
Received provider recommendation to get daughter HPV vaccine	
No	856 (43.8)
Yes	1045 (56.2)
Household characteristics	
Poverty status	
Below poverty	309 (18.9)
Above poverty, $75,000	908 (50.7)
Above poverty, >$75,000	658 (30.4)
Urbanicity	
Non-MSA	775 (36.9)
MSA, non-central city	723 (38.8)
MSA, central city	453 (24.3)
Appalachian subregion	
Northern	343 (32.3)
North Central	402 (10.1)
Central	200 (8.0)
South Central	309 (19.0)
Southern	696 (30.7)

Note. Totals may not sum to stated sample size due to missing data. Percents may not sum to 100% due to rounding. HPV=human papillomavirus; MSA=metropolitan statistical area.

Table 2

Correlates of HPV vaccination among adolescent females from Appalachia

	HPV Vaccine Initiation[a]			HPV Vaccine Completion[b]			HPV Vaccine Follow-Through[c]		
	Initiated weighted %	Univariable OR (95% CI)	Multivariable OR (95% CI)	Completed weighted %	Univariable OR (95% CI)	Multivariable OR (95% CI)	Followed Through weighted %	Univariable OR (95% CI)	Multivariable OR (95% CI)
Total	40.8	--	--	27.7	--	--	67.8	--	--
Year									
2008	32.4	ref.	ref.	19.2	ref.	ref.	59.4	ref.	ref.
2009	44.6	1.68 (1.23–2.31)*	1.58 (1.15–2.18)*	29.4	1.75 (1.20–2.55)*	1.58 (1.09–2.30)*	65.8	1.32 (0.79–2.18)	1.32 (0.78–2.23)
2010	45.4	1.74 (1.28–2.35)**	1.54 (1.11–2.15)*	34.5	2.22 (1.55–3.16)**	2.01 (1.39–2.92)**	76.1	2.18 (1.33–3.57)*	2.18 (1.27–3.73)*
Daughter characteristics									
Age									
13 yr	35.9	ref.	ref.	20.8	ref.	ref.	58.0	ref.	ref.
14 yr	43.0	1.34 (0.92–1.97)	1.34 (0.88–2.04)	29.4	1.58 (1.02–2.46)*	1.61 (1.00–2.58)	68.4	1.56 (0.83–2.93)	1.64 (0.84–3.21)
15 yr	41.6	1.27 (0.87–1.85)	1.17 (0.77–1.76)	27.0	1.40 (0.91–2.18)	1.23 (0.77–1.98)	64.9	1.34 (0.72–2.47)	1.36 (0.73–2.55)
16 yr	42.5	1.32 (0.90–1.95)	1.45 (0.95–2.22)	28.5	1.52 (0.97–2.38)	1.56 (0.98–2.49)	67.1	1.47 (0.79–2.75)	1.50 (0.81–2.79)
17 yr	41.4	1.26 (0.83–1.92)	1.37 (0.89–2.13)	33.1	1.88 (1.17–3.02)*	2.04 (1.26–3.31)*	79.9	2.88 (1.47–5.66)*	3.01 (1.48–6.11)*
Race/ethnicity									
White, non-Hispanic	40.6	1.20 (0.71–2.02)	--	28.3	1.30 (0.68–2.50)	--	69.6	1.29 (0.58–2.88)	--
Black, non-Hispanic	44.8	1.42 (0.74–2.71)	--	26.6	1.20 (0.54–2.65)	--	59.4	0.83 (0.32–2.17)	--
Other	36.4	ref.	ref.	23.2	ref.	ref.	63.9	ref.	--
Visited healthcare provider in last year									
No	22.6	ref.	ref.	15.9	ref.	ref.	70.2	ref.	ref.
Yes	43.9	2.68 (1.74–4.13)**	2.17 (1.42–3.34)**	29.7	2.25 (1.36–3.71)*	1.65 (1.00–2.72)*	67.7	0.89 (0.41–1.94)	--
Healthcare coverage									
Through parent employer or union	38.6	1.79 (0.97–3.31)	1.30 (0.64–2.65)	25.5	3.43 (1.41–8.36)*	2.21 (0.80–6.13)	66.0	3.63 (1.29–10.17)*	2.60 (0.73–9.23)
Other insurance	47.8	2.61 (1.38–4.92)*	1.83 (0.89–3.76)	35.3	5.48 (2.21–13.57)**	3.67 (1.32–10.20)*	73.9	5.29 (1.83–15.31)*	3.83 (1.04–14.09)*
No insurance	26.0	ref.	ref.	9.1	ref.	ref.	34.9	ref.	ref.
Parent characteristics									
Mother's age									
<35 yr	39.2	ref.	--	23.7	ref.	--	60.5	ref.	--
35–44 yr	39.7	1.02 (0.65–1.60)	--	27.1	1.20 (0.72–2.00)	--	68.2	1.40 (0.71–2.77)	--
45+ yr	42.6	1.15 (0.73–1.82)	--	29.5	1.35 (0.80–2.25)	--	69.1	1.47 (0.74–2.91)	--

	HPV Vaccine Initiation[a]			HPV Vaccine Completion[b]			HPV Vaccine Follow-Through[c]		
	Initiated weighted %	Univariable OR (95% CI)	Multivariable OR (95% CI)	Completed weighted %	Univariable OR (95% CI)	Multivariable OR (95% CI)	Followed Through weighted %	Univariable OR (95% CI)	Multivariable OR (95% CI)
Mother's education									
High school or less	40.4	ref.	--	26.3	ref.	--	65.1	ref.	--
Some college	42.1	1.07 (0.79–1.45)	--	28.7	1.13 (0.80–1.60)	--	68.3	1.16 (0.71–1.88)	--
College graduate	40.2	0.99 (0.74–1.32)	--	28.8	1.13 (0.82–1.57)	--	71.6	1.35 (0.85–2.15)	--
Mother's marital status									
Married	38.4	0.68 (0.52–0.90) *	0.74 (0.53–1.02)	26.5	0.79 (0.58–1.08)	0.90 (0.64–1.27)	68.9	1.18 (0.77–1.80)	--
Other	47.8	ref.	ref.	31.2	ref.	ref.	65.3	ref.	ref.
Heard of HPV									
No	35.5	ref.	ref.	19.1	ref.	ref.	53.9	ref.	ref.
Yes	42.0	1.32 (0.95–1.83)	0.79 (0.51–1.23)	29.5	1.77 (1.21–2.59) *	1.36 (0.84–2.20)	70.3	2.03 (1.20–3.43) *	2.33 (1.28–4.24) *
Heard of HPV vaccine									
No	18.4	ref.	ref.	7.3	ref.	ref.	39.9	ref.	ref.
Yes	42.1	3.24 (1.66–6.30) **	2.53 (1.14–5.63) *	29.0	5.15 (1.97–13.50) **	2.29 (0.79–6.65)	68.7	3.31 (0.99–11.06)	2.23 (0.44–11.43)
Provider recommendation to get daughter HPV vaccine									
No	21.8	ref.	ref.	15.6	ref.	ref.	71.9	ref.	--
Yes	55.7	4.52 (3.45–5.91) **	4.07 (3.06–5.43) **	37.6	3.25 (2.40–4.39) **	2.71 (1.99–3.70) **	67.5	0.81 (0.51–1.28)	--
Household characteristics									
Poverty status									
Below poverty	42.0	ref.	--	27.3	ref.	--	65.0	ref.	--
Above poverty, ≤$75,000	40.0	0.92 (0.65–1.30)	--	27.2	1.00 (0.67–1.48)	--	68.1	1.15 (0.68–1.95)	--
Above poverty, >$75,000	40.2	0.93 (0.65–1.33)	--	26.4	0.96 (0.64–1.43)	--	65.7	1.03 (0.60–1.77)	--
Urbanicity									
Non-MSA	36.7	0.64 (0.46–0.88) *	0.83 (0.57–1.19)	25.1	0.70 (0.49–1.00) *	0.96 (0.65–1.41)	68.3	1.00 (0.61–1.65)	--
MSA, non-central city	40.4	0.75 (0.54–1.03)	0.83 (0.58–1.17)	27.1	0.77 (0.54–1.10)	0.92 (0.64–1.34)	67.0	0.94 (0.57–1.56)	--
MSA, central city	47.6	ref.	ref.	32.6	ref.	ref.	68.4	ref.	--
Appalachian subregion									
Northern	50.0	ref.	ref.	37.8	ref.	ref.	75.7	ref.	ref.
North Central	39.0	0.64 (0.42–0.98) *	0.69 (0.44–1.10)	24.6	0.54 (0.33–0.87) *	0.54 (0.32–0.91) *	63.1	0.55 (0.28–1.07)	0.51 (0.26–1.02)
Central	28.7	0.40 (0.26–0.62) **	0.47 (0.28–0.78) *	15.6	0.30 (0.18–0.51) **	0.33 (0.19–0.57) **	54.5	0.39 (0.19–0.79) *	0.36 (0.17–0.75) *
South Central	39.6	0.66 (0.45–0.95) *	0.70 (0.46–1.06)	30.2	0.71 (0.48–1.06)	0.79 (0.52–1.20)	76.4	1.04 (0.55–1.98)	0.96 (0.50–1.89)
Southern	35.6	0.55 (0.40–0.76) **	0.67 (0.47–0.95) *	19.5	0.40 (0.28–0.57) **	0.48 (0.34–0.69) **	54.9	0.39 (0.24–0.65) **	0.36 (0.22–0.61) **

Note. HPV = human papillomavirus, OR = odds ratio, CI = confidence interval, ref. = referent group, MSA=metropolitan statistical area. Multivariable models did not include variables with dashes (--), as these variables did not have $p<0.15$ in univariable models.

[a]Receipt of at least one dose of HPV vaccine. Multivariable model included data on 1879 adolescent females due to missing data for potential correlates.

[b]Receipt of three doses of HPV vaccine. Multivariable model included data on 1879 adolescent females due to missing data for potential correlates.

[c]Vaccine completion among only those females who initiated the vaccine regimen. Multivariable model included data on 732 adolescent females due to missing data for potential correlates.

[*]$p<0.05$,

[**]$p<0.001$

Table 3

Main reasons why parents from Appalachia did not intend to get their adolescent daughters HPV vaccine in the next year (n=587)[a]

	n (weighted %)
Vaccination not needed or not necessary	116 (21.5)
Lack of knowledge	99 (18.5)
Daughter not sexually active	106 (17.1)
Vaccine safety concern/side effects	73 (12.3)
Did not receive provider recommendation	61 (9.7)
Daughter not appropriate age	45 (6.3)
Need more information/new vaccine	30 (4.0)
Costs	21 (3.6)
Family/parents' decision	19 (2.5)
Other reason	14 (2.4)
Child fearful	12 (2.3)
Handicapped/special needs/illness	9 (1.4)
Don't believe in vaccinations	5 (1.4)
No doctor or doctor's visit not scheduled	6 (1.2)
Already up to date	6 (1.1)
No obstetrician/gynecologist	3 (0.9)
Child should make decision	6 (0.6)
Not a school requirement	4 (0.5)
Daughter already sexually active	1 (0.4)
Religion/orthodox	1 (0.3)
Increased sexual activity concern	2 (0.1)
Effectiveness concern	2 (0.1)
College shot	1 (0.1)
Not available	1 (0.0)
Time	0 (0.0)

[a]Includes parents with unvaccinated daughters who indicated "not likely at all," "not too likely," or "not sure/don't know" about their daughters receiving HPV vaccine in the next year