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Human papillomavirus vaccine uptake among 9–17 year old males in the United States

The National Health Interview survey, 2010

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Abbreviations: HPV, human papillomavirus; NHIS, National Health Interview Survey; FDA, Food and Drug Administration; ACIP, Advisory Committee on Immunization Practices; VFC, vaccines for children; FPL, federal poverty level

In 2009, a quadrivalent HPV vaccine was approved and "permissively" recommended for US males aged 9 to 26 y to protect against genital warts. The purpose of this study was to examine parental awareness and HPV vaccine uptake among 9–17 y old males during the first year following this recommendation. Data from the 2010 National Health Interview Survey (NHIS) were obtained to assess vaccination status (n = 2973) of this age group. Univariate logistic regression analysis was performed to examine correlates of parental awareness and uptake of the HPV vaccine. Overall, 55% of parents with sons were aware of the HPV vaccine. The likelihood of parental awareness was lower among minorities and adolescents with low family incomes, and higher among adolescents with insurance, higher parental education, and those who had a well-child check up and dental examination in the past year than their counterparts. Only 2.0% and 0.5% of 9–17 y old males initiated (≥ 1 dose) and completed (≥ 3 doses) the vaccine series, respectively. Adolescents with a Hispanic origin (odds ratio (OR) 2.03, 95% confidence interval (CI) 1.09–3.78), low family income (OR 2.89, 95% CI 1.48–5.57), and history of influenza vaccination in the past year (OR 1.89, 95% CI 1.11–3.22) were more likely than their counterparts to initiate the HPV vaccine. On the other hand, adolescents with private insurance (OR 0.44, 95% CI 0.20–0.94) and those who had college educated parents (OR 0.45, 95% CI 0.22–0.89) were less likely to initiate the vaccine. This study showed that very few adolescent males received any doses of HPV vaccine during the first year following its recommendation for this gender. Thus, interventional programs are needed to improve vaccine uptake among adolescent males.

Introduction

Human papillomavirus (HPV) is highly prevalent among US males with estimates ranging from 20 to 65% among low-risk sexually active males under 40 y of age.[1] Most HPV infections are asymptomatic in males, but persistent infection with non-oncogenic HPV types (6 and 11) can cause genital warts while oncogenic types (mainly 16 and 18) can cause anal, penile, and oropharyngeal cancers.[2,3] In October 2009, a quadrivalent HPV vaccine was approved by the US Food and Drug Administration (FDA) for use in males aged 9–26 y to protect against genital warts.[4] Soon after, the Advisory Committee on Immunization Practices (ACIP) issued a "permissive" recommendation of the vaccine (vaccination is at the discretion of the physician) among males aged 9–26 y.[4] Later, in October 2011, ACIP issued routine HPV vaccination for 11–12 y old males and "catch up" vaccination for those 13–21 y old.[5] Moreover, the ACIP recommended that the cost of HPV vaccines be covered by the Vaccines for Children (VFC) Program for eligible males ≤ 18 y of age.[6]

Two national studies have reported estimates of uptake of the HPV vaccine among adolescent males approximately one year after it was first approved and permissively recommended for males.[7,8] One of these studies reported on an online survey of a national sample of parents of 11–17 y old males selected through a dual frame approach (random-digit dialing supplemented by address-based sampling).[7] The other (National Immunization Survey-Teen) used a two phase survey (random-digit dialing survey to identify households with an eligible adolescent aged 13 to 17 y and a provider record check for vaccination histories).[8] However, neither examined correlates of parental awareness and HPV vaccine uptake among adolescent males. In this study, we used data from the 2010 National Health Interview Survey (NHIS), an in-person survey, to examine parental awareness about the HPV vaccine and estimate vaccine uptake along with their correlates among 9–17 y old males in the US.

Results

A total of 97.4% (2897/2973) of parents of adolescent males (9–17 y) responded to questions on HPV vaccination. Of the

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2897 adolescents, more than half were white (58.1%), privately insured (58.5%), and had a family income ≥ 200% of the federal poverty line (53.1%), as well as a well-child check-up (74.4%) and dental examination (83.3%) in the past year. Most parents had some college hours or college degree (61.2%). About 55% of parents had ever heard of the HPV vaccine. Overall 2.0% and 0.5% of adolescent males had initiated (received ≥ 1 dose) (n = 56) and completed (received ≥ 3 doses) (n = 14) the vaccine series, respectively.

Univariate logistic regression analyses showed that parental awareness about the HPV vaccine was lower among minorities than whites and among adolescents with a family income < 200% of the federal poverty level (FPL) than ≥ 200% of the FPL. It was higher among adolescents with higher parental education (≥ high school graduate), insurance coverage (public or private), and those who had a well-child check up and dental examination in the past year (**Table 1**). The likelihood of HPV vaccine initiation was higher among Hispanics (odds ratio (OR) 2.03, 95% confidence interval (CI) 1.09–3.78), adolescents with a family income < 100% of the FPL (OR 2.89, 95% CI 1.48–5.57) and those who had received an influenza vaccine in the past year (OR 1.89, 95% CI 1.11–3.22) compared with their counterparts. The likelihood of vaccine initiation was lower among privately insured than uninsured (OR 0.44, 95% CI 0.20–0.94) or publicly insured adolescents (OR 0.53, 95% CI 0.29–0.95) and among those who had college educated parents compared with those who had parents with a less than high school diploma (OR 0.45, 95% CI 0.22–0.89). No significant correlates of vaccine completion were identified.

Discussion

Our analysis, based on data from the 2010 NHIS, showed that only 2.0% of 9–17 y old males had initiated (received ≥ 1 dose) and 0.5% completed (received ≥ 3 doses) the HPV vaccine series. Another study, which used an online survey on a nationally representative panel also found similar rates (2% and < 1%) among 11–17 y old adolescent males based on data collected through September 2010.[7] Together, these two studies demonstrate that HPV vaccine initiation and completion rates were very low among adolescent males (< 18 y of age) in the US during the first year it was recommended for males.

Similar to other studies, we observed that HPV vaccine initiation rates among adolescent males were much lower than those observed among adolescent females during the first year following its approval for that gender (1.4–2.0% in males vs. 10–30% in females).[7-11] Several reasons might be responsible for this large difference. First, the vaccine was permissively recommended (vaccination at the discretion of the physician) for adolescent males in 2009 for prevention of genital warts.[4] In contrast, the HPV vaccine was routinely recommended for adolescent females for prevention of cervical cancer in 2006, the first year it was available.[12] The permissive national recommendation for males may have resulted in physicians choosing not to discuss it with their patients. This is supported by two studies before approval of the HPV vaccine for females, based on a hypothetical situation using pediatricians and family practice physicians in the US which observed that physicians were more willing to recommend the HPV vaccine to female compared with male adolescents.[13,14] However, one study conducted after the approval of the vaccine for females did not find any differences between physician recommendations of both genders.[15]

In December 2010, the FDA approved the quadrivalent HPV vaccine for prevention of anal cancer in males and females,[5,16] In 2011, ACIP also issued a routine recommendation of HPV vaccine for males.[5] However, these both occurred after the 2010 NHIS was completed. These new approvals/recommendations may increase male's willingness to receive the vaccine.[17] Thus, studies based on 2011–12 data need to be conducted to assess their impact.

It is also possible that parental awareness about the HPV vaccine played a role in the observed differences in vaccination rates between adolescent males and females. About 78% of parents of adolescent females were aware of the HPV vaccine based on data collected within one year of its recommendation for females.[10] In this study, we observed that only 55% of parents of adolescent males were aware of the HPV vaccine based on the same timeframe. Few data are available on parental awareness of the HPV vaccine specifically for males. This question was not asked in the 2010 NHIS. However, Reiter et al. observed that only 20% of parents of adolescent males knew about vaccinating males against HPV based on data collected within one year of its permissive recommendation for males.[7] Lack of media coverage on HPV vaccine use in males may have played a role in the low awareness as coverage regarding administration of this vaccine in males was not as widespread as that which occurred for females in 2006.[7]

We observed a higher initiation rate of the HPV vaccine among Hispanics than whites and among adolescent males with < 100% of FPL than those with ≥ 200% of FPL. Similar findings were observed among adolescent females based on the data collected within two years after the approval of the HPV vaccine for females.[18] Assistance from the federally funded VFC programs for those living below the poverty level could be responsible for this higher initiation rate as the poverty level has been reported to be higher among Hispanics than whites.[8,18] Higher initiation of HPV vaccination among uninsured/publicly insured than privately insured adolescents was also likely due to the fact that the federal VFC program covers uninsured and underinsured individuals for this vaccine at no cost.[6]

Several limitations of this study should be acknowledged. First, self-reported NHIS data may be subjected to recall bias. Unlike the National Immunization Survey-Teen, parental reports on vaccination status and number of doses were not verified by provider immunization records. Second, this survey did not collect data on the time periods between receipt of the first dose and subsequent doses, which limited our ability to evaluate whether the 3-dose vaccine series had been completed within the ACIP recommended time. Third, data concerning doctors' recommendation and parents' willingness to vaccinate their sons in the future were not available in the 2010 NHIS. Finally, the significant correlates of vaccine uptake we observed in this study should

Table 1. Factors associated with parental awareness and initiation of HPV vaccine among 9–17 y old males

	Parents ever heard of HPV vaccine			Initiation of HPV vaccine		
	n[a]	Wgtd %	OR (95% CI)[b]	n[a]	Wgtd %	OR (95% CI)[b]
All	2897	55.3	-	2895	2.0	-
Age (years)						
9–10	581	54.3	Ref.	581	1.7	Ref.
11–12	602	54.4	1.06 (0.84–1.33)	601	2.0	1.18 (0.49–2.88)
13–17	1714	56.0	1.06 (0.88–1.28	1714	2.1	1.36 (0.65–2.85)
Race/Ethnicity						
White	1305	64.0	Ref.	1303	1.2	Ref.
Black	490	51.5	0.61 (0.49–0.75)*	490	3.7	1.79 (0.86–3.75)
Hispanic	832	38.4	0.32 (0.27–0.39)*	832	3.5	2.03 (1.09–3.78)*
Asian	160	30.4	0.27 (0.19–0.38)*	160	0.2	0.45 (0.06–3.38)
Other[c]	110	55.8	0.84 (0.56–1.35)	110	1.9	1.32 (0.30–5.77)
Region of residence						
Northeast	459	53.2	Ref.	457	2.0	Ref.
Midwest	604	61.2	1.63 (1.28–2.09)*	604	1.4	1.39 (0.51–3.80)
South	1052	56.3	1.18 (0.94–1.46)	1052	2.6	1.60 (0.65–3.99)
West	782	49.2	0.92 (0.73–1.16)	782	1.7	1.67 (0.65–4.27)
Parental highest education level						
Less than HS	451	31.7	Ref.	451	3.6	Ref.
HS Graduated/GED	642	49.9	2.09 (1.62–2.69)*	642	2.0	0.54 (0.24–1.21)
Some college/college degree	1486	64.8	3.86 (3.08–4.84)*	1484	1.4	0.45 (0.22–0.89)*
Family income % of federal poverty level						
≥ 200%	529	41.4	Ref.	529	3.5	Ref.
100 to < 200%	583	51.3	0.58 (0.48–0.70)*	583	2.7	1.86 (0.91–3.83)
< 100%	1490	62.3	0.41 (0.33–0.50)*	1488	1.1	2.89 (1.48–5.57)*
Unknown	295	51.3	0.70 (0.54–0.90)*	295	2.4	1.98 (0.82–4.79)
Insurance coverage						
None	331	40.2	Ref.	331	2.4	Ref.
Public	999	45.8	1.32 (1.02–1.71)*	999	3.1	0.82 (0.39–1.73)
Private	1562	63.1	2.68 (2.10–3.43)*	1560	1.3	0.44 (0.20–0.94)*
Well-child checkup in the past year						
No	773	50.3	Ref.	773	1.7	Ref.
Yes	2116	56.9	1.30 (1.10–1.53)*	2114	2.1	1.34 (0.71–2.56)
Dental examination in the past year						
No	535	43.4	Ref.	535	1.2	Ref.
Yes	2344	57.6	1.77 (1.46–2.14)*	2342	2.1	1.35 (0.63–2.87)
Influenza vaccine in the past year[d]						
No	1739	54.0	Ref.	1739	1.7	Ref
Yes	1157	57.2	1.03 (0.89–1.20)	1155	2.5	1.89 (1.11–3.22)*

Wgtd % = Percentages are weighted to the population of males aged 9–17 y. Abbreviation: HPV, human papillomavirus; OR, odds ratios; CI, confidence interval; HS, high school; GED, graduate equivalency diploma. [a]Numbers do not add up to 2897 or 2895 due to missing data; [b]Univariate logistic regression analyses were used (* $p < 0.05$ considered statistically significant); [c]Includes non-Hispanic American Indian Alaska Native, not releasable, and multiracial; [d]Includes H1N1 and/or seasonal flu shot and/or nasal spray.

be interpreted with caution because of the small number of vaccinations. We also could not use any multivariate procedures to examine predictors of vaccine uptake for the same reason. Despite these limitations, this study serves the important purpose of examining recent HPV vaccine uptake and their correlates among adolescent males using a large nationally representative sample.

In conclusion, HPV vaccine uptake was very low among adolescent males during the year following its permissive national recommendation for this gender. Future research is needed to examine changes in vaccine uptake among adolescent males as this vaccine is now routinely recommended for males and approved for prevention of anal cancer. If vaccination rates remain low, strategies to improve its uptake among adolescent males in the US are warranted.

Materials and Methods

The National Health Interview Survey (NHIS) is an in-person annual (January to December) household survey with a cross-sectional design based on a nationally representative US noninstitutionalized civilian population sampled and selected through a complex, stratified, multistage probability design. Detailed methods of this survey have been published elsewhere.[19] All procedures were approved by the Institutional Review Board of University of Texas Medical Branch.

In the 2010 NHIS-Sample Child Module, a total of 11,277 children < 18 y of age were surveyed with an overall response rate of 70.7%. A child < 18 y of age (the "sample child") was randomly selected from each participating family. A parent (91% cases) or parent proxy (9% cases) answered questions on behalf of the "sample child." The HPV vaccine related questions were administered to all families with adolescents who were age-eligible for HPV vaccination at the time of the survey. We obtained data on 9–17 y old males (n = 2973) from this module. Race/ethnicity, region, parental highest education level, family income by % of federal poverty level (minimum yearly income that a family needs in order to provide its basic needs), insurance coverage by no insurance, public insurance (government-subsidized health care plan), and private insurance (health care plan provided by entities other than government), and preventive health behaviors (well-child check up, dental examination and having flu vaccine in the past year) were also assessed.

Parents' awareness about HPV vaccine was assessed from the question, "Two vaccines/shots to prevent HPV infection are available in the US. Both vaccines prevent cervical cancer and one also prevents genital warts. The two HPV vaccines are sometimes called CERVARIX or GARDASIL. Before this survey, have you ever heard of HPV vaccines or shots?" The responses were "yes" or "no." The receipt of the vaccine and number of vaccine doses were assessed from the parental responses to following two questions, "Did your child ever receive an HPV shot?" and "How many HPV shots did your child receive?" We measured receipt of ≥ 1 dose and ≥ 3 doses of vaccine from the number of shots received. Seven parents who reported receipt of 4 doses of the vaccine were included in the ≥ 3 doses categories.

We used STATA 10 *svy* commands (STATA Corporation, College Station, TX) for data analysis by incorporating probability sampling weights in conjunction with strata and primary sampling units (psu) generated by NHIS complex survey design. Percentages for parental awareness, initiation (≥ 1 dose) and completion (≥ 3 doses) of HPV vaccine were estimated by age groups (9–10, 11–12, and 13–17), race/ethnicity, region, parental highest education levels, family income (< 100% of FPL, 100% to < 200% of FPL, ≥ 200% of FPL), insurance coverage (none, public and private), and preventive health behaviors. Univariate logistic regression analyses were used to examine the association of these variables with parental awareness, and initiation and completion of HPV vaccine among these adolescents. All estimates were weighted to population of males aged 9–17 y.

Disclosure of Potential Conflicts of Interest

No potential conflicts of interest were disclosed.

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