

## Research Article

## Provider-Verified HPV Vaccine Coverage among a National Sample of Hispanic Adolescent Females

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## Abstract

**Background:** Hispanic females have the highest cervical cancer incidence rate of any racial or ethnic group in the United States, yet relatively little research has examined human papillomavirus (HPV) vaccination among this fast-growing population. We examined HPV vaccination among a national sample of Hispanic adolescent females.

**Methods:** We analyzed provider-verified vaccination data from the 2010–2011 National Immunization Survey-Teen for Hispanic females ages 13 to 17 years ( $n = 2,786$ ). We used weighted logistic regression to identify correlates of HPV vaccine initiation (receipt of one or more doses), completion (receipt of three doses), and follow-through (receipt of three doses among those who initiated the series).

**Results:** HPV vaccine initiation was 60.9%, completion was 36.0%, and follow-through was 59.1%. Initiation and completion were more common among older daughters and those whose parents had received a provider recommendation to vaccinate (all  $P < 0.05$ ). Completion was less common among daughters who had moved from their birth state ( $P < 0.05$ ). All vaccination outcomes were less common among daughters without health insurance (all  $P < 0.05$ ). Vaccination did not differ by parents' preferred language (all  $P > 0.05$ ), although intent to vaccinate was higher among Spanish-speaking parents ( $P < 0.01$ ). Spanish-speaking parents were more likely to indicate lack of provider recommendation (20.2% vs. 5.3%) and cost (10.9% vs. 1.8%) as main reasons for not intending to vaccinate (both  $P < 0.05$ ).

**Conclusions:** Many Hispanic females have not received HPV vaccine. Several factors, including provider recommendation and health insurance, are key correlates of vaccination.

**Impact:** HPV vaccination programs targeting Hispanics are needed and should consider how potential barriers to vaccination may differ by preferred language. *Cancer Epidemiol Biomarkers Prev*; 23(5); 742–54. ©2014 AACR.

## Introduction

Oncogenic human papillomavirus (HPV) types cause virtually all cases of cervical cancer (1, 2). National data indicate that Hispanic females ages 14 to 59 years have the second highest prevalence of HPV infection of any racial or ethnic group in the United States, with 44% infected with at least one type of HPV and 31% infected with an oncogenic HPV type (3). Hispanic women have the highest cervical cancer incidence rate of any racial or ethnic group in the United States (4). The cervical cancer incidence rate among Hispanic women is 74% higher

than that of non-Hispanic White women, and the cervical cancer mortality rate is 48% higher among Hispanic women (5).

Given this substantial burden of HPV infection and related disease among Hispanic females, HPV vaccination may be of particular importance for this population. HPV vaccine has been available for females in the United States since 2006. Both the bivalent and quadrivalent HPV vaccines offer protection against oncogenic HPV types 16 and 18 (which cause more than 70% of cervical and anal cancers and lower percentages of other cancer types; ref. 2), and the quadrivalent vaccine offers protection against types 6 and 11 (which cause almost all genital warts; ref. 6). The Advisory Committee on Immunization Practices currently recommends that adolescent females ages 11 to 12 years receive three doses of prophylactic HPV vaccine, with catch-up vaccination through the age of 26 years (7). As of 2012, only 53.8% of adolescent females in the United States had received the first dose of the HPV vaccine and 33.4% had received all three recommended doses (8). Importantly, annual increases in HPV vaccine coverage among adolescent females have stalled (9, 10). Even with this moderate HPV vaccine

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coverage, the prevalence of HPV types included in the bivalent and quadrivalent HPV vaccines has already begun to decrease among adolescent females (11).

Little research has examined HPV vaccination among Hispanics compared with research on other racial and ethnic groups. Knowledge about HPV and HPV vaccine tends to be modest among Hispanic adults (12–17), though most Hispanic parents are willing to vaccinate their adolescent daughters (17–21). Recent data suggest that HPV vaccine initiation (receipt of at least one dose) may be higher among Hispanic adolescent females compared with non-Hispanic Whites (8), though Hispanics may be less likely to complete the three-dose series after receiving the first dose (8, 22). Among Hispanic females, data suggest that HPV vaccine coverage is lower among those with less U.S. acculturation (23, 24). Acculturation can be defined as "a process of cultural adaptation that occurs when groups of individuals from different cultures come into contact, leading to changes in the cultural patterns of either or both groups" (25). Acculturation is a complex construct that has been measured in several ways in past research, ranging from proxy measures (e.g., preferred language) to multidimensional scales (26).

Many of these past studies examining HPV vaccination among Hispanic females included participants from a limited geographic area (13–21, 23), which may reduce the generalizability of results. Furthermore, few of these studies identified correlates of vaccination, perhaps due to small samples or lack of variation in vaccine uptake among respondents. Identifying correlates is important for planning future programs to increase HPV vaccination among Hispanics. We analyzed provider-verified vaccination data from a national sample of Hispanic adolescent females from the National Immunization Survey-Teen (NIS-Teen) to provide further information about HPV vaccine coverage among Hispanic females and identify correlates of vaccination. Given that Hispanics are one of the fastest growing U.S. populations (27, 28), we believe results from this study will have important public health implications.

## Materials and Methods

### Study design

We conducted a secondary data analysis of publicly available data from the NIS-Teen (29, 30), which has been described extensively elsewhere (31). Briefly, the Centers for Disease Control and Prevention (CDC) conducts the NIS-Teen annually to examine vaccination among adolescents ages 13 to 17 years in the United States. We examined NIS-Teen data from 2010 and 2011, the two most recent years with available data at the time of analyses.

The NIS-Teen collects data using both a random-digit-dialed (RDD) telephone survey with parents and a mailed survey of adolescents' healthcare providers. The RDD sampling frame for the 2010 NIS-Teen contained landline telephones, and the 2011 NIS-Teen used a dual-frame

sampling approach with independent RDD samples of landline and cellular telephones (32, 33). A complex stratified sampling strategy ensures that the NIS-Teen obtains a national probability sample. If a sampled household had multiple adolescents ages 13 to 17 years, one child was randomly selected as the index child for the NIS-Teen. The 2010 NIS-Teen had a household response rate of 58.0% (34), and the 2011 NIS-Teen had household response rates of 57.2% for landline households and 22.4% for cellular households (35). For the current study, we report data on a total of 2,786 Hispanic adolescent females from the 2010 and 2011 NIS-Teen.

Data collection for the NIS-Teen received approval from the National Center for Health Statistics Research Ethics Review Board; analysis of deidentified NIS-Teen data is exempt from the federal regulations for the protection of human research participants. The Institutional Review Board at The Ohio State University (Columbus, OH) deemed this study exempt from review.

### Measures

We examined three HPV vaccination outcomes as our primary outcome variables (34): (i) initiation: receipt of at least one dose of the three-dose HPV vaccine series; (ii) completion: receipt of all three doses; and (iii) follow-through: receipt of all three doses among only those who initiated the vaccine series (i.e., completion among initiators). The denominators differed for completion (all Hispanic adolescent females) and follow-through (only those Hispanic adolescent females who received the first dose). Vaccination data were based on provider-verified vaccination records.

Among parents of unvaccinated daughters, we examined intent to get their daughters HPV vaccine in the next year. The NIS-Teen assessed intent by asking these parents, "How likely is it that 'TEEN' will receive HPV shots in the next 12 months?" Response options included "not likely at all," "not too likely," "not sure/don't know," "somewhat likely," and "very likely" (coded 1–5). Parents who indicated "not likely at all," "not too likely," or "not sure/don't know," were then asked, "What is the main reason 'TEEN' will not receive HPV shots in the next 12 months?" Parents could indicate multiple responses for this open-ended item, with the CDC coding responses into categories.

The NIS-Teen collects data on several demographic and health-related characteristics (Table 1). If someone other than the mother in a participating household completed the parent survey, this individual provided information about the mother's age, education level, and marital status. We examined daughter's race (White, Black, or other) because the NIS-Teen assessed race separately from ethnicity. We examined whether daughters lived in the state where they were born at the time of data collection (i.e., geographic mobility) and whether parents completed the NIS-Teen telephone survey in English or Spanish (i.e., preferred language). The preferred language variable served as a proxy measure of acculturation for this study.

**Table 1.** Characteristics of parents and their Hispanic adolescent daughters from the NIS-Teen ( $n = 2,786$ )

	Number (weighted %)
Year	
2010	1,199 (46.4)
2011	1,587 (53.6)
<i>Daughter characteristics</i>	
Age	
13 y	613 (20.3)
14 y	607 (19.2)
15 y	562 (24.1)
16 y	533 (19.4)
17 y	471 (17.0)
Race	
White	2,389 (86.1)
Black	160 (5.6)
Other	237 (8.4)
Visited healthcare provider in last year	
No	525 (22.4)
Yes	2,233 (77.6)
Currently lives in state where born	
No	784 (27.7)
Yes	2,002 (72.3)
Healthcare coverage	
Through parent employer or union	1,224 (37.1)
Other insurance, including Medicaid	1,184 (47.6)
No insurance	357 (15.4)
Eligible for VFC program	
No	1,320 (42.7)
Yes	1,458 (57.3)
<i>Parent characteristics</i>	
Mother's age	
<35 y	346 (14.7)
35–44 y	1,380 (51.2)
45+ y	1060 (34.1)
Mother's education	
Less than high school	854 (39.4)
High school	600 (21.9)
Some college	691 (21.2)
College graduate	641 (17.6)
Mother's marital status	
Not married	898 (34.5)
Married	1,888 (65.5)
Language of NIS-Teen interview	
English	1,733 (55.4)
Spanish	1,048 (44.6)
Heard of HPV	
No	424 (18.8)
Yes	2,319 (81.2)

*(Continued in the following column)***Table 1.** Characteristics of parents and their Hispanic adolescent daughters from the NIS-Teen ( $n = 2,786$ ) (Cont'd)

	Number (weighted %)
Heard of HPV vaccine	
No	309 (16.7)
Yes	2,446 (83.3)
Received provider recommendation to get daughter HPV vaccine	
No	1,206 (50.2)
Yes	1,467 (49.8)
<i>Household characteristics</i>	
Poverty status	
Below poverty	963 (43.3)
Above poverty, $\leq$ \$75,000	1,090 (40.0)
Above poverty, $>$ \$75,000	612 (16.7)
Number of children in household	
1	873 (23.9)
2–3	1,490 (55.1)
4+	423 (21.0)
Region of residence	
Northeast	394 (12.5)
Midwest	334 (9.9)
South	1,216 (32.1)
West	842 (45.4)

NOTE: Totals may not sum to stated sample size due to missing data. Percentages may not sum to 100% due to rounding.

Language preference is a commonly used proxy for acculturation, and it correlates with acculturation scales and is a domain within several such scales (26). Parents also indicated whether they had ever heard of HPV and HPV vaccine, and whether they had ever received a healthcare provider recommendation to have their daughters receive HPV vaccine.

### Data analysis

We used logistic regression to identify correlates of our three primary HPV vaccination outcomes (initiation, completion, and follow-through). For each outcome separately, we entered all variables associated with the outcome in bivariate models ( $P < 0.05$ ) into a multivariate logistic regression model. The multivariate models produced adjusted ORs and 95% confidence intervals (CI). Similar to previous analyses of NIS-Teen data (36), we did not examine parents' awareness of HPV and HPV vaccine as potential correlates. We excluded these variables as candidates because awareness was likely due to a healthcare provider's recommendation or actual vaccination for some parents, whereas for other parents, awareness preceded provider interaction or vaccination.

We believed that differences in additional outcomes by acculturation would be important for guiding future intervention efforts, so we determined whether parents' intent to vaccinate (linear regression) and reasons for not intending to vaccinate (logistic regression) differed by parents' preferred language. All analyses accounted for the complex design of the NIS-Teen (32, 33) by applying appropriate sampling weights when determining proportions and effect estimates. Frequencies were not weighted. Statistical tests were two tailed with a critical  $\alpha$  of 0.05, with analyses conducted in SAS Version 9.2 using procedures for complex survey data.

## Results

### Participant characteristics

The age distribution among daughters was fairly even, with each age having at least 17.0% of the sample (Table 1). The race of most Hispanic daughters was White (86.1%), with fewer Black (5.6%), and other races (8.4%). About three-fourths of daughters had visited their healthcare provider in the last year (77.6%) and lived in the state where they were born (72.3%). Most mothers were at least 35 years old (85.3%), did not have any college education (61.3%), and were married (65.5%). Just under half of parents completed the NIS-Teen telephone survey in Spanish (44.6%). Most (81.2%) parents had heard of HPV, 83.3% had heard of HPV vaccine, and 49.8% had received a recommendation from their healthcare provider to get their daughters vaccinated.

### Initiation

Overall, 60.9% of Hispanic adolescent females had received at least one dose of HPV vaccine. Initiation increased from 56.2% in 2010 to 65.0% in 2011 (OR = 1.47; 95% CI, 1.09–1.98), according to multivariate analyses (Table 2). HPV vaccine initiation was higher among Hispanic daughters who were ages 16 (OR = 1.89; 95% CI, 1.18–3.00) or 17 years (OR = 2.22; 95% CI, 1.41–3.51) compared with those who were age 13 years. Daughters were also more likely to have initiated the HPV vaccine regimen if they had visited a healthcare provider in the last year (OR = 1.67; 95% CI, 1.09–2.56), had health insurance that was not through their parent's employer or union (OR = 2.34; 95% CI, 1.37–3.98), had parents who had received a provider recommendation to vaccinate (OR = 1.63; 95% CI, 1.18–2.25), or lived in households that contained multiple children. Compared with daughters from the West region of the United States, daughters living in the Midwest (OR = 0.49; 95% CI, 0.31–0.77) or South (OR = 0.54; 95% CI, 0.37–0.77) regions were less likely to be initiators.

### Completion

About 36.0% of Hispanic adolescent females had completed the three-dose HPV vaccine regimen. Completion increased from 29.5% in 2010 to 41.6% in 2011 (OR = 1.52;

95% CI, 1.11–2.08), according to multivariate analyses (Table 3). Completion was higher among daughters who were ages 16 (OR = 2.08; 95% CI, 1.32–3.29) or 17 years (OR = 1.85; 95% CI, 1.11–3.06), lived in the same state where they were born (OR = 1.50; 95% CI, 1.05–2.17), had health insurance through their parents' employer or union (OR = 1.84; 95% CI, 1.05–3.22), or had some other type of health insurance (OR = 3.00; 95% CI, 1.71–5.27). Daughters whose mothers were ages 35 to 44 (OR = 1.77; 95% CI, 1.09–2.89) or at least 45 years old (OR = 1.68; 95% CI, 1.00–2.82) or whose parents had received a provider recommendation to vaccinate (OR = 1.60; 95% CI, 1.17–2.18) were also more likely to have completed the three-dose regimen.

### Follow-through

Among initiators, 59.1% completed the HPV vaccine regimen (Table 4). In multivariate analyses, daughters with health insurance that was not through their parents' employer or union (OR = 2.40; 95% CI, 1.26–4.57) were more likely to follow-through the vaccine regimen after receiving the first dose compared with daughters without health insurance. Follow-through was also higher among daughters whose mothers were 35 to 44 years old (OR = 2.29; 95% CI, 1.22–4.28) or at least 45 years old (OR = 2.11; 95% CI, 1.08–4.14) or whose mothers were college graduates (OR = 2.39; 95% CI, 1.19–4.83). Follow-through was lower among daughters from households containing at least four children (OR = 0.42; 95% CI, 0.22–0.81).

### Intent to vaccinate and reasons for not intending to vaccinate

Parents with unvaccinated daughters reported moderate intent to vaccinate in the next year (mean = 2.66, SE = 0.09). About 37.0% of these parents indicated their daughters were "somewhat likely" or "very likely" to receive HPV vaccine in the next year. Parents whose preferred language was Spanish reported higher intent to vaccinate (mean = 2.97, SE = 0.15) compared with those whose preferred language was English (mean = 2.45, SE = 0.11;  $P < 0.01$ ; Fig. 1).

The most common main reasons for parents not intending to vaccinate their daughters in the next year were lack of knowledge (22.7%), concerns about vaccine safety and side effects (21.1%), believing vaccination is not needed or not necessary (19.8%), daughter not being sexually active (15.7%), and not having received a provider recommendation (10.2%; Table 5). All other reasons were reported by less than 10.0% of parents. Compared with parents whose preferred language was English, parents whose preferred language was Spanish were more likely to indicate not having received a provider recommendation (20.2% vs. 5.3%) and cost (10.9% vs. 1.8%) as a main reason for not intending to vaccinate (both  $P < 0.05$ ). Spanish-speaking parents were less likely to report concerns about vaccine safety and side effects as a main reason (5.9% vs. 28.5%;  $P < 0.001$ ).

**Table 2.** HPV vaccine initiation among Hispanic adolescent females ( $n = 2,786$ )

	No. initiated/total No. in category (weighted %)	Bivariate OR (95% CI)	Multivariate OR (95% CI)
Total	1,639/2,786 (60.9)	—	—
Year			
2010	665/1,199 (56.2)	ref.	ref.
2011	974/1,587 (65.0)	1.45 (1.09–1.93) <sup>a</sup>	1.47 (1.09–1.98) <sup>a</sup>
<i>Daughter characteristics</i>			
<i>Age</i>			
13 y	329/613 (52.0)	ref.	ref.
14 y	342/607 (58.7)	1.31 (0.86–1.99)	1.25 (0.79–1.96)
15 y	334/562 (58.0)	1.27 (0.81–2.00)	1.30 (0.81–2.09)
16 y	344/533 (66.2)	1.81 (1.17–2.79) <sup>a</sup>	1.89 (1.18–3.00) <sup>a</sup>
17 y	290/471 (72.2)	2.40 (1.56–3.70) <sup>b</sup>	2.22 (1.41–3.51) <sup>b</sup>
<i>Race</i>			
White	1,389/2,389 (60.7)	ref.	—
Black	94/160 (63.8)	1.14 (0.67–1.96)	—
Other	156/237 (61.4)	1.03 (0.60–1.77)	—
<i>Visited healthcare provider in last year</i>			
No	268/525 (47.9)	ref.	ref.
Yes	1,355/2,233 (64.9)	2.01 (1.40–2.90) <sup>b</sup>	1.67 (1.09–2.56) <sup>a</sup>
<i>Currently live in state where born</i>			
No	449/784 (55.5)	ref.	—
Yes	1,190/2,002 (63.0)	1.37 (1.00–1.86)	—
<i>Healthcare coverage</i>			
Through parent employer or union	655/1,224 (55.8)	1.53 (0.96–2.43)	1.19 (0.69–2.05)
Other insurance, including Medicaid	788/1,184 (69.5)	2.76 (1.73–4.41) <sup>b</sup>	2.34 (1.37–3.98) <sup>a</sup>
No insurance	180/357 (45.2)	ref.	ref.
<i>Eligible for VFC program</i>			
No	711/1,320 (58.5)	ref.	—
Yes	926/1,458 (62.8)	1.20 (0.90–1.60)	—
<i>Parent characteristics</i>			
<i>Mother's age</i>			
<35 y	219/346 (64.4)	ref.	—
35–44 y	841/1,380 (60.9)	0.86 (0.55–1.36)	—
45+ y	579/1,060 (59.4)	0.81 (0.51–1.29)	—
<i>Mother's education</i>			
Less than high school	545/854 (64.3)	ref.	—
High school	355/600 (63.0)	0.94 (0.64–1.38)	—
Some college	391/691 (55.7)	0.70 (0.47–1.02)	—
College graduate	348/641 (57.0)	0.73 (0.49–1.11)	—
<i>Mother's marital status</i>			
Not married	565/898 (65.5)	ref.	—
Married	1,074/1,888 (58.5)	0.74 (0.55–1.00)	—
<i>Language of NIS-Teen interview</i>			
English	951/1,733 (58.0)	ref.	—
Spanish	685/1,048 (64.5)	1.32 (0.98–1.77)	—
<i>Received provider recommendation to get daughter HPV vaccine</i>			
No	568/1,206 (55.7)	ref.	ref.
Yes	996/1,467 (66.9)	1.61 (1.19–2.18) <sup>a</sup>	1.63 (1.18–2.25) <sup>a</sup>

(Continued on the following page)

**Table 2.** HPV vaccine initiation among Hispanic adolescent females ( $n = 2,786$ ) (Cont'd)

	No. initiated/total No. in category (weighted %)	Bivariate OR (95% CI)	Multivariate OR (95% CI)
<i>Household characteristics</i>			
Poverty status			
Below poverty	626/963 (63.8)	ref.	—
Above poverty, $\leq$ \$75,000	604/1,090 (59.7)	0.84 (0.60–1.18)	—
Above poverty, $>$ \$75,000	330/612 (54.6)	0.68 (0.47–1.01)	—
Number of children in household			
1	472/873 (54.6)	ref.	ref.
2–3	910/1,490 (61.6)	1.33 (0.98–1.81)	1.42 (1.02–1.98) <sup>a</sup>
4+	257/423 (66.4)	1.65 (1.06–2.55) <sup>a</sup>	1.78 (1.10–2.89) <sup>a</sup>
Region of residence			
Northeast	256/394 (64.2)	0.88 (0.60–1.28)	0.71 (0.47–1.07)
Midwest	175/334 (53.6)	0.56 (0.37–0.86) <sup>a</sup>	0.49 (0.31–0.77) <sup>a</sup>
South	685/1,216 (53.0)	0.55 (0.39–0.78) <sup>b</sup>	0.54 (0.37–0.77) <sup>b</sup>
West	523/842 (67.2)	ref.	ref.

NOTE: Totals may not sum to stated sample size due to missing data. Multivariate model did not include variables with dashes (—). Multivariate model included data on 2,629 Hispanic adolescent females due to missing data for potential correlates.

Abbreviation: ref., referent group.

<sup>a</sup> $P < 0.05$ .

<sup>b</sup> $P < 0.001$ .

## Discussion

Hispanic women have higher cervical cancer incidence and mortality rates compared with non-Hispanic White women (5). Despite these existing cervical cancer disparities, relatively little research has examined HPV vaccination among this higher risk population. Among a national sample of Hispanic adolescent females, we found that just more than 60% had initiated the HPV vaccine regimen and only about one-third had received all three recommended doses according to healthcare provider records. These estimates are noticeably higher than those from the 2010 National Health Interview Survey (NHIS), which found only 31% initiation and 12% completion among Hispanic adolescent females (37). However, the NHIS vaccination data were not verified by medical records and relied solely on parent-reported vaccination data. Furthermore, NHIS analyses included data on 11 to 12 year olds, who often have lower HPV vaccination coverage than older adolescents (38). Less than 60% of Hispanic females in our study who received the first dose went on to complete the three-dose regimen. This finding agrees with those from other U.S. national studies (e.g., NHIS, the National Health and Nutrition Examination Survey), where follow-through was typically around 50% to 60% among adolescent females (11, 35, 37). Thus, many females who receive the first dose fail to complete the vaccine regimen.

Healthcare provider recommendation was one of the key determinants of HPV vaccination among Hispanic adolescent females. Prior research similarly shows pro-

vider recommendation to be among the strongest correlates of HPV vaccination among adolescent females (38–40). However, less than 50% of parents of Hispanic daughters in this study had received a provider recommendation to vaccinate their daughters against HPV, despite more than 75% of daughters having visited their providers in the last year. This finding suggests that healthcare providers are missing many opportunities for recommending and administering HPV vaccine to Hispanic adolescent females (41). Future efforts to increase provider recommendation are likely key to increasing HPV vaccine coverage in this population.

HPV vaccination outcomes tended to be higher among older daughters and those with health insurance. These findings support and extend those of past studies examining HPV vaccination among adolescent females in the United States (10, 38, 42, 43). Older adolescents likely had more opportunities to initiate and complete the HPV vaccine regimen compared with younger adolescents. However, targeting younger Hispanic adolescent females for HPV vaccination is important because more than 20% of Hispanic females self-report having sexual intercourse by the age of 15 years (44), putting them at risk of HPV infection. HPV vaccine is among the most expensive vaccines available (45), and vaccine cost is a concern for some parents (40, 43), which may partially explain why vaccine coverage was lower among daughters without health insurance. Lack of health insurance may be a particularly important barrier to HPV vaccination among Hispanics, as they have the highest

**Table 3.** HPV vaccine completion among Hispanic adolescent females ( $n = 2,786$ )

	No. completed/total No. in category (weighted %)	Bivariate OR (95% CI)	Multivariate OR (95% CI)
Total	1,025/2,786 (36.0)	—	—
Year			
2010	402/1,199 (29.5)	ref.	ref.
2011	623/1,587 (41.6)	1.70 (1.27–2.28) <sup>a</sup>	1.52 (1.11–2.08) <sup>b</sup>
<i>Daughter characteristics</i>			
<i>Age</i>			
13 y	185/613 (27.5)	ref.	ref.
14 y	217/607 (34.7)	1.40 (0.91–2.17)	1.53 (0.94–2.47)
15 y	209/562 (34.3)	1.38 (0.87–2.19)	1.37 (0.85–2.21)
16 y	226/533 (43.6)	2.04 (1.31–3.16) <sup>b</sup>	2.08 (1.32–3.29) <sup>b</sup>
17 y	188/471 (41.2)	1.84 (1.16–2.92) <sup>b</sup>	1.85 (1.11–3.06) <sup>b</sup>
<i>Race</i>			
White	868/2,389 (35.7)	ref.	—
Black	64/160 (39.9)	1.20 (0.70–2.06)	—
Other	93/237 (36.8)	1.05 (0.62–1.79)	—
<i>Visited healthcare provider in last year</i>			
No	156/525 (25.0)	ref.	ref.
Yes	860/2,233 (39.6)	1.97 (1.35–2.87) <sup>a</sup>	1.48 (0.98–2.23)
<i>Currently live in state where born</i>			
No	247/784 (27.4)	ref.	ref.
Yes	778/2,002 (39.3)	1.72 (1.22–2.42) <sup>a</sup>	1.50 (1.05–2.17) <sup>a</sup>
<i>Healthcare coverage</i>			
Through parent employer or union	440/1,224 (35.7)	2.57 (1.56–4.24) <sup>a</sup>	1.84 (1.05–3.22) <sup>b</sup>
Other insurance, including Medicaid	493/1,184 (42.6)	3.44 (2.08–5.67) <sup>a</sup>	3.00 (1.71–5.27) <sup>a</sup>
No insurance	84/357 (17.8)	ref.	ref.
<i>Eligible for VFC program</i>			
No	472/1,320 (37.4)	ref.	—
Yes	551/1,458 (35.0)	0.90 (0.68–1.21)	—
<i>Parent characteristics</i>			
<i>Mother's age</i>			
<35 y	119/346 (26.9)	ref.	ref.
35–44 y	529/1,380 (37.0)	1.60 (1.02–2.51) <sup>b</sup>	1.77 (1.09–2.89) <sup>b</sup>
45+ y	377/1,060 (38.5)	1.70 (1.07–2.70) <sup>b</sup>	1.68 (1.00–2.82) <sup>b</sup>
<i>Mother's education</i>			
Less than high school	307/854 (33.2)	ref.	—
High school	222/600 (38.0)	1.23 (0.83–1.83)	—
Some college	263/691 (35.3)	1.10 (0.76–1.59)	—
College graduate	233/641 (40.5)	1.37 (0.90–2.07)	—
<i>Mother's marital status</i>			
Not married	346/898 (38.6)	ref.	—
Married	679/1,888 (34.7)	0.85 (0.63–1.14)	—
<i>Language of NIS-Teen interview</i>			
English	600/1,733 (35.3)	ref.	—
Spanish	424/1,048 (37.0)	1.08 (0.80–1.45)	—
<i>Received provider recommendation to get daughter HPV vaccine</i>			
No	327/1,206 (29.8)	ref.	ref.
Yes	645/1,467 (41.9)	1.70 (1.25–2.31) <sup>a</sup>	1.60 (1.17–2.18) <sup>b</sup>

(Continued on the following page)

**Table 3.** HPV vaccine completion among Hispanic adolescent females ( $n = 2,786$ ) (Cont'd)

	No. completed/total No. in category (weighted %)	Bivariate OR (95% CI)	Multivariate OR (95% CI)
<i>Household characteristics</i>			
Poverty status			
Below poverty	372/963 (36.3)	ref.	—
Above poverty, $\leq$ \$75,000	387/1,090 (35.8)	0.98 (0.70–1.37)	—
Above poverty, $>$ \$75,000	226/612 (38.4)	1.10 (0.75–1.60)	—
Number of children in household			
1	313/873 (38.7)	ref.	ref.
2–3	575/1,490 (37.7)	0.96 (0.70–1.31)	1.11 (0.79–1.56)
4+	137/423 (28.5)	0.63 (0.40–0.99) <sup>b</sup>	0.86 (0.51–1.45)
Region of residence			
Northeast	175/394 (41.3)	ref.	ref.
Midwest	104/334 (31.1)	0.64 (0.41–1.01)	0.72 (0.46–1.14)
South	425/1,216 (32.2)	0.67 (0.47–0.97) <sup>b</sup>	0.84 (0.57–1.25)
West	321/842 (38.3)	0.88 (0.62–1.26)	1.19 (0.80–1.76)

NOTE: Totals may not sum to stated sample size due to missing data. Multivariate model did not include variables with dashes (—). Multivariate model included data on 2,629 Hispanic adolescent females due to missing data for potential correlates.

<sup>a</sup> $P < 0.001$ .

<sup>b</sup> $P < 0.05$ .

percentage of uninsured children of any racial or ethnic group in the United States (46). It is important that Hispanic parents are aware of the Vaccines for Children (VFC) program, which can provide vaccines free of charge to children meeting certain criteria (i.e., American Indian or Alaska native, Medicaid-eligible, uninsured, or underinsured; ref. 47). Although VFC eligibility was not associated with HPV vaccination outcomes in our study, many of the daughters who had health insurance from sources other than their parent's employer or union likely received HPV vaccine through the VFC program, as over half were covered by Medicaid.

Hispanic adolescent females who had moved from their birth state were less likely to have completed the HPV vaccine regimen. It is possible that geographic mobility among these adolescents disrupted their medical homes. Medical homes provide accessible and continuous health care to adolescents (including vaccinations; ref. 48), and adolescents without a medical home may have more trouble obtaining the second and third doses of the HPV vaccine regimen. Geographic mobility and its potential effect on HPV vaccination may be important for the Hispanic population because about 80% of migrant and seasonal farm workers are Hispanic (49). Research has shown that Hispanic farm workers lack awareness and knowledge about HPV vaccine and access to care is a barrier to obtaining preventive services for this population (50). Our results provide initial support that geographic mobility may be associated with lower completion of the three-dose HPV vaccine regimen. However, the NIS-Teen does not include information on when adolescents moved from their birth state, leaving open the

possibility that geographic mobility made it more difficult for the NIS-Teen to obtain complete HPV vaccination histories from healthcare providers. Future research is needed to clarify the relationship between geographic mobility and HPV vaccination behaviors.

Parents' preferred language, our proxy measure of acculturation, was not associated with past HPV vaccination. This finding is encouraging because a few studies have found lower HPV vaccine coverage among Hispanics with less U.S. acculturation (23, 24). However, we did find that parents whose preferred language was Spanish reported higher intent to vaccinate their daughters in the future, suggesting that it will be important to monitor how acculturation affects future trends in HPV vaccine coverage among Hispanic females. Furthermore, our results suggest that parents' main reasons for not intending to vaccinate may differ by preferred language. Spanish-speaking parents may be more concerned about cost of HPV vaccine and be less likely to receive a healthcare provider recommendation to vaccinate, whereas English-speaking parents with Hispanic daughters may be more concerned about vaccine safety and potential side effects. In the current study, only 34.6% of Spanish-speaking parents had received a healthcare provider recommendation to vaccinate compared with 61.5% of English-speaking parents with Hispanic daughters. The lack of provider recommendation among Spanish-speaking parents may be partly attributable to language barriers and may also help explain why fewer of these parents reported concerns about vaccine safety and potential side effects. It is possible that some of these parents do not spend a great

**Table 4.** HPV vaccine follow-through among Hispanic adolescent females ( $n = 1,639$ )<sup>a</sup>

	No. follow-through/ total No. in category (weighted %)	Bivariate OR (95% CI)	Multivariate OR (95% CI)
Total	1,025/1,639 (59.1)	—	—
Year			
2010	402/665 (52.5)	ref.	ref.
2011	623/974 (64.0)	1.61 (1.10–2.37) <sup>b</sup>	1.37 (0.92–2.05)
<i>Daughter characteristics</i>			
<i>Age</i>			
13 y	185/329 (52.9)	ref.	—
14 y	217/342 (59.2)	1.29 (0.71–2.34)	—
15 y	209/334 (59.2)	1.29 (0.72–2.33)	—
16 y	226/344 (65.9)	1.72 (0.95–3.12)	—
17 y	188/290 (57.0)	1.18 (0.63–2.19)	—
<i>Race</i>			
White	868/1,389 (58.8)	ref.	—
Black	64/94 (62.5)	1.17 (0.55–2.49)	—
Other	93/156 (60.0)	1.05 (0.54–2.06)	—
<i>Visited healthcare provider in last year</i>			
No	156/268 (52.3)	ref.	—
Yes	860/1,355 (61.0)	1.43 (0.86–2.39)	—
<i>Currently live in state where born</i>			
No	247/449 (49.3)	ref.	ref.
Yes	778/1,190 (62.4)	1.70 (1.12–2.60) <sup>b</sup>	1.53 (0.96–2.45)
<i>Healthcare coverage</i>			
Through parent employer or union	440/655 (64.0)	2.75 (1.45–5.21) <sup>b</sup>	1.98 (0.98–4.00)
Other insurance, including Medicaid	493/788 (61.3)	2.45 (1.33–4.49) <sup>b</sup>	2.40 (1.26–4.57) <sup>b</sup>
No insurance	84/180 (39.3)	ref.	ref.
<i>Eligible for VFC program</i>			
No	472/711 (63.9)	ref.	—
Yes	551/926 (55.7)	0.71 (0.48–1.05)	—
<i>Parent characteristics</i>			
<i>Mother's age</i>			
<35 y	119/219 (41.7)	ref.	ref.
35–44 y	529/841 (60.7)	2.15 (1.24–3.75) <sup>b</sup>	2.29 (1.22–4.28) <sup>b</sup>
45+ y	377/579 (64.8)	2.57 (1.44–4.61) <sup>b</sup>	2.11 (1.08–4.14) <sup>b</sup>
<i>Mother's education</i>			
Less than high school	307/545 (51.7)	ref.	ref.
High school	222/355 (60.4)	1.43 (0.86–2.37)	1.49 (0.87–2.53)
Some college	263/391 (63.5)	1.63 (0.98–2.71)	1.60 (0.91–2.81)
College graduate	233/348 (71.0)	2.29 (1.35–3.88) <sup>b</sup>	2.39 (1.19–4.83) <sup>b</sup>
<i>Mother's marital status</i>			
Not married	346/565 (58.9)	ref.	—
Married	679/1,074 (59.2)	1.01 (0.69–1.50)	—
<i>Language of NIS-Teen interview</i>			
English	600/951 (60.8)	ref.	—
Spanish	424/685 (57.3)	0.87 (0.59–1.27)	—
<i>Received provider recommendation to get daughter HPV vaccine</i>			
No	327/568 (53.5)	ref.	—
Yes	645/996 (62.6)	1.46 (0.98–2.17)	—

(Continued on the following page)

**Table 4.** HPV vaccine follow-through among Hispanic adolescent females ( $n = 1,639$ )<sup>a</sup> (Cont'd)

	No. follow-through/ total No. in category (weighted %)	Bivariate OR (95% CI)	Multivariate OR (95% CI)
<i>Household characteristics</i>			
Poverty status			
Below poverty	372/626 (57.0)	ref.	ref.
Above poverty, ≤\$75,000	387/604 (60.0)	1.13 (0.73–1.76)	0.71 (0.43–1.16)
Above poverty, >\$75,000	226/330 (70.4)	1.80 (1.08–2.99) <sup>b</sup>	0.78 (0.40–1.55)
Number of children in household			
1	313/472 (70.9)	ref.	ref.
2–3	575/910 (61.2)	0.65 (0.42–0.99) <sup>b</sup>	0.67 (0.43–1.03)
4+	137/257 (42.9)	0.31 (0.17–0.55) <sup>c</sup>	0.42 (0.22–0.81) <sup>b</sup>
Region of residence			
Northeast	175/256 (64.4)	1.37 (0.86–2.17)	—
Midwest	104/175 (58.1)	1.05 (0.60–1.85)	—
South	425/685 (60.8)	1.17 (0.74–1.84)	—
West	321/523 (57.0)	ref.	—

NOTE: Totals may not sum to stated sample size due to missing data. Multivariate model did not include variables with dashes (—). Multivariate model included data on 1,544 Hispanic adolescent females due to missing data for potential correlates.

<sup>a</sup>Follow-through was defined as receipt of all three doses among only those who initiated the vaccine series (i.e., completion among initiators).

<sup>b</sup> $P < 0.05$ .

<sup>c</sup> $P < 0.001$ .

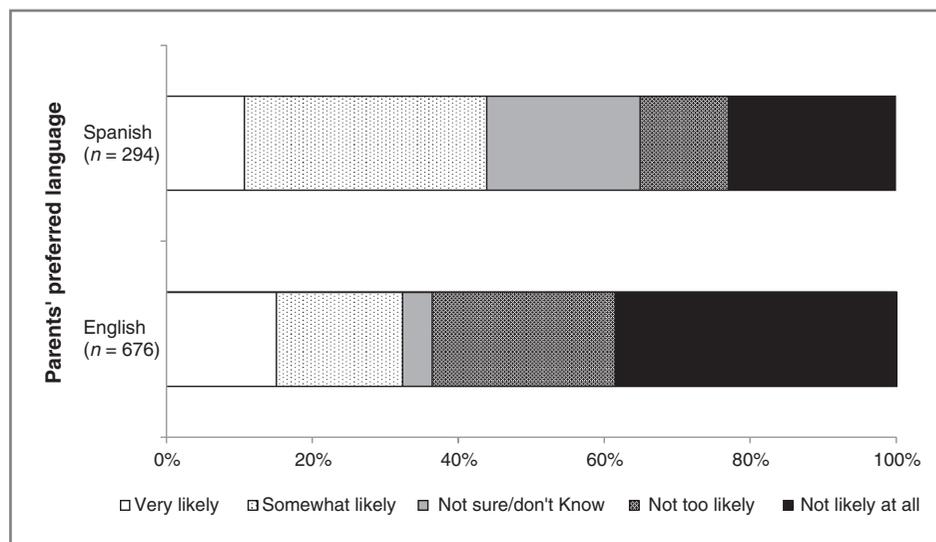
deal of time considering issues such as vaccine safety until after a healthcare provider has discussed vaccination with them and provided a recommendation.

Regardless of preferred language, lack of knowledge among parents was a common reason for not intending to vaccinate their daughters. Almost a quarter of parents in our analyses indicated lack of knowledge as a main reason, which is noticeably higher than the 10.2% of parents in the United States (all races and ethnicities)

who indicated this reason in 2010 (51). It is important that future programs to increase HPV vaccination among Hispanics provide information about HPV and HPV vaccine, while also considering how other potential barriers to vaccination may differ by acculturation level.

Study strengths include using data from the NIS-Teen, which provided a large national sample of Hispanic adolescent females and HPV vaccination data based on

**Figure 1.** Parents' intent to vaccinate their Hispanic adolescent daughters against HPV in the next year.



**Table 5.** Main reasons why parents did not intend to get their Hispanic adolescent daughters HPV vaccine in the next year ( $n = 560$ )

	Total <i>n</i> (weighted%)	Parents' preferred language	
		English <i>n</i> (weighted %)	Spanish <i>n</i> (weighted %)
Lack of knowledge	89 (22.7)	56 (18.8)	32 (30.9)
Vaccine safety concern/side effects	156 (21.1)	132 (28.5)	24 (5.9) <sup>a</sup>
Vaccination not needed or not necessary	99 (19.8)	79 (16.8)	19 (26.1)
Daughter not sexually active	96 (15.7)	85 (18.7)	10 (9.4)
Did not receive provider recommendation	54 (10.2)	39 (5.3)	15 (20.2) <sup>b</sup>
Daughter not appropriate age	38 (5.1)	26 (5.5)	12 (4.2)
Costs	15 (4.7)	9 (1.8)	6 (10.9) <sup>b</sup>
Need more information/new vaccine	19 (3.6)	17 (4.6)	2 (1.6)
Daughter should make decision	11 (3.3)	8 (4.5)	3 (0.8)
Family/parent decision	20 (3.0)	20 (4.4)	0 (0.0)
Other reason	7 (0.9)	7 (1.4)	0 (0.0)
Handicapped/special needs/illness	5 (0.7)	3 (0.8)	2 (0.5)
Don't believe in vaccinations	7 (0.6)	7 (0.9)	0 (0.0)
Not a school requirement	4 (0.4)	1 (0.1)	3 (1.1)
Daughter fearful	4 (0.3)	4 (0.4)	0 (0.0)
No doctor or doctor's visit not scheduled	2 (0.3)	1 (0.3)	1 (0.2)
Religion/orthodox	2 (0.1)	2 (0.1)	0 (0.0)
Effectiveness concern	2 (0.1)	2 (0.2)	0 (0.0)
No obstetrician/gynecologist	1 (0.1)	1 (0.1)	0 (0.0)
Time	1 (<0.1)	0 (0.0)	1 (<0.1)

NOTE: Table includes parents of unvaccinated daughters who indicated they were "not likely at all," "not too likely," or "not sure/don't know" about getting their daughters HPV vaccine in the next year.

<sup>a</sup> $P < 0.001$ .

<sup>b</sup> $P < 0.05$ .

healthcare provider records. We were also able to examine geographic mobility and parents' preferred language as potential correlates, variables that may be especially important to the Hispanic population. Limitations include household response rates below 60% for the years of NIS-Teen data analyzed. Although language preference correlates with acculturation scales and is an important component of several of them, it is a proxy for acculturation (26). The NIS-Teen public-use datasets did not contain information about the country of origin among Hispanics (e.g., Mexican, Cuban, etc.). Additional factors (e.g., parents' health beliefs; refs. 39, 52) may be key determinants of HPV vaccination among Hispanics. Despite these limitations, we believe our study represents an important early step in examining correlates of HPV vaccination, parents' intent to vaccinate, and reasons for not intending to vaccinate among the Hispanic population.

HPV vaccination among Hispanic adolescent females in the United States is suboptimal, with many adolescents remaining unvaccinated. Similar to other racial and ethnic groups, efforts are needed to increase healthcare provider recommendation for vaccination and to increase vaccine coverage among younger adolescents and those without health insurance. Additional factors, such as geographic

mobility and preferred language, should also be considered when examining HPV vaccination among the Hispanic population and designing programs to increase vaccination.

#### Disclosure of Potential Conflicts of Interest

P.L. Reiter has received commercial research grants from Merck Sharp & Dohme Corp. and Cervical Cancer-Free America, via an unrestricted educational grant from GlaxoSmithKline. N.T. Brewer has received commercial research grants from GSK and Merck, honoraria from the speakers' bureau of Merck, and is a consultant/advisory board member of the same. E.D. Paskett has received commercial research grant from Merck. J.S. Smith has received commercial research grants from, and is a consultant/advisory board member of, GSK and Merck. No potential conflicts of interest were disclosed by the other authors.

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