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Trends in HPV Vaccine Initiation and Completion among Girls in Texas: Behavioral Risk Factor Surveillance System Data, 2008–2010

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Trends in HPV Vaccine Initiation and Completion among Girls in Texas: Behavioral Risk Factor Surveillance System Data, 2008–2010

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Objective: The objective of this study was to evaluate the trend of HPV vaccine initiation and completion among girls in Texas from 2008 to 2010.

Methods: Data were obtained from the Behavioral Risk Factors Surveillance System (BRFSS) over 3 years (2008–2010). The information regarding HPV vaccination was gathered from the parents of 9- to 17-year-old daughters (choosing only 1 per household) in randomly selected households in the sample area.

Results: The highest prevalence of vaccine initiation and completion were detected in 2010 (20.9% and 9.7%, respectively). Over the study period, HPV vaccine initiation statistically significantly increased (2008, 14.9%; 2009, 20.7%; 2010, 24.3%; p = 0.002), corresponding to an annual increase in coverage of 33.5% (odds ratio [OR] = 1.33; 95% confidence interval [CI]: 1.11–1.60). Similarly, HPV vaccination completion increased (2008, 6.3%; 2009, 9.6%; 2010, 11.6%; p = 0.021), corresponding to an annual increase in coverage of 37.1% (OR = 1.37; 95% CI: 1.05–1.79). Increasing trends in HPV vaccination initiation and completion were observed in mothers, white, non-Hispanic parents, parents who had attended some college or were college graduates, parents who were married/partnered, and parents who lived in urban areas.

Conclusion: Although HPV vaccination coverage in Texas is lower than recommended, there have been increases in the trends of vaccine initiation and completion. The campaigns promoting HPV vaccination should target specific population groups in which HPV immunization rates did not increase over time. [*P R Health Sci J 2017;36:152-158*]

Key words: HPV vaccination, Trend, Girls, Texas

In 2007 the Advisory Committee on Immunization Practices (ACIP) recommended routinely administering a quadrivalent HPV vaccine to females aged 9 to 26 years, with females aged 11 to 12 comprising the target (with associated age range) for the vaccination (1, 2). In the United States (US), the cost of HPV vaccination is covered by health insurance as well as the federal Vaccines for Children program (3). Additionally, numerous states have introduced legislation to require the HPV vaccine, fund the vaccine, or educate the public about the vaccine (4).

Previous analyses of the data from the Behavioral Risk Factor Surveillance System (BRFSS) highlighted variations in the coverage of the HPV vaccine in girls aged 14 to 17 across 6 states (5). Pruitt et al.'s study indicated that the lowest rate (20.6%) of HPV vaccination (≥1 vaccine injection) was reported in Texas, while the highest (50.4%) was observed in New York (5). Despite an attempt to make HPV vaccination mandatory in Texas in 2007 (6), the rate of vaccine coverage remained the lowest of the states surveyed in the following year (5). Furthermore, cancer registry data suggested that most counties in Texas had low compliance of cervical cancer screening among adult women, while the incidence and mortality of that particular cancer in the state remained high (7). Thus, low vaccine coverage in this population could lead to the persistence of cancer burden associated with HPV infection in the following decades (8).

Although a recent rise in the rate of HPV vaccination has been observed at the national level, the coverage in Texas remains one of the lowest in the country (9). Given that HPV is the most common sexually transmitted disease (10) and is the principal risk factor for the development of cervical cancer later in life (11), there is an increasing concern that full HPV vaccination coverage of girls aged 13 to 15 will not reach the US Department of Health and Human Services Healthy People 2020 goal of

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80% by 2020 (12). Furthermore, the President's Cancer Panel (12) considers the increasing of HPV vaccination rates to be a national priority: Current disparities in vaccination uptake could (probably will) later lead to like disparities in cervical cancer incidence. For this reason, in order to increase HPV vaccination uptake, the panel has suggested, then, that reducing the number of missed opportunities for recommending or administering (or both) the vaccine to eligible adolescents would result in increasing the uptake of the vaccination, as would maximizing the acceptance of the vaccine by parents and caregivers and overall access to it (12).

Because of the continuously low proportion of females who are being immunized against the HPV infection in Texas, it is necessary to identify whether there is a change in the trajectory of HPV vaccine coverage; particular attention must be paid to the disparities experienced by certain population subgroups The aim of the BRFSS survey was to evaluate the trends of HPV vaccine initiation and completion among adolescent females in Texas from 2008 to 2010 and to describe potential disparities in HPV vaccination among girls in the population of that state.

Materials and Methods

Behavioral risk factor surveillance system

The Centers for Disease Control and Prevention's BRFSS is a state-based telephone interview survey conducted each year to monitor the health-related behaviors, chronic health conditions, and use of preventive services of US citizens aged 18 and above (13). State-level sampling and weighting was used to obtain a representative sample (in each state) of the general population living in households with land telephones. Post-stratification, the method of choice for weighting data in the BRFSS, consisted of simultaneously adjusting for age, race/ethnicity, sex, geographic region, and other characteristics to those proportions identified in the US Census (14). As of 2006, a more sophisticated weighting method was used; it included iterative proportional fitting, which allowed researchers to adjust for each variable individually in a series of data processing–intensive iterations. Finally, the weights were adjusted until the sample weights were deemed representative of the population (14). The BRFSS survey consists of core modules, optional modules, and state-added questions. The child HPV-vaccination module is optional and is not used assessed in all states. Furthermore, this module was not used in BRFSS surveys after 2010.

Data collection

Data on child HPV vaccination were available for 3 consecutive years (2008, 2009, 2010). Because of changes in the data collection (the inclusion of households with cellular telephones, only), including analyses that cross over from 2010 to 2011 is not recommended as such analyses have the potential to influence the validity of survey results (14). The dataset for our survey included residents of Texas, exclusively. The choice to include only the members of that population in our sample was made based on the availability of said residents as well as their having already been surveyed using the "child HPV vaccination" optional module for several consecutive years. The information regarding HPV vaccination was gathered from the parents of randomly selected children, aged 9 to 17 years. The analyses included girls, only, because data regarding boys were collected only for 2010. The HPV vaccination status was evaluated by asking "Has this child ever had an HPV vaccination?" followed by "How many HPV shots did she receive?" Parents who responded affirmatively to the former question were considered to have initiated the HPV vaccination. Other variables in the analysis were race/ethnicity (non-Hispanic white, non-Hispanic black, Hispanic, and other), level of education (high school or less/some college or more), income of parents (<$50,000 vs. ≥ $50,000 annual income), and the geographic area in which the household was located (urban, suburban, rural). Information regarding whether the responding parent had undergone a routine check-up in the year prior to the survey (yes, no) was also taken into consideration.

The Institutional Review Board (IRB) of the City College of New York considered the ethical aspects of this research and determined that this analysis did not qualify as "human subject research" as defined by federal regulations (45 CFR 46.102(d) (f)). Therefore, no further IRB review or approval was required.

Statistical analysis

Summary statistics describing the study sample included proportions. Vaccination coverage according to selected categories was presented as percentages, with corresponding 95% confidence intervals (CI). All estimates were adjusted for unequal probability sampling weight and post-stratification. When calculating 95% CIs and p-values, we adjusted for the multistage sampling design of the BRFSS survey. Linear trend was analyzed for HPV vaccine initiation (first dose) and for HPV vaccination completion (all 3 doses received). In the equation estimating linear trend, the dependent variables were HPV coverage rates for each of the 3 years, according to parental socio-demographic characteristics, while the independent variable was time (2008–2010). Odds ratios (OR) and corresponding 95% CIs were calculated to assess the increase in trend per year. A probability level of p less than 0.05 was considered statistically significant. The statistical analysis was performed using the SAS software package, version 9.3.

Results

For the period of 2008 to 2010, there were a total of 3,085 parents whose children were eligible for HPV vaccination. The socio-demographic characteristics of these parents are shown in Table 1. Most respondents were non-Hispanic whites (48.3%), had attended some college or were college graduates (59.1%), were married (70.8%) and had 1 child in their household (42.2%), had a household income of $50,000 or more (51.7%),

Table 1. Socio-demographic characteristics of parents of children eligible to be vaccinated for HPV who participated in the 2008–2010 BRFSS survey in Texas

Variable	Year			Overall
	2008 n (%)	2009 n (%)	2010 n (%)	
Totals	791 (100.0)	833 (100.0)	1461 (100.0)	3085 (100.0)
Sex				
Female	555 (70.1)	531 (63.7)	973 (66.6)	2059 (66.7)
Male	236 (29.9)	302 (36.3)	488 (33.4)	1026 (33.3)
Race/Ethnicity				
Non-Hispanic white	418 (52.8)	439 (52.7)	632 (43.3)	1489 (48.3)
Non-Hispanic black	64 (8.1)	70 (8.4)	99 (6.8)	233 (7.5)
Hispanic	280 (35.4)	284 (34.1)	680 (46.5)	1244 (40.3)
Other	29 (3.7)	40 (4.8)	50 (3.4)	119 (3.9)
Education				
High school or less	313 (39.6)	302 (36.2)	648 (44.3)	1263 (40.9)
Some college or more	478 (60.4)	531 (63.8)	813 (55.7)	1822 (59.1)
Marital status				
Married/partnered	546 (69.0)	596 (71.6)	1041 (71.2)	2183 (70.8)
Divorced	144 (18.2)	132 (15.8)	236 (16.2)	512 (16.6)
Other	101 (12.8)	105 (12.6)	184 (12.6)	390 (12.6)
Number of children in household				
1	363 (45.9)	345 (41.4)	594 (40.7)	1302 (42.2)
2	246 (31.1)	305 (36.6)	464 (31.8)	1015 (32.9)
≥3	182 (23.0)	183 (22.0)	403 (27.5)	768 (24.9)
Household income				
<$50,000 (US)	410 (51.8)	385 (46.2)	801 (54.8)	1596 (51.7)
≥$50,000 (US)	381 (48.2)	448 (53.8)	660 (45.2)	1489 (48.3)
MSA code				
Urban	419 (53.0)	512 (61.5)	882 (60.4)	1813 (58.8)
Suburban	246 (31.1)	232 (27.8)	351 (24.0)	829 (26.9)
Rural	126 (15.9)	89 (10.7)	228 (15.6)	443 (14.4)
Routine check-up in past year				
Yes	497 (62.8)	498 (59.8)	839 (57.4)	1834 (59.4)
No	294 (37.2)	335 (40.2)	622 (42.6)	1251 (40.6)

Legend. MSA: metropolitan statistical area

and lived in urban areas (58.8%). More than one half (59.4%) of the parents had had a routine check-up in the year prior to the survey.

Table 2 displays the prevalences of HPV shots according to parental socio-demographic characteristics. The highest prevalence of vaccine initiation and completion were detected in 2010. Overall, the highest vaccination coverage in all the examined categories was noted for 1 HPV shot. On the other hand, the lowest prevalence was observed for vaccination completion (all 3 HPV shots).

Over the study period, HPV initiation statistically significantly increased (2008, 14.9%; 2009, 20.7%; 2010, 24.3%; p = 0.002) (Table 3), corresponding to an annual increase in coverage of 33.5% (OR = 1.33; 95% CI: 1.11–1.60). A statistically significant increasing trend in the rates of HPV initiation was observed in mothers (p = 0.008; 30% increase/year), white, non-Hispanic parents (p<0.001; 60% increase/year), parents who had attended some college or were college graduates (p<0.001; 54% increase/year), parents who were married/partnered (p<0.001; 50% increase/year), parents who had 2 children in their household (p = 0.021; 48% increase/year), parents who lived in urban areas (p = 0.018; 33% increase/year), and parents who had had a routine check-up in the year prior to the survey (p<0.001; 80% increase/year) (Table 3). We observed this trend in families with annual incomes of both less than $50,000 and $50,000 and higher (Table 3). By 2010, the highest initiation rate was 37%, and most subgroups had initiation rates ranging from 20% to 28%.

Similar to what we noted regarding vaccine initiation, we observed an overall increase in the tendency to complete the process of HPV vaccination (2008, 6.3%; 2009, 9.6%; 2010, 11.6%; p = 0.021) (Table 3). The estimated annual increase in coverage of all 3 doses of HPV vaccine (vaccination completion) was 37.1% (OR = 1.37; 95% CI: 1.05–1.79). A statistically significant increase in the trend of HPV completion was registered in mothers (p = 0.008; 39% increase/year), white, non-Hispanic parents (p = 0.001; 71% increase/year), parents who had attended some college or were college graduates (p = 0.009; 50% increase/year), parents who were either married/partnered or divorced (p = 0.001; 61% increase/year and p = 0.040, 50% increase/year, respectively), parents who had 1 child in their household (p = 0.025; 50% increase/year), parents who lived in urban areas (p = 0.019; 51% increase/year), and parents who had not reported having had a routine check-up in the year prior to the survey (p = 0.017; 64% increase/year) (Table 4). Similar to what was noted in vaccine initiation, the increasing trend in HPV vaccine completion was observed in families with annual incomes of both less than $50,000 and $50,000 and higher (Table 4). By 2010, the highest completion rate was 24.0%, and most subgroups had completion rates that ranged from 10% to 15%.

Discussion

Since 2010 the BRFSS survey has not included a module for collecting HPV vaccination data for children (13). For this reason, the trend analysis presented in this research article provides important findings. The results of our study show that HPV vaccination initiation and completion in adolescent girls in Texas increased from 2008 to 2010 in many population subgroups. This means that in spite of this state's having one of the lowest state coverage rates (5, 9), an overall increasing (over time) tendency in responding to HPV vaccination is present. Similarly, in North Carolina, an upward trend was observed among adolescent girls for the same period (15). However, compared with girls in North Carolina (15), girls in Texas had roughly 2 times lower rates of overall vaccine initiation (40–50% in North Carolina versus 20–28% in Texas) in 2010.

Although an increase in vaccination trend was noted at the state level, vaccination initiation improved to a greater degree in certain population groups. For instance, our results show that mothers were more likely to report that their daughters had initiated and completed the vaccination process. Regarding vaccine initiation, a similar finding was described for girls in North Carolina (15). A rising trend of reporting HPV initiation was observed among male parents, which was at the level of marginal statistical significance. Women—both mothers and caregivers—might be more involved than their male counterparts in the health and in the vaccination status of the children for whom they are responsible. Several studies suggested that both mothers and fathers may inaccurately report vaccination uptake (16–18). In line with this, various authors have reported somewhat conflicting findings (16–18). Stupiansky et al. documented that, even though recall of vaccination had high sensitivity and reasonable specificity, only 76% of the participating mothers/female caregivers actually knew whether their daughters/wards had received the HPV vaccine (16). Adequate accuracy in the classification of the HPV vaccination status of daughters has also been reported by Ojha et al. (17), while a recent report using a smaller sample of parents (79 in total) than were used in the former 2 studies reported that 40% of parents or guardians had failed to recall the accurate number of HPV shots that their daughters had received (18). Given the reports, it is reasonable to presume that parents/caregivers may under-report vaccine uptake.

Table 2. Prevalence of HPV shots according to parental socio-demographic characteristics

Variable	HPV vaccination		
	≥ 1 shot % (95% CI)	≥ 2 shots % (95% CI)	All 3 shots % (95% CI)
Year			
2008	14.9 (11.2–18.6)	10.4 (6.9–13.9)	6.3 (3.4–9.2)
2009	20.6 (16.3–24.9)	13.2 (8.8–17.5)	9.6 (6.7–12.5)
2010	24.3 (20.1–28.4)	15.9 (11.8–20.0)	11.6 (8.5–14.7)
Overall	20.9 (18.5–23.2)	13.7 (11.3–16.0)	9.7 (7.9–11.5)
Sex			
Female	23.9 (21.6–26.6)	17.0 (14.4–19.5)	12.2 (9.5–14.9)
Male	15.6 (11.9–19.3)	8.6 (5.6–11.5)	5.6 (3.4–7.8)
Race/Ethnicity			
Non-Hispanic white	19.6 (16.5–22.7)	12.4 (9.8–14.9)	9.1 (6.9–11.2)
Non-Hispanic black	27.7 (17.1–38.3)	21.6 (10.6–32.6)	17.8 (7.0–28.5)
Hispanic	20.5 (16.8–24.2)	13.9 (10.7–17.0)	8.9 (6.3–11.4)
Other	13.4 (3.2–23.5)	5.7 (1.9–13.3)	0.7 (0.3–1.7)
Educational attainment			
High school or less	20.3 (16.6–24.0)	14.0 (10.7–17.3)	9.1 (6.2–12.0)
Some college or more	20.3 (17.4–23.2)	12.9 (10.5–15.2)	9.4 (7.2–11.5)
Marital status			
Married/partnered	19.4 (16.8–21.9)	12.4 (10.2–14.5)	8.7 (6.7–10.6)
Divorced	25.9 (19.6–32.2)	20.3 (14.4–26.2)	12.9 (8.7–17.0)
Other	21.1 (13.8–28.3)	13.3 (6.8–19.8)	10.2 (3.9–16.4)
Number of children in household			
1	20.1 (16.5–23.6)	13.9 (11.0–16.8)	9.2 (6.8–11.5)
2	22.3 (18.0–26.6)	12.8 (9.3–16.3)	9.9 (6.8–13.0)
≥3	17.9 (14.3–21.4)	13.2 (9.1–17.3)	8.7 (5.0–12.4)
Household income			
<$50,000 (US)	20.4 (16.9–23.9)	13.5 (10.6–16.4)	8.1 (5.9–10.2)
≥$50,000 (US)	19.9 (16.6–23.2)	12.8 (10.1–15.5)	9.8 (7.2–12.3)
MSA code			
Urban	23.7 (20.2–27.2)	15.8 (13.0–18.5)	10.7 (8.1–13.2)
Suburban	15.8 (12.19–19.5)	11.0 (7.9–14.1)	8.9 (6.0–11.8)
Rural	21.2 (13.7–28.6)	11.1 (6.4–15.8)	5.0 (2.4–7.5)
Routine check-up in past year			
Yes	22.8 (19.3–26.3)	16.0 (13.4–18.5)	11.5 (9.3–13.6)
No	17.1 (14.0–20.2)	9.9 (7.1–12.6)	6.5 (3.9–9.0)

Legend. CI: confidence interval; MSA: metropolitan statistical area

In terms of race/ethnicity, a significant increase in HPV vaccine initiation and completion was observed in Texas in non-Hispanic whites. By contrast, non-Hispanic blacks had the highest rates of vaccination in 2008 and 2010, but the coverage did not improve with time. As a result, racial/ethnic disparities may appear to be lessening since some population subgroups (non-Hispanic blacks) will not continue to make the same gains in health experienced by others (non-Hispanic whites). Our results are also comparable to those of the US Health Information National Trends Survey (19). Specifically, white women were found to be 1.86 times more willing to vaccinate their daughters (19). In North Carolina, however, a statistically significant increasing trend of initiating HPV vaccination was seen in populations other than non-Hispanic whites and non-Hispanic blacks (15). Data from 2009 from Hispanic populations in 3 US regions, including Texas, indicated moderate levels of vaccine awareness among caregivers/parents (20). Barriers to HPV immunization in this population included concerns about negative effects on the daughter's sexual behavior, fertility, and overall health (21). Although higher levels of acculturation are associated with a greater likelihood of vaccination in low-income Hispanic communities, physician recommendation and low concern about paying for the vaccine have been deemed as independent predictors of HPV vaccine uptake (22).

A significant increase in the proportion of physicians who always recommend HPV vaccine for female patients aged 11 or 12 years was observed from 2009 to 2011 (22). However, this was not noticed for patients aged 13 to 17 years (22). In North Carolina, for example, an increase in vaccination initiation was observed among those who had a regular health care provider (15). According to the 2009 National Immunization Survey-Teen, adolescents who received a recommendation from their health care providers were 4.81 times more likely to undergo HPV vaccination, regardless of race/ethnicity, compared with those who did not receive such a recommendation (23). Still, racial/ethnic minorities were less likely overall to receive this kind of recommendation (23). Vadaparampil et al. (24) pointed

out that in 2009, HPV vaccination rates in Florida were higher among the patients of pediatricians who had a private practice, practiced in a single specialty setting, and saw primarily non-Hispanic white patients. To secure higher HPV vaccination coverage, it is essential to provide counseling and vaccination recommendations to all population groups.

Moreover, HPV immunization completion is another emerging issue. Although we observed an overall upward trend in vaccine completion, fewer parents reported having their daughter complete all 3 doses of HPV as opposed to 1 or 2 doses. One of the reasons for suboptimal coverage may be that HPV vaccination completion takes 3 doses (25). A randomized study by Romanowski et al. (26) observed that immune response to a 2-dose vaccine in girls aged 9 to 14 years is comparable to the response to the standard 3-dose series in women aged 15 to 25 years up to 4 years after the first vaccination. This means that the use of a vaccine with fewer doses could improve HPV vaccination completion rates. Additionally, using a 2-dose HPV vaccine would cost less. For example, the decision regarding whether or not to undergo HPV vaccination is profoundly influenced by an individual's health beliefs; however, there is a statistically significant decrease in acceptability as the cost of the vaccine increases (27).

Although cost issues represent a likely barrier to vaccination, we observed significant increases in the trends of both of the income categories included in our study. This was not the case in North Carolina, where an upward tendency of increased HPV vaccine initiation was observed only among families with annual incomes of $50,000 or more (15). However, as expected, a trend toward increased rates of immunization was documented among parents who had attended at least some college, both in Texas and in North Carolina (15). It was noted that in the decision-making process as to whether to vaccinate a daughter against HPV, 40% of the mothers in Southeast Texas made this decision independently, whereas 22% involved husbands/partners (28). Moreover, one third of the mothers included their daughters in decision making (28). However, in our study, as well as in North Carolina (15), significantly higher HPV vaccination uptake was established among those whose parents/guardians were married/partnered, which may be more reflective of other correlates such as higher socioeconomic status or social support. In terms of residence, in 2008 the highest HPV coverage was found in metropolitan counties (29). Similarly, over the following 2 years, a significant increase in HPV vaccination trends was observed in urban areas. In contrast, over the same period in North Carolina, an increasing tendency to initiate the vaccine process was noted in rural areas (15). This finding suggests that promotions of HPV vaccination should include suburban and remote areas, equally.

Because the BRFSS survey collects self-reported data, there may be some misclassifications of vaccination status which could have caused an over-/underestimation of the number of respondents who actually had had their daughters vaccinated against HPV. The sample size of the racial/ethnic group classified as "Other" was much smaller than the other categories and might have been particularly heterogeneous (Asians/American Indians/Pacific Islanders). Therefore, the trend analysis in this subgroup should be interpreted with caution.

Table 3. Trend of HPV vaccine initiation among girls aged 9–17 in Texas, 2008–2010 BRFSS

Parental characteristics	HPV vaccine initiation 2008 % (95% CI)	2009 % (95% CI)	2010 % (95% CI)	OR (95% CI)*	Wald χ^2	p
Sex						
Female	18.7 (14.0–23.4)	23.9 (18.4–29.4)	28.1 (23.2–33.0)	1.30 (1.07–1.58)	6.94	0.008
Male	9.5 (3.2–15.7)	17.2 (10.9–23.5)	18.8 (12.1–25.5)	1.40 (0.96–2.03)	3.09	0.079
Race/Ethnicity						
Non-Hispanic white	10.2 (6.9–13.5)	22.3 (16.8–27.8)	24.8 (18.7–30.9)	1.60 (1.27–2.00)	15.81	<0.001
Non-Hispanic black	24.3 (3.5–45.1)	20.7 (1.8–22.5)	37.2 (20.7–53.7)	1.43 (0.69–2.95)	0.95	0.330
Hispanic	17.8 (11.1–24.5)	20.0 (13.4–26.9)	23.2 (17.3–29.1)	1.18 (0.89–1.57)	1.36	0.244
Other	24.1 (8.8–39.4)	16.3 (5.0–37.7)	3.3 (0.4–6.2)	0.37 (0.16–0.86)	5.34	0.020
Educational attainment						
High school or less	16.8 (9.7–23.8)	23.9 (17.2–30.5)	20.4 (14.7–26.1)	1.09 (0.82–1.45)	0.33	0.566
Some college or more	13.7 (9.8–17.6)	18.5 (13.2–23.8)	26.9 (21.4–32.4)	1.54 (1.23–1.93)	13.82	<0.001
Marital status						
Married/partnered	10.7 (7.8–13.6)	21.7 (16.8–26.6)	23.8 (19.1–28.5)	1.50 (1.24–1.83)	17.20	<0.001
Divorced	21.6 (9.8–33.4)	35.1 (23.1–47.1)	24.3 (16.5–32.1)	1.03 (0.71–1.50)	0.03	0.858
Other	29.4 (13.1–45.7)	10.5 (3.2–17.7)	28.1 (15.9–40.2)	1.05 (0.60–1.85)	0.03	0.859
Number of children in household						
1	17.1 (11.4–22.8)	17.6 (11.7–23.5)	24.9 (18.4–31.4)	1.29 (0.98–1.70)	3.36	0.067
2	14.9 (7.4–22.3)	22.2 (15.1–29.2)	28.3 (20.6–35.9)	1.48 (1.06–2.07)	5.30	0.021
≥3	10.8 (5.1–16.5)	23.2 (13.4–33.0)	18.9 (12.0–25.8)	1.25 (0.90–1.74)	1.78	0.181
Household income						
<$50,000 (US)	14.2 (9.3–9.1)	21.9 (15.0–28.8)	24.3 (18.2–30.4)	1.35 (1.05–1.75)	5.42	0.020
≥$50,000 (US)	12.4 (8.1–16.7)	19.5 (13.8–25.2)	25.6 (19.3–31.9)	1.53 (1.19–1.98)	10.75	0.001
MSA code						
Urban	19.1 (13.4–24.8)	21.4 (16.1–26.7)	28.8 (22.9–34.7)	1.33 (1.05–1.69)	5.63	0.018
Suburban	12.3 (5.8–18.8)	14.1 (7.6–20.6)	19.5 (13.4–25.6)	1.33 (0.92–1.91)	2.35	0.125
Rural	8.8 (3.5–14.1)	36.4 (20.1–52.7)	20.7 (8.3–33.0)	1.35 (0.86–2.11)	1.72	0.189
Routine check-up in past year						
Yes	6.7 (3.8–9.6)	18.8 (11.7–25.8)	23.1 (17.0–29.2)	1.80 (1.36–2.39)	16.86	<0.001
No	20.4 (14.7–26.1)	22.2 (17.1–27.3)	25.1 (19.6–30.6)	1.15 (0.91–1.44)	1.39	0.239

Legend. CI: confidence interval; OR: odds ratio; MSA: metropolitan statistical area, *year effect, bold values are statistically significant

Table 4. Trend in HPV vaccine completion among girls aged 9–17 in Texas, 2008–2010 BRFSS

Parental characteristics	HPV vaccine completion 2008 % (95% CI)	2009 % (95% CI)	2010 % (95% CI)	OR (95% CI)*	Wald χ^2	p
Sex						
Female	7.6 (4.7–10.54)	13.6 (8.9–18.3)	14.7 (10.9–18.4)	1.39 (1.09–1.77)	7.08	0.008
Male	4.3 (1.4–10.0)	5.3 (2.4–8.2)	7.0 (1.9–12.1)	1.29 (0.60–2.73)	0.43	0.511
Race/Ethnicity						
Non-Hispanic white	4.1 (1.9–6.2)	9.7 (6.2–13.2)	12.6 (8.1–17.1)	1.71 (1.25–2.34)	11.22	<0.001
Non-Hispanic black	12.7 (8.7–34.3)	17.2 (5.3–39.7)	24.0 (9.3–38.7)	1.48 (0.55–3.98)	0.59	0.440
Hispanic	7.8 (3.5–12.1)	9.4 (5.3–13.5)	9.2 (4.5–13.9)	1.08 (0.72–1.61)	0.13	0.718
Other	0 (0)	0.9 (0.8–2.7)	1.1 (0.9–3.1)	2.17 (0.43–10.90)	0.88	0.348
Educational attainment						
High school or less	7.2 (1.3–13.1)	9.6 (5.5–13.7)	10.4 (5.5–15.3)	1.20 (0.75–1.93)	0.61	0.433
Some college or more	5.7 (2.9–8.4)	9.3 (5.4–13.2)	12.4 (8.5–16.3)	1.50 (1.10–2.05)	6.74	0.009
Marital status						
Married/partnered	3.7 (2.1–5.3)	10.1 (6.6–13.6)	11.2 (7.7–14.7)	1.61 (1.23–2.10)	12.38	<0.001
Divorced	5.4 (1.7–9.1)	20.8 (9.6–32.0)	15.8 (8.5–23.0)	1.50 (1.01–2.21)	4.15	0.040
Other	19.5 (3.2–35.8)	3.1 (0.5–5.6)	10.4 (2.0–18.8)	0.69 (0.29–1.63)	0.72	0.396
Number of children in household						
1	5.8 (2.5–9.1)	9.3 (5.4–13.2)	12.5 (8.0–17.0)	1.50 (1.05–2.13)	5.03	0.025
2	8.8 (1.5–16.0)	8.2 (4.5–11.9)	12.6 (6.7–18.5)	1.26 (0.74–2.15)	0.71	0.398
≥3	3.4 (0.5–6.3)	12.6 (4.0–21.2)	9.4 (3.3–15.5)	1.38 (0.59–2.22)	1.76	0.184
Household income						
<$50,000 (US)	3.8 (2.0–5.6)	8.2 (4.7–11.7)	11.9 (7.0–16.8)	1.76 (1.28–2.49)	10.28	0.001
≥$50,000 (US)	5.6 (2.5–8.7)	10.8 (6.1–15.5)	12.1 (7.4–16.8)	1.44 (1.02–2.03)	4.36	0.037
MSA code						
Urban	6.2 (2.5–9.9)	10.8 (7.1–14.5)	13.9 (9.2–18.6)	1.51 (1.07–2.13)	5.52	0.019
Suburban	7.1 (1.2–13.0)	9.0 (3.3–14.7)	10.2 (5.7–14.7)	1.22 (0.75–1.97)	0.63	0.427
Rural	4.6 (0.9–8.3)	6.2 (1.1–11.3)	4.1 (0.2–8.0)	0.92 (0.49–1.71)	0.07	0.792
Routine check-up in past year						
Yes	8.8 (7.2–10.4)	11.4 (6.7–16.1)	13.8 (9.9–17.7)	1.28 (1.92–1.79)	5.67	0.137
No	2.5 (2.0–7.0)	7.5 (3.8–11.2)	8.5 (4.0–13.0)	1.64 (1.09–2.46)	2.21	0.017

Legend. CI: confidence interval; OR: odds ratio; MSA: metropolitan statistical area, *year effect, bold values are statistically significant

Additionally, pediatricians may not routinely offer the vaccine to younger girls (9 and 10 years old), which age group we included in the analysis. This vaccine is proven to be safe and effective for girls as young as 9 but should be given before sexual debut, and some pediatricians might feel more comfortable bringing up the topic of vaccination to the parents of girls who are 11 or 12 (or older). Therefore, it might be that the coverages of initiation and completion might differ according to the age of the child/adolescent (9- to 10-year-olds vs. 11- to 13-year-olds, for example).

Although HPV vaccination coverage in Texas is lower than is recommended, there were significant increases in the tendencies to initiate and complete the process of HPV vaccination. Because HPV vaccination has a profound role in improving public health, Campaigns promoting HPV vaccination should target specific population groups in which HPV immunization rates did not significantly increase over time. It is strongly recommended that HPV uptake surveillance continue among girls. Given that the HPV vaccine also is recommended for boys, the monitoring of HPV vaccination among boys is also warranted.

Resumen

Objetivo: El objetivo de este estudio fue evaluar la tendencia de la iniciación de la vacuna contra el VPH en las niñas en Texas desde 2008 a 2010. Métodos: Los datos se obtuvieron del "Behavioral Risk Factors Surveillance System" (BRFSS) durante tres años (2008-2010). La información sobre la vacunación contra el VPH se recopiló de los padres de las hijas de 9 a 17 años (eligiendo sólo 1 por hogar) en los hogares seleccionados al azar. La información sobre la vacunación contra el VPH fue recopilada de los padres de una hija seleccionada aleatoriamente de 9 a 17 años en el hogar. Resultados: La iniciación de vacunación más alta, así como la prevalencia de la finalización de vacunación se detectó en 2010 (20.9% y 9.7% respectivamente). Se observó aumento del inicio de vacunación (2008, 14.9%; 2009, 20.7%; 2010, 24.3%; p = 0.002) con un aumento de cobertura de 33.5% al año (odds ratio [OR] = 1.33, intervalo de confianza 95% [IC] 1.11-1.60). Se observó aumento de la finalización de vacunación (2008, 6.3%; 2009, 9.6%, 2010, 11.6%; p=0.021) con un aumento de cobertura de 37.1% al año (OR=1.37, 95% IC 1.05-1.79). Ambos aumentos se observaron entre madres, los padres blancos que no eran hispanos, los que asistieron a universidad o eran graduados universitarios, los padres que eran casados/en una relación, y vivían en zonas urbanas. Conclusión: A pesar de que la cobertura de vacunación contra el VPH en Texas es más baja de la recomendada, hay aumentos en la tendencia de la iniciación y finalización de vacunación. La promoción de la vacunación debe dirigirse a grupos específicos de población en la que la inmunización contra el VPH no aumentó con el tiempo.

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