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ORIGINAL PAPER

Ethnic and Racial Disparities in HPV Vaccination Attitudes

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Abstract
There are substantial racial and ethnic disparities in the vaccination rate for human papillomavirus (HPV), which helps protect against cervical cancer. Using data from the 2007 Health Information National Trends Survey, we explore differences between Whites, Blacks, Hispanics, and Asians in attitudes toward vaccinating adolescent girls for HPV. We use logistic regression models to explore whether racial/ethnic differences in attitudes toward HPV vaccinations are explained by HPV knowledge, demographic and socioeconomic status, and/or general distrust of the healthcare system. We include interactions to explore whether the effects of HPV knowledge and doctor distrust vary by racial/ethnic group. We find that greater HPV knowledge increases general willingness to vaccinate for all groups except Blacks. Our findings point to a need for additional research and design of culturally appropriate interventions that address barriers to vaccination.

Keywords HPV vaccine · HPV knowledge · Health disparities · Adolescent health

Introduction

Human papillomavirus (HPV) is the most common sexually transmitted infection (STI) in the United States [1]. Nearly 80 million individuals are infected with HPV, with over 14 million new cases each year, half of which are among 15–24-year-olds [1, 2]. While the majority of HPV cases resolve without long-term effects, several strains of the virus can lead to cancer later in life; the most common type is cervical cancer, with nearly 12,000 HPV-related cases diagnosed each year. The age-adjusted incidence rate of HPV-related cervical cancer is substantially lower for White women at 7.4 per 100,000 than for Black and Hispanic women at 9.9 and 11.3 per 100,000, respectively [3].

There are two relatively new FDA-approved vaccines that effectively protect against two HPV strains that are responsible for 70% of cervical cancer cases [2]. Despite the availability of these vaccines, only 50% of girls aged 13–17 received at least one dose of the vaccine, and only a third completed the three-dose series [4]. White adolescent females are more likely to complete the vaccine series than their Black and Hispanic counterparts [4–7]. This is especially problematic given the higher cervical cancer rates of Black and Hispanic women. A better understanding of racial/ethnic differentials in attitudes regarding HPV vaccination may be helpful in understanding factors that contribute to cervical cancer disparities.

Although knowledge about HPV and its vaccine might seem to be a necessary precursor to willingness to vaccinate, a systematic review of studies suggests inconsistent findings for the relationship between the two [8]. While some studies indicate that vaccine uptake is related to greater knowledge about HPV and the vaccine [9, 10], others indicate that it is not associated with HPV knowledge [7, 11, 12]. There are sociodemographic disparities in knowledge about HPV and the vaccine. Whites, those with college education, and those with higher socioeconomic status (SES) have greater knowledge both about HPV [10, 13, 14], and the vaccine [6, 10, 14].

Since the HPV vaccine is recommended for adolescents, several studies have examined parental attitudes toward HPV vaccination. The majority of parents support vaccinating their children for HPV [7, 8], but White and Hispanic parents hold more favorable attitudes toward vaccination than Black parents [7, 13–15]. Lower willingness to vaccinate among Blacks has been attributed to concerns about the safety and efficacy of the vaccine, potential side effects, and a general distrust of the healthcare system [5, 13, 16–20].

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African American parents note particular concerns about doctor trust and fear of experimentation [18–20].

Although numerous studies have assessed sociodemographic disparities in HPV and HPV vaccine knowledge and vaccine acceptability, these studies have drawn on limited samples that include only women and parents [6, 7, 9, 15, 20]. Considering that social networks, such as peers, partners, and husbands, influence HPV vaccine awareness and willingness to vaccinate [8, 10–12], we believe that the attitudes of all adults, not just parents, are important in creating a positive attitude towards HPV vaccination. Thus we explore attitudes of all respondents to HPV vaccination, not just parents of adolescent girls. Further, while several studies have examined racial/ethnic differences in HPV knowledge and vaccination attitudes [7, 10, 13, 14, 19, 20], to our knowledge, none have examined whether the effect of HPV knowledge on willingness to vaccinate differs between all four major race/ethnic groups.

To address these gaps in research, our study focuses on the following research questions: (1) are there differences among Whites, Blacks, Hispanics, and Asian/Pacific Islanders in attitudes toward vaccinating (actual and potential) adolescent daughters for HPV? (2) Do these attitudes differ by HPV knowledge? (3) Are these attitudes influenced by doctor trust? and (4) Do the effects of knowledge and doctor distrust differ by racial/ethnic groups?

Methods

Sample

Our analysis uses data from the 2007 Health Information National Trends Survey (HINTS), a nationally representative sample of 7674 adults that includes an oversample of minorities [21]. The analytic sample for this study included 5675 self-identified White, Black, Hispanic, and Asian/Pacific Islander adults who responded to questions related to HPV and doctor trust. While there have been subsequent HINTS surveys, the 2007 survey was the last to ask about HPV vaccination attitudes.

Measures

The dependent variable is a dummy variable for willingness to vaccinate based on the question "A vaccine or shot that protects against HPV, a virus that can cause cervical cancer, was recently recommended for girls ages 11–12. If you had a daughter that age, would you have her get it?" (at the time the vaccine had not yet been approved for boys.) Our sample includes both those who currently have adolescent daughters and those who do not. Thus, our dependent variable is a measure of prevailing attitudes toward HPV vaccination not behavioral intentions. For ease of presentation, the response was dichotomized as "yes" vs. "no/not sure" (reference). We discuss below the one substantive difference found by disaggregating the reference category.

The key independent variables are race/ethnicity (White, Black, Hispanic, Asian/Pacific Islander), HPV knowledge, and doctor trust. Following previous work [7], we created an HPV knowledge index using five HPV knowledge-related survey questions, which are presented in Table 1. For each question, a "yes" response is scored 1, while a "no" response is scored 0. Respondents who had never heard of HPV were not asked the subsequent questions and were given the minimum total score of 0. The HPV knowledge index was categorized as none (score of 0), low (scores of 1–2), moderate (score of 3), and high (scores of 4–5).

Table 1 HPV knowledge-related survey questions

Questions	Proportion
Have you ever heard of HPV?	
Yes	0.63
No	0.37
Have you ever heard about a vaccine or shot to prevent cervical cancer?	
Yes	0.65
No	0.35
Do you think HPV can cause cervical cancer?	
Yes	0.55
No	0.45
Do you think you can get HPV through sexual contact?	
Yes	0.44
No	0.56
Do you think HPV can go away on its own, without treatment?	
Yes	0.04
No	0.96

Doctor trust is operationalized using the question "In general, how much would you trust information about health or medical topics from a doctor or other health care?" HINTS had a four-point response scale with options of "a lot," "some," "a little," and "not at all." We use "a lot" to indicate doctor *trust* and the remaining responses as indicators of doctor *distrust*.

We also include controls for demographic characteristics, including age (18–34, 35–54, 55 and older) and sex. We also control for highest education level attained (< high school, High school graduate, Some college, College graduate), marital status (Married, Previously married, Single), and presence of children in household (No kids, Males only, At least one female).

Analytic Approach

We present a nested logistic regression model to explore whether racial/ethnic differences in attitudes toward HPV vaccinations are explained by HPV knowledge, demographic and socioeconomic status, or more general distrust of the healthcare system. While some methodologists note issues with comparing coefficients and odds ratios across nested models [22, 23] alternative approaches yielded no substantive differences. All statistical analyses were performed using SPSS version 24 (SPSS, Inc.). Model diagnostics indicated no concerns about collinearity or influential cases.

We computed interactions to examine whether the effects of HPV knowledge and doctor distrust vary by racial/ethnic group. Model 1 includes the HPV knowledge index and race/ethnicity. Model 2 adds controls for demographics, achieved characteristics, and doctor trust. Model 3 adds interactions between race/ethnicity and HPV knowledge. Model 4 adds interactions between race/ethnicity and doctor trust to Model 2. Model 5 incorporates significant effects for both sets of interaction terms from Models 3 and 4.

Results

Descriptive Statistics

Table 2 presents descriptive statistics for the sample weighted utilizing the HINTS composite weight, which takes into account oversampling and the inclusion of both RDD and mail sample cases [21]. For regression analyses we created an analytic weight, which scales the composite weight down to the analytic N, in order not to unnecessarily reduce standard errors. Alternative weighting schemes do not yield substantive differences.

Table 2 highlights that 58% of the sample indicated willingness to vaccinate a (potential or actual) daughter for HPV. HPV knowledge is rather polarized: 38% of respondents had high knowledge, while 29% had never heard of HPV. Almost 70% of respondents reported that they trust information about health or medical topics from a doctor. The majority of respondents are White (71%), female (51%), married (57%), and have no children living in the household (60%). Forty percent of respondents are 35–54 and 32% are 18–34. Approximately 61% have at least some college education, while 25% have a high school diploma or GED.

Table 2 Weighted descriptives for study sample

	Proportion
Willing to vaccinate daughter against HPV	
Yes	0.58
No	0.42
HPV knowledge index	
None	0.29
Low	0.16
Moderate	0.17
High	0.38
Race/ethnicity	
White	0.71
Hispanic	0.13
Black	0.12
Asian and Pacific Islander	0.05
Sex	
Male	0.49
Female	0.51
Age	
18–34	0.32
35–54	0.40
55 and older	0.28
Education	
Less than high school	0.14
High school graduate	0.25
Some college	0.35
College graduate	0.26
Marital status	
Married	0.57
Previously married	0.16
Single	0.26
Kids in household gender	
No kids	0.60
Males only	0.13
At least one female	0.26
Trust doctor	
Trust	0.69
Distrust	0.31

Analytic N = 5675

Weighted N = 175,782,258

Source: Authors tabulation of HINTS 2007 data

Logistic Regression Results

Table 3 presents weighted logistic regression results for the five nested models examining the predictors of HPV vaccination willingness. Across all models, having any knowledge of HPV significantly increases willingness to vaccinate, but vaccination willingness differs significantly by race/ethnicity. Model 1 shows that Hispanics are approximately 30% *more* likely ($\beta = 0.26$, OR = 1.30, $p < .01$) while Blacks are almost 20% *less* likely ($\beta = -0.20$, OR = 0.82, $p < .02$) than Whites to be willing to vaccinate. Whites and Asian/Pacific Islanders do not differ significantly in their willingness to vaccinate.

The second model adds control variables. Sex, age, education, marital status, and doctor trust are all significant predictors of willingness to HPV vaccination willingness. Women are 27% less likely than men to favor vaccination ($\beta = -0.31$, OR = 0.73, $p < .001$). Younger respondents (ages 18–34) are 23% more likely to favor vaccination ($\beta = 0.20$, OR = 1.23, $p < .01$). Those with less than a high school diploma are 30% more likely than those with a high school diploma to favor vaccination ($\beta = 0.26$, OR = 1.30, $p < .01$) while married people are less likely to favor vaccination. Doctor distrust also substantially reduces willingness to vaccinate ($\beta = -0.39$, OR = 0.68, $p < .001$). Blacks remain less willing to vaccinate net of controls, while the difference for Hispanics is no longer significant.

Model 3 suggests that the effect HPV knowledge differs significantly by race. Overall, greater HPV knowledge increases willingness to vaccinate ($\beta = 0.40$, OR = 1.49, $p < .001$ for low, $\beta = 0.75$, OR = 2.11, $p < .001$ for moderate, and $\beta = 0.81$, OR = 2.27, $p < .001$ for high knowledge, respectively). However, for Blacks, any knowledge of HPV *decreases* willingness to vaccinate compared with having no knowledge ($\beta = -0.81$, OR = 0.45, $p < .001$ for low, $\beta = -0.70$, OR = 0.50, $p < .01$ for moderate, and $\beta = -0.37$, OR = 0.69, $p < .10$ for high knowledge, respectively), though the negative effect decreases with greater knowledge. The effects for all other variables remain similar. Only statistically significant interactions are shown in Table 3.

Model 4 highlights how the effect of doctor trust varies by race/ethnicity. As expected, Whites (main effect) and Blacks (interaction) who distrust doctors are significantly less willing to vaccinate than those who trust doctors. Somewhat surprisingly, the effect for Hispanics is the opposite, with distrust increasing willingness to vaccinate ($\beta = 0.57$, OR = 1.77, $p < .001$).

Model 5 indicates that both racial/ethnic differences and doctor trust are significant predictors of willingness to vaccinate. The effects for all variables are mostly similar to those in Model 4. We summarize the interaction effect of HPV knowledge and race/ethnicity on willingness to vaccinate in Fig. 1, which shows the predicted probabilities of willingness to vaccinate a daughter for HPV (calculated from the coefficients in Model 5).

HPV knowledge generally increases the likelihood of willingness to vaccinate. For example, just 47% of Whites with no HPV knowledge are willing to vaccinate, compared with 65% of those with high knowledge. The trend for Hispanics and Asian Pacific Islanders is very similar. However, as Fig. 1 highlights, HPV knowledge works differently for Blacks. Whereas 53% of Blacks with no HPV knowledge are willing to vaccinate, this figure *decreases* to 39% for those with low knowledge, then rises to 50% for moderate knowledge and 57% for high knowledge. For Whites, Hispanics, and Asian Pacific Islanders there is a substantial increase in willingness to vaccinate (well over 10 percentage points) between those with no knowledge and those with high levels of knowledge, for Blacks this increase is much smaller (4 percentage points), with only high knowledge exceeding no knowledge.

Discussion

This study's findings are somewhat consistent with other studies that have examined racial and ethnic differences in HPV vaccination uptake and attitudes [6, 13–15, 18, 20]. Although our results show that a majority of Americans are willing to vaccinate a (real or hypothetical) daughter for HPV, there are clear racial/ethnic disparities. Blacks are significantly less willing to vaccinate than Whites, even after controlling for sociodemographic factors. Contrary to prior qualitative work [15], we detected no difference between Whites and Hispanics or Whites and Asians, net of sociodemographic factors.

Our results for this broader sample also suggest a generally positive effect of HPV knowledge on one's willingness to vaccinate, in contrast to some prior studies [7]. However, this effect differs for Blacks, for whom HPV knowledge has a negative effect. Blacks with no HPV knowledge are more likely to favor vaccination than those with some or moderate knowledge. This finding is relevant for future education and health policy campaigns, as it suggests that the lower rates of vaccination, reflected in less favorable attitudes toward vaccination among Blacks, is not simply due to lack of knowledge. Increasing knowledge may well decrease willingness to vaccinate for this group. Controlling for distrust does not eliminate the difference by race.

One possible explanation is distrust of doctors and the medical profession in general, which is higher among African Americans [5, 13, 16–20, 24]. Our findings show that distrust of doctors generally decreases willingness to vaccinate, and the effect is largest among Black respondents. In addition, Black respondents were also most likely to cite

Table 3 Logistic regression model for willingness to vaccinate

	Model 1			Model 2			Model 3			Model 4			Model 5		
	β	S.E.	OR	β	S.E.	OR	β	S.E.	OR	β	S.E.	OR	β	S.E.	OR
HPV knowledge															
Low (ref: no knowledge)	0.19	0.09	1.21**	0.27	0.09	1.31***	0.40	0.10	1.49***	0.28	0.09	1.32***	0.40	0.10	1.50***
Moderate	0.57	0.08	1.77***	0.65	0.09	1.92***	0.75	0.10	2.11***	0.65	0.09	1.91***	0.75	0.10	2.11***
High	0.63	0.07	1.88***	0.77	0.08	2.15***	0.81	0.08	2.27***	0.77	0.08	2.17***	0.83	0.08	2.29***
Race/ethnicity															
Hispanic (ref: white)	0.26	0.08	1.30***	0.14	0.09	1.15	0.16	0.09	1.17*	−0.09	0.11	0.91	−0.08	0.11	0.93
Black	−0.20	0.09	0.82**	−0.26	0.09	0.77***	0.12	0.14	1.12	−0.10	0.11	0.91	0.32	0.16	1.37**
API	0.13	0.13	1.14	0.10	0.14	1.11	0.12	0.14	1.13	0.13	0.16	1.14	0.15	0.16	1.16
Demographic characteristics															
Female (ref: male)				−0.31	0.06	0.73***	−0.31	0.06	0.74***	−0.31	0.06	0.74***	−0.30	0.06	0.74***
18–34 (ref: 35–54)				0.20	0.08	1.23***	0.22	0.08	1.24***	0.21	0.08	1.23***	0.22	0.08	1.25***
55 and older				0.03	0.08	1.04	0.04	0.08	1.04	0.04	0.08	1.04	0.04	0.08	1.04
Education															
Less than HS (ref: HS)				0.26	0.09	1.30***	0.27	0.09	1.30***	0.25	0.09	1.29***	0.26	0.09	1.30***
Some college				−0.12	0.07	0.89*	−0.11	0.07	0.89*	−0.12	0.07	0.89*	−0.11	0.07	0.89*
College grad				−0.15	0.08	0.86*	−0.13	0.08	0.88	−0.14	0.08	0.87*	−0.13	0.08	0.88
Family status															
Single (ref: married)				0.24	0.08	1.36***	0.29	0.08	1.34***	0.32	0.08	1.37***	0.31	0.08	1.36***
Prev. married				0.31	0.08	1.27***	0.23	0.08	1.26***	0.25	0.08	1.28***	0.24	0.08	1.28***
Male kids (ref: no kids)				0.14	0.09	1.15	0.13	0.09	1.14	0.15	0.09	1.16	0.14	0.09	1.15
Female kids				0.07	0.08	1.08	0.08	0.08	1.08	0.08	0.08	1.08	0.08	0.08	1.09
Distrust doctor				−0.39	0.06	0.68***	−0.39	0.06	0.68***	−0.41	0.07	0.67***	−0.40	0.07	0.67***
Interaction: Black and knowledge															
Black-low							−0.81	0.24	0.45***	–	–	–	−0.84	0.24	0.43***
Black-moderate							−0.70	0.25	0.50***	–	–	–	−0.77	0.25	0.46***
Black-high							−0.37	0.22	0.69*	–	–	–	−0.37	0.23	0.67*
Interaction: race and distrust															
Hispanic-distrust										0.57	0.17	1.77***	0.57	0.17	1.77***
Black-distrust										−0.48	0.19	0.62***	−0.52	0.19	0.59***
API-distrust										−0.13	0.32	0.88	−0.12	0.32	0.89
Constant	−0.05	0.06	0.95	−0.02	0.09	0.99	−0.09	0.09	0.92	−0.02	0.09	0.98	−0.10	0.09	0.91
−2 log-likelihood			7593.3			7460.3			7445.5			7438.6			7422.5

N = 5675

β regression coefficient, *S.E.* denotes standard error, *OR* denotes odds ratio

***p < .01; **p ≤ .05; *p ≤ .10

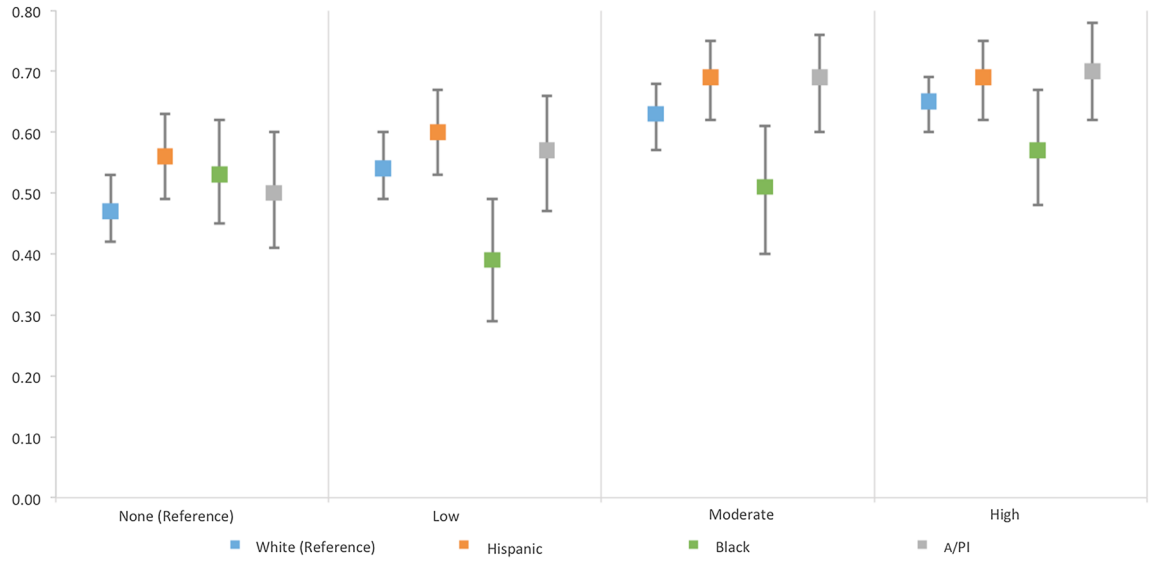

Fig. 1 Predicted probabilities and 95% confidence intervals for willingness to vaccinate by HPV knowledge and race and ethnicity

concerns about vaccine safety as a reason not to vaccinate (data not shown).

Concerns about trust in doctors may create ambivalence about vaccination among Blacks as they learn about HPV. We also conducted multinomial logistic regressions to model three possible responses: "yes," "no," and "not sure/it depends." The one notable difference we found between the two analyses was that Blacks were more likely to be not sure about their willingness to vaccinate. Thus, Blacks are more likely than other groups to be ambivalent or unsure of their feelings regarding HPV vaccination. This ambivalence suggests there may be room to change these attitudes.

Large racial/ethnic disparities in HPV vaccination still exist. Additional targeted interventions are required to improve HPV vaccination, particularly among Blacks. However, our findings suggest that simply increasing HPV knowledge is not enough. Such interventions may actually reduce vaccination rates among Blacks if knowledge dissemination is the sole focus. Our findings point to a need for more research and design of culturally sensitive approach aimed at building physician trust and rapport, while highlighting safety and addressing concerns about vaccination.

Compliance with Ethical Standards

Conflict of interest The authors declare they have no conflict of interest.

Ethical Approval This article does not contain any studies with human participants performed by any of the authors. The article makes use of publicly available secondary data that was collected by the National Cancer Institute, in which informed consent was obtained by the NCI from all individual participants included in the study [18].

References

1. Centers for Disease Control and Prevention. Genital HPV infection–fact sheet [updated March 20, 2014]. http://www.cdc.gov/std/HPV/STDFact-HPV.htm (2014).
2. Centers for Disease Control and Prevention. HPV vaccine information for clinicians-fact sheet [updated July 12, 2012]. http://www.cdc.gov/std/hpv/stdfact-hpv-vaccine-hcp.htm (2012).
3. Centers for Disease Control and Prevention. Human papillomavirus-associated cancers-United States, 2004–2008. Morb Mortal Wkly Rep. 2012;61(15):258–61.
4. Centers for Disease Control and Prevention. National and state vaccination coverage among adolescents aged 13–17 years-United States, 2012. Morb Mortal Wkly Rep. 2013;62(34):685–93.
5. Downs LS Jr, et al. Overcoming the barriers to HPV vaccination in high-risk populations in the US. Gynecol Oncol. 2010;117(3):486–90.
6. Polonijo AN, Carpiano RM. Social inequalities in adolescent human papillomavirus (HPV) vaccination: a test of fundamental cause theory. Soc Sci Med. 2013;82:115–25.
7. Lai JY, Tinker AV, Cheung WY. Factors influencing the willingness of US women to vaccinate their daughters against the human papillomavirus to prevent cervical cancer. Med Oncol. 2013;30(2):582–10.
8. Brewer NT, Fazekas KI. Predictors of HPV vaccine acceptability: a theory-informed, systematic review. Prev Med. 2007;45(2):107–14.
9. Gerend MA, Weibley E, Bland H. Parental response to human papillomavirus vaccine availability: uptake and intentions. J Adolesc Health. 2009;45(5):528–31.
10. Hughes J, et al. Disparities in how parents are learning about the human papillomavirus vaccine. Cancer Epidemiol Biomarkers Prev. 2009;18(2):363–72.
11. Boehner CW, et al. Viral sexually transmitted disease vaccine acceptability among college students. Sex Transm Dis. 2003;30(10):774–8.
12. Dempsey AF, et al. Factors that are associated with parental acceptance of human papillomavirus vaccines: a randomized

intervention study of written information about HPV. Pediatrics. 2006;117(5):1486–93.
13. Cates JR, et al. Racial differences in HPV knowledge, HPV vaccine acceptability, and related beliefs among rural, southern women. J Rural Health. 2009;25(1):93–7.
14. Gelman A, et al. Racial disparities in awareness of the human papillomavirus. J Women's Health. 2011;20(8):1165–73.
15. Constantine NA, Jerman P. Acceptance of human papillomavirus among Californian parents of daughters: a representative statewide analysis. J Adolesc Health. 2007;40(2):108–15.
16. Scarinci IC, Garcés-Palacio IC, Partridge EE. An examination of acceptability of HPV vaccination among African American women and Latina immigrants. J Women's Health. 2007;16(8):1224–33.
17. Wilson R, et al. Knowledge and acceptability of the HPV vaccine among ethnically diverse black women. J Immigr Minor Health. 2013;15(4):747–57.
18. Jacobs EA, et al. Understanding African Americans' views of the trustworthiness of physicians. J Gen Intern Med. 2006;21:642–7.
19. Kennedy BR, Mathis CC, Woods AK. African Americans and their distrust of the health care system: healthcare for diverse populations. J Cult Divers. 2007;14(2):56–60.
20. Fu LY, et al. Associations of trust and healthcare provider advice with HPV vaccine acceptance among African American parents. Vaccine. 2017;35:802–7.
21. Cantor D, et al. Health Information National Trends Survey (HINTS) 2007 Final Report. Rockville, MD: Westat. http://hints.cancer.gov (2009).
22. Mood C. Logistic regression: why we cannot do what we think we can do, and what we can do about it. Eur Sociol Rev. 2010;26(1):67–82.
23. Karlson KB, Holm A, Breen R. Comparing regression coefficients between same-sample nested models using logit and probit: a new method. Sociol Methodol. 2012;42(1):286–313.
24. Gamble VN. Under the shadow of Tuskegee: African Americans and health care. Am J Public Health. 1997;87(11):1773–8.