

Factors Associated with Human Papilloma virus Vaccination among White-American Females

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Abstract

Introduction: Human papilloma virus (HPV) is a public health concern because of its association with cervical cancer. Despite the evidence about HPV vaccination benefits, debate persists about the rate of receiving HPV vaccination.

Objective: The main objective of this study is to examine the uptake rate of HPV vaccination among White-American females.

Design and Method: This study analyzed data from the 2015 and 2016 National Health Interview Survey (NHIS), a cross sectional study of non-institutionalized population in the United States. Females aged 18-85 years were included in the survey.

Result: The White-American females odds are (OR=3.84; 95% CI 2.74-5.39) three times higher than males.

Conclusion: Our results highlight the uptake rate of HPV vaccination in preventing cervical cancer among White-American population.

Introduction

Cervical cancer is an important public health problem in the United States¹. It is caused by Human Papilloma Virus (HPV). About 20 million people have genital HPV and 6.2 million people are infected annually in the United States [1]. Approximately, 50% of HPV infections spread through skin-to-skin and oral contact during sexual activity [2]. HPV is one of the most common sexually transmitted infections with the potential to cause genital warts, warts in the throat, and cancers of the vulva, vagina, penis, anus, mouth, and pharynx [4]. The incidence and mortality rate of cervical cancer due to HPV infection are higher among White-Americans and African-Americans compared to Latin-American women living in low socioeconomic areas [5].

In addition, the prevalence of HPV among females aged 15-19 and 20-24 are estimated to be 33% and 54%, respectively [6]. About 87% of all HPV cases are females [6]. In particular two HPV types (16 and 18) cause approximately 70% of cervical cancers, whereas two other types (6 and 11) cause approximately 90% of anogenital warts [7,8]. The HPV vaccine was approved by Food and Drug Administration (FDA) in 2006 for females [9]. Currently in the United States, there are two types of HPV vaccines available: bivalent and quadrivalent vaccines [6]. Both vaccines protect against the two HPV types causing 70% of cervical cancer [6]. These two vaccines are Gardasil and Cervarix (HPV4 Gardasil approved in 2006 and Cervarix approved in 2009) [10]. These two vaccines have demonstrated safety and nearly 100% efficiency in protecting against HPV 16 and HPV 18 responsible for genital warts and warts in the respiratory tract [1]. The vaccine should be administered to 13-26 year old girls before the onset of sexual activity [1]. These vaccine are administered as a 3-dose series with the 2nd and 3rd dose given at 2 and 6 months following the first dose [6,7]. The HPV vaccine was proven as an effective preventive measure to reduce the public health burden of cervical cancer and HPV related diseases [7].

In the literature, there are many factors associated with the HPV vaccination. The factors that were consistently shown to be positively associated with HPV vaccination are: higher maternal education, more access to health care, and health insurance coverage. Furthermore, other factors include access to health care, knowledge about HPV infections, as well as vaccine acceptability, reasonable cost of the vaccine, higher perceived effectiveness of the vaccine, and less fear of side effects of the HPV vaccine such as fever, headache, dizziness, nausea, vomiting, diarrhea, insomnia, sore throat, cough, tooth pain, and muscle pain [5-7].

This study aims to examine the uptake rate of the HPV vaccination among White- American females. The study also analyzes other factors related to the HPV vaccine such as, health care changes in the past 12 months, changes related to health insurance, and uptake of other vaccines including hepatitis A & B.

Materials and Methods

Data

Data from the 2015 and 2016 National Health Interview Survey (NHIS) were analyzed. The NHIS is a cross-sectional household interview survey. Samples were collected by conducting continuous quarterly (1-4) interviews throughout each year [12]. The household interview surveys population with age-range between 18-85 years old. The total NHIS sample is subdivided into four separate panels, or sub designs, such that each panel is a representative sample of the U.S. population. The main objective of the NHIS is to monitor the health of the United States population through the collection and analysis of data on a broad range of health topics. A major strength of this survey lies in the ability to display these health characteristics by many demographic and socioeconomic characteristics. The NHIS covers the civilian noninstitutionalized population residing in the United States at the time of the interview [12]. Data is collected through a personal household interview conducted by interviewers employed and trained by the U.S. Census Bureau [12]. Approximately, 1-2 participants are randomly selected per family. These individuals must self-report responses to questions in this section. The NHIS questionnaire uses a Computer Assisted Personal Interviewing (CAPI) mode. The CAPI version of the NHIS questionnaire is administered using a laptop and interviewers enter responses directly into the laptop during the interview. This computerized mode offers distinct advantages in terms of timeliness of the data and improved data quality [12].

Study variables

Independent variables: The independent variables consisted of the following socio-demographic personal characteristics: age (18-85 years), sex (male and female), marital status (married, others [widowed, divorced, separated]), region (Northeast, Midwest, South, and West), race/ethnicity (white-American, African-American, American-Indian, Alaska-Native, Asian, and Multiple race including (Chinese, Filipino, other Asian), changes of health insurance plans (yes/no), and changes of healthcare place in the past 12 months (yes/no). Were hepatitis A & B vaccines received? What was the number of hepatitis A vaccine received? Pap-smear test done in the past 12 months?

Dependent variables: The self-reported HPV vaccination was our outcome of interest. Participants in the 2015& 2016 NHIS survey were asked, "Have you ever received HPV shot/vaccination?" (The variable coded as 1=Yes and 2=No).

Statistical analysis

Descriptive statistics summarized the characteristics of the sample. Inferential statistics included in Chi-square test to identify association between two categorical variables. We then conducted univariate and multivariate logistic regression model of analysis including variables that were found to be significantly associated with dependent variable. Results of the logistic regression were presented as the odds ratio (OR) and associated 95% confidence interval (95% CI). All statistical analyses were performed using IBM SPSS statistics for windows, version 24 (IBM Corp. Released 2015. IBM SPSS Statistics for Windows, Version 24.0. Armonk, N. Y: IBM Corp).

Results

The sociodemographic characteristics of the participants in the 2015 & 2016 NHIS are summarized in the Table 1. Total (n=66,700) female and male participants in this study. About 54.9% of the participants were female (n=36,638). The majority of participants were married (42.5%), females (54.9%), White-American (78.5%) and resided in the South region (34.7%), with average age (50.35±18.49 SD) that ranged from 18-85 years. Among the 66,700 respondents, 3,999 (6%) reported ever receiving HPV vaccination. With regard to other preventive measures, 26.5% of respondents reported receiving hepatitis B vaccine, 13.1% received hepatitis A, and 23% had a Pap smear test during past 12 months.

Table 1: Description of respondents to National Health Interview Survey (NHIS) 2015 & 2016 with HPV Vaccination (n=66,700).

Variables	N	%
Sex		
Male	30,062	45.1
Female	36,638	54.9
Marital Status		
Married	28,373	42.5
Others	34,194	51.3
Race		
White-American	52,355	78.5
African-American	8,358	12.5
AI/AN	749	1.1
Asian	3,653	5.5
Multiple Race	1,386	2.1
Region		
Northeast	11,170	16.7
Midwest	14,447	21.7
South	23,133	34.7
West	17,950	26.9
Change of Health Insurance		
Yes	1,278	1.9
Change Health care place past 12 months		
Yes	5,079	7.6
Hepatitis B vaccine		
Yes	17,680	26.5
Hepatitis A vaccine		
Yes	8,710	13.1
Ever Received HPV shot		
Yes	3,999	6
Pap-Smear test past 12 months		
Yes	15,368	23
Age	Mean±SD	Min-Max
	50.35±18.497	18-85

The Table 2 compares the characteristics of people who ever received the HPV vaccination and those who did not. A higher rate of HPV vaccination was found among female vs male $p < 0.01$ (80.2% vs 19.8%). Unmarried (Other marital category [widowed, divorced, separated]) were getting higher rate of HPV vaccination compared to married $p < 0.01$ (74.2% vs 25.8%), with average age (27.42 ± 8.90 SD) that ranged from 18-85 years. In addition, regarding the zone of residence, a high proportion of residents from the South $p < 0.01$ (31.0%) reported having received the HPV shot compared to 20.8% from the Midwest, and 19.1% from the Northeast. Furthermore, those who received HPV vaccination had the higher rate of hepatitis B vaccination (67.2% vs 31%, $p < 0.01$). Similarly, those who received HPV vaccination recipients also received higher frequency of hepatitis A vaccination (43% vs 15.1%, $p < 0.01$). Furthermore, the recipients

had HPV vaccination 10% higher percent of pap-smear tests done during past 12 months 60.6% vs 50.7%, $p < 0.01$).

The unadjusted and adjusted logistic regression models are shown in the Table 3. The unadjusted modeling for gender signifies that female respondents were significantly more likely (3.79, 95% CI 3.49-4.10) to get HPV vaccination than males. Considering married participants as reference category, unmarried (other marital categories [widowed, divorced, and separated]) were less likely to be vaccinated for HPV (0.36, 95%CI 0.34-0.39). Asians were less likely to get HPV vaccination 1.07; 95% CI 0.92-1.24) compared to White-American (0.85, 95%CI 0.77-0.93) and multiple race considered as a reference category (OR=1). Furthermore, respondents from Northeast (0.87, 95%CI 0.79-0.96) were less likely to be vaccinated for HPV than Midwest (1.10, 95%CI 1.00-1.2), South (1.19, 95%CI 1.09-1.29), and West used as a reference category. In addition, those who changed their health insurance plan were more likely to get HPV vaccination (1.31, 95%CI 1.04-1.63). Those who received hepatitis B vaccination were less likely to get HPV vaccination (0.21, 95%CI 0.20-0.23), this is similar with hepatitis A (0.23, 95%CI 0.22-0.25). Furthermore, those who are at the average age ranged from 18-85 years were more likely getting HPV vaccination (1.13, 95% CI 1.13-1.14).

Table 2: Comparing Socio-demographic Characteristics of Female Participants in National Health Interview Survey (NHIS) 2015 & 2016, by history of HPV Vaccination (n=66,700).

Variables	HPV+ n (%) N=66,700	HPV- n (%) N=66,700	P value
Sex			
Male	793 (19.8%)	20,619 (48.4%)	<0.01
Female	3,206 (80.2%)	22,002 (51.6%)	
Marital Status			
Married	914 (25.8%)	19,351 (49%)	<0.01
Others	2,630 (74.2%)	20,170 (51%)	
Race			
White-American	2,979 (74.8%)	33,021 (77.7%)	<0.01
African-American	586 (14.7%)	5,515 (13%)	
AI/AN	65 (1.6%)	524 (1.2%)	
Asian	211 (5.3%)	2,501 (5.9%)	
Multiple Race	142 (3.6%)	915 (2.2%)	
Region			
Northeast	764 (19.1%)	6,722 (15.8%)	<0.01
Midwest	833 (20.8%)	9,254 (21.7%)	
South	1,241 (31.0%)	14,925 (35%)	
West	1,161 (29%)	11,720 (27.5%)	
Change of Health Insurance			
Yes	114 (23.1%)	920 (28.3%)	<0.01
Change Health care place past 12 months			
Yes	493 (14.7%)	3,255 (9.1%)	<0.01
Hepatitis B vaccine			
Yes	2,463 (67.2%)	12,336 (31%)	<0.01
Hepatitis A vaccine			
Yes	1,438 (43%)	5,886 (15.1%)	<0.01
Pap-Smear test past 12 months			
Yes	1,938 (60.6%)	11,103 (50.7%)	<0.01
Age	Mean±SD	Mean±SD	
	27.42±8.909	43.64±12.884	

Table 3: Adjusted and Un-Adjusted Odds Ratio for HPV Vaccination of Female Participants in National Health Interview Survey (NHIS) 2015 & 2016 (n=66,700).

Variables	Un-Adjusted OR (95% CI)	Adjusted OR (95% CI)
Sex		
Male	1	1
Female	3.79 (3.49-4.10)	3.84 (2.74-5.39)
Marital Status		
Married	1	1
Others	0.36 (0.34-0.39)	0.65 (0.47-0.89)
Race		
White-American	0.85(0.77-0.93)	1.00 (0.66-1.52)
African-American	0.73 (0.56-0.94)	1.29 (0.22-7.56)
AI/AN	1.07 (0.92-1.24)	1.34 (0.76-2.37)
Asian	0.58 (0.48-0.69)	1.51 (0.68-3.31)
Multiple Race	1	1
Region		
Northeast	0.87 (0.79-0.96)	0.92 (0.59-1.45)
Midwest	1.10 (1.00-1.2)	0.94 (0.63-1.41)
South	1.19 (1.09-1.29)	0.99 (0.68-1.42)
West	1	1
Change of Health Insurance		
Yes	1.31 (1.04-1.63)	0.90 (0.65-1.25)
Hepatitis B vaccine		
Yes	0.21 (0.20-0.23)	0.47 (0.33-0.65)
Hepatitis A vaccine		
Yes	0.23 (0.22-0.25)	0.44 (0.32-0.61)
Age	1.13 (1.13-1.14)	1.12 (1.11-1.15)

AI/AN- American-Indian and Alaska Native

These factors were then entered in the multivariate logistic regression model. Results show that compared to males, female odds for the HPV vaccination uptake was 3.84 times higher (95% CI 2.74-5.39). In addition, unmarried (other marital category participants [widowed, divorced, and separated]) were less likely to get the HPV vaccination (0.65, 95%CI 0.47-0.89) compared to married. Similarly, those who received hepatitis B vaccinations were less likely to get the HPV vaccination (0.47, 95%CI 0.33-0.65), and those who received hepatitis A vaccinations (0.44, 95%CI 0.32-0.61). Furthermore, those who are at the average age ranged from 18-85 years were more likely to receive the HPV vaccination (1.12, 95% CI 1.11-1.15).

Discussion

In this study, we observed the majority of participants who reported receiving HPV vaccine were female, white-American, other marital category and from the South. Most participants we have found were White-American married females who resided in the South region, with an average age ranging from 18-85 years. Among the 66,700 respondents, only 6% received the HPV vaccination. An unadjusted logistic regression model for gender signifies that other White-American married females were significantly more likely to get the HPV vaccination than males. After adjusting for potential confounders, race did appear to be associated with the vaccination.

The final model of this study is that the HPV vaccination rate of White-American married females who have received the HPV vaccination is 74.8% than previous study. These findings are in agreement with similar studies on HPV vaccine uptake among White-American population, this study reported that 65% of white young women (n=11) completed the 3-dose series of HPV vaccination [13]. There is 10% increase rate of HPV vaccination in the current study. In addition, the previous study findings on HPV vaccination status among female college students have also demonstrated that White-American females who were receiving the HPV vaccine were (40.5%) [1]. The current study which is reported receiving HPV vaccine were female (80.2%). There is 40% increase rate of female participants in the current study.

The HPV vaccination is most effective if administered before becoming sexually active. In 2010, 27% of females and 28% of males aged 15-17 years old reported initiating sexual intercourse [11,14,15]. As a result, parents (and future parents) must understand, while not all young adolescents are engaging in sexual activity, administering the vaccine should occur well before any sexual encounter to maximize the protective benefits. In addition to administering the vaccine prior to the first sexual encounter, the American Academy of Pediatrics recommends initiating the 3-dose series in adolescents aged 11-12 years old because of the optimal immune response in younger children [11]. By targeting potential parents early on, knowledge of vaccine benefits and safety will be inherent when making informed decisions on whether and when, regardless of age, future daughters should receive the HPV vaccine.

According to Health Belief Model and Theory of Planned Behavior [5,11,13], parents and their children have the potential to address these attitudes and beliefs regarding the HPV vaccine. Additionally, public health officials can encourage those supporting the HPV vaccine mandate to advocate to representatives and policy-

makers to ensure the health of future generations is protected against HPV infections.

The final finding of this study is that African-American were less likely to receive the HPV vaccination compared to White-American females. Similarly, AI/AN and multiple races are less likely to receive the HPV vaccination compared to White-American females. Therefore, we must increase the HPV vaccination rates among African-American, AI/AN, and multiple races by allocating resources, recommendations of HPV vaccination at every visit. Improve and development of nationwide vaccination standard and affordable price for HPV vaccine to deal with health insurance companies and also with stakeholders.

Strength

The broad sample size (n=66,700) is considered to be a strength of this study including the participants are from different regions such as Northeast, Midwest, South, and West in the United States.

Limitations

This study has some limitations. First, unclear data variables include dosage of vaccine and number of HPV shots, and age at first received vaccine. Second, there is the possibility of self-report biases even though NHIS data collection techniques are designed to limit reporting biases. Self-reporting bias may arise due to the individual not remembering previous HPV vaccination or the individual refuses to answer due to the stigma and possible discrimination associated with HPV infection.

Finally, this study looked at only a few sociodemographic characteristics for the HPV vaccination uptake. The information is related to change in health insurance plans, hepatitis A and hepatitis B vaccines received, marital status, sex, age, race, and region. The importance of the HPV vaccination, the number of HPV vaccinations and the age at first vaccine received should be gathered in the future NHIS surveys.

Conclusion

The purpose of our study was to examine the uptake rate of the HPV vaccination among White-American females. In this study, we examined married and other marital category females because they are a unique population. Our findings show the greatest indicators of vaccinating participants were White-American females, rather than African-American, AI/AN, and multiple races. As evidenced in our findings, the majority of female participants 54.9% believed that vaccinations against HPV helped to avoid negative health outcomes such as genital warts and various cancers. The final model of this study is that White-American married females who have received the HPV vaccination were 3.84 times higher. This study did not focus towards male populations and did not assess intentions for vaccinating males, which is an area in need of more research. However, these findings, in addition to emerging evidence on HPV vaccine uptake.

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