

Why human papilloma virus vaccination coverage is low among adolescents in the US? A study of barriers for vaccination uptake

Shyamkumar Sriram¹, Radhika Ranganathan¹

¹Department of Health Services Policy and Management, University of South Carolina, Columbia, South Carolina, USA

ABSTRACT

Introduction: Cervical cancer and Human papillomavirus (HPV) affects women, men, and children of all races, ethnicities, and backgrounds. The objective of this study is to examine the association between adolescent (13–17 years) HPV vaccination uptake and the key factors influencing the uptake rates of HPV vaccination. **Materials and Methods:** The 2016 NIS-Teen data, an annual survey conducted by the CDC to monitor vaccination uptake in the United States is used for this study. Multivariable logistic regression model was used to estimate the relationship between various factors and HPV vaccine uptake. **Results:** Male adolescents were 0.26 times less likely to get the HPV vaccines; adolescents covered by private health insurance were 0.18 times less likely to get HPV vaccines; Hispanic adolescents were 1.47 times more likely, adolescents from other races including Asians were 1.75 times more likely to get vaccinated for HPV compared to non-Hispanic white adolescents. Adolescents from the low-income families were 1.21 times more likely to get vaccinated for HPV; adolescents from North-eastern regions of the United States were 1.62 times more likely to get vaccinated; adolescents who were not recommended for vaccination by the family physicians were 0.43 times less likely to get HPV vaccination; adolescents who did not have any safety concerns and concerns about side effects were 3.24 times more likely to get the HPV vaccine; adolescents from households that did have not orthodox religious beliefs were 13.67 times more likely to get vaccinated. **Conclusions:** Vaccination uptake rates are low for adolescents in the US and the results of this study identified important barriers which need to be addressed in order to improve vaccine uptake rates among the target groups which are less likely to get vaccinated. Also, knowing the sociodemographic and community level factors associated with HPV vaccination uptake status, health planners can better plan strategies to improve HPV vaccination in their local settings.

Keywords: Adolescents, human papillomavirus, vaccination

Introduction

Cervical cancer and human papillomavirus affect everyone—women, men and children of all races and ethnicities and backgrounds. Globally, HPV infection accounts for an estimated 530,000 cervical cancer cases (~270,000 deaths) annually, with 5.2% of the worldwide cancer burden.^[1] Human Papilloma Virus (HPV) is the most common sexually transmitted infection in the United States and about 79 million Americans, most in

their late teens and early 20s, are infected with HPV.^[2] HPV causes more than 30,000 cases of cancer every year and more than 70% of US population will experience at least one HPV infection at some point.^[3] Infection with high-risk “oncogenic” types of human papillomavirus is the cause of 100% of cervical cancers, 90% of anal cancers, 40% of vulvar and vaginal cancers, at least 12% of oropharyngeal cancers, and 3% of oral cancers.^[4]

HPV vaccines offer a promising breakthrough to curb the global burden of cervical cancer. The HPV vaccine protects against about 90% of those cancers previously mentioned.^[3] Uptake of Meningococcal vaccine and Tdap (tetanus, diphtheria and

Address for correspondence: Dr. Shyamkumar Sriram, Department of Health Services Policy and Management, University of South Carolina, Columbia, South Carolina, USA. E-mail: shyam.silverhawk@gmail.com

Access this article online

Quick Response Code:



Website:
www.jfmpc.com

DOI:
10.4103/jfmpc.jfmpc_107_19

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

For reprints contact: reprints@medknow.com

How to cite this article: Sriram S, Ranganathan R. Why human papilloma virus vaccination coverage is low among adolescents in the US? A study of barriers for vaccination uptake. J Family Med Prim Care 2019;8:866-70.

pertussis) vaccine among adolescents has reached healthy people 2020 goals, but HPV vaccine has not.¹⁵ A systematic review showed that adolescents had limited awareness and knowledge of HPV infections and vaccines, even 10 years after the vaccine had become available and they concluded that barriers to the uptake of vaccine needs to be addressed.¹⁶ Since 2006, the vaccine has been approved for use in over 100 countries. Globally, the United States was among the first countries to introduce a HPV immunization program funded by the Government.¹⁷ The Advisory Committee on Immunization Practices of the Centers for Disease Control and Prevention (CDC) recommended the provision of HPV vaccine (3 doses completion) for girls aged 11 or 12 years, and for females aged 13 through 26 years who were not previously vaccinated. ACIP expanded its recommendation in 2011 to include boys as well into the program get the vaccination.^{18,9} In addition, Cervical Cancer Prevention Act (2016) allows parents access to information about the HPV and the HPV vaccine by providing educational materials to them. Despite all these initiatives, barriers to complete access exist which may be due to factors like moral or religious concerns about sexual activity, cost, inaccessibility, and missed opportunities. Therefore, the information on research related to factors influencing HPV vaccination uptake can be used by multiple levels of Government or other officials to plan interventions to improve uptake of HPV vaccination performance.

Studies have shown that economic burden and barriers to care among lower income ethnic minority or rural communities could result in lower HPV vaccination initiation because of fewer health resources and limited financial resources.^{9,10} Although various studies on many factors influencing vaccination uptake in adolescent girls are being reported using the National Immunization Survey – Teens (NIS-Teen) until 2012,^{9,11-13} but there are no studies done on generalized adolescent population including males, and the association between individual/family level factors. In this study, we would use the recent National level survey data on factors which influence HPV vaccination uptake in adolescents aged between 13 and 17 years of age. The objective of this study is to examine the association between adolescent (13–17 years) HPV vaccination uptake and the key factors influencing the uptake rates of HPV vaccination.

Materials and Methods

The 2016 NIS-Teen data, an annual survey conducted by the CDC to monitor vaccination uptake in the United States is used for this study. The NIS-Teen includes a nationally representative sample of girls and boys aged 13 to 17 years in all 50 states and the District of Columbia. The survey is based on random-digit dialing of both landline and cellular telephone numbers to identify eligible households. It includes two parts: a survey of parents or guardians of teens 13–17 years old to collect information about demographic and socioeconomic characteristics, and a survey mailed to all vaccination providers whom the parents identified and consented to verify their teen's immunization histories. The survey sampling procedures have been elaborated in the NIS-Teen

report.¹⁴ The 2016 NIS-Teen included 43,071 adolescents aged 13–17 years, respectively, with completed surveys in the United States. The dependent or outcome variable for analysis is the uptake of HPV vaccination status (i.e., house hold reported HPV vaccination shots, if taken or not). The various independent variables included in the statistical model were the main reasons that the teen will not receive HPV vaccination shots in the next 12 months, age of the teen, census region based on true state of residence, education level of the mother with four categories, race/ethnicity of the teen with multi-race category, sex of the teen, insurance status, and family income. Statistical analysis was done using STATA/IC 15.1 version. Descriptive data was expressed as the percentage and categorical variables were analyzed using Chi-square test. Multivariable logistic regression model was used to calculate the adjusted odds ratios (AOR) and 95% Confidence Intervals of HPV vaccination uptake rates and its association with various individual level and community level influencing factors.

Results

Sociodemographic characteristics of the study population are presented in Table 1. The sample consisted of around 19.56% of adolescents in the 13-year age group, 20.15% in the 14-year age group, 20.20% in the 15-year age group, 20.76% the 16-year age group, and 19.32% in the 17-year age group. Totally, 52.40% of the sample consists of male adolescents, 46.53% of the mothers of the adolescents were college educated, and 10.38% of the mothers were educated less than 12 years. Majority of the

Table 1: Sociodemographic characteristics of the sample population

Characteristics	Frequency (n=43,071)	Percent
Age	13 years	8,425
	14 years	8,680
	15 years	8,702
	16 years	8,941
	17 years	8,323
Sex	Male	22,570
	Female	20,501
Mother's education	<12 years	4,472
	12 years	7,139
	Non-college grad	11,420
Race/ethnicity	College grad	20,040
	Hispanic	7,848
	Non-Hispanic white	25,915
	Non-Hispanic Black	4,479
Family income	Other races	4,829
	Low income	11,391
	Above lower income	27,507
	Don't know	1,389
Insurance status	Refused	2,784
	Private	12,758
	Medicaid	6,203
	Other insurance	810
	Uninsured	702

sample consisted of Non-Hispanic White population (60.77%), followed by Hispanic population (18.22%), other races including Asians (11.21%), and Non-Hispanic Black (10.40%). Family income variables were categorized as low-income (<\$50,000 annually), and above low-income (>\$50,000 annually). Around 26.45% of the sample consisted of adolescents from low-income families, and 63.86% of the adolescents from above low-income families. 62.32% of the adolescents were covered by private health insurance, 30.30% by Medicaid, 3.96% by other types of health insurance, and 3.43% were uninsured. The Geographical characteristics of the sample is given in Table 2. Adolescents from South constituted most of the sample with 38.40%, followed by adolescents from West (21.47%), Mid-West (20.71%), and North-East (19.42%). Partial and semi partial correlation of each of the independent variables to access for multicollinearity was done.

The main reasons for the adolescents not getting vaccination in the past 12 months for HPV are given in Table 3. Around 14.16% of the adolescents were not recommended by the family physicians to get the HPV vaccinations. Cost was not a concern to get the vaccination for 88.65% of the adolescents. 14.32% of the adolescents reported that safety and side effects were the major concern for getting the HPV vaccination. About 87.37% of the adolescents did not have family and parental support for the vaccine uptake. Religion especially in its orthodox form prevented 89.14% of the adolescents from HPV vaccine uptake.

The results of the logistic regression are given in Table 4. The male adolescents were 0.26 times (OR: 0.74; 95% CI: 0.66-0.83) less likely to get the HPV vaccination shots compared to female adolescents. Adolescents who were covered by private health insurance were 0.18 times (OR: 0.82; 95% CI: 0.70-0.96) less likely to get vaccinated for HPV when compared to adolescents from families covered by Medicaid health insurance plans. The Hispanic adolescents were 1.47 times (OR: 1.47; 95% CI: 1.24-1.74) more likely to get vaccinated for HPV compared to non-Hispanic white adolescents, and the adolescents from other races including Asians were 1.75 times (OR: 1.75; 95% CI: 1.48-2.07) more likely to get vaccinated for HPV compared to non-Hispanic white adolescents. Adolescents from the low-income families were 1.21 times (OR: 1.21; 95% CI: 1.04 -1.43) more likely to get vaccinated for HPV compared to families having higher levels of income. Adolescents from North-eastern regions of the United States were 1.62 times (OR: 1.62; 95% CI: 1.38-1.90) more likely to get HPV vaccinations compared to adolescents from the southern regions of the United States.

Adolescents who were not recommended for vaccination by the family physicians were 0.43 times (OR: 0.57; 95% CI: 0.49-0.65) less likely to get HPV vaccination compared to adolescents who were recommended to get the vaccination. Adolescents who did not have any safety concerns and concerns about side effects were 3.24 times (OR: 3.24; 95% CI: 2.68-3.93) more likely to get the HPV vaccine compared to adolescents who had safety concerns about the vaccine. Adolescents from households that did not

Table 2: Geographic level characteristics

Region	Frequency	Percent
South	16,125	38.40
North-East	8,156	19.42
Mid-West	8,695	20.71
West	9,018	21.47

Table 3: Main reasons that the teen will not receive HPV vaccination shots

Main reason for not taking HPV shots	Frequency	Percent
Not recommended by family physician	Yes	2,393 14.16
	No	12,742 75.39
Cost concern	Yes	152 0.90
	No	14,983 88.65
Safety/side effects	Yes	2,420 14.32
	No	12,715 75.23
Family/parental decision	Yes	368 2.18
	No	14,767 87.37
Religion/orthodox	Yes	70 0.41
	No	15,065 89.14

Table 4: Multivariate Logistic Regression

Categories	Odds ratio	95% confidence interval	P	
Sex	Male	0.74	0.66-0.83	0.000
Insurance Status	Private	0.82	0.70-0.96	0.014
Race/ethnicity	Hispanic	1.47	1.24-1.74	0.000
	Others	1.75	1.48-2.07	0.000
Family Income	Low-income	1.21	1.04-1.43	0.015
	Don't know	1.69	1.16-2.47	0.006
Region	North-east	1.62	1.38-1.90	0.000
Reason-Not recommended by family physicians		0.57	0.49-0.65	0.000
Reason-Safety/side effects		3.24	2.68-3.93	0.000
Reason-Family/parental decision		2.18	1.38-3.45	0.001
Reason-Religion/orthodox		13.67	1.84-101.36	0.011

orthodox religious beliefs were 13.67 times (OR: 13.67; 95% CI: 1.84-101.36) more likely to get vaccinated for HPV compared to adolescents from orthodox families. Adolescents from households which did not provide family/parental consent for HPV vaccination were 2.18 times (OR: 2.18; 95% CI: 1.38-3.45) more likely to get the vaccination compared to adolescents from households with a favorable decision for the HPV vaccine uptake.

Discussion

In this study, male adolescents were less likely to get the HPV vaccination shots compared to female adolescents. Another study showed that the uptake of HPV vaccines among adolescent males is increasing after recommendations for vaccinating adolescent males were provided by the Advisory Committee on Immunization Practices in 2009 and it was implemented as a routine recommendation in physician practice.^[15] Hispanic adolescents were more likely to get vaccinated for HPV in our

study and another study showed similar results that Hispanic males had higher uptake of the HPV vaccine.^[16] Adolescents from the low-income families were more likely to get vaccinated for HPV compared to families having higher levels of income. A study among African American women showed that income level of the household was significantly associated with knowledge level regarding HPV vaccinations and cervical cancer which act as barriers for the uptake of HPV vaccine.^[17] Adolescents who did not have any safety concerns and concerns about side effects were more likely to get the HPV vaccine compared to adolescents who had safety concerns about the vaccine. In consistent with our study, another study showed that mothers were more worried about the health concerns of the vaccines and the perceived benefits of the vaccine when getting their daughters vaccinated for HPV.^[18] In our study adolescents from households which did not provide family/parental consent for HPV vaccination were more likely to get the vaccination compared to adolescents from households with a favorable decision for the HPV vaccine uptake. A study showed that consent of mothers was very vital in getting the daughters vaccinated for HPV following the physician's recommendation.^[18] Adolescents who are not recommended for vaccination by the family physicians are less likely to get HPV vaccination compared to adolescents who were recommended to get the vaccination. Studies have shown that black adolescents were less likely to get recommended for vaccination for HPV by the physicians.^[19,20] This study shows that the adolescents from North-eastern regions of the United States were more likely to get HPV vaccinations compared to adolescents from the southern regions of the United States. Also, the adolescents from households that did not have orthodox religious beliefs were more likely to get vaccinated for HPV. These results highlight some of the cultural and religious differences in different parts of the United States. The southern regions of the United States are more conservative regarding their religious practices compared to the northern and eastern regions of the country which may prevent the uptake of the vaccines among adolescents. In our study, adolescents who were covered by private health insurance were less likely to get vaccinated for HPV when compared to adolescents from families covered by Medicaid health insurance plans. Potential restrictions by private insurance companies on the uptake of HPV vaccines and physician's recommendations for HPV vaccine among adolescents covered by private health insurance plans needs to be studied further.

Conclusion

Vaccination uptake rates are low for adolescents in the United States and the results of this study identified important barriers which need to be addressed in order to improve vaccine uptake rates among the target groups which are less likely to get vaccinated. Also keeping in mind, the sociodemographic and community level factors associated with HPV vaccination uptake status, providers especially family medicine physicians can better plan strategies to improve HPV vaccination in their local practice settings. Future research could focus on the weighted percentage of uptake rates of different types of HPV vaccinations in

comparison with other vaccinations from previous years to better know the trend in uptake level status over a period to plan public health intervention models which caters to the needs of entire population.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. Tota JE, Chevarie-Davis M, Richardson LA, Devries M, Franco EL. Epidemiology and burden of HPV infection and related diseases: Implications for prevention strategies. *Prev Med* 2011;53(Suppl 1):S12-21.
2. Centers for Disease Control and Prevention. Genital HPV Infection - Fact Sheet. Available from: <https://www.cdc.gov/std/hpv/stdfact-hpv.htm>. [Last accessed on 2018 Dec 08].
3. de Martel C, Plummer M, Vignat J, Franceschi S. Worldwide burden of cancer attributable to HPV by site, country and HPV type. *Int J Cancer* 2017;141:664-70.
4. Parkin DM, Bray F. Chapter 2: The burden of HPV-related cancers. *Vaccine* 2006;24(Suppl 3):S3/11-25.
5. Zimmerman RK, Raviotta JM, Nowalk MP, Moehling KK, Reis EC, Humiston SG, *et al*. Using the 4 pillars practice transformation program to increase adolescent human papillomavirus, meningococcal, tetanus-diphtheria-pertussis and influenza vaccination. *Vaccine* 2017;35:6180-6.
6. Loke AY, Kwan ML, Wong Y-T, Wong AKY. The uptake of human papillomavirus vaccination and its associated factors among adolescents: A systematic review. *J Prim Care Community Health* 2017;8:349-62.
7. Santhanes D, Yong CP, Yap YY, Saw PS, Chaiyakunapruk N, Khan TM. Factors influencing intention to obtain the HPV vaccine in South East Asian and Western pacific regions: A systematic review and meta-analysis. *Sci Rep* 2018;8:3640.
8. Kuehn BM. CDC panel backs routine HPV vaccination. *JAMA* 2006;296:640-1.
9. Henry KA, Stroup AM, Warner EL, Kepka D. Geographic factors and human papillomavirus (HPV) vaccination initiation among adolescent girls in the United States. *Cancer Epidemiol Biomarkers Prev* 2016;25:309-17.
10. Arcury TA, Gesler WM, Preisser JS, Sherman J, Spencer J, Perin J. The effects of geography and spatial behavior on health care utilization among the residents of a rural region. *Health Serv Res* 2005;40:135-55.
11. Chao C, Velicer C, Slezak JM, Jacobsen SJ. Correlates for human papillomavirus vaccination of adolescent girls and young women in a managed care organization. *Am J Epidemiol* 2010;171:357-67.
12. Pruitt SL, Schootman M. Geographic disparity, area poverty, and human papillomavirus vaccination. *Am J Prev Med* 2010;38:525-33.
13. Tsui J, Gee GC, Rodriguez HP, Kominski GF, Glenn BA, Singhal R, *et al*. Exploring the role of neighborhood socio-demographic factors on HPV vaccine initiation among low-income, ethnic minority girls. *J Immigr Minor Health* 2013;15:732-40.

14. Centers for Disease Control and Prevention. The 2011 National Immunization Survey- Teen Data User's Guide. Atlanta, GA: Centers for Disease Control and Prevention; 2016. Available from: <https://www.cdc.gov/vaccines/imz-managers/nis/datasets.html>. [Last accessed on 2019 Jan 10].
15. Nanagas VC, Stolfi A, Nanagas MT, Eberhart GM, Alter SJ. Adolescent male human papillomavirus vaccination. *Glob Pediatr Health* 2016;3:2333794X16642373.
16. Reiter PL, Brewer NT, Gilkey MB, Katz ML, Paskett ED, Smith JS. Early adoption of the human papillomavirus vaccine among hispanic adolescent males in the United States. *Cancer* 2014;120:3200-7.
17. Strohl AE, Mendoza G, Ghant MS, Cameron KA, Simon MA, Schink JC, *et al*. Barriers to prevention: Knowledge of HPV, cervical cancer, and HPV vaccinations among African American women. *Am J Obstet Gynecol* 2015;212:65.e1-5.
18. Cunningham-Erves JL, Kelly-Taylor KD, Mayo-Gamble TL, Deakings JA, Talbott LL. A physician's recommendation for human papillomavirus vaccination: What makes African-American mothers compliant? *Pediatr Infect Dis J* 2018;37:e222-5.
19. Perkins RB, Lin M, Silliman RA, Clark JA, Hanchate A. Why are U.S. girls getting meningococcal but not human papilloma virus vaccines? Comparison of factors associated with human papilloma virus and meningococcal vaccination among adolescent girls 2008 to 2012. *Womens Health Issues* 2015;25:97-104.
20. Allen JD, De Jesus M, Mars D, Tom L, Cloutier L, Shelton RC. Decision-making about the HPV vaccine among ethnically diverse parents: Implications for health communications. *J Oncol* 2012;2012:401979.