

Geographic Variability in Human Papillomavirus Vaccination Among U.S. Young Women

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Background: Little information is available on geographic disparity of human papillomavirus (HPV) vaccination among women aged 18–26 years in the U.S. Genital HPV is the most common sexually transmitted infection in the U.S. Persistent HPV infection with oncogenic types can cause cervical cancer.

Purpose: This study utilized data collected from the 2010 National Health Interview Survey (NHIS). It identified geographic variability and other factors contributing to the disparities in HPV vaccine series initiation in a nationally representative sample of women aged 18–26 years.

Methods: The study utilized data collected from 1867 women who participated in the Cancer Control Module Supplement of the 2012 NHIS. A multivariable logistic regression model was used to assess characteristics associated with initiation of the HPV series. Analyses were performed in 2012.

Results: After adjusting for other characteristics, women living in the West and North Central/Midwest had 54% and 20% greater odds of initiating the HPV series, respectively, compared with those living in the Northeast. Other factors associated with HPV series initiation were younger age, Hispanic background, being single/never married, childlessness, a history of HPV, and current alcohol use. Factors correlated with failure to initiate the HPV series were: not having insurance, living below the 200% poverty level, not being a high school graduate, not currently using hormone-based birth control, most recent Pap >1 year ago, no regular provider, last clinic visit \geq 12 months ago, and never having received the hepatitis B vaccine.

Conclusions: Results demonstrate disparity in HPV vaccine uptake by region of residence in the U.S. among young women. Further research is needed to understand the factors contributing to this geographic disparity. Evaluation of vaccination policies and practices associated with higher coverage regions might help characterize effective methods to improve HPV vaccination among women aged 18–26 years.

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Introduction

Genital human papillomavirus (HPV) is the most common sexually transmitted infection in the U.S.¹ Persistent HPV infection with oncogenic types can cause cervical cancer. The first HPV vaccine was licensed in 2006; that same year, the Advisory Committee on Immunization Practices recommended routine HPV vaccination of girls aged 11 or 12 years, and catch-up vaccination for girls aged 13–26 years.²

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Although HPV vaccination initiation reached 48.7% among girls aged 13–17 years,³ only 20.7% of women aged 19–26 years received one or more doses of HPV vaccine in 2010.⁴ Demographic, health-related, and healthcare utilization characteristics have been found to be correlated with HPV vaccination disparity in these two populations.^{5–11} Research on geographic variability of HPV vaccination has been limited to girls aged 13–17 years. HPV vaccination coverage was found to be lower among girls living in the southeastern U.S. compared with those living in other regions.³ The current study is the first, to the authors' knowledge, to examine whether initiation of the HPV series among U.S. women aged 18–26 years varies by geographic region. The results provide critical information for the development of targeted strategies to increase HPV vaccination initiation among young women.

Methods

This study utilized data collected from the 2010 National Health Interview Survey (NHIS).¹² The current study initially included 2011 women aged 18–26 years who participated in the 2010 NHIS Cancer Control Module Supplement.¹² The response of *ever received HPV vaccine* was used as the study's outcome variable of HPV series initiation. Individuals (144) in the response categories of *unknown-refused*, *unknown-not ascertained*, and *unknown-don't know* were excluded from the study. The resulting sample consisted of 1867 women. In addition to the "region" variable, the study also examined the influence of demographic characteristics, as well as variables related to women's health, other health issues, and healthcare utilization (Table 1).^{5–11}

Data Analysis

The 2010 NHIS data were collected using a stratified, multistage, cluster sampling design, oversampling for minorities (blacks, Hispanics, and Asians). Both bivariate and multivariable analyses were weighted for the probability of selection and accounted for the complex sample design of NHIS.¹³ Analyses were performed in 2012 using SAS, version 9.3.

In bivariate analyses, unadjusted weighted ORs were obtained to determine the relationship between the individual independent variables and HPV series initiation. A multivariable logistic regression model and its corresponding adjusted ORs assessed the characteristics that were associated independently with initiation of the HPV series among women aged 18–26 years. Initially, the model was fit maintaining all variables (Table 1); the least significant nondemographic variables with *p*-value >0.05 were then removed one at a time from the model. The final model retained all demographic variables as well as all significant nondemographic variables.

Results

Of the 1867 women included in the study, 408 (21.9%) had initiated the HPV three-dose vaccine series. To ensure an adequate number of subjects within each age category for analyses, subjects who were close in age were pooled if they did not have significantly different HPV series initiation rates. The distribution of characteristics, as well as the unadjusted and adjusted weighted ORs, is shown in Table 1.

The adjusted ORs for the sample showed that women aged 18–26 years who lived in the West and North Central U.S./Midwest were more likely to receive HPV vaccine than Northeastern residents. In addition, Hispanics were slightly more likely to initiate the HPV series than non-Hispanic whites. Women who were single and never married were more than twice as likely to initiate the HPV series than those who were married or living with a partner. Those who had never had children or who had a history of HPV infection were more likely to initiate the HPV series. Current alcohol use was associated with a higher likelihood of initiating the HPV series.

In contrast, older age was associated with a lower likelihood of initiating the HPV series in women aged

18–26 years, and the lowest likelihood was reached by those aged 24–25 years. Those who were uninsured, whose family income was below 200% of the federal poverty index, or who did not have a high school degree were less likely to initiate the HPV series. Women who were not current hormone-based birth control users or whose last Pap was >1 year ago were less likely to have initiated the series. As for healthcare utilization, having no regular provider, having last visited a clinic >12 months ago, and having not received a hepatitis B vaccine were correlated with not having initiated the HPV series.

Discussion

After adjusting for other characteristics, women living in the West and North Central U.S./Midwest had 54% and 20% greater odds, respectively, of initiating the HPV series, compared with those living in the Northeast. The current study is the first to demonstrate disparity in HPV vaccine uptake by region of residence for women aged 18–26 years.

In a previous study, geographic disparity in the HPV vaccination was examined among girls aged 13–17 years in six U.S. states.¹⁴ It found that girls in states with higher poverty levels were less likely to be vaccinated. In contrast, it also found that girls in counties with higher poverty levels and in the lowest-income families were more likely to be vaccinated, which the current authors believe is due to the Vaccines for Children (VFC) program. The VFC program provides HPV vaccines only to girls aged <19 years in low-income families. Low-income or uninsured women aged 19–26 years are therefore not eligible.

A similar result was found in the present study; after adjusting for other characteristics, women aged 18 years were two to six times more likely to initiate the HPV series than those aged 19–26 years. Further, this study showed that living 200% below the poverty level and having no insurance were both barriers to initiating the HPV series among women aged 18–26 years.^{7–10} Geographic variability in HPV vaccination initiation observed in the current study may be due to regional variability of providers' recommendations regarding HPV vaccination, as well as women's knowledge about HPV and HPV vaccines.^{15,16}

Limitations

The current study has several limitations. First, the cross-sectional study design precludes causal inference. Second, self-reported data could be subject to recall bias. Third, bias may exist for non-inclusion of households without landline telephones. People living in households without landline telephones tend to be younger, low-income, and from minority groups.¹⁷ Despite these limitations, the primary strength of this study is that it is the

Table 1. Unadjusted and adjusted weighted ORs for HPV vaccination initiation of 1867 women, NHIS, 2010

Characteristic	n (%)	Unadjusted OR	p-value	AOR ^a	p-value
Age, years^b					
18	148 (7.9)	1.00		1.00	
19, 20	345 (18.5)	0.63 (0.59, 0.69)	<0.0001	0.49 (0.47, 0.51)	<0.0001
21	193 (10.3)	0.45 (0.28, 0.73)	0.0014	0.33 (0.30, 0.37)	<0.0001
22, 23	470 (25.2)	0.28 (0.25, 0.32)	<0.0001	0.20 (0.13,0.30)	<0.0001
24, 25	470 (25.2)	0.21 (0.12, 0.34)	<0.0001	0.15 (0.15, 0.15)	<0.0001
26	241 (12.9)	0.29 (0.12, 0.65)	0.0030	0.27 (0.22, 0.33)	<0.0001
Region					
Northeast	242 (13.0)	1.00		1.00	
North Central U.S./Midwest	433 (23.2)	1.20 (1.17, 1.23)	<0.0001	1.20 (1.14, 1.25)	<0.0001
South	695 (37.2)	0.90 (0.88, 0.93)	<0.0001	1.07 (0.80, 1.43)	0.6374
West	497 (26.6)	1.33 (0.91, 1.94)	0.1369	1.54 (1.46, 1.63)	<0.0001
Race					
White, non-Hispanic	959 (51.4)	1.00		1.00	
Black, non-Hispanic	343 (18.4)	0.75 (0.58, 0.97)	0.0278	1.00 (0.89, 1.13)	0.9612
Hispanic	449 (24.1)	0.68 (0.63, 0.73)	<0.0001	1.04 (1.02, 1.06)	0.0003
Asian	116 (6.2)	0.65 (0.50, 0.85)	0.0013	0.90 (0.59, 1.38)	0.6309
Single/never married	1199 (64.2)	2.83 (1.50, 5.35)	0.0014	2.40 (1.39, 4.16)	0.0018
Uninsured	483 (26.0)	0.43 (0.37, 0.51)	<0.0001	0.69 (0.48, 0.99)	0.0461
Poverty index<200%	1027 (55.0)	0.82 (0.63, 1.08)	0.1525	0.73 (0.68, 0.78)	<0.0001
Not a high school graduate	291 (15.6)	0.66 (0.51, 0.86)	0.0015	0.68 (0.48, 0.97)	0.0309
Currently employed	1090 (58.4)	0.99 (0.78, 1.26)	0.9521	0.88 (0.77, 1.00)	0.0550
Women's health					
Never had kids	1186 (63.5)	2.40 (1.92, 3.00)	<0.0001	1.28 (1.17, 1.40)	<0.0001
Not currently taking birth control (pills, implants, or shots)	1210 (64.8)	0.43 (0.42, 0.44)	<0.0001	0.49 (0.48, 0.50)	<0.0001
Last Pap >1 year ago	814 (43.6)	0.71 (0.51, 0.99)	0.0436	0.81 (0.66, 1.00)	0.0447
Abnormal Pap results, past 3 years	225 (12.1)	1.57 (1.23, 2.01)	0.0003	—	—
Ever had HPV	134 (7.2)	2.01 (1.34, 3.02)	0.0007	2.19 (1.69, 2.84)	<0.0001
Non-HIV STD, past 5 years	152 (8.1)	1.30 (1.24, 1.35)	<0.0001	—	—
Other health-related issues					
Fair/poor self-assessed physical health	184 (9.9)	0.85 (0.76, 0.95)	0.0039	—	—
Current daily smoker	249 (13.3)	0.83 (0.41, 1.67)	0.5955	—	—

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Table 1. (continued)

Characteristic	n (%)	Unadjusted OR	p-value	AOR ^a	p-value
Alcohol status					
Heavy/moderate	293 (15.7)	2.03 (1.79, 2.29)	<0.0001	2.03 (1.35, 3.06)	0.0007
Light/infrequent	899 (48.2)	1.35 (1.03, 1.79)	0.0327	1.56 (1.44, 1.70)	<0.0001
None or former	675 (36.2)	1.00		1.00	
Healthcare utilization					
No regular provider	474 (25.4)	0.47 (0.42, 0.52)	<0.0001	0.67 (0.61, 0.73)	<0.0001
Last clinic visit ≥12 months ago	305 (16.3)	0.32 (0.28, 0.37)	<0.0001	0.49 (0.32, 0.75)	0.0011
Received no hepatitis B vaccine	779 (41.7)	0.60 (0.53, 0.67)	<0.0001	0.75 (0.64, 0.87)	0.0002

^aAdjusted for all demographic variables as well as all but four nonsignificant nondemographic variables (abnormal Pap results in the past 3 years, non-HIV STD in the past 5 years, fair/poor self-assessed physical health, and current daily smoker)

^bTo ensure an adequate number of subjects within each age category for analyses, subjects close in age were pooled if they did not have significantly different HPV series initiation rates.

HPV, human papilloma virus; NHIS, National Health Interview Survey; STD, sexually transmitted disease

first, to our knowledge, that uses a nationally representative sample to examine geographic disparity of HPV series initiation among women aged 18–26 years.

Conclusion

The current findings demonstrate geographic disparity of HPV series initiation among women aged 18–26 years. Future research is needed to understand why geographic disparity exists. Evaluation of vaccination policies and practices associated with higher coverage might help characterize effective methods to improve HPV vaccination among women aged 18–26 years.

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