Racial Disparities in Awareness of the Human Papillomavirus

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Abstract

Background: Human papillomavirus (HPV) is the most common sexually transmitted infection in the United States yet is one of the least recognized among the general public. HPV awareness may be relatively low among minority women. Because HPV awareness is associated with uptake of the HPV vaccine, it is critical to assess HPV awareness in the population and identify any racial/ethnic gaps.

Methods: This study used nationally representative data collected by the National Survey of Family Growth between July 2007 and December 2008. A multivariable logistic regression model was used to determine the independent effect of race/ethnicity on HPV awareness while controlling for sociodemographic and clinical confounders in a sample of 4088 women. Stratified multivariable analysis was also conducted to assess the relationship between race/ethnicity and HPV awareness among women in different age groups.

Results: After adjusting for confounders, Hispanic and black women overall were significantly less likely to have heard of HPV compared to white women (odds ratio [OR] 0.39, 95% confidence interval [CI] 0.29-0.54 and OR 0.39, 95% CI 0.29-0.54, respectively). Black women aged 15–18 and Hispanic women aged 19–26 had particularly low rates of HPV awareness (OR 0.17, 95% CI 0.07-0.43 and OR 0.18, 95% CI 0.11-0.30, respectively) compared to white women of the same ages.

Conclusions: Hispanic and black women have significantly lower levels of HPV awareness than white women. Targeted educational efforts will be important to improve HPV awareness and associated preventive health measures to avoid HPV-related morbidity and mortality.

Introduction

HUMAN PAPILLOMAVIRUS (HPV) is the most common sexually transmitted infection (STI) in the United States, with at least 50% of the sexually active population expected to become infected at some point in their lives.¹ Although there are over 100 HPV types and infection is common, most HPV types do not lead to clinical manifestation and usually clear without intervention. However, in a small percentage of cases, HPV causes significant morbidity and mortality.² Most notably, certain HPV types are linked to anogenital cancers. In particular, HPV is associated with virtually all cases (99.7%) of cervical cancer.³ Other HPV types may cause benign, although potentially distressing, genital warts.

Despite its high prevalence, HPV has been considered one of the least recognized STIs.⁴ In a study of women in the

United Kingdom in 2002, only 30% had heard of HPV and only 11% recognized its link with cervical cancer.⁵ The public release of the first HPV vaccine, Gardasil (Merck), in 2006 and the extensive advertising campaign that accompanied it, is expected to increase recognition of HPV and its link to cervical cancer. One recent study of parents of adolescent girls suggested that HPV awareness has more than doubled since 2005.⁶ Although HPV awareness appears to be increasing, recent studies suggest HPV awareness may still be relatively low among minorities.^{6–10} Indeed, in the study noted, parents who were black were less likely to have heard of HPV compared to white parents.⁶ Similarly, in a study of emergency department patients, black participants were less likely to have heard of HPV and to know that HPV causes cervical cancer compared to white participants.⁸ Other minority groups may also have low rates of HPV awareness. In a small

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study of Latina mothers in 2005, only 22% had heard of HPV.¹¹ Hispanic women were also shown to have lower levels of HPV and HPV vaccine awareness compared to non-Hispanic women in more recent studies.^{9,12} Other studies, however, have suggested that HPV awareness among US Hispanics may be comparable to that in the rest of the population.^{8,13,14}

Lack of HPV awareness is a concern, given the positive association between HPV awareness and action with regard to cervical cancer prevention. Nelson et al.¹⁵ found that knowledge of HPV was associated with compliance with the recommended Papanicolaou (Pap) screen protocol, the mainstay of cervical cancer prevention. Additionally, studies have demonstrated that HPV awareness is associated with interest in receiving the HPV vaccine,⁷ acceptance of the HPV vaccine,¹⁶ intention to receive the HPV vaccine,^{17,18} and receipt of the HPV vaccine.¹⁹ Similarly, HPV awareness among parents of adolescent girls was associated with a greater interest in having one's daughter vaccinated.⁷ Conversely, mothers most commonly cited a lack of knowledge about HPV or the HPV vaccine to explain why they would decline vaccination for their child.^{7,13} Other studies, however, have found comparable levels of support for the vaccine among individuals with varying degrees of HPV awareness.^{20–23} Nonetheless, it is reasonable to assume that individuals who understand the protection that the HPV vaccine confers will generally be more likely to accept the HPV vaccine if it is offered or to request it in situations when it is not offered.

Given the importance of HPV awareness in prevention efforts, reliable estimates of HPV awareness in racial minorities, who have significantly greater incidence of and mortality from cervical cancer,²⁴ are needed to guide educational interventions. Previous studies have largely assessed awareness before the advent of the HPV vaccine or assessed HPV awareness very soon after HPV vaccination recommendations were published. Furthermore, studies have been limited by small sample sizes and narrow study populations, for example, restricting sampling to particular geographic areas. To address these limitations, we used 2007–2008 data from the National Survey of Family Growth (NSFG) to arrive at a greater understanding of HPV awareness and the independent effect of race/ethnicity on HPV awareness among women of reproductive age in the United States.

Materials and Methods

Data source

This study used data from the July 2007–December 2008 portion of Cycle 7 of the NSFG, a national cross-sectional survey.²⁵ The NSFG is designed and administered by the National Center for Health Statistics, an agency of the US Department of Health and Human Services, to provide national estimates of behaviors and attitudes regarding pregnancy and family planning. Unlike previous NSFG cycles, which were conducted over the course of a given year, Cycle 7 uses a continuous data collection. Interviewing for Cycle 7 began in July 2006, and the first installment, released in May 2010, comprises the period between July 2006 and December 2008. Cycle 7 will eventually include interviews from a 4-year period.

Study sample

The NSFG uses a national probability sample designed to represent men and women aged 15–44 living in households in all 50 States and the District of Columbia. Cycle 7 drew its sample from 110 major areas (Primary Sampling Units), which were divided into four national subsamples, one for each of the 4 years of Cycle 7. Hence, each year of interviewing can be considered a nationally representative sample, and results from multiple years may be combined for more reliable population estimates. Teenage, Hispanic, black, and female participants were oversampled, and the NSFG provides sampling weights to adjust for the different sampling and response rates within the survey sample. In each selected household, screening interviews were conducted to determine if anyone aged 15–44 lived at the residence. If so, one person was chosen at random for the interview and offered a chance to participate. Some questions, including those that pertained to HPV, were added or modified at the beginning of the second year of interviewing (July 2007). The study sample for data collected from July 2007 to December 2008 includes 4283 women.

Primary study outcome

The primary outcome variable in this analysis was whether the respondent had heard of HPV at the time of the interview. The question was phrased in the following manner:

Have you ever heard of human papillomavirus, or HPV? This is different from human immunodeficiency virus, or HIV, which we were just talking about. (Question 1)

Secondary outcomes

We considered awareness of the HPV vaccine as a secondary outcome. This was ascertained in the NSFG by a question immediately following Question 1:

HPV is a common sexually transmitted virus that can cause genital warts and cervical cancer in women. A vaccine to prevent the HPV infections most commonly associated with warts and cervical cancer is available for women 9–26 years of age and is sometimes called the cervical cancer vaccine, HPV shot, or Gardasil. Before today, have you ever heard of the cervical cancer vaccine, HPV shot, or Gardasil? (Question 2)

HPV awareness rather than HPV vaccine awareness was chosen as our primary outcome measure in order to assess awareness of the virus itself and its potential to cause disease. Because Question 2 contained a brief HPV primer as well as a product reference, participants without prior awareness of HPV or the indications of the product Gardasil may have responded affirmatively to this second question.

Although the NSFG collects information about HPV vaccination status, vaccination rates in this cycle were low, presumably because of the short duration between the availability of the vaccine and NSFG data collection. Therefore, we did not use vaccination status as a primary outcome in this study but did examine rates of HPV vaccine uptake by race/ethnicity. Vaccine uptake was self-reported, based on the question:

Have you received the cervical cancer vaccine, also known as the HPV shot or Gardasil? (Question 3)

TABLE 1. BASELINE DEMOGRAPHIC/CLINICAL CHARACTERISTICS BY RACE/ETHNICITY (*n*=4283)

Variable	White (<i>n</i> =2,243)	Hispanic (<i>n</i> =974)	Black (<i>n</i> =871)	Other ^a (<i>n</i> =195)	<i>p</i> value
Total population	63.6	16.8	14.3	5.3	–
Age, years					0.330
15–18	12.2	13.6	16.5	12.5	
19–26	27.9	28.8	25.8	23.4	
27–44	59.9	57.7	57.6	64.1	
Insurance					<0.001
Public/none ^b	29.2	67.0	49.0	30.0	
Private ^c	70.8	33.1	51.0	70.0	
Education					<0.001
High school diploma or less	42.2	71.1	53.3	26.0	
At least some college	57.9	28.9	46.7	74.0	
Parity					<0.001
0	47.3	31.2	41.4	42.9	
1 or 2	38.1	37.1	39.2	38.4	
3 or more	14.6	31.7	19.4	18.7	
Marital status					<0.001
Never been married	43.3	44.2	62.0	42.3	
Ever been married	56.7	55.8	38.0	57.7	
Lifetime male sexual partners (number)					<0.001
0	14.1	11.5	12.1	18.0	
1	17.5	36.9	11.9	44.6	
2–5	35.5	41.4	37.9	23.5	
6 or more	32.9	10.2	38.2	13.9	
Religion					<0.001
None	20.9	11.7	11.0	16.2	
Catholic	18.3	60.6	5.4	27.0	
Protestant	51.6	23.5	80.8	21.7	
Other	9.2	4.2	2.9	35.2	
Poverty level (%) ^d					<0.001
<100	15.5	37.6	33.8	13.6	
100–499	73.6	60.2	62.5	76.9	
>499	10.8	2.2	3.7	9.5	
Received Pap smear ^e	62.0	51.2	66.0	49.2	<0.001
Received STD counseling, testing, or treatment ^e	15.9	14.7	22.0	10.1	0.003

Data shown are percents.

Weighted to reflect the U.S. female civilian noninstitutionalized population.

^aOther is non-Hispanic other.

^bPublic insurance included Medicaid, Medicare, Indian health service, Children's Health Insurance Program, state-sponsored or other government program.

^cPrivate insurance included private health insurance and Medi-Gap.

^dPoverty threshold based on 2007–2008 level defined by the US Census Bureau, which takes into account total household income and number.

^eIndicates receipt of service within the last 12 months.

STD, sexually transmitted disease.

If a participant affirmed that she had received at least one of the three HPV vaccine shots, she was considered to have received the vaccine. Vaccination rates were assessed only among participants who had heard of the HPV vaccine (yes in response to Question 2) and who were <age 25. In addition, participants who had heard of the HPV vaccine and were living with at least one daughter aged 9–18 were asked about the vaccination status of their daughters.

Independent variables

The primary predictor of interest was self-reported race/ethnicity. Participants were first asked if they were Hispanic, Latina, or of Spanish origin. Those who answered affirmatively were classified as Hispanic. The remaining participants were categorized as non-Hispanic white, non-Hispanic black,

or non-Hispanic other based on a follow-up question about their racial background. Demographic factors, including age, insurance status, education, parity, marital status, number of lifetime male sexual partners, religion, and household income, were examined as potential confounders. Age was divided into three categories: 15–18 years old, 19–26 years old, and 27–44 years old. As 9–26 years was the age range for HPV vaccination approved by the United States Food and Drug Administration at the time of data collection,²⁶ we considered women >age 26 as a singular group of vaccine-ineligible women. We also examined relevant clinical covariates, including receipt of a Pap smear within the last 12 months and receipt of sexually transmitted disease (STD) counseling, testing, or treatment within the last 12 months, as these encounters may have provided opportunities to receive information about HPV and the HPV vaccine.

TABLE 2. ODDS RATIOS OF AWARENESS OF HUMAN PAPILLOMAVIRUS

Variable	HPV awareness	Unadjusted OR and 95% CI (n = 4,283)	p value	Adjusted ^a OR and 95% CI (n = 4088)	p value
Race/ethnicity			<0.001		<0.001
White	89.4%	Reference	–	Reference	–
Hispanic	61.5%	0.19 (0.14-0.25)	<0.001	0.39 (0.29-0.54)	<0.001
Black	75.3%	0.36 (0.25-0.52)	<0.001	0.39 (0.29-0.54)	<0.001
Other ^b	68.7%	0.26 (0.16-0.43)	<0.001	–	–
Age, years			0.004		0.122
15–18	76.2%	Reference	–	Reference	–
19–26	85.0%	1.77 (1.31-2.39)	<0.001	0.81 (0.51-1.30)	0.380
27–44	81.2%	1.35 (1.01-1.80)	0.040	0.53 (0.27-1.06)	0.074
Insurance			<0.001		0.057
Public/none ^c	71.1%	Reference	–	Reference	–
Private ^d	88.1%	3.01 (2.19-4.15)	<0.001	1.48 (0.99-2.21)	0.057
Education			<0.001		<0.001
High school diploma or less	72.1%	Reference	–	Reference	–
At least some college	90.3%	3.60 (2.68-4.83)	<0.001	3.07 (2.12-4.45)	<0.001
Parity			<0.001		0.920
0	84.5%	Reference	–	Reference	–
1 or 2	81.5%	0.81 (0.62-1.05)	0.105	1.08 (0.71-1.65)	0.699
3 or more	74.9%	0.55 (0.41-0.73)	<0.001	1.09 (0.68-1.74)	0.711
Marital status			0.744		–
Never been married	82.0%	Reference	–	–	–
Ever been married	81.3%	0.96 (0.74-1.24)	0.744	–	–
Lifetime male sexual partners (number)			<0.001		0.002
0	77.9%	Reference	–	Reference	–
1	73.0%	0.77 (0.56-1.06)	0.107	0.75 (0.47-1.21)	0.237
2–5	81.9%	1.29 (0.97-1.70)	0.080	1.05 (0.60-1.85)	0.867
6 or more	89.3%	2.37 (1.73-3.26)	<0.001	1.70 (0.91-3.16)	0.095
Religion			<0.001		0.077
None	87.0%	Reference	–	Reference	–
Catholic	75.2%	0.45 (0.29-0.70)	0.001	0.65 (0.41-1.04)	0.070
Protestant	83.9%	0.78 (0.56-1.09)	0.142	0.82 (0.55-1.20)	0.297
Other	75.6%	0.46 (0.29-0.74)	0.002	0.54 (0.33-0.90)	0.018
Poverty level (%) ^e			<0.001		0.0075
<100	67.1%	Reference	–	Reference	–
100–499	84.6%	2.70 (2.05-3.54)	<0.001	1.65 (1.18-2.30)	0.004
>499	94.3%	8.09 (4.53-14.44)	<0.001	2.58 (1.27-5.25)	0.010
Received Pap smear ^f			<0.001		0.014
No ^g	74.7%	Reference	–	Reference	–
Yes	86.2%	2.13 (1.58-2.86)	<0.001	1.58 (1.10-2.27)	0.014
Received STD counseling, testing, or treatment ^f			<0.001		0.206
No ^g	80.6%	Reference	–	Reference	–
Yes	86.8%	1.59 (1.17-2.15)	0.004	1.26 (0.88-1.82)	0.206

Weighted to reflect the U.S. female civilian noninstitutionalized population.

^aAdjusted for all significant variables in unadjusted analysis ($p < 0.10$).

^bOther is non-Hispanic other.

^cPublic insurance included Medicaid, Medicare, Indian health service, Children's Health Insurance Program, state-sponsored or other government program.

^dPrivate insurance included private health insurance and Medi-Gap.

^ePoverty threshold based on 2007–2008 level defined by the US Census Bureau, which takes into account total household income and number.

^fIndicates receipt of service within the last 12 months.

^gNo includes those who answered no and don't know, as well as those who refused to answer the question.

CI, confidence interval; OR, odds ratio.

Statistical analysis

Demographic and clinical characteristics were compared by race/ethnicity using chi-square tests for all categorical variables. We examined the bivariate association between

each covariate and our primary study outcome and generated unadjusted odds ratios (ORs) for each pair. A multivariable logistic regression model was then used to determine the adjusted ORs (AORs) of HPV awareness while adjusting for covariates that were significant (p value < 0.10) in bivariate

TABLE 3. ODDS RATIOS OF AWARENESS OF HUMAN PAPILLOMAVIRUS, STRATIFIED BY AGE ($n=4077$)

	15–18 ($n=571$) ^a		19–26 ($n=1209$) ^b		27–44 ($n=2297$) ^b	
	Adjusted OR (95% CI)	p value	Adjusted OR (95% CI)	p value	Adjusted OR (95% CI)	p value
Race/ethnicity		0.002		<0.001		0.003
White	Reference	–	Reference	–	Reference	–
Hispanic	0.37 (0.16–0.85)	0.020	0.18 (0.11–0.30)	<0.001	0.52 (0.31–0.90)	0.020
Black	0.17 (0.07–0.43)	<0.001	0.29 (0.18–0.48)	<0.001	0.55 (0.37–0.81)	0.003

Ages are in years.

Weighted to reflect the U.S. female civilian noninstitutionalized population.

^aAdjusted for all significant variables in unadjusted analysis in Table 2 ($p<0.10$), except for education. Education was dropped from the analysis in this age group because education (at least some college) predicted the outcome perfectly. The analysis thus included race/ethnicity, age, insurance, parity, lifetime male sexual partners, religion, poverty level, receipt of a Pap smear in the last 12 months, and receipt of STD counseling, testing, or treatment in the last 12 months.

^bAdjusted for all significant variables in unadjusted analysis in Table 2 ($p<0.10$): race/ethnicity, age, insurance, education, parity, lifetime male sexual partners, religion, poverty level, receipt of a Pap smear in the last 12 months, and receipt of STD counseling, testing, or treatment in the last 12 months.

analysis. Women in the other non-Hispanic race category were excluded from multivariable analyses, as they were too heterogeneous and limited in size as a group to produce meaningful conclusions. This resulted in a final sample of 4088 for multivariable modeling. A stratified multivariable analysis examining racial/ethnic variation in HPV awareness within each of the three age groups considered in this study was also conducted. The sample size for this analysis is 4077; 11 observations were dropped from the analysis because education perfectly predicted outcome in the youngest age group.

Similar bivariate and multivariable analyses were conducted for the secondary outcome, HPV vaccine awareness. We also compared vaccine uptake among participants and among the daughters of participants by race/ethnicity using chi-square tests.

Statistics for this analysis were produced using Stata 11 SE software (StataCorp), using appropriate adjustment for the NSFG's complex sample design. All percentages shown have been weighted to reflect national estimates; however, actual sample sizes are also provided to give the reader an indication of the reliability of the estimates. This study was approved by the University of Pittsburgh Institutional Review Board.

Results

Table 1 shows the demographic and clinical characteristics of the study sample by race/ethnicity. Approximately 64% of women were non-Hispanic white, 17% were Hispanic, 14% were non-Hispanic black, and 5% were of other non-Hispanic race/ethnicity.

Results from bivariate and multivariable analyses are shown in Table 2. Overall, 82% of women had heard of HPV. White women were more likely to have heard of HPV than other racial/ethnic categories: 89% of white women compared to 62% of Hispanic women, 75% of black women, and 69% of women of other races ($p<0.001$). After adjusting for covariates, we found that Hispanic and black women were significantly less likely to have heard of HPV compared to white women (AOR 0.39, 95% confidence interval [CI] 0.29–0.54, $p<0.001$, and AOR 0.39, 95% CI 0.29–0.54, $p<0.001$, respectively). College education, income above the national poverty level, and receipt of a Pap smear within the last 12

months were significantly associated with higher levels of HPV awareness ($p<0.05$).

Results from the multivariable analysis stratified by age group are shown in Table 3. Hispanic and black women in all three groups had significantly lower levels of HPV awareness than women in the corresponding white age group, and HPV awareness among 15–18-year-old black women and among 19–26-year-old Hispanic women was dramatically lower than that of white women of the corresponding ages (AOR 0.17, 95% CI 0.07–0.43, $p<0.001$, and AOR 0.18, 95% CI 0.11–0.30, $p<0.001$, respectively).

Bivariate and multivariable analyses using HPV vaccine awareness as the outcome yielded similar trends as those for HPV awareness (Table 4). As with HPV awareness, multivariable analysis demonstrated lower levels of HPV vaccine awareness in Hispanic and black women compared to white women (AOR 0.30, 95% CI 0.20–0.45, $p<0.001$, and AOR 0.36, 95% CI 0.24–0.55, $p<0.001$, respectively).

Vaccination uptake among participants <age 25 and among the daughters (aged 9–18) of participants is shown in Figure 1. The overall rate of vaccination among women aged 15–24 was 23%. White women were the most likely to have received the HPV vaccine: 26% of white women in this age group had received the vaccine compared to 18% of Hispanic women, 11% of black women, and 20% of women of other races ($p<0.01$). The overall rate of vaccination for daughters of participants was 27%. Rates were similar for the daughters of white and Hispanic women (30% and 33%, respectively) but lower for daughters of black women and women of other races (13% and 5%, respectively) ($p<0.01$).

Discussion

In a sample of 4088 women, we found that black and Hispanic women were significantly less likely to have heard of HPV and the HPV vaccine, even after controlling for socio-demographic and clinical confounders. We found that this relationship was most pronounced in women ≤ 26 years old, although it persisted among older women of reproductive age as well. We also found that HPV vaccination rates were lower in black and Hispanic women than in white women and that black women were less likely to have had their daughters vaccinated.

TABLE 4. ODDS RATIOS OF AWARENESS OF HUMAN PAPILLOMAVIRUS VACCINE

Variable	HPV vaccine awareness	Unadjusted OR and 95% CI (n=4283)	p value	Adjusted ^a OR and 95% CI (n=4088)	p value
Race/ethnicity			<0.001		<0.001
White	90.5%	Reference	—	Reference	—
Hispanic	61.9%	0.17 (0.11-0.25)	<0.001	0.30 (0.20-0.45)	<0.001
Black	74.3%	0.30 (0.20-0.47)	<0.001	0.36 (0.24-0.55)	<0.001
Other ^b	73.9%	0.30 (0.16-0.54)	<0.001	—	—
Age, years			0.369		—
15–18	80.9%	Reference	—	—	—
19–26	84.4%	1.27 (0.88–1.83)	0.188	—	—
27–44	82.0%	1.07 (0.72-1.59)	0.725	—	—
Insurance			<0.001		0.014
Public/none ^c	71.8%	Reference	—	Reference	—
Private ^d	89.2%	3.24 (2.34-4.50)	<0.001	1.52 (1.09-2.11)	0.014
Education			<0.001		<0.001
High school diploma or less	73.5%	Reference	—	Reference	—
At least some college	90.7%	3.52 (2.63-4.73)	<0.001	2.57 (1.80-3.68)	<0.001
Parity			0.003		0.673
0	85.5%	Reference	—	Reference	—
1 or 2	82.0%	0.77 (0.57-1.06)	0.103	0.86 (0.57-1.28)	0.438
3 or more	76.4%	0.55 (0.40-0.75)	<0.001	0.85 (0.58-1.25)	0.405
Marital status			0.735		—
Never been married	82.8%	Reference	—	—	—
Ever been married	82.2%	0.96 (0.75-1.23)	0.735	—	—
Lifetime male sexual partners (number)			<0.001		0.009
0	81.6%	Reference	—	Reference	—
1	74.7%	0.66 (0.41-1.07)	0.088	0.57 (0.32-1.02)	0.056
2–5	82.3%	1.04 (0.71-1.54)	0.828	0.74 (0.43-1.26)	0.259
6 or more	89.0%	1.82 (1.17-2.85)	0.009	1.13 (0.65-1.96)	0.660
Religion			0.071		0.232
None	86.4%	Reference	—	Reference	—
Catholic	78.6%	0.58 (0.36-0.92)	0.022	1.04 (0.63-1.70)	0.881
Protestant	83.7%	0.81 (0.54-1.22)	0.305	0.89 (0.55-1.45)	0.643
Other	78.8%	0.59 (0.37-0.94)	0.029	0.55 (0.28-1.08)	0.082
Poverty level (%) ^e			<0.001		0.011
<100	67.2%	Reference	—	Reference	—
100–499	85.7%	2.92 (2.03-4.18)	<0.001	1.65 (1.11-2.45)	0.014
>499	95.9%	11.38 (5.56-23.30)	<0.001	2.75 (1.26-6.01)	0.012
Received Pap smear ^f			<0.001		0.010
No ^g	77.1%	Reference	—	Reference	—
Yes	86.1%	1.84 (1.42-2.37)	<0.001	1.52 (1.11-2.07)	0.010
Received STD counseling, testing, or treatment ^f			0.106		—
No ^g	81.9%	Reference	—	—	—
Yes	85.7%	1.32 (0.94-1.86)	0.106	—	—

Weighted to reflect the U.S. female civilian noninstitutionalized population.

^aAdjusted for all significant variables in unadjusted analysis ($p < 0.10$).

^bOther is non-Hispanic other.

^cPublic insurance included Medicaid, Medicare, Indian health service, Children's Health Insurance Program, state-sponsored or other government program.

^dPrivate insurance included private health insurance and Medi-Gap.

^ePoverty threshold based on 2007–2008 level defined by the US Census Bureau, which takes into account total household income and number.

^fIndicates receipt of service within the last 12 months.

^gNo includes those who answered no and don't know, as well as those who refused to answer the question.

Our methodology is similar to that in a study by Jain et al.,⁹ which used the National Immunization Survey-Adult (NIS-Adult), conducted May through August 2007. NIS-Adult, like the NSFG, is designed to produce nationally representative estimates. However, unlike the NSFG, it spans only a 4-month period and represents a slightly older population (aged 18–

49). Consistent with that study, we found lower levels of HPV awareness in Hispanic women compared to white women. However, unlike Jain et al., who found significantly lower levels of HPV awareness only among older black women compared to white women (aged 27–49 in that study), we found a marked disparity in HPV awareness in the younger,

FIG. 1. Human Papilloma-virus (HPV) vaccine uptake by race/ethnicity. Weighted to reflect the U.S. female civilian noninstitutionalized population. ^aReceipt of the HPV vaccine was defined as receiving one or more doses. ^bVaccination status was only asked of participants who had heard of the HPV vaccine. ^c $p=0.003$. ^d $p=0.0085$ (the stratum mean is centered at the grand mean to compute a p value because of a singleton primary sampling unit (PSU)). ^eOther is non-Hispanic other.

vaccine-eligible black women as well. Moreover, Jain et al. did not find statistically significant differences in vaccine uptake among Hispanic, black, and white women aged 18–26. Our analysis used more recent data, comprising the period between July 2007 and December 2008, and included a larger sample size, enabling more accurate estimates of HPV vaccine uptake in different racial groups. Additionally, the NSFG's unique continuous data collection will allow for updated estimates of HPV vaccination.

Unlike NIS-Adult, NIS-Teen, which determines vaccination rates in adolescents aged 13–17, did find discrepancies in HPV vaccine uptake among racial minorities in data collected throughout 2009.²⁷ Although NIS-Teen found no difference in vaccine initiation by race/ethnicity, Hispanic and black women were less likely to have completed the entire three-dose series. Although we cannot directly compare our data to the NIS-Teen data because of differences in age groups, both studies suggest disparities in vaccine use. Updated estimates of HPV vaccine uptake and the extent of adherence with the three-dose protocol will be needed to further clarify racial variation in effective vaccine uptake in the United States.

Our findings add to the body of literature documenting racial and ethnic disparities in reproductive healthcare.²⁸ Because doctors do not always discuss HPV prevention with their patients,^{29,30} patients may be required to raise the subject with their physician. In this case, a lack of awareness could translate into a missed opportunity for protection against cervical cancer and genital warts. Because HPV vaccination is most effective when given before an infection with HPV,²⁶ it should ideally be administered to women before the onset of sexual activity. Thus, the Centers for Disease Control and Prevention's (CDC) Advisory Committee on Immunization Practices recommends routine vaccination of women aged 11–12, with catch-up vaccination up to age 26.³¹ The relative lack of awareness in vaccine-eligible (i.e., younger) Hispanic and black women is, therefore, particularly troublesome.

The different rates of vaccination among women who have heard of the HPV vaccine in our study suggest that there are other contributors, besides awareness, that shape vaccination decisions. Indeed, several studies have demonstrated opposition to the HPV vaccine even after receipt of educational materials about HPV.^{10,23,32} In one study conducted before the

release of the HPV vaccine, 33% of women said they would not consent to having their adolescent daughters vaccinated, with their major concerns being unknown side effects and the belief that their children were not sexually active.³² The notion that the vaccine is too new was endorsed by both adolescent girls and their parents in another study.⁷ Another concern among parents is that children are more likely to be sexually active if they receive the HPV vaccine.^{23,33}

Several studies have indicated that black women are less accepting of the HPV vaccine than other racial groups.^{33,34} Skepticism about the vaccine's effectiveness and possible side effects were common concerns cited among black women in one qualitative study.³⁴ Such skepticism may reflect a general distrust toward the medical profession in this racial group.^{35–37} Additionally, other subpopulations may be less likely to support vaccination. Marlow et al.¹⁰ showed that ethnicity and religion predict acceptability of the HPV vaccine; acceptance was highest among white women and women with no religion and lowest among South Asian women and women from non-Christian religions. The reasons for supporting or opposing the vaccine differed among ethnic groups in this study. White mothers were more likely to endorse the belief that the vaccine offers protection compared to South Asian and Caribbean mothers, and South Asian women were more likely to refuse the vaccine for sex-related reasons (including “it encourages promiscuity” and “the risk of premarital sex”) compared to white women. In contrast, some studies have demonstrated that Hispanics are more accepting of the HPV vaccine compared to non-Hispanic women.^{12,33,38} Attitudes about the vaccine may vary across cultural groups^{10,34,38} and may contribute to observed disparities in vaccination rates.

Our study has several important limitations. First, the question used to assess HPV awareness in the NSFG was closed-ended and only required recognition of a term. Previous research on HPV awareness has shown that simple yes/no questions testing the recognition of the terms HPV or human papillomavirus overestimate HPV awareness. In one study, only 52% of participants who affirmed that they had “heard” of HPV reported “knowing” what it is.³⁹ Confusing HPV with other STIs, such as herpes simplex virus (HSV), also is common.^{40,41} Similarly, HPV vaccine awareness may have been overestimated because of the brief description of HPV

and the reference to the product Gardasil in Question 2. Product recognition in particular may have led individuals to respond affirmatively. We are interested in racial differences in HPV and HPV vaccine awareness, however, and have no reason to suspect that the trends found in this study would change given a more thorough assessment of HPV knowledge. Second, the HPV question series was introduced relatively soon after the approval of the HPV vaccine. It is likely that both HPV awareness and vaccine uptake will increase over time and population estimates will be more accurate with future Cycle 7 NSFG data releases. Indeed, NIS-Teen demonstrated that rates of HPV initiation rose from 37.2% in 2008 to 44.3% in 2009 among women aged 13–17.²⁷ Lastly, vaccination rates were self-reported and subject to recall bias. Again, this limits our ability to ascertain accurate estimates of this variable but likely does not alter comparisons between racial groups.

Conclusions

After controlling for confounding factors, Hispanic and black women, particularly those in younger age groups, were less likely than white women to be aware of HPV and the HPV vaccine and to have received the HPV vaccine. Healthcare providers and programs should be cognizant of discrepancies in HPV awareness in certain populations in order to provide effective educational interventions and reduce the racial gap.

Acknowledgments

We thank Kwonho Jeong from the University of Pittsburgh's Clinical and Translational Sciences Institute (NIH/NCRR/CTSA grant UL1 RR024153) for his help with statistical analysis. This article was made possible by S.B.'s grant (05 KL2 RR024154-05) from the National Center for Research Resources (NCRR), a component of the National Institutes of Health (NIH), and NIH Roadmap for Medical Research. E.B.S. was supported by NICHD grant K23 HD051585. The content of this publication is solely the responsibility of the authors and does not necessarily represent the official view of NCRR or NIH.

Disclosure Statement

No competing financial interests exist.

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