

# Disparities in How Parents Are Learning about the Human Papillomavirus Vaccine

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## Abstract

**Background:** Differential access to basic health information may contribute to persistent cervical cancer disparities. We examined whether human papillomavirus (HPV) vaccine awareness, HPV knowledge, and use of information sources about the vaccine differ by sociodemographic characteristics associated with cervical cancer.

**Methods:** Study participants ( $n = 889$ ) were caregivers of adolescent girls ages 10 to 18 years living in southeastern North Carolina. Analyses simultaneously controlled for caregivers' gender, race, age, education, income, and rural residence.

**Results:** Although most caregivers were aware of HPV (83%) and the HPV vaccine (82%), awareness differed by gender, race, education, and income. The largest differences were for race, with 87% of Whites versus 68% of African Americans having heard of the vaccine ( $P < 0.001$ ). Caregivers correctly answered an average of 69% of questions on HPV, with differences by race

and education. Most respondents heard of the HPV vaccine through drug company advertisements (83%) or broadcast media coverage (69%). African Americans were less likely than Whites to have heard about the vaccine from advertisements but more likely from a broadcast source ( $P < 0.05$ ). Health care providers (88%) and the internet (65%) were the most favored sources for future information about the vaccine. Vaccine uptake was associated with awareness, knowledge, and media use.

**Discussion:** Whereas drug company advertisements seem to play a central role in high HPV vaccine awareness, doctors and the internet are the preferred future "go to" sources for seeking out information. Communication-based interventions for caregivers from cervical cancer risk groups, especially African Americans, may need to use different communication channels and content. (Cancer Epidemiol Biomarkers Prev 2009;18(2):363–72)

## Introduction

Cervical cancer is a preventable disease, yet it kills many women every year. In the United States, an estimated 11,070 women will be diagnosed with cervical cancer in 2008 (1), and an estimated one third of these diagnosed will die from the disease (2). Cervical cancer is caused by persistent infection with human papillomavirus (HPV; ref. 3). HPV is one of the most common sexually transmitted infections in the United States (3–5), with ~20 million Americans currently infected (6)<sup>4</sup> and an estimated 80% of sexually active women infected during their lifetimes (2, 7).

A prophylactic vaccine against HPV is the most recent development in cervical cancer prevention (2). Two HPV vaccines (one of which received Food and Drug Administration approval recently) show almost 100% efficacy in preventing persistent oncogenic HPV infection (8, 9). In the United States, the recommended age for vaccination of females is 11 to 12 years, although it can be administered as early as age 9 years (2). Catch-up

vaccination is recommended for females ages 13 to 26 years who have not previously been vaccinated (2). A U.S. study conducted in 2006, near the time of our study, found that 5% of females ages 13 to 26 years attending primary care clinics had received at least one dose of the three-dose HPV vaccine (10). A population-based study found that, by 2007, 25.1% of U.S. adolescent females had initiated the HPV vaccine series (11).

Despite the proven efficacy of HPV vaccines and a surge in media coverage of cancer-related topics in recent years, past research suggests that this new prevention strategy is little understood by the public (12–15). A review of seven studies found that 58% of respondents had never heard of HPV (12). Awareness was especially low among certain groups, including adolescents, lower-income individuals, and minorities (16). Moreover, HPV awareness did not ensure accurate knowledge (14), and many did not know that HPV can cause cervical cancer (12, 14, 17). However, all of these studies occurred before the HPV vaccine became available. To our knowledge, few published studies have yet examined awareness and knowledge of HPV and the vaccine after its licensing and subsequent extraordinary media attention.

Cervical cancer is a disease of disparities. Race, ethnicity, and other important sociodemographic

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<sup>4</sup> <http://www.cdc.gov/std/hpv/stdfact-hpv.htm>

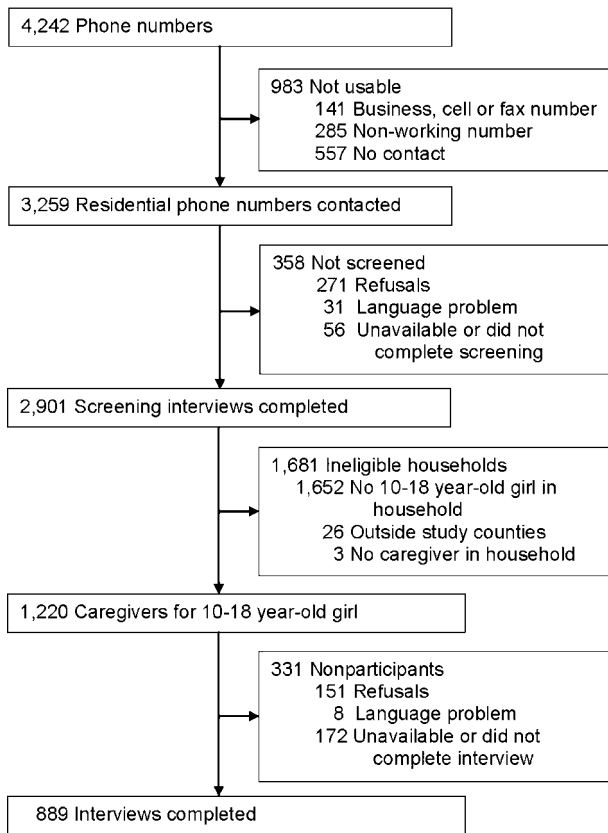


Figure 1. Survey sample.

characteristics play a central role in the epidemiology of cervical cancer in the United States (2, 18-21). African American women in the United States have cervical cancer mortality rates twice those of White women (22).<sup>5</sup> Hispanic women also have higher cervical cancer mortality rates than White women (22). Women living in rural areas experience higher rates of mortality from cervical cancer than their urban counterparts (18). Socioeconomic status also plays a key role, with lower socioeconomic status being associated with disparities in cervical cancer screening, diagnosis, and treatment (18).

Differential access to health information is one potential explanation for persistent disparities experienced among social groups (23). Indeed, African American women are less likely to have heard of HPV than White women (24). Access to this information is important because increased awareness is the first stage of many that people adopting health behaviors pass through (25, 26). Narrowing the gap between the "information rich" and the "information poor" (27) by raising awareness and increasing education about HPV and the HPV vaccine may help to decrease disparities in cervical cancer mortality.

Numerous studies show the role of mass media in shaping cancer beliefs (28, 29). Whereas many sources

offer health information, the general public often turns to mass media (30-33). Thus, harnessing the power of media is one way to educate the public on this important and timely issue. Experts have called for more health communication efforts around HPV, the HPV vaccine, and cervical cancer (14, 24, 34), and persistent disparities in cervical cancer call for interventions that target high-risk groups.

To explore the role of communication about HPV and the HPV vaccine in cervical cancer prevention, we conducted a study of caregivers of adolescent girls. In this article, we examine whether HPV and HPV vaccine awareness, knowledge, and use of information sources differ by caregivers' sex, race, age, education, income, and rural/urban residence. We chose to examine these variables because all are associated with cervical cancer disease burden. These variables may also offer insight into opportunities for targeted communications about the HPV vaccine.

## Materials and Methods

**Participants.** Study participants were caregivers of adolescent girls ages 10 to 18 y, ages for which the HPV vaccine is recommended, living in five counties in southeastern North Carolina. Caregivers were parents, grandparents, or any other individual who self-identified as being responsible for the adolescents' care. Eleven North Carolina counties met study inclusion criteria of having high rates of invasive cervical cancer (i.e., incidence >10 cases/100,000 women annually 1993-2003 and mortality >4 cases/100,000 women annually 1994-2004); 20% or more African American residents; and at least 1,500 girls in the targeted age range (to allow a minimum number of potential caregivers). Nine counties, eight rural and one urban, were geographically clustered in the southeast of the state. After matching the eight rural counties on population size, proportion of African American residents, and rates of cervical cancer, we randomly selected four rural counties to study (Duplin, Harnett, Sampson, and Wayne counties). We selected only four counties because, as part of another study, we also interviewed all local medical facilities likely to provide HPV vaccine and had resources to include only four rural counties (35). The fifth county, Cumberland (population of 302,963; 464 people per square mile; ref. 36),<sup>6</sup> was the only urban county in the region that met inclusion criteria.

Interviewers contacted a sample of households from a random digit-dialing telephone frame (5%) and a nonoverlapping targeted-list frame of directory-listed residential telephone numbers with available recent household demographic information (95%). We oversampled households likely to include a female child between ages 10 and 18 y, African Americans, and rural telephone exchanges. Rural residence was defined using the U.S. Census classification (37).<sup>7</sup>

<sup>5</sup> <http://planning.cancer.gov/disease/Cervical-Snapshot.pdf>

<sup>6</sup> [http://factfinder.census.gov/servlet/SAFFPopulation?\\_event=Search&\\_name=cumberland+county&\\_state=04000US37&\\_county=cumberland+county&\\_cityTown=cumberland+county&\\_zip=&\\_sse=on&\\_lang=en&\\_pctxt=fph](http://factfinder.census.gov/servlet/SAFFPopulation?_event=Search&_name=cumberland+county&_state=04000US37&_county=cumberland+county&_cityTown=cumberland+county&_zip=&_sse=on&_lang=en&_pctxt=fph)

<sup>7</sup> [http://factfinder.census.gov/home/en/epss/glossary\\_u.html](http://factfinder.census.gov/home/en/epss/glossary_u.html)

At 4,242 phone numbers we attempted to contact, 1,220 eligible caregivers were identified (Fig. 1). Of these eligible caregivers, 889 (73%) completed the survey. Most caregivers (94%) were female (Table 1). Most respondents were White (70%) or African American (23%); the remaining respondents identified themselves as another race or ethnicity [Hispanic ( $n = 28$ ) was the most common] or declined to state a race. Respondents' mean age was 43 y (range, 21-79 y). Most had some college education or higher (79%) and had a median annual household income of less than \$50,000 (32%). Slightly less than half (49%) lived in rural areas. The response rate was higher for caregivers residing in urban than in rural areas (76% versus 69%;  $\chi^2 = 7.54$ ,  $P = 0.006$ ).

**Procedures.** Trained interviewers from the University of North Carolina Survey Research Unit conducted the interviews between July and October 2007 using computer-assisted telephone interviewing equipment. Interviewers first attempted to interview the female caregiver or, if she was not available, interviewed the male caregiver. If a household had more than one female child age 10 to 18 y, the software randomly selected one of them as the index child for questions. Respondents gave verbal consent for the study and received a 10-dollar payment for the 20-min interview. The institutional review board at the University of North Carolina approved the study protocol.

### Measures

**Awareness and Knowledge.** Awareness of HPV was measured by asking, "Have you heard of HPV or human papillomavirus?" Knowledge of HPV was assessed for respondents who had heard of HPV using items adapted from the Health Information National Trends Survey (HINTS; ref. 38) and a previously published HPV knowledge scale (39). Knowledge was assessed by asking if HPV can cause cervical cancer, can cause abnormal Pap smears, can cause genital warts, is a sexually transmitted disease, or is rare. The presentation order of the knowledge items was randomized. Responses were coded as correct or incorrect (true is the correct answer

for all but the fifth item above). Refusals were dropped from the analyses ( $n = 5$ ). A summary scale of the five items was created for which higher scores indicated more knowledge ( $\alpha = 0.65$ ). After the knowledge questions, all participants were told that "HPV is a common sexually transmitted infection that sometimes leads to genital warts, abnormal Pap tests, and cervical cancer."

Participants were next told: "An HPV vaccine is now available that protects against most genital warts and cervical cancer. Sometimes it's called the cervical cancer vaccine, HPV shot, or Gardasil. I'll call it the HPV vaccine." Then awareness of the HPV vaccine was measured for all respondents by asking, "Have you ever heard of the HPV vaccine before today?"

**Past Information Sources.** To assess past sources of information on the HPV vaccine, interviewers asked "Have you ever heard about the HPV vaccine from any of these sources?" followed by health care provider, family or friend, brochure, advertisement, television, radio, internet, and newspaper. This item is modified slightly from the HINTS (13, 38). The "advertisement" item specified ads or commercials from a drug company. The "television" and "internet" items specified information about the vaccine heard in news stories or on websites not including advertisements. Responses for the brochure and newspaper answer choices were combined and labeled print media. Responses for the television and radio answer choices were combined and labeled broadcast media. When we found statistically significant associations with either of the composite print or broadcast media variables, we conducted post hoc tests with each component of the composite. Respondents' perceptions of the media coverage of the vaccine was assessed by asking, "Has what you have heard about the HPV vaccine in the media, say in the newspaper or on TV, been mostly positive, mostly negative, or would you say it's been neutral?" This variable was dichotomized to indicate having heard positive or neutral/negative coverage.

**Potential Information Sources.** Potential sources of information about the HPV vaccine were assessed by asking, "Imagine you had a strong need to get information about the HPV vaccine. Where would you go?" Interviewers recorded caregivers' multiple, open-ended responses into one of the following categories: book/journal, brochure/pamphlet, library, internet, magazine, newspaper, doctor or other health care provider, family/friend/coworker, telephone number, cancer organization, health department, or other. None of the responses coded as "other" were common enough to allow us to form additional categories. Responses for the book/journal, brochure/pamphlet, magazine, newspaper, and library answer choices were combined to create a single print media variable.

**Vaccine Uptake.** Vaccine uptake was assessed by asking, "Has [daughter's name] had any shots of the HPV vaccine?" Response options were no and yes. Data for three caregivers who responded "don't know" were dropped from analyses of vaccine uptake.

**Participant Characteristics.** Demographic information collected was the caregiver's age, race, urban/rural residence, sex, marital status, income, level of education, and relationship to the referent child. Rural residence was determined based on U.S. Census classification for

**Table 1. Sample demographic characteristics**

	% ( $n = 889$ )
Sex	
Female	94 (835)
Male	6 (54)
Race	
White	70 (624)
African American	23 (206)
Other	7 (59)
Age	
Up to 39 y	28 (245)
40+ y	72 (644)
Education	
High school or less	21 (190)
Some college or more	79 (699)
Income	
<\$50,000	32 (288)
\$50,000+	63 (560)
Missing	5 (41)
Residence	
Rural	49 (437)
Urban	51 (452)

**Table 2. Awareness of HPV and HPV vaccine**

	n	Aware of HPV		Aware of HPV vaccine		
		% Unadjusted OR (95% CI)	Adjusted OR (95% CI)	% Unadjusted OR (95% CI)	Adjusted OR (95% CI)	
Total	889	83		82		
Sex						
Female	835	84	1.0	83	1.0	
Male	54	56	0.24* (0.13-0.41)	0.22* (0.12-0.41)	0.27* (0.15-0.48)	0.24* (0.13-0.44)
Race						
White	624	87	1.0	87	1.0	
African American	206	72	0.40* (0.27-0.59)	0.40* (0.27-0.61)	0.31* (0.21-0.44)	0.32* (0.21-0.48)
Other	59	73	0.41 <sup>†</sup> (0.22-0.77)	0.43 <sup>†</sup> (0.22-0.84)	0.40* (0.21-0.74)	0.41 <sup>†</sup> (0.21-0.78)
Age						
Up to 39 y	245	84	1.0	83	1.0	
40+ y	644	82	0.85 (0.57-1.27)	—	0.89 (0.61-1.32)	—
Education						
High school or less	190	69	1.0	69	1.0	
Some college or more	699	86	2.80* (1.92-4.07)	2.55* (1.69-3.84)	2.58* (1.78-3.74)	2.23* (1.48-3.37)
Income						
<\$50,000	288	77	0.48* (0.33-0.69)	0.67 <sup>†</sup> (0.44-1.00)	0.43* (0.30-0.61)	0.59 <sup>†</sup> (0.40-0.88)
\$50,000+	560	87	1.0	87	1.0	
Missing	41	56	0.19* (0.10-0.36)	0.24* (0.12-0.48)	0.26* (0.13-0.51)	0.35 <sup>†</sup> (0.17-0.73)
Residence						
Rural	437	83	1.0	84	1.0	
Urban	452	82	0.74 (0.52-1.05)	—	0.69 <sup>†</sup> (0.49-0.98)	0.95 (0.64-1.40)

\**P* < 0.001.<sup>†</sup>*P* < 0.05.

the census block where the respondent was living (37). Residences within an urban area or an urbanized cluster were designated as urban, and the others were designated rural.

**Data Analyses.** Logistic regression was used to examine differences in dichotomous outcome measures (awareness, media perception, past information sources, and future information sources). Linear regression was used to examine differences in the continuous outcome measure (i.e., knowledge scale). Unadjusted regressions examined bivariate relationships between each outcome and caregivers' sex, race, age, education, income, and residence. Next, adjusted regressions examined relationships between each outcome and statistically significant predictors from the unadjusted models. We also examined whether the awareness, knowledge, and media variables were associated with vaccine uptake using logistic regressions that controlled for caregiver demographics. Although only adjusted findings appear in the text, tables present the findings of most unadjusted and adjusted analyses. Post hoc multivariate linear regression analysis examined differences in individual knowledge items for predictor variables that were statistically significantly associated with the composite knowledge scale. Data were analyzed with SPSS (SPSS, Inc.). All analyses were unweighted and two-tailed with a critical  $\alpha$  of 0.05.

## Results

**Awareness.** Most participants had heard of HPV (83%) and the HPV vaccine (82%; Table 2). Caregivers who were male, African American, other races, less educated, and had lower or nonreported incomes were less likely to have heard about HPV or the HPV vaccine. Urban and rural residents had nearly identical levels of awareness of HPV (82% and 83%, respectively) and of the HPV vaccine (79% versus 84%).

**Knowledge.** Caregivers answered 69% of the HPV knowledge questions correctly, on average. Most respondents knew that HPV causes abnormal Pap smears (85%) and cervical cancer (84%). Many also knew that HPV infection is not rare (75%) and is sexually transmitted (57%), whereas fewer knew that HPV can cause genital warts (43%). African Americans had lower overall knowledge than White respondents (mean knowledge scores, 63% versus 71%, respectively;  $d = 0.30$ ,  $P = 0.002$ ), as did respondents of other races relative to White respondents (mean knowledge scores, 63% versus 71%, respectively;  $d = 0.05$ ,  $P = 0.047$ ; Fig. 2). Respondents with less education had lower knowledge of HPV than those with more education (mean knowledge scores, 62% versus 70%, respectively;  $d = 0.29$ ,  $P = 0.006$ ). Post hoc analyses examined whether education and racial knowledge differences were general or specific to individual scale items. African American caregivers were less likely than White caregivers to know that HPV is a sexually transmitted infection [44% versus 61%; odds ratio (OR), 0.49; 95% confidence interval (95% CI), 0.33-0.70] and is not rare (60% versus 78%; OR, 0.41; 95% CI, 0.28-0.61). Caregivers of other races were less likely than White caregivers to know that HPV can cause genital warts (28% versus 44%; OR, 0.47; 95% CI, 0.24-0.93). More educated caregivers were more likely to know that HPV is sexually transmitted (61% versus 42%; OR, 2.22; 95% CI, 1.50-3.27) and is not rare (76% versus 66%; OR, 1.77; 95% CI, 1.17-2.67).

**Past Sources of Information.** Most respondents had heard of the HPV vaccine through drug company advertisements (83%; Table 3). The second most common information source was broadcast media (69%), followed by print sources (55%), health care providers (45%), and the internet (22%). Male caregivers were less likely than female caregivers to have heard about the HPV vaccine in an advertisement. African American

caregivers were more likely than White caregivers to have heard about the HPV vaccine through a broadcast source yet were less likely to have heard about the vaccine in an advertisement. Whites were more likely to have heard about the vaccine through family or friends than African Americans. Respondents who had attended college were more likely to have heard of the HPV vaccine from a health care provider, the internet, and print media. Respondents with an annual income less than \$50,000 were less likely to have heard of the vaccine from a family or friend than respondents with higher incomes.

Media coverage of the vaccine was recalled as being positive overall by most respondents (62%), although African American caregivers were less likely to report positive recall than White caregivers (50% versus 66%; Table 4). Post hoc analyses revealed that caregivers were more likely to recall positive media coverage of the vaccine if they had heard about it from a health care provider (OR, 2.22; 95% CI, 1.49-3.29) or in a newspaper (OR, 1.89; 95% CI, 1.06-3.37) than if they had not heard about the vaccine from these sources. Caregivers were less likely to recall positive media coverage if they heard about the vaccine on the radio (OR, 0.51; 95% CI, 0.32-0.82).

**Potential Sources of Information.** Health care providers (88%) were the most common potential source of information about the HPV vaccine (Table 5). The internet was the second most common potential source (65%). Print media sources were rarely mentioned (7%). Only 3% of respondents said they would go to family and friends for more information, and 3% said they would go to a health department for more information about the HPV vaccine. Six percent of respondents said they would choose "other" sources of information about the vaccine in the future (including pharmacies and television). Male caregivers were less likely than females to plan to seek information about the vaccine from a health care provider (78% versus 89%;  $P < 0.05$ ). The most notable differences in planned information sources were by race. African American caregivers were less likely than Whites to say that the internet would be a potential source of information about the vaccine (53% versus 70%;  $P < 0.001$ ). More African American than White caregivers said they would seek more information from a print source (10% versus 5%;  $P < 0.05$ ). Caregivers ages 40 years and older were more likely than younger caregivers to anticipate using print sources to obtain information about the HPV vaccine (8% versus 4%;

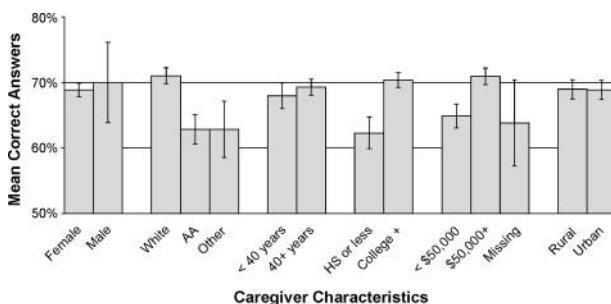
$P < 0.05$ ). Respondents with more education were more likely to use the internet for future vaccine information (69%) as compared with respondents with less education (52%;  $P < 0.05$ ). Caregivers with lower incomes (57%;  $P < 0.05$ ) and not providing an income (42%;  $P < 0.001$ ) were less likely to seek vaccine information on the internet than caregivers with higher incomes (71%).

**Vaccine Uptake.** Caregivers were more likely to have had their daughters vaccinated with any doses of HPV vaccine if they had heard of HPV (OR, 3.02; 95% CI, 1.27-7.17), had heard of the HPV vaccine (OR, 26.93; 95% CI, 3.67-196.72), or had higher scores on the knowledge scale (OR, 3.64; 95% CI, 1.35-6.93). They were also more likely to have had their daughter vaccinated if they heard about the vaccine from print media (OR, 2.59; 95% CI, 1.48-4.53), health care providers (OR, 10.93; 95% CI, 6.05-19.74), or family or friends (OR, 1.98; 95% CI, 1.28-3.05). Post hoc analyses of print media revealed that caregivers were more likely to have vaccinated their daughter if they had heard about the vaccine from a brochure (OR, 2.60; 95% CI, 1.68-4.03) but not from a newspaper (OR, 1.24; 95% CI, 0.77-1.99). Other sources of past information were unrelated to vaccine uptake. Vaccine uptake was higher for the daughters of caregivers who had heard mostly positive media coverage of the vaccine (OR, 2.73; 95% CI, 1.69-4.39).

## Discussion

Our findings suggest that much has changed with respect to HPV awareness since the Food and Drug Administration approval of the vaccine. A massive advertising campaign and extensive media coverage seem to have had large effects on caregivers' awareness. Four of five caregivers in our study had heard of HPV and the HPV vaccine. HPV awareness levels are more than double those reported in studies conducted in 2005 with a nationally representative sample of adult women (37%, 2,090 of 5,586; ref. 13) and in 2000 [28%, 291 of 1,006 (weighted)] with a nationally representative sample of American adults (40).<sup>8</sup> A study conducted in 2006 using a convenience sample of rural North Carolina adult women found that only 36% (49 of 138) had heard of HPV (24). To our knowledge, few published studies have examined awareness and knowledge of HPV and the vaccine after its licensing and subsequent extraordinary media attention. In addition, to our knowledge, no studies have shown the association of sociodemographic factors, media use, and awareness of HPV and the HPV vaccine. Moreover, our study fills an important gap in that the 2005 HINTS survey did not examine women's sources of information about HPV and cervical cancer (13).

The high levels of HPV and HPV vaccine awareness found in our study are likely attributable to pharmaceutical marketing efforts, especially those associated with the 2006 introduction of Gardasil. Most caregivers heard of the vaccine from an advertisement from a drug company (83%), making these companies the de facto public health educators of our nation on this issue. Other common sources were broadcast media, print media, and doctors. Most caregivers heard positive things about the vaccine, which is perhaps not surprising given that most had heard of it through commercially purchased ads. This advertising and the concurrent media frenzy may have been many individuals' first exposure



**Figure 2.** HPV knowledge. Based on answers to a five-item HPV knowledge scale. Bars, SE. AA, African American; HS, high school.

**Table 3. Past sources of information about the HPV vaccine**

	n	Advertisement		Broadcast source	
		% Unadjusted OR (95% CI)	Adjusted OR (95% CI)	% Unadjusted OR (95% CI)	Adjusted OR (95% CI)
Total	726	83		69	
Sex					
Female	695	84	1.0	69	1.0
Male	31	65	0.35* (0.16-0.74)	74	1.28 (0.56-2.91)
Race					
White	544	82	1.0	68	1.0
African American	139	76	0.53* (0.34-0.84)	78	1.63* (1.05-2.52)
Other	43	81	0.75 (0.34-1.69)	58	0.65 (0.34-1.22)
Age					
Up to 39 y	203	84	1.0	72	1.0
40+ y	523	83	0.95 (0.61-1.47)	68	0.82 (0.57-1.17)
Education					
High school or less	131	82	1.0	71	1.0
Some college or more	595	84	1.14 (0.70-1.86)	69	0.91 (0.60-1.38)
Income					
<\$50,000	213	82	0.86 (0.57-1.32)	68	1.09 (0.77-1.54)
\$50,000+	487	84	1.0	69	1.0
Missing	26	85	1.07 (0.36-3.18)	85	2.64 (0.87-7.94)
Residence					
Rural	369	84	1.0	71	1.0
Urban	357	83	0.92 (0.63-1.36)	68	1.11 (0.81-1.52)
	n	Print source		Health care provider	
		% Unadjusted OR (95% CI)	Adjusted OR (95% CI)	% Unadjusted OR (95% CI)	Adjusted OR (95% CI)
Total	726	55		45	
Sex					
Female	695	56	1.0	45	1.0
Male	31	39	0.50 (0.24-1.04)	36	0.68 (0.32-1.43)
Race					
White	544	55	1.0	45	1.0
African American	139	59	1.16 (0.80-1.70)	48	1.15 (0.79-1.67)
Other	43	42	0.58 (0.31-1.09)	30	0.54 (0.27-1.05)
Age					
Up to 39 y	203	53	1.0	44	1.0
40+ y	523	56	1.15 (0.83-1.60)	45	1.04 (0.75-1.44)
Education					
High school or less	131	44	1.0	33	1.0
Some college or more	595	58	1.78* (1.22-2.61)	47	1.82* (1.22-2.71)
Income					
<\$50,000	213	49	0.71* (0.51-0.98)	42	0.84 (0.61-1.17)
\$50,000+	487	58	1.0	46	1.0
Missing	26	54	0.85 (0.38-10.87)	39	0.73 (0.33-1.65)
Residence					
Rural	369	52	1.0	46	1.0
Urban	357	58	0.79 (0.59-1.05)	43	0.88 (0.66-1.18)
	n	Family or friend		Internet	
		% Unadjusted OR (95% CI)	Adjusted OR (95% CI)	% Unadjusted OR (95% CI)	Adjusted OR (95% CI)
Total	726	31		22	
Sex					
Female	695	31	1.0	22	1.0
Male	31	39	1.41 (0.67-2.96)	19	0.86 (0.35-2.13)
Race					
White	544	34	1.0	22	1.0
African American	139	23	0.58* (0.38-0.90)	22	0.96 (0.61-1.51)
Other	43	23	0.59 (0.28-1.22)	16	0.68 (0.30-1.57)

(Continued on the following page)

**Table 3. Past sources of information about the HPV vaccine (Cont'd)**

	<i>n</i>	Family or friend		Internet	
		% Unadjusted OR (95% CI)	Adjusted OR (95% CI)	% Unadjusted OR (95% CI)	Adjusted OR (95% CI)
Age					
Up to 39 y	203 35	1.0	—	22	1.0
40+ y	523 30	0.79 (0.56-1.12)	—	22	1.01 (0.68-1.49)
Education					
High school or less	131 26	1.0	—	15	1.0
Some college or more	595 32	1.37 (0.89-2.10)	—	23	1.68* (1.00-2.80)
Income					
<\$50,000	213 25	0.64* (0.45-0.92)	0.67* (0.47-0.97)	19	0.81 (0.54-1.21)
\$50,000+	487 35	1.0	1.0	23	1.0
Missing	26 15	0.34 (0.12-1.01)	0.36 (0.12-1.07)	23	1.02 (0.40-2.59)
Residence					
Rural	369 29	1.0	—	21	1.0
Urban	357 33	1.21 (0.88-1.65)	—	23	1.11 (0.78-1.58)

NOTE: Past information source questions were only asked of the *n* = 726 who had heard of the HPV vaccine.

\**P* < 0.05.

to HPV information (15). A promising area for future research is the analysis of how different types of pharmaceutical advertisements (television, radio, magazine, etc.) serve as information sources about the vaccine. Vaccine uptake was higher for people who had heard of the vaccine through brochures, possibly available in the doctor's office or through schools. Print media may allow detailed information to be consumed at an individual's own pace. Through future research, it would be useful to examine which channels are the most effective ways to disseminate information about the vaccine to increase awareness, knowledge, and uptake.

Greater awareness, however, did not ensure greater knowledge. Caregivers were fairly knowledgeable about HPV and its link to cervical cancer and abnormal Pap tests. However, consistent with other studies (39, 41-43),

few caregivers were familiar with other characteristics of HPV, such as it being a sexually transmitted infection. Educational campaigns that have successfully raised awareness of HPV and the vaccine may not have increased knowledge about the characteristics of the virus. A lack of knowledge about HPV and the HPV vaccine may affect caregivers' ability to make informed decisions about vaccination (34), although this may reflect a more general gap in caregivers' knowledge about maintaining sexual health. Although a systematic review of studies found mixed associations between HPV knowledge and vaccine acceptability (12), our study found that higher HPV and HPV vaccine awareness and knowledge were associated with greater vaccine uptake. Plausible reasons for the association include higher knowledge and awareness increasing vaccination uptake; vaccination leading to

**Table 4. Recall of positive media coverage**

	<i>n</i>	%	Recall positive media coverage of HPV vaccine	
			Unadjusted OR (95% CI)	Adjusted OR (95% CI)
Total	552	62		
Sex				
Female	528	63	1.0	—
Male	24	54	0.71 (0.31-1.61)	—
Race				
White	410	66	1.0	1.0
African American	112	50	0.52* (0.34-0.80)	0.52* (0.34-0.80)
Other	30	60	0.79 (0.37-1.68)	0.79 (0.37-1.68)
Age				
Up to 39 y	155	54	1.0	—
40+ y	397	64	1.32 (0.90-1.92)	—
Education				
High school or less	98	60	1.0	—
Some college or more	454	63	1.10 (0.71-1.73)	—
Income				
<\$50,000	155	60	0.88 (0.60-1.30)	—
\$50,000+	375	63	1.0	—
Missing	22	64	1.03 (0.42-2.52)	—
Residence				
Rural	306	65	1.0	—
Urban	246	58	0.92 (0.65-1.30)	—

NOTE: Only those who had heard about the HPV vaccine in the media (TV, radio, internet, or newspaper) were asked this question (*n* = 552).

\**P* < 0.05.

**Table 5. Potential sources of information about the HPV vaccine**

	n	Health care provider			Internet			Print source		
		%	Unadjusted OR (95% CI)	Adjusted OR (95% CI)	%	Unadjusted OR (95% CI)	Adjusted OR (95% CI)	%	Unadjusted OR (95% CI)	Adjusted OR (95% CI)
Total	889	88			65			7		
Sex										
Female	835	89	1.0	1.0	65	1.0	—	7	1.0	—
Male	54	78	0.46* (0.23-0.89)	0.46* (0.23-0.89)	63	0.91 (0.52-1.62)	—	4	0.53 (0.13-2.21)	—
Race										
White	624	89	1.0	—	70	1.0	1.0	5	1.0	1.0
African American	206	86	0.77 (0.49-1.23)	—	53	0.48 <sup>†</sup> (0.35-0.66)	0.52 <sup>†</sup> (0.37-0.73)	10	1.93* (1.08-3.44)	1.92* (1.07-3.43)
Other	59	85	0.70 (0.33-1.49)	—	58	0.59 (0.34-1.02)	0.62 (0.36-1.09)	10	2.03 (0.81-5.06)	2.03 (0.81-5.06)
Age										
Up to 39 y	245	87	1.0	—	64	1.0	—	4	1.0	1.0
40+ y	644	88	1.18 (0.76-1.83)	—	66	1.08 (0.79-1.46)	—	8	2.21* (1.07-4.56)	2.28* (1.10-4.73)
Education										
High school or less	190	89	1.0	—	52	1.0	1.0	4	1.0	—
Some college or more	699	88	0.87 (0.53-1.45)	—	69	2.04 <sup>†</sup> (1.48-2.83)	1.85* (1.31-2.61)	7	1.79 (0.84-3.84)	—
Income										
<\$50,000	288	90	1.46 (0.92-2.31)	—	57	0.55 <sup>†</sup> (0.41-0.74)	0.70* (0.51-0.96)	7	0.97 (0.55-1.72)	—
\$50,000+	560	86	1.0	—	71	1.0	1.0	7	1.0	—
Missing	41	90	1.45 (0.50-4.19)	—	42	0.29 <sup>†</sup> (0.15-0.56)	0.32 <sup>†</sup> (0.17-0.63)	5	0.70 (0.16-3.03)	—
Residence										
Rural	468	90	1.0	—	65	1.0	—	6	1.0	—
Urban	421	86	0.68 (0.45-1.02)	—	65	1.03 (0.78-1.36)	—	8	1.44 (0.84-2.47)	—

NOTE: Caregivers also mentioned several other sources, including health departments ( $n = 30$ ) and a combination of other cited sources (pharmacy, TV, etc.), which did not fit into a category and were coded as "other" ( $n = 56$ ). Because none of these other potential sources were mentioned by a significant number of people to warrant individual categories, we were unable to look at associations with demographic characteristics.

\* $P < 0.05$ .

<sup>†</sup> $P < 0.001$ .

attentiveness to new information about the vaccine; or perhaps a doctor's recommendation increasing awareness, knowledge, and uptake.

Cervical cancer incidence and mortality disproportionately affect people according to their race, income, education, and other sociodemographic factors. In our study, awareness of HPV and the HPV vaccine also differed among these groups. Caregivers who were female, White, had at least some college education, or a higher income were more likely to be aware of HPV and the HPV vaccine. White caregivers and those with some college education had higher HPV knowledge. Our findings are consistent with studies that identified racial differences in awareness and knowledge of HPV, the HPV vaccine, and cervical cancer (13, 14, 24). Studies have also found awareness of HPV to be lower among the less educated and higher among non-Hispanic Whites (13, 14).

Past and potential information sources offer clues about where such disparities may have come from and how they could be addressed. First, the finding that African American caregivers were somewhat less likely to have heard about the HPV vaccine from an advertisement than Whites may have implications for efforts to reach African Americans through this communications vehicle. Further research on possible reasons for this difference might inform future advertisements about the

vaccine. African Americans indicated they would be more likely than White caregivers to seek information about the vaccine from a print source, although rates were low overall. The difference suggests that communications, including advertisements, targeting African Americans use such sources.

African Americans were less likely than Whites to have heard about the vaccine from a friend or family member, and those who heard about the vaccine from a family member were more likely to have had their daughters vaccinated. Disseminating information by word of mouth (44, 45) and within social networks (46) is an influential communications strategy, especially for health topics (47). Our study supports efforts to stimulate discussion of the vaccine among African American caregivers. *Tell Someone*, the multi-media campaign sponsored by HPV vaccine manufacturer Merck & Co., Inc., encourages women to speak to each other about the vaccine (48).<sup>8</sup> Campaigns such as this, as well as grassroots efforts to stimulate vaccine discussion, may benefit from making targeted efforts to engage African Americans.

A final significant finding of racial differences was that African American caregivers were less likely than their

<sup>8</sup> <http://www.tellsomeone.com.my>

White counterparts to recall positive media coverage of the vaccine. Racial differences in media perception may be due to African Americans' lower trust of traditional sources of health information (49, 50). Individuals who lack trust in traditional sources, such as health care professionals or the media, may be less receptive to new health information (14). One study found distrust of health information to be negatively associated with HPV awareness (14). African American focus group participants in another study felt that an African American spokesperson would be the most effective in delivering health messages to their community (17). It will be important for future research to assess what other components of health messages, such as source credibility, parents perceive as positive or negative and how that influences their decisions. Research is needed to explore the link between components of health messages, perceptions of content, and how these factors may affect HPV awareness, knowledge, and behavior. Finally, because perceived positivity of past media coverage was associated with greater vaccine uptake, a potentially fruitful line of inquiry for future research may be to identify specific qualities of positive messages that influence vaccine uptake.

The internet is increasingly the medium of choice for those seeking health information (51-53). In 2000, 60 million U.S. residents went online for health-related information (54). The popularity of this medium is also shown in our study, with 65% of respondents saying they would go to the internet for HPV vaccine information. Those with higher education were more likely to have heard about the vaccine from the internet, likely due to the fact that internet accessibility is linked to higher incomes and education. Likewise, our study found that caregivers with lower incomes or not reporting an income were less likely to use this source, and caregivers with more education were more likely to cite the internet as a future source of vaccine information. An often overlooked problem in cancer communication is health literacy (55, 56). Two reviews of readability of cancer information on the internet found that most cervical, breast, prostate, and colorectal cancer information online is at high school or college level, which is higher than readability guidelines recommend (51, 53). Communications efforts about the HPV vaccine, especially those that involve online components, should be made accessible to people of all literacy levels.

Previous studies have found that doctors' recommendations powerfully affect HPV vaccine acceptability (12). In our study, although health care providers were the most commonly cited potential source of information, they were not the most frequently cited past source of information. One explanation may be that many people do not have access to doctors, do not visit them regularly, or had not been to a provider since the HPV vaccine rollout. Research to better understand patient-provider communication about the HPV vaccine may be needed, for example, to better understand motivations to seek health information from doctors and other expert sources, as well as people's ability to retain this information. Caregivers recalled hearing about the vaccine most frequently from drug company advertisements and broadcast media. However, the parents who had heard of the vaccine from their doctor were

especially likely to have vaccinated, perhaps because of the high source credibility and opportunity for immediate action.

Strengths of our study include interviewing a large sample of caregivers from areas where cervical cancer rates are high, as well as filling important gaps in the literature about the relationship of several cervical cancer risk factors to media use and understanding the HPV vaccine. Limitations include our findings potentially not generalizing fully to caregivers living in other areas. Because the response rate was higher for urban than rural areas, our results may be somewhat less representative of rural respondents. Caregivers without a telephone line were not interviewed, potentially biasing our survey coverage toward higher income or more educated caregivers. This may be a small limitation, given that most U.S. homes have telephones (57). In addition, analyses accounting for the sampling design yielded the same pattern of results (data not shown). Although conducting surveys in English limited our ability to interview caregivers who speak only Spanish or other languages, we encountered language problems with few caregivers during recruitment. Hispanic women and caregivers are an important group for future research given Hispanic women's elevated rates of cervical cancer and the indications in our data that fewer caregivers in the "other" race category (who were mostly Hispanic women) were aware of the vaccine, knowledgeable about HPV, and connected to potential outlets for vaccine information. Because most respondents were women, our findings for male caregivers are less definitive than studies with larger samples of men will provide.

Despite high levels of overall HPV and HPV vaccine awareness found in our study, sociodemographic disparities in awareness and knowledge that mirror disparities in cervical cancer incidence and mortality persist. Future research in this area should explore use of media by sociodemographic subgroups to obtain information about HPV and the vaccine. Our findings also suggest that future research with African Americans pursue the links between differential media use and HPV awareness levels. Finally, information about HPV and the HPV vaccine needs to be available to caregivers of all education levels, ensuring readability and accuracy of content. If targeted effectively, health communications offer great promise in helping to raise awareness levels among caregivers of adolescent girls.

### Disclosure of Potential Conflicts of Interest

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