

National Trends in Human Papillomavirus Awareness and Knowledge of Human Papillomavirus–Related Cancers



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Introduction: The President’s Cancer Panel released a report in 2014 calling for communication strategies to promote the human papillomavirus vaccine among males and females. The purpose of this study was to (1) estimate changes in human papillomavirus awareness and knowledge of human papillomavirus–related cancers from 2014 to 2017 using a nationally representative survey of adults in the U.S. and (2) identify differences in population subgroups that showed significant changes in human papillomavirus awareness and knowledge of human papillomavirus–related cancers.

Methods: Data were from the Health Information National Trends Survey (2014 and 2017 surveys). Health Information National Trends Survey is a cross-sectional, nationally representative survey of non-institutionalized adults (aged ≥ 18 years) in the U.S. Human papillomavirus awareness was assessed with one item indicating aware or never heard of human papillomavirus. Human papillomavirus–related cancer knowledge was assessed with four items asking if human papillomavirus can cause cervical, anal, oral, or penile cancer (responses coded yes/no or not sure).

Results: The majority (64%, SE=1.4) were aware of human papillomavirus. Awareness was higher among females and the vaccine-eligible subpopulation. No change in awareness was observed. Knowledge of cervical cancer was high (78%), but low for anal (26%); oral (30%); and penile (30%) cancers. Cervical cancer knowledge significantly increased among females, and anal cancer knowledge increased among college graduates and non–vaccine eligible subgroups. No other increases in human papillomavirus–related cancer knowledge were observed.

Conclusions: The general public was moderately aware of human papillomavirus, but associated human papillomavirus with cervical cancer. Knowledge of non-cervical human papillomavirus–related cancers is low, even among vaccine-eligible subgroups. Public health education is needed to raise awareness of non-cervical human papillomavirus–related cancers.

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INTRODUCTION

A subset of human papillomaviruses (HPVs) are known carcinogens and can be transmitted through anal, vaginal, and oral sexual contact.¹ Every year in the U.S., approximately 33,700 cancers (including cervical, anal, penile, and oral cancers) are attributable to HPV infection.² Oral cancers—with an estimated 11,600 cancers annually, account for the largest burden of HPV-related cancers in the U.S.² Oral cancers are more common in men.³ In fact, more than 40% of all

HPV-related cancers in the U.S. occur in men.² Despite this, HPV cancer prevention has largely been framed as a

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women's health issue because of HPV's connection with cervical cancer.⁴ As a result, men in the U.S. are less aware of HPV and less likely to have heard of the HPV vaccine compared with women.⁵ Qualitative research suggests that exposure to HPV vaccine promotion information may perpetuate perceptions that HPV is a women's health issue and not directly relevant to cancer prevention for men.^{6–8}

Information diffusion about HPV is also unequal across socioeconomic groups, with higher awareness of HPV among non-Hispanic white, college-educated, and higher-income populations.⁹ Knowledge in the general population regarding HPV as a cause of non-cervical cancers like anal, penile, and oral cancers is low. In a nationally representative survey of U.S. adults in 2014, a total of 56% of men and 72% of women had heard of HPV. Among this group, just 32% of men and 29% of women knew that HPV can cause oral cancer.⁵ Knowledge was even lower for anal and penile cancer. This is compared with 76% and 79% of men and women who had heard of HPV and could accurately identify HPV as a cause of cervical cancer.

Although HPV knowledge does not appear to directly influence vaccination,^{10,11} knowledge of non-cervical HPV-related cancers (e.g., oral cancers) may be indirectly related to vaccination by modifying risk perceptions associated with certain sexual practices (e.g., oral sex)—particularly among men in the catch-up age groups.^{12–15} Thus, perceptions that HPV only impacts women's health may result in low HPV vaccine utilization among men in the catch-up age ranges, as well as among adolescent males whose parents may be unaware of the direct health effects of HPV on males.

The *Healthy People 2020* initiative set a goal of HPV vaccination coverage of adolescents aged 13–15 years to reach 80% by the end of the decade. Current estimates of actual utilization fall short of this public health target, particularly among males.^{13,16} The most recent estimates of HPV vaccine utilization indicate that 14% of men aged 19–26 years (compared with 49% of women) had received at least one dose of HPV vaccine in 2016 and 63% of boys aged 13–17 years (compared with 67% of girls) had received one dose in 2017.^{17–19} As of 2017, only 44% of boys have completed the HPV vaccine series compared with 53% of girls.¹⁸

Since 2014, there have been coordinated efforts to raise awareness about HPV and increase HPV vaccine utilization. At the federal level, the President's Cancer Panel released a report that called for the Centers for Disease Control and Prevention to partner with organizations in order to promote HPV vaccination.²⁰ Since then, several major initiatives have been undertaken by public and private organizations to raise awareness about HPV and

HPV-related cancers and to promote HPV vaccination. Some examples include activities of the National HPV Vaccination Roundtable,²¹ the National Association of County and City Health Officials,²² the Area Health Education Centers,²³ the American Academy of Pediatrics,²⁴ and the Academic Pediatric Association.²⁵ In 2016, Merck launched a campaign highlighting the direct impact of HPV in males.²⁶ Nonprofit patient advocacy groups have also engaged in public education efforts during or after 2014 focusing on raising awareness of HPV cancers in general (e.g., “Think about the link”),²⁷ as well as oral (e.g., “Be Part of the Change”)²⁸ and anal cancers, specifically (e.g., “Behind Closed Drawers”).²⁹ The collective impact of these campaigns and national efforts on public awareness and knowledge of HPV-related cancers is unknown.

The purpose of this study is to (1) estimate changes in HPV awareness and knowledge of HPV-related cancers from 2014 to 2017 using a nationally representative survey of adults in the U.S. and (2) identify differences in population subgroups that showed significant changes in HPV awareness and knowledge of HPV-related cancers. Given the unequal diffusion of HPV information across socioeconomic populations,⁹ and the constellation of public health promotion surrounding the HPV vaccine during these years, it is hypothesized that knowledge of (1) cervical cancer will significantly increase among women; (2) knowledge of non-cervical HPV-related cancers will increase in vaccine relevant populations (i.e., adults who are aged 18–26 years or have an immediate family member between the ages of 9 and 26 years); and (3) knowledge of HPV-related cancers will increase among those who discussed HPV vaccination with a healthcare provider.

METHODS

Study Sample

This study was a secondary analysis of cross-sectional Health Information National Trends Survey (HINTS) data. Two surveys were combined using data obtained between August and November 2014 (HINTS 4 Cycle 4 [HINTS 4.4]) and January and May 2017 (HINTS 5 Cycle 1 [HINTS 5.1]) and were analyzed in 2018. HINTS is a nationally representative probability-based survey of adults aged ≥18 years of the civilian non-institutionalized population of the U.S.³⁰ Participants completed a self-administered mailed questionnaire in English or Spanish. The response rates were 33% and 32% for HINTS 4.4 and 5.1, respectively. A total of 3,677 (HINTS 4.4, 2014) and 3,285 (HINTS 5.1, 2017) participants returned completed questionnaires.

Measures

HPV awareness was assessed with one item asking: *Have you ever heard of HPV? HPV stands for Human Papillomavirus. It is not HIV, HSV, or herpes.* Response options were *yes* or *no*. Knowledge of HPV-related cancers were assessed with the following items

only among respondents who had previously heard of HPV: (1) *Do you think HPV can cause anal cancer?* (2) *Do you think HPV can cause oral cancer?* (3) *Do you think HPV can cause penile cancer?* (4) *Do you think HPV can cause cervical cancer?* Response options were *yes*, *no*, or *not sure*. Options *no* and *not sure* were collapsed into a single category to reflect lack of knowledge.

Differences in sociodemographic subpopulations were assessed (sex, age, ethnoracial identity, educational attainment) that were previously found to be associated with HPV knowledge.³¹ Because of low cell sizes, those who identified as Asian (Asian Indian, Chinese, Filipino, Japanese, Korean, Vietnamese, Other Asian); Native Hawaiian/Alaskan; Guamanian/Chamorro; Samoan; other Pacific Islander; or multi-racial were aggregated into one category (other, non-Hispanic). The following items were used to assess relevance and provider communication: *Including yourself, is anyone in your immediate family between the ages of 9 and 27 years old?* If the respondent indicated *yes* for this item, he or she was presented with this follow-up question: *In the last 12 months, has a doctor or health care professional ever talked with you or an immediate family member about the HPV shot or vaccine?* Responses to this item were coded as *yes* or *no/don't know*. These variables were used to create grouping variables for subpopulation analyses.

Statistical Analysis

Data were analyzed using SAS, version 9.4, and SAS callable SUDAAN. Population-level point estimates were obtained by using the respective full sample weights, and the SEs for statistical modeling were generated using the 50 jackknife replicate weights from each respective iteration.³² The analytic sample was 3,677 from 2014 and 3,285 from 2017 (N=6,962). Hot-deck imputation was used to replace missing responses for the following demographic variables: age (5.0% in 2014, 4.2% in 2017); sex (1.9% in 2014, 2.1% in 2017); educational attainment (4.1% in 2014, 3.2% in 2017); race (8.9% in 2014, 7.0% in 2017); and ethnicity (10.2% in 2014, 9.3% in 2017).³³ Listwise deletion was used for the HPV-knowledge outcomes, resulting in <5% missing data for any given analysis. Weighting procedures adjusted for household-level non-response and noncoverage biases. Detailed survey methodology can be found elsewhere.^{34,35}

Cross-sectional survey years were pooled by harmonizing variable names for comparable items and creating a recoded set of statistical weights, resulting in one final sample weight and 100 jackknife replicate weights. SAS callable SUDAAN was used to estimate change in proportion of HPV knowledge between 2014 and 2017 (using the DIFFVAR option in PROC DESCRIPT). Relative changes from 2014 to 2017 by demographic factors were estimated by modeling (PROC RLOGIST) the interaction term of survey year X each significant demographic variable (e.g., year X sex) while controlling for all other covariates. Knowledge of HPV-related cancers was only assessed for respondents who had previously heard of HPV; thus, estimates of HPV-related cancer knowledge and changes in knowledge from 2014 to 2017 were only assessed among those who were aware of HPV.

RESULTS

Approximately 64.0% of the population had heard of HPV in 2014 and 2017 (Table 1). HPV awareness was statistically higher among females (compared with

males) in 2014 (71.9% vs 56.3%) and 2017 (73.5% vs 53.8%). In 2014 and 2017, awareness was higher among individuals aged 18–40 years compared with those aged ≥61 years (72.9% vs 45.1% and 76.7 vs 45.3%, respectively), as well as among those with a college degree compared with those with a high school education or less (71.9% vs 49.1% and 77.4% vs 50.5%, respectively). Awareness was also higher among respondents who were vaccine eligible or had an immediate family member who was vaccine eligible (70.1% vs 58.7% in 2014 and 71.3% vs 57.0% in 2017). In 2014, the non-Hispanic white subgroup had higher awareness of HPV than the non-Hispanic black and other race subgroups (67.7% vs 56.7%, and 48.3%, respectively); however, these differences were not statistically significant in 2017.

The proportion of the overall population who had previously heard of HPV was not significantly different between 2014 and 2017 (Table 1); however, there was a change among the college-educated subgroup. HPV awareness increased from 71.9% to 77.4% (increase of 5.5%, 95% CI=2.7%, 8.2%) among those with a college degree. This increase was statistically significant (B=0.52, 95% CI=0.10, 0.94) after adjusting for demographic covariates, indicating a relative increase in HPV awareness among college-educated compared with respondents with technical school training or some college. No significant change occurred among the high school or less group.

Knowledge of HPV as a cause of anal cancer (26.1% and 29.1%); oral cancer (30.1% and 30.7%); and penile cancer (29.5% and 31.2%) was low in the general U.S. population in 2014 and 2017, respectively (Table 2). By comparison, awareness of HPV as a cause of cervical cancer was much greater (78.0% and 81.5%).

There were significant differences in HPV cancer knowledge by demographic factors within each survey year (Table 2). In both years, a higher percentage of females (compared with males); younger (compared with older); non-Hispanic white (compared with Hispanic and non-Hispanic black), and those with a college degree (compared with those without college degrees) were knowledgeable that HPV causes cervical cancer. Fewer differences between demographic groups were found in knowledge of non-cervical HPV-related cancers. In 2017, a larger percentage of respondents who were not vaccine eligible and did not have an immediate family member who was vaccine eligible knew that HPV causes anal or oral cancers. Also, in 2017, those with higher educational attainment were more likely to know that HPV can cause oral cancers. In both years, knowledge that HPV can cause penile cancer was higher among respondents who had discussed the HPV vaccine with a healthcare provider. Discussing the HPV vaccine

Table 1. Trends in HPV Awareness From 2014 (N=3,677) to 2017 (N=3,285) by Demographic Groups

Characteristics	Heard of HPV		
	2014, % (SE)	2017, % (SE)	Change from 2014 to 2017, % change (95% CI)
Total	64.3 (1.4)	64.0 (1.3)	−0.4 (−4.3, 3.5)
Sex			
Male	56.3 (2.0)	53.8 (2.2)	−2.4 (−8.2, 3.2)
Female	71.9 (1.8)	73.5 (1.5)	1.7 (−2.8, 6.1)
Age, years			
18–40	72.9 (2.7)	76.7 (2.8)	3.8 (−3.8, 11.4)
41–60	67.1 (2.0)	65.3 (2.0)	1.7 (−9.1, 5.7)
≥61	45.1 (1.7)	45.3 (1.8)	0.2 (−4.7, 5.0)
Ethnoracial identity			
Hispanic, any race	63.2 (3.8)	63.7 (2.7)	0.5 (−6.3, 7.3)
White, non-Hispanic	67.7 (1.5)	65.8 (1.9)	−2.0 (−6.0, 2.1)
Black, non-Hispanic	56.7 (3.4)	59.3 (3.9)	2.6 (−5.8, 11.1)
Other, non-Hispanic	48.3 (6.4)	57.0 (3.9)	8.7 (−14.0, 31.5)
Education			
High school or less	49.1 (3.2)	50.5 (2.8)	1.4 (−6.2, 9.0)
Technical school or some college	69.1 (2.1)	62.0 (3.2)	−7.1 (−15.2, 1.0)
College graduate	71.9 (1.6)	77.4 (1.5)	5.5 (2.7, 8.2)
Self or immediate family member in HPV vaccine age range, 9–26 years			
Yes	70.1 (2.0)	71.3 (1.7)	1.2 (−7.3, 3.8)
No	58.7 (1.9)	57.0 (2.3)	−1.7 (−7.3, 3.8)

Note: Boldface indicates statistical significance ($p < 0.05$). HPV, human papillomavirus.

with a healthcare provider was not associated with knowledge of anal or oral cancers.

Across both survey years, knowledge that HPV can cause anal, oral, and penile cancers was significantly related (ϕ correlation coefficients ≥ 0.66). For example, the majority of participants who knew HPV can cause anal cancer (pooled across years) also knew that HPV can cause cervical (98.7%); oral (85.0%); and penile (87.1%) cancers. In 2014, a total of 20.8% of participants knew that HPV can cause cervical, anal, oral, and penile cancers. This proportion was statically equivalent in 2017 (21.5%).

Among those who had previously heard of HPV, knowledge that HPV can cause anal, oral, penile, and cervical cancers did not change significantly from 2014 to 2017 (Table 2). Although the point estimates were >1 (e.g., 3.0% increase in HPV–anal cancer awareness), the CIs for these changes included zero (e.g., 95% CI= −2.0%, 8.1%, for anal cancer knowledge).

There were interactions between some demographic groups X survey year. Knowledge of HPV as a cause of anal cancer increased 7.5% (95% CI=0.3, 14.6) among respondents with a college degree and 9.6% (95% CI=0.7, 18.5) among respondents who were not vaccine eligible

and did not have a family member who was vaccine eligible (Table 2). These increases remained statistically significant for the college-educated (B=0.79, 95% CI=0.18, 1.40) and vaccine-ineligible (B=0.55, 95% CI=0.09, 1.02) subgroups after adjusting for other demographic covariates.

Knowledge of HPV as a cause of cervical cancer increased 5.8% (95% CI=2.1, 9.5) among females; 6.1% (95% CI=1.9, 10.3) among the non-Hispanic white subgroup; and 6.3% (95% CI=3.7, 9.0) among those with technical school training or some college education. These increases were not statistically significant after controlling for demographic covariates. However, there were significant decreases in knowledge among the non-Hispanic other ethnoracial group. Knowledge decreased 16.1% (95% CI= −27.1, −10.4) among this demographic subgroup—a statistically significant decline when compared with non-Hispanic whites and after adjusting for other demographic covariates (B= −1.40, 95% CI= −2.37, −0.42).

DISCUSSION

The general public was moderately aware of HPV, but associated HPV with cervical cancer. Knowledge of non-cervical HPV-related cancers is low, even among vaccine

Table 2. Trends in Knowledge of HPV-associated Cancers in U.S. Adults Who Have Previously Heard of HPV (n=4,273)

Characteristics	Anal cancer			Oral cancer			Penile cancer			Cervical cancer		
	2014, % (SE)	2017, % (SE)	% change (95% CI)	2014, % (SE)	2017, % (SE)	% change (95% CI)	2014, % (SE)	2017, % (SE)	% change (95% CI)	2014, % (SE)	2017, % (SE)	% change (95% CI)
Total	26.1 (1.8)	29.1 (1.8)	3.0 (−2.0, 8.1)	30.1 (1.6)	30.7 (1.7)	0.6 (−4.1, 5.3)	29.5 (1.8)	31.2 (1.6)	1.7 (−3.0, 6.4)	78.0 (1.8)	81.5 (1.3)	3.5 (−0.8, 7.9)
Sex												
Male	27.5 (2.9)	29.8 (3.9)	2.3 (−11.2, 15.8)	31.8 (3.1)	30.9 (3.3)	−0.9 (−11.1, 9.4)	30.2 (3.0)	30.0 (3.1)	−0.3 (−12.0, 11.5)	76.0 (2.7)	76.0 (2.8)	0 (−6.5, 6.5)
Female	25.0 (2.0)	28.7 (2.1)	3.7 (−3.7, 11.0)	28.9 (1.7)	30.6 (2.1)	1.7 (−5.0, 8.4)	28.9 (2.1)	31.9 (2.3)	3.0 (−3.2, 9.2)	79.4 (2.0)	85.2 (1.2)	5.8 (2.1, 9.5)^a
Age, years												
18–40	27.8 (3.2)	28.0 (3.2)	0.2 (−13.8, 14.2)	31.2 (3.1)	29.3 (3.1)	−1.9 (−14.3, 10.4)	32.5 (3.3)	28.2 (2.8)	−4.3 (−17.2, 8.6)	83.0 (2.7)	84.3 (2.2)	1.3 (−3.2, 5.8)
41–60	23.5 (2.3)	30.6 (2.4)	7.1 (−0.5, 14.8)	27.8 (2.6)	32.6 (2.6)	4.8 (−0.4, 10.0)	26.7 (2.5)	33.8 (2.4)	7.2 (0.1, 14.2)	77.1 (2.3)	82.5 (2.3)	5.4 (−1.3, 12.1)
≥61	27.0 (2.6)	27.9 (2.6)	0.9 (−6.5, 8.3)	32.7 (3.0)	29.7 (2.8)	−3.0 (−14.2, 8.2)	27.4 (2.5)	31.6 (2.5)	4.2 (−3.2, 11.6)	65.8 (2.5)	73.1 (2.4)	7.3 (0, 14.6)
Ethnoracial identity												
Hispanic, any race	28.0 (3.8)	23.7 (5.0)	−4.3 (−13.1, 4.5)	27.7 (3.8)	25.9 (5.0)	−1.7 (−12.6, 9.2)	29.3 (4.6)	27.1 (4.5)	−2.1 (−9.2, 4.9)	75.3 (4.7)	73.6 (4.5)	−1.7 (−9.5, 6.1)
White, non-Hispanic	26.1 (2.1)	30.6 (2.5)	4.4 (−4.5, 13.3)	30.1 (2.2)	32.0 (2.1)	1.9 (−5.9, 9.7)	28.8 (2.3)	31.3 (1.9)	2.5 (−6.4, 11.4)	79.1 (2.1)	85.2 (1.7)	6.1 (1.9, 10.3) ^a
Black, non-Hispanic	24.9 (4.6)	28.6 (3.7)	3.7 (−13.1, 20.5)	32.5 (5.7)	27.0 (3.1)	−5.5 (−22.9, 11.9)	31.8 (4.9)	37.0 (4.1)	5.1 (−7.7, 17.9)	69.6 (4.0)	77.3 (3.9)	7.7 (−2.3, 17.6)
Other, non-Hispanic	22.2 (7.3)	27.1 (5.0)	5.0 (−15.1, 25.0)	32.8 (7.2)	33.8 (6.8)	1.0 (−15.7, 17.7)	34.0 (7.6)	29.9 (5.1)	−4.1 (−26.3, 18.2)	87.1 (3.5)	71.0 (5.6)	−16.1 (−21.7, −10.4)
Education												
High school or less	30.4 (3.8)	22.7 (3.2)	−7.7 (−16.9, 1.6)	29.9 (3.5)	22.7 (3.2)	−7.3 (−15.8, 1.3)	31.4 (3.8)	26.0 (3.3)	−5.4 (−14.9, 4.0)	64.9 (3.5)	68.0 (3.5)	3.1 (−10.0, 16.1)
Technical school or some college	28.6 (3.4)	32.9 (3.9)	4.3 (−7.3, 15.9)	30.4 (3.0)	30.6 (2.7)	0.2 (−9.5, 10.0)	32.8 (3.7)	34.3 (2.8)	1.5 (−8.4, 11.5)	78.4 (3.1)	84.8 (2.0)	6.3 (3.7, 9.0) ^a
College graduate	22.2 (2.1)	29.7 (2.0)	7.5 (0.3, 14.6)	30.0 (2.6)	35.0 (2.2)	5.0 (−0.4, 10.3)	26.2 (2.4)	31.6 (1.8)	5.4 (−1.0, 11.8)	84.1 (1.7)	86.5 (1.4)	2.4 (−1.0, 5.9)
Self or family vaccine eligible ^b												
Yes	28.0 (2.4)	25.6 (1.9)	−2.4 (−12.1, 7.3)	30.4 (2.2)	28.2 (2.3)	−2.2 (−10.6, 6.3)	31.7 (2.5)	29.2 (2.0)	−2.5 (−10.9, 5.8)	79.1 (2.5)	81.7 (2.0)	2.6 (−1.4, 6.5)
No	23.7 (2.4)	33.3 (2.9)	9.6 (0.7, 18.5)	29.7 (2.4)	33.7 (2.1)	4.0 (−5.1, 13.1)	26.7 (2.4)	33.5 (2.0)	6.8 (−1.3, 14.9)	76.8 (2.2)	81.4 (1.6)	4.5 (−0.3, 9.3)
Discussed HPV vaccine with healthcare provider ^c												
Yes	30.6 (4.0)	30.1 (2.9)	−0.5 (−18.3, 17.2)	33.3 (3.4)	33.8 (4.4)	0.5 (−15.3, 16.4)	36.7 (3.7)	38.5 (3.8)	1.8 (−13.3, 16.9)	82.5 (3.1)	87.8 (2.9)	5.3 (−2.4, 13.0)
No/don't know	24.9 (2.8)	23.6 (2.6)	−1.3 (−7.2, 4.6)	26.8 (2.9)	25.7 (2.7)	−1.2 (−7.4, 5.1)	27.2 (2.8)	24.1 (2.4)	−3.1 (−8.7, 2.5)	76.1 (3.3)	78.6 (2.8)	2.5 (−2.1, 7.1)

Note: Boldface indicates statistical significance (p<0.05).

^aNot significant (p>0.05) after adjusting for covariates.

^bRespondents who were themselves, or if they had a family member, in the licensed HPV vaccine age range (i.e., aged 9–26 years).

^cOnly asked of respondents who had heard of HPV and were themselves, or had an immediate family member, in the licensed HPV vaccine age range (i.e., aged 9–26 years) in 2014 (n=1,196) or 2017 (n=865).

HPV, human papillomavirus.

eligible subgroups. Approximately one in three respondents who had previously heard of HPV knew that HPV could also cause anal, oral, and penile cancers. It should also be noted that this is an inflated estimate as approximately 36% of the overall U.S. population has never heard of HPV and are thus unaware of the preventable cause of these cancers. Also, knowledge that HPV can cause anal, oral, and penile cancers was positively correlated, suggesting that only a small subset of those who have heard of HPV and who know that HPV causes cervical cancer receive more comprehensive information about HPV-related cancers. Overall, these findings suggest that comprehensive information about HPV-related cancers is not being widely disseminated.

Females were more aware about HPV compared with males and more knowledgeable about the link with cervical cancer, likely resulting from routine cervical cancer screening and the initial licensing of HPV vaccines as cervical cancer prevention. And even though the quadrivalent HPV vaccine was licensed for use in males in 2009,³⁶ the issue of HPV prevention was, and currently is, largely framed as a women's health issue. This is evidenced by the lower awareness of HPV among men in both survey years.

Healthcare providers are a trusted source of information regarding HPV and HPV vaccination.³⁷ Providers have the opportunity to educate their patients about the full range of benefits of HPV vaccination, including the prevention of non-cervical cancers. The findings from this study reflect this with regard to cervical and penile cancer knowledge, but not for oral or anal cancer knowledge. Notably, knowledge of anal, oral, and penile cancers did not change between cross-sectional survey years among who discussed HPV vaccination with their providers. These findings suggest that there may be a lack of information about HPV and the benefits of HPV vaccination being disseminated by providers, especially given that oropharyngeal cancer is the most common HPV-related cancer and rates continue to increase.²

An unexpected finding is that knowledge of anal cancer did increase among respondents who were not eligible to receive the HPV vaccine and who did not have family members in the vaccine eligible age range. Knowledge of anal cancer also increased among the most educated subgroup. These findings suggest that current HPV awareness campaigns are not reaching the priority populations and that there is differential distribution of HPV information among populations with higher SES. Targeted communication strategies are needed to more equally diffuse information about non-cervical HPV-related cancers.

Ongoing cancer education efforts will require continued surveillance to determine effects on HPV awareness,

knowledge, and vaccine utilization over longer periods of time and across at-risk subgroups. Although the President's Cancer Panel report was released during this time period,²⁰ programmatic research activities stemming from this report are just beginning to roll out. For example, the National Cancer Institute developed funding opportunities (e.g., PAR-16-338) to support HPV vaccination research in response to this report, and the impact of this research has not yet fully reached the public.

Limitations

There are notable limitations to this study that warrant discussion. First, there was large variability in estimated changes to HPV knowledge in subgroup analysis because of low sample sizes. As an example, the large decrease in cervical cancer knowledge among the non-Hispanic other ethnorracial subgroup should be interpreted with caution as this was the smallest subgroup and based on less than 200 total respondents per year. Second, the vaccine relevance subgroup was a single measure of self or family vaccine eligibility. This complicates the interpretation of the differences observed in this group and may affect the reliability of this variable. Third, the time between comparisons was just 3 years, so longer-term surveillance of HPV awareness and knowledge are needed. Finally, no adjustments were made for multiple comparisons in order to minimize type 2 errors.

CONCLUSIONS

Health promotion efforts need to move beyond framing HPV vaccine as a women's issue in the context of cervical cancer prevention, as both men and women are susceptible to HPV-related cancers. As HPV vaccine uptake shows low or modest increases in coverage over recent years, increased efforts to raise awareness about HPV and knowledge of all HPV-related cancers are needed.

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