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Knowledge and Awareness of Human Papillomavirus Among College Students in South Carolina

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ABSTRACT: Despite the existence of a safe and effective vaccine, human papillomavirus (HPV) remains prevalent in the United States, with late adolescence and early adulthood being periods of increased risk. Thus, targeting college-aged individuals for HPV prevention and vaccination promotion is critical—particularly in regions such as the Deep South where vaccination rates remain low. This study sought to examine awareness and knowledge of HPV as well as experiences and attitudes regarding HPV vaccination among college students in the Deep South. Specifically, we completed a cross-sectional survey of 256 undergraduate students from a large public university in South Carolina. Although a majority of participants were aware of HPV, significant knowledge gaps existed, particularly regarding prevention, symptoms, and consequences of HPV infection. Participants were also largely unaware of men's susceptibility for negative HPV outcomes. Multivariate regression modeling was used to identify predictors of HPV knowledge, with results indicating that participants who were female and white, as well as those who were vaccinated, had higher levels of HPV knowledge. Findings highlight the need for comprehensive HPV education on college campuses and offer insights to priority populations that may be appropriate focuses of efforts to increase HPV knowledge and vaccination rates.

KEYWORDS: Human papillomavirus, papillomavirus infections, vaccination, health knowledge, adolescent health, student health, surveys and questionnaires

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Introduction

Around 79 million Americans are estimated to be infected with genital human papillomavirus (HPV), the most common sexually transmitted infection in the world.^{1,2} Human papillomaviruses are a family of viruses that infect epithelial tissue; while most types are low-risk and resolve spontaneously or become undetectable, certain high-risk types—most notably HPV 16 and 18—are oncogenic, causing a wide range of cancers that affect women (eg, cervical, vaginal, and vulvar cancers), men (eg, penile cancer), and both sexes (eg, oropharyngeal and anal cancers).² HPV is prevalent among college-aged individuals (eg, aged 18–22) due to increased rates of high-risk sexual behaviors, including multiple sexual partners and engagement in unprotected sex.³ Such behavioral risks yield high rates of HPV, with data from 2007 to 2010 indicating an HPV prevalence of 59.8% among young women aged 20 to 24.⁴ Other potential causes for increased HPV risk during this period have been suggested and include a lack of engagement in preventive care and limited HPV knowledge.⁵

Beginning in 2006, vaccination against the main types of high-risk HPV has been available in the United States, with 3 vaccines (ie, Cervarix, Gardasil, Gardasil 9) currently approved for use.² Routine vaccination is recommended for male and female adolescents at ages 11 to 12, though vaccination can begin as early as age 9.² Despite this recommendation, uptake of the HPV vaccine has been slow and uneven in the United States, with many youth remaining un- or under-vaccinated.² Currently, only 60% of US adolescents between the ages of 13

and 17 have received at least one dose of the HPV vaccine, with 2 or 3 doses needed for full coverage depending on the selected vaccine.⁶ HPV vaccination coverage among female adolescents increased gradually following the vaccine's approval for girls in 2006; in contrast, coverage among male adolescents has risen rapidly since its approval for boys in 2011, resulting in a shrinking “gender-gap” in vaccination uptake.⁶ However, several interesting racial and ethnic differences in HPV vaccination coverage remain. Currently, African American and Hispanic youth in the United States are significantly more likely to receive the HPV vaccine than white, non-Hispanic youth, with 65.9% of African American adolescents and 69.8% of Hispanic adolescents receiving at least one dose of the HPV vaccine, compared to 54.7% of white, non-Hispanic youth.⁶

In addition, significant geographic disparities in HPV vaccination persist, with several states in the “Deep South” region (eg, Mississippi, Alabama, South Carolina) falling significantly below the national average and far below recommended Healthy People 2020 goals of 80% coverage (see Figure 1).^{6,7} South Carolina is representative of these regional challenges, with only 30.8% of females and 27.4% of males aged 13 to 17 years currently “up-to-date” with the HPV vaccination series.⁶ This low uptake is particularly alarming given the estimated 30 000 new cases of anogenital cancer and 4000 deaths from cervical cancer that are estimated to occur yearly in the United States due to HPV.⁸ Regional differences in HPV vaccine uptake are likely to stem from complex and intersecting factors including policy-related and socio-cultural factors, as



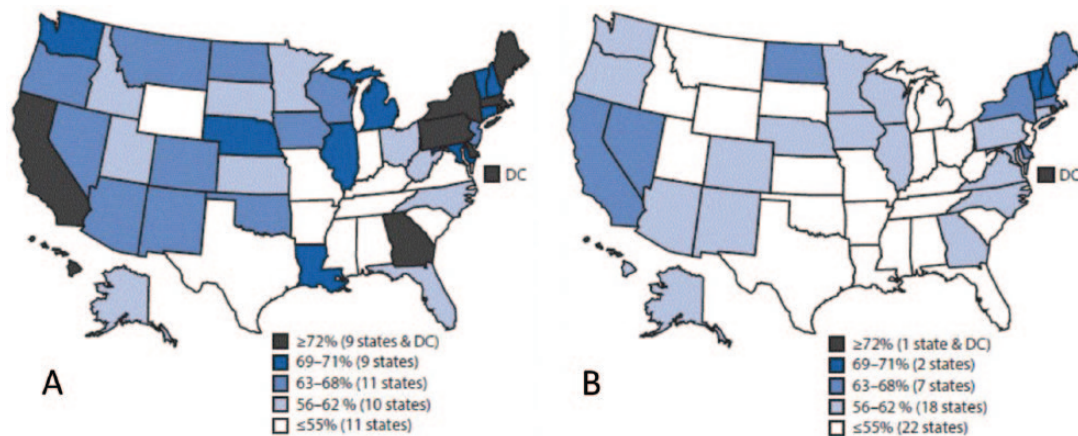


Figure 1. Estimated vaccination coverage with ≥ 1 HPV vaccine among female (A) and male (B) adolescents aged 13 to 17 years—National Immunization Survey-Teen, United States, 2016. HPV indicates human papillomavirus. Reproduced from Walker et al.⁶

well as factors related to health care services and infrastructure. In the United States, youth residing in rural areas (ie, non-Metropolitan Statistical Areas) are less likely to receive the HPV vaccine than non-rural peers, possibly due to fewer pediatric primary care providers in these areas.^{6,9} These urban-rural disparities are not present for Tdap coverage, suggesting that a lack of access to vaccines is not a likely reason for low HPV vaccination among rural adolescents.⁶ Regional and state variation in HPV vaccination may also be due to lower levels of HPV knowledge and awareness among residents and unwillingness or discomfort of providers to initiate discussions about HPV with families.⁵ Some Southern states such as Georgia have had success in rapidly increasing adolescent HPV vaccination rates through a variety of initiatives, including statewide health promotion campaigns, policy-related efforts, and the development of vaccination partnerships with local health departments and health care providers.¹⁰

Because HPV vaccination is recommended through age 21 for males and through age 26 for females and other priority populations (eg, men who have sex with men, transgender individuals), college and university health systems have an important role to play in comprehensive, public health approaches to reducing the burden of HPV. College health professionals may work to raise awareness and knowledge of HPV, encourage the adoption of healthy sexual practices, and provide vaccination to willing students. College may be a particularly important window of opportunity for late HPV vaccination as it is a time when individuals assume greater responsibility for their medical care and frequently begin to make medical decisions, including receiving vaccination, without parental knowledge or consent. Although much research on attitudes and beliefs of HPV vaccination has focused on parents,^{11–14} an emerging body of literature is beginning to explore how college students make decisions about HPV vaccination. This literature suggests a positive association between students' HPV knowledge, perceptions of HPV vaccine acceptability, and actual uptake of the vaccine.^{15,16}

Given the need to target college-aged individuals in the South for “catch-up” HPV vaccination, it is important to gain a deeper understanding of factors that may increase their likelihood to be vaccinated and/or engage in other preventive behaviors (eg, routine condom use). The Health Belief Model¹⁷ provides a theoretical framework to investigate key factors that may influence HPV-related behaviors, and suggests that an individual's awareness and knowledge of HPV, including perceived severity and risk, are likely to influence HPV-related behaviors. Understanding college students' HPV-related knowledge, attitudes, and perceived risk may help to inform future interventions and policies aimed at HPV-preventive behaviors, including “catch-up” vaccination among college students. Thus, the purpose of this study was to explore awareness and knowledge of HPV, as well as experiences and attitudes regarding HPV vaccination among college students in South Carolina, as well as to identify current sources of HPV information. This information may serve as a starting place to identify effective strategies and interventions to increase HPV vaccination and thus reduce the prevalence of high-risk strains of HPV among a key target population (ie, college-aged individuals).

Method

Participants

A non-probability, purposive sample of college students from South Carolina were recruited for this study from undergraduate courses in the College of Arts & Sciences and School of Public Health at a large public university. The study protocol was approved by the Institutional Review Board at the University of South Carolina, which waived requirement for written documentation of informed consent due to the study's minimal risk of harm. Interested students were provided with a research information sheet that described study goals and included potential benefits and risks of participation. This sheet was reviewed with interested students, and in total, 256

participants consented to participate. All then individually completed a paper-pencil survey in a classroom setting, with data collection occurring between September and October of 2017. Students who participated were eligible to be entered into a drawing for 1 of 6 US \$25 incentives.

Measures

Demographic characteristics. Participants provided information about demographics including age, gender, sexual orientation, race, ethnicity, year in college, undergraduate major, and state of home residence. Participants also reported whether they had ever engaged in sexual contact with others.

HPV awareness, perceptions, and experiences. To assess awareness, participants were asked to report if they had “ever heard” of HPV and the HPV vaccine, with response options including “yes,” “no,” and “I don’t know.” Participants were asked if a health care provider had ever recommended that they receive the HPV vaccine and if they had received at least one dose of the HPV vaccine (“yes,” “no,” “I don’t know”). Participants rated their perceived risk for HPV infection using a 5-point Likert scale, as well as the level of shame they would feel if they found out they had HPV. Higher scores indicate greater perceived risk and more shame. Finally, participants were asked to endorse any encountered sources of information of HPV (eg, health care providers, friends, family, health classes, Internet).

HPV-Knowledge 18. For this study, we created an 18-item HPV knowledge scale to assess participants’ accurate knowledge of HPV infection, HPV-related outcomes, HPV screening, and HPV prevention, with all items adapted from existing published measures.^{16,18–21} Participants read a series of 18 statements on HPV and responded by endorsing “True,” “False,” or “I don’t know.” Participants received one point for each correct response; points were summed to create a total knowledge score (ie, range of 0–18). The *HPV-Knowledge 18* (*HPV-K18*) yielded strong internal consistency ($\alpha = .79$).

Statistical analysis

We conducted statistical analysis using STATA. Initially, we tabulated descriptive statistics for all variables. Chi-square tests were calculated to examine differences in HPV awareness, vaccine awareness, vaccination status, and sources of HPV information by gender, race, and ethnicity. *t* Tests were used to compare gender, race, and ethnicity differences in HPV knowledge; perceived risk for HPV; and HPV-associated shame. In addition, we used *t* tests to compare differences in HPV knowledge based on reported sources of information. We then ran a regression model with HPV knowledge as the outcome variable and predictor variables of age, gender (male, female), race (non-white, white), ethnicity (Hispanic/Latino, not Hispanic/Latino), history of sexual activity (no, yes), and HPV vaccination status (no/don’t know, yes).

Results

Demographic and behavioral characteristics of participants are shown in Table 1. The majority of the sample was female (80.9%), white (78.5%), and not of Hispanic or Latino ethnicity (88.7%). Participants ranged from 18 to 31 years of age ($M=19.7$ $SD=1.7$). About half of participants (50.7%) reported being from South Carolina, with 78.5% from the Southern United States. Most participants (96.1%) identified as heterosexual, with 84.8% reporting a history of sexual activity.

The vast majority of the participants reported being aware of HPV (95.3%) and the HPV vaccine (90.6%) prior to the day of the survey. Ethnicity was not significantly associated with awareness; however, some differences were observed by gender and race. Female participants were more likely than males to report HPV awareness (97% vs 88%, $P=.005$) and awareness of the HPV vaccine (95% vs 76%, $P<.001$). In addition, white participants were more likely than non-white participants (97% vs 90%, $P=.04$) to report awareness of HPV. Self-reported vaccination rates fell well below Healthy People 2020 targets, with 64.1% of participants reporting having received at least one dose of the HPV vaccine. A larger proportion (72.7%) indicated that a physician or other health care provider had previously recommended that they receive the vaccine. Those who were vaccinated did not differ significantly by gender, race, and ethnicity when compared with those who were not vaccinated.

A summary of participant responses on *HPV-K18* items are presented in Table 2. Participants’ mean total knowledge score was 8.9 ($SD=3.7$), indicating moderate levels of overall HPV knowledge (ie, potential range of 0–18). Significant differences in HPV knowledge existed between genders and races. Female participants displayed greater overall HPV knowledge ($M=9.2$) than male participants ($M=7.2$, $P=.02$), and white participants displayed higher levels of knowledge ($M=9.3$) than non-white participants ($M=7.7$, $P=.01$).

Item analysis revealed patterns of knowledge gaps regarding HPV. For instance, participants were largely incorrect in responding to items about men and HPV. Only 7% of participants correctly responded to an item that asked whether screening is commonly used to test men for HPV (ie, currently there is no approved test for HPV in men), and only 36% knew that HPV may cause penile cancer. Participants displayed confusion about the distinction between HPV and genital herpes, with only 13% of participants aware that HPV does not cause genital herpes. Participants underestimated the prevalence of HPV, with just 15% correctly indicating that at some point almost all sexually active women and men will contract HPV. Although a majority of participants (53%) understood that HPV can cause genital warts, a much smaller portion (9%) were familiar with the fact that most HPV infections will clear on their own. Moreover, more than half of the respondents (51%) were unaware that there is no cure for HPV. On the other hand, some aspects of HPV knowledge seemed well understood by the majority of participants, including that

Table 1. Demographic characteristics and HPV experiences of study participants (N=256).^a

VARIABLE	NO. (%)	MEAN (SD)
Gender		
Female	207 (80.9)	
Male	49 (19.1)	
Age		19.7 (1.7)
Race		
American Indian or Alaskan Native	2 (0.8)	
Asian	13 (5.1)	
Black or African American	31 (12.1)	
White	201 (78.5)	
Other	2 (0.8)	
Not reported	7 (2.7)	
Ethnicity		
Hispanic or Latino	8 (3.1)	
Not Hispanic or Latino	227 (88.7)	
Other	9 (3.5)	
Not reported	12 (4.7)	
State of home residence		
Northeast	31 (12.1)	
Midwest	15 (5.9)	
South	201 (78.5)	
West	8 (3.1)	
Other	1 (0.4)	
Year in school		
Freshman	72 (28.1)	
Sophomore	62 (24.2)	
Junior	62 (24.2)	
Senior	58 (22.7)	
Other	1 (0.4)	
Not reported	1 (0.4)	
Sexually active		
No	39 (15.2)	
Yes	217 (84.8)	
Sexual orientation		
Heterosexual (straight)	246 (96.1)	
Gay or lesbian	5 (2.0)	
Bisexual	4 (1.6)	

Table 1. (Continued)

VARIABLE	NO. (%)	MEAN (SD)
Not sure	1 (0.4)	
Ever heard of HPV?		
Yes	244 (95.3)	
No/Do not know	12 (4.7)	
Ever heard of the HPV vaccine?		
Yes	232 (90.6)	
No/Do not know	23 (9.0)	
Not reported	1 (0.4)	
Has a health care provider recommended the HPV vaccine to you?		
Yes	186 (72.7)	
No/Do not know	70 (27.3)	
Have you received at least one dose of the HPV vaccine?		
Yes	164 (64.1)	
No/Do not know	91 (35.5)	
Perceived risk of HPV infection (on a 5-point scale) ^b		2 (1.2)
Perceived shame associated with HPV infection (on a 5-point scale) ^b		4 (1.0)
Total HPV knowledge (out of 18 total points) ^b		8.9 (3.7)

Abbreviation: HPV, human papillomavirus.

^aMissing values are not shown in the table but are listed here by number missing: age (4), perceived risk of HPV infection (2), total HPV knowledge score (6), and received one dose of HPV vaccine (1).

^bHigher scores indicate greater perceived risk for HPV, HPV-related shame, and HPV knowledge.

HPV is sexually transmitted (85%), that HPV can lay dormant in the body without symptoms (81%), and that having a greater number of sexual partners increases a person's chance of acquiring HPV (80%).

Individual items were also analyzed to assess for gender differences (see Table 2). When compared with female participants, males were less likely to know that an abnormal Pap smear may indicate HPV for women (49% vs 72%, $P < .01$) and were also less likely to know about HPV's association with cervical cancer (57% vs 82%, $P < .01$). Female participants were more likely than males to be aware that HPV infections may be asymptomatic (84% vs 67%, $P = .01$) and that it is possible for a person to acquire more than one type of HPV (70% vs 51%, $P = .01$). Females also were more knowledgeable that there is currently no cure for HPV (52% vs 35%, $P = .03$) and that HPV is a common virus (76% vs 59%, $P = .02$) as compared with their male counterparts.

Table 2. Number and percentage of participants correctly answering HPV-Knowledge 18 items and gender differences by item.^a

HPV-K18 ITEM (CORRECT RESPONSE)	NO. (%)			P-VALUE
	FEMALE	MALE	TOTAL	
1. HPV is a sexually transmitted infection. (T)	174 (84)	43 (88)	217 (85)	.52
2. There is a cure for HPV. (F)*	108 (52)	17 (35)	125 (49)	.03
3. Having one type of HPV means that you cannot acquire new types. (F)*	145 (70)	25 (51)	170 (66)	.01
4. There is a screening that is commonly used to test males for HPV. (F)	16 (8)	1 (2)	17 (7)	.15
5. An abnormal Pap smear may indicate that a woman has HPV. (T)*	149 (72)	24 (49)	173 (68)	.00
6. Most genital HPV infections do not clear up on their own. (F)	19 (9)	5 (10)	24 (9)	.80
7. A person usually has symptoms when infected with HPV. (F)	112 (54)	20 (41)	132 (52)	.09
8. HPV is not a very common virus. (F)*	157 (76)	29 (59)	186 (73)	.02
9. HPV infection can cause genital warts. (T)	113 (55)	23 (47)	136 (53)	.34
10. HPV infection can cause genital herpes. (F)	27 (13)	5 (10)	32 (13)	.59
11. Certain types of HPV can lead to cervical cancer in women. (T)*	170 (82)	28 (57)	198 (77)	.00
12. HPV can lay dormant in the body for years without symptoms. (T)*	174 (84)	33 (67)	207 (81)	.01
13. A person's chances of getting HPV increase with the number of sexual partners they have. (T)	163 (79)	42 (86)	205 (80)	.30
14. Most people with HPV have visible signs or symptoms of the infection. (F)	107 (52)	25 (51)	132 (52)	.93
15. Genital warts can cause cervical cancer. (F)	41 (20)	11 (22)	52 (20)	.68
16. Condoms are not effective in preventing HPV. (F)	115 (56)	30 (61)	145 (57)	.47
17. HPV can cause penile cancer. (T)	75 (37)	15 (31)	90 (36)	.49
18. Nearly all sexually active men and women will contract HPV at some point. (T)	28 (14)	9 (19)	37 (15)	.36

Abbreviation: HPV, human papillomavirus.

^aMissing values are not shown in the table but are listed here by number missing: Item 6 (2), Item 12 (1), Item 13 (1), Item 17 (3), and Item 18 (2).

*Gender difference in correct response = $P < .05$.

Participants were also asked to indicate sources of knowledge of HPV, with the most reported sources being health care provider (68%), school health education class (64%), and the Internet (50%) (see Table 3). Female students were more likely than males to report that they had learned about HPV from a health care provider (73% vs 47%, $P < .01$), radio/TV (33% vs 12%, $P < .01$), and magazines/newspapers (19% vs 6%, $P = .03$). We next examined whether a particular source of information was associated with higher overall HPV knowledge scores. Participants who reported learning about HPV from health care providers ($P = .03$), school health education classes ($P < .01$), and the Internet ($P = .05$) had higher levels of HPV knowledge than those who did not endorse that particular source of knowledge.

Finally, multivariate regression analysis was used to test whether key demographic and behavioral variables significantly predicted higher HPV knowledge (see Table 4). Specifically, the variables of gender, age, race, ethnicity, HPV vaccination status, and history of sexual activity were included in the regression model. Results of the regression indicated that

the predictors explained 8.2% of the variance ($R^2 = 0.08$, $F_{(6, 237.4)} = 3.5$, $P \leq .01$). Three variables in the model were significant predictors of total HPV knowledge: gender, HPV vaccination status, and race. Being female significantly predicted HPV knowledge ($B = 1.20$, $SE = 0.59$, $P = .04$), as did having received the HPV vaccine ($B = 1.25$, $SE = 0.48$, $P = .01$). Finally, being white also significantly predicted higher total HPV knowledge ($B = 1.21$, $SE = 0.60$, $P = .04$). Age ($B = 0.12$, $SE = 0.14$), ethnicity ($B = 0.47$, $SE = 0.93$), and sexual activity ($B = 0.84$, $SE = 0.63$) were not significant ($P > .05$) in the model.

Discussion

This study aimed to explore knowledge and awareness of HPV and HPV vaccination among male and female college students in South Carolina. Results of our research are consistent with recent studies that have found a substantial increase in HPV awareness among college students over the past decade.²¹⁻²⁴ In this study, more than 9 out of every 10 participants were aware of HPV and the HPV vaccine. Increasing awareness has been the focus of multiple recent public health campaigns designed

Table 3. Number and percentage of participants endorsing sources of HPV information and gender differences.

SOURCES OF HPV INFORMATION	FEMALE NO. (%)	MALE NO. (%)	TOTAL NO. (%)	P-VALUE
Health care provider*	151 (73)	23 (47)	174 (68)	.00
School health education class	131 (63)	32 (65)	163 (64)	.79
Internet	104 (50)	24 (49)	128 (50)	.87
Radio/TV*	69 (33)	6 (12)	75 (29)	.00
Family member	66 (32)	9 (18)	75 (29)	.06
Friend	49 (24)	12 (24)	61 (24)	.90
Magazine/newspaper*	40 (19)	3 (6)	43 (17)	.03
Community health program	16 (8)	1 (2)	17 (7)	.15
Other	6 (3)	2 (4)	8 (3)	.67
Centers for Disease Control and Prevention (CDC) National Sexually Transmitted Diseases (STD) hotline	4 (2)	0 (0)	4 (2)	.33

Abbreviation: HPV, human papillomavirus.

*Gender difference = $P < .05$.

Table 4. Estimates from regression model predicting HPV knowledge ($R^2 = 0.08$, $F_{(6, 237.4)} = 3.5$, $P \leq .01$).

VARIABLE	B	SE	P
Intercept	2.65	3.06	
Gender	1.20*	0.59	.04
Age	0.12	0.14	>.05
HPV vaccination status	1.25*	0.48	.01
Sexually active	0.84	0.63	>.05
Race	1.21*	0.60	.04
Ethnicity	0.47	0.93	>.05

Abbreviation: HPV, human papillomavirus.

* $P \leq .05$.

to promote the benefits of HPV vaccination to parents and adolescents.²⁵ Despite this high level of awareness, we found many gaps in actual knowledge of HPV, similar to much prior research.^{5,26,27} The majority of participants were uninformed about the high prevalence of HPV in the general population, as well as current options for screening and treatment. Furthermore, many had limited knowledge about the causal role of HPV in a variety of cancers and genital warts—

information that may be key in prompting vaccination. This raises concerns that comprehensive information on HPV is not reaching key youth populations. There is an urgent need to better educate college-aged individuals on HPV. Student health and wellness programs should routinely evaluate the content and impact of current HPV-related services to ensure that comprehensive information on HPV, including the effectiveness of the HPV vaccine and opportunities for vaccination, reach their intended audience.²⁵

A second key finding was that the majority of college students in this study perceived their own risk for HPV to be low. Although clinical HPV status was not evaluated in this study, previous research with college populations has found a large portion of women who believe themselves to be “not at risk” for HPV actually test positive, with Ramirez et al²⁸ finding a 35% HPV prevalence rate among college women who perceived themselves to not be at risk. Students also underestimated overall prevalence, with only 15% of participants familiar with the fact that nearly all US adults will acquire HPV at some point in their lives. According to the Health Belief Model,¹⁷ low perceived risk for HPV is likely to decrease an individual’s willingness to engage in vaccination or other preventive behaviors, such as routine condom use.^{15,29} Among the sample, there was also widespread lack of awareness of the severity of HPV, including its causal links with penile cancer and cervical cancer (ie, particularly among male participants). Increasing college students’ understanding of the likelihood of HPV acquisition and the potential severity of the virus may promote important preventive health behaviors. Making college students more aware of how widespread HPV actually is may also serve to reduce the high levels of shame associated with infection.

Consistent with previous research,^{21,24,26,30,31} we found that young men were less aware of HPV and displayed poorer knowledge than young women. Moreover, in comparison to white students, non-white students were less likely to be aware of HPV, had lower levels of HPV knowledge, and reported lower perceived risk. These sex and racial differences are important, both for identifying priority populations for future college health promotion campaigns and for exploring potential socio-cultural and systemic factors that may underlie these disparities. Because many men do not develop visible symptoms of HPV and there continues to be no approved male HPV screening tool, men often remain unaware of their positive HPV status—potentially contributing to lower levels of HPV awareness and knowledge.³² In addition, numerous socio-cultural and psychological variables also likely contribute to these observed gender differences. Men have been dubbed “the forgotten fifty percent”³³ due to a history of omission from many aspects of sexual and reproductive public health discourse. Societal beliefs regarding gender-based power and gender norms (eg, norms surrounding masculinity) contribute in complex ways to gendered behavioral health practices, and college-aged men have identified multiple barriers to seeking health information and

services, including social stigma and concerns about perceived vulnerability.³⁴ In addition to gender disparities, we also found that non-white college students had lower levels of awareness and knowledge than white individuals. This is concerning, particularly within the context of South Carolina, which has some of the largest racial health disparities in the nation and where African American women face significantly increased risk for death from cervical cancer when compared with white women.³⁵ Reducing persistent disparities in HPV infection among African American women³⁶ and promoting equity in the uptake of HPV vaccine is a public health priority, especially in the Southern United States. To achieve these aims, more research is needed to develop culturally specific frameworks of behavioral decision-making regarding HPV, as well as culturally tailored HPV prevention interventions.^{37,38}

In our sample, the majority of students indicated that they would feel shame if they acquired HPV. This finding is concerning because shame associated with HPV may be a barrier for cervical cancer screening.³⁹ Shame may also hinder individuals from disclosing a positive HPV status to their partners and/or families.⁴⁰ Available literature suggests that the extent to which the acquisition of HPV infection is perceived as shameful is positively associated with awareness about the sexually transmitted nature of this virus and negatively associated with knowledge of the high prevalence of HPV.^{39,41} Within the current sample, the majority of college students knew about the sexual transmission of HPV and had limited knowledge about its high prevalence, which may have contributed to perceptions of HPV as “shameful.” Reducing the stigma associated with sexually transmitted infections and increasing open communication about sexual health must be foundations of health promotion campaigns designed to lower current rates of HPV and increase acceptability of vaccination.

Finally, this study found that the college students received information about HPV from a myriad of sources but overwhelmingly through health care providers, school health education classes, and the Internet. Health care providers who work in college and university health centers thus have a critical role to play in promoting HPV vaccination for the “catch-up” age range (eg, through age 21 or 26), including assessing vaccination status, initiating discussions about vaccination (ie, for the un- or under-vaccinated), offering general HPV prevention messaging to all, and ensuring that routine screening for cervical cancer is completed when indicated. In addition, health outreach programs are needed campus-wide to increase HPV awareness and improve knowledge. The rapid increase in the consumption of online health information offers both advantages (eg, ease of access, reduction of common barriers to care such as stigma, transportation, and cost) and disadvantages (eg, potential for misinformation) for college populations. College and university health centers can take a lead in making sure that students can access accurate and supportive health information by ensuring that their websites contain reliable

information on HPV and the benefits of vaccination. A recent study found video messaging to be an effective way to increase HPV knowledge as well as vaccination intentions among college-aged individuals,⁴² and incorporating brief, educational videos online or during patient visits may be a cost-effective strategy. In addition, social networking sites (eg, Facebook, Twitter, etc) may be effective mediums to deliver HPV vaccination messages though much more research is needed in this domain.⁴³

Limitations

Results of this research must be considered in the context of its limitations. First, although the study’s findings on differences by gender and race for HPV awareness and knowledge are important, they must be considered within the context of the sample. The vast majority of individuals in this study were born in the mid-to-late 1990s. Thus, many female participants were in the first age cohort of girls eligible for HPV vaccination when the vaccine was introduced for females in 2006. The recommendation for male vaccination not made until 2011, by then many male participants were older than the recommended age range of 10 to 11 years. Considering cohort effects on HPV, awareness and knowledge is particularly important, given the major changes in recommendations and uptake over the past decade. Current data on HPV vaccination uptake in the United States indicate that the male-female coverage gap is rapidly shrinking and that racial and ethnic minorities are now vaccinated against HPV at higher rates than non-minorities.⁶ Thus, these findings are unlikely to generalize across age cohorts, and should, most importantly, be used to inform current policy and programs that aim to promote “catch-up” vaccination for college students in South Carolina who may have missed opportunities for education and vaccination during their adolescence.

In addition, the study relied on self-reported data, and we did not confirm participants’ HPV vaccination status or assess the total number of doses received. To reduce the potential for social desirability bias in responding, the survey was anonymous with no identifying data collected. Our sample presents several limitations as well. The sample consisted of students recruited from courses in public health, sociology, and other disciplines. Because we did not employ a probability sampling framework, our participants may not be representative of the broader college population in South Carolina.

Conclusions

HPV remains a critical issue in the United States, and increasing preventive health behaviors, most notably HPV vaccination, is a public health priority. College and university health services can play a key role in promoting sexual health and assisting in “catch up” vaccination efforts for the un- and under-vaccinated. However, low perceived risk for HPV, limited HPV knowledge, and high levels of HPV-associated shame may be barriers to

efforts to prevent HPV infection and increase vaccination coverage among college populations. Results of this study confirm the need to accelerate efforts to improve HPV knowledge and increase vaccination among college-aged individuals, particularly in the Deep South. Future studies are needed to identify culturally appropriate frameworks that can speed the reduction of HPV disparities across both places and populations.

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Author Contributions

CP and SH designed and implemented the original research study. SK led analysis of study results and drafted the initial manuscript. SH oversaw all aspects of the study, including analysis, manuscript development, and revisions. All authors provided feedback during manuscript development and approved the final manuscript.

Informed Consent

Informed consent was provided by all individual participants included in the study, in accordance with study approval from the University of South Carolina Institutional Review Board (#00068790).

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