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Public Awareness of Human Papillomavirus as a Causative Factor for Oropharyngeal Cancer

Michael U. Williams[1], Michele M. Carr, DDS, MD, PhD[1], and David Goldenberg, MD[1]

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Abstract

Objective. To assess the public's awareness of human papillomavirus (HPV) as a causative factor for oropharyngeal cancer.

Study Design. Twenty-three-item survey.

Setting. Local shopping malls and Maxwell Air Force Base in 2012.

Methods. Respondents were randomly chosen to participate in 23-item survey at various local shopping malls and at Maxwell Air Force Base in 2012. The χ^2 test was used in statistical analysis.

Results. The majority of respondents (n = 319) were civilians; 158 were military officer trainees (MOTs). All MOTs had a bachelor's degree or higher, while 37% of civilian respondents had a bachelor's degree or higher. Most MOTs (82%) were aware of oropharyngeal cancer, and 53% of civilians had not heard of oropharyngeal cancer ($P < .0001$). Most respondents (73% civilian and 91% military) were aware of the association between HPV and cervical cancer. Conversely, 75% of civilian population and 49% of MOTs were not aware of the association between HPV and oropharyngeal cancer ($P < .0001$). The majority of respondents (61% military and 81% civilian) did not know that both sexes were eligible for HPV vaccine ($P < .0001$).

Conclusions. Most respondents were aware that HPV is a causative agent of cervical cancer. However, the majority were not aware of the association between oropharyngeal cancer and HPV. Furthermore, many respondents were not aware that HPV equally affects males and females and that the vaccine is available for both sexes. This underscores the need to educate the public on the availability of HPV vaccine and the association between HPV and oropharyngeal cancer.

Keywords

oropharyngeal, cancer, papilloma, HPV, oropharyngeal squamous cell cancer, vaccine, public, head and neck, otolaryngology, military

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Human papillomavirus (HPV) is the most common sexually transmitted infection, and its relationship with oropharyngeal squamous cell cancer (OSCC) has been well established for several decades.[1] In the United States, the adolescent population has the highest cumulative prevalence rate of HPV, and almost all sexually active males and females may be infected in their lifetime by the virus.[2] Multiple studies have indicated that HPV is responsible for 40% to 80% of OSCC in the United States.[1,2] Over the past 3 decades, the incidence of OSCC has increased significantly worldwide, and this trend is attributed to high-risk HPV subtypes.[3-5] In the United States from 1988 to 2004, the incidence of HPV-negative OSCC decreased by 50%, while the incidence of HPV-positive OSCC increased by 225%, primarily among younger white male population (aged 40-55 years).[1] The reasons for the male predominance is unclear. Nonetheless, current epidemiologic research indicates that the increase among the younger population is attributed to sexual behavioral changes since the 1950s, such as an increase in oral sex practice and more lifetime sexual partners.[6] According to the American Cancer Society, the 2014 estimated incidence of OSCC and cervical cancer in the United States is 37,000 and 12,360, respectively. Annually in the United States, approximately 10,000 new cases of OSCC can be attributed to a particular strain of HPV.[7] If current trends continue, the incidence of HPV-positive OSCC could surpass cervical cancer diagnosis by 2020.[6]

Currently, there are >150 known strains in the HPV family, and >40 are thought to be transmitted through oral, genital, or anal areas of both sexes.[8] HPV subtypes are divided into high and low risk based on their malignant potential. Although approximately 15 high-risk subtypes are

[1]Department of Surgery, Division of Otolaryngology–Head and Neck Surgery, The Pennsylvania State University, College of Medicine, Hershey, Pennsylvania, USA

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Corresponding Author:
David Goldenberg, MD, Penn State Hershey Medical Center, Department of Surgery, Division of Otolaryngology–Head and Neck Surgery, 500 University Drive, MC H091, Hershey, PA 17033-0850, USA.
Email: dgoldenberg@hmc.psu.edu

known, only HPV subtypes 16, 18, 31, 33, and 35 have been identified to play a role in oropharyngeal cancer.[8] The presence of oral HPV-16 infection is strongly associated with oropharyngeal cancer, with no evidence of synergy between HPV exposure and tobacco or alcohol.[1] High-risk HPV disrupts the cell cycle by producing oncoproteins E6 and E7, which bind to and inactivate tumor suppressor protein p53 and retinoblastoma protein pRb, respectively, leading to uncontrolled cell cycle progression and ultimately to uncontrolled proliferation.[7] Additionally, inactivation of pRb results in upregulation of p16 protein that is used as a surrogate marker for HPV-positive oropharyngeal cancer.[8]

Several studies demonstrated that the public is relatively well informed about HPV as a sexually transmitted disease.[9] Likewise, the relationship between HPV and cervical cancer has been well established, and the public appears to be well aware of this association.[9] Cervical cancer screening has contributed to public awareness about the association between HPV and cervical cancer. Vaccines for the high-risk HPV strains are now widely available, and their effectiveness in preventing cervical cancer has been established. Yet, the efficacy of these vaccines in preventing HPV positive OSCC is yet to be determined. Our objective was to determine awareness of HPV and its relationship to OSCC. Our findings will help us determine if there is a need for implementation of public education on HPV as it pertains to OSCC.

Methods

A 23-question anonymous survey (see appendix at www.otojournal.org) was offered to 507 respondents using a systematic sample collection at various shopping malls in the Harrisburg, Pennsylvania, area and Maxwell Air Force Base, Alabama. The data from Maxwell Air Force Base were collected in June 2012 and between July and November 2012 in the Harrisburg area; 158 respondents at the Maxwell Air Force Base were all military officer candidates. The rest of the respondents (n = 319) were civilian personnel with various educational backgrounds, and 30 respondents deferred. The minimum age requirement for participation was 18 years. The survey consisted of 4 categories of questions: general knowledge about HPV, general knowledge about the HPV vaccine, general knowledge about oropharyngeal cancer, and respondent demographic data. The questions were concise, and 80% of the inquiry survey required only 1 response. Respondents were encouraged to completely fill out the whole survey. Nonetheless, incompletely filled surveys were included in the analysis. The lucidity of the questions was ensured by testing the survey during development among a random group of readers before approval. Furthermore, intrarater reliability of the entire survey was made certain by the analysis of test-retest (done by 15 respondents), with a 0.9 intraclass correlation coefficient. The Pennsylvania University College of Medicine institutional review board approved the protocol of the survey (40104EM). The data was analyzed using χ^2 test.

Table 1. Demographics.

Characteristics	All	Military	Civilian
Sex[a]	462	156	306
Female[b]	50.6	36.5	57.8
Male	49.3	63.4	42.1
Age, y	452	152	300
18-25	44.6	46.0	44
26-35	30.9	46.0	23.3
36-45	11.2	6.5	13.6
46-55	7.5	1.3	10.6
55+	5.5	0	8.3
Education	458	156	302
High school degree or less	17.0	0	25.8
Some college or associate	24.4	0	37.0
Bachelor degree	38.6	62.1	26.4
Graduate degree	19.8	37.8	10.6
Race	452	153	299
Black or African American	11.0	5.8	13.7
Hispanic or Latino	8.8	5.2	10.7
White	68.3	72.5	66.2
Asian/AI/AN/NH/PI	11.7	16.3	9.3

Abbreviations: AI, American Indian; AN, Alaskan Native; NH, Native Hawaiian; PI, Pacific Islander.
[a]Values in the main entry are presented in numbers.
[b]Values in the subentry are presented in percentages.

Results

Participant's Characteristics

A total of 507 surveys were given out, and 477 were completed. Civilian personnel filled out 319 surveys, while 158 respondents were military officer trainees (MOTs). The response rate from civilian respondents was 91%, with 30 people deferring, while 100% of all MOTs filled out the survey. A total of 345 respondents answered all questions. Demographic information of the respondents is provided in **Table 1**. The majority of the total respondents were between the ages of 18 and 25 years. All military respondents had a bachelor degree or higher.

Knowledge of HPV

The majority of people responded that they had heard of HPV (75%): 141 (89%) of MOTs and 68% of civilians (n = 318). Seventy-seven percent of all respondents accurately believed that HPV affects both sexes (n = 361). However, 17% of military (n = 141) and 26% of civilian (n = 220) respondents believed that HPV affected only women. Eighty-one percent of the surveyed population knew about the association between HPV and cervical cancer. Ninety-one percent of military (n = 141) and 73% of civilian (n = 220) respondents stated that HPV is related to cervical cancer. Fifty-three percent of all respondents (n = 361) stated that HPV is related to genital warts. Forty-six percent of military (n = 141) and 47% of civilian (n = 220)

respondents incorrectly stated that HPV is not related to genital warts. Sixty percent of military respondents (n = 141) and 63% of civilian respondents (n = 220) responded that HPV is not related to genital cancer. Additionally, the majority of all respondents (72%) wrongly stated that HPV is not related to oropharyngeal cancer (n = 361). Sixty percent of military (n = 141) and 80% of civilian (n = 220) respondents were not aware that HPV is related to oropharyngeal cancer.

While 32% of military respondents (n = 141) indicated that they learned that HPV was related to genital warts in school, only 13% of civilian respondents (n = 220) learned the same relationship in school ($P < .0001$). Eleven percent of military respondents (n = 141) and 18% of civilian respondents (n = 220) learned that HPV was related to genital warts through their health care provider ($P < .06$). Fifty-seven percent of military respondents (n = 141) and 16% of civilian (n = 220) learned that HPV is related to cervical cancer in school ($P < .0001$), while 23% of military and 27% of civilian respondents learned the same information from their health care provider. Twenty-one percent of military (n = 141) and 8% of civilian (n = 220) respondents learned through school that HPV is related to genital cancer, while 9% of military and 10% civilian respondents learned the same information from their health care provider. Of the small number of respondents who were aware that HPV is related to oropharyngeal cancer, 20% of military (n = 141) and 2% of civilian (n = 220) respondents learned the relationship in school, while 5% military and 4% civilian respondents acquired same knowledge through their health care provider.

Of all respondents (n = 361) who answered the question of how HPV is acquired and spread, most indicated that HPV is not acquired by handshake (99%), bathrooms (96%), sharing towels (98%), or open-mouth kissing (93%). Ninety-six percent of military respondents (n = 141) indicated that HPV is acquired and spread by sexual intercourse, while 86% of civilian respondents (n = 220) stated that HPV is acquired and spread by sexual intercourse ($P < .0011$). While 62% of military respondents (n = 141) accurately indicated that HPV is acquired and spread by oral sex, 61% of civilian respondents (n = 220) incorrectly answered that there was no such association ($P < .0001$).

Outlook and Knowledge of HPV Vaccine

Part of the study was designed to assess the respondents' knowledge and thoughts about the HPV vaccine. Most (92%) of all respondents (N = 345) correctly identified that an HPV vaccine is currently available. Of the military respondents (n = 137), 98% stated that the HPV vaccine is available now, and 2% indicated that the vaccine is not available; 89% of civilians (n = 208) responded that an HPV vaccine is available now, while a minority was either unaware of its current availability (8%) or thought that it would be available only within the next 10 years ($P < .0006$). No military respondents indicated that the vaccine would be available in 5 and 10 years.

Table 2. Respondents' Beliefs about Who Should Receive Human Papillomavirus Vaccine (in Percentages).

Ages, y	All Respondents (n = 354)	Military (n = 140)	Civilian (n = 214)
11 or 12			
Boys	0.5	0	0.9
Girls	7.0	5.7	7.9
Boys and girls	4.8	2.8	6.0
9-26			
Males	0.5	0.7	0.4
Females	33.6	40	29.4
Females and males	27.1	39.2	19.1
No age limit: females and males	11.0	4.2	15.4
I don't know	15.2	7.1	20.5

The majority of all respondents (73%) were not aware that an HPV vaccine is available for males and females aged 9 to 26 years (n = 354). Sixty-one percent of military and 81% of civilians indicated that groups other than males and females aged 9 to 26 years should receive the HPV vaccine ($P < .0001$), as indicated in **Table 2**. Ninety-six percent of MOTs (n = 139) said that the vaccine was safe and effective; 3% said it was dangerous; and 1% indicated that it might result in autism. While 85% of civilians (n = 208) believed that the HPV vaccine was safe and effective, 10% stated that it was dangerous; 3% indicated that it might result in autism; and 2% thought it could result in mental retardation ($P < .009$).

Only 19% of military respondents (n = 139) and 43% of civilian (n = 216) indicated that they had children. Just 1 military participant and 18 civilian respondents indicated that they had vaccinated their child or children. Questions about HPV vaccine eligibility revealed that 14% of military (n = 140) and 6% of civilian (n = 215) respondents were not qualified for the HPV vaccine, while 4% of military and 8% of civilian did not know if they were eligible for the vaccine. Of the 115 eligible military respondents, only 23 confirmed that they had received the HPV vaccine, and only 37 of 184 eligible civilians indicated that they had received it. Of all respondents (n = 60) who received the vaccine, the majority received all 3 doses (73%), while a few received either 2 doses (8%) or 1 (12%).

Knowledge about Oropharyngeal Cancer

Most MOT respondents (82%, n = 155) stated that they had heard of oropharyngeal cancer, while only 47% of civilian respondents (n = 313) had heard of oropharyngeal cancer ($P < .0001$). Majority of MOTs (62%, n = 130) learned about oropharyngeal cancer in school, while video media was the most common form of awareness among civilians (34%, n = 153; $P < .0001$; see **Table 3**). More than half of all respondents did not know that HPV causes oropharyngeal

Table 3. Knowledge of Oropharyngeal Cancer (in Percentages).

	All Respondents (n = 283)		Military (n = 130)		Civilian (n = 153)	
Question	Yes	No	Yes	No	Yes	No
What is your primary source of information on oropharyngeal cancer?						
Video media	24.0	75.9	12.3	87.6	33.9	66.0
Health care provider	28.6	71.3	26.9	73.0	30.0	69.9
Friends/family	19.7	80.2	8.4	91.5	29.4	70.5
Print media	18.0	81.9	13.0	86.9	22.2	77.7
Internet	25.4	74.5	23.8	76.1	26.8	73.2
School	40.6	59.3	61.5	38.4	22.8	77.1
Other	9.5	90.4	6.1	93.8	12.4	87.5
To your knowledge, what causes oropharyngeal cancer?						
Bacteria	16.6	83.3	13.8	86.1	18.9	81.0
Alcohol	16.6	83.3	21.5	78.4	12.4	87.5
HPV	36.0	63.9	49.2	50.7	24.8	75.1
Poor diet	13.0	86.9	16.9	83.0	9.8	90.2
Smoking	68.5	31.4	74.6	25.3	63.4	36.6
Pollution	23.3	76.6	31.5	68.4	16.3	83.6
Tobacco chewing	60.4	39.5	75.3	24.6	47.7	52.2

Abbreviation: HPV, human papillomavirus vaccine.

cancer. While 49% of military (n = 130) were aware that HPV causes oropharyngeal cancer, 75% of civilian (n = 153) were not informed of this association ($P < .0001$). We then wanted to assess the population awareness on the association between tobacco and oropharyngeal cancer and found that 75% of military respondents (n = 130) answered correctly while 52% of civilian respondents (n = 153) indicated that there is no association between them ($P < .0001$).

Discussion

To our knowledge, this is the first study to investigate public awareness of HPV and its association with OSCC. HPV-positive OSCC is a unique clinical disease and differs from HPV-negative OSCC in its behavior and biological characteristics.[10] In addition, >90% of patients with HPV-positive OSCC are positive for the high-risk HPV-16 strain.[1] Mounting evidence suggests that the incidence of HPV-positive OSCC is increasing worldwide and will eventually surpass cervical cancer diagnosis by the year 2020.[6] The decline in cigarette smoking has led to a decrease in non-HPV OSCC, while the incidence of HPV-positive OSCC continues to rise.[1] Periodic cervical cancer screening in females aged 21 years and older and the availability of HPV vaccine have contributed to the decline in HPV-associated cervical cancer and decline in HPV infection among women, respectively.

In 2006, the US Food and Drug Administration approved the first HPV vaccine, Gardasil. Gardasil is a quadrivalent HPV vaccine proven to be effective against low-risk HPV strains 6 and 11 and high-risk strains 16 and 18.[11] Gardasil is efficacious in prevention of cervical, vaginal, vulvar, and anal cancer[12]; it is also effective in preventing genital warts and is the only HPV vaccine tested and licensed for use in males. In 2009, the Food and Drug Administration approved a bivalent HPV vaccine against high-risk HPV strains 16 and 18, called Cervarix. Gardasil and Cervarix are given as a 3-dose series: both are safe and effective, and no causative mortality has been linked to either vaccine.[12,13] Both vaccines are currently recommended for females and males aged 9 through 26 years, and the Centers for Disease Control and Prevention recommends routine HPV vaccination for boys and girls 11 or 12 years old with either brand. Given its effectiveness in prevention of cervical, vaginal/vulvar, and anal cancer, it is plausible that the HPV vaccine will have an influence in the prevention of HPV-positive OSCC.[13] However, there is no evidence that the HPV vaccines are effective against OSCC, and current clinical investigation on HPV vaccines and their potential to prevent OSCC is ongoing.[14]

On the whole, our data revealed that most of the civilians and MOTs had heard of HPV. However, 26% of civilians and 17% of MOTs were not aware that HPV equally affects men as opposed to women alone. This finding among the MOTs was surprising since 100% of them had a bachelor's degree or higher. We found that most respondents accurately believe that HPV is related to cervical cancer, which correlates with the public's awareness of the relationship between cervical cancer and HPV. Surprisingly, the majority of all respondents (62%) inaccurately stated that HPV is not related to genital cancer, perhaps because public awareness programs usually focus on cervical cancer, since its incidence is much higher than that of other associated genital cancers. The percentage of respondents lacking knowledge on HPV and genital cancer was similar between the civilians and MOTs, at 63% and 60%, respectively. Not surprising, most people were not aware that HPV is

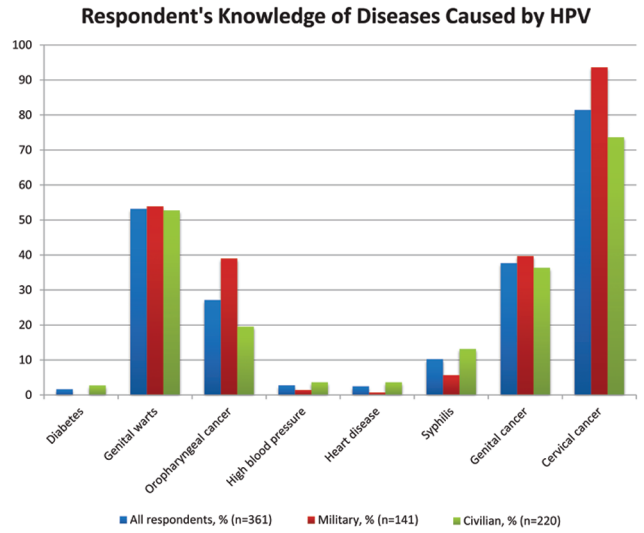

Figure 1. True diseases: genital warts, oropharyngeal cancer, genital cancer, cervical cancer.
Distractors: diabetes, high blood pressure, heart disease, syphilis.

related to oropharyngeal cancer (**Figure 1**). The lack of knowledge was high between both the civilian and MOT groups; the majority of civilian respondents were not aware of the association between HPV and oropharyngeal cancer irrespective of education level. Although most respondents were not aware of the association between HPV and oropharyngeal cancer, it was more evident in the civilian population, with 75% unaware versus 51% in the MOT population. This may be due to the higher education levels among the MOT population. Perhaps, then, awareness should be directed at the middle and high school levels, since 74% of the civilian group had a high school education. This would also address the age group with the highest incidence of HPV infection before it starts to engage in sexual behaviors including oral sex, an activity shown to be associated with HPV-16 transmission. This awareness can be incorporated into the current sexual education curriculum and discussed with education of HPV and cervical cancer.

Our result also revealed that most respondents learned about HPV-related diseases in school. An equally important but often underutilized source of information is the health care provider. Even among the MOT population, only 27% knew about oropharyngeal cancer from the health care provider. Pamphlets can be made available at primary care physicians' offices. This should also be mentioned in HPV brochures, which are targeted at cervical cancer awareness. Additionally, health care providers can improve education on HPV-related diseases apart from cervical cancer and genital warts. These data reveal that most people receive most HPV-related disease information from the school environment, and an effort to create awareness of the increasing incidence of HPV-positive OSCC should be implemented in school. Nonetheless, efforts to increase public awareness of HPV's association with OSCC should also include active involvement of the health care providers, media, and the Internet. Of the 74% of civilians who were cognizant of oropharyngeal cancer, a majority knew from video media. Thus, another effective modality of awareness can include television public service announcements and campaigns run on social media platforms such as YouTube and Facebook. Again, it would target the population with the highest incidence of OSCC: younger males.

In addition, the majority of MOTs (>60%) were aware that HPV is acquired and spread by oral sex, while only 40% were aware in the civilian group. Again, disparity in education was noted to be a factor in the civilian respondents, as most of those who were unaware that HPV is spread by oral sex had less than a bachelor's degree while all MOTs had at least a bachelor's degree or higher. Although our data indicated that a majority of all respondents were aware of the availability of the HPV vaccine, most were not aware that the eligibility of the vaccine includes both females and males aged 9 to 26 years, even among the MOT group. Safety was not an issue, as 89% of all respondents indicated that the HPV vaccine is safe and effective. Again, this suggests that educational awareness needs to improve. This can all be incorporated into sexual education for prepubescent and young adults. Our study revealed that respondents (68%) indicated that they would get the HPV vaccine if it was free and they were eligible. This highlights the importance of public awareness.

Limitations of our study include recruitment of civilian respondents in only the Harrisburg area, which may not reflect the entire US population.

Conclusion

This study revealed limited knowledge of the association between HPV and OSCC and the necessity for effective and efficient educational awareness for the US population. The HPV vaccine has been shown to prevent cervical, vaginal, vulvar, and anal cancer in addition to genital warts. However, whether an HPV vaccine will prevent OSCC is yet to be determined, and current research is ongoing. However, both available HPV vaccines immunize against HPV-16, one of the high-risk subtypes associated with other reproductive organ cancers. Recent studies indicate that although head and neck surgeons do not consider the HPV vaccination discussion with patients their primary role, they are willing to educate their patients and families about OSCC prevention.[15] Brochures on HPV and OSCC can also be incorporated in the waiting areas of otolaryngologist offices. This desire by the head and neck surgeon will be intensified if it can be proven that the HPV vaccine prevents OSCC. Primary care physicians play a role in encouraging vaccination, especially among their male patients. It is promising that family doctors and pediatricians are active in discussing HPV vaccine with their adolescent male and female patients.[16]

Author Contributions

Michael U. Williams, data collection, data analysis, manuscript writing; **Michele M. Carr**, data analysis, manuscript review; **David Goldenberg**, data analysis, manuscript review.

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Supplemental Material

Additional supporting information may be found at http://otojournal.org/supplemental.

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