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Practice patterns and knowledge among California pediatricians regarding human papillomavirus and its relation to head and neck cancer☆

Michael H. Berger, Yarah M. Haidar, Benjamin Bitner, Monica Trent, Tjoson Tjoa*

University of California, Irvine Department of Otolaryngology Head and Neck Surgery, United States of America

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ABSTRACT

Objective: To identify practice patterns regarding human papillomavirus (HPV) vaccination efforts and vaccination rates in context of head and neck cancer prevention, identify barriers to vaccination, and identify gaps in knowledge regarding the link between HPV and head and neck cancer in the pediatrician population.
Study design/Methods: A 27-question cross-sectional survey was distributed to members of the four California chapters of the American Academy of Pediatrics.
Results: Of the completed responses, 89.4% identified as "always" recommending the HPV vaccine to patients, but only 19.5% of pediatricians estimated that > 75% of their eligible patients had completed the HPV vaccination series. 71.5% of respondents felt that further education about HPV's link to head and neck cancer them more comfortable discussing vaccination. Physicians who were in practice longer were less likely to respond that additional education about HPV and its link to head and neck cancer would make them more comfortable discussing vaccination with patients ($p = 0.043$). Physicians who were in practice longer were more likely to correctly respond that HPV type 16 is the most common strain linked to head and neck cancer ($p = 0.021$).
Conclusion: There is need to improve both the knowledge base and comfort level of pediatricians in counseling their patients during vaccine recommendations. Otolaryngologists have a critical role in providing education to physicians, trainees, and the general public in the effort to combat the epidemic of HPV-associated head and neck cancer.

1. Introduction

The Human Papillomavirus (HPV) is the most common sexually transmitted infection in the United States [1]. HPV has long been associated with cervical, vaginal, vulvar, anal, and penile cancer, and more recently has been found to have an association with oropharyngeal cancers, with a markedly increasing incidence [2–4].

A prophylactic vaccine against HPV has been recommended by the Advisory Committee on Immunization Practices since 2006 for girls for the prevention of cervical cancer and since 2011 for boys for the prevention of anal cancer [5]. Recent studies have demonstrated that the HPV vaccine has efficacy in decreasing the prevalence of oral HPV infection [6–8]. However, despite the demonstrated link between HPV and malignancy and despite the suggested efficacy of the vaccine, vaccination rates are still low [9].

Studies have consistently shown that one of the strongest factors relating to parental acceptance of a vaccine is a recommendation from the physician [10–13]. It stands to reason that provider awareness regarding HPV's link with head and neck cancer aids in providing effective counseling to patients regarding the importance of vaccination. In a recent statewide survey to pediatricians, it was found that most responding providers were unaware that HPV-related oropharyngeal cancer primarily affects males and that HPV-related oropharyngeal cancer in males is as common as HPV-related cervical cancer in females [14]. In our study, we aimed to further elucidate the extent of knowledge regarding HPV and its link to head and neck cancer, identify barriers to vaccination, and evaluate vaccination practices through a survey to pediatricians practicing in California.

2. Materials and methods

A cross-sectional survey was distributed to active members of the four California chapters of the American Academy of pediatricians. The survey was distributed via email or included in an e-newsletter by

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* Corresponding author at: University of California, Irvine Department of Otolaryngology – Head and Neck Surgery, 101 the City Drive South, Building 56, Suite 500, Orange, CA 92868, United States of America.
E-mail address: tjoat@uci.edu (T. Tjoa).

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representatives from each chapter. A cover letter describing the contents and purpose of the survey was included with the link to the web-based survey. Two reminder emails were sent to each chapter. Surveys were completed online anonymously without any identifying information asked of respondents.

There were 27 total questions included in the survey and were written in a multiple-choice format. Questions were grouped into 4 categories: 1) questions designed to identify the respondent's practice location/population, 2) questions designed to identify respondent's population's level of vaccination 3) questions to identify barriers to vaccination, and 4) questions designed to assess respondent's knowledge about HPV and its link to oropharyngeal cancer. Data analysis was performed with Microsoft Excel (Microsoft Corp., Redmond, WA) and SPSS v25 (IBM Corp., Armonk, NY) using Pearson chi-squared testing with Cochran-Armitage trend testing performed on ordinal data. Statistical significance was determined with a $p < 0.05$. This study received exemption by the University of California, Irvine Institutional Review Board.

3. Results

There were 132 total respondents. All respondents were members of California branches of the American Academy of Pediatrics. Nine respondents were excluded from analysis as those individuals started the survey but did not complete it. Demographic information of the respondents who completed the entire survey are summarized in Table 1. The majority of respondents had been in private practice (54.5%) for over 20 years (52.0%).

Regarding practice patterns in relation to vaccination against HPV (see Table 2), most respondents reported "always" recommending the HPV vaccine to patients (89.4%), however a lower percentage (72.4%) reported that HPV's link to HNC influenced their vaccination recommendation, and a majority of respondents (62.1%) reported not offering educational material regarding HPV and its relation to HNC in their respective practices. A small proportion (5.4%) of the respondents were not aware of the link between HPV and HNC. Most respondents reported that they would not be more likely to offer the HPV vaccine to their female patients (81.3%). The vaccination most commonly offered was Gardasil-9 (87.8%) at ages 11–12 (84.6%). Only 19.5% of pediatricians estimated that > 75% of their eligible patients had completed the HPV vaccination series.

Table 1
Demographics of respondents' practices.

Years in Practice	0–5 years: 17.1% (N = 21) 6–10 years: 14.6% (N = 18) 11–15 years: 9.8% (N = 12) 16–20 years: 6.5% (N = 8) > 20 years: 52.0% (N = 64)
Type of Practice	Private: 54.5% (N = 67) Community: 18.7% (N = 23) Academic: 11.4% (N = 14) Managed Care: 15.4% (N = 19)
Location of Practice	Urban, inner city: 18.7% (N = 23) Urban, not inner city: 75.6% (N = 93) Rural: 5.7% (N = 7)
Proportion of patients who are members of Medicaid	< 10%: 38.2% (N = 47) 10–29%: 22.8% (N = 28) 30–50%: 10.6% (N = 13) > 50%: 28.5% (N = 35)
Proportion of patients aged 10–18	< 10%: 2.4% (N = 3) 10–29%: 43.1% (N = 53) 30–50%: 47.2% (N = 58) > 50%: 7.3% (N = 9)
Proportion of Black/African-American Patients in Practice	< 10%: 74.0% (N = 91) 10–29%: 22.0% (N = 27) 30–50%: 4.1% (N = 5) > 50%: 0% (N = 0)
Proportion of Hispanic/Latino Patients in Practice	< 10%: 13.0% (N = 16) 10–29%: 43.1% (N = 53) 30–50%: 22.0% (N = 27) > 50%: 22.0% (N = 27)
Proportion of Asian Patients in Practice	< 10%: 34.1% (N = 42) 10–29%: 54.5% (N = 67) 30–50%: 9.8% (N = 12) > 50%: 1.6% (N = 2)
Proportion of White/Caucasian Patients in Practice	< 10%: 21.1% (N = 26) 10–29%: 38.2% (N = 47) 30–50%: 26.0% (N = 32) > 50%: 14.6% (N = 18)

N = 123.

The most common barriers to vaccination were "parents are opposed for safety reasons", "parents are unconvinced that the HPV vaccine confers benefit", and "parents are opposed to the HPV vaccine for ethical or spiritual reasons" (see Table 3 for a summary of barriers to vaccination). Regarding the link to HNC (see Table 4), most respondents knew the oropharynx is the most common primary site of HPV-related HNC (71.5%) and estimated that the latency period between initial HPV infection and the development of HPV-related HNC was 10–30 years (75.6%). However, only 46.3% of respondents were aware that HPV 16 is the most commonly implicated strain in HNC. When asked if further education about HPV and its link to HNC would make respondents more comfortable discussing HPV vaccination, 71.5% answered "yes".

Using Cochran-Armitage trend testing on ordinal data, there was a statistically significant correlation in that physicians who were in practice longer were less likely to respond that additional education about HPV and its link to head and neck cancer would make them more comfortable discussing HPV vaccination with patients ($p = 0.043$). Additionally, physicians who were in practice longer were also more likely to correctly respond that HPV type 16 is the most common strain of HPV linked to head and neck cancer ($p = 0.021$).

4. Discussion

The rate of HPV-related oropharyngeal cancer is increasing markedly [15], with HPV now estimated to cause approximately 70–90% of oropharyngeal cancers [16]. While oropharyngeal cancer is projected to be more common than cervical cancer in the United States by the year 2020 [15], knowledge regarding HPV's link to oropharyngeal cancer is still limited among medical specialties. One manifestation of this is lower rates of vaccination for HPV than for other common virally-transmitted diseases, despite a clear link between HPV vaccination and decreased rates of oral HPV infection [6]. Based on the 2017 Centers for Disease Control (CDC) vaccination coverage data, only 48.6% of adolescents aged 13–17 have completed the recommended 3 doses of the HPV vaccine, which is in stark contrast to those vaccines against tetanus diphtheria acellular pertussis (88.7% adolescents up to date), measles mumps rubella (92.1% up to date), and hepatitis B (91.9% up to date) [9].

This study demonstrates that while almost all of the responding pediatricians recommend the HPV vaccine to their patients, there are barriers preventing vaccination completion, and a desire for increased education regarding the link between HPV and oropharyngeal cancer. Specifically, despite that almost 90% of respondents always recommending the HPV vaccine to their patients, only 19.5% estimated that > 75% of their eligible patients had completed the HPV vaccine series. This low vaccination rate noted in our study is consistent with recent CDC estimates that only 53.4% of adolescents have completed the HPV vaccine in the state of California [9]. Previous studies have endorsed that a major barrier to vaccination is lack of recommendation in favor of the vaccine from providers [17]. However, in our study almost all of the respondents did recommend the vaccine, so other barriers exist.

Frequently cited barriers to HPV vaccination in the literature

Table 2
Practice patterns of respondents in regard to HPV vaccination.

How Often Do You Recommend the HPV Vaccine to Your Patients?	Never: 0.8% (N = 1) Rarely: 0% (N = 0) Sometimes: 1.6% (N = 2) Very Often: 8.1% (N = 10) Always: 89.4% (N = 110)
Do you offer any educational material regarding HPV and its relation to head and neck cancer in your practice?	Yes: 37.9% (N = 47) No: 62.1% (N = 77)
Does the link between HPV and head and neck cancer influence your decision to recommend the HPV vaccine to your patients?	Yes: 72.4% (N = 89) No: 27.6% (N = 34)
Are you more likely to recommend the HPV vaccine to your female patients?	Yes: 18.7% (N = 23) No: 81.3% (N = 100)
How often do you discuss the link between HPV and head and neck cancer with your female patients in comparison to your male patients	F > M: 0% (N = 0) M > F: 19.5% (N = 24) Equally: 53.7% (N = 66) Not discussed: 26.8% (N = 33)
Which HPV vaccine do you offer your patients?	Gardasil: 9.8% (N = 12) Gardasil-9: 87.8% (N = 108) Cervarix: 0 (N = 0) None: 2.4% (N = 3)
At what age do you first offer the vaccine?	< 11: 13.0% (N = 16) 11–12: 84.6% (N = 104) 13–18: 1.6% (N = 2) > 18: 0% (N = 0) Not offered: 0.8% (N = 1)
What percentage of patients have completed the HPV vaccine series?	< 25%: 8.1% (N = 10) 25–50%: 33.3% (N = 41) 50–75%: 39.0% (N = 48) > 75%: 19.5% (N = 24)

Table 3
Barriers to HPV vaccination.

How often do the following statements represent barriers to vaccination in your practice?	
Parents unconvinced that HPV vaccine confers benefit	Never: 2.4% (N = 3) Rarely: 17.9% (N = 22) Sometimes: 57.7% (N = 71) Very Often: 21.1% (N = 26) Always: 0% (N = 0)
Insurance fails to cover the HPV vaccine	Never: 74.8% (N = 92) Rarely: 21.1% (N = 26) Sometimes: 4.1% (N = 5) Very Often: 0% (N = 0) Always: 0% (N = 0)
HPV vaccine is not adequately reimbursed	Never: 69.9% (N = 86) Rarely: 20.3% (N = 25) Sometimes: 7.3% (N = 9) Very Often: 2.4% (N = 3) Always: 0% (N = 0)
HPV vaccine is too expensive for practice to purchase	Never: 83.7% (N = 103) Rarely: 7.3% (N = 9) Sometimes: 6.5% (N = 8) Very Often: 0.8% (N = 1) Always: 0.8% (N = 1)
Parents opposed to the HPV vaccine for safety reasons	Never: 3.3% (N = 4) Rarely: 21.1% (N = 26) Sometimes: 51.2% (N = 63) Very Often: 22.8% (N = 28) Always: 1.6% (N = 2)
Parents opposed to HPV vaccine for ethical or spiritual reasons	Never: 12.2% (N = 15) Rarely: 35.8% (N = 44) Sometimes: 34.1% (N = 42) Very Often: 17.1% (N = 21) Always: 0.8% (N = 1)
It takes too long to discuss HPV vaccination with parents	Never: 52.8% (N = 65) Rarely: 31.7% (N = 39) Sometimes: 13.8% (N = 17) Very Often: 1.6% (N = 2) Always: 0% (N = 0)
There is a language barrier interfering with adequate counseling about the HPV vaccine	Never: 58.5% (N = 72) Rarely: 33.3% (N = 41) Sometimes: 5.7% (N = 7) Very Often: 2.4% (N = 3) Always: 0% (N = 0)

Table 4
HPV knowledge questions posed to providers.

Are you aware of the link between HPV and head and neck cancer?	Yes: 79.0% (N = 98) Now that I am reminded of it, yes: 14.5% (N = 18) I am aware of the supposed link, but I am not convinced: 0% (N = 0) I was not aware of this: 5.6% (N = 7)
Do you offer any educational material regarding HPV and its relation to head and neck cancer in your practice?	Yes: 38.2% (N = 47) No: 61.8% (N = 76)
Are you comfortable discussing HPV and HPV vaccination with your patients?	Yes: 98.4% (N = 122) No: 0.8% (N = 1)
Considering the annual number of HPV-related cancers in the U.S., would you say these occur:	Only F: 0% (N = 0) Mostly F: 54.5% (N = 67) Equal: 43.1% (N = 53) Mostly M: 2.4% (N = 3) Only M: 0% (N = 0)
Considering the annual number of HPV-related head and neck cancers in the U.S., would you say these occur:	Only F: 0% (N = 0) Mostly F: 4.9% (N = 6) Equal: 61.0% (N = 75) Mostly M: 34.1% (N = 42) Only M: 0% (N = 0)
Which of the following do you feel is the most common location for HPV-related head and neck malignancy?	Sinonasal: 0% (N = 0) Oral cavity: 11.4% (N = 14) Oropharynx: 71.5% (N = 88) Neck: 13.0% (N = 16) Larynx: 4.1% (N = 5)
What is the typical latency period between HPV infection and head and neck cancer presentation	No latency period: 0% (N = 0) 0–10 years: 13.8% (N = 17) 10–30 years: 75.6% (N = 93) 30–50 years: 10.6% (N = 13) > 50 years: 0% (N = 0)
Which strain of HPV is most associated with head and neck cancer?	Type 1: 4.1% (N = 5) Type 6: 25.2% (N = 31) Type 11: 16.3% (N = 20) Type 16: 46.3% (N = 57) Type 18: 8.1% (N = 10)
Would further education on the link between HPV and head and neck cancer make you more comfortable discussing HPV vaccination with your patients?	Yes: 71.5% (N = 88) No: 28.5% (N = 35)

include parental concern about the vaccine's safety, parental concerns of the vaccine's effect on altering sexual behavior, the perception that the risk of HPV infection is low, and vaccine cost [17]. The respondents in our study did endorse similar barriers. The two most frequently reported barriers were that parents were unconvinced of the benefit of the vaccine and parents were opposed of the vaccine for safety reasons. These barriers are likely directly related to poor education and lack of awareness of the benefit of the HPV vaccine and lack of awareness of the long-term consequences of HPV infection, particularly in relation to head and neck cancer. Indeed, a survey of adults in the United States revealed that only 0.8% identified HPV as a risk factor for head and neck cancer and only 12.8% noted the association when specifically asked about it [18].

It has been consistently shown that provider recommendation is among the most important factors to increase vaccine uptake in the United States [10–13], and Gilkey demonstrated that while high-quality recommendation from providers was strongly associated with increased vaccine uptake, only 36% of parents felt they were getting a high-quality recommendation [19]. In order to best counsel patients about the benefit of the HPV vaccine, particularly in relation to head and neck cancer prevention, it is critical that providers have a strong knowledge base.

Unfortunately, previous studies have demonstrated knowledge gaps among providers regarding HPV's link to head and neck cancer. Rohrbach and Wieland surveyed Wisconsin pediatricians and found that most were not aware that HPV-related oropharyngeal cancer primarily affects males nor were they aware of the rising incidence of HPV-related oropharyngeal cancer [14]. Furthermore, when informed that HPV-mediated oropharyngeal cancer was as common has HPV-mediated cervical cancer, half of responding providers then reported they'd be more likely to recommend the vaccine to their male patients. Similarly, we found that only 34.1% of respondents correctly noted that HPV-related oropharyngeal cancer is most common in males. Interestingly, Rohrbach and Wieland additionally noted that respondents who were in practice for > 10 years were more likely to highly rate their knowledge of HPV's link to oropharyngeal cancer than respondents who were in practice for < 10 years [14]. This experience-based stratification is similar to the results of a survey to Turkish pediatricians that found older physicians had greater knowledge about HPV and HPV vaccination [20]. Our results also suggest an experience-based correlation in that the longer a respondent had been in practice, the more likely they were to correctly identify HPV type 16 as the most commonly implicated strain in head and neck cancer ($p = 0.043$). Additionally, the longer a respondent had been in practice, the less likely they were to feel that additional education regarding HPV's link to head and neck cancer would make them feel more comfortable discussing the vaccine with their patients ($p = 0.021$). These findings thus suggest that younger providers are disproportionately affected by knowledge gaps on this issue.

Indeed, the literature supports that young physicians are affected by knowledge gaps regarding HPV's link to head neck cancer. In a survey of pediatrics residents, fellows, and attendings at a tertiary care hospital, 68.3% of respondents rated their prior education as “none” or “fair” on HPV's role in oropharyngeal cancer and 52.9% reported never discussing oropharyngeal cancer when providing HPV counseling to their patients [21]. A recent study suggests lack of emphasis within medical school curricula as one of the root causes of knowledge gaps in young providers regarding HPV's link to head and neck cancer. A survey of medical students from 10 medical schools in New York state revealed that only 47.2% of medical students are aware of HPV's link to head and neck cancer [22]. One potential way to widely increase awareness of the association between HPV and head and neck cancer would be to adjust medical school curricula so that graduating physicians are better equipped to provide well-informed recommendations to their patients.

Efforts to increase HPV's vaccination rate will need to be multifaceted. Adding updated information about the importance of head and neck manifestations of HPV to medical school curriculum is necessary. It is equally imperative to improve education for providers already in practice. Krantz et al. successfully increased HPV vaccination rates through various quality improvement measures, including organizing didactics for providers regarding HPV and creating “pocket cards” on HPV facts and statistics to help physicians counsel patients [23]. The otolaryngologist should have a role in the development of such educational material to those specialties in the position to provide the HPV vaccine.

The otolaryngologist can also have a more direct impact on increasing HPV vaccination rates. Laitman et al. and Todd et al. in a recent commentary and response noted that pediatric and general otolaryngologists see many vaccine-eligible patients in their practices and thus should consider providing the vaccine to these patients [24,25]. Yet, the most impactful intervention to increase HPV vaccination rates may be advocacy for national policy change. In Australia, free HPV vaccination is offered in schools and has been offered since 2007 via a nationally funded program. Based on the most recently published data from Australia, 78.6% of female adolescents and 72.9% of male adolescents had completed the HPV vaccine series, which is a considerably higher rate than what is currently found in the United States [26]. As Todd et al. recently suggested, one of the major roles otolaryngologists should play in the effort to increase HPV vaccination rates is to advocate for health policy changes on a national level [27].

Otolaryngologists have a unique and important perspective on the long-term sequela of HPV infection in the head and neck. By sharing that knowledge with policy makers, otolaryngologists may help enact important changes in HPV vaccination policy.

Our study does have limitations that must be considered. For one, the number of respondents is relatively low, but the response rate is difficult to determine. The method by which the survey was distributed was inconsistent. Two chapters distributed the survey via an e-newsletter. One chapter distributed the survey through a dedicated email to all members of the respective mailing list. Another chapter did not specify how the survey was distributed. As the survey was embedded in an e-newsletter in at least half of the chapters, we are unable to determine how many members of each chapter actually saw the survey and decided to respond or not to respond. Additionally, there is a selection bias in those who decided to respond to the survey. Regardless, the results of the survey demonstrate both a desire and need for education among pediatricians on the association of HPV with head and neck cancer.

5. Conclusion

The current HPV-associated oropharyngeal cancer epidemic may be entirely reversible and eventually preventable with improved vaccination practices. There are multiple barriers preventing HPV vaccination from reaching widespread acceptance comparable to other common childhood vaccines. Studies repeatedly show that one of the major factors in a parent's decision to vaccinate their child is a strong recommendation from a physician. The results of this survey of California pediatricians demonstrate that opportunities exist to improve both the knowledge base and comfort level of pediatricians in counseling their patients during vaccine recommendations. Otolaryngologists are perhaps the most knowledgeable clinicians on the long-term implications of HPV infection in the head and neck and it is critical that we share that knowledge with medical students, with our primary care colleagues, with policymakers, and with the general public. By providing such education, we will have a critical role in the multifaceted approach required to address this public health crisis.

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