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Oral HPV prevalence and HPV vaccination among special needs population in the US

Siddardha G. Chandrupatla[a,*], Isma Khalid[b], Mary Tavares[c]

[a] Part-time Faculty, Dept. of Oral Health Policy and Epidemiology, Harvard School of Dental Medicine, USA
[b] Resident, Pediatric Dentistry, Henry M. Goldman School of Dental Medicine, Boston University, USA
[c] Dental Public Health, Oral Health Policy and Epidemiology, Harvard School of Dental Medicine, USA

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ABSTRACT

Introduction: Special needs population have barriers accessing healthcare, higher incidence of sexual assaults and lower sexual education. Due to the above this study was conducted- 1) To assess the current prevalence of oral HPV infection among individuals with SHCN (special health care needs) as compared to the general population and 2) To compare the prevalence of HPV vaccination in SHCN individuals (within the recommended age groups) to general population.

Methods: This data was obtained from NHANES 2013-14 and included 665 individuals with special needs. Weighted prevalence estimates and prevalence ratios (PR) were calculated for oral HPV infection by gender, age (18–59 years), race, smoking history, economic status, and sexual behavior. Prevalence rates were calculated for HPV vaccination.

Results: Oral HPV was detected in 9% (7.1–11.5; p = 0.05) of special needs adults. High-risk HPV genotypes prevalence was also higher among adults with special needs [5.56% (3.9–7.9) vs 3.87% (2.7–5.4)]. The HPV vaccination rates among 9–26 years special needs females (33.5% vs 37%) and males aged 9–21 years (16.7% vs 21.2%) with special needs was lower than non-special needs individuals.

Conclusion: There is higher burden of oral HPV infection among adults with special needs compared to general population. Contrastingly, lower vaccination rates were observed among them within the recommended age groups. Further studies are required to determine the barriers to HPV vaccination among individuals with special needs.

1. Introduction

Human Papillomavirus (HPV) has been well established as the most common cause for cervical, Oropharyngeal cancers (OPC), and a subset of anogenital cancers [1–3]. Studies have established a causal relation between OPC and the presence of HPV [4–6]. The HPV- 16 strain is detectable in almost 90% of HPV related OPC cases [7–9]. The incidence of HPV related cancers has increased worldwide in the last decade.

Developing HPV related OPC has predictably shown a strong association to sexual activity [10]. Lifetime number of sexual partners and oral sex activities were strongly associated with HPV cancers [6,11]. Among those who have one to five sexual partners, the odds of HPV-OPC increase by two times, and five times among those who have six or more partners [5]. The incidence of HPV related OPC among younger age groups, men, and non-Hispanic whites have increased due to changes in sexual practices [10,12].

The American Academy of Pediatric Dentistry (AAPD) defines special health care needs (SHCN) as “any physical, developmental, mental, sensory, behavioral, cognitive, or emotional impairment or limiting condition that requires medical management, health care intervention, and/or use of specialized services or programs. The condition may be congenital, developmental, or acquired through disease, trauma, or environmental cause and may impose limitations in performing daily self-maintenance activities or substantial limitations in a major life activity” [13]. Studies have indicated higher level of sexual abuse and victimization among individuals with SHCN [14–19]. Individuals with SHCN have low sexual esteem, acceptance, and knowledge of sex compared to non-special needs individuals [20,21]. The combination of lower sexual knowledge, higher frequency of sexual assaults, and a difficulty to access health care facilities [22,23] places the individuals with SHCN at a higher risk of acquiring sexually transmitted diseases.

* Corresponding author. 188 Longwood Ave, Oral Health Policy and Epidemiology, Boston, MA, 02115, USA.
E-mail addresses: sgc4060@gmail.com, sc406@hsdm.harvard.edu (S.G. Chandrupatla).

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Recent studies have shown a decrease in HPV prevalence among general population and the increasing utilization of HPV vaccinations among adolescents and younger adults [24,25]. These studies have shown the efficacy of HPV vaccination in preventing HPV transmission. There is a higher risk of sexual assaults and lower sexual knowledge, but there are no nationally representative studies in the US that indicate the current prevalence of oral HPV and uptake of HPV vaccine among individual with SHCN. We undertook this study to 1) estimate the prevalence of Oral HPV infection among adults with SHCN and 2) to compare the HPV vaccine (within the recommended age groups) uptake among the individuals with SHCN to the general population.

2. Materials and methods

2.1. Study design and HPV genotyping

In this study, we used the publicly available National Health and Nutrition Examination Survey (NHANES) 2013-14 dataset for the analysis. NHANES is conducted among a nationally representative non-institutionalized civilian US population. The demographics, vaccination history, and sexual behavior questionnaires were recorded. Oral HPV rinse samples were collected at the examination site by NHANES examiners. Purified DNA samples were analyzed for 37 types of HPV via Roche Linear Array HPV Genotyping Test and the Roche Linear Array Detection Kit. This test helps to determine the presence of 14 high-risk HPV genotypes and 23 low-risk HPV genotypes.

2.2. Statistical analysis

The population prevalence values were reported as weighted counts and percentages for the presence of estimated oral HPV infection among a subsample of individuals aged 18–59 years who have SHCN. Sample weights were used to account for the complex survey design. A chi-square test was used to measure the association of selected demographic and presence of oral HPV infection. The presence of oral HPV infection was defined by the variable ORXHPV that was based on the results from the Roche Linear Array HPV Genotyping Test. The disability survey recorded whether the individual had serious hearing, vision (even with corrective lens), walking, dressing, and/or bathing difficulties. A positive response for any of the above variables was coded as having a physical disability. A positive response for having serious difficulty in concentrating, remembering, or making decisions because of a physical, mental, or emotional condition was coded as having a intellectual disability. Positive answers to both questions were coded as having both (physical & intellectual) disabilities. Multivariable logistic regression was used to determine the prevalence ratios of oral HPV infection. All analyses were conducted using STATA 13.0 version. Differences with P values of < 0.05 were considered statistically significant.

3. Results

Table 1 describes the demographic features of the population with SCHN and without SCHN based on the presence of Oral HPV infection, aged 18–59 years. About 9% of the people, aged 18–59 years, have oral HPV infection. This is significantly different ($p = 0.04$) from the population who do not have any special needs (6.7%). The prevalence of HPV was significantly higher among males compared to women in both the categories ($p = 0.008$ & < 0.0001). The prevalence was significantly higher among African Americans compared to all the other races among SCHN ($p = 0.009$). HPV prevalence was higher among current smokers compared to those who never smoked and individuals who had smoked in the past ($p = 0.017$). Socio-economic status did not show any association to oral HPV infection. As oral HPV is associated with sexual behavior, it showed higher prevalence among those who have had any form of sexual intercourse compared to those who have never partaken ($p = 0.01$).

Table 2 shows the unadjusted and the adjusted prevalence ratios of oral HPV presence and associated factors among SCHN individuals. The prevalence of oral HPV infection was significantly higher among men (adjusted PR = 2.74, $p = 0.02$) compared to women. African Americans had higher odds of oral HPV compared to non-Hispanic Whites (APR = 2.7, $p = 0.05$). Hispanics had higher adjusted prevalence ratio (APR = 1.4) and other races had a lower prevalence ratio (0.44), but were not significant. Smoking behavior had a significant association to oral HPV. Subjects who had sexual encounters with one to four partners (APR = 4.4, $p = 0.22$) had higher prevalence ratios compared to those who have never had sexual encounters. Subjects who had more than five lifetime partners had adjusted prevalence ratios of 11.01 ($p = 0.02$). Those who ever performed oral sex had higher prevalence ratio (PR = 1.42) compared to those who never performed oral sex, but was not significant ($P = 0.6$).

Table 3 describes the prevalence of high-risk HPV presence among the special needs population. High-risk oral HPV genotypes were found in 5.5% of the subjects compared to 3.8% of the non-special needs population ($p = 0.15$). Males and females with special needs had a higher prevalence of high-risk HPV. Males with SHCN had a 7.7% prevalence of high-risk oral HPV compared to the 6.6% prevalence of the general population, but was not significant. There was a significantly higher prevalence of high-risk HPV among special needs women (3.6%) compared to the 1.5% prevalence among the general population ($p = 0.004$).

Table 4 represents the HPV vaccination rates among the nine to 26 year old population. The analysis was completed among this age group that was recommended by the Advisory Committee on Immunization Practices (ACIP) and the CDC for HPV vaccinations. Among females with SHCN, 32% were vaccinations compared to 37% of the general population. Among males with SHCN, 16% had been vaccinated compared to 21% in the general population. The vaccination rates are slightly lesser among the special needs population but the findings are not statistically significant.

4. Discussion

The overall prevalence of oral HPV infection among adults with SHCN is about 9% (7.1–11.5), which is significantly greater than the general population (6.7%; $p = 0.05$). This approximates to 2.5 million Americans with SHCN. We found a higher prevalence in men than in women. The gender difference is consistent with the prevalence of oral HPV among people without SHCN [26]. Prevalence of high-risk HPV genotypes was also higher among adults with SHCN.

People with SHCN may have lower sexual self-esteem, partners, knowledge, and acceptance[19–20]. Although sexual encounters may be less among people with disabilities, previous studies have highlighted their vulnerability to physical and sexual assaults [13–18]. This increased vulnerability supports the need for more proactive vaccination among people with SHCN. Previous studies have established the role of oral sex and oral HPV. Our study results show that those who performed oral sex on a partner had higher prevalence of oral HPV (8.7%) compared to those who did not (6.2%, $p = 0.6$).

Smoking and intensity of smoking are associated with HPV infection. Smokers have higher HPV viral load compared to non-smokers. Smoking also increases the risk of viral persistence, which is a key factor for malignancy development [27,28]. Smoking can cause immunosuppression by decreasing the number of Langerhans cells and helper T lymphocytes, which suggests the independent role of smoking towards HPV related neoplasia [29–31]. Consistent with other previous studies [10,12], our study results show that current and past smokers have higher chances of contracting oral HPV. Previous studies conducted that among the general population, the use of marijuana and alcohol as predictors for oral HPV infection was inconsistent [11,12,32]. Our study also did not show any significance for the above

Table 1
Prevalence of Oral Human Papillomavirus (HPV) Infection Among Men and Women with special health care needs (SHCN) and non-SHCN, aged 18–59 years, National Health and Nutrition Examination Survey, 2013–14.

	Among SHCN			Non-SCHN		
	Weighted Percentage	(95% CI)	P-value	Weighted Percentage	(95% CI)	P-value
Total	9.07	(7.1–11.5)		6.7	(5.1–8.8)	0.04
Age						
18–27	7.71	(4.3–13.3)	0.44	5.26	(3.2–8.4)	0.06
28–39	7.27	(4.2–12.1)		6.28	(4.5–8.6)	
40–49	12.78	(6.5–23.5)		6.42	(4.4–9.2)	
50–59	8.36	(4.7–14.2)		9.67	(6.2–14.6)	
Gender						
male	13.45	(9.4–18.9)	0.008	10.76	(8.1–14.2)	< 0.0001
female	5.08	(3.0–8.8)		2.75	(1.8–4.1)	
Type of disability						
Physical	9.21	(5.4–15.2)	0.88	–	–	
Intellectual	8.07	(4.6–13.6)		–	–	
Both	9.93	(5.5–17)		–	–	
Race						
Non-Hispanic white	8.11	(5.7–12)	.009	7.44	[5.2–10.5)	0.08
Non-Hispanic black	17.46	(10.2–28.5)		7.52	(5.8–9.6)	
Hispanic	7.84	(5.5–11)		5.02	(3.2–7.5)	
Other	2.77	(0.8–8.8)		4.44	(2.7–7.1)	
smoking						
Never smoker	6.06	(3.6–10.3)	0.017	4.59	(3.2–4.4)	< 0.0001
Past smoker	6.70	(3.7–12)		8.35	(5.9–11.7)	
Current smoker	13.88	(9.7–20.4)		12.18	(8.2–17.8)	
Ever had oral, vaginal or anal sex						
Yes	8.56	(6.3–11.8)	0.012	6.91	(5.1–9.2)	0.09
No	0.92	(.0.1–7.4)		2.24	(0.5–8.8)	
Income poverty ratio						
< =1	9.61	(5.7–16.6)	0.89	7.81	(5.9–10.2)	0.80
> =1 to < =2	9.52	(4.6–20)		6.32	(3.5–10.9)	
> =2 to < =3	9.85	(3.2–26.8)		6.36	(3.7–10.7)	
> =3	7.10	(3.3–14.6)		6.65	(4.5–9.5)	

Table 2
Prevalence ratios of HPV prevalence among special needs population in the US-2013-14.

	Unadjusted prevalence ratio of Oral HPV infection	p- value	Adjusted Prevalence ratios	p-value
Sex				
Female	1.00		1.00	
Male	2.90	0.01	2.74	0.021
Race				
Non-Hispanic White	1.00		1.00	
African American Descent	2.39	0.02	2.72	0.05
Hispanic	0.96	0.89	1.39	0.30
Others	0.32	0.07	0.44	0.26
Smoking status				
Never Smoker	1.00		1.00	
Former Smoker	1.11	0.76	0.87	0.751
Current smoker	2.49	0.02	2.48	0.023
Sexual activity				
No. of lifetime sex partners				
Never had sex	1.00		1.00	
1 to 2 partner	3.40	0.30	4.35	0.23
3–4 partners	3.66	0.311	4.47	0.22
5 or more partners	13.60	0.021	11.01	0.019
Ever performed oral sex				
No	1.00		Omitted	
Yes	1.42	0.608		

among the population with SHCN (results not shown).

HPV vaccination, under optimistic conditions, has shown to be highly cost effective. Inclusion of males up to 21 years, women and gay men up to 26 years in vaccination programs have showed better QALY gain [33–36]. The Advisory Committee on Immunization Practices (ACIP) recommends routine HPV vaccination for 11 and 12 year old children. HPV vaccination can be started as early as nine years of age. As a catch-up vaccination recommendation, males up to 21 years and females up to 26 years of age should be vaccinated. Immunocompromised individuals and children with sexual abuse history can be vaccinated up to the age of 26 years according to this recommendation [37]. In our analysis, we have determined that HPV vaccination rate among the individuals with SHCN is lower than in the general population. Females aged 9–26 years and males aged 9–21 years with special needs had a vaccination rate of 32% (vs 37%) in females and 16% (vs 21%) in males. Previous studies have also indicated the lower vaccination rates; however, these studies were limited to small sample size and geography [38–41].

Table 3
High risk HPV oral infection prevalence.

	Special needs status		
	Yes- % (CI)	No (CI)	P-value
Females	3.69% (1.8–7.1)	1.15% (0.8–1.6)	0.004
Males	7.74% (4.1–14.1)	6.62% (4.5–9.5)	0.68
Total	5.56% (3.9–7.9)	3.87% (2.7–5.4)	0.16

Table 4
HPV vaccination rates among special needs population. Females between 9 years and 26 years and males 9–21 Years.

Gender	Special needs status		
	Yes (CI)	No (CI)	P-value
Females	33.55% (22.9–46)	37.18% (31.7–42.9)	0.50
Males	16.7% (10.1–26.3)	21.25% (18.6–24)	0.32

There are a few limitations in our study. The study did not include the individuals with SHCN living in institutional settings. Sexual behaviors and sexuality are difficult to capture and biased due to selective misreporting. Special needs/disability and vaccination history are self-reported and may result in bias. The self-reporting bias may be less due to the randomization of the sample in NHANES. The cross-sectional nature of this study cannot establish causal relation.

To our knowledge, this is the first study of oral HPV prevalence and vaccination among individuals with SHCN. Given that incidents of sexual assault and violence are higher among people with SHCN, the vaccination rates need to be increased among them. Through this study, we have determined that vaccination rates, although not significant, are lower among individuals with special needs. This tips the balance towards more HPV incidence among individuals with SHCN. The vaccination rates are far off from the healthy people 2020 target of 80% among 13–15 year old individuals. Our study bridges the gap between the low vaccination rates and higher prevalence of Oral HPV among SHCN adults. There is a need for development of programs aimed to provide recommended HPV vaccination to individuals with SHCN.

5. Conclusion

Our study provides the first national estimate of prevalence of oral HPV infection among adults with SHCN. Compared to the general population, individuals with SHCN have higher prevalence of oral HPV (6.7% vs 9%; $p = 0.05$). Vaccination rates among the ACIP recommended age groups are also lower among the individuals with SHCN. Overall, our analysis implicates a need to provide higher access to and to further study the barriers of HPV vaccination among individuals with SHCN.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.pvr.2019.100182.

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