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Behavioral analysis of HPV + oropharyngeal cancer: Do you know your patients?☆

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ABSTRACT

Objective: Evaluate the epidemiologic makeup of a population of HPV + OPSCC patients treated at one institution over approximately a decade.
Study design: Prospective survey study of HPV + OPSCC treated between 2007 and 2016.
Setting: Mount Sinai Health System
Subjects and methods: Patients aged 18 + who underwent treatment for HPV + OPSCC. 223 patients were asked to complete a health survey including substance use and sexual history in order to specifically characterize the social behaviors of patients with HPV + OPSCC.
Results: Eighty-two patients responded, 70 male (85.4%) and 12 female (14.6%). While half of patients were nonsmokers, 18.3% had a smoking history of < 15 pack years, and 32.9% had a 15 + pack-year smoking history. Nearly 25% reported significant drinking history (3 + drinks/day). Males had an average of 18 lifetime sexual partners, and females had 7 partners. Eight patients reported > 100 sexual partners.
Conclusions: HPV + OPSCC was more prevalent in white males with a high number of lifetime sexual partners, as expected. Careful evaluation revealed other findings of significance that are not generally associated with this population. Half of our patients had significant historical tobacco and alcohol consumption. One quarter of patients had a history of another malignancy. These findings highlight the importance of taking a comprehensive history when determining appropriate treatment or designing future de-escalation trials in HPV + OPSCC.

1. Introduction

Human Papillomavirus-associated oropharyngeal squamous cell carcinoma (HPV + OPSCC) is an established epidemic of our time. Over the past several decades, the overall incidence of OPSCC has increased globally while the incidence of environmentally related head and neck cancers has decreased [1,2]. From 1988 to 2004 there was a 225% increase in the incidence of HPV + OPSCC in the United States, with a concomitant 50% decrease in HPV- OPSCC [3,4]. Chaturvedi et al. estimated that by 2020 the incidence of HPV + OPSCC in the United States will surpass that of cervical cancer, and that by 2030 half of all head and neck cancers will be associated with HPV [3]. As predicted, oropharyngeal cancer has now exceeded cervical cancer as the most common site of HPV-related cancer in the United States [5,6].

Traditionally, OPSCC was caused by long-term exposure to tobacco and alcohol. With the identification of HPV + OPSCC as a recognized mechanism of oncogenesis, this patient profile changed. Patients tend to be younger, educated white males of a higher socioeconomic status with a history of multiple oral sexual partners [4]. They are less likely to have long-term tobacco and alcohol exposure. The majority of the cases are caused by the high-risk HPV 16 [4]. Regarding the anatomic site, HPV + OPSCC primarily affects the palatine tonsils and the lingual tonsillar tissue of the base of tongue. These subsites contain numerous tonsillar crypts lined with reticular crypt epithelium characterized by a disrupted basal cell layer and basement membrane [7]. It is hypothesized that discontinuities in the basal cell layer may facilitate viral entry into these lymphoid tissues, resulting in the predilection of these anatomic subsites.

Clinically, patients with HPV + OPSCC tend to present with small primary tumors with advanced cervical nodal disease. Despite commonly presenting with nodal metastasis, these patients have improved prognosis and treatment sensitivity when compared to patients with HPV-OPSCC [4,8,9]. This finding has led to the concept of de-escalation therapy in this particular subset of patients, as well as establishing and

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validating a new staging system specific to HPV disease [10–12].

2. Materials and methods

2.1. Participants

Participants were at least 18 years old with a confirmed diagnosis of HPV+ OPSCC, confirmed with polymerase chain reaction (PCR) or fluorescent in-situ hybridization (FISH). Patients were identified from a database of those treated with transoral robotic surgery (TORS) for OPSCC at the Mount Sinai Health System between April 2007 and October 2016. Mount Sinai was an early adopter of TORS for HPV-related OPSCC, and the majority of early stage HPV + OPSCC are treated with TORS and adjuvant therapy as indicated by final pathology at our institution. This dataset was selected to identify patients with early stage HPV-related OPSCC, representative of patients that would generally be candidates for de-escalation therapy strategies. Institutional review board approval was obtained at Mount Sinai (IRB-16-01058).

2.2. Data collection

Identified subjects were mailed an institutional review board-approved informed consent form and a survey with a postage-paid return envelope. The survey asked questions about ethnicity, profession, and past medical, surgical, and social history including substance use and sexual behavior. Patients also consented to review of their medical records.

Subjects were considered smokers if they had smoked at least 100 cigarettes in their lifetime and regular drinkers if they had consumed alcoholic beverages at least once a week for a year or more during their lifetime, as per the methodology used by Dahlstrom et al. [13]. Subjects were considered regular smokeless tobacco users if they had used smokeless tobacco regularly for at least a year, regular pipe smokers if they used at least once a week for a year, and regular cigar smokers if they used at least once a week for a year. Those who reported non-regular or occasional use were grouped with those who had never used the substance. Illicit drugs including marijuana, cocaine, methamphetamine, or heroin were reported if the respondent had ever used the substance.

2.3. Data analysis

The study population was described using standard descriptive statistics. We compared differences in demographics, substance use habits, sexual behaviors, and comorbidities using Pearson's chi-square tests or Fisher's exact tests for categorical variables. We considered two-tailed P-value ≤ 0.05 as statistically significant. All analyses were performed using R Version 3.3.2 (R Foundation for Statistical Computing, Vienna, Austria).

3. Results

There were 227 patients identified in the database, 200 male (88.1%) and 27 female (11.9%). Four patients were deceased at the time of the study (3 males and 1 female). Of the 223 patients eligible for the study, 82 consented to participate (37% response rate). There were 70 males (85.4%) and 12 females (14.6%), which was representative of the overall sample.

Of the included patients, 5 females (41.7%) and 17 males (24.3%) were treated with surgery as the primary modality (26.8% overall). 30.5% overall (31.4% of males, 25% of females) also underwent chemotherapy and radiation; 40.2% overall (42.9% of males, 25% of females) underwent adjuvant radiation alone. Four patients (4.9%) received immunotherapy as part of a clinical trial, two of which also underwent adjuvant radiation.

Table 1
Demographics and socioeconomics of subjects.

	Overall (n = 82)	Male (n = 70)	Female (n = 12)	P-value
	No. (%)	No. (%)	No. (%)	
Age in years				
40–49	15 (18.3)	11 (15.7)	4 (33.3)	0.119
50–59	29 (35.4)	26 (37.1)	3 (25)	
60–69	23 (28)	22 (31.4)	1 (8.3)	
70+	15 (18.3)	11 (15.7)	4 (33.3)	
Ethnicity				
White	78 (95.1)	66 (94.3)	12 (100)	0.901
Other	4 (4.9)	4 (5.7)	0 (0)	
Place of birth				1
US	75 (91.5)	64 (91.4)	11 (91.7)	
Other	7 (8.5)	6 (8.6)	1 (8.3)	
Income	n = 70	n = 59	n = 11	0.469
< $50,000	12 (17.1)	9 (15.3)	3 (27.3)	
$50,000–$99,999	9 (12.9)	7 (11.9)	2 (18.2)	
$100,000+	49 (70)	43 (72.9)	6 (54.5)	
Education	n = 80	n = 68	n = 12	0.97
High school, GED or less	17 (21.3)	15 (22.1)	2 (16.7)	
Some college	17 (21.3)	14 (20.6)	3 (25)	
College degree	19 (23.8)	16 (23.5)	3 (25)	
Advanced degree	27 (33.8)	23 (33.8)	4 (33.3)	
Marital status				0.064
Married	62 (75.6)	56 (80)	6 (50)	
Widowed	2 (2.4)	1 (1.4)	1 (8.3)	
Divorced	14 (17.1)	9 (12.9)	5 (41.7)	
Never married	3 (3.7)	3 (4.3)	0 (0)	
Living with partner	1 (1.2)	1 (1.4)	0 (0)	
Years with current partner	n = 64	n = 57	n = 7	0.823
< 10	3 (4.7)	3 (5.3)	0 (0)	
11–24	17 (26.6)	15 (26.3)	2 (28.6)	
25+	44 (68.8)	39 (68.4)	5 (71.4)	

3.1. Demographics

Demographic data is shown in Table 1. Average age at diagnosis for both males and females was 60 years (range for males: 42–78 years; range for females: 41–85 years). Average age at time of survey was 63 for males (range 45–84 years) and 64 for females (range 44–88 years). At the time of the survey, the majority of males were married, while only half of females were married. The average length of their longest relationship was 23.5 years for females and 27.8 years for males.

3.2. Education, profession, and total family income

Over half of respondents had received a college degree, and approximately a third of both males and females had received an advanced degree. Professions were varied throughout the cohort (Table 2). The majority of respondents (70%) reported an annual total family income in excess of $100,000. Of these, 17.1% of respondents had an annual household income of $100,000 to 149,999, 20% earned between $150,000 and $199,999, 22.9% earned between $200,000 and $399,999, and 10% earned greater than $400,000 annually.

3.3. Past medical history

Overall respondents tended to be healthy with little comorbidity (Table 3). A quarter of patients had a history of other non-head and neck cancers, including skin (11), prostate (4), lung (3), and one each of bladder, colon, kidney, melanoma, and cervical cancer. Females were significantly more likely to report a history of anemia, though this is expected secondary to menstruation. The majority of patients reported good to excellent dental health, and most had seen a dentist in the prior 12 months. In terms of sexual health, half of the women reported a

Table 2
Professions of subjects.

	Overall (n = 82)
Profession	No. (%)
Undisclosed	18 (22.0)
Finance or business	14 (17.1)
Sales	6 (7.3)
Education/Training/Library Occupation	6 (7.3)
Architecture/Engineering	6 (7.3)
Management	5 (6.1)
Office/Administration	5 (6.1)
Legal Profession	4 (4.9)
Arts/Design/Entertainment	4 (4.9)
Protective Services	3 (3.7)
Transportation/Material Moving	3 (3.7)
Computer/Technology	3 (2.4)
Health Care Practitioners	2 (2.4)
Health Care Support	2 (2.4)
Construction/Extraction	2 (2.4)
Personal Care/Services	1 (1.2)

Note: Percentages do not add to 100% because several respondents listed multiple professions in different categories.

Table 3
Medical history of subjects. Significant P-values are designated with an asterisk (*) and shading. H&N = head and neck.

History of:	Overall (n = 82)	Male (n = 70)	Female (n = 12)	P-value
	No. (%)	No. (%)	No. (%)	
HIV/AIDS	0 (0)	0 (0)	0 (0)	1
STD	20 (24.4)	17 (24.3)	3 (25)	1
Genital warts	8 (9.8)	6 (8.6)	2 (16.7)	0.729
Abnormal Pap	6 (7.3)	n/a	6 (50)	
Autoimmune disease	2 (2.4)	2 (2.9)	0 (0)	1
Organ transplant	1 (1.2)	1 (1.4)	0 (0)	1
Other non H&N cancer	21 (25.6)	19 (27.1)	2 (16.7)	0.682
Asthma	9 (11)	7 (10)	2 (16.7)	0.44
Diabetes	9 (11)	9 (12.9)	0 (0)	0.414
Stroke	2 (2.4)	2 (2.9)	0 (0)	1
CAD	6 (7.3)	6 (8.6)	0 (0)	0.642
Anemia	6 (7.3)	3 (4.3)	3 (25)	0.054
Dental health	n = 81	n = 70	n = 11	0.037*
Good - excellent	65 (80.2)	57 (81.4)	8 (72.7)	
Fair	7 (8.6)	4 (5.7)	3 (27.3)	
Poor	9 (11.1)	9 (12.9)	0 (0)	

history of an abnormal Pap smear. One patient had received the HPV vaccine, though it was received after he completed treatment for his cancer. Eleven women had used hormonal contraception in the past but did not currently use it, while one women reported current use. None of the men had ever used hormonal therapy.

3.4. Sexual history

Data is portrayed in Table 4. All participants identified as heterosexual, however three males reported homosexual activity (two with male anal sex partners, and one with both male anal and oral sex partners). No females reported homosexual activity. Average age at first time having any kind of sex (oral, vaginal, or anal) was 17.8 years for women (range: 14–21 years) and 17.4 years for men (range: 12–30 years).

Overall, females reported a mean average of 15 lifetime sexual partners, or a median average of 6 partners (range 4 to 100). Males reported a mean average of 38 lifetime sexual partners, or a median average of 17 partners (range 1 to 800). Females had a mean average of 11 lifetime oral sex partners, or a median average of 3 partners (range 0–89). Males had a mean average of 18 lifetime oral sex partners, or a median average of 12 partners (range 0–100).

Participants were generally between 18 and 39 years of age when they experienced their highest number of sexual partners. Only 2.6% reported their highest number of sexual partners when they were younger than 18, and only 8% reported their highest number of partners when they were 40 years old or older. In the year prior to completing the survey, most participants had either one sexual partner (41.7% of females; 77.9% of males) or zero sexual partners (50% of females; 19.1% of males).

Table 4
Sexual behaviors of subjects. Significant P-values are designated with an asterisk (*) and shading.

	Overall (n = 82)	Male (n = 70)	Female (n = 12)	P-value
	No. (%)	No. (%)	No. (%)	
Lifetime # open mouth kiss partners	n = 74	n = 64	n = 10	0.167
1	1 (1.4)	1 (1.6)	0 (0)	
2 – 4	2 (2.7)	2 (3.1)	0 (0)	
5 – 9	12 (16.2)	8 (12.5)	4 (40)	
10+	59 (79.7)	53 (82.8)	6 (60)	
Age at first sex	n = 80	n = 68	n = 12	0.95
< 18	44 (55)	38 (55.9)	6 (50)	
18+	36 (45)	30 (44.1)	6 (50)	
Lifetime # sex partners	n = 76	n = 65	n = 11	0.007*
1	2 (2.6)	2 (3.1)	0 (0)	
2 – 4	4 (5.3)	3 (4.6)	1 (9.1)	
5 – 9	14 (18.4)	8 (12.3)	6 (54.5)	
10+	56 (73.7)	52 (80)	4 (36.4)	
Lifetime # casual sex partners	n = 71	n = 62	n = 9	< 0.001*
0	12 (16.9)	6 (9.7)	6 (66.7)	
1	3 (4.2)	2 (3.2)	1 (11.1)	
2 – 4	15 (21.1)	14 (22.6)	1 (11.1)	
5 – 9	12 (16.9)	12 (19.4)	0 (0)	
10+	29 (40.8)	28 (45.2)	1 (11.1)	
Oral sex	n = 80	n = 68	n = 12	0.934
Never	2 (2.5)	1 (1.5)	1 (8.3)	
Ever	78 (97.5)	67 (98.5)	11 (91.7)	
Age at first oral sex	n = 76	n = 67	n = 9	0.365
< 18	27 (35.5)	22 (32.8)	5 (55.6)	
18+	49 (64.5)	45 (67.2)	4 (44.4)	
Lifetime # oral sex partners	n = 75	n = 64	n = 11	0.02*
0	2 (2.7)	1 (1.6)	1 (9.1)	
1	5 (6.7)	4 (6.3)	1 (9.1)	
2 – 4	15 (20)	10 (15.6)	5 (45.5)	
5 – 9	9 (12)	7 (10.9)	2 (18.2)	
10+	44 (58.7)	42 (65.6)	2 (18.2)	
Anal sex	n = 79	n = 67	n = 12	0.025*
Never	39 (49.4)	29 (43.3)	10 (83.3)	
Ever	40 (50.6)	38 (56.7)	2 (16.7)	
Lifetime # anal sex partners	n = 79	n = 67	n = 12	0.149
0	39 (49.4)	29 (43.3)	10 (83.3)	
1	17 (21.5)	16 (23.9)	1 (8.3)	
2 – 4	14 (17.7)	13 (19.4)	1 (8.3)	
5 – 9	5 (6.3)	5 (7.5)	0 (0)	
10+	4 (5.1)	4 (6)	0 (0)	
Sex in exchange for money	n = 80	n = 68	n = 12	0.634
No	74 (92.5)	62 (91.2)	12 (100)	
Yes	6 (7.5)	6 (8.8)	0 (0)	
Under 23 partner 10+ years older	n = 80	n = 68	n = 12	0.183
No	56 (70)	50 (73.5)	6 (50)	
Yes	24 (30)	18 (26.5)	6 (50)	
History of STD	20 (24.4)	17 (24.3)	3 (25)	1
History of genital warts	8 (9.8)	6 (8.6)	2 (16.7)	0.729
History of abnormal pap	6 (7.3)	n/a	6 (50)	< 0.001*

Table 5
Tobacco, alcohol, and drug use of participants.

	Overall (n = 82)	Male (n = 70)	Female (n = 12)	P-value
	No. (%)	No. (%)	No. (%)	
Cigarettes				0.78
0 py	40 (48.8)	35 (50)	5 (41.7)	
< 15 py	15 (18.3)	12 (17)	3 (25)	
15+ py	27 (32.9)	23 (33.3)	4 (32.9)	
Smokeless Tobacco				1
Never	79 (96.3)	67 (95.7)	12 (100)	
Regular	3 (3.7)	3 (4.3)	0 (0)	
Pipes				0.90
Never	78 (95.1)	66 (94.3)	12 (100)	
Regular	4 (4.9)	4 (5.7)	0 (0)	
Cigars				0.41
Never	73 (89)	61 (87.1)	12 (100)	
Regular	9 (11)	9 (12.9)	0 (0)	
Alcohol				0.71
Never	14 (17.1)	11 (15.7)	3 (25)	
Regular	68 (82.9)	59 (84.3)	9 (75)	
Marijuana				1
Never	23 (28.0)	20 (28.6)	3 (25.0)	
Ever	59 (72.0)	50 (71.4)	9 (75.0)	
Cocaine				0.997
Never	59 (72)	51 (72.9)	8 (66.7)	
Ever	23 (28)	19 (27.1)	4 (33.3)	
Meth				1
Never	76 (92.7)	65 (92.9)	11 (91.7)	
Ever	6 (7.3)	5 (7.1)	1 (8.3)	
Heroin				1
Never	80 (97.6)	68 (97.1)	12 (100)	
Ever	2 (2.4)	2 (2.9)	0 (0)	

3.5. Tobacco, alcohol, and illicit drug use

Overall, 36.6% had never smoked a single cigarette. Nearly half, 48.8%, of respondents (41.7% of females and 50% of males) were considered nonsmokers, which includes those who smoked fewer than 100 cigarettes in their lifetime (Table 5). Of the smokers, there were nearly twice as many heavy smokers with 15 or more pack years (32.9%) than light to moderate smokers with fewer than 15 pack years (18.3%). A small number, all males, reported regular use of smokeless tobacco (3.7%), pipes (4.9%), and cigars (19.5%). At the time of the survey, one patient continued to smoke cigarettes and another continued to smoke cigars; the rest were former smokers. A high number of respondents (80.5%) reported exposure to second-hand smoke as a child, and as an adult (41.5%). Of the males exposed, the average number of years exposed to second-hand smoke at home was 18.5 years, while at work the average was 16.7 years. Females had an average of 14.5 years of second-hand smoke exposure at home, and only two years exposure at work.

One respondent reported he had never had a drink of alcohol; all others reported some alcohol intake. The majority of respondents (82.9%) were regular drinkers at some point in their lives. The average age of start of regular drinking was 21 years. Nearly a quarter (24.1%) reported a significant drinking history of three or more drinks per day; all were male.

Though 72% of respondents had tried marijuana, 26.8% were regular users, meaning they had used marijuana at least once a month for a year. Nearly a third (29.1%) had tried cocaine or crack, with only 3.7% admitting to regular use, defined as 100 or more days of use. Few (8.5%) had tried methamphetamines, and 2.5% had tried heroin, with none reporting regular use.

4. Discussion

With the rise of HPV+ OPSCC in younger people with limited tobacco and alcohol exposure, the importance of behavioral risk factors is important to better understand this unique population. Sexually transmitted HPV has been established as the primary risk factor for cervical cancer in women [14,15], although the link between sexual behavior and HPV+ OPSCC is not as well-established. Oral HPV infections have been associated with sexual behaviors, such as lifetime number of any, oral, and vaginal sex partners [16,17]. Similarly, HPV+ OPSCC has also been found to be associated with an increasing number of lifetime sexual partners (> 9), and engaging in oral sex, suggesting the likely mode of transmission of HPV to the upper aerodigestive tract is through oral-genital contact [13].

Often patients who present with HPV-related OPSCC are assumed to be “non-smokers, non-drinkers” and a somewhat binary thinking by providers leads to inadequate stratification of patients for therapy and trial enrollment. This type of thinking may adversely affect trial design as well. Due to our observations of the subtleties of social behaviors in this population, we sought to accurately examine behavioral associations with HPV+ OPSCC. To our knowledge, this is the first analysis of behavioral differences between males and females in this population.

We found that males with HPV+ OPSCC were significantly more likely than females to have more lifetime and casual sex partners, more oral sex partners, and to have ever engaged in anal sex. While the majority of male participants (80%) described > 10 lifetime sexual partners, this was true for only approximately one third (36.4%) of females. For males, the lifetime sexual partner average number more than doubled that of females, even when considering medians. Men were also more likely to engage in casual sex, with nearly half (45.2%) claiming 10 or more lifetime casual sex partners, compared to only one female (11.1%). In terms of lifetime number of oral sex partners, 65.6% of males claimed 10 or more, while only 18.2% of females could say the same. Interestingly, there were two participants who deny ever engaging in oral sex, which supports the notion that there are modes of transmission other than oral-genital contact. Another proposed method is deep oral contact, as from open-mouth kissing. One report linked a higher prevalence of oral HPV among college-aged men with higher numbers of open-mouth kissing partners, suggesting a possible salivary transmission [18]. We found that while nearly 80% of our patients had more than 10 open-mouth kissing partners, that left 20% with fewer partners than this in their lifetimes. Though many people reported high numbers of lifetime sexual partners, most encounters occurred at younger ages (i.e., twenties and thirties), several decades prior to their diagnosis of HPV+ OPSCC. Most participants reported zero or one sexual partner in the year before taking the survey, and being in long-term marriages. Prior studies suggest that exposure to HPV, marked by the presence of HPV antibodies, precedes oropharyngeal cancers by > 10 years [19]. This highlights the confusion some patients and their spouses may feel by the association of this diagnosis with sexual activity, and counseling should be given to highlight the delayed nature of cancer onset after exposure to the virus.

Another proposed form of transmission of HPV to the oropharynx is autoinoculation, though evidence is lacking [20]. Of note, half of the females in this study had a history of an abnormal Pap smear, and one had a history of cervical cancer. If they were cervical carriers of HPV, then it is possible they may have transmitted the virus to their own oropharynx, through sexual or nonsexual activity.

Oral HPV prevalence has also been shown to be higher in people infected with HIV [21]. It had been documented that oral HPV prevalence is higher among individuals infected with HIV. In our study, nobody reported a history of HIV infection. A low number of patients reported an autoimmune disorder.

Cigarette smoking has also been associated with a higher prevalence of oral HPV infection compared to non-smokers or former smokers, perhaps suggesting an immunosuppressive role [17,22]. While nearly half of our patients were nonsmokers, one third had heavy smoking histories. Of note, a high proportion of our cohort reported second-hand smoke exposure, and half had a significant personal smoking history.

Also of interest is that nearly one quarter of the cohort were regular marijuana users and a significant number had historical exposure to illicit drugs. Alcohol use was common in the cohort as well, with only a single subject reporting zero lifetime exposure to alcohol. These findings highlight the fact that capturing a static social history, at the time of diagnosis, is somewhat like trying to determine the plot of a movie with a single frame of film. The social history and behavior of patients diagnosed with OPSCC is hardly binary in nature as is commonly assumed and careful histories are critical when designing or assigning subjects to de-escalation trials, or considering alternative therapy, even in cases of early stage HPV + OPSCC.

4.1. Limitations

Our study had several limitations. Although our respondents were representative of the overall sample, we had a low response rate of 37%, which may bias the results if significant differences exist between those who responded to the study and those who did not. Therefore, the reduced sample size limited statistical power and the ability to perform subgroup analyses. In particular, the number of female respondents was significantly smaller than the number of male respondents, which preempted our ability to perform logistic regression of the data. This made it impossible to evaluate statistical significance in our analysis of this segment of the cohort. The retrospective nature of the survey imparts a recall bias, and the sensitive nature of some of the questions may also affect reporting.

Another limitation is the institutional bias in the cohort. At the Mount Sinai Health System, the majority of early-stage HPV-related oropharyngeal cancers are treated with upfront surgery as the primary modality. This resulted in the cohort lacking significant numbers of subjects who underwent radiation or concurrent chemoradiotherapy as the primary modality. This also represented an element of the design of the study, as very few patients with advanced disease would benefit from surgery or de-escalation of therapy, and therefore specific features of the social history may have less relevance in the setting of advanced stage disease. Nevertheless, this may impart a bias in terms of disease burden, social behaviors resulting in later presentation (i.e., heavy alcohol abuse or illicit drug use). Patients with more advanced disease may have a different demographic and historical profile than this cohort. Similarly, this cohort was primarily drawn from the New York City area, which has specific socioeconomic, and demographic characteristics that may not be generalizable to other populations. Of specific mention is the fact that in one of the most diverse populations in the country, the makeup of the study cohort was markedly less diverse, indicating not only an observation directly related to the etiology of HPV-related OPSCC, but also raising the possibility that social selection, behavioral selection, and institutional factors may affect the makeup of the cohort.

5. Conclusions

The majority of HPV+ OPSCC occurred in white males. Compared to females, males were significantly more likely to have higher numbers of lifetime, casual, oral, and anal sexual partners. While HPV+ OPSCC is generally regarded as a disease of relatively healthy non-smokers and non-drinkers, we found that half of our patients had smoking histories, and approximately one third had heavy smoking and drinking histories. A history of illicit drug use was commonly reported in this population as well. Additionally, one quarter of the patients had a previous history of another malignancy. These findings have special relevance in the era of de-escalation and the design of future clinical trials in this population. Careful, standardized social histories are critical in the management of this patient population to guide decision-making.

Conflict of interest

The authors have no relevant financial interests, activities, relationships, affiliations, or funding sources to disclose.

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