Public awareness of the association between human papillomavirus and oropharyngeal cancer

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Background: Early diagnosis of human papillomavirus (HPV) associated oropharyngeal cancer (OPC) is associated with improved survival. To achieve early diagnosis, it might be beneficial to increase awareness of the link between HPV and OPC. This increase of awareness could also be an important way to increase vaccination rates. The aim of our study was to explore the current public knowledge in the Netherlands regarding the association of HPV with OPC.

Methods: An online cross-sectional survey was used and sent by the company Flycatcher Internet Research to 1539 of their panel members. Data were analyzed statistically by gender, age, educational level and the participants’ use of alcohol and tobacco.

Results: The response rate was 68% (1044 participants). Our data revealed that 30.6% of the participants had heard of HPV. There was a knowledge gap regarding HPV in males (P < 0.001), people older than 65 years (P < 0.001), people with low education level (P < 0.001) and current smokers (P < 0.001). Of the respondents who had heard of HPV, only 29.2% knew of the association between HPV and OPC. We also found that only 49.7% of the population knew of the existence of an HPV vaccine.

Conclusions: The results of this survey indicate that the public awareness of HPV and the association of HPV with OPC is lacking. Interventions to increase awareness of HPV and its association with non-cervical cancer should be considered. This might help to increase the HPV vaccine uptake both for girls and boys and earlier diagnosis of this disease leading to improved survival.

Introduction

Head and neck squamous cell carcinoma (HNSCC) has been the seventh most common cancer worldwide in 2018, accounting for 3% of all cancers.1 The majority of HNSCC cases are tobacco and alcohol associated, but research in the past decades has highlighted the increasing importance of human papillomavirus (HPV) infection as a risk factor for developing HNSCC, especially for oropharyngeal carcinomas (OPC).2 While the incidence of tobacco related disease has declined in the past two decades, there is an increase in HPV associated OPC.2, 3 The HPV associated oropharyngeal tumors have different properties than the HPV negative HNSCC; patients are younger, more often male and non-smokers and non-drinkers. In addition, HPV associated OPC is more often seen in population with a higher socio-economic class.2, 6 Individuals with frequent oral sex encounters, a greater number of different sexual partners, and earlier sexual experiences seem to be at a higher risk for HPV associated OPC development.2, 7 Earlier diagnosis of HPV associated OPC is associated with improved survival.8 To achieve early diagnosis, it might be beneficial to increase awareness of the link between HPV and OPC.

Recent data in the United States suggests that the incidence of HPV related OPC exceeds the incidence of HPV related cervical cancer in high income countries, although some reservations must...
be made because of regional differences. The HPV vaccine not only protects against the development of cervical cancer, but also against oropharyngeal cancer. In the Netherlands, since 2009 girls aged 13 years have been offered an HPV vaccination to prevent cervical cancer development from the National Vaccination Program.12 The vaccine has been included in the vaccination program for boys since the beginning of 2021. Children will also be vaccinated at a younger age from 2021, namely from the age of 9. To maximize the potential benefits of HPV vaccination, it is necessary to get the vaccination coverage as high as possible. The national vaccination coverage for HPV for girls was 53% in the Netherlands in 2019.13 Because the parents decide on the vaccination, it is important that they are aware of the association between HPV and not only cervical cancer, but also OPC.

Since vaccination against HPV became available, awareness of HPV has dramatically increased. A study by Williams et al. under the general public in the United States showed that most respondents were aware that HPV is a causative agent of cervical cancer. However, the majority were not aware of the association between HPV and oropharyngeal cancer. Data from a recent study regarding the public awareness of HPV associated oropharyngeal cancer in men and women in the United Kingdom showed that 37% of the respondents had ever heard of HPV and of these 38.7% recognized HPV as a risk factor for OPC.

The aim of our study was to explore the current public knowledge in the Netherlands regarding the association of HPV with oropharyngeal cancer. Our findings will help us to determine if there is need to increase public education on HPV and oropharyngeal cancer. By increasing education and uptake of the HPV vaccine, we hope to combat the development of HPV associated oropharyngeal cancers and other HPV associated tumors.

Methods

Survey design and administration

The medical ethics review committee of Maastricht University Medical Centre approval was obtained on the basis that data collection was anonymized and no vulnerable participants were involved.

A short questionnaire was already developed by Lechner et al., which was kindly provided to us and which we have adapted to our situation. The questionnaire of nine items (see Supplementary data) assessed the knowledge of HPV, of OPC risk factors and symptoms, of the association between HPV and OPC, the knowledge of the HPV vaccine and the participants’ use of alcohol and tobacco. Tobacco use was divided into current user, former smoker, and non-smoker (never smoked), and alcohol consumption was classified in 1–7 drinks per week, 8–14 drinks per week, 15–21 drinks per week, more than 21 drinks per week or no drinks. Demographic characteristics of the participants were provided to us by the company Flycatcher Internet Research, as they sent the online questionnaire to their panel members. These characteristics included gender, age, education level and living in which province. Education level was measured as low, middle and high. Low was defined as having no certificate or having a certificate of pre-vocational secondary education or secondary vocational education. Middle was defined as having a certificate of intermediate vocational education, or senior general secondary education or pre-university education or having a first-year’s degree in higher professional education or in university education. High was defined as having a certificate of higher professional education or of university education or having a doctoral or post-doctoral degree.

The company Flycatcher Internet Research sent the online questionnaire to the research group selected from a sample from their panel consisting of people older than 18 years who have registered voluntarily. The sample was stratified by gender, age, educational level and province. This guarantees that the people in the sample were a representative reflection of the Dutch population aged 18 and older. The selected panelists received an e-mail describing the study, and interested respondents were directed to a website where the survey could be completed. The intended response rate was 1000 participants. Respondents were encouraged to completely fill out the whole survey. Incompletely filled surveys were excluded in the analysis.

Statistical analysis

Statistical analyses were performed using SPSS statistical software for Windows, version 25 (IBM). Descriptive analyses with calculated measures of central tendency and variation were computed, along with frequency tables for categorical variables. Whether distributions of categories are different was tested using Chi-square test. The significance level was set at $P = 0.05$.

Results

Participant characteristics

The online questionnaire was sent to 1539 panel members, of whom 1044 completed the questionnaire (response rate 68%). In 16 other questionnaires, one or more questions were skipped and therefore excluded.

This population reflected the Dutch population in terms of gender, age, education level and province. The characteristics of the participants are shown in table 1.

Knowledge of HPV

Of the 1044 respondents, 30.6% had ever heard of HPV (table 2).

| Characteristic | N  | %   |
|---------------|----|-----|
| Sex           |    |     |
| Male          | 517| 49.0|
| Female        | 527| 51.0|
| Age           |    |     |
| 18–29 years   | 173| 16.7|
| 30–65 years   | 590| 56.6|
| >65 years     | 281| 27.0|
| Educational level | |     |
| Low           | 293| 28.0|
| Middle        | 463| 44.0|
| High          | 288| 28.0|
| Smoking       |    |     |
| Non-smoker    | 491| 47.0|
| Former smoker | 426| 41.0|
| Current smoker| 127| 12.0|
| Alcohol: drinks per week | |     |
| No alcohol use| 382| 37.0|
| 1–7 drinks    | 504| 48.0|
| 8–14 drinks   | 110| 11.0|
| 15–21 drinks  | 34 | 3.0 |
| >21 drinks    | 14 | 1.0 |

Two times more women were aware of HPV than men (41.6% vs. 19.3% ($P < 0.001$). Participants aged 18–29 years had most often heard of HPV (44.5%) and participants over 65 years the least (10.7%) ($P < 0.001$). Participants with a low educational level had heard of HPV less often than participants with a high education level (12.3% vs. 46.9%) ($P < 0.001$). Participants who did not smoke more frequently had heard about HPV than those who smoked or had smoked (38.5% vs. 18.9% and 24.9% ($P < 0.001$). Of the respondents who already had heard of HPV, 79.9% knew that HPV is transmitted during sex, 72.7% that HPV is transmitted during oral sex, 78.4% that HPV is not rare and only 64.6% knew that HPV does not cause HIV (table 3).
Table 2 Knowledge about HPV and oropharyngeal cancer in the Dutch population (N = 1044)

| Characteristics               | Yes. I had heard of HPV before today | Yes. I’m aware of an HPV vaccine | Yes. I’m aware of an HPV vaccine AND I knew of HPV | Yes. I knew of the link between HPV and OPC | Yes. I knew of the link between HPV and OPC AND I knew of HPV |
|-------------------------------|--------------------------------------|----------------------------------|--------------------------------------------------|---------------------------------------------|--------------------------------------------------|
|                               | N          | %                | P-value | N          | %                | P-value | N          | %                | P-value | N          | %                | P-value |
| Sex                           |            |                  |         |            |                  |         |            |                  |         |            |                  |         |
| Male                          | 100        | 19.3             | <0.001  | 202        | 39.1             | <0.001  | 75         | 75.0             | 0.013  | 47         | 9.1             | 0.049   |
| Female                        | 219        | 41.6             |         | 317        | 60.2             |         | 187        | 85.4             |         | 68         | 12.9            |         |
| Age                           |            |                  |         |            |                  |         |            |                  |         |            |                  |         |
| 18–29 years                   | 77         | 44.5             | <0.001  | 101        | 58.4             | <0.001  | 62         | 80.5             | 0.008  | 26         | 15.0            | 0.008   |
| 30–65 years                   | 212        | 35.9             |         | 313        | 53.1             |         | 179        | 84.4             |         | 71         | 12.0            |         |
| > 65 years                    | 30         | 10.7             |         | 105        | 37.4             |         | 21         | 70.0             |         | 18         | 6.4             |         |
| Educational level             |            |                  |         |            |                  |         |            |                  |         |            |                  |         |
| Low                           | 36         | 12.3             | <0.001  | 118        | 40.3             | <0.001  | 29         | 80.6             | 0.046  | 19         | 6.5             | 0.002   |
| Middle                        | 148        | 32.0             |         | 219        | 47.3             |         | 115        | 77.7             |         | 51         | 11.0            |         |
| High                          | 135        | 46.9             |         | 182        | 63.2             |         | 118        | 87.4             |         | 45         | 15.6            |         |
| Smoking                       |            |                  |         |            |                  |         |            |                  |         |            |                  |         |
| Current smoker                | 24         | 18.9             | <0.001  | 47         | 37.0             | 0.004   | 14         | 58.3             | 0.011  | 5          | 3.9             | 0.001   |
| Former smoker                 | 106        | 24.9             |         | 202        | 47.4             |         | 86         | 81.8             |         | 39         | 9.2             |         |
| Non-smoker                    | 189        | 38.5             |         | 270        | 55.0             |         | 162        | 85.7             |         | 71         | 14.5            |         |
| Alcohol – drinks per week     |            |                  |         |            |                  |         |            |                  |         |            |                  |         |
| 1–7 drinks                    | 171        | 33.9             | 0.076   | 263        | 52.2             | 0.041   | 140        | 81.9             | 0.24   | 60         | 11.9            | 0.303   |
| 8–14 drinks                   | 22         | 20.0             |         | 50         | 45.5             |         | 16         | 72.7             |         | 8          | 7.3             |         |
| 15–21 drinks                  | 7          | 20.6             |         | 14         | 41.2             |         | 6          | 85.7             |         | 2          | 5.9             |         |
| > 21 drinks                   | 1          | 7.1              |         | 2          | 14.3             |         | 0          | 0.0              |         | 0          | 0.0             |         |
| No alcohol use                | 118        | 30.9             |         | 190        | 49.7             |         | 100        | 84.7             |         | 45         | 11.8            |         |

a: Percentage of participants who were aware of an HPV vaccine and did NOT heard of HPV before today = 34.5%.

Note: HPV, human papillomavirus; OPC, oropharyngeal cancer.
Table 3 Knowledge about HPV when already heard of HPV (N = 319)

| Risk factor                          | Yes | No   | Not sure |
|--------------------------------------|-----|------|---------|
| N         | %  | N    | %      | N      | %   |
| Is HPV rare?                         | 20  | 6.3  | 250     | 78.4  | 49  | 15.4 |
| Is HPV transmitted during sex?       | 255 | 79.9 | 29      | 9.1   | 35  | 11.0 |
| Is HPV transmitted during oral sex?  | 232 | 72.7 | 30      | 9.4   | 57  | 17.9 |
| Can HPV cause HIV (Aids)?           | 22  | 6.9  | 206     | 64.6  | 91  | 28.5 |

Note: HPV, human papillomavirus; HIV, Human immunodeficiency virus.

Table 4 Knowledge of reported risk factor for oropharyngeal cancer in the general Dutch population (N = 1044)

| Risk factor                          | Yes | No   | Not sure |
|--------------------------------------|-----|------|---------|
| N         | %  | N    | %      | N      | %   |
| Excessive alcohol consumption       | 626 | 60.0 | 139     | 13.3  | 279 | 26.7 |
| Smoking                              | 1016| 97.3 | 10      | 1.0   | 18  | 1.7  |
| Chewing of tobacco                  | 778 | 74.5 | 48      | 4.6   | 218 | 20.9 |
| Chewing of betel leaf, catchu and area nuts | 317 | 30.4 | 87      | 8.3   | 640 | 61.3 |
| Marijuana use                       | 547 | 52.4 | 109     | 10.4  | 388 | 37.2 |
| Poor oral hygiene                   | 398 | 38.1 | 274     | 26.2  | 372 | 25.6 |
| Herpes simplex virus infection      | 277 | 26.5 | 139     | 13.3  | 628 | 60.2 |
| Human papilloma virus infection     | 281 | 26.9 | 112     | 10.7  | 651 | 62.4 |
| Family history of cancer            | 646 | 61.9 | 136     | 13.0  | 262 | 25.1 |
| Low fruit and vegetable consumption | 253 | 24.2 | 338     | 32.4  | 453 | 43.4 |
| Sun exposure                         | 167 | 16.0 | 454     | 43.5  | 423 | 40.5 |

Knowledge about HPV vaccine

Despite knowledge of HPV in 30.6% (N = 319) of all participants (mentioned above), we found that 49.7% (N = 519) of all participants knew that there is an HPV vaccine available. This is remarkable, because this means that a part of the participants who had no knowledge of HPV knew that there is a vaccine (table 2). Participants older than 65 years were less aware of HPV vaccination (70%, P = 0.008), but there was less spread in the knowledge of the HPV vaccine between the different education levels. Current smokers and participants drinking more than 21 alcoholic drinks per week were also less aware of the existence of an HPV vaccine (58.3% and 0%, respectively), although the latter group was small (14 persons).

Knowledge about oropharyngeal cancer

In the overall population, 11% knew of the association between HPV and OPC. Interestingly, of the respondents who had heard of HPV, only 29.2% recognized HPV as risk factor of OPC (table 2). In comparison to the knowledge of the existence of HPV, men were now more aware of this link than women (34.0% vs. 26.9%, P = 0.20), but the knowledge of the link was more equal across the different age categories and education levels. Because parents decide whether or not their children will undergo HPV vaccination, we also looked specifically at the participants aged 30–45 years for the knowledge about HPV and OPC. This knowledge was not different from the participants aged 45–65 years (data not shown). Current smokers and participants drinking more than 21 alcoholic drinks per week were again less aware of the link between HPV and OPC (16.7% and 0%, respectively).

Participants were confronted with 11 factors and asked whether these were risk factors for OPC or not. Only 26.9% of the participants correctly identified HPV as a risk factor for OPC (table 4), which is higher than the initial 11.0% (mentioned above). Awareness of other well-established risk factors was much higher: for example, smoking (97.3%) and chewing tobacco (74.5%). Excessive alcohol consumption, poor oral hygiene and chewing of betel leaf, catchu and areca nuts were less recognized (60%, 38.1% and 30.4%, respectively).

Before this question, the participants were asked with an open question what they think could affect a person’s chance of throat cancer. Notable factors mentioned include poor air quality (94 times), harmful chemicals (84 times), hot drinking (42 times) and spicy food (17 times).

Discussion

Over the past three decades, there has been a clear decrease in the prevalence of tobacco use and an associated decline in tobacco related head and neck cancers in many industrialized countries. The incidence of HPV positive OPC, however, is increasing worldwide, predominantly among men. Recent data in the United States suggests that the incidence of HPV related OPC exceeds the incidence of HPV related cervical cancer in high income countries, although some reservations must be made because of regional differences. The HPV vaccine not only protects against cervical cancer, but also against oropharyngeal cancer. Several studies suggested that the public is relatively well informed about HPV as a sexually transmitted disease and of the relationship between HPV and cervical cancer. In contrast, there seems to be a lack of knowledge about the association of HPV and OPC.

The present study focused on the awareness of the Dutch population concerning the association between HPV and OPC. Our data revealed that 30.6% of the population had heard of HPV and that this knowledge was less in males, people older than 65 years, low education level and current smokers. Of the respondents who had heard of HPV, only 29.2% knew of the association between HPV and OPC. This frequency is slightly lower in comparison with earlier studies, for example the study of Williams et al., in which 36% of the respondents reported to know that HPV is a causative factor for OPC. An explanation could be the fact that more than 75% of the participants in the study of Williams were aged between 18 and 35, while in our study only 17% of the respondents were aged 18–29 years and 56% aged 30–65 years. In the study of Lechner et al. however, 38.7% of the respondents knew of the association between HPV and OPC and the age range of the participants was comparable with that in our study. The participants of our study who were aware of HPV were in general well aware of the prevalence and the (oral) sexually transmission of HPV.

We also found that 49.7% of the population knew of the existence of an HPV vaccine, this percentage was remarkable because it is higher than the percentage of the population knowing of the virus itself. So, 34.5% of the respondents who had never heard of HPV were aware of the presence of an HPV vaccine. One explanation for this difference could be that the addition of ‘vaccine’ to ‘HPV’ increases the knowledge because it creates an association, which people have less with the word ’HPV’ alone. Another explanation could be that people don’t know what the HPV vaccine is for. In addition, it was striking that if we asked in an open question whether the participants knew about the link between HPV and OPC, only 11% answered positively, whereas when we presented...
Lechner et al. reported that the level of awareness of HPV and patients harboring symptoms of HPV positive cancers to go in time is needed. In addition, greater awareness of the disease may prompt smokers and non-drinkers. This is beneficial because this group has in men.

necessary to improve vaccine uptake, in women but especially also might help to increase the HPV vaccination uptake and earlier diag-

association with non-cervical cancer should be considered. This fore have influenced the response rate.

ties, greater awareness of the role of HPV infection in OPC is.

This study was conducted during the COVID pandemic, which may result in an increased interest in virus vaccines and could there-

fore have influenced the response rate.

In conclusion, the results of this survey indicate that the public awareness of HPV and the association of HPV with oropharyngeal cancer is lacking. Interventions to increase awareness of HPV and its association with non-cervical cancer should be considered. This might help to increase the HPV vaccination uptake and earlier diag-

This survey are largely consistent with previously published data on HPV awareness.

This survey is the first to examine awareness on human papillomavirus (HPV)-associated oropharyngeal cancer (OPC) among the Dutch population.

• 30.6% of the participants had heard of human papillomavirus (HPV) and only 29.2% of these participants knew about the association between HPV and oropharyngeal cancer.
• The results of this survey indicate that the public awareness of HPV and the association with oropharyngeal cancer is lacking.
• Interventions to increase this knowledge might help to increase the HPV vaccination uptake and earlier diagnosis of this disease leading to improved survival.

Supplementary data
Supplementary data are available at EURPUB online.

Conflict of interest
E.-J.S. reports grants from Pfizer and Novartis and honoraria from BMS. The funders had no role in this particular study design; in the collection, analyses, or interpretation of the data; in the writing of the manuscript or in the decision to publish the results. The other authors declare no conflict of interest.

Key points
• This study is the first to examine awareness on human papillomavirus (HPV)-associated oropharyngeal cancer (OPC) among the Dutch population.

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