



# Trend Analysis of Global Web Searches (2004–2022) on Oral Cancer and Its Major Risk Factors

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J Health Allied Sci<sup>NU</sup> 2023;13:373–379.

## Abstract

**Background** Oral cancer is the 15th leading cause of mortality globally. The Internet is an online source of information pertaining to oral cancer and its major risk factors. This study aims to analyze the trend of global online interest on oral cancer and its major risk factors through an analysis of web searches of oral cancer.

**Materials and Methods** This study analyzed the web searches conducted, from 2004 to January 2022, on oral cancer and its major risk factors (tobacco use, harmful alcohol use, and human papillomavirus [HPV] infection) using data obtained from Google Trends.

**Results** Within the time frame under study, oral cancer had multiple peak search periods, with the highest relative search volume index (SVI) for a period being 1; the peak search period for alcohol was March 2020 (SVI = 100); the peak search periods for tobacco were March to April 2004 (SVI = 17); and the peak search period of HPV was April 2004 (SVI = 1). Globally, alcohol was the most common searched term among these four terms (oral cancer, alcohol, tobacco, and HPV) except in Turkey where tobacco was the most common (55%) searched term. The top 25 search queries for oral cancer, HPV, tobacco, and alcohol had SVI ranges of 22 to 100, 12 to 100, 28 to 100, and 18 to 100, respectively. From these search queries, it was observed that people have interest in oral cancer symptomatology, and the adverse effects of tobacco, alcohol, and HPV.

**Conclusion** This study revealed an overall decline in the online interest on oral cancer and its major risk factors on a global scale.

## Keywords

- ▶ oral cancer
- ▶ tobacco
- ▶ alcohol
- ▶ human papillomavirus
- ▶ web search
- ▶ Google Trends

article published online  
October 6, 2022

DOI <https://doi.org/10.1055/s-0042-1756479>.  
ISSN 2582-4287.

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Thieme Medical and Scientific Publishers Pvt. Ltd., A-12, 2nd Floor, Sector 2, Noida-201301 UP, India

## Introduction

Oral cancer is the commonest malignancy affecting the head and neck region, the 16th commonest malignancy, and the 15th leading cause of mortality globally.<sup>1,2</sup> Oral cancer is a very notorious public health problem with a 5-year survival rate among 40 to 50% of patients diagnosed with the disease.<sup>3</sup> The incidence of oral cancer increases with age and majority of cases occur among people in their fifth or older decade.<sup>1</sup> However, reports have also shown an increased incidence of oral cancer cases among young people under the age of 40 years and human papillomavirus (HPV) infection has been strongly implicated in these cases.<sup>4,5</sup>

Oral cancer is a preventable disease with various associated risk factors including tobacco use, harmful alcohol use, HPV infection, nutritional deficiency, genetic predisposition, sunlight exposure.<sup>4,6,7</sup> Of all these risk factors, the three commonly associated ones are tobacco use, harmful alcohol use, and HPV infection.<sup>4,6–8</sup> The common clinical features (symptoms and signs) of oral cancer include chronic non-healing oral ulceration, enlargement of the lymph nodes, intraoral bleeding episodes, and teeth mobility.<sup>9–11</sup>

The lack of adequate knowledge and awareness concerning oral cancer is a factor contributing to the delay in oral cancer presentation and diagnosis among patients, leading to poor prognosis<sup>12–14</sup>; hence, the need for public education about the risk factors, symptomatology of the disease cannot be over-emphasized.<sup>11,15,16</sup>

The Internet has been a source of health information for patients and its use for this purpose is growing daily.<sup>17–19</sup> The Internet is also found to provide important information and support systems for oral cancer patients by improving awareness, facilitating treatment adherence, and enhancing professional–patient interaction even when there are concerns about the quality, validity, and patient’s understanding of these information.<sup>17,18</sup>

Globally, there are over 2.5 billion Internet and social media users, and this population is expected to continue to rise.<sup>20,21</sup> Therefore, Internet-based sources of information, such as YouTube, Instagram, Twitter, Facebook, and search engines (e.g., Google), have been used as channels for accessing, sharing, and disseminating information to disseminate health information and health promotion, including those about oral cancer.<sup>22–24</sup>

Google is a leading Internet-based search engine used for seeking diverse information, including those pertaining to health.<sup>25–27</sup> Pertinently, populations’ health information-seeking behavior has been evaluated by analyzing online interests using Google Trends.<sup>25,26</sup> For example, Google Trends analysis has been used to evaluate online interest dynamics on coronavirus disease 2019 (COVID-19), salmonellosis, and mental health.<sup>27–30</sup> After extensive literature, it was observed that no know study has analyzed the global online interest on oral cancer. This study therefore aims to analyze the trend of global online interest on oral cancer and its major risk factors through an analysis of web searches of oral cancer from 2004 to 2022. The outcome of this study will provide deep insights on the global trend of information-seeking patterns on oral cancer.

## Materials and Methods

This study was an infodemiological study that measured the global online search interest on oral cancer and its major risk factors (tobacco use, harmful alcohol use, and HPV infection)<sup>4,6–8</sup> through the analysis of global web searches on Google Trends (<http://trends.google.com>). Google Trends is a web site, owned by Google, which analyzes the degree of popularity of top search queries in Google Search across various periods (times), languages, and regions. On Google Trends, search trends are measured in the unit of search volume index (SVI). An SVI of 0 depicts insufficient data on the popularity of a search term, an SVI of 100 refers to the peak popularity of a search term, and an SVI of 50 means half popularity of a search term.

On February 16, 2022, we did a comparative search of “oral cancer,” “alcohol,” “tobacco,” and “human papillomavirus” using the “all categories,” “2004–present,” “worldwide,” and “web search” filters on the Explore page on Google Trends (<https://trends.google.co.uk/trends/explore>). The SVIs, related queries, and maps generated from the search were extracted from the search outcomes for trend analysis. The results were presented in texts, maps, charts, and table.

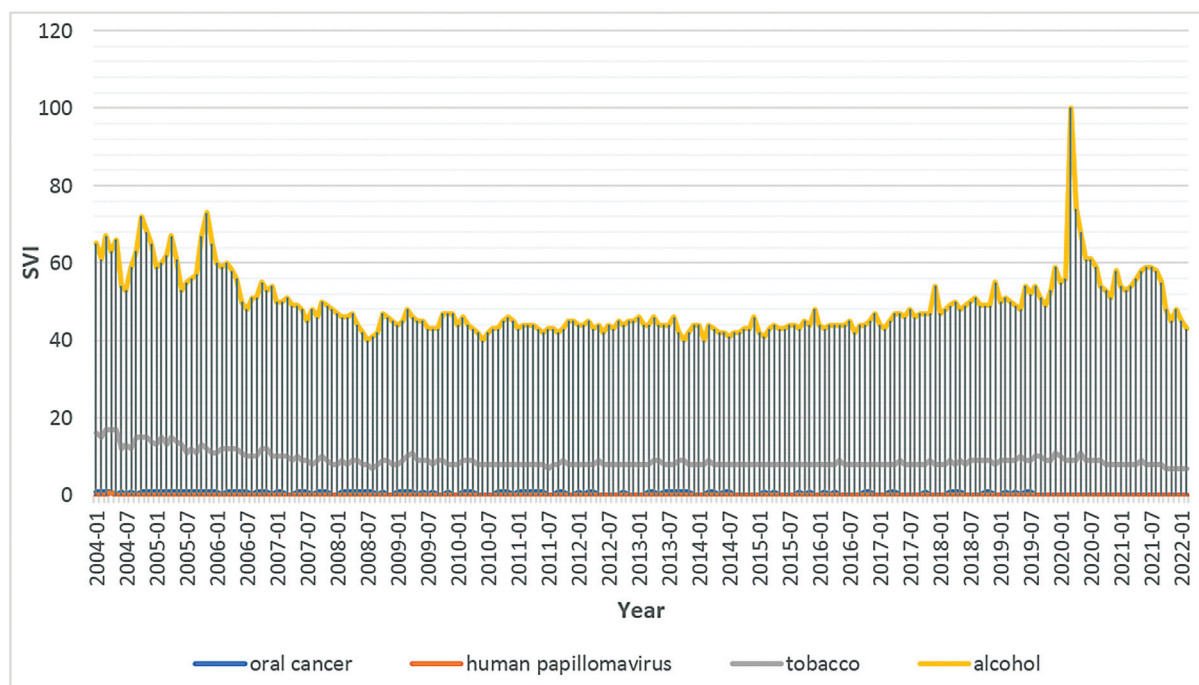
## Results

This study analyzed the web searches on oral cancer, alcohol, tobacco, and HPV across 218 countries. Between the time frame from 2004 to January, 2022, oral cancer had multiple peak search periods, with the highest relative SVI in a period being 1; the peak search period for alcohol was March 2020 (SVI = 100); the peak search periods for tobacco were March to April 2004 (SVI = 17); and the peak search period of HPV was April 2004 (SVI = 1) (►Fig. 1).

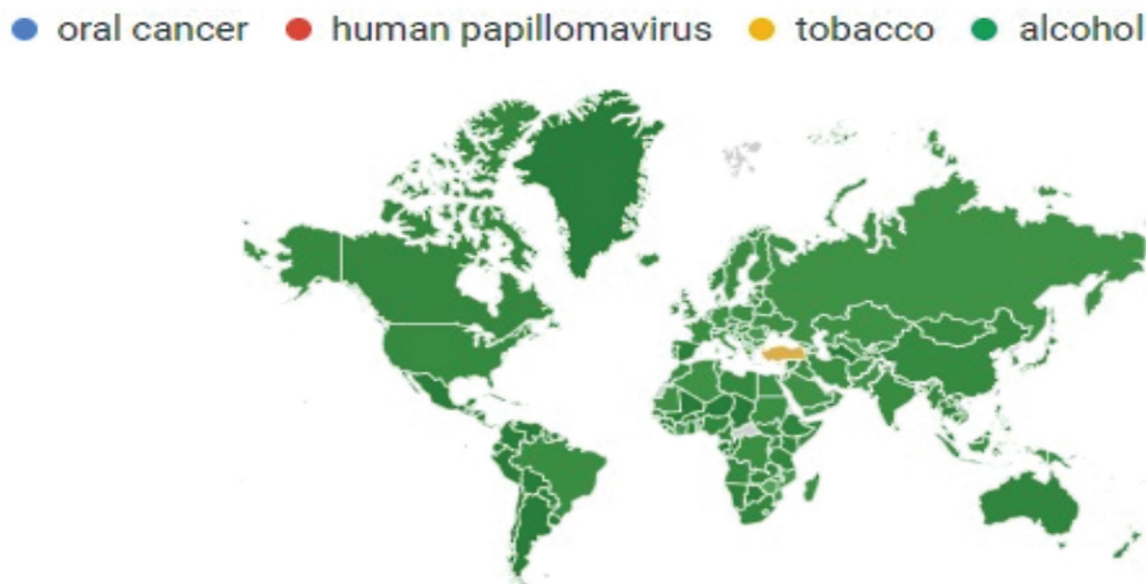
►Fig. 2 (Data source: Google Trends [<https://www.google.com/trends>]) is an analytic geo-map developed from the comparative analysis of searches, from 2004 to January, 2022, on web searches per country on oral cancer, tobacco, alcohol, and HPV. In this figure, all countries, including countries with low SVIs ( $n = 178$ ), were included. In the geo-map, the most prominent search term in a country has the color indicating the search term. It is noteworthy that oral cancer was not the most prominent search term in any of these countries. However, in all these countries, alcohol was the most common searched term, except for Turkey where tobacco was the most common (55%) searched term.

After excluding the countries with low SVIs, countries with high and moderate SVIs ( $n = 40$ ) were subjected to further analysis. Brazil had the highest proportion (0.04%) of searches-per-country on oral cancer, Argentina had the highest proportion (99%) of searches-per-country on alcohol, Turkey had the highest proportion (55%) of searches-per-country on tobacco, and Kenya (1%) and Nigeria (1%) had the highest proportions of searches-per-country on HPV (►Fig. 3).

►Table 1 shows the list of top 25 search queries used on Google Trends to search for oral cancer, HPV, tobacco, and alcohol, from 2004 to January 2002. The top 25 search queries for oral cancer, HPV, tobacco, and alcohol had SVI ranges of 22 to 100, 12 to 100, 28 to 100, and 18 to 100,



**Fig. 1** Comparative global trend analysis of search volume indices on oral cancer and its major risk factors (time frame: 2004 to January, 2022).



**Fig. 2** Comparative analysis of global web searches of oral cancer and its major risk factors using a geo-map (time frame: 2004 to January, 2022). SVI, search volume index.

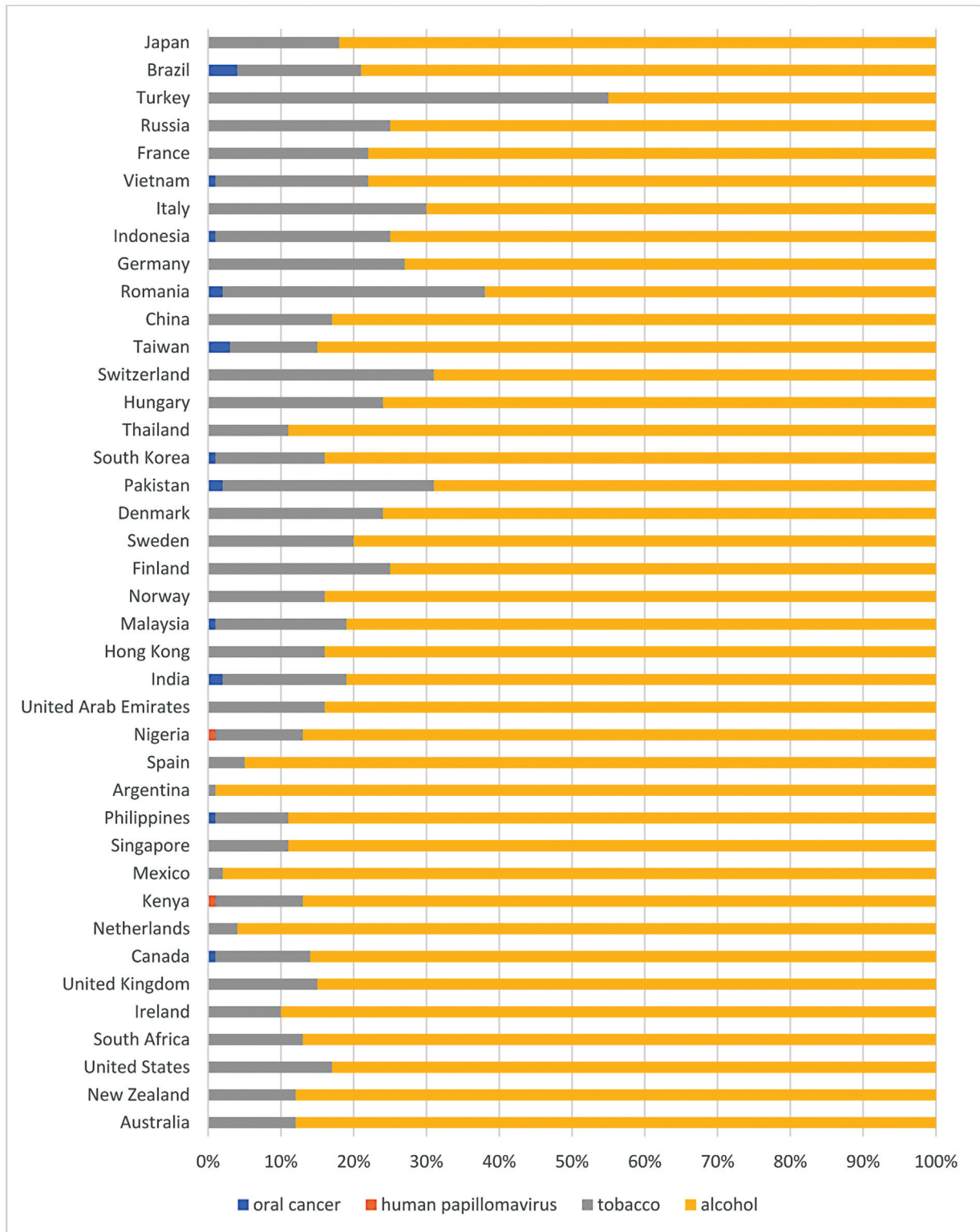
respectively. From these search queries, it was observed that people have interest in oral cancer symptomatology, and the adverse effects of tobacco, alcohol, and HPV.

### Discussion

The findings obtained in this study were noteworthy. From the results obtained, it was observed that while the global

search interest in alcohol and tobacco was more varied over time with an overall decrease in the use of these search terms, web search interests in HPV and oral cancer appeared to be more stable maintaining a rough plateau over this 18-year time frame under study.

Of particular interest was the sudden spike in the SVI of global web search of alcohol in March 2020. Coincidentally, March 2020 was the period when several nations started



**Fig. 3** Comparative analysis of global web searches of oral cancer and its major risk factors using a bar graph (time frame: 2004 to January, 2022).

announcing/implementing lockdowns to deter COVID-19 outbreak.<sup>31–35</sup> Over a period of approximately 3 months (March 2020–June 2020), the SVI spike gradually declined to its previous level. From the juxtaposition of this decline with the timeline of multinational COVID-19 lockdown experience, it was observed that May/June 2020 was the

period when countries started easing lockdowns.<sup>35,36</sup> Pertinently, because of the lockdown—as human movement was massively restricted—many people used online markets to purchase alcoholic beverages. This can be confirmed by a reported two-digit increase (36%) in alcohol use observed in several countries during the COVID-19 lockdown.<sup>37</sup> On the

**Table 1** Queries used to search for oral cancer, HPV, tobacco, and alcohol globally (time frame: 2004 to January, 2022)

Oral cancer		HPV		Tobacco		Alcohol	
SQ	SVI	SQ	SVI	SQ	SVI	SQ	SVI
Oral cancer	100	HPV infection	100	Pipe tobacco	100	Alcohol drinking	100
Cancer symptoms	100	HPV	100	Pipe	100	What is alcohol	91
Oral mouth cancer	98	HPV	100	Tobacco shop	96	el alcohol	77
Mouth cancer	96	Cancer	44	American tobacco	85	Alcohol content	65
Tongue cancer	58	HPV cancer	44	Chewing tobacco	84	Beer	54
Oral cancer tongue	58	HPV vaccine	43	Smoking	71	Alcohol effects	44
Tongue	58	Virus	40	Smoking tobacco	71	Rubbing alcohol	42
Throat cancer	49	HPV virus	40	Tobacco near me	66	Alcohol 120	42
Oral cancer treatment	41	HPV symptoms	37	British tobacco	61	Alcohol free	40
Oral cancer HPV	40	HPV infection	33	British American tobacco	56	Wine	40
HPV cancer	40	HPV infection	33	Cigarettes	54	Alcohol test	33
HPV	40	What is HPV	30	What is tobacco	54	No alcohol	33
Oral HPV	40	Warts	30	Tobacco store	53	Alcohol withdrawal	31
Symptoms of cancer	40	HPV warts	30	Cigarette tobacco	51	Isopropyl alcohol	30
Symptoms of oral cancer	40	Genital HPV	25	Cigarette	51	Isopropyl	30
What is oral cancer	36	Herpes	22	Tobacco use	42	Effects of alcohol	28
Oral cancer pictures	35	Cervical cancer	19	Tobacco road	41	Alcohol drinks	27
Oral cancer signs	32	Papilloma	17	Tobacco company	38	Alcohol abuse	24
Oral cancer causes	32	HPV	17	Alcohol	36	Vodka	23
Sexo oral cancer	26	HPV causes	16	Best tobacco	36	Alcoholic	22
Oral cancer screening	26	HPV men	14	Nicotine	35	Alcohol syndrome	22
Signs of oral cancer	24	HPV treatment	14	Tobacco effects	33	Alcohol poisoning	21
Oral cancer on tongue	23	Chlamydia	13	Rolling tobacco	29	Alcohol near me	20
Breast cancer	22	STD	13	Tobacco shops	28	Alcohol level	19
Gum cancer	22	Genital warts	12	Pipes	28	Sugar alcohol	18

Abbreviations: HPV, human papillomavirus; SQ, search query; STD, sexually transmitted disease; SVI, search volume index.

other hand, the peak periods of tobacco and HPV web searches were about two decades ago (year 2004), while that of oral cancer was multiple; these suggested that COVID-19 lockdown had no obvious effect on the rate of their web searches.

It is interesting to note that the overall volume of global searches on oral cancer, alcohol, tobacco, and HPV was unequal. Out of these four terms, alcohol and tobacco were the most searched, while HPV and oral cancer were less searched. The low relative SVIs of oral cancer and HPV is probably a reflection of the low level of lay public knowledge recorded in multiple surveys concerning these two terms.<sup>16,38–48</sup> Based on this finding, evidence-based educational interventions are recommended to encourage public online interests and information-seeking behavior concerning these health terms, particularly on oral cancer, and HPV. Furthermore, it is recommended that these interventions are country-specific interventions to reduce the existing inequalities in the search volumes on these terms across countries. For example, the proportion of searches on oral cancer in India was very low. However, in India, unlike in

Brazil and several other countries, oral cancer forms over 30% of its cancer cases and, also, about one-third of global oral cancer cases are from India.<sup>49,50</sup> In addition, only two countries—Nigeria and Kenya—had appreciable search proportions on HPV. With the current explosion in the global burden of HPV-induced oropharyngeal cancers and low web searches on HPV, it becomes imperative for all countries to start focusing more on interventions that will enhance digital health literacy and improve HPV understanding.<sup>21,51–53</sup>

As earlier noted, alcohol and tobacco were the two most searched terms out of the four investigated search terms. Some search queries, such as “alcohol near me,” “tobacco shops,” and “tobacco near me,” suggest that some of these web searches were for sourcing alcohol and tobacco. It is pertinent that the forms of online information concerning these two substances are diverse, many of which were commercial-, policy-, or health-related.<sup>19,54–57</sup> However, research had identified that some of those web-based sources encouraging the use of alcohol and tobacco are highly promoted, more engaging, more accessible, and more

enticing, while those discouraging alcohol and tobacco use are difficult to access by the public, and less engaging.<sup>16,21,54–57</sup> Hence, it is recommended that all relevant public health organizations should intensify the optimization, promotion, reachability, and regular update of their web pages on health information pertaining to tobacco and harmful alcohol use prevention, to ensure that Internet surfers can easily access credible information on health and alcohol and tobacco use prevention.

However, this study has its limitation. This study was based on the data obtained from Google Trends while only 92.47% of all global Internet searches are conducted using Google search<sup>58</sup> hence, not all search engines were included in this study. Notwithstanding this limitation, this study is believed to be the first to explore the online search interests on oral cancer and its major risk factors, from 2004 till date.

In conclusion, this study provided credible evidence, with logical explanations, about the overall declining online interest on oral cancer and its major risk factors on a global scale.

#### Funding

None.

#### Conflict of Interest

None declared.

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