Prevalence, presentation, risk factors and awareness of oral cancer: A systematic review of the Nigerian experience

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Abstract

Background: Oral cancers are malignant neoplasia of the lip and/or oral cavity that represent a major part of head and neck carcinomas (HNCs) along with laryngeal and pharyngeal carcinomas. Although oral cancers can be considered a health burden, available evidence on the actual burden in Nigeria is sparse.

Aims: The aim of this review was to determine the prevalence, presentation, risk factors, and awareness of oral cancer in different geopolitical zones in Nigeria.

Methods: Systematic literature searches were conducted in PubMed (NLM), Cochrane, Ovid Medline, OpenGrey and Google scholar databases, to identify publications on the prevalence, presentation, risk factors, and awareness of oral cancer in different geo-political zones in Nigeria.

Results: Oral cancer was found to be the most common form of HNCs in several of the included studies. Although reports from included studies varied across geopolitical zones in Nigeria, generally, oral cancers were most found in males, between the 5th and 6th decade, and the tongue, palate, maxilla, and mandible were common sites. In addition, a suboptimal level of awareness of oral cancer was reported by the majority of reviewed studies.

Conclusion: This review showed variations in prevalence, presentation, and risk factors of oral cancer across different geopolitical zones in Nigeria and highlighted the low level of knowledge and awareness of oral cancer among the Nigerian population.

Keywords: oral cancer; prevalence; presentation; risk factors; awareness; systematic review; Nigeria

Introduction

Oral cancers are malignant neoplasia of the lip and/or oral cavity that represent a major part of head and neck carcinomas (HNCs) along with laryngeal and pharyngeal carcinomas. They remain a health burden as their incidence ranks sixth globally amongst all cancers, accounting for approximately 5% of all malignant tumors.[1,2] Majority (90%) of oral cavity carcinomas originate histologically from squamous cells, therefore, oral cancers are traditionally defined as oral squamous cell carcinomas (OSCC).[3,4] They are associated with low five-year survival rate especially in underdeveloped and developing countries[5] and they represent a major cause of morbidity and mortality worldwide.[5,6]

Nigeria is a developing country in Western Africa with an estimated population of 225 million persons (2023) spread across a land area of 923,768.64 square kilometers.[7] The country is made up of six geopolitical zones including Northcentral, Northeast, Northwest, Southeast, Southsouth and Southwest

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Nigeria, and although the reason is unclear, previous studies have suggested a varied prevalence and presentation among these geopolitical zones within the Nigerian population.[8] Available evidence on the actual burden of oral cancer in Nigeria is sparse.[9] This is further highlighted by the low number of oral cancer related publications from Nigeria seen in various global cancer registries.[5] In addition,

majority of the oral cancer related studies in Nigeria are hospital-centered and not population-centered which may not give an accurate representation of the oral cancer burden in Nigeria.[9,10]

The World Health Organization (W.H.O) has reported an increased prevalence of cancer-related deaths among underdeveloped countries.[9] Although Nigeria is a developing country with 11 cancer registries located in teaching hospitals across the country, majority of these centers are poorly funded which may result in unfavorable oral cancer management outcomes.[5] Cancer-related deaths are often times associated with the stage of the lesion at diagnosis and intervention; early stage lesions present with better prognosis compared to their late stage counterparts.[11,12]

In Nigeria, oral cancer is frequently diagnosed in the late stage as most patients present later in the course of the disease.[13,14] Several studies[4,5,13–15] have attributed this negative health-related behavior to financial challenges, lack of awareness and traditional beliefs. These studies[4,5,13–15] led to the proposition and implementation of oral cancer awareness campaigns and advocacies across various communities in Nigeria over the past decade, the effects of which is sparsely documented, and requires further investigation. With this in view, this paper aimed to review the prevalence, presentation, risk factors, and awareness of oral cancer in different geopolitical zones in Nigeria, and proffer solutions to problematic trends identified.

Methodology

Eligibility criteria: In order to ensure a thorough review of all available information, case-control, retrospective, cohorts, cross-sectional and experimental studies were included to allow for review of a wide collection of information and high level of evidence. Case reports, case series and review articles were excluded. Studies on HNCs were also excluded from the review. However, in cases where data for oral cancers could be extracted from HNCs; extractable data were included in the review.

The initial search was done to only include studies published up to December 2023. However, independent searches yielded studies published after this date. This was done to ensure review of more recent and up to date information. The included studies had to report on the prevalence of oral cancer in a Nigerian population, the presentation of oral cancer, identified risk factors, and/or awareness of oral cancer in a Nigerian population.

Only articles written in English or with English language translations were considered for the review. There were no other publication conditions. Studies included were of different study designs, published in different parts of Nigeria to allow for heterogeneity of source of information for the review.

Nigeria can be divided into six geopolitical zones: Northcentral, Northeast, Northwest, Southeast, Southsouth and Southwest, and oral cancers have been shown to have varying distribution patterns across these zones. Included studies were divided according to the geopolitical zones in Nigeria to allow for comparability between zones in Nigeria. Multicentered studies with included participants from different geopolitical zones in Nigeria were also included, stating all the geopolitical zones represented in the study.

Information sources: Computerized systematic literature searches were conducted in PubMed (NLM), Cochrane, Ovid Medline, OpenGrey and Google scholar databases to identify publications on prevalence, presentation, risk factors, and awareness of oral cancer in Nigeria published till December 2023. Hand searching of the reference section of selected studies and purposeful online searches up to November 2024 were also done to identify additional eligible studies.

Search strategy: The search strategy for PubMed involved the use of the following keywords and Boolean operators: oral cancer OR oral carcinoma OR oral squamous cell carcinoma OR head and neck cancers AND prevalence OR epidemiology OR distribution AND etiological factors OR risk factors AND presentation OR clinical presentation OR histologic presentation AND awareness OR knowledge AND Nigeria. Similar search strategies were used for other database searches, and the inclusion criteria used for screening were articles written in English language by Nigerian authors about the Nigerian population.

Study selection: A total of 137 article abstracts were identified after inclusion of all keywords. The identified studies were screened for eligibility. For studies appearing to meet the inclusion criteria or for
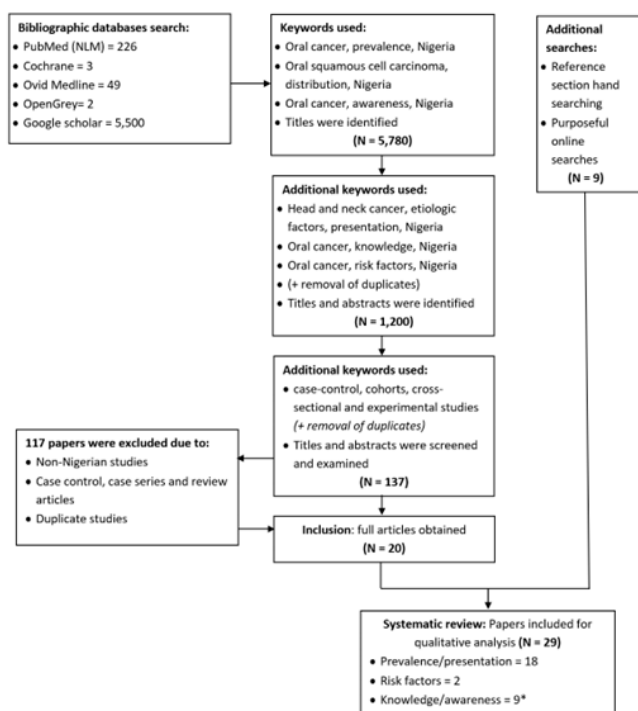
which there were insufficient data in the abstract to make a clear decision, full study reports were obtained. Full reports were also assessed to determine whether the studies met all the criteria and to eliminate duplicate studies. Only 29 articles were identified as meeting all inclusion criteria and were included in the study. Details of the study selection process are shown in Figure 1.

Data extraction: Data extraction was done if the paper provided original data on oral cancer in Nigeria in accordance with the aim of this review and when available, qualitative and quantitative analyses of study data were extracted and reported. The data extraction forms were piloted on several papers and modified as required before use.

Data items: For included studies, the following data were recorded (where available): Author's name, year of publication, study design, geopolitical zone in Nigeria, prevalence of oral cancer, age, sex, site and histopathology of oral cancer in Nigeria.

Methodological quality assessment: The quality of included studies was assessed using a modified version of the Newcastle-Ottawa scale (NOS)[17] adopted from Barbosa et al, 2017.[18] The NOS items used (where available) were study design, sample selection criteria (case definition, patient representativeness and patient selection process) and oral cancer evaluation criteria (diagnostic processes and sample loss for longitudinal studies) for oral cancer prevalence/presentation studies. Study design, sampling method and sample size determination were used for knowledge/awareness studies. The scale scores ranged from 0 to 6 with 0, 1, 2 representing low quality, 3, 4 representing moderate quality, and 5, 6 representing high quality.

Results
Included studies
The review process yielded 29 full articles that met all inclusion criteria: 18 studies[9,13-15,19-32] on prevalence/presentation of oral cancer, two studies[33,34] on risk factors of oral cancer, and nine studies[4,35-42] of knowledge/awareness of oral cancer. The study by Lawoyin et al. 2003[33] was included in

Figure 1: Flow chart of the study search strategy and selection process according to PRISMA[16]

Table I: Table of included studies

Geopolitical zones	Authors, year of publication	Study design	Quality score
• *Prevalence/presentation*			
Northcentral	Otoh et al. 2004[27]	Retrospective study	3/6
Northeast	Akinmoladun et al. 2013[28]	Retrospective study	3/6
	Otoh et al. 2005[29]	Retrospective study	3/6
Northwest	Omisakin et al. 2023[30]	Retrospective study	3/6
Southeast	Oji and Chukwuneke 2006[14]	Retrospective study	3/6
Southsouth	Bassey et al. 2015[15]	Retrospective study	3/6
	Okoh et al. 2015[31]	Retrospective study	3/6
Southwest	Adeyemi et al. 2008[32]	Retrospective study	3/6
	Ajayi et al. 2007[19]	Retrospective study	3/6
	Amusa et al. 2004[20]	Retrospective study	3/6
	Arotiba et al. 1999[21]	Retrospective study	3/6
	Arotiba et al. 2010[22]	Retrospective study	3/6
	Gbotolorun et al. 2016[13]	Cross-sectional study	4/6
	Popoola et al. 2013[9]	Cross-sectional study	4/6
	Effiom et al. 2008[23]	Multicenter retrospective study	4/6
	Olusanya et al. 2018[24]	Retrospective study	3/6
	Lawal et al. 2020[25]	Multicenter retrospective study	3/6
Southwest and Southsouth	Omitola et al. 2007[26]	Multicenter cross-sectional study	4/6
• Risk factors			
Southwest	Lawoyin et al. 2003[33]	Cross-sectional study	4/6
	Lawal et al. 2011[34]	Case-control study	4/6
• *Knowledge/awareness*			
Northwest	Adebola et al. 2013[35]	Cross-sectional study	4/6
Southeast	Uguru et al. 2023[36]	Cross-sectional study	4/6
Southsouth	Okoh et al. 2015[37]	Cross-sectional study	4/6
Southwest	Egbunah et al. 2022[4]	Cross-sectional study	4/6
	Gbotolorun et al. 2014[38]	Cross-sectional study	4/6
	Gbotolorun et al. 2015[39]	Cross-sectional study	4/6
	Kanmodi et al. 2017[40]	Multicentered cross-sectional study	4/6
	Lawoyin et al. 2003[33]	Cross-sectional study	4/6
	Kanmodi et al. 2022[41]	Cross-sectional study	4/6
	Oyapero et al. 2024[42]	Cross-sectional study	4/6

Table II: Prevalence of oral cancer across geopolitical zones in Nigeria.

Geopolitical zones	Authors, year of publication	Prevalence (%)
Northcentral	Otoh et al. 2004[27]	7.6
Northeast	Akinmoladun et al. 2013[28]	28.8
	Otoh et al. 2005[29]	15.4
Northwest	Omisakin et al. 2023[30]	Not reported
Southeast	Oji and Chukwuneke 2006[14]	2.7*
Southsouth	Bassey et al. 2015[15]	43.5
	Okoh et al. 2015[31]	56.1
Southwest	Adeyemi et al. 2008[32]	71.7
	Ajayi et al. 2007[19]	44.0
	Amusa et al. 2004[20]	36.8
	Arotiba et al. 1999[47]	1.2*
	Arotiba et al. 2010[22]	28.7
	Gbotolorun et al. 2016[13]	41.6
	Popoola et al. 2013[9]	0.46*
	Effiom et al. 2008[23]	10.8*
	Olusanya et al. 2018[24]	38.0
	Lawal et al. 2020[25]	Not reported
	Omitola et al. 2007[26]	Not reported

*Note: The study by Arotiba et al. 1999, Oji and Chukwuneke 2006, Popoola et al. 2013 and Effiom et al. 2008 reported prevalence of oral cancer among all neoplasms or all cancers, and not prevalence among head and neck malignancies as reported by other included studies.

the review for risk factors and knowledge/awareness of oral cancer. The PRISMA flow chart for this review can be seen in Figure 1 and details of included studies can be found in Table I.

Quality assessment
The quality of studies was evaluated using the NOS scale adopted from Barbosa et al, 2017.[18] All included studies were of moderate or intermediate quality according to the NOS scale. No low-quality study was identified. The quality assessment result for each study is itemized in Table I.

Prevalence
Oral cancers are among the most common cancers worldwide, with approximately 442,760 incident cases and 241,418 deaths reported in the last worldwide oral cancer census.[43,44] There are geographical variations in the incidence of oral cancers, with increase among men and women in some European and African countries, stabilization in certain Asian countries, and decrease in Canada and USA.[45,46]

Several epidemiological studies have been conducted on oral cancer in different geopolitical zones in Nigeria. North-Central Nigeria reported that OSCC constitute 7.6% of all HNCs[27] while North-East Nigeria reported 19.5% of all HNCs.[28] OSCC was reported to account for 2.7% of all cancer cases in South-East Nigeria,[14] 18.7% – 25.1% in South-South Nigeria[15,31] and 9.7 – 18% in South-West Nigeria.[47,48] Omitola et al. 2017[26] conducted a prospective multicentered study involving four oral cancer healthcare centers across two geopolitical zones; Southsouth and Southwest. Results of this study showed that oral cancer was significantly more prevalent in the Southsouth region (59.2%) compared to the Southwest region (40.8%).

Survival following a diagnosis of OSCC remains poor with overall five-year survival around 68%.[49] Only limited improvements have been recorded since the late 1980s.[49] The results of these previous studies suggest regional variations in prevalence of oral cancers across geopolitical zones in Nigeria arising from the varying lifestyle and cultural practices of these regions. In addition, studies[50] have pointed to an increase in incidence and mortality rates of oral cancers especially among the younger age group, which may be due to lifestyle changes and/or increased awareness and reporting of the condition. Table II shows prevalence of oral cancer among HNCs across different geopolitical zones in Nigeria.

Age distribution
Although oral cancer can occur at any age, it is commonly considered as a disease of the middle age and elderly.[51] Previous studies[51,52] have suggested that the increased incidence of oral cancer with increasing age may be due to the increased reactions of free radicals in the body with age. In addition, these studies[51,52] suggest that cancer surveillance by immune cells reduce with age which results in a diminished ability of the immune system to eliminate damaged and mutated cells. Oral cancers have also been associated with harmful social habits such as cigarette smoking and alcohol consumption.[4,34] These habits have a deterministic effect on the occurrence of several types of cancer including oral cancers.[34] The effects of these habits buildup over time, and may be responsible for the oral cancer eventuality occurring in an older age group. In Nigeria, a recent study by Gbotolorun et al. 2016[13] showed that the peak age of incidence of oral cancer was in the 5th decade. In addition to the 5th decade, similar studies[14,15,19,28,53] conducted in the Nigerian population have reported the 6th and 7th decade as the most common age group involved. The study by Otoh et al. 2004[27] reported a wide age range of 15-75 years. The multicentered study by Omitola et al. 2017[26] reported a higher mean age distribution in the Southsouth of 65.4 years compared to a mean age of 54.4 years seen in the Southwest region. The

study by Amusa et al. 2004[20] was the only study to report the 1st decade as the most prevalent age range for incidence of oral cancer. This discrepancy, however, may be due to the addition of all HNCs including cancers in the oral cavity, neck, thyroid, esophagus, and paranasal sinuses (Table III).

Sex distribution

Oral cancers have been reported to be two to three times more common in males than females.[51] This is majorly attributed to social habits such as cigarette smoking, alcohol consumption, betel nut chewing, etc. that are more commonly practiced by males than females. Recent studies, however, have reported a reduction in the male predilection for oral cancer, stating that the practice of these harmful social habits are no longer peculiar to males.[54] This is similar to reports from majority of previous Nigerian studies.[9,13,19,22,28] The study by Popoola et al. 2013[9] reported a male to female ratio as high as 5:1. Other Nigerian studies[13,14,22,27,53] reported reduction in male preponderance ranging from 2.4 to 1.1:1 male to female ratio. The multicentered study by Omitola et al. 2017[26] reported a relatively even male to female ratio in the Southwest region while a male preponderance was seen in the Southsouth region with a male to female ratio of 1.5:1.

The study by Otoh et al. 2005[29] conducted in Northeast Nigeria reported a slight female preponderance for oral cancer. A similar result was seen in Southsouth Nigeria by Bassey et al. 2015[15] who reported a male to female ratio of 1:1.5 (Table III). These discrepancies highlight the variations of oral cancer presentation in different geopolitical zones in Nigeria. In addition, the increased female predilection of oral cancer reported in these two studies[15,29] corroborate the findings of Scully, 2013[54] who reported a reduction in male predilection for oral cancer due to the universal practice of harmful social habits, no longer peculiar to men.

Site distribution

The tongue is the most common site for oral cancer in the U.S.[55] Some studies have reported that the floor of the mouth and the lip are most common in patients who consume alcohol regularly and in light-skinned patients respectively.[55] In Northcentral Nigeria, the tongue was the most common site for oral cancer.[27] Also, the oral cavity and tongue were the most common site for oral cancer in Southeast Nigeria,[14] while the palate was the most common site for oral

Table III: Age, sex, and site distribution of oral cancer across geopolitical zones in Nigeria.

Geopolitical zones	Authors, year of publication	Most common age groups involved (%)	Sex distribution (male: female)	Most common site distribution (%)
Northcentral	Otoh et al. 2004[27]	15-75 years (92.6)	2.4:1	Tongue (33.3), palate (27.8), lips (16.7), others (22.2)
Northeast	Akinmoladun et al. 2013[28]	7th decade (18.8) 5th decade (12.5) 6th decade (12.5)	1.2:1	Palate (30.5), gingiva (16.9), maxilla (15.3), buccal mucosa (13.6), mandible (10.2), others (13.5)
	Otoh et al. 2005[29]	6th decade (mean= 56.5 ± 14.8 years)	1:1.2	Palate (44.2), lips (13.9), floor of the mouth (9.3), others (32.6)
Northwest	Omisakin et al. 2023[30]	Mean 37.64 years	2.32:1.51	Mandible (31.9), maxilla (25.5), tongue (17.9), cheek (9.2), gingivae (6.4), floor of the mouth (4.9), lip (4.3)
Southeast	Oji and Chukwuneke 2006[14]	7th decade (35.8) 5th decade (18.5)	1.5:1	Oral cavity (35.0), tongue (29.0), floor of the mouth (21.0) and the lip (15.0)
Southsouth	Bassey et al. 2015[15]	5th decade (mean= 34.6 years)	1:1.5	Mandible (47.8), maxilla (41.3), floor of the mouth (10.9)
	Okoh et al.2015[31]	7th decade (23.1), mean 51 ± 17.9 years	1:1.1	Palate (18.8), parotid area (18.1), retromolar (12.5, alveolar mucosa (11.9), buccal mucosa (5.6)
Southwest	Adeyemi et al. 2008[32]	6th decade (mean= 43.8 ± 19.6 years)	1.8:1	Oral cavity and oropharynx (31.1)
	Ajayi et al. 2007[19]	5th decade (22.3) 6th decade (17.9)	2:1	Maxilla (28.6), mandible (27.7), palate (11.6), tongue (8.9), floor of the mouth (5.4), others (17.8)
	Amusa et al. 2004[20]	1st decade (19.2) 5th decade (16.0)	1.4:1	Mandible and maxilla (84.3), palate (10.4), lips (2.3), tongue (2.6)
	Arotiba et al. 1999[47]	6th decade (mean= 53.7 years)	1.5:1	Most common site= palate
	Arotiba et al. 2010[22]	6th decade (28.4) 5th decade (21.4)	1.4:1	Palate (32.8), floor of the mouth (30.1), tongue (23.4), others (13.7)
	Gbotolorun et al. 2016[13]	Median= 49 years	1.4:1	Tongue (40.0), mandible (26.7), floor of the mouth (20.0), others (13.3)
	Popoola et al. 2013[9]	Not reported	5:1	Maxilla (33.3), others (66.7)
	Effiom et al. 2008[23]	3rd and 5th decade (mean= 45.3 years)	1.4:1	Mandibular gingiva (31.8), maxillary gingivae (23.3), tongue (17.6)
	Olusanya et al. 2018[24]	Mean 53.9 ± 18.9 years	1.45:1	Maxilla (26.0), mandible (18.2), tongue (18.2), palate (13.0)
	Lawal et al. 2020[25]	Included patients were ≤40 years	1.5:1	Mandible (28.7), maxilla (25.5), palate (14.9)
Southwest and Southsouth	Omitola et al. 2007[26]	Mean 56.2 ± 16.4 years	1.3:1	Maxilla (20.4), palate (20.4), mandible (14.2), floor of the mouth (10.5)

Figure 2: Oral cancer of the floor of the mouth raising and displacing the tongue and extending to involve the mandible (left: intraoral, right: extraoral). (Image credit: Department of Oral and Maxillofacial Surgery, Lagos University Teaching Hospital, Nigeria)

Figure 3: Oral cancer of the palate showing non-healing ulcer, extraction socket indicating tooth loss, and molar teeth displacement due to bone destruction by cancer (left: intraoral, right: extraoral). (Image credit: Department of Oral and Maxillofacial Surgery, Lagos University Teaching Hospital, Nigeria)

Figure 4: Oral cancer of the mandible showing large inflamed non-healing ulcer originating from the molar and paramolar region (left: intraoral, right: extraoral). (Image credit: Department of Oral and Maxillofacial Surgery, Lagos University Teaching Hospital, Nigeria)

cancer in Northeast Nigeria.[28,29] Studies from Southsouth and Southwest Nigeria reported varied site predilection which included maxilla, mandible, palate, and tongue as most common sites for oral cancer[9,13,15,19,20,22,53] (Table III). Figures 2 – 4 shows oral cancer in different locations in the oral cavity.

Histopathological types of oral cancer

Oral cancers may develop from epithelial (carcinomas), mesenchymal (sarcomas), or hematolymphoid tissues (lymphomas, leukemias, plasmacytomas).[56] However, the most common histopathologic presentation of oral cancer is the OSCC which originates histologically from squamous cells.[3] Reports from developed countries state that the OSCC make up about 90% of all oral cavity carcinomas.[3] Similar to these reports,[3] in North central Nigeria, Otoh et al. 2004[27] reported that among all diagnosed HNCs, 81.5% were carcinomas, 16.7% were sarcomas, and 1.8% were lymphomas, and OSCC represented 84.1% of diagnosed carcinomas. Similar results were seen in other geopolitical zones in Nigeria. In Northeast Nigeria, carcinomas (majorly OSCC) represented majority of HNCs[28,29] with Akinmoladun et al. 2013[28] reporting a prevalence of 81.3%. From the Southeast, Oji and Chukwuneke 2006[14] reported that 96% of all invasive carcinomas were OSCCs. Majority of reports from Southwest Nigeria reported a prevalence of OSCC of 60-70%.[19,22,32] Ajayi et al. 2007[19] reported a prevalence of 63% of all HNCs, Arotiba et al. 2010[22] reported 66.4%, and Adeyemi et al. 2008[32] reported 66.7%. Gbotolorun et al. 2016[13] reported a prevalence of 41.7% of all HNCs, which was the most common histologic type reported, but was lower than other reports from the region. Similarly, in Southsouth Nigeria, although OSCC were reported as the most common histopathologic type of HNCs, its prevalence was not as high as reported in other geopolitical zones in Nigeria. Bassey et al. 2015[15] reported that OSCC was the most common with a prevalence of 43.5%, followed by Burkitt lymphoma 17.4%, estrogenic sarcoma 13.0%, rhabdomyosarcoma 8.7%, adenoid cystic carcinoma 6.5%, mucoepidermoid carcinoma 4.3%, and non-Hodgkins lymphoma 2.2% in that order. Also, Okoh et al. 2015[31] reported majority of oral cancers as OSCC (58.6%), with acinic cell (8.6%) and adenocystic carcinomas (8.1%) as second and third respectively.

Risk factors of oral cancer

The etiology of oral cancer is multifactorial involving multiple steps.[57] However, there is substantial evidence that precancerous habits such as tobacco use, alcohol consumption, betel quid and

kola nut chewing, exposure to carcinogens in the workplace, excessive sun exposure, poor diet, vitamin deficiency, viral infections and sexual behaviors resulting in Human Papilloma Virus (HPV) infection are significant risk factors in the etiology of OSCC. [49,58–61]

Tobacco has been proven to increase the risk of several cancers including oral cancer, and it has a synergistic effect with alcohol consumption. Studies[62,63] have shown that the risk for developing oral cancer is increased three times in patients who smoke cigarettes, and the risk of a nonsmoker developing oral cancer increases by 87% when exposed to consistent secondhand smoke. In addition, Marron et al. 2010[64] reported that the risk of developing oral cancer reduces by 35% if a patient quits smoking for at least 4 years. The tobacco and the smoke from the cigarette results in hypoxia and weakened immunity of the oral environment resulting in outcomes such as gingivitis, periodontitis, and oral cancer.[55] In Nigeria, tobacco has been associated with the development of oral cancer. Otoh et al. 2004[27] in Northcentral Nigeria reported an association between cigarette smoking and development of oral cancer. Another study[65] from Northcentral Nigeria reported a synergistic effect and a significant association between tobacco smoking, alcohol consumption and oral cancer. Similarly, Lawal et al. 2011[34] in Southwest Nigeria reported a 4.05 increased risk in oral cancer development with tobacco use.

Kola nut chewing and tobacco chewing have also been reported to be significantly associated with oral cancer in the Nigerian population. In Northcentral Nigeria, kola nut and tobacco chewing were associated with development of oral cancer.[27] In addition, Odukoya et al. 1990[66] in Southwest Nigeria reported that kola nuts promote palatal keratinization in cigarette smokers serving as synergistic co-carcinogen, promoting the development of OSCC. Unhealthy diets have also been associated with the development of oral cancer in Nigerians. In Southwest Nigeria, Lawal et al. 2011[34] reported that the odds of developing oral cancer was three times more in patients who did not consume fruits and vegetables regularly. Similarly, a study[65] in Northcentral Nigeria reported that patients with oral cancer had significantly lower levels of antioxidant vitamins A, C and E compared to healthy controls with p<0.05 for all tested associations.

Not all reports out of Nigeria agreed with current trends. Two studies[33,47] from Southwest Nigeria showed no association between oral cancer and known precancerous habits like tobacco and alcohol. They[33,47] suggested that other predisposing factors like genetics, nutrition, and infection may play more important roles in oral cancer development in their environment. Similarly, Oji and Chukwuneke in Southeast Nigeria reported that majority of patients with oral cancer in their health center gave no positive history of tobacco use and alcohol consumption.[14] They[14] postulated other risk factors such as poor education, low socioeconomic class, poverty, malnutrition, and poor oral hygiene as major causes of oral cancer in their environment.

Knowledge and awareness of oral cancer

Oral cancer is one of the most lethal diagnoses encountered in dental and maxillofacial surgery.[13] In Nigeria, It is often encountered at a late stage due to late patient presentation resulting in poor prognosis.[13,47] This is often attributed to low socioeconomic class, illiteracy, healthcare inaccessibility, harmful beliefs and stereotypes, utilization of traditional, and untested healthcare methods.[34,65] A study done on the knowledge of oral cancer among adults in a rural community in Southwest Nigeria showed that over 90% of respondents had low knowledge of the general features of oral cancer, 61.7% had low knowledge of its risk factors, 71.7% had low knowledge of its treatment options and 75.3% had low overall knowledge of oral cancer.[4] The study also showed that increased knowledge was associated with higher level of education and increased utilization of healthcare facilities (p<0.05 for both associations).[4] A similar study in Northwest Nigeria among traditional healers and herbalists reported that majority (66.7%) of traditional healers had never heard of oral cancer.[67] Knowledge of oral cancer was also significantly associated with level of education; traditional healers with low level of education exhibited low levels of knowledge of oral cancer.[67] This is particularly concerning because previous studies[34,65] have reported that a good number of Nigerians frequent these traditional healers and herbalists, and if these healers do not have adequate knowledge of oral cancer, it further results is poor management, late presentation, and overall poor

prognosis of oral cancer in the Nigerian population. Recent reports from Southeast Nigeria among military personnel showed only 15.3% had knowledge of oral cancer, and less than half of them could identify risk factors of oral cancer such as cigarette smoking and alcohol consumption.[36] The study also showed that majority of military personnel believed that oral cancer was caused by a supernatural phenomenon, further highlighting the deficiencies in knowledge.[36] A study by Kanmodi et al. 2022[41] assessed knowledge of HNCs and oral cancer among secondary school students in Nigeria. The study[41] included respondents from all geopolitical zones in Nigeria except Southeast Nigeria. Only 31.2% of them had knowledge of HNCs, and more than half of them had below average scores in their knowledge assessment tests.[41] In addition, a low (32.4%) amount of respondents had received either formal or informal education on oral cancer, and over 80% of respondents indicated an interest in knowing more about HNCs and oral cancers, indicating a lack of awareness of oral cancer among secondary school students in Nigeria. In Southsouth Nigeria, a study on knowledge of oral cancer among graduating dental students showed that although all participants had knowledge of oral cancer, only about 23% of students had high scores in their knowledge of oral cancers and risk factors test,[37] corroborating results from other Nigerian studies. The lack of significantly high knowledge of oral cancer indicates the need for improved awareness to improve outcomes of oral cancer in the Nigerian population.

Discussion

The prevalence of oral cancer reported in included studies in this review highlights variations in prevalence across different geopolitical zones in Nigeria which is like previous reports both within[5,51] and outside[45,46] Nigeria. The differences may be due to differences in cultural and lifestyle practices and may also be due to reporting bias as no study on prevalence of oral cancer was found from Northwest Nigeria. Studies[45,46] from developed countries have reported a reduction in the incidence of oral cancer primarily due to increased oral cancer surveillance. This review, however, points to an increase in incidence and mortality of oral cancer which may be due to increased risk factors, failed oral cancer

surveillance, or due to reporting bias, as more studies on oral cancer have been published in the past decade compared to previous decades. Irrespective of the reason, it's clear that the effects of oral cancer awareness programs conducted over the past decade have had limited effects on oral cancer outcomes, which is a cause for concern.

Also highlighted in this study is the increased presentation of oral cancer among lower age groups. Oral cancer is particularly known to be a disease of middle age and elderly, however, studies by Amusa et al. 2004[20] and Otoh et al. 2004[27] reported increased involvement of patients in their first and second year of life respectively. Sex distribution shows a predilection for the male sex, however, like studies in developed countries,[45,46] this review shows narrowing between the male and female sex in incidence of oral cancer. Variations in site predilection have been reported in both developed[45,46] and developing countries.[5,51] In this review, variations in site predilection may be due to differences in social habits across geopolitical zones in Nigeria. Studies from Northcentral Nigeria[27,65] reported increased cigarette smoking and alcohol consumption habits compared to reports from Southwest[33,47] and Southeast Nigeria[14] that reported genetics, nutrition, and infection as more important roles in oral cancer development compared to tobacco and alcohol.

This review also brings to the fore the low level of knowledge on oral cancer among the general population in Nigeria. Knowledge of oral cancer was seen to be significantly associated with the level of education.[4] Public policies for free and affordable education up to secondary school level is therefore recommended, as this will significantly improve oral cancer outcomes and overall healthcare in the Nigerian population This review also highlighted the need for effective oral cancer education and surveillance among educated individuals, as low levels of knowledge on oral cancer was seen in secondary school students and military personnels, both of whom had received significant formal education.[37,41]

Although oral cancer awareness programs have been recommended and instituted in the past across Nigeria,[4,5,13–15] this review highlights a lack of effectiveness in current practices. It is therefore recommended that stronger oral cancer awareness

and advocacy programs be instituted across all levels of government in all geopolitical zones in Nigeria. Aggressive oral cancer training and surveillance including regular oral health checks, early recognition of symptoms, knowledge on risk factors, and dangers associated with poor management and late presentation should be implemented across all geopolitical zones in Nigeria. In the hospital setting, medical and paramedical practitioners should be trained in methods for early detection of oral cancer as this will improve the prognosis and overall outcome of oral cancer in Nigeria. The results of this review may also inform investigators on gaps requiring future research such as the need for convenient and readily available screening tools for early detection of oral cancer in Nigeria, as well as further investigation on the molecular events associated with oral cancer in Nigeria.

Conclusion

Oral cancers are the most common forms of head and neck cancers, and they represent a public health burden in Nigeria. This review showed variations in prevalence, age predilection, sex predilection, site predilection, histopathology, and risk factors of oral cancer across different geopolitical zones in Nigeria. In addition, this review highlighted the low level of knowledge and awareness of oral cancer among the Nigerian population, particularly seen in people with low level of education.

There is therefore a need for increased awareness of oral cancer among Nigerians, as well as improved advocacy, preventive care, surveillance, and screening methods for oral cancer to aid overall outcomes of oral cancer in Nigeria. In addition, to reduce the prevalence of oral cancer in Nigeria, school-based and community-based education programs on oral cancer risk factors, public education-based campaigns on awareness and early detection of oral cancer, and early and affordable clinical interventions by medical and dental practitioners are recommended.

Conflict of interest

The authors declare no conflict of interest.

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