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Oral cavity and oropharyngeal cancer incidence trends and disparities in the United States: 2000–2010

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ABSTRACT

Background: Changes in the incidence of oral cancer based on anatomic location and demographic factors over time have been reported in the United States. The purpose of this study was to use recent data to examine oral cancer incidence trends and disparities by demographic factors and anatomic location.
Methods: Surveillance, Epidemiology, and End Results (SEER) incidence data from 2000 to 2010 were used to characterize and analyze oral cancer incidence trends by anatomic region and subsite, age at diagnosis, gender, race/ethnicity, and stage at diagnosis. Poisson regression was used to compare incidence risk by select demographic factors.
Results: About 75,468 incident oral cancer cases were diagnosed from 2000 to 2010. The tonsil was the most frequently diagnosed anatomic subsite (23.1%) and the subsite with the greatest contribution to the overall, age-standardized cumulative incidence rate of 8.4 cases per 100,000 (95% confidence interval (CI): 8.3, 8.4). An increasing incidence trend was observed for cancers in the oropharyngeal region, in contrast to a decreasing trend seen in the oral cavity region. In the Poisson regression model, all race/ethnicity groups showed a lower incidence risk relative to whites for oral cavity and oropharyngeal cancer, and white males displayed the highest incidence rate of all race/ethnicity-gender groups during the study period (14.1 per 100,000; 95% CI: 14.0, 14.2).
Conclusions: This study's epidemiological findings are especially important for oral health care providers, patient education, and the identification of risk profiles associated with oral cancer. The distinct epidemiological trends of oral cavity and oropharyngeal cancers dictate that oral cancer can no longer be viewed as a discrete entity. Oral health providers should have a strong understanding of the different risk factors associated with oral cavity and oropharyngeal cancers and educate their patients accordingly.

1. Introduction

Cancers of the oral cavity and pharynx (International Classification of Diseases, 10th edition codes: C00–C14) constitute a serious, global public health concern. These anatomically related cancers are collectively the sixth most common type of cancer worldwide [1]. In 2008, there were an estimated 260,000 oral cavity and 136,000 pharyngeal incident cancer cases globally, with approximately two-thirds occurring in developing countries [2]. In the United States, it is estimated that 41,380 persons were newly diagnosed and 7890 died from these cancers in 2013 [3].

The anatomic location of these cancers largely influences their associated risk factors, treatment options, and related epidemiological characteristics [4]. The head and neck region consists of the oral cavity, pharynx, larynx, nasal cavity, and paranasal sinuses [5]. The term "oral cavity" generally refers to the lips, anterior 2/3 of the tongue, buccal and labial mucosa, gingiva, hard palate, retromolar pad, and floor of the mouth [5]. The pharynx comprises the nasopharynx, hypopharynx, and oropharynx with the term "oropharynx" generally referring to the posterior 1/3 of the tongue,

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palatine and lingual tonsils, soft palate, and the posterior pharyngeal wall [5]. The vast majority (>90%) of cancers of the oral cavity and oropharynx are squamous cell carcinomas (SCCs) [2].

Tobacco and alcohol use are well-accepted and documented major risk factors for oral cavity cancers [6]; however, their role as risk factors is less clear for cancers of the oropharynx [7]. Over the last 30 years, oral cavity cancer incidence rates in the USA have decreased in conjunction with decreases in cigarette smoking and alcohol consumption [7,8]. In contrast, incidence rates for oropharyngeal cancer have been increasing over the same time period [7,8], suggesting that other risk factors independent of the traditional ones may be at play. Indeed, human papillomavirus (HPV) has been found to be a major etiological factor associated with oropharyngeal cancers [7–10], with recent North American studies having detected HPV in up to 80% of oropharyngeal cancers [5,11–13], and HPV type 16 observed in approximately 90% of HPV-positive oropharyngeal cancers [6].

Historically, African-American males have had higher oral cancer incidence rates than their white counterparts [14]. However, recent studies have documented changes in the distribution by race/ethnicity [15–17]. A study by Brown et al. [16] examined racial/ethnic and gender trends for oral cavity and oropharyngeal cancer incidence using SEER 9 and 13 data (1975–1991 and 1992–2008). During 1992–2008, total incidence rates were found to decrease significantly for all race/ethnic-gender groups except white men, with strong declining trends observed in African-Americans [16]. This finding was driven by a substantial increase in oropharyngeal cancer incidence in white males, whereas rates for these cancers either declined or remained stable for other race/ethnic-gender groups [16].

Given these demographic shifts in incidence, the primary goal of this study is to provide a comprehensive understanding of the incidence and trends for oral cavity and oropharyngeal cancer in the USA by anatomic subsites and demographic factors from 2000 to 2010. Additionally, this study will use Poisson regression to examine differences in incidence risk by demographic factors, with particular emphasis on racial/ethnic and gender disparities. It is the authors' hope that this study's findings can provide dentists with epidemiological information to be used in conjunction with their clinical experience to help them better identify patients at risk for oral cancer and diagnose oral cancer at early stages when chances for survival are much greater [2].

2. Materials and methods

2.1. Study sample

Surveillance, Epidemiology, and End Results (SEER) cancer registries actively follow-up with and receive cancer-related data from local hospitals, physicians, and laboratories on individuals diagnosed with cancer, who are residents of the geographical area covered by the SEER registry at the time of diagnosis [18]. This study used the SEER 18 registries, which provide cancer information for approximately 28% of the US population from 18 geographical regions [18,19].

SEER*Stat software (version 8.1.5) was used to access publically available, de-identified data from the National Cancer Institute's SEER program [20]. Oral cancer cases diagnosed during the 2000–2010 time period were included for analysis. International Classification of Diseases for Oncology, 3rd edition (ICD-O-3) codes were used to identify cases by anatomic subsite [21]. The anatomic subsite classification was based primarily on a scheme used by Chaturvedi et al. [8], and the cancers were further grouped into oral cavity (OC) and oropharyngeal (OP) regions.

The following anatomic sites were examined in the OC region: lip (ICD-O-3 codes: C000–C009), oral tongue (C020–023, C028–029), floor of mouth (C040–049), and gums/hard palate/other sites (C030–C039, C050, C058–C059, C060–C069). The OP region included the following anatomic subsites: base of tongue (C019), tonsil (C024, C090–C099), and oropharynx (excluding base of tongue and tonsil) (C051, C052, C100–109, C142). Cancers of the salivary glands were excluded from analysis because they tend to have a different histopathology (non-SCC) [2]. A total of 75,468 incident oral cancer cases diagnosed from 2000 to 2010 from the SEER 18 geographical regions were used to generate frequency and incidence statistics.

2.2. Study variables

Oral cancer cases were characterized according to age at diagnosis, gender, race/ethnicity, and stage at diagnosis. Age was categorized into <50, 50–59, 60–69, and 70+ years groups, consistent with age categories from a previous study of oral cancer SEER data [9]. Race/ethnicity was created by merging a race variable (consisting of white, black, and other race categories) with a Hispanic ethnicity variable (consisting of Hispanic and non-Hispanic categories) to create the following categories: non-Hispanic white, non-Hispanic black, Hispanic, and non-Hispanic other (which consisted of both Asian/Pacific Islanders and American Indian/Alaskan natives due to the smaller sample size of each individual group). Finally, the stage of diagnosis variable used "SEER Historic Stage" categories: localized, regional, distant, and unstaged.

2.3. Data analysis

Cases diagnosed from 2000 to 2010 were characterized by the demographic variables (Section 2.3) using the Frequency Session in SEER [22]. SAS Version 9.3 (SAS Institute, Inc., Cary, NC, USA) was used to perform χ^2 tests to compare the distribution of the demographic factors for cases diagnosed in the OC region and in the OP region. The level of statistical significance used was $P \leq 0.05$.

Cumulative, age-standardized incidence rates per 100,000 for 2000–2010 time period were generated in Rate Session in SEER [22]. The 2000 US standard population was used for age standardization. Associated 95% CIs were also generated using the Tiwari et al.'s modification for CIs [23]. SEER generated these rates by summing the incidence proportions for each individual year (2000–2010) and then age-standardizing. The incidence proportion for each individual year was the case count divided by the population for that year. The case count information was obtained from the SEER 18 cancer registries, whereas the corresponding population information for the SEER 18 registry regions was obtained through U.S. Census figures from the U.S. Census Bureau [24]. Rates were displayed as cases per 100,000, rounded to the nearest 10th decimal place.

Cumulative, age-standardized incidence rates and 95% CIs were displayed for total OC and OP cancer, individual anatomic subsites, and OC and OP regions by the demographic factors. Incidence rates were plotted over the time period by anatomic subsite, anatomic region, and race/ethnicity-gender groups.

Poisson multivariate regression analysis was used to determine the independent association between demographic covariates and incidence for OC and OP cancer during the time period. Count and population figures obtained from SEER were used to conduct the regression analysis using SAS version 9.3. Crude and fully adjusted incidence proportion ratios (IPRs) and 95% CIs were determined for age, gender, race/ethnicity, and stage at diagnosis categories when compared with a reference category in each covariate. This study was reviewed and approved by the National Institutes of Health Institutional Review Board.

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