

Research Paper
 Head and Neck Oncology

The influence of insurance status on treatment and outcomes in oral cavity cancer: an analysis on 46,373 patients

J. Y. Shin¹, J. K. Yoon¹, A. K. Shin²,
 A. Z. Diaz¹

¹Department of Radiation Oncology, Rush University Medical Center, Chicago, Illinois, USA; ²School of Dentistry, University of Michigan, Ann Arbor, Michigan, USA

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Abstract. The purpose of this study was to determine the influence of insurance status on treatment and outcomes in oral cavity cancer. Patients were identified in the National Cancer Database (NCDB). Data were collected and analyzed using χ^2 tests, Kaplan–Meier methods, and multivariable Cox regression models. Those uninsured or on Medicaid were more likely to be younger ($P < 0.001$), minority race ($P < 0.001$), have a lower median household income ($P < 0.001$), lower educational attainment ($P < 0.001$), not undergo primary resection ($P < 0.001$), present with higher T ($P < 0.001$), N ($P < 0.001$), and M ($P < 0.001$) stage of disease, and have a higher tumor grade ($P < 0.001$). On univariate analysis, those with private insurance had significantly better overall survival than those uninsured (hazard ratio (HR) 1.481), under Medicaid (HR 2.006), or on Medicare (HR 1.921). On multivariable Cox regression analysis, insurance status remained an independent prognosticator even after accounting for multiple demographic, socioeconomic, treatment, and clinicopathological factors. These data suggest that insurance status is associated with treatment and outcomes in patients with oral cavity cancer. Being uninsured or on Medicaid was found to be associated with a higher risk of a poorer prognosis when compared to private insurance, and the data suggest the need to expand comprehensive medical coverage and optimize access to adequate medical care in vulnerable patient populations.

Key words: oral cavity cancer; insurance status; socioeconomic status; outcomes; NCDB.

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There will be an estimated 32,670 new cases of oral cavity cancer in the USA in 2017, and an estimated 6650 deaths¹. Age-adjusted incidence rates of new cases have been rising on average about 0.6%

per year over the past 10 years². Known disease-related prognostic factors indicative of a worse prognosis for oral cavity cancer include nodal metastasis, extracapsular extension of involved lymph nodes,

positive surgical margins, tumor size, perineural invasion, and higher tumor grade^{3–6}.

Insurance status and its association with health treatment and outcomes has become

an important topic of debate in the USA^{7–9}. The Affordable Care Act was introduced by President Barack Obama on March 23, 2010, and launched major regulatory changes of the US healthcare system with the goal of increasing patient access to health insurance coverage¹⁰. In 2013, 13.3% of the entire US population was found to be uninsured for the entire year, and the uninsured rate had decreased to 10.4% for the calendar year 2014¹¹.

The objective of this hospital-based retrospective study of 46,373 patients diagnosed with squamous cell carcinoma of the oral cavity during the years 2004–2013 was to determine the influence of insurance status on treatment and outcomes for patients in the USA, in order to identify those who may be at higher risk of a poorer disease outcome.

Materials and methods

Patient population

The population dataset included 46,373 patients diagnosed with squamous cell carcinoma of the oral cavity, including the anterior two-thirds of the tongue, lip, gingiva, floor of the mouth, hard palate, buccal mucosa, vestibule of the mouth, retromolar trigone, and oral cavity not otherwise specified (NOS) (ICD-0-3 histology code 8070/3–8078/3), from 2004 to 2013 (the total number of new cases in the USA during the time period is shown in the Supplementary Material, Fig. S1). This population was extracted from a de-identified National Cancer Database (NCDB) file. The NCDB is a joint project of the Commission on Cancer of the American College of Surgeons and the American Cancer Society and collects hospital registry data from more than 1500 Commission on Cancer-accredited facilities¹². The American College of Surgeons and the Commission on Cancer have not verified and are not responsible for the analytical or statistical methodology employed, or the conclusions drawn from these data by the investigators. This study was approved by the Institutional Review Board of Rush University Medical Center, Chicago, Illinois, which waived the need for informed consent for use of this de-identified data.

Insurance status was identified as the patient's primary insurance carrier at the time of initial diagnosis and/or treatment¹². Insurance status classifications include uninsured, private, Medicaid, and Medicare. Median household income classifications include <\$38,000, \$38,000–\$47,999, \$48,000–\$62,999, and ≥\$63,000. Classifications

for measure of educational attainment (percentage of adults in the patient's zip code who graduated from high school) include ≤79%, 79.1–87.0%, 87.1–93.0%, and >93.0%. Five-year income and poverty estimates are available for all geographic units, including census tracts and block groups, by pooling 5 years of American Community Survey data¹³. Comorbidities as described by the Charlson/Deyo comorbidity score were defined by a weighted score derived from the sum of the scores for each of the comorbid conditions listed in the Charlson Comorbidity Score Mapping Table^{14,15}. A score of 0 indicated no significant comorbid conditions and higher scores indicated greater comorbidity burden. Because of the small proportion of cases with a Charlson comorbidity score exceeding 2, the NCDB has truncated the data to 0, 1, and 2 (greater than 1). Minority race was classified as those of either Black or Hispanic race. Patients younger than 18 years of age or whose insurance or community-level socioeconomic status was unknown were excluded from the analysis.

Statistical analysis

All data analyses were performed using IBM SPSS Statistics, version 23.0 (IBM Corp., Armonk, NY, USA). The proportional distributions of demographic, treatment, and clinicopathological factors by insurance status were compared using the two-tailed χ^2 test. A cross-tabulation was performed, and the *P*-value (significance level of 0.05) was used to determine whether the null hypothesis (no significant difference between specified populations; any observed difference being due to sampling error) could be rejected and whether a statistical association between categorical variables existed. Kaplan–Meier estimates were used to analyze estimates for overall survival (OS) with the comparison of rates among the groups performed using the two-tailed log-rank test. The OS endpoint was defined as time to death from the date of diagnosis of squamous cell carcinoma of the oral cavity. The 2009–2013 subgroup was excluded from the 5-year OS calculation to allow for a minimum of 5 years of follow-up for data running through 2013. Univariate and multivariable Cox proportional hazards models were used to analyze the difference in the hazard ratio of death events by demographic, socioeconomic, treatment, and clinicopathological characteristics. Factors significant on univariate analysis were included in a Cox regression multivariable analysis, which was used to compute hazard ratios (HR) with 95% confidence intervals (CI) to identify independent prognostic factors of OS using a

forwards selection variable selection process. A two-sided *P*-value of <0.05 was considered statistically significant.

Results

Patient and treatment characteristics

A total of 46,373 patients with squamous cell carcinoma of the oral cavity were identified (Table 1). The median age was 66 years (range 18–90 years). Of these patients, 24,247 (52.3%) had Medicare, 15,742 (33.9%) had private insurance, 3976 (8.6%) had Medicaid, and 2408 (5.2%) were uninsured.

Uninsured patients were more likely to be younger (*P* < 0.001), be minority race (*P* < 0.001), have a lower median household income (*P* < 0.001), lower educational attainment (*P* < 0.001), not undergo primary resection (*P* < 0.001), present with higher T (*P* < 0.001), N (*P* < 0.001), and M (*P* < 0.001) stage of disease, and have a higher tumor grade (*P* < 0.001) (Table 1).

Survival outcome

The median duration of follow-up was 51.9 months (range 1–131.5 months). Five-year overall survival (OS) for the study population was 51.7% (Supplementary Material, Table S1). Black patients had significantly worse 5-year OS than White, Hispanic, Asian, and other patients (35.4% vs. 53.0%, 47.9%, 53.8%, and 52.9%; *P* < 0.001). Those with private insurance (64.9%) had significantly better 5-year OS than those uninsured (51.5%), under Medicaid (41.3%), or on Medicare (44.5%) (*P* < 0.001) (Fig. 1). Univariate analysis demonstrated insurance status, treatment facility type, median household income, educational attainment, age at diagnosis, race, Charlson/Deyo comorbidity score, primary resection, T, N, and M stage of disease, and tumor grade to be statistically significant outcome factors (Table 2).

Multivariable analysis

On Cox regression multivariable analysis, having private medical insurance was a significant prognosticator for improved OS when compared to being uninsured (HR 1.290, 95% CI 1.164–1.430; *P* < 0.001), on Medicaid (HR 1.498, 95% CI 1.385–1.619; *P* < 0.001), or on Medicare (HR 1.202, 95% CI 1.137–1.271; *P* < 0.001) (Table 3). Higher educational attainment, not being treated at a community treatment facility, younger age, non-Black race, lower Charlson/Deyo

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