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Impact of payer status on survival in parotid malignancy☆

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ABSTRACT

Objective: In the setting of current national healthcare reform, it becomes especially relevant to understand the current state of healthcare disparities with regards to insurance status. To determine the impact of payer status on survival in parotid malignancy, we utilized the National Cancer Database (NCDB).
Study design: Retrospective database review.
Setting: National Cancer Database (2004–2012).
Subjects and methods: The NCDB was queried for cases of primary malignancy of the parotid gland between 2004 and 2012. The impact of payer status on overall survival was evaluated, as well as the relationship of insurance status with patient and tumor variables.
Results: 15,815 cases met inclusion criteria. A majority had private insurance (47.8%), followed by Medicare (40.9%), Medicaid (5.0%), uninsured (3.2%) and other government sources (1.3%). Medicare patients had the lowest 5 and 10-year survival rates (50.7% (95% CI [49.3–52.1]) and 27.8% (95% CI [25.0–30.9]), respectively). On multivariable analysis, uninsured, Medicare, and Medicaid patients had worse overall survival than the privately insured (HR 1.42, 95% CI [1.17–1.74]; HR 1.29, 95% CI [1.17–1.42]; HR 1.36, 95% CI [1.13–1.62], respectively). Uninsured and Medicaid patients were more likely than the privately insured to present with advanced stage disease, nodal metastasis and longer times to treatment following diagnosis.
Conclusion: In parotid malignancy, uninsured, Medicaid, and Medicare patients have worse survival outcomes compared to those with private insurance. Uninsured and Medicaid patients also present with more advanced stage disease and have increased wait times before definitive treatment is initiated.

1. Introduction

Parotid gland malignancies encompass a diverse group of rare neoplasms that, together, have a reported incidence of approximately 8 per 1,000,000 [1], comprising < 6% of head and neck cancers [2]. Unlike many other subsites of the head and neck where squamous cell carcinoma is most prominent, parotid cancer consists of a wide diversity of histopathological subtypes [3]. Due to its overall low incidence and varied histological nature, parotid malignancy has traditionally been difficult to research on a large scale, leading to a lack of generalizable data, especially with regards to access to care. Furthermore, several recent studies have reported an rise in incidence of parotid malignancy, noting an increase of 1.13% annually between the years of 1973 and 2009 [4], highlighting the need for more comprehensive data.

While a first step in improving access to care is identifying existing health care disparities, this data is lacking in parotid malignancy. However, with the increasing use of large national databases that serve to collect information from multiple institutions, the evaluation of large numbers of patients over long periods of time without selection or treatment biases of a single institution is possible. This becomes especially advantageous for less common entities.

These large datasets have been utilized previously to provide insights into access to care disparities. Both more advanced stages of cancer and worse survival in cancer patients in general are associated with reduced access to health care [5]. In fact, information from the National Cancer Data Base (NCDB) has shown that, for all cancer sites combined, uninsured patients or those with Medicare were 1.6 more times likely to die than those with private insurance [5]. Within the head and neck, it has been shown that patients with oropharyngeal

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cancer are diagnosed with more advanced stage, larger tumors, and a greater degree of lymph node metastasis if they are uninsured or have Medicare when compared with patients who have private insurance [6]. Using the NCDB, decreased relative survival was also seen in uninsured and Medicare patients with laryngeal cancer [7].

While several subsites of head and neck cancer have been evaluated, they have focused mainly on squamous cell carcinoma. In contrast, parotid malignancy tends to be more histologically diverse than other subsites in the head and neck without a clear association with tobacco and alcohol [3,8]. To our knowledge, it is unknown at this point if there are similar trends with respect to payer status as found within other previous head and neck cancers. The aim of this study is to analyze the influence of payer status on parotid malignancy survival by utilizing data from the National Cancer Database (NCDB).

2. Methods

Information from the National Cancer Database (NCDB) was obtained on March 4th, 2016 for tumors involving the head and neck diagnosed between 2004 and 2012. The NCDB is a project sponsored by both the American College of Surgeons and the American Cancer Society established in 1989. It provides a comprehensive clinical oncology database comprising data collected from > 1500 Commission on Cancer accredited facilities and includes > 34 million records, representing > 70% of newly diagnosed cancer cases in the United States [9].

To specifically analyze overall survival of patients with parotid malignancy with regards to insurance status, the NCDB was queried using the ICD-O-3 (International Classification of Diseases for Oncology, Third Edition) topography code for cases with a primary site of the parotid gland (C07.9). Only cases with behavior code of '/3' were included: 'Malignant neoplasms stated or presumed to be primary'. Patients were excluded if they did not have values for either follow-up or vital status. Cases were also excluded if they were recorded as having had surgery at a distant site to avoid confounding of different surgical procedures. Furthermore, those with the histologic subtype of squamous cell carcinoma (SCC) were excluded from the study population as it is unknown whether these lesions were regional metastasis from a cutaneous origin or were truly a primary parotid cancer.

The variables investigated included insurance status, age at diagnosis, sex, race, ethnicity, comorbidity score using the Charlson/deyo score, income, education level, treatment facility type, facility location, tumor histologic subtype, tumor grade, clinical T stage, clinical N stage, overall clinical stage, and treatment modality. Insurance status was categorized as 'private', 'uninsured', 'Medicaid', 'Medicare', 'other government', and 'unknown'. Treatment facility type was classified as 'Community Cancer Program', 'Comprehensive Cancer Program', 'Academic/Research Cancer Program', 'Integrated Network Cancer Program', and 'Other'. Tumor characteristics of clinical T and N stages were classified according to the 7th Edition American Joint Committee on Cancer classification. Tumor grade was classified into low (grade I – well differentiated and grade II – moderately differentiated) and high (grade III – poorly differentiated; and grade IV- undifferentiated, anaplastic). The overall stage was categorized as early (stages I and II) and advanced (stages III and IV). Treatment modalities included surgery, radiation, and/or chemotherapy.

Univariate analysis for categorical variables was performed using Pearson $\chi 2$ for categorical variables. Unadjusted Kaplan-Meier estimates and log-rank tests were used for univariable comparison of overall survival outcomes, and multivariable Cox proportional hazard models were generated for multivariable comparisons. Variables included in the final multivariable Cox proportional hazard model were: age, sex, race, ethnicity, insurance status, treatment modality, income, comorbidity score, facility type, facility location, education, tumor histologic subtype, clinical T stage, and clinical N stage. Logistic regression was used to examine the relationship of insurance status with patient and tumor variables including overall clinical stage at presentation, histopathologic grade and presence of lymph nodes clinically.

Table 1
Demographics for all subjects.

Characteristic	n (%)
Total n	15,815
Age (Mean (SD))	60.1 (18.04)
Sex	
Male	8255 (52.2)
Female	7560 (47.8)
Race	
White	13,188 (83.4)
Black	1663 (10.5)
Other	669 (4.2)
Unknown	295 (1.9)
Ethnicity	
Hispanic	796 (5.0)
Non-Hispanic	13,922 (88.0)
Unknown	1097 (6.9)
Insurance status	
Private	7566 (47.8)
Uninsured	508 (3.2)
Medicaid	786 (5.0)
Medicare	6471 (40.9)
Other Government	198 (1.3)
Unknown	286 (1.8)
Comorbidity (Charlson/Deyo Score)	
0	13,137 (83.1)
1	2146 (13.6)
2	532 (3.4)
Income	
Less than $38,000	2468 (15.6)
$38,000–$47,999	3579 (22.6)
$48,000 - $62,999	4040 (25.5)
$63,000 and greater	5459 (34.5)
NA	269 (1.7)
Education level[a]	
21% or more	2450 (15.5)
13%–20.9%	3773 (23.9)
7–12.9%	5159 (32.9)
< 7%	4132 (26.1)
NA	262 (1.7)
Facility type	
Community Cancer Program	1258 (8.0)
Comprehensive Community Cancer Program	5559 (35.2)
Academic/Research Cancer Program	5818 (36.8)
Integrated Network Cancer Program	1013 (6.4)
Other	2167 (13.7)

Abbreviations: SD, standard deviation.
[a] Education level designated as percent in area without high school diploma.

All data processing and analysis was performed with Microsoft Open R v. 3.3.2 (https://mran.microsoft.com/open/) via RStudio v. 1.1.23 (RStudio, Boston, MA, USA). The National Cancer Data Base (NCDB) is a joint project of the Commission on Cancer (CoC) of the American College of Surgeons and the American Cancer Society. The CoC's NCDB and the hospitals participating in the CoC NCDB are the source of the de-identified data used herein; they have not verified and are not responsible for the statistical validity of the data analysis or the conclusions derived by the authors. This study was determined to be exempt by the Institutional Review Board of the Hospital of the University of Pennsylvania.

3. Results

A total of 15,815 patients were identified with primary parotid malignancy in the NCDB. Demographics are shown in Table 1. Notable findings include an average age of 60.1 years, a slight male predominance (52.2%), and majority of white (83.4%) and non-Hispanic (88.0%) patients. Tumor characteristics can be found in Table 2. Mucoepidermoid carcinoma was the most common histologic subtype

Table 2
Tumor characteristics for all patients.

Characteristic	n (%)
Histology[a]	
Mucoepidermoid carcinoma	4431 (28.0)
Acinic cell carcinoma	2729 (17.3)
Adenocarcinoma	1711 (10.8)
Intraepithelial carcinoma	1272 (8.0)
Adenoid cystic carcinoma	1231 (7.8)
Carcinoma ex pleomorphic adenoma	553 (3.5)
Epithelial-myoepithelial carcinoma	395 (2.5)
Clinical stage at diagnosis	
Stage 1	3223 (20.4)
Stage 2	2537 (16.0)
Stage 3	1453 (9.2)
Stage 4	2447 (15.5)
Unknown	6155 (38.9)
Tumor grade	
Grade 1: Well differentiated	3015 (19.1)
Grade 2: Moderately differentiated	2461 (15.6)
Grade 3: Poorly differentiated	3668 (23.2)
Grade 4: Anaplastic/Undifferentiated	1171 (7.4)
Unknown	5500 (34.8)

[a] Histologies listed are those representing at least 2% of the sample.

(22.8%) in a histologically diverse population. Patients presented across all stages and grades. Median overall survival was 107 months (95% CI [103 − 112]) with a 5-year survival of 63.6% (95% CI [62.7%–64.5%].

The majority of patients had private insurance (47.8%), followed by Medicare (40.9%), Medicaid (5.0%), uninsured (3.2%) and other government sources of insurance (1.3%). Unadjusted Kaplan-Meier overall survival based on Insurance status is shown in Fig. 1. Univariable analysis of overall survival is displayed in Table 3 and Multivariable cox proportional hazard analysis is found in Table 4. Although comprising the second most prevalent source of insurance in this population, those insured under Medicare had the poorest survival outcomes with 5-year overall survival of 50.7% (95% CI [49.3–52.1]) and 10-year overall survival of 27.8% (95% CI [25.0–30.9). Those with private insurance had the best 5 and 10-year overall survival with 81.0% (95% CI [80.0–82.0]) and 70.7% (95% CI [68.6–72.9]), respectively. Significantly worse overall survival was seen for those patients insured with Medicare versus those with private insurance with a hazard ratio of 3.24 ($P < 0.0001$). On multivariate analysis, this statistic remained significant (HR 1.24, [1.15–1.34], $P < 0.0001$) after controlling for patient and tumor factors. Patients with Medicaid and without insurance were also found to have worse survival (HR 1.42 [1.23–1.65], $P < 0.0001$ and HR 1.37 [1.16–1.63], $P < 0.001$ respectively) as shown in Table 3.

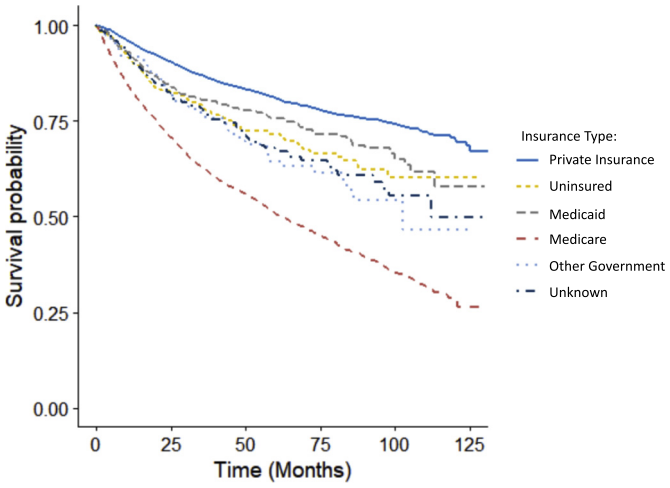

Fig. 1. Unadjusted Kaplan-Meier overall survival based on Insurance status.

On logistic regression analysis, both uninsured and Medicaid patients were more likely to present with advanced stage (stage 3 or 4) disease (OR 2.17, 95% CI [1.66–2.85] and OR 1.84, 95% CI [1.44–2.35], respectively) while controlling for other demographic and tumor factors. Similarly, these two populations were also more likely to present with nodal metastasis (OR 1.73, 95% CI [1.27–2.32] and OR 1.77 95% CI [1.36–2.31], respectively) and high grade (grades 3 or 4) lesions (OR 1.57 95% CI [1.18–2.1] and OR 1.5, 95% CI [1.17–1.92], respectively).

When examining time to treatment by insurance status, the average time from diagnosis to treatment overall was 17 days (SD = 34). The over 65 years of age population was used in further analysis to take into account the group most likely to utilize Medicare for insurance coverage. Those who were privately insured had an average time to treatment of 19.9 days. Comparatively, the uninsured population was treated an average of 33.5 days following diagnosis. The average time to treatment for patients with Medicaid was 25.8 days, other government insurance was 35.3 days, and Medicare was 19.9 days. Findings are summarized in Fig. 2.

4. Discussion

In this NCDB analysis of 15,815 cases of parotid malignancy, uninsured, Medicaid, and Medicare patients had worse survival outcomes compared to those patients with private insurance. Furthermore, uninsured and Medicaid patients were more likely to present with advanced stage disease, nodal metastasis, and high grade lesions. Patients without insurance, Medicaid and other government insurance such as Veterans Administration (VA) patients, have the longest times to treatment following diagnosis.

To our knowledge, this is the first study to examine the influence of insurance status on parotid cancer survival. While demographic and socioeconomic factors have been examined with regards to survival of major salivary gland malignancy, insurance status was not included [10]. Our data in the current study is similar to results found when looking at other subsites in the head and neck. In a study by Chen et al. uninsured and Medicare patients with oropharyngeal cancer were found to be diagnosed with more advanced stage, larger tumors, and a greater degree of lymph node metastasis, and our data showed similar trends with these two populations being diagnosed at more advanced stage and with greater degree of lymph node metastasis [6]. Another study by Mehta et al. found decreased survival of laryngeal cancer patients in the uninsured and Medicare patient populations as well [7]. Despite the fact that other sites in the head and neck are dominated by squamous cell carcinoma and parotid malignancy is histologically distinct, the uninsured, Medicare, and Medicaid patient populations appear to be similarly at high risk.

We found that patients with Medicaid, other government insurance and the uninsured had longer times from diagnosis to treatment. In a recent study by Morse et al., treatment times in salivary gland cancer as a whole were examined. Using the NCDB they examined factors that may influence several treatment times and found that in addition to race, comorbidities, age, T and N stage, and facility volume and location, insurance status was associated with prolonged treatment time [11]. They found an average of 31 days for diagnosis-to treatment initiation, which was longer than the 17 day average found in our study; however, the prior study investigated all salivary gland cancers and only included those treated with primary surgery, so this likely affected treatment timing. There was no association between diagnosis to treatment time and survival outcomes. While the association of diagnosis to treatment time and survival directly is out of the scope of the current study, those patients with Medicaid and without insurance had the longest diagnosis to treatment times as well as the poorest survival.

The findings that uninsured and Medicaid patients tend to have

Table 3
Survival statistics and univariable cox proportional hazard analysis for overall survival.

	3-year survival (%) [95% CI]	5-year survival (%) [95% CI]	10-year survival (%) [95% CI]	Hazard ratio [95% CI]	P value
All	76.0 [75.3–76.7]	67.4 [66.5–68.2]	50.8 [49.0–52.7]		
Insurance status					
Private	86.8 [86.0–87.6]	81.0 [80.0–82.0]	70.7 [68.6–72.9]	1 (ref)	
Uninsured	78.3 [74.5–82.4]	71.5 [66.9–76.4]	60.3 [53.4–68.2]	**1.69** [1.41–2.03]	< **0.0001**
Medicaid	80.5 [77.5–83.5]	75.6 [72.2–79.2]	58.0 [48.9–68.7]	**1.45** [1.24–1.69]	< **0.0001**
Medicare	62.7 [61.5–64.0]	50.7 [49.3–52.1]	27.8 [25.0–30.9]	**3.33** [3.13–3.56]	< **0.0001**
Other Government	76.5 [70.3–83.3]	64.5 [56.8–73.2]	46.5 [32.4–66.9]	**1.97** [1.52–2.56]	< **0.0001**
Unknown	77.5 [72.5–82.9]	67.2 [61.1–74.0]	50.0 [38.4–65.0]	**1.85** [1.49–2.31]	< **0.0001**

Abbreviations: CI, confidence Interval.
Bolded values are significant with P < 0.05.

Table 4
Multivariable Cox proportional hazard analysis for overall survival.

Insurance status	HR [95% CI]	P value
Private	1 (ref)	
None	**1.42** [1.17–1.74]	< **0.001**
Medicaid	**1.36** [1.13–1.62]	< **0.001**
Medicare	**1.29** [1.17–1.42]	< **0.0001**
Other Government	1.26 [0.95–1.68]	0.111
Unknown	1.13 [0.89–1.43]	0.331

Abbreviations: CI, confidence Interval.
Bolded values are significant with P < 0.05.

worse survival outcomes and present at more advanced cancer stages become increasingly relevant in the current political climate during which the insurance status of millions of Americans has been called into question. While parotid cancer is a relatively rare malignancy, these trends may be indicative of other cancer outcomes as well. A possible explanation of our findings is that those without insurance are more reluctant to present to their healthcare providers when they initially have concerns, whether this is due to financial disincentives or failure to establish primary care relationships that may have brought attention to cancer concerns at an earlier time point. While our data focuses on parotid malignancy, it highlights the possibility that these trends could be extrapolated to other cancers as well.

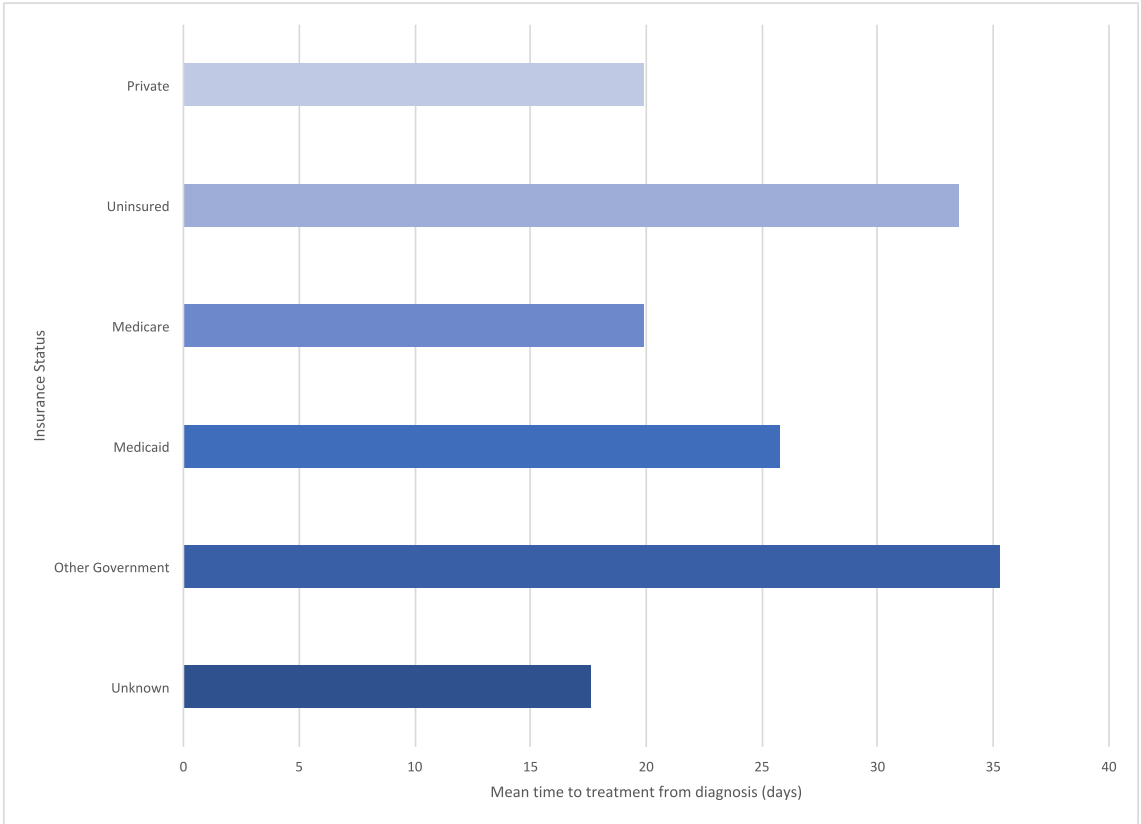

Fig. 2. Time to treatment by insurance status in over 65 population.

There are several limitations to consider in interpreting our findings. First, while the NCDB is the largest cancer registry in the world and maintenance of data integrity is highly prioritized with standardization of all data reporting, the data is collected retrospectively. Therefore, direct causality cannot be explicitly determined. Due to ethical reasons, however, it would be unreasonable to carry out a prospective trial focusing on treatment times and cancer survival outcomes. Furthermore, the data is limited to characteristics collected in the database. For instance, the NCDB uses Charleson/Deyo comorbidity index to measure overall health status, which may not be specific enough to control for all other health problems that these patients face. The Charlson/Deyo score is a cumulative weighted point value given for the following comorbidities: myocardial infarction, congestive heart failure, peripheral vascular disease, dementia, chronic pulmonary disease, rheumatologic disease, peptic ulcer disease, liver disease, diabetes, hemiplegia or paraplegia, renal disease, and AIDS. Because of the small proportion of cases with a Charlson/Deyo score that exceeds 2, the score data is truncated to 0, 1 and 2 by the NCDB, with a score of 2 representing greater than 1of these conditions. Additionally, overall survival, as opposed to disease specific survival was used. It is therefore possible that uninsured patients had comorbidities that were more severe than those with private insurance and this could not adequately be controlled for. Moreover, by using the NCDB, there is an inherent selection bias as only CoC accredited facilities contribute information to the database. However, given the rarity of parotid cancer, using a large database becomes necessary to achieve adequate numbers for meaningful statistical analysis. Future studies examining effects of insurance status in a prospective and more widespread manner would be beneficial to further elucidate impact on cancer care.

5. Conclusion

In our analysis of 15,815 cases of parotid malignancy, insurance status was found to be associated with survival outcomes. Patients who were uninsured or who had Medicaid or Medicare had worse survival outcomes compared to those patients with private insurance. Uninsured and Medicaid patients were also more likely to present with advanced stage disease, nodal metastasis, and high grade lesions. The longest times to treatment following diagnosis were found in patients without insurance, Medicaid and other government insurance such as the Veterans Administration (VA). These findings become especially pertinent in the setting of the current national healthcare reform.

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