Research Paper

An assessment of racial differences in epidemiological, clinical and psychosocial factors among head and neck cancer patients at the time of surgery

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Abstract  Objective: Racial disparities have been well characterized and African American (AA) patients have 30% lower 5-year survival rates than European Americans (EAs) for head and neck squamous carcinoma (HNSCC). This poorer survival can be attributed to a myriad of different factors. The purpose of this study was to characterize AA-EA similarities and differences in sociodemographic, lifestyle, clinical, and psychosocial characteristics in HNSCC patients near the time of surgery.

Methods: Setting: Single tertiary care center. Participants: Thirty-nine newly diagnosed,
untreated HNSCC patients \( (n = 24 \text{ EAs}, n = 15 \text{ AAs}) \) who were to undergo surgery were recruited. Study Design: Cross-sectional study Sociodemographic, lifestyle factors, and disease factors (cancer site, AJCC clinical and pathologic stage, and HPV status) were assessed. Risk factors, leisure time, quality of life and social support were also assessed using validated questionnaires. Exposures: EA and AA patients were similar in the majority of sociodemographic factors assessed. AAs had a higher trend toward pathologically later stage disease compared to EAs and significantly increased time to treatment.

**Results:** EA and AA patients were similar in the majority of sociodemographic factors assessed. AAs had a higher trend toward pathologically later stage disease compared to EAs. AAs also had significantly increased time to treatment \( (P = 0.05) \). The majority of AA patients \( (62\%) \) had later stage pathologic disease. AA were less likely to complete high school or college \( (P = 0.01) \) than their EA counterparts. Additionally, AAs were more likely to report having a gap in health insurance during the past decade \( (37\% \text{ vs. } 15\%) \).

**Conclusions:** This preliminary study demonstrates a similar profile of demographics, clinical and psychosocial characteristics preoperatively for AAs and EAs. Key differences were AAs tending to have later pathologic stage disease, educational status, delays in treatment initiation, and gaps in health insurance.

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**Introduction**

Head and neck squamous carcinoma (HNSCC) refers to a diverse suite of malignancies that will cause an estimated 100,300 deaths in the US in 2018. Pronounced racial disparities exist in survival of head and neck cancers. The 5-year relative survival is 30% lower in African Americans (AAs) compared with European Americans (EAs). Treatment of HNSCC depends on anatomic site and extent of disease, but can include surgery, chemotherapy, and radiotherapy, and there is ongoing work on immunotherapy. With the ongoing epidemic of HPV-related HNSCC, optimal therapies have become even more debated. While the growing population of head and neck cancer patients are more likely to be nonsmokers, nondrinkers and HPV-positive, a large number of patients, particularly AA patients and those of lower socioeconomic status generally do not meet this picture.

Several studies have investigated the underlying factors that contribute to racial disparities in HNSCC. First, in the SEER database, AAs were 76% more likely than EAs to be diagnosed with distant metastases. For HNSCC patients who are surgical candidates, several studies have observed that AAs are significantly less likely than EAs to undergo surgery, even among populations with similar health insurance status. Another possible reason for disparities is that AAs have biologically more aggressive disease than EAs. AAs are significantly more likely than EAs to be diagnosed with HPV-negative disease and have much poorer survival as a consequence. Additionally, AAs have been observed to have a heavier burden of comorbid conditions compared with EAs, which has been observed to contribute to higher mortality for late stage HNSCC patients.

Thus, there are clear lines of evidence characterizing clinical factors associated with the racial disparity in HNSCC survival. The racial disparity in HNSCC survival persists even after adjusting for stage, performance status and other clinical risk indicators, indicating that there are likely other factors contributing to this racial disparity. This is in keeping with understanding that health disparities are multifactorial and complex. Approaches that integrate sociodemographic, lifestyle, clinical, and psychosocial factors hold promise for achieving deeper understanding of the racial disparity in HNSCC survival. Only by understanding the underlying reasons for this disparity can optimal strategies be developed to close the survival gap.

The present study was carried out as a small-scale step in this direction by describing the similarities and differences by race according to these characteristics in 39 HNSCC patients near the time of surgery. Focusing solely on surgical patients helps to eliminate receipt of definitive treatment as an explanatory factor. With the advent of the eight edition of the American Joint Committee on Cancer (AJCC), understanding these factors is paramount in developing modernized treatment guidelines. The purpose of this study was to characterize AA-EA similarities and differences in sociodemographic, lifestyle, clinical, and psychosocial characteristics in HNSCC patients near the time of surgery at a single tertiary care center.

**Methods**

**Study Design**

This study was a cross-sectional investigation of 39 newly diagnosed, untreated HNSCC patients \( (n = 24 \text{ EAs}, n = 15 \text{ AAs}) \). The research was guided by a conceptual model that accounted for a comprehensive set of factors that may be related to racial differences in HNSCC. A patient questionnaire containing sociodemographic, lifestyle, psychosocial and health care access questions was administered preoperatively and clinical data were abstracted from the patients’ electronic medical record using a standardized
chart review data abstraction form. The study was approved by the Institutional Review Board of the Medical University of South Carolina.

Study population

This was a cross-sectional survey study with prospective collection of clinical data carried out at the Hollings Cancer Center of the Medical University of South Carolina. The eligible patient population was comprised of those (1) with a new diagnosis of HNSCC with primary tumors of the oral cavity, oropharynx, larynx, or hypopharynx; (2) planning to undergo surgery as a part of their definitive treatment; (3) at least 18 years of age and capable of informed consent; (4) who spoke English as their primary language; (5) who received no prior treatment for their cancer; (6) with no prior history of other cancers; and (7) with African American or European American ancestry. Potential participants were approached during routine treatment planning visits by research staff to discuss the study and complete informed consent paperwork if interested.

Data collection

Sociodemographic variables

During their initial visit demographic information including race, age, gender, education, employment status, income, marital status, and insurance status were assessed. Education status was stratified by whether or not the patient graduated high school. Employment status categories included: unemployed/disabled, employed, or retired. Income categories included whether household income was greater or less than $25000. Marital status was defined as married or not, and widowed or divorced patients were not separated from single patients.

Lifestyle factors

Lifestyle behaviors were assessed using selected questions from the Behavioral Risk Factor Surveillance System (BRFSS).21 Tobacco use was assessed using questions concerning ever use (whether participant had smoked at least 100 cigarettes in lifetime), current use (everyday, some days or not at all) and time since quit. We also assessed drinking status and binge drinking (whether participant drank 4 or 5 drinks in one occasion for men and women, respectively). Lastly, we assessed average physical activity using the Godin Leisure-Time questionnaire and average number of fruit and vegetable servings per day.22

Clinical factors

Health care access. Health care access was measured by self-report using several investigator-developed items to assess whether the respondent had experienced a gap in health insurance coverage in the past 10 years or an inability to see a physician when desired over the past 2 years. We also assessed whether the respondent had an established primary care physician before diagnosis and when he or she had the most recent routine check-up. Data abstracted from the medical record included type of cancer, stage at diagnosis, anatomic site, HPV status, comorbidities, body mass index and time to treatment (as defined as time from date of diagnosis to start of first treatment modality).

Psychosocial factors

Perceived Stress. Perceived Stress was assessed using the 10-item Perceived Stress Scale.23 This widely used instrument assesses the degree to which situations in one’s life were appraised as stressful during the last month (1 = Never to 5 = Very Often) and has demonstrated suitable psychometric properties. Fatalism was assessed using the 5-item Fatalism Scale.24 These items examine frequency of fatalistic beliefs about one’s health in the context of a cancer diagnosis. Each item (e.g., “I’ve given up trying to get better”) used a Likert-type scale, ranging from 1 (not at all) to 5 (extremely) with higher scores indicating greater level of fatalism.

Social support. Social support was assessed with the (ISEL-12).25 This instrument includes 12 statements concerning the perceived availability of potential social resources and provides an overall measure of support as well as perceived availability of three separate functions of social support including appraisal, tangible and belonging support. Participants reported the extent to which statements about support were true for them (1 = Definitely False to 4 = Definitely True).

Statistical analysis

Descriptive statistics were used to summarize variables and determine difference between the two groups (AAs versus EAs). For categorical variables, Fisher’s exact test or Wilcoxon Rank Sum tests were performed to assess significance. For continuous variables, t-tests were performed for normally distributed data points and Mann–Whitney or Kruskal-Wallis for non-normal distributions. All statistical analysis was performed on SAS version 9.4 and SPSS version 24.0 (IBM Corp., Armonk, NY).

Results

Demographic differences in European American and African American patients

The frequency distributions of the sociodemographic and lifestyle variables are summarized in Table 1. The mean age was 60.7 years in European Americans (EAs) and 58.3 years in African Americans (AAs). The majority of patients for both races were male, but more AAs were male compared with EAs (79% vs. 65% males). Compared with EAs, AAs had significantly lower levels of formal schooling ($P = 0.01$) and higher levels of unemployment ($P = 0.049$). AAs compared with EAs had lower income levels and were less likely to be married but these differences were not statistically significant. With respect to tobacco smoking and alcohol drinking, AAs were slightly more likely to have been ever smokers but less likely to be current smokers, less likely to be current drinkers but more likely to binge drink if they were current drinkers. With respect to lifestyle characteristics, both racial groups had similar levels of exercise and...
consumption of fruits and vegetables. AAs had a mean body mass index that was 13% lower than EAs ($P$-value 0.054).

### Features of disease between European American and African American patients

The frequency distributions of the clinical characteristics showed little difference between EAs and AAs for anatomic site of the tumor and HPV status of the tumor (Table 2). Interestingly, the clinical stage of the tumor was much more similar between AAs and EAs than the pathologic state, which showed a marked trend toward late-stage disease in AAs compared with EAs. Median time to treatment was significantly shorter for EAs (33 IQR: 20-42) compared to AAs (55 IQR: 25-74) ($P < 0.05$).

### Distribution of HPV-related diseases in European American and African American patients

A subset of 20 patients in this study had available data for race and HPV status. Of note, 100% of AA HPV+ patients had oral cavity cancer but 100% of HPV+ EA patients had oropharyngeal cancer (Table 3). AA patients that were HPV-had disease either of the oral cavity (33%) and oropharynx (67%). EA patients that were HPV- had disease more commonly in oral cavity (64%) and other sites of the head and neck (36%).

### Psychosocial differences in European American and African American patients

With respect to psychosocial characteristics, the two racial groups were similar with respect to overall social support as well as the individual components of appraisal, belonging, and tangible support (Table 4). AAs had a mean religiosity score that was 18% higher than EAs, a difference that was

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**Table 1** Frequency distributions of demographic and lifestyle characteristics of head and neck cancer patients by race.

| Factors                  | European American ($n = 24$) | African American ($n = 15$) | $P$-value |
|--------------------------|------------------------------|-----------------------------|-----------|
| **Age (years)**          |                              |                             |           |
| Average Age              | 60.7                         | 58.3                        | 0.55a     |
| ≤65                      | 61%                          | 80%                         |           |
| >65                      | 39%                          | 20%                         |           |
| Missing                  | 1                            | 0                           |           |
| **Gender**               |                              |                             |           |
| Male                     | 65%                          | 79%                         | 0.48p     |
| Female                   | 35%                          | 21%                         |           |
| Missing                  | 1                            | 1                           |           |
| **Education**            |                              |                             |           |
| <High School Graduate    | 8%                           | 50%                         | 0.01p     |
| ≥High School Graduate    | 92%                          | 50%                         |           |
| Missing                  | 0                            | 5                           |           |
| **Employment**           |                              |                             |           |
| Unemployed/Disability    | 38%                          | 80%                         | 0.049b    |
| Employed                 | 29%                          | 20%                         |           |
| Retired                  | 33%                          | 0                           |           |
| Missing                  | 0                            | 5                           |           |
| **Average Income($)**    |                              |                             |           |
| <25000                   | 35%                          | 50%                         | 0.46p     |
| >25000                   | 65%                          | 50%                         |           |
| Missing                  | 1                            | 5                           |           |
| **Marital Status**       |                              |                             |           |
| Married                  | 63%                          | 50%                         | 0.70p     |
| Not Married (Single/ Wid./Div.) | 37%                  | 50%                         |           |
| Missing                  | 0                            | 5                           |           |
| **Smoking Status**       |                              |                             |           |
| Never                    | 21%                          | 20%                         | 0.34p     |
| Former                   | 46%                          | 20%                         |           |
| Current                  | 33%                          | 60%                         |           |
| Missing                  | 0                            | 5                           |           |
| **Alcohol Use**          |                              |                             |           |
| Never                    | 13%                          | 10%                         | 0.10p     |
| Former                   | 8%                           | 40%                         |           |
| Current                  | 79%                          | 50%                         |           |
| Missing                  | 0                            | 5                           |           |
| **Binge Drinking**       |                              |                             |           |
| No                       | 39%                          | 20%                         | 0.62p     |
| Yes                      | 61%                          | 80%                         |           |
| Missing                  | 6                            | 10                          |           |
| **Exercise**             |                              |                             |           |
| No Exercise              | 25%                          | 30%                         | 0.96p     |
| Mild                     | 37%                          | 30%                         |           |
| Moderate                 | 25%                          | 20%                         |           |
| Strenuous                | 13%                          | 20%                         |           |
| Missing                  | 0                            | 5                           |           |

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**Table 1 (continued)**

| Factors                  | European American ($n = 24$) | African American ($n = 15$) | $P$-value |
|--------------------------|------------------------------|-----------------------------|-----------|
| **Diet**                 |                              |                             |           |
| Average Fruit Consumption| 1.8                          | 2.4                         | 0.24a     |
| Average Vegetable Consumption| 2.1                    | 1.8                         | 0.64      |
| Missing                  | 0                            | 5                           |           |
| **BMI**                  |                              |                             |           |
| Average BMI              | 27.4                         | 23.9                        | 0.054b    |
| <18.5                    | 9%                           | 21%                         |           |
| 18.5–24.9                | 26%                          | 29%                         |           |
| 25.0–29.9                | 30%                          | 43%                         |           |
| ≤30.0                    | 35%                          | 7%                          |           |
| Missing                  | 1                            | 1                           |           |

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<sup>a</sup> = t-test.  
<sup>b</sup> = Fisher’s exact test.
not statistically significant (P-value 0.19). Both racial groups had nearly equal levels of perceived stress. Compared with EAs, AAs had 21% higher level of fatalism (P-value 0.57).

### Differences in access to healthcare in European American and African American patients

No statistically significant differences were noted with respect to access to healthcare (Table 5), but the risk profile tended to be worse for EA compared with AA patients for having a primary care physician prior to diagnosis, having a recent routine check-up, and ability to see a physician. Despite nearly equal percentages of both groups currently having insurance, AAs were more likely to report having a gap in health insurance during the past decade (37% vs. 15%).

### Discussion

This cross-sectional pilot study was conducted among a racially diverse sample of HNSCC patients who received surgical resection to ascertain potential racial differences in the risk profile that may contribute to poorer survival among AAs compared to their EA counterparts. Unlike prior studies that primarily utilized existing retrospective medical record data, the current study was designed to explore a comprehensive array of risk factors at the: a) socio-demographic level (e.g. race, ethnicity, age, gender, marital status, years of education, employment status, family income and health insurance), b) lifestyle level (e.g. tobacco use, alcohol use, exercise and fruit/vegetable intake), c) clinical level (e.g. cancer type, stage and anatomical site, comorbidities, healthcare access, primary care provider, HPV status, BMI and time to treatment, and d) psychosocial level (e.g. perceived stress, fatalism, HNSCC symptoms and social support). To our knowledge, most prior studies that examined differences in the risk profile of HNSCC patients by race did not assess factors such as employment status, years of education, social support, tobacco use, diet and exercise. Thus, the current study was designed to explore not only previously validated HNSCC risk factors, but also some novel risk factors that are understudied due to their absence in most clinical datasets.

### Table 2 Comparison of clinical characteristics of head and neck cancer patients by race.

| Factors            | European American (n = 24) | African American (n = 15) | P-value |
|--------------------|---------------------------|---------------------------|---------|
| Subsite            |                           |                           |         |
| Oral Cavity        | 67%                       | 55%                       | 0.77    |
| Oropharynx         | 14%                       | 18%                       |         |
| Larynx             | 19%                       | 27%                       |         |
| Missing            |                           |                           |         |
| Clinical Stage     |                           |                           |         |
| I                  | 30%                       | 7%                        | 0.22a   |
| II                 | 22%                       | 43%                       |         |
| III                | 9%                        | 21%                       |         |
| IV                 | 39%                       | 29%                       |         |
| Missing            |                           |                           |         |
| Pathologic Stage   |                           |                           |         |
| I                  | 45%                       | 23%                       | 0.56b   |
| II                 | 14%                       | 15%                       |         |
| III                | 9%                        | 8%                        |         |
| IV                 | 32%                       | 54%                       |         |
| Missing            |                           |                           |         |
| HPV                |                           |                           |         |
| Negative           | 73%                       | 60%                       | 0.68    |
| Positive           | 27%                       | 40%                       |         |
| Missing/Unknown    |                           |                           |         |
| Time to Treatment  | Median (range)            |                           |         |
|                    | 33 (20–42)                | 55 (25–74)                | 0.05    |

### Table 3 Comparison of race and HPV status by anatomic site (%).

| Factors | Cases | Anatomic Site |
|---------|-------|---------------|
|         |       | Oral Cavity   |
|         |       | Oropharynx    |
|         |       | Other         |
| HPV + EA| 4     | 0             |
|         |       | 100           |
|         |       | 0             |
| HPV + AA| 2     | 100           |
|         |       | 0             |
| HPV − EA| 11    | 64            |
|         |       | 0             |
|         |       | 36            |
| HPV − AA| 3     | 33            |
|         |       | 67            |
|         |       | 0             |

### Table 4 Comparison of psychosocial characteristics of head and neck cancer patients by race.

| Factors | European American (n = 24) | African American (n = 15) | P-value |
|---------|---------------------------|---------------------------|---------|
| Social Support (%) |                          |                           |         |
| Appraisal | 10.0                       | 9.8                       | 0.87a   |
| Belonging  | 9.8                        | 10.2                      | 0.71    |
| Tangible  | 8.2                        | 8.7                       | 0.24    |
| Overall   | 27.9                       | 28.7                      | 0.89    |
| Missing   | 0                          | 5                         |         |
| Religiosity | Total Score               | 22.3                      | 26.4    |
|           | 1                          | 5                         | 0.19a   |
| Perceived Stress | Total Score       | 17.6                      | 17.9    |
|           | 0                          | 6                         | 0.93b   |
| Fatalism  | Average Score             | 1.9                       | 2.3     |

\[ a = \text{Fisher’s test.} \]
\[ b = \text{Wilcoxon Rank Sum test.} \]
EAs. This finding suggests that social deprivation may be an important factor to examine in the future in terms of risk for HNSCC.

Lifestyle factors assessed in the current study included fruit and vegetable consumption, physical activity, tobacco use, alcohol use and BMI. There was no racial differences identified in terms of fruit/vegetable consumption and exercise. This finding conflicts with some prior studies but support findings from other studies. In our cohort, AAs had lower BMI than EAs as well.

Our study noted that 70% of EA patients and 60% AA patients were HPV negative. The majority of new head and neck cancer diagnoses are HPV related, however this data was collected at a time when HPV was not routinely tested at this institution. As such, many patients did not have documented HPV status. Interestingly 100% of HPV + AA patients had oral cavity cancer, and the prognostic significance of HPV status on sites other than the oropharynx is still not well known. Furthermore all AA patients with oropharynx cancer were HPV negative, a disease with much poorer prognosis compared to HPV + disease corroborating similar reports. In contrast all HPV + EA patients had oropharyngeal cancer, which has been well described and is expected.

This study found many more similarities in access to care, psychosocial characteristics, and insurance status than differences. However, in our limited cohort, AA patients had lower levels of formal schooling and higher levels of unemployment; findings similar to previously reported cohorts. There was no difference in overall social support, however perceived fatalism was slightly higher in AA patients. One key difference in socioeconomic status was that AA patients were more likely to have a gap in their insurance consistent with previous research.

In the current study, AAs were more likely than EAs to experience cancer upstaging between clinical and pathological diagnosis. While the underlying reason for this finding is unclear, this finding warrants further investigation in a larger more controlled study. It is possible that AAs are more likely to experience cancer upstaging between clinical and pathological diagnosis due to underlying genetic differences. In other cancers such as prostate and breast cancer, the presence of more aggressive disease has been implicated as a predictor of poorer survival in AAs. It is also possible that AAs are more likely to experience cancer upstaging between diagnosis and surgery due to differences in quality of diagnostic work up. Specifically, factors such as time between diagnosis and surgery, array of diagnostic test and characteristics of the medical settings and professionals who perform diagnostic work-up should be investigated in future research. AAs in this study were found to have significantly increased time to treatment initiation as well.

Limitations

A number of strengths and weaknesses should be considered in interpreting the results from this study. A key strength of the study was the holistic approach that was utilized on a small scale as a model to ramp up in larger studies and the use of validated questionnaires. Key weakness of the study was the small sample size with substantial amounts of missing data. Most specifically there is limited information on HPV status. Due to the limited sample size, generalization of our findings requires further work with a larger cohort.

Conclusions

This prospective study highlights important similarities and differences of patients with head and neck cancer prior to treatment. Disparities appear to continue to exist by race in a number of clinical and psychosocial variables that deserve further attention and research. Future prospective work investigating racial disparities in head and neck cancer patients should be encouraged. Elucidating factors can lead to potential public health interventions that may be implemented to reduce disparities.

Key points

Questions: Which racial differences in epidemiological, clinical, and psychosocial contributors can be accounted for prior to treatment in patients undergoing surgery for HNSCC in a cross-sectional study at a single NCI-designated tertiary care center?

Findings: Time to treatment initiation and gaps in health insurance were significantly higher, formal education was significantly lower for African American patients in this...
cross sectional study. Furthermore, African American patients were more likely to have a higher pathologic stage as well.

Meaning: Many similarities and some key differences in sociodemographic, lifestyle, clinical, and psychosocial characteristics in African American and European American patients near the time of surgery for head and neck squamous cell carcinoma.

Presentations
None.

Declaration of Competing Interest
None.

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References

1. Siegel RL, Miller KD, Jemal A. Cancer statistics, 2018. CA Cancer J Clin. 2018;68:7–30.
2. DeSantis CE, Siegel RL, Sauer AG, et al. Cancer statistics for African Americans, 2016: Progress and opportunities in reducing racial disparities. CA Cancer J Clin. 2016;66(4):290–308.
3. Rose BS, Jeong JH, Nath SK, Lu SM, Mell LK. Population-based study of competing mortality in head and neck cancer. J Clin Oncol. 2011;29:3501–3509.
4. Adelstein D, Gillison ML, Pfister DG, et al. NCCN guidelines insights: head and neck cancers, version 2.2017. J Natl Compr Cancer Netw. 2017;15:761–770.
5. Cavaliere S, Rivoltini L, Bergamini C, Locati LD, Licitra L, Bossi P. Immuno-oncology in head and neck squamous cell cancers: News from clinical trials, emerging predictive factors and unmet needs. Cancer Treat Rev. 2018;65:78–86.
6. Chaturvedi AK, Engels EA, Pfeiffer RM, et al. Human papillomavirus and rising oropharyngeal cancer incidence in the United States. J Clin Oncol. 2011;29:4294–4301.
7. Deschler DG, Richmon JD, Khariwala SS, Ferris RL, Wang MB. The “new” head and neck cancer patient-young, nonsmoker, nondrinker, and HPV positive: evaluation. Otolaryngol Head Neck Surg. 2014;151:375–380.
8. Hinni ML, Nagel T, Howard B. Oropharyngeal cancer treatment: the role of transoral surgery.Curr Opin Otolaryngol Head Neck Surg. 2015;23:132–138.
9. Wang MB, Liu JY, Gornbein JA, Nguyen CT. HPV-positive oropharyngeal carcinoma: a systematic review of treatment and prognosis. Otolaryngol Head Neck Surg. 2015;153:758–769.
10. Gillison ML, D’Souza G, Westra W, et al. Distinct risk factor profiles for human papillomavirus type 16-positive and human papillomavirus type 16-negative head and neck cancers. J Natl Cancer Inst. 2008;100:407–420.
11. Jiron J, Sethi S, Ali-Fehmi R, et al. Racial disparities in Human Papillomavirus (HPV) associated head and neck cancer. Am J Otolaryngol. 2014;35:147–153.
12. Mahal BA, Inverso G, Aizer AA, Bruce Donoff R, Chuang SK. Impact of African-American race on presentation, treatment, and survival of head and neck cancer. Oral Oncol. 2014;50:1177–1181.
13. Subramanian S, Chen A. Treatment patterns and survival among low-income medicaid patients with head and neck cancer. JAMA Otolaryngol Head Neck Surg. 2013;139:489–495.
14. Du XL, Liu CC. Racial/Ethnic disparities in socioeconomic status, diagnosis, treatment and survival among medicare-insured men and women with head and neck cancer. J Health Care Poor Underserved. 2010;21:913–930.
15. Zakeri K, MacEwan I, Vazirnia A, et al. Race and competing mortality in advanced head and neck cancer. Oral Oncol. 2014;50:40–44.
16. Hayes DN, Peng G, Pennella E, et al. An exploratory subgroup analysis of race and gender in squamous cancer of the head and neck: inferior outcomes for African American males in the LORHAN database. Oral Oncol. 2014;50:605–610.
17. Ragin CC, Langevin SM, Marzouk M, Grandis J, Taioli E. Determinants of head and neck cancer survival by race. Head Neck. 2011;33:1092–1098.
18. Daraei P, Moore CE. Racial disparity among the head and neck cancer population. J Cancer Educ. 2015;30:546–551.
19. Moore CE, Warren R, Maclin JR SR. Head and neck cancer disparity in underserved communities: probable causes and the ethics involved. J Health Care Poor Underserved. 2012;23:88–103.
20. Amin MB. American Joint Committee on Cancer, American Cancer Society. AJCC cancer Staging Manual. Springer; 2017: 1024.
21. Sandulache VC, Kubik MW, Skinner HD, Malsky JA, Gelbard AH, Zevallos JP. Impact of race/ethnicity on laryngeal cancer in patients treated at a Veterans Affairs Medical Center. Laryngoscope. 2013;123:2170–2175.
22. Duez J, Holleran JP, Ndour PA, et al. Splenic retention of Plasmodium falciparum gametocytes to block the transmission of malaria. Antimicrob Agents Chemother. 2015;59:4026–4024.
23. Taylor JM. Psychometric analysis of the ten-item perceived stress scale. Psychol Assess. 2015;27:90–101.
24. Shen L, Condit CM, Wright L. The psychometric property and validation of a fatalism scale. Psychol Health. 2009;24:597–613.
25. Cohen S, Hoberman H. Positive events and social supports as buffers of life change stress. J Appl Social Psychol. 1993;13:99–125.
26. Gourin CG, Podolsky RH. Racial disparities in patients with head and neck squamous cell carcinoma. Laryngoscope. 2006;116:1093–1106.
27. Guttmann DM, Kobie J, Grover S, et al. National disparities in treatment package time for resected locally advanced head and neck cancer and impact on overall survival. Head Neck. 2018;40:1147–1155.
28. Trinh-Shevrin C, Pollack HJ, Tsang T, et al. The Asian American hepatitis B program: building a coalition to address hepatitis B health disparities. Prog Community Health Partnersh. 2011;5:261–271.
29. August KJ, Sorkin DH. Racial/ethnic disparities in exercise and dietary behaviors of middle-aged and older adults. J Gen Intern Med. 2011;26:245–250.
30. Chung CH, Zhang Q, Kong CS, et al. p16 protein expression and human papillomavirus status as prognostic biomarkers of non- oropharyngeal head and neck squamous cell carcinoma. J Clin Oncol. 2014;32:3930–3938.
31. Fakhry C, Westra WH, Wang SJ, et al. The prognostic role of sex, race, and human papillomavirus in oropharyngeal and nonoropharyngeal head and neck squamous cell cancer. Cancer. 2017;123:1566–1575.

32. Settle K, Posner MR, Schumaker LM, et al. Racial survival disparity in head and neck cancer results from low prevalence of human papillomavirus infection in black oropharyngeal cancer patients. Cancer Prev Res (Phila). 2009;2:776–781.

33. Naghavi AO, Echevarria MI, Strom TJ, et al. Treatment delays, race, and outcomes in head and neck cancer. Cancer Epidemiol. 2016;45:18–25.

34. Cohen JH, Schoenbach VJ, Kaufman JS, et al. Racial differences in clinical progression among Medicare recipients after treatment for localized prostate cancer (United States). Cancer Causes Control. 2006;17:803–811.

35. Chlebowski RT, Chen Z, Anderson GL, et al. Ethnicity and breast cancer: factors influencing differences in incidence and outcome. J Natl Cancer Inst. 2005;97:439–448.

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