Community Dent Oral Epidemiol

COMMUNITY DENTISTRY AND ORAL EPIDEMIOLOGY

Racial disparities in being recommended to surgery for oral and oropharyngeal cancer in the United States

Yanqiu Weng and Jeffrey E. Korte

Division of Biostatistics and Epidemiology, Department of Medicine, Medical University of South Carolina, Charleston, SC, USA

Weng Y, Korte JE. Racial disparities in being recommended to surgery for oral and oropharyngeal cancer in the United States. Community Dent Oral Epidemiol 2011. © 2011 John Wiley & Sons A/S

Abstract – *Objectives:* To investigate the impact of race on the likelihood of patients being recommended for surgery after a diagnosis of oral and oropharyngeal cancer. *Methods:* A total of 68 445 cases of oral and oropharyngeal cancer were extracted from the 1988 to 2005 Surveillance, Epidemiology, and End Results (SEER) database. County-level rurality data and income data were merged using the US Department of Agriculture Rural-Urban Continuum Codes dataset and US Census Bureau Small Area Income & Poverty Estimates dataset. We used logistic regression analyses to investigate the impact of race on being recommended to surgery for oral and oropharyngeal cancer, adjusting for demographic, socioeconomic, and clinical factors. Stratified analyses were further conducted by tumor site and rural/urban status. *Results:* Recommendation to surgery varied significantly by race, with black patients less likely than white patients to be recommended to surgery for their oral and oropharyngeal cancer. The racial difference in recommendation to surgery varied significantly by age, geography, and tumor subsite. Racial disparities are most evident in lip and buccal cancer from rural areas (OR, 4.4; 95% CI, 2.6–7.5); and least evident in oropharyngeal cancer from urban areas (OR, 1.2; 95% CI, 1.1–1.3). The magnitude of the racial disparity is attenuated with increasing age. *Conclusions:* We observed substantial racial disparities in surgery recommendation for oral and oropharyngeal cancer in the United States. Our results suggest the need to improve accessibility to better health care in racial minority groups, particularly in rural areas, and call for individual and institutional efforts to avoid physician bias related to the patient's sociodemographic characteristics in healthcare service.

Key words: health disparity; oral cancer; oropharyngeal cancer; race; surgery

Yanqiu Weng, Division of Biostatistics and Epidemiology, Department of Medicine, Medical University of South Carolina, Charleston, SC 29425-8350, USA
Tel.: (843) 876-1100
Fax: (843) 876-1126
e-mail: weng@musc.edu

Submitted 18 August 2010; accepted 22 July 2011

It is well documented by the American Cancer Society that black patients have significantly higher mortality and lower 5-year relative survival compared with white patients for oral and oropharyngeal cancer. The racial disparity in survival ranks 2nd among all cancers (1, 2). While no evidence to date supports a biological mechanism underlying this disparity between blacks and whites, a difference in stage at diagnosis seems clear – in one study, only 20% of oral and oropharyngeal cancer in black patients were diagnosed in the localized stage, compared with 37% in the comparable stage among white patients (3). Delayed diagnosis is a plausible predictor of poor prognosis, but studies have shown that delayed diagnosis alone is not able to fully explain the black–white disparity in mortality and 5-year survival rate (4–7).

Appropriate cancer treatment is another important factor contributing to better prognosis. Racial disparities in receipt of optimal cancer therapy have been reported in breast cancer (8), cervical cancer (9), and lung cancer (10), but the scientific literature is sparse for oral and oropharyngeal cancer. Although oral and oropharyngeal cancer can be managed by surgery alone or combined with any combination of radiotherapy, chemotherapy, and immunotherapy, surgery is a key primary treatment modality (11, 12). The level of accessibility to surgery can reflect the general access to optimal treatment for oral and oropharyngeal cancer. To date, there is no convincing evidence that black and white patients have equitable access to surgery for oral cancer. One paper investigated the relationship between race and pattern of care for oral cancer in 84 subjects, but the small sample size limited the statistical power and the generalizability of the conclusions (13). Several studies included treatment as a covariate in the multiple logistic models in studying patient survival, but no distinct information with respect to the association between race and treatment was reported in these studies (14, 15).

It is difficult to separate the effects of social, economic, and cultural factors in racial disparities research. However, measures reflecting low socioeconomic status (SES) such as poverty, inadequate education, and lack of health insurance are believed to be the structural barriers associated with racial minorities to limit access to optimal health care and contribute to the elevated risk of oral and oropharyngeal cancer (16–19). We therefore conducted a cross-sectional study based on the SEER database – a population-based cancer database funded by the National Cancer Institute, linked with the Rural-Urban Continuum Codes (RUCC) data set and the Small Area Income & Poverty Estimates (SAIPE) data. The purpose of this study was to investigate the impact of race on the likelihood of patients being recommended to surgery, adjusting for various demographic, socioeconomic, and clinical factors.

Materials and methods

Data source

The data used for this analysis were the 1988–2005 SEER Limited-Use Dataset, which were collected by the cancer registries in 17 different geographical regions and covered approximately 26% of the US population. SEER data are generally considered representative of the US population and useful for various topics in cancer research (20).

Surveillance, Epidemiology, and End Results Limited-Use Data do not provide any information on rurality of residence and socioeconomic information (e.g. household income, medical insurance). To adjust for these covariates in the analysis, we linked SEER data to another two datasets based on each subject's county-level information. First, the RUCC dataset from the United States Department of Agriculture was used to dichotomize each subject as a rural or urban resident. The RUCC divided all counties into urban (metro) and rural (nonmetro) areas according to their population size and degree of urbanization (21). Second, the SAIPE data from the US Census Bureau were employed to dichotomize subjects as residing in a wealthy county or poor county. Based on the US federal definition, 'poverty areas' are regions where ≥20% of the population lives below the poverty line (22), a threshold that varies by size and age composition of household. This cutoff has been confirmed effective as an index in study of socioeconomic inequalities in health (23, 24) and thus was applied in this study.

Variables analyzed

The outcome variable – whether surgery was recommended or not – was derived from the variable 'Reason for no surgery' in the original SEER data set and dichotomized into two categories: surgery recommended and nonrecommended. The former included those patients with surgery performed, surgery recommended by the physician but refused by the patient, surgery recommended but not performed for unknown reasons, and surgery recommended but not confirmed to have been carried out. The surgery nonrecommendation group included those with surgery not recommended or surgery contraindicated because of other conditions. Our main predictor of interest was race, limited to black and white patients.

The covariates for this analysis included the following: age (in years), gender, marital status, year of diagnosis (i.e. from 1998 to 1996 or 1997 to 2005), residence area (i.e. rural or urban), poverty indicator (i.e. residing in a county with poverty rate ≥20%, or <20%), tumor stage (i.e. *in situ*, localized, regional, or distant), and tumor site (i.e. tongue, gum, lip and buccal, oropharyngeal region, salivary gland, and others).

Statistical analyses

In preliminary analysis, demographic, socioeconomic, and clinical characteristics were described using means for continuous variables and proportions for categorical variables.

We performed unadjusted analyses to explore any significant differences between various groups with respect to surgery recommendation or race. Bivariate analyses of race and surgery recommendation were also stratified by different covariates to evaluate possible effect modifiers.

We fit multiple logistic regression models to obtain adjusted odds ratios for race and surgery recommendation. We considered covariates for inclusion in the final model based on the results of bivariate analyses: Variables significantly associated with both race and surgery recommendation ($P < 0.05$) and causing >10% absolute change in ORs for race between adjusted and unadjusted analyses were considered potential confounders; variables by which stratified analyses were conducted indicating a significant change in ORs for race across strata ($P < 0.05$ for Breslow-Day Test) were considered effect modifiers; and variables recognized as important confounders or effect modifiers in the previous literature. Covariates meeting at least one of the above three criteria were considered for inclusion in the final model. A backward stepwise procedure for model building was used to obtain the most parsimonious model. SAS 9.1 (SAS Institute Inc., Cary, NC, USA) was used for all data analyses in this study.

Results

Characteristics of study population

Table 1 shows the distribution of covariates by race. We observed significant racial differences in the distributions of age, gender, marital status, year of diagnosis, residence area, poverty indicator, tumor stage, and tumor site.

Not recommended to surgery

Table 2 shows the distribution of covariates by surgery nonrecommendation. The crude odds ratio

Table 1. Patient demographic and tumor characteristics by race

Covariate	All *n* (%)	Race		Odds ratio (95% CI) Black versus White
		Black *n* (%)	White *n* (%)	
Age				
18–39	3096 (5)	319 (6)	2705 (4)	1.0 (Reference)
40–59	24 492 (36)	3355 (51)	21 137 (34)	1.1 (1.0, 1.2)
60–79	32 022 (47)	2508 (38)	29 514 (48)	0.6 (0.5, 0.7)
80-	8835 (13)	356 (5)	8479 (14)	0.3 (0.2, 0.3)
Gender				
Female	22 725 (33)	2040 (31)	20 685 (33)	1.0 (Reference)
Male	45 720 (67)	4570 (69)	41 150 (67)	1.1 (1.1, 1.2)
Marital status				
Married	35 959 (56)	2124 (34)	33 835 (59)	1.0 (Reference)
Single	27 857 (44)	4080 (66)	23 777 (41)	2.7 (2.6, 2.9)
Residence area				
Urban	59 509 (87)	6332 (96)	53 177 (86)	1.0 (Reference)
Rural	8936 (13)	278 (4)	8658 (14)	0.3 (0.2, 0.3)
Poverty indicator				
Rich	60 140 (88)	4886 (74)	55 254 (89)	1.0 (Reference)
Poor	8296 (12)	1724 (26)	6572 (11)	3.0 (2.8, 3.2)
Year of diagnosis				
1988–1996	22 925 (33)	2359 (36)	20 566 (33)	1.0 (Reference)
1997–2005	45 520 (67)	4251 (64)	41 269 (67)	0.9 (0.85, 0.95)
Tumor stage				
In situ	2382 (4)	140 (2)	2242 (4)	1.0 (Reference)
Localized	25 840 (40)	1631 (26)	24 209 (42)	1.1 (0.9, 1.3)
Regional	30 248 (47)	3472 (56)	26 776 (46)	2.1 (1.7, 2.5)
Distant	6070 (9)	971 (16)	5099 (8)	3.1 (2.5, 3.7)
Tumor site				
Tongue	17 272 (25)	1631 (25)	15 641 (25)	1.0 (Reference)
Gum	6285 (9)	533 (9)	5752 (9)	0.9 (0.8, 0.98)
Lip or buccal mucosa	10 109 (15)	251 (4)	9858 (16)	0.2 (0.2, 0.3)
Oropharyngeal area	24 798 (36)	3276 (50)	21 522 (35)	1.5 (1.4, 1.6)
Gland and other	9981 (15)	919 (14)	9062 (15)	1.0 (0.9, 1.1)
Surgery recommendation				
Yes	53 865 (79)	4413 (67)	49 452 (80)	1.0 (Reference)
No	14 580 (21)	2197 (33)	12 383 (20)	2.0 (1.9, 2.1)
Total	68 445	6610	61 835	

Odds ratio (95% confidence interval) of being black relative to white across variables.

Table 2. Patient demographic and tumor characteristics by surgery recommendation

Covariate	All n (%)	Surgery recommendation No n (%)	Yes n (%)	Odds ratio (95% CI) No versus Yes
Age				
18–39	3096 (5)	245 (2)	2851 (5)	1.0 (Reference)
40–59	24 492 (36)	5192 (36)	19 300 (36)	3.1 (2.7, 3.6)
60–79	32 022 (47)	7131 (49)	24 891 (46)	3.3 (2.9, 3.8)
80-	8835 (13)	2012 (14)	6823 (13)	3.4 (3.0, 3.9)
Gender				
Female	22 725 (33)	4136 (28)	18 589 (35)	1.0 (Reference)
Male	45 720 (67)	10 444 (72)	35 276 (65)	1.3 (1.3, 1.4)
Marital status				
Married	35 959 (56)	6585 (48)	29 374 (59)	1.0 (Reference)
Single	27 857 (44)	7127 (52)	20 730 (41)	1.5 (1.5, 1.6)
Residence area				
Urban	59 509 (87)	13 252 (91)	46 257 (86)	1.0 (Reference)
Rural	8936 (13)	1328 (9)	7608 (14)	0.6 (0.6, 0.7)
Poverty indicator				
Rich	60 140 (88)	12 495 (86)	47 645 (88)	1.0 (Reference)
Poor	8296 (12)	2085 (14)	6211 (12)	1.3 (1.2, 1.4)
Year of diagnosis				
1988–1996	22 925 (33)	4099 (28)	18 826 (35)	1.0 (Reference)
1997–2005	45 520 (67)	10 481 (72)	35 039 (65)	1.4 (1.3, 1.4)
Tumor stage				
In situ	2382 (4)	181 (1)	2201 (4)	1.0 (Reference)
Localized	25 840 (40)	2049 (15)	23 791 (47)	1.0 (0.9, 1.2)
Regional	30 248 (47)	8623 (64)	21 625 (42)	4.8 (4.2, 5.7)
Distant	6070 (9)	2564 (19)	3506 (7)	8.9 (7.6, 10.4)
Tumor site				
Tongue	17 272 (25)	2248 (15)	15 024 (28)	1.0 (Reference)
Gum	6285 (9)	894 (6)	5391 (10)	1.1 (1.0, 1.2)
Lip or buccal mucosa	10 109 (15)	561 (4)	9548 (18)	0.4 (0.4, 0.4)
Oropharyngeal area	24 798 (36)	9834 (67)	14 964 (28)	4.4 (4.2, 4.6)
Gland and other	9981 (15)	1043 (7)	8938 (17)	0.8 (0.7, 0.8)
Race				
White	61 835 (90)	12 383 (85)	49 452 (92)	1.0 (Reference)
Black	6610 (10)	2197 (15)	4413 (8)	2.0 (1.9, 2.1)
Total	68 445	14 580	53 865	

Odds ratio (95% confidence interval) of surgery being recommended relative to surgery not being recommended across variables.

between race and nonrecommendation to surgery is 2.0 (1.9, 2.1), meaning the odds for not being recommended for surgery was twice as high among black patients as it was among white patients. The surgery nonrecommendation rates also differed by age, gender, marital status, year of diagnosis, residence area, poverty indicator, tumor stage, and tumor site.

Stratified odds ratio for race and surgery nonrecommendation

The Breslow-Day Test for homogeneity indicated significant variations in ORs when stratifying by residence area, year of diagnosis, tumor stage, and tumor site in unadjusted analyses, suggesting these variables might be effect modifiers of the association between race and surgery recommendation. Age, gender, marital status, poverty indicator, and tumor stage did not show any significance in this test. The unadjusted ORs for race and surgery nonrecommendation stratified by the possible effect modifiers are shown in Table 3.

Multivariable logistic regression

Based on the results of bivariate analyses, we developed multivariable logistic regression models using backward stepwise elimination of insignificant covariates. The covariates in the final parsimonious model included age (continuous), gender, marital status, year of diagnosis, poverty indicator, and tumor stage; we also fit two interaction terms with race: residence area (urban/rural) and tumor site. Year of diagnosis and tumor stage were not significant effect modifiers in the multivariable setting.

Table 3. Stratified odds ratios (and 95% confidence intervals) of nonrecommendation to surgery of black relative to white patients across significant effect modifiers from bivariate analysis

Stratum variable	Odds ratio (95% CI) (White as reference)	*P*-value of Breslow-Day test
Residence area		
Urban	4.4 (3.4, 5.6)	0.0001
Rural	1.8 (1.7, 1.9)	
Year of diagnosis		
1988–1996	2.3 (2.1, 2.5)	0.0017
1997–2005	1.9 (1.8, 2.0)	
Tumor stage		
In situ	2.3 (1.4, 3.8)	0.0007
Localized	2.1 (1.8, 2.5)	
Regional	1.6 (1.4, 1.7)	
Distant	1.6 (1.4, 1.8)	
Tumor site		
Tongue	2.1 (1.9, 2.4)	<0.0001
Gum	1.6 (1.3, 2.0)	
Lip or buccal mucosa	3.3 (2.3, 4.7)	
Oropharyngeal area	1.4 (1.3, 1.5)	
Gland and other	1.7 (1.4, 2.1)	

Table 4 shows the adjusted odds ratios from the final model with ORs stratified by race, rural/urban residence, and tumor site, reflecting the interaction terms included in the model. The variation in stratified ORs for race and surgery recommendation by tumor location and residence area indicated the varying magnitude of racial disparity across different subgroups in the population: The racial disparity was most severe among rural patients with lip and buccal cancer, with a fourfold increase in the odds of nonrecommendation to surgery among black patients (OR, 4.4; 95% CI, 2.6–7.5), and was least evident in urban patients with oropharyngeal cancer, where we observed only a 20 percentage increase in odds among black patients (OR, 1.2; 95% CI, 1.1–1.3). The model also suggested that elderly single men from poor counties, with late-stage cancer, were less likely to be recommended to surgery.

In secondary analyses, we fit an additional interaction between race and age (in years) in the multivariable model. We found a significant interaction with a negative coefficient of −0.01 and a *P*-value of 0.0001, indicating an attenuation of racial disparities with increasing age.

Discussion

Oral and oropharyngeal cancer is generally managed by surgery alone or combined with concomitant radiotherapy, chemotherapy, and immunotherapy (11). In this paper, instead of investigating the full range of treatment options, we focused our interest on surgery recommendation alone because: (i) surgery remains the first line of treatment for oral and oropharyngeal cancer, and whether surgery is recommended can therefore be considered a ‘surrogate’ outcome for general access to optimal treatment; (ii) controversies still exist regarding the optimal combinational therapy (i.e. radiotherapy and/or chemotherapy)

Table 4. Adjusted odds ratios (and 95% confidence intervals) for surgery nonrecommendation for main predictor (race) and covariates from the primary model

Variable (reference category)	Stratum 1	Stratum 2	Odds ratio (95% CI)
Race[a]	Urban	Tongue	1.7 (1.5, 1.9)
		Gum	1.5 (1.2, 1.9)
		Lip or buccal mucosa	2.2 (1.4, 3.4)
		Oropharyngeal area	1.2 (1.1, 1.3)
		Gland and other	2.1 (1.7, 2.7)
	Rural	Tongue	3.4 (2.4, 4.7)
		Gum	3.0 (2.1, 4.4)
		Lip or buccal mucosa	4.4 (2.6, 7.5)
		Oropharyngeal area	2.4 (1.8, 3.3)
		Gland and other	4.3 (3.0, 6.2)
Age (in years)			1.03 (1.03, 1.03)
Gender (female)			1.2 (1.1, 1.2)
Marital status (married)			1.4 (1.3, 1.4)
Year of diagnosis (1988–1996)			1.4 (1.4, 1.5)
Poverty indicator (rich)			1.5 (1.4, 1.6)
Tumor stage[b]			2.2 (2.1, 2.3)

[a]The reference category for race: white patient from urban area with a diagnosis of tongue cancer.
[b]We considered tumor stage as an ordinal variable (*in situ*, localized, regional, and distant). The ORs represent one unit escalation over this order.

and their sequence (i.e. presurgical or postsurgical) (12, 25), and including these combinational options in analysis might lead to underestimation of disparities in receipt of optimal treatment in reality. On the other hand, it is true that not all patients are candidate for surgery: Patients with late-stage, posterior-site cancer are more likely to be contra-indicated for surgery (26), which is also confirmed by our finding: Patients with late-stage (distantly developed), posterior-site cancer (oropharyngeal cancer) had almost a 10-fold increase in surgery nonrecommendation risk compared with patients with early-stage (*in situ*) and anterior-site cancer (lip and buccal cancer).

Instead of exploring racial differences in receipt of treatment, we focused on the difference in recommendation of treatment with respect to race, to more directly address the question of to what extent the behavior of healthcare providers contributes to the inequality of care. Previous research has found that black patients with coronary artery disease were less likely than white patients to be recommended for cardiac catheterization (27); and that black patients with end-stage renal disease were less likely than comparable white patients to be referred for evaluation of renal transplantation (28). In this study, we found that black patients were less likely than white patients to be referred for surgery for oral and oropharyngeal cancer irrespective of their cancer stage and SES. This evidence provides support for the hypothesis that health and human service providers contribute to institutional racism in the current heath care system (29).

Our findings suggest that racial disparities in surgery recommendation are least obvious in posterior-site cancer (oropharyngeal cancer), while most obvious in anterior-site cancer (lip and buccal cancer). This may be due to a late-stage diagnosis of most oropharyngeal cancers, leading to a more uniform 'standard' treatment for both black and white patients: Surgery was less frequently recommended, and the patients' characteristics and personalities may be less likely to influence the physician's recommendation. As research on social categorization and stereotyping has pointed out, it is unrealistic to expect physicians to view each patient with complete objectivity and impartiality. To make everything more manageable, people usually make their judgment or apply their attitude toward a specific individual based on the image of a group or class that the individual belongs to, i.e. stereotype usage (30). Unfortunately, time pressure, the need to make quick judgments, and heavy cognitive load make physicians one of the most vulnerable groups for using stereotypes (31).

Socioeconomic status is another important factor contributing to the disparities in health care. Owing to low income, inadequate education, and lack of insurance coverage, patients with lower SES have limited access to routine health examination, which might contribute to higher cancer incidence (19) and delayed cancer treatment (18). Shavers (13) investigated the relationship between race, SES (i.e. income, education, insurance status), and cancer-directed treatment for oral, pharyngeal, and laryngeal cancer: While black patients had a lower average SES than white patients, no significant effect of SES on treatment pattern was found when controlling for race in the multivariable model (possibly limited by small sample size). With a much larger sample size in the SEER Limited-Use data, we did find that oral and oropharyngeal cancer patients from low income area had 50% higher odds of not being recommended to surgery than those from other areas. Furthermore, we believe this estimate is likely conservative, because of possible nondifferential misclassification of SES by using county-level factors in the absence of individual-level SES measures. In addition, we did not find any significant interaction between race and SES, meaning racial disparities appeared consistent across income groups. It is possible that our results would have differed if we had been able to include individual-level SES measures in our analysis; therefore, further study is warranted using individual-level SES measures to investigate this relationship.

We also investigated the effect of residence area on treatment recommendation. It has been reported that rural residents often face more barriers to high quality care, and studies have suggested that racial disparities in health care might be exacerbated by a variety of factors tied to local or regional conditions (32, 33); however, studies to date have not provided a definitive understanding of these effects (34). Findings of our study might provide a supportive answer to this question: An intensification of racial disparities was observed in rural areas, with an almost twofold increase in treatment disparities between black and white patients for oral and oropharyngeal cancer as compared to that in urban areas. Possible reasons for this larger gap in access to health care in rural areas might be that rural residents, on average, are poorer, have less health insurance coverage, and have less provider availability compared with their urban counterparts. These results underscore the necessity of improving healthcare accessibility for racial minorities, especially in rural populations. Furthermore, as this group has been reported less likely to visit the dentist but instead may see a primary care physician, training physicians with basic oral and oropharyngeal cancer knowledge in these regions may benefit the population (35).

Some studies have found a concentration of racial disparities in health care among young people. Garg et al. (36) found that blacks with end-stage renal disease were less likely than whites to be placed on the waiting list for renal transplant, and the racial disparity is greatest in the youngest and healthiest black patients. Interestingly, we observed a similar trend: Racial inequality in surgery recommendation for oral and oropharyngeal cancer was more obvious among younger patients. Previous literature has suggested that young patients might hold a more skeptical attitude toward their health provider (37), particularly when they confronted a physician of a different racial group (28, 38). Meanwhile, the physician's beliefs and expectations might be negatively influenced by the patient's characteristics and personality (29), and their conscious or unconscious racial biases and stereotype usage might be intensified by the patient's skepticism. Therefore, we believe improving trust and understanding between patients and physicians across races might mitigate the barriers to partnership and effective communication in healthcare service.

This study has several limitations. First, like many population-based studies (10, 39), we were not able to retrieve individual-level SES such as household income and health insurance information from the SEER Limited-Use data. Census county-level measures are imperfect indicators of individual-level SES (15, 40, 41), and accordingly, our results may be somewhat biased by residual confounding. Second, no information was available regarding patients' concomitant disease in the SEER database, so we were not able to evaluate its effect on surgery recommendation in these analyses. Third, possible racial profiling among physicians, and personal beliefs among patients, might influence decision making for surgery, but it is impossible to assess these factors in this cross-sectional study. Therefore, future work including the information of individual-level SES, patients' concomitant diseases, and measurements of physician's behaviors is strongly desired.

There are several important strengths of this study. SEER data are clearly representative of the overall US population, and the large sample size available made it possible for us to conduct subgroup analyses, such as by rural/urban residence and by cancer subsite, within the broader spectrum of oral and oropharyngeal cancer. In addition, the quality of SEER data made it possible for us to evaluate and control for tumor stage and other important factors.

In conclusion, the results of this study suggest black patients were less likely than white patients to be recommended to surgery for oral and oropharyngeal cancer across a variety of descriptor variables such as gender, marital status, SES, and tumor stage. In addition, precise delineation of magnitude of these disparities depends on patients' age, residence, and tumor site: Racial disparities were most evident among young people from rural areas and with lip and buccal cancer, and least evident among older people from urban areas with oropharyngeal cancer. Our findings underscore the persistence of racial disparities in health care in the United States and demonstrate the urgent need to improve accessibility to high-quality health care among racial minorities, particularly in rural areas. In addition, individual and institutional interventions aimed at decreasing physician biases elicited from the patient's sociodemographic characteristics and personality are needed to guarantee a more equitable environment for healthcare services, including improving the physician's consciousness, physician training on the use and misuse of stereotypes and the incorporation of more individual patient information in their perception of the patient, and enhancing physician-patient communication.

References

1. Horner MJ, Ries LAG, Krapcho M, Neyman N, Aminou R, Howlader N et al. editors. Seer cancer statistics review, 1975–2006. Bethesda, MD: National Cancer Institute; 2009.
2. American Cancer Society. Cancer facts & figures – 2009. Atlanta, Georgia: American Cancer Society (ACS); 2009.
3. Jemal A, Murray T, Ward E, Samuels A, Tiwari RC, Ghafoor A et al. Cancer statistics, 2005. CA Cancer J Clin 2005;55:10–30.
4. Boyer-Chammard A, Taylor TH, Anton-Culver H. Survival differences in breast cancer among racial/ethnic groups: a population-based study. Cancer Detect Prev 1999;23:463–73.

5. Cooper GS, Yuan Z, Rimm AA. Racial disparity in the incidence and case-fatality of colorectal cancer: analysis of 329 united states counties. Cancer Epidemiol Biomarkers Prev 1997;6:283–5.
6. Kimmick G, Muss HB, Case LD, Stanley V. A comparison of treatment outcomes for black patients and white patients with metastatic breast cancer. The piedmont oncology association experience. Cancer 1991;67:2850–4.
7. Vernon SW, Tilley BC, Neale AV, Steinfeldt L. Ethnicity, survival, and delay in seeking treatment for symptoms of breast cancer. Cancer 1985;55:1563–71.
8. Muss HB, Hunter CP, Wesley M, Correa P, Chen VW, Greenberg RS et al. Treatment plans for black and white women with stage ii node-positive breast cancer. The national cancer institute black/white cancer survival study experience. Cancer 1992;70:2460–7.
9. Howell EA, Chen YT, Concato J. Differences in cervical cancer mortality among black and white women. Obstet Gynecol 1999;94:509–15.
10. Bach PB, Cramer LD, Warren JL, Begg CB. Racial differences in the treatment of early-stage lung cancer. N Engl J Med 1999;341:1198–205.
11. Oliver RJ, Clarkson JE, Conway DI, Glenny A, Macluskey M, Pavitt S et al. Interventions for the treatment of oral and oropharyngeal cancers: surgical treatment. Cochrane database of systematic reviews (Online) 2007;4:CD006205.
12. Glenny AM, Furness S, Worthington HV, Conway DI, Oliver R, Clarkson JE et al. Interventions for the treatment of oral cavity and oropharyngeal cancer: radiotherapy. Cochrane database of systematic reviews (Online) 2010;12:CD006387.
13. Shavers VL, Harlan LC, Winn D, Davis WW. Racial/ethnic patterns of care for cancers of the oral cavity, pharynx, larynx, sinuses, and salivary glands. Cancer Metastasis Rev 2003;22:25–38.
14. Tomar SL, Loree M, Logan H. Racial differences in oral and pharyngeal cancer treatment and survival in florida. Cancer Causes Control 2004;15:601–9.
15. Arbes SJ Jr, Olshan AF, Caplan DJ, Schoenbach VJ, Slade GD, Symons MJ. Factors contributing to the poorer survival of black americans diagnosed with oral cancer (united states). Cancer Causes Control 1999;10:513–23.
16. Broder S. Progress and challenges in the national cancer program. In: Brugge J, Curran T, Harlow E, McCormick F, editors. Origins of human cancer: a comprehensive review. Plainview, NY: Cold Spring Harbor Laboratory Press; 1991, 27–33.
17. Shavers VL, Brown ML. Racial and ethnic disparities in the receipt of cancer treatment. J Natl Cancer Inst 2002;94:334–57.
18. Ward E, Jemal A, Cokkinides V, Singh GK, Cardinez C, Ghafoor A et al. Cancer disparities by race/ethnicity and socioeconomic status. CA Cancer J Clin 2004;54:78–93.
19. Conway DI, Petticrew M, Marlborough H, Berthiller J, Hashibe M, Macpherson LM. Socioeconomic inequalities and oral cancer risk: a systematic review and meta-analysis of case–control studies. Int J Cancer 2008;122:2811–9.
20. Hankey BF, Ries LA, Edwards BK. The surveillance, epidemiology, and end results program: a national resource. Cancer Epidemiol Biomarkers Prev 1999;8:1117–21.
21. US Department of Agriculture. Economic research service. Briefing rooms: measuring rurality: rural-urban continuum codes. Available at: http://www.ers.usda.gov/Briefing/Rurality/RuralUrbCon. Accessed: May 22, 2010.
22. Bureau of the Census, US Department of Commerce. Poverty areas. Washington, DC: Bureau of the Census; 2002.
23. Krieger N, Chen JT, Waterman PD, Soobader MJ, Subramanian SV, Carson R. Geocoding and monitoring of us socioeconomic inequalities in mortality and cancer incidence: does the choice of area-based measure and geographic level matter?: the public health disparities geocoding project. Am J Epidemiol 2002;156:471–82.
24. Singh GK, Miller BA, Hankey BF, Edwards BK. Area socioeconomic variations in us cancer incidence, mortality, stage, treatment, and survival 1975–1999. Bethesda, MD: National Cancer Institute; 2003.
25. Furness S, Glenny AM, Worthington HV, Pavitt S, Oliver R, Clarkson JE et al. Interventions for the treatment of oral cavity and oropharyngeal cancer: chemotherapy. Cochrane database of systematic reviews (Online) 2010;9:CD006386.
26. Shah JP, Lydiatt W. Treatment of cancer of the head and neck. CA Cancer J Clin 1995;45:352–68.
27. Schulman KA, Berlin JA, Harless W, Kerner JF, Sistrunk S, Gersh BJ et al. The effect of race and sex on physicians' recommendations for cardiac catheterization. N Engl J Med 1999;340:618–26.
28. Ayanian JZ, Cleary PD, Weissman JS, Epstein AM. The effect of patients' preferences on racial differences in access to renal transplantation. N Engl J Med 1999;341:1661–9.
29. van Ryn M, Fu SS. Paved with good intentions: do public health and human service providers contribute to racial/ethnic disparities in health? Am J Public Health 2003;93:248–55.
30. Lalonde RN, Gardner RC. The intergroup perspective on stereotype organization and processing. Br J Soc Psychol 1989;28:289–303.
31. van Ryn M, Burke J. The effect of patient race and socio-economic status on physicians' perceptions of patients. Soc Sci Med 2000;50:813–28.
32. Slifkin RT, Goldsmith LJ, Ricketts TC. Race and place: urban-rural differences in health for racial and ethnic minorities. Chapel Hill, NC: University of North Carolina at Chapel Hill; 2000.
33. Agency for Healthcare Research and Quality. Health care disparities in rural areas: selected findings from the 2004 national healthcare disparities report. Rockville, MD: Agency for Healthcare Research and Quality; 2005.
34. Ricketts TC. Geography and health disparity. Woodrow Wilson Center Conference Proceedings. Washington, DC, 2007.
35. Oh J, Kumar J, Cruz G. Racial and ethnic disparity in oral cancer awareness and examination: 2003 new york state brfss. J Public Health Dent 2008;68: 30–8.

36. Garg PP, Diener-West M, Powe NR. Reducing racial disparities in transplant activation: whom should we target? Am J Kidney Dis 2001;37:921–31.
37. Fiscella K, Franks P, Clancy CM. Skepticism toward medical care and health care utilization. Med Care 1998;36:180–9.
38. Cooper-Patrick L, Gallo JJ, Gonzales JJ, Vu HT, Powe NR, Nelson C et al. Race, gender, and partnership in the patient-physician relationship. JAMA 1999;282:583–9.
39. Krieger N. Overcoming the absence of socioeconomic data in medical records: validation and application of a census-based methodology. Am J Public Health 1992;82:703–10.
40. Geronimus AT, Bound J. Use of census-based aggregate variables to proxy for socioeconomic group: evidence from national samples. Am J Epidemiol 1998;148:475–86.
41. Hyndman JC, Holman CD, Hockey RL, Donovan RJ, Corti B, Rivera J. Misclassification of social disadvantage based on geographical areas: comparison of postcode and collector's district analyses. Int J Epidemiol 1995;24:165–76.