Racial Disparities on the Use of Invasive and Noninvasive Staging in Patients with Non-small Cell Lung Cancer

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Introduction: Racial disparities have been reported in non-small cell lung cancer (NSCLC) staging and therapeutic outcomes. We investigated whether such disparities exist in the era of modern noninvasive staging modalities, including positron emission tomography scan use.

Methods: NSCLC patients from the California Cancer Registry diagnosed between January 1, 1994, and December 31, 2004, were included. The likelihood of obtaining invasive (thoracoscopy, bronchoscopy, and mediastinoscopy) and noninvasive staging procedures (computed tomography, magnetic resonance imaging, and positron emission tomography scans), along with surgical resection, were analyzed using logistic regression adjusted for known confounders.

Results: Of 13,762 NSCLC patients, 12,395 with adequate staging information were included. 10,217 patients (82%) were classified as white, 2178 patients (18%) were non-white, and 738 were black patients (6%). No association was seen between race and the use of either noninvasive (odds ratio [OR] = 1.02; $p = 0.76$) or invasive staging procedures (OR = 0.96; $p = 0.44$). However, compared with white patients, black patients had a lower likelihood of undergoing surgery, regardless of noninvasive (OR = 0.6; $p < 0.001$) or invasive staging use (OR = 0.63; $p = 0.02$). There was no survival difference for those who underwent surgery between white and non-white patients, regardless of noninvasive (hazard ratio = 0.95; $p = 0.45$) or invasive staging (hazard ratio = 1.03; $p = 0.79$).

Conclusions: In contrast to prior published work, we found no difference in rates of both invasive and noninvasive staging between white and non-white patients. However, non-white patients—particularly blacks—were less likely to receive surgery. The reason for the apparent difference in surgical rates could not be explained by the variables we evaluated. Thus, other factors such as personal preference or access to care require further investigation.

Key Words: NSCLC, Lung cancer, Race, Disparities, Staging.

(*J Thorac Oncol.* 2010;5: 1772–1778)

Lung cancer is considered a public health hazard and has been the leading cause of cancer-related death in the United States for decades. Non-small cell lung cancer (NSCLC) is the most common subtype, accounting for approximately 85% of all cases. Published reports investigating racial differences in cancer epidemiology have revealed that black patients have a higher mortality rate compared with whites in several malignancies, including lung, breast, colon, and prostate cancers.[1–3]

Several factors potentially contribute to the racial disparities related to lung cancer diagnosis and management. Difficulties with access to care can result in black patients presenting at a more advanced stage compared with non-black patients.[4,5] Other factors include quality of care after diagnosis,[6] noncancer-related comorbid conditions,[7] and socioeconomic factors,[8] which may influence treatment decisions.

There is controversy whether race independently affects patient outcomes. Previous studies have suggested an association between race and the likelihood of undergoing surgery for resectable NSCLC.[9–11] In 1998, Greenwald et al.[11] published analysis of the National Cancer Institute's Surveillance, Epidemiology, and End Results (SEER) database from three regions (Detroit, San Francisco, and Seattle) that reported whites being 20% more likely to undergo surgery than blacks and 31% more likely to survive 5 years. Bach et al.[9] subsequently presented further analysis of the SEER database and reported that after accounting for con-

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Disclosure: The authors declare no conflicts of interest.

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Author Contributions: Drs. Suga, Gandara, and Lara had full access to all of the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis. Study concept and design: Suga and Lara. Acquisition of data: Nguyen and Brown. Analysis and interpretation of data: Nguyen, Brown, Mohammed, Suga, and Lara. Drafting of the manuscript: Suga, Nguyen, Mohammed, and Lara. Critical revision of the manuscript for important intellectual content: Nguyen, Brown, Gandara, Calhoun, Yoneda, and Lara. Statistical analysis: Nguyen and Mohammed. Obtained funding: Lara. Administrative, technical, and material support: Brown, Nguyen, and Lara. Study supervision: Gandara and Lara.

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ISSN: 1556-0864/10/0511-1772

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founding factors including coexisting illness, socioeconomic status (SES), insurance, and availability of care, blacks were 12.7% less likely than whites to undergo surgical resection. Five-year survival rate was also lower for blacks (26 versus 34%; $p < 0.001$).

Proper staging is crucial for patients who are diagnosed with lung cancer to deliver an accurate prognosis and determine further treatment recommendations. Lathan et al. examined the SEER database to determine whether race impacted invasive staging including mediastinoscopy, bronchoscopy, and thoracoscopy. These investigators reported that black patients were less likely to undergo invasive staging and, even once properly staged, were still less likely to undergo surgery.[12]

It is currently unknown whether there are any racial disparities in obtaining noninvasive tests for staging. In particular, the use of positron emission tomography (PET) scan has increased significantly in the last several years. Previous work from our group showed an increased use of PET scan from 6.5% in 1994–1998 to 20.1% in 1999–2004, which was associated with fewer patients with stage III disease but more patients with stage IV disease during those two periods.[13] It is unclear whether this increase is seen in all patients regardless of race and whether the additional staging information provided by PET scans influence the decision of whether surgery is performed.

Therefore, we sought to define the frequency of obtaining both invasive and noninvasive staging stratified by race and determine whether race is an independent predictor for undergoing surgical resection for newly diagnosed NSCLC.

PATIENTS AND METHODS

Data were obtained from the California Cancer Registry (CCR), a state-wide population-based cancer surveillance system composed of eight regional registries collecting cancer incidence and mortality information since 1988. Cases are reported to the Cancer Surveillance Section of the California Department of Public Health from hospitals and any other facilities providing care or therapy to cancer patients residing in California.[14] Cases included in these analyses were invasive NSCLC diagnosed between January 1, 1994, and December 31, 2004, and reported to the Cancer Surveillance Program, the Sacramento Region or Region 3 of the CCR as of October 2006. NSCLC was defined using International Classification of Diseases for Oncology second and third edition site codes C34.0–C34.9 and histology codes, 8004, 8010, 8012, 8013, 8020–8022, 8031–8033, 8046, 8070–8076, 8082–8084, 8123, 8140, 8145, 8230, 8249–8253, 8255, 8260, 8310, 8430, 8550, 8560, 8574, and 8720.[15,16]

Race/ethnicity was based on information obtained from the medical record, which can be derived from patient self-identification; assumptions based on personal appearance; or inferences based on the race/ethnicity of the parents, birthplace, surname, or maiden name. Hispanic ethnicity was based on information from the medical record and computerized comparisons with the 1980 U.S. census list of Hispanic surnames. Patients identified as Hispanic on the medical record or patients identified as white, black, or of unknown race with a Hispanic surname were classified as Hispanic.

SES and rural/urban designation were assigned at the Census block group level (2000 U.S. Census) and based on the address at the time of initial diagnosis as reported in the medical record. This SES variable is an index that uses education, employment characteristics, median household income, proportion of the population living 200% below the federal poverty level, median rent, and median housing value of census tract of residence for case and denominator population. A principal components analysis was used to identify quintiles of SES ranging from 1 (lowest) to 5 (highest).[17] Rural/urban designation was defined by Rural Urban Commuting Area codes developed and categorized by the University of Washington's Rural Health Research Center.[18]

Stage at diagnosis was collected from the patient's medical record and coded according to the American Joint Commission on Cancer Staging Manual, Sixth Edition.[19] Stage determination was based on information after all staging procedures were completed. Text fields pertaining to x-rays, scoping procedures, and any additional remarks were extracted from the CCR's data management system. A computer program was developed specifically to search, identify, and code all keywords and synonyms implicit of an imaging procedure.[20] Chest x-ray, CT scan, magnetic resonance imaging (MRI), PET scan, mediastinoscopy, bronchoscopy, thoracoscopy, and radiofrequency ablation were coded as "done" or "not done" based on the presence or lack of keywords or phrases within the extracted text fields. Cases that could not be assigned values based on keyword coding were manually reviewed.

This study was reviewed and approved by the appropriate Institutional Review Boards at UC Davis and the CCR.

Statistical Analysis

Differences in the distribution of noninvasive (PET, MRI, and CT scan) and invasive (mediastinoscopy, bronchoscopy, and thoracoscopy) staging procedure use, age at diagnosis, sex, residence type (urban or rural), disease stage, surgery type, radiation, and chemotherapy between white and non-white patients were evaluated using the *t* test for continuous variables and χ^2 testing for proportions. Logistic regression models were used to evaluate the likelihood (odds) of noninvasive (and similarly for invasive) staging procedure adjusted for known confounders. Similarly, logistic regression was used to evaluate the odds of receiving surgery among staged patients. The "any invasive" group include patients who also could have received noninvasive procedures, just as the "any noninvasive" group include patients who have received invasive procedures. SES score represented quintiles (1 = low to 5 = high) and was modeled as a continuous variable; therefore, the odds ratio (OR) reported corresponds to a quintile change. Comparison of survival between white and non-white patients was based on the Kaplan-Meier method,[21] and log-rank statistic was used for the comparison of overall survival distributions.[22] Cox regression analysis[23] was used to obtain adjusted hazard ratios for death for non-white and white groups. In our secondary analyses, we repeated the above described analyses to eval-

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uate the likelihood of staging type, surgery, and survival with race categorized as white, black, and other. All analyses were performed using SAS 9.2 (SAS Institute Inc., Cary, NC). All p values reported are for two-sided tests.

RESULTS

Patient Characteristics

There were 13,762 patients with NSCLC identified from the CCR. The study cohort includes a total of 12,395 patients who had adequate staging information (stage I–IV). The cohort consisted of 10,217 (83%) white and 2178 (17%) non-white patients. The non-white group comprised 738 patients classified as non-Hispanic black (6%), 736 (5.9%) Hispanic patients, 667 (5.4%) Asian/Pacific Islander patients, and the 37 (0.3%) remaining were classified as non-Hispanic American Indian or other/unknown patients.

Table 1 summarizes characteristics for all patients by race. White patients had an older mean age compared with non-whites as well as had higher SES levels. More non-white patients resided in urban areas compared with white patients. More white patients had stages I and II disease, whereas more non-white patients had stages III and IV disease. More white patients underwent surgery, whereas more non-white patients received chemotherapy.

Table 1 also summarizes the use of noninvasive and invasive staging procedures stratified by race. There was no difference between the two groups with respect to noninvasive or invasive staging. Eight patients with missing residence type data were excluded from subsequent analyses.

Likelihood of Noninvasive and Invasive Staging Procedures

The likelihood (odds) of patients obtaining any noninvasive staging procedures (PET, CT, or MRI use) or invasive staging procedures (bronchoscopy, thoracoscopy, or mediastinoscopy) was determined using logistic regression controlling for confounders. There was no difference in the odds of obtaining noninvasive staging procedure between non-white and white patients: OR was 1.02 (95% CI: 0.89–1.2; $p = 0.76$). Similarly, race did not affect the likelihood of obtaining invasive staging procedures: OR was 0.96 (95% CI: 0.87–1.06; $p = 0.44$). Table 2 summarizes the results of obtaining any noninvasive and invasive staging procedure.

Table 3 focuses on the odds of obtaining specific staging procedures. Table 3 summarizes the odds of obtaining a PET, MRI, or CT scan. PET use OR (non-white to white) was 0.98 (95% CI: 0.85–1.12; $p = 0.72$); MRI use OR was 0.80 (95% CI: 0.63–1.01; $p = 0.06$); and CT use OR was 1.05 (95% CI: 0.91–1.21; $p = 0.50$). Male patients were associated with lower chance of using PET scan ($p = 0.01$), and a higher SES was significantly associated with increased likelihood of obtaining a PET scan ($p < 0.0001$). Residence type (rural/urban area) did not affect the likelihood of having a noninvasive staging procedure. Stage II patients were more likely

TABLE 1. Patient Characteristics by Race

Characteristics	Nonwhite Patients ($n = 2178$)	White Patients ($n = 10,217$)	p
Age, mean (range)	65.7 (22–95)	68.3 (21–100)	<0.001
Sex (%)			
Male	1252 (58)	5548 (54)	0.007
SES (%)			
Lowest quartile	577 (27)	1228 (12)	<0.001
Highest quartile	120 (6)	764 (8)	
Disease stage (%)			
Stage I	382 (18)	2219 (22)	<0.001
Stage II	66 (3)	452 (4)	
Stage III	715 (33)	3130 (31)	
Stage IV	1015 (47)	4416 (43)	
Residence (%)			
Urban	2060[a] (95)	8679[a] (85)	<0.001
Staging procedure[b] (%)			
CT scan	1900 (87)	8866 (87)	0.57
MRI	92 (4)	475 (5)	0.39
PET scan	291 (13)	1517 (15)	0.07
Bronchoscopy	879 (40)	4005 (39)	0.32
Mediastinoscopy	63 (3)	337 (3)	0.33
Thoracoscopy	11 (0.5)	57 (0.6)	0.76
Type of treatment[b] (%)			
Lobectomy/partial pneumonectomy	442 (20)	2542 (25)	<0.001
Pneumonectomy	41 (2)	280 (3)	
Lung surgery, NOS	5 (0.2)	52 (0.5)	
None or unknown	1690 (78)	7343 (72)	
Radiation	933 (43)	4312 (42)	0.59
Chemotherapy	795 (37)	3374 (33)	0.002

[a] Denominator is reduced by 2 and 8 for non-white and white patients, respectively.
[b] Total greater than column denominator because a patient can have multiple staging procedure/treatment.
SES, socioeconomic status; CT scan, computed tomography scan; MRI, magnetic resonance imaging; PET scan, positron emission tomography scan; NOS, not otherwise specified.

TABLE 2. Predictors of Undergoing Noninvasive and Invasive Staging Procedures

	Any Noninvasive[a]		Any Invasive[b]	
	OR	p	OR	p
Race	1.02	0.76	0.96	0.44
Nonwhite (reference = white)				
Age	1	0.23	0.99	<0.0001
Sex				
Male (reference = female)	1.02	0.8	1.22	<0.0001
Residence				
Rural (reference = urban)	0.94	0.49	0.79	<0.0001
SES	1.06	0.02	0.93	<0.0001
Stage II	1.07	0.67	1.48	<0.0001
Stage III	0.95	0.55	1.73	<0.0001
Stage IV (reference = stage I)	1.03	0.72	0.88	0.01

[a] CT scan use, MRI use, and/or PET scan use.
[b] Bronchoscopy, mediastinoscopy, and/or thoracoscopy.
SES, socioeconomic status; CT scan, computed tomography scan; MRI, magnetic resonance imaging; PET scan, positron emission tomography scan; OR, odds ratio.

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TABLE 3. Predictors of Undergoing Specific Noninvasive Staging Procedures

	PET Scan		MRI		CT Scan	
	OR	*p*	OR	*p*	OR	*p*
Race						
Nonwhite (reference = white)	0.98	0.72	0.8	0.06	1.05	0.5
Age	1	0.89	0.98	<0.0001	1	0.47
Sex						
Male (reference = female)	0.87	0.01	1.02	0.79	1.04	0.47
Residence						
Rural (reference = urban)	0.87	0.08	0.87	0.29	1	0.99
SES	1.15	<0.0001	1.02	0.6	1.04	0.08
Stage II	1.27	0.03	2.55	0.01	1.08	0.58
Stage III	0.55	<0.0001	2.05	0.01	1.1	0.2
Stage IV (reference = stage I)	0.42	<0.0001	9.96	<0.0001	1.03	0.64

SES, socioeconomic status; CT scan, computed tomography scan; MRI, magnetic resonance imaging; PET scan, positron emission tomography scan; OR, odds ratio.

TABLE 4. Predictors of Undergoing Invasive Staging Procedures

	Bronchoscopy		Mediastinoscopy		Thoracoscopy	
	OR	*p*	OR	*p*	OR	*p*
Race						
Nonwhite (reference = white)	0.96	0.41	0.85	0.24	0.95	0.87
Age	0.99	<0.0001	0.98	<0.0001	0.98	0.06
Sex						
Male (reference = female)	1.21	<0.0001	1.22	0.06	1.16	0.55
Residence						
Rural (reference = urban)	0.8	<0.0001	0.7	0.03	1.88	0.03
SES	0.93	<0.0001	1.09	0.05	1.01	0.95
Stage II	1.47	<0.0001	1.72	0.01	0.44	0.27
Stage III	1.71	<0.0001	1.34	0.03	0.82	0.51
Stage IV (reference = stage I)	0.92	0.09	0.44	<0.0001	0.4	0.01

OR, odds ratio.

to obtain a PET scan (OR = 1.27, 95% CI: 1.02–1.58; $p = 0.03$), and stage IV had the highest odds of obtaining MRI scan (OR = 9.96, 95% CI: 6.53–15.2; $p = 0.0001$), whereas CT scan use was not significantly different based on stage.

Similarly, the odds of patients obtaining different invasive staging procedures were evaluated and summarized in Table 4. Similar to the results above for the use of noninvasive staging procedures by white and non-white patients, race did not affect the likelihood of obtaining any individual invasive staging procedure. Males were more likely to undergo bronchoscopy (OR = 1.21, 95% CI: 1.13–1.31; $p < 0.001$). Rural patients were less likely to obtain bronchoscopy (OR = 0.8, 95% CI: 0.72–0.89; $p < 0.001$) or mediastinoscopy (OR = 0.7, 95% CI: 0.49–0.97; $p = 0.03$) but more likely to obtain thoracoscopy (OR = 1.88, 95% CI: 1.05–3.36; $p = 0.03$). Higher SES was associated with the increased likelihood of obtaining a mediastinoscopy, and conversely, bronchoscopy was more likely to be obtained in the lower SES group. Stage III patients were more likely to obtain a bronchoscopy (OR = 1.71, 95% CI: 1.54–1.89; $p < 0.0001$), whereas stage II patients had the highest odds of obtaining a mediastinoscopy (OR = 1.72, 95% CI: 1.13–2.6; $p = 0.01$). Stage IV patients were the least likely to obtain invasive staging, both individual and overall.

We note that the no association between race and the likelihood of obtaining noninvasive (and similarly for invasive) staging procedures remains unchanged when we analyzed the data with race categorized as white, black, and other. That is, the odds of obtaining noninvasive (or invasive) staging were not different between black and white patients and between other and white patients (results not shown). In addition, we performed a sensitivity analysis that included the entire cohort of 13,762 patients, and the results remained unchanged compared with the 12,395-patient study cohort (results not shown).

Likelihood of Surgery and Survival of Staged Patients

We examined the likelihood (odds) of receiving surgery among staged patients stratified by noninvasive (N = 11,044) or invasive (N = 5070) staging procedure use adjusted for known confounders (Table 5). Analysis of the effect of race categorized as white or non-white patients (Table 5) suggests that non-white patients who underwent noninvasive staging were less likely to undergo surgery compared with whites (OR = 0.78; 95% CI: 0.67–0.92; $p = 0.003$). For non-white patients who underwent invasive staging, the estimated odds of surgery is also lower compared with whites, although the results were not statistically significant (OR = 0.88; $p = 0.26$). We further examined the relationship between race, adjusted for known confounders, but with race further categorized as white, black, and other (Table 5). Black patients who underwent noninvasive staging were substantially less likely than white patients to undergo surgery (OR = 0.60; 95% CI: 0.46–0.78; $p = <0.001$), and this was similar for black patients who underwent invasive staging (OR = 0.63; 95% CI: 0.43–0.93; $p = <0.001$). The "race other" group was not different from the white race group.

We further examined the survival characteristics among patients who underwent surgery. Based on univariate and multivariate analysis, using Kaplan-Meier and Cox regression analysis, respectively, we found no difference in survival between white and non-white patients. Specifically, among noninvasively staged patients who underwent surgery, the median survival was 3.7 and 3.8 years for white and non-

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TABLE 5. Likelihood of Surgery Among Staged Patients

	Noninvasive Staging		Invasive Staging	
	OR	***p***	**OR**	***p***
Race: white/nonwhite				
Race				
Black	0.6	<0.001	0.63	0.02
Other	0.89	0.2	1.02	0.89
(reference = white)				
Age	0.95	<0.001	0.96	<0.001
Sex				
Male (reference = female)	0.96	0.5	1.06	0.52
Residence				
Rural (reference = urban)	1.05	0.57	0.96	0.78
SES	1.19	<0.001	1.17	<0.001
Stage II	0.96	0.73	0.86	0.39
Stage III	0.06	<0.001	0.05	<0.001
Stage IV (reference = stage I)	0.01	<0.001	0.01	<0.001
Race: white/black				
Race				
Black (reference = white)	0.60	<0.001	0.63	0.02
Age	0.89	0.2	1.02	0.89
Sex				
Male (reference = female)	0.95	0.52	1.06	0.54
Residence				
Rural (reference = urban)	1.04	0.63	0.96	0.74
SES	1.18	<0.001	1.17	<0.001
Stage II	0.96	0.77	0.87	0.43
Stage III	0.06	<0.001	0.05	<0.001
Stage IV (reference = stage I)	0.01	<0.001	0.01	<0.001

SES, socioeconomic status; OR, odds ratio.

white groups, respectively ($p = 0.98$). Similarly, for invasively staged patients, the median survival was 3.4 and 3 years ($p = 0.3$) for white and non-white groups, respectively. These results remain unchanged after adjusting for confounding covariates using Cox regression analysis: the adjusted hazard ratio for non-white patients was 0.95 (95% CI: 0.83–1.09; $p = 0.45$) for patients undergoing noninvasive staging. The result was similar for patients undergoing invasive staging procedure: the adjusted hazard ratio for non-white was 1.03 (95% CI: 0.86–1.23; $p = 0.79$).

DISCUSSION

In this analysis of patients reported to the CCR from the Sacramento region in Northern California, we found no detectable differences in staging procedures between white and non-white NSCLC patients. Noninvasive staging procedure use was similar and not influenced by race, age, sex, residence, or stage on initial presentation. There was a small but real difference seen in PET scan use based on SES, where the higher SES group had an increased likelihood of obtaining a PET scan. Obtaining invasive staging procedures such as bronchoscopy, mediastinoscopy, or thoracoscopy was not influenced by race; however, all other variables evaluated, including age, sex, residence, SES, and stage on presentation, seemed to be independent predictors for the use of invasive staging. Although staging seemed to be similar between the two groups, there was a nonsignificant difference between white and non-white patients and the likelihood of obtaining operative therapy. This difference became more apparent and statistically significant when black patients were compared with white patients, and the difference was not seen between white and other non-white patients. The most powerful negative predictors of surgery was stage III and IV disease and race, while SES and age were also found to be significant independent factors. Survival was similar for those who underwent surgery. Our data suggest that staging procedure usage does not seem to be contributing to the striking differences in operative rates between the two groups.

To our knowledge, this is the first study that looked at both invasive and noninvasive staging patterns for NSCLC, including PET scan use, stratified by race. Our findings are in contrast to prior work by Lathan et al., which reported a difference in invasive staging use between black and white patients. There are many possible explanations for why our results differed from the study by Lathan et al. First, there may be some regional differences for staging of NSCLC. Our analysis focused on one region of California, which may differ from national patterns for lung cancer staging. In addition, Lathan et al. looked at Medicare-eligible patients only, whereas the CCR looked at all NSCLC diagnosed during the 10-year period evaluated. However, our data are consistent with Lathan et al. and several other studies that uniformly show lower surgical rates for black patients.[9–12,24,25]

Many have speculated different reasons for this racial disparity. One proposed explanation is that black patients may not have access to quality subspecialty care necessary for optimal care. There is some evidence that physicians who treat black patients are more likely to report that they have difficulties getting access to high-quality subspecialists, diagnostic imaging, and nonemergency admissions to the hospital.[26] Cykert et al.[27] identified that lack of regular source of care along with more comorbid illnesses was found to be a significant factor in explaining the lower surgery rates in black patients. Other studies have suggested that physician–patient interactions may be important. A study of SEER Medicare database showed that despite a recommendation for surgery, there was a lower resection rate in black patients compared with whites.[24] Cykert et al.[27] also found that for all patients, negative perceptions of patient–physician communication along with negative perceptions of 1-year prognosis postsurgery were strongly associated with decisions to forgo surgery. Mistrust in physicians may be another reason for the lower rates of surgery in blacks. A study conducted at a Southern Veterans Affairs center suggested that black patients reported lower postvisit trust in physicians compared

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with white patients and that black patients judged physician communications to be less supportive, less partnering, and less informative.[28] Different belief systems based on race have also been reported. A study by Margolis et al.[29] found 38% of patients, of whom 61% were black patients, stated that they believed air exposure at time of surgery caused tumor spread. In addition, 19% of black patients cited that this belief was the reason for refusing surgery.

There are some limitations to our study. The CCR did not collect information about comorbidities or performance status at time of presentation, which influences the recommendation for surgery. It is certainly possible that black patients had more comorbidities or a lower performance status at the time of presentation compared with white patients, which could partly explain the lower rates of surgery. Blackstock et al.[30] reported an analysis of Cancer and Leukemia Group B clinical trials data, which suggested that the survival rates of black patients were inferior compared with non-black patients; however, the effect of race disappeared after adjustment for performance status and weight loss. SES was based on the address of the patient at time of diagnosis and census data. It is unclear whether community-based SES determination is comparable with individual-based SES. Insurance status was not included in our model. Instead, we used SES as an indirect surrogate for this variable. Mulligan et al.[4] examined patients from the VA system and found that the racial disparities disappeared when access to care was universal for the entire group, which suggests that insurance status may have a big impact on outcome. SES and insurance status captures similar information but are likely not interchangeable. We also did not examine smoking status in our analysis. There have been conflicting reports whether smoking affects treatment outcome. Although some reports have found a relationship between smoking status and outcomes,[31–33] others have not.[34] Another potential limitation of the reported results is the effect of misclassification of race. This misclassification may lead to attenuation of effect estimates, leading to null results. Finally, our study looked at the CCR data reported by the Sacramento region and therefore may not be fully generalizable to other regions in the country.

In conclusion, we were able to show that unlike prior reports, race was not a significant predictor in obtaining noninvasive or invasive staging procedures for lung cancer, and other factors such as SES may be more relevant. Even though the staging work-up for NSCLC seemed to be similar based on race, there was a significant difference in surgical rates between white and black patients, confirming other previously published studies. More research on health care factors and physician–patient interactions, which may influence the disparities seen in surgical rates, is warranted.

ACKNOWLEDGMENTS

Supported by the National Center for Research for Medical Research (Grant no. UL1 RR024146).

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