Influence of Comorbidity on Racial Differences in Receipt of Surgery Among US Veterans With Early-Stage Non–Small-Cell Lung Cancer

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ABSTRACT

Purpose

It is unclear why racial differences exist in the frequency of surgery for lung cancer treatment. Comorbidity is an important consideration in selection of patients for lung cancer treatment, including surgery. To assess whether comorbidity contributes to the observed racial differences, we evaluated racial differences in the prevalence of comorbidity and their impact on receipt of surgery.

Patients and Methods

A total of 1,314 patients (1,135 white, 179 black) in the Veterans Health Administration diagnosed with early-stage non–small-cell lung cancer in 2007 were included. The effect of comorbidity on surgery was determined by using generalized linear models with a logit link accounting for patient clustering within Veterans Administration Medical Centers.

Results

Compared with whites, blacks had greater prevalence of hypertension, liver disease, renal disease, illicit drug abuse, and poor performance status, but lower prevalence of respiratory disease. The impact of most individual comorbidities on receipt of surgery was similar between blacks and whites, and comorbidity did not influence the race-surgery association in a multivariable analysis. The proportion of blacks not receiving surgery as well as refusing surgery was greater than that among whites.

Conclusion

Blacks had a greater prevalence of several comorbid conditions and poor performance status; however, the overall comorbidity score did not differ by race. In general, the effect of comorbidity on receipt of surgery was similar in blacks and whites. Racial differences in comorbidity do not fully explain why blacks undergo lung cancer surgery less often than whites.

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INTRODUCTION

Surgical resection is the recommended therapy for early-stage (stage I or II) non–small-cell lung cancer (NSCLC).¹ Comorbidity is of great concern for clinical management of lung cancer, because the type, number, and severity of comorbid conditions can preclude delivery of optimal treatment, particularly surgery as a result of potential adverse effects and complications during or after surgery.² The effect of comorbidities on treatment decisions may mediate associations between pre-existing conditions and survival. Studies of comorbid diseases in patients with lung cancer have examined their impact on treatment³⁻⁶ and survival.⁷⁻⁹ A recent report among elderly veterans noted that approximately half of patients with comorbidities and 40% of patients with no comorbidities did not have guideline-

recommended surgery for early-stage NSCLC.¹⁰ The role of comorbidities in patients with cancer is complex, partially because effects can vary by many patient characteristics, including race/ethnicity. Studies have consistently demonstrated that blacks are less likely than whites to receive surgery for early-stage NSCLC.¹¹⁻¹⁴ Another study in veterans with early-stage NSCLC found that blacks were less likely to be evaluated by a surgeon, to have surgery recommended, and to undergo surgical resection compared with whites.¹⁵ In an equal access health care system such as the Veterans Health Administration (VHA), we would expect minimal, if any, racial differences in lung cancer treatment and outcomes, but there is evidence of excess morbidity among blacks compared with whites.¹⁶ It is thus plausible that racial differences in comorbid conditions contribute to racial disparities observed in surgical resection.

Little attention, however, has been given to potential racial differences in the prevalence of comorbidities in patients with lung cancer and the effect of comorbidities on receipt of surgery. This study investigated the prevalence of comorbidities among blacks and whites in the VHA diagnosed with early-stage NSCLC and examined their effect on racial differences in receipt of surgery.

PATIENTS AND METHODS

Data Source

The External Peer Review Program (EPRP) Lung Cancer Special Study was conducted by the VHA Office of Analytics and Business Intelligence (formerly the Office of Quality and Performance) to assess quality of lung cancer care in the Veterans Administration (VA). Patients were identified by the VA Central Cancer Registry¹⁷ as being diagnosed with lung cancer between October 1, 2006, and December 31, 2007. Patients in the registry cohort were excluded from the EPRP Lung Cancer Special Study on the basis of the following criteria: no pathologic confirmation of lung cancer in the medical record, diagnosed at autopsy, death less than 31 days postdiagnosis, hospice enrollment less than 31 days postdiagnosis, enrollment onto a cancer clinical trial, pre-existing or concurrent diagnosis of metastatic cancer (other than lung cancer), documentation of comfort measures only, or life expectancy ≤ 6 months.

Data Collection

Chart abstraction was performed to collect patient data for the following categories: organizational identifiers, patient identifiers, validation of lung cancer diagnosis, vital status, hospice/palliative care, clinical trial enrollment, prediagnostic procedures, clinical and pathologic staging, consultations, initial treatment, symptom management, end-of-life care, and comorbidities.

Analytic Data Set

The analytic data set consisted of patients with pathologically confirmed stage I or II NSCLC. The outcome was receipt of surgery, defined as lung resection surgery performed within 6 months of diagnosis at a VA or non-VA facility. Patient characteristics were the exposures of interest and included comorbidities, performance status, and demographics. Comorbidity was defined as pre-existing medical conditions documented in the patients' records during the 2 months before or 1 month after the pathologic confirmation of lung cancer diagnosis. Comorbidities were assessed by using the Adult Comorbidity Evaluation-27 (ACE-27),¹⁸ which was developed for and validated in patients with cancer. Each comorbid condition has three grades: 1, mild; 2, moderate; 3, severe.¹⁹ The ACE-27 comorbidity score, used to assess overall comorbidity, consisted of four levels (0, none; 1, mild; 2, moderate; 3, severe) and was defined by the highest ranked single condition. If two or more conditions in different organ systems were classified as grade 2, then the overall comorbidity score was grade 3. Scales used to describe performance status include the Karnofsky score of 0 (dead) to 100 (normally active) and the Eastern Cooperative Oncology Group (ECOG) score of 1 (fully active, no restriction) to 5 (dead). In the EPRP Lung Cancer Special Study, poor performance status was defined as Karnofsky score less than 60, ECOG score more than 2, or other documentation of poor performance status by the clinician. Patients with unknown surgery status ($n = 2$) and those missing all comorbidity data ($n = 110$) were excluded from the analyses. The final analytic data set consisted of 1,314 patients (1,135 white; 179 black). A total of 109 facilities were represented, with an average of 12 patients per facility (range, 1 to 41 patients). The Durham VA Medical Center institutional review board approved this study.

Statistical Analysis

The prevalence of comorbid conditions was calculated overall and by race. Racial differences in demographic and clinical characteristics were tested by using Pearson χ^2 statistics and t tests, depending on the data distribution. Separate models tested whether an association between receipt of surgery and clinical characteristics differed by race. Receipt of surgery was the outcome in all models. Predictors included race, the clinical characteristic of interest, and the interaction term between race and the clinical characteristic of interest. Statistically significant interaction terms would indicate that there is a racial

difference in the association between the clinical characteristic and receipt of surgery. The overall relationships between receipt of surgery and demographic and clinical characteristics were similarly examined by using separate models. A multivariable model examined the association between receipt of surgery and race controlling for comorbidity score, age, marital status, and performance status. All odds ratios (ORs) and CIs in these analyses were derived from generalized linear models with a logit link accounting for patient clustering within VA Medical Centers by using the generalized estimating equations method. The proportion of blacks and whites not receiving surgery and the proportion of patients refusing surgery were evaluated according to differing levels of comorbidity severity. Analyses were conducted by using SAS 9.2. (SAS Institute, Cary, NC). A P value less than .05 was considered statistically significant.

RESULTS

The mean age of the total sample was 68 years, and approximately half the patients were married (Table 1). Blacks were slightly younger than whites, with mean ages of 67 and 69, respectively ($P = .041$), and were less likely to be married ($P = .013$).

The most prevalent individual comorbidities among both blacks and whites were hypertension, respiratory disease, diabetes mellitus, angina/coronary artery disease, and psychiatric disorder (Table 1). Although the prevalence of most conditions was comparable among both races, the burden of several comorbidities was significantly different between blacks and whites. The most profound difference in prevalence was noted for respiratory disease, which was present in 28.5% of blacks and 48.4% of whites. Conversely, comorbidities more prevalent in blacks included hypertension, liver disease, renal disease, and illicit drug abuse. Nine percent of patients had no comorbidities. There was no racial difference in overall comorbidity ($P = .747$), but a higher proportion of blacks had poor performance status (13.4% v 7.6%; $P = .010$).

In this sample, there were two comorbidities with a statistically significant interaction with race on receipt of surgery: venous disease ($P = .045$) and stomach/intestinal disease ($P = .025$; data not shown). For whites, a rate similar to that of patients who had venous disease was noted between those who had surgery and those who did not (20 of 802 v eight of 333; OR, 1.02; 95% CI, 0.47 to 2.20). For blacks, only one of 107 who had surgery also had venous disease compared with seven of 72 who did not have surgery (OR, 0.08; 95% CI, 0.01 to 0.87). For whites, 35 of 802 who had surgery had stomach/intestinal disease compared with 12 of 333 who did not have surgery (OR, 1.25; 95% CI, 0.67 to 2.32). For blacks, only two of 107 who had surgery had stomach/intestinal disease compared with six of 72 who did not have surgery (OR, 0.18; 95% CI, 0.04 to 0.89).

Table 2 demonstrates the association between demographic and clinical characteristics with receipt of surgery. Because of few statistically significant interactions between comorbidity and race, ORs for the overall sample are presented rather than race-specific estimates. Increasing age correlated with lower odds of having surgery, and blacks were less likely than whites to have surgery (OR, 0.63; 95% CI, 0.48 to 0.83). For individual comorbidities, Table 2 shows the odds of having surgery among those with a specific comorbidity compared with those who did not have that specific comorbidity. The comorbidities with statistically significant associations with surgery were congestive heart failure, arrhythmias, peripheral artery disease, respiratory disease, renal disease, and stroke. The presence of these conditions indicated lower odds of receiving surgery, although most of them

Table 1. Demographic and Clinical Characteristics of the Sample

Characteristic	Total (N = 1,314)		Mean ± SD	Blacks (n = 179)		Mean ± SD	Whites (n = 1,135)		Mean ± SD	P
	No.	%		No.	%		No.	%		
Demographic characteristics										
Age, years			68.4 ± 9.5			67.0 ± 9.6			68.6 ± 9.5	.041
Male sex	1,279	97.3		174	97.2		1,105	97.4		1.000
Marital status*										.013
Not married	692	52.7		110	61.5		582	51.4		
Married	620	47.3		69	38.5		551	48.6		
Clinical characteristics†										
Cardiovascular system										
Myocardial infarction	123	9.4		11	6.1		112	9.9		.129
Angina/coronary artery disease	282	21.5		32	17.9		250	22.0		.240
Congestive heart failure	102	7.8		16	8.9		86	7.6		.547
Arrhythmia	89	6.8		6	3.4		83	7.3		.054
Hypertension	819	62.3		131	73.2		688	60.6		.002
Venous disease	36	2.7		8	4.5		28	2.5		.137
Peripheral artery disease	92	7.0		16	8.9		76	6.7		.344
Respiratory system										
Respiratory disease	600	45.7		51	28.5		549	48.4		< .001
GI system										
Hepatic (liver) disease	65	4.9		20	11.2		45	4.0		< .001
Stomach/intestinal (GI) disease	55	4.2		8	4.5		47	4.1		.841
Pancreatic disease	13	1.0								
Renal system										
End-stage renal disease	78	5.9		22	12.3		56	4.9		< .001
Endocrine system										
Diabetes mellitus	304	23.1		45	25.1		259	22.8		.505
Neurologic system										
Stroke	96	7.3		12	6.7		84	7.4		.763
Dementia	39	3.0		5	2.8		34	3.0		1.000
Paralysis	12	0.9								
Neuromuscular disorder	5	0.4								
Psychiatric disorder	210	16.0		33	18.4		177	15.6		.380
Rheumatologic disorder	35	2.7		5	2.8		30	2.6		1.000
Immunologic system										
HIV/AIDs	10	0.8								
Malignancy										
Second solid tumor (including melanoma)	179	13.6		21	11.7		158	13.9		.483
Leukemia and myeloma	6	0.5								
Lymphoma	11	0.8								
Substance abuse										
Alcohol	170	12.9		28	15.6		142	12.5		.280
Illicit drugs	46	3.5		18	10.1		28	2.5		< .001
Body weight										
Morbid obesity‡	42	3.3		3	1.7		39	3.6		.259
At least one hospitalization in past year	380	28.9		48	26.8		332	29.3		.536
ACE-27 comorbidity score										.747
0 (none)	113	8.6		16	8.9		97	8.5		
1 (mild)	470	35.8		61	34.1		409	36.0		
2 (moderate)	355	27.0		45	25.1		310	27.3		
3 (severe)	376	28.6		57	31.8		319	28.1		
Poor performance status	110	8.4		24	13.4		86	7.6		.010

Abbreviations: ACE-27, Adult Comorbidity Evaluation-27; BMI, body mass index; SD, standard deviation.

*Two patients have unknown marital status and are excluded from the denominator in percentage calculations.

†With the exception of poor performance status, all clinical characteristics were assessed using the ACE-27; race-specific prevalence rates are not presented for comorbidities with total prevalence ≤ 1%.

‡BMI ≥ 38 kg/m². Fifty patients have missing BMI data because of missing weight and/or height. Those with missing data are excluded from the denominator in percentage calculations.

Table 2. Prevalence and Odds of Having Surgery Based on Demographic and Clinical Characteristics

Characteristic	Surgery (n = 909)		Mean ± SD	No Surgery (n = 405)		Mean ± SD	OR*	95% CI	P
	No.	%		No.	%				
Demographic characteristics									
Age, years			67.0 ± 9.2			71.5 ± 9.4	0.95	0.93 to 0.96	< .001
Race									.001
White	802	88.2		333	82.2		1.00		
Black	107	11.8		72	17.8		0.63	0.48 to 0.83	
Marital status†									.106
Not married	466	51.3		226	55.9		1.00		
Married	442	48.7		178	44.1		1.22	0.96 to 1.56	
Clinical characteristics‡									
Cardiovascular system									
Myocardial infarction	77	8.5		46	11.4		0.71	0.48 to 1.04	.078
Angina/coronary artery disease	186	20.5		96	23.7		0.82	0.61 to 1.11	.196
Congestive heart failure	45	5.0		57	14.1		0.34	0.23 to 0.49	< .001
Arrhythmias	47	5.2		42	10.4		0.48	0.31 to 0.75	.001
Hypertension	550	60.5		269	66.4		0.81	0.61 to 1.08	.152
Venous disease	21	2.3		15	3.7		0.59	0.30 to 1.19	.141
Peripheral artery disease	57	6.3		35	8.6		0.67	0.46 to 0.997	.048
Respiratory system									
Respiratory disease	372	40.9		228	56.3		0.55	0.44 to 0.70	< .001
Gastrointestinal system									
Hepatic (liver) disease	49	5.4		16	4.0		1.44	0.86 to 2.43	.169
Stomach/intestinal (GI) disease	37	4.1		18	4.4		0.91	0.52 to 1.58	.734
Renal system									
Renal disease	39	4.3		39	9.6		0.44	0.28 to 0.68	< .001
Endocrine system									
Diabetes mellitus	200	22.0		104	25.7		0.86	0.67 to 1.12	.268
Neurologic system									
Stroke	58	6.4		38	9.4		0.65	0.43 to 0.998	.049
Dementia	21	2.3		18	4.4		0.53	0.28 to 1.03	.060
Psychiatric disorder	151	16.6		59	14.6		1.22	0.86 to 1.73	.274
Rheumatologic disorder	25	2.8		10	2.5		1.22	0.55 to 2.70	.619
Malignancy									
Second solid tumor (including melanoma)	120	13.2		59	14.6		0.86	0.65 to 1.15	.324
Substance abuse									
Alcohol	123	13.5		47	11.6		1.22	0.87 to 1.69	.250
Illicit drugs	34	3.7		12	3.0		1.28	0.64 to 2.54	.482
Body weight†§									
Morbid obesity	27	3.1		15	3.8		0.86	0.43 to 1.69	.657
At least one hospitalization in past year	261	28.7		119	29.4		0.99	0.74 to 1.32	.939
ACE-27 comorbidity score									
0 (none)	90	9.9		23	5.7		1.00		< .001
1 (mild)	361	39.7		109	26.9		0.91	0.50 to 1.67	.761
2 (moderate)	256	28.2		99	24.4		0.71	0.37 to 1.38	.314
3 (severe)	202	22.2		174	43.0		0.32	0.17 to 0.59	< .001
Poor performance status	33	3.6		77	19.0		0.16	0.10 to 0.24	< .001

Abbreviations: ACE-27, Adult Comorbidity Evaluation-27; OR, odds ratio; SD, standard deviation.

*ORs and 95% CIs are derived from separate generalized linear models with a logit link accounting for patient clustering within Veterans Administration Medical Centers by using the generalized estimating equations method.

†Two patients have unknown marital status and are excluded from the denominator in percentage calculations.

‡With the exception of poor performance status, all clinical characteristics were assessed using the ACE-27; comorbidities with a prevalence ≤ 1% in total sample (pancreas, paralysis, neuromuscular, leukemia and myeloma, HIV/AIDS, and lymphoma) are excluded from the table.

§BMI ≥ 38 kg/m². Fifty patients have missing BMI data because of missing weight and/or height. Those with missing data are excluded from the denominator in percentage calculations.

had low prevalence in the overall sample. Congestive heart failure was a strong predictor of not undergoing surgery (OR, 0.34; 95% CI, 0.23 to 0.49). Respiratory disease was the only highly prevalent condition that was associated with receipt of surgery. Patients with respiratory disease were less likely to have surgery compared with those who did

not have respiratory disease (OR, 0.55; 95% CI, 0.44 to 0.70). The ORs of several comorbidities (liver disease, psychiatric disorder, rheumatologic disorder, and substance abuse) were suggestive of increased odds of having surgery; however, these estimates did not reach statistical significance. Regarding overall comorbidity, only patients with

Table 3. Multivariable Analysis Examining Influence of Race on Odds of Having Surgery

Model	OR*	95% CI	P
Black race (reference, white race)	0.63	0.46 to 0.87	.005
Age	0.95	0.93 to 0.96	< .001
Married (reference, not married)	1.44	1.09 to 1.90	.010
Poor performance status	0.19	0.13 to 0.29	< .001
ACE-27 comorbidity score (reference, no comorbidity)			< .001
Mild	0.99	0.50 to 1.99	.985
Moderate	0.81	0.39 to 1.69	.580
Severe	0.39	0.19 to 0.80	.011

Abbreviations: ACE-27, Adult Comorbidity Evaluation-27; OR, odds ratio.

*ORs and 95% CIs are derived from a generalized linear model with a logit link accounting for patient clustering within Veterans Administration Medical Centers by using the generalized estimating equations method.

severe comorbidities were less likely to receive surgery (OR, 0.32; 95% CI, 0.17 to 0.59) compared with those without any comorbidities. Poor performance status was a strong predictor of not having surgery given that those with poor performance status were less likely than those without poor performance status to have surgery (OR, 0.16; 95% CI, 0.10 to 0.24). In a model controlling for overall comorbidity, age, marital status, and poor performance status, blacks were less likely than whites to receive surgery (OR, 0.63; 95% CI, 0.46 to 0.87; Table 3).

Figure 1 illustrates the proportion of patients not receiving surgery by overall comorbidity score. Among patients with no comorbidities, 13% of blacks (two of 16) did not have surgery compared with 22% of whites (21 of 97). For all other severity categories, a larger proportion of blacks than whites did not undergo surgery. For patients with severe comorbidities, 56% of blacks and 45% of whites did not have surgery. Figure 2 shows the proportion of patients who refused surgery by overall comorbidity. Among whites, the proportions of patients with mild, moderate, and severe comorbidities who refused surgery were 23%, 19%, and

Fig 1. Proportion of patients who did not receive surgery according to categories of Adult Comorbidity Evaluation-27 comorbidity score. Table data represent denominator of patients in each Adult Comorbidity Evaluation-27 comorbidity score category.

Fig 2. Proportion of patients who refused surgery according to categories of Adult Comorbidity Evaluation-27 comorbidity score among patients who did not receive surgery. Table data represent denominator of patients in each Adult Comorbidity Evaluation-27 comorbidity score category among patients who did not receive surgery.

13%, respectively. Approximately one third of blacks in each severity category refused surgery.

DISCUSSION

The overall goal of this study was to examine the prevalence of specific comorbidities in blacks and whites with early-stage NSCLC and determine their impact on receipt of surgery. Regardless of race, myriad comorbidities influence a decision to perform surgery on a patient with early-stage lung cancer. We found cardiovascular and respiratory illnesses to be strong negative predictors of surgery, which was expected because of the great potential for cardiopulmonary complications of lung surgery.²⁰ Other studies have reported a high prevalence of comorbidity among patients with lung cancer, particularly for cardiovascular and respiratory diseases.^{9,21} In our study, the prevalence rate of hypertension was 62%, although other populations of patients with lung cancer have reported hypertension rates of approximately 47%.⁴ Similarly, almost half our sample had respiratory disease compared with prevalence rates of approximately 30% in other studies.^{4,22} The higher rates observed here may reflect the higher prevalence of smoking among US military veterans compared with nonveterans.²³ It is also important to note that 16% of veterans in our study had psychiatric disorders, although another study reported a 5% prevalence of psychiatric disease among those with lung cancer.²² This emphasizes that the burden of certain conditions is greater among the US veteran population and may therefore present a unique set of challenges in managing lung cancer in this population.

The more specific objective of this work was to determine whether there are racial differences in the prevalence of comorbidities and in the impact of comorbidities on surgical treatment. Prior reports document that blacks have a greater burden of comorbidity than whites for several index cancers.²⁴⁻²⁶ In addition, lower surgical rates among blacks have been reported for pancreatic, prostate, colorectal, and breast cancers.^{27,28} Together, this evidence suggests that increased comorbidity burden among blacks may be largely responsible for racial disparities in treatment and survival. In a study of more than

15,000 incident cancer cases, black male participants had higher rates of hypertension, diabetes, and cerebrovascular disease compared with white participants but lower rates of respiratory disease.²⁵ We also observed less respiratory disease in blacks. The reason is unclear but may reflect underdiagnosis as a result of racial differences in pulmonary function testing²⁹ or lower risk of chronic obstructive pulmonary disease in blacks.³⁰ Landrum et al¹⁵ reported that among veterans not receiving surgery for early-stage lung cancer, black patients were more likely to have poor health. Despite observing racial differences in the prevalence of several comorbidities in our study, overall comorbidity did not influence the race-surgery association, and the independent effect of the conditions on receipt of surgery was similar for blacks and whites, thus not supporting our hypothesis. The only exceptions were venous disease and stomach/intestinal disease; however, we cannot make strong conclusions about these conditions because of their low prevalence in our sample. Although overall comorbidity was similar in blacks and whites, blacks were more likely to have poor performance status, suggesting that the combined effect of several comorbidities may be greater in blacks than whites resulting in worse physical function. Comorbidity may also differentially influence patient decisions regarding treatment. This is partially evident by the greater patient refusal rate among blacks, as also noted in other studies,^{31,32} which correlated with increasing severity of comorbidities. This warrants further investigation to help identify target areas for extensive monitoring, treatment, and control of lung cancer comorbidities in an effort to increase the likelihood of surgery.

Among patients with early-stage lung cancer who underwent lung resection, similar outcomes in blacks and whites have been noted in a nationally representative sample¹² and in a single VHA medical facility.³³ Given that surgical resection is a quality indicator for early-stage NSCLC, and knowing that surgical treatment yields similar outcomes, the disparity in lung cancer surgery is a quality-of-care issue. Approaches are needed to increase the rate of patients receiving surgery, especially among blacks, to reduce the disparity in resection rates, and thereby improve quality of care among veterans. Our study illustrates that the lower rate of resection among blacks in the VHA is due to factors other than racial differences in comorbidity. Furthermore, it is important to determine whether patients considered medically in-

operable or who refuse surgery are opting for alternative curative-intent therapies.

This study has several limitations. Information was collected retrospectively by chart abstractions; therefore, underestimation of comorbidities is possible because of ascertainment bias. However, chart abstractors were uniformly trained specifically to collect data for the EPRP Lung Cancer Special Study. The ACE-27 comorbidity assessment was developed for use among patients with cancer, but it does not encompass all clinical factors relevant to decisions regarding lung cancer surgery. Although we were able to assess the independent effect of specific comorbidities, the multiplicative effect may be more relevant because the burden of multiple conditions may differ by race. When considering the effects of individual comorbidities, it is important to note that the prevalence rate of these conditions varies and affects the statistical power to detect an association with surgery. Therefore, a lack of statistical significance for individual comorbidities, particularly those with low prevalence, should be interpreted with caution. These results are from a sample of veterans, predominantly male, and may not be generalizable to other populations.

In conclusion, certain comorbid conditions were more prevalent in blacks than whites, yet overall comorbidity burden was similar. There appear to be no racial differences in the impact of comorbidities or performance status on receipt of surgery. Comorbidities alone do not explain the lower rates of surgical resection among blacks; therefore, reasons for undertreatment require further investigation to reduce this disparity in the quality of care.

AUTHORS' DISCLOSURES OF POTENTIAL CONFLICTS OF INTEREST

The author(s) indicated no potential conflicts of interest.

AUTHOR CONTRIBUTIONS

Conception and design: Christina D. Williams, Dawn Provenziale, Michael J. Kelley

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