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Underuse of Surgical Resection for Localized, Non–Small Cell Lung Cancer Among Whites and African Americans in South Carolina

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Abstract

Background—Early studies using Medicare data reported racial disparities in surgical treatment of localized, non–small cell lung cancer. We analyzed the independent effect of race on use of surgical resection in a recent, population-based sample of patients with localized non–small cell lung cancer, controlling for comorbidity and socioeconomic status.

Methods—All cases of localized non–small cell lung cancer reported to our state Cancer Registry between 1996 and 2002 were identified and linked to the Inpatient/Outpatient Surgery Files and 2000 Census. Comorbidity (Romano-Charlson index) was calculated using administrative data codes. Educational level and income were estimated using census data. Characteristics of white and African American patients were compared using ×2 tests. Odds ratios of resection and 95% confidence intervals were calculated using logistic regression.

Results—We identified 2,506 white and 550 African American patients. African Americans were more likely to be younger, male, not married, less educated, poor, and uninsured or covered by Medicaid (all $p < 0.0001$), and to reside in rural communities ($p = 0.0005$). Use of surgical resection across races was lower than previously reported, and African Americans were significantly less likely to undergo surgery compared with whites (44.7% versus 63.4%; $p < 0.0001$). Even after controlling for sociodemographics, comorbidity, and tumor factors, the adjusted odds ratio for resection for African Americans was 0.43 (95% confidence interval, 0.34 to 0.55).

Conclusions—Underuse of surgical resection for localized, non–small cell lung cancer is a persistent problem, particularly among African Americans. Further studies are urgently needed to identify the patient, physician, and health system–related factors underlying these observations and optimize resection rates for non–small cell lung cancer.

It is estimated that lung and bronchus cancer will account for 213,380 new cancer cases and 160,390 cancer deaths in the United States in 2007 [1]. African American men have a significantly higher incidence rate and are twice as likely to die of lung and bronchus cancer compared with whites. In addition, although African Americans are only slightly less likely to present with localized disease compared with whites (14% versus 16%), their overall 5-year survival is significantly lower (42% versus 50%) [1].

Several factors may account for racial or ethnic differences in cancer outcomes, including differences in tumor biology, more advanced stage at presentation, poor access to care, underuse of cancer treatments, and differences in response to therapy [2]. Approximately one third of patients with the most common type of lung cancer, non–small cell lung cancer (NSCLC), present with early, potentially curable disease [3]. Numerous studies suggest that there are no apparent racial or ethnic differences in the efficacy or effectiveness of specific treatments for NSCLC, including surgery, radiation, and chemotherapy. Survival in whites and African Americans with early-stage NSCLC is similar after resection [3, 4]. In patients with more advanced disease, race-related survival is also comparable after radiation and systemic therapy [5, 6].

There is a growing body of literature suggesting that racial or ethnic disparities in cancer treatment may explain much of the observed variation in cancer outcomes [2]. Several studies have shown that African Americans are less likely to undergo surgical resection, radiation therapy, or chemotherapy for lung cancer compared with whites [3, 6 –10]. In a study of Medicare patients with early-stage NSCLC, the rate of surgical resection was 12.7% lower in African Americans compared with whites [3].

Surgical resection is the cornerstone of therapy in patients with localized NSCLC. Underuse of surgery in these patients would thus represent a serious breach in the standard of care and pose a serious public health hazard. Many of the previous studies reporting underuse of surgery among African Americans with localized NSCLC have been criticized because they were hospital-based, limited to Medicare patients, or failed to adequately control for comorbidity or socioeconomic status. In this study, we analyzed the independent effect of African American race on receipt of surgical resection in a recent, racially diverse, population-based sample of patients with localized NSCLC, while controlling for other important demographic, clinical, socioeconomic, and tumor variables.

Material and Methods

A data set was created by identifying all cases of non-metastatic, primary, invasive lung cancer reported to the South Carolina Central Cancer Registry from 1996 to 2002. Cases diagnosed at the time of autopsy were excluded. This data set was linked to the South Carolina Inpatient Files and Outpatient Surgery Files and the 2000 Census by the South Carolina Office of Research and Statistics. The study was approved by the institutional review boards of the Medical University of South Caroline and the South Carolina Department of Health and Environmental Control.

Patient demographics, tumor factors, year of diagnosis, and type of surgery performed (if any) were obtained from the Cancer Registry file. Age, sex, race, and marital status were self-reported and abstracted from the medical record for submission to the Cancer Registry. Tumor location and stage and type of surgery performed to the primary tumor site were submitted using nationally standardized data items, coding definitions, and transmission format specifications as defined by the North American Association of Central Cancer Registries. Anatomic location and histology (i.e., morphology code) was reported following the definitions provided by the World Health Organization's International Classification of

Disease for Oncology, Third Edition [11]. Surveillance, Epidemiology, and End Results (SEER) summary stage at the time of initial diagnosis was assigned in each case according to the 2000 SEER Summary Staging Manual [12].

Because we were only interested in receipt of surgery among patients with localized NSCLC, we excluded patients with nonlocalized tumors and inappropriate morphology codes (8000, 8003, 8041, 8041, 8042, 8043, 8044, 8045, 8082, 8240, 8243, 8246, 8800, 8850, 8890, 8972, 8980, 9041, 9053, and 9140). Type of surgery performed to the primary tumor site as part of the first course of treatment was coded according to the Commission of Cancer's 1996 Registry Operations and Data Standards manual and its 1998 supplement [13, 14].

Comorbidity, patient residence, and insurance status were obtained from the linked South Carolina Inpatient Files and Outpatient Surgery Files. Romano-Charlson comorbidity index was calculated using International Classification of Disease (9th Revision, Clinical Modification) diagnosis and procedure codes from all inpatient admissions and outpatient surgeries during the 12 months before and including the date of lung cancer diagnosis [15]. Patient residence and insurance status were obtained from files corresponding to the index lung cancer surgery. In patients who did not undergo resection, this information was obtained from the last entry in the Inpatient/Outpatient Surgery Files before the date of cancer diagnosis. Patient residence was defined as urban or rural based on the Metropolitan Statistical Area of the county in which patients resided, as defined by the U.S. Department of Health and Human Services Office of Rural Health Policy.

Educational level and income were estimated at the zip code level using 2000 Census data. Patients who resided in zip codes where greater than 20% of individuals age 25 or older had not completed high-school were classified as having a low level of education, which corresponded to the lowest quartile. Patients who resided in census tracts or zip codes where the median income, adjusted for household size, was less than 200% of the federal poverty guideline (as defined by the Department of Health and Human Services and issued each year in the Federal Register) were defined as living in poverty [16]. This poverty threshold was chosen because it is the current basis for determining financial eligibility for a number of means-tested federal programs.

To minimize confounding by previous or synchronous cancers, the analysis was limited to patients with a single occurrence of primary lung cancer during the study period. Owing to sample size limitations, patients who were separated or divorced and patients with a Romano-Charlson comorbidity index of 2 or greater were collapsed into single groups, respectively. Patients with payor status reported as worker's compensation or other government (eg, Tricare, state-or county-funded) or payor status reported as self-pay or indigent or charitable organization were combined into two new, payor groups, “other” or “self pay,” respectively. Patients who underwent no cancer-directed surgery of their primary site or underwent local tumor destruction alone were classified as “not resected.” All other patients were classified as having been resected.

Differences in patient demographics, comorbidity, socioeconomic status, and tumor factors by race were compared using Student's t (for mean age) or overall ×2 tests (for all other ordinal and categorical variables). Unadjusted odds ratios (OR) and 95% confidence intervals (CI) of resection for the various patient and tumor factors were estimated using the maximum likelihood method and logistic regression. Adjusted ORs of resection for race were generated using a series of logistic regression models sequentially controlling for demographics, comorbidity, socioeconomic status, and tumor factors. At each step, ordinal and categorical variables were checked for the linearity assumption with the log odds of resection. Variables were retained in the models on the basis of whether or not they were a confounder (i.e., changed the crude OR by 10% or more, either by themselves or collectively with the other covariates). Variables were removed from the models if they were not a confounder, did not improve the model fit, or increased the standard error of the OR of resection for race. Potential interactions of interest that were tested once the final models were developed included race by age, sex, comorbidity, patient residence, income, education, and insurance status. A probability value less than 0.05 (two-sided) was used as the cutoff point for statistical significance for individual variables, and interactions were considered statistically significant if their probability value was less than 0.10. The SAS System Version 9.1 (Cary, NC) was used to conduct all analyses.

Results

A total of 8,551 patients with a single occurrence of nonmetastatic, invasive, primary lung cancer diagnosed between 1996 and 2002 were identified from the cancer registry files. Patients with race reported as “other” or “unknown,” nonlocalized (i.e., regional) disease, or inappropriate morphology codes were excluded, leaving 3,056 patients in our final cohort.

There were a total of 2,506 white and 550 African American patients in our study. The distribution of patient demographics, comorbidity scores, socioeconomic status, year of diagnosis, and tumor factors according to race are shown in Table 1. African American patients were younger and more likely to be male or not married compared with white patients.

Of note, the distribution of comorbidity scores between whites and African Americans was almost identical. African Americans patients were more likely than white patients to reside in rural communities, be less educated, live in poverty, or be uninsured or covered by Medicaid. There was no association between year of diagnosis or tumor location and race.

Receipt of surgery (percent of patients resected and OR of resection) according to patient and tumor characteristics is shown in Table 2. Age had no apparent effect on receipt of surgery except in patients age 70 or older, who were significantly less likely to undergo resection. African American race had an adverse effect of resection: 63.4% of whites were resected, compared with less than half (44.7%) of African Americans (unadjusted OR, 0.46; 95% CI, 0.39 to 0.56). Patients who were single or widowed were less likely to undergo resection compared with married patients. As might be expected, there was an inverse relationship between increasing comorbidity index and surgical resection. Patients with low education and those living in poverty were less likely to undergo resection. Interestingly,

66.7% of patients enrolled in a health maintenance organization underwent resection, compared with 80% of patients covered by standard commercial insurance ($p = 0.011$). Lack of medical insurance and coverage by Medicare or Medicaid also had a negative effect on resection.

A series of logistic regression models were used to assess the independent effect of race on resection by sequentially controlling for the other patient sociodemographic and tumor factors (Table 3). African American race was independently associated with a lower odds of resection (adjusted OR, 0.43; 95% CI, 0.34 to 0.55) even after controlling for other patient demographics, comorbidity, socioeconomic status, and tumor factors. Of note, there were no interaction effects between race and the other sociodemographic or tumor variables.

The independent predictors of underuse of surgical resection are shown in Table 4. Advanced age, African American race, separated or divorced or widowed status, comorbidity, living in poverty, lack of insurance, and enrollment in a health maintenance organization, Medicare, or Medicaid were all associated with lower odds of surgical resection. Of note, sex, educational level, urban or rural residence, and year of diagnosis had no apparent effect on the odds of resection when controlling for these other factors.

Comment

Using a large, racially diverse, population-based sample of patients with localized NSCLC diagnosed between 1996 and 2002, we found that overall use of surgical resection across races was significantly lower than previously reported. More specifically, approximately 37% of whites and more than half of African Americans with potentially curable disease did not undergo surgery. A significant proportion of the patients in our study were African American, and a higher proportion of these patients resided in rural counties or was of lower socio-economic status compared with whites. After controlling for these and other sociodemographic, comorbidity, and tumor factors, however, African American race was found to be a powerful, independent predictor of underuse of surgical resection. Additional adverse predictors of surgical treatment included age older than 70, unmarried status, increased comorbidity, living in poverty, lack of insurance, and coverage by a health maintenance organization, Medicare, or Medicaid.

Previous studies have reported lower rates of lung resection among African Americans with NSCLC, even when controlling for stage at presentation [3, 6 –10]. In a seminal study, Bach and colleagues [3] used SEER Medicare data from 1985 to 1993 to compare surgical resection and survival rates between whites and African Americans with stage I or II NSCLC. The rate of surgery in African American patients was only 64.0% compared with 76.7% among whites ($p < 0.001$). African American race was associated with a relative risk of resection of 0.54, even when controlling for the effects of age, sex, comorbidity, median income, and tumor stage. Overall, 5-year survival was lower for African Americans compared with whites (26.4% versus 34.1%; $p < 0.001$). In contrast, the 5-year survival of African American and white patients who underwent surgery was roughly similar (39.1 versus 42.9%; $p = 0.10$), as was survival among patients who did not undergo surgery (4% versus 5%; $p = 0.25$). On further analysis, the authors concluded that the racial disparity in

resection rates largely accounted for the lower survival rate among African Americans in their study.

The current study involved a more recent, population-based sample of patients with localized NSCLC and included patients of all ages, irrespective of insurance status. Our data suggest that resection rates among patients with localized NSCLC may be significantly lower than previously reported among Medicare patients, particularly among African Americans. Of note, our study was limited to patients in the South Carolina Central Cancer Registry, and thus, direct comparison of our results with previous studies that used SEER or SEER-Medicare data may not be valid. On the other hand, our study controlled for additional sociodemographic confounders (i.e., marital status, urban or rural residence, level of education, poverty status) and may thus provide stronger evidence for an independent, adverse effect of African American race on use of surgical resection.

The observed disparity in surgical treatment for NSCLC in our study may be attributable to several patient-, physician-, and health system–related factors. In a recent report from the cancer registry at the Henry Ford Health System in Detroit, the rate of surgical resection among African American patients with early-stage NSCLC was lower than among whites (58% versus 74%, respectively; $p = 0.004$) [17]. After controlling for comorbidity, pulmonary function, and tumor stage, however, race had no apparent effect on the odds of being offered surgery, but did have a negative effect on the rate at which surgery was declined by patients (OR for African American race, 4.1; 95% CI, 0.34 to 0.55).

Patients' misconceptions about cancer and its treatment may contribute to their willingness to undergo surgery. Margolis and associates [18] interviewed 626 consecutive patients in pulmonary and lung cancer clinics in Philadelphia, Los Angeles, and Charleston to assess the prevalence of the belief that lung cancer surgery causes tumor spread and the effect of this belief on patients' willingness to undergo lung resection. Thirty eight percent of patients supported this belief, and African American race was the most significant, independent predictor of this belief (OR, 3.5; 95% CI, 1.9 to 6.5). Of note, 14% of African Americans stated that they would not trust their physicians' reassurance that this belief was false, and 19% of them stated that they would avoid surgery based on this belief. The authors concluded that the belief in accelerated tumor spread at surgery was particularly prevalent in African Americans and could account for racial differences in rates of resection among patients with lung cancer. In a related study, Gansler and coworkers [19] conducted a national telephone survey of 957 adults to determine the prevalence and racial or socioeconomic factors associated with several, commonly held misconceptions about cancer and its treatment. The most prevalent misconception, “Treating cancer with surgery can cause it to spread throughout the body,” was espoused by 41% of the respondents, particularly if they were older, nonwhite, or Southern.

Patients' risk perception of surgery may be central to their willingness to undergo surgery. If so, higher risk aversion to surgery may partly account for an apparent underuse of surgical treatment among certain patients. This concept was explored by Oddone and colleagues [20] in a prospective study of African American and white patients with carotid stenosis faced with the prospect of carotid angiography and carotid endarterectomy. African American

patients expressed higher aversion to carotid endarterectomy than white patients (31% versus 15% in the highest aversion quartiles, respectively; p = 0.01). During follow-up, 14% of African Americans underwent surgery, compared with 20% of whites (p = 0.19).

Health-care system–related factors, such as access to care or differences in referrals for surgical consultation, could also explain our findings. Lathan and associates [4] recently analyzed the effect of race on invasive staging and surgery in 21,219 patients with stage I to III NSCLC using SEER-Medicare data. African American patients were less likely to undergo invasive staging compared with white patients (OR, 0.75; 95% CI, 0.67 to 0.83). To control for differences in access to care, the authors also analyzed the effect of race on the likelihood of surgery among staged patients. As in the current study, African American race was a powerful, negative predictor of surgical resection (OR, 0.55; 95%CI, 0.47 to 0.64), even when the analysis was limited to patients previously staged with mediastinoscopy. In addition, African American patients were more likely to have a negative recommendation for surgery (71.4% versus 67.0%; p < 0.05) and more likely to refuse surgery (3.4% versus 2.0%; p = 0.013) according to SEER data recording. The persistent racial disparity in surgical resection, despite similar access to care and patient willingness to undergo invasive staging, led the authors to conclude that miscommunication or bias during the patient–physician encounter was likely involved.

Referral patterns for lung surgery in South Carolina may account for the observed underuse of surgical resection across races in our cohort. In a previous study, our group reported that one half of lobectomies and nearly 60% of pneumonectomies in South Carolina were performed by general surgeons, and that the perioperative mortality after lobectomy was significantly higher among patients treated by general surgeons compared with thoracic surgeons (5.3% versus 3.0%; p < 0.05) [21]. A recent analysis from the Nationwide Inpatient Sample revealed that African Americans who underwent lung resection were less likely to undergo surgery at high-volume hospitals compared with whites, and as a result, were more likely to die during the perioperative period [22]. Selective referral of African American patients with NSCLC to non–thoracic surgeons (combined with referrals to low-volume centers) could result in inferior surgical outcomes over time, which could in turn deter primary care physicians from referring patients for lung resection and dissuade patients from undergoing surgery.

Our study has several potential limitations. Our analysis was limited to patients in South Carolina, which may limit its generalizability to other parts of the United States. Except for the higher proportion of African American patients in our study, however, the distribution of demographic and tumor characteristics by race in our study was similar to that in previously cited studies using SEER data. The fact that the adjusted OR for resection for African American race in our study was also similar to the OR in these studies further supports our findings and speaks to their generalizability. Stage at presentation was recorded in the cancer registry using SEER summary stage, rather than American Joint Commission on Cancer stage. Although this may have limited our ability to control for tumor stage at presentation, it is important to remember that all the patients in our study had localized NSCLC at presentation, and aside from differences in comorbid conditions that would have precluded surgery, would have been equally likely to undergo surgical resection. Zip code

level data were used to estimate socioeconomic status, which is not always correlated with individual level data [23]. Because of the large percentage of rural patients in our study, we were unable to obtain exact addresses for many of the patients and therefore relied on zip code, rather than census tract level data, to estimate educational level and poverty status. Although use of census-tract data would have been optimal, the direction and magnitude of the univariate associations between education and poverty status and resection at the two levels were similar (data not shown) [24]. Therefore, we do not believe that the use of census tract level data would have changed our conclusions significantly. Finally, we did not have access to patients' outpatient files (other than the Outpatient Surgery Files). As a result, we could not determine whether underuse of resection among African Americans in our study was related to lower rates of surgical consultation or higher rates of referral to less aggressive, non–thoracic surgeons.

Despite the fact that a substantial proportion of patients with early-stage NSCLC benefit from surgical resection, our study suggests there is persistent underuse of surgical treatment across races. In addition, African American race is a powerful, independent predictor of nonresection, even when controlling for comorbidity, socioeconomic status, and insurance status. Our group is currently involved in a research program to determine (and eventually address) the patient-, physician-, and health system–related factors underlying these observations. In the interim, outreach programs to optimize resection rates in patients with localized NSCLC may be warranted and should target patients at the time of diagnosis.

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Table 1
Characteristics of Study Population by Patient Race[a]

Characteristic[b]	White(n = 2,506)	African American (n = 550)	*p* Value
Age (y)	68.3 + 9.6	66.3 + 11.0	0.0001
Age(y)			<0.0001
<50	3.6	7.3	
50–59	13.9	20.8	
60–69	33.6	29.5	
70–79	38.4	30.9	
≥80	10.5	11.5	
Sex			<0.0001
Male	58.1	66.9	
Female	41.9	33.1	
Marital status [n = 159]			<0.0001
Married	64.7	45.6	
Single	4.1	16.2	
Separated or divorced	9.8	15.6	
Widowed	21.4	22.6	
Romano-Charlson comorbidity index [n = 284]			0.876
0	46.1	47.1	
1	34.5	33.3	
2+	19.4	19.6	
Residency [n = 194]			0.0005
Urban	72.4	64.8	
Rural	27.6	35.2	
Education, zip code level [n = 265]			<0.0001
High education	70.4	60.4	
Low education	29.6	39.6	
Income, zip code level [n = 265]			<0.0001
Not living in poverty	89.5	68.7	
Living in poverty	10.5	31.3	
Insurance status [n = 203]			<0.0001
Commercial	19.9	15.7	
HMO	2.3	3.7	
Medicare	70.3	63.6	
Medicaid	2.4	7.2	
Other	1.6	1.8	
Self-pay	3.5	8.0	
Year of diagnosis			0.660
1996	15.1	12.4	
1997	13.0	13.1	
1998	14.3	15.3	

Characteristic[b]	White(n = 2,506)	African American (n = 550)	*p* Value
1999	13.7	15.6	
2000	15.0	14.7	
2001	14.9	14.2	
2002	14.0	14.7	
Tumor location			0.258
Main bronchus	2.9	2.7	
Upper lobe	58.3	59.5	
Middle lobe	5.4	6.0	
Lower lobe	28.4	24.7	
Overlapping lesion	1.3	2.0	
NOS	3.7	5.1	

[a] Values are reported as percentages, except for age, which is reported as mean ± standard deviation.

[b] Numbers given in brackets indicate number of patients with missing data.

HMO = health maintenance organization; NOS = not otherwise specified.

Table 2
Receipt of Surgery by Patient and Tumor Characteristics

Characteristic[a]	% Resected	OR (95% CI)	*p* Value
Age(y)			
<50	74.8	1.0	
50-59	75.0	1.01(0.65–1.58)	0.965
60-69	66.4	0.67(0.44–1.01)	0.055
70-79	54.9	0.41(0.27–0.62)	<0.0001
≥80	32.4	0.16(0.10–0.26)	<0.0001
Sex			
Male	59.1	1.0	
Female	61.7	1.11 (0.96–1.29)	0.152
Race			
White	63.4	1.0	
African American	44.7	0.46(0.39–0.56)	<0.0001
Marital status [n = 159]			
Married	65.7	1.0	
Single	54.1	0.62(0.45–0.84)	0.002
Separated or divorced	60.2	0.79(0.62–1.01)	0.058
Widowed	47.2	0.47(0.39–0.56)	<0.0001
Romano-Charlson comorbidity index [n = 284]			
0	66.4	1.0	
1	60.3	0.77(0.65–0.92)	0.003
2+	46.6	0.44(0.36–0.54)	<0.0001
Residency [n = 194]			
Urban	62.0	1.0	
Rural	56.4	0.79(0.67–0.93)	0.006
Education, zip code level [n = 265]			
High education	61.6	1.0	
Low education	54.4	0.84(0.72–0.99)	0.038
Income, zip code level [n = 265]			
Not living in poverty	66.2	1.0	
Living in poverty	48.5	0.57(0.46–0.71)	<0.0001
Insurance status [n = 203]			
Commercial	80.0	1.0	
HMO	66.7	0.50(0.29–0.85)	0.011
Medicare	55.0	0.31(0.24–0.38)	<0.0001
Medicaid	52.1	0.27 (0.17–0.43)	<0.0001
Other	70.2	0.59(0.30–1.14)	0.114
Self-pay	56.1	0.32(0.21–0.48)	<0.0001
Year of diagnosis			
1996	58.7	1.0	

Characteristic[a]	% Resected	OR (95% CI)	*p* Value
1997	60.2	1.06(0.81–1.40)	0.667
1998	57.2	0.94(0.72–1.23)	0.650
1999	60.2	1.06 (0.81–1.39)	0.654
2000	61.3	1.11(0.85–1.45)	0.439
2001	60.6	1.08(0.83–1.41)	0.567
2002	63.0	1.19(0.91–1.57)	0.201
Tumor location			
Main bronchus	18.4	1.0	
Upper lobe	62.7	7.45(4.30–12.93)	<0.0001
Middle lobe	60.1	6.69(3.58–12.49)	<0.0001
Lower lobe	63.4	7.70(4.39–13.47)	<0.0001
Overlapping lesion	84.1	23.4(8.86–62.05)	<0.0001
NOS	21.7	1.23(0.61–2.46)	0.563

[a] Numbers given in brackets indicate number of patients with missing data.

CI - confidence interval; HMO - health maintenance organization; NOS - not otherwise specified; OR - odds ratio.

Table 3

Odds Ratios of Resection for African American Race, Unadjusted (Crude) and Adjusted for Other Sociodemographic, Clinical, and Tumor Factors

Models	OR (95% CI)	*p* Value
1. Crude model (race)	0.46(0.39–0.56)	<0.001
2. Model 1 + demographics[a]	0.45(0.36–0.55)	<0.001
3. Model 2 + comorbidity[b]	0.42(0.34–0.53)	<0.001
4. Model 3 + socioeconomic status[c]	0.46(0.36–0.58)	<0.001
5. Model 4 + tumor factors[d]	0.43(0.34–0.55)	<0.001

[a] Age, sex, marital status.

[b] Romano-Charlson comorbidity index.

[c] Patient residence, income, education, insurance status.

[d] Year of diagnosis, tumor location.

CI = confidence interval; OR = odds ratio.

Table 4

Independent Predictors of Surgical Resection in Patients With Localized, Non-Small Cell Lung Cancer[a]

Variable	OR (95% CI)	*p* Value
Age 70–79	0.48 (0.28–0.82)	0.0078
Age > 80	0.18 (0.10–0.32)	<0.001
African American race	0.43 (0.34–0.55)	<0.001
Separated or divorced	0.71 (0.52–0.97)	0.029
Widowed	0.60 (0.48–0.76)	<0.001
Comorbidity	0.69 (0.62–0.78)	<0.001
Living in poverty	0.67(0.51–0.88)	0.005
HMO	0.47(0.26–0.85)	0.013
Medicare	0.53 (0.39–0.72)	<0.001
Medicaid	0.37(0.22–0.64)	0.0003
Self-pay	0.41 (0.25–0.67)	0.0004

[a]Note: All tumor locations (except those not otherwise specified) were associated with higher odds of resection compared with tumor location at main bronchus (data not shown).

CI = confidence interval; HMO = health maintenance organization; OR = odds ratio.