Factors Associated With Decisions to Undergo Surgery Among Patients With Newly Diagnosed Early-Stage Lung Cancer

Samuel Cykert, MD
Peggye Dilworth-Anderson, PhD
Michael H. Monroe, MD
Paul Walker, MD
Franklin R. McGuire, MD
Giselle Corbie-Smith, MD, MSc
Lloyd J. Edwards, PhD
Audrina Jones Bunton, MA

Context Lung cancer is the leading cause of cancer death in the United States. Surgical resection for stage I or II non–small cell cancer remains the only reliable treatment for cure. Patients who do not undergo surgery have a median survival of less than 1 year. Despite the survival disadvantage, many patients with early-stage disease do not receive surgical care and rates are even lower for black patients.

Objectives To identify potentially modifiable factors regarding surgery in patients newly diagnosed with early-stage lung cancer and to explore why blacks undergo surgery less often than whites.

Design, Setting, and Patients Prospective cohort study with patients identified by pulmonary, oncology, thoracic surgery, and generalist practices in 5 communities through study referral or computerized tomography review protocol. A total of 437 patients with biopsy-proven or probable early-stage lung cancer were enrolled between December 2005 and December 2008. Before establishment of treatment plans, patients were administered a survey including questions about trust, patient-physician communication, attitudes toward cancer, and functional status. Information about comorbid illnesses was obtained through chart audits.

Main Outcome Measure Lung cancer surgery within 4 months of diagnosis.

Results A total of 386 patients met full eligibility criteria for lung resection surgery. The median age was 66 years (range, 26-90 years) and 29% of patients were black. The surgical rate was 66% for white patients (n=179/273) compared with 55% for black patients (n=62/113; $P=.05$). Negative perceptions of patient-physician communication manifested by a 5-point decrement on a 25-point communication scale (odds ratio [OR], 0.42; 95% confidence interval [CI], 0.32-0.74) and negative perception of 1-year prognosis postsurgery (OR, 0.27; 95% CI, 0.14-0.50; absolute risk, 34%) were associated with decisions against surgery. Surgical rates for blacks were particularly low when they had 2 or more comorbid illnesses (13% vs 62% for <2 comorbidities; OR, 0.04 [95% CI, 0.01-0.25]; absolute risk, 49%) and when blacks lacked a regular source of care (42% with no regular care vs 57% with regular care; OR, 0.20 [95% CI, 0.10-0.43]; absolute risk, 15%).

Conclusions A decision not to undergo surgery by patients with newly diagnosed lung cancer was independently associated with perceptions of communication and prognosis, older age, multiple comorbidities, and black race. Interventions to optimize surgery should consider these factors.

JAMA. 2010;303(23):2368-2376 www.jama.com

LUNG CANCER REMAINS THE LEADING cause of cancer death in the United States and proportionally this burden is greater for blacks.[1] Non–small cell histology represents more than 80% of cases.[2,3] Surgical resection for stage I or II disease remains the only reliable cure.[4] Patients who do not undergo appropriate surgery face a median survival of less than 1 year and the sequelae of progressive cancer and then death; while those who undergo appropriate surgery have a median survival of more than 4 years.[5-7] Despite patients' fear of cancer[8] and the dismal outcomes for those who do not proceed to surgery, administrative data[5,9] consistently show that almost one-third of patients with potentially curable disease do not undergo resection surgery. A persistent surgical gap that disadvantages black patients has been reported for more than a decade.[10-12]

For editorial comment see p 2411.

CME available online at www.jamaarchivescme.com and questions on p 2420.

Author Affiliations: Cecil G. Sheps Center for Health Services Research, Chapel Hill, North Carolina (Drs Cykert, Corbie-Smith, Edwards, and Ms Bunton); Division of General Internal Medicine and Clinical Epidemiology, School of Medicine (Drs Cykert and Corbie-Smith), Department of Health Policy and Management and UNC Institute on Aging (Dr Dilworth-Anderson), and Department of Biostatistics (Dr Edwards), University of North Carolina, Chapel Hill; Internal Medicine Program, Moses Cone Health System–Greensboro Area Health Education Center, Greensboro, North Carolina (Dr Cykert); Department of Internal Medicine, Carolinas Medical Center, Charlotte, North Carolina (Dr Monroe); Leo Jenkins Cancer Center, Brody School of Medicine, East Carolina University, Greenville, North Carolina (Dr Walker); and Division of Pulmonary and Critical Care Medicine, School of Medicine, University of South Carolina, Columbia (Dr McGuire).
Corresponding Author: Samuel Cykert, MD, Internal Medicine Teaching Program, Moses Cone Hospital, 1200 N Elm St, Greensboro, NC 27401 (samuel_cykert@med.unc.edu).

Although administrative data underscore variations in medical care, including racial disparities, these data often lack the detail needed to identify modifiable factors effecting differences. This limitation is particularly important with cancer because decisions against appropriate therapy, whether caused by misperceptions, poor communication, or disorganized systems of care can jeopardize patients' survival. A prospective cohort study was performed of newly diagnosed patients with early-stage lung cancer to identify potentially modifiable factors regarding surgery and to explore why black patients undergo surgery even less than white patients.

METHODS

Using pulmonary, oncology, thoracic surgery, and generalist practices in 5 communities, patients with early-stage non–small cell lung cancer were enrolled. Inclusion criteria were (1) age of 21 years or older; (2) probability higher than 60% of a lung lesion being malignant calculated by Bayesian analysis (derived from clinical and radiographic criteria or biopsy-proven disease); and (3) a clinical classification of stage I or II disease based on studies such as computed tomographic (CT) scans, positron emission tomographic scans, bone scans, mediastinoscopy, or any procedure short of thoracotomy. Patients were enrolled during the narrow time window between discussion of diagnosis and determination of treatment plans. Patients were excluded if they were incarcerated, had severe cognitive impairment, or did not speak English. Patients were enrolled between December 2005 and December 2008.

Patients from 5 health systems in North and South Carolina were included in the study. The participating sites served a mix of urban and rural areas and represented university and community settings. At 2 of the sites, more than 90% of patients were evaluated through a multidisciplinary thoracic oncology program prior to establishing therapeutic decisions while the other sites had less organized care systems that depended more on a patient's entry point into care and consultations with individual physicians. Each site had a limited number of pulmonary specialists and thoracic surgeons. Because of the concentration of patients with lung cancer in these practices, recruitment was concentrated in these offices.

Generalist practices were sent recruitment flyers and e-mails and announcements were made at grand rounds and staff meetings. With the agreement of the specialty practices, the participating health systems, and each institutional review board, patients with probable stage I or stage II non–small cell lung cancer were identified using a real-time search of digital chest CT scans coupled with a Bayesian algorithm (with an accuracy of 96% and sensitivity of 98% derived from previous reports).[13,14] The algorithm was imbedded in a computerized calculator that multiplied serial odds derived from the patient's age and smoking history coupled with the CT findings of nodule size, edge pattern, and presence or absence of calcification. The tool proved reliable because only 6 of the original 437 patients had benign disease.

Patients were contacted through the practice that ordered the CT scan unless they were seen in an emergency department and had no follow-up. In the latter situation, the research associate was allowed to contact the patient directly and arrange follow-up care. The CT protocol allowed recruitment to help overcome possible surgical referral bias. Cancer registry data indicate that approximately 900 patients with early-stage non–small disease received clinical care in participating health systems and would be eligible for the study during the 3-year recruitment period.

Sampling occurred randomly by direct physician referral, discovery through CT review while the patient was still in the enrollment window, and research associates' regular rotation through sites providing lung cancer care. Informed consent was obtained from all patients in writing after explanation of the study and review of written information in face-to-face meetings with trained research associates. Institutional review board approval was obtained at all participating institutions.

Research associates verbally administered a 106-item survey at the time of enrollment in either private areas sequestered from the clinic or at nonclinical sites. Data were collected on a laptop computer and then uploaded to a secure Web site. Survey questions included items on demographics, perceptions of patient-physician communication, perceived certainty of diagnosis, attitudes about lung cancer, religiosity, past health care experiences, access to a regular source of care, and decision makers such as a spouse, child, or spiritual advisor.

Because of the persistent disparities between black and white patients documented in the lung cancer surgery literature, interviewers asked patients "what racial or ethnic group best describes you?" and followed up with a list of options derived from the US census. Validated scales were used, including the Mental Adjustment to Cancer Scale,[15] the trust domain of the Primary Care Assessment Survey,[16] and the Short Form 12 (SF-12) Health Survey.[17]

Research associates performed chart reviews for each patient 4 months after enrollment. The information obtained from the chart abstraction included the date of lung cancer surgery and pathological diagnosis (if performed), preoperative stage, medical comorbidities, and preoperative pulmonary function results. All patients included in this study had postdiagnosis medical follow-up and a 4-month chart review.

The primary outcome was lung cancer surgery within 4 months of study enrollment. The goal was to make this study's prospective data be comparable with the administrative Surveillance, Epidemiology, and End Results database, which only collects information on initial cancer-directed therapies. For lung cancer, these are specifically defined as surgery or

Table 1. Patients With Lung Cancer by Race, With or Without Disease Diagnoses, and by Lung Surgery Rates[a]

	No. (%) of Patients (N = 386)			
	Black (n = 113)		White (n = 273)	
Diagnosis	Total	Received Surgery	Total	Received Surgery
Coronary artery disease				
Yes	23 (20)	15 (65)	77 (28)	49 (64)
No	90 (80)	47 (52)	195 (71)	131 (67)
Diabetes mellitus				
Yes	26 (23)	15 (58)	60 (22)	39 (65)
No	87 (77)	47 (54)	212 (78)	140 (66)
Hypertension				
Yes	86 (76)	47 (55)	142 (52)	94 (66)
No	27 (24)	15 (56)	130 (48)	85 (65)

[a]Comparisons between presence and absence of disease are not statistically significant.

Table 2. Demographic Characteristics of Patients With Early-Stage Lung Cancer (N = 386)

Characteristic	No. (%) of Patients[a]
Black race	113 (29)
Married	246 (64)
Male sex	215 (56)
Insurance	349 (90)
Private only	88 (23)
Medicare	65 (17)
Medicaid	26 (7)
Medicare and Medicaid	44 (11)
Private and Medicare	114 (30)
Other	12 (3)
No insurance	29 (8)
Education >high school	135 (35)
Age, median (range), y	66 (26-90)
Household income, median (range), $	35 500 (17 860-86 700)

[a]Unless otherwise indicated.

radiation applied within 4 months of diagnosis.

Descriptive statistics, including selected bivariate associations, were computed for all study variables. Statistical power was computed by constraining the sample size to be a total of 425 patients, unequal for whites (n=255) and oversampled for blacks (n=170). A minimal difference of 0.11 could be detected between the proportion of whites (0.76) and blacks (0.65) who underwent surgery using a power level of 80%. Because the outcome was dichotomous, a generalized linear model for clustered data using logit link function (essentially a logistic regression for clustered data) with multiple predictors was used to assess the simultaneous effect of predictors on the outcome. To take same site correlations into account, the generalized estimating equation approach was used to fit the regression models.[18] The modeling approach fitted a maximum model using main effects only (initially there were no interactions).

Preliminary analyses of similar data indicate that the sample size combined with a sufficient number of events (ie, surgery performed) would allow an upwards of 30 to 35 main effects to be included in the model with good reliability for estimation and inference. Predictors used in the regression model were determined from a combination of factors assessing the strength of the bivariate relationship, investigator interest in potential effects, and having relevance to what had been used in the literature. Selected interactions and any additional variables were considered for inclusion into the final main-effects model separately to assess their significance beyond what was already in the model. Because of large differences in several bivariate associations of lung cancer surgery according to race, regression modeling stratified by race also was performed.

Because of the hypotheses generated from preliminary work and published data, the following factors were incorporated in all models: race, patient perception of diagnostic certainty, trust, patient perception of prognosis, quality of communication, functional status measured by SF-12 scores, religiosity, access to a regular source of care, and comorbid illnesses. Coronary artery disease, hypertension, and diabetes were prevalent and equivalent in both racial groups and did not effect surgical decisions in either the bivariate (TABLE 1) or regression analyses and were dropped from the final models. Therefore, for the purpose of this analysis, significant comorbidities included chronic obstructive pulmonary disease, renal insufficiency, poor mobility, congestive heart failure, cerebrovascular disease, obstructive sleep apnea, and oxygen dependence.

Survey items that described patient perceptions about shared communication (eg, quality of the physician's explanation of risk, benefit, and prognosis; patient's perception of the physician's willingness to listen; and patient's comfort with expressing concerns to the physician) were combined into a 5-item scale yielding a Cronbach α level of .84. This communication variable was incorporated into all models. Because there were many attitudinal variables measured, the list of other possible predictor variables remained large. Therefore, bivariate analyses were used, including correlations and χ^2 tests of association, to make preliminary assessments of the relationships between study variables overall and by race.

All statistical analyses were performed using SAS software version 9.2 (SAS Institute Inc, Cary, North Carolina). A priori statistical significance for independent variables and the primary outcome was set at less than or equal to .05 based on a 2-sided test for bivariate and multivariate associations.

RESULTS

A total of 437 patients were enrolled while 47 patients who were approached declined (12 black and 35 white). Seven patients interviewed were not white or black by self-report and were excluded from the analysis. Be-

cause enrollment was time sensitive and surveys needed to be administered before treatment decisions were made, 40 patients did not meet the entry criteria once preoperative evaluations were completed and were excluded postenrollment. These evaluations found advanced cancer in 28 patients and benign lesions in 6 patients.

No lung surgeries were performed on patients who had forced expiratory volume in the first second of expiration lower than 25% of predicted on pulmonary function tests, so this value was used as the threshold for absolute contraindication to surgical consideration (n=6). Four patients were lost to follow-up. Therefore, 386 patients met entry criteria and remained eligible for lung resection surgery. Demographic information is reported in TABLE 2. Specifically, black patients comprised 29% of the study sample (n=113).

Twenty-four percent of referring physicians (n=20) practiced primary care and were contacted through the CT review protocol. Thirty-three were pulmonologists (40%), 17 were thoracic surgeons (20%), and 13 were medical oncologists (16%). Note that generalists accounted for 1 patient per physician, pulmonologists accounted for 3.5 patients per physician (31% of patients), and thoracic surgeons accounted for 10 patients per physician (47% of patients). Physicians were evenly divided between university and community settings.

Sixty-seven percent of patients had biopsy-proven disease at enrollment (n=257) and only 62% (n=159) of this group went on to surgical resection. Of the 129 with CT-defined probable disease, 64% (n=82) underwent surgery. Combining the early-biopsy group and the later surgical group, 88% of patients (n=339) had confirmed tissue diagnosis of non–small cell disease. Forty-seven patients (12%) never had tissue confirmation despite highly suspicious lesions on CT scan. Two hundred forty-one patients (62%) had lung cancer surgery as defined by the primary outcome (179/273 white patients [66%] vs 62/113 black patients

Table 3. Receipt of Lung Cancer Surgery and Associations With Patient Demographic Characteristics, Clinical Information, and Patient Attitudes

	No. (%) Patients (N = 386)[a]		*P* Value
	Surgery	No Surgery	
Race			
Black	62 (55)	51 (45)	.05
White	179 (66)	94 (34)	
Age, y			
≥73	53 (48)	57 (42)	<.001
<73	188 (68)	88 (32)	
Married			
Yes	160 (65)	86 (35)	.16
No	81 (58)	59 (42)	
Education, y			
1-12	154 (62)	96 (38)	.68
≥13	86 (64)	49 (36)	
Sex			
Male	130 (60)	85 (40)	.37
Female	111 (65)	60 (35)	
Income			
Lowest tertile	68 (54)	57 (46)	.02
Upper 2 tertiles	173 (66)	88 (34)	
Insurance			
Private	113 (70)	49 (30)	.01
Other	128 (57)	96 (43)	
Regular source of health care			
Yes	211 (63)	125 (37)	.70
No	30 (60)	20 (40)	
Comorbidities			
≥2	16 (31)	35 (69)	<.001
<2	225 (68)	108 (32)	
Diagnosis			
Biopsy-confirmed	159 (62)	98 (38)	.74
CT-defined probable disease	82 (64)	47 (36)	
Hospitalized in last year			
Yes	104 (56)	83 (44)	.007
No	137 (69)	62 (31)	
Score for mental component of SF-12			
Lowest quartile	51 (54)	44 (46)	.04
Upper 3 quartiles	190 (65)	101 (35)	
Score for physical component of SF-12			
Lowest quartile	46 (51)	44 (49)	.01
Upper 3 quartiles	195 (66)	101 (34)	
Belief in diagnosis			
≥90%	127 (69)	56 (31)	.005
<90%	109 (55)	88 (45)	
Physician discusses pros and cons of surgery			
Agree	154 (64)	86 (36)	.40
Disagree	85 (60)	57 (40)	
Believe exposure to air during surgery spreads cancer			
Agree	93 (53)	82 (47)	<.001
Disagree	148 (70)	63 (30)	
Family must approve surgery			
Agree	93 (57)	69 (43)	.08
Disagree	148 (66)	76 (34)	
Want surgery even if end up in nursing home			
Agree	95 (61)	60 (39)	.70
Disagree	146 (63)	85 (37)	

(continued)

Table 3. Receipt of Lung Cancer Surgery and Associations With Patient Demographic Characteristics, Clinical Information, and Patient Attitudes (continued)

	No. (%) Patients (N = 386)[a]		*P* Value
	Surgery	No Surgery	
Faith alone cures disease			
Agree	84 (52)	78 (48)	<.001
Disagree	157 (70)	67 (30)	
Prayer will cure cancer			
Agree	114 (57)	86 (43)	.02
Disagree	127 (68)	59 (32)	
Plan to have surgery if worse in 1 y			
Agree	57 (41)	83 (59)	<.001
Disagree	183 (75)	62 (25)	
Want surgery even if chair-bound postoperatively			
Agree	85 (62)	53 (38)	.79
Disagree	156 (63)	92 (37)	
Believe patients receive worse care due to race			
Agree or mildly disagree	128 (58)	92 (42)	.05
Strongly disagree	113 (68)	53 (32)	
	Mean (SD)		
Trust score[b]	80.5 (11.9)	78.3 (13.1)	.09
Communication score[b]	20.1 (3.2)	18.7 (3.1)	<.001
Mental adjustment to cancer[c]			
Anxious or preoccupied	43.3 (18.8)	45.0 (16.3)	.36
Fighting spirit	73.2 (13.9)	71.5 (12.6)	.22
Fatalism	58.2 (15.1)	61.9 (12.5)	.02

Abbreviations: CT, computed tomographic; SF-12, Short Form 12.
[a] Unless otherwise indicated. Patients have been diagnosed with early-stage non–small cell lung cancer.
[b] Based on responses to Primary Care Assessment Survey.
[c] Based on Mental Adjustment to Cancer Scale.

[55%]; *P*=.05). This gap occurred despite the much lower average age for black patients of 64 years compared with 68 years for white patients (*P*<.001).

When the analysis was limited to only the patients who had tissue confirmation, the race-specific surgical rate was 75% for white patients compared with 63% for black patients (*P*=.03), demonstrating a nearly identical gap in treatment when compared with the entire cohort. Of the 145 patients that did not undergo lung cancer surgery, 15 patients (10.3%) declined (9.6% of black patients and 10.8% of white patients; *P*=.90). Of these patients, comorbid illness was reported as the reason for the decision not to have surgery in 29% (n=42). Thirty-nine of the nonsurgical patients (27%) were still being followed up serially and 5 patients (3%) died prior to surgical intervention. No other specific reasons were listed for the remainder of the nonsurgical group. Bivariate results for the entire cohort are summarized in **Table 3** and stratified by race in **Table 4**.

In regression analyses, generalized estimating equations were used to account for clustering by site (and therefore multidisciplinary thoracic oncology program use). Black race was significantly associated with no surgical treatment for early-stage lung cancer (odds ratio [OR], 0.75; 95% confidence interval [CI], 0.58-0.99; absolute risk, 11%). Other variables associated with not undergoing surgical care were age of 73 years or older (OR for highest age quartile, 0.32 [95% CI, 0.20-0.51]; absolute risk, 19%), 2 or more comorbid illnesses (OR, 0.24 [95% CI, 0.08-0.73]; absolute risk, 36%), and religiosity as defined by the belief that faith alone can cure disease (OR, 0.56 [95% CI, 0.39-0.79]; absolute risk, 18%).

Potentially reversible factors associated with omitting cancer surgery included (1) a patient's belief that the lung cancer diagnosis was less than 90% certain (OR, 0.37 [95% CI, 0.14-0.93]; absolute risk, 14%), (2) a feeling that overall quality of life would be worse in 1 year because of lung cancer surgery (OR, 0.27 [95% CI, 0.14-0.50]; absolute risk, 34%), and (3) patients' perception of lower-quality cancer communication manifested by a 5-point decrement on a 25-point communication scale (OR, 0.42 [95% CI, 0.32-0.74]). A factor related to no surgery that might be reversible was a bottom quartile score on the mental component of the SF-12 (OR, 0.51 [95% CI, 0.28-0.91]; absolute risk, 12%). **Table 5** contains a summary of the regression results.

In the models stratified by race, highest age quartile and patients' anticipation of a worse prognosis 1 year after surgery compared with no surgery remained consistently associated with decisions against surgery for both white and black patients. Worse perceptions of communication as documented by responses to the 25-point communication scale and lower certainty in belief of cancer diagnosis also affected both black and white patients (Table 5). Black patients with 2 or more comorbid illnesses had a very low chance of surgery (OR, 0.04 [95% CI, 0.01-0.25]; absolute risk, 49%) while the same situation in white patients was not associated with a limited rate (OR, 0.45 [95% CI, 0.10-2.00]). Surgical rates were also low for black patients when they lacked a regular source of care (42% with no regular care vs 57% with regular care; OR, 0.20 [95% CI, 0.10-0.43]; absolute risk, 15%). Lower income was associated with fewer surgeries for white patients (OR, 0.42 [95% CI, 0.22-0.84]; absolute risk, 14%). This relationship was not seen for blacks (OR, 0.36 [95% CI, 0.11-1.20), but only 17% were in the highest income tertile compared with 41% of whites, so lack of income effect could be a statistical artifact.

COMMENT

In this multisite prospective study of early-stage non–small cell lung can-

cer, we were able to measure medical factors and patient perceptions that were associated with decisions against surgical care and confirm the persistent double-digit treatment gap experienced by black patients and exhibited in administrative data.[5,9,10,12,19] Perceptions of worse communication and less diagnostic certainty affect both white and black patients but a lack of a regular source of care and documentation of comorbid illness are exclusively associated with lower surgical rates for black patients.

Concerning comorbid illness, Battafarano et al[20] reported that among 451 patients who underwent lung resection surgery, average 3-year survival, even for patients who had severe comorbidities, was 70%. Although 3-year survival was lower compared with patients without comorbid illness (86%), it was better than the 10% 3-year survival rate reported for those who did not have surgery.[5,7] Strand et al[21] assessed the prognostic role of the Charlson comorbidity index on 30-day mortality and found that the effect was minimal. Given that formal measurements of patient preferences regarding life with progressive lung cancer are low,[8] and that no absolute contraindications anchored to comorbid illness have been established, the relative independence of surgical intervention to comorbidities seen with white patients is more evidence-based than the negative association seen with black patients.

The reduced rate of cancer surgery for black patients with comorbid illnesses could be explained in several ways. In 1999, Schulman et al[22] reported an increase in physicians' decisions against cardiac catheterization when hypothetical scenarios were connected with the picture of a black patient. Later, Green et al[23] measured 287 physicians' "prowhite and problack" bias using the implicit association test by Greenwald et al[24] and found physicians' decisions against aggressive cardiac care were more common for scenarios with black patients when respondents had a prowhite implicit bias. These results suggest that an over-

Table 4. Receipt of Lung Cancer Surgery for Treatment of Early-Stage Non–Small Cell Cancer by Race (N = 386)

	No. (%) of Black Patients[a]			No. (%) of White Patients[a]		
	Surgery	No Surgery	*P* Value	Surgery	No Surgery	*P* Value
Age, y						
≥73	9 (39)	14 (61)	.09	44 (51)	43 (49)	<.001
<73	53 (59)	37 (41)		135 (73)	51 (27)	
Married						
Yes	29 (55)	24 (45)	.98	131 (68)	62 (32)	.21
No	33 (55)	27 (45)		48 (60)	32 (40)	
Education, y						
1-12	48 (53)	42 (47)	.63	106 (66)	54 (34)	.78
≥13	13 (59)	9 (41)		73 (65)	40 (35)	
Sex						
Male	36 (54)	31 (46)	.77	94 (64)	54 (36)	.44
Female	26 (57)	20 (43)		85 (68)	40 (32)	
Income						
Lowest tertile	31 (53)	27 (47)	.76	37 (55)	30 (45)	.04
Upper 2 tertiles	31 (56)	24 (44)		142 (69)	64 (31)	
Insurance						
Private	18 (55)	15 (45)	.96	95 (74)	34 (26)	.008
Other	44 (55)	36 (45)		84 (58)	60 (42)	
Regular source of health care						
Yes	54 (57)	40 (43)	.22	157 (65)	85 (35)	.50
No	8 (42)	11 (58)		22 (71)	9 (29)	
Comorbidities						
≥2	2 (13)	13 (87)	<.001	14 (39)	22 (61)	.003
<2	60 (62)	37 (38)		165 (70)	71 (30)	
Diagnosis						
Biopsy-confirmed	45 (55)	37 (45)	>.99	114 (65)	61 (35)	.84
CT-defined probable disease	17 (55)	14 (45)		65 (66)	33 (34)	
Hospitalized in last year						
Yes	30 (52)	28 (48)	.49	74 (57)	55 (43)	.007
No	32 (58)	23 (42)		105 (73)	39 (27)	
Score for mental component of SF-12						
Lowest quartile	12 (46)	14 (54)	.31	39 (57)	30 (43)	.07
Upper 3 quartiles	50 (57)	37 (43)		140 (69)	64 (31)	
Score for physical component of SF-12						
Lowest quartile	13 (46)	15 (54)	.30	33 (53)	29 (47)	.02
Upper 3 quartiles	49 (58)	36 (42)		146 (69)	65 (31)	
Belief in diagnosis						
≥90%	25 (60)	17 (40)	.37	102 (72)	39 (28)	.01
<90%	35 (51)	34 (49)		74 (58)	54 (42)	
Physician discusses pros and cons of surgery						
Agree	35 (57)	26 (43)	.56	119 (66)	60 (34)	.74
Disagree	27 (52)	25 (48)		58 (64)	32 (36)	
Believe exposure to air during surgery spreads cancer						
Agree	34 (53)	30 (47)	.67	59 (53)	52 (47)	.001
Disagree	28 (57)	21 (43)		120 (74)	42 (26)	
Family must approve surgery						
Agree	19 (46)	22 (54)	.17	74 (61)	47 (39)	.17
Disagree	43 (60)	29 (40)		105 (69)	47 (31)	
Want surgery even if end up in nursing home						
Agree	21 (53)	19 (48)	.71	74 (64)	41 (36)	.72
Disagree	41 (56)	32 (44)		105 (66)	53 (34)	

(continued)

Table 4. Receipt of Lung Cancer Surgery for Treatment of Early-Stage Non–Small Cell Cancer by Race (N = 386) (continued)

	No. (%) of Black Patients[a]			No. (%) of White Patients[a]		
	Surgery	No Surgery	*P* Value	Surgery	No Surgery	*P* Value
Faith alone cures disease						
Agree	31 (49)	32 (51)	.17	53 (54)	46 (46)	.002
Disagree	31 (62)	19 (38)		126 (72)	48 (28)	
Prayer will cure cancer						
Agree	42 (50)	42 (50)	.08	72 (62)	44 (38)	.30
Disagree	20 (69)	9 (31)		107 (68)	50 (32)	
Plan to have surgery if worse in 1 y						
Agree	18 (38)	29 (62)	.003	39 (42)	54 (58)	<.001
Disagree	44 (67)	22 (33)		139 (78)	40 (22)	
Want surgery even if chair-bound postoperatively						
Agree	20 (50)	20 (50)	.44	65 (66)	33 (34)	.84
Disagree	42 (58)	31 (42)		114 (65)	61 (35)	
Believe patients receive worse care due to race						
Agree or mildly disagree	44 (54)	38 (46)	.67	84 (61)	54 (39)	.10
Strongly disagree	18 (58)	13 (42)		95 (70)	40 (30)	
	Mean (SD)			Mean (SD)		
Trust score[b]	75.6 (13.0)	77.0 (14.0)	.60	82.3 (11.0)	79.1 (12.6)	.03
Communication score[b]	19.7 (3.4)	18.5 (2.9)	.04	20.3 (3.2)	18.9 (3.2)	.002
Mental adjustment to cancer[c]						
Anxious or preoccupied	45.2 (20.3)	44.1 (16.1)	.75	42.6 (18.3)	45.4 (16.5)	.22
Fighting spirit	72.8 (15.3)	72.0 (11.9)	.74	73.4 (13.4)	71.3 (13.0)	.22
Fatalism	62.3 (17.4)	64.4 (13.3)	.48	56.8 (14.0)	60.5 (11.9)	.03

Abbreviations: CT, computed tomographic; SF-12, Short Form 12.
[a] Unless otherwise indicated.
[b] Based on responses to Primary Care Assessment Survey.
[c] Based on Mental Adjustment to Cancer Scale.

whelmingly nonblack physician group could unconsciously use the subjective nature of comorbidity data to formulate different recommendations for white and black patients.

An alternative explanation is that some comorbidities tend to be more severe in black patients than in white patients,[25] and this could have affected patient and/or physician decision making. In our chart audit, we were able to document major comorbidities but did not capture enough severity differences to calculate a formal Charlson comorbidity index. Pulmonary reserve, however, is a major concern for lung resection surgery and we did obtain pulmonary function results for 80% of patients. The mean percentage-predicted forced expiratory volume in the first second of expiration did not differ by race (69.3% for black patients and 69.2% for white patients; $P = .50$) or did the diagnosis of chronic obstructive pulmonary disease (40% in both race groups). While some disease severity differences by race remain possible, to reiterate the work by Battafarano et al,[20] the expected survival decrease would still not approach the poor survival associated with excluding surgery.

McCann et al[12] in 2005 and Farjah et al[19] in 2009 reported a marginally higher refusal rate for surgery by black patients and proposed factors such as cultural beliefs, distrust, and limited access to subspecialty care as driving forces. In contrast, Lathan et al[11] found that physicians' recommendations against surgery substantially explained lower surgical rates even when patients withstood aggressive staging. In our study, we did not detect a higher surgical refusal rate by race. Paradoxically, we found that black patients with higher trust scores received lung cancer surgery less often, suggesting that physicians' surgical recommendations may have been framed in less favorable terms. In the patient-physician relationship, blind trust has been correlated with patient passivity.[26] Black patients tend to be more passive[27]; in cancer decision making, passive patients want the physician to decide.[28] This interpretation is also consistent with the literature on quality of communication and shared decision making that demonstrates limited questioning, less dialogue, and fewer explanations for black patients.[29-32] In addition, black perceptions of physicians as uninterested and less engaging lead to fewer adherences to physician recommendations and inadequate understanding of treatment options.[27] The fact that blacks with comorbidities rarely proceeded to surgery despite being significantly younger suggests that the patient-physician communication between black patients and lung cancer specialists may lack effect.

More than 90% of study patients had health insurance. Despite near universal health insurance, one-fifth of patients lacked a regular source of care and blacks in this predicament received cancer surgery less often than whites. While Mulligan et al[33] postulated that universal access to care can eliminate the ethnic difference in lung cancer survival, our data suggest this equivalency does not entirely exist even with insurance.

Implicit bias, negative perceptions of communication, and lack of a primary care physician likely create obstacles to health equity that are too difficult to overcome without systematic solutions. Remedies for suboptimal rates of cancer surgery and racial differences will be multifaceted and involve communication, systems of care, and transparency. Effective communication in cancer care leads to medically beneficial health outcomes and fulfills "ethical, legal, and humanistic mandates."[34] We found that patients' negative perceptions about the communication process and misperceptions

tions of quality of life 1 year after lung cancer diagnosis were related to lower surgical rates in everyone. These results suggest the need for preoperative discussions that pay close attention to the prognosis for functional and pulmonary recovery after surgery compared with expected cancer progression without intervention.

Proceduralist physicians, when encumbered by time constraints, are unlikely to meet all communication needs. An effective alternative could be a designated cancer educator who is trained in active listening, patient-centered communication, and teach-back methods. This supernavigator could serve as a physician communication extender who addresses unmet needs beyond the limits of clinical visits. The teach-back method has been used to improve care in low health literacy populations[35-37] and could identify misperceptions of process, surgical risk, and long-term prognosis while providing a forum to vent concerns and resolve them. To enhance this effect for black patients, Johnson et al[30] maintain that physicians can engage in patient-centered communication whereby patients are engaged in the medical dialogue. As Williams et al[38] discovered, black patients deem patient-physician communication as effective when it is clear that the physician shows interest in the patient and his or her family on a human level and uses appropriate language.

Because of the subjective interpretation surrounding the use of patients' clinical characteristics in lung surgery decision making suggested by our data and the apparent disadvantage experienced by black patients, systematic standardization and transparency in the process of care is justified. Audit and data feedback have been associated with improved patient outcomes in practice,[39] while a recent study demonstrated that a tracking system combined with race-specific feedback to physicians reduced underuse of adjuvant therapy for breast cancer and narrowed racial differences.[40] Given the consequences of lung cancer surgery decision making and the limited time to reverse course, decisions against surgery should be subject to real-time tracking, be consistently flagged, and systematically readdressed.

The major limitation of this cohort study is that, although it was performed prospectively, cause and effect cannot be established with certainty. However, the results described identify a logical starting point from which investigation of nuances and controlled interventions can be pursued. Additionally, point estimates of many of the significant findings were surrounded by wide 95% CIs. This variation is attributable to small numbers falling into analytic cells in a large logistic regression model for a relatively small study. As in most situations requiring close consideration of psycho-

Table 5. Regression Predictors of Decisions Against Lung Cancer Surgery in Patients With Stage 1 or 2 Non–Small Cell Cancer (N = 386)

Factor	OR (95% CI)[a]		
	Overall	Black Patients (n = 113)	White Patients (n = 273)
Potentially reversible			
Belief that diagnosis is <90% certain	0.37 (0.14-0.93)	0.43 (0.24-0.78)	0.26 (0.07-1.00)
Feeling that overall quality of life would be worse in 1 year after undergoing surgery	0.27 (0.14-0.50)	0.25 (0.08-0.79)	0.25 (0.17-0.37)
Perception of poor cancer communication (score drops 5 of 25 points)	0.42 (0.32-0.74)	0.27 (0.15-0.51)	0.47 (0.24-0.93)
No regular source of health care	0.60 (0.21-1.72)	0.20 (0.10-0.43)	1.30 (0.32-5.30)
Other			
Black race	0.75 (0.57-0.99)		
Increased trust (for each 10-point increase on trust domain of the Primary Care Assessment Survey)	0.84 (0.71-1.00)	0.54 (0.35-0.85)	1.00 (0.76-1.40)
Marital status (no current partner)	1.38 (0.80-2.41)	0.91 (0.36-2.30)	0.61 (0.37-0.99)
Top quartile in age (>73 y)	0.32 (0.20-0.51)	0.48 (0.24-0.96)	0.33 (0.19-0.58)
≥2 Comorbid conditions	0.24 (0.08-0.73)	0.04 (0.01-0.25)	0.45 (0.10-2.00)
Fatalism (10-point increase on mental adjustment to cancer on a 100-point scale)	0.82 (0.74-0.92)	0.86 (0.75-0.98)	0.70 (0.49-0.98)
Bottom quartile of physical component score on Short Form 12	0.71 (0.38-1.33)	1.30 (0.19-11.0)	0.55 (0.32-0.93)
Bottom quartile of mental component score on Short Form 12	0.51 (0.28-0.91)	0.85 (0.09-8.30)	0.55 (0.24-1.23)
Religiosity (determined by agreement with the statement: faith alone can cure disease)	0.56 (0.39-0.79)	0.81 (0.19-3.50)	0.34 (0.21-0.56)
Lowest 2 tertiles of median household income (vs highest tertile, which is >$38 850)	0.45 (0.23-0.88)	0.36 (0.11-1.20)	0.42 (0.22-0.84)

Abbreviations: CI, confidence interval; OR, odds ratio.

[a] Model includes sex, education, insurance (private vs other), biopsy confirmation, hospitalization during the previous year, and agreement or disagreement with the following items: (1) physician discusses pros and cons of surgery, (2) prayer can cure cancer, (3) exposure to air during surgery will cause cancer to spread, (4) family must approve surgery, (5) want surgery even if end up in a nursing home, (6) want surgery even if chair-bound postoperatively, (7) some patients get worse care because of race, and (8) Mental Adjustment to Cancer Scale scores for fighting spirit and anxious or preoccupied.

social context, analyses used to explain omission of lifesaving treatment are complex and imperfect. However, given the long-standing underuse of cancer treatment for blacks, discourse about possible cause and effect must progress and excuses of complexity or imperfection must not preclude the next steps to be taken.

Too many patients miss the opportunity for surgical cure when diagnosed with early-stage non–small cell lung cancer. Within this group, disparities between black and white patients persist in both biopsy-proven and presumptive disease. A decision not to undergo surgery by patients with newly diagnosed lung cancer was independently associated with perceptions of communication and prognosis, older age, multiple comorbidities, and black race. Current consideration of comorbidities and lack of a regular source of health care may be forces that unfairly disadvantage black patients. Interventions to optimize surgery should consider these factors.

Author Contributions: Dr Cykert had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.
Study concept and design: Cykert, Dilworth-Anderson, Corbie-Smith, Edwards, Bunton.
Acquisition of data: Cykert, Monroe, Walker, McGuire, Edwards, Bunton.
Analysis and interpretation of data: Cykert, Dilworth-Anderson, Monroe, Edwards.
Drafting of the manuscript: Cykert, Dilworth-Anderson, Edwards.
Critical revision of the manuscript for important intellectual content: Cykert, Dilworth-Anderson, Monroe, Walker, McGuire, Corbie-Smith, Edwards, Bunton.
Statistical analysis: Cykert, Dilworth-Anderson, Corbie-Smith, Edwards.
Obtained funding: Cykert, Dilworth-Anderson, Bunton.
Administrative, technical, or material support: Cykert, Monroe, Walker, McGuire, Bunton.
Study supervision: Cykert, Bunton.
Financial Disclosures: None reported.
Funding/Support: This project was funded by the American Cancer Society via grant RSGPB-05-217-01-CPPB.
Role of the Sponsor: The American Cancer Society played no role in design or conduct of the study; in collection, management, analysis, and interpretation of the data; and preparation, review, or approval, of the manuscript.
Additional Contributions: We thank the American Cancer Society for its dedication to the elimination of health disparities and their funding of this project. We acknowledge Timothy Carey, MD, MPH (director, Cecil G. Sheps Center for Health Services Research and professor of medicine, University of North Carolina School of Medicine, both in Chapel Hill), for his suggestions throughout the project and thoughtful review of the manuscript. Dr Carey did not receive any compensation for his contribution.

REFERENCES

1. National Cancer Institute. SEER Cancer Statistics Review: 1975-2005. http://seer.cancer.gov/csr/1975_2005/. Accessibility verified May 19, 2010.
2. Youlden DR, Cramb S, Baade P. The International Epidemiology of Lung Cancer. *J Thorac Oncol*. 2008;3(8):819-831.
3. Jemal A, Siegel R, Ward E, et al. Cancer statistics, 2007. *CA Cancer J Clin*. 2007;57(1):43-66.
4. National Cancer Institute. SEER Cancer Statistics Review: 1975-2004. http://seer.cancer.gov/csr/1975_2004/. Accessibility verified May 19, 2010.
5. Bach PB, Cramer LD, Warren JL, Begg CB. Racial differences in the treatment of early-stage lung cancer. *N Engl J Med*. 1999;341(16):1198-1205.
6. Lin AY, Ihde DC. Recent developments in the treatment of lung cancer. *JAMA*. 1992;267(12):1661-1664.
7. Vrdoljak E, Mise K, Sapunar D, et al. Survival analysis of untreated patients with non-small-cell lung cancer. *Chest*. 1994;106(6):1797-1800.
8. Cykert S, Phifer N. Surgical decisions for early stage, non-small cell lung cancer. *Med Decis Making*. 2003;23(2):167-176.
9. Greenwald HP, Polissar NL, Borgatta EF, et al. Social factors, treatment, and survival in early-stage non-small cell lung cancer. *Am J Public Health*. 1998;88(11):1681-1684.
10. Esnaola NF, Gebregziabher M, Knott K, et al. Underuse of surgical resection for localized, non-small cell lung cancer among whites and African Americans in South Carolina. *Ann Thorac Surg*. 2008;86(1):220-226.
11. Lathan CS, Neville BA, Earle CC. The effect of race on invasive staging and surgery in non-small-cell lung cancer. *J Clin Oncol*. 2006;24(3):413-418.
12. McCann J, Artinian V, Duhaime L, et al. Evaluation of the causes for racial disparity in surgical treatment of early stage lung cancer. *Chest*. 2005;128(5):3440-3446.
13. Dewan NA, Shehan CJ, Reeb SD, et al. Likelihood of malignancy in a solitary pulmonary nodule. *Chest*. 1997;112(2):416-422.
14. Edwards FH, Schaefer PS, Callahan S, et al. Bayesian statistical theory in the preoperative diagnosis of pulmonary lesions. *Chest*. 1987;92(5):888-891.
15. Osborne RH, Elsworth GR, Kissane DW, et al. The Mental Adjustment to Cancer (MAC) scale. *Psychol Med*. 1999;29(6):1335-1345.
16. Safran DG, Kosinski M, Tarlov AR, et al. The Primary Care Assessment Survey. *Med Care*. 1998;36(5):728-739.
17. Ware J Jr, Kosinski M, Keller SD. A 12-Item Short-Form Health Survey. *Med Care*. 1996;34(3):220-233.
18. Diggle P, Liang K, Zeger S. *Analysis of Longitudinal Data.* New York, NY: Oxford University Press; 1994.
19. Farjah F, Wood DE, Yanez ND III, et al. Racial disparities among patients with lung cancer who were recommended operative therapy. *Arch Surg*. 2009;144(1):14-18.
20. Battafarano RJ, Piccirillo JF, Meyers BF, et al. Impact of comorbidity on survival after surgical resection in patients with stage I non-small cell lung cancer. *J Thorac Cardiovasc Surg*. 2002;123(2):280-287.
21. Strand TE, Rostad H, Damhuis RA, Norstein J. Risk factors for 30-day mortality after resection of lung cancer and prediction of their magnitude. *Thorax*. 2007;62(11):991-997.
22. Schulman KA, Berlin JA, Harless W, et al. The effect of race and sex on physicians' recommendations for cardiac catheterization. *N Engl J Med*. 1999;340(8):618-626.
23. Green AR, Carney D, Pallin D, et al. Implicit bias among physicians and its prediction of thrombolysis decisions for black and white patients. *J Gen Intern Med*. 2007;22(9):1231-1238.
24. Greenwald AG, McGhee DE, Schwartz JLK. Measuring individual differences in implicit cognition. *J Pers Soc Psychol*. 1998;74(6):1464-1480.
25. McWilliams JM, Meara E, Zaslavsky AM, Ayanian JZ. Differences in control of cardiovascular disease and diabetes by race, ethnicity, and education. *Ann Intern Med*. 2009;150(8):505-515.
26. Kraetschmer N, Sharpe N, Urowitz S, Deber RB. How does trust affect patient preferences for participation in decision-making? *Health Expect*. 2004;7(4):317-326.
27. Gordon HS, Street RL Jr, Sharf BF, Souchek J. Racial differences in doctors' information-giving and patients' participation. *Cancer*. 2006;107(6):1313-1320.
28. Salkeld G, Solomon M, Short L, Butow PN. A matter of trust—patient's views on decision-making in colorectal cancer. *Health Expect*. 2004;7(2):104-114.
29. Clever SL, Ford DE, Rubenstein LV, et al. Primary care patients' involvement in decision-making is associated with improvement in depression. *Med Care*. 2006;44(5):398-405.
30. Johnson RL, Roter D, Powe NR, Cooper LA. Patient race/ethnicity and quality of patient-physician communication during medical visits. *Am J Public Health*. 2004;94(12):2084-2090.
31. King WD, Wong M, Shapiro M, et al. Does racial concordance between HIV-positive patients and their physicians affect the time to receipt of protease inhibitors? *J Gen Intern Med*. 2004;19(11):1146-1153.
32. Torke AM, Corbie-Smith GM, Branch WT Jr. African American patients' perspectives on medical decision making. *Arch Intern Med*. 2004;164(5):525-530.
33. Mulligan CR, Meram AD, Proctor CD, et al. Unlimited access to care. *Cancer Epidemiol Biomarkers Prev*. 2006;15(1):25-31.
34. Baile WF, Aaron J. Patient-physician communication in oncology. *Curr Opin Oncol*. 2005;17(4):331-335.
35. Paasche-Orlow MK, Riekert KA, Bilderback A, et al. Tailored education may reduce health literacy disparities in asthma self-management. *Am J Respir Crit Care Med*. 2005;172(8):980-986.
36. Wilson FL, Baker LM, Nordstrom CK, Legwand C. Using the teach-back and Orem's self-care deficit nursing theory to increase childhood immunization communication among low-income mothers. *Issues Compr Pediatr Nurs*. 2008;31(1):7-22.
37. Yin HS, Dreyer BP, van Schaick L, et al. Randomized controlled trial of a pictogram-based intervention to reduce liquid medication dosing errors and improve adherence among caregivers of young children. *Arch Pediatr Adolesc Med*. 2008;162(9):814-822.
38. Williams SW, Hanson LC, Boyd C, et al. Communication, decision making, and cancer. *J Palliat Med*. 2008;11(9):1221-1226.
39. Jamtvedt G, Young JM, Kristoffersen DT, et al. Audit and feedback. *Cochrane Database Syst Rev*. 2006;(2):CD000259.
40. Bickell NA, Shastri K, Fei K, et al. A tracking and feedback registry to reduce racial disparities in breast cancer care. *J Natl Cancer Inst*. 2008;100(23):1717-1723.

