

Disparities in Socioeconomic Status and Access to
Lung Transplantation in Cystic Fibrosis

Bradley S. Quon

A thesis

submitted in partial fulfillment of the
requirements for the degree of

Master of Science

University of Washington

2012

Committee:

Christopher I. Li

Christopher H. Goss

Program Authorized to Offer Degree:

Epidemiology

University of Washington

Abstract

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Bradley S. Quon

Chair of Supervisory Committee:

Research Professor, Christopher I. Li

Department of Epidemiology

Context: Patients with Medicaid experience persistent health disparities for a wide range of diseases and treatments in the United States compared to those without Medicaid, but disparities with respect to access to lung transplantation for cystic fibrosis (CF) patients are largely unknown.

Objective: To determine whether access to lung transplantation for CF patients with end-stage lung disease differs according to Medicaid status.

Design, Setting and Participants: Observational study of 2,167 adult CF patients with end-stage lung disease who underwent initial lung transplant evaluation

between 2001 to 2009 identified through the United States CF Foundation Patient Registry including 1009 (47%) receiving Medicaid and 1158 (53%) without Medicaid. The main outcome measure was acceptance for lung transplant following evaluation.

Results: 1,349 (62%) of 2,167 adult CF patients who underwent lung transplant evaluation were accepted. In a multivariate logistic model accounting for demographic characteristics, disease severity, potential contraindications to lung transplant, and pre-/post-use of the lung allocation score, Medicaid recipients were 54% [95% confidence interval (CI):25%-88%] more likely to be not accepted for lung transplant compared to patients without Medicaid. This association was independent of other SES indicators including race, education, zip code median household income, and driving time from residence to closest transplant center (OR=1.37, 95% CI:1.10-1.72). Patients not completing high school (OR=2.37, 95% CI:1.49-3.79) and those residing in the lowest (vs. highest) zip code median household income category (OR=1.39, 95% CI:1.01-1.93) were also more likely not to be accepted for lung transplant.

Conclusions: In this nationally representative study of adult CF patients, multiple indicators of a lower socioeconomic position, including receipt of Medicaid, were associated with higher likelihoods of not being accepted for lung transplant. A more complete understanding of what specific aspects of socioeconomic position influence acceptance for lung transplantation is needed in order to ensure more equitable allocation of this treatment.

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List of Abbreviations and Acronyms

aOR: adjusted odds ratio

BMI: body mass index

CF: cystic fibrosis

CFFPR: Cystic Fibrosis Foundation Patient Registry

CI: confidence interval

COPD: chronic obstructive lung disease

FEV₁ % pred: forced expiratory volume in 1 second percent-predicted

FPL: federal poverty level

IPF: idiopathic pulmonary fibrosis

LAS: lung allocation score

SES: socioeconomic status

UNOS: United Network for Organ Sharing

US: United States

Preface

This abstract has been submitted to the 2012 North American Cystic Fibrosis Conference for a poster presentation.

I take full responsibility for the study design, data analysis, and drafting of the manuscript. Kevin Psoter helped conduct the geo-spatial analysis and revised the draft manuscript. Christopher Goss, Christopher Li, Nicole Mayer-Hamblett and Moira Aitken assisted with the study design and helped revise the manuscript for important intellectual content.

The study was conducted with the approval of the University of Washington Human Subjects Division. Given the de-identified nature of the patient data, this study did not meet the federal regulatory definition of “human subjects research” and therefore did not require full IRB review (Determination Form #41146).

Acknowledgements

I am grateful to Christopher Li, Christopher Goss, Kevin Psoter, Nicole Mayer-Hamblett and Moira Aitken for their contributions to this project. I am also indebted to the Cystic Fibrosis Foundation and the Cystic Fibrosis Foundation Patient Registry Committee for providing the CF Foundation Patient Registry Data.

Funding from the University of British Columbia Clinical Investigator Program and the British Columbia Lung Association supported this work.

Introduction

Cystic fibrosis (CF) patients are living longer but most will die prematurely due to progressive respiratory failure. Lung transplantation is a life-saving medical procedure that has been shown to prolong survival and improve quality of life for adult CF patients with end-stage lung disease in observational studies¹⁻⁴. Worldwide, CF remains the third most common indication for lung transplantation and is the most common indication for bilateral lung transplantation⁵.

Low socioeconomic position has been associated with worse health outcomes and increased mortality for CF patients^{6,7}, which are often attributed to barriers in accessing quality health care⁸. Previous studies suggest that access to care for CF patients does not vary appreciably by socioeconomic status. Specifically, those of lower socioeconomic position (as indicated by eligibility for Medicaid) are just as likely to be seen in outpatient specialty clinics, receive recommended chronic therapies, and receive appropriate treatment during acute pulmonary exacerbations^{7,9,10}.

To our knowledge, no previous study has examined insurance type or other indicators of socioeconomic status (SES) as determinants of access to lung transplantation in CF or any other chronic lung disease. Data from the United States CF Foundation Patient Registry provides a unique opportunity to explore this important question. As the majority of end-stage CF patients have medical insurance coverage and are cared for at accredited CF care centers, we hypothesized that

socioeconomic position would not influence access to lung transplantation among CF patients.

Methods

Study population and Data Sources

We utilized annual data from the United States (U.S.) CF Foundation Patient Registry (CFFPR). The CFFPR contains longitudinal individual-level data on patients followed at Cystic Fibrosis Foundation-accredited care centers across the U.S. From 2001 to 2009, the CFFPR captured data on a cohort of over 34,000 unique patients, estimated to represent over 90% of the U.S. CF population. The CFFPR currently collects detailed patient-level data on over 300 unique variables. A transplant evaluation indicator along with a corresponding decision of accept, decline, or defer was first recorded in the CFFPR in 2000. Accepted patients are subsequently placed on the lung transplant waiting list.

We studied adult CF patients 18 years of age and older with at least one annual CFFPR record between January 1, 2001 and December 31, 2009. Patients were potentially eligible for this study if they underwent their first lung transplant evaluation as an adult during this time period (n=2187). The Institutional Review Board at the University of Washington approved this study.

Socioeconomic Status Measures

We used receipt of Medicaid insurance as our primary indicator for low socioeconomic position as this is the most common proxy for low SES in the CF literature^{7,9,10}. Although Medicaid eligibility criteria vary slightly from state to state, it is always linked to family income relative to the federal poverty level. Medicaid status was ascertained at the time of lung transplant evaluation and was categorized

as a binary variable (yes or no) independent of whether the patient had other forms of health insurance. Of the 2,187 patients referred for transplant from 2001 to 2009, nine were identified as not having health insurance and nine did not have an insurance type recorded and were excluded from the analysis. Two additional patients were excluded due to incomplete data on transplant evaluation decision. This resulted in a final analytic sample size of 2,167 patients (**Figure 1**).

We also examined other potential sources of disparities including: 1) race, categorized as white vs. non-white; 2) individual-level educational attainment, categorized as did not complete high school vs. graduated from high school; 3) a neighborhood level indicator of SES based on median household income of patients' residential zip code relative to the 2000 federal poverty level (FPL), categorized as: <200% of FPL, 200-300% of FPL, >300% of FPL, and 4) quartiles of driving time from residence to closest lung transplant center. Race and education data are available from the CFFPR database. Zip code median household income and distance from residence to closest lung transplant center were based on residential zip code obtained from the CFFPR database. Driving time was calculated from the centroid of the patient's home zip code to the geocoded closest adult lung transplant center zip code using ArcGIS 10 software (ESRI Inc, Redlands, California). A total of 59 adult lung transplant centers were deemed active from 2001 to 2009¹¹. Selection of the closest adult lung transplant center was based on driving time alone irrespective of interstate boundaries, potentially shorter travel time by airplane, or patient choice to travel farther to a particular transplant center.

Outcome Measure

Our outcome of interest, acceptance onto the waiting list for lung transplant following initial lung transplant evaluation, was categorized as ‘accepted’ or ‘not accepted’. The ‘not accepted’ group consisted of patients that were either declined or deferred. As initially deferred subjects could have been accepted on repeat evaluation, we performed a sensitivity analysis based on a final evaluation decision of ‘accepted’ or ‘declined’ by the end of cohort follow-up.

Statistical Analyses

Descriptive statistics were produced for and compared between Medicaid vs. non-Medicaid patients at the time of lung transplant evaluation. Continuous variables were evaluated with Students’ t-test and categorical variables with Fisher’s exact test. Unless otherwise specified, covariate values were ascertained in the same year as initial transplant evaluation.

We fit a series of multivariate logistic regression models to examine the association between Medicaid status as the primary SES indicator and the binary outcome of ‘accepted’ or ‘not accepted’ for lung transplant to assess the impact of various potential confounders on our risk estimates. To account for the possible correlated nature of transplant evaluation decisions by transplant center, all regression models included robust variance estimates with transplant center as a cluster (grouping) variable (n=59). Statistical significance was set at $P < 0.05$ and all statistical tests were two-sided. Analyses were performed using STATA 12.0 (StataCorp). We began with a base model (Model 1) that included Medicaid status,

age, sex, and race. Adjustment variables were then introduced as sequential sets of related variables to determine their influence on our primary association of interest. Model 2 added a set of variables related to disease severity to Model 1 including: forced expiratory volume in 1 second percent-predicted (FEV₁ % pred.), number of acute pulmonary exacerbations in the previous year, supplemental oxygen use, non-invasive mechanical ventilation use, body mass index (BMI), and diagnosis of CF-related diabetes requiring insulin. Model 3 was then fitted adding potential contraindications to lung transplant to Model 2 including: *Burkholderia cepacia* culture status, non-tuberculous mycobacteria status, cirrhosis complicated by portal hypertension, renal failure requiring dialysis, osteoporosis, cancer, current smoking, depression, lack of social support, and treatment non-adherence. We used presence or absence of a partner/spouse as a proxy for social support and less than four recommended outpatient visits per year as a proxy for non-adherence. Model 4 then involved the addition of lung transplant period (pre-2005 vs. 2005+), which corresponds to the timing of the lung allocation score (LAS) introduction in 2005, to Model 3. Lastly, in Model 5 we further adjusted Model 4 for other SES indicators (educational attainment, zip code level median household income, and driving time from residence to closest lung transplant center) to determine the independent association between Medicaid status as the primary SES indicator and access to lung transplant. This approach to multivariate model building (Models 1 through 5) was then repeated replacing the primary predictor, Medicaid status, with each of the other four SES indicators: race, educational attainment, zip code level median household income, and driving time from residence to closest lung transplant

center. With respect to effect modification, we evaluated a pre-hypothesized potential interaction between Medicaid status and lung transplant period (pre-2005 vs. 2005+). We hypothesized that if there were a disparity in access by Medicaid status pre-2005, introduction of the LAS would attenuate any such disparity due to more objective criteria for acceptance and wait listing. Post-hoc, we also evaluated the potential interaction between Medicaid status and presence vs. absence of a partner/spouse given the appreciable difference between Medicaid and non-Medicaid patients for this variable in bivariate analysis.

Results

Cohort Characteristics

Of the 2167 patients included in this study, 1009 (47%) were Medicaid recipients and 1158 (53%) did not receive Medicaid. At the time of lung transplant evaluation, patients with Medicaid were significantly younger and more likely to be non-white (**Table 1**). Despite their younger age, Medicaid recipients had more severe disease as reflected by a greater number of acute exacerbations in the previous year, greater requirement for supplemental oxygen and non-invasive mechanical ventilation, lower BMI, and a higher prevalence of CF-related diabetes requiring insulin. Medicaid recipients were also less likely to have a partner as social support and be adherent with recommended outpatient follow-up. Receipt of Medicaid was associated with other indicators of low socioeconomic position including: lack of high school completion, residence in the farthest quartile in terms of driving time from the closest lung transplant center, and belonging to the lowest zip code level median household income category.

Multivariable Analysis

Primary SES Indicator: Medicaid Status

Following adjustment for age, sex and race (Model 1), the odds of not being accepted for lung transplant following initial evaluation was 1.48 (95% CI 1.23-1.78) fold higher for Medicaid recipients compared to patients without Medicaid (**Table 2**). The odds ratio of Model 1 did not change materially following adjustment for underlying differences between Medicaid and non-Medicaid patients with

respect to disease severity (Model 2: Adjusted odds ratio (aOR) 1.52, 95% CI 1.25-1.85), potential contraindications to lung transplant (Model 3: aOR 1.52, 95% CI 1.24-1.86), pre- vs. post use of the LAS (Model 4: aOR 1.54, 95% 1.25-1.88), and other SES indicators (Model 5: aOR 1.37, 95% 1.10-1.72).

Tests for interaction did not provide evidence that introduction of the LAS ($P=0.39$) or presence of a partner/spouse (social support) ($P=0.53$) significantly modified the relation between Medicaid status and not being accepted for lung transplant. In a sensitivity analysis comparing patients that were ultimately accepted to those that were ultimately declined by the end of cohort follow-up, the association between Medicaid and being declined for lung transplant was also similar to the primary analysis (Model 5: aOR 1.62, 95% CI 1.23-2.12).

Additional SES Indicators

Following adjustment for potential confounders (Model 4), individuals that were non-white (aOR 1.51, 95% CI 1.08-2.12), did not complete high school (aOR 2.70, 95% CI 1.70-4.29), resided within a neighborhood with a zip code median household income of less than 200% of the FPL (vs. >300% of the FPL) (aOR 1.69, 95% CI 1.27-2.26) and/or lived greater than 150 minutes away (vs. within 30 minutes) in terms of driving time from the closest lung transplant center (aOR 1.38, 95% CI 1.00-1.90) were associated with not being accepted for lung transplant (**Table 2**). Following additional adjustment for the other SES indicators (Model 5), only individuals that did not complete high school (aOR 2.37, 95% CI 1.49-3.79) or that resided within a zip code with a median household income of less than 200% of

the FPL (vs. >300% of the FPL) (aOR 1.39, 95% CI 1.27-2.26) were independently associated with not being accepted for lung transplant.

Discussion

In contrast to our *a priori* hypothesis, we found that Medicaid recipients were 54% more likely to be not accepted for lung transplant. This key finding was independent of differences in demographic factors, disease severity indicators, potential contraindications to lung transplant, pre/post-use of the lung allocation score, and SES indicators between Medicaid and non-Medicaid patients. To our knowledge, this is the first study to examine disparities with respect to access to lung transplant early in the evaluation process (i.e. prior to lung transplant wait listing). While UNOS oversees organ allocation in the United States and has a mandate to ensure access will not be based on ‘political influence, race, gender, religion, or financial or social status’, this governance is primarily limited to post-wait listing¹². Our study also demonstrates that other indices of low SES, including not graduating from high school and residing in lower income zip codes were independently associated with not being accepted following lung transplant evaluation.

The underlying reasons for disparities in access to lung transplant for CF patients of low SES are likely complex and multifactorial. It is possible that transplant physicians are less likely to accept patients of low SES due to a belief that they are less likely to benefit compared to patients of high SES. This belief is not unfounded as a recent study demonstrated worse post-lung transplant survival for Medicaid compared to privately insured patients, which is believed to be related to differences in reimbursement for medications and access to care¹³. Poor social support and poor compliance with medical regimens represent two key elements of

a lung transplant candidacy evaluation that are difficult to measure. Our findings could be partly explained if CF patients of low socioeconomic position are more likely than those of high socioeconomic position to share these two characteristics. Not graduating from high school was the SES indicator most strongly associated with not being accepted suggesting that educational attainment may influence acceptance beyond its role as a SES indicator. Transplant physicians might be less willing to wait-list patients with inadequate health literacy due to concerns about compliance with prescribed post-transplant treatment regimens, as has been suggested in the renal transplant literature¹⁴. Driving time from residence to closest lung transplant center (by quartile) was not independently associated with not being accepted for lung transplant. This lack of association supports a previous finding from the renal transplant literature, which failed to demonstrate reduced access to kidney transplant for patients residing farther from the nearest transplant center¹⁵.

Our study is subject to a few important limitations. First, we used Medicaid as a proxy for low socioeconomic position. This proxy has been criticized in previous studies¹⁰ as patients with more severe disease are more likely to qualify for Medicaid, as medical expenses are considered when evaluating eligibility¹⁶. While this can be problematic when studying the association between SES and health outcomes, this may not be a significant limitation when studying access to care, particularly when disease severity is accounted for. As there is no single accepted measure for SES¹⁷, we examined four alternate indicators of low socioeconomic position, each of which have inherent limitations. Median household

income by zip code is an ecologic measure and therefore requires relative homogeneity of household income within a geographic region for it to be reliable measure of individual-level SES in non-linear models¹⁸. Therefore, these results should not be interpreted at the individual-level; rather these results should be seen as an area level effect that could represent a larger, multifactorial effect resulting in less access to care. Estimation of distance from residence to closest lung transplant center was also an ecologic measure that required a few assumptions. We assumed that patients chose their transplant center based on proximity alone (e.g. patients did not travel longer to another center of choice) and that co-morbidities (e.g. colonization with *Burkholderia cepacia*) did not influence selection of transplant center. We chose driving time as opposed to road distance as travel times for identical road distance can vary based on highway vs. city vs. rural driving. High school graduation also has limitations, as graduation may be affected by disease severity with more severely diseased patients missing more schooling due to illness.

Our analysis focused on the outcome of the initial lung transplant evaluation, but a potential concern is that approximately one-third of patients were deferred and thus classified as 'not accepted'. Patients who were initially deferred (or not accepted) could have been accepted during repeat evaluation. To evaluate the effect of this classification, we performed a sensitivity analysis comparing patients that were ultimately accepted to those that were ultimately declined for transplant at the end of cohort follow-up. This resulted in a slightly stronger association between low socioeconomic position and reduced access to transplant. We decided to focus on the initial transplant evaluation decision as initial deferral may have untoward

consequences. For example, further investigations, medical optimization, and/or deliberation may lead to critical delays such that these patients might be more likely to die prior to wait listing, thus reducing their opportunity for transplant.

Our study findings are concerning since virtually all end-stage CF patients have health insurance and are followed at an accredited CF care center. Despite this, there was still a strong differential access to lung transplant by SES. The differences observed in CF are likely exaggerated in other pre-lung transplant populations such as chronic obstructive pulmonary disease (COPD) and idiopathic pulmonary fibrosis (IPF) whereby a wider spectrum exists with respect to quality of care and health insurance coverage. It remains unclear as to why CF patients of low socioeconomic position experience differential access to lung transplant but it cannot be explained by underlying differences in disease severity or potential contraindications. It is possible that residual confounding and/or mediation were introduced. For example, we have used lack of a partner/spouse as a crude proxy for poor social support, however this variable does not factor in friends or family that might also provide significant social support. Furthermore, we were unable to account for social habits such as alcohol or other substance abuse that are likely more common among patients of low SES and may also represent contraindications to lung transplant. We believe the overall influence of residual confounding/mediation on our results is likely minimal as we have adjusted for a number of variables with little or no impact on the strength of the association between Medicaid insurance and not being accepted for lung transplant.

In conclusion, we found evidence that acceptance for lung transplantation was lower for CF patients of low socioeconomic position. We in the medical community need to support an urgent call for studies and evaluations to 1) focus on identifying the mechanisms behind this selection process bias in order to improve equitable access to lung transplantation for adult CF patients and 2) investigate whether this differential access to care is present in other populations in which evaluation for lung transplant occurs.

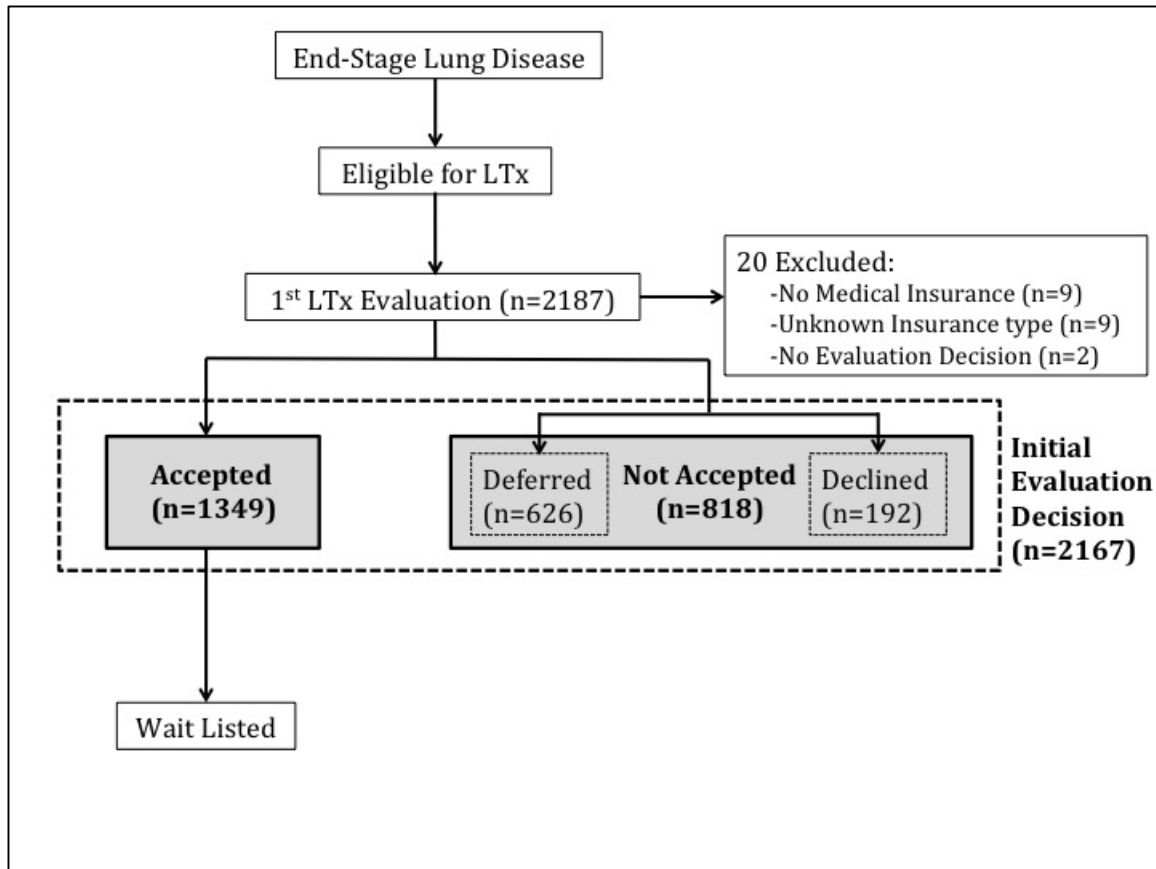


Figure 1. Study Cohort Selection of Adult Cystic Fibrosis Patients undergoing their First Lung Transplant (LTx) Evaluation, 2001-2009

Table 1. Demographic and Clinical Characteristics of Adult Cystic Fibrosis Patients (>= 18 years) undergoing Initial Lung Transplant Evaluation, 2001-2009

	Any Medicaid (n=1009)	No Medicaid (n=1158)	P value ^a
Demographic Characteristics			
Age in years, mean [SD]	28 [8]	32 [10]	<0.001
Male Sex, number [%]	495 [49]	596 [51]	0.26
Non-White Race, number [%]	91 [9]	51 [4]	<0.001
Indicators of Disease Severity			
FEV1 % predicted, mean [SD]	31 [12]	32 [14]	0.13
No. of Acute Exacerbations in past year, mean [SD]	3.5 [2.7]	2.7 [2.4]	<0.001
Supplemental Oxygen use, number [%]	744 [75]	796 [70]	0.01
Non-Invasive Mechanical Ventilation use, number [%]	146 [15]	120 [10]	0.004
Body Mass Index in kg/m ² , mean [SD]	19.4 [3.0]	19.9 [3.1]	<0.001
CFRD on Insulin, number [%]	410 [41]	387 [33]	<0.001
Potential Contraindications to LTx			
<i>B. cepacia</i> culture positive, number [%]	57 [6]	79 [7]	0.25
Non-tuberculous mycobacteria culture positive, number [%]	23 [2]	40 [4]	0.12
Cirrhosis with Portal Hypertension, number [%]	35 [4]	48 [4]	0.44
Renal Failure requiring dialysis, number [%]	15 [1.5]	13 [1.1]	0.45
Osteoporosis, number [%]	145 [15]	140 [12]	0.11
Cancer, number [%]	6 [0.6]	7 [0.6]	1.00
Smoking, number [%]	8 [0.8]	2 [0.2]	0.05
Depression, number [%]	295 [30]	261 [23]	<0.001
No Partner, number [%]	708 [72]	572 [50]	<0.001
< 4 Outpatient Visits in past year, number [%]	192 [19]	234 [20]	0.52
LTx Period			
Evaluated since use of Lung Allocation Score (2005+), number [%]	553 [55]	631 [54]	0.90
Other SES Indicators			
Did Not Complete High School, number [%]	94 [10]	27 [3]	<0.001
Quartile of Driving Time from Residence to Closest LTx Center, number [%]			<0.001
0-25% (< 30 min)	204 [21]	343 [30]	
25-50% (30 - 75 min)	246 [25]	290 [26]	
50-75% (75 - 150 min)	259 [26]	251 [22]	
75-100% (> 150 min)	271 [28]	245 [22]	
Median Household Income by Residence Zip Code relative to FPL, number [%]			<0.001
> 300%	208 [22]	416 [38]	
200-300%	472 [49]	495 [45]	
< 200%	283 [29]	190 [17]	

^aStudents' t-test or Fisher's exact test

Abbreviations: *B. cepacia* = *Burkholderia cepacia*; CFRD = CF-related diabetes; FPL = federal poverty level; LTx = lung transplant

Table 2. Multivariable Logistic Regression Models Evaluating the Odds of Not Being Accepted for Lung Transplant following Initial Evaluation in Adult Cystic Fibrosis Patients from 2001-2009 for each Socioeconomic Status (SES) Indicator

Primary SES Indicator	n	%	Model 1: Base model adjusted for age, sex, and race		Model 2: Model 1 + indicators of disease severity ^a		Model 3: Model 2 + potential LTx contraindications ^c		Model 4: Model 3 + pre- vs. post- use of LAS		Model 5: Model 4 + other SES indicators	
			OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Medicaid Recipient												
No	1158	53	1	[REF]	1	[REF]	1	[REF]	1	[REF]	1	[REF]
Yes	1009	47	1.48	[1.23-1.78]	1.52	[1.25-1.85]	1.52	[1.24-1.86]	1.54	[1.25-1.88]	1.37	[1.10-1.72]
Race												
White	2021	93	1	[REF]	1	[REF]	1	[REF]	1	[REF]	1	[REF]
Non-White	142	7	1.56	[1.14-2.14]	1.62	[1.15-2.27]	1.50	[1.08-2.10]	1.51	[1.08-2.12]	1.23	[0.78-1.93]
Completed High School												
Yes	1837	94	1	[REF]	1	[REF]	1	[REF]	1	[REF]	1	[REF]
No	121	6	2.63	[1.81-3.84]	2.79	[1.84-4.23]	2.68	[1.70-4.24]	2.70	[1.70-4.29]	2.37	[1.49-3.79]
Median Household Income by Residence												
Zip Code relative to FPL												
>300%	624	30	1	[REF]	1	[REF]	1	[REF]	1	[REF]	1	[REF]
200-300%	967	47	1.13	[0.95-1.34]	1.16	[0.96-1.41]	1.20	[0.97-1.48]	1.21	[0.98-1.49]	1.11	[0.89-1.38]
<200%	473	23	1.41	[1.10-1.81]	1.55	[1.17-2.05]	1.66	[1.24-2.22]	1.69	[1.27-2.26]	1.39	[1.01-1.93]
Driving time from residence to closest LTx center, minutes												
<30	547	26	1	[REF]	1	[REF]	1	[REF]	1	[REF]	1	[REF]
30-75	536	25	1.22	[0.92-1.61]	1.20	[0.91-1.57]	1.20	[0.90-1.59]	1.17	[0.88-1.54]	1.08	[0.81-1.42]
75-150	510	24	1.30	[0.99-1.70]	1.25	[0.93-1.67]	1.23	[0.91-1.66]	1.21	[0.90-1.64]	1.05	[0.76-1.45]
>150	516	24	1.43	[1.09-1.88]	1.43	[1.06-1.93]	1.41	[1.02-1.94]	1.38	[1.00-1.90]	1.18	[0.83-1.67]

^aRobust estimates of variance with transplant center as the cluster (grouping) variable

^bIndicators of disease severity: FEV1% predicted, number of acute exacerbations per year, supplemental oxygen use, non-invasive mechanical ventilation use, body mass index, CF-related diabetes

^cPotential LTx contraindications: *Burkholderia cepacia* culture positive, Non-tuberculous mycobacteria positive, cirrhosis with portal hypertension, renal failure requiring dialysis, osteoporosis, cancer, smoker, no partner, non-adherent with outpatient visits

Abbreviations: *B. cepacia* = FPL = federal poverty level; LAS = lung allocation score; LTx = lung transplant; SES = socioeconomic status

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