

## Original Research Reports

# The Psychosocial Assessment of Candidates for Transplantation: A Cohort Study of its Association With Survival Among Lung Transplant Recipients



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**Background:** *The United Network for Organ Sharing mandates a psychosocial assessment of transplant candidates before listing. A quantified measure for determining transplant candidacy is the Psychosocial Assessment of Candidates for Transplant (PACT) scale. This instrument's predictive value for survival has not been rigorously evaluated among lung transplantation recipients. Methods:* We reviewed medical records of all patients who underwent lung transplantation at Mayo Clinic, Rochester from 2000–2012. A transplant psychiatrist had assessed lung transplant candidates for psychosocial risk with the PACT scale. Recipients were divided into high- and low psychosocial risk cohorts using a PACT score cutoff of 2. The main outcome variable was posttransplant survival. Mortality was analyzed using the Kaplan-Meier estimator and Cox proportional hazard models. **Results:** This study

*included 110 lung recipients: 57 (51.8%) were females, 101 (91.8%) Whites, mean age: 56.4 years. Further, 7 (6.4%) recipients received an initial PACT score < 2 (poor or borderline candidates) and later achieved a higher score, allowing transplant listing; 103 (93.6%) received initial scores ≥ 2 (acceptable, good or great candidates). An initial PACT score < 2 was modestly associated with higher mortality (adjusted hazard ratio = 2.73,  $p = 0.04$ ). Conclusions:* Lung transplant recipients who initially received a low score on the PACT scale, reflecting poor or borderline psychosocial candidacy, experienced greater likelihood of mortality. This primary finding suggests that the psychosocial assessment, as measured by the PACT scale, may provide additional mortality risk stratification for lung transplant candidates.

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**Key words:** transplantation, lung, mortality, survival, risk assessment.

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# The Psychosocial Assessment of Candidates for Transplantation

## BACKGROUND

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The psychosocial assessment of transplant candidates is an essential part of the transplant evaluation, required by the United Network for Organ Sharing before transplant listing. Transplants are usually a highly complex procedure with frequent pretransplant and posttransplant medical care and need for rehabilitation. The process necessitates that patients have effective and adaptive coping strategies and social support. Thus, evidence-based psychosocial risk assessments would greatly facilitate the determination of transplant candidacy. Also, 3 validated and widely used instruments for this purpose are the Psychosocial Assessment of Candidates for Transplant (PACT) scale,<sup>1</sup> the Transplant Evaluation Rating Scale (TERS),<sup>2</sup> and the Stanford Integrated Psychosocial Assessment for Transplantation (SIPAT) scale.<sup>3</sup>

There is an emerging medical literature on associations between pretransplant psychosocial factors and outcome measures, including mortality following transplantation. To our knowledge, 4 studies<sup>4-7</sup> have evaluated the association between pretransplant psychosocial risk assessed by the PACT, TERS, or SIPAT, and posttransplant mortality. Further, 2 of these studies<sup>5,6</sup> found an association between the pretransplant psychosocial risk assessment and mortality, both in bone marrow recipients but using different scales (PACT and TERS, respectively). There has been 1 published study<sup>4</sup> in lung recipients, which found no association between PACT score and 1-year posttransplant survival. The predictive value of this instrument on longer-term survival in lung transplant recipients has not been previously evaluated.

In lung recipients, 2 prior studies<sup>8,9</sup> have demonstrated that lower pretransplant memory and executive function and lower pretransplant quality of well-being were associated with greater mortality following transplantation. Studies<sup>8-10</sup> have also examined the effect of pretransplant depressive symptoms on transplant outcome; none of them found an association with survival. However, both pretransplant depression that persists posttransplant<sup>9</sup> and 6-month posttransplant depressive symptoms/emotional distress<sup>11</sup> were associated with mortality following lung transplantation.

At our institution, transplant psychiatrists have been using the PACT scale since 2000 as part of their pretransplant clinical assessment and as a quantified measure to communicate psychosocial risk to the

transplant teams. The PACT is a clinician-rated instrument that assesses 4 domains: social support, psychological health, lifestyle factors (including substance use and compliance with medications), and understanding of transplant and follow-up. A lower score indicates higher psychosocial risk. In this study, our primary aim was to assess for an association between the PACT score, as a measure of psychosocial risk, and survival following lung transplantation. Our main hypothesis was that a PACT score <2 (poor or borderline candidate for listing by psychosocial criteria) at the time of initial Transplant Center psychiatric evaluation was associated with higher posttransplant mortality among lung recipients during a 12-year follow-up period. Secondary aims were to assess for association between the PACT score and postoperative length of stay and the following clinical outcomes during the first posttransplant year: number of readmissions due to any cause, acute graft rejection, smoking relapse, new episode of depression, and antidepressant first-time use.

## METHODS

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### Study Design

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We conducted this historical cohort study in compliance with established ethical standards, and it was approved by the Institutional Review Board of the Mayo Clinic Rochester (Institutional Review Board number: 14-003123). Eligible patients included all those who underwent lung transplantation at the Mayo Clinic Transplant Center, Rochester, MN, between January 1, 2000 and December 31, 2012. Those meeting inclusion criteria were 18 years of age or older, consented to inclusion in retrospective research according to Minnesota law, and completed a psychosocial assessment that included the PACT scale at the time of their Transplant Center initial evaluation. The PACT scale was integrated into the psychiatric evaluation beginning in 2000, although some of the patients assessed during the early 2000s did not receive PACT scores.

We excluded lung recipients who underwent combined heart-lung transplantation or those whose medical record did not include an explicit PACT score (numeric value). A member of the research team (M.J.H.) abstracted the data from the electronic medical record.

### The PACT Scale and Clinical Variables

The PACT is an 8-item clinician-rated semistructured scale that assesses social support, psychologic health, lifestyle factors including substance use and compliance with medications, and understanding of transplant and follow-up. Each item ranges from 0 (worse score) to 4 (best score). The final global assessment is an evaluator's integration of all previous items into one final score: 0, poor candidate; 1, borderline candidate; 2, acceptable candidate; 3, good candidate; and 4, excellent candidate. This integration involves the clinical judgment of the assessor in review of the scale's multiple domains. It is a subjective determination of whether the severity of a single factor (e.g., absence of support system or active addiction) or multiple factors places the patient at high risk. The psychosocial assessment was performed by an American Board of Psychiatry and Neurology certified psychiatrist during a semistructured clinical interview and included information from a transplant center social worker's assessment.

We used the initial pretransplant PACT score to divide patients into 2 groups. The exposed (high psychosocial risk) cohort consisted of those patients with a PACT score initially  $<2$  (poor or borderline candidates). The reference (low psychosocial risk) cohort included those patients with a PACT score of 2 or higher (acceptable, good, or excellent candidates). Transplant candidates with poor or borderline psychosocial risk (PACT score  $<2$ ) at their first evaluation must pursue recommended interventions to improve their psychosocial risk (e.g., achieve smoking cessation, stabilize mood disorder, establish alcohol and drug abstinence in cases of substance use disorders, and strengthen support system) before subsequent visits, to increase their PACT score to an acceptable level of psychosocial risk (PACT  $\geq 2$ ) and proceed to transplant listing. This cutoff is consistent with clinical practice. At the Mayo Clinic Transplant Center, a transplant candidate must have at least an acceptable psychosocial risk to be listed, which means a PACT score  $\geq 2$ .

Other clinical variables included demographic information, pulmonary diagnosis, time awaiting listing (months between initial PACT score and listing), waitlist time (months between listing and transplant), lung allocation score before transplant, single or bilateral lung transplantation, smoking status, alcohol use disorder history, benzodiazepine use at transplant, and depressive disorder and antidepressant use during

the year before transplant. Pulmonary diagnosis was obtained from the clinical evaluation of a Board-certified pulmonologist. Pulmonary diagnoses were grouped within 4 clusters: restrictive lung disease, obstructive lung disease, pulmonary vascular disease, and bronchiectasis (which included cystic fibrosis). Smoking status was divided into 2 categories: previous smoker or never smoker. All lung transplantation candidates must maintain tobacco abstinence for a minimum of 6 months before listing. The pulmonologist and psychiatrist assessed smoking status, alcohol, and drug use histories through clinical interview and with biomarkers (nicotine, cotinine, anabasine, alcohol, and other drug levels by urine and serum surveys). The psychiatrist assessed for symptoms of a depressive disorder during the initial and follow-up monitoring examinations.

### Follow-Up Process and Posttransplant Outcome Measures

Outcome data were retrieved from the electronic medical record following the same procedures for both the exposed (PACT  $< 2$ ) and reference (PACT  $\geq 2$ ) patients. The primary outcome measure was mortality following transplantation, which was assessed until December 31, 2014. All lung transplant recipients received scheduled follow-up care at the transplant center, in-person, or by phone, thus status was constantly updated.

Secondary outcomes included postoperative length of stay and any of the following during the first posttransplant year: number of readmissions because of any cause (any vs none), occurrence of acute graft rejection, smoking relapse, a new episode of a depressive disorder, and antidepressant first-time use. Acute graft rejection was determined from transbronchial biopsies obtained during the first year following transplant and graded by a transplant pathologist according to published guidelines.<sup>12</sup> Smoking relapse during the first year following transplantation was obtained from either transplant team or psychiatrist visits and nicotine/cotinine laboratory testing. Depression and antidepressant use during the first year following transplantation were obtained from psychiatrist visits, first-year discharge summaries, and medication records. A patient with a "new episode of a depressive disorder" or "antidepressant first-time use" was someone who experienced an episode of depression (major depressive episode or depression due to a

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general medical condition) or who started an antidepressant medication during their first year post-transplantation and was without any depressive episode or antidepressant use 1 year before transplant.

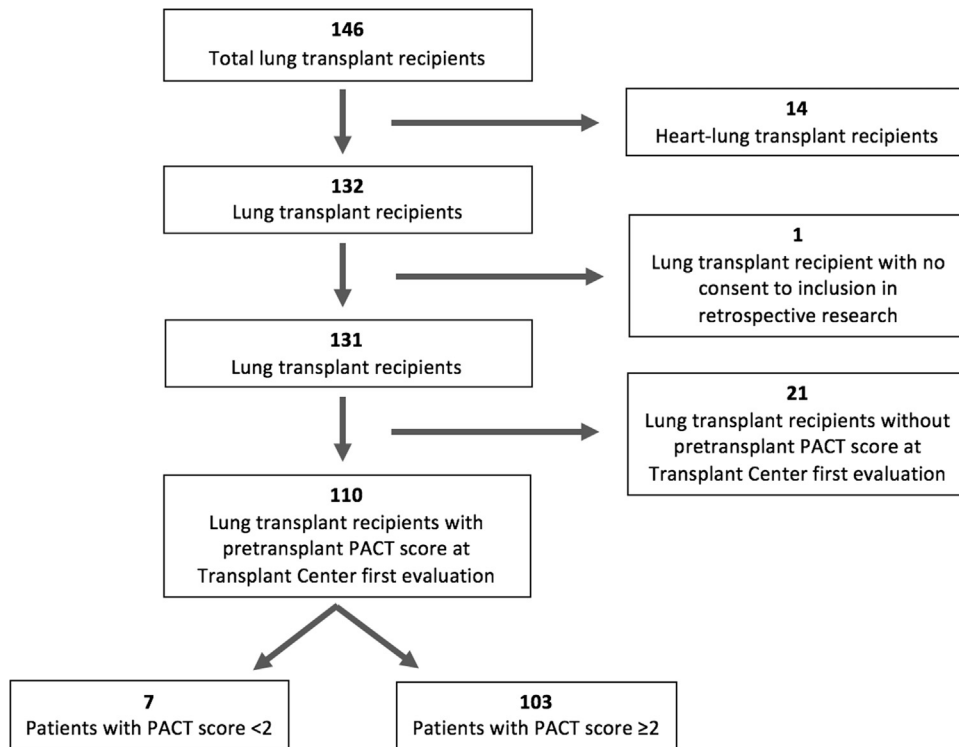
## Statistical Analysis

To address potential selection bias, comparisons of baseline characteristics between patients with an initial PACT score (eligible) vs those without a PACT score (excluded) were performed using Student's *t* test or Wilcoxon Rank Sum test for continuous variables, and Chi-square or Fisher's exact test for categorical variables. We similarly compared baseline demographic and clinical characteristics between the PACT < 2 (exposed) and PACT ≥ 2 (reference) groups.

The relationship of PACT score and the primary outcome (mortality) was analyzed using the Kaplan-Meier estimator and Cox proportional hazard regression. The date of transplant was time 0; data were censored at a date of last follow-up or December 31, 2014, whichever came first. The proportional

hazards assumption of the Cox model was tested using the score test and the natural log of follow-up time. PACT score was analyzed as a dichotomous variable (the primary variable of interest: PACT < 2 vs PACT ≥ 2) and as a categorical variable (PACT < 2, 2.0–2.75, 3.0–3.75, 4.0); the latter was done to assess the legitimacy of the preplanned cutoff of PACT < 2. Having any vs no readmissions due to any cause in the first-year posttransplant was analyzed using a logistic regression. Other binary secondary outcomes such as first-year posttransplant occurrence of acute graft rejection, smoking relapse, new episode of depression, and antidepressant first-time use also were analyzed using logistic regression. Postoperative length of stay was analyzed as a binary variable rather than a continuous variable owing to its skewed distribution. The median length of stay was 12 days, which was used as the cutoff for this binary outcome measure. We included sex and age in every adjusted model based on clinical expertise. All statistical analyses were performed using SAS version 9.3 (Cary, NC) with a *p* < 0.05 as the level for statistical significance.

**FIGURE 1. Sample Attrition Flowchart**



## RESULTS

Of 132 lung transplant recipients over a 12-year timeframe, 21 patients did not receive a PACT score during their Transplant Center initial psychiatric evaluation and 1 patient did not consent for inclusion in retrospective research according to Minnesota law. The final study sample was 110 patients. Lung transplantation recipients with a pretransplant initial PACT score were older than those without a pretransplant PACT score (mean  $\pm$  SD age: 56.4  $\pm$  10.7 vs 50.4  $\pm$  10.7 years,  $p = 0.02$ ), less likely to be married (73% vs 90%,  $p = 0.08$ ), and more likely to be on an antidepressant medication in the year before transplant (38% vs 0%,  $p = 0.0006$ ). A sample attrition flowchart is presented in [Figure 1](#).

The demographic and clinical characteristics of the study sample, total and divided by initial psychosocial risk (PACT score  $< 2$  and  $\geq 2$ ), are shown in [Table 1](#).

Those with PACT  $< 2$  were younger and more likely to have an alcohol use disorder history. They also had a higher prevalence of depressive disorder during the year before transplant. The mean length of stay for those with PACT  $< 2$  and PACT  $\geq 2$  was 24.3 and 15.5 days, respectively. The median follow-up time of the study sample was 3.6 years. A total of 64 patients died during the follow-up interval. The survival rate at 1 and 5 years for those with PACT  $< 2$  was 71% and 29%, respectively. For those with PACT  $\geq 2$ , survival rate at 1 and 5 years was 83% and 55%, respectively.

In a univariate analysis, a PACT score  $< 2$  trended toward higher mortality with a hazard of death ratio over 2-fold higher than those with PACT score  $\geq 2$  (hazard ratio [HR] = 2.29, 95% CI: 0.98–5.37, Wald  $p = 0.0553$ ); a Kaplan-Meier generated survival curve is shown in [Figure 2](#) (log-rank test  $p = 0.0484$ ). After adjustment for sex, age, pulmonary vascular disease, and bilateral lung transplantation, an initial PACT

**TABLE 1. Demographic and Clinical Characteristics of Lung Transplantation Recipients, Total and Divided by Pretransplant Initial PACT Score  $< 2$  and  $\geq 2$  ( $n = 110$ )**

Characteristic	Total sample ( $n = 110$ )	PACT $< 2$ ( $n = 7$ )	PACT $\geq 2$ ( $n = 103$ )	$p$ Value
Females	57 (51.8%)	3 (42.9%)	54 (52.4%)	0.6239*
Age at transplant (years)	56.4 $\pm$ 10.7	48.0 $\pm$ 12.3	56.9 $\pm$ 10.4	0.0143†
Whites	101 (91.8%)	7 (100%)	94 (91.3%)	1.000‡
Married patients	81 (73.0%)	5 (71.4%)	76 (73.1%)	1.000‡
Years of education	13.7 $\pm$ 2.3	12.7 $\pm$ 1.3	13.8 $\pm$ 2.4	0.2412†
Pulmonary diagnosis				0.2491‡
Obstructive lung disease	52 (46.9%)	5 (71.4%)	47 (45.2%)	
Restrictive lung disease	47 (42.3%)	1 (14.3%)	46 (44.2%)	
Pulmonary vascular disease	6 (5.4%)	0 (0%)	6 (5.8%)	
Bronchiectasis	6 (5.4%)	1 (14.3%)	5 (4.8%)	
Time awaiting listing (months)§	1.8 (6.3)	5.1 (6.4)	1.6 (5.6)	0.3995†
Waitlist time (months)¶	6.0 (14.3)	6.0 (19.4)	6.0 (14.5)	0.5887†
Lung allocation score before transplant¶¶	36.6 (10.6)	34.0 (1.7)	37.3 (11.3)	0.1566†
Bilateral lung transplantation	75 (68.2%)	4 (57.1%)	71 (68.9%)	0.6773‡
Former smokers	81 (73.6%)	6 (85.7%)	75 (72.1%)	0.6731‡
Alcohol use disorder history	22 (20.0%)	4 (57.1%)	18 (17.5%)	0.0286‡
Depressive disorder 1 year before transplant	16 (14.6%)	3 (42.9%)	13 (12.6%)	0.0620‡
Antidepressant use 1 year before transplant	42 (38.2%)	4 (57.1%)	38 (36.9%)	0.4242‡
Benzodiazepine use at transplant	20 (18.2%)	2 (28.6%)	18 (17.5%)	0.6087‡
Mortality during transplant hospitalization	9 (8.2%)	1 (14.3%)	8 (7.8%)	0.4595‡

PACT = psychosocial assessment of candidates for transplantation.

Log-rank test  $p$  value = 0.0484.

\* Chi-square test.

† Wilcoxon rank sum test.

‡ Fisher's exact test.

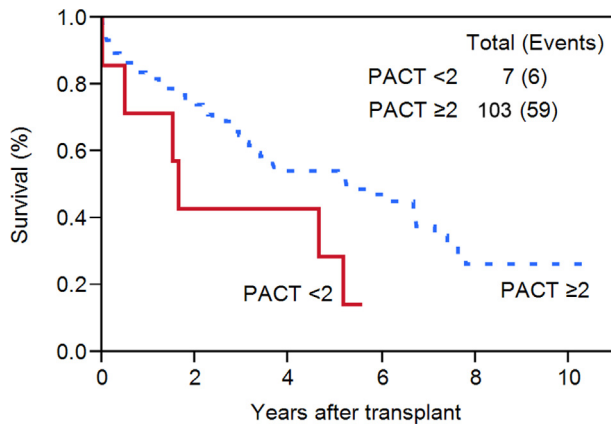
§ Time between initial PACT score and listing, reported as median (IQR).

¶ Time between listing and transplant, reported as median (IQR).

¶¶ PACT  $< 2$ :  $n = 5$ , PACT  $\geq 2$ :  $n = 84$ ; reported as median (IQR). This score is routinely performed since 2005.

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**FIGURE 2. Survival Curve of Lung Transplantation Recipients by Pretransplant Initial PACT Score <2 and ≥2 (n = 110).**



score <2 was significantly associated with higher mortality (adjusted HR = 2.73, 95% CI: 1.07–7.01,  $p = 0.0364$ ) compared with those with PACT score ≥2 (Table 2) in this small cohort of 7 patients.

Among those who survived their first hospitalization, an initial PACT score <2 was not associated with postoperative length of stay more than 12 days (odds ratio [OR] = 2.52,  $p = 0.2985$ ); the likelihood of one or more first year posttransplant readmissions due to any cause (OR = 1.88,  $p = 0.5715$ ); acute graft rejection (OR = 1.82,  $p = 0.5260$ ), new episode of depressive disorder (OR = 0.74,  $p = 0.7833$ ), or antidepressant first-time use (OR = 1.40,  $p = 0.7677$ ).

To assess the association of a high-risk PACT score (PACT cutoff of 2.0 used routinely in Mayo Clinic Transplant Center), we analyzed a possible association between the categorical version of the PACT and mortality. As the highest value of the PACT score (4.0) was hypothesized as being the least

likely to die, we set this as the reference group. In the unadjusted Cox model, a PACT score of 2.0–2.75 and a PACT score of 3.0–3.75 were not significantly (3 degrees of freedom,  $p = 0.2779$ ) or meaningfully different than the PACT = 4.0 (HR = 1.17 and 1.05, respectively, compared to the PACT = 4;  $p > 0.65$  for each); the hazard for patients with PACT < 2 in this model was 2.47 times that of patients with PACT = 4.0 ( $p = 0.08$ ). Adjusting for the non-significant variables of age and sex, the significant variables of type of lung disease (pulmonary vascular disease vs others), and unilateral vs bilateral transplant, a PACT score of 2.0–2.75 and a PACT score of 3.0–3.75 had a nonsignificantly elevated hazard compared to PACT = 4 (HR = 1.44 and 1.31, respectively;  $p > 0.35$  for both); the hazard for patients with PACT < 2 in this model was 3.54 higher than for patients with PACT = 4 ( $p = 0.029$ ).

Only 2 (2.0%) lung transplant recipients had relapsed to smoking at 1-year follow-up: 1 in each group defined by PACT < 2 vs ≥2.

## DISCUSSION

We found in this sample of 110 lung transplant recipients, with 7 who received an initial PACT score <2, that the initial pretransplant psychosocial risk measured by the PACT scale was associated with posttransplant mortality in a multivariate model over 12 years of monitoring. At any time following lung transplant, the risk of death for those with an initial PACT score <2 (higher psychosocial risk) was 2.7 times greater than those with a PACT score ≥2 (lower psychosocial risk) after adjustment for covariates. This is the first study to suggest an association between scorescorea global pretransplant

**TABLE 2. Multivariate Survival Analysis for Lung Transplantation Recipients With Initial PACT Score <2 vs Those With PACT Score ≥2 (n = 110)**

Predictor	HR	95% CI	p Value
PACT < 2	2.733	1.066, 7.007	0.0364
Females	1.487	0.868, 2.547	0.1484
Age at transplant (per 5-year increase)	0.964	0.849, 1.093	0.9838
Pulmonary vascular disease	3.515	1.073, 11.520	0.0379
Bilateral lung transplantation	0.482	0.278, 0.838	0.0097

PACT = psychosocial assessment of candidates for transplantation; HR= hazard ratio.

psychosocial rating scale, specifically the PACT, and mortality after lung transplantation.

Those patients with initially high psychosocial risk (PACT score < 2) had to improve their PACT score to a minimum of 2 to qualify for listing and transplantation (e.g., through completion of smoking cessation, substance use treatment, mood stabilization, and support system strengthening). Despite treatment interventions and patient efforts to reduce risk, the data suggest that the candidates with initial high risk remain vulnerable to a more complicated posttransplant course and higher posttransplantation mortality far below expected posttransplant survival. This finding affirms the need for clinical attention to high-risk patients throughout the transplantation process to provide support and treatment interventions. It also argues for close scrutiny of initially high-risk patients before PACT score advancement and transplant listing. Further study of specific psychosocial domains and their association with mortality may clarify those at greatest risk.

The PACT is one of several structured psychosocial risk scales for evaluation of transplant candidates. The TERS and SIPAT scales are other well-validated options. Presberg *et al.*<sup>13</sup> compared the TERS with the PACT scale. Similarly, Maldonado *et al.*<sup>3</sup> compared the SIPAT with the PACT. Both the TERS and SIPAT scales had comparable interrater reliability and shared similar conceptual items with the PACT scale. The TERS has been associated with mortality only in bone marrow transplant recipients.<sup>5</sup> The PACT scale has been associated with mortality in bone marrow recipients as well,<sup>6</sup> and our study suggests association with mortality in lung transplant recipients. The SIPAT scale has not yet been associated with mortality after solid-organ transplant.<sup>7</sup> The SIPAT scale is the newest psychosocial assessment instrument (published in 2012) explaining the absence of analysis of its predictive value for long-term survival. In a study,<sup>14</sup> the TERS score was associated with increased rejection rates at 1 year and quality of life scores in a combined population of lung, liver, kidney, and heart transplant patients assessed prospectively.

Woodman *et al.*<sup>4</sup> investigated the association between the PACT score and survival among lung recipients and did not find an association. There are several methodological differences between their study and ours, which may explain this discrepancy. Their study included only 30 patients who were followed for

only a year after transplant, and mortality was analyzed as a binary outcome instead of a time-dependent variable. By contrast, Smith *et al.*<sup>9</sup> and Squier *et al.*<sup>8</sup> found an association between specific pretransplant psychosocial factors (executive function and memory performance, and quality of well-being, respectively) and mortality following lung transplantation, which supports our main finding. However, they did not use a structured psychosocial risk scale that accounts for all psychosocial factors.

Several complex and interconnected mechanisms may explain the association between psychosocial variables and medical outcomes in this population. In their review, Dobbels *et al.*<sup>15</sup> identified pretransplant psychosocial and behavioral factors to consider in the assessment of lung transplant candidates: anxiety and depression, personality disorders, neurocognitive problems, lack of social support, noncompliance with medication, alcohol abuse or dependence, smoking, noncompliance with dietary guidelines, and noncompliance with monitoring of vital parameters and infections. All these items are captured in the PACT score, either as a major domain or subitem within a domain. To better understand the domains on the PACT that contributed to the lower PACT score in our patients, we reviewed the medical records of the 7 patients with PACT < 2 (higher psychosocial risk). We found that 6 patients had active smoking, alcohol, or polysubstance abuse/dependence as the reason for their low initial PACT score. In addition, 2 were considered at risk of noncompliance and 1 patient had lack of social support. These concerns do not explain the mechanisms of this association, although they provide some direction for future hypotheses and investigations.

This study has several limitations. First, 16% of the lung transplant recipients were excluded because of omission of an initial PACT score at the time of their first Transplant Center evaluation. Eligible subjects with initial PACT scores were older, less likely to be married, and more likely to be on an antidepressant medication in the year before transplant. This finding suggests that candidates without an initial PACT score were at lower psychosocial risk. We compared our primary outcome (mortality after transplant) between these groups adjusting for age and did not find a significant difference ( $p = 0.2161$ ). Therefore, we view this weakness as having limited effect on our results. Second, there were few patients ( $n = 7$ ) in the exposed

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cohort group (PACT < 2); this raises concerns about how robust are our conclusions were and about the number of variables in the multivariate survival model. Third, the sample is over 90% White, which limits its generalization to non-White populations. Fourth, this study did not include information about those patients with an initial PACT < 2, who never proceeded to listing because of a persistently low PACT score. It is inherently unknown whether they might have managed the transplant process adequately with survival comparable to those with fewer psychosocial risk factors. Fifth, this cohort included a smaller percentage of patients with cystic fibrosis than those observed in some comparable transplant centers. This finding was likely related to 2 clinical factors: our center does not perform pediatric lung transplantation, and our center became a Cystic Fibrosis Center after completion of this data collection. Finally, given our study's retrospective nature, it lacked structured psychiatric follow-up care to detect depression and antidepressant first-time use during the first year following transplant. Therefore, our secondary psychiatric findings must be interpreted with caution.

Further work is encouraged to identify PACT subitems associated with mortality and posttransplant psychosocial outcomes. Foster et al.<sup>6</sup> found that the PACT subscales "social support availability" and

"relevant knowledge and receptiveness to education," but not the final global score, predicted survival after transplant among allogeneic bone marrow recipients. There is no published comparable subanalysis for other transplant populations. Moreover, future studies should investigate the association between pre-transplant psychosocial factors and specific mortality causes. Once the PACT score predictive value is well established, an additional step might be the adaptation of the PACT scale to specific clinical situations. Maltby et al.<sup>16</sup> took this approach in their modification of the PACT scale to improve the predictive value of psychosocial outcomes in left ventricular assist device recipients.

To our knowledge, this is the first study in a lung transplant cohort to suggest an association of a standardized pretransplant psychosocial risk scale on post-transplant mortality. In this clinical sample, a multivariate model demonstrated an association between an initial PACT score < 2 (higher psychosocial risk) and higher mortality after transplant. This finding suggests that the psychosocial assessment, as measured by the PACT scale, may provide additional mortality risk stratification for lung transplant candidates.

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