Socioeconomic Position and Graft Failure in Pediatric Heart Transplant Recipients

Tajinder P. Singh, MD, MSc; Kimberlee Gauvreau, ScD; Heather J. Bastardi, PNP; Elizabeth D. Blume, MD; John E. Mayer, MD

Background—Socioeconomic (SE) position may affect availability of resources, health-related behavior, and outcomes. We assessed whether patient SE position, determined for the block group of patient residence (average population 1000, smallest census unit with SE data), is associated with graft failure in pediatric heart transplant recipients.

Methods and Results—We used the US Census 2000 database to derive a composite SE score for the block group of residence for all patients who underwent their first heart transplant at Children’s Hospital Boston between 1991 and 2005 (n=135). Cox proportional hazards models were used to determine the risk of graft failure (death or retransplant) in the lowest tertile SE group (low SE group) compared with the remaining 2 of 3 patients (controls). The 2 groups were similar with respect to age, gender, diagnosis, and year of transplant. White race was less frequent in low SE group (64% versus 90%, P=0.001). Graft failure occurred in 46 transplant recipients (40 deaths, 6 retransplant). Low SE group (hazard ratio 2.4, 95% CI 1.3 to 4.3) and nonwhite race (hazard ratio 2.7, 95% CI 1.4 to 5.2) were both associated with higher risk of graft failure. In a multivariable model controlling for diagnosis and pretransplant support, race, and low SE position (hazard ratio 2.0, 95% CI 1.0 to 3.7, P=0.04) remained associated with graft failure. Low SE position group had a higher incidence rate of graft rejection and was at a higher risk of late rejection.

Conclusion—Low SE position may be an independent risk factor for graft failure in pediatric heart transplant recipients. (Circ Heart Fail. 2009;2:160-165.)

Key Words: pediatrics ■ transplantation ■ survival ■ follow-up studies ■ risk factors

Several studies have reported association of black race with higher incidence of late rejection and graft failure in recipients of heart and other solid organ transplantation.1–9 This association has often been attributed to differences in biological (genetic and immunologic) factors.3,8,10–12 However, race is also a social construct and is associated with socioeconomic (SE) position through differences in income, wealth, and education between various races. SE position affects availability of resources, may affect an individual’s health-related behavior and may partially explain the race-outcome association after organ transplantation.13,14 Because SE data are not routinely collected for medical records, its association with patient outcomes after transplantation has been difficult to study. Analyses using proxy SE variables for the zip code of patient residence (such as median income or proportion of residents below poverty level) have not shown association of SE position with patient outcome.3,15

Clinical Perspective on p 165

Zip codes have an average population of 30 000 and are administrative units established by the United States Postal Service for the most efficient delivery of mail.16 They do not respect census statistical area boundaries and may have large internal heterogeneity with respect to SE position of its residents. A much smaller unit of population, block group, contains on average 1000 persons, is the smallest geographic census unit for which census SE data are tabulated and is designed to be relatively homogeneous with respect to economic status and living conditions of its residents.16,17 A block group is essentially the neighborhood of a person’s residence. Previous studies using block group SE data have demonstrated associations of low SE position with incident coronary heart disease, cancer and all-cause mortality.16–19

The purpose of this study was to evaluate whether patient SE position, determined by the SE characteristics of the block group of patient residence, is associated with graft failure in pediatric heart transplant recipients.

Methods

This was a single-center retrospective cohort study. All patients who underwent their first heart transplant at Children’s Hospital Boston between January 1, 1991 and December 31, 2005 were eligible. The exclusion criteria were (1) retransplants, and (2) non US-residents (international patients) who came to the United States for heart transplant. The study was approved by the Committee on Clinical Investi-
gations at Children’s Hospital Boston with a waiver of informed consent.

Assessment of SE Position
Each patient’s home address at the time of transplant was used to extract the block group of residence from the US census report 2000. On the basis of a previously described measure of SE position from the SE characteristics of block group of residence, a composite SE score was determined for each transplant recipient—this score was used as the main indicator of the SE position of the patient.15,16 The 6 SE variables selected for the composite score were originally described by Diez Roux et al16 using factor analysis, a statistical technique to determine which variables out of a large set (eg, a large set of Census SE variables) can be meaningfully combined into a composite score.

To determine this score, data on 6 SE variables for each subject’s block group were collected from the US Census web site. Three of these variables represent the dimensions of wealth and income (log of the median household income, log of the median value of housing units, and the percentage of households receiving interest, dividend, or net rental income), 2 represent education (the percentage of adults 25 years of age or older who had completed high school, and the percentage of adults 25 years of age or older who had completed college), and the 6th variable represents occupation (the percentage of employed persons 16 years of age or older in executive, managerial, or professional specialty occupations) of the residents of the block group. For each variable, a z score for each block group was estimated by subtracting the overall mean (across all block groups in the sample) from the value of the variable for that block group and dividing by the standard deviation. The composite SE score for each subject was calculated by summing the 6 z scores (1 for each of the 6 variables) for that subject. Finally, we also collected data on a simple measure of block group SE position, the proportion of individuals living in the block group who were below the federally defined poverty level.19

Data Analysis
Patients were followed until their graft failure (event) or censored on May 31, 2007. The primary outcome variable was time to graft failure (defined as time to death or retransplantation). We also evaluated the association of low SE position with 3 variables related to graft rejection (secondary outcomes): time to first rejection episode, time to first late rejection (defined as a rejection episode more than 1 year after transplant in subjects surviving at least 1 year), and the incidence rate of rejection. A rejection episode was defined as either of the 3: (1) an endomyocardial biopsy showing ISHLT grade 2R (old grade 3A), (2) antibody mediated rejection, or (3) rejection based on clinical or echocardiography findings resulting in acute augmentation of immune suppression.1,2,20

Patients were divided into 2 groups based on their composite SE scores: low SE group (tertile with lowest composite SE scores, n=45) and control group (the remaining patients, n=90). The groups were compared for distribution of demographic and SE variables (of their block groups of residence) using Fisher exact test and Wilcoxon rank sum test, respectively. Kaplan-Meier survival curves (with log-rank test) were used to compare time to graft failure. Multivariable Cox proportional hazard analyses were performed to assess the association of low SE position with the outcome variables of time to graft failure, time to first rejection, and time to first late rejection. Association of early hospital mortality with potential risk factors was evaluated using a logistic regression model. A Poisson regression model was used to assess the association of SE position with incidence rate of rejection.

The authors had full access to and take full responsibility for the integrity of the data. All authors have read and agree to the manuscript as written.

Results

Subjects
One hundred and forty-three patients underwent a heart transplant at our institution between 1990 and 2005. We excluded 8 of these patients from further analysis (3 retransplants and 3 non-US residents; 2 subjects was excluded because there was no home address in medical records for SE data). The remaining 135 patients formed the study cohort. The median age of these subjects was 8.4 years (range 6 days to 23.4 years), 78 (58%) were male, 110 (82%) were white and 25 (18%) were nonwhite (10 black, 8 Hispanic, and 7 other). Sixty-six subjects (49%) had cardiomyopathy as the underlying diagnosis for which cardiac transplantation was performed.

Data on all variables reported in this study (demographic and clinical variables, SE data for block group of residence, and all outcome variables) were complete with no missing data. A comparison of clinical and demographic variables between the low SE group patients and controls is shown in Table 1. The groups were similar with respect to age, gender, diagnosis, year (era) of transplant, and management by extracorporeal membrane oxygenation (ECMO) or ventricular assist device (VAD) before transplant. White race was less frequent in low SE group (64% versus 90%, P=0.001).

Table 1. Comparison of Patient Demographic and Clinical Characteristics by SE Groups

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Low SE Group (N=45)</th>
<th>Control Group (N=90)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age at transplant, y</td>
<td>6.4 (29 d–22.9)</td>
<td>8.9 (6 d–23.4)</td>
</tr>
<tr>
<td>Age at transplant</td>
<td>&lt;1 y</td>
<td>7 (15.6)</td>
</tr>
<tr>
<td></td>
<td>1–10 y</td>
<td>23 (51.1)</td>
</tr>
<tr>
<td></td>
<td>≥11 y</td>
<td>15 (33.3)</td>
</tr>
<tr>
<td>Race/ethnicity</td>
<td>White</td>
<td>29 (64.4)</td>
</tr>
<tr>
<td></td>
<td>Nonwhite</td>
<td>16 (35.6)</td>
</tr>
<tr>
<td>Gender</td>
<td>Male</td>
<td>28 (62.2)</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>17 (37.8)</td>
</tr>
<tr>
<td>Diagnosis</td>
<td>Cardiomyopathy</td>
<td>21 (46.7)</td>
</tr>
<tr>
<td></td>
<td>Congenital heart disease</td>
<td>24 (53.3)</td>
</tr>
<tr>
<td>Transplant era</td>
<td>1990–1995</td>
<td>8 (17.8)</td>
</tr>
<tr>
<td></td>
<td>1996–2000</td>
<td>20 (44.4)</td>
</tr>
<tr>
<td></td>
<td>2001–2005</td>
<td>17 (37.8)</td>
</tr>
<tr>
<td>ECOMO/VAD</td>
<td>14 (31.1)</td>
<td>19 (21.4)</td>
</tr>
<tr>
<td>Graft failure</td>
<td>22 (48.9)</td>
<td>24 (26.7)</td>
</tr>
</tbody>
</table>

Data are expressed as median (range) or n (%).

*P=0.001, †P=0.01. The group differences for other variables were not statistically significant.

SE Characteristics
Table 2 demonstrates the SE characteristics of the block groups of patient residence. As expected, the difference between low SE and control groups was statistically significant for all SE variables (P<0.001 for all comparisons). Patients in low SE group lived in block groups with lower median income, lower median value of housing units, fewer adults who had completed high school or college education, fewer workers in managerial, professional or executive profession and fewer
Table 2. Comparison of Socioeconomic Characteristics Between Groups

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Low SE Group (N=45)</th>
<th>Control Group (N=90)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Composite SE score</td>
<td>-4.7 (−13.4 to −2.7)</td>
<td>2.1 (−2.6 to 12.4)</td>
</tr>
<tr>
<td>Median household income in $</td>
<td>30.4 (12–61)</td>
<td>61.6 (22–125)</td>
</tr>
<tr>
<td>Median value of houses in $</td>
<td>89.2 (28–199)</td>
<td>159.5 (79–486)</td>
</tr>
<tr>
<td>% Households with rental, dividend or interest income</td>
<td>25.8 (8–46)</td>
<td>47.7 (19–79)</td>
</tr>
<tr>
<td>% Residents &gt;25 years with high school graduation</td>
<td>72.7 (26–88)</td>
<td>91.4 (62–100)</td>
</tr>
<tr>
<td>% Residents &gt;25 years with college degree</td>
<td>13.8 (0–25)</td>
<td>31.8 (11–88)</td>
</tr>
<tr>
<td>% Employed as manager, professional or executive</td>
<td>23.8 (5–50)</td>
<td>41.3 (22–81)</td>
</tr>
<tr>
<td>% Individuals below poverty level</td>
<td>15.8 (3–55)</td>
<td>4.1 (0–46)</td>
</tr>
</tbody>
</table>

Data expressed as median (range). For all comparisons, P<0.001.

households that had rental, interest, or dividends as the source of their income. They lived in block groups with significantly higher proportion of individuals living below poverty level (median 15.8% versus 4.1%, P<0.001).

Graft Failure

Graft failure occurred in 46 transplant recipients (40 deaths, 6 retransplant). Graft survival was 87% (95% CI 81 to 92), 82% (CI 74 to 88) and 75% (CI 66 to 81) 1, 3, and 5 years posttransplant for the entire study cohort. Time to graft failure was significantly shorter in low SE group compared with controls (Figure 1, P=0.003, log-rank test). Graft survival was lower in low SE group compared with control group at 1 year (80% versus 91%, P=0.06), 3 years (73% versus 87%, P=0.05) and 5 years (64% versus 80%, P=0.05) posttransplant. In univariate analysis, low SE group (hazard ratio [HR] 2.4, CI 1.3 to 4.3, P=0.003) and nonwhite race (HR 2.7, 95% CI 1.4 to 5.2, P=0.002) were both associated with higher risk of graft failure (Table 3). In a multivariable model, low SE position remained significantly associated with graft failure (HR 2.0, 95% CI 1.0 to 3.7, P=0.04, Table 3) after controlling for diagnosis, pretransplant ECMO/VAD support and nonwhite race (HR 2.3, CI 1.2 to 4.5, P=0.02).

There were 9 early deaths during transplant hospitalization, 6 (13.3%) in low SE group and 3 (3.3%) in the control group. Seven of these 9 patients were supported by ECMO or VAD during the pretransplant period. The cause of early hospital deaths was early graft failure in 6 patients, multiorgan failure in 2 patients and rejection in 1 patient. In unadjusted analysis, early hospital mortality was associated with pretransplant ECMO/VAD support (odds ratio [OR] 13.5, CI 2.6 to 69, P=0.002), age <1 year at transplant (OR 4.3, CI 1.0 to 19.5, P=0.05) and low SE position (OR 4.5, CI 1.1 to 18.8, P=0.04) but not with era, race, or diagnosis of congenital heart disease. After adjusting for ECMO/VAD (OR 12.4, P=0.003), the association of low SE group with early hospital mortality was weaker (OR 3.9, P=0.08).

Among 126 patients who survived to discharge, the total follow-up period was 810 patient-years. The median follow-up period was 6 years (range 0.14 to 17.4 years). Graft failure occurred in 37 of these 126 transplant recipients during follow-up (31 deaths, 6 retransplants). Time to graft failure in hospital survivors was significantly shorter in low SE group compared with controls (Figure 2, P=0.02, log-rank test). The cause of death in these patients was posttransplant graft coronary artery disease in 11, sudden death in 12, acute rejection in 3, acute infection in 3, chronic graft dysfunction in one and posttransplant lymphoproliferative disease in one patient. The indication for retransplantation was posttransplant coronary artery disease in 5 patients and chronic graft dysfunction in 1 patient.

When income and education components of SE position (instead of the composite SE score) were individually related to the outcome variable of graft failure, the association was weaker. When patients from neighborhoods with lowest median household income (lowest tertile) were compared with the remaining patients, the HR for graft failure was 2.0 (CI 1.1 to 3.7, P=0.002). When patients from neighborhoods with the lowest percentage of adults with high school graduation were compared

Figure 1. Kaplan–Meier survival curves comparing time to graft failure in the low SE group versus the control group. The difference in survival between the 2 groups was statistically significant (P=0.003).

Table 3. Univariate and Multivariable Predictors of Graft Failure (Cox Models)

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Univariate HR (95% CI)</th>
<th>P</th>
<th>Multivariable HR (95% CI)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age &lt;1 year</td>
<td>1.9 (0.8, 4.4)</td>
<td>0.13</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>Age 1–10 years</td>
<td>1.1 (0.6, 2.0)</td>
<td>0.85</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>Female gender</td>
<td>1.6 (0.8, 2.9)</td>
<td>0.13</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>Transplant 1990–1995</td>
<td>1.7 (0.7, 4.2)</td>
<td>0.24</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>Transplant 1996–2000</td>
<td>1.5 (0.6, 3.4)</td>
<td>0.38</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>Diagnosis (congenital)</td>
<td>1.7 (1.0, 3.1)</td>
<td>0.07</td>
<td>1.8 (1.0, 3.3)</td>
<td>0.06</td>
</tr>
<tr>
<td>ECMO/VAD</td>
<td>1.7 (0.9, 3.2)</td>
<td>0.11</td>
<td>1.8 (0.9, 3.5)</td>
<td>0.07</td>
</tr>
<tr>
<td>Race (nonwhite)</td>
<td>2.7 (1.4, 5.2)</td>
<td>0.002</td>
<td>2.3 (1.2, 4.5)</td>
<td>0.02</td>
</tr>
<tr>
<td>Low SE group</td>
<td>2.4 (1.3, 4.3)</td>
<td>0.003</td>
<td>2.0 (1.0, 3.7)</td>
<td>0.04</td>
</tr>
</tbody>
</table>

*The model included variables significant at P=0.10.
†Age at transplant with reference group ≥11 years at transplant.
‡Reference group transplants performed during 2001–2005.
with the remaining patients, the HR for graft failure was 2.4 (CI, 1.4 to 4.3, \(P=0.003\)); a similar comparison using college degree resulted in a HR of 1.6 (CI 0.9 to 3.0, \(P=0.10\)). Finally, using proportion of individuals below federally defined poverty level to differentiate low SE from the rest, the HR for graft failure was 1.5 (CI 0.9 to 2.8, \(P=0.15\)).

### Risk of Rejection

A total of 219 rejection episodes were diagnosed in the study cohort (median number of rejection episodes=1, interquartile range 0 to 2). At least 1 rejection episode occurred in 84 of 135 patients (62.2%). Late rejection episodes (rejection episode >1 year after transplant) occurred in 55 (47%) of 118 patients (1-year survivors). All 3 rejection-related outcome variables were associated with earlier years of transplant (heart transplant before 2001) with lower risk of rejection in the most recent era.

Time to first rejection episode was not associated with low SE position or nonwhite race in either univariate or multivariable analysis. Table 4 lists univariate and multivariable predictors of rejection incidence. Rejection episode was shorter in low SE group (HR 1.8, CI 1.0 to 3.2, \(P=0.05\)) after controlling for nonwhite race (HR 0.9, CI 0.4 to 2.0), transplant era, age at transplant, and history of rejection during the first year after transplant. Patients in low SE group (incidence rate ratio 1.4, CI 1.1 to 1.9, \(P=0.02\)) and nonwhites (incidence rate ratio 1.7, CI 1.2 to 2.4, \(P=0.003\)) also had higher incidence rate of rejection in adjusted analysis controlling for era, age at transplant, and gender (Table 4).

### Discussion

The results of our study suggest that low SE position may be an independent risk factor for graft failure in pediatric heart transplant recipients. This may be mediated by a higher early posttransplant mortality and a higher incidence rate of rejection in these patients. A previous study in pediatric heart transplant recipients used median income in the zip code of patient residence as a proxy for patient SE position and did not find association with survival.3 In absence of individual and family level SE data, characterizing SE position of patients based on SE characteristics of their immediate neighborhoods (block groups) is a superior approach.16,19 The results suggest that SE differences may, in part, explain the previously described racial differences in posttransplant outcomes. Possible biological and SE factors that mediate these racial differences in outcomes may relate to pretransplant status, in hospital posttransplant outcomes, and outcomes after discharge. The in-hospital posttransplant outcomes may be highly affected by the pretransplant events, such that patients with low SE status may present later with more severe disease and be more likely to require support with ECMO/VAD and thus have worse in-hospital outcomes. These findings need to be confirmed in a larger, multicenter transplant population with a higher representation of racial/ethnic minorities and make a case for routine collection of patient and area SE variables in transplant registries to better understand their role in patient outcomes. Furthermore, prospective studies designed to study biological and genetic differences between races and relate them to posttransplant outcomes should routinely control for SE position as a potential confounder.

The concept that SE position has biological consequences for health is well recognized. There is extensive evidence from
population studies that SE position is associated with health inequities within all racial/ethnic groups.\textsuperscript{21–23} Furthermore, SE differences between different racial/ethnic groups play a causal role in health outcome disparities (assessed as frequency of low birth weight, life expectancy, and all-cause mortality) across these groups.\textsuperscript{23,24} Because we report neighborhood rather than patient-specific SE data, the results do not provide a mechanistic insight into which patient-specific social and economic factors link the association of low SE position with higher risk of rejection and graft failure. Transplant recipients require life-long immune suppression and several additional medications administered daily according to a defined schedule. They require frequent clinic visits to monitor their immune suppression and graft function. Transplant recipients and their caretakers are well-served by a working knowledge and understanding of their medical condition, of potential complications and by availability of resources that allows them access to medical care at all times. All patients in our study had medical insurance, had access to medical personnel, and availability of medications during their clinical course. The differences in outcomes between the 2 groups may suggest that control group patients were more likely to use these available resources compared to low SE group patients. The association of early hospital mortality with low SE position was likely mediated by variables such as difference in demographics and in hemodynamic support; however, small number of events did not allow a multivariable analysis.

The results of previous studies that analyzed association of SE position with transplant outcomes have not been consistent. In studies where patient-specific variables were used to determine SE position, the results support such an association. When zip code based SE variables are used, however, the association has been absent or weak. For example, Goldfarb-Rumyantzev et al\textsuperscript{25}, analyzing US Renal Data System, reported that renal transplant recipients with college or higher education had longer graft and patient survival independent of their race. Patients with private insurance were also noted to have better outcomes. The association of higher level of patient education or private insurance with better outcome was also described in an analysis of 29,481 liver transplant patients in the United Network of Organ Sharing database.\textsuperscript{26} However, the study did not find any association between median income in zip code of patient residence and graft survival. Finally, Mahle et al analyzed racial differences in outcomes in pediatric heart transplant recipients from United Network of Organ Sharing database and reported that median income in the zip codes of patient residence was significantly lower for black compared to white patients. However, in multivariable analysis, this measure of SE position was not found to be significant as a predictor of graft survival. The negative results in these clinical postransplant cohorts using zip code based SE measures are not surprising. Previous population based studies have shown that even when SE measures obtained from block groups (average population 1000) and census tracts (average population 4000) demonstrate significant relationships with health outcomes (all-cause and cause-specific mortality rates, cancer incidence), zip code measures of SE position for the same population often demonstrated either no gradients for outcomes or those contrary to that observed for block groups and census tracts.\textsuperscript{16}

The findings of this study should be interpreted within the context of the study design and its limitations. First, SE position was defined entirely by the SE characteristics of neighborhood of residence. Some researchers advocate collection of SE data at multiple levels (individual, family and neighborhood levels) to understand their relative contribution to health even though variables are strongly correlated.\textsuperscript{27} We did not have parental/family level data regarding income, education, or occupation available to us. Second, the change in SE position of transplant recipients over time was not assessed. SE position was thus characterized similar to any baseline biological variable.\textsuperscript{19,28,29} Third, because the study population was predominantly white, it is not expected to provide a reliable estimate of the magnitude of confounding effect of SE variables in race-outcome association. A more precise assessment of this estimate will require larger sample size and a higher representation of racial/ethnic minorities. Finally, we cannot conclude from this study that the observed association is causal.

Because low SE position is more common in nonwhite subjects, the relative role of these correlated variables (race and SE position) may be difficult to assess with a small sample size, even with multivariable analysis. In a hypothetical extreme scenario, if all low SE patients were nonwhite, the 2 variables cannot be used together in a multivariable model. A larger sample size would offer 2 potential benefits: adequate representation of racial groups across SE groups and the ability to assess role of SE position with outcomes within racial subgroups. Both of these will help to demonstrate if low SE position is indeed independent from race as a risk factor for graft failure.

If SE position of transplant recipients is confirmed to be a significant confounder in race-outcome association, improving outcomes will require strategies that are quite different from those likely to be effective if race was predominantly a biological construct. Recent focus on reducing racial/ethnic disparities in various medical disciplines has resulted in systematic investigations into several approaches. The potential targets for such interventions are not only patients and their families but also providers and health care organizations.\textsuperscript{30} Multilevel, culturally sensitive interventions that target the mechanisms and causes of differences in outcomes are most likely to be successful.\textsuperscript{31}

In conclusion, this study demonstrates association of low SE position with higher risk of graft failure among pediatric heart transplant recipients. These findings need to be confirmed in larger, multicenter cohorts and in different geographic regions with different racial/ethnic mix. Interventions directed at low SE group patients may improve posttransplant outcomes.

Disclosures

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CLINICAL PERSPECTIVE

The association of race with graft failure in recipients of heart and other solid organ transplantation has often been attributed to differences in biological (genetic and immunologic) factors. However, race is also a social construct and is associated with socioeconomic (SE) position through differences in income, wealth, and education in racial groups. In this study, we assessed whether patient SE position, based on the SE characteristics of the neighborhood of patient residence, is associated with graft failure in pediatric heart transplant recipients. We used the US Census 2000 database to derive a composite SE score for the block group of residence for 135 patients who underwent their first heart transplant at our institution between 1991 and 2005. We compared the risk of graft failure (death or retransplant) in the lowest tertile SE group (low SE group) to the remaining 2 of 3 patients (controls). Graft failure occurred in 46 transplant recipients (40 deaths, 6 retransplant). Low SE patients had a 140% increase in risk and nonwhite patients a 170% increase in risk of graft failure in univariate analysis. In a multivariable model controlling for diagnosis and pretransplant support, race and low SE position remained significant risk factors for graft failure. Low SE position patients also had a higher incidence of graft rejection. These findings indicate the importance of controlling for SE factors in research relating clinical posttransplant outcomes to biological and genetic differences in different racial groups. Multilevel interventions directed at low SE group patients may improve posttransplant outcomes.
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