

Socioeconomic Disparities in Heart Transplantation A Universal Fix?

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Heart transplantation is a definitive therapy for advanced heart failure refractory to standard medical and surgical therapy. Although over 4000 transplants are performed annually worldwide, approximately half of which are performed in the United States, this is not enough to meet the current need of those waiting.¹ Selection of candidates is a comprehensive process to ensure appropriate medical necessity, absence of prohibitive contraindications, as well as adequate social and financial resources to maintain graft longevity and recipient survival.² Socioeconomic deprivation is associated with increased incidence, earlier presentation, and worse survival in an array of cardiovascular diseases, including heart failure.³ Socioeconomic disparities have been demonstrated after heart transplant⁴⁻⁷; however, the impact of these disparities in a universal healthcare system is largely unknown.

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In this issue of *Circulation: Cardiovascular Quality and Outcomes*, Evans et al⁸ address this knowledge gap by assessing the impact of socioeconomic deprivation on outcomes after heart transplantation in a system of universal healthcare in England. Under the auspices of the National Health Service, universal healthcare is free to all residents with small charges for prescribed medications, though patients with long-term conditions or those living in low-income households are exempt. All patients entitled to care under the National Health Service may be referred for heart transplant evaluation regardless of socioeconomic status (SES) or ethnicity, with national consensus guidelines⁹ applied for patient selection. The degree of socioeconomic deprivation was assessed for each recipient by postcode at the time of transplant using the United Kingdom index of multiple deprivation,¹⁰ which assesses (1) income, (2) employment, (3) health and disability, (4) education, skills and training, (5) barriers to housing and services, (6) living environment, and (7) crime. During the study period (1995–2014), 2384 adult recipients underwent heart transplant. One thousand

one hundred and one deaths occurred during 17040 patient-years of follow-up. Median overall survival was 12.6 years with conditional survival (contingent on 1-year survival after transplant) 15.6 years. Comparing the most deprived to the least deprived socioeconomic quintile, adjusted hazard ratios for all-cause mortality were 1.27 (95% confidence interval [CI] 1.04–1.55; $P=0.021$) and 1.59 (95% CI 1.22–2.09, $P=0.001$) in the overall and conditional survival models, respectively. Ultimately, median overall and conditional survival was 3.4 years shorter in the most deprived socioeconomic quintile. Short-term outcomes were not affected because no differences in survival were observed at 30 days and 1 year after transplant.

Prior studies of SES in heart transplantation occurred in healthcare systems without universal health care. In these systems, there is significant variability in access to care and resources provided (ie, medication benefits, ease of referral, access to rehabilitation) and are often contingent on whether insurance is public or private. In a study of 4 heart transplant centers in Boston, the SES of 520 recipients was derived from United States Census data with grouping by quartile. In recipients surviving the transplant hospitalization, nonwhite ethnicity (hazard ratio 1.8, 95% CI 1.1–2.9) and low socioeconomic group (hazard ratio 1.7, 95% CI 1.1–2.5) were associated with a greater risk of subsequent graft loss with and without adjustment. Rejection episodes were also more frequent in nonwhite transplant recipients and in those in the low socioeconomic group.⁴ This observation of more rejection in nonwhites may be due to racial differences in immunosuppression drug metabolism. Blacks may have a different cytochrome p450 system than whites.

The effect of insurance type and education in survival after heart transplantation in the United States was examined using the United Network of Organ Sharing registry. Survival differences were noted by both insurance and education. Recipients with Medicare and Medicaid had 8.6% and 10.0% lower 10-year survival, respectively, than private/self-pay patients. In addition, college-educated patients had 7.0% higher 10-year survival. On multivariable analysis, college education decreased mortality risk by 11%. Medicare and Medicaid increased mortality risk by 18% and 33%, respectively ($P=0.001$). The survival differences observed by insurance type may reflect different levels of access to care, which may in part be a surrogate for SES. The differences by education level may serve as an opportunity for intervention.⁷

Similarly, SES influences outcomes in pediatric heart transplantation.^{5,6} SES was derived using US Census data by zipcode. Long-term risk-adjusted patient survival was worse among low SES (hazard ratio 1.41, 95% CI 1.10–1.80) and mid-SES (hazard ratio 1.29, 95% CI 1.04–1.59) groups. The incidence of non-compliance was higher among low SES patients ($P<0.0001$). Low SES is associated with worse outcomes on both the

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waitlist and late after transplantation. Higher SES patients had more complex transplants with higher early mortality.

The population assessed by Evans et al⁸ is distinct in several ways to that of the previous cohorts because this is a large heart transplant population coupled with close clinical follow-up and universal healthcare. This system would seemingly ensure continued insurance coverage in addition to the elimination of barriers to obtaining post-transplant medications and care. However, higher levels of socioeconomic deprivation, as assessed by United Kingdom index of Multiple Deprivation, were associated with worse long-term survival, despite this healthcare system with these differences persisting after multivariate adjustment. These findings are important and suggest that there are additional barriers beyond access to healthcare and prescription drug coverage that mitigate long-term heart transplant survival in a highly selected population based on programmatic and national criteria. Further study is warranted to identify modifiable risk factors within these profiles to address these disparities in long-term survival. Interestingly, short-term survival (30 days and 1 year) was not different by SES, which may reflect differences in care during the first year versus later years after transplant.

There are limitations to these studies. Most importantly, the use of postal codes as a proxy for individual SES has some inherent weaknesses, such as they may not accurately reflect heterogeneous populations and may change over time. Furthermore, SES may change over time, and the use of SES at the time of transplant may not reflect these subsequently.

Where do we go from here? Socioeconomic factors have significant implications for heart transplantation, with substantial impact on long-term outcomes. Evans et al⁸ clearly show that access to universal healthcare alone does not mitigate the impact of different SESs. Although the magnitude of the effect of low SES is considerable, this alone should not preclude transplantation. Rather, these findings should stimulate efforts to identify factors, both modifiable and fixed, contributing to these worse outcomes. Improving success rather than limiting therapy should be the next step. Reducing inequality in healthcare outcomes may be more complex and challenging than by simply providing access to healthcare.¹¹ Reducing socioeconomic disparities will likely require complex interventions to improve coordination of care within and outside the healthcare system. Although there is growing evidence of strategies to reduce preventable admissions, little is known about reducing socioeconomic inequalities in healthcare outcomes. Potential strategies to improve outcomes of transplant recipients may include an emphasis on understanding patient resources, education, and individualized interventions to help mitigate the risk in this high-risk group. With the life-long follow-up of heart transplant recipients, there are numerous opportunities for further investigation to intervene to improve long-term outcomes of all recipients, regardless of SES.

Disclosures

None.

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