Disparities in Kidney Transplant Outcomes: A Review

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Abstract

Sociocultural and socioeconomic disparities in graft survival, graft function, and patient survival in adult kidney transplant recipients are reviewed. Studies consistently document worse outcomes for black patients, patients with low income, and less education, whereas better outcomes are reported in Hispanic and Asian kidney transplant recipients. However, the distinct roles of racial/ethnic versus socioeconomic factors remain unclear. Attention to potential pathways contributing to disparities has been limited to immunological and nonimmunological factors, for which the mechanisms have yet to be fully illuminated. Interventions to reduce disparities have focused on modifying immunosuppressant regimens. Modifying access to care and health care funding policies for immunosuppressive medication coverage are also discussed. The implementation of culturally sensitive approaches to the care of transplant candidates and recipients is promising. Future research is needed to examine the mechanisms contributing to disparities in graft survival and to ultimately intervene effectively.

Keywords

Kidney transplantation; socioeconomic status; race/ethnicity; disparities; graft survival; patient survival; outcomes

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I. INTRODUCTION

Problem of Disparities in Kidney Transplant Outcomes

Kidney graft loss in the first 10 years following transplantation is a significant problem despite scientific advances in treating acute and chronic rejection. While short-term acute rejection has reached encouraging levels with 1-year survival rates surpassing 91%, long-term graft survival remains much lower.1 Kidney transplantation is the treatment of choice for transplant-eligible patients with end-stage renal disease (ESRD) since it improves life expectancy, reduces morbidity, offers better quality of life,2–3 and is more cost-effective than dialysis.4

The presence of sociocultural and socioeconomic (SES) disparities in transplant outcomes compounds the problem of inadequate long-term graft survival and constitutes a public health problem.5 Health disparities can be defined as “potentially avoidable differences in health (or in health risks that policy can influence) between groups of people who are more or less advantaged socially; these differences systematically place socially disadvantaged groups at further disadvantage on health.”6 The elimination of health disparities is a national healthcare priority.7 8 Disparities in transplant outcomes can threaten public trust in transplantation, and can thereby reduce the public’s willingness to donate organs, which leads to a reduced number of available organs for transplantation.9 The organ shortage exacerbates disparities in access to transplantation and outcomes.10 Therefore, understanding and mitigating disparities and their contributing factors is essential to improve transplant outcomes.

This paper reviews the literature on disparities and factors contributing to sociocultural and socioeconomic disparities in kidney transplant outcomes. We focus on graft survival and patient survival as the key outcome measures in kidney transplantation. We assess available interventions designed to reduce disparities, and propose future research and policy mechanisms aimed to reduce disparities. We conclude by providing clinical practice recommendations.

Our review includes empirical studies and review articles written in English examining socioeconomic disparities in adult kidney transplant outcomes published between 1993–2008. We searched PubMed and Highwire (http://highwire.stanford.edu/) bibliographic databases and used Google Scholar, using the following search terms: kidney transplantation, renal transplantation, ESRD, graft survival, patient survival, graft function, outcomes, disparity(ies), health disparity, socioeconomic, inequity, inequality, racial, ethnic, gender, age, education, income, insurance, finance, cost, international, cross-cultural, geographic. We searched the reference lists of included articles for additional sources. We focus our review on studies conducted in the United States (U.S.) due to unique historical, cultural, economic, and policy contexts occurring in the U.S.

Disparities in Transplant Outcomes

The kidney transplant literature documents extensive sociocultural (racial/ethnic, gender, age, educational); socioeconomic (income, insurance); and geographic disparities in transplant outcomes. Most research concentrates on disparities by ethnic/racial groups, and focuses heavily on comparing non-Hispanic whites to blacks rather than comparing them to Hispanics and Asians or others. A pervasive assumption in the kidney transplant literature on disparities is the putative biological basis of ‘race,’ which has no genetic basis.11 Despite this limitation, our review uses the terms ‘black,’ and ‘white’ recognizing that race is largely a social construct, and that each group overlaps with diverse ethnic backgrounds.

Repeatedly, studies demonstrate worse graft function and shorter graft survival in black kidney transplant recipients12–15 (see Table 1). For example, the half-lives of the transplanted kidney for deceased donor kidneys in black and white recipients are 8 years and 14 years, respectively.
Blacks are also found to have higher rates of chronic allograft nephropathy compared to whites and other ethnic/racial groups. For instance, the mean time to chronic allograft nephropathy was shorter in black recipients than in white patients (18 vs. 37 months), although the incidence of chronic allograft nephropathy was comparable.

Older studies reveal higher rates of graft survival among Hispanics and Asians than among whites, albeit with some inconsistency. While one older study concluded that blacks and Hispanics were independent predictors of graft failure compared to whites, other studies have reported equivalent renal graft survival and mortality rates between Hispanics and whites, and more recent studies demonstrate better patient and graft survival among Hispanics and Asians than whites. Non-black patients experience better patient survival than blacks.

Less research has examined disparities in transplant outcomes by other sociodemographic variables. Worse graft survival has been associated with patients who are male, age over 61, being single (unmarried) patients, have less education, and being unemployed. Worse patient survival has been associated with older age, less education, unemployment, and being female.

Kidney transplant outcomes correlate with income and insurance coverage. Graft survival is lower in patients with: lower income, less insurance coverage, or Medicare or Medicaid versus private insurance. Recent research found that the duration of Medicare’s coverage of immunosuppression affects graft survival differently by income level. Yet income-related disparities in graft survival were eliminated among patients who received lifetime Medicare coverage based on age >65 years or disability.

Because race/ethnicity and SES are interrelated, it is difficult to determine their individual effects on graft survival. This has yet to be empirically determined. When controlling for SES, race/ethnicity remains a significant factor affecting graft survival. Race and ethnicity clearly affect outcomes for blacks, however, outcomes by race/ethnicity can differ by SES. In contrast, when controlling for race/ethnicity, SES appears to be a more prominent factor affecting graft outcome.

Disparities in transplant outcomes also occur by geography. Specifically, a lower incidence of graft survival was found among kidney recipients living in the poorest compared to the richest areas, and living further from the closest transplant center, however, no significant difference in graft survival was found between rural and urban residents.

II. MECHANISMS CONTRIBUTING TO DISPARITIES

The causes of sociocultural and socioeconomic disparities in graft survival remain unclear. Relatively little research has focused on understanding the factors contributing to disparities and on reducing disparities in transplant outcomes. The mechanisms contributing to sociocultural and sociodemographic disparities in graft outcomes are likely multifactorial, and can be categorized into two groups: immunological factors and non-immunological factors. While immunological factors seem to play a greater role in early graft loss, nonimmunological factors seem to be more important in the development of allograft loss after 1 year.

Immunological Risk Factors

Racial differences in transplant outcomes have been attributed to biological, immune, genetic, metabolic and pharmacologic factors. Most of these biological reasons have been described in blacks and few focus on Hispanics. Higher immunological risk factors for blacks have been explained by greater variation in human leukocyte antigen polymorphisms, stronger
immune response, requiring higher doses of immunosuppression, and different pharmacokinetics (absorption) of immunosuppressive drugs. In Hispanic patients, 1-year graft survival was not affected by broad sensitization compared with blacks. Additionally, it appears that Hispanics and Asians require less immunosuppression than whites.

Non-immunological Risk Factors

Nonimmunologic factors identified to date include comorbidities, time on dialysis, donor characteristics, organ characteristics, socioeconomic status, medication adherence, access to care and health policies. Racial/ethnic groups have more comorbidities than whites; and patients with comorbidities have an increased risk for all-cause mortality. Compared to whites, blacks, Hispanics, and other ethnic/racial groups experience greater delays in referral to transplant centers, longer waiting times for transplantation, longer time on dialysis prior to transplantation, less frequent preemptive transplants, and are less likely to be transplanted. All of these factors are associated with adverse transplant outcomes.

With regard to donor characteristics, studies suggest that male recipients of male donor kidneys have better graft survival, and kidney recipients of black deceased donors have worse graft survival.

With regard to organ characteristics, blacks receive proportionately more deceased versus live donor kidneys, and more expanded criteria donor than standard criteria donor kidneys; both factors are associated with worse graft survival.

Blacks and Hispanics have been reported to be less adherent than whites which is associated with lower graft survival. Yet other studies could not demonstrate this relationship after controlling for SES. As the data are limited, the relationship between race, SES, adherence, and graft survival remains inconclusive.

Health policies on financing immunosuppression also serve as a mechanism contributing to disparities in graft survival in the U.S. and abroad, but they are minimally examined. Woodward’s studies documented the disproportionately beneficial impact on low income groups of extending Medicare’s coverage from 1 to 3 years in the U.S. Yen and colleagues estimated that lifetime immunosuppressant coverage would improve graft survival in the fourth year post-transplant.

Health policies relating to the financing of transplantation vary by country. A comparative study of healthcare systems and kidney transplant outcomes found that industrialized nations differ in the percentage of patients with functioning renal transplants according to the type of healthcare system. Developing countries have especially poor outcomes compared to developed countries due to: 1) low priority placed on renal replacement therapy in two-tiered healthcare systems, 2) shortages of nephrologists and transplant centers, 3) absence of state-funded programs for renal replacement therapy or health insurance, 4) discontinuing immunosuppression due to high costs, 5) absence of cadaveric donation programs, 6) lax selection criteria for recipients and donors, high rates of infection, and cardiovascular complications, and 8) lack of a national organized organ sharing network due to poor infrastructure.

III. INTERVENTIONS TO REDUCE DISPARITIES

Interventions

Inadequate attention has focused on reducing disparities in transplant outcomes. One intervention devised to reduce racial/ethnic disparities in transplant outcomes is to modify

Semin Nephrol. Author manuscript; available in PMC 2011 January 1.
immunosuppression regimens for different racial groups. Close monitoring of the cyclosporine levels can narrow the disparity gap for blacks. However, it is unknown if adequate immunosuppression levels affect racial outcomes long-term.

Another intervention entails implementing a culturally sensitive approach through a comprehensive transplant program. Providing care that considers patients’ and families’ cultural beliefs, values, and social context is associated with a reduction in disparities in outcomes among Hispanics.

In an effort to reduce global disparities in transplantation, the Transplant Society established the Global Alliance for Transplantation in 2002, and instituted three programs. The programs entail collecting global information, education, and developing professional guidelines for organ donation and transplantation. The effects of these programs have yet to be assessed, however, promoting professional guidelines for transplantation is likely to improve outcomes. In addition, policy efforts to remove financial disincentives for donation may reduce disparities particularly among ethnic/racial groups.

Several factors may contribute to the paucity of interventions. First, the underlying mechanisms driving the disparities remain unclear. Second, the measurement of racial/ethnic groups remains difficult because race and ethnicity are commonly erroneously conflated in the transplant literature and refer to putatively biological or cultural concepts, respectively. Third, recruiting a sufficiently large cohort of patients from diverse ethnic/racial backgrounds can be challenging due to their relatively smaller representation in the general public, albeit larger representation in the ESRD population. Fourth, interventions would need to address the difficulties in accessing and utilizing the healthcare system relating to language barriers, low rates of medical insurance coverage, low incomes, and limited knowledge of health services. Such interventions require a multi-level approach, i.e., recognizing cultural differences and tailoring patient care to the needs of individual patients, which has not been done in a systematic way.

Future research

Future research on disparities in transplant outcomes should be guided by the Agency for Healthcare Research and Quality’s broader conceptualization of disparities, which accounts for population-based and health services-based factors as determinants of health disparities. Population-based determinants include: health literacy, perceived racial discrimination, residential segregation, and acculturation. Health services-based determinants include: health beliefs, preferences, and behaviors. This conceptualization will enable the analysis of a broader array of factors that have been shown to contribute to disparities in other conditions.

We propose future research on four domains: patient populations, mechanisms of disparities, measurement tools, and interventions to reduce disparities. As existing research on disparities in graft outcomes has primarily focused on blacks, little is known about graft survival rates for other ethnic/racial groups. Because of the increase in prevalence in ESRD among Hispanics and other racial/ethnic groups, future research is needed to examine how other groups fare. Additionally, within-group comparisons are needed to assess how cultural factors bear upon outcomes.

We propose future research into the mechanisms of disparities, including health literacy, geographic differences (residential segregation), and perceived discrimination in access to transplantation. Research showing disparities in kidney recipients’ health literacy levels, which were related to creatinine levels, suggests the need for better education about transplant self-care, the benefits of transplantation versus dialysis, and the process of gaining access to transplantation.
We also propose the development of new instruments to measure different mechanisms in the kidney transplant population. Recommendations include: designing health literacy instruments specifically for kidney recipients, examining in-depth biological mechanisms contributing to disparities, and understanding the effect of environment, education, poverty, and lifestyle choices.

We propose three clinical and organizational interventions that may improve graft function or survival and ameliorate disparities through different social levels. At the micro-level, we recommend devising culturally competent educational programs to enhance medication adherence, increase organ donation, and increase social support for kidney recipients. At the clinical practice level, we recommend that transplant programs provide patients with assistance in finding employment, which has been shown to be cost-effective; and enlist clinical pharmacists to provide counseling to patients about medication therapy to enhance adherence.

At the meso-level, we advocate for research investigating how the Chronic Care Model of chronic illness management may affect transplant outcomes. The Chronic Care Model is known to improve patient outcomes for other chronic illnesses and contain costs. Greater attention to quality care indicators in transplantation may benefit all patients. Lastly, at the macro-level, we recommend extending Medicare’s coverage of immunosuppressants for the life of the kidney transplant.

IV. CONCLUSION

Although considerable research has identified disparities in transplant outcomes, more research is needed to better understand the range of factors contributing to disparities, the underlying mechanisms, and to devise interventions to reduce disparities. In particular, the independent and interactional roles of socioeconomic status and racial/ethnic background in graft survival remain largely unclear and merit further investigation. Further research is needed to assess the independent role of the immunological and nonimmunological factors in multivariate analyses.

Acknowledgments

Dr. Gordon is supported by a Career Development Award from the National Institute of Diabetes and Digestive and Kidney Diseases, Bethesda, MD (DK063953). We thank Vadim Lyuksemburg for his research assistance.

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Table 1

Adjusted Kidney Graft Survival Rates (%) by Ethnicity and Race at 1-year, 3-years, and 5-years, from Deceased non-Expanded Criteria Donors (DD non-ECD), Deceased Expanded Criteria Donors (DD ECD), and Living Donors (LD)\textsuperscript{28}

<table>
<thead>
<tr>
<th></th>
<th>1-Year</th>
<th>3-Years</th>
<th>5-Years</th>
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<tr>
<td></td>
<td>DD</td>
<td>DD</td>
<td>LD</td>
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<tr>
<td></td>
<td>non-ECD</td>
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<tr>
<td>Hispanic</td>
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<tr>
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<td>Black</td>
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### Table x
Risk Factors for Worse Graft Function by Type of Disparities

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<th>Sociocultural</th>
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<th>Geographic</th>
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<td>Living in Poor Areas</td>
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<td>Male</td>
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<td>Older Age</td>
<td>Medicare or Medicaid</td>
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<td>Low Socioeconomic Status</td>
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<tr>
<td>Less Education</td>
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### Table Y
Mechanisms Contributing to Disparities

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<th>Immunological Factors</th>
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<td>Organ characteristics</td>
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<td>Recipient characteristics</td>
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<tr>
<td>Socioeconomic status</td>
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<tr>
<td>Access to care</td>
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<td>Health policy regarding financing transplantation</td>
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