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ADDRESSING DISPARITIES IN KIDNEY TRANSPLANT OUTCOMES: INSIGHTS FROM LUPUS NEPHRITIS PATIENTS

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	the demographic groups in this study. Physicians should be aware of these discrepancies in order to identify patients with higher risk. Further exploration is necessary to identify additional gaps in care and to improve the equity of kidney transplantation across racial, ethnic and sex groups.

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ABSTRACT

Introduction:
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Methods:
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Blacks had the highest graft failure rate, Asians had the lowest graft failure rate ($p<.001$). Whites had the highest mortality at 11.67% (N=173), Asians had the lowest mortality at 5.1% (N=27). Females had a lower graft failure rate at 18.25 (N=943) than males at 20.97% (N=241). Recipients from a deceased donor exhibited a higher mortality of 10.66% (N=441), than recipients from a living donor at 6.97% (N=152).

Conclusions:
Significant discrepancies in both graft failure and mortality exist across the demographic groups in this study. Physicians should be aware of these discrepancies in order to identify patients with higher risk. Further exploration is necessary to identify additional gaps in care and to improve the equity of kidney transplantation across racial, ethnic and sex groups.

Abbreviations:

LN: lupus nephritis
ESRD: end-stage renal disease
NHW: non-Hispanic whites
SLE: systemic lupus erythematosus
SES: socioeconomic status
GFR: glomerular filtration rate
KM: Kaplan-Meier
BMI: body mass index
cPRA: calculated panel reactive antibody
KDPI: kidney donor profile index
DCD: donors with cardiac death
ECD: expanded criteria donors
CIT: cold ischemic time

INTRODUCTION

Systemic lupus erythematosus (SLE) is a complex and severe rheumatic disease with diverse clinical manifestations and significant morbidity. Up to 50% percent of SLE patients will develop lupus nephritis (LN) which can lead to nephrotic syndrome, nephritic syndrome, end-stage renal disease (ESRD) and subsequent renal transplant. In patients with SLE, 25% to 50% will have evidence of LN at the time of diagnosis, and the overall prevalence of LN in SLE patients increases throughout the disease course.[1] LN disproportionately affects children and adults living in poor geographic areas despite adjustment for age, sex and race/ethnicity.[2,3,4] LN is associated with a greater risk of mortality following kidney transplantation compared to diabetic nephropathy, autosomal dominant polycystic kidney disease, chronic glomerulonephritis and other causes of ESRD. LN patient graft failure rates were comparable to other causes of ESRD. Overall outcomes for LN kidney transplantation are favorable with a reported 95% 5-year patient survival rate and a 93% kidney survival rate.[5]

The preferred treatment for ESRD is renal transplant. Renal transplant is associated with less overall mortality and improved quality of life compared to long-term hemodialysis.[6] Access to treatment is impacted by race and socioeconomic status (SES). The average number of American College of Rheumatology member physicians per state is inversely associated with the prevalence of both SLE and LN. This suggests underdiagnosis and undertreatment of both conditions in these states and likely contributes to poorer outcomes. Despite higher rates of ESRD, Blacks have longer times on transplant waiting lists and have a higher incidence of diabetes after transplant. Low SES minorities are more likely to receive care from doctors who are less knowledgeable in specialized areas including organ transplantation.[7,8,9] Patient-related issues include lack of psychosocial support, misconception about the risk to recipients and donors, mistrust about equity in the organ-allocation process, inadequate insurance or low SES and increased medical comorbidities in minority populations. Neighborhoods with lower SES and poor healthcare have significantly reduced opportunities for living donor kidney transplantation. In particular, black candidates have median lower rates of living donor kidney transplantation when compared to whites.[10]

LN occurs almost twice as frequently in Blacks (62%) as in whites (32%) and the prognosis in Black individuals is significantly worse.[3,4,11] Progression to ESRD in Blacks is almost nine times greater than in non-Hispanic whites (NHW). Additionally, Hispanics are commonly impacted by LN. One registry detected LN in 54% of Hispanic women compared to 25% in NHW women.[8] Although lupus predominantly affects adult women, boys and non-white children more commonly experience LN. Black transplant recipients with LN have a greater risk of mortality and graft failure and greater association with lower SES when compared to Black transplant recipients without LN. Black ethnicity was also independently related to the rate of recurrent LN after transplant. Yet, when accounting for factors such as socio-demographic characteristics and immunological disparities between Blacks and NHWs, differences of rates of graft failure and mortality are insignificant.[12]

The incidence of ESRD is greater amongst men than women although chronic kidney disease is more prevalent in women.[13] Males with LN have greater disease severity, including accelerated clinical progression to diagnosis, renal injury and failure.[14] Women are less likely to be recipients of living donor kidneys, but more likely to be donors. Women also have longer wait times on the transplant donor lists than men. However, women are less likely to be waitlisted for kidney transplantation.[15] Broad variability exists in the decision-making process to refer a patient for kidney transplant, but there is no significant difference in likelihood of referral based on candidate sex.[16] Outcome discrepancies between males and females after kidney transplants for LN is understudied.

We aimed to investigate and identify the factors contributing to the disproportionate outcomes of LN in kidney transplant patients.

MATERIALS AND METHODS:

Data and Data Sources

A retrospective analysis was performed employing the UNOS database between January 1, 2010 and June 30, 2022. Transplant recipients who had a systemic lupus erythematosus or lupus as the primary diagnosis (N=6,317) were extracted. Individuals aged 17 or below or had multiple-organ transplants were excluded.

Population and Variables

Outcomes including graft failure and mortality with a diagnosis of lupus were assessed by sex and age. There were 5,168 females and 1,149 males. Ethnic subgroups were comprised of 1,483 white, 2,687 Black, 1,501 Hispanic, 529 Asian, and 117 others. Different recipient characteristics included age, days on waitlist, retransplant recipient, diabetes status, dialysis status, glomerular filtration rate (GFR), BMI, and calculated panel reactive antibody (cPRA) at the time of transplant. For donor characteristics, we queried age, sex, ethnicity, BMI, creatinine, history of hypertension, and measures for organ quality including Kidney Donor Profile Index (KDPI), kidneys from the donors with cardiac death (DCD) and expanded criteria donors (ECD). Additional transplant-related variables, such as HLA mismatch level as well as cold ischemic time (CIT) and organ sharing status were also included.

Statistical Analysis

The basic patient, donor and transplant characteristics were compared by sex and by recipient ethnicity using t-/Wilcoxon-Mann-Whitney and Chi-sq/Fishers exact tests, depending on the sample size and the distribution of the variables included. Patient and graft survival rates (at 3-, 6-month, and 1-, 3- and 5- year post-transplant) were analyzed. Survival curves and the estimates for outcomes were obtained using the Kaplan-Meier (KM) Product Limit method. In the survival analysis of outcomes, death and graft failure were the endpoints. Recipients who did not

experience any of the endpoints or whose life and graft status was unknown were censored on the last follow-up or the last day of the analysis. Multivariate Cox regression analyses were performed for clinically suspected risk factors. The potential risk factors explored are recipient and donor demographics, clinical factors, donor characteristics linked to organ quality including KPDI and additional donor characteristics that are not part of the KPDI calculation, and transplant related variables. Statistical significance was defined by $p<0.05$.

RESULTS

Tables 1 and 2 summarize the results of the descriptive analyses comparing patient, donor and transplant characteristics across sex and race groups respectively. Table 1 indicates that female lupus patients were more likely to be Black (43% vs. 38%, p=0.002) and less likely to be White (22% vs. 29%, p<0.001). Females also had a higher cPRA (30 vs. 17, p<0.001) on average, were more likely to receive kidneys that were nationally shared (11% vs. 9%, p=0.012), with a longer cold ischemic time (13 vs. 11, p=0.013), and from Black donors (16% vs. 13%, p=0.009). They were less likely to be on dialysis at the time of transplant (80% vs. 82%, p=0.036) and to receive kidneys from live donors (34% vs. 37%, p=0.051). Among female recipients, 4.52% had diabetes at the time of transplantation, while among male recipients, the percentage was slightly higher at 5.66% (p=0.098). Additionally, the mean dialysis vintage at the time of transplantation was 4.88 years (SD=3.49) for female recipients and 4.58 years (SD=3.22) for male recipients (p=0.015). There was a higher rate of graft failure in deceased donor transplants (20.23%) than in living donor transplants (15.92%, p<0.001). Mortality was also higher in deceased donor transplants (10.66%) than in living donor transplants (6.97%, p<0.001).

Table 2 demonstrates significant variations in patient, donor and transplant characteristics across race. Most notably, White patients were more likely to be male (22.66%, p<0.001), re-transplant (10%, p=0.001), or live donor transplant (51%, p<0.001) recipients. They were less likely to be on dialysis at the time of transplant (66%, p<0.001). Blacks waited the longest on the waitlist (688 days, p<0.001), were more likely to receive kidneys from donors who were diabetic (5%, p=0.006), hypertensive (18%, p<0.001), after cardiac death (16%, p=0.001), and with high-BMI (28, p<0.001). Blacks were also likely to receive regionally (11%, p<0.001) or nationally (13%, p=0.001) shared kidneys with a longer cold ischemic time (14 hours, p<0.001) compared to other race groups. Among the recipients, the prevalence of diabetes at the time of transplantation was 4.05% for Whites, 5.71% for Blacks, 3.47% for Hispanics, and 4.91% for Asians. At the time of transplantation, the mean dialysis vintage in years was 3.49 (SD=2.88) for Whites, 5.32 (SD=3.42) for Blacks, 4.97 (SD=3.63) for Hispanics, and 4.73 (SD=3.47) for Asians.

Figure 1 compares graft failure by race. Blacks had the highest graft failure while Asians had the lowest graft failure (p<0.001). Table 3 summarizes the results of COX regressions for deceased and live donor transplants, showing risk factors correlated with graft failure and patient mortality adjusted for covariates. For deceased donor transplants, being older (HR=0.991, p=0.004), Asian

(HR=0.578, p=0.002) or Hispanic (HR=0.726, p=0.006) reduced the risk of graft failure by 1%, 42% and 27% respectively. Being male (HR=1.304, p=0.001), on dialysis at the time of transplant (HR=1.442, p=0.002), and having a higher KDPI (HR=3.013, p<0.001) increased the risk of graft failure by 30%, 44% and 200% respectively. The results for living donor transplants were similar. Being older (HR=0.972, p<0.001), Asian (HR=0.471, p=0.003) or Hispanic (HR=0.724, p=0.04) reduced the risk of graft failure by 3%, 53% and 28% respectively. Being on dialysis at the time of transplant (HR=1.287, p=0.048) and having a higher value of cPRA (HR=1.005, p=0.004) increased the risk of graft failure by 29% and 0.5% respectively. Receiving a kidney from an older donor (HR=1.022, p<0.001) and having higher HLA mismatches (HR=1.069, p=0.044) also increased the risk of graft failure by 2% and 7% respectively.

Over the length of the study the overall graft failure rate was 18.74% (N=1000). Blacks had the highest graft failure rate at 22.37% (N=601), whites were 19.42% (N=288), Hispanics were 14.12% (N=212) and Asians had the lowest graft failure rate at 11.15% (N=59). Females had a lower graft failure rate at 18.25 (N=943) than males at 20.97% (N=241). Recipients from a deceased donor exhibited a higher graft failure rate at 20.23% (N=837) than recipients from a living donor (15.92%, N=347). The overall mortality was 9.39% (N=593). Whites had the highest mortality at 11.67% (N=173) followed by Blacks at 10.98% (N=295). Asians and Hispanics (N=85) had the lowest mortality at 5.1% (N=27) and 5.66% (N=85) respectively. Females exhibited a lower mortality rate compared to males with 9.13% (N=472) vs 10.53% (N=121). Recipients from a deceased donor exhibited a mortality of 10.66% (N=441) while recipients from a living donor had a mortality of 6.97% (N=152).

DISCUSSION

Kidney transplantation for LN patients provides a notable survival benefit. The incidence of ESRD secondary to LN has leveled off in recent years. However, disparities in outcomes persist across demographic groups based on race, sex and other patient characteristics.[12] Our analysis has highlighted several important trends in the demographics and outcomes of kidney transplant for LN. To our knowledge, this is the first large-scale work to assess multiple social and biological variables on the disparities in graft survival and mortality for LN kidney transplantation amongst multiple ethnicities and both sexes.

Race

There is a higher associated risk of graft failure in general renal transplants when either the donor or recipient is Black.[17] Black LN-ESRD patients have increased risk of death and cardiovascular events compared to other racial groups. Asian populations have the lowest risk of death and cardiovascular events. However, post-renal transplant mortality outcomes for LN are similar amongst different racial groups.[18] We added to this literature by showing Black and White patients with LN receiving kidney transplants suffer disproportionately from bad outcomes.

While the overall graft failure rate was 18.74%, we highlight discrepancies in graft failure rate among racial groups. Blacks notably had a higher rate at 22.37% compared to all other racial groups, but especially Asian patients at 11.15%, suggesting potential underlying racial determinants influencing transplantation outcomes. Overall mortality was 9.39%, but Whites had the highest rate of mortality (11.67%) among racial groups. Asians, similarly, had the lowest rate of mortality (5.1%).

The results of this analysis affirms persistent disparities, Blacks experienced longer wait times and increased graft failure rates. Blacks were also more likely to receive kidney transplants that had longer cold ischemic times and from donors with chronic conditions (e.g., hypertension, diabetes), which may negatively affect graft success. This indicates a potential modification to practice which may serve to reduce the negative outcomes in Black LN patients.[19] Providers may spend less time giving instructions to Blacks in clinical settings when compared to non-Black individuals. Clinicians should consider the implications of this and our results in their practice. Pre-transplant protocols and post-transplant care strategies should be improved, giving special consideration to improving health disparities for populations with historically worse outcomes. Clinicians should tailor their care plans based on these insights, potentially intensifying post-transplant monitoring and interventions for individuals at higher risk. In practice, these results underscore the importance of personalized, patient-centered care and a commitment to addressing disparities within the healthcare system, ultimately leading to more equitable and improved outcomes for all kidney transplant recipients, particularly those with lupus nephritis. One potential solution to address longer wait times for Blacks, who often have a higher prevalence of the B blood type, could involve expanding donor compatibility. This might entail utilizing A blood type and donors for B and O blood type recipients which may improve the donor-recipient ratio and thus increase access to transplantation.

Additional genetic differences between these demographic groups may further explain discrepancies in graft failure. Variations in the apol1 gene exist only in individuals with recent African ancestry and confer a higher risk for a variety of kidney diseases. These diseases are nondiabetic and include hypertension-associated end-stage kidney disease, focal segmental glomerulosclerosis, HIV-associated nephropathy and more.[20] Recipients with apol1 genetic variants have lower rates of graft survival, although the nature of this relationship is outside the scope of this manuscript.[21] Genetic differences between individuals of European and African-American ancestry also contribute to significantly varied metabolism of tacrolimus. Individuals of African-American descent require larger doses of tacrolimus due to an increased metabolism when compared to individuals of European descent.[22] We acknowledge that our study did not delve into these specific factors, which represents a weakness in our research.

Diabetes

Pre-existing diabetes mellitus poses a substantial risk for graft failure and mortality post-renal transplantation. Black patients tend to have a higher occurrence of diabetes before receiving a

transplant. They also often spend a longer period on dialysis, which worsens their diabetes. These patients have a greater prevalence and severity of cardiovascular risk factors that can affect their transplant success.[23] The impact of pre-existing diabetes on kidney transplant outcomes for patients with LN remains an unexplored area of research. While past studies have identified diabetes mellitus as a driving factor for the disparities between Black and non-black transplant outcomes, our data illustrates that diabetes does not affect mortality or graft failure regardless of living or deceased donors or race.

Dialysis

Blacks who undergo kidney transplants typically spend a longer duration of time on dialysis before their transplant compared to other ethnic groups. Black patients are also referred for transplantation later.[23] LN does not significantly impact a patient's survival once they begin dialysis, but it does worsen overall patient mortality following a kidney transplant. Increased mortality may be due to a history of aggressive immunosuppressive treatment and presence of antiphospholipid antibodies which may increase the risk of allograft thrombosis and other vascular complications. Graft failure rates are not affected by the presence of LN in patients. Furthermore, complications from LN may lead to a reduced overall rate of transplantation, including preemptive kidney transplants.[24] We showed dialysis vintage did not significantly affect graft failure for either deceased or living donors. Increased risk of graft failure was noted if the recipient had been on dialysis prior to transplant and that whites were less likely to be on dialysis than non-whites. For deceased donors, longer dialysis vintage was significantly associated with higher mortality. This correlation was not observed for living donors. Conversely, dialysis at the time of treatment was significantly correlated with mortality for living donors but not for deceased donors. Further research is warranted to explore the underlying mechanisms driving these associations and to develop targeted interventions aimed at optimizing transplant success and patient survival for both living and deceased donors.

BMI

Kidney transplantation in obese patients poses higher surgical complication risks compared to non obese individuals, resulting in limited access to transplantation and prolonged wait times.[25] A very low or high BMI increases the risk of post-kidney transplant mortality and is associated with increased graft failure. The lowest risk is associated with a BMI between 22 and 32 kg/m^2.[26] Higher recipient BMI in patients with LN receiving kidney transplants had a significant association with graft survival, but a significant relationship was not present with recipient survival.[17] Similarly, living donor recipients with increased BMI have increased graft failure. This could explain the significantly reduced rates of graft failure and patient mortality for the Asian population, given that they have the lowest BMI amongst other ethnicities.[27] This relationship was not observed in deceased donor recipients with increased BMI.

Sex

The influence of sex on kidney transplantation outcomes is a subject of controversy within transplant medicine. Research on the impact of sex on kidney transplantation outcomes in patients with lupus nephritis is notably lacking. Our results provide some clarity illustrating a discrepancy in kidney transplant outcomes based on sex. Males experienced higher rates of graft failure (20.97%) than females (18.25%). Patient mortality rate was not significantly different between the two groups. For living donor transplants, there were no significant differences in post-transplant outcomes between males and females. Sex discrepancies also notably include that females with LN are less likely to receive kidneys from live donors compared to males. The reasons for the male-female discrepancy are likely to be multifactorial, although potential explanations for this trend have been identified. For example, women report better adherence with follow-up evaluations and immunosuppressive therapy and higher levels of circulating estrogen may be protective against ischemia and delayed graft function.[28] In the case of transplants between male and female sexes, the recipient immune system may perceive the transplanted organ as foreign or incompatible to a greater extent than in sex-matched scenarios. Thus, worse transplant outcomes in male patients may be due to a combination of poorer medical adherence and lack of protective hormonal effects. Identifying significant differences in risk factors and outcomes between sexes is an important first step towards changing practice to best support the most at-risk individuals.

Donor source

Living donor recipients of kidney transplants have superior graft survival and mortality compared to their deceased donor recipient counterparts.[29] LN patients receiving kidney transplants from deceased donors have increased risk of mortality and graft failure compared to patients with ESRD due to another etiology. This relationship was not observed for living donor transplants. This could be due to a trauma in the deceased donor, different immunological response, higher risk of ischemic injury, and suboptimal matching due to time constraints.[30] Living donor recipients scored better on measures including health-related quality of life and societal participation when compared to deceased donor recipients within 5 years post-transplant. This difference was partly due to the younger age, higher education and better kidney function of living donor recipients, but these variables could not entirely explain these differences.[31] Deceased donors had higher rates of graft failure and mortality Our study was consistent with previous literature, as deceased donor recipients had higher rates of graft failure and mortality.

Miscellaneous Factors

Presence of pre-transplant HLA antibodies, specifically class I and II, also lead to delayed graft function and impaired graft survival. The presence of both HLA antibody classes is reflective of a generally increased alloreactivity which can cause subclinical rejections. These rejections may go undetected in the early post-transplant phase due to the potent concentration of immunosuppression that these patients receive.[32] HLA mismatch level is correlated with increased graft rejection from living donors and the presence of higher cPRA scores are

associated with increased graft rejection and mortality from living donors but have no effect when the donor is deceased. Given their limited availability of potential donor kidneys, it is possible that the recipients with higher cPRA often do not receive the most optimal kidneys. Additionally, increased age is associated with the development of delayed graft function. Prior research has reported a decreased survival rate and a higher graft failure in the recipients ≥ 60 years of age when compared to younger recipients.[33] Our data supports worsening renal transplant outcomes with respect to age regardless of living or deceased donor.

Our study design does introduce inherent limitations. Unmeasured variables such as comorbidities, beyond diabetes, or socioeconomic factors, beyond longer wait times, were not considered in this analysis and could affect graft failure rates. This data cannot be generalized to patients under 17 years old or with multiple-organ transplants as they were not included. The retrospective nature of this work only demonstrates associations, not causative relationships between independent variables and outcomes. Possibly confounding variables may not have been included in the Cox model. This work did not collect data on socioeconomic status, the apol1 gene, tac levels, or estrogen levels, all of which present possible mechanistic explanations for kidney transplant discrepancies. The greatest strength of our research was our large sample size of 6,317 transplant recipients highlighting the statistical power of our findings.

CONCLUSION

This investigation highlights the significant disparities in kidney transplant access and outcomes among individuals with Lupus Nephritis in the context of race, sex, and availability of live donor kidneys**.** Our data not only can inform our understanding of these disparities but can also call for further investigation and a renewed commitment to addressing them. Future research should delve into the underlying factors contributing to the observed disparities, with a focus on refining risk assessment, optimizing transplant allocation policies, and tailoring post-transplant care to mitigate the heightened risks faced by certain demographic groups. The community should explore strategies that promote equitable opportunity to living donor kidneys, reduce waiting times, and enhance the overall quality of care for individuals with lupus nephritis, regardless of their background. In doing so, we can make a lasting impact on the lives of those with lupus nephritis and, by extension, contribute to the broader goal of healthcare equity.

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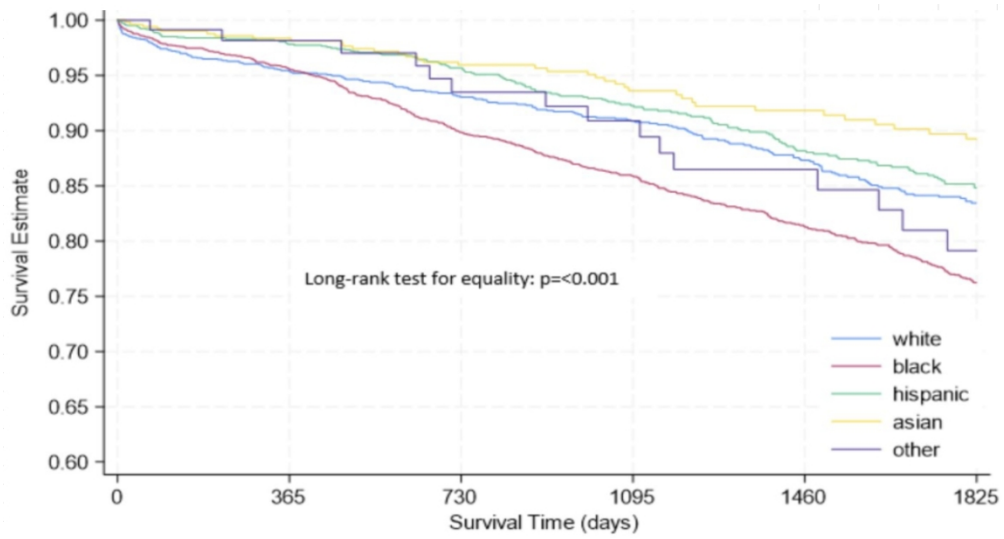

Figure 1. Graft Failure Rates by Race

227x128mm (144 x 144 DPI)

Table 1. Descriptive Statistics for Sex

Characteristics	Female Recipients (n=5,168)	Male Recipients (n=1,149)	P-value
Patient Characteristics			
Age, mean (SD)	49.60 (12.35)	41.16 (12.89)	0.227
Race, n (%)			
White	1,147 (22.19%)	336 (29.24%)	<0.001
Black	2,246 (43.46%)	441 (38.38%)	0.002
Hispanic	1,231 (23.82%)	270 (23.50%)	0.817
Asian	449 (8.69%)	80 (6.96%)	0.056
Other	95 (1.84%)	22 (1.91%)	0.862
Wait time (in days), median (SD)	534 (901.12)	544 (866.09)	0.520
Retransplant, n (%)	379 (7.33%)	95 (8.27%)	0.277
Diabetes at the time of TX	233 (4.52%)	65 (5.66%)	0.098
BMI at the time of TX	25.86 (5.63)	26.37 (4.94)	0.001
Dialysis at the time of TX	4,083 (79.70%)	934 (82.44%)	0.036
cPRA at the time of TX	30.00 (38.22)	17.14 (30.96)	<0.001
GFR at the time of TX, mean (SD)	12.69 (4.87)	13.08 (4.74)	0.146
Donor Characteristics			
Age, mean (SD)	38.20 (12.40)	37.98 (11.95)	0.584
Male, n (%)	2,851 (55.17%)	635 (55.27%)	0.951
Race, n (%)			
White	3,053 (59.08%)	707 (61.53%)	0.125
African American	840 (16.25%)	151 (13.14%)	0.009
Hispanic	980 (18.96%)	243 (21.15%)	0.090
Asian	227 (4.39%)	36 (3.13%)	0.053
Other	95 (1.84%)	22 (1.91%)	0.862
Living donor	1,755 (33.96%)	425 (36.99%)	0.051
Creatinine at the time of TX	1.22 (1.05)	1.29 (1.13)	0.096
Diabetes at the time of TX	196 (3.82%)	42 (3.67%)	0.817
Hypertensive at the time of TX	814 (15.93%)	171 (15.01%)	0.441
BMI at the time of TX	27.79 (5.96)	26.86 (5.98)	0.703
KDPI, mean (SD)	0.34 (0.24)	0.32 (0.24)	0.114
History of hypertension, n (%)	814 (15.93%)	171 (15.01%)	0.441
BMI, mean (SD)	27.79 (5.96)	27.86 (5.98)	0.703
Donor after Cardiac Death, n (%)	734 (14.02%)	153 (13.32%)	0.434
Expanded Criteria Donor, n (%)	225 (6.59%)	53 (7.32%)	0.477
HLA mismatch level, mean (SD)	3.89 (1.61)	3.97 (1.58)	0.118
Cold Ischemic time (hours), mean (SD)	12.65 (10.35)	11.79 (10.30)	0.013
Locally shared, n (%)	4,134 (79.99%)	967 (84.16%)	0.001
Regionally shared, n (%)	443 (8.57%)	80 (6.96%)	0.073
Nationally shared, n (%)	591 (11.44%)	102 (8.88%)	0.012

120x179mm (144 x 144 DPI)

Table 2. Descriptive Statistics for Race

Characteristics	White Recipients (n=1,483)	Black Recipients (n=2,687)	Hispanic Recipients (n=1,501)	Asian Recipients (n=529)	Other Recipients (n=117)	P-value
Patient Characteristics						
Age, mean (SD)	45.06 (13.49)	41.35 (11.97)	38.6 (11.56)	41.27 (11.74)	39.14 (12.64)	<0.001
Male, n (%)	336 (22.66%)	441 (16.41%)	270 (17.99%)	80 (15.12%)	22 (18.8%)	<0.001
Wait time (in days), median (SD)	353 (817.04)	688 (910.59)	483 (882.88)	654 (984.00)	404 (837.00)	<0.001
Retransplant, n (%)	147 (9.91%)	179 (6.66%)	99 (6.6%)	43 (8.13%)	6 (5.13%)	0.001
Diabetes at the time of TX, n (%)	60 (4.05%)	153 (5.71%)	52 (3.47%)	26 (4.91%)	7 (6.03%)	0.011
BMI at the time of TX, mean (SD)	26.21 (5.52)	26.46 (5.59)	25.93 (5.28)	23 (4.81)	25.41 (5.46)	<0.001
Dialysis at the time of TX, n (%)	961 (66.05%)	2339 (87.54%)	1223 (82.14%)	402 (76.43%)	92 (80.7%)	<0.001
cPRA at the time of TX, mean (SD)	22.55 (35.27)	31.38 (38.46)	27.6 (37.52)	23.91 (35)	24.41 (34.94)	<0.001
GFR at the time of TX, mean (SD)	13.67 (4.5)	11.59 (5.1)	12.8 (4.61)	14.07 (4.46)	12.66 (4.83)	<0.001
Donor Characteristics						
Age, mean (SD)	40.72 (12.72)	37.23 (12.12)	37.14 (11.79)	38.95 (12.54)	36.68 (12.31)	<0.001
Male , n (%)	766 (51.65%)	1533 (57.05%)	826 (55.03%)	295 (55.77%)	66 (56.41%)	0.022
Race, n (%)						
White	1,248 (84.15%)	1,547 (57.57%)	637 (42.44%)	263 (49.72%)	65 (55.56%)	<0.001
African American	79 (5.33%)	768 (28.58%)	93 (6.2%)	31 (5.86%)	20 (17.09%)	<0.001
Hispanic	128 (8.63%)	291 (10.83%)	727 (48.43%)	62 (11.72%)	15 (12.82%)	<0.001
Asian	17 (1.15%)	51 (1.9%)	23 (1.53%)	162 (30.62%)	10 (8.55%)	<0.001
Other	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	117 (100%)	<0.001
Living donor	758 (51.11%)	599 (22.29%)	573 (38.17%)	212 (40.08%)	38 (32.48%)	<0.001
Creatinine at the time of TX	1.17 (1.00)	1.24 (1.01)	1.26 (1.16)	1.30 (1.23)	1.10 (0.86)	0.226
Diabetes at the time of TX	39 (2.64%)	124 (4.65%)	45 (3.03%)	24 (4.57%)	6 (5.13%)	0.006
Hypertensive at the time of TX	208 (14.15%)	484 (18.25%)	202 (13.59%)	75 (14.34%)	16 (13.68%)	<0.001
BMI at the time of TX	27.58 (5.54)	28.09 (6.24)	27.91 (5.82)	26.92 (6.12)	26.6 (5.22)	<0.001
KDPI, mean (SD)	0.34 (0.24)	0.32 (0.24)	0.32 (0.24)	0.34 (0.24)	0.32 (0.24)	0.114
History of hypertension, n (%)	208 (14.15%)	484 (18.25%)	202 (13.59%)	75 (14.34%)	16 (13.68%)	<0.001
BMI, mean (SD)	27.58 (5.54)	28.09 (6.24)	27.91 (5.82)	26.92 (6.12)	26.60 (5.22)	<0.001
Donor after Cardiac Death, n (%)	179 (12.07%)	422 (15.71%)	205 (13.66%)	62 (11.72%)	19 (16.24%)	0.001
Expanded Criteria Donor, n (%)	62 (8.55%)	136 (6.51%)	55 (5.93%)	20 (6.31%)	5 (6.33%)	0.281
HLA mismatch level, mean (SD)	3.47 (1.76)	4.22 (1.40)	3.71 (1.66)	3.98 (1.62)	4.06 (1.55)	<0.001
Cold Ischemic time (hrs), mean (SD)	10.18 (10.68)	14.27 (9.86)	12.02 (10.36)	11.37 (10.37)	11.69 (9.51)	<0.001
Locally shared, n (%)	1 266 (85.37%)	2,059 (76.63%)	1,238 (82.48%)	439 (82.99%)	99 (84.62%)	<0.001
Regionally shared, n (%)	74 (4.99%)	290 (10.79%)	108 (7.2%)	42 (7.94%)	9 (7.69%)	<0.001
Nationally shared, n (%)	143 (9.64%)	338 (12.58%)	155 (10.33%)	48 (9.07%)	9 (7.69%)	0.001

193x162mm (144 x 144 DPI)

Table 3. COX Regression Analysis for Graft Failure and Patient Mortality

	Graft Failure				Patient Mortality			
Deceased Donor Transplants	HR	P-value	[95% C.I.]		HR	P-value	[95% C.I.]	
Recipient Age	0.989	0.001	0.983	0.996	1.042	<0.001	1.033	1.051
Male Recipient[a]	1.306	0.003	1.098	1.554	1.336	0.019	1.049	1.700
African American Recipient[b]	1.384	<0.001	1.167	1.641	1.374	0.011	1.074	1.757
White Recipient[b]	1.439	0.001	1.160	1.784	1.640	0.001	1.229	2.188
Dialysis at the time of TX	1.457	0.001	1.157	1.835	1.527	0.003	1.153	2.022
Diabetes at the time of TX	1.152	0.332	0.865	1.535	1.454	0.017	1.069	1.978
BMI at the time of TX	1.010	0.194	0.995	1.024	1.011	0.277	0.991	1.032
Patient BMI/Donor BMI>1.33 (top 10%)	1.252	0.054	0.996	1.573	1.273	0.119	0.940	1.725
cPRA at the time of TX	1.002	0.100	1.000	1.003	1.004	0.001	1.002	1.007
KDPI	3.067	<0.001	2.279	4.128	2.568	<0.001	1.727	3.821
HLA mismatch level	1.009	0.720	0.962	1.058	1.039	0.250	0.973	1.110
Living Donor Transplants	HR	P-value	[95%	C.I.]	HR	P-value	[95%	C.I.]
Recipient Age	0.970	<0.001	0.959	0.981	1.034	<0.001	1.018	1.050
Male Recipient[a]	1.021	0.884	0.770	1.354	1.095	0.670	0.721	1.664
African American Recipient[b]	1.432	0.068	0.974	2.107	1.821	0.042	1.021	3.249
White Recipient[b]	1.391	0.023	1.047	1.849	1.504	0.067	0.972	2.326
Dialysis at the time of TX	1.316	0.033	1.023	1.694	1.789	0.003	1.219	2.627
Diabetes at the time of TX	0.992	0.981	0.517	1.903	0.990	0.979	0.464	2.113
BMI at the time of TX	1.030	0.024	1.004	1.056	0.995	0.807	0.956	1.036
Patient BMI/Donor BMI>1.33 (top 10%)	1.233	0.406	0.752	2.023	2.049	0.044	1.021	4.113
cPRA at the time of TX	1.006	0.003	1.002	1.009	1.005	0.079	0.999	1.010
Donor Age	1.023	<0.001	1.013	1.033	1.018	0.026	1.002	1.033
African American Donor[b]	1.351	0.121	0.924	1.974	0.926	0.789	0.526	1.630
Hypertensive Donor	0.740	0.361	0.388	1.412	0.372	0.095	0.116	1.188
Donor BMI	1.004	0.803	0.974	1.035	1.020	0.403	0.974	1.068
HLA mismatch level	1.077	0.027	1.009	1.151	1.059	0.260	0.959	1.169

[a] Female is the reference

[b] All other race groups are the reference (Asian, Hispanic, and Other)

200x168mm (144 x 144 DPI)