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Ethnic Background Is a Potential Barrier to Living Donor Kidney Transplantation in Canada: A Single-Center Retrospective Cohort Study

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Background. We examined if African or Asian ethnicity was associated with lower access to kidney transplantation (KT) in a Canadian setting. **Methods.** Patients referred for KT to the Toronto General Hospital from January 1, 2003, to December 31, 2012, who completed social work assessment, were included (n = 1769). The association between ethnicity and the time from referral to completion of KT evaluation or receipt of a KT were examined using Cox proportional hazards models. **Results.** About 54% of the sample was white, 13% African, 11% East Asian, and 11% South Asian; 7% had “other” (n = 121) ethnic background. African Canadians (hazard ratio [HR], 0.75; 95% CI: 0.62-0.92) and patients with “other” ethnicity (HR, 0.71; 95% CI, 0.55-0.92) were less likely to complete the KT evaluation compared with white Canadians, and this association remained statistically significant in multivariable adjusted models. Access to KT was significantly reduced for all ethnic groups assessed compared with white Canadians, and this was primarily driven by differences in access to living donor KT. The adjusted HRs for living donor KT were 0.35 (95% CI, 0.24-0.51), 0.27 (95% CI, 0.17-0.41), 0.43 (95% CI, 0.30-0.61), and 0.34 (95% CI, 0.20-0.56) for African, East or South Asian Canadians and for patients with “other” ethnic background, respectively. **Conclusions.** Similar to other jurisdictions, nonwhite patients face barriers to accessing KT in Canada. This inequity is very substantial for living donor KT. Further research is needed to identify if these inequities are due to potentially modifiable barriers.

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Kidney transplantation (KT) is associated with reduced morbidity and mortality,¹⁻⁴ improved quality of life,^{5,6} and reduced healthcare costs^{7,8} when compared with dialysis. Living donor KT (LDKT) is the treatment of choice for suitable patients with end-stage kidney disease (ESKD), because of shortage of deceased donors⁹ and better outcomes.¹⁰⁻¹² However, KT, and LDKT in particular, is underused.^{2,13}

The contribution of ethnocultural factors to accessing KT has mainly been documented for African Americans, Native Americans, and Hispanics¹⁴⁻¹⁷ living in the U.S. African Americans take longer to complete the KT evaluation (KTE)^{18,20}

and are less likely to get waitlisted and transplanted^{19,21,22} than whites. A U.S. study showed that transplantation among Asians was even lower than among African Americans.²³

There are differences in the social environment and health-care delivery in Canada versus the United States; therefore, clinical research findings in one country cannot be readily extrapolated to the other. Although individuals with African or Asian background represent almost 10% of the population of Canada²⁴ (close to 20% in Ontario²⁵), only a few studies assessed ethnic disparities in access to KT in Canada.²⁶⁻²⁸ Two studies analyzing data from before 2000 showed that

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KT rates were lower for ethnic groups (Aboriginal, African, South Asian, and East Asian Canadians) compared with white Canadians.^{27,28}

To our knowledge, no data have been reported about the association between ethnicity and completing the KTE in Canada. Furthermore, no studies have evaluated access to KT in a more contemporary Canadian cohort. Therefore, we aimed to assess the association between ethnicity and the likelihood of completing the KTE and receiving a KT in a large Canadian transplant center.

MATERIALS AND METHODS

Study Design and Population

This is a single-center, retrospective cohort study of adults (≥ 18 years) referred to the Toronto General Hospital for KT between January 1, 2003, and December 31, 2012 ($n = 2584$). Patients were followed up until December 31, 2013. We excluded multiorgan transplant candidates ($n = 63$) and patients who did not complete the social work assessment ($n = 752$) (Figure 1). We obtained approval for this study from the University Health Network Research Ethics Board. The clinical and research activities being reported are consistent with the Principles of the Declaration of Istanbul as outlined in the “Declaration of Istanbul on Organ Trafficking and Transplant Tourism.”

Data Sources and Management

We created a data collection form to abstract and record information about ethnicity as well as about language barrier

and marital status from the pretransplant social work assessment notes. These notes have been transcribed into the Organ Transplant Tracking Record (OTTR) software. OTTR has been the main electronic medical record system for patients referred, waitlisted, and transplanted at our center since 2000. If any information was absent or unclear, letters dictated by physicians and progress notes, and so on, were examined.

After quality checks, the data collected for this study were merged with our in-center research database, the Comprehensive Renal Transplant Research Information System (CoReTRIS).²⁹ CoReTRIS contains recipient, donor, transplant, laboratory, pathology, treatment, and follow-up data for all patients who received KT at our center since 2000. Moreover, it includes detailed clinical information on all new referrals since January 1, 2003. These data have been abstracted from patient charts (electronic and paper), entered into the database, and audited for completeness and accuracy.

Exposure Assessment and Classification

The exposure of interest was ethnicity as identified primarily in the social work notes. The notes were usually transcribed or scanned into OTTR. The social work assessment at our institute has been a semistructured detailed interview with the patient. The overall structure and content areas of this evaluation have not changed during the study period. During the interview, the following areas are explored by the social worker: personal and family history; current social situation, living environment; work history, financial situation and drug coverage; support systems (personal support,

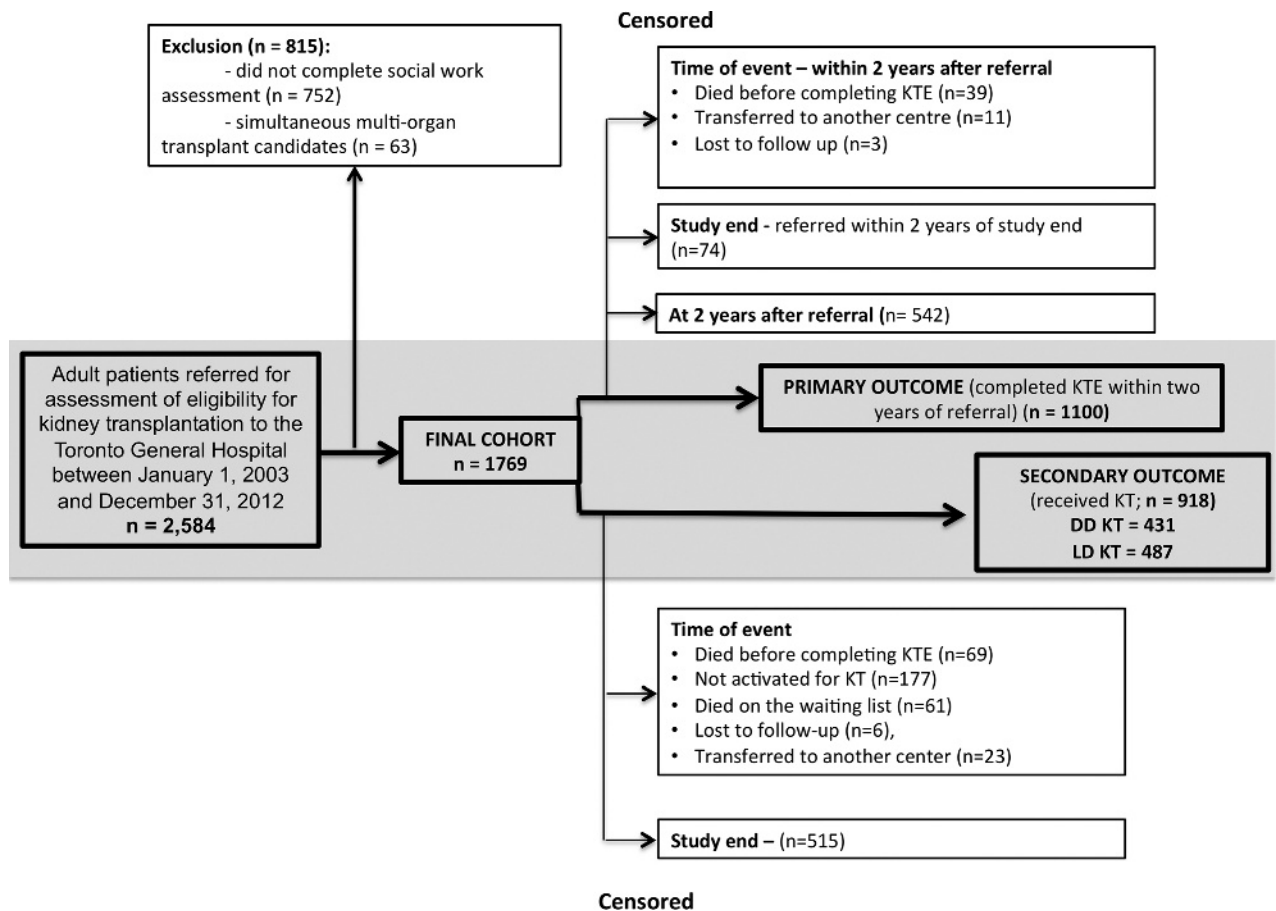


FIGURE 1. Study flow diagram.

housing situation, transportation, and so on); substance use and mental health history (smoking, alcohol use, recreational drugs, history of mental health problems, concerns regarding adherence); expectations from and motivation for KT; planning for KT (family discussion, financial and logistic planning). In addition, any indication of country of origin, immigration date, or ethnic background was also considered. The following categories were generated^{30,31}: (1) white, (2) African, (3) East Asian (eg, Chinese, Japanese, Korean), (4) South Asian (eg, Indian, Pakistani, Sri Lankan, Indo-Caribbean), and (5) Other (Canadian First Nations, Pacific-Islander, Middle Eastern, and so on).

Outcome Assessment and Classification

The primary outcome of interest was time from referral to completion of the KTE (ie, activate on the waiting list, not activate on the waiting list, or clear a patient for LDKT) within 2 years of referral. We also conducted sensitivity analyses with the outcome “cleared for transplant” (ie, activate a patient to the waiting list or clear a patient for LDKT). The secondary outcomes of interest were: (1) receipt of any KT; (2) deceased donor KT (DDKT) or (3) LDKT.

Patient Follow-Up

The date of referral to the transplant center, completion of the KTE, transplant or death were recorded in OTTR. The data were abstracted, then stored in CoReTRIS after quality checks and audits.²⁹ The time origin for all analyses was the date of referral to the transplant center. For the primary outcome (ie, completing the KTE) patients were followed until decision about transplant candidacy or study end. Participants who died before completion of the KTE were censored at the time of death. Patients who did not complete the KTE but who had been referred within 2 years of study end (December 31, 2012) were censored at study end. Patients who were still in evaluation at 2 years after referral were censored at that time point (Figure 1). Patients accepted for KT were followed up until transplantation or study end. Participants who died while waiting for KT, were lost to follow-up or transferred to another center were censored at the time of the event (Figure 1).

Potential Confounders

To assess the independent association between the exposure and outcome, we built multivariable Cox proportional hazards models that adjusted for covariates that were chosen based on their association with the exposure and outcome, clinical experience, and data from the literature. Variables entered in the models included recipient age, sex, marital status, employment, ability to communicate in English (as described by the social worker), socioeconomic status, comorbidities, blood group, and peak panel-reactive antibody (PRA) at the time of referral. Sociodemographic, clinical characteristics, and comorbidities were obtained from CoReTRIS. To characterize socioeconomic status, we used the Ontario Marginalization Index (OMI).³² The OMI is a census-based and geographically based index that considers residential instability, material deprivation, ethnic concentration, and dependency. Participants were allocated to a deprivation quintile based on their postal code. Quintiles 1 to 5 of the OMI represent the least to the most deprived, respectively. Comorbid conditions adjusted for in multivariable models included diabetes mellitus, coronary artery disease or myocardial infarction,

heart failure, stroke, peripheral vascular disease, chronic lung disease, and/or nonskin cancer.

Statistical Analysis

Categorical variables were described using frequencies and percentages while continuous variables were depicted using the mean (standard deviation, SD) for normally distributed data and the median (interquartile range [IQR]) for skewed variables. We evaluated the distribution of baseline characteristics across ethnic categories using parametric and non-parametric tests as appropriate. We graphically assessed the cumulative probabilities of the study endpoints using the Kaplan-Meier product limit method, and examined differences across survival functions using the log-rank test. We explored univariable and multivariable associations between the exposure and outcome in Cox proportional hazards models. To account for potentially varying baseline hazards over the relatively long time period of study entry, we stratified our Cox models for 2 eras of study entry (cutoff December 31, 2007, the mid-point of our study period). We sequentially fit models that contained an expanding set of covariates. The proportional hazards assumption was tested using scaled Schoenfeld residuals. No important departures from proportionality were detected.

We conducted sensitivity analyses using the outcome “cleared for transplant” (activated to the waiting list or cleared for LDKT) instead of “completing KTE”. In additional sensitivity analyses, we recoded censored cases (other than censored for study end) as ones reaching an endpoint to assess if informative censoring could have biased our results. We also tested our models with recoding censored observations as reaching the 2-year follow-up without an endpoint.

Missingness was less than 5% for all variables, except for peak PRA (38%) and the Ontario Marginalization Index (8%). We used the method of multiple imputation by chained equations to address missingness.³³ This method replaces missing values with a set of imputed values in different imputed data sets based on the joint distribution of existing values of variables entered in the imputation model. We performed analyses on 5 complete imputed data sets and combined the results using Rubin’s rules.

We performed sensitivity analyses to test the robustness of our findings with regards the potential impact of missing information about ethnicity on our results after case wise deletion of participants with “unknown” ethnicity.

We performed all statistical analyses using Stata 13.0 (StataCorp, College Station, TX). A 2-sided *P* value less than 0.05 was considered statistically significant.

RESULTS

During the study period, 2584 patients were referred for assessment of KT eligibility. After applying the a priori exclusion criteria, we included 1769 potential KT recipients for the analysis (Figure 1). The baseline characteristics of the study cohort are shown in Table 1. About 54% of the sample (958 patients) were white, 13% (225 patients) African Canadian, 11% (191 patients) East Asian, and 11% (202 patients) South Asian Canadians. Seven percent of patients had other (*n* = 121) and 4% unknown (*n* = 72) ethnic background. Diabetic kidney disease was the most frequent cause of ESKD among South Asian and African Canadian patients, whereas glomerular diseases were more frequent among East

TABLE 1.
Baseline characteristics of the study sample

Variables	Whole cohort (N = 1769)	White (N = 958)	African Canadian (N = 225)	East Asian (n = 191)	South Asian (N = 202)	Other (121)	Unknown (N = 72)	P*
Mean age at referral (± SD), y	49 (±14)	49 (±14)	48 (±15)	49 (±13)	48 (±14)	51 (±13)	54 (±13)	0.05
Sex								
Male	1066 (60)	581 (61%)	125 (56%)	107 (56%)	138 (68%)	79 (65%)	36 (50%)	0.02
Female	703 (40)	377 (39%)	100 (44%)	84 (44%)	64 (32%)	42 (35)	36 (50%)	
Time in dialysis (from dialysis initiation to referral date)								
Preemptive	506 (29%)	355 (37%)	27 (12%)	36 (19%)	49 (24%)	24 (20%)	13 (18%)	<0.001
0-24 mo	978 (55%)	484 (51%)	138 (61%)	112 (59%)	118 (59%)	83 (69%)	43 (60%)	
> 24 mo	285 (16%)	119 (12%)	60 (27%)	43 (22%)	33 (17%)	14 (11%)	16 (22%)	
Cause of ESKD								
GN	559 (32%)	287 (30%)	69 (31%)	89 (47%)	69 (34%)	27 (22%)	18 (25%)	<0.001
DM	509 (29%)	239 (25%)	79 (35%)	35 (18%)	72 (36%)	50 (41%)	34 (47%)	
PKD	194 (11%)	149 (16%)	11 (5%)	11 (6%)	9 (5%)	8 (7%)	6 (9%)	
HTN	176 (10)	78 (8%)	35 (16%)	27 (14%)	19 (9%)	14 (12%)	3 (4%)	
Other, unknown	331 (19)	205 (21%)	31 (13%)	29 (15%)	33 (16%)	22 (18%)	11 (15%)	0.19
Peak PRA	0 (0, 22)	0 (0, 18)	0 (0, 36)	0 (0, 26)	0 (0, 11)	0 (0, 20)	0 (0, 68)	
Blood group								
A	615 (35)	381 (40%)	73 (32%)	42 (22%)	55 (31%)	37 (31%)	27 (38%)	<0.001
AB	86 (5)	43 (4%)	7 (3%)	18 (9%)	11 (5%)	1 (1%)	6 (6%)	
B	289 (16)	99 (10%)	41 (18%)	56 (29%)	58 (29%)	23 (19%)	12 (17%)	
O	778 (44)	435 (45%)	104 (46%)	75 (39%)	78 (39%)	60 (50%)	26 (37%)	<0.001
Unable to communicate in English	143 (8%)	34 (4%)	6 (3%)	52 (27%)	34 (17%)	14 (12%)	3 (4%)	
Marital status								
Single, never married	371 (21%)	191 (20%)	61 (27%)	40 (21%)	40 (20%)	25 (21%)	14 (19%)	<0.001
Married, domestic partnership or common law	1090 (62%)	619 (65%)	105 (47%)	121 (63%)	134 (66%)	65 (54%)	46 (64%)	
Widowed, divorced, or separated	298 (17%)	141 (15%)	56 (25%)	30 (16%)	28 (14%)	31 (26%)	12 (17%)	
Employment								
Unemployed	762 (44%)	364 (38%)	116 (52%)	87 (47%)	102 (51%)	58 (19%)	35 (50%)	<0.001
Employed	594 (34%)	367 (39%)	57 (26%)	69 (37%)	57 (28%)	30 (25%)	14 (20%)	
Other	393 (22%)	220 (23%)	49 (22%)	31 (17%)	41 (21%)	31 (26%)	21 (30%)	
Ontario Marginalization Index								
Highest (least deprived)	312 (20%)	194 (22%)	15 (7%)	34 (19%)	42 (23%)	12 (11%)	15 (21%)	<0.001
Mid	364 (22%)	216 (24%)	41 (20%)	30 (17%)	41 (23%)	25 (24%)	11 (16%)	
Lowest (most deprived)	307 (19%)	118 (13%)	82 (40%)	41 (23%)	24 (13%)	29 (28)	13 (19%)	

Continued next page

TABLE 1. (Continued)

Variables	Whole cohort (N = 1769)	White (N = 958)	African Canadian (N = 225)	East Asian (n = 191)	South Asian (N = 202)	Other (121)	Unknown (N = 72)	P*
Comorbidity								
History of diabetes	656 (38%)	318 (34%)	99 (44%)	51 (28%)	87 (44%)	63 (53%)	38 (57%)	<0.001
History of coronary artery disease/MI	429 (25%)	211 (22%)	51 (23%)	32 (17%)	64 (32%)	42 (35%)	29 (43%)	<0.001
History of CHF	123 (7%)	64 (7%)	21 (9%)	6 (3%)	12 (6%)	14 (12%)	6 (9%)	0.05
History of stroke or TIA	122 (7%)	64 (7%)	16 (7%)	8 (4%)	12 (6%)	12 (10%)	10 (15%)	0.05
History of PVD	188 (11%)	104 (11%)	30 (14%)	11 (6%)	13 (7%)	16 (14%)	14 (21%)	0.003
History of chronic lung disease	129 (8%)	76 (8%)	9 (4%)	10 (5%)	13 (7%)	10 (8%)	11 (17%)	0.02
History of nonskin cancer	141 (8%)	89 (9%)	18 (8%)	11 (6%)	7 (4%)	8 (7%)	8 (12%)	0.06

* P value represents the result of the overall statistical comparison of the baseline characteristics between ethnic groups (ie, χ^2 test, ANOVA, or Kruskal-Wallis test). ANOVA, analysis of variance; GN, glomerulonephritis; DM, diabetes mellitus; PKD, polycystic kidney disease; HTN, hypertension; MI, myocardial infarction; CHF, congestive heart failure; TIA, transient ischemic attack; PVD, peripheral vascular disease.

Asian Canadians. AB and B blood group were most prevalent among patients with Asian background (Table 1). Language barrier was mainly present in patients with Asian backgrounds. Socioeconomic deprivation was more prevalent among African Canadians, compared with other groups.

A total of 1100 patients completed the KTE within 2 years of referral (median follow-up: 307 [IQR: 193-452] days). Of these patients, only 103 were deemed ineligible for transplantation. During the follow-up period, 918 patients received either a deceased or living donor KT over a median of 629 (IQR, 362-1120) days from the time of referral. Four hundred eighty-seven patients received LDKT (Figure 1).

Compared with white Canadians (68.9%; 95% confidence interval [CI], 65.8-71.8), African Canadians (59.1%; 95% CI, 52.5-65.7) and patients with “other” ethnicity (54.8%; 95% CI, 46.1-64.0)], but not South Asian (61.7%; 95% CI, 54.8-68.6]) or East Asian Canadians (67.3%; 95% CI, 60.5-74.0), had a lower cumulative probability of completing the KTE within 2 years of referral (Figure 2). African Canadian and “other” ethnicity were associated with a significantly reduced unadjusted hazard ratio (HR) of completing the KTE in a univariable Cox proportional hazards model (HR, 0.75; 95% CI, 0.62-0.92; P = 0.006 and 0.71; 95% CI, 0.55-0.92; P = 0.013, respectively) (Table 2). Sequential adjustments for an expanding set of covariates did not appreciably alter the point estimate, and the association between ethnicity and completing the KTE remained statistically significant. In the final model (model 4), the adjusted HR for completing the KTE was 0.78 (95% CI, 0.64-0.94; P = 0.012) and 0.77 (95% CI, 0.59-1.00; P = 0.05) for patients with African Canadian and “other” ethnicity, respectively (Table 2). We found qualitatively similar results in analyses using “cleared for transplant” as outcome (Table S1, SDC, <http://links.lww.com/TP/B396>).

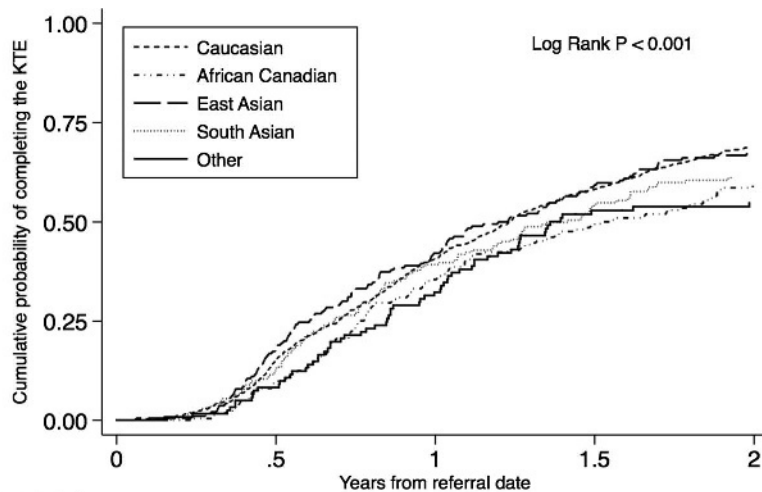
Ethnicity was associated with lower cumulative probability of receiving a KT (either from living or deceased donor) (Figure 3). In multivariable Cox proportional hazards models, all ethnic groups assessed had lower likelihood of receiving a KT (Table 3).

All ethnic groups, except East Asian Canadians, had similar probability of receiving a DDKT (Figure S1, SDC, <http://links.lww.com/TP/B396>). The association between ethnicity and access to DDKT remained qualitatively unchanged after multivariable adjustment (Table S2, SDC, <http://links.lww.com/TP/B396>). In contrast, there was a striking difference between white and non-white patients in receiving LDKT (Figure 4). Compared with white Canadians (61.1%; 95% CI, 54.3-68.0), African (31.0%; 95% CI, 19.8-46.4), East Asian (21.4%; 95% CI, 12.9-34.4), South Asian Canadians (38.4%; 95% CI, 26.1-54.0), and patients with “other” ethnicity (20.9%; 95% CI, 11.6-35.9) had significantly lower cumulative probability of receiving LDKT. These significant differences remained qualitatively unchanged after adjusting for sociodemographic and clinical variables (Table 4).

We tested the robustness of the primary results in several sets of sensitivity analyses (Table S3-S5, SDC, <http://links.lww.com/TP/B396>). The HR estimates did not materially change for the strategies used to re-analyze the data.

DISCUSSION

In this retrospective study, we showed that African Canadians and patients with “other” ethnicity were less



	Number at risk				
Caucasian	958	812	561	376	261
African Canadian	225	202	141	105	81
East Asian	191	156	110	74	53
South Asian	202	175	118	83	63
Other	121	111	82	49	46

FIGURE 2. Cumulative probability of completing the KT evaluation by ethnicity.

likely to complete the KTE when compared with white Canadians. Furthermore, patients with African, Asian, or “other” ethnicity were significantly less likely than whites to receive a KT or a LDKT.

These results suggest that ethnic background represents a significant barrier to accessing LDKT in a Canadian setting. This is important for at least 2 reasons. First, reduced access to LDKT for African or Asian Canadian patients will likely result in poorer health outcomes. Furthermore, some of the ethnocultural barriers may be modifiable, as demonstrated for African Americans in the United States.^{16,17,34-36}

Similar to our findings, studies in the United States reported that African Americans were substantially less likely to complete the KTE compared to whites. Socioeconomic status, geographical location, insurance status, patient preferences, lack of transplant related knowledge, experiences with discrimination were some of the potential factors that were felt to contribute.^{14,16,19,22,23,35,37-40} African Canadians in our sample were more likely to be deprived compared with other ethnic groups. The reduced access to waitlisting for African Canadians, however, remained significant even after adjusting for the Ontario Marginalization Index. Patient preferences, behavioural factors, health literacy, lack of understanding of the process, mistrust, or communication barriers may contribute to the observed inequities.

Similarly, patients with “other” ethnicity were also less likely to complete KTE. Most patients in this group were Indigenous, Hispanic, Middle Eastern, or Pacific Islander Canadians. The low number of individuals in each subgroup did not allow for more detailed analysis. Significant disparities in accessing KT have been reported for Indigenous People in Canada⁴¹⁻⁴³ and for the other ethnicities in the United States.²³

Important differences between the transplant evaluation process in the United States and at our center need to be considered when interpreting our results. In the United States most of the KTE is organized by the transplant centers after the patient had been referred. At our center, referral for KT is only accepted once the patient completed most of their KTE, which is done at or in close proximity to the dialysis unit. This is preferred by most patients, primarily because the reduced travel time and costs and better coordination with dialysis scheduling. On the other hand, this can contribute to inefficiencies because the priorities of the dialysis staff primarily focus on dialysis related concerns. Among others, this may be a contributing factor to the frequently lengthy evaluation process.

Access to DDKT was similar between the ethnic groups, except East Asian Canadians were more likely to receive a DDKT, primarily several years after referral. The reason for

TABLE 2.

Multivariable adjusted, era stratified likelihood of completing the KTE within 2 years after referral for patients with various ethnic backgrounds

Cox proportional hazards model	African Canadian HR (95% CI)	East Asian HR (95% CI)	South Asian HR (95% CI)	Other HR (95% CI)
Model 1	0.75 (0.62-0.92)	1.00 (0.82-1.22)	0.86 (0.70-1.05)	0.71 (0.55-0.92)
Model 2	0.77 (0.63-0.94)	1.00 (0.82-1.22)	0.85 (0.69-1.04)	0.73 (0.57-0.95)
Model 3	0.75 (0.61-0.93)	1.01 (0.83-1.24)	0.86 (0.70-1.06)	0.74 (0.57-0.95)
Model 4	0.78 (0.64-0.94)	0.99 (0.81-1.22)	0.90 (0.73-1.10)	0.77 (0.59-1.00)

Model 1, univariable.

Model 2, Model 1 + age, sex, marital status,

Model 3, Model 2 + English communication, OMI, employment status.

Model 4, Model 3 + history of: diabetes, coronary artery disease/myocardial infarction, heart failure, stroke and peripheral vascular disease, chronic lung disease, non-skin cancer.

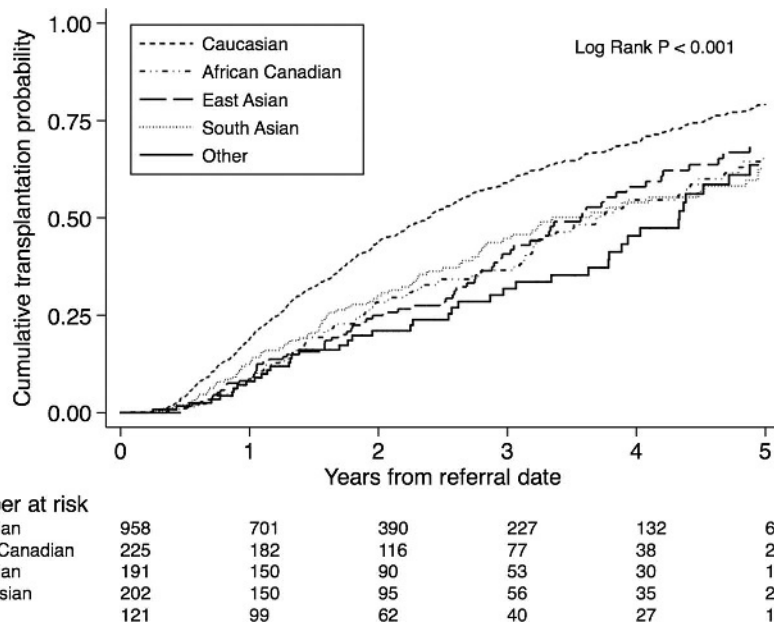


FIGURE 3. Cumulative probability of receiving a deceased donor KT by ethnicity.

this difference is not clear at this point. It is possible that this may be due, in part, to longer waiting time for Asian patients with blood group “B” and “AB” and a consequent allocation of compatible blood group “O” kidney to those patients.

Patients of African or Asian background had substantially lower likelihood of receiving LDKT. Similar differences had been demonstrated in the United States and also in 2 earlier Canadian papers that used pre-2000 registry data.^{27,28} In our more contemporary and more granular data set, we demonstrate that the presence and magnitude of ethnic disparities in accessing LDKT have remained largely unchanged over the last decades in Canada.

Only limited information is available about access to KT outside the United States. Dudley et al⁴⁴ reported that non-white patients in the United Kingdom were more likely to be waitlisted than whites. This could support the assumption that universal access to healthcare may reduce or eliminate ethnic disparities in access to KT. The Canadian experience reported here, however, seems to partially contradict this assumption: access to healthcare is universal in Canada but some of the ethnic disparities seem to be similar to those seen in the U.S. Similar to our findings, a few reports indicated that disparities in access to KT are found even when universal healthcare coverage is provided.⁴⁵

The lack of transplant related knowledge is a modifiable barrier to KT.^{16,37,46,47} The differences between ethnic groups observed in our analysis may reflect a lack of awareness about the benefits of LDKT, concerns about safety of the donor or culturally determined negative attitudes towards LDKT.

African American patients may have fewer suitable living donors due to familial clustering of comorbidity⁴⁸ and this could also be true for Asian Canadians. Differences in the family structure and social networks may also contribute to the observed disparities in LDKT.^{40,49} African Canadian patients were less likely to be married or having common law relationship, that might have limited the number of potentially available living donors. Finally, recent immigrants may not have family members available to donate and may not be sufficiently integrated into the local community to allow identification of potential living donors. Compatible with the potential role of social networks in accessing LDKT, preliminary results of our study demonstrated that unrelated donor candidates were less frequently identified by African or Asian when compared with white Canadians.⁵⁰

Little is known about the factors that may contribute to the observed differences in patients of Asian background. Prasad et al speculated that the lack of awareness about the

TABLE 3. Multivariable adjusted, era stratified likelihood of receiving a KT for patients with various ethnic backgrounds

Cox proportional hazards model	African Canadian HR (95% CI)	East Asian HR (95% CI)	South Asian HR (95% CI)	Other HR (95% CI)
Model 1	0.60 (0.47-0.75)	0.68 (0.54-0.86)	0.67 (0.53-0.84)	0.49 (0.36-0.66)
Model 2	0.62 (0.49-0.79)	0.68 (0.53-0.86)	0.66 (0.53-0.83)	0.52 (0.38-0.70)
Model 3	0.61 (0.48-0.78)	0.64 (0.51-0.82)	0.68 (0.54-0.86)	0.52 (0.38-0.71)
Model 4	0.63 (0.49-0.81)	0.65 (0.51-0.83)	0.71 (0.56-0.90)	0.54 (0.40-0.73)

Model 1, univariable.

Model 2, Model 1 + age, sex, marital status, OMI, English communication, employment status.

Model 3, Model 2 + the history of: diabetes, coronary artery disease/myocardial infarction, heart failure, stroke and peripheral vascular disease, chronic lung disease, non-skin cancer.

Model 4, Model 3 + blood group and peak PRA.

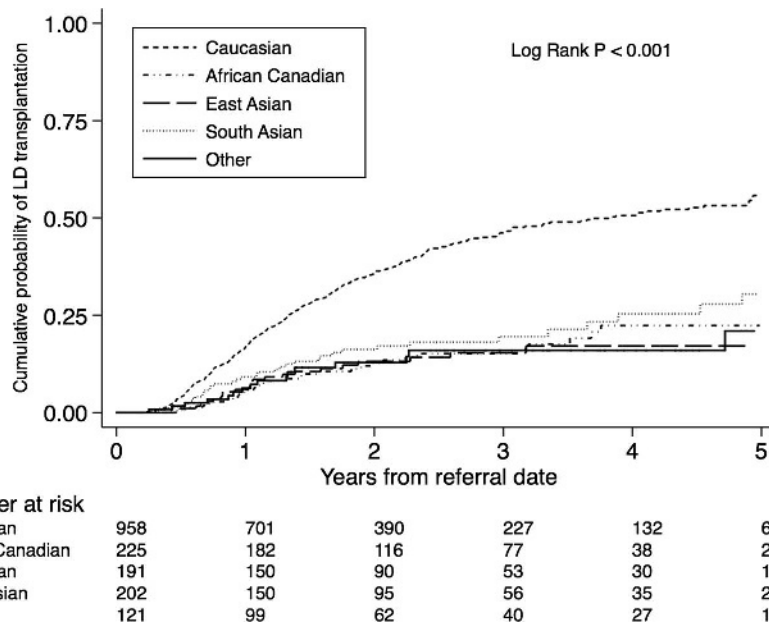


FIGURE 4. Cumulative probability of receiving a living donor KT by ethnicity.

benefits of KT and language barriers may play a role.⁵¹ In 2 qualitative studies the lack of communication about death and organ donation within the family or in the community, and the need to preserve an intact body emerged as potential barriers to deceased donation among East Asian⁵² and South Asian⁵³ Canadians. Type 2 diabetes mellitus is very prevalent among South Asian Canadians and this may limit the availability of suitable living donors. Culture specific beliefs about the potential negative impact of surgery on one's health, concerns about the safety and subsequent health of the living donor, concerns about the expenses associated with the surgery and subsequent financial stability of the family and also potential fear from stigma associated with chronic illness may limit the willingness of patients with Asian background to consider living donor transplant or may prevent potential living donors to come forward.

Our study is notable for its relatively large sample size, carefully documented clinical and sociodemographic variables and long follow-up. However, limitations of the analysis also deserve note. First, our data set is derived from a single-center, which may limit generalizability. Second, a significant proportion of the referred patients did not complete social work assessment and thus had to be excluded. Importantly, reasons for not completing the social work assessment

may be related to ethnocultural background. There are several potential reasons why a patient may not have available record of social worker assessment in our database. Patients who had relatively recently referred or were still in the process of assessment may not have yet completed the social work assessment. On the contrary, for some patients, who had initiated the workup but the process halted for some reason, the social worker visit was not completed. For patients who were referred during the earlier years of the recruitment period, hard copies of the social work note could not have been located or may have been sent off site. For some patients only a brief note about the assessment summary was available in our electronic records that did not have sufficient information for extraction for the purposes of this study. Third, ethnic background was unknown for some participants. However, no systematic biases in reporting and recording ethnic information could be identified and our results are consistent with similar studies from Canada and other countries. Fourth, information about ethnicity was abstracted from patient records and ethnicity was not based on self-report. We are aware that the ethnocultural categories used in our study are not homogenous. At this stage of our understanding and within the limitations of a retrospectively collected data set, however, we felt that more

TABLE 4. Multivariable adjusted, era stratified likelihood of receiving a living donor KT for patients with various ethnic backgrounds

Cox proportional hazards model	African Canadian HR (95% CI)	East Asian HR (95% CI)	South Asian HR (95% CI)	Other HR (95% CI)
Model 1	0.32 (0.22-0.45)	0.29 (0.19-0.44)	0.43 (0.31-0.61)	0.28 (0.17-0.46)
Model 2	0.35 (0.24-0.51)	0.28 (0.19-0.44)	0.42 (0.30-0.60)	0.31 (0.19-0.52)
Model 3	0.34 (0.23-0.50)	0.27 (0.18-0.42)	0.43 (0.30-0.61)	0.32 (0.19-0.54)
Model 4	0.35 (0.24-0.51)	0.27 (0.17-0.41)	0.43 (0.30-0.61)	0.34 (0.20-0.56)

Model 1, univariable.

Model 2, Model 1 + age, sex, marital status, OMI, English communication, employment status.

Model 3, Model 2 + the history of: diabetes, coronary artery disease/myocardial infarction, heart failure, stroke and peripheral vascular disease, chronic lung disease, non-skin cancer.

Model 4, Model 3 + blood group and peak PRA.

granular geographic, ethnic or religious diversity could not be analyzed appropriately. Finally, although we adjusted for multiple sociodemographic and clinical covariates, the potential for residual confounding cannot be excluded.

We conclude that African Canadians and patients with “other ethnicity” are less likely to complete the KT evaluation compared to whites. Furthermore, our results indicate that non-white (vs white) patients face barriers to accessing LDKT in Canada. Further research is needed to identify if these inequities are due to potentially modifiable barriers.

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