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Racialized and Immigrant Status and the Pursuit of Living Donor Kidney Transplant - a Canadian Cohort Study

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Introduction: Both immigrant and racialized status may be associated with the pursuit of living donor kidney transplant (LDKT).

Methods: This study was a secondary analysis of a convenience cross-sectional sample of patients with kidney failure in Toronto, obtained from our "Comprehensive Psychosocial Research Data System" research database. The exposures included racialized, immigrant, and combined immigrant and racialized status (White nonimmigrant, racialized nonimmigrant, White immigrant and racialized immigrant). Outcomes include the following: (i) having spoken about LDKT with others, (ii) having a potential living donor (LD) identified, (iii) having allowed others to share the need for LDKT, (iv) having directly asked a potential donor to be tested, and (v) accept a hypothetical LDKT offer. We assessed the association between exposure and outcomes using univariable, and multivariable binary or multinominal logistic regression (reference: White or White nonimmigrant participants).

Results: Of the 498 participants, 281 (56%) were immigrants; 142 (28%) were African, Caribbean, and Black (ACB); 123 (25%) were Asian; and 233 (47%) were White. Compared to White nonimmigrants, racialized immigrants (relative risk ratio [RRR]: 2.98; 95% confidence interval [CI]: 1.76–5.03) and racialized nonimmigrants (RRR: 2.84; 95% CI: 1.22–6.65) were more likely not to have spoken about LDKT with others (vs. having spoken or planning to do so). Both racialized immigrant (odds ratio [OR]: 4.07; 95% CI: 2.50–6.34), racialized nonimmigrants (OR: 2.68; 95% CI: 1.31–5.51) and White immigrants (OR: 2.68; 95% CI: 1.43–5.05) were more likely not to have a potential LD identified.

Conclusion: Both racialized and immigrant status are associated with less readiness to pursue LDKT. Supporting patients to communicate their need for LDKT may improve equitable access to LDKT.

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Kidney transplantation is associated with better patient and graft survival,[1] better health-related quality of life compared to staying on dialysis for eligible patients.[2–5] LDKT allows for shorter waiting times[6,7] and better outcomes.[8] Despite its benefits, LDKT is underutilized.[9–11]

Ethnocultural and socioeconomic factors and racialization are associated with lower utilization of LDKT.[12–17] Frequently, the term "race" is used to ascribe individuals to groups based on ancestral origin, which is assumed to contribute to genetic, cultural, educational, and socioeconomic characteristics of group members. Instead, we use the term "racialization"[18–24] to emphasize the complex historical, social, and political processes that form the racialized categories. This term also indicates that the processes forming and reinforcing those categories are, frequently and to a large extent, driven and informed by values, judgments, biases, and sociopolitical structures external to the affected individuals and groups. "Race" or "racialized status" is considered to be a significant characteristic of the identity of "racialized" individuals, who frequently face

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implicit or overt bias, microaggression and macroaggression, racism, and discrimination.[25-28] These experiences are also related to health inequities.[29-32]

Members of ACB and Asian communities in Canada are less likely to receive LDKT[33-37] compared to White patients. Gaps in transplant-related knowledge[38,39] and the impact of systemic racism and medical mistrust[40-42] contribute to these inequities. Studies in the United States assessed motivation, and the readiness to pursue LDKT among African Americans.[23,43-46] However, this has not been well-studied outside of the United States, or for Asian communities.

In Canada, a significant proportion of racialized people are immigrants.[47,48] In the context of our data set "Immigrant" refers to a person who (at our baseline assessment) is, or who had ever been, a landed immigrant, refugee, or been on a work/minister permit in Canada. Prior to 1970, immigrants were mainly arriving to Canada from European countries, whereas they are now primarily of Asian and African descent.[47] Challenges experienced by immigrants include social isolation, unemployment, psychosocial distress, discrimination, as well as reduced access to health care.[49-54] Kidney failure is known to be more prevalent among immigrants in Ontario.[14] The association between immigrant status and the pursuit of LDKT has not been documented in Canada. Kidney replacement therapy, including kidney transplant is covered for immigrants under provincial health insurance programs or the "Interim Federal Health Program" (for refugee claimants) regardless of the time they spent in the country. This coverage would also include health care-related expenses related to workup for potential LD candidates in Canada.

Insofar as immigrant and racialized status intersect, we examine the association between immigrant and racialized status with 5 actions consistent with pursuing LDKT among Canadian patients with kidney failure. We used an assessment model based on the transtheoretical model of behavioral change,[55] which has been applied to the pursuit of kidney transplant.[43,56,57] We hypothesize that racialized and immigrant participants will be less willing to consider actions to pursue LDKT compared to White or nonimmigrant participants.

METHODS

Study Design, Participants, and Data Sources

This was a secondary analysis of cross-sectional data selected from our research database, the Comprehensive Psychosocial Research Data System (REB #17-5916- AE). Data from studies assessing aspects of illness experience among patients with chronic kidney disease or solid organ transplant are added to this database. At the time of this analysis, the database included records from approximately 1700 participants, with data elements about clinical and sociodemographic characteristics, patient-reported outcome measures and knowledge and attitudes related to kidney transplantation.

Ethics approval was obtained from the University Health Network Research Ethics Board (UHN REB #15-9775 and 16-5314) and from the ethics boards of the participating hospitals (#2016-011-M, #2016-003-M; #16-249; #NEP-18-016; #377-2017; #17-0061). All study procedures were conducted in accordance with the standards of the University Health Network research ethics board and with the 1964 Helsinki declaration and its later amendments.

The primary studies included adults (18–80 years old) with advanced chronic kidney disease (estimated glomerular filtration rate <30 ml/min per 1.73 m^2 or on dialysis) and kidney transplant recipients, but excluded the following: patients who (i) had initiated dialysis between 0 to 90 days before enrollment, (ii) had active cancer or history of malignancy within 2 years of successful treatment, (iii) had active chronic infection that contraindicates kidney transplant, (iv) were non-English speakers, (v) had a diagnosis of dementia and/or severe cognitive impairment, and (vi) were unwilling or unable to provide informed consent.

For this analysis we excluded patients in the database who had a functioning kidney transplant, who were missing racialized or immigrant status and those who self-identified other than White, Asian, or ACB.[58-60] Following written informed consent, participants completed study questionnaires on an electronic data capture system (Data Driven Outcomes System - DADOS, Techna Institute, University Health Network, Toronto, Ontario, Canada) on tablet devices.[61] The study questionnaires included sociodemographic questions and validated questionnaires.

Clinical and Sociodemographic Variables

Self-reported sociodemographic characteristics included age, sex, level of education, marital status, self-reported income, employment status, and immigrant and racialized status. Socioeconomic status is described using the material deprivation domain of the Ontario Marginalization Index, which includes area-based census indicators.[62] Weighted average factor scores for each postal code in Ontario were ranked to generate quintiles from the least (1) to the most deprived (5).[62] Clinical information was extracted from medical records using a standardized extraction form. Dialysis vintage was defined as the length of time since the start of the latest period of dialysis (modality

changes were not considered as new start) and was categorized as: "<1 year," "1-3 years," and ">3 years". The comorbid conditions ascertained were used to calculate the Charlson Comorbidity Index.

Transplant Related Knowledge - Knowledge Assessment of Renal Transplantation (KART)

The kidney transplant-related knowledge of participants was assessed using the validated KART questionnaire.[63] KART is composed of 10 True/False/Do not know items and 5 multiple-choice questions pertaining to risks and benefits of kidney transplantation. Scores range from 0 to 30, with higher scores indicating more kidney transplant knowledge.[63]

Exposure Assessment and Classification

In this study, we used 2 coprimary exposures (i.e., self-reported immigrant and racialized status).[23] Immigrant status was assessed with the question: "Are you now or have you ever been a landed immigrant, refugee, or been on a work/minister permit [temporary resident permit] in Canada?" [64] Answers were dichotomized as "immigrant" versus "nonimmigrant". Racialized status is defined as groups that are distinct from the White "reference" group, which generally holds higher political, social, and economic power in a society. Racialized status was recoded from answers to the question: "Which of the following best describes your racial or ethnic group?" The response options included East Asian (e.g., Chinese, Japanese, and Korean), South Asian (e.g., Indian, Pakistani, and Sri Lankan), South East Asian (e.g., Malaysian, Filipino, and Vietnamese), Black-African (e.g., Ghanaian, Kenyan, and Somali), Black-Caribbean (e.g., Barbadian, and Jamaican), Black-North American (e.g., Canadian and American), First Nations, Indigenous/Aboriginal, Metis, Inuit, Indian-Caribbean, Latin American, Middle Eastern, White-European (e.g., English, Italian, Portuguese, and Russian), White-North American (e.g., Canadian and American), Mixed Heritage (e.g., Black-African and White-North American) and "other". From these responses, the final racialized status was classified into categories in line with the Canadian census data collection and the Toronto Public Health "Health Equity Data Collection Research Project" recommendations[33,64-66] as follows: (i) ACB participants (e.g., African, Caribbean, and Black Canadian [Black-North American]), (ii) Asian participants (e.g., East Asian, South Asian, South East Asian, Indian-Caribbean), (iii) White participants (e.g., White-European and White-North American), and (iv) Other. For this analysis, we retained only participants who self-identified as ACB, Asian or White. Following initial analyses with both coprimary exposures, a combined variable (i.e., the third exposure of interest) between immigrant status and binary-racialized status (i.e., White vs. racialized participants) was created to investigate its relationships with outcomes, to provide further understanding of the complex associations between racialized and immigrant status versus LDKT related actions. The categories of the combined variable were created to avoid small sample size within each, mutually exclusive category: White immigrant, racialized immigrant, White nonimmigrant, and racialized nonimmigrant participants.[23]

Outcome Assessment and Classification

Our primary outcome was having already spoken to family or friends about the need for getting LDKT. Response options were as follows: (i) I have already done this; (ii) I plan to do this; (iii) I do not plan to do this. The secondary outcomes included the following: (i) having at least 1 potential LD identified (Question: do you have at least 1 potential LD identified at this time? [Yes/No]), (ii) having allowed spouse and friends to share need for LDKT with others, (iii) having directly asked the potential LD to be tested, (iv) willingness to accept a hypothetical LDKT offer. Response options for outcomes (ii) to (iv) were the same as for the primary outcome.

Statistical Analysis

Categorical variables were described using frequencies and percentages, and continuous variables were summarized using mean and SD for normally distributed data and median (interquartile range) for skewed variables. We used chi-square tests to assess the association of exposures with outcome variables. We also used univariable, and multivariable binary or multinominal logistic regression to examine the association between the exposures and outcomes. The following 3 models were explored: (i) unadjusted model with immigrant status; (ii) unadjusted model with racialized status; and (iii) model with both immigrant status and racialized status plus age, sex, marital status, years of education, Ontario Marginalization Index deprivation, comorbidity (categorized as Charlson Comorbidity Index $\geq$4), presence of diabetes, transplant knowledge (KART score). For the combined racialized immigrant exposure variable, we built the following 2 models: (i) univariable model; (ii) model 1 plus age, sex, marital status, years of education and Ontario Marginalization Index deprivation quintiles, comorbidity (categorized as Charlson Comorbidity Index $\geq$4), presence of diabetes and transplant knowledge. These covariables were selected based on expected associations with exposure or outcome variables according to data in the literature, clinical experience, and theoretical consideration.

Table 1. Baseline sociodemographic and clinical characteristics of the sample

Characteristics	Total $N = 498$	Immigrant status			Racialized status			
		Immigrant participants $n = 281$	Nonimmigrant participants $n = 217$	*P*-value	ACB participants $n = 142$	Asian participants $n = 123$	White participants $n = 233$	*P*-value
Sociodemographic variables								
Age, yr, mean [SD]	58 [13]	60 [12]	54 [14]	<0.001	58 [13]	55 [14]	59 [13]	<0.001
Sex (male), *n* (%)	313 (63)	179 (64)	134 (62)	0.655	86 (61)	81 (66)	146 (63)	0.671
Marital Status, *n* (%)								
Single	112 (23)	51 (18)	61 (29)	0.020	44 (31)	23 (19)	45 (20)	0.001
Married or common law	269 (55)	157 (57)	112 (52)		55 (39)	74 (62)	140 (60)	
Widowed/ divorced/separated	111 (22)	70 (25)	41 (19)		43 (30)	22 (19)	46 (20)	
Education, *n* (%)								
<12 yr	186 (39)	120 (44)	66 (32)	0.006	77 (56)	27 (23)	82 (36)	<0.001
Annual self-reported income, *n* (%)								
<$30,000/yr	153 (58)	106 (70)	47 (41)	<0.001	56 (78)	41 (67)	56 (42)	<0.001
≥$30,000/yr	113 (42)	45 (30)	68 (59)		16 (22)	20 (33)	77 (58)	
Time since immigration, *n* (%)								
<20 yr	54 (20)	54 (20)	–	–	24 (21)	27 (29)	3 (5)	<0.001
≥20 yr	218 (80)	218 (80)	–		94 (79)	66 (71)	58 (95)	
OMI Material Deprivation, *n* (%)								
Low deprivation	128 (27)	53 (21)	75 (35)	<0.001	17 (13)	25 (21)	86 (38)	<0.001
Moderate deprivation	81 (17)	34 (13)	47 (22)		14 (11)	22 (19)	45 (20)	
High deprivation	260 (56)	169 (66)	91 (43)		95 (75)	70 (60)	95 (42)	
Clinical variables								
Diabetes (yes), *n* (%)	234 (47)	146 (52)	88 (41)	0.013	77 (54)	52 (42)	105 (45)	0.113
CCI (≥4), *n* (%)	201 (48)	120 (49)	81 (45)	0.480	63 (50)	38 (37)	100 (52)	0.035
KRT modality, *n* (%)								
Hemodialysis	355 (72)	221 (79)	134 (63)	<0.001	121 (85)	85 (70)	149 (65)	<0.001
Peritoneal dialysis	66 (14)	30 (11)	36 (17)		15 (11)	16 (13)	35 (16)	
None	70 (14)	27 (10)	43 (20)		5 (4)	21 (17)	44 (19)	
Dialysis vintage, *n* (%)								
≥1 yr	110 (28)	53 (22)	57 (35)	0.012	29 (23)	25 (27)	56 (31)	0.068
1–3 yr	141 (35)	85 (36)	56 (34)		39 (31)	31 (33)	71 (39)	
>3 yr	149 (37)	99 (42)	50 (31)		58 (46)	37 (40)	54 (30)	
Blood hemoglobin (g/l), mean (SD)	111 (14)	111 (15)	110 (14)	0.374	110 (13)	111 (17)	112 (14)	0.498
Serum albumin (g/l), mean (SD)	38 (5)	38 (4)	39 (5)	0.210	38 (4)	38 (5)	38 (5)	0.726
KART score, median (IQR)	7 (5,9)	6 (4,8)	8 (6,10)	<0.001	6 (4,8)	6 (4,7)	8 (5.5, 10)	<0.001

ACB, African, Caribbean, and Black; CCI, Charlson comorbidity index; IQR, interquartile range; KART, knowledge assessment of renal transplantation questionnaire; KRT, kidney replacement Therapy; OMI, Ontario Marginalization Index.

Multicollinearity was assessed using a variance inflation factor (variance inflation factor >5 was considered collinearity). Missingness was less than 15% for all variables except the self-reported income (26%). We used multiple imputations by chained equations to address missingness.[67] This method replaces missing values with a set of imputed values in different imputed data sets based on the joint distribution of existing variables entered into the imputation model. Analyses were performed on 5 complete imputed data sets, and the results were combined using Rubin's rules. Statistical analysis was conducted using STATA 15.0 (StatCorp, College Station, TX). A 2-sided *P* value of <0.05 was considered statistically significant.

RESULTS

Of the 656 potentially eligible participants in the database, 158 were excluded (Supplementary Figure S1). Of the remaining 498 participants, 56% ($n = 281$) were immigrants and 53% ($n = 265$) were racialized participants. Baseline characteristics of the cohort are shown in Table 1. Both immigrant and racialized participants were more likely to report less income, live in areas with high deprivation, to be on hemodialysis and to have lower transplant knowledge (KART) score.

The associations between our exposure and outcome variables are shown in Table 2. Both immigrant and racialized participants were significantly more likely not to have already engaged in actions explored by the outcome questions, compared to nonimmigrant and White participants, respectively. Similarly, immigrant versus nonimmigrant (64% vs. 37%) and racialized (72% vs. 56% vs. 39%, for ACB, Asian and White participants, respectively) participants were significantly more likely not to have a potential LD identified ($P < 0.001$ for both). A similar pattern was observed

Table 2. Association between exposures of interest (immigrant status or racialized status) and outcomes of interest

Outcome	Total $N = 498$	Immigrant status			Racialized status			
		Nonimmigrant participants $n = 217$	Immigrant participants $n = 281$	*P*-value	ACB participants $n = 142$	Asian participants $n = 123$	White participants $n = 233$	*P*-value
Have you spoken to others about the need for LDKT?								
Do not plan	150 (32)	59 (29)	91 (35)	<0.001	45 (35)	38 (35)	67 (30)	<0.001
Planning	158 (34)	55 (27)	103 (40)		59 (46)	43 (39)	56 (25)	
Already done	156 (34)	91 (44)	65 (25)		25 (19)	29 (26)	102 (45)	
Do you have at least 1 potential living donor identified at this time? *n* (%)								
No	241 (52)	75 (37)	166 (64)	<0.001	96 (72)	61 (56)	84 (39)	<0.001
Would you allow spouse and friends to share needs for LDKT? *n* (%)								
Do not plan	151 (33)	61 (30)	90 (36)	<0.001	49 (39)	38 (35)	64 (29)	<0.001
Planning	170 (38)	60 (30)	110 (44)		56 (44)	46 (42)	68 (31)	
Already done	131 (29)	80 (40)	51 (20)		21 (17)	25 (23)	85 (39)	
Have you directly asked the potential LD to be tested? *n* (%)								
Do not plan	215 (47)	98 (48)	115 (46)	<0.001	61 (48)	50 (46)	104 (48)	<0.001
Planning	137 (30)	45 (22)	92 (37)		50 (39)	41 (38)	46 (21)	
Already done	101 (22)	60 (30)	41 (16)		17 (13)	17 (16)	67 (31)	
Would you accept an LDKT offer? *n* (%)								
Do not plan	82 (19)	31 (16)	51 (20)	0.003	26 (20)	19 (18)	37 (18)	0.006
Planning	257 (58)	101 (53)	156 (63)		85 (67)	65 (61)	107 (52)	
Already done	101 (23)	59 (31)	42 (17)		16 (13)	22 (21)	63 (30)	

ACB, African, Caribbean, and Black; LD, living donor; LDKT, living donor kidney transplant.

for associations between outcomes and the combined exposure variable (Supplementary Table S1).

Having Spoken to Family and Friends About the Need for LDKT

In the unadjusted regression models, both immigrant and racialized participants were more likely to "not plan" or only to "plan" to talk about their need for LDKT with others as opposed to "having already talked", compared to participants in the respective reference group (Table 3). After adjusting for all covariates, the relationship remained significant for ACB participants ("not plan": RRR: 2.21, [1.02–4.79], $P = 0.045$; "plan": RRR: 3.81, [1.85–7.84], $P < 0.001$) and Asian ("plan": RRR: 3.15, [1.54–6.47], $P = 0.002$) participants (Table 3.). The pattern was similar for the combined exposure variable (Table 4). Both racialized nonimmigrant ("not plan": RRR: 3.19, [1.25–8.14], $P = 0.016$; "plan": RRR: 3.56, [1.36–9.33], $P = 0.010$) and racialized immigrant participants ("not plan": RRR: 2.13, [1.18–3.86], $P = 0.012$; "plan": RRR: 3.51; [1.85–6.32], $P < 0.001$) were more likely not yet to have talked with others about their need for a potential LDKT (Table 4).

Having at Least 1 Potential LD Identified

In the univariable logistic regression model, both immigrant and racialized participants were more likely not to have at least 1 potential LD identified compared to the respective referent category (Table 3). The association with racialized status (ACB: OR: 2.82 [1.4–5.52], $P = 0.003$; Asian: OR: 2.16 [1.17–4.01], $P = 0.014$), but not with immigrant status, remained significant in the adjusted logistic regression model (Table 3). For the combined exposure, all subgroups had substantially and significantly greater odds to not have at least 1 LD identified compared to White nonimmigrant participants in the adjusted models (racialized nonimmigrant: OR: 3.82 [1.64–8.90], $P = 0.002$; White nonimmigrant: OR: 2.13 [1.07–4.24], $P = 0.031$; racialized immigrant: OR 3.63 [2.18–6.04], $P < 0.001$) (Table 4).

Having Allowed Spouse and Friends to Share Needs for LDKT

In the adjusted models for "having allowed spouse and friends to share needs for LDKT," Asian participants (but not immigrant or ACB participants) were more likely to "plan" rather than "having allowed" this, compared to the reference group (Table 3). For the combined exposure, racialized nonimmigrant participants were more likely to "not plan", and racialized immigrant participants were more likely to "not plan" or "plan" over "having already allowed" spouse and friends to share the need for LDKT in comparison to White nonimmigrant participants in the adjusted model (Table 4).

Table 3. Binary logistic regression models estimating odds of not having a potential living donor identified and multinomial regression models estimating the likelihood of not having engaged in steps toward LDKT

			Immigrant status			Racialized status					
			Immigrant participants $n = 281$			ACB participants $n = 142$			Asian participants $n = 123$		
Outcome		Model	OR	95% CI	*P*-value	OR	95% CI	*P*-value	OR	95% CI	*P*-value
Do you have at least 1 potential living donor identified? ($n = 347$)	No	1	3.03	2.09–4.40	<0.001						
		2				4.19	2.53–6.92	<0.001	1.97	1.25–3.12	0.004
		3	1.48	0.88–2.49	0.140	2.82	1.44–5.52	0.003	2.16	1.17–4.01	0.014
			RRR	95% CI	*P*-value	RRR	95% CI	*P*-value	RRR	95% CI	*P*-value
Have you spoken to others about the need for LDKT ($n = 350$)	Do not plan	1	2.16	1.37–3.40	0.001						
		2				2.74	1.54–4.88	0.001	1.99	1.12–3.54	0.018
		3	1.05	0.55–1.98	0.889	2.21	1.02–4.79	0.045	1.84	0.91–3.75	0.092
	Planning	1	2.62	1.66–4.14	<0.001						
		2				4.30	2.43–7.60	<0.001	2.70	1.52–4.79	0.001
		3	1.04	0.57–1.91	0.894	3.81	1.85–7.84	<0.001	3.15	1.54–6.47	0.002
Would you allow spouse and friends to share your needs for LDKT? ($n = 344$)	Do not plan	1	2.30	1.42–3.71	0.001						
		2				2.97	1.62–5.42	<0.001	1.94	1.08–3.48	0.027
		3	1.10	0.58–2.11	0.763	1.93	0.90–4.14	0.091	1.85	0.88–3.92	0.107
		Model	RRR	95% CI	*P*-value	RRR	95% CI	*P*-value	RRR	95% CI	*P*-value
	Planning	1	2.08	1.32–3.29	0.002						
		2				3.11	1.69–5.71	<0.001	2.17	1.24–3.82	0.007
		3	1.38	0.76–2.50	0.294	1.83	0.87–3.83	0.109	2.08	1.04–4.17	0.038
Have you directly asked the potential LD to be tested? ($n = 343$)	Do not plan	1	1.69	1.00–2.85	0.051						
		2				2.31	1.27–4.20	0.006	1.65	0.87–3.12	0.123
		3	0.76	0.35–1.66	0.487	2.28	0.99–5.24	0.053	2.70	1.19–6.09	0.017
	Planning	1	2.90	1.66–5.05	<0.001						
		2				4.10	2.14–7.86	<0.001	3.04	1.53–6.02	0.002
		3	1.04	0.46–2.37	0.922	3.56	1.54–8.25	0.003	4.40	1.92–10.1	<0.001
Would you accept an LDKT offer? ($n = 332$)	Do not plan	1	2.26	1.26–4.06	0.006						
		2				2.61	1.26–5.41	0.010	1.51	0.71–3.18	0.278
		3	1.19	0.51–2.78	0.679	1.72	0.66–4.51	0.267	1.36	0.51–3.64	0.538
	Planning	1	2.08	1.32–3.29	0.002						
		2				3.14	1.71–5.78	<0.001	1.66	0.96–2.86	0.070
		3	1.38	0.76–2.50	0.294	2.25	1.07–4.71	0.032	1.58	0.81–3.07	0.177

ACB, African, Caribbean, and Black; CI, confidence interval; LD, living donor; LDKT, living donor kidney transplant; OR, odds ratio; RRR, relative risk ratio.
In this analysis immigrant status (yes or no) and racialized status (ACB, Asian or White participant) are the coprimary exposure or independent variables. Participants who identified as "nonimmigrant" or "White" are the reference group, respectively. For the outcome variables "having at least 1 potential living donor identified: yes," and having already engaged in steps toward LDKT and are the refence response options, respectively. ORs and RRRs, confidence intervals and *P* values shown for the immigrant status and racialized status columns, respectively, for models 3 are from the same model. The results shown are derived from analyses performed on 5 complete imputed data sets, and the results were combined using Rubin's rules. Model 1: immigrant status (reference: nonimmigrants); model 2: racialized status (reference: White); model 3: immigrant status, racialized status, age, sex, marital status, educational level, OMI deprivation quintile, transplant knowledge, comorbidity, presence of diabetes.

Having Directly Asked a Potential Donor to be Tested

In the adjusted regression models for "having directly asked the potential living donor," immigrant status was not significantly associated with this outcome after adjusting for racialized status. On the other hand, both ACB and Asian participants were more likely to "not plan" or "plan" to ask over "having already asked" compared to White participants in the fully adjusted model (Table 3). For the combined outcome, both racialized nonimmigrant and racialized immigrant participants were more likely to "not plan" or "plan" to ask over "having already asked" compared to White nonimmigrant participants (Table 4).

Accepting a Potential Offer of LDKT

The association between "not plan" or "plan" to accept a hypothetical LDKT offer was significant in the unadjusted model for immigrant and ACB participants (Table 3). In the unadjusted models for the combined exposure, White immigrant participants were more likely to "not plan," whereas racialized immigrant participants were more likely to both "not plan" and "plan" to accept a hypothetical LDKT offer compared to White nonimmigrant participants.

In the adjusted model, ACB participants were significantly more likely to "plan" rather than "having accepted", compared to White participants. In the adjusted model for the combined exposure variable,

Table 4. Binary logistic regression models estimating odds of not having a potential living donor identified and multinomial regression models estimating the likelihood of not having engaged in steps toward LDKT

			Combined immigrant and racialized status								
			Racialized nonimmigrant participants $n = 46$			White immigrant participants $n = 63$			Racialized immigrant participants $n = 219$		
Model			OR	95% CI	*P*-value	OR	95% CI	*P*-value	OR	95% CI	*P*-value
Do you have at least 1 potential living donor identified? ($n = 347$)	No	1	2.68	1.31–5.51	0.007	2.68	1.43–5.05	0.002	4.07	2.50–6.34	<0.001
		2	3.82	1.64– 8.90	0.002	2.13	1.07–4.24	0.031	3.63	2.18–6.04	<0.001
			RRR	95% CI	*P*-value	RRR	95% CI	*P*-value	RRR	95% CI	*P*-value
Have you spoken to others about the need for LDKT? ($n = 350$)	Do not plan	1	2.84	1.22–6.65	0.016	2.08	1.04–4.18	0.039	2.98	1.76–5.03	<0.001
		2	3.19	1.25–8.14	0.016	1.43	0.66–3.08	0.362	2.13	1.18–3.86	0.012
	Planning	1	2.67	1.10–6.51	0.031	1.57	0.74–3.35	0.243	4.14	2.46–6.97	<0.001
		2	3.56	1.36–9.33	0.010	1.15	0.50–2.61	0.746	3.51	1.95–6.32	<0.001
Would you allow spouse and friends to share your needs for LDKT? ($n = 344$)	Do not plan	1	3.44	1.38–8.55	0.008	2.86	1.34–6.09	0.006	3.07	1.76–5.35	<0.001
		2	4.39	1.47–13.1	0.009	2.06	0.91–4.67	0.084	2.16	1.12–4.15	0.021
	Planning	1	2.05	0.81–5.22	0.132	2.26	1.03–4.97	0.043	3.61	2.11–6.16	<0.001
		2	2.41	0.84–6.88	0.100	1.95	0.86–4.43	0.109	3.32	1.78–6.17	<0.001
		Model	RRR	95% CI	*P*-value	RRR	95% CI	*P*-value	RRR	95% CI	*P*-value
Have you directly asked the potential LD to be tested? ($n = 343$)	Do not plan	1	4.74	1.56–14.4	0.006	2.62	1.23–5.62	0.013	2.25	1.29–3.89	0.004
		2	7.96	2.46–25.8	0.001	1.87	0.80–4.38	0.148	2.00	1.07–3.75	0.030
	Planning	1	3.46	0.97–12.3	0.055	1.67	0.68–4.15	0.265	4.33	2.27–8.28	<0.001
		2	5.76	1.50–22.1	0.011	1.17	0.44–3.13	0.748	4.19	2.08–8.44	<0.001
Would you accept an LDKT offer? ($n = 332$)	Do not plan	1	2.37	0.77–7.28	0.132	3.08	1.21–7.80	0.018	2.55	1.29–5.04	0.007
		2	3.07	0.81–11.6	0.098	2.06	0.75–5.63	0.160	1.79	0.84–3.85	0.132
	Planning	1	2.02	0.80–5.05	0.134	1.88	0.84–4.21	0.123	2.60	1.54–4.38	<0.001
		2	2.14	0.79–5.79	0.134	1.75	0.76–4.01	0.187	2.65	1.49–4.70	0.001

CI, confidence interval; LD, living donor; LDKT, living donor kidney transplant; OR, odds ratio; RRR, relative risk ratio.
In this analysis the combined racialized immigrant status is the exposure or independent variable. Participants who identified as "White nonimmigrant" are the reference group. For the outcome variables "having at least 1 potential living donor identified: yes," and having already engaged in steps toward LDKT and are the refence response options, respectively. The results shown are derived from analyses performed on 5 complete imputed data sets, and the results were combined using Rubin's rules.

only to "plan" to accept an offer versus "having accepted" remained significantly associated with racialized immigrant status, compared to White nonimmigrant participants (Table 4).

As sensitivity analysis, we repeated our regression analyses on a "complete case" data set. These analyses yielded overall similar results compared to the imputed analyses, supporting the robustness of our findings for both the individual (immigrant and racialized status) and the combined exposure (Supplementary Table S2 and S3).

DISCUSSION

Our findings demonstrate that both immigrant and racialized patients with kidney failure are less likely to be taking actions to pursue LDKT compared to nonimmigrant and White participants. These actions include ways of communicating the need for LDKT to their family and friends. Consistent with these findings both immigrant and racialized participants (compared to nonimmigrant and White participants) were less likely to have a potential LD identified.

The lower readiness of racialized and immigrant patients to discuss their need for LDKT with their family and friends has major clinical implications; they may lose the chance to receive preemptive kidney transplant, may face longer wait times on the deceased donor list, and may experience substantial decline in health due to spending more time on dialysis.[36,68–70]

In our analyses, less readiness to communicate about LDKT was more strongly and consistently associated with racialized versus immigrant status. Other studies have also reported that African and Hispanic American patients were less willing to communicate their need for LDKT[43,71] compared to White participants. Our ongoing analysis of qualitative data collected from members of ACB, South Asian, and Chinese Canadian communities[24] suggest that this may be related to mistrust of the Canadian health care system,[72,73] gaps in transplant-related knowledge,[74] potential stigma associated with kidney failure, and cultural norms around privacy concerning health issues.[75,76] Patients may also have concerns about the impact of donation on the donor; therefore, they avoid talking about LDKT with their parents, children or other relatives. Lower transplant-related knowledge has repeatedly been

considered as a factor contributing to racial inequities in LDKT.[39] In our analyses, important and substantial differences remained even after adjusting for transplant-related knowledge (in addition to sociodemographic and economic factors, clinical characteristics), suggesting that factors other than factual knowledge may also be important.

Very little is known about the access to kidney care for immigrant patients in Canada. These patients face challenges associated with migration,[51] and barriers to accessing health care.[52,77] Recently, we published that immigrant and racialized status was associated with psychosocial distress in patients with kidney failure.[23] In this present analysis, we found that immigrant participants were less ready to communicate about their needs of LDKT. Further studies, including qualitative research, will be needed to help better understand the impact of immigrant status on the readiness to pursue LDKT.

Although both immigrant and racialized status were associated with less willingness to accept a hypothetical LDKT offer, when both variables were in the model, the association was only significant for ACB participants. Similar findings have been reported for African Americans in the United States.[41,78-80] For the combined exposure variable, only racialized immigrant participants were significantly less ready to accept an offer, compared to White nonimmigrants. Although the lack of statistical significance may be related to the low number of participants in some of the groups, these results may also indicate that many patients would be open to accept an offer. These findings are consistent with the results of a qualitative study, which showed that patients who had not found an LD were still interested in LDKT.[81] They were willing to accept an offer; however, they were reluctant to initiate conversations and preferred waiting to be approached by a potential donor.[46,82-84]

Not having a potential LD identified at the time of transplant assessment was strongly associated with not receiving an LDKT subsequently,[33] indicating that it is a good surrogate for the eventual receipt of LDKT. The strong association between not having a potential LD identified and immigrant and racialized status remained statistically significant even when both variables were entered in the model. The lower readiness to communicate the need for LDKT, as discussed above, may be an important reason for this result. In addition, hypertension, diabetes, and obesity are prevalent among families and friends of Asian and ACB patients.[85-90] Therefore, patients in need of LDKT may have concern about the health of a family member as a potential donor. Alternatively, an interested donor may not be suitable for donation. Another reason why immigrant patients may fail to find a potential live donor is that many of their family members live in a different country. Time since immigration may also play a role in this, with more recent immigrants potentially having a harder time in identifying an LD compared to immigrants who have been in Canada for longer. However, our sample largely consisted of participants who had immigrated more than 20 years before enrollment, limiting our ability to meaningfully analyze this question in this data set. Therefore, immigrant and racialized patients may benefit from strategies to support their communication with potential LD candidates.[46,82,84,91-93]

The relevance of immigrant status is demonstrated by the results of the analyses using the combined racialized immigrant exposure. Even White immigrant participants had higher odds of not having a potential LD identified, compared to White nonimmigrants, although the difference was more marked for racialized participants. These results highlight the intersection and the additive impact of immigrant and racialized status on readiness to pursue LDKT. It is important to note that the relationship between immigrant status and health-related concerns is a complex one. A number of related, intersecting factors, such as time since immigration, age at immigration, and the method of immigration (e.g., refugee or skilled worker status) are also important factors that contribute to readiness to pursue LDKT among immigrant participants. These factors are not necessarily easy to disentangle, and our data set was not large and granular enough to get more in-depth insight into the complex interaction of multiple closely related factors.

Strengths of our work include relatively large, clinically, and sociodemographically diverse sample, detailed sociodemographic and clinical information, and a multifaceted and granular assessment in assessing patients' readiness to pursue LDKT. Immigrant and racialized status were self-identified.

However, the limitations of this work will also need to be considered when interpreting the results. We analyzed data from a convenience sample, which may reduce generalizability. Canada has a publicly funded, universally accessible health care system, and this may also limit generalizability to jurisdictions with a substantially different health care system. We generated aggregate race and ethnicity categories. Although these groups may share some common experiences at the population level, they are diverse communities. However, these categories are frequently used when analyzing racial and ethnic differences in access to or outcomes of health care interventions. In addition, we did not have information about the circumstances under which our participants resettled in Canada, and we

did not have information about their legal status in Canada at the time of enrollment. Furthermore, a large majority (80%) of all immigrant participants in this sample immigrated >20 years before enrollment. Time since immigration, age at immigration and current age are variables that may all be associated with factors that may have a significant impact on the willingness to pursue LDKT. However, because those variables are correlated, it may be quite difficult to disentangle their complex association with our outcomes. Our relatively small sample size and the skewed distribution of time since immigration did not allow us to attempt such an analysis. The response options used for the outcome variables reflect the stages of behavioral change (precontemplation, contemplation/preparation, and action)[55] that have been applied to transplant decision making.[9,43,44,56,57,94] In our context, the response reflecting contemplation/preparation may be confounded by cultural norms of communication and social desirability bias. Refusing an idea directly ("not planning") may be considered rude, or impolite in many cultures.[38] We did not have information regarding waitlisting or receipt of transplant for our participants. Several subgroups of our study were small, limiting the statistical power of our analysis. Specifically, our sample included only a very small number of nonimmigrant racialized participants, which prevented us from formally and reliably assessing the interaction between immigrant and racialized status. For this reason, we generated an aggregate combined exposure variable to assess this issue; however, we acknowledge that it does not substitute for a formal interaction analysis. Furthermore, we cannot rule out that residual confounding may be present in our analysis. Finally, non-English speakers were excluded; thus, their experiences are not represented.

CONCLUSION

Lower willingness to engage in communication with potential donor candidates may contribute to lower access to LDKT among immigrant and racialized patients with kidney failure. An important next step is to develop strategies and tools to better support patients from these communities to reduce inequities in accessing the best treatment for kidney failure. Those strategies have to build on an enhanced understanding of the barriers patients from these communities may face when exploring their treatment options, which will be derived mainly from qualitative, community engaged research. Importantly, due to experiences with racism and discrimination both within and outside the health care system, efforts to increase readiness of patients from racialized communities in engaging the pursuit of LDKT can only be successful if they are codesigned with the communities affected, and delivered by trusted individuals, preferably community members with lived experience of kidney failure and transplant.

DISCLOSURE

All the authors declared no competing interests.

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AUTHOR CONTRIBUTIONS

Study conception and design was done by EL and IM. Data acquisition was done by EL, NS, and IM. Data analysis was performed by EL, JG, MH, NS, XX, and IM. Data interpretation was conducted by EL, JG, MH, CW, NS, PO, XX, PB, CEJ, ADW, BE, and IM. Drafting of the manuscript was done by EL, JG, MH, PO, CW, and IM. All the authors contributed important intellectual content during manuscript drafting or revision and accept accountability for the overall work by ensuring that questions pertaining to the accuracy or integrity of any portion of the work are appropriately investigated and resolved. Study supervision was done by IM. Final manuscript approval was by EL, JG, MH, CW, NS, PO, XX, PB, CEJ, ADW, BE, and IM.

SUPPLEMENTARY MATERIAL

Supplementary File (PDF)

Table S1. Association of combined immigrant and racialized status with outcomes of interest.

Table S2. Complete case analysis: multinomial regression model estimating the likelihood of not having engaged in activities toward the pursuit of LDKT, and binary logistic regression model estimating odds of not having a potential living donor identified. In this analysis immigrant status (yes or no) and racialized status (ACB, Asian, or White participant) are the coprimary exposure or independent variables. Participants who identified as "nonimmigrant" or "White" are the reference group, respectively. For the outcome variables, having already engaged in the activity assessed and "having at least 1 potential living donor identified: yes" are the reference response options, respectively. Fully adjusted model: immigrant status, racialized status, age, sex, marital status, educational level, OMI deprivation quintile,

transplant knowledge, comorbidity, presence of diabetes. ORs, RRRs, confidence intervals and *P* values shown for the immigrant status and racialized status columns, respectively, for models 3 are from the same model.

ACB, African, Caribbean, and Black; CI, confidence interval; LD, living donor; LDKT, living donor kidney transplant; OMI, Ontario Marginalization Index; RRR, relative risk ratio

Table S3. Complete case analysis: multinomial regression model estimating the likelihood of not having engaged in activities toward the pursuit of LDKT, and binary logistic regression model estimating odds of not having a potential living donor identified. In this analysis the combined racialized immigrant status is the exposure or independent variable. Participants who identified as "White nonimmigrant" are the reference group. For the outcome variables, having already engaged in the activity assessed and "having at least 1 potential living donor identified: yes" are the refence response options, respectively. Fully adjusted model: immigrant status, racialized status, age, sex, marital status, educational level, OMI deprivation, transplant knowledge, comorbidity, diabetes.

ACB, African, Caribbean, and Black; CI, confidence interval; LD, living donor; LDKT, living donor kidney transplant; Ontario Marginalization Index; RRR, relative risk ratio

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