ESOT

Special Issue

# Transplant International

## Diversity, Equity, and Inclusion in Transplantation

Transplant International

frontiers | Publishing Partnerships

Transplant
International

EDITOR-IN-CHIEF
**Thierry Berney**

DEPUTY EDITORS-IN-CHIEF
**Oriol Bestard**
**Nina Pilat**
**Stefan Schneeberger**
**Maria Irene Bellini**
(and Social Media Editor)
**Núria Montserrat**
(Honorary)

EXECUTIVE EDITORS
**Cristiano Amarelli,**
Naples
**Frederike Ambagtsheer,**
Rotterdam
**Federica Casiraghi,**
Bergamo
**John Forsythe,**
London
**Marius Miglinas,**
Vilnius
**Nazia Selzner,**
Toronto
**Olivier Thaunat,**
Lyon

ASSOCIATE EDITORS
**Coby Annema,** Groningen
**Jutta Arens,** Enschede
**Chiara Becchetti,** Niguarda
**Irene Bello,** Barcelona
**Marina Berenguer,** Valencia
**Ekaterine Berishvili,** Tbilisi
**Saskia Bos,** Leuven
**Olivia Boyer,** Paris
**Sophie Brouard,** Nantes
**Jadranka Buturovic-Ponikvar,**
Ljubljana
**Ligia Camera Pierrotti,** Brazil
**Sanem Cimen,** Ankara
**Sarwa Darwish Murad,**
Rotterdam
**Fabian Eibensteiner,** Vienna
**Farsad-Alexander Eskandary,**
Vienna
**Stuart M. Flechner,** Cleveland
**Lucrezia Furian,** Padova
**Maddalena Giannella,** Bologna
**Nicholas Gilbo,** Belgium
**Ilkka Helanterä,** Helsinki
**Sarah Hosgood,** Cambridge
**Nichon Jansen,** Leiden
**Katja Kotsch,** Berlin
**Rohan Kumar,** Geneva
**Cécile Legallais,** Compiegne
**Wai H. Lim,** Perth
**Pål-Dag Line,** Oslo
**Mehdi Maanaoui,** Lille
**Oriol Manuel,** Lausanne
**Shruti Mittal,** Oxford
**Letizia Morlacchi,** Milan
**Johan Nilsson,** Lund
**Gabriel Oniscu,** Stockholm
**David Paredes-Zapata,**
Barcelona
**Lorenzo Piemonti,** Mialan
**Karen C Redmond,** Dublin
**Hanne Scholz,** Oslo
**Norihisa Shigemura,**
Philadelphia
**Piotr Socha,** Warsaw
**Donzília Sousa Silva,** Porto
**Jelena Stojanovic,** London
**Christian Toso,** Geneva
**Ifeoma Ulasi,** Enugu
**Pablo Daniel Uva,** Beunos Aires
**Pedro Ventura-Aguiar,**
Barcelona
**Andreas Zuckermann,** Vienna

EDITOR-IN-CHIEF EMERITUS
**Ferdinand Mühlbacher, Vienna**

STATISTICAL EDITOR
**Thomas Neyens, Leuven**

ASSOCIATE STATISTICAL
EDITOR
**Maarten Coemans,** Leuven

EDITORIAL FELLOWS
**Louise Benning,**
University of Heidelberg,
Germany
**Christophe Masset,**
Centre Hospitalier Universitaire
de Nantes, France
**Beat Möckli,**
University of Geneva,
Switzerland
**Marco Maria Pascale,**
Agostino Gemelli University
Polyclinic, Italy
**Mario Sabatino,**
IRCCS Hospital Company of
Bologna, Italy

Editorial Office
Nathan Masters
Richard Hales
ti@frontierspartnerships.org

ESOT

# Diversity, Equity, and Inclusion in Transplantation

**Special Issue Editors**

Hannah Valantine — Stanford University, United States
Ifeoma Ulasi — University of Nigeria, Nigeria
Chloe Balleste — University of Barcelona, Spain
Paulo Martins — University of Massachusetts Medical School, United States
Maria Irene Bellini — Sapienza University of Rome, Italy
Luciano Potena — IRCCS University Hospital of Bologna Sant Orsola Polyclinic, Italy

Transplant International
Book Copyright Statement

The copyright in the text of individual articles in this eBook is the property of their respective authors or their respective institutions or funders. The copyright in graphics and images within each article may be subject to copyright of other parties. In both cases this is subject to a license granted to Frontiers.
The compilation of articles constituting this eBook is the property of Frontiers.
Each article within this eBook, and the eBook itself, are published under the most recent version of the Creative Commons CC-BY licence. The version current at the date of publication of this eBook is CC-BY 4.0. If the CC-BY licence is updated, the licence granted by Frontiers is automatically updated to the new version.
When exercising any right under the CC-BY licence, Frontiers must be attributed as the original publisher of the article or eBook, as applicable.
Authors have the responsibility of ensuring that any graphics or other materials which are the property of others may be included in the CC-BY licence, but this should be checked before relying on the CC-BY licence to reproduce those materials. Any copyright notices relating to those materials must be complied with.
Copyright and source acknowledgement notices may not be removed and must be displayed in any copy, derivative work or partial copy which includes the elements in question.
All copyright, and all rights therein, are protected by national and international copyright laws. The above represents a summary only. For further information please read Frontiers' Conditions for Website Use and Copyright Statement, and the applicable CC-BY licence.

ISSN 1432-2277
ISBN 978-2-8325-5733-4
DOI 10.3389/978-2-8325-5733-4

# Table of contents

## Editorial

36 **Providing “Free” Access to Dialysis and Transplant to the Disfranchised. A Sustainable Model for Low and Low Middle Income Countries (LMICs)**

DOI: 10.3389/ti.2023.11290

Mirza Naqi Zafar and Syed Adibul Hasan Rizvi

A community-government partnership was developed in a LMIC where dialysis and transplant were provided free of cost to all patients. Daily 1500 patients are dialyzed and 1-2 transplanted. One and 5-year graft survival of 6553 transplants is 97% and 88%.

49 **Representation of Women in Contemporary Kidney Transplant Trials**

DOI: 10.3389/ti.2023.11206

A. J. Vinson and S. B. Ahmed

Women are better represented in kidney transplant trials than for medical disciplines, however they remain underrepresented in transplant trials examining immunosuppression or transplant rejection risk.

56 **Breaking Barriers and Bridging Gaps: Advancing Diversity, Equity, and Inclusion in Kidney Transplant Care for Black and Hispanic Patients in the United States**

DOI: 10.3389/ti.2023.11455

Chi Zhang and Amit K. Mathur

Safety attitudes were preserved at our high-volume transplant center despite serious pandemic-induced disruptions. The SAQ is a valuable tool that can longitudinally assess transplant culture of safety as a component of quality assurance and performance improvement initiatives.

65 **Eliminating Race From eGFR Calculations: Impact on Living Donor Programs**

DOI: 10.3389/ti.2022.10787

Maria Irene Bellini, Mikhail Nozdrin, Maarten Naesens and Paulo N. Martins

In view of the recent OPTN approval of elimination of race-based calculation for transplant candidate listing, a reappraisal of its impact on living donor programs, both from the donor’s and the recipient’s perspective, could lead to a more equitable access.

68 **Decisional Needs of People From Minority Ethnic Groups Around Living Donor Kidney Transplantation: A UK Healthcare Professionals’ Perspective**

DOI: 10.3389/ti.2023.11357

Ahmed Ahmed, Anna Winterbottom, Shenaz Ahmed, John Stoves and Sunil Daga

Living-donor kidney transplantation is the best treatment option; however, minority ethnic groups choose to wait for deceased-donor organ despite longer wait and poorer outcomes. This intricate decision-making process is supported by healthcare professionals. Herein, we present their perspective on the decisional needs and potential solutions

European Society for Organ Transplantation (ESOT)

# Tackling Inequalities in Organ Transplantation: A Pathway Forward

Manifesto
2024–2029

EUROPEAN SOCIETY FOR ORGAN TRANSPLANTATION®

ESOT®

about us

SPECIAL ISSUE EDITORIAL
published: 09 October 2024
doi: 10.3389/ti.2024.13832

# Diversity, Equity, and Inclusion in Transplantation

*Maria Irene Bellini*[1]*, *Chloe Balleste*[2,3], *Paulo N. Martins*[4], *Ifeoma Ulasi*[5], *Hannah Valantine*[6] *and Luciano Potena*[7]

[1]Sapienza University of Rome, Rome, Italy, [2]University of Barcelona, Barcelona, Spain, [3]Donation and Transplantation Institute, Barcelona, Spain, [4]University of Oklahoma, Oklahoma City, OK, United States, [5]College of Medicine, University of Nigeria, Enugu, Nigeria, [6]Stanford University, Stanford, CA, United States, [7]IRCCS University Hospital of Bologna Sant' Orsola Polyclinic, Bologna, Italy

**Keywords: transplant equity, diversity and inclusion, racial disparity, gender differences, organ and tissue donation and transplantation**

## Editorial on the Special Issue

## Diversity, Equity, and Inclusion in Transplantation

As a component of the European Society for Organ Transplantation (ESOT) call for action in 2022, Transplant International launched a Special Issue entitled "*Diversity, Equity, and Inclusion in Transplantation*" [1]. The call for papers focused on sex, gender, ethnic and racial disparities in transplant access, management and outcomes. Emphasis was put on the changes of policies/ interventions required to address the existing inequities and the needs to build a true global access and foster a culture of diversity and inclusion in transplantation research.

With regards to sex and gender inequity, studies from United States and Nepal demonstrated barriers in the liver and kidney transplant processes, limiting the access to women from entering and completing waitlist evaluation (Giorgakis et al.; Singh Shah et al.), highlighting how they face barriers to be considered for surgery. Notably, this also reflects the disparity in the living donation process [2]: in a context where countries in Southeast Asia were reported to have the lowest rates of deceased donors, the majority of kidney living donors are women, although the highest proportion of recipients are men. To further explore the disparities in this area, a review compared the top organ donor countries, to elucidate possible interventions and establish a fair transplant process in Southeast Asia (Cowie et al.). This article provides a brilliant approach by analyzing the differences in healthcare systems and how resources and organization can impact the effectiveness of transplant programs in addition to education and cultural attitude. Within the variety of economic and developmental backgrounds, the authors identified Malaysia as one of the potential countries able to build an effective deceased donor program, recognizing the general principle that there is no "one size fits all" for organ donation systems, but that government support through financial inputs in healthcare, and therefore access to publicly funded healthcare, is fundamental for successful donation and transplantation activity.

Another interesting report dealing with a sustainable model to overcome the gender and social disparity in renal replacement therapy in Low and Middle Income Countries (Zafar and Rizvi) showed that establishing satellite centers reduces patient time and travel costs, with a model of community-government partnership, where dialysis and transplantation are integrated and offered "free of cost" to all in need.

Adequate women representation is a known unmet need in clinical science, with a documented discrepancy between the epidemiological prevalence of a disease and the rate of women enrolled in related clinical trials. Vinson and Ahmed found that in the field of kidney transplantation, women's representation is more adequate when compared to other medical disciplines. However, they remain significantly underrepresented in research trials testing immunosuppressive drugs and surgical interventions. This finding is particularly striking in the context of the known increased risk of

***Correspondence**
*Maria Irene Bellini,*
✉ *mariairene.bellini@uniroma1.it*

***Received:*** *20 September 2024*
***Accepted:*** *23 September 2024*
***Published:*** *09 October 2024*

***Citation:***
*Bellini MI, Balleste C, Martins PN, Ulasi I, Valantine H and Potena L (2024) Diversity, Equity, and Inclusion in Transplantation. Transpl Int 37:13832. doi: 10.3389/ti.2024.13832*

rejection for women, raising the hypothesis that this might also be partially related to the disparity in accessing interventional research.

Inequity in transplant access and management was described for rural and remote populations, as well as specific ethnic and caste groups, where cultural beliefs could be inherent causes of bias (Zhang and Mathur). Particular emphasis was given therefore to the proposal of eliminating race from eGFR calculations (Bellini et al.) in accessing national waitlist, a decision approved a few years ago by the OPTN Board [3], which settled in this way the tone towards a more equitable assessment of prospective transplant and donor candidates.

This remarkable change could have consequences for living kidney transplantation; a UK study (Ahmed et al.) investigated how to improve decision making from the healthcare professional's perspective for people from diverse ethnic groups, as this precious resource remains underutilized. An education strategy seems realistic to implement the diversity of the organ donor registry, aiming to gain the support of key influencers (such as religious and community leaders, media editors, local figures) and tackle barriers negatively influencing support for organ donation in minority ethnic groups (Pradeep et al.) [4]. To this purpose, it is relevant to stress how difficult it remains to determine the impact of patient ethnicity, race or immigration background, especially in consideration of the inconsistency of how migrant and ethnic minority populations are defined in European studies [5]. This is why when analyzing such complex systems, it is recommended to consider an intersectionality approach (Nonterah) i.e., non-medical aspects of an individual's life, as where they live, are raised, engage in recreational activities, and their vocation, to better represent the full environmental context leading to disparity in organ transplantation access, management and outcomes.

Luckily, the prevention and elimination of inequities related to patient characteristics is increasingly being recognized in transplant research. It has been reported that the demand for organs can largely be reduced if there is a sustained commitment to public health interventions and culturally competent approaches are implemented in the management of long-term conditions, taking also into consideration the demand from underrepresented minority populations, such as migrants (Grossi et al.). In this regard, the current state of the art in Italy was reviewed (Grossi et al.) and described that minority ethnic background individuals and immigrants present significantly higher rates of cardiovascular disease and endocrinological disorders, potentially leading to organ failure. Unfortunately, despite the presence of a public health system with universal healthcare coverage, non-European born residents are less likely to receive living kidney donation transplantation and more likely to have inferior long-term outcomes compared with European born individuals. These findings are not novel in general and reproduce what was already reported in other health national system realities, such as the United Kingdom [6] and United States [7].

To complete the insights into organ donation and transplantation in the immigrant population in Italy, a mention to the comparison of refusal rates showed that these were higher, especially in some non-native Italian populations countries, supporting the need for communication approaches tailored for cultural diversities, when discussing donation with families with a potential language barrier and a non-western cultural background (Grossi et al.).

It is worth remembering that the standard approaches to patient education and management are less likely to be effective with subjects from immigrant and/or ethnic minority groups, and instead tailored interventions to meet the needs of these populations remain a challenge. For instance, a report found that in abdominal transplant recipients language preference other than English was independently associated with delay to vaccination in the United States (de Crescenzo et al.). It would be therefore worth exploring alternative ways, for example, by the use of digital technology, as the reconstruction of education after the COVID-19 pandemic [8] revealed an unforeseen potential.

Could then modern technology help in pushing the boundaries of the XXI century transplant outcomes? Medical digitalization is nowadays being increasingly utilized in clinical practice, and it was suggested that blockchain technology (Anselmo et al.), defined as a peer-to-peer distributed database without centralized authority, could soon become of pivotal importance in overcoming some limitations of transplant programs. In particular, it was suggested that distribution ledger technology could affect the organ donor traffic in the black market, by providing a real integration between different national health systems with real-time auditability.

What could be the role of scientific societies, institutions and stakeholders? According to a survey by the Equity, Diversity, and Inclusion Committee of ESOT, reported as a qualitative research approach, the main areas of intervention included initiatives aiming to foster a culture of transparency in selection procedures, always considering diversity when evaluating candidates and anonymizing applications to eliminate inherent bias, using different languages in meetings and diverse panels in conferences, limiting the tenure of Council members, and promoting a bottom-up instead of a top-down organization (Pengel et al.). The recruitment of professionals from a variety of countries, backgrounds, and ethnicities or the facilitation of combining career and family life could be supported by initiatives such as access to digital learning solutions, i.e., webinars and online courses. In fact, the disparities described above could significantly hinder career development, which limits creativity and innovation by professionals from minority groups. Individuals from all backgrounds should instead have equal opportunities to enter and excel in their field and this will also promote scientific advancement and better care for the patients (Andacoglu et al.).

Our modern Society increasingly embraces the general concept of equity for all individuals, and organ donation and transplantation must follow this ethical principle and have a transparent system to assure no discrimination is carried out [9]. To achieve health equity, the same treatment options must be available to any individual affected by end-stage organ failure, regardless of sex, gender, race, ethnicity, socioeconomic backgrounds and their interplay. As the transplantation journey is a multistep process, the disparity affecting one or more phases, from clinician's referral for evaluation to the actual moment when transplant occurs, should be explored for possible interventions to reduce the existing evidence in disparity when receiving an organ transplant. The aim of this Special Issue is to build on the promotion of healthcare and social equity worldwide, by highlighting possible areas of interventions, following what professional groups in the transplant community have identified as strategic initiatives or explicit goals in their mandates.

## AUTHOR CONTRIBUTIONS

CB, PM, IU, and HV reviewing and editing the draft. LP Conceptualization, reviewing and editing the draft. MB Conceptualization, writing the original draft. All authors contributed to the article and approved the submitted version.

## CONFLICT OF INTEREST

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

## GENERATIVE AI STATEMENT

The author(s) declare that no Generative AI was used in the creation of this manuscript.

## REFERENCES

1. Diversity, Equity, and Inclusion in Transplantation. Available from: https://www.frontierspartnerships.org/research-topics/24/diversity-equity-and-inclusion-in-transplantation (Accessed September 9, 2024)
2. Bellini MI, Nozdrin M, Pengel L, Knight S, Papalois V. How Good Is a Living Donor? Systematic Review and Meta-Analysis of the Effect of Donor Demographics on Post Kidney Transplant Outcomes. *J Nephrol* (2022) 35(3):807–20. doi:10.1007/s40620-021-01231-7
3. OPTN. OPTN Board Approves Elimination of Race-Based Calculation for Transplant Candidate Listing (2022). Available from: https://optn.transplant.hrsa.gov/news/optn-board-approves-elimination-of-race-based-calculation-for-transplant-candidate-listing/ (Accessed September 9, 2024).
4. Bellini MI, Charalampidis S, Stratigos I, Dor FJMF, Papalois V. The Effect of Donors' Demographic Characteristics in Renal Function Post-Living Kidney Donation. Analysis of a UK Single Centre Cohort. *J Clin Med* (2019) 8(6):883. doi:10.3390/jcm8060883
5. Farkas L. Analysis and Comparative Review of Equality Data Collection Practices in the European Union. Available from: https://commission.europa.eu/system/files/2021-09/data_collection_in_the_field_of_ethnicity.pdf (Accessed August 6, 2024).
6. Wu DA, Robb ML, Watson CJE, Forsythe JLR, Tomson CRV, Cairns J, et al. Barriers to Living Donor Kidney Transplantation in the United Kingdom: A National Observational Study. *Nephrol Dial Transpl* (2017) 32(5):890–900. doi:10.1093/ndt/gfx036
7. Herbst LR, Zeiser LB, Mitchell J, Nijhar K, Perincherry V, López JI, et al. Examination of Racial and Socioeconomic Disparity in Use of Nondirected Kidney Donation in the US. *J Am Coll Surg* (2022) 234(4):615–23. doi:10.1097/XCS.0000000000000099
8. Bellini MI, Pengel L, Potena L, Segantini L, Group EC-W. COVID-19 and Education: Restructuring After the Pandemic. *Transpl Int* (2021) 34(2):220–3. doi:10.1111/tri.13788
9. National Academies of Sciences, Engineering, and Medicine; Health and Medicine Division; Board on Health Care Services; Board on Health Sciences Policy; Committee on A Fairer and More Equitable, Cost-Effective, and Transparent System of Donor Organ Procurement, Allocation, and Distribution. 4, Confronting and Eliminating Inequities in the Organ Transplantation System. In: Hackmann M, English RA, Kizer KW, editors *Realizing the Promise of Equity in the Organ Transplantation System*, Washington (DC): National Academies Press (US) (2022). Available from: https://www.ncbi.nlm.nih.gov/books/NBK580030/ (Accessed September 9, 2024).

ESOT | Transplant International

LETTER TO THE EDITOR
published: 02 November 2023
doi: 10.3389/ti.2023.11667

# Women Referred for Liver Transplant Are Less Likely to Be Transplanted Irrespective of Socioeconomic Status

*Emmanouil Giorgakis*[1]*, *Martha M. Estrada*[1], *Allison Wells*[1], *Mauricio Garcia Saenz de Sicilia*[2], *Matthew Deneke*[2], *Raj Patel*[1], *Gary Barone*[1], *Lyle Burdine*[1] *and Mary K. Rude*[2]

[1]*Division of Solid Organ Transplantation, Department of Surgery, University of Arkansas for Medical Sciences, Little Rock, AR, United States,* [2]*Division of Gastroenterology and Hepatology, Department of Medicine, University of Arkansas for Medical Sciences, Little Rock, AR, United States*

**Keywords: disparities, liver transplant, social vulnerability index, sex disparities, public policy**

Dear Editors,

Liver transplantation is the standard of care for end-stage liver disease (ESLD) and transplant oncology patients. Given the organ shortage, equitable organ distribution is key. Recent studies have repeatedly reported that, in the US, waitlisted patients of female sex are less likely to be transplanted and more likely to die awaiting a liver transplant [1, 2]. This has been largely attributed to an imperfect model for end-stage liver disease (MELD) scoring systems and donor-recipient size mismatch [1, 3, 4].

After obtaining institutional board review exemption (IRB 275415), we explored socioeconomic and sex-related disparities of patients referred for liver transplant at Arkansas' single liver transplant institution. The Centers for Disease Control and Prevention (CDC)/Agency for Toxic Substances and Disease Registry (ATCSDR) Social Vulnerability Index (SVI) was employed as surrogate indicator of socioeconomic status [5]. Social vulnerability refers to the resilience of a population when confronted by a health stressor, be it a disease outbreak or a natural or human-caused disaster. CDC/ATSDR SVI database "*can help communities prepare for and recover from public health emergencies, and prevent adverse effects among socially vulnerable populations, such as emotional distress, loss of property, illness, and death*" [5]. The SVI calculation encompasses parameters reflecting a community's *socioeconomic* (e.g., poverty, unemployment, *per capita* income, education, and health insurance), *population* (e.g., children or elderly, disability, single parent, minority, limited English), and *housing/transportation* (e.g., mobile homes, crowding, no vehicle, living in group quarters) *vulnerability*. Data was sourced from the Arkansas Clinical Data Repository.

Patients with less than 1 year follow-up or missing data were excluded. SVI scores were assigned by patient's ZIP code, which reflects the patient's location of residence. The patients were split into SVI quartiles, based on SVI median and interquartile range. Logistic regression was performed for enlisting, adjusted for SVI quartile, age, sex, body mass index, and insurance payor. A Fine-Gray survival model was built, with liver transplant as the primary outcome and death a competing event controlled for sex, SVI quartile, and insurance. Analyses were conducted using R software (4.1.0) and STATA version (17.0).

Study period was from 1st January 2019 to 31st December 2022. The study population included $N = 779$ patients who had been referred to our center during that time for liver transplant evaluation.

OPEN ACCESS

***Correspondence:**
*Emmanouil Giorgakis*
*egiorgakis@uams.edu*

***Received:*** *09 June 2023*
***Accepted:*** *23 October 2023*
***Published:*** *02 November 2023*

***Citation:***
*Giorgakis E, Estrada MM, Wells A, Garcia Saenz de Sicilia M, Deneke M, Patel R, Barone G, Burdine L and Rude MK (2023) Women Referred for Liver Transplant Are Less Likely to Be Transplanted Irrespective of Socioeconomic Status. Transpl Int 36:11667. doi: 10.3389/ti.2023.11667*

---

**Abbreviations:** ATCDR, agency for toxic substances and disease registry; CDC, centers for disease control and prevention; ESLD, end-stage liver disease; MELD, model for end-stage liver disease; NASH, non-alcoholic steatohepatitis; SVI, social vulnerability index.

**TABLE 1 |** Multivariate analysis of liver transplant outcome.

| | Odds ratios (OR) | 95% CI | p |
|---|---|---|---|
| Male Sex | **2.73** | **1.70–4.52** | **<0.001** |
| Private Insurance payor | **2.2** | **1.35–3.70** | **0.002** |
| SVI quartile | | | |
| (Intercept) | 0.16 | 0.03–0.78 | 0.025 |
| 2 | 0.56 | 0.27–1.12 | 0.108 |
| 3 | 1.09 | 0.63–1.92 | 0.756 |
| 4 | 1.09 | 0.60–1.99 | 0.769 |
| Age | 0.98 | 0.96–1.00 | 0.061 |

*Bold value indicates the male sex and private insurance independently favored liver transplant (odds ratio [OR] 2.73; 95% CI, 1.70–4.52, and 2.2; 95% CI, 1.35–3.70, respectively).*

**TABLE 2 |** Fine gray competing risk survival analysis of patients referred for liver transplant.

| | OR | 95% CI | p |
|---|---|---|---|
| Medicare/Medicaid | **0.48** | **0.30–0.76** | **0.002** |
| Male Sex | **2.38** | **1.53–3.70** | **<0.001** |
| SVI quartile | | | |
| 2 (0.53–0.75) | 0.59 | 0.30–1.13 | 0.112 |
| 3 (0.76–0.81) | 1.04 | 0.64–1.71 | 0.864 |
| 4 (≥0.81) | 1.00 | 0.59–1.69 | 0.994 |

*Bold value indicates the male sex favored liver transplantation (OR 2.38; 95% CI, 1.53–3.70). Medicare/Medicaid insurance payor decreased the odds getting a liver transplant (OR 0.48; 95% CI, 0.30–0.76).*

43.2% ($N = 336$) of these patients were female. Logistic regression analysis indicated that, irrespective of SVI quartile, male sex and private insurance were independent predictors favoring liver transplantation (odds ratio [OR] 2.73; 95% CI, 1.70–4.52, and 2.2; 95% CI, 1.35–3.70, respectively; **Table 1**). Likewise, on Fine-Gray analysis adjusted for SVI quartile, male sex and Medicare/Medicaid insurance payor were independent risk factors (OR 2.38; 95% CI, 1.53–3.70, and 0.48; 95% CI, 0.30–0.76, respectively) (**Table 2**). *Waitlisted* male patients with private insurance were more likely to get transplanted and survive after a liver transplant. What is more, male sex patients *referred* for liver transplant were found more likely to be *evaluated* (OR 1.76, $p < 0.001$), *enlisted* (OR 2.07, $p < 0.001$) and *transplanted* (OR 2.55, $p < 0.001$) compared to their female counterparts (**Supplementary Data**).

In conclusion, our study indicates that, in the population and period studied, there are sex related barriers in the liver transplant process. These obstacles may prevent female sex patients from entering and completing liver transplant evaluation. This gap may be ascribed to *functional status assessment* barriers [2], e.g., higher perceived frailty among females, particularly elderly; *clinical*, e.g., higher female prevalence of nonalcoholic steatohepatitis (NASH), with NASH known to be associated with higher surgical risk; *social* [1, 2], e.g., work or family obligations preventing completion of the evaluation process; the *stigma* of alcohol excess [1, 2]; or *geographic*, i.e., within minority groups residing in remote locations. Beyond introducing remedies such as scoring system upgrades accounting for patient's sex [1, 2], it is also necessary to address sex-based barriers presenting early on in the liver transplant referral and evaluation process [2]. A good start may be the 1) creation of national or regional liver disease/ESLD registries in order to achieve better data granularity; 2) introduction of transplant referral and evaluation efficiency metrics (e.g., time from referral to decision over enlisting) [2]; 3) implementation of objective frailty testing methods [2]; and 4) provisions for a more flexible evaluation process, tailored to individual socioeconomic, geographic, and cultural needs.

Limitations of this pilot study were its limited sample, retrospective nature, and the inclusion of liver transplant referrals to a single US transplant institution.

## DATA AVAILABILITY STATEMENT

The raw data supporting the conclusion of this article will be made available by the authors, without undue reservation.

## ETHICS STATEMENT

The studies involving humans were approved by UAMS Institutional Review Board. The studies were conducted in accordance with the local legislation and institutional requirements. Written informed consent for participation was not required from the participants or the participants' legal guardians/next of kin in accordance with the national legislation and institutional requirements.

## AUTHOR CONTRIBUTIONS

Conceptualization, EG and MR; methodology, EG and AW; software, EG and AW; formal analysis, AW; data curation, EG and AW; writing-original draft preparation, EG; writing-review and editing, EG, ME, LB, RP, MG, MD, GB, and MR; visualization, EG; supervision, EG. All authors contributed to the article and approved the submitted version.

## CONFLICT OF INTEREST

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

## SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontierspartnerships.org/articles/10.3389/ti.2023.11667/full#supplementary-material

## REFERENCES

1. Nephew LD, Serper M. Racial, Gender, and Socioeconomic Disparities in Liver Transplantation. *Liver Transpl* (2021) 27(6):900–12. doi:10.1002/lt.25996
2. Sawinski D, Lai J, Pinney S, Gray AL, Jackson AM, Stewart D, et al. Addressing Sex-Based Disparities in Solid Organ Transplantation in the United States-A Conference Report. *Am J Transplant* (2023) 23:316–25. doi:10.1016/j.ajt.2022.11.008
3. Locke JE, Shelton BA, Olthoff KM, Pomfret EA, Forde KA, Sawinski D, et al. Quantifying Sex-Based Disparities in Liver Allocation. *JAMA Surg* (2020) 155(7):e201129. doi:10.1001/jamasurg.2020.1129
4. Allen AM, Heimbach JK, Larson JJ, Mara KC, Kim WR, Kamath PS, et al. Reduced Access to Liver Transplantation in Women: Role of Height, MELD Exception Scores, and Renal Function Underestimation. *Transplantation* (2018) 102(10):1710–6. doi:10.1097/TP.0000000000002196
5. CDC/ATSDR. *CDC/ATSDR Social Vulnerability Index* (2023). Available From: https://www.atsdr.cdc.gov/placeandhealth/svi/index.html (Accessed September 7, 2023).

ORIGINAL RESEARCH
published: 30 November 2023
doi: 10.3389/ti.2023.11635

# Equity in Transplantation Access in Nepal: An Analysis of Gender, Geographic, and Caste-Based Disparities in Transplants

**Dibya Singh Shah[1]*, Midhan Shrestha[1]*, Bikash Khatri[2], Santosh Chhetri[3], Kalpana Shrestha[4], Sangita Sedhai[5], Upendra Joshi[5] and Manish Gautam[6]**

*[1]Department of Nephrology and Transplantation Medicine, Institute of Medicine, Tribhuvan University Teaching Hospital, Kathmandu, Nepal, [2]Bir Hospital, Kathmandu, Nepal, [3]KIST Medical College, Kathmandu, Nepal, [4]Shahid Dharmabhakta National Transplant Centre, Bhaktapur, Nepal, [5]Grande International Hospital, Kathmandu, Nepal, [6]Anweshan Pvt. Ltd., Kathmandu, Nepal*

Transplantation is a lifesaving modality for addressing various organ failures. While kidney transplant services became available in Nepal in 2008, the introduction of liver transplantation is more recent. The government provides financial assistance to support lifelong dialysis and kidney transplantation. The importance of equitable access to transplantation cannot be overemphasized. This study aims to examine the equity in accessing transplantation services. This retrospective observational study encompasses patients who underwent kidney transplantation up until December 2022 across five major hospitals. Through standardized data collection and analysis, we evaluated the distribution of recipients based on gender, caste/ethnicity, and geographic location. A total of 2040 kidney transplantations were performed during the period. Notably, 79% of the recipients were men and, interestingly, 70% of the donors were women. Geographically, the highest proportion (31.8%) of recipients were from Bagmati, while the lowest (l2.8%) were from Karnali. Regarding caste and ethnicity, Janajatis accounted for 31% and Chhetris for 22.9%; Madhesis were lowest at 8.12%. Only 17 liver transplantations were conducted during the same period. Although access to kidney transplantation exists in Nepal, this study highlights persistent disparities. Women, rural and remote populations, as well as specific ethnic and caste groups encounter barriers to accessing transplantation services.

**Keywords: equity, kidney transplant, Nepal, barriers, accessibility**

***Correspondence:**
*Dibya Singh Shah*
*dibyasingh@hotmail.com*
*Midhan Shrestha*
*drmidhan@hotmail.com*

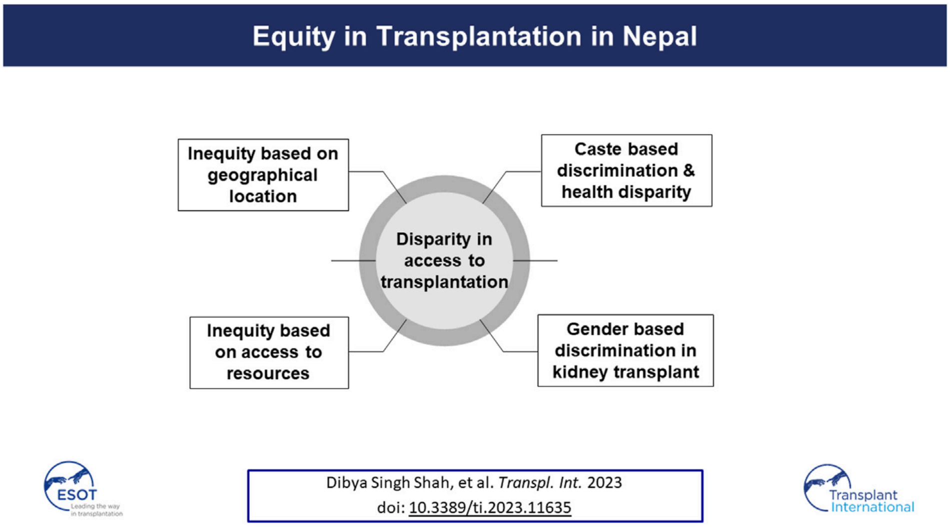
***Received:** 01 June 2023*
***Accepted:** 13 November 2023*
***Published:** 30 November 2023*

***Citation:***
*Singh Shah D, Shrestha M, Khatri B, Chhetri S, Shrestha K, Sedhai S, Joshi U and Gautam M (2023) Equity in Transplantation Access in Nepal: An Analysis of Gender, Geographic, and Caste-Based Disparities in Transplants. Transpl Int 36:11635. doi: 10.3389/ti.2023.11635*

## INTRODUCTION

According to the World Health Organization (WHO), health equity represents the ideal state in which each individual possesses a fair opportunity to reach their optimal health potential. Transplantation serves as a life-saving treatment for numerous end-stage organ failures, enhancing both survival rates and quality of life while also proving to be economically viable. The importance of equitable access to this critical procedure cannot be overstated.

In a low-resource setting like Nepal, realizing this ideal state of equity comes with numerous challenges. Key obstacles include lack of infrastructure, limited human resources, low expenditure in healthcare, sociocultural behavior, and a substantial population living in remote rural areas.



**GRAPHICAL ABSTRACT**

Despite Nepal's recent elevation to a lower middle-income country status in the World Bank's latest country classification [1], a significant 79% of the population remain concentrated in rural areas.

The population of Nepal, as of 9 March 2021, was 29.16 million, divided across the country's seven provinces, which cover 147,181 square kilometers. According to the national Census of 2021, Koshi accounts for 17.01% of the total population; Madhesh 20.97%; Bagmati 20.97%; Gandaki 8.46%; Lumbini 17.56%; Karnali 5.79%; and Sudurpaschim constitutes 9.24% of the country's total population [2].

Nepal has identified 142 caste/ethnic groups. Among them, Brahmins comprise 11.29%, Chhetris 16.45%, Newars 4.60%, Janajatis (indigenous population) 36.04%, Dalits 12.38%, and Madhesis 19.24% of the country's total population [3].

## Healthcare System

Healthcare in Nepal comprises a hybrid model encompassing both public and private sectors. The country's healthcare system is predominantly reliant on out-of-pocket expenditure, with public hospitals offering services at relatively low costs. With a *per capita* GDP of USD 1,037, the World Bank's 2022 data indicates that healthcare expenditure accounts for 4.45% of the 59 GDP [4].

In an effort to alleviate the burden of healthcare costs for citizens facing financial constraints, the Government of Nepal provides subsidies through the Disadvantaged Citizens Medical Treatment Fund. This initiative covers eight chronic conditions: cardiovascular diseases, cancer, renal failure, Alzheimer's disease, Parkinson's disease, head and spinal cord injury, sickle-cell anemia, and stroke [5].

The World Health Organization has identified universal health coverage as a key approach in reducing equity gaps within a country, with social health insurance as a recommended mechanism. Nepal's legislative parliament endorsed the National Health Insurance bill on 10 October 2017 [6]. The governing body for the bill is the National Health Insurance Board, which aims to achieve universal health coverage by 2030.

## Non-Communicable Diseases

The burden of non-communicable diseases is on a steep ascent, driven by the increasing prevalence of diabetes and hypertension. This surge is attributed to shifts in lifestyle and dietary habits, as well as heightened exposure to chemicals and medications. While an official registry for end-stage organ failure is absent, based on the global scenario of end-stage kidney diseases, the estimated annual incidence stands at 100 cases per million population. Given the late stage presentation of diseases in the South Asian region, the actual prevalence could potentially surpass this estimate [7].

## Transplantation in Nepal

Although corneal transplantation started in Nepal in the 1980s, the history of solid organ transplantation is more recent. The first piece of legislation, the Human body transplantation Act, came in 1998. The country's first successful solid organ transplantation was kidney transplantation, which was performed in August 2008 at the Institute of Medicine, Tribhuvan University Teaching Hospital [8]. The transplantation program is mainly centered on living donor transplants. The eligibility criteria for organ donors are strictly defined by law, limiting donation to close relatives, and the present law strictly prohibits unrelated organ donations [9]. The first amendment of the 1998 Act was made in 2016 with the inclusion of brain death criteria, Pair exchange and some extension of the related donation. The first brain death kidney transplantation was carried out in the same year at Sahid Dharma Bhakta Organ Transplant center. The first liver transplantation was started in 2017 with the assistance of a Korean liver transplant team, and there are currently three centers performing liver transplantation, but the program is dependent upon the visiting expert team from India.

The government provides around USD 5,000 per patient to cover kidney transplantation expenses and 1 year's worth of immunosuppressive medication in government hospitals, facilitated through the Disadvantaged Citizens Medical Treatment Fund. Additionally, a provision of up to USD 900 per year for post-transplantation medications is extended to those under the coverage of the national health insurance policy. However, despite this support, a substantial number of patients still face barriers in accessing transplantation. Consequently, this study seeks to examine the current status of kidney transplantation and equity in access to this life-saving treatment modality within Nepal.

## MATERIALS AND METHODS

This study follows a retrospective observational design. It was reviewed and approved by the Institutional Review Committee of the Institute of Medicine [R. no. 551 (6-11) E2].

The study's scope included all recipients of kidney transplantation until December 2022 across five major hospitals. The list of hospitals authorized for transplantation, and the total number of transplantations conducted at these centers until December 2022, was obtained from the Department of Health Services. Standardized data encompassing gender, ethnicity, caste, place of residence, and donor relation was collected from hospital records through relevant departments.

The collected data was analyzed to assess the distribution of gender, geographical location, caste, and ethnicity in relation to transplantation access.

Additionally, data regarding the number of dialysis centers, hemodialysis machines, registered nephrologists, and transplant surgeons were obtained from records maintained by the Department of Health Services, respective dialysis units, and the Nepal Society of Nephrology.

Subsequent analysis of this data aimed to reveal the distribution of facilities and access to transplantation based on gender, ethnic groups, caste, and geographical locations.

## RESULTS

Until December 2022, a total of 12 centers had obtained permission for kidney transplantation, with four centers approved for liver transplantation. Apart from two centers in Koshi province and one in Lumbini for kidney transplants, along with one center in Lumbini for liver transplant, all the other centers were located in Bagmati.

Among these centers, only five were actively conducting kidney transplantations, while the rest ceased operations after initial procedures. Regarding liver transplantation, a total of 17 liver transplantations have been performed. Among them, five were carried out in Lumbini province and the rest in Bagmati province. Only two transplantations were from deceased donors. These cases were performed in Nepal with assistance of transplant teams from Korea and India. With the exception of two recipients, all other recipients were men. Among all the donors, only two donors were men. The common donors were sisters, wives, and daughters.

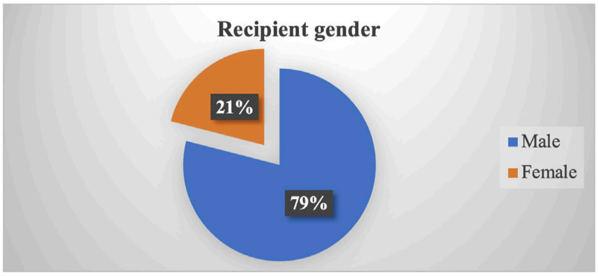


**FIGURE 1 |** Proportion of recipient gender.

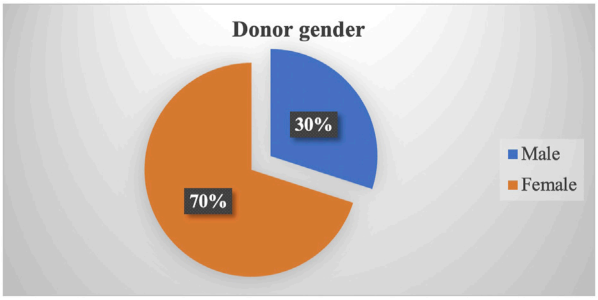


**FIGURE 2 |** Proportion of donor gender.

From August 2008 to December 2022, a total of 2,040 kidney transplantations were carried out. Of these, 2022 (99.11%) occurred in five hospitals (three public and two private) located in Bagmati. Among recipients, 79% were men whereas women constituted 70% of donors (**Figures 1**, **2**). The predominant transplantation type was living donor (barring eight cases), with mothers and wives being the most common donors.

Distribution by region showed that the highest proportion (32.52%) of kidney transplant recipients were from Bagmati, which consists of only 20.97% of the population. Subsequently, 19.3% were from Koshi (17.07% of the population), 17.51% from Gandaki (8.46% of the population), 14.76% from Lumbini (17.56% of the population), 9.82% from Madhesh (20.97% of the population), 3.56% from Sudurpaschim (9.24% of the population), and the least 2.80% from Karnali (5.79% of the population) (**Figures 3**, **4**).

Regarding caste and ethnicity, the recipients comprised 31% Janajatis, 22.90% Chhetris, 14.77% Brahmins, 10.04% Newars (locals of the Kathmandu Valley), 11.08% Dalits, and the lowest proportion (8.12%) were Madhesi (people from the Terai), despite consisting 19.3% of the total population and being situated in a geographically accessible region (**Figure 5**).

According to the Nepal Society of Nephrology, the country has 69 registered nephrologists, with 52 practicing within Kathmandu Valley located in Bagmati Province and 17 outside. The total number of licensed kidney transplant surgeons stood at 12, of which 11 were active within Kathmandu Valley in Bagmati Province.

A regional comparison of hemodialysis machines per million population showed the highest concentration in Bagmati, at

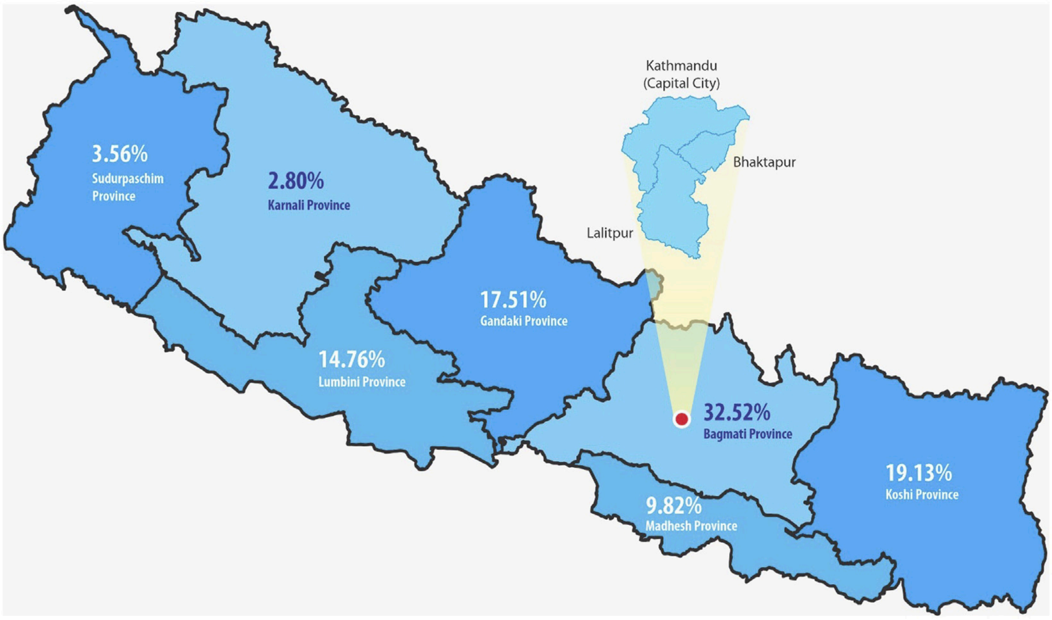


**FIGURE 3 |** Transplant recipients in different provinces of Nepal.

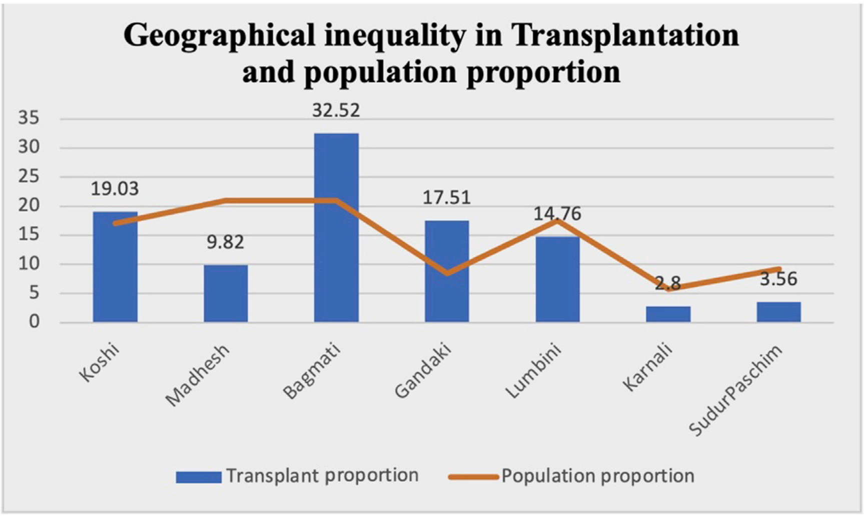


**FIGURE 4 |** Proportion of transplant patients as compared to population proportion in different provinces.

72.81 machines, followed by 21.78 per million in Gandaki, 16.98 per million in Lumbini, 15.34 per million in Karnali, 11.67 per million in Koshi, 8.65 per million in Madhesh, and the lowest, 5.9 per million, in Sudurpaschim (**Figure 6**).

Since 2008, there has been a steady rise in the number of annual kidney transplantations, barring the years 2020 and 2021 when the COVID-19 pandemic led to a decline. Over 300 kidney transplantations were performed in 2022 alone (**Figure 7**). However, this figure remains insufficient when contrasted with the number of individuals undergoing dialysis (**Figure 8**).

# DISCUSSION

## Inequity Based on Geographical Location

In our study, the majority of recipients (32.52%) were from Bagmati, which encompasses 20.97% of the total population of the country. However, despite Madhesh having an equal proportion of the population as well as being geographically convenient, only 9.82% of the recipients hailed from the province. Conversely, Gandaki, comprising a mere 8.46% of the population, yielded a higher recipient percentage of 14.76%

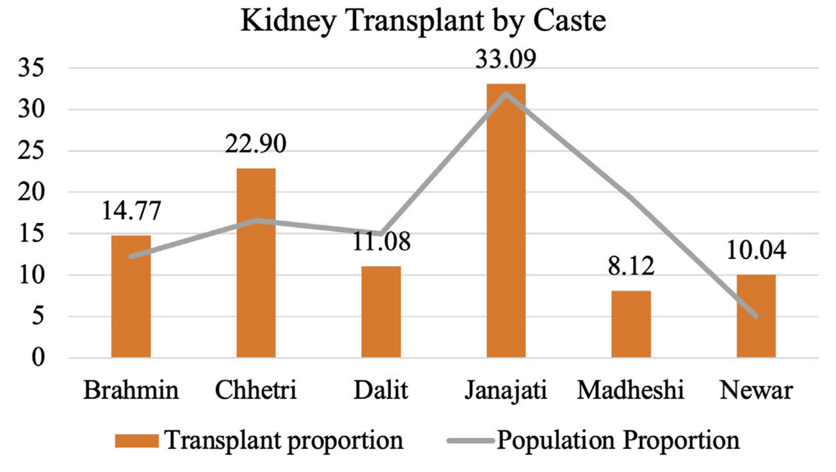


**FIGURE 5 |** Proportion of transplant recipients by caste as compared to population proportion.

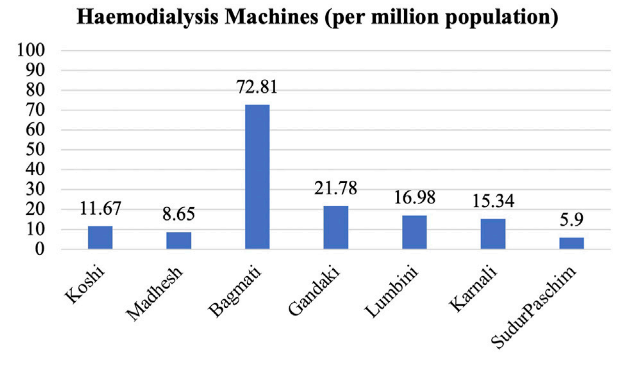


**FIGURE 6 |** Distribution of HD machines according to provinces.

of recipients. The lowest rate of recipients, at 2.8%, was in Karnali.

This disparity stems largely from the clustering of specialists, dialysis centers, and machines within urban centers. Rural residents often must either migrate toward cities or undertake extensive journeys to access maintenance hemodialysis. While continuous ambulatory peritoneal dialysis could be a potential solution, difficulties in accessing peritoneal dialysis fluid and high transportation costs to remote areas render this modality less feasible for patients.

Another contributing factor to this disparity lies in the limited number of public hospitals performing regular transplantations, with waiting time stretching between three to 6 months. Consequently, individuals often need to temporarily relocate to the capital city, Kathmandu, for work-up, surgery, and follow-up care. This adds to the cost, including the loss of wages for accompanying family members. Geographical disparities in transplantation accessibility have also been reported in studies from other parts of the world [10, 11].

## Inequity Based on Access to Resources

Although the number of transplantations has increased steadily over the years, with around 250 to 300 procedures carried out annually, this figure remains disproportionately low when compared to the demand for transplantation in the country. Many are compelled to endure lifelong dialysis due to scarcity of living donors. In Nepal, the organ procurement law restricts donations to close relatives. Unfortunately, many patients discontinue dialysis due to various socioeconomic reasons. Some patients even travel abroad to seek unrelated transplantation. With regards to liver transplantation, a limited number of procedures have been conducted with the assistance of foreign experts. For those who possess the financial means, traveling abroad for liver and other organ transplants is an option, albeit one that remains inaccessible to the majority of the population.

Notably, although the Amendment of the Human body organ Transplantation Act with the inclusion of brain death criteria was approved in 2016, only four donations have happened so far. The deceased donor program has not developed as a national program, as it is centered in only one government hospital, in which patients voluntarily register their names for the deceased organs.

However, a digitalized format for a central wait-listing platform has recently been developed by the department of health including all the transplant centers in Nepal. More importantly, there is an intense need for dedicated National Organ transplantation office under the government for the promotion, coordination, and implementation of the deceased organ transplantation program in Nepal, which will not only reduce the gap of the present demand but also open the door to move forward with other organ transplantations.

## Gender-Based Discrimination in Kidney Transplantation

A notable gender disparity is evident in our study, with 79% of recipients being men and 70% of donors being women. Mothers and wives emerge as the most common related donors. The data

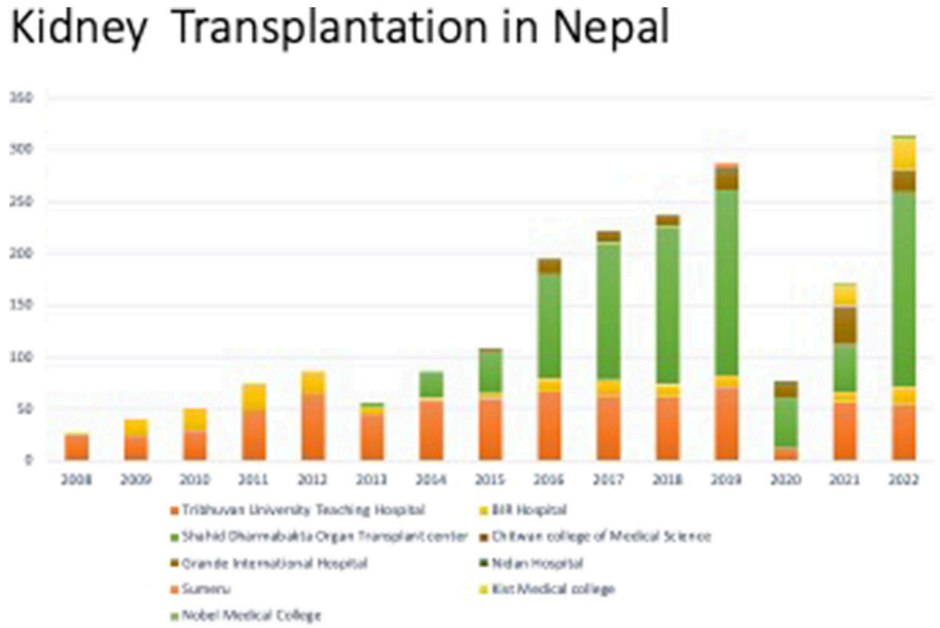


**FIGURE 7 |** Renal transplantations performed at different centers in Nepal.

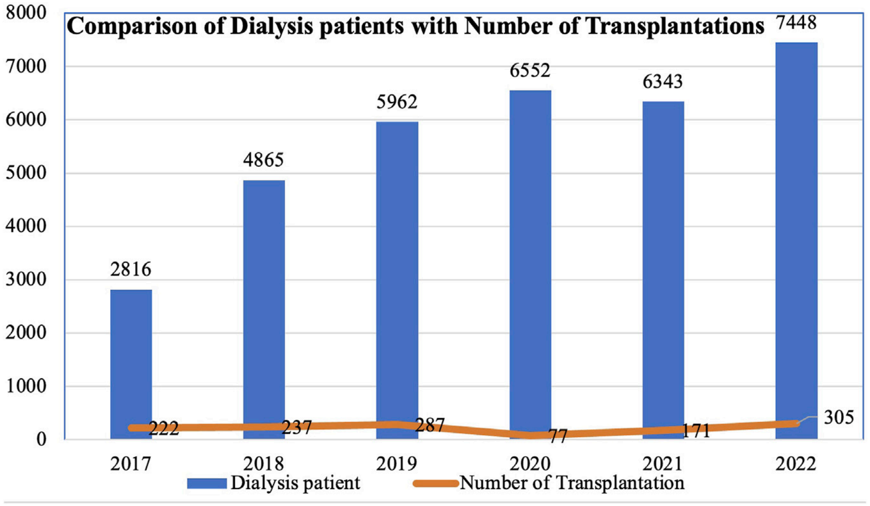


**FIGURE 8 |** Number patients on dialysis and renal transplantations performed per year.

shows that women are less likely to be referred for kidney transplantation and subsequently face greater challenges in securing donors, resulting in lower likelihood of undergoing transplantation [12]. This discrepancy can be attributed to the prevailing patriarchal societal norms, by which men are commonly seen as the primary earners and women the homemakers. As a result, women are often obliged to donate organs for the greater benefit of the family [13].

Furthermore, as men are seen as protectors and assets to the family, family members discourage them from donating organs. This discrimination is not unique to Nepal and other South Asian countries; some degree of discrimination exists even in developed nations [14, 15].

## Caste-Based Discrimination and Health Disparity

Within our study, Madhesi and Dalit communities exhibit low representation in accessing kidney transplantation, whereas Brahmins and Chhetris have higher representation. Janajati communities also hold a relatively greater representation compared to their respective population proportions. We generalize this as a part of general health discrimination among different groups. A confluence of factors, especially racial discrimination in areas such as housing, education, nutrition, healthcare, and employment, contribute to this discrepancy. Similar to other minorities, Dalits in Nepal tend to have lower incomes, less education, and live in areas with limited access to nutritious food. This further translates to restricted access to diagnosis and treatment for chronic health issues.

Inequalities in various aspects of End Stage Kidney Disease have been well-documented, even in developed countries like the United Kingdom. Ethnic minorities tend to experience a more rapid progression from Chronic Kidney Disease (CKD) to End Stage Kidney Disease. Moreover, minority groups face challenges in accessing timely care and frequently experience late referrals to specialist renal care. The difference between ethnic groups occurs at multiple points and across diverse outcomes throughout the kidney care system. The combination of individual factors and system-related variables affects ethnic groups differently, indicating a need for culturally intelligent policies informed by research to address the needs of disadvantaged populations [16].

Interestingly, a study conducted by Poudyal et al. in Nepal identified the so-called Dalit caste as an independent risk factor for CKD. The study's overall CKD prevalence was 6.0%, and factors independently associated with CKD included older age, Dalit caste, hypertension, diabetes mellitus, elevated total cholesterol levels, and an increased waist-to-hip ratio [17].

Global studies highlight that ethnic minorities with End Stage Kidney Disease are disproportionately represented in transplantation modalities. This stems from various factors linked to the transplantation systems of different countries. These factors include listing rates for transplantation, movement from the waiting list to transplantation, variations across transplant centers, pre-dialysis care differences, and cadaveric and live donation rates, all of which indicate disparities when comparing ethnic minorities with majority populations [18].

## CONCLUSION

Nepal's only established organ transplantation program is kidney transplantation. Despite notable progress in this field, significant disparities in access persist, with resources concentrated in urban centers. This leaves rural, vulnerable, and marginalized groups underserved.

The solution lies in restructuring healthcare for regional autonomy, implementing uniform universal healthcare, and promoting deceased donor programs, which can help bridge gaps and address disparities.

## DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding authors.

## ETHICS STATEMENT

The study was reviewed and approved by Institutional Review Committee of Institute of Medicine.

## AUTHOR CONTRIBUTIONS

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

## CONFLICT OF INTEREST

Author MG is affiliated to Anweshan Pvt. Ltd.

The remaining authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

## REFERENCES

1. Cosic D, Dahal S, Kitzmuller M. *Climbing Higher: Toward a Middle-Income Nepal*. Washington, DC: World Bank (2017).
2. Central Bureau of Statistics. *Central Bureau of Statistics* (2021). Available at: https://censusnepal.cbs.gov.np (Accessed February 26, 2023).
3. Census Nepal. *National Population and Housing Census 2021, Caste/Ethnicity Report* (2021). Available at: https://censusnepal.cbs.gov.np (Accessed October 24, 2023).
4. World Economics. *Nepal GDP Per Capita. Real | Data |* 2020. Available at: https://worldeconomics.com/grossdomesticproduct/real-gdp-per-capita/Nepal.aspx. [Accessed February 26, 2023].
5. Ministry of Health and Population, Government of Nepal. *Medical Treatment of Deprived Citizens* (2023). Available at: https://mohp.gov.np/program/medical-treatment-of-deprived-citizens/en (Accessed February 26, 2023).
6. Government of Nepal. *Health Insurance Act* (2017). Available at: https://lawcommission.gov.np (Accessed February 26, 2023).
7. Thurlow JS, Joshi M, Yan G, Norris KC, Agodoa LY, Yuan CM, et al. Global Epidemiology of End-Stage Kidney Disease and Disparities in Kidney Replacement Therapy. *Am J Nephrol* (2021) 52(2):98–107. doi:10.1159/000514550
8. Chalise PR, Shah DS, Sharma UK, Gyawali PR, Shrestha GK, Joshi BR, et al. Renal Transplantation in Nepal: The First Year′ S Experience. *Saudi J Kidney Dis Transplant* (2010) 21(3):559–64.
9. Government of Nepal. *The Human Organ Transplantation (Regulation and Prohibition) Act* (1998). Available at: https://lawcommission.gov.np (Accessed February 26, 2023).
10. Lynch RJ, Patzer RE. Geographic Inequity in Transplant Access. *Curr Opin Organ Transplant* (2019) 24(3):337–42. doi:10.1097/MOT.0000000000000643
11. Medina-Pestana JO, Galante NZ, Harada KM, Garcia VD, Abbud-Filho M, Campos HH, et al. Kidney Transplantation in Brazil and Its Geographic Disparity. *J Bras Nefrol* (2011) 33:472–84. doi:10.1590/S010128002011000
12. Rasmussen S, Paneru P, Shrestha K, Shrestha PC. Gender Bias and Organ Transplantation in Nepal. *Clin Transplant* (2016) 21(3):314–20.
13. Bhowmik D, Dash SC, Guleria S, Panigrahi A, Gupta S, Agarwal S, et al. Spousal Renal Transplants: Implications in Developing Countries. *Transplantation Proceedings*. Orlando, FL: Grune & Stratton (2003). p. 1969.
14. Bal MM, Saikia B. Gender Bias in Renal Transplantation: Are Women Alone Donating Kidneys in India?. *Transplantation Proceedings*. Netherlands: Elsevier (2007).

15. Wilkinson E, Brettle A, Waqar M, Randhawa G. Inequalities and Outcomes: End Stage Kidney Disease in Ethnic Minorities. *BMC Nephrol* (2019) 20(1): 234–12. doi:10.1186/s12882-019-1410-2
16. Poudyal A, Karki KB, Shrestha N, Aryal KK, Mahato NK, Bista B, et al. Prevalence and Risk Factors Associated With Chronic Kidney Disease in Nepal: Evidence From a Nationally Representative Population-Based Cross-Sectional Study. *BMJ open* (2022) 12(3):e057509. doi:10.1136/bmjopen-2021-057509
17. Kayler LK, Rasmussen CS, Dykstra DM, Ojo AO, Port FK, Wolfe RA, et al. Gender Imbalance and Outcomes in Living Donor Renal Transplantation in the United States. *Am J Transplant* (2003) 3(4):452–8. doi:10.1034/j.1600-6143.2003.00086.x
18. Achille M, Soos J, Fortin MC, Pâquet M, Hébert MJ. Differences in Psychosocial Profiles Between Men and Women Living Kidney Donors. *Clin Transplant* (2007) 21(3):314–20. doi:10.1111/j.1399-0012.2007.00641.x

REVIEW
published: 30 August 2023
doi: 10.3389/ti.2023.11233

# Healthcare System Impact on Deceased Organ Donation and Transplantation: A Comparison Between the Top 10 Organ Donor Countries With 4 Countries in Southeast Asia

*Sandra Cowie*[1], *Seow-Huey Choy*[2], *Diana Mohd Shah*[3], *Maria Paula Gomez*[4], *Boon-Koon Yoong*[2] *and Jun-Kit Koong*[2]*

*[1]Department of Epidemiology, Biostatistics and Occupational Health, McGill University, Montreal, QC, Canada, [2]Faculty of Medicine, University of Malaya, Kuala Lumpur, Malaysia, [3]National Transplant Resource Centre, Kuala Lumpur, Malaysia, [4]Donation and Transplant Institute, Barcelona, Spain*

The need for organ donation is constantly increasing. Some countries have made improvements, while others, such as countries in Southeast Asia (SEA), have some of the lowest rates of deceased donors (pmp). This review aims to compare 14 countries with regards to many variables related to healthcare systems. Countries leading in deceased organ donation spend more on health and education, which is associated with increased potential for deceased organ donation. Out-of-pocket expenditure, is also associated with a decrease in deceased organ donation. Countries in SEA are lacking in healthcare resources such as workforce and materials, which are both necessary for a successful transplant program. Most countries in SEA have an excellent foundation for successful organ donation systems, including proper legislation, government support, and brain death laws along with an overall acceptance of brain death diagnosis. Priorities should include improving coordination, donor identification, and healthcare worker education. Countries in SEA have a lot of potential to increase deceased organ donation, especially by investing in healthcare and education. There is no one size fits all for organ donation programs and countries in SEA should focus on their strengths and take cultural differences into consideration when planning interventions.

**Keywords: transplantation, organ donation, deceased donation, Southeast Asia (SEA), healthcare systems**

***Correspondence:**
*Jun-Kit Koong*
*jkkoong@hotmail.com*

***Received:** 31 January 2023*
***Accepted:** 11 August 2023*
***Published:** 30 August 2023*

***Citation:***
*Cowie S, Choy S-H, Shah DM, Gomez MP, Yoong B-K and Koong J-K (2023) Healthcare System Impact on Deceased Organ Donation and Transplantation: A Comparison Between the Top 10 Organ Donor Countries With 4 Countries in Southeast Asia. Transpl Int 36:11233. doi: 10.3389/ti.2023.11233*

---

**Abbreviations:** DCD, donation after circulatory death; EXT, external health expenditure; GDP, gross domestic product; GGHE-D, domestic general government health expenditure; ICU, intensive care unit; IMR, infant mortality rate; MMR, maternal mortality ratio; OOPS, out-of-pocket spending; pmp, per million population; PVT, private health expenditure; RTA, road traffic accident; SEA, Southeast Asia.

# INTRODUCTION

Around the world, the need for organ transplantation is constantly growing due to an increase in non-communicable diseases and aging populations. Medical advances and expanding health coverage in the past few decades have allowed people to live much longer with their chronic illnesses, but an organ transplant remains the most cost-effective and long-lasting option in many cases [1]. Although organ donation has been steadily increasing in the last couple of decades, there remains great inequalities between different regions around the world. Europe and North America are far ahead of the other regions, with Spain and the US having 49.61 and 36.88 actual deceased organ donors per million population (pmp), respectively in 2019 [2]. In comparison, nations in SEA had some of the lowest rates of deceased organ donors in the world [3], with 3.66 pmp in Thailand and only 0.53 pmp in Malaysia [2]. This gap highlights the importance of establishing a solid framework for organ donation in SEA, which will rely on changes in legislation, education, and healthcare [3]. A lot of research has been done on the reasons why countries in SEA have such low rates of deceased organ donors, but a comparison of healthcare systems between the countries with the highest rates of deceased organ donors and countries in SEA with extremely low rates has never been done. The main purpose of this research is to highlight the similarities and differences between the healthcare systems of countries leading in deceased organ donation and countries in SEA. Furthermore, the authors wanted to identify strengths and weaknesses of each country in order to suggest interventions to increase deceased organ donation.

Healthcare systems worldwide are extremely varied and unique. A combination of resources, population needs, and organizational capacity leads to differences in access and utilization. Variation in deceased organ donation between countries has been proven to be unrelated to medical need [4, 5], but instead correlated with the availability of healthcare resources, a country's GDP *per capita*, and health expenditure (percentage of GDP spent on healthcare) [4–7]. Intuitively, higher income *per capita* allows for higher health spending and better access to advanced medical technology required for transplantation [5]. Another reason for differences in healthcare system may be due to having different healthcare related priorities due to cultural and social values [8]. Therefore,

**FIGURE 1 |** Healthcare system variables possibly related to organ donation.

when comparing countries with different demographics, it is essential to remain aware of the circumstantial differences of each country [8]. A healthcare system is a dynamic and constantly growing mechanism. There are many different aspects that have immense impacts on efficiency and outcomes, and no one healthcare system looks the same. **Figure 1** shows the variables chosen to be explored in this research.

The countries chosen for this analysis include the ten countries with the highest rates of deceased donors per million population according to IRODaT 2019, which are Spain, United States, Croatia, Portugal, France, Belgium, Czechia, Finland, Belarus, and Malta [2]. No countries were excluded based on population size or systemic or legislative requirements. The four remaining countries were chosen due to their geographic location (being in SEA) and due to being part of the Organ Donation Initiative Strategies for Southeast Asia (ODISSeA) consortium. ODISSeA's main objective is to design and implement an academic postgraduate program in organ donation in eight universities across Malaysia, Myanmar, Philippines, and Thailand [3].

## CURRENT STATUS OF ORGAN DONATION IN SOUTHEAST ASIA

SEA continues to experience low rates of deceased organ donors despite seeing a steady increase in economic growth. Inadequate organ donation legislation has led to struggles with organ trafficking and transplant tourism [9], leading to demands towards government officials to make changes regarding healthcare financing, legislation, and medical technology diffusion [10]. The Istanbul declaration of 2008 aimed to decrease illegal practices in organ transplantation, but previous higher rates of donation, which were partially due to transplant tourism, decreased dramatically and have not been able to recover [10]. Below are brief summaries of the status of organ donation in the four countries in SEA studied.

### Malaysia

The healthcare services for a population of 33 million in Malaysia are delivered through public and private providers. Malaysia does not have a national insurance program; however, all citizens get treatments including transplants through centrally funded and administered government health facilities at very low cost [11]. The first organ transplant was performed in 1975 with a living-related kidney transplant and the first deceased kidney transplant was performed the following year [12]. Facilities for kidney, liver, heart, and lung transplants are available in seven public and private hospitals, all located around the capital city. Only public and university hospitals carry out transplants from deceased donors. The National Transplantation Programme is governed by the National Transplantation Council under the Malaysian ministry of health. The National Transplant Resource Centre was established in 1997 to coordinate deceased organ and tissue donation at the national level and is supported by Tissue Organ Procurement teams, which are available in regional hospitals [13]. The practice of deceased donation is legalised by the Human Tissues Act (1974) [14] and supported by the National Fatwa (1970) [15]. Despite efforts to increase organ donation, deceased donation rates remained below 1.0 donor pmp. Living donations make up the majority the organ transplantation [16].

### Thailand

The country of approximately 69.6 million performed its first transplant in 1972 [17]. Thailand now performs kidney, liver, heart and lung transplants in 28 transplant centers across the country [18]. The Organ Donation Center, established in 1994 under the authority of the Thai Red Cross Society, is responsible for overseeing the transplant practice, recovery and distribution of deceased organs, public relations, fundraising, and legal issues [17]. Except for the basic principles set by the Medical Council and the Red Cross, Thailand has no laws specific to organ donation [19]. Three government health coverage schemes, namely, the Civil Servant Medical Beneficiary System, the Social Security Organization, and the Universal Health Coverage Scheme (UCS), cover the entire population. In 2008, the cost of surgery, including post-operative care and immunosuppressive medication, became reimbursable for all citizens following the launch of universal renal replacement therapy program under the UCS [20]. Deceased donation rate improved remarkably from 0.7 in 2005 to 4.8 pmp in 2020 and is now the highest in SEA [2]. The number of kidney transplant from deceased donors exceeds the number of transplants from living donors since 2011 [18]. Unlike Malaysia, both public and private hospitals perform transplant from deceased donors [18]. Organ donation rates have been on the rise thanks to public organ donation campaigns supported by the Thai Royal family; however, shortage of organs still limits the rate of transplantation [18].

### Philippines

The Philippines, with a population of 108.1 million population, recorded only 26 deceased donations between 2017 and 2019 [2]. Philippines has an administratively decentralized public health system, where local governments have full policy and fiscal freedom [21]. The Department of Health (DOH) is the national health agency that develops and regulates national policies and provide tertiary and specialized hospital services [21]. Social health insurance was introduced in 1995 and administered by the Philippine Health Insurance Corporation (PhilHealth) to enhance the nation's financial risk protection, however it only contributes to a small portion of total health expenses [21]. The Passage of Organ Donation Act of 1991 legalized deceased donation for treatment, research, or medical education by will of the deceased or consent from family members [22]. Philippine Network for Organ Sharing (PhilNOS), which was established in 2010 by the DOH, is the central coordinating body that regulates transplant activities including deceased donation, organ allocation, and maintaining the national registry [9]. Organ Procurement Organizations (OPO) operate under donor service areas designated by PhilNOS responsible for brain death certification, acquiring consent, donor maintenance, retrieval organ and tissues from deceased donors for transplantation [23]. There were 18 accredited transplant centers distributed in different regions of the Philippines [24].

**TABLE 1** | Healthcare system comparison variables results.

| Country | A. Demographic and socioeconomic characteristics | | | | | | | | B. Health financing and health spending | | | C. Health spending by financial source *per capita* in US$ (% total) (2018) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Population 2019 (millions) | Life expectancy | Median age | 65+ (%) | HDI | Education expenditure (% of GDP) | Mean years of school | Medical schools (pmp) | GDP *per capita* 2019 (USD) | Health expenditure (% GDP) 2019 | Risk of impoverishing expenditure for surgical care (% of people at risk) | GGHE-D | OOPS | PVT-D-OOPS | EXT |
| Spain | 47.13 | 83.49 | 44.9 | 19.6 | 0.90 | 4.21 | 10.3 | 0.91 | 29,564.7 | 9.0 | 0.1 | 1,926 (70.4%) | 606 (22.1%) | 204 (7.5%) | 0 (0.0%) |
| United States | 328.24 | 78.79 | 38.3 | 16.2 | 0.93 | 4.96 | 13.4 | 0.59 | 65,297.5 | 16.9 | 0.2 | 5,356 (50.4%) | 1,148 (10.8%) | 4,120 (38.8%) | 0 (0.0%) |
| Croatia | 4.07 | 78.42 | 44.3 | 20.9 | 0.85 | 3.92 | 11.4 | 0.98 | 14,944.4 | 6.8 | 0.1 | 844 (83.2%) | 106 (10.5%) | 64 (6.3%) | 0 (0.0%) |
| Portugal | 10.29 | 80.68 | 46.2 | 22.4 | 0.86 | 5.02 | 9.3 | 0.78 | 23,214.0 | 9.4 | 0.3 | 1,361 (61.4%) | 654 (29.5%) | 198 (8.9%) | 2 (0.1%) |
| France | 67.06 | 82.56 | 42.3 | 20.4 | 0.90 | 5.45 | 11.5 | 0.57 | 40,496.4 | 11.3 | 0 | 3,441 (73.4%) | 434 (9.3%) | 815 (17.4%) | 0 (0.0%) |
| Belgium | 11.50 | 81.75 | 41.9 | 19.0 | 0.93 | 6.41 | 12.1 | 0.61 | 46,345.4 | 10.3 | 0 | 3,723 (75.8) | 936 (19.1%) | 254 (5.2%) | 0 (0.0%) |
| Czechia | 10.67 | 79.13 | 43.2 | 19.8 | 0.90 | 3.85 | 12.7 | 0.84 | 23,489.8 | 7.6 | 0 | 1,460 (82.7%) | 251 (14.2%) | 54 (3.1%) | 0 (0.0%) |
| Finland | 5.52 | 81.79 | 43.1 | 22.1 | 0.94 | 6.38 | 12.8 | 0.91 | 48,771.4 | 9.0 | 0 | 3,547 (78.6%) | 832 (18.4%) | 136 (3.0%) | 0 (0.0%) |
| Belarus | 9.42 | 74.23 | 40.3 | 15.2 | 0.82 | 4.79 | 12.3 | 0.42 | 6,698.0 | 5.6 | 0.1 | 251 (70.5%) | 89 (25.0%) | 15 (4.2%) | 1 (0.3%) |
| Malta | 0.50 | 82.60 | 42.6 | 20.8 | 0.90 | 4.82 | 11.3 | 4.00 | 29,737.3 | 9.0 | 0 | 1,748 (63.5%) | 944 (34.3%) | 61 (2.2%) | 0 (0.0%) |
| Mean | 49.44 | 80.34 | 42.71 | 19.64 | 0.89 | 4.98 | 11.71 | 1.06 | 32,855.88 | 9.50 | 0.08 | 2,365.7 (71.0%) | 600 (19.3%) | 592.1 (9.65%) | 0.3 (0.04%) |
| Thailand | 69.63 | 77.15 | 40.1 | 12.4 | 0.78 | 4.12 | 7.9 | 0.33 | 7,806.7 | 3.8 | 4.7 | 210 (76.1%) | 30 (10.9%) | 35 (12.7%) | 1 (0.4%) |
| Malaysia | 31.95 | 76.16 | 30.3 | 6.9 | 0.81 | 4.16 | 10.4 | 1.00 | 11,414.2 | 3.8 | 3.5 | 219 (51.2%) | 150 (35.0%) | 59 (13.8%) | 0 (0.0%) |
| Philippines | 108.12 | 71.23 | 25.7 | 5.3 | 0.72 | 2.54 | 9.4 | 0.41 | 3,485.1 | 4.4 | 18.6 | 45 (32.8%) | 74 (54.0%) | 17 (12.4%) | 1 (0.7%) |
| Myanmar | 54.05 | 67.13 | 29.0 | 6.0 | 0.58 | 1.93 | 5.0 | 0.11 | 1,407.8 | 4.8 | — | 9 (15.3) | 45 (76.3%) | 0 (0.0%) | 5 (8.5%) |
| Mean | 65.94 | 72.92 | 31.28 | 7.65 | 0.72 | 3.19 | 8.18 | 0.46 | 6,028.45 | 4.20 | 8.93 | 120.75 (43.8%) | 74.75 (44.1%) | 27.75 (9.7%) | 1.75 (2.4%) |

| Country | D. Organ demand and supply | | | | | | | | E. System performance and safety | | | | G. Organ donation system | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Prevalence of treated ESRD (pmp) | Dialysis (pmp) | Waitlist active[a] (pmp) | WaitlistMortality[b] | RTA mortality (pmp) | Stroke mortality (pmp) | Actual deceased donors (ppm) | DCD (pmp) | Infant mortality rate | Maternal mortality ratio | Births attended by skilled health staff | Immunization coverage (%) | Consent | Year | Registry | Next-of-kin can veto decision | In-hospital donor coordinator | Brain death legislation |
| Spain | 1234[c] | 587[c] | 83.45 | — | 0.39 | 0.79 | 49.61 | 16.06 | 2.6 | 4 | — | 96.67 | Opt-out | 1979 | No | NA | Yes | Yes |
| United States | 2,354 | 1,699 | 184.52 | 3.88% | 1.27 | 0.58 | 36.88 | 8.26 | 5.6 | 19 | 99.1 | 91.67 | Opt-in | 1967 | Yes | No | Yes | Yes |
| Croatia | — | 610[d] | 58.29 | 2.72% | 0.79 | 1.86 | 34.63 | 0 | 4.1 | 3 | 99.9 | 93.33 | Opt-out | 1988 | Yes | Yes | Yes | Yes |
| Portugal | 2,014 | 1,265 | 195.24 | 0.86% | 0.82 | 1.62 | 33.8 | 2.6 | 3.1 | 10 | 98.7 | 98.67 | Opt-out | 1993 | Yes | — | Yes | Yes |
| France | 1,349 | 731 | 128.87 | 2.05% | 0.51 | 0.67 | 33.25 | 6.97 | 3.8 | 4 | 98.1 | 92.33 | Opt-out | 1997 | Yes | Yes | Yes | Yes |
| Belgium | 1,290[c] | 1,481[c] | 79.48 | 2.01% | 0.58 | 0.81 | 30.3 | 10.52 | 2.7 | 5 | 99.3 | 97.00 | Opt-out | 1986 | Yes | No | — | Yes |
| Czechia | 1,128 | 656 | 49.02[e] | 5.38%[e] | 0.59 | 1.08 | 27.14 | 1.79 | 2.5 | 1 | 99.8 | 95.33 | Opt-out | 2002 | Yes | No | Yes | Yes |
| Finland | 926 | 367 | 66.85 | 0.95% | 0.39 | 1.01 | 26.23 | 0 | 1.9 | 8 | 100 | 93.50 | Opt-out | 2001 | Yes | No | Yes | Yes |
| Belarus | 248[c] | 151[c] | 19.85 | 6.32% | 0.76 | 1.80 | 26.2 | 0 | 2.4 | 1 | 99.8 | 97.67 | Opt-out | 1997 | Yes | Yes | — | Yes |
| Malta | — | 600[d] | 178.22 | 5.00% | 0.41 | 0.66 | 25 | 0 | 6.1 | 0 | 99.7 | 97.33 | Opt-in | 2016 | Yes | — | Yes | Yes |

(Continued on following page)

**TABLE 1** | (*Continued*) Healthcare system comparison variables results.

| Country | D. Organ demand and supply | | | | | | | | E. System performance and safety | | | | G. Organ donation system | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Prevalence of treated ESRD (pmp) | Dialysis (pmp) | Waitlist active[a] (pmp) | WaitlistMortality[b] | RTA mortality (pmp) | Stroke mortality (pmp) | Actual deceased donors (ppm) | DCD (pmp) | Infant mortality rate | Maternal mortality ratio | Births attended by skilled health staff | Immunization coverage (%) | Consent | Year | Registry | Next-of-kin can veto decision | In-hospital donor coordinator | Brain death legislation |
| Mean | 1510.08 | 943.60 | 106.76 | 3.24% | 0.65 | 1.09 | 32.30 | 4.62 | 3.48 | 5.50 | 99.38 | 95.35 | | | | | | |
| Thailand | 2,028 | 1,885 | 92.16[f] | — | 3.22 | 0.73 | 3.66 | 0 | 7.7 | 24 | 99.1 | 96.67 | Opt-in | None | Yes | Yes | No | Yes |
| Malaysia | 1,412 | 1,357 | 161.10[e] | 8.92%[e] | 2.25 | 0.62 | 0.53 | 0 | 7.3 | 23 | 99.6 | 97.33 | Opt-in | 1974 | Yes | Yes | No[h] | No |
| Philippines | 224[g] | 607[f] | 64.74[f] | — | 1.20 | 0.67 | 0.09 | 0 | 21.6 | 206 | 84.4 | 65.67 | Opt-in | 1992 | — | Yes | No | Yes |
| Myanmar | — | 75[f] | — | — | 2.04 | 1.53 | 0 | 0 | 35.8 | 244 | 60.2 | 88.00 | n/a | 2004 | No | NA | No | No |
| Mean | 1221.33 | 981.06 | 106.00 | — | 2.18 | 0.89 | 1.07 | 0.00 | 18.10 | 124.25 | 85.83 | 86.92 | | | | | | |

[a] *Number of people on the waitlist at the end of 2019.*

[b] *Number of people who died while on the waitlist over the total number of people who were on the waitlist in 2019.*

[c] *Data from 2016 instead of 2018.*

[d] *Data from 2019, not 2018.*

[e] *Data from 2018 instead of 2019.*

[f] *Year of data unknown but published recently.*

[g] *Data from 2013.*

[h] *Malaysia now has a few hospitals with donor coordinators since 2020. Data in table is based on 2019, to reflect rated of actual deceased organ donors.*

## Myanmar

Myanmar has a shorter history of organ transplantation, having started with kidney transplants in 1995 and liver transplants in 2004 [25, 26]. Currently, transplant for kidney and liver are available in nine hospitals. Myanmar, with a population of 54 million, has universal health coverage through public facilities but national health insurance system is not available [26]. It is an under-resourced country with key challenges in organ transplantation including shortage of immunology transplant laboratories, trained medical personnel, medication, and financial support. Before 2010, there was an average of 4–5 kidney transplants per year. With the help of international experts through joint operations, on-site medical knowledge sharing, and fellowship training programmes, the number increased substantially over the next 10 years. There were 78 kidney transplants performed in 2018, the highest number ever recorded since the launch of the program. Between 2004 and 2021, 56 liver transplants including two from deceased donor were performed [27]. Despite the improvement in transplantation, a deceased donor program has not been established in Myanmar. The Body Organ Donation Law enacted in 2004 and revised in 2015 allows deceased organ donations with the will of the deceased or consent from the relative, but most transplants are nevertheless from living and non-related donors.

# HEALTHCARE SYSTEM COMPARISON

## Demographic and Socioeconomic Characteristics

Life expectancy is on average lower in SEA than in countries leading in deceased organ donation, though there are some exceptions, such as Thailand and Malaysia having a higher life expectancy than Belarus. The Human Development Index (HDI) is associated with deceased donation rate, suggesting that a country needs to have a minimum socioeconomic level to set up and support a deceased donor program [9, 10]. Malaysia is classified as having a very high human development along with other countries leading in deceased organ donation. This reflects the country's high potential to develop efficient deceased donor activities. Thailand and Philippines have high human development, while Myanmar falls under the medium human development category [11]. Finally, countries in SEA have much younger populations compared to countries leading in deceased organ donation; less than 10% of the population in Malaysia, Philippines and Myanmar are aged 65 years and above (See **Table 1**: Section A).

Countries in SEA spend less on education and individuals in Thailand and Myanmar receive on average less years of schooling. However, Malaysia does have the greatest number of medical schools pmp after Malta (See **Table 1**: Section A). Government education expenditure is positively associated with deceased kidney transplant rates and the percentage of the population with higher education significantly associated with higher rates of organ donation [4, 7]. Educational attainment is also significantly associated with willingness to donate [1, 28]. Overall, education is a vital aspect of an efficient organ donation system. Increased spending on education could increase the knowledge about organ donation in the general population and improve the quality of education available to healthcare workers interested in the field of organ donation. The concept of health literacy may also be important, especially since healthcare systems have been becoming more complex and more difficult to navigate [29].

Another vital impact on organ donation are cultural and religious beliefs. In Malaysia, many cite religion to be a reason why they would refuse to become organ donors. However, some of the more common reasons for not wanting to become an organ donor was related to a lack of trust in the healthcare system to use their body in an appropriate manner and a lack of understanding of what organ donation was and why it was such a necessity. Some cultural beliefs such as wanting their body to remain intact after death was also a common response [30]. Strong beliefs surrounding familial involvement in the decision may also be a reason why people do not give consent for donation before death [31].

A study done in Germany comparing organ donation as it relates to Christians, Muslims, Jews, Hindus, and Buddhists showed that most view organ donation as an altruistic and heroic act, as long as certain rules are respected. All except Buddhism had a universal acceptance of the concept of brain death and believed both the donor and family members had the right to decide for the donor. Despite this, many in the study had still not signed a card saying that they accepted to be organ donors. This was largely due to misconceptions or misunderstandings of religious doctrines and a fear of doing something wrong [32].

The countless studies on organ donation, culture, and religion shows the importance of education and campaigns with a highlight on religious acceptance of them. Encouraging individuals to discuss organ donation with friends and family should also be encouraged since familial decision making is so important.

## Health Financing

One of the most important aspects when determining the strength of a healthcare system is undeniably related to money. Countries leading in deceased organ donation have on average 5.5 times higher GDP *per capita* than countries in SEA and spend around 2.25 times more of their GDP on health (health expenditure) (See **Table 1**: Section B). Countries leading in organ donation spend on average 9.5% of their GDP on health, ranging from 5.6% in Belarus to 16.9% in the United States. Countries from our SEA group spend on average 4.2% of the GDP on health, ranging from 3.8% in Thailand and Malaysia, to 4.8% in Myanmar. We also need to consider the difference in raw GDP, meaning the low percentage is exponentially lower in actual amount of money spent. Increased health expenditure is associated with increased quality of critical care, which is essential for organ donation [33]. Furthermore, individuals living in SEA are much more at risk of impoverishing expenditure due to need of surgical care, a risk that does not exist in countries leading in organ donation.

## Health Spending

To better understand health financing, we need to look at the sources of financing, namely, government, external sources, out-of-pocket (household spending), and other private sources such as insurance (See **Table 1**: Section C; **Figure 2A**). Government contribution in SEA is fairly low, especially in the Philippines and Myanmar. However, the government in Thailand contributes on average 76%, which is more than any other SEA country and even surpasses some countries leading in organ donation. Percent share of OOPS is much higher in SEA, although the United States has the highest crude OOPS by far, it only accounts for 10.8% of all health financing. This could be due to differences in cost of care in different countries [34]; individuals in the United States pay more for health services, but the government and private sources also contribute more (See **Figure 2B**). The United States has the highest crude and proportion of spending coming from other private sources due to its notable privatized insurance system. The proportion of financing coming from private sources is much higher in SEA, except Myanmar, which instead has a notable source of funding coming externally.

Higher government spending (%) and lower OOPS (%) is associated with higher rates of deceased organ transplantation, whereas private health expenditure had no impact on rates of deceased organ transplantation (See **Figure 3**). By decreasing out-of-pocket costs by either increasing government spending or by increasing access to equitable and efficient private insurance, deceased organ donation capacity may be greatly increased in SEA.

## Organ Demand and Supply

The incidence and prevalence of end-stage-renal disease (ESRD) is increasing globally. This is also leading to an increase in need for dialysis and transplantation. In this 14-country comparison, there is not a big difference in ESRD prevalence between the two groups (See **Table 1**: Section D). Malaysia and Thailand have higher rates of dialysis than the average for countries leading in organ donation (943.60). Philippines and Myanmar, however, are below that average, possibly due to high out-of-pocket costs for dialysis [34]. Dialysis is a very expensive, long-term treatment, costing generally twice as much as a renal transplant when looking at a time frame of more than 1 year [35]. In countries with government reimbursement for dialysis, such as Thailand and Malaysia, increasing deceased organ donation should be a government goal due to cost-effectiveness.

Waitlist length is difficult to interpret because a low number could represent either a low need for transplantation, an unused waitlist system, or an effective transplant system. Waitlist mortality, represented as the percentage of people who died while waiting for an organ (Waitlist includes total for kidney, liver, heart, lungs, pancreas, and small bowel) out of everyone who was ever on the waitlist in that year, is a better indicator of unmet needs for organ donation. Malaysia has a waitlist mortality of 8.92%, nearly three times larger than the average for countries leading in organ donation. Data for the other three countries in SEA could unfortunately not be found.

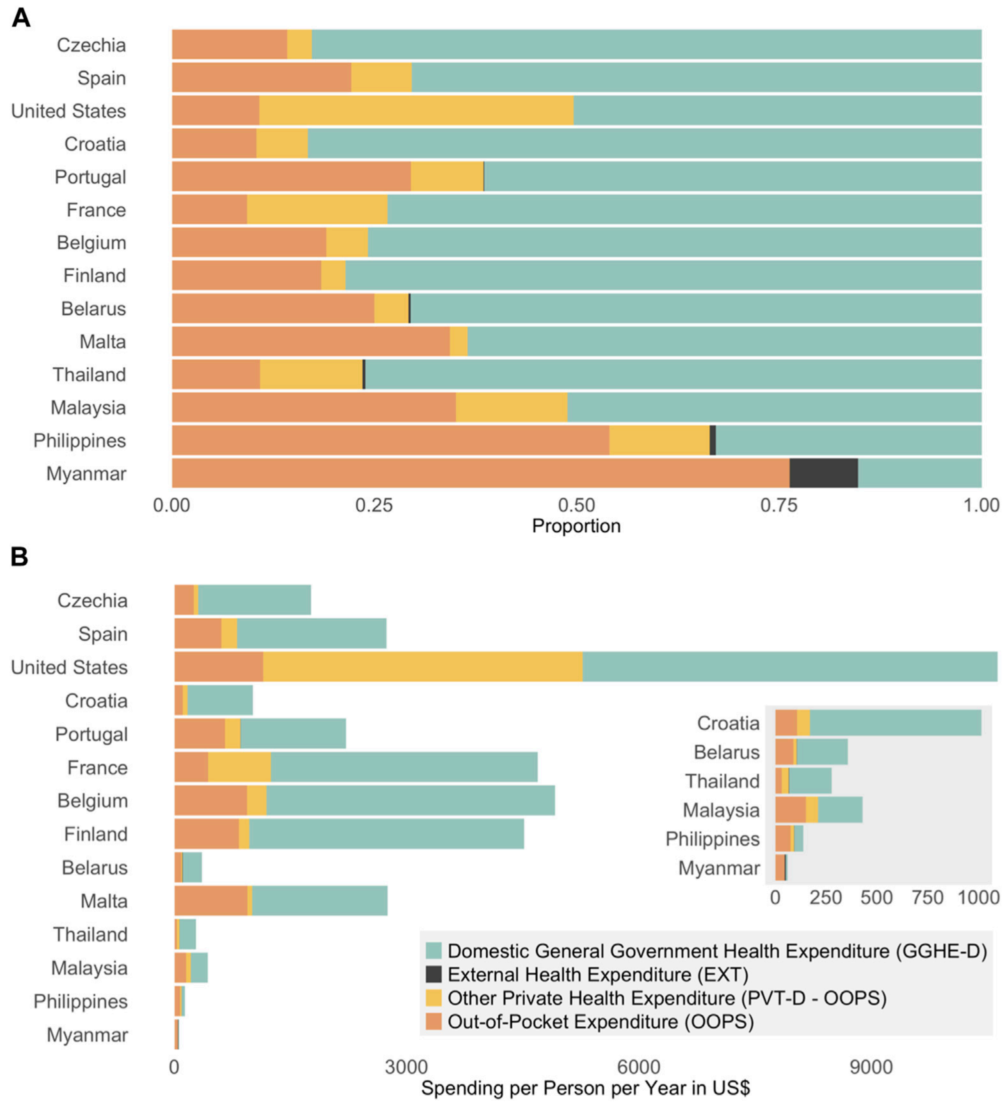


**FIGURE 2 | (A)** proportion of health spending by financial source. **(B)** Health spending by financial source *per capita* in US$.

Most deceased organ donation occurs after brain death, usually caused by road traffic accident (RTA) injury and stroke [36]. Countries in SEA have on average 3.35 times more deaths from RTA injury (pmp) than countries leading in organ donation but have on average fewer deaths due to stroke (pmp). Donation after circulatory death (DCD) is becoming increasingly common. No country in SEA performs DCD, but 6 of the top 8 countries do as of December 2020, with Croatia and Finland planning to implement legislation in the near future [37]. Finland did have its first DCD transplants in 2021 (IRODaT). Some researchers recommend expanding DCD programs to increase potential donors in countries with currently low rates of deceased organ donation [38, 39]. Unfortunately, instating legislation for DCD is complex and requires a lot of organizational and financial capacity [37]. Furthermore, the need for DCD is mostly due to the decreasing rates of traumatic brain injuries from RTA in developed countries, a problem that SEA is not yet facing [40]. For these reasons, implementing DCD should not be a priority for SEA at this time. However, due to a high number of potential donors due to elevated RTA mortality, donor identification, one of the first steps in the deceased organ donation process, should be prioritized [41]. This comes back to investing in educational programs for healthcare workers.

## System Performance and Safety

Some health indicators are more often used to measure the status of a healthcare system and are widely accepted as representative of a country's overall health. These often include infant mortality (IMR) and maternal mortality (MMR) [42, 43]. Because most maternal deaths are preventable, they should be close to zero in a safe and effective system [43]. High maternal mortality is often

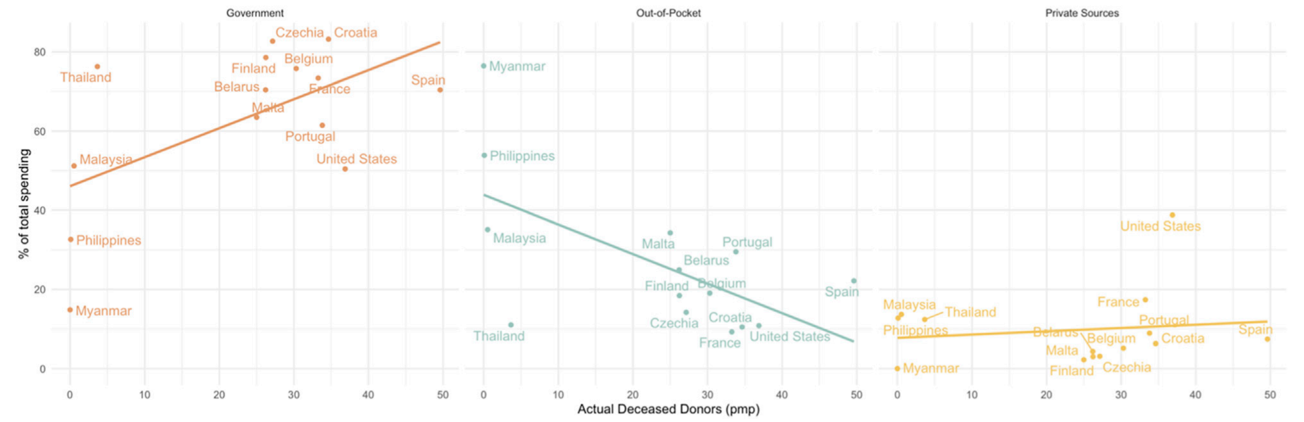


**FIGURE 3 |** The relationship between actual deceased donors (pmp) and financial source.

associated with scarcity of health resources and certain political issues such as government corruption [43]. The IMR in Thailand and Malaysia only about twice as high as the average IMR in countries leading in deceased organ donation. However, the IMR is 6 times greater in Philippines and 10 times greater in Myanmar compared to the top 10 countries. MMR follows the same trend, with Thailand and Malaysia being around 4 times greater than the average for countries leading in organ donation, whereas Philippines and Myanmar have a MMR 37.5 times and 44.3 times greater, respectively. Delivery by a skilled birth attendant is a measure of the progress toward eliminating maternal mortality and is commonly used as a measure of access to and safety of healthcare in a country [44]. Almost 100% of births are attended by a skilled healthcare professional in Thailand and Malaysia, like all countries leading in organ donation, whereas only 84.4% of births in Philippines and 60.2% of births in Myanmar are attended by a skilled healthcare professional. Average infant immunization rates (Hepatitis B, Measles, and DTP) are also as high in Thailand and Malaysia, but Myanmar and Philippines are still lacking in this area (See **Table 1**: Section E). The system performance between countries is very different in SEA, namely, Malaysia and Thailand appear to be far ahead of Myanmar and Philippines. Malaysia and Thailand have a lot of potential to increase deceased organ donation through slight alterations in legislation and education, whereas Myanmar and Philippines may need a few more years to catch up and organ donation may not be a priority at this time. Major issues of safety and access first need to be addressed.

## Healthcare Resources

Some of the biggest barriers for obtaining organ donors include poor hospital infrastructure, missing manpower, and inability to identify and support brain dead donors [45]. On average, countries leading in organ donation have 4.1 times more physicians, 9.8 time more surgical workforce, 4.6 times more neurosurgeons, and 3.6 times more nurses and midwives than countries in SEA. Regarding materials, countries leading in organ donation have on average around 3.5 times more beds, ICU beds, and transplant centres (pmp). Data for healthcare resources can be found in **Supplementary Table S2** and are visually presented in **Figure 4**.

The availability of staff and materials has a very negative effect on the organ donation process. The "death to donation to transplantation process" suggested by Manzano in 2014 relies heavily on availability of healthcare professionals for donor identification and retrieval, consent to donation, and organ retrieval [41]. The lack of nurses and doctors in SEA severely decreases the ability of staff to fulfill organ donation related tasks on top of their regular tasks. To optimize the process, countries in SEA should focus on incentivising people to enter healthcare professions. Another option is to use non-medical professionals to carry out donor coordinator tasks, like what is done in the United States. Although donor coordinators should ideally be given enough time to carry out donor coordinator related task, a minimum requirement would be to pay them for the work they do, either per patient or per hour. This is done in most countries leading in organ donation who do not have donor coordinator only positions.

The organ donation process is also dependent on expensive materials for donor assessment, donor maintenance, and organ storage and transportation [41]. A lack of essential equipment such as hospital beds and ICU beds could be detrimental to deceased organ donation [38]. If there are insufficient beds, the hospital cannot justify keeping a bed for even just several hours to wait for a recipient of the organs. However, the use of ICU beds in the organ donation process varies greatly from country to country, meaning some countries may have a more efficient way of managing ICUs and distributing patients across different levels of care units [46].

This can be seen with the leader of deceased organ donation, Spain, having one of the lowest number of ICU beds per 100,000 population in the top 10 leading countries, having even fewer ICU beds per 100,000 population than Thailand (See **Supplementary Table S2**). This demonstrates that although a baseline ICU capacity is needed, efficient

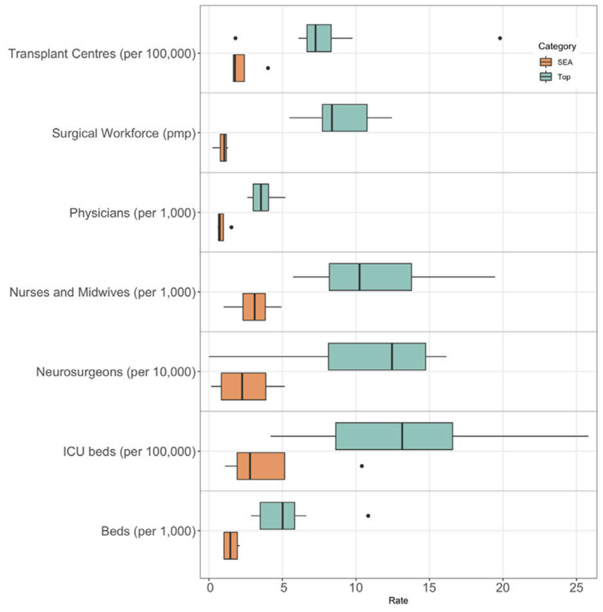


**FIGURE 4 |** Healthcare resources in SEA compared to countries leading in deceased organ donation.

management of assessing and treating potential donors is just as important if not more. This is due to other necessary components of an efficient transplant system such as institutional reformation, quality assurance, reimbursement schemes and comprehensive training programs [47]. The organizational components of Spain's transplant system, such as donor coordinators, may also contribute to the efficiency of their ICUs without the need for as many beds as other countries leading in organ donation. Another non-medical but closely related variable that organ donation is highly dependent on is access to efficient transport. In Spain, individuals in rural areas needing transplant can be transported by helicopter, whereas this type of rapid transport is not available in SEA. This rapid transportation system makes for an extremely efficient transplant network.

## Organ Donation System

Every country has a unique combination of laws and regulations regarding practices, coordination, and consent (See **Table 1**: Section G). All countries in SEA have opt-in consent systems, except Myanmar, which lacks regulations to be considered either. Countries leading in deceased organ donation are mostly opt-out countries, except US and Malta. A lot of research has been done comparing opt-in versus opt-out countries and found that although deceased donor rates are higher in opt-out countries, the difference is not significant and is most likely not solely due to the consent legislation, but rather due to other organizational components [7, 48, 49]. There does not seem to be an association between rates of organ donation and the year of initial donation legislation, since Malaysia was one of the first to implement legislation, even before Spain. However, organ donation did not take off in Spain until the creation of the National organization of transplantation (ONT) in 1989 [50]. This suggests that merely having a legislation or law regarding organ donation is not sufficient to increase organ donation and having organizational components are mandatory for efficiency and success.

The usefulness of registries is also a topic of debate. Most countries have a registry, either to opt-in or opt-out, or in the case of Belgium, both opt-in and opt-out. Donor registries can be useful not only for identifying potential donors, but also to promote public awareness [51]. However, since Spain does not have a registry, we can confidently say that the success of an organ donation system does not depend on the presence of a registry, though this may be truer for opt-out systems. There has never been research done on the effectiveness of a registry and how many donors come from checking the registry compared to asking family for consent. Obtaining consent from family members is considered one of the essential elements of a successful organ donation system [51]. In most countries, the final decision is ultimately up to the next-of-kin, also known as soft opt-out [52]. In Belgium, however, an individual's name on either the opt-in or opt-out registry is legally binding. So even if the family knows their loved one had changed their mind, the organs cannot be retrieved. In Malaysia and Thailand, consent to donate is always asked from the next-of-kin whether the individuals' name is on the registry or not. With this, individuals who have opted-in can still become non-viable donors due to declined family consent. Some believe this "overrule" could jeopardize the trust in the donation system, since individuals will not feel like their wishes will be respected [1]. Many countries with hard opt-out legislation still use a soft opt-out approach because not following the wishes of the family leads to more negative publicity that could put organ donation in a negative light.

Another vital component of the organ donation system are donor coordinators. Spain is often cited as the poster-child of deceased organ donation, having the most successful program in the world [2]. The "Spanish Model" relies on access to higher education to support doctors and nurses working in ICUs who have high exposure to potential donors [40]. With advanced education in donor identification, brain death diagnosis, donor management, family approach, grief counselling, refusal management, and organ allocation, healthcare professionals are more familiar and have a more positive view of the organ donation process [53, 54]. In Spain, donor coordinators are often physicians familiar with the critical care unit and are highly motivated about organ donation. This maximizes efficiency since they may already have a relationship with the families, they approach to request donation consent [55]. Donor coordinators are different from transplant coordinators, who often work on dialysis units and support recipients of organs. Many countries have followed Spain's example and have implemented in-hospital donor coordinators such as Croatia [56], leading to a dramatic increase in deceased organ donation. However, Germany also attempted to implement this type of in-hospital coordinator in 2012 but did not see the same success [40]. The ODISSeA project allowed a group of physicians from SEA to attend seminars in Spain in 2019 to help develop a post-graduate organ donation program in SEA. Some trained healthcare professionals in organ donation started working in hospitals as acting donor coordinators at the start of 2020 and, despite the negative impacts of COVID-19 on the healthcare system, Malaysia saw an increase from 0.53 pmp in 2019 to 0.9 pmp in 2020. Many hope that by increasing the availability of these programs in universities across SEA and implementing more in-hospital donor coordinators, countries could continue to see an increase in deceased donor transplantation.

Increasing organ donation relies heavily on both professional and public acceptance of brain death [46]. The lack of awareness around this concept can lead to a significant reduction in potential donors as well as a decrease in donor identification [45]. Although most countries have some laws regarding brain death diagnosis, these vary slightly between different countries [57]. Brain death legislation was introduced a lot later in most Asian countries, where cultural resistance and fear of abuse remain serious issues [39]. Brain death is legally recognized in Thailand (1989), Malaysia (2006), Philippines (1991) and Myanmar (2009), but there is no official law in Malaysia and Myanmar [58]. Brain death diagnosis requires multiple exams separated by a determined time and the presence of 2–3 doctors with varying qualifications (neurologist/neurosurgeon, anesthesiologist, intensivist, internist). These criteria are the same in countries leading in organ donation, but the availability of such specialists is a lot lower in SEA. Brain death is becoming more accepted among both health professionals and the general population in SEA. Nevertheless, religion and culture are still some of the main reasons for family objection to donation [59].

## DISCUSSION

The countries in this comparison come from a variety of economic and developmental backgrounds. This makes comparison very difficult. For example, even in SEA, Thailand and Malaysia are very different from Philippines and Myanmar regarding financial and resource capacity. In the group of countries leading in deceased organ donation, countries are more homogeneous, with Belarus being a unique example. Belarus is the only upper-middle income country in the group of top ten countries in deceased organ donation. This is possible evidence that Thailand and Malaysia, which are both also upper-middle income countries, have the capacity to increase deceased organ donation through organizational changes. Due to cultural, social, and economic differences between the four SEA countries, every country has strengths and weaknesses regarding deceased organ donation capacity and should implement strategies to increase donation based on those particularities (See **Table 2**).

Thailand currently has the highest number of deceased donors pmp in SEA. They have a high HDI and the second fastest growing GDP and GDP *per capita* in SEA after the Philippines. They already have high government spending on health and therefore low out-of-pocket costs for health. Along with the highest rates of surgical workforce, hospital beds, neurosurgeons, and ICU beds in SEA, they also have the highest rates of transplant centres in SEA. With a decrease in IMR and MMR and an increase in access and safety of healthcare, Thailand is on its way to catching up to other countries leading in organ donation. Some things standing in the way of Thailand perfecting its transplant program include lower than average levels of population education, low levels of doctors and nurses, and a high prevalence of ESRD and dialysis, meaning an elevated need for organ donation. The Thai government should focus on organ donation based on cost-effectiveness; encouraging people to become organ donors after death to help the thousands of people on dialysis. They also need to address the low levels of doctors and nurses, encouraging people to enter the profession. Luckily, Thailand already has an incredible infrastructure and just needs to fine tune its organizational components to increase donor identification and referral. We recommend funding University level programs for the training of donor coordinators that could increase the efficiency of Thailand's transplant program.

Malaysia also has a lot of potential, considering its very high HDI, high GDP *per capita*, and high spending on education leading to a highly educated population and the most number of medical schools pmp. This in turn leads to Malaysia having the highest rates of physicians. Malaysia is also catching up the high-income countries leading in organ donation with its good monitoring system for disease, treatment, and organ donation activity, decreasing IMR and MMR, and increase in access and safety of healthcare. Weaknesses include high out-of-pocket costs for healthcare, a high prevalence of ESRD and dialysis, and a high waitlist mortality. Malaysia should prioritize developing an efficient organ donation system due to so many people requiring dialysis. They should focus on training physicians to be donor coordinators by making more programs available throughout the country. The government should also focus on population education through educational campaigns to raise awareness about organ donation. Finally, the Malaysian government should focus on reducing out-of-pocket spending by either increasing government spending or increasing access to private insurance.

The Philippines has a high HDI with the fastest growing GDP and GDP *per capita* in SEA. They also have the highest ratio of nurses in SEA and high levels of population education despite having a low GDP *per capita* and low education expenditure. What weakens the healthcare system is a lack of physician and hospital beds, high out-of-pocket spending for healthcare, and inadequate diseases, treatment, and organ donation activity surveillance. We recommend the Philippines to nevertheless focus on training donor coordinators but also include nurses at potential donor coordinators to compensate for the low levels of physicians. Increasing surveillance will also help in the efficiency of the transplant system. As a final comment, the Philippines has struggled with organ trafficking and transplant tourism, especially in the past, creating a threat to creating an efficient organ donation program [10]. New legislation has made it more difficult to illegally sell organs, but the population still has some negative views towards the practice in general.

Myanmar may have the lowest rates of actual deceased donors pmp but medical professionals in the country remain motivated and hopeful, participating in ODISSeA and other research contributing to finding ways to increase organ donation in the country. Unfortunately, they do have the

**TABLE 2 |** SWOT analysis of increasing deceased organ donation in 4 SEA countries.

| | Strengths | Weaknesses | Opportunities | Threats |
|---|---|---|---|---|
| Thailand | - Highest actual deceased donors pmp in SEA<br>- High HDI<br>- Second fastest growing GDP and GDP *per capita* in SEA<br>- High government spending (%) on health<br>- Low out-of-pocket spending<br>- Highest rate of RTA mortality = high potential for brain dead donors<br>- Highest rate of surgical workforce, beds, neurosurgeons, and ICU beds in SEA<br>- Highest rate of transplant centres in SEA<br>- Decreasing IMR and MMR<br>- High access and safety of healthcare | - Low level of population education<br>- High prevalence of ESRD and dialysis = high need for transplantation<br>- Low levels of doctors and nurses | - Focus on organ donation for cost-effectiveness, since so many people require dialysis<br>- To address low levels of doctors and nurses, either encourage more to enter healthcare professions or use non-medical staff as donor coordinators<br>- Infrastructure (transplant centres) is already pretty good, so just focus on organizational components to increase donor identification and referral: consider Spanish model donor coordinators | |
| Malaysia | - Very high HDI<br>- High GDP *per capita*<br>- High government spending (%) on education<br>- Highly educated population (mean years of school)<br>- Highest number of medical schools pmp<br>- Highest rate of physicians in SEA<br>- Good monitoring system for disease, treatment, and organ donation activity<br>- Decreasing IMR and MMR<br>- High access and safety of healthcare | - Excessive out-of-pocket costs<br>- High prevalence of ESRD and dialysis = high need for transplantation<br>- High waitlist mortality | - Continue training physicians to be donor coordinators by making more programs available throughout the country<br>- Focus on population education through educational campaigns to raise awareness about organ donation<br>- Focus on organ donation for cost-effectiveness, since so many people require dialysis<br>- Reduce out-of-pocket spending by either increasing government spending or increasing access to private insurance | - Population level superstitions related to organ donation [28]<br>- Slowest growing GDP in SEA |
| Philippines | - High HDI<br>- Fastest growing GDP (80% 10 year increase) and GDP *per capita* (57% 10 year increase) in SEA<br>- Highest ratio of nurses to population in SEA<br>- Good education despite low GDP *per capita* and low education expenditure | - Lowest level of physicians and hospital beds<br>- Inadequate diseases, treatment, and organ donation activity surveillance<br>- High out-of-pocket spending | - Use nurses as donor coordinator to compensate for the low levels of physicians<br>- Increase surveillance of supply and demand of transplantation along with illness to better track progress | - Issues with organ trafficking and transplant tourism [10] |
| Myanmar | - Relatively fast-growing GDP *per capita*<br>- Medical professionals remain motivated and hopeful, participating in ODISSeA and other research contributing to finding ways to increase organ donation in the country<br>- Lowest rates of actual deceased donors per population means the greatest potential to increase | - Low HDI<br>- Low GDP *per capita*<br>- Low education attainment<br>- Low government health spending (15%)<br>- High out-of-pocket spending (76%)<br>- No private sources of health financing<br>- Inadequate diseases, treatment, and organ donation activity surveillance | - Focus on education initiative for both the general population and healthcare professionals | - Political instability [56]<br>- Health-seeking behaviour rooted in traditional health beliefs [56] |

lowest rates on almost all indicators presented in this review and have a long way to go to catch up to the other 3 SEA countries in this review but by focusing primarily on education, both of medical professionals and the general population, they can develop their transplant program with the help of countless motivated healthcare professionals. Some threats to developing an efficient organ donation program include political instability [60] and health-seeking behaviour rooted in traditional health beliefs [60].

## Limitations of the Review

This research is a very broad overview of healthcare system variables in relation to organ donation capacity. The limited number of countries makes it difficult to make conclusions regarding concrete areas in need of improvement, but hopefully the research highlights many areas of interest for future research. Another major limitation is the lack of some data, especially for the Philippines and Myanmar. These countries often do not report some disease, treatment, and organ donation data due to lack of advanced surveillance systems. Furthermore, we could not get an interview with a representative from each country and for the countries we did get further input, it was from one single expert. Finally, using globally reported variables is also problematic due to not being able to control for variation in data collection. This is especially problematic when taking variables from different sources, such as was done for ICU beds and prevalence of ESRD and dialysis.

## CONCLUSION

Organ transplantation is a lifesaving practice that increases the quality of life of those lucky enough to receive one. Deceased organ donation is a very efficient way of mitigating organ waitlists. Although some countries have been able to increase efficiency and maximize their potential by using their strengths, other countries have fallen behind. Countries in SEA have a lot of unused potential which could be utilized by having government support through financial inputs in healthcare. Organ donation education for healthcare workers, such as the initiation of the ODISSeA (Organ Donation Innovative Strategies in Southeast Asia) [3] in Malaysia, Philippines, Myanmar, and Thailand, is an essential part of any developing nation regardless of their resources and limitation.

Due to cultural and economic differences, countries in SEA have different strengths and weaknesses, and should focus on these when planning interventions. There is no one-size-fits-all for organ donation systems; the priority is to find the system that works the best with what each country has to offer.

## AUTHOR CONTRIBUTIONS

SC—First author, data collection, data interpretation, statistical analysis, manuscript draft, revision of manuscript, final manuscript preparation. J-KK—Corresponding author, data interpretation, manuscript draft, final manuscript preparation. S-HC—Data interpretation, statistical analysis, manuscript draft, revision of manuscript, final manuscript preparation. DS—Data interpretation, manuscript draft, final manuscript preparation. PG—Data interpretation, manuscript draft, final manuscript preparation. B-KY—Data interpretation, manuscript draft, final manuscript preparation.

## CONFLICT OF INTEREST

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

## ACKNOWLEDGMENTS

Thank you for all those who took the time to answer the questionnaire and attend an informal interview: Zeljca Gavranovic (ICU doctor and Transplant Procurement Manager at University Hospital Centre, Zagreb, Croatia), Luc Colembie (National Transplant Coordinator at Expert | DG Health Care | Organs, Embryo's and Bio-Ethics, Belgium), Richard Pietroski (Former OPO Director at Gift of Life Michigan, United States), Chatchai Mingmalairak (Assistant Professor of Surgery, Head of the Division of Hepatopancreatobiliary Surgery and Transplantation and Chairman of the Department of Surgery at Thammasat University Hospital, Thailand).

## SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontierspartnerships.org/articles/10.3389/ti.2023.11233/full#supplementary-material

## REFERENCES

1. Naghavi N, Mubarik MS, Rasiah R, Sharif Nia H. Prioritizing Factors Affecting Deceased Organ Donation in Malaysia: Is a New Organ Donation System Required? *Int J Gen Med* (2020) 13:641–51. doi:10.2147/IJGM.S253372
2. IRODT. *Database: Donation Activity Charts 2019: IRODAT - International Registry on Organ Donation and Transplantation* (2019). Available from: https://www.irodat.org/?p=database#data (Accessed September 22, 2021).
3. Peralta P, Gómez MP, Vera E, Valero R, Manyalich M, Zanello M, et al. Organ Donation Innovative Strategies For Southeast Asia: Odissea. *Transplantation* (2020) 104(S3):S104. doi:10.1097/01.tp.0000698792.21512.21
4. Bendorf A, Pussell BA, Kelly PJ, Kerridge IH. Socioeconomic, Demographic and Policy Comparisons of Living and Deceased Kidney Transplantation Rates Across 53 Countries. *Nephrology (Carlton).* (2013) 18(9):633–40. doi:10.1111/nep.12101
5. White SL, Hirth R, Mahíllo B, Domínguez-Gil B, Delmonico FL, Noel L, et al. The Global Diffusion of Organ Transplantation: Trends, Drivers and Policy Implications. *Bull World Health Organ* (2014) 92:826–35. doi:10.2471/BLT.14.137653
6. Mizraji R, Godino M, Tommasino N, Alvarez I. Donation Rates: What Matters? *Transpl Proc* (2014) 46(9):2940–4. doi:10.1016/j.transproceed.2014.07.021
7. Rithalia A, McDaid C, Suekarran S, Myers L, Sowden A. Impact of Presumed Consent for Organ Donation on Donation Rates: A Systematic Review. *BMJ* (2009) 338:a3162. doi:10.1136/bmj.a3162
8. Schmulson M, Corazziari E, Ghoshal U, Myung SJ, Gerson C, Quigley E, et al. A Four-Country Comparison of Healthcare Systems, Implementation of Diagnostic Criteria, and Treatment Availability for Functional Gastrointestinal Disorders: A Report of the Rome Foundation Working Team on Cross-Cultural, Multinational Research. *Neurogastroenterology Motil* (2014) 26(10):1368–85. doi:10.1111/nmo.12402
9. de Castro LD. Organ Donation in the Philippines: Should the Dead Do More? *Indian J Med Ethics* (2014) 11(3):143–50. doi:10.20529/IJME.2014.039
10. Chan-On C, Sarwal MM. A Comprehensive Analysis of the Current Status and Unmet Needs in Kidney Transplantation in Southeast Asia. *Front Med (Lausanne)* (2017) 4:84. doi:10.3389/fmed.2017.00084
11. World Health Organization. *Malaysia Health System Review*. Manila: WHO Regional Office for the Western Pacific (2012).
12. 2004 TNTR. *First Report of the National Transplant Registry 2004*. Kuala Lumpur: Malaysian Society of Transplantation (2005).
13. Malaysia MoH. *National Organ, Tissue and Cell Transplantation Policy*. Kuala Lumpur: Ministry of Health Malaysia (2007).
14. Kassim PNJ. Organ Transplantation in Malaysia: A Need for a Comprehensive Legal Regime. *Med L* (2005) 24:173–89.
15. Malaysia MoH. *Organ Transplantation from the Islamic Perspective*. Kuala Lumpur: Ministry of Health Malaysia (2011).
16. TRNTR. *Thirteenth Report of the National Transplant Registry 2016* (2016). Available from: http://www.mst.org.my/ntrsite/index.htm (Accessed July 1, 2016).
17. Elsevier. Thirteen Years of the Thai Red Cross Organ Donation Centre. In: Nivatvongs S, Dhitavat V, Jungsangasom A, Attajarusit Y, Sroyson S, Prabjabok S, et al. editors. *Transplantation Proceedings*. Netherlands: Elsevier (2008).
18. Society TT. *Annual Report of Organ Transplantation in Thailand*. Bangkok: Thai Transplantation Society (2019).
19. Martphol T. Alternative Choice of Organ Donation in Thailand: A Study Opt-Out and Mandate Choice System. *Thammasat Business L J* (2020) 10:49–58.

20. Larpparisuth N, Cheungpasitporn W, Lumpaopong A. Global Perspective on Kidney Transplantation: Thailand. *Kidney360* (2021) 2:1163–5. doi:10.34067/KID.0002102021
21. Dayrit MM, Lagrada LP, Picazo OF, Pons MC, Villaverde MC. *The Philippines Health System Review*. New Delhi: World Health Organization (2018).
22. Ancog AC. Philippine Law on Donations of Human Organs. *J Int Bioethique* (1992) 3(3):169–71.
23. (PhilNOS) PNfos. *Implementing Guidelines for Organ Procurement Organizations*. Manila: Department of Health, Philippines (2015).
24. Abacan MA. Profile of Hospital Transplant Ethics Committees in the Philippines. *Developing World Bioeth* (2021) 21:139–46. doi:10.1111/dewb.12281
25. Thin N. An Audit and Comparative Analysis of the Kidney Transplantation Programme in Burma. *Int J Surg* (2004) 2(2):84–7. doi:10.1016/S1743-9191(06)60049-6
26. Hyodo T, Hirawa N, Hayashi M, Than KMM, Pattanasittangkur K, Hu LW, et al. Present Status of Renal Replacement Therapy at 2015 in Asian Countries (Myanmar, Vietnam, Thailand, China, and Japan). *Ren Replace Ther* (2017) 3(1):11–4. doi:10.1186/s41100-016-0082-7
27. Htay KM. editor Myanmar. Penang, Malaysia: Asian Society of Transplantation (2021).
28. Rasiah R, Manikam R, Chandrasekaran SK, Naghavi N, Mubarik S, Mustafa R, et al. Deceased Donor Organs: What Can Be Done to Raise Donation Rates Using Evidence From Malaysia? *Am J Transpl* (2016) 16(5):1540–7. doi:10.1111/ajt.13603
29. Griese L, Berens EM, Nowak P, Pelikan JM, Schaeffer D. Challenges in Navigating the Health Care System: Development of an Instrument Measuring Navigation Health Literacy. *Int J Environ Res Public Health* (2020) 17(16):5731. doi:10.3390/ijerph17165731
30. Tumin M, Noh A, Jajri I, Chong CS, Manikam R, Abdullah N. Factors that Hinder Organ Donation: Religio-Cultural or Lack of Information and Trust. *Exp Clin Transplant: official J Middle East Soc Organ Transplant* (2013) 11(3):207–10. doi:10.6002/ect.2012.0194
31. Aijing L, Wenzhao X, Wei W, Qiquan W, Xuantong D. Public Opinion on Organ Donation After Death and Its Influence on Attitudes Toward Organ Donation. *Ann Transplant* (2016) 21:516–24. doi:10.12659/aot.899268
32. Doerry K, Oh J, Vincent D, Fischer L, Schulz-Jürgensen S. Religious and Cultural Aspects of Organ Donation: Narrowing the Gap Through Understanding Different Religious Beliefs. *Pediatr Transplant* (2022) 26(7):e14339. doi:10.1111/petr.14339
33. Prin M, Wunsch H. International Comparisons of Intensive Care: Informing Outcomes and Improving Standards. *Curr Opin Crit Care* (2012) 18(6):700–6. doi:10.1097/MCC.0b013e32835914d5
34. Tang SC, Yu X, Chen HC, Kashihara N, Park HC, Liew A, et al. Dialysis Care and Dialysis Funding in Asia. *Am J Kidney Dis* (2020) 75(5):772–81. doi:10.1053/j.ajkd.2019.08.005
35. Rees MA, Dunn TB, Kuhr CS, Marsh CL, Rogers J, Rees SE, et al. Kidney Exchange to Overcome Financial Barriers to Kidney Transplantation. *Am J Transplant* (2017) 17(3):782–90. doi:10.1111/ajt.14106
36. Ganapathy K. Brain Death Revisited. *Neurol India* (2018) 66(2):308–15. doi:10.4103/0028-3886.227287
37. Lomero M, Gardiner D, Coll E, Haase-Kromwijk B, Procaccio F, Immer F, et al. Donation After Circulatory Death Today: An Updated Overview of the European Landscape. *Transpl Int* (2020) 33(1):76–88. doi:10.1111/tri.13506
38. Tackmann E, Dettmer S. Measures Influencing Post-Mortem Organ Donation Rates in Germany, the Netherlands, Spain and the UK: A Systematic Review. *Der Anaesthesist* (2019) 68(6):377–83. doi:10.1007/s00101-019-0600-4
39. Lo CM. Deceased Donation in Asia: Challenges and Opportunities. *Liver Transpl* (2012) 18:S5–7. doi:10.1002/lt.23545
40. Matesanz R, Dominguez-Gil B, Coll E, de la Rosa G, Marazuela R. Spanish Experience as a Leading Country: What Kind of Measures Were Taken? *Transpl Int* (2011) 24(4):333–43. doi:10.1111/j.1432-2277.2010.01204.x
41. Manzano A, Pawson R. Evaluating Deceased Organ Donation: A Programme Theory Approach. *J Health Organ Manag* (2014) 28(3):366–85. doi:10.1108/JHOM-07-2012-0131
42. Gonzalez RM, Gilleskie D. Infant Mortality Rate as a Measure of a Country's Health: A Robust Method to Improve Reliability and Comparability. *Demography* (2017) 54(2):701–20. doi:10.1007/s13524-017-0553-7
43. Sajedinejad S, Majdzadeh R, Vedadhir A, Tabatabaei MG, Mohammad K. Maternal Mortality: A Cross-Sectional Study in Global Health. *Globalization and health* (2015) 11(1):4–13. doi:10.1186/s12992-015-0087-y
44. Harvey SA, Blandón YCW, McCaw-Binns A, Sandino I, Urbina L, Rodríguez C, et al. Are Skilled Birth Attendants Really Skilled? A Measurement Method, Some Disturbing Results and a Potential Way Forward. *Bull World Health Organ* (2007) 85(10):783–90. doi:10.2471/blt.06.038455
45. Sulania A, Sachdeva S, Jha D, Kaur D, Sachdeva R. Organ Donation and Transplantation: An Updated Overview. *MAMC J Med Sci* (2016) 2:18–27. doi:10.4103/2394-7438.174832
46. Manara A, Procaccio F, Dominguez-Gil B. Expanding the Pool of Deceased Organ Donors: The ICU and Beyond. *Intensive Care Med* (2019) 45(3):357–60. doi:10.1007/s00134-019-05546-9
47. Streit S, Johnston-Webber C, Mah J, Prionas A, Wharton G, Casanova D, et al. Ten Lessons From the Spanish Model of Organ Donation and Transplantation. *Transpl Int: official J Eur Soc Organ Transplant* (2023) 36:11009. doi:10.3389/ti.2023.11009
48. Cotrău P, Hodosan V, Vladu A, Daina L, Negrau M, Daina C, et al. Consent Model, Opt-In/Opt-Out System, and Organ Donation Rates in the European Union Countries. *Appl Med Inform* (2019) 41.
49. Arshad A, Anderson B, Sharif A. Comparison of Organ Donation and Transplantation Rates Between Opt-Out and Opt-In Systems. *Kidney Int* (2019) 95(6):1453–60. doi:10.1016/j.kint.2019.01.036
50. Etheredge HR. Assessing Global Organ Donation Policies: Opt-In vs Opt-Out. *Risk Manag Healthc Pol* (2021) 14:1985–98. doi:10.2147/RMHP.S270234
51. Li A. *Registration and Familial Consent for Deceased Organ Donation Among Ethnic Minorities in Ontario, Canada: Opportunities for Improvement*. Western Ontario: University of Western Ontario (2016).
52. Rosenblum AM, Horvat LD, Siminoff LA, Prakash V, Beitel J, Garg AX. The Authority of Next-of-Kin in Explicit and Presumed Consent Systems for Deceased Organ Donation: An Analysis of 54 Nations. *Nephrol Dial Transpl* (2012) 27(6):2533–46. doi:10.1093/ndt/gfr619
53. Soyama A, Eguchi S. The Current Status and Future Perspectives of Organ Donation in Japan: Learning From the Systems in Other Countries. *Surg Today* (2016) 46(4):387–92. doi:10.1007/s00595-015-1211-6
54. In: Lin L, Lin CC, Chen C, Lin CC, editors. Effects of an Education Program on Intensive Care Unit Nurses' Attitudes and Behavioral Intentions to Advocate Deceased Donor Organ Donation. *Transplantation Proceedings*. Netherlands: Elsevier (2014).
55. Rodríguez-Arias D, Wright L, Paredes D. Success Factors and Ethical Challenges of the Spanish Model of Organ Donation. *The Lancet* (2010) 376(9746):1109–12. doi:10.1016/S0140-6736(10)61342-6
56. Zivcic-Cosic S, Busic M, Zupan Z, Pelcic G, Anusic Juricic M, Jurcic Z, et al. Development of the Croatian Model of Organ Donation and Transplantation. *Croat Med J* (2013) 54(1):65–70. doi:10.3325/cmj.2013.54.65
57. Wahlster S, Wijdicks EFM, Patel PV, Greer DM, Hemphill JC, 3rd, Carone M, et al. Brain Death Declaration: Practices and Perceptions Worldwide. *Neurology* (2015) 84(18):1870–9. doi:10.1212/WNL.0000000000001540
58. Chua HC, Kwek TK, Morihara H, Gao D. Brain Death: The Asian Perspective. *Semin Neurol* (2015) 35(2):152–61. doi:10.1055/s-0035-1547539
59. Greer DM, Shemie SD, Lewis A, Torrance S, Varelas P, Goldenberg FD, et al. Determination of Brain Death/Death by Neurologic Criteria: The World Brain Death Project. *JAMA* (2020) 324(11):1078–97. doi:10.1001/jama.2020.11586
60. Moos B, Roberts R, Aye M. The Myanmar Military Coup: Propelling the 2030 Milestones for Neglected Tropical Diseases Further Out of Reach. *PLoS Negl Trop Dis* (2021) 15(7):e0009532. doi:10.1371/journal.pntd.0009532

ORIGINAL RESEARCH
published: 11 July 2023
doi: 10.3389/ti.2023.11290

# Providing "Free" Access to Dialysis and Transplant to the Disfranchised. A Sustainable Model for Low and Low Middle Income Countries (LMICs)

*Mirza Naqi Zafar*[1]* *and Syed Adibul Hasan Rizvi*[2]

[1]*Department of Pathology, Sindh Institute of Urology and Transplantation, Karachi, Pakistan,* [2]*Department of Urology, Sindh Institute of Urology and Transplantation, Karachi, Pakistan*

Pakistan is a low-middle income country where incidence of End Stage Kidney Disease (ESKD) is 100–150 per million population (pmp). Paucity and high costs of renal replacement therapy (RRT) renders the majority disfranchised, since the dialysis rate is 15 pmp and the transplant rate is 4–5 pmp. In view of this, our center started an integrated dialysis and transplant program where all treatment is provided "Free of Cost" to all patients, with lifelong follow-up and medications. The model is based on the concept of community-government partnership funded by both partners. The annual contribution in 2021 was $37.4 million. >1,500 patients were dialyzed daily, and 6–8 received transplants weekly. Of the 6,553 transplants performed between 1985–2021, 988 (15%) were children. Overall, the 1 and 5-year graft survival rate was 97% and 88%. The donor clinic has 3,786 donors in regular yearly follow-up for up to 30–35 years where ESKD prevalence is 0.29%. Access to dialysis was increased by establishing six satellite centers reducing patient time and travel costs. Cost reductions by dialyzer reuse and generic drugs resulted in an annual saving of $5.8 m. This sustainable model has overcome the inherent socio-economic, logistic, cultural, and gender biases in RRT in LMICs. It has provided RRT with equity to the disfranchised in Pakistan and can be replicated in other LMICs with community-government support.

**Keywords: free model, dialysis, transplantation, disfranchised, LMIC**

***Correspondence:**
*Mirza Naqi Zafar*
*info@siut.org*

***Received:*** *20 February 2023*
***Accepted:*** *15 June 2023*
***Published:*** *11 July 2023*

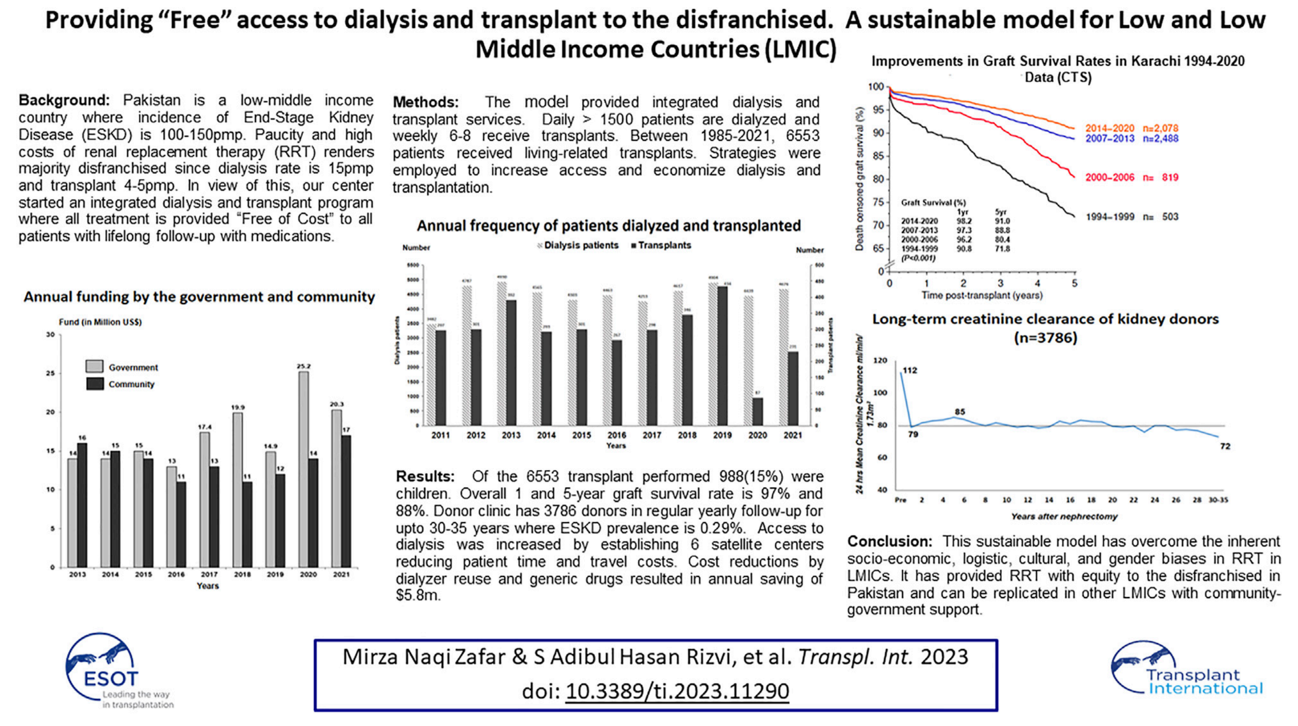
***Citation:***
*Zafar MN and Rizvi SAH (2023) Providing "Free" Access to Dialysis and Transplant to the Disfranchised. A Sustainable Model for Low and Low Middle Income Countries (LMICs). Transpl Int 36:11290. doi: 10.3389/ti.2023.11290*

## INTRODUCTION

Renal replacement therapy (RRT) through dialysis or transplantation are the standard of care life-saving therapies for patients with End Stage Kidney Disease (ESKD). In a report by Global Kidney Health Atlas of 160 countries, the incidence of ESKD in High Income Countries (HIC) was 149 per million population (pmp) as compared to 129 pmp in low income countries (LIC) [1]. The average

---

**Abbreviations:** AKI, acute kidney injury; ATG, antithymocyte globulin; AVF, arterio-venous fistula; AZA, azathioprine; CrCl, creatinine clearance; CMV, cytomegalovirus; CTS, collaborative transplant study; CyA, cyclosporine; ESKD, end stage kidney disease; GDP, gross domestic product; HIC, high-income countries; HLA, human leucocyte antigen; IL-2, interleukin 2 antagonist; IMPDH, inosine-5′-monophosphate dehydrogenase; LIC, low-income countries; LMIC, low and low middle income countries; MMF, mycophenolate mofetil; PRA, panel reactive antibodies; RRT, renal replacement therapy; TAC, tacrolimus; TB, tuberculosis; UTI, urinary tract infection.



**Providing "Free" access to dialysis and transplant to the disfranchised. A sustainable model for Low and Low Middle Income Countries (LMIC)**

**Background:** Pakistan is a low-middle income country where incidence of End-Stage Kidney Disease (ESKD) is 100-150pmp. Paucity and high costs of renal replacement therapy (RRT) renders majority disfranchised since dialysis rate is 15pmp and transplant 4-5pmp. In view of this, our center started an integrated dialysis and transplant program where all treatment is provided "Free of Cost" to all patients with lifelong follow-up with medications.

**Methods:** The model provided integrated dialysis and transplant services. Daily > 1500 patients are dialyzed and weekly 6-8 receive transplants. Between 1985-2021, 6553 patients received living-related transplants. Strategies were employed to increase access and economize dialysis and transplantation.

**Annual funding by the government and community**

**Annual frequency of patients dialyzed and transplanted**

**Results:** Of the 6553 transplant performed 988(15%) were children. Overall 1 and 5-year graft survival rate is 97% and 88%. Donor clinic has 3786 donors in regular yearly follow-up for upto 30-35 years where ESKD prevalence is 0.29%. Access to dialysis was increased by establishing 6 satellite centers reducing patient time and travel costs. Cost reductions by dialyzer reuse and generic drugs resulted in annual saving of $5.8m.

**Improvements in Graft Survival Rates in Karachi 1994-2020 Data (CTS)**

**Long-term creatinine clearance of kidney donors (n=3786)**

**Conclusion:** This sustainable model has overcome the inherent socio-economic, logistic, cultural, and gender biases in RRT in LMICs. It has provided RRT with equity to the disfranchised in Pakistan and can be replicated in other LMICs with community-government support.

Mirza Naqi Zafar & S Adibul Hasan Rizvi, et al. *Transpl. Int.* 2023
doi: 10.3389/ti.2023.11290

**GRAPHICAL ABSTRACT |**

rate of RRT globally was 759 pmp. The rate in HIC was 969 pmp, LMIC 321 pmp, and LIC 4.4 pmp [1]. In LMICs in the neighboring region of South Asia, including India, Pakistan, Bangladesh, and Sri Lanka, the ESKD incidence is 100–160 pmp, the RRT rate is 20–70 pmp, and the transplantation rate is 1–10 pmp [2].

There is therefore a disparity between the incidence of ESKD and RRT in LMICs. Firstly, due to economic constraints where the government expenditure on health is <1%–4.0% of the gross domestic product (GDP). Secondly, *per capita* income ranges from $3,000–24,000 per year and 10%–50% of people live below the poverty line on <$2/day [2]. Thirdly, 25%–65% of the population live in rural settings and have problems accessing dialysis and transplant centers situated in cities [2, 3]. Finally, if they are able to access treatment centers, only 20%–30% get free RRT in LMICs. The rest have to pay, and costs are often beyond their reach as Haemodialysis costs $13,510/year/person, kidney transplant (1st year) costs $11,746, and kidney transplant (after 1st year) costs $5,659/year/person [1].

Pakistan is an LMIC with a population of 221 million where GDP *per capita* is $1,658/year. The government expenditure on health is 1.2% of GDP, 50% live below the poverty line on < $2 a day, and 65% of the people live in rural settings [4]. Estimated ESKD incidence is 100–150 pmp and in terms of RRT, the dialysis rate is 15 pmp, and the transplant rate is 4.5 pmp [2, 5]. The cost of hemodialysis for 1 year is $4,873, where 51%–75% are out-of-pocket expenses [6]. The cost of a transplant is ~$10,000 in the private sector [2].

In this backdrop of disparity between the incidence of ESKD and RRT therapy, a model based on Community Government Partnership was established at our center to provide an integrated dialysis and transplant service "free of cost" to the disfranchised of the country irrespective of caste, color, creed, religion, and socioeconomic status [7]. The guiding principles of the model are equity, transparency, accountability to its supporting partners, and to provide the best care to all its patients with life-long follow-up with medications [8].

In this paper, we describe the achievements of our model and strategies for sustainability. Its ability to provide equitable RRT by overcoming problems of economics, accessibility, gender, and cultural bias by "free of cost care."

## PATIENTS AND METHODS

### Model of Community Government Partnership

The Institute is a public sector organization where the government provided land, infrastructure, equipment, utilities, and staff salaries. The community was mobilized to support the services offered in kind or cash. A trust was established in the 1980s where notables of society, professionals, and government officers formed a Board of Governors. The government in view of free services upgraded a Urology Ward to an Institute of Urology and Transplantation by an act of the provincial parliament in 1991. The Institute receives a yearly grant-in-aid from provincial budget and another source of funds is contribution from the community. It runs as an autonomous body accountable to the community and government. The accounts are audited by independent firms of auditors and presented to both the partners of the model.

## Dialysis

The institute has 350 dialysis machines, of which 25 are dedicated to Hepatitis B patients. In the year 2021, there were 4,676 registered patients who were dialyzed 2–3 times a week using bicarbonate solution. There are eight dialysis centers (two in the main campus and six satellite centers) working 6 days a week. Emergency dialysis is available 24/7. Dialysis is performed by lines initially and arterio-venous fistula (AVF) are made within the first 3 weeks for maintenance dialysis.

Adequacy of dialysis is checked clinically and by urea reduction rate (URR) [(Pre dialysis urea—Post dialysis urea) × 100/Pre dialysis urea] to be in the range 65%–70%. During dialysis, venous pressure is checked to be maintained at half of the flow rate of 250 mL/h. Routinely urea and creatinine are checked every 4 weeks.

### Cost Saving Strategies in Dialysis

Dialyzer reuse was introduced in 1996, except for Hepatitis B-positive patients. Dialyzer reuse is stopped when the reprocessing machine gives a Bundle Pressure of <80% or reports a pressure failure. Basic dialysis machines are used without profiling or dialysate modeling. Dialysis fluid is prepared in-house from imported reagents in a dedicated department with strict quality control by daily monitoring of constituents and cultures.

## Transplantation

### Recipient Follow-Up

A total of 6,553 renal transplants were performed between 1985 and 2021 by live related donors. Since 1994, 5883 transplants were reported to the Collaborative Transplant Study (CTS), a transplant outcome registry, Heidelberg University [9]. A total of six to eight transplants are performed weekly. All recipients are followed-up on in a dedicated clinic with a volume of 80–120 patients per day. The clinic comprises surgeons, nephrologists, specialists in Internal medicine, dieticians, and medical social workers. Laboratory facility, ultrasound, and pharmacy are part of the clinic. Patients are given immunosuppression medication at each visit for 1–3 months depending on their place of residence in the country.

### Immunosuppression

The protocol evolves as and when the drugs become available in the country. A detailed protocol has been published before [10]. Immunosuppression protocol is based on HLA match. Briefly, all patients with a 3–6 antigen match receive a triple-drug regimen comprising Cyclosporine (CyA)/Azathioprine (AZA) and Prednisolone. CyA is given at 6 mg/kg body weight while paediatric patients receive 8 mg/kg. Target blood levels for CyA are 200–250 ng/mL. Dose reduction by 3 mg/kg is undertaken in patients who are rejection free at 3 months with a target level of 150–200 ng/mL and 2-h level of 800–1,000 ng/mL.

Recipients with poor match (0–2 antigen) and panel reactive antibodies (PRA >30% are given Tacrolimus (TAC), Prednisolone, and Mycophenolate Mofetil (MMF) as initial therapy along with induction with Antithymocyte Globulin (ATG). TAC is given at 0.15 mg/kg with a target level for the first 1–3 months of 8–10 ng/mL. Dose reduction to 0.1 mg/kg is considered at 3 months if the patient is rejection free. Interleukin 2 Antagonist (IL-2) is given to all children <12 years of age. Biopsy-proven graft rejections are treated with methylprednisolone boluses. Methylprednisolone resistant acute rejections are treated by ATG 3–5 mg/kg for 10–14 days. All graft dysfunction are evaluated by drug levels, Color Doppler, and graft biopsy. Patients are monitored for urinary tract infections (UTI), cytomegalovirus (CMV), tuberculosis, hepatitis B and C, and other infections when indicated.

### Cost Saving Strategies in Immunosuppression

Patent drugs were replaced by generics as and when they became available in Pakistan. CyA was replaced in 1999 and generic Tacrolimus was introduced in 2002. Bioequivalence studies were undertaken by one-to-one conversion for CyA and TAC and area under the curve (AUC) for CyA with a 6-point sampling.

### Tissue Typing

Initially, tissue typing was done on microlymphocytotoxicity assay on 60 well Human Leucocyte Antigen (HLA) Class I and Class II Terasaki Plates. Thereafter since 1994, 120 Sera Plates were used for Class I and Class II purchased from CTS Heidelberg Germany. In 1996 CTS sequence-specific primers were used for Class II typing. Antibody screening is by microlymphocytotoxicity assay and flow cross-match for T and B cells was added in 1994. PRA were initially tested on 60 well cell plates and in 2010, Luminex platform was added for pre and post-transplant antibody screening for HLA Class I, and Class II.

### Donor Selection

Donors are selected according to the guidelines of the Amsterdam Forum and according to the protocol published before [11, 12]. Donors are genetically related or spouses aged between 18–60 years in most cases. All the eligible donors are seen in the pre-transplant donor clinic by physicians, nephrologists, surgeons, medical social workers, and psychologists. They are counseled according to their socio-cultural, educational background, vocation, and family structure. Prospective donors are made to interact with kidney donors to address their apprehensions about future health issues.

### Donor Follow-Up

Donors are seen weekly in the first month after donation, thereafter 3 times monthly for a year, and then yearly. Up to 2021, 5,185 donors had registered in the donor clinic for regular follow-up where they are assessed for hypertension, renal

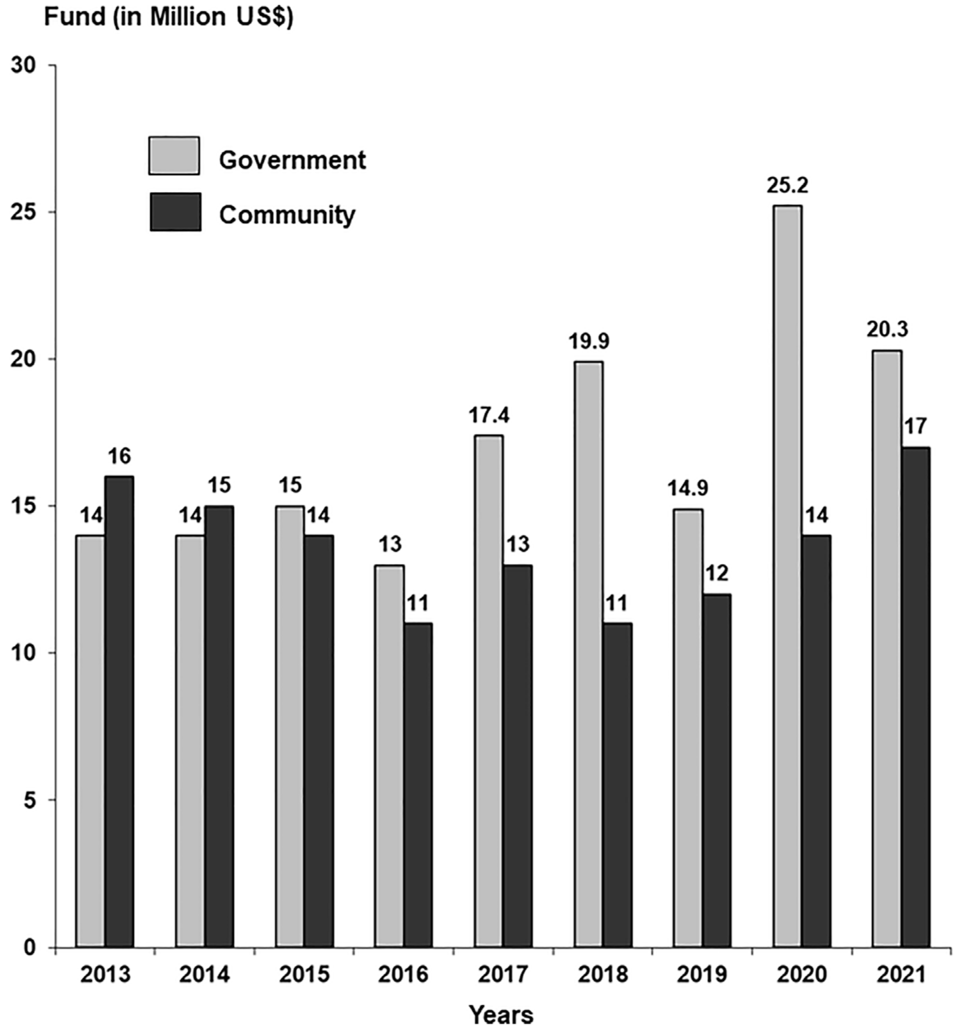


**FIGURE 1 |** Annual funding by the government and community.

function, Lipidemia, liver functions, kidney ultrasound, urine analysis and culture, and 24-h urine for creatinine clearance (CrCl) and protein excretion, and any other medical care as needed. All medications for any condition are provided free to the donors.

## Statistical Analysis

All the data were entered and analyzed in SPSS version. 21.0. Descriptive statistics were used to summarize the normally distributed continuous variables as means and standard deviations and non-normally distributed variables as median (IQR). Categorical variables were reported as count and percentages. Kaplan Meier survival function and analysis was performed for comparison of survival curves, and a log-rank test was used. A *p*-value <0.05 was considered to be statistically significant.

A dollar rate of Rupees 230 to a dollar is used for conversion purposes.

# RESULTS

## Strategies for Sustainability of the Model

The model of Community-Government Partnership has been operative for more than 4 decades with increasing support from the government and community. The contributions of the two partners for the last 9 years are given in **Figure 1**. The overall funding in 2021 was $37.3 million. The development of the model was gradual, in which the government provided infrastructure and staff salaries while the community was asked to donate in kindness or cash to run services. The community was engaged through press and electronic media for donations highlighting the free services to the poor, and personally by presentations in social clubs, business houses, corporations, and industries. A number of schemes were introduced to fund costs incurred for the treatment and expansion of the facilities. The government supported by providing tax benefits on donations to community services or foundations. The schemes included 1) patient sponsorship, e.g., dialysis for a year or immunosuppressive drugs for a year 2) Sponsor equipment scheme, e.g., an ECG machine, a laboratory analyzer, an operation table, an X-ray Unit, a dialysis machine, etc. In time, due to the free treatment provided to thousands of patients, the Institute become a focal point for philanthropists, corporations, and business houses.

The third scheme was Sponsor a unit. The scheme resulted in the establishment of a 20-machine dialysis unit for Hepatitis B patients worth US$ 0.7 million in 1999, an Electron microscopy unit worth $ 1 million in 1994, and a lithotripsy unit in 1988 worth $0.8 million. A business house funded construction of a 6-storey building for Dialysis and Transplantation worth $5 million in 1990. In 2000 another business house constructed a 6-storey Oncology center fully equipped with radiation therapy worth $7 million and a 14-storey Transplant Centre fully equipped with four theatres worth $ 15 million in 2016.

The credibility of the Institute being established has helped maintain contributions of the community. The donors are kept informed of the institute activities by a quarterly newsletter that has been running since 1994 with a current distribution of 40,000. In the last decade, social media platforms like Facebook and Twitter disseminate the institute's awareness programs and services to keep the supporters up to date.

The hallmark of this sustainability is the transparency of services, equity in treatment, and state of art treatment facilities that have made the Institute the largest dialysis and transplant center in the country. All facilities are under one roof and services have expanded to cater for Gastrointestinal Diseases, Hepatology, Cardiology, Internal Medicine, Oncology, Laboratory Medicine, Radiology, and Radiotherapy. Sustainability of the model is shown by the growth of services from 2010 to 2021 in **Table 1**.

**TABLE 1** | Growth of services at the Institute (2011–2021).

| Parameters | 2011 | 2021 |
|---|---|---|
| No. of patients | 770,478 | 2,960,217 |
| Outpatients | 202,456 | 426,328 |
| Inpatients | 33,743 | 61,034 |
| Emergency | 92,102 | 150,025 |
| Minor and major surgical procedures | 66,146 | 109,863 |
| Dialysis sessions | 187,284 | 410,969 |
| Total Transplants from 1986 | 3,228 | 6,271 |
| Radiology tests | 203,216 | 596,533 |
| Laboratory investigations | 6,145,004 | 11,211,665 |
| Medical Costs ($ million) | 4.3 | 10.2 |
| Total staff | 1,440 | 3,012 |

## Haemodialysis Services

In 2021, a total of 4,676 patients registered for dialysis. Of these, 401 presented with acute kidney injury (AKI), 375 recovered and 26 developed ESKD, 306 presented with advanced stage disease with multi organ failure and died, and 3,969 were on regular dialysis. Of the 3,969 active patients, 401 (10.1%) were children ≤18 years of age with a mean age of 13.0 ± 3.6 years (Range 3–18) and 63% were male. The mean age of adult patients was 44.49 ± 15.0 years (Range 19–89), where 60% were men. The number of patients registered yearly in the last 11 years is given in **Figure 2**. Overall, 410,969 dialysis sessions were performed in 2021.

## Increasing Accessibility—Dialysis at the Doorstep

Registered patients come from long distances, 16% from 1500 km, 26% from 1000 km, 17% from 500 km, and 30% from within 100 km. Many cannot afford the travel costs of $10–30 from other cities for the 2-3 weekly dialysis. Therefore, many patients live in tents on footpaths near and around the Institute. To cater to these patients and increase accessibility, the institute established 4 satellite dialysis centers in Karachi with a total of 148 machines. Two centers were established in other cities, Sukkur 550 km away with 44 machines and Larkana 450 km away with 26 machines. In 2021, there were 1875 patients on regular dialysis these centers. Satellite centers have resulted in substantial savings in time and travel costs to the patients. Patients residing near and around Sukkur and Larkana reach these centers within 1 h as compared to 7–8 h to Karachi and travel costs were reduced from $10–30 to $1–2 per daily visit.

## Economizing Dialysis

Simple dialysis machines are used which do not have built-in blood pressure, KT/V (K = Urea Clearance of dialyzer (mL/min), T = time in minutes and V = Volume of fluid removed in ml) and disinfection system or endotoxin filter. These machines cost $5,500 as compared to $8,500 for machines with monitors. The dialysis fluid is prepared in-house, where the cost of each dialysis is $1. Dialysis reuse on automatic processors allows a medium reuse of up to 7.0 times. The cost of a dialyzer is $4.5, and reuse reduces the cost to $0.64/dialysis. Considering yearly dialysis sessions in 2021, the cost without reuse would be $1.849 million however with reuse the cost is $0.264 million, a saving of $1.58 million/year.

## Renal Transplantation

A total of 6,553 transplants were performed between 1985–2021 using living related donors. The number of transplants performed in the last 11 years is given in **Figure 2**. The activity was stopped for 6 months during COVID-19 pandemic in 2020. Of the 6,553 transplants, 988 were pediatric transplants ≤18 years and 601 were spousal transplants. The demographics, clinical characteristics, and outcomes of 6,553 transplants performed between 1985–2021 are given in **Table 2**. The overall mean age of recipients was 29.15 ± 10.1 years (Range 2–62) with 78% men. The mean age of pediatric transplants was 14.6 ± 3.1 years (range 2–18) whereas 72% were men. The primary disease was unknown in the majority (53.47%) as patients present late with small shrunken kidneys. The mean age of donors was 34.2 ± 9.6 years (Range 18–66) where men were 56%. In the majority (82.65%), initial maintenance immunosuppression was by CyA/AZA/Steroids. Acute rejections were reported in 17%. The main post transplant infections were CMV in 35.8%, recurrent UTIs in 17.6%, and tuberculosis in 14.3%. The majority of the CMV

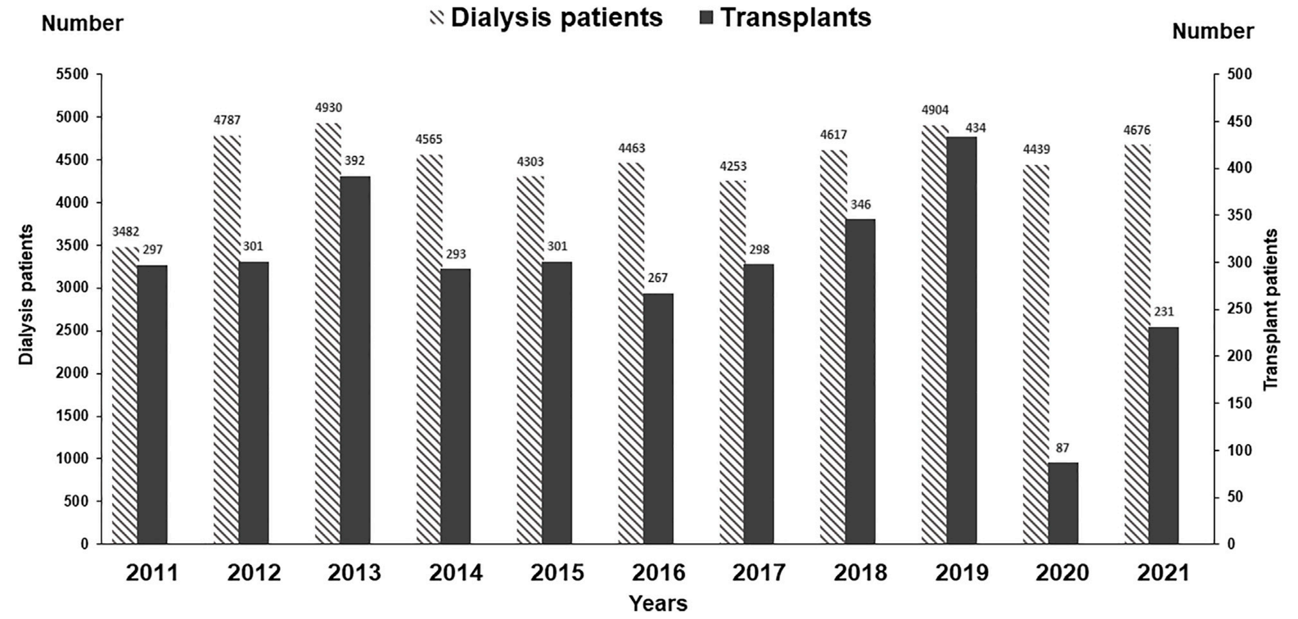


**FIGURE 2 |** Annual frequency of patients dialyzed and transplanted.

infection 2018 (86%) occurred between 3–6 months post-transplant. Recurrent UTI in the first 6 months post-transplant and TB beyond 1 year transplant. Overall, 1 and 5-year graft survival was 97% and 87%. The main causes of 698 graft losses were Interstitial fibrosis and tubular atrophy (IFTA) in (54%), acute rejection (14%), recurrence of disease (5%), infections (8%), and death with functioning graft (19%). Overall, 1 and 5 years patient survival was 97% and 88%. The main cause of death was infection in 58%.

## Economizing Immunosuppression

Firstly, generic drugs are used instead of patent drugs to reduce costs and secondly, immunosuppression protocol is based on HLA match where 82.6% recipients are given CyA/AZA/Steroids and 18% TAC/MMF or AZA/Steroids. Induction by ATG or IL-2 is given to 17% of the patients. The cost of CyA/AZA/Steroids for the first year is $650 while for TAC/MMF/Steroids the cost is $1,300. The total saving using CyA/AZA is around $4.2 million.

We have compared the immunosuppressive drugs used in our Institute with those in Europe and their impact on graft outcomes. **Figure 3** shows the use of different Calcineurin and Inosine-5′-monophosphate dehydrogenase (IMPDH) inhibitors for first living donor transplants between Europe and our Institute from 1994–2020 (Courtesy CTS) [9]. The comparison is based on 5,883 transplants at our Institute and 38,949 in Europe. Induction therapy by ATG or IL-2 in Karachi is used in 19% vs. 40% in Europe (**Figure 3A**). Calcineurin Inhibitor CyA is used in 88% in Karachi while TAC is used in 89% in Europe (**Figure 3B**). IMPDH inhibitor AZA is used in 88% in Karachi while MMF is used in 94% in Europe (**Figure 3C**). A comparison of death-censored graft survival with different Immunosuppressive drugs is in **Figure 4**. Graft survival rates are similar in induction vs. no induction both in Europe and Karachi (**Figure 4A**). TAC vs. CyA (**Figure 4B**) and AZA vs. MMF/MPA (**Figure 4C**). Using cheaper immunosuppressive drugs and HLA driven immunosuppression we are able to achieve similar graft survival rates between Induction vs. No Induction, CyA vs. TAC, and AZA vs. MMF. Improvement in immunosuppression by availability of drugs in the country and better diagnosis of infections have improved 1- and 5-year graft survival rates from 90.8% to 71.8% in 1994–1999 to 98.2% and 91% in the period 2014–2020 (**Figure 5**). The major cause of death in our patients is infection in >50% as compared to 33% in Europe and 45% in the region (**Figure 6**).

## Donor Follow-Up

Donor clinic has registered 5,185 donors since its inception in 2000. Of the 5,185 registered, 4,883 (94%) are in follow-up. A total of 3,786 (77%) are in regular serial yearly follow-up. The rest have follow-up gaps of 2–5 years, especially >10–15 years after donation due to normal renal function and health. Mean post-donation age at >15 years was 49.5 ± 10.2 (Range 33–83), and 30–35 years was 62.0 ± 9.2 (Range 48–80). The mean serial CrCl in mL/min/1.73 $m^2$ of 3,786 is donors given in **Figure 7A**. Pre-donation mean CrCl was 112 ± 23, which dropped to 79 ± 18 at 1 year. CrCl gradually increased to 85 ± 20 at 5 years and thereafter, there was an age-related fall to a mean of 72 ± 17 at 30–35 years. Overall protein excretion in mg/24 h at different time points is given in **Figure 7B**. The majority (76%) had protein excretion within the normal range <150 mg/24 h (76%) and 42 (1.1%) had protein >1,000 mg/24 h. In the follow-up period, 757 (20%) developed hypertension, 265 (7%)

**TABLE 2 |** Demographics, clinical characteristics, and outcomes of renal transplant recipients (*n* = 6,553).

| Parameters | Results |
|---|---|
| Overall Age (years, mean, SD) | 29.15 ± 10.19 |
| Adult > 18 (years, mean, SD) | 31.72 ± 8.76 |
| Paediatric ≤ 18 (years, mean, SD) | 14.66 ± 3.18 |
| Spousal (years, mean, SD) | 36.65 ± 7.75 |
| Pediatric up to 18 years (n, %) | 988 (15.1) |
| Spousal (*n*, %) | 601 (9.2) |
| Gender (*n*, %) | |
| Overall Male (*n*, %) | 5,154 (78.7) |
| Children Male (*n*, %) | 712 (72.1) |
| Spousal Male (*n*, %) | 510 (84.9) |
| Primary renal disease (*n*, %) | |
| Glomerulopathies | 1,361 (20.76) |
| Congenital/Urologic/Cystic | 340 (5.19) |
| Hypertension | 678 (10.35) |
| Diabetes | 102 (1.56) |
| Stone Disease | 568 (8.67) |
| Unknown | 3,504 (53.47) |
| Time on dialysis (months, median, IQR) | 5 (IQR: 3–10) |
| Donor Age (mean, SD) | 34.28 ± 9.67 |
| Male (*n*, %) | 3,690 (56.3) |
| Female (*n*, %) | 2,863 (43.7) |
| Donor Gender | |
| Paediatric Transplants, Females | 571 (57.8) |
| Spousal Transplants, Females | 510 (84.9) |
| HLA Match (*n*, %) | |
| 4–6 | 3,771 (57.5) |
| 3 | 1,988 (30.3) |
| 0–2 | 794 (12.1) |
| Panel reactive antibodies (PRA) (*n*, %) | |
| 0%–10% | 6,083 (92.8) |
| >10% | 470 (7.2) |
| Immunosuppression (*n*, %) | |
| Induction therapy (ATG/IL-2) | 1,120 (17) |
| Initial Maintenance (*n*, %) | |
| Cyclosporine/Aza/Steroid | 5,416 (82.65) |
| Tacrolimus/MMF/Steroid | 668 (10.19) |
| Cyclosporine/MMF/Steroid | 239 (3.6) |
| Tacrolimus/Aza/Steroid | 555 (8.4) |
| mTOR Inhibitors | 586 (8.9) |
| Acute rejection (*n*, %) | 1,141 (17) |
| Post-Transplant Chronic infections (*n*, %) | |
| Tuberculosis | 937 (14.3) |
| Recurrent UTI | 1,156 (17.6) |
| HCV | 819 (12.5) |
| CMV | 2,346 (35.8) |
| 1 and 5-year Graft Survival (*n*, %) | |
| Overall | 6,553, 97% and 87% |
| Paediatric | 988, 96% and 85% |
| Spousal | 601, 97% and 85% |
| 1 and 5-year Patient Survival (*n*, %) | |
| Overall | 6,553, 97% and 88% |
| Paediatric | 988, 97% and 90% |
| Spousal | 601, 98% and 88% |

diabetes, and ESKD in 11 (0.29%). Overall 14 donors died, four in ESKD. The overall ESKD rate in donors was 2.5/10,000 person-years and mortality 4.5/10,000 person-years.

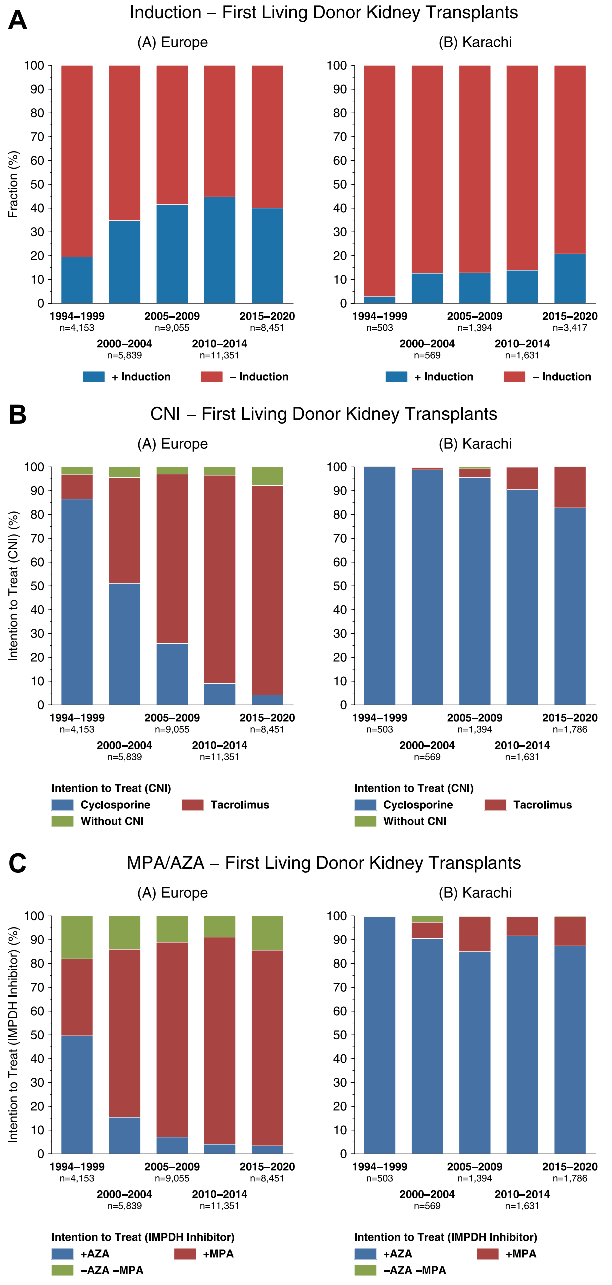


**FIGURE 3 |** Comparison of immunosuppression between Europe and Karachi - First living donor kidney transplants **(A)**: Induction Therapy **(B)**: Calcineurin Inhibitors **(C)**: IMPDH Inhibitors.

## Rehabilitation Program

Many of the recipients come from a low socio-economic background. The institute started a vocational training center where patients of all genders are given training in tailoring and computing, and beautician courses for women by qualified volunteers from the community. Furthermore, recipients and their donors are given employment on merit in the institute whenever possible. Presently over 175 are employed by the institute. Lastly, financial support is given to

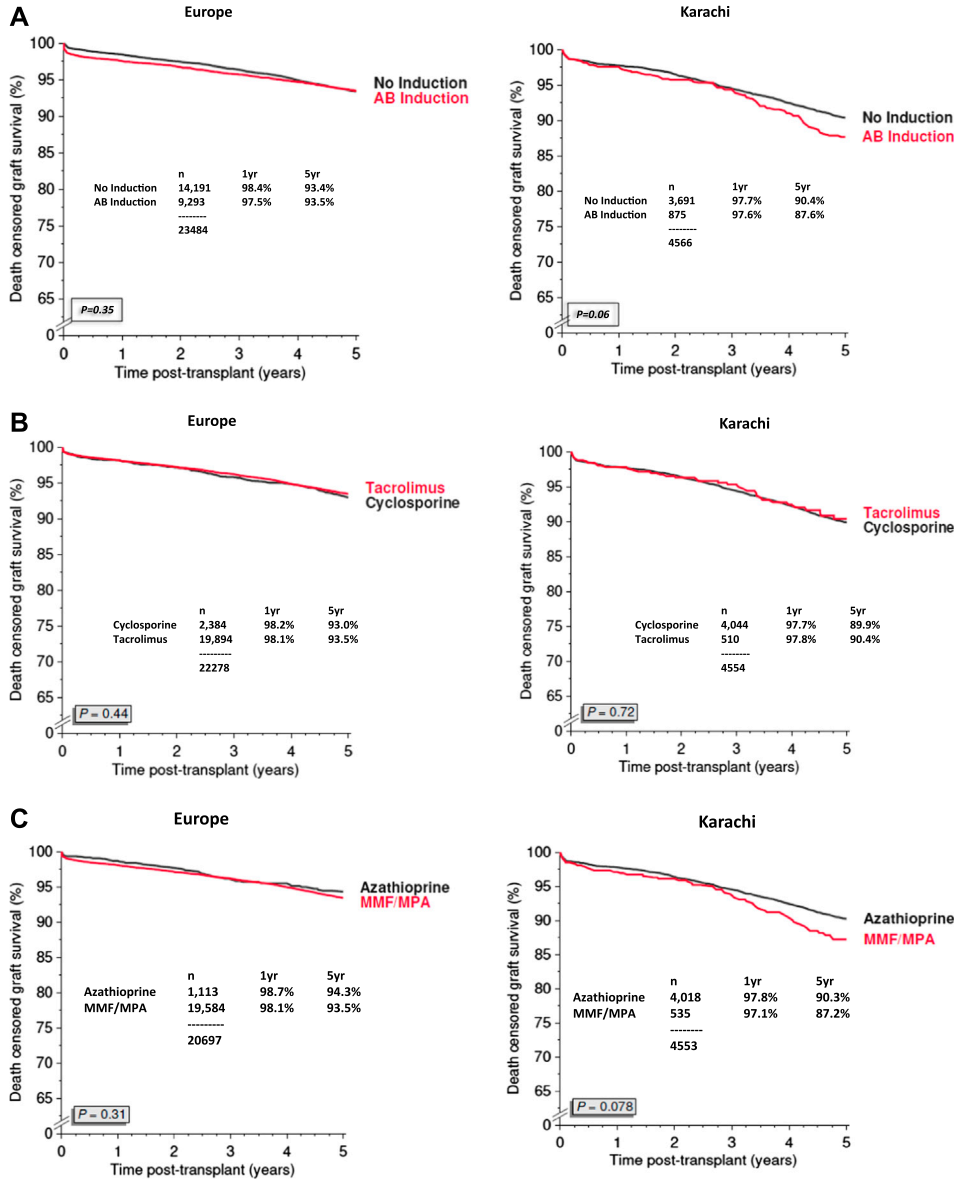


**FIGURE 4 |** Graft survival based on Immunosuppression regime between Europe and Pakistan (2007–2020) **(A)**: Induction Therapy **(B)**: Calcineurin Inhibitors **(C)**: IMPDH Inhibitors.

recipients to establish small businesses, e.g., home beauty parlor, tailor shop, vegetable, and fruit stalls.

# DISCUSSION

Pakistan is an LMIC with paucity of RRT. The estimated incidence of ESKD is 100–150 pmp where the dialysis rate is 15 pmp and transplant 4.5 pmp. In view of this paucity, a model of community-government partnership was established where dialysis and transplantation were integrated and offered “Free of cost” to all who need it with lifelong follow-up of recipients and donors with medications. Daily, >1,500 patients are dialyzed and 6–8 transplants are performed per week. Overall, 1- and 5-year graft survival of 6,553 transplants are 97% and 87%. The funds contributed by the community and government to sustain all services in 2021 were $37.3 million.

## Access to Dialysis and Transplantation

### Dialysis

In LMICs there are several problems associated with access to RRT. A major problem is that 20%–80% of the population resides in rural areas, while dialysis centers are located in urban centers [2, 3]. In our experience, although dialysis is free, patients have poor dialytic compliance due to long-distance and travel costs [13]. Establishment of satellite centers nearer to the doorstep of

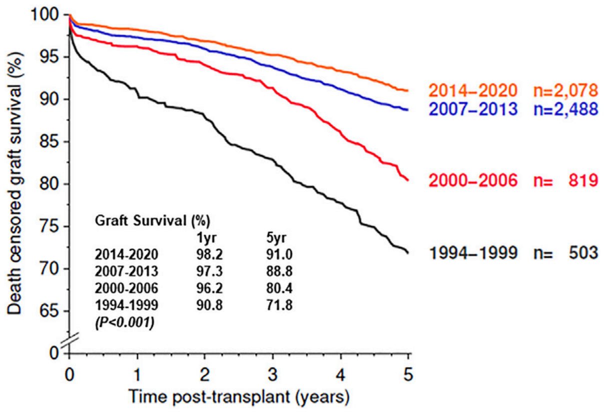


**FIGURE 5 |** Graft survival of First Living Donor Kidney Transplant in Karachi.

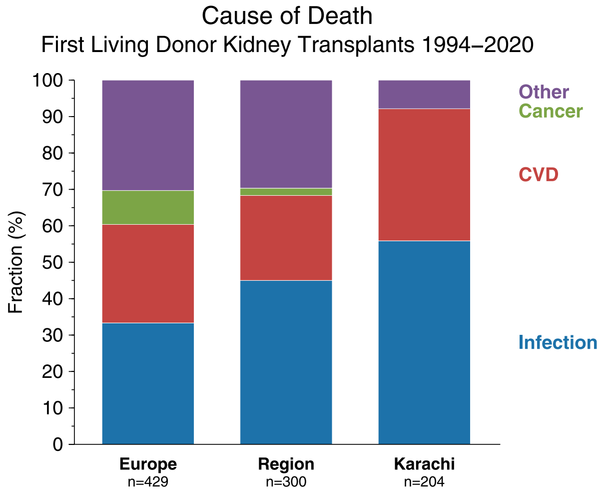


**FIGURE 6 |** Comparison of cause of death between Europe, Middle East ("Region"), and institute ("Karachi").

the patients have helped 1,875 patients access dialysis near their area of residence with substantial savings in time and travel costs. The other major issue is the cost of dialysis. In India where dialysis is available in rural settings, almost 50% stopped dialysis due to cost constrains [14]. In Nigeria, dialysis is available in public and private sector, however, patients cannot afford the costs resulting from a dialysis period of less than 1 month [15]. The reason for this drop out is high costs of dialysis in LMICs in the range of $13,510–$19,263 while free dialysis by public funding is only 22%–30%. When other funding models are included, e.g., out of pocket expenses, private funding, and models of public-private partnership the universal coverage for RRT is in the range 50%–70% in LMICs [1].

In a global survey based on World Bank income groups, public funding for chronic dialysis in LIC is 18%, and 22% in LMICs as compared to 58% in HIC [16]. In another study by International Society of Nephrology on dialysis funding in LMICs reported government contribution in 37.6%, out of pocket payment in 19.7%, employment insurance in 15.1% and private insurance 18.3% [17]. In summary, the majority of the patients are disfranchised from dialysis in LMICs due to lack of public services and high costs in the private sector. In fact, 50%–70% of the patients drop out of dialysis due to costs [18, 19]. In view of this, a number of LMICs have developed models of public private funding systems, similar to our model to offer dialysis to those who cannot due to cost constraints.

### Transplantation

In LMICs the main treatment for ESKD is hemodialysis in a majority of the patients (range 10%–95%) and <1%–10% receive a kidney transplant (KT) [5]. A global survey of capacity for KT reported an incidence of 3.5 pmp for LIC and 4.3 pmp for LMICs [20]. The reason for this low activity is primarily absence of deceased donor programmes, thus transplants are only from living donors [2, 20]. In our own experience, the transplant rate is 1/3 of the dialysis rate and the main reason is the absence of deceased donors. Secondly, medical and social problems in potential donors, and thirdly patients with ESKD present late where pre-emptive transplants are not possible. Finally, the reason for low transplant rates is costs. The cost of KT in LMICs in the 1st year per person is $ 11,746 and after 1st year, it is $5,659/year [1]. These are beyond the means of the majority and when KT is available in an LIC it is publicly funded in 50%, and funded by a public-private partnership in 50%, while in an LMIC it is publicly funded in 27% and public-private in 54%.

When transplanted, the other issue is affording the cost of immunosuppression. In the majority, it is out of pocket or a public private partnership model. An international cross-sectional survey reported that funding for immunosuppression drugs was free at point of delivery in 20% in LICs and 42% in LMICs [21]. Therefore, the majority acquire drugs through out-of-pocket payment or other sources. The overall graft survival is therefore low in LMICs, 1- and 5-year range from 95%–83% and 93%–60% [2] as compared to HIC in Europe 98% at 1 year and 93.5% at 5 years. Providing free transplantation and life-long drugs, our overall graft survival rate at 1 year is 97% and 5 years 88%. Improving with time, the current survival rate is comparable to Europe 98.2% at 1 year and 91% at 5 years [9].

Paediatric transplant constitutes 4%–8% of the total living donor transplants in LMICs [22, 23]. The reasons for low activity in a report from Middle East countries identified delayed referrals, lack of infrastructure, and absence of dialysis facilities [23]. In a study from India, the main reasons were socioeconomic status, low wages, and distance from the transplant center [24]. Generally, in LMICs, lack of facilities and costs exclude children from transplantation. Transplant outcomes are also poor in LMICs with 1- and 5-year graft survival rates of 82%–98% and 44%–67% [25, 26] as compared to 99.5% and 97% in HIC (United States) [25]. Overcoming socioeconomic and logistic barriers in our Institute, children constitute 15% of all transplants with graft survival rates of 97% and 90% at 1 and 5 years.

## Cost Reduction Strategies for Increasing RRT

Costs of RRT are a burden for the government and patients in LMICs [27]. To reduce costs in dialysis one of the strategies

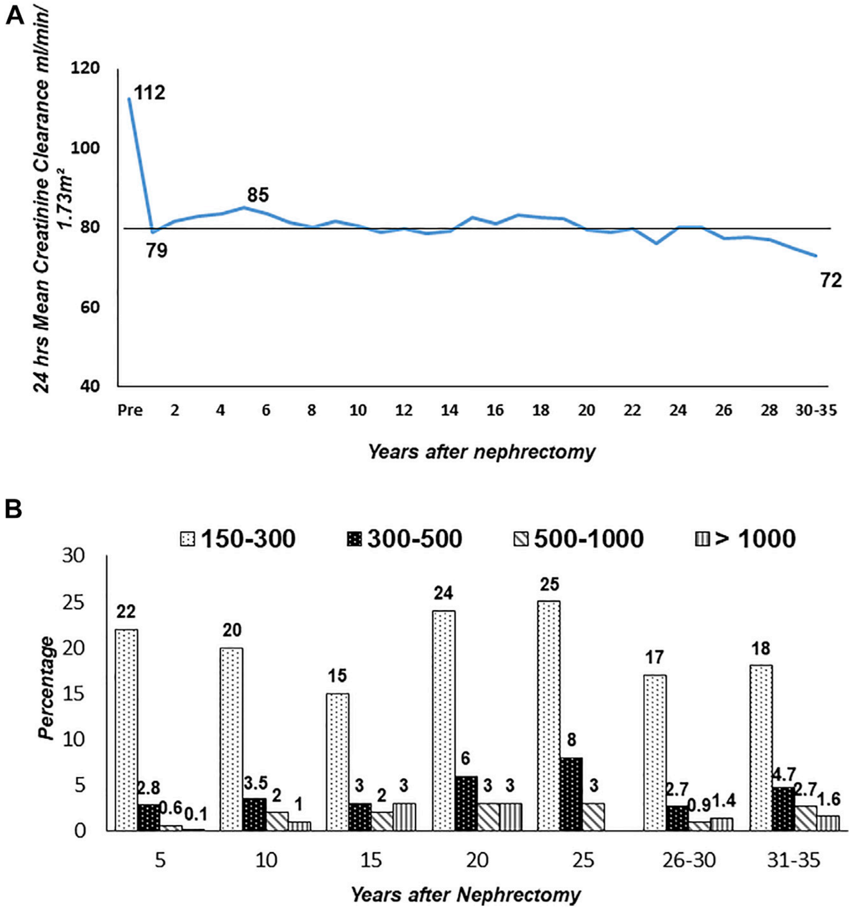


**FIGURE 7 |** Long-term creatinine clearance and proteinuria in donors (*n* = 3,786). Figure **(A)**: Serial yearly creatinine clearance (CrCl). Figure **(B)**: Range of proteinuria (mg/24 h) by years after nephrectomy.

employed is dialyzer reuse. This is not only cost-effective but also microbiologically safe [28]. In our experience, medium reuse was 7 days while others have reported average reuse of 3–10 times [18, 27]. In our experience, reuse allowed substantial savings by reducing the cost of dialysis to $0.64/dialysis from $4.5/ dialysis. Reuse saved the institute $1.58 million in 2021. Early placement of AVF reduces costs of lines and costs of treatment of line associated infectious complications.

In transplantation, generic drugs provided a cost-effective option. The use of generic CyA and TAC at our institute for living donor transplants has shown comparable outcomes to living donor transplants in Europe. In fact, when newer generic drugs such as TAC and MMF have become available in the country, together with effective diagnosis and treatment of infections we have observed significant improvement in graft survival rates from 90.8% to 98.2% % at 1 year and 71.8%–91% at 5 years mostly using generic drugs. In a multicenter double-blinded randomized trial in Iran, generic CyA in comparison with a patent drug was found to be equally effective in terms of acute rejections, infections complications, and graft survival compared [29]. The same results were found in one-to-one conversion in stable renal transplant recipients [30]. In similar comparative studies of generic TAC vs. a patent drug, no difference was observed in rejection episodes, graft survival, and adverse events, e.g., infections and new onset diabetes [31, 32]. The use of generics thus offers LMICs a viable option as there are substantial savings, allowing more patients to be transplanted and given medications by public funding.

## Gender Disparities in RRT

A report by ERA-EDTA registry found that the lifetime risk of ESKD is 50% higher in men as compared to women [33]. In LMICs from Asia, ESKD rates in men ranged from 35%–65% [34]. Similarly, in a HIC (United States) the incidence of ESKD is 1.5 times higher in men than women [34]. A study from Pakistan reported that men constituted 51% of all CKD patients [35]. The disease is more prevalent in men, which is also confirmed by our own data where 60% of the patients on dialysis are men. Although disease is more prevalent in men, there appears to be a gender bias in dialysis due to cultural and logistic reasons.

Considering gender bias in transplantation, a study of 120 countries by Bikbov et al reported a Male:Female ratio of 10: 2.5 for transplantation [36]. In LMICs there appears to be a gender bias where more men are recipients and more women are donors [37]. A meeting report from the Asia Pacific Region where data was based on National and Non-National resources showed that the proportion of female donors was 63%–78% in Bangladesh, 62%–65% in India, 53%–68% in Malaysia, 61% in Myanmar and 44% in Pakistan [37].

In contrast, there is predominance of male donors in some countries of the region. For instance, in Saudi Arabia 60%–70% are male donors [38]. The reason for this is the conservative Middle Eastern Society, which is culturally overprotective of women. A report from Iran based on data from the National Registry of 16,672 transplants showed that men constituted 62% of the recipients and 80% of the donors. Male predominance is likely due to economic, social, and cultural norms in Iran and perhaps their regulated compensation program may also attract male donors [39].

In a study from India, donation rates were compared from 2001–2009 and 2010–2018. There were improvements in male donor rates from 26.05% to 38.58% and male recipient rates decreased from 81.51% to 78.7% mainly due to awareness programs in the country [40].

In our experience men constitute 78% of the recipients and 54% of the donors. Although overall, women constituted 44% of the donors, however in paediatric transplants they constitute 58% and spousal transplants 85%. The majority of our patients belong to low a socio-economic class where men are the main financial earners and women homemakers. Women are socially and economically dependent on men and therefore easily volunteer to be donors. It may also be a social and cultural factor where women have a sense of obligation, love and altruism and care of the family [2, 11]. The main concern of both genders, especially men, is post donation health and wellbeing and the impact of donation on their ability to provide sustenance for their family. Our donor clinic has played an important role in bringing forward male donors. The donor clinic provides a forum for prospective donors to interact with kidney donors who have been in follow-up for more than 30 years. Good health of kidney donors gives confidence to prospective donors of a normal life post donation [11].

## The Way Forward for Dialysis and Transplantation in LMICs

In LMICs neither the government nor the patient has the capacity to pay for RRT. The governments can provide only 20%–30% of the patients free RRT and the patients *per capita* income is #3,000–24,000 per year while dialysis costs $13,510/year/person and transplant costs $11,746 in the first year. Several models of public-private partnership have been developed to fund RRT. Our model of community-government partnership has been sustained for over four decades with increasing support from the government and community. Dialysis at the doorstep of patients has increased accessibility and maintains equity in socio-economic and gender factors. This has given equal opportunity for women for dialysis and transplantation. Several models exist in LMICs where public-private partnerships have been able to provide RRT free of cost to patients. In India, the state government of Andhra Pradesh introduced an insurance scheme for poor households in 2007 called the Rajiv Aarogyasri Community Health Insurance Scheme (RACHIS), which offers free dialysis care [18]. In Guyana, a private-public partnership offers free transplantation with the help of a foundation called Subraj Foundation which has been sustained since 2007 [41]. In LMICs, models based on a government-private partnership offer a viable solution to enhance RRT.

## CONCLUSION

The results of our study where all RRT is provided "free of cost" to the disfranchised by a community government partnership may be duplicated in other LMICs. It may help overcome hurdles of logistics, economics, and gender and cultural biases inherent in LMICs.

## DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

## ETHICS STATEMENT

The data for this retrospective study was extracted from the Institute anonymized database of transplant recipients and donors and database of Collaborative Transplant Study, Heidelberg. The study was approved by the Institutional Research Advisory Board (No. 470).

## AUTHOR CONTRIBUTIONS

MZ—Study conception and design, acquisition of data, analysis and interpretation of data, drafting of manuscript, critical revision of manuscript. SR—Study conception, analysis and interpretation of data, critical revision of manuscript. All authors contributed to the article and approved the submitted version.

## CONFLICT OF INTEREST

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

## ACKNOWLEDGMENTS

We are grateful to Dr. Tran Hien and Mr. Christian Unterrainer from the Collaborative Transplant Study, Heidelberg University for generating analysis and graphs for this paper from the CTS database.

# REFERENCES

1. Yeung E, Bello AK, Levin A, Lunney M, Osman MA, Ye F, et al. Current Status of Health Systems Financing and Oversight for End-Stage Kidney Disease Care: a Cross-Sectional Global Survey. *BMJ Open* (2021) 11(7):e047245. doi:10.1136/bmjopen-2020-047245
2. Rizvi SAH, Zafar MN. Living Related Kidney Transplantation in Developing Countries: Life-Long Follow-Up of Recipients and Donors. In: Rohit A, Abraham G, editors. *Handbook of Renal Transplantation in Developing Countries*. New Delhi, India: Oxford University Press (2020). p. 133–47.
3. Nkunu V, Wiebe N, Bello A, Campbell S, Tannor E, Varghese C, et al. Update on Existing Care Models for Chronic Kidney Disease in Low- and Middle-Income Countries: A Systematic Review. *Can J Kidney Health Dis* (2022) 9: 20543581221077505. doi:10.1177/20543581221077505
4. Asian Development Bank. *Key Indicators for Asia and the Pacific 2022.* 53rd ed. Mandaluyong, Philippines: Asian Development Bank (2022). doi:10.22617/FLS220346-3
5. Sahay M, Jasuja S, Tang SCW, Alexander S, Jha V, Vachharajani T, et al. Aetiology, Practice Patterns and burden of End-Stage Kidney Disease in South Asia and South-East Asia: A Questionnaire-Based Survey. *Nephrology (Carlton)* (2021) 26(2):142–52. doi:10.1111/nep.13825
6. Divyaveer SS, Ramachandran R, Sahay M, Singh Shah D, Akhtar F, Bello AK, et al. International Society of Nephrology Global Kidney Health Atlas: Structures, Organization, and Services for the Management of Kidney Failure in South Asia. *Kidney Int Suppl* (2021) 11(2):e97–e105. doi:10.1016/j.kisu.2021.01.006
7. Rizvi SA, Naqvi SA, Zafar MN, Hussain Z, Hashmi A, Hussain M, et al. A Renal Transplantation Model for Developing Countries. *Am J Transpl* (2011) 11(11):2302–7. doi:10.1111/j.1600-6143.2011.03712.x
8. Rizvi SA, Naqvi SA, Zafar MN, Akhtar SF. A Kidney Transplantation Model in a Low-Resource Country: an Experience from Pakistan. *Kidney Int Suppl* (2013) 3(2):236–40. doi:10.1038/kisup.2013.22
9. Collaborative Transplant Study. Collaborative Transplant Study, Heidelberg University of Immunology (2023). Available from:https://www.ctstransplant.org (Accessed February 14, 2023).
10. Zafar MN, Wong G, Aziz T, Abbas K, Rizvi SAH. Living Donor Risk Model for Predicting Kidney Allograft and Patient Survival in an Emerging Economy. *Nephrology (Carlton)* (2018) 23(3):279–86. doi:10.1111/nep.12983
11. Ethics Committee of the Transplantation Society. The Consensus Statement of the Amsterdam Forum on the Care of the Live Kidney Donor. *Transplantation* (2004) 78(4):491–2. doi:10.1097/01.tp.0000136654.85459.1e
12. Rizvi SA, Zafar MN, Jawad F, Aziz T, Hussain Z, Hashmi A, et al. Long-term Safety of Living Kidney Donation in an Emerging Economy. *Transplantation* (2016) 100(6):1284–93. doi:10.1097/TP.0000000000001075
13. Mazhar F, Nizam N, Fatima N, Siraj S, Rizvi SA. Problems Associated with Access to Renal Replacement Therapy: Experience of the Sindh Institute of Urology and Transplantation. *Exp Clin Transpl* (2017) 15(1):46–9. doi:10.6002/ect.mesot2016.O27
14. Hemachandar R. Practice Pattern of Hemodialysis Among End-Stage Renal Disease Patients in Rural South India: A Single-center Experience. *Saudi J Kidney Dis Transpl* (2017) 28(5):1150–6. doi:10.4103/1319-2442.215134
15. Ajayi S, Raji Y, Bello T, Jinadu L, Salako B. Unaffordability of Renal Replacement Therapy in Nigeria. *Hong Kong J Nephrol* (2016) 18:15–9. doi:10.1016/j.hkjn.2015.11.002
16. Qarni B, Osman MA, Levin A, Feehally J, Harris D, Jindal K, et al. Kidney Care in Low- and Middle-Income Countries. *Clin Nephrol* (2020) 93(1):21–30. doi:10.5414/CNP92S104
17. Luyckx VA, Smyth B, Harris DCH, Pecoits-Filho R. Dialysis Funding, Eligibility, Procurement, and Protocols in Low- and Middle-Income Settings: Results from the International Society of Nephrology Collection Survey. *Kidney Int Suppl* (2020) 10(1):e10–e18. doi:10.1016/j.kisu.2019.11.005
18. Shaikh M, Woodward M, John O, Bassi A, Jan S, Sahay M, et al. Utilization, Costs, and Outcomes for Patients Receiving Publicly Funded Hemodialysis in India. *Kidney Int* (2018) 94(3):440–5. doi:10.1016/j.kint.2018.03.028
19. Dhrolia MF, Nasir K, Imtiaz S, Ahmad A. Dialyzer Reuse: Justified Cost Saving for South Asian Region. *J Coll Physicians Surg Pak* (2014) 24(8):591–6.
20. Mudiayi D, Shojai S, Okpechi I, Christie EA, Wen K, Kamaleldin M, et al. Global Estimates of Capacity for Kidney Transplantation in World Countries and Regions. *Transplantation* (2022) 106(6):1113–22. doi:10.1097/TP.0000000000003943
21. Bello AK, Levin A, Lunney M, Osman MA, Ye F, Ashuntantang GE, et al. Status of Care for End Stage Kidney Disease in Countries and Regions Worldwide: International Cross Sectional Survey. *BMJ* (2019) 367:l5873. doi:10.1136/bmj.l5873
22. Rizvi SA, Sultan S, Zafar MN, Naqvi SAA, Lanewala AA, Hashmi S, et al. Pediatric Kidney Transplantation in the Developing World: Challenges and Solutions. *Am J Transpl* (2013) 13(9):2441–9. doi:10.1111/ajt.12356
23. Saeed B. Pediatric Kidney Transplantation in the Middle East: Challenges and Solutions. *Exp Clin Transpl* (2022) 20(3):7–14. doi:10.6002/ect.PediatricSymp2022.L2
24. Pais P, Blydt-Hansen TD, Michael Raj JA, Dello Strologo L, Iyengar A. Low Renal Transplantation Rates in Children with End-Stage Kidney Disease: A Study of Barriers in a Low-Resource Setting. *Pediatr Transpl* (2021) 25(2): e13867. doi:10.1111/petr.13867
25. Chua A, Cramer C, Moudgil A, Martz K, Smith J, Blydt-Hansen T, et al. Kidney Transplant Practice Patterns and Outcome Benchmarks over 30 Years: The 2018 Report of the NAPRTCS. *Pediatr Transpl* (2019) 23(8):e13597. doi:10.1111/petr.13597
26. Iyengar A, McCulloch MI. Paediatric Kidney Transplantation in Under-resourced Regions-A Panoramic View. *Pediatr Nephrol* (2022) 37(4): 745–55. doi:10.1007/s00467-021-05070-3
27. Alexander S, Jasuja S, Gallieni M, Sahay M, Rana DS, Jha V, et al. Impact of National Economy and Policies on End-Stage Kidney Care in South Asia and Southeast Asia. *Int J Nephrol* (2021) 2021:6665901. doi:10.1155/2021/6665901
28. Ribeiro IC, Roza NAV, Duarte DA, Guadagnini D, Elias RM, Oliveira RB. Clinical and Microbiological Effects of Dialyzers Reuse in Hemodialysis Patients. *J Bras Nefrol* (2019) 41(3):384–92. doi:10.1590/2175-8239-JBN-2018-0151
29. Khatami SM, Taheri S, Azmandian J, Sagheb MM, Nazemian F, Razeghi E, et al. One-Year Multicenter Double-Blind Randomized Clinical Trial on the Efficacy and Safety of Generic Cyclosporine (Iminoral) in De Novo Kidney Transplant Recipients. *Exp Clin Transpl* (2015) 13(3):233–8. doi:10.6002/ect.2013.0139
30. Cortinovis M, Gotti E, Trillini M, Carrara F, Gaspari F, Ruggenenti P, et al. Conversion from Brand-Name Neoral to the Generic Ciqorin in Stable Renal Transplant Recipients. *Nephron* (2017) 135(3):173–80. doi:10.1159/000453671
31. Melilli E, Crespo E, Sandoval D, Manonelles A, Sala N, Mast R, et al. De Novo use of a Generic Formulation of Tacrolimus versus Reference Tacrolimus in Kidney Transplantation: Evaluation of the Clinical Results, Histology in Protocol Biopsies, and Immunological Monitoring. *Transpl Int* (2015) 28(11):1283–90. doi:10.1111/tri.12626
32. Son SY, Jang HR, Lee JE, Yoo H, Kim K, Park JB, et al. Comparison of the Long-Term Efficacy and Safety of Generic Tacrobell with Original Tacrolimus (Prograf) in Kidney Transplant Recipients. *Drug Des Devel Ther* (2017) 11: 203–10. doi:10.2147/DDDT.S118154
33. ERA-EDTA. *ERA-EDTA Registry Annual Report 2017* (2017). Available from: http://www.era-online.org/wp-content/uploads/2022/11/ERA-Registry-Annual-Report-2017.pdf (Accessed February 14, 2023).
34. Ricardo AC, Yang W, Sha D, Appel LJ, Chen J, Krousel-Wood M, et al. Sex-related Disparities in CKD Progression. *J Am Soc Nephrol* (2019) 30(1):137–46. doi:10.1681/ASN.2018030296
35. Salman B, Imtiaz S, Qureshi R, Dhrolia MF, Ahmad A. The Causes of Chronic Kidney Disease in Adults in a Developing Country. *J Nephrol Ren Dis* (2017) 1:1. doi:10.4172/2576-3962.1000105
36. Bikbov B, Perico N, Remuzzi G. On Behalf of the GBD Genitourinary Diseases Expert Group Disparities in Chronic Kidney Disease Prevalence Among Males and Females in 195 Countries: Analysis of the Global Burden of Disease 2016 Study. *Nephron* (2018) 139(4):313–8. doi:10.1159/000489897
37. Kim Y, Ahmed E, Ascher N, Danguilan R, Hooi LS, Hustrini NM, et al. Meeting Report: First State of the Art Meeting on Gender Disparity in Kidney

Transplantation in the Asia-Pacific. *Transplantation* (2021) 105(9):1888–91. doi:10.1097/TP.0000000000003841

38. Guella A, Mohamed E. Donor and Recipient Gender Distribution in a Saudi Kidney Transplant Center. *Transpl Proc* (2011) 43(2):415–7. doi:10.1016/j.transproceed.2011.01.049
39. Taheri S, Alavian SM, Einollahi B, Nafar M. Gender Bias in Iranian Living Kidney Transplantation Program: a National Report. *Clin Transpl* (2010) 24(4):528–34. doi:10.1111/j.1399-0012.2009.01120.x
40. Bhuwania S, Saxena S, Bansal R, Goel R. Gender Bias in Kidney Donation in India: Has it Changed Over the Past 2 Decades? *Transpl Proc* (2020) 52(6):1665–70. doi:10.1016/j.transproceed.2019.12.056
41. Guy-Frank CJ, Persaud K, Butsenko D, Jindal RM, Guy SR. Developing a Sustainable Renal Transplant Program in Low- and Middle-Income Countries: Outcome, Challenges, and Solutions. *World J Surg* (2019) 43(11):2658–65. doi:10.1007/s00268-019-05093-w

BRIEF RESEARCH REPORT
published: 14 April 2023
doi: 10.3389/ti.2023.11206

# Representation of Women in Contemporary Kidney Transplant Trials

**A. J. Vinson**[1,2]* **and S. B. Ahmed**[3,4,5,6]

[1]Division of Nephrology, Department of Medicine, Dalhousie University, Halifax, NS, Canada, [2]Nova Scotia Health, Halifax, NS, Canada, [3]Cumming School of Medicine, University of Calgary, Calgary, AB, Canada, [4]Libin Cardiovascular Institute, Calgary, AB, Canada, [5]O'Brien Institute of Public Health, Calgary, AB, Canada, [6]Alberta Kidney Disease Network, Calgary, AB, Canada

Women are often underrepresented in clinical trials. It is unclear if this applies to trials in kidney transplant (KT) and whether the intervention or trial focus influences this. In this study, the weighted participation-to-prevalence ratio (PPR) for women enrollees in KT trials was determined for leading medical transplant or kidney journals between 2018 and 2023 using meta-regression overall and in three sensitivity analyses by: 1) Whether the intervention involved immunosuppression; 2) Area of trial focus; rejection, cardiometabolic, infection, lifestyle, surgical; 3) Whether the intervention was medical/surgical or social/behavioral. Overall, 33.7% of participants in 24 trials were women. The overall pooled PPR for the included trials was 0.80, 95% CI 0.76–0.85, with significant heterogeneity between trials ($I^2$ 56.6%, p-value < 0.001). Women had a lower PPR when the trial involved immunosuppression (PPR 0.77, 95% CI 0.72–0.82) than when it did not (PPR 0.86, 95% CI 0.80–0.94) and were less likely to participate in trials with a medical/surgical versus behavioral intervention; the lowest PPR for women was in studies examining rejection risk (PPR 0.75, 95% CI 0.70–0.81). There is better representation of women in KT trials compared to other medical disciplines, however women remain underrepresented in transplant trials examining immunosuppression and rejection.

**Keywords: disparity, trials, gender, sex, participation**

***Correspondence:**
*A. J. Vinson*
*amanda.vinson@nshealth.ca*

***Received:*** *18 January 2023*
***Accepted:*** *30 March 2023*
***Published:*** *14 April 2023*

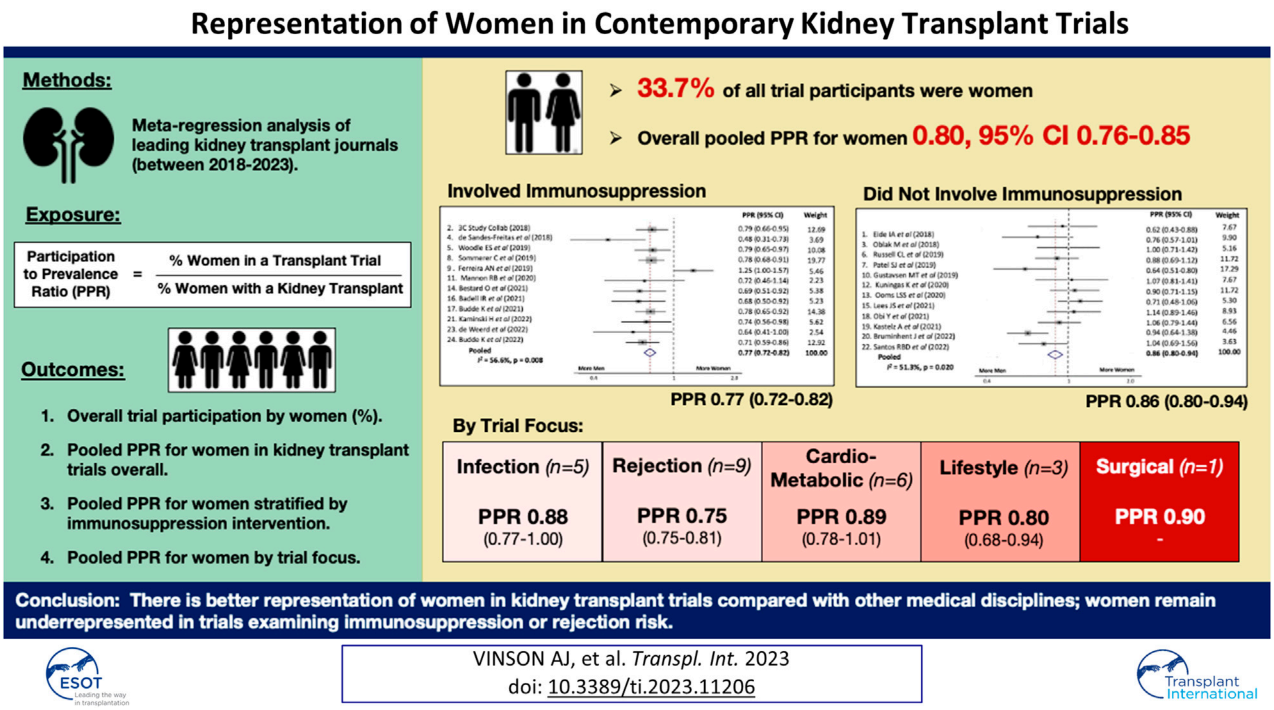
***Citation:***
*Vinson AJ and Ahmed SB (2023) Representation of Women in Contemporary Kidney Transplant Trials. Transpl Int 36:11206. doi: 10.3389/ti.2023.11206*

## INTRODUCTION

Sex and gender have been shown to play significant roles in kidney transplant outcomes in terms of differential immune reactivity, sensitization and rejection risk, immunosuppression medication pharmacokinetics and adherence, infectious pathogen risk, and overall graft survival (1–3). Thus, it is paramount that transplant clinical trials include appropriate representation of males and females to allow for assessment of sex and/or gender-stratified effect.

The representation of women in transplant trials can best be evaluated using the participation to prevalence ratio (PPR) which is a measure of how trial recruitment corresponds with disease or condition prevalence in the general population, i.e., the percentage of women in a trial divided by the percentage of women with a disease state in the general population, in this case, a kidney transplant. A PPR of 0.8–1.2 indicates appropriate trial representation (4, 5).

A recent study published in 2021 examined the PPR for women and minority populations in 172 abdominal transplant trials in the United States from 2000 to 2018. Compared to non-transplant studies where women have been historically and often woefully under included (4, 6–8), in abdominal transplant trials, women were surprisingly well represented (PPR 0.87) (9).



**Representation of Women in Contemporary Kidney Transplant Trials**

**Methods:**

Meta-regression analysis of leading kidney transplant journals (between 2018-2023).

**Exposure:**

Participation to Prevalence Ratio (PPR) = % Women in a Transplant Trial / % Women with a Kidney Transplant

**Outcomes:**

1. Overall trial participation by women (%).
2. Pooled PPR for women in kidney transplant trials overall.
3. Pooled PPR for women stratified by immunosuppression intervention.
4. Pooled PPR for women by trial focus.

- 33.7% of all trial participants were women
- Overall pooled PPR for women 0.80, 95% CI 0.76-0.85

**Involved Immunosuppression**

PPR 0.77 (0.72-0.82)

**Did Not Involve Immunosuppression**

PPR 0.86 (0.80-0.94)

**By Trial Focus:**

| Infection (*n*=5) | Rejection (*n*=9) | Cardio-Metabolic (*n*=6) | Lifestyle (*n*=3) | Surgical (*n*=1) |
|---|---|---|---|---|
| PPR 0.88<br>(0.77-1.00) | PPR 0.75<br>(0.75-0.81) | PPR 0.89<br>(0.78-1.01) | PPR 0.80<br>(0.68-0.94) | PPR 0.90<br>- |

**Conclusion: There is better representation of women in kidney transplant trials compared with other medical disciplines; women remain underrepresented in trials examining immunosuppression or rejection risk.**

VINSON AJ, et al. *Transpl. Int.* 2023
doi: 10.3389/ti.2023.11206

**GRAPHICAL ABSTRACT** |

Importantly however, this study did not examine trial characteristics that may have influenced female recruitment. For example, many trials in transplantation are non-interventional and whether this modified the PPR for women was not examined. Likewise, whether the area examined within transplant influences recruitment (for example, rejection, infection, cardiometabolic, adherence, etc.), remains to be seen. Previous work has suggested there may be gender differences in decision-making around trial enrollment (10). Higher proportions of female participants have been demonstrated for trials examining preventative and behavioral interventions compared with those examining treatment or medical/surgical interventions (8); whether this applies to patients with a solid organ transplant has not been previously examined.

Therefore, in this study we aimed to determine the PPR for women versus men in kidney transplant trials published in leading kidney or transplant journals over the last 5 years and determine if the PPR for women participants varied by 1) whether the intervention was related to immunosuppression or not, 2) the area of trial focus (rejection, cardiometabolic, infection, lifestyle, or surgical) and 3) whether the intervention was medical/surgical or social/behavioral.

## METHODS

We included all adult kidney transplant trials published in the top 10 transplant or nephrology journals defined based on Scimago Journal and Country Rank (SJC) (11, 12) between 2018 and 2023, excluding review journals, supplements, non-kidney transplant and basic science journals. Therefore, we reviewed the American Journal of Transplantation (AJT), the Clinical Journal of the American Society of Nephrology (CJASN), Nephrology Dialysis Transplantation (NDT), Transplantation, the Clinical Kidney Journal (CKJ), Transplant International (Tx Int), the Journal of the American Society of Nephrology (JASN), Kidney International (KI), the American Journal of Kidney Disease (AJKD), the American Journal of Nephrology (AJN), and Advances in Chronic Kidney Disease (Advances in CKD). Trials were restricted to those with at least 50 participants and studies examining non-kidney transplant or simultaneous/multi-organ transplant were excluded. Within each journal's website, articles were searched using the terms "trial" and "kidney" if it was a transplant focussed journal, or "trial" and "transplant" if it was a kidney focussed journal. We excluded any trials pertaining to waitlisted candidates not yet transplanted, donor or donor kidney interventions prior to transplant, and those looking at desensitization protocols for patients with incompatible living kidney donors given the disproportionate representation of women in this population on account of pregnancy-induced incompatibility with spouse donors (13).

While the terms sex and gender are often used interchangeably, they are not synonymous, however for this study we assumed women to mean female sex and men to mean male sex. The percentage of males and females (or men and women where indicated) in each trial was determined, and the prevalence of females in each trial was adjusted for the global prevalence of females with a kidney transplant (0.42) based on literature suggesting this is appropriate for most countries except Pakistan, India and Nepal (14).

The weighted PPR for women enrollees in kidney transplant trials was determined overall using meta-regression, and in three sensitivity analyses by:

i. Whether the intervention was related to immunosuppression or not.
ii. Area of trial focus; rejection, cardiometabolic, infection, lifestyle, surgical.
iii. Whether the intervention was medical or social/behavioral.

Heterogeneity in PPR overall and within each sensitivity subgroup was examined using the Higgins $I^2$ and chi-square test of heterogeneity (15). The proportion of trials reporting effect results in a sex-stratified analysis was also determined as was the number of trials commenting on menopausal or reproductive age status in women participants. Exclusion criteria was assessed to determine if there were barriers to enrollment specific to women of reproductive age.

## RESULTS

We identified 25 trials conducted in kidney transplant recipients over the study period (AJT $n = 12$; Transplantation $n = 2$; KI $n = 1$; JASN $n = 1$; Tx Int $n = 9$); 1 additional AJT study was excluded on the basis of examining desensitization protocols in patients with an incompatible living donor. A flow diagram of identified trials and subsequent exclusions is shown in **Supplementary Figure S1** and a summary of trial populations is presented in **Supplementary Table S1**.

The percentage of women in each trial ranged from 20.0% to 52.4% with 7/24 trials including less than 30% women and 18/24 trials including less than 40% women. Only 1/24 trials had ≥50% women participants. Overall, 33.7% of trial participants were women.

Adjusting for the global prevalence of women living with a kidney transplant, the overall pooled PPR for the included trials was 0.80, 95% confidence interval (CI) 0.76–0.85, **Figure 1**. There was significant heterogeneity in the PPR for the examined trials ($I^2$ 56.6%, $p$-value <0.001).

In sensitivity analyses we examined the PPR for the above trials stratified by the primary intervention type and study focus. When the intervention involved immunosuppression the PPR for women was 0.77, 95% CI 0.72–0.82 versus 0.86, 95% CI 0.80–0.94 when it did not, **Figure 2**. Study heterogeneity for both analyses was similar to that for the overall cohort.

A breakdown of trial participation by study focus demonstrated the highest PPR for women when the trial was examining surgical complications (only one study included; PPR 0.90), followed by cardiometabolic risk [PPR 0.89, 95% CI 0.78–1.01 ($n$ = 6)] and infectious risk [PPR 0.88, 95% CI 0.77–1.00 ($n$ = 5)], **Supplementary Figure S2**. The lowest PPR for women was in studies examining rejection risk [PPR 0.75, 95% CI 0.70–0.81 ($n$ = 9)]. Heterogeneity for PPR was significant for all subcategories of study focus except rejection risk ($I^2$ 0.0%, $p$-value 0.953) suggesting *consistent* underrepresentation of women in these trials (26.6%–33.2% women participants). When the intervention was medical (a medication or surgical intervention) the PPR for women was 0.80, 95% CI 0.75–0.84, whereas behavioural or lifestyle intervention trials had a slightly higher PPR for women of 0.86, 95% CI 0.74–0.98, **Supplementary Figure S3**.

Of the 24 studies examined, 2 presented results in a sex-stratified manner and 0/24 commented on menopausal or reproductive age status for women trial participants. Seven excluded pregnant or lactating women, or women of childbearing potential unless using effective methods of contraception, and 1 study listed "breastfeeding or of childbearing potential" as an exclusion with no further explanation, **Supplementary Table S1**.

## DISCUSSION

In this study, we demonstrate better representation of women in kidney transplant trials compared to what has been shown for other medical disciplines, confirming Zaldana et al's earlier findings (9). Overall, we demonstrate a pooled PPR of 0.80 (a PPR of 0.8–1.2 indicates appropriate trial representation) (4, 5) which is significantly better than our earlier examination of the PPR for women in recent non-transplant clinical trials examining medications with important cardiorenal indications (PPR 0.70 for sodium glucose cotransporter-2 inhibitors, 0.72 for glucagon-like peptide-1 receptor agonists, and 0.56 for non-steroidal mineralocorticoid receptor antagonists) (6).

However, there were important gender differences in transplant trial participation based on the trial's aim. When we examined the involvement of women in trials by intervention type, the PPR for women was lower when the study examined changes to immunosuppression (0.77 for immunosuppression trials versus 0.86 for other interventions). Similarly women were better represented in trials that examined the outcome of infectious risk (PPR 0.88), cardiometabolic risk (PPR 0.89), or surgical complications (PPR 0.90; only one trial) compared with a rejection outcome (PPR 0.75). Finally, trials examining a social or behavioural intervention included more women than those examining medical or surgical interventions (PPR 0.86 versus 0.80).

Potential reasons for these differences require further investigation. Female kidney transplant recipients are at higher risk for transplant rejection and death-censored graft loss (1) relating to sex-based differences in immunosuppression pharmacokinetics and pharmacodynamics (16, 17), gender-related differences in medication adherence (18), genetic and estrogen-related stimulation of the immune response (19, 20) and other less defined mechanisms. Importantly, existing common immunosuppressive therapies including mycophenolic acid (21, 22) and tacrolimus (23–25) have shown significant differences in clearance and metabolism by sex, with differential drug concentrations and side effects noted in women and men on equivalent doses. Therefore, the fact that recent clinical transplant trials examining rejection risk and immunosuppressive therapies included the lowest proportion of women (below what is considered an acceptable PPR range) is a major concern. Furthermore, given the

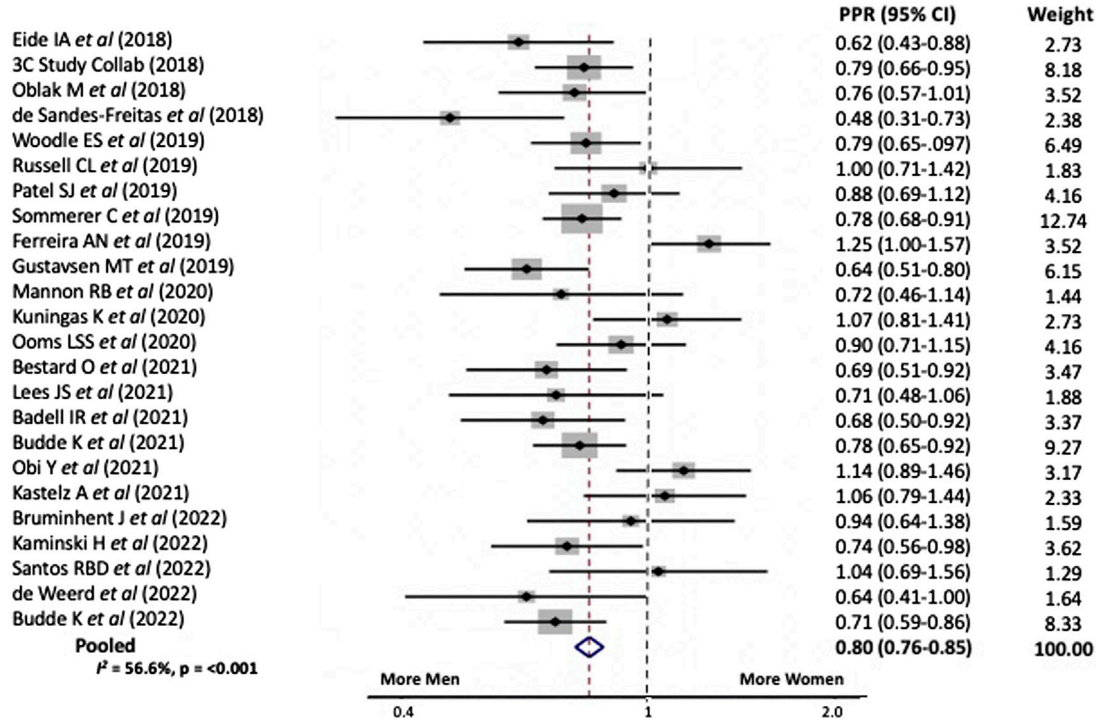


**FIGURE 1 |** Pooled participation to prevalence ratio for women in kidney transplant trials between 2018 and 2023.

changes in sex hormone expression (and thereby immune response) over the lifespan, recipient current age has been shown to modify the association between recipient sex and transplant outcomes (1, 19). There is a drop in sex hormone levels in post-menopausal women which associates with less immune reactivity and thereby rejection risk compared with women of reproductive age (26, 27). However, despite the influence menopause status has been shown to have on transplant rejection risk, menopause status was not mentioned in any of the 24 trials included in this meta-regression.

Why women are better represented in kidney transplant trials than in studies of other medical disciplines is unknown. Women have been shown to be more risk averse than men and demonstrate a greater perception of harm associated with trial participation, resulting in a corresponding reluctance to enrol in clinical trials (28, 29). However, kidney transplant recipients may represent a biased population of women who are more risk tolerant in so far as they accepted the potential risk of kidney transplant, and thus may similarly be more willing to participate in clinical trials. Another potential explanation is that there is a relative paucity of evidence in the kidney transplant population (30) and therefore more equipoise regarding the benefit with currently accepted standards of care. This may result in less perception of risk with trial enrollment; this requires further study. Furthermore, women make informed decisions differently from men; they spend more time gathering information before signing a consent, and they rely on different sources (medical and non-medical) and often seek advice from family members or friends (10, 31). A study of American transplant clinicians identified adequate social supports as the second most important factor to define transplant eligibility (32); therefore transplant may select for a subset of women with social supports to facilitate discussions, and potentially reassurance, regarding trial participation.

Importantly with the literature available, we are unable to ascertain whether the barrier to trial participation is that women are not being approached and consented for enrollment at the same rate as their male counterparts, or if women are being approached but declining involvement. This is a critical first step to ensuring equitable representation in trials by gender. In the included studies, 29.2% listed breastfeeding, pregnancy or childbearing potential without efficient contraception as exclusions. Importantly, 1 study listed "breastfeeding or of childbearing potential" as an exclusion criteria which may have systematically biased against the recruitment of women of reproductive age.

Given the potential for sex and/or gender differences in drug effect or complications, appropriate representation of women in clinical transplant trials is imperative, particularly since rejection risk and immunosuppression metabolism is known to vary by sex. Studies should be adequately powered to examine potential sex-by-treatment interactions and sex-stratified analyses should be reported. Only 2 of the 24 trials included presented a sex-stratified supplementary analysis. Potential strategies to improve recruitment of women in clinical trials have been previously published (6, 33, 34) and include actionable items at the government, industry, researcher, journal, and patient level. These include, but are not limited to, ensuring gender sensitive recruitment and communication tools, targeted recruitment of women and gender diverse participants, and the inclusion of more women and gender diverse researchers on study teams, patient

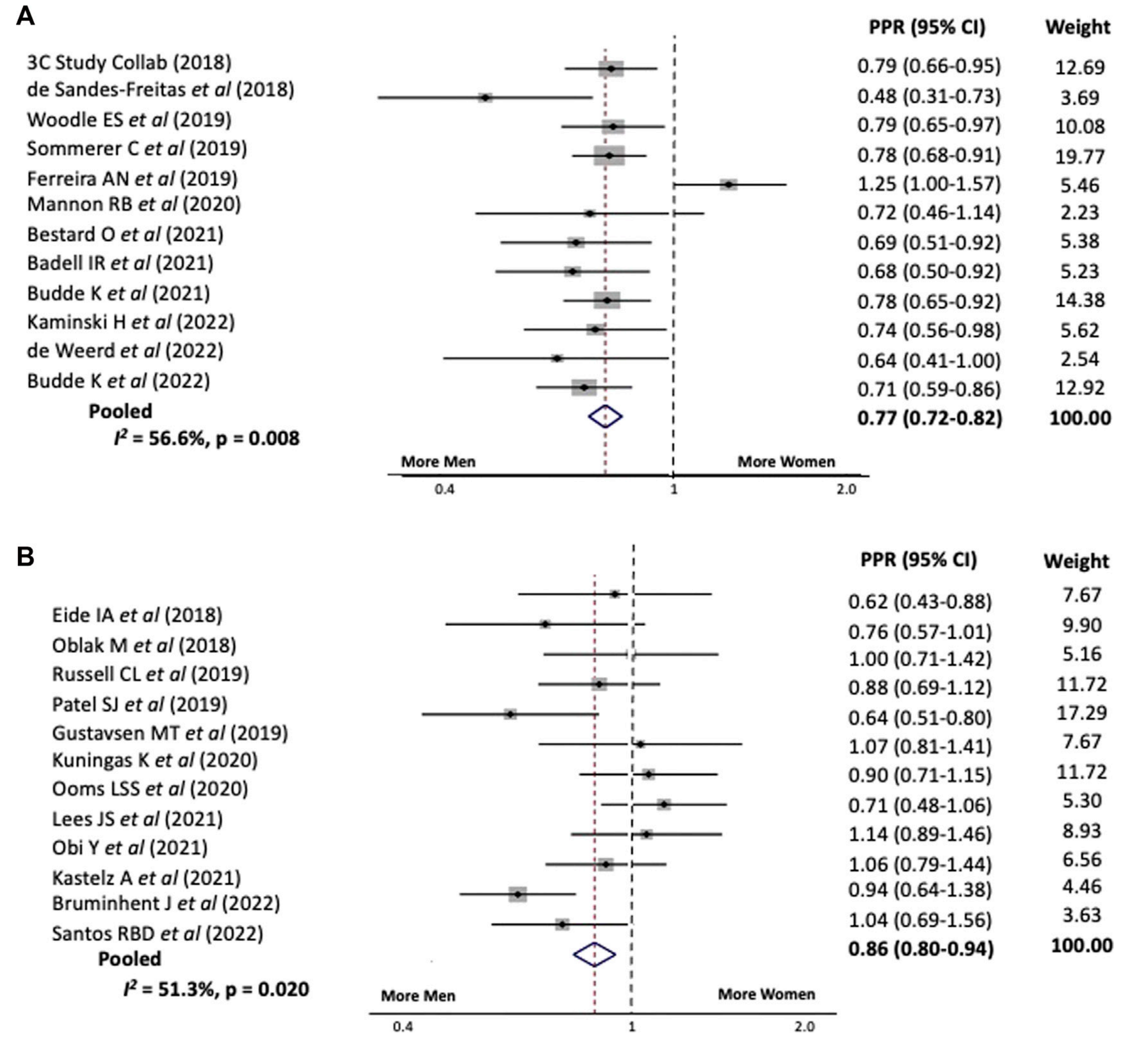


**FIGURE 2 |** Pooled participation to prevalence ratio for women in kidney transplant trials between 2018 and 2023 stratified by whether the intervention **(A)** Involved immunosuppression or **(B)** Did not involve immunosuppression.

advisory boards, and in leadership positions for regulatory agencies and pharmaceutical companies (6). However, even when studies have pre-specified aims to recruit 50% women, women are often still underrepresented in the final results as demonstrated in the Action to Control Cardiovascular Risk in Diabetes (ACCORD) trial which planned to include 50% women, but ultimately included only 38.4% women (35). Importantly, lack of adequate diversity amongst trial constituents can result in an inability to identify treatment effect in specific trial populations (including women); extrapolation of data from one population to another may not be appropriate particularly in the face of substantial biologic or sociodemographic differences.

In light of the perpetual underrepresentation of women in clinical trials, policymakers have examined strategies to bolster trial recruitment of women (36, 37). The Sex and Gender Equity in Research (SAGER) guidelines provide recommendations for the reporting of sex and gender in medical research and were developed based on a recognition of sex and/or gender differences in disease prevalence, outcomes, and response to therapy. A 2021 letter to editor published in Transplantation in 2021 highlighted the fact that while an increasing number of science and medical journals were endorsing the SAGER guidelines, no transplant focussed journals had pledged to the same (38). In response, *Transplantation* now includes a link to the SAGER guidelines in their instructions to authors, however it is as of yet too early to tell whether this has improved sex and/or gender-based reporting.

While this study contributes to the growing body of literature surrounding equitable representation of women in clinical trials, there are important limitations. First, this study identified clinical trials published in the top 10 transplant or nephrology journals defined using SJC over the study period using discrete search terms on the journal's website; "kidney" + "trial" for transplant journals and "transplant" + "trial" for kidney journals. Thus, while we anticipate most, it not all, relevant clinical trials would be identified in this manner, it is possible there were otherwise appropriate trials that did not meet our search criteria that were not included.

However, we would expect such trials to be missing at random and unlikely to significantly deviate from or impact our pooled PPR results. Secondly, the PPR in and of itself has limitations. The base population prevalence used was an average global prevalence for women living with kidney transplant based on 2016 data. There has been little change in the proportion of women versus men transplanted over time, and this value is felt to appropriately reflect the prevalence of women with a kidney transplant in most countries especially over this contemporary timespan, however there are likely small degrees of geographic variability not accounted for (14). That said, no trial was conducted in one of the three countries noted to have a disproportionately low rate of transplantation in women versus men in the above study (e.g., Pakistan, India or Nepal) (14). Finally, there are a paucity of clinical trials occurring in the kidney transplant population. This entire analysis included 4,811 participants over 24 studies. For comparison, the recently published EMPA-KIDNEY trial examining Empagliflozin in patients with chronic kidney disease randomized 6,609 patients in and of itself. Although we restricted our study to include only trials with at least 50 participants, many individual trials were relatively small hence why we performed a weighted meta-regression to create a pooled PPR for the primary and each secondary subgroup analyses; only one trial had a surgical focus ($n = 200$) and thus the results for this subgroup PPR must be interpreted with caution.

In order to generate evidence in kidney transplant patients that applies to both men and women, participants of all genders must be represented in clinical transplant trials with appropriate sex stratification in analysis and reporting of results. This requires women of all ages be approached for recruitment and not disproportionately excluded from participation, and importantly, women have to be willing to partake. Strategies to not only increase the inclusion of women in trials, but also to collect female sex-specific factors have been outlined elsewhere (39, 40). Fortunately the representation of women in kidney transplant trials appears to be better than for other fields in medicine (4, 6–8). Whether transplant researchers are intentionally more inclusive with recruitment, or women living with a kidney transplant are more willing to participate in trials remains to be seen. Importantly despite this, women remain underrepresented in kidney transplant trials examining rejection and immunosuppression therapies; both areas where patient sex modifies risk. Thus, despite advances in inclusivity in transplant studies relative to other genres of medicine, there are still gains to be made.

## DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/**Supplementary Material**, further inquiries can be directed to the corresponding author.

## AUTHOR CONTRIBUTIONS

AV designed the study in discussion with SA. AV performed the analyses and wrote the initial draft. SA provided feedback and revised the manuscript.

## CONFLICT OF INTEREST

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

## SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontierspartnerships.org/articles/10.3389/ti.2023.11206/full#supplementary-material

## REFERENCES

1. Vinson AJ, Zhang X, Dahhou M, Süsal C, Döhler B, Sapir-Pichhadze R, et al. Age-Dependent Sex Differences in Graft Loss after Kidney Transplantation. *Transplantation* (2021) 106(7):1473–84. doi:10.1097/TP.0000000000004026
2. Lau A, West L, Tullius SG. The Impact of Sex on Alloimmunity. *Trends Immunol* (2018) 39(5):407–18. doi:10.1016/j.it.2018.01.008
3. Lepeytre F, Dahhou M, Zhang X, Boucquemont J, Sapir-Pichhadze R, Cardinal H, et al. Association of Sex with Risk of Kidney Graft Failure Differs by Age. *J Am Soc Nephrol* (2017) 28(10):3014–23. doi:10.1681/ASN.2016121380
4. Jin X, Chandramouli C, Allocco B, Gong E, Lam CSP, Yan LL. Women's Participation in Cardiovascular Clinical Trials from 2010 to 2017. *Circulation* (2020) 141(7):540–8. doi:10.1161/CIRCULATIONAHA.119.043594
5. Scott PE, Unger EF, Jenkins MR, Southworth MR, McDowell TY, Geller RJ, et al. Participation of Women in Clinical Trials Supporting FDA Approval of Cardiovascular Drugs. *J Am Coll Cardiol* (2018) 71(18):1960–9. doi:10.1016/j.jacc.2018.02.070
6. Vinson AJ, Collister D, Ahmed S, Tennankore K. Underrepresentation of Women in Recent Landmark Kidney Trials: The Gender Gap Prevails. *Kidney Int Rep* (2022) 7(11):2526–9. doi:10.1016/j.ekir.2022.08.022
7. Sosinsky AZ, Rich-Edwards JW, Wiley A, Wright K, Spagnolo PA, Joffe H. Enrollment of Female Participants in United States Drug and Device Phase 1-3 Clinical Trials between 2016 and 2019. *Contemp Clin Trials* (2022) 115:106718. doi:10.1016/j.cct.2022.106718
8. Steinberg JR, Turner BE, Weeks BT, Magnani CJ, Wong BO, Rodriguez F, et al. Analysis of Female Enrollment and Participant Sex by Burden of Disease in US Clinical Trials between 2000 and 2020. *JAMA Netw Open* (2021) 4(6):e2113749. doi:10.1001/jamanetworkopen.2021.13749
9. Zaldana A, Barhouma S, Rocque B, Barbetta A, Goldbeck C, Sher L, et al. Racial and Sex Representation in Clinical Trials: Where Are We in Abdominal Organ Transplantation? *Am J Transpl* (2021) 21(10):3491–3. doi:10.1111/ajt.16619
10. Lobato L, Bethony JM, Pereira FB, Grahek SL, Diemert D, Gazzinelli MF. Impact of Gender on the Decision to Participate in a Clinical Trial: a Cross-Sectional Study. *BMC Public Health* (2014) 14(1):1156. doi:10.1186/1471-2458-14-1156
11. Scimago. Scimago Journal & Country Rank. April 2022 2021 (2022). Available at: https://www.scimagojr.com/journalrank.php?category=2727 (Accessed 27 February, 2023).
12. Scimago. Scimago Journal & Country Rank. April 2022 2021 (2022). Available at: https://www.scimagojr.com/journalrank.php?category=2747 (Accessed 27 February, 2023).
13. Bromberger B, Spragan D, Hashmi S, Morrison A, Thomasson A, Nazarian S, et al. Pregnancy-Induced Sensitization Promotes Sex Disparity in Living Donor Kidney Transplantation. *J Am Soc Nephrol* (2017) 28(10):3025–33. doi:10.1681/ASN.2016101059

14. Bikbov B, Perico N, Remuzzi G, on behalf of the GBD Genitourinary Diseases Expert Group. Disparities in Chronic Kidney Disease Prevalence Among Males and Females in 195 Countries: Analysis of the Global Burden of Disease 2016 Study. *Nephron* (2018) 139:313–8. doi:10.1159/000489897
15. Higgins JP, Thompson SG. Quantifying Heterogeneity in a Meta-Analysis. *Stat Med* (2002) 21(11):1539–58. doi:10.1002/sim.1186
16. Han SS, Yang SH, Kim MC, Cho JY, Min SI, Lee JP, et al. Monitoring the Intracellular Tacrolimus Concentration in Kidney Transplant Recipients with Stable Graft Function. *PLoS One* (2016) 11(4):e0153491. doi:10.1371/journal.pone.0153491
17. Momper JD, Misel ML, McKay DB. Sex Differences in Transplantation. *Transpl Rev (Orlando)* (2017) 31(3):145–50. doi:10.1016/j.trre.2017.02.003
18. Boucquemont J, Pai ALH, Dharnidharka VR, Hebert D, Furth SL, Foster BJ. Gender Differences in Medication Adherence Among Adolescent and Young Adult Kidney Transplant Recipients. *Transplantation* (2019) 103(4):798–806. doi:10.1097/TP.0000000000002359
19. Taneja V. Sex Hormones Determine Immune Response. *Front Immunol* (2018) 9:1931. doi:10.3389/fimmu.2018.01931
20. Maenosono R, Nian Y, Iske J, Liu Y, Minami K, Rommel T, et al. Recipient Sex and Estradiol Levels Affect Transplant Outcomes in an Age-specific Fashion. *Am J Transpl* (2021) 21:3239–55. doi:10.1111/ajt.16611
21. Tornatore KM, Meaney CJ, Wilding GE, Chang SS, Gundroo A, Cooper LM, et al. Influence of Sex and Race on Mycophenolic Acid Pharmacokinetics in Stable African American and Caucasian Renal Transplant Recipients. *Clin Pharmacokinet* (2015) 54(4):423–34. doi:10.1007/s40262-014-0213-7
22. Spasić A, Catić-Đorđević A, Veličković-Radovanović R, Stefanović N, Džodić P, Cvetković T. Adverse Effects of Mycophenolic Acid in Renal Transplant Recipients: Gender Differences. *Int J Clin Pharm* (2019) 41(3):776–84. doi:10.1007/s11096-019-00837-z
23. Ito A, Okada Y, Hashita T, Aomori T, Hiromura K, Nojima Y, et al. Sex Differences in the Blood Concentration of Tacrolimus in Systemic Lupus Erythematosus and Rheumatoid Arthritis Patients with CYP3A5*3/*3. *Biochem Genet* (2017) 55(3):268–77. doi:10.1007/s10528-017-9795-8
24. Tornatore KM, Meaney CJ, Attwood K, Brazeau DA, Wilding GE, Consiglio JD, et al. Race and Sex Associations with Tacrolimus Pharmacokinetics in Stable Kidney Transplant Recipients. *Pharmacotherapy* (2022) 42(2):94–105. doi:10.1002/phar.2656
25. Velickovic-Radovanovic R, Mikov M, Paunović G, Djordjević V, Stojanović M, Tatjana C, et al. Gender Differences in Pharmacokinetics of Tacrolimus and Their Clinical Significance in Kidney Transplant Recipients. *Gend Med* (2011) 8:23–31. doi:10.1016/j.genm.2011.01.003
26. Giefing-Kroll C, Berger P, Lepperdinger G, Grubeck-Loebenstein B. How Sex and Age Affect Immune Responses, Susceptibility to Infections, and Response to Vaccination. *Aging Cell* (2015) 14(3):309–21. doi:10.1111/acel.12326
27. Klein SL, Flanagan KL. Sex Differences in Immune Responses. *Nat Rev Immunol* (2016) 16(10):626–38. doi:10.1038/nri.2016.90
28. Peterson ED, Lytle BL, Biswas MS, Coombs L. Willingness to Participate in Cardiac Trials. *Am J Geriatr Cardiol* (2004) 13(1):11–5. doi:10.1111/j.1076-7460.2004.01709.x
29. Ding EL, Powe NR, Manson JE, Sherber NS, Braunstein JB. Sex Differences in Perceived Risks, Distrust, and Willingness to Participate in Clinical Trials: a Randomized Study of Cardiovascular Prevention Trials. *Arch Intern Med* (2007) 167(9):905–12. doi:10.1001/archinte.167.9.905
30. Vinson AJ, Singh S, Chadban S, Cherney D, Gaber O, Gill JS, et al. Premature Death in Kidney Transplant Recipients: The Time for Trials Is Now. *J Am Soc Nephrol* (2022) 33:665–73. doi:10.1681/ASN.2021111517
31. Delaney R, Strough J, Parker AM, de Bruin WB. Variations in Decision-Making Profiles by Age and Gender: A Cluster-Analytic Approach. *Pers Individ Dif* (2015) 85:19–24. doi:10.1016/j.paid.2015.04.034
32. Ladin K, Emerson J, Butt Z, Gordon EJ, Hanto DW, Perloff J, et al. How Important Is Social Support in Determining Patients' Suitability for Transplantation? Results from a National Survey of Transplant Clinicians. *J Med Ethics* (2018) 44(10):666–74. doi:10.1136/medethics-2017-104695
33. Tobb K, Kocher M, Bullock-Palmer RP. Underrepresentation of Women in Cardiovascular Trials-it Is Time to Shatter This Glass Ceiling. *Am Heart J Plus: Cardiol Res Pract* (2022) 13:100109. doi:10.1016/j.ahjo.2022.100109
34. Bierer BE, Meloney LG, Ahmed HR, White SA. Advancing the Inclusion of Underrepresented Women in Clinical Research. *Cel Rep Med* (2022) 3(4):100553. doi:10.1016/j.xcrm.2022.100553
35. Kingry C, Bastien A, Booth G, Geraci TS, Kirpach BR, Lovato LC, et al. Recruitment Strategies in the Action to Control Cardiovascular Risk in Diabetes (ACCORD) Trial. *Am J Cardiol* (2007) 99(12A):68i–79i. doi:10.1016/j.amjcard.2007.03.025
36. Coakley M, Fadiran EO, Parrish LJ, Griffith RA, Weiss E, Carter C. Dialogues on Diversifying Clinical Trials: Successful Strategies for Engaging Women and Minorities in Clinical Trials. *J Womens Health (Larchmt)* (2012) 21(7):713–6. doi:10.1089/jwh.2012.3733
37. Hohmann AA, Parron DL. How the New NIH Guidelines on Inclusion of Women and Minorities Apply: Efficacy Trials, Effectiveness Trials, and Validity. *J Consult Clin Psychol* (1996) 64(5):851–5. doi:10.1037//0022-006x.64.5.851
38. Vinson AJ, Chong AS, Clegg D, Falk C, Foster BJ, Halpin A, et al. Incorporation of Sex and Gender Guidelines into Transplantation Literature. *Transplantation* (2021) 105(11):e261–e262. doi:10.1097/TP.0000000000003967
39. Nicolas J, Edens M, Vogel B, Mehran R. Best Practices for Designing Informative Trials Including Women. *Curr Atheroscler Rep* (2022) 24(11):885–8. doi:10.1007/s11883-022-01064-0
40. Chang DH, Dumanski SM, Ahmed SB. Female Sex-specific Considerations to Improve Rigor and Reproducibility in Cardiovascular Research. *Am J Physiol Heart Circ Physiol* (2022) 324:H279–H287. doi:10.1152/ajpheart.00462.2022

REVIEW
published: 27 September 2023
doi: 10.3389/ti.2023.11455

# Breaking Barriers and Bridging Gaps: Advancing Diversity, Equity, and Inclusion in Kidney Transplant Care for Black and Hispanic Patients in the United States

*Chi Zhang*[1,2] *and Amit K. Mathur*[1]*

[1]*Mayo Clinic Arizona, Phoenix, AZ, United States,* [2]*Robert D. and Patricia E. Kern Center for the Science of Health Care Delivery, Mayo Clinic, Rochester, MN, United States*

Kidney transplantation offers better mortality and quality of life outcomes to patients with end-stage renal failure compared to dialysis. Specifically, living donor kidney transplantation is the best treatment for end-stage renal disease, since it offers the greatest survival benefit compared to deceased donor kidney transplant or dialysis. However, not all patients from all racial/ethnic backgrounds enjoy these benefits. While black and Hispanic patients bear the predominant disease burden within the United States, they represent less than half of all kidney transplants in the country. Other factors such as cultural barriers that proliferate myths about transplant, financial costs that impede altruistic donation, and even biological predispositions create a complex maze and can also perpetuate care inaccessibility. Therefore, blanket efforts to increase the overall donation pool may not extend access to vulnerable populations, who may require more targeted attention and interventions. This review uses US kidney transplantation data to substantiate accessibility differences amongst racial minorities as well as provides examples of successful institutional and national systemic level changes that have improved transplantation outcomes for all.

**Keywords: kidney transplant, solid organ transplant, to transplantation, diversity and inclusion, kidney allocation**

***Correspondence:**
*Amit K. Mathur*
*mathur.amit@mayo.edu*

***Received:*** *07 April 2023*
***Accepted:*** *15 September 2023*
***Published:*** *27 September 2023*

***Citation:***
*Zhang C and Mathur AK (2023) Breaking Barriers and Bridging Gaps: Advancing Diversity, Equity, and Inclusion in Kidney Transplant Care for Black and Hispanic Patients in the United States. Transpl Int 36:11455. doi: 10.3389/ti.2023.11455*

## CURRENT HEALTHCARE DELIVERY CHALLENGES IN KIDNEY TRANSPLANTATION

In patients with end-stage renal disease (ESRD), kidney transplantation (KT) affords improved survival, quality of life, and overall cost advantages over other forms of renal replacement therapy such as dialysis. Patients on dialysis who remain on the waiting list have a 16.5% annual death rate, compared to 1.2% in patients who underwent KT. With further follow up, there was a 50% reduction in the 5 year mortality rate after KT compared to patients who remain on the waiting list [1]. Specifically, living donor kidney transplantation (LDKT) is the best treatment for ESRD, since it

---

**Abbreviations:** ESRD, end-stage renal disease; KT, kidney transplantation; LDKT, living donor kidney transplantation; DDKT, deceased donor kidney transplant; LDC, living donor champion; NLDAC, national living donor assistance center; NKR, national kidney registry; QAPI, quality-assurance and performance improvement.

offers the greatest survival benefit compared to deceased donor kidney transplant (DDKT) or dialysis and reduces time spent on the waiting list. In addition to mortality benefits, KT also offers financial advantages. The current annual costs of dialysis are approximately $80,000 per patient per year compared to KT, which costs $30,000 per patient per year if the first-year costs are amortized over the recipient post-transplant lifetime [2, 3]. Despite clear benefits, only 3% of patients receive preemptive transplantation, including LDKT and DDKT, while the remaining initiate maintenance dialysis [2].

Though the United States has one of the most successful KT programs worldwide, as of the end of 2022, nearly 100,000 people await kidney transplantation in the US. Organ scarcity leads to a significant disparity between the demand and supply of organs as there were only 19,636 DDKT and 5,863 LDKT in 2022 [4]. While this difference is striking, the demand for organs is likely underestimated when one considers the entire continuum of care as a patient's path towards KT requires a referral from a nephrologist, timely transplant evaluation, multidisciplinary decision regarding transplant candidacy, and time spent on the waiting list. For example, though there were approximately 560,000 patients on dialysis for ESRD in the US by the end of 2022, data suggests that failure to proceed towards transplantation is related to stagnation along any of the numerous steps in the transplant process, as only 13% of patients on dialysis were waitlisted [2, 5].

In addition to logistical barriers related to a necessarily careful evaluation process and negotiating the disease progress towards ESRD, individual barriers such as unemployment, female sex, lack of knowledge in patients and providers regarding transplantation, minority race/ethnicity, and lower socioeconomic status can also limit access to KT [6, 7]. Of course, none of these negative predictive factors exist in isolation, making the current healthcare ecosystem even more difficult to navigate for certain minority groups. According to the annual data published by the National Institute of Diabetes and Digestive and Kidney Diseases, minority patients experience higher rates of ESRD compared to white patients [2]. Yet, despite ESRD being 4.3 times more prevalent in black patients, white patients are twice as likely to undergo KT. Additionally, while Hispanic patients are twice as likely to be diagnosed with ESRD compared to white patients, they are less than half as likely to be waitlisted for KT compared to white patients from similar socioeconomic backgrounds [8]. So, KT rate variations between different racial groups could also be attributed to the likelihood of being waitlisted for KT.

The acknowledgement of the ongoing organ supply and demand narrative alone is inadequate as there are complex undercurrents that drive persistent care disparities. The process of providing more equitable care necessarily involves the understanding of disparities in current transplant care delivery using robust national and institutional data, defining disparities, and leveraging this knowledge to provide improved outcomes for all. These interventions should be aimed at providing resources to improve access, education about donation and transplantation, and to support patients before, during, and after surgery. Therefore, targeted interventions are necessary to improve equity for potential transplant candidates, their potential living donors, family members, and caregivers. Of course, changes are not one-size-fits all, so it will be necessary for individual institutions to tailor solutions to their unique patient demographics and adapt to the ever-changing healthcare landscape through the lens of quality improvement.

## THE PROBLEM: UNDERSTANDING DISPARITIES IN CURRENT PRACTICES

Improving access to LDKT is the most reliable solution for ESRD patients. In addition to its survival benefit that exceeds DDKT and shortened waiting time, it improves access for all patients by expanding the donor pool. Increasing LDKTs could potentially address allograft access issues overall as the use of extended criteria organs have only modestly increased the donor pool and living donation would provide a higher potential source of healthy organs [9]. However, similar to other barriers to transplantation, minority patient access to LDKT is also limited compared to majority counterparts [10]. To inform effective interventions, we must first elucidate the specific barriers experienced by minority groups, as specific cultural beliefs, language barriers, and financial hardships all contribute to access issues.

### Cultural and Educational Barriers

Provision of culturally competent care for ESRD patients requires addressing beliefs that may affect transplant candidacy, recruitment of living donation, and providing education for the entire transplant process. Though outpatient dialysis centers interact with patients multiple times each week, there is large variation in referral rates between different facilities to transplant centers [11, 12]. For-profit dialysis are 50% less likely to place referrals, and nephrologists at for-profit institutions were 60% less likely to provide transplant education, citing the lack of financial incentives in time-restricted appointments as the primary reason [13, 14]. The problem with the lack of education has been so prevalent that it has penetrated popular media, with late-night comedian John Oliver, producing a segment on the issue in 2017 [15]. However, the issue is not just in the profit margins, as the comedian suggests. Compared to physicians who serve predominantly white populations, those who primarily treat black patients report spending less time on LDKT education, which is further exacerbated by the higher rates of denial regarding the need for organ transplantation in these patients [16, 17]. Even for patients who do undergo transplant candidacy assessments, black patients have protracted evaluation times due to additional testing, longer dialysis to waitlisting time, lower pre-emptive transplant rates, and a lower rate of pre-transplantation evaluation completion [18, 19]. However, medical comorbidities also do not completely explain practice variations as the 30% of patients did not receive KT education tended to be older, have non-private insurance, and receive less nephrology care prior to ESRD [20]. Not receiving education regarding KT is associated with a 53% lower rate of any access to transplantation and a 65% lower rate to LDKT, specifically. In the same study, being black was associated with a 27% increased rate of being deemed psychologically unfit for KT, a 24% lower rate of transplant care access, and a 64% reduction in the rate of LDKT access.

Healthcare disparities are complex systems that cannot be explained by racial motives alone. The Social Deprivation Index is a composite measure that incorporates data on income, education, employment, housing type, housing characteristics, transportation, and age of adults within each household [21]. Within the ESRD population, Hispanic (65%) and black patients (57%) experienced higher levels of social deprivation compared to white patients (21%). Additionally, patients with higher social deprivation indices tend to have more medical comorbidities [2]. It follows that part of the lack of education for minority populations could be a system level issue. If potential transplant candidates seek care late in the progression of chronic kidney disease, clinicians may be left scrambling to manage the organ failure, overwhelming the clinical interaction with more immediate medical concerns, rather than discussions about donor options or LDKT education [22]. Therefore, systematic and early conversations by primary care physicians, community nephrologists, and dialysis centers are necessary to promote kidney transplant access for both DDKTs and LDKTs [23].

The provision of education is necessary because without it, patients are less likely to inquire about KT on their own accord, with many either not knowing that KT is an available option and other patients not fully understanding that there is a difference between DDKT and LDKT [24]. In a survey of patients undergoing dialysis, over 10% of black men and 15% of black women reported experiencing racial discrimination during healthcare interactions [25]. The psychological stress as a result of systemic discrimination increases the fear of rejection and death from transplant surgery [26]. Similarly, in addition to general mistrust of the healthcare system, pervasive cultural myths and linguistic dissonance can further limit LDKT even when initial education is provided for Hispanic patients [27]. Family members need also be included in educational sessions because their cultural misconceptions and the belief that donors would have dramatically shorter life expectancies, be unable to have children, and contract kidney disease overtime can discourage LDKT [28]. Additionally, education does not just address information deficit because when asked specifically about their attitudes towards LDKT, they reported that lack of interest were primarily related to feelings of guilt and indebtedness to the donor [29]. This coupled with the cultural expectation that the potential donor should be the one to initiate the conversations make LDKT virtually impossible.

### Linguistic Barriers

Linguistic barriers can be another major obstacle that prevent Hispanic patients from accessing transplantation care, as over 70% of Hispanics in the United States come from Spanish speaking only households [30, 31]. This is particularly important given the secular trends in the US population as Hispanic-origin persons will constitute the largest population subgroup by the year 2050 [32]. Though most centers have access to language interpretation services, misunderstandings and mistranslations are common [33]. While families could aid in communication and often have the patients' best interest, they lack adequate training, infringe on patient privacy in certain cases, and may distort information for the sake of protecting their loved ones [34]. Linguistic concordance is a key element of culturally competent care, and patient preferences should be considered, especially since there is incredible variation in English and Spanish fluency and linguistic preferences within Hispanic families [35, 36]. Additionally, same language patient-provider dyads are associated with greater satisfaction than the use of third-party translator.

Interestingly, over 85% of all LDKTs are performed in just 10 United States transplant programs. Additionally, all of these centers had multilingual physicians, with approximately half of them being proficient in Spanish [37]. Providing culturally concordant care is not only sensible, but also effective, with multiple centers that have created platforms to help address disparities in the Hispanic population requiring renal transplant. This presents challenges in the delivery of surgical and non-surgical care in large US hospitals due to a lack of personnel with the requisite clinical expertise and cultural or linguistic background.

### Financial Barriers

Living donor evaluation is a complex process and involves multiple appointments with transplant professionals, laboratory and imaging tests, and other healthcare interactions. These take valuable time and money from donors, as some of the costs are not reimbursed through medical insurance [38, 39]. While a donor's gift can save millions of healthcare dollars spent on dialysis, individual donors incur costs related to travel, lodging, lost wages, child and dependent care [40]. These costs are magnified after donation surgery, especially if there are unforeseen complications [41, 42]. In addition to entrenched mistrust minority populations have about healthcare, potential donors from the same communities may experience similar healthcare access barriers. Undue financial burdens, fear of poor outcomes, and the cost associated with a prolonged and difficult evaluation after transplantation have all been identified as barriers to donation [43, 44]. This is particularly critical for vulnerable populations such as the Black and Hispanic populations, who have lower annual household incomes according to US data from the Department of Labor, as current trends suggest that living donation is an income-dependent process [45].

## SOLUTIONS THAT WORK: OVERCOMING PRACTICE BARRIERS

### Facilitating Conversations About Living Donation by Creating a Culturally Competent Transplant Program

Broaching potential donors is difficult because it involves admitting feelings of vulnerability, pride related to solving one's own problems, and concerns over the impact on the health of the donor, and many other issues. Of course, fears about surgery, organ rejection, death, and future kidney disease for the donor are also prevalent for patients of all races [46, 47]. While being white and higher levels of education were predictive of willingness to initiate conversations, other factors such as age, dialysis status, and even prior transplants were surprisingly not predictive of patient ability to approach LDKT [48]. Initiating dialogue can be intimidating, especially without the guidance of a transplant team. Mistrust in the healthcare system, fears that the transplant may fail, and concerns about the health of donors post-donation not only dissuade patients from considering becoming living donors, but they can also lead potential recipients to reject these offers without thoroughly considering the repercussions of their decision [49].

Several transplant programs across the United States have developed culturally concordant transplant program models to address the needs of this population to optimize care of the recipient and potential living donors. These models have helped to improve care for vulnerable populations and have proven to be successful in achieving high rates of LDKTs, satisfaction with recipients, donors, and their families, in largely a cost-neutral approach for the transplant center [50]. To increase outreach, programs have built patient-centered and referring physician base by recruiting from high minority density dialysis units. At referral, patient preferences for culturally concordant education and language preferences are solicited and targeted education is directed with an emphasis on breaking down cultural barriers that may provide negative impressions of transplantation or of living donation. In a culturally concordant, language-sensitive approach, these initiatives have identified several barriers for patients including typical medical concerns, but also the possibility of financial burden, along with other cultural concerns such as future family planning, permanent disability, medical needs, and sexual dysfunction [51, 52]. Using a holistic initiative including the employment of bilingual and bicultural staff and engagement of local dialysis centers to facilitate outreach for Hispanic patients, programs were able to increase the proportion of Hispanic patients in the kidney waitlist by 90% and LDKT by 70% within the first 5 years of the program [53]. Follow up qualitative studies involving Hispanic kidney transplant outreach programs across multiple states showed that participants of Hispanic-focused outreach groups felt that the primary use of the Spanish language enhanced understanding regarding transplantation. While few patients and families had any knowledge regarding living donation before, over 97% of patients became more in favor of kidney transplantation in general as well as specifically in living donation at the conclusion of the information sessions [54].

While ensuring understanding about one's own medical conditions is important, it is also necessary to engage family members because initiating conversations about the need to find a living kidney donor can be taboo in many cultures [48]. One way that has been successful in navigating this barrier is the creation of a separate advocate, a Living Donor Champion (LDC). Nearly anyone could be identified as an LDC for individual kidney recipients, including those who wished but were unable to donate. This program addresses the difficulty that some patients have with broaching the topic of living donation by empowering family members to do so on their behalf. This not only provides the family with the opportunity for active participation in their loved ones' care, but also improves the chances of LDKT. The transplant center at John's Hopkins was one of the first to start a formalized program. After receiving education about kidney failure and living donation, the LDC are provided vetted material and business cards to distribute to potential donors. At the end of the program, 25 potential donors were identified for the 15 patients enrolled when there was none before [55]. Other transplant centers have adopted similar programs and the added social media outreach to their training programs. Not only does this expand their network of potential donors, but attracted potential donors may also be younger and healthier [56]. Furthermore, LDC tempered some of the disparities seen in certain cultural groups as participation in such programs was associated with the 5–6 fold higher likelihood of a potential living donor referral regardless of race [57].

## Leveraging Financial Advantages

While providing the necessary language for both patients and for their families to communicate the need for kidney allografts could increase donor pool, donation interest could be thwarted by financial disincentives. Despite their altruism, there are significant financial barriers for both designated and non-designated living donors. Most living donors unintentionally incur out-of-pocket costs related to living donation, which can prohibit donation [41, 58]. Studies in Canada have additional shown that despite the maximum reimbursement being $5,500 in some provinces, the personal financial costs of organ donation often exceed the maximum reimbursement amount [41, 59, 60]. In the US, while it is illegal to provide compensation in exchange for donation, recipients are legally permitted to reimburse donors for the costs associated with living donation to make it financially neutral. Established in 2007, the National Living Donor Assistance Center (NLDAC) is a federally funded program that helps offset financial hardships incurred by altruistic donation and is available at all US transplant centers [61, 62]. Currently, 8%–10% of US living donors utilize the NLDAC means-tested program, which calculates reimbursement based on the recipient's household income in the case of directed donation. This program helps defray out-of-pocket costs related to living donation, with over 75% of donors stating post-donation that they would not have been able to go forward with surgery without receiving financial assistance [3, 62, 63].

Other living donor expense reimbursement programs exist through paired kidney exchanges, state-based programs, or philanthropic resources. Living donor transplant programs and their social workers must be equipped with the knowledge of these resources to ensure that they can adequately counsel individual donors. Importantly, financial costs incurred after living donation can be reimbursed by a multitude of payers including funds from transplant programs themselves, state-based programs, insurance companies, and by the recipients themselves. The National Kidney Registry (NKR) is a nonprofit organization. It was started by a father who searched for multiple kidney exchange programs for his 10 years-old daughter. She eventually found a match, and the father went on to donate his kidney in exchange for a voucher, in case she would ever require a second KT [64]. The NKR aims to facilitate living kidney donor exchange, with data showing that patients who receive care at NKR hospitals are up to 3 times more likely to undergo LDKT [65].

## Optimizing Organ Utilization

For patients to gain access to transplantation, it is also critical for the transplant program to optimize practices to address the needs of waitlisted patients. Clinical protocols on living donor candidacy vary substantially between transplant programs with different institutions employing different clinical cutoffs for age, body mass index, family history of cardiovascular disease and medical conditions such as diabetes and hypertension [66, 67]. An important aspect of addressing disparities in healthcare delivery is to continuously re-evaluate clinical criteria used to offer surgical therapy by the program itself. For living donation, continuous engagement with national data and program data using a quality-assurance and performance improvement (QAPI) approach is required for regulatory compliance [68–70]. Programs must innovate in the development and execution of their clinical criteria to ensure they are casting the widest net and, in the case of living donation, facilitating the donor's autonomy to help their intended recipient. In the context of LDKT, which is the best option to address renal failure, it is important to also understand programmatically its limitations in addressing disparities.

Not all who want to be living donors will safely be able to do so. For some patients, undergoing a DDKT is the next best option. However, waiting times vary substantially for DDKT across the United States, exceeding 10 years in many areas of the country and the rate of organ discard remains high at 30% despite the insufficiency in the number of kidney allografts available due to transplant center practice variations [71, 72]. Optimizing the use of all offered deceased donor organs is a difficult challenge but may be one of the best opportunities to address vulnerable populations. Fortunately, policies to improve coordination amongst different parts of the system such as the donor hospitals, organ procurement organizations, and transplant centers as well as improved national allocation protocols that prioritize extended criteria organs to centers that have demonstrated a history of using medically complex organs [73, 74]. This requires a clear understanding of clinical outcomes with certain types of donors, program growth, and development of resources across disciplines [75–77].

# IMPLEMENTATION OF FUTURE SOLUTIONS

Interventions to improve healthcare disparities begin with understanding the current conditions of the problems in a data-driven manner and defining the disparities subsequently. In the field of transplantation, the immediate issue is the incompatibility between a lengthy waiting list and insufficient of donors. LDKT rates are modifiable, and ensuring optimal access to these is critical. Yet, it has been stagnant over the course of decades, with most of the donors being white [4]. The identification of racial disparities in LDKT within the larger problem of high mortality on the waiting list has created opportunities to provide more equitable healthcare for patients. Multiple initiatives including having providers of the same linguistic and cultural backgrounds, educational opportunities, identification of advocates that initiated conversations on the patients' behalf, and financial reimbursements have all helped reduce barriers among racial/ethnic minority communities that have been traditionally overlooked.

Addressing disparities have expanded the living donor pool, but further effort is needed. Racial and ethnic minority patients tend have difficulties finding matched donors due to higher rates of uncommon HLA types and antibody levels that may lead to organ rejection [78, 79]. Despite seemingly immutable biologic hurdles, an expanded network beyond individual centers of living donors have improved access to care for all patients in the form of paired kidney exchanges, especially when directed donors are incompatible. Paired kidney exchange has been designed and implemented throughout the United States and has helped overcome multiple types of incompatibility including ABO mismatch, HLA incompatibility, optimizing age-matching, eplet matching, and has ushered in novel concepts including temporal incompatibility, advanced donation, and voucher donation. This has been popularized in the lay media on television, and now accounts for more than 1,000 living donor transplants each year in the US [80–83]. Paired exchange improves access for minority patients with rare blood types and antibodies that are commonly found in these groups, staving off mortality and prolonged time on dialysis while waiting for an appropriate deceased donor [84]. For LDKT, paired exchange is transformational and has indirectly become an agent in the efforts to reduce disparities in access to transplant.

The United Network for Organ Sharing implemented a new kidney allocation system in 2014 to address ongoing racial disparities for deceased donor organ allocation. Given the numerous access barriers for disadvantaged minority patients, the new system not only prioritizes increased wait times, but also transitioned to using the first day of regular dialysis instead of the first day of listing. Additionally, more highly sensitized patients received priority points and the donor service area boundaries were also expanded. This translated to salient KT access changes as the previous KT access gap of 27% and 28% between black and Hispanic patients compared to white patients, respectively, narrowed to <5%. Additionally, the national KT rate for all patients also increased by 5% [85].

To address other ongoing racial tensions in healthcare, the National Kidney Foundation and the American society of Nephrology (NKF-ASN) has created a taskforce to re-evaluate the use of race in the estimation of glomerular filtration rate (eGFR). Previous models have included creatinine, age, gender, and race (black vs. non-black) based on the assumption that creatinine concentrations are directly proportional to muscle mass [86]. Clinically, this translated to black patients having higher eGFR when matched to non-black patients with identical serum creatinine measurements, age, and gender. The NKF-ASN task force recommendations to use only race-neutral equations for eGFR took place in 2022. In comparison to previous equations that included race in the estimation, the exclusion of race reduced bias and promoted earlier access to necessary transplant care [87].

## OUTCOMES AND MAINTENANCE

While improving access to LDKT and DDKT are commendable, the work continues. Repeatedly, minority patients demonstrate shorter graft survival, worse graft function, and higher rates of chronic allograft nephropathy [88–90]. Poorer outcomes are linked to several social determinants of health including education, health literacy, and employment [91–94]. Recent policies to expand immunosuppression drug coverage beyond 3 years has been a major legislative victory for the entire transplant population, but particularly for those recipients with concerning risk factors. Similar analyses that lead to innovative care and health policies are, therefore, necessary. Additionally, any changes made to the delivery of healthcare must function in a complex social system that can change in unpredictable ways [95]. One structured way is using Plan-Do-Study-Act (PDSA) cycles. These quickly and pragmatically test theories in a complex system in a way that is concordant with the scientific method as opposed to randomized controlled trials where variations are eliminated [96, 97]. It is through short reiterative testing that can detect if interventions can adapt to local context and respond to changing obstacles.

In addition to being more equipped to identify and to understand unique cultural practices within minority communities that may affect transplant decision making, transplant centers must also work to identify internal biases. A survey of stakeholders at a major transplant center that included transplant physicians, administrators, and clinical staff demonstrated that misconceptions regarding the increase of Hispanic patients was rooted in cultural misunderstandings. While stakeholders did not object to outreach efforts to this particular group, there was little awareness prior to the survey regarding the existence of racial disparities in transplant care access at all [98]. Additionally, misconceptions about this group also fuelled concerns about the financial impact of expanding access to Hispanic patients. This was, of course, dispelled by concrete evidence that over 40% of Hispanic patients had commercial insurance, which is 10% more compared to non-Hispanic whites [4].

## CONCLUSION

While KT, specifically LDKT, is the best treatment for ESRD, certain racial minority groups continue to experience access barriers. While new allocation and eGFR estimation algorithms have improved access at the healthcare system level, access barriers persist for black and Hispanic patients. The process of addressing disparities in transplantation begins with the definition of disparities, including the recognition of socioeconomic limitations, linguistic barriers, and racial inequities. With improved understanding, physicians can work to dispel cultural barriers that proliferate misinformation regarding transplantation and propagate knowledge of ways to offset financial disincentives to living donation to improve outcomes for all.

## AUTHOR CONTRIBUTIONS

CZ and AM both contributed to the conception of the review as well as the writing. All authors contributed to the article and approved the submitted version.

## CONFLICT OF INTEREST

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

## REFERENCES

1. Kaballo MA, Canney M, O'Kelly P, Williams Y, O'Seaghdha CM, Conlon PJ. A Comparative Analysis of Survival of Patients on Dialysis and After Kidney Transplantation. *Clin Kidney J* (2018) 11:389–93. doi:10.1093/ckj/sfx117
2. United States Renal Data System. *USRDS Annual Data Report: Epidemiology of Kidney Disease in the United States*. Bethesda, MD: National Institutes of Health, National Institute of Diabetes and Digestive and Kidney Diseases (2022).
3. Mathur AK, Xing J, Dickinson DM, Warren PH, Gifford KA, Hong BA, et al. Return on Investment for Financial Assistance for Living Kidney Donors in the United States. *Clin Transpl* (2018) 32:e13277. doi:10.1111/ctr.13277
4. OPTN. *2021 Annual Report of the U.S. Organ Procurement and Transplantation Network and the Scientific Registry of Transplant Recipients: Transplant Data 2010-2021*. Minneapolis, MN: Scientific Registry of Transplant Recipients (2022).
5. Alexander GC, Sehgal AR. Why Hemodialysis Patients Fail to Complete the Transplantation Process. *Am J Kidney Dis* (2001) 37:321–8. doi:10.1053/ajkd.2001.21297
6. Alexander GC, Sehgal AR. Barriers to Cadaveric Renal Transplantation Among Blacks, Women, and the Poor. *Jama* (1998) 280:1148–52. doi:10.1001/jama.280.13.1148
7. Patzer RE, Amaral S, Wasse H, Volkova N, Kleinbaum D, McClellan WM. Neighborhood Poverty and Racial Disparities in Kidney Transplant Waitlisting. *J Am Soc Nephrol* (2009) 20:1333–40. doi:10.1681/ASN.2008030335
8. United States Renal Data System. *USRDS Annual Data Report: Epidemiology of Kidney Disease in the United States*. Bethesda, MD: National Institutes of Health, National Institute of Diabetes and Digestive and Kidney Diseases (2022).
9. Testa G, Siegler M. Increasing the Supply of Kidneys for Transplantation by Making Living Donors the Preferred Source of Donor Kidneys. *Medicine (Baltimore)* (2014) 93:e318. doi:10.1097/MD.0000000000000318
10. Sequist TD, Narva AS, Stiles SK, Karp SK, Cass A, Ayanian JZ. Access to Renal Transplantation Among American Indians and Hispanics. *Am J Kidney Dis* (2004) 44:344–52. doi:10.1053/j.ajkd.2004.04.039
11. Alexander GC, Sehgal AR, Transplant Task Force of The Renal Network, Inc. Variation in Access to Kidney Transplantation Across Dialysis Facilities: Using

Process of Care Measures for Quality Improvement. *Am J kidney Dis* (2002) 40: 824–31. doi:10.1053/ajkd.2002.35695

12. Kucirka LM, Purnell TS, Segev DL. Improving Access to Kidney Transplantation: Referral Is Not Enough. *Jama* (2015) 314:565–7. doi:10.1001/jama.2015.8932
13. Balhara KS, Kucirka LM, Jaar BG, Segev DL. Disparities in Provision of Transplant Education by Profit Status of the Dialysis Center. *Am J Transplant* (2012) 12:3104–10. doi:10.1111/j.1600-6143.2012.04207.x
14. Patzer RE, McPherson L, Wang Z, Plantinga LC, Paul S, Ellis M, et al. Dialysis Facility Referral and Start of Evaluation for Kidney Transplantation Among Patients Treated With Dialysis in the Southeastern United States. *Am J Transpl* (2020) 20:2113–25. doi:10.1111/ajt.15791
15. [LastWeek Tonight]. *Dialysis: Last Week Tonight with John Oliver (HBO) [Video]*. Youtube. Available from: https://www.youtube.com/watch?v=yw_nqzVfxFQ&t=244s&ab_channel=LastWeekTonight.
16. Purnell TS, Hall YN, Boulware LE. Understanding and Overcoming Barriers to Living Kidney Donation Among Racial and Ethnic Minorities in the United States. *Adv Chronic Kidney Dis* (2012) 19:244–51. doi:10.1053/j.ackd.2012.01.008
17. Lunsford SL, Simpson KS, Chavin KD, Hildebrand LG, Miles LG, Shilling LM, et al. Racial Differences in Coping With the Need for Kidney Transplantation and Willingness to Ask for Live Organ Donation. *Am J Kidney Dis* (2006) 47: 324–31. doi:10.1053/j.ajkd.2005.10.018
18. Joshi S, Gaynor JJ, Bayers S, Guerra G, Eldefrawy A, Chediak Z, et al. Disparities Among Blacks, Hispanics, and Whites in Time From Starting Dialysis to Kidney Transplant Waitlisting. *Transplantation* (2013) 95:309–18. doi:10.1097/TP.0b013e31827191d4
19. Monson RS, Kemerley P, Walczak D, Benedetti E, Oberholzer J, Danielson KK. Disparities in Completion Rates of the Medical Prerenal Transplant Evaluation by Race or Ethnicity and Gender. *Transplantation* (2015) 99:236–42. doi:10.1097/TP.0000000000000271
20. Kucirka LM, Grams ME, Balhara KS, Jaar BG, Segev DL. Disparities in Provision of Transplant Information Affect Access to Kidney Transplantation. *Am J Transplant* (2012) 12:351–7. doi:10.1111/j.1600-6143.2011.03865.x
21. Robert Graham Center. *Social Deprivation Index (SDI)*. Roobert Graham Center (2020).
22. Yarnall KS, Pollak KI, Østbye T, Krause KM, Michener JL. Primary Care: Is There Enough Time for Prevention? *Am J Public Health* (2003) 93:635–41. doi:10.2105/ajph.93.4.635
23. Waterman AD, Morgievich M, Cohen DJ, Butt Z, Chakkera HA, Lindower C, et al. Living Donor Kidney Transplantation: Improving Education Outside of Transplant Centers About Live Donor Transplantation-Recommendations From a Consensus Conference. *Clin J Am Soc Nephrol : CJASN* (2015) 10: 1659–69. doi:10.2215/CJN.00950115
24. Huml AM, Sedor JR, Poggio E, Patzer RE, Schold JD. An Opt-Out Model for Kidney Transplant Referral: The Time Has Come. *Am J Transpl* (2021) 21: 32–6. doi:10.1111/ajt.16129
25. Klassen AC, Hall AG, Saksvig B, Curbow B, Klassen DK. Relationship Between Patients' Perceptions of Disadvantage and Discrimination and Listing for Kidney Transplantation. *Am J Public Health* (2002) 92:811–7. doi:10.2105/ajph.92.5.811
26. Wachterman MW, McCarthy EP, Marcantonio ER, Ersek M. Mistrust, Misperceptions, and Miscommunication: A Qualitative Study of Preferences About Kidney Transplantation Among African Americans. *Transpl Proc* (2015) 47:240–6. doi:10.1016/j.transproceed.2015.01.016
27. Alvaro EM, Siegel JT, Turcotte D, Lisha N, Crano WD, Dominick A. Living Kidney Donation Among Hispanics: A Qualitative Examination of Barriers and Opportunities. *Prog Transpl* (2008) 18:243–50. doi:10.1177/152692480801800406
28. Gordon EJ, Uriarte JJ, Lee J, Kang R, Shumate M, Ruiz R, et al. Effectiveness of a Culturally Competent Care Intervention in Reducing Disparities in Hispanic Live Donor Kidney Transplantation: A Hybrid Trial. *Am J Transpl* (2022) 22: 474–88. doi:10.1111/ajt.16857
29. Waterman AD, Stanley SL, Covelli T, Hazel E, Hong BA, Brennan DC. Living Donation Decision Making: Recipients' Concerns and Educational Needs. *Prog Transplant* (2006) 16:17–23. doi:10.1177/152692480601600105
30. Krogstad JM, Lopez MH. *Use of Spanish Declines Among Latinos in Major U.S. Metros*. Washington, DC: Pew Research Center (2017).
31. Talamantes E, Norris KC, Mangione CM, Moreno G, Waterman AD, Peipert JD, et al. Linguistic Isolation and Access to the Active Kidney Transplant Waiting List in the United States. *Clin J Am Soc Nephrol* (2017) 12:483–92. doi:10.2215/CJN.07150716
32. Cohn JSPDV. *Pew Research Center's Hispanic Trends Project*. Washington, DC: Pew Research Center (2008).
33. Alvidrez J, Pérez-Stable EJ. Diabetes Care in Latinos With Limited English Proficiency: What Do Language Concordant Clinicians Add? *JAMA Intern Med* (2017) 177:313–5. doi:10.1001/jamainternmed.2016.8661
34. Rimmer A. Can Patients use Family Members as Non-Professional Interpreters in Consultations? *BMJ* (2020) 368:m447. doi:10.1136/bmj.m447
35. Gordon EJ, Feinglass J, Carney P, Vera K, Olivero M, Black A, et al. A Culturally Targeted Website for Hispanics/Latinos About Living Kidney Donation and Transplantation: A Randomized Controlled Trial of Increased Knowledge. *Transplantation* (2016) 100:1149–60. doi:10.1097/TP.0000000000000932
36. Gordon EJ, Uriarte JJ, Anderson N, Romo E, Caicedo JC, Shumate M. Implementation and Modification of an Organizational-Level Intervention: A Prospective Analysis. *Implement Sci Commun* (2022) 3:59. doi:10.1186/s43058-022-00296-0
37. Caicedo JC, Carbunaru S, Brooks JT, Ortiz CC, Ortiz AC, Benavides X, et al. Analysis of Linguistically and Culturally Tailored Initiatives in Websites of Kidney Transplant Programs in the United States Between 2013-2018. *Prog Transpl* (2021) 31:13–8. doi:10.1177/1526924820978593
38. Rodrigue JR, Schold JD, Morrissey P, Whiting J, Vella J, Kayler LK, et al. Direct and Indirect Costs Following Living Kidney Donation: Findings From the KDOC Study. *Am J Transpl* (2016) 16:869–76. doi:10.1111/ajt.13591
39. Klarenbach S, Gill JS, Knoll G, Caulfield T, Boudville N, Prasad GVR, et al. Economic Consequences Incurred by Living Kidney Donors: A Canadian Multi-Center Prospective Study. *Am J Transplant* (2014) 14:916–22. doi:10.1111/ajt.12662
40. Klarenbach SW, Tonelli M, Chui B, Manns BJ. Economic Evaluation of Dialysis Therapies. *Nat Rev Nephrol* (2014) 10:644–52. doi:10.1038/nrneph.2014.145
41. Przech S, Garg AX, Arnold JB, Barnieh L, Cuerden MS, Dipchand C, et al. Financial Costs Incurred by Living Kidney Donors: A Prospective Cohort Study. *J Am Soc Nephrol* (2018) 29:2847–57. doi:10.1681/ASN.2018040398
42. McCune TR, Armata T, Mendez-Picon G, Yium J, Zabari GB, Crandall B, et al. The Living Organ Donor Network: A Model Registry for Living Kidney Donors. *Clin Transpl* (2004) 18(12):33–8. doi:10.1111/j.1399-0012.2004.00215.x
43. Sieverdes JC, Nemeth LS, Magwood GS, Baliga PK, Chavin KD, Ruggiero KJ, et al. African American Kidney Transplant Patients' Perspectives on Challenges in the Living Donation Process. *Prog Transpl* (2015) 25:164–75. doi:10.7182/pit2015852
44. Wolfe WA. Increasing African-American Living Kidney Donors: The Feasibility and Potential Role of Nephrology Nurses and Social Workers. *Soc Work Health Care* (2003) 37:73–89. doi:10.1300/J010v37n04_05
45. U.S. DEPARTMENT OF LABOR. *Earnings Disparities by Race and Ethnicity*. Washington, DC: Department of Labor (2023).
46. Sheu J, Ephraim PL, Powe NR, Rabb H, Senga M, Evans KE, et al. African American and Non-African American Patients' and Families' Decision Making about Renal Replacement Therapies. *Qual Health Res* (2012) 22: 997–1006. doi:10.1177/1049732312443427
47. Hamoda RE, McPherson LJ, Lipford K, Jacob Arriola K, Plantinga L, Gander JC, et al. Association of Sociocultural Factors With Initiation of the Kidney Transplant Evaluation Process. *Am J Transpl* (2020) 20:190–203. doi:10.1111/ajt.15526
48. Rodrigue JR, Cornell DL, Kaplan B, Howard RJ. Patients' Willingness to Talk to Others About Living Kidney Donation. *Prog Transpl* (2008) 18:25–31. doi:10.1177/152692480801800107
49. Waterman AD, Peipert JD, Hyland SS, McCabe MS, Schenk EA, Liu J. Modifiable Patient Characteristics and Racial Disparities in Evaluation Completion and Living Donor Transplant. *Clin J Am Soc Nephrol* (2013) 8: 995–1002. doi:10.2215/CJN.08880812

50. Wang A, Caicedo JC, McNatt G, Abecassis M, Gordon EJ. Financial Feasibility Analysis of a Culturally and Linguistically Competent Hispanic Kidney Transplant Program. *Transplantation* (2021) 105:628–36. doi:10.1097/TP.0000000000003269
51. Gordon EJ, Lee J, Kang R, Ladner DP, Skaro AI, Holl JL, et al. Hispanic/Latino Disparities in Living Donor Kidney Transplantation: Role of a Culturally Competent Transplant Program. *Transplant direct* (2015) 1:e29. doi:10.1097/TXD.0000000000000540
52. Gordon EJ, Romo E, Amórtegui D, Rodas A, Anderson N, Uriarte J, et al. Implementing Culturally Competent Transplant Care and Implications for Reducing Health Disparities: A Prospective Qualitative Study. *Health Expect* (2020) 23:1450–65. doi:10.1111/hex.13124
53. Gordon EJ, Lee J, Kang R, Ladner DP, Skaro AI, Holl JL, et al. Hispanic/Latino Disparities in Living Donor Kidney Transplantation: Role of a Culturally Competent Transplant Program. *Transpl Direct* (2015) 1:e29. doi:10.1097/TXD.0000000000000540
54. Alhalel N, Francone NO, Salazar AM, Primeaux S, Ruiz R, Caicedo JC, et al. Patients' Perceptions of a Culturally Targeted Hispanic Kidney Transplant Program: A Mixed Methods Study. *Clin Transpl* (2019) 33:e13577. doi:10.1111/ctr.13577
55. Garonzik-Wang JM, Berger JC, Ros RL, Kucirka LM, Deshpande NA, Boyarsky BJ, et al. Live Donor Champion: Finding Live Kidney Donors by Separating the Advocate From the Patient. *Transplantation* (2012) 93:1147–50. doi:10.1097/TP.0b013e31824e75a5
56. Reed RD, Hites L, Mustian MN, Shelton BA, Hendricks D, Berry B, et al. A Qualitative Assessment of the Living Donor Navigator Program to Identify Core Competencies and Promising Practices for Implementation. *Prog Transplant* (2019) 30:29–37. doi:10.1177/1526924819892919
57. King EA, Ruck JM, Garonzik-Wang J, Bowring MG, Kumar K, Purnell T, et al. Addressing Racial Disparities in Live Donor Kidney Transplantation Through Education and Advocacy Training. *Transplant Direct* (2020) 6:e593. doi:10.1097/TXD.0000000000001041
58. Barnieh L, Arnold JB, Boudville N, Cuerden MS, Dew MA, Dipchand C, et al. Living Kidney Donors' Financial Expenses and Mental Health. *Transplantation* (2021) 105:1356–64. doi:10.1097/TP.0000000000003401
59. Caulfield T, Nelson E, Goldfeldt B, Klarenbach S. Incentives and Organ Donation: What's (Really) Legal in Canada? *Can J Kidney Health Dis* (2014) 1:7. doi:10.1186/2054-3581-1-7
60. Trillium Gift of Life Network. *Program for Reimbursing Expenses of Living Organ Donors*. Ontario, Canada: Trillium (2023).
61. LaPointe Rudow D, Cohen D. Practical Approaches to Mitigating Economic Barriers to Living Kidney Donation for Patients and Programs. *Curr Transplant Rep* (2017) 4:24–31. doi:10.1007/s40472-017-0135-z
62. Mathur AK, Stewart Lewis ZA, Warren PH, Walters MC, Gifford KA, Xing J, et al. Best Practices to Optimize Utilization of the National Living Donor Assistance Center for the Financial Assistance of Living Organ Donors. *Am J Transpl* (2020) 20:25–33. doi:10.1111/ajt.15684
63. National Living Donor Assistance Center. *National Living Donor Assistance Center* (2023). Available from: https://www.livingdonorassistance.org/ (Accessed March 17, 2023).
64. Our story: The Hil family. *National Kidney Registry* (2023). Available from: https://www.kidneyregistry.org/about/our-story/ (Accessed March 9, 2023).
65. Ghanbariamin R, Chung BW. The Effect of the National Kidney Registry on the Kidney-Exchange Market. *J Health Econ* (2020) 70:102301. doi:10.1016/j.jhealeco.2020.102301
66. Mandelbrot DA, Pavlakis M, Danovitch GM, Johnson SR, Karp SJ, Khwaja K, et al. The Medical Evaluation of Living Kidney Donors: A Survey of US Transplant Centers. *Am J Transpl* (2007) 7:2333–43. doi:10.1111/j.1600-6143.2007.01932.x
67. Lentine KL, Kasiske BL, Levey AS, Adams PL, Alberú J, Bakr MA, et al. KDIGO Clinical Practice Guideline on the Evaluation and Care of Living Kidney Donors. *Transplantation* (2017) 101:S1–s109. doi:10.1097/TP.0000000000001769
68. OPTN. *Modify Living Donor Exclusion Criteria* (2022). Available from: https://optn.transplant.hrsa.gov/policies-bylaws/public-comment/modify-living-donor-exclusion-criteria/ (Accessed March 17, 2023).
69. OPTN. *Align OPTN Policy With U.S. Public Health Service Guideline, 2020* (2020). Available from: https://optn.transplant.hrsa.gov/policies-bylaws/public-comment/align-optn-policy-with-us-public-health-service-guideline-2020/ (Accessed March 17, 2023).
70. Services CfMM. Department of Health and Human Services - Centers for Medicare (2007).
71. Wilk AR, Beck J, Kucheryavaya A. *The Kidney Allocation System (KAS) - The First Two Years - UNOS*. United Network for Organ Sharing (2017). Available from: https://unos.org/wp-content/uploads/unos/KAS_First-two-years_041917.pdf.
72. Gill J, Rose C, Lesage J, Joffres Y, Gill J, O'Connor K. Use and Outcomes of Kidneys From Donation After Circulatory Death Donors in the United States. *J Am Soc Nephrol* (2017) 28:3647–57. doi:10.1681/ASN.2017030238
73. UNOS. *Two New Transplant Performance Metrics to Implement July 14, 2022*. UNOS (2022).
74. CMS. *CMS Finalizes Policy that Will Increase the Number of Available Lifesavings Organs by Holding Organ Procurement Organizations Accountable Through Transparency and Competition* (2020). Available from: https://www.cms.gov/newsroom/press-releases/cms-finalizes-policy-will-increase-number-available-lifesavings-organs-holding-organ-procurement#:~:text=Today%2C%20the%20Centers%20for%20Medicare,performance%2C%20highlighting%20the%20best%20and (Accessed March 17, 2023).
75. Heilman RL, Mathur A, Smith ML, Kaplan B, Reddy KS. Increasing the Use of Kidneys From Unconventional and High-Risk Deceased Donors. *Am J Transpl* (2016) 16:3086–92. doi:10.1111/ajt.13867
76. Jadlowiec CC, Heilman RL, Smith ML, Khamash HA, Huskey JL, Harbell J, et al. Transplanting Kidneys From Donation After Cardiac Death Donors With Acute Kidney Injury. *Am J Transpl* (2020) 20:864–9. doi:10.1111/ajt.15653
77. Jadlowiec CC, Hanna WA, Ninan J, Ryan MS, Das DM, Smith M, et al. Transplant Outcomes Using Kidneys From High KDPI Acute Kidney Injury Donors. *Clin Transpl* (2021) 35:e14279. doi:10.1111/ctr.14279
78. Switzer GE, Bruce JG, Myaskovsky L, DiMartini A, Shellmer D, Confer DL, et al. Race and Ethnicity in Decisions About Unrelated Hematopoietic Stem Cell Donation. *Blood* (2013) 121:1469–76. doi:10.1182/blood-2012-06-437343
79. Kulkarni S, Ladin K, Haakinson D, Greene E, Li L, Deng Y. Association of Racial Disparities With Access to Kidney Transplant After the Implementation of the New Kidney Allocation System. *JAMA Surg* (2019) 154:618–25. doi:10.1001/jamasurg.2019.0512
80. Anatomy Gs. *There's No 'I' in Team*. Apex Leadership Ltd (2008).
81. UNOS. *Kidney Paired Donation — KPD*. Arlington, VA: United Network of Organ Sharing (2023).
82. Garg N, Waterman AD, Ranasinghe O, Warnke L, Morris J, Cooper M, et al. Wages, Travel, and Lodging Reimbursement by the National Kidney Registry: An Important Step Toward Financial Neutrality for Living Kidney Donors in the United States. *Transplantation* (2021) 105:2606–11. doi:10.1097/TP.0000000000003721
83. Veale J, Hil G. National Kidney Registry: 213 Transplants in Three Years. *Clin Transpl* (2010) 333–44.
84. Melancon JK, Cummings LS, Graham J, Rosen-Bronson S, Light J, Desai CS, et al. Paired Kidney Donor Exchanges and Antibody Reduction Therapy: Novel Methods to Ameliorate Disparate Access to Living Donor Kidney Transplantation in Ethnic Minorities. *J Am Coll Surg* (2011) 212:740–5. doi:10.1016/j.jamcollsurg.2011.01.012
85. Melanson TA, Hockenberry JM, Plantinga L, Basu M, Pastan S, Mohan S, et al. New Kidney Allocation System Associated With Increased Rates Of Transplants Among Black And Hispanic Patients. *Health Aff* (2017) 36:1078–85. doi:10.1377/hlthaff.2016.1625
86. Delgado C, Baweja M, Crews DC, Eneanya ND, Gadegbeku CA, Inker LA, et al. A Unifying Approach for GFR Estimation: Recommendations of the NKF-ASN Task Force on Reassessing the Inclusion of Race in Diagnosing Kidney Disease. *Am J Kidney Dis* (2022) 79:268–88.e1. doi:10.1053/j.ajkd.2021.08.003
87. Zelnick LR, Leca N, Young B, Bansal N. Association of the Estimated Glomerular Filtration Rate With vs Without a Coefficient for Race With Time to Eligibility for Kidney Transplant. *JAMA Netw Open* (2021) 4:e2034004. doi:10.1001/jamanetworkopen.2020.34004
88. Gjertson DW. Determinants of Long-Term Survival of Adult Kidney Transplants: A 1999 UNOS Update. *Clin transplants* (1999) 341–52.

89. Hariharan S, Johnson CP, Bresnahan BA, Taranto SE, McIntosh MJ, Stablein D. Improved Graft Survival After Renal Transplantation in the United States, 1988 to 1996. *New Engl J Med* (2000) 342:605–12. doi:10.1056/NEJM200003023420901
90. Butkus DE, Meydrech EF, Raju SS. Racial Differences in the Survival of Cadaveric Renal Allografts: Overriding Effects of HLA Matching and Socioeconomic Factors. *New Engl J Med* (1992) 327:840–5. doi:10.1056/NEJM199209173271203
91. Gill JS, Abichandani R, Kausz AT, Pereira BJ. Mortality After Kidney Transplant Failure: The Impact of Non-Immunologic Factors. *Kidney Int* (2002) 62:1875–83. doi:10.1046/j.1523-1755.2002.00640.x
92. Petersen E, Baird BC, Barenbaum LL, Leviatov A, Koford JK, Shihab F, et al. The Impact of Employment Status on Recipient and Renal Allograft Survival. *Clin Transplant* (2008) 22:428–38. doi:10.1111/j.1399-0012.2008.00803.x
93. Goldfarb-Rumyantzev AS, Koford JK, Baird BC, Chelamcharla M, Habib AN, Wang BJ, et al. Role of Socioeconomic Status in Kidney Transplant Outcome. *Clin J Am Soc Nephrol* (2006) 1:313–22. doi:10.2215/CJN.00630805
94. Schaeffner ES, Mehta J, Winkelmayer WC. Educational Level as a Determinant of Access to and Outcomes After Kidney Transplantation in the United States. *Am J kidney Dis* (2008) 51:811–8. doi:10.1053/j.ajkd.2008.01.019
95. Berwick DM. Developing and Testing Changes in Delivery of Care. *Ann Intern Med* (1998) 128:651–6. doi:10.7326/0003-4819-128-8-199804150-00009
96. Moen R, Norman C. *Evolution of the PDCA Cycle*. Citeseer (2006).
97. Speroff T, O'Connor GT. Study Designs for PDSA Quality Improvement Research. *Qual Manag Healthc* (2004) 13:17–32. doi:10.1097/00019514-200401000-00002
98. Kim JJ, Basu M, Plantinga L, Pastan SO, Mohan S, Smith K, et al. Awareness of Racial Disparities in Kidney Transplantation Among Health Care Providers in Dialysis Facilities. *Clin J Am Soc Nephrol* (2018) 13:772–81. doi:10.2215/CJN.09920917

NEWS AND VIEWS
published: 11 November 2022
doi: 10.3389/ti.2022.10787

# Eliminating Race From eGFR Calculations: Impact on Living Donor Programs

**Maria Irene Bellini**[1]*†, **Mikhail Nozdrin**[2]†, **Maarten Naesens**[3]† and **Paulo N. Martins**[4]†

[1]Department of Surgical Sciences, Sapienza University, Rome, Italy, [2]Faculty of Medicine, Imperial College London, London, United Kingdom, [3]Department of Microbiology, Immunology and Transplantation, KU Leuven, Leuven, Belgium, [4]Transplant Division, Department of Surgery, University of Massachusetts, Worcester, MA, United States

**Keywords: kidney transplantation, end stage renal disease, race, ethnicity, living kidney donation, transplant access, inequity**

***Correspondence:**
Maria Irene Bellini
mariairene.bellini@uniroma1.it

**†ORCID:**
Maria Irene Bellini
orcid.org/0000-0003-0730-4923
Mikhail Nozdrin
orcid.org/0000-0001-6740-274X
Maarten Naesens
orcid.org/0000-0002-5625-0792
Paulo N. Martins
orcid.org/0000-0001-9333-0233

**Received:** 21 July 2022
**Accepted:** 31 October 2022
**Published:** 11 November 2022

**Citation:**
Bellini MI, Nozdrin M, Naesens M and Martins PN (2022) Eliminating Race From eGFR Calculations: Impact on Living Donor Programs. Transpl Int 35:10787. doi: 10.3389/ti.2022.10787

The recent decision to remove race-based calculations of kidney function for candidates on the national waitlist approved by the OPTN Board has set the tone towards a more equitable assessment of prospective transplant and donor candidates (1). The change will take effect by the 27th of July in the USA and will allow hospitals to use only race neutral equations (without the black race coefficient) (2). This policy change alone will not likely address all the existing disparities in kidney transplantation (3, 4), but a reappraisal of the elimination of race from eGFR calculations is needed in view of its potential impact on living donor kidney transplantation (LDKT), the best treatment option for patients affected by end stage renal disease (ESRD), both from the donor's and the recipient's perspective.

In greater detail, there remains a disparity in providing equitable access to racial minorities (5), especially in areas where social-related status often limits access to care, as in the USA, where private insurance affects to the likelihood of treatment exposure and transplant referral: a recent analysis showed in fact that African American candidates have a lower incidence of LDKT than candidates of other races, regardless of primary payer (6). Furthermore, in Low- and Middle-Income countries, where deceased organ donation programs are not well-established, LDKT is the only curative treatment alternative to dialysis or death (7).

Evidence is lacking regarding ethnicity and organ donation in Europe. In fact, data collection is not generally undertaken and standardized, based mainly on self-identification or recorded country of birth. Furthermore, the discrepancy between national methodologies limits access to data for various minority groups, which in turn renders not only national, but also gathered European data collection less reliable than and less comparable to what happens in the USA (6). Additionally, in many countries, "race" data are simply not collected, primarily because it is felt that it could amount to racial discrimination; the flipside is that since the data are not there, it is not possible to fully assess the extent of racial discrimination in many ways.

In the UK, non-white ethnic minorities, comprise 11% of the population, 7% of organ donors, 35% of people awaiting a kidney transplant and 21% of people who died on the waiting list (7). In other European countries, the situation is similar to or worse than that described in the UK, and in Norway, one of the countries with the highest LDKT rates, living organ donation appears to be rare amongst migrant and ethnic minority groups, who then rely upon organs from deceased donors (8), with mitigation for the disparity in access to kidney care between ethnic groups being advocated worldwide (9).

Demographic characteristics of donors (10), recipients (11), and the interaction between these two (12), are increasingly considered in the establishment of research protocols and healthcare

---

**Abbreviations:** CKD, chronic kidney disease; eGFR, estimated glomerular filtration rates; LDKT, living donor kidney transplantation; ESRD, end stage renal disease.

policies. To achieve better outcomes, and in consideration of the known discrepancy in life expectancy and morbidity between different ethnicities, it is therefore of utmost importance to consider comprehensively the interrelation between donor and recipient races on the respective health outcomes, to provide equitable access to individuals of different socio-racial backgrounds, yet without a further exacerbation of the already existing inequalities.

Race is a variable often considered in eGFR calculations, with the potentiality to overestimate renal function in Black patients, causing about 16% misclassification of kidney disease stage (2), and thus exacerbating health inequalities by the miscalculation of kidney function in minority groups. The equations most in use today include serum creatinine, age, sex, and race, and adjust the final calculation based on a presumed higher muscle mass in Black individuals; this applies specifically for the commonest methods in use among adults, namely the Modification of Diet in Renal Disease (MDRD) and the Chronic Kidney Disease Epidemiology Collaboration (CKD-EPI) (13). Yet, there are additional social determinants of health in relation to income, education and general lifestyle conditions that could significantly affect the final eGFR calculation. Furthermore, most of the eGFR equations were originally developed considering a relatively small sample size and with limited demographic characteristics (i.e., White men), therefore their transferability to other backgrounds could be argued in view of the lack of inclusion of other specific demographic characteristics for the calculation of the equation itself and for its original validation, in contradiction with the principles of diversity and inclusion.

As a result of health inequality, Black and Asian minority people in need of a kidney transplant wait for longer in comparison to their Caucasian counterparts (14). This has also been proven for Hispanic ethnicity and female gender (15), where lack of formal education and minority race are negatively associated with referral to a transplant center (14). The extended time on the waiting-list unfortunately often leads to a deterioration of the general health conditions to a grade at which the underlying comorbidities of these candidates cause their ineligibility to undergo kidney transplantation, mostly because of the limited organ donor pool, with the sad result of death for many.

To possibly meet the organ donor offer, LDKT not only represents the best opportunity of success in terms of definitive renal replacement therapy, but it also allows pre-emptive treatment of kidney failure. Since LDKT is unfortunately a precious resource not available for everyone, educational campaigns aiming to expand living organ donation should target these minority backgrounds, and content related to risks for the altruistic act of donation by Black and Asian candidates should cover topics related to the effects of donor and recipient races on the respective health outcomes.

What is then the available evidence on the effect of race on living kidney donors, and the impact on recipients' outcomes? As previously stated, data on post-donation eGFR might be affected by the formulas used in the calculation, so they remain heterogenous and inconclusive, therefore a more accurate analysis could focus on the percentage change in eGFR or slope eGFR in longitudinal observations (11) or in a comprehensive assessment evaluating biological data, socioeconomic status, and eventual complementary data affecting the health-related status of an individual.

In greater detail, we previously demonstrated that race, *per se*, should not be a barrier to increase the living donor kidney pool: on average, 88% of the entire living donor pool of this international cohort are Caucasian, but with the help of the previous mentioned educational campaigns, up to 40% of Black and Asian minorities have proven to be a realistic target to contribute to the living organ donor pool (16).

If we look at the incidence of proteinuria, another important parameter to assess the parenchymal damage secondary to the compensation hyperfiltration of the remnant kidney, there seems to be no difference among Africans or Caucasians (8) 1-year post-donation, thus confirming that living donation is an option for all the races to increase chances and access to transplantation.

Besides, there is no difference in incidence of ESRD between the Caucasian and Asian or Hispanic/Latin ethnic backgrounds (8), thus providing further support to the hypothesis that in addition to just genetic conditions, there are factors such as socioeconomic deprivation and racial discrimination to be considered for the long-term outcomes.

To this regard, an analysis from the OPTN/UNOS database found significantly higher rates of ESRD in African donors compared to Caucasians: Lentine et al., adjusted HR 2.32 (1.48–3.62) $p < 0.001$ (17). There has also been higher incidence of ESRD reported in both Caucasian and African donors, in comparison to their healthy counterparts in the general population (10); however, more than three times higher ESRD rates in the general population are registered in African adults, 8%, compared to Caucasians, 2%–3% respectively, leading ultimately to a further disadvantage of African donors and creating a vicious cycle. Therefore, it is compelling to protect those who come forward for a generous act of self-giving, without additional harm secondary to a racial demographic.

Finally, if we look at what happens to Black kidney transplant recipients, in a recent meta-analysis we demonstrated no significant difference between the 1-year mortality in comparison to Caucasians (11), as well as with regards to the data on acute rejection, concluding that recipient's race is not related to patient and graft survivals (11).

In conclusion, Black deceased donors are more likely to experience CKD compared to Caucasians, mainly in view of the trends present in the general population.

This should not be considered a barrier to the expansion of the living donor pool and the possibility to offer LDKT to candidates of Black and Asian minorities should instead be concrete and actively incentivized.

The new proposed OPTN/UNOS race-neutral eGFR calculations (13) might be considered sufficiently accurate for clinical practice in many circumstances but may lead to systematic differences in accuracy of eGFR between race groups, with implications for individual patients and public health. There have also been some concerns that the elimination of the black coefficient would decrease the eGFR and reduce the eligibility of potential black living donors, although this concern is not valid because most if not all centers do not use eGFR in the workup for living donors (4), but more reliable tests or 24 h urine clearance.

We believe that future studies need to focus on how to overcome this barrier in consideration of the current organ donor shortage, to minimize the effect of race in kidney function and provide equitable access to individuals of different socio-racial backgrounds. We also strongly support the omission of adjustment for ethnicity in the eGFR formulas, in agreement with current research looking at new endogenous filtration markers and interventions to eliminate racial and ethnic disparities, supporting consideration in health outcome differences due to health inequalities rather than race.

Transplant and Nephrology Societies should favor this new policy change to intervene on the long overdue negative impact of race on eGFR, with the aim to reduce delayed referrals for transplant and delays in qualifying for waiting time and for donor's eligibility. Equity in health means "equal opportunity" (18) and thus patients should all start from equal assessment to be offered equal treatment options.

## DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/Supplementary Material, further inquiries can be directed to the corresponding author.

## AUTHOR CONTRIBUTIONS

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

## CONFLICT OF INTEREST

PM is the chair of the Minority Affairs Committee of UNOS/OPTN.

The remaining authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

## REFERENCES

1. OPTN. OPTN Board Approves Elimination of Race-Based Calculation for Transplant Candidate Listing - OPTN (2022). Available from: https://optn.transplant.hrsa.gov/news/optn-board-approves-elimination-of-race-based-calculation-for-transplant-candidate-listing/ (Accessed July 20, 2022).
2. Diao JA, Inker LA, Levey AS, Tighiouart H, Powe NR, Manrai AK. In Search of a Better Equation - Performance and Equity in Estimates of Kidney Function. *N Engl J Med* (2021) 384:396–9. doi:10.1056/NEJMp2028243
3. Martins PN, Pavlakis M, Diez A. New Equations for Estimating the GFR without Race. Reply. *N Engl J Med* (2022) 386:1672–3. doi:10.1056/NEJMc2119761
4. Doshi MD, Schaubel DE, Xu Y, Rao PS, Sung RS. Clinical Utility in Adopting Race-free Kidney Donor Risk Index. *Transpl Direct* (2022) 8:e1343. doi:10.1097/TXD.0000000000001343
5. Kim IK, Martins PN, Pavlakis M, Eneanya ND, Patzer RE. Past and Present Policy Efforts in Achieving Racial Equity in Kidney Transplantation. *Curr Transpl Rep* (2022) 9:114–8. doi:10.1007/s40472-022-00369-y
6. European Commission. Analysis and Comparative Review of equality Data Collection Practices in the European Union (2022). Available from: https://ec.europa.eu/info/sites/default/files/data_collection_in_the_field_of_ethnicity.pdf (Accessed July 20, 2022).
7. ODT Clinical. Annual Activity Report (2021). Available from: https://www.odt.nhs.uk/statistics-and-reports/annual-activity-report/ (Accessed July 20, 2022).
8. Husain SA, King KL, Adler JT, Mohan S. Racial Disparities in Living Donor Kidney Transplantation in the United States. *Clin Transpl* (2022) 36:e14547. doi:10.1111/ctr.14547
9. Vedadi A, Bansal A, Yung P, Famure O, Mitchell M, Waterman AD, et al. Ethnic Background Is Associated with No Live Kidney Donor Identified at the Time of First Transplant Assessment-An Opportunity Missed? A Single-center Retrospective Cohort Study. *Transpl Int* (2019) 32:1030–43. doi:10.1111/tri.13476
10. Bellini MI, Nozdrin M, Pengel L, Knight S, Papalois V. Risks for Donors Associated with Living Kidney Donation: Meta-Analysis. *Br J Surg* (2022) 109:671–8. doi:10.1093/bjs/znac114
11. Bellini MI, Nozdrin M, Pengel L, Knight S, Papalois V. The Impact of Recipient Demographics on Outcomes from Living Donor Kidneys: Systematic Review and Meta-Analysis. *J Clin Med* (2021) 10:5556. doi:10.3390/jcm10235556
12. Bellini MI, Nozdrin M, Pengel L, Knight S, Papalois V. How Good Is a Living Donor? Systematic Review and Meta-Analysis of the Effect of Donor Demographics on post Kidney Transplant Outcomes. *J Nephrol* (2022) 35:807–20. doi:10.1007/s40620-021-01231-7
13. Inker LA, Eneanya ND, Coresh J, Tighiouart H, Wang D, Sang Y, et al. New Creatinine- and Cystatin C-Based Equations to Estimate GFR without Race. *N Engl J Med* (2021) 385:1737–49. doi:10.1056/NEJMoa2102953
14. Park C, Jones MM, Kaplan S, Koller FL, Wilder JM, Boulware LE, et al. A Scoping Review of Inequities in Access to Organ Transplant in the United States. *Int J Equity Health* (2022) 21:22. doi:10.1186/s12939-021-01616-x
15. Cozzi E, Alvarez M, Carmona M, Mahillo B, Forsythe J, Lomero M, et al. An Analysis by the European Committee on Organ Transplantation of the Council of Europe Outlining the International Landscape of Donors and Recipients Sex in Solid Organ Transplantation. *Transpl Int* (2022) 35:10322. doi:10.3389/ti.2022.10322
16. Bellini MI, Charalampidis S, Stratigos I, Dor FJMF, Papalois V. The Effect of Donors' Demographic Characteristics in Renal Function Post-Living Kidney Donation. Analysis of a UK Single Centre Cohort. *J Clin Med* (2019) 8(6):883. doi:10.3390/jcm8060883
17. Lentine KL, Schnitzler MA, Garg AX, Xiao H, Axelrod D, Tuttle-Newhall JE, et al. Race, Relationship and Renal Diagnoses after Living Kidney Donation. *Transplantation* (2015) 99:1723–9. doi:10.1097/TP.0000000000000733
18. Braveman P, Gruskin S. Defining Equity in Health. *J Epidemiol Community Health* (2003) 57:254–8. doi:10.1136/jech.57.4.254

ORIGINAL RESEARCH
published: 24 July 2023
doi: 10.3389/ti.2023.11357

# Decisional Needs of People From Minority Ethnic Groups Around Living Donor Kidney Transplantation: A UK Healthcare Professionals' Perspective

*Ahmed Ahmed*[1,2]*, *Anna Winterbottom*[1,2], *Shenaz Ahmed*[3], *John Stoves*[4] *and Sunil Daga*[1,5]

*[1]Department of Renal Medicine, Leeds Teaching Hospitals NHS Trust, Leeds, United Kingdom, [2]Leeds Institute of Health Sciences, Faculty of Medicine and Health, University of Leeds, Leeds, United Kingdom, [3]Division of Psychological and Social Medicine, Leeds Institute of Health Sciences, University of Leeds, Leeds, United Kingdom, [4]Department of Renal Medicine, Bradford Teaching Hospitals NHS Foundation Trust, Bradford, United Kingdom, [5]Leeds Institute of Medical Research, Faculty of Medicine and Health, University of Leeds, Leeds, United Kingdom*

Despite improved patient and clinical outcomes, living donor kidney transplantation is underutilized in the United Kingdom, particularly among minority ethnic groups, compared to deceased donor kidney transplantation. This may in part be due to the way in which kidney services present information about treatment options. With a focus on ethnicity, semi structured interviews captured the views of 19 kidney healthcare professionals from two renal centres in West Yorkshire, about the decisional needs and context within which people with advanced kidney disease make transplant decisions. Data were analysed using thematic analysis. Themes were categorized into three groups: 1) Kidney healthcare professionals: language, cultural awareness, trusted personnel, and staff diversity, 2) Patient information resources: timing and setting of education and suitability of patient-facing information and, 3) People with advanced kidney disease: knowledge, risk perception, and cultural/religious beliefs. To our knowledge, this is the first study in the United Kingdom to investigate in depth, healthcare professionals' views on living donor kidney transplantation decision making. Six recommendations for service improvement/delivery to support decision making around living donor kidney transplantation among minority ethnic groups are described.

***Correspondence:**
*Ahmed Ahmed*
*ahmed.ahmed30@nhs.net*

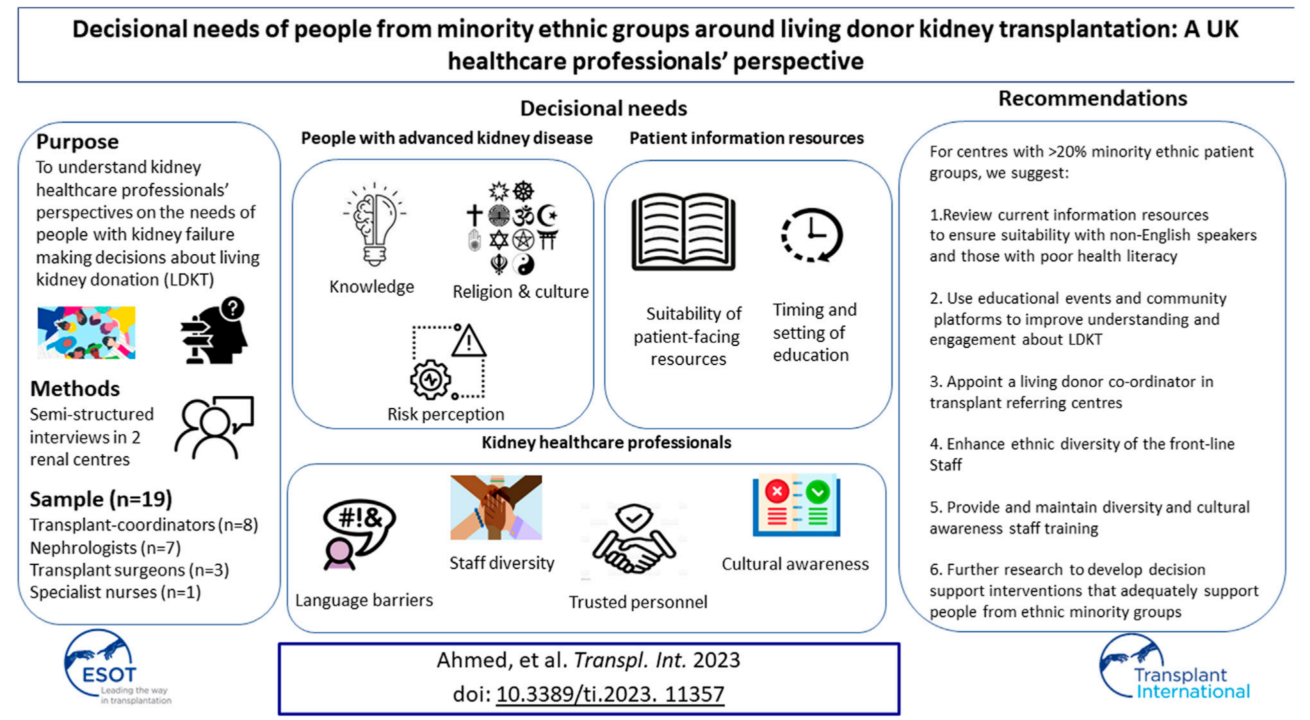
***Received:*** *13 March 2023*
***Accepted:*** *04 July 2023*
***Published:*** *24 July 2023*

***Citation:***
*Ahmed A, Winterbottom A, Ahmed S, Stoves J and Daga S (2023) Decisional Needs of People From Minority Ethnic Groups Around Living Donor Kidney Transplantation: A UK Healthcare Professionals' Perspective. Transpl Int 36:11357. doi: 10.3389/ti.2023.11357*

**Keywords: transplantation, living donor, advanced kidney disease, ethnic minorities, decision making**

## INTRODUCTION

Living donor kidney transplantation (LDKT) has superior patient and clinical outcomes for people with advanced kidney disease (AKD), including better quality of life, survival, graft success compared to deceased donor transplantation, and is more cost effective than dialysis [1, 2]. Despite this, few people with kidney disease receive a live donor transplant compared to other renal replacement options; [3], and ethnic and socio-demographic differences in the uptake of LDKT are reported; [4]. AKD is up to five times more common among minority ethnic groups due to a higher prevalence of long term conditions such as diabetes mellitus and hypertension [5, 6]. In the United Kingdom (UK), 27% of people on renal replacement therapy (RRT) are from minority ethnic groups [6]. More than half of transplant centres in the UK have >20% of their waiting list from people from ethnic minority groups with a third of these centres with >20% people from South Asian heritage [6, 9]. Yet the ethnic



**Decisional needs of people from minority ethnic groups around living donor kidney transplantation: A UK healthcare professionals' perspective**

**Purpose**
To understand kidney healthcare professionals' perspectives on the needs of people with kidney failure making decisions about living kidney donation (LDKT)

**Methods**
Semi-structured interviews in 2 renal centres

**Sample (n=19)**
Transplant-coordinators (n=8)
Nephrologists (n=7)
Transplant surgeons (n=3)
Specialist nurses (n=1)

**Decisional needs**

**People with advanced kidney disease**
Knowledge
Religion & culture
Risk perception

**Patient information resources**
Suitability of patient-facing resources
Timing and setting of education

**Kidney healthcare professionals**
Language barriers
Staff diversity
Trusted personnel
Cultural awareness

**Recommendations**

For centres with >20% minority ethnic patient groups, we suggest:

1.Review current information resources to ensure suitability with non-English speakers and those with poor health literacy

2. Use educational events and community platforms to improve understanding and engagement about LDKT

3. Appoint a living donor co-ordinator in transplant referring centres

4. Enhance ethnic diversity of the front-line Staff

5. Provide and maintain diversity and cultural awareness staff training

6. Further research to develop decision support interventions that adequately support people from ethnic minority groups

Ahmed, et al. *Transpl. Int.* 2023
doi: 10.3389/ti.2023. 11357

**GRAPHICAL ABSTRACT |**

diversity of living kidney donors in United Kingdom (UK) has remained the same between 2006 and 2017 [7]. South Asians, the second largest ethnic group in the UK [8], receive only 17% of live donor kidney transplants compared to 33% for White and 11% for Black ethnic groups [9]. The disproportionately low number of organ donors from these groups results in longer waiting times for a deceased donor, and worse outcomes because of longer periods of dependence on dialysis treatments [10, 11].

National frameworks recommend timely preparation of people with AKD for renal replacement therapy (RRT), options including LDKT. This includes offering balanced, accurate information about all forms of RRT and how they may impact on people's lives [12]. However, these guidelines do not address how variations in practice might impact on treatment uptake rates (by ethnicity), nor do they identify which interventions are most effective in helping to prepare people to make treatment decisions [13–15]. Several challenges exist for kidney services providing decision support as outlined below:

1) People making decisions about LDKT are presented with multiple treatment decisions often considered simultaneously, i.e., dialysis modality decisions, alongside decisions about deceased donor and living kidney donor transplantation. Each treatment has multiple different options, attributes, and consequences [16, 17]. Some patient information and patient decision aids present these treatment options equally, despite LDKT having optimal patient and clinical outcomes and the potential to forgo the need of dialysis with pre-emptive transplantation [18]. It is unknown how transplantation options should be described in patient information to accurately reflect how services present these to individuals with AKD [13]. Significant systemic changes and new ways of thinking are required to increase the uptake LDKT and furthermore to achieve it prior to the need for dialysis treatments [19].
2) Patient leaflets are most used to support face to face discussions within consultations. Quality assessments of this information suggests that it is presented in a way that is difficult to understand, does not signpost to cultural/religious relevant information and focusses more on preparation for surgery and treatment and/or service information that is not relevant to decision making [20–22].
3) People with AKD seeking LDKT take an active role in seeking and approaching potential donors. To do so, they must have knowledge about the transplantation process. This may be particularly challenging for people from ethnic minorities, as health literacy rates, i.e., people's ability to read, understand and act upon health information, are often low [23, 24]. This may in part explain why some people prefer to adopt a "watch and wait" approach in the hope of being called up for a deceased kidney donor transplantation [25, 26]. Designing interventions to support people with low health literacy may improve people's understanding and decision making [27].

To date, decision support interventions for people making LDKT decisions have been developed in non-UK settings and address various aspects of the decision making process, including interventions targeting recipient [28–30] or donor education [31, 32], decision coaching [33], and decision aids for healthcare providers [34]. In the UK, whilst various groups have started to explore decisional needs for LDKT, these studies have lacked diversity in terms of ethnicity and inclusion of non-English language speakers [35, 36]. Our team are undertaking research studies to develop an understanding of the decision needs for LDKT decision making in a diverse population including non-English speakers and minority ethnic groups, particularly South Asians [37]. This exploratory research aims to understand the decisional needs of people from minority ethnic groups in relation to LDKT from the perspective of kidney healthcare professionals (HCPs). This will increase our understanding about the type(s) of interventions that can enhance LDKT decision making.

# METHODS AND MATERIALS

## Design

This study employs a qualitative methodology using semi-structured interviews with kidney HCPs. Research governance approvals via the Health Research Authority and NHS Research Ethics committee were granted in June 2020 (Reference: 21/NW/0095).

## Setting

The study was conducted at Leeds and Bradford renal units in West Yorkshire, UK. The Leeds Renal Unit is the regional transplanting centre and oversees the care of 1,200 kidney transplant recipients and 450 living donors, with around 200 transplants performed annually. The Bradford Renal Unit is a transplant referral centre and provides care for 430 kidney transplant recipients and approximately 50 living donors. There are 150 patients active on the national transplant waiting list for Leeds and Bradford centres, combined. Around 40% and 18% of people with AKD on RRT in Bradford and Leeds respectively are from minority ethnic groups [3].

## Sample

Non-probability sampling was employed [38]. Participants were eligible to take part if they met the following inclusion criteria: Kidney HCPs directly involved in assisting people with AKD in making LDKT decisions. The following groups were not eligible to participate: Kidney HCP with no direct involvement in transplantation, those who support living-donors or paediatric patients and colleagues (authors) directly involved in conduct of this research.

## Recruitment

Eligible participants were contacted via NHS email. **Figure 1** describes the recruitment process in the study centres.

## Study Materials

An interview guide was developed using published literature on people decision making about LDKT and guided by the expertise of the research team and relevant stakeholders from each renal centre. The interview guide contained three parts: 1) Introduction: Briefing, demographics and describing clinical context 2) Exploration of views: HCP perspectives on patient's decisional needs and patient information resources supporting LDKT decision making 3) close: opportunity to add any additional comments. For further information see **Supplementary Material**.

## Data Collection

Semi-structured interviews were conducted virtually via Microsoft Teams (version 4.2.4.0) by researcher (AA) and took an average of 41 min (range 27–63 min). Participants were given the opportunity to ask questions about the study and provided their written consent to take part, before the interview. Data were transcribed using Otter software (Otter.ai, Indigo, 2.2.22/26 June 2020). Interviews were conducted until saturation of themes [39].

## Data Analysis

Interviews were analysed using thematic analysis [40]. NVivo software (QSR International, release 1.7.1) was used to manage the data.

# RESULTS

The characteristics of the participants (P) are described in **Table 1**.

Themes are categorised under three broad headings: a) Kidney HCPs, b) patient information resources c) people with AKD.

## Kidney HCPs

### Language Barriers

HCPs believed that communication with non-English speaking patients could be difficult.

> "We have language deficits; I think that's a massive issue. Clearly, we have a major second language probably Urdu /Hindi variant" P *3, F, Transplant co-ordinator*

In these instances, hospital interpreters and family members were used to support discussions, and HCPs preferred hospital interpreters because of their familiarity with medical terminology. However, hospital interpreters were also felt to be time consuming, and less likely to provide accurate and complete translations.

> "I think it's difficult to get information across, however good the translator is, and when some time is spent in translation, it means that maybe you haven't got the time to focus on those other important things, like live donation" *P 11, M, Transplant surgeon*

### Cultural Awareness, Trusted Personnel and Staff Diversity

HCP highlighted several ways in which services could improve the delivery of information to people from ethnic minority groups who are making LDKT decisions. These included, improving the ethnic diversity of front-line staff, trusted

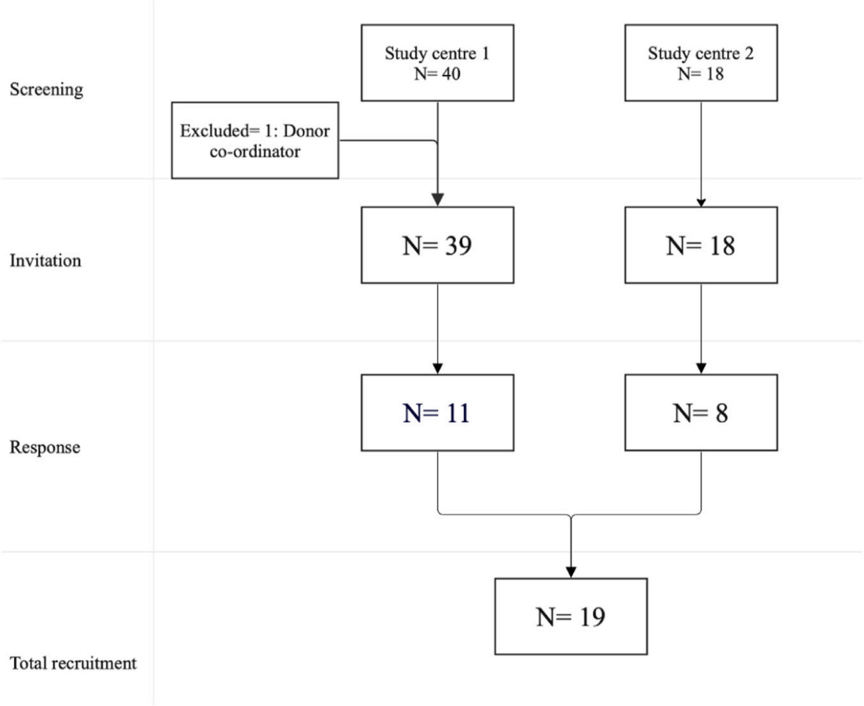


**FIGURE 1 |** Consort diagram of recruitment process of participants.

personnel to improve communication, engagement with the kidney services and overcoming cultural barriers in LDKT decision making.

> "I'd be very honest to say that all the transplant coordinators are from white ethnicity. Having someone from same community who has a real understanding of the issues that affect donation in that community, would be useful" *P 6, M, Consultant nephrologist*
>
> "Let's put the effort in, before we approach patients, to get them to engage we need to know how living donation sits within their culture" *P, 14, Female, Specialist nurse*

A lack of trust was thought to relate to peoples' prior experiences with health services, as well as more generalised concerns about how people of different ethnic groups are treated by the NHS. Furthermore, participants highlighted the need for training about gender-related cultural issues, and different religious viewpoints. One participant cited the importance of their cultural improvement officer for enhancing rapport and patient engagement.

> "There may be some sort of distrust if they've kind of not grown up necessarily in this country. And I think it's very important when we meet with those patients to address some of those issues, or find out why people aren't coming forward" *P 1, F, Transplant co-ordinator*
>
> "I think there are worries, you know, certainly at the moment, in terms of how people with different ethnicities that are treated in different areas of the NHS, you must know about the high maternity deaths among Black ethnic groups" *P 4, F, Transplant co-ordinator*

## Patient Information Resources

### Timing of Education

HCPs suggested that information and education designed to prepare people for making decisions about renal replacement therapies should be provided at an earlier stage of the kidney disease pathway. They recognised that people with AKD are often asked to consider different treatment options, e.g., dialysis and transplantation at the same time, and that it would be beneficial to have more time to consider the options.

> "When they are in low clearance clinic, they are already symptomatic, you are asking them what option do you want? dialysis? what sort of dialysis? Ok let me tell you about transplant. But you need to make a decision about dialysis as well. You need access. Do you have a live donor? too much and need to be spaced" *P 2, F, Consultant nephrologist*

### Setting of Education

HCPs saw value in providing group education sessions to help people make treatment decisions and dispel misconceptions about transplantation, rather than in one-to-one consultations with nephrologists and transplant co-ordinators. They proposed

**TABLE 1** | Sample participant characteristics.

| Participants' characteristics | Transplanting centre N = 11 | Referral centre N = 8 |
|---|---|---|
| Sex | | |
| Female (F) | 6 | 5 |
| Male (M) | 5 | 3 |
| Ethnicity | | |
| White | 10 | 4 |
| South Asian | 1 | 4 |
| Clinical Role | | |
| Nephrologist | 4 | 3 |
| Transplant surgeon | 3 | 0 |
| Transplant co-ordinator | 4 | 4 |
| Specialist nurses | 0 | 1 |

a variety of settings such as the renal unit, primary care and community and faith-based community settings.

> "I have attended community events where we talked about and promoted transplantation and donation, people feel more comfortable sometimes [to go] somewhere [where] they are used to [going] and [engaging] in different discussions" *P 1, F, Transplant co-ordinator*

### Suitability of Patient Facing Information

HCP use information leaflets to supplement their discussions with patients. They valued these resources' ability to provide people with AKD with basic treatment information. However, they believed that this generic information might not be appropriate for non-English speakers and those with lower levels of health literacy. Apart from one booklet in Urdu, HCPs reported that the current written resources are all in English. It was suggested that resources should be translated into regional languages, particularly for people from South Asia, as this ethnicity makes up a significant proportion of their local population.

> "I think in somewhere like [Study centre 2] where there's a large Asian population, it will be a great help for this literature and booklets to be available in the local language, predominantly local language" *P 15, M, Consultant nephrologist*

Additionally, HCPs had concerns about the readability of the patient facing materials they use to supplement their LDKT discussions.

> "Potentially, some patients may find them difficult to understand, their language sometimes can be a little bit complex for some people, they need to be simplified to suit more people" *P 19, F, transplant co-ordinator*

HCPs felt that patient-facing materials should include clarification of common misconceptions about the transplantation process, and information related to different cultures and religions in relation to transplantation.

> "We are all concerned about live donation in South Asians and Muslims, but those books don't really [talk] about live donation in Islam. Or how helping someone else sits with that culture" *P 14, F, Specialist nurse*
>
> "Sometimes little things can make big difference, for example displaying a cartoon picture of a Sikh person with a turban can make people more trusting and willing to know more about treatments like this" *P, 14, Female, Specialist nurse.*

Furthermore, HCPs thought that it was valuable for people with AKD to talk to other people in a similar situation to share their experiences

> "Sometimes people find it easier if they see the story of someone who had the same journey" *P 4, F, Transplant co-ordinator*

## People With Advanced Kidney Disease

### Knowledge About LDKT

HCPs believed that people with AKD do not have enough knowledge about the advantages and disadvantages of LDKT, alternative treatment options, the transplantation process, donor-work up and donation suitability, to make an informed decision. They believed that knowledge gaps are more prevalent among people with low levels of health literacy particularly those with low education, low socioeconomic status and the non-English speakers.

> "You know, we have many of the non-English speaking patients around this region, also some have low education and bad social circumstances. They are low in literacy, they may not have the required knowledge, they even sometimes have wrong knowledge about live donation" *P 3, F, Transplant co-ordinator*

### Risk Perception

Healthcare professionals felt that this lack of knowledge about transplantation could lead to concerns about the short- and long-term consequences of transplantation, the physical risk of an operation and the financial implications of donation.

> "Because of what they have been through with kidney disease, some people have genuine concerns about how someone could have a healthy life with one kidney, those are the ones who won't ask their family even if that means they stay on dialysis forever if they don't get a kidney from the list" *P 7, M, Consultant nephrologist*

> "They do often worry and ask how long till their donors are able to work? What about their job, etc. And specially when it's a donor coming from abroad, they worry about airfare and loss of earnings" *P 12, M, Consultant nephrologist*

### Cultural and Religious Beliefs

Healthcare professionals identified instances where they felt that cultural and religious beliefs impacted on decision making. For example, Muslims were thought to require greater clarification about their religion stance on donation.

> "Islam in the Great Britain is not a homogenous entity. So, communities are very dependent on what their own Imam thinks. Certainly, some Imams don't take the same lead as the Muslim Council of Great Britain. So, I suppose there are a lot of different perceptions about living donation" *P 6, M, Consultant nephrologist*

Healthcare professionals also suggested that in their experience, people from ethnic minorities were less likely to trust the health service, and people from South Asia were more private and less willing to discuss their health and had concerns about others perception of a woman's suitability for marriage after donation.

> "So sometimes we have kind of media campaigns, Our South Asian patients will not consider this, obviously, not a lot of people like that, but they like to keep more private" *P 4, F, Transplant co-ordinator*

> "It tends to be older women from the Asian community who end up donating, they worry if a young girl donated a kidney, she's somehow seen as less suitable when it comes to marriage" *P 15, M, Consultant nephrologist*

## DISCUSSION

This study identifies themes that HCPs believed were important in supporting people to make decisions about LDKT. Some of the themes pertain to the individual characteristics of people with AKD, such as knowledge, religion, and culture, whereas others, such as the way in which education about LDKT is delivered (including timing and setting), are linked to the range and availability of resources that may assist them in making transplant decisions. While some themes are thought to be shared by all ethnic groups, others such as knowledge gaps were thought to be more prevalent among non-English speakers and those with lower socioeconomic status. The multitude of these attributes within minority ethnic groups add another layer of complexity when considering tailored interventions to improve LDKT uptake [60]. Understanding how to support people with AKD who need to make treatment decisions requires an appreciation of the different goals, values, knowledge, skills and motivation of the key stakeholders who support the decision making process, including families/carers and HCPs [41, 42]. There are few qualitative studies assessing the perspective of HCPs each with a difference focus, including African American populations patient level [43], communication barriers [44], and interventions to improve access to LDKT using existing models [45] (**Table 2**). To our knowledge, we have conducted the first UK based study that explores the views of HCPs about the decisional needs of minority ethnic groups around LDKT, with a view to developing a culturally sensitive decision support intervention.

Consistent with other studies, we found that religious and cultural beliefs and trust are consistently reported as major barriers to people pursuing LDKT, particularly in minority ethnic groups [46, 47, 61]. Information should signpost to religious and cultural information relevant to transplantation that is available in patient-facing resources [20] and within community outreach and informal promotions. The latter associates with a higher number of people pursuing LDKT [44]. In the UK, community- and faith-based platforms have been used to address cultural and religious barriers to LDKT [48]. These outreach interventions have increased awareness and interest in LDKT however there has been only a limited effect on uptake rates [49].

Furthermore, our study participants highlighted the need for diversity training to improve cultural and religious awareness of factors that might impact on people's willingness to pursue transplantation. Similar conclusions were made in a Dutch study that examined HCPs engagement with culturally diverse populations [61]. Providing regular training should improve skills and confidence over time, rather than reinforce stereotypes and leave staff feeling overcautious and uncertain and in their ability to communicate with people from ethnic minorities [50, 51]. A regular programme of staff training also is important to maintain quality of education [62]. Moreover, as recommended in the National Health Service (NHS) people plan [53], employing ethnically diverse front-line staff who are more representative of the local population can support people with AKD by improving engagement and trust in medical services [52].

Written patient information is commonly used by HCPs to supplement discussions and support shared decision-making [20]. There is considerable variation in its quality [20, 21] and HCPs in our study expressed the view that this information is not suitable for non-English speakers and people with low health literacy, who are often from minority ethnic groups [21]. Signposting people to resources produced in alternative and multi-lingual formats, use of interpreters or bilingual staff may address these language and health literacy needs [54, 61]. Such tailored resources (culturally sensitive written information and videos) have only recently been developed by community organisations working with patient groups and HCPs, including the sharing of experiences of other people with AKD who have previously made a decision about LDKT into educational sessions. The need to implement the use of these resources was advocated by participants in this study. This has already been recognised nationally with inclusion of resources in the NHS Blood and Transplant "Transplant TV" series [55], the National Black, Asian and minority ethnic (BAME) Transplant Alliance initiative [63], and other projects that support LDKT decision making [56, 57]. Recent guidance on the inclusion of narratives in patient decision aids interventions, suggest that whilst they may be beneficial to help people understand others experiences of the process with which a decision was made, they may also bias people's decision making [58].

**TABLE 2** | Summary of qualitative studies exploring HCPs' perspective and LDKT.

| Study | Shilling et al. [43] | Sandal et al. [44] | Bailey et al. [45] |
|---|---|---|---|
| Country | USA | Canada | UK |
| HCPs number | 18 | 16 | 15 |
| Type | Focus group | Semi-structured interview | Semi-structured interview |
| Focus | Patient level barriers | Barriers in discussing LDKT with patient | Development of multicomponent intervention from existing interventions |
| Overlapping themes | Medical mistrust Knowledge Risk perception | Language, Cultural barriers | Cultural barriers and resource limitations |
| Recommendation | Further research on tailored educational program | Policy changes to inform health delivery systems of targeted and effective intervention | Evaluate the multicomponent intervention in RCT |

The timing and setting of patient education about LDKT is another important aspect of decision making. There is a wide variation in practice between renal units within the UK, with many large non-transplanting centres undertaking the work-up and evaluation of potential living kidney donors locally rather than referring them to the transplanting centre. Delays at various stages of the living donor pathway contribute to lower LDKT rates in non-transplanting renal centres, and the presence of Living Donor Coordinators (LDCs) in these centres would facilitate more timely decision making. National Health Service Blood and Transplant (NHSBT) and the UK Living Kidney Donor Network have developed a LDC workforce calculator to support the commissioning of LDCs [63] but implementation remains a challenge. In addition, a NHSBT-led UK transplant workforce survey of staff in transplanting and non-transplanting UK centres is in progress and this may help to identify unwarranted variation in staffing resource between centres.

This study recruited a range of kidney health professionals working within two large inner city kidney units; however, the findings may be limited in their generalisability to other UK kidney units as the diversity of these units may represent a proportion of the population with different needs to that as a whole. It is promising however that a national workshop involving multi-centre HCPs at the 2022 UK Living Kidney Donor Network meeting identified the same top three resource-related barriers to LDKT (cultural issues, language, and health literacy) [59].

Based on the study findings we recommend the following measures to improve LDKT decision making for people from diverse ethnic groups in units where minority ethnic groups represent >20% of the deceased donor waiting list:

1. Review current patient information resources to ensure their suitability for people particularly with low health literacy and non-English speakers, including signposting to culturally tailored information involving those communities that are most disadvantaged [20, 55, 63].
2. Explore ways in which the experience of other people with AKD can be used in educational events and platforms [55–57] to improve understanding and health literacy without biasing people's decision making [58].
3. Appoint living donor co-ordinators in transplant referral centres as per national guidance and supported by the NHSBT LDC workforce calculator [63]. This will facilitate a dedicated and proactive LDC role within all renal centres and therefore reduce unwarranted variation in practice.
4. Enhance the ethnic diversity of the frontline staff such as transplant coordinators by affirmative recruitment, for better engagement of ethnic minority groups with kidney services and to improve the quality of decision support.
5. Develop and maintain a regular programme of diversity and cultural awareness staff training that addresses all of the issues pertinent to transplantation and organ donation.
6. Further research and review of the current evidence base to develop tailored decision support interventions that adequately support people from ethnic minority groups.

## DATA AVAILABILITY STATEMENT

The datasets presented in this article are not readily available because informed consent included data collection solely for this study purpose. Requests to access the datasets should be directed to AA, ahmed.ahmed30@nhs.net.

## ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Health Research Authority and NHS Research Ethics Committee (Ref 21/NW/0095). The patients/participants provided their written informed consent to participate in this study.

## AUTHOR CONTRIBUTIONS

AA: Design, recruitment, data collection, analysis, writing and editing. AW: design, writing and critical review. SA: design, writing and critical review. JS: Design, recruitment, writing and critical review. SD: Design, recruitment, writing and critical review. All authors contributed to the article and approved the submitted version.

## FUNDING

We acknowledge Kidney research Yorkshire (Ref: 19-127) which helped initiate this research and Leeds Hospitals Charity (Ref: A2001851) for funding the project.

## CONFLICT OF INTEREST

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

## SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontierspartnerships.org/articles/10.3389/ti.2023.11357/full#supplementary-material

## REFERENCES

1. Terasaki PI, Cecka JM, Gjertson DW, Takemoto S. High Survival Rates of Kidney Transplants From Spousal and Living Unrelated Donors. *N Engl J Med* (1995) 333(6):333–6. doi:10.1056/NEJM199508103330601
2. Laupacis A, Keown P, Pus N, Krueger H, Ferguson B, Wong C, et al. A Study of the Quality of Life and Cost-Utility of Renal Transplantation. *Kidney Int* (1996) 50(1):235–42. doi:10.1038/ki.1996.307
3. National Health Service. *Blood and Transplant Organ Donation and Transplantation Annual Activity Report 2021-2022* (2022). Available at: https://www.organdonation.nhs.uk/helping-you-to-decide/about-organ-donation/statistics-about-organ-donation/transplant-activity-report/ (Accessed January, 2023).
4. Wu, Robb ML, Watson CJE, Forsythe JLR, Tomson CRV, Cairns J, et al. Barriers to Living Donor Kidney Transplantation in the United Kingdom: A National Observational Study. *Nephrol Dial Transplant* (2017) 32(5):890–900. doi:10.1093/ndt/gfx036
5. Goff E Ethnicity and Type 2 Diabetes in the UK. *Bet Med* (2019) 36(8):927–38. doi:10.1111/dme.13895
6. UK Renal Registry. *UK Renal Registry 24th Annual Report – Data to 31/12/2020* (2022). Available at: https://ukkidney.org/audit-research/annual-report (Accessed July, 2022).
7. Bailey PK, Wong K, Robb M, Burnapp L, Rogers A, Courtney A, et al. Has the UK Living Kidney Donor Population Changed Over Time? A Cross-Sectional Descriptive Analysis of the UK Living Donor Registry Between 2006 and 2017. *BMJ Open* (2020) 10(6):e033906. doi:10.1136/bmjopen-2019-033906
8. UK census. *UK Census* (2021), Available at: https://census.gov.uk/census-2021-results (Accessed October, 2022).
9. National Health Service. *Blood and Transplant Organ Donation and Transplantation Annual Report on Ethnic Differences* (2022). Available at: https://www.odt.nhs.uk/statistics-and-reports/annual-report-on-ethnicity-differences/ (Accessed January, 2023).
10. Foley RN, Parfrey PS, Harnett JD, Kent GM, Martin CJ, Murray DC, et al. Clinical and Echocardiographic Disease in Patients Starting End-Stage Renal Disease Therapy. *Kidney Int* (1995) 47:186–92. doi:10.1038/ki.1995.22
11. Cheung A, Sarnak MJ, Yan G, Berkoben M, Heyka R, Kaufman A, et al. Cardiac Diseases in Maintenance Hemodialysis Patients: Results of the HEMO Study. *Kidney Int* (2004) 65:2380–9. doi:10.1111/j.1523-1755.2004.00657.x
12. National Institute for Health and Care Excellence (NICE). *Guidance on Renal Replacement Therapy and Conservative Management (NICE Guideline NG107, 03.October.2018)* (2018). Available at: https://www.nice.org.uk/guidance/ng107/chapter/recommendations (Accessed January, 2023).
13. Bekker HL, Winterbottom A, Gavaruzzi T, Finderup J, Mooney. Decision Aids to Assist Patients in Choosing the Right Treatment for Kidney Failure. *Clin Kidney J – Spec Edition* (2023) 23:236. doi:10.1186/s12882-022-02853-0
14. Van Biesen W, van der Veer SN, Murphey M, Loblova O. Patients' Perceptions of Information and Education for Renal Replacement Therapy: An Independent Survey by the European Kidney Patients' Federation on Information and Support on Renal Replacement Therapy. *PLoS ONE* (2014) 9:e103914. doi:10.1371/journal.pone.0103914
15. Combes G, Sein K, Allen K. How Does Pre-Dialysis Education Need to Change? Findings From a Qualitative Study With Staff and Patients. *BMC Nephrol* (2017) 18:334. doi:10.1186/s12882-017-0751-y
16. Bekker HL, Winterbottom A, Gavaruzzi T, Mooney A, Wilkie M, Davies S, et al. *The Dialysis Decision Aid Booklet: Making the Right Choices for You.* United Kingdom: Kidney Research UK (2015). Available at: https://kidneyresearchuk.org/wp-content/uploads/2019/05/KR-decision-Aid-DOWNLOAD.pdf (Accessed October, 2022).
17. Winterbottom A, Bekker HL, Russon L, Hipkiss V, Ziegler L, Williams R, et al. Dialysis vs Conservative Management Decision Aid: A Study Protocol. *J Kidney Care* (2018) 3:179–85. doi:10.12968/jokc.2018.3.3.179
18. Winterbottom A, Mooney A, Russon L, Hipkiss V, Ziegler L, Williams R, et al. Kidney Disease Pathways, Options and Decisions: An Environmental Scan of International Patient Decision Aids. *Nephrol Dial Transplant* (2020) 35(12):2072–82. doi:10.1093/ndt/gfaa102
19. Isaac K, Maggiore U, Knight SR, Rana Magar R, Pengel LHM, Dor FJMF Pre-Emptive Living Donor Kidney Transplantation: A Public Health Justification to Change the Default. *Front Sec Health Econ* (2023) 11. doi:10.3389/fpubh.2023.1124453
20. Winterbottom A, Conner M, Mooney A, Bekker HL. Evaluating the Quality of Patient Leaflets About Renal Replacement Therapy Across UK Renal Units. *Nephrol Dial Transplant* (2007) 22(8):2291–6. doi:10.1093/ndt/gfm095
21. Winterbottom A, Stoves J, Ahmed S, Ahmed A, Daga S. Patient Information About Living Donor Kidney Transplantation Across UK Renal Units: A Critical Review. *J Ren Care* (2021) 49(1):45–55. doi:10.1111/jorc.12404
22. Winterbottom A, Mooney A, Russon L, Hipkiss V, Williams R, Ziegler L, et al. Critical Review of Leaflets About Conservative Management Used in UK Renal Services. *J Ren Care* (2020) 46(1):250–7. doi:10.1111/jorc.12327
23. Liu C, Wang D, Liu C, Jiang J, Wang X, Chen H, et al. What Is the Meaning of Health Literacy? A Systematic Review and Qualitative Synthesis. *Community Health*(2020) 8(2):e000351. doi:10.1136/fmch-2020-000351
24. Fransen MP, Harris VC, Essink-Bot ML. Low Health Literacy in Ethnic Minority Patients: Understandable Language Is the Beginning of Good Healthcare. *Ned Tijdschr Geneeskd* (2013) 157(14):A5581.
25. Kranenburg LW, Zuidema WC, Weimar W, Hilhorst MT, Ijzermans JNM, Passchier J, et al. Psychological Barriers for Living Kidney Donation: How to Inform the Potential Donors? *Plantation* (2007) 84(8):965–71. doi:10.1097/01.tp.0000284981.83557.dc
26. Rodrigue JR, Cornell DL, Kaplan B, Howard RJ. Patients' Willingness to Talk to Others About Living Kidney Donation. *Transplant* (2008) 18(1):25–31. doi:10.1177/152692480801800107
27. Boonstra MD, Reijneveld SA, Foitzik EM, Westerhuis R, Navis G, de Winter AF. How to Tackle Health Literacy Problems in Chronic Kidney Disease Patients? A Systematic Review to Identify Promising Intervention Targets and Strategies. *ant* (2020) 36(7):1207–21. doi:10.1093/ndt/gfaa273
28. Patzer RE, Basu M, Larsen CP, Pastan SO, Mohan S, Patzer M, et al. iChoose Kidney: A Clinical Decision Aid for Kidney Transplantation Versus Dialysis Treatment. *Transplantation* (2016) 100(3):630–9. doi:10.1097/TP.0000000000001019
29. Waterman AD, Robbins ML, Paiva AL, Peipert JD, Kynard-Amerson CS, Goalby CJ, et al. Your Path to Transplant: A Randomized Controlled Trial of a Tailored Computer Education Intervention to Increase Living Donor Kidney Transplant. *BMC Nephrol* (2014) 15(1):166. doi:10.1186/1471-2369-15-166
30. Axelrod DA, Kynard-Amerson CS, Wojciechowski D, Jacobs M, Lentine KL, Schnitzler M, et al. Cultural Competency of a Mobile, Customized Patient Education Tool for Improving Potential Kidney Transplant Recipients' Knowledge and Decision-Making. *Clin Transplant* (2017) 31(5):e12944. doi:10.1111/ctr.12944
31. Garonzik-Wang JM, Berger JC, Ros RL, Kucirka LM, Deshpande NA, Boyarsky BJ, et al. Live Donor Champion: Finding Live Kidney Donors by Separating the Advocate From the Patient. *Transplantation* (2012) 93(11):1147–50. doi:10.1097/TP.0b013e31824e75a5

32. Waterman AD, McSorley AMM, Peipert JD, Goalby CJ, Peace LJ, Lutz PA, et al. Explore Transplant at Home: A Randomized Control Trial of an Educational Intervention to Increase Transplant Knowledge for Black and White Socioeconomically Disadvantaged Dialysis Patients. *BMC Nephrol* (2015) 16(1):150. doi:10.1186/s12882-015-0143-0
33. Foundation NK. *The Big Ask, the Big Give* (2016). Available at: www.kidney.org/livingdonation (Accessed August 04, 2016).
34. Gupta A, Chen G, Kaplan B. KDPI and Donor Selection. *Am J Transplant* (2014) 14(11):2444–5. doi:10.1111/ajt.12930
35. Wong K, Owen-Smith A, Caskey F, MacNeill S, Tomson CRV, Dor FJMF, et al. Investigating Ethnic Disparity in Living-Donor Kidney Transplantation in the UK: Patient-Identified Reasons for Non-Donation Among Family Members. *J Clin Med* (2020) 9(11):3751. doi:10.3390/jcm9113751
36. Bailey P, Ben-Shlomo Y, Caskey FJ, Al-Talib M, Lyons H, Babu A, et al. Development of an Intervention to Improve Access to Living-Donor Kidney Transplantation (The ASK Study). *PLoS One* (2021) 16(6):e0253667. doi:10.1371/journal.pone.0253667
37. Ahmed A, Winterbottom A, Stoves J, Ahmed S, Daga S. Facilitators and Barriers to Living Donor Kidney Transplantation. *J Kidney Care* (2022) 6(6):276–84. doi:10.12968/jokc.2021.6.6.276
38. Schreuder HT, Gregoire TG, Weyer JP. For What Applications Can Probability and Non-Probability Sampling Be Used? *Environ Monit Assess* (2001) 66:281–91. doi:10.1023/A:1006316418865
39. Legard R, Keegan J, Ward K. In-depth Interviews. In: Ritchie J, Lewis J, editors. *Qualitative Research Practice: A Guide for Social Science Students and Researchers*. London: Sage (2003). p. 139–69.
40. Braun V, Clarke V. Using Thematic Analysis in Psychology. *Qual Res Psychol* (2008) 3(2):77–101. doi:10.1191/1478088706qp063oa
41. Bekker HL. Representation of Making Health Decisions Individually, and Together (MIND-IT) (V1). In: Breckenridge K, Bekker HL, van der Veer SN, Gibbons E, Abbott D, Caskey FJ, editors. *NDT Perspectives*. Oxford: Oxford University Press (2019).
42. Bomhof-Roordink H, Gartner FR, Stiggelbout AM, Pieterse AH. Key Components of Shared Decision Making Models: A Systematic Review. *BMJ Open* (2019) 9:e031763. doi:10.1136/bmjopen-2019-031763
43. Shilling, Norman ML, Chavin KD, Hildebrand LG, Lunsford SL, Martin MS, et al. Healthcare Professionals' Perceptions of the Barriers to Living Donor Kidney Transplantation Among African Americans. *J Natl Med Assoc* (2006) 98(6):834–40.
44. Sandal S, Charlebois K, Fiore JF, Jr, Wright DK, Fortin MC, Feldman LS, et al. Health Professional-Identified Barriers to Living Donor Kidney Transplantation: A Qualitative Study. *Can J Kidney Health Dis* (2019) 6:2054358119828389. doi:10.1177/2054358119828389
45. Bailey PK, Ben-Shlomo Y, Caskey FJ, Al-Talib M, Lyons H, Babu A, et al. Development of an Intervention to Improve Access to Living-Donor Kidney Transplantation (The Ask Study). *PLOS ONE* (2021) 16(6):e0253667. doi:10.1371/journal.pone.0253667
46. Ahmed A, Winterbottom A, Stoves J, Ahmed S, Daga S. Factors Impacting Conversations With Friends and Family About Living Kidney Donation. *The Physician* (2021) 7(1):1–7. doi:10.38192/1.7.1.3
47. Religious Beliefs and Attitudes to Organ Donation. *Religious Beliefs and Attitudes to Organ Donation* (2019). Available at: https://www.gov.wales/sites/default/files/statistics-and-research/2019-07/150730-religious-beliefs-attitudes-organ-donation-summary-en.pdf (Accessed October, 2022).
48. NBTA. *Living Transplant Initiative by National Health Service Blood and National Black, Asian and Minority Ethnicities Transplant Alliance Report* (2019). Available at: https://www.nbta-uk.org.uk/living-transplant-initiative/ (Accessed October, 2022).
49. NBTA. *Living Transplant Initiative by National Health Service Blood and National Black, Asian and Minority Ethnicities Transplant Alliance Report* (2019). Available at: https://www.nbta-uk.org.uk/wp-content/uploads/2019/11/LTI-FINAL-REPORT-Nov-2019.pdf (Accessed October, 2022).
50. Bezrukova K, Spell CS, Perry JL, Jehn KA. A Meta-Analytical Integration of Over 40 Years of Research on Diversity Training Evaluation. *Psychol Bull*(2016) 142(11):1227–74. doi:10.1037/bul0000067
51. Anand R, Winters MF. A Retrospective View of Corporate Diversity Training From 1964 to the Present. *Acad Manage Learn Educ* (2008) 7:356–72. doi:10.5465/AMLE.2008.34251673
52. Akhtar T, Hipkiss V, Stoves J. Improving the Quality of Communication and Service Provision for Renal Patients of South Asian Origin: The Contribution of a Cultural and Health Improvement Officer. *J Ren Care* (2014) 40:41–6. doi:10.1111/jorc.12086
53. National Health Service. *Improving Diversity in Recruitment Practices in the National Health Service* (2021). Available at: https://www.nhsemployers.org/articles/improving-diversity-recruitment-practices-nhs (Accessed January, 2023).
54. Alsuliman T, Alasadi L, Mouki A, Alsaid B. Language of Written Medical Educational Materials for Non-English Speaking Populations: An Evaluation of a Simplified Bi-Lingual Approach. *BMC Med Educ* (2019) 19(1):418. doi:10.1186/s12909-019-1846-x
55. Transplant TV. *The Institute of Transplantation* (2023). Available at: https://transplant.tv/themes/lets-talk-about/ (Accessed January, 2023).
56. David L, Iraheta YA, Ho EW, Murillo AL, Feinsinger A, Waterman AD. Living Kidney Donation Stories and Advice Shared Through a Digital Storytelling Library: A Qualitative Thematic Analysis. *Kidney Med* (2022) 4:100486. doi:10.1016/j.xkme.2022.100486
57. Waterman A, Wood EH, Ranasinghe ON, Faye Lipsey A, Anderson C, Balliet W, et al. A Digital Library for Increasing Awareness About Living Donor Kidney Transplants: Formative Study. *JMIR Form Res* (2020) 4(7):e17441. doi:10.2196/17441
58. Winterbottom A, Bekker HL, Conner M, Mooney A. Does Narrative Information Bias Individual's Decision Making? A Systematic Review. *Oc Sci Med* (2008) 67(12):2079–88. doi:10.1016/j.socscimed.2008.09.037
59. The Supporting Living Donor Workshop. *Uk Living Kidney Donor Network Newsletter* (2022). Available at: https://nhsbtdbe.blob.core.windows.net/umbraco-assets-corp/26748/quarterly-uk-living-donor-network-newsletter-edition-may-22.pdf (Accessed January, 2023).
60. Khalil K, Brotherton A, Moore S, Evison F, Gallier S, Hodson J, et al. Interaction Between Socioeconomic Deprivation and Ethnicity for Likelihood of Receiving Living-Donor Kidney Transplantation. *BMC Nephrol* (2022) 23:113. doi:10.1186/s12882-022-02742-6
61. Ismail SY, Claassens L, Luchtenburg AE, Roodnat JI, Zuidema WC, Weimar W, et al. Living Donor Kidney Transplantation Among Ethnic Minorities in the Netherlands: A Model for Breaking the Hurdles. *Patient Educ Couns* (2013) 90:118–24. doi:10.1016/j.pec.2012.08.004
62. Redeker S, Ismail SY, Busschbach JJ, Weimar W, Massey E. National Implementation of the Kidney Team at Home Educational Intervention. *Transplantation* (2020) 104(S3):S291. doi:10.1097/01.tp.0000699960.37154.4d
63. Living Transplant Initiative. NBTA. Available from: https://www.nbta-uk.org.uk/living-transplant-initiative/ (Accessed January 2023).

ORIGINAL RESEARCH
published: 17 July 2023
doi: 10.3389/ti.2023.11243

# Examining the Role of the Health Belief Model Framework in Achieving Diversity and Equity in Organ Donation Among South Asians in the United Kingdom

*Agimol Pradeep*[1]*, *Titus Augustine*[2†], *Gurch Randhawa*[3] and *Paula Ormandy*[4†]

*[1]NHS Blood and Transplant, Watford, United Kingdom, [2]Manchester Centre for Transplantation, Manchester Royal Infirmary, Manchester University NHS Foundation Trust, Manchester, United Kingdom, [3]University of Bedfordshire, Luton, United Kingdom, [4]School of Health and Society, University of Salford, Salford, United Kingdom*

Organ donation continues to be low among ethnic minorities in the United Kingdom (UK), especially within the South Asian community, with a disproportionate number of patients of South Asian ethnicity awaiting organ transplants. In 2020/21, Minority Ethnic (ME) patients comprised almost a third of the national transplant waiting list, highlighting the continued imbalance between the need for transplants in South Asian communities and the availability of suitable organs. Median waiting times for transplants show that, generally, white patients wait less time than ME patients; Only 39.5% of ME families consented to proceed with deceased organ donation when approached compared to 69% of white families. How to increase awareness among the South Asian community on the scarcity of organ donors continues to be a growing challenge facing the healthcare system in the UK and globally. This article reflects on the education strategy implemented using the Health Belief Model. It provides a detailed framework with which to consider the rationale that led to a specific behaviour, in this case organ donation among the three major ethnicities (i.e., Indian, Pakistani, Bangladeshi) within the South Asian community as part of a single study.

**Keywords: education, knowledge, South Asian, organ donation and transplantation, health belief model framework**

***Correspondence:**
*Agimol Pradeep*
*agimolpradeep@gmail.com*

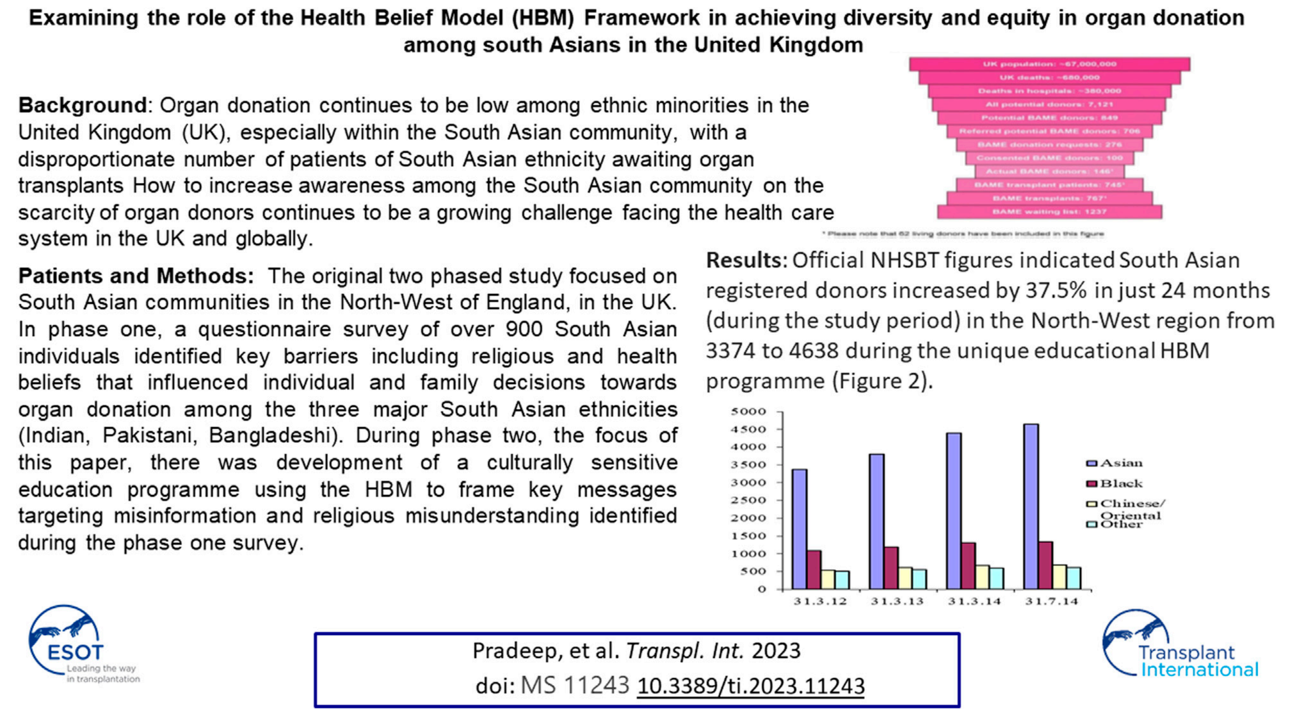
**†ORCID:**
*Titus Augustine*
*orcid.org/0000-0002-7391-1839*
*Paula Ormandy*
*orcid.org/0000-0002-6951-972X*

***Received:*** *01 February 2023*
***Accepted:*** *21 June 2023*
***Published:*** *17 July 2023*

***Citation:***
*Pradeep A, Augustine T, Randhawa G and Ormandy P (2023) Examining the Role of the Health Belief Model Framework in Achieving Diversity and Equity in Organ Donation Among South Asians in the United Kingdom. Transpl Int 36:11243. doi: 10.3389/ti.2023.11243*

## INTRODUCTION

Organ donation continues to be low among ethnic minorities in the United Kingdom (UK), especially within the South Asian (representing individuals from India, Pakistan, and Bangladesh) community, with a disproportionate number of South Asian patients waiting for transplants, because suitable matches are more often found between individuals of the same ethnic group [1, 2]. Minority Ethnic (ME) patients represent almost a third of those waiting for a lifesaving organ transplant [2]. Median waiting times to transplant in the UK show that, generally white patients wait less time than ME patients. For kidney transplants, ME patients wait almost a year longer than white patients (median waits are 824 days for black, 682 days for Asian, 678 days for other ME and 527 days for white people). Donors of Asian ethnicity (2020/21) represented only 3% of deceased kidney donors and comprised 16% of recipients of deceased donor's kidney transplants, however, make up 19% of the transplant waiting list in the United Kingdom (**Figure 1**). During the same period only 39.5% of ME families agreed to consent to proceed with deceased organ donation when approached compared



**Examining the role of the Health Belief Model (HBM) Framework in achieving diversity and equity in organ donation among south Asians in the United Kingdom**

**Background**: Organ donation continues to be low among ethnic minorities in the United Kingdom (UK), especially within the South Asian community, with a disproportionate number of patients of South Asian ethnicity awaiting organ transplants How to increase awareness among the South Asian community on the scarcity of organ donors continues to be a growing challenge facing the health care system in the UK and globally.

**Patients and Methods:** The original two phased study focused on South Asian communities in the North-West of England, in the UK. In phase one, a questionnaire survey of over 900 South Asian individuals identified key barriers including religious and health beliefs that influenced individual and family decisions towards organ donation among the three major South Asian ethnicities (Indian, Pakistani, Bangladeshi). During phase two, the focus of this paper, there was development of a culturally sensitive education programme using the HBM to frame key messages targeting misinformation and religious misunderstanding identified during the phase one survey.

**Results:** Official NHSBT figures indicated South Asian registered donors increased by 37.5% in just 24 months (during the study period) in the North-West region from 3374 to 4638 during the unique educational HBM programme (Figure 2).

Pradeep, et al. *Transpl. Int.* 2023
doi: MS 11243 10.3389/ti.2023.11243

**GRAPHICAL ABSTRACT |**

to 69% of white families. Reasons reported for declining consent to donation by ME families includes difficulties because organ donation was not something discussed with their deceased relative and concerns regarding alignment of organ donation with their religious beliefs [2].

Even though National Health Service Blood and Transplant (NHSBT) and Department of Health (DH) identified the scarcity of South Asian donors two decades ago, it was only relatively recently that a sustained education campaign to address this was deployed [3]. The Community Investment Scheme (CIS) was funded nationally and led by the community itself at a local level in the last 4 years. There remains limited evidence through research studies on what campaigns or interventions work within the South Asian communities, why, and how [4].

This paper supports the notion of a whole community approach and provides a framework for culturally sensitive education using the Health Belief Model (HBM) [5], alongside identifying key South Asian community influencers to improve the equity and diversity of ME organ donation.

## Patients and Methods

The original two phased study [6] focused on South Asian communities in the North-West of England, in the United Kingdom. In phase one, a questionnaire survey of over 900 South Asian individuals identified key barriers including religious and health beliefs that influenced individual and family decisions towards organ donation among the three major South Asian ethnicities (Indian, Pakistani, Bangladeshi) [7].

During phase two, which was the focus of this paper, a culturally sensitive education programme was developed using the HBM to frame key messages targeting misinformation and religious misunderstanding identified during the phase one survey. The HBM is a psychological model to explain and predict health behaviours by focusing on the attitudes and beliefs of individuals. It has been applied widely in different health contexts [5]. The model focuses on the cost and benefit, which the individual perceives to be inherent in the specified organ donor behaviour. More importantly it evaluates how susceptible an individual may feel from the organ donation behaviour, the benefits from being a donor, the barriers stopping them donating an organ or any internal or external cues that influence them to be a potential organ donor [5, 6].

## Core Educational Content Included

- Perceived severity and susceptibility—plight of South Asian community, threat/prevalence of Chronic Kidney Disease (CKD), scarcity of organs, transplant waiting time, improved match within same ethnicity
- Perceived barriers—religious clarification that donation is acceptable, myths around organ donation process including: respect in handling the donor body, burial rituals, disfigurement
- Perceived benefits—helping South Asian people, gift of life, way of serving God, real stories

Organ donation and transplant education information was delivered by the South Asian educators, at over 289 community

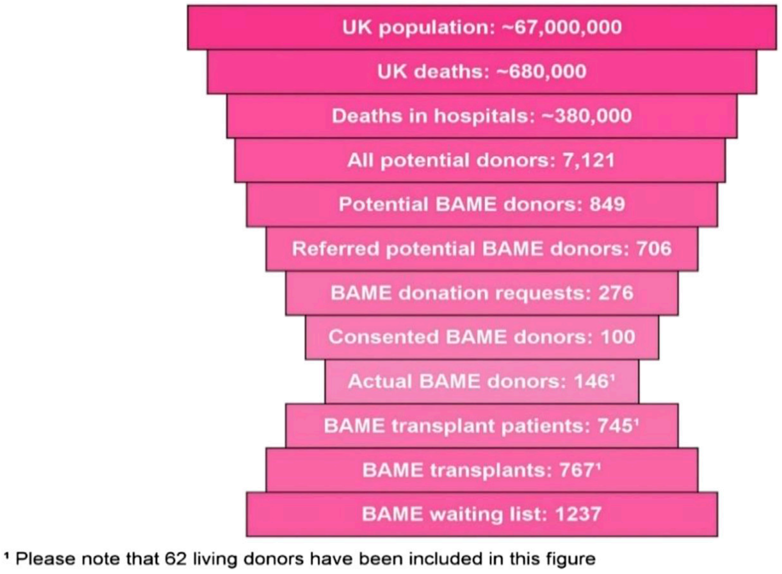


**FIGURE 1 |** UK BAME potential organ donor population (April 2020–March 2021) Source: [2].

events, over 24 months which included: 127 Religious events (23 Muslim, 24 Hindu, 8 Sikh, 12 Jain, 1 Nepal, 56 Christian, and 3 multi-faith), 134 social community events, 24 health outreach events, and four university events targeting students and staff. Perceived severity and susceptibility awareness was raised through "real life" South Asian patient stories, sharing the experiences/struggles of those individuals with CKD and the positive experience of post-transplant patients, through social and digital media to influence the perceptions and opinions of the South Asian families and the community towards organ donation. Different education strategies were applied to the different meetings to engage first community influencers/leaders, then individuals and the wider community.

## RESULTS

Official NHSBT figures indicated that South Asian registered donors increased by 37.5% in just 24 months in the North-West region from 3,374 to 4,638 during the unique educational HBM programme (**Figure 2**). In reality the sign up of South Asian organ donors totalled 2,874 people across the different peer education sessions. Delays and issues with coding organ donor forms to track registrants to the project resulted in a loss of 522 coded forms identified after data reconciliation, and a failure to track the first 1,088 South Asian organ donor registrants for the first 6 months of the project.

The annual number of Asian deceased donor organs donated throughout the North-West ITU sites was low prior to the project but was observed to increase over the study period. In 2011–2012 eight Asian families were approached for organ donation without consent from any family. Eleven families were approached in 2012–2013, and one family provided consent. After intensive community and family education in 2013/2014, eight potential Asian donor families were approached, and three families consented to organ donation. This reinforced the need to continue to educate families, particularly if they were not themselves registered organ donors.

The findings demonstrated that using an HBM targeted education programme directly increased South Asian organ donor registrations. It highlighted the fact that increasing the individual or collective understanding that South Asians as a community were susceptible to kidney disease, that organ donation does not impede religious beliefs, and changing people's health beliefs confer benefit for the community through organ donation was a successful educational strategy. What was important to note was that many individuals within the ME group claimed to have "*never heard these targeted messages before*" which suggested that targeting perceptions in susceptibility and the severity of the illness, and prevalence, such as "*this could happen to you*" education was effective to foster community attention (**Table 2**). These key elements (**Box 1** and **Table 1**) within the HBM education programme influenced organ donor registrations. To address sensitive health issues, educators need an awareness of cultural differences and how these differences affect their health. Understanding needs of culturally directed health education by South Asian peers increased the number of registered donors over a short period of time. A pre-meeting with respected gate keepers (religious and community leaders) across different communities gained their trust and support for the education programme, increased access to the community, encouraged listening, and fostered community attention (**Table 1**, examples of key learning). South Asian individuals with a lived experience story within the community reinforced the accuracy of the information delivered and for some, directly influenced a change in health beliefs. Face to face education sessions were more successful in encouraging individuals to sign up to the organ donor register, demonstrating the importance of trust in the person delivering the message.

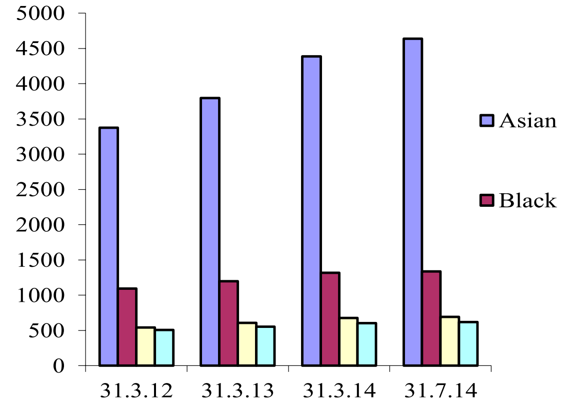


**FIGURE 2 |** National Organ Donor Registry Ethnicity Data from UK Northwest during the study period. Source: [6].

## HBM EDUCATION INCREASED ORGAN DONORS AND IMPROVED EQUITY—DISCUSSION

Fundamental to the HBM is that a person's belief of a personal threat combined with their belief in the effectiveness of the proposed behaviour predicts the likelihood of that behaviour [5]. Health beliefs are affected by numerous factors when applied to the topic of organ donation; this included underlying knowledge, attitudes, religion, ethnicity, community influences, misconceptions, mistrust, and misinterpretation. People are rational in their thoughts and actions and take the best health supporting action if they feel that it is possible to address a negative health issue, believing in taking the proposed action to expect a positive result [5, 8]. Six key concepts serve as the foundation for the HBM: perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and self-efficacy [5]. These concepts are discussed below in turn with specific reference to the South Asian community's collective perceptions and individual behaviour; being an organ donor, consenting to organ donation, or potentially needing an organ.

**BOX 1 | Perceived severity and susceptibility—Community education key messages**

- In the United Kingdom, three people die every day waiting for an organ (more than 1,000 per year)
- Nearly 5,000 people die each year in circumstances where their organs could be donated, and less than 1,500 go on to donate
- Better match and outcome if the donor and recipient are from the same ethnicity
- South Asians are more prone to develop CKD
- Blood group and tissue type match
- More than 10,000 patients on the waiting list in total and 17% are South Asians

### Perceived Susceptibility

Perceived susceptibility is the assessment of the likelihood of an individual (or the collective community) developing a specific condition [5]. South Asians living in the UK are three to four times more likely to need a kidney transplant compared to the white population, reflecting higher inherent rates of diabetes and hypertension, both of which are major causes of CKD [9]. There are a disproportionately high number of Asian patients on the kidney transplant waiting list. The most successful matched donors come from the same ethnic community [1]. However, donors from the South Asian community were not forthcoming, coupled with a lack of knowledge and awareness of the needs of the South Asian community [1, 3]. This crucial information was employed within the education model to really expose and increase a person's knowledge of their individual and community perceived susceptibility.

Within this study we found that, when there was improved understanding of the perceived susceptibility of developing CKD themselves, or in a family member, there was recognition of the positive outcome of organ donation, which directly influenced organ donor registrations among the South Asian community. Many individuals registering as organ donors expressed the view that this was the first time they had heard this message, despite countless campaigns over the last two decades [6]. Indeed, feedback from some participants indicated that as a result of knowing that their organs when donated would more than likely allocated to someone of the same ethnicity, a "*gift of life*" motivated their behaviour to donate or influenced their decision to consent to their family members organs being donated. The South Asian community had strong bonds of the specific community related benefits in organ donation, which were taken on board. Awareness and motivation were important aspects of the education model to promote the organ donation message among the South Asian community [10].

### Perceived Severity

Perceived severity was defined as how severely a person (or collective community) may be affected if they were to suffer the condition [5]. Like susceptibility, the severity of the condition and the impact on individuals in that community was evident in the lack of organs being donated, and the increased time of an ethnic South Asian's wait for a kidney transplant [11]. Severity is increased through the difficulty in blood groups and tissue type matching, to offer the best possible kidney match [2]. Ultimately, the gold standard treatment option of transplantation is significantly reduced due to the lack of donors from the same ethnicity group [12]. These facts once understood were shocking for some, especially for those with relatives with renal failure, and stimulated the motivation behind the behaviour change to register as an organ donor. For individuals and families unaffected by kidney disease, their perceived severity may remain low. However, to further stimulate perceived severity we co-opted the support of those (**Table 1**) who know that they themselves or someone they know may need a transplant at some point in time, further stimulating the collective organ donor registration.

**TABLE 1 |** Key influencers and education strategies using HBM.

| Event, experience and activity—Field notes | Key rules of engagement |
|---|---|
| Meeting A<br>• Pre-meeting with event organisers, educated about scarcity of organ donation, educated on key susceptibility and severity messages, Committee members shocked as this was the first time, they had heard this information, they wanted to do their best to support the issue<br>• Wrote article about the organ donation shortage in the native language and provided small video reinforcing the key messages of severity and susceptibility<br>• Published article 3 days prior to the meeting, prepared the audience, informed readers they can join the ODR during the meeting in presence of expert for clarification<br>• 182 individuals registered from an event attended by 400 | Pre-event meeting with editorial team<br>Identify key information to generate passion for cause<br>Publish information to increase awareness prior to an event<br>Influencer—South Asian Press |
| Meeting B<br>• Meeting community leader in advance, before the event, educated on key susceptibility and severity messages<br>• Community leader keen to promote the key message<br>• Advertised the facility of ODR registration along with his own special request for people to join the register via social media and advertising material<br>• 134 individuals registered from an event attended by 200, people more willing and already informed | Pre-meeting with community leader<br>Educate key influential people to gain support for cause<br>Pre-event advertising via social media by the influential community leader<br>Influencer—Community Leader |
| Meeting C<br>• Meeting with religious leader and discussion surrounding key susceptibility and severity messages<br>• Gained access and permission to have 30 min during one of their religious group session<br>• Religious leader introduced the researcher to the group and his positive view on organ donation<br>• Religious leader willing to clarify religious concerns during education session –more convincing than health professional<br>• 15–20 min presentation on the topic by the researcher and 15 min question and answers, led by the religious leader<br>• 18 individuals registered from an event attended by 26 | Pre-meeting with religious leader<br>Educate then gain support for cause and permission to access group<br>Endorsed by South Asian Scholar in respected position<br>Religious Leader available to support the education with positive religious interpretation<br>Influencer—Religious Leader |
| Meeting D<br>• Researcher introduced to event organisers by Transplant patient, influential in local association<br>• Group already aware of topic and impact of CKD from the patient belonging to their community<br>• Local champion (transplant patient) enabled access to future events and endorsed education<br>• 46 individuals registered from an event attended by 70 | Pre-meeting with local organisers to confirm purpose<br>Recommended by respected member of community<br>Use of "real" life experience—inside group supporter<br>Influencer—person with lived experience from within community |

## Perceived Benefit

Perceived benefit is the belief in how effective the action taken will be in mitigating the problems of the condition [5]. In this case the perceived benefit of organ donation being: the increase in available South Asian donor's will translate into opportunities for ME patients with organ failure to receive the optimum and gold standard treatment option of transplantation, and thereby improving their quality of life [12]. The perception of this benefit was reinforced by their religious or community leader (a key community influencer), who interpreted the positive benefit from the different spiritual and community perspectives. For example, benefit gained from a selfless act provides reward in the afterlife (Buddhism, Sikh, Hindu, and Islam); organ donation deemed a "*gift of life*" without any personal gain, an act satisfying divine perceptions. Individuals often join the organ donor register because they want to be a hero by saving or improving the lives of others [7, 13]. Impactful education transpired into promoting and explaining the notion that, by donating deceased organs, up to nine people could benefit following their death influenced some to take the decision to donate. Morgan et al. (2006) discussed the notion that using strong community bonding to educate on the subject of tissue type and matching organs within ME communities was more beneficial and successful, which motivated people to sign up as an organ donor to benefit their own community.

## Perceived Barriers

Perceived barriers are the individual's perceptions of the difficulties one would encounter in taking the proposed actions, including both physical and psychological barriers [5]. Barriers leading to the shortage of Asian organ donors joining the organ donor register included: medical mistrust, religious beliefs, mistrust in the healthcare system, lack of awareness, misinterpretation of faith, and lack of discussion by the health professionals [7]. A lack of motivation to register as an organ donor was influenced by uncertainty about the donation decision, a lack of knowledge about the process of organ donation, and a simple lack of knowledge about how and where to register [7, 14]. The HBM perceived barriers informed the education content. A comment from a participant suggested that "*feeling blamed for not registering would not have been helpful*," rather the non judgemental delivery of the education

**TABLE 2 |** Overview of key HBM concepts and organ donation.

| | Organ donation | Possible cues for action |
|---|---|---|
| Perceived susceptibility | • Increase awareness of:<br>- CKD prevalence<br>- scarcity of ethnic organs<br>- time on waiting list<br>- blood and tissue typing<br>- overall plight of South Asian community | ✓ Provide accurate information to increase knowledge<br>✓ Information on how to register on ODR<br>✓ Personal stories and experiences from real people to raise awareness<br>✓ Use of South Asian Media/TV<br>✓ Reassurance of best possible treatment by healthcare professionals when dying |
| Perceived severity | • Identify level of risks to self, family and wider community<br>• Concerns over deceased organ donation, less active treatment by medical staff to save own life | ✓ GP recruitment or provision of information for ODR<br>✓ Reinforce message that donation will directly benefit ethnic minority community |
| Perceived benefits | • Increased number of available ethnic minority organs incase needed by individual, family or member of wider community<br>• Reduced time on the transplant waiting list for South Asians<br>• Increased number of South Asians receiving the optimum treatment option of transplantation reducing the number on dialysis<br>• "Gift of life" selfless act to help others fulfilling religious and cultural practices—feeling of being a "hero" | ✓ Share and disseminate Fatwa advice to wider community—clarify religious stance for different groups<br>✓ Engage local religious leaders to spread positive message, encourage wider religious debate<br>✓ Cultural reassurance as to how a dead body is managed when donating an organ<br>✓ Educate families and in particular elders |
| Perceived barriers | • Lack of knowledge and awareness of need and how to become ODR<br>• Religious misinterpretation<br>• Religious leaders and family elders<br>• Poorly trained health professionals not culturally sensitive<br>• Mistrust in health system to sustain life of ill person<br>• Inappropriate cultural management of deceased donor | ✓ Peer education or education by a person who understands and belongs to the South Asian community<br>✓ Sustained education programs (maybe earlier in schools/universities)<br>✓ Training/education of whole team of health professionals on South Asian culture and religion to ensure effective communication and trust |
| Self-efficacy | Encourage individual confidence in own decision making, confidence to make appropriate decisions for next of kin, and wider community | |

enabled people to listen with a positive attitude and motivated some to join the register.

## Cues to Action

Cues to action are the strategies or prompts that allow a person to feel that they are ready to take the prescribed action [5]. Research shows that various media such as newspapers [15], television dramas [16] and television news [17], can serve as prompts for individuals and strategies to activate willingness to be an organ donor. The Asian community needs to be informed and reminded of the transplant crisis it faces and their shared responsibility to contribute donated organs. A number of strategies or "Cues to actions" were used to stimulate increased organ donation registrants within the HBM education.

Increasing public awareness of the National organ donor register as a means to record preferences on this issue is clearly a worthwhile goal [18]. Educational programmes by primary healthcare professionals about organ donation and transplantation could directly influence the attitudes and knowledge of potential donors [19]. A local research study identified that the South Asian community would trust their General Practitioner (GP) asking them to donate, and this would positively influence their decision [20].

Targeting minority ethnic press and media was an effective way to deliver information to people in this study (**Table 1**); Modern media shapes not only what people think about but also how they think about issues [21]. Culturally directed health education (by South Asian educators) increased the number of registered donors over a short time [20]. Similarly, peer education within ME groups has been shown to be effective, particularly concerning disease prevention [22].

In the UK in the last 5 years (data from 1 April 2017–31 March 2022), despite opt-out implementation, around 60% of ethnic minority eligible donors' consent/authorisation was declined by their families, to proceed with organ donation [2]. A lack of discussion by healthcare professionals with families of the potential donor has been suggested as a reason for lower donation rates among Black families in the United Kingdom [19, 23]. Misconceptions about organ donation can be improved through community and family education and awareness [24] which in turn can increase the number of new donors [25]. However, organ donation consent by the family member depends on the skill of transplant/donor coordinators influencing a relative's decisions to offer organ donation [26]. Van Embden et al. (2008) advocate that whatever the approach, prompt or cue for action, an essential component is the involvement of the whole team of healthcare workers, sensitive to the values and the traditions of ethnic communities.

This study [6] demonstrated that a whole systems approach [4] to donor and transplant education using the HBM to frame key messages, delivered by educators from the South Asian community who themselves were aware of the cultural perceived barriers, supported by community influencers, improved the uptake and action of the community to register as organ donors. This is reinforced by previous studies identifying that education alone is not sufficient motivation [1]. Taking time to identify the right educator is the key to influencing the views of a community. Additional findings can be drawn from the HBM education programme to inform education models of the future. For example, to address sensitive health issues, educators need to be aware about the cultural differences and how these differences affect their health and understanding needs. Culturally directed health education by South Asian peers increased the number of registered donors over a short time period [20]. Targeting respected gate keepers to communities, gaining their trust, and bringing them on board with the education programme opens doors and gathers the attention of the community to encourage them to listen. Real South Asian people with a story to tell influenced misinformation and changed health beliefs.

Trust in the South Asian educators was key to delivering the message and overcoming mistrust at the outset. A Hindu religious leader commented: *"in the past we have been approached by a health worker not from an Asian background with a request to have an opportunity to speak to the congregation about organ donation, but as I was not sure about the intentions and the rationale for his approach I decline permission. I now understand and I will definitely support your campaign."* Like other studies, educators from the same community were not sufficient, face-to-face delivery was also important; so the community could decide if they trusted the educator, before they trusted the message [11].

## Self-Efficacy

Self-efficacy was not measured within this study but in the HBM it is described as confidence in one's ability to act and this can be increased through information, knowledge, encouragement, and support [5]. Within this context self-confidence of an individual could influence their belief in the "*gift of life*," influenced by the perceptions of the community, the religious leader or family. To overcome this, we targeted and educated the community as a whole, to drive peer support and community belief in the messages, which in turn potentially influenced the confidence of an individual, but this requires further research.

Drawing together the key learning (**Table 2**) from the HBM study as a whole, a number of strategies were influential in the success of the education campaign which considerably increased the number of organ donors to be registered. Using the key learning to build national campaigns in the future stimulating whole community ownership and action to address the lack of ME organs will improve the equity and diversity of available organs for the future.

## KEY POINTS OF LEARNING

- The HBM is successful in framing key messages that will impact on the South Asian community to raise awareness and stimulate action to register as an organ donor or allow the donation of family organs to help the wider community.
- Perceived susceptibility, severity, and benefit are useful to frame key messages that will foster collective and individual action across ME communities. The belief that they are doing something that will benefit the wider community is a cue to action.
- Drawing on real life stories from people within the community provides authenticity to the need for organ donors and emphasises the reality of the problem for people, supporting the HBM key messages as to the benefit of matched ME organs.
- Employing skilled peer educators from the same community, aware of the cultural barriers to organ donation, increased the likelihood of community access, the message being heard, and the educator being trusted.
- Gaining the support of key influencers (such as religious and community leaders, media editors, local figures) within a community will improve access to community events, endorse the importance and trust in the key messages, and positively influence the community to take collective action.
- Religious leader support to help explain and discuss barriers within the community allays fears created by misinformation and myths, which influences support for organ donation in ME groups.
- Targeting minority ethnic press and media is a potentially effective way to get information to people within a community if the media is a trusted source of information within the community.

## CONCLUSION

A South Asian education programme based on HBM theory successfully increased the diversity of the organ donor register base, showing promise of a way to begin to reduce health inequalities for people on the transplant waiting list, a long-term national NHSBT vision for 2030 [27]. Perceived susceptibility, severity, barriers, and benefits of organ donation need to be communicated effectively to foster organ donation and family support for the "gift of life" message. Following the HBM framework provided guidance to the educator, to understand the South Asian individual's beliefs, knowledge, attitudes, and behaviours as determinants of willingness to become an organ donor. A combination of multi-level strategies that target the whole ME community; HBM education programmes, using community educators, and community influencers are required to instigate action. This whole systems approach [4] at a local, national, and international level can tackle the scarcity of ME donors linked to time served initiatives and start to seriously improve the number of ME donors coming forward in the UK similar to other European countries [28].

## DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

## ETHICS STATEMENT

The study obtained ethical approval from different organizations; the National Research Ethics Committee, Central Manchester University Hospitals Foundation Trust (CMFT) Ethical Committee (employer of the Researcher), University of Salford Research Ethics Committee (where Researcher was a PhD student) and NHS Blood and Transplant (to access the statistics of the Organ Donor Register). Questionnaire participants were informed that participation is voluntary in order to obtain informed consent. So informed consent was presumed on return of a completed paper or online questionnaire. Interview participants were required to sign a consent form prior to the interview, giving permission to use their anonymous quotes in media, journals and social websites. Additional separate written consent was obtained from participants, religious leaders, transplanted patients, or celebrities to use film and media footage on the advertisements and giving permission to upload onto the study website platform and social medias.

## AUTHOR CONTRIBUTIONS

AP: co-designed the study, undertook fieldwork, co-analysed the data, conceived and wrote paper. TA: critical review and edit paper, co-designed study. GR: critical review and edit paper. PO: co-designed the study, co-analysed the data, critical review and wrote paper. All authors contributed to the article and approved the submitted version.

## FUNDING

The study was funded by the British Renal Society and Kidney Care UK.

## CONFLICT OF INTEREST

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

## REFERENCES

1. Morgan M, Hooper R, Mayblin M, Jones R. Attitudes to Kidney Donation and Registering as a Donor Among Ethnic Groups in the UK. *J Public Health* (2006) 28(3):226–34. doi:10.1093/pubmed/fdl045
2. NHSBT. *Organ Donation and Transplantation Annual Report for 2021/2022: Annual Report on Ethnicity Differences in Organ Donation and Transplantation*. United Kingdom: NHS Blood and Transplant (2022). Available from: https://www.gov.uk/government/publications/nhs-blood-and-transplant-annual-report-and-accounts-2021-to-2022 (Accessed February 22, 2023).
3. NHSBT Report on Community Investment Scheme Project. *Progress Report for BAME Community Investment Scheme Initiative*. United Kingdom: NHS Blood and Transplant (2020). Available from: https://www.nhsbt.nhs.uk/cisreport/ (Accessed January 10, 2023).
4. Randhawa G, Gardiner D. Tackling Organ Donation Among Minority Ethnic Communities in the UK – a Whole Systems Approach. *Br Med Bull* (2022) 142:4–14. doi:10.1093/bmb/ldac008
5. Rosenstock IM, Irwin M, Kazdin AE, editors. *Encyclopedia of Psychology*, 4. New York, NY, US: Oxford University Press (2000). p. 78–80.
6. Pradeep A. *Increasing Organ Donation in the North West South Asian Community through Targeted Education*. Published Thesis. United Kingdom: University of Salford (2014). https://salford-repository.worktribe.com/output/1419067/increasing-organ-donation-in-the-north-west-south-asian-community-through-targeted-education (Accessed December 10, 2022).
7. Pradeep A, Ormandy P, Augustine T, Randhawa G, Whitling M. Attitudes and Beliefs Regarding Organ Donation Among South Asian People in the UK. *J Kidney Care* (2019) 4(4):184–98. doi:10.12968/jokc.2019.4.4.184
8. Otto AK, Ketcher D, McCormick R, Davis JL, McIntyre MR, Liao Y, et al. Using the Health Belief Model to Assess Racial/ethnic Disparities in Cancer-Related Behaviors in an NCI-Designated Comprehensive Cancer center Catchment Area. *Cancer Causes and Control* (2021) 32(10):1085–94. doi:10.1007/s10552-021-01457-7
9. Goff LM. Ethnicity and Type 2 Diabetes in the UK. *Diabetic Med* (2019) 36(8):927–38. doi:10.1111/dme.13895
10. Saleem T, Ishaque S, Habib N, Hussain S, Jawed A, Khan A, et al. Knowledge, Attitudes and Practices Survey on Organ Donation Among a Selected Adult Population of Pakistan. *Bio Med Cent Med Ethics* (2009) 10:5. doi:10.1186/1472-6939-10-5
11. Locke JE, Segev DL, Warren DS, Dominici F, Simpkins CE, Montgomery RA. Outcomes of Kidneys from Donors after Cardiac Death: Implications for Allocation and Preservation. *Am J Transplant* (2007) 7(7):1797–807. doi:10.1111/j.1600-6143.2007.01852.x
12. Churak JM. Racial and Ethnic Disparities in Renal Transplantation. *J Natl Med Assoc* (2005) 97:153–60.
13. Quick BL, Lavoie NR, Scott AM, Morgan SE, Bosch D. Perceptions about Organ Donation Among African American, Hispanic, and White High School Students. *Qual Health Res* (2010) 22:921–33. doi:10.1177/1049732312439631
14. Hyde KM, White MK. To Be a Donor or Not to Be? Applying an Extended Theory of Planned Behavior to Predict Posthumous Organ Donation Intentions. *J Appl Soc Psychol* (2009) 39(4):880–900. doi:10.1111/j.1559-1816.2009.00464.x
15. Feeley T, Vincent D. How Organ Donation Is Represented in Newspaper Articles in the United States. *Health Commun* (2007) 21:125–31. doi:10.1080/10410230701307022
16. Morgan SE, Harrison T, Chewning L, Davis L, DiCorcia M. Entertainment (Mis)education: The Framing of Organ Donation in Entertainment Television. *Health Commun* (2007) 22:143–51. doi:10.1080/10410230701454114
17. Quick BL, Kim DK, Meyer K. A 15-year Review of ABC, CBS, and NBC News Coverage of Organ Donation: Implications for Organ Donation Campaigns. *Health Commun* (2009) 24:137–45. doi:10.1080/10410230802676516
18. Geddes CC, Stuart R, Rodger C. Kidneys for Transplant. *Br Med J* (2006) 332(10):1124–7.
19. Pradeep A, Siddiky A, Ormandy P, Augustine A. Organ Donation Among Ethnic Minorities: How UK Primary Care Can Help Promote it. *Br J Gen Pract* (2018) 68 (668):134–5. doi:10.3399/bjgp18X695093
20. Pradeep A. *An Investigation into the Reasons for the Scarcity of Deceased Organ Donors for Renal Transplant Among Migrant South Asians in the North West Region of the United Kingdom*. Unpublished MSc Dissertation. United Kingdom: University of Salford (2010).
21. Burton G. *Media and Society: Critical Perspectives*, 2nd Edition. United Kingdom: McGraw-Hill Education (2010).
22. Jain N, Farooqi A, Feehally J. Raising Awareness of Chronic Kidney Disease Among South Asians and Primary Care: The ABLE Project. *J Ren Care* (2008) 34(4):173–8. doi:10.1111/j.1755-6686.2008.00037.x
23. Symvoulakis EK, Komninos ID, Antonakis N, Morgan M, Alegakis A, Tsafantakis E, et al. Attitudes to Kidney Donation Among Primary Care

Patients in Rural Crete, Greece. *BioMedCentral Public Health* (2009) 10(9):54. doi:10.1186/1471-2458-9-54

24. Vaughn ML, Jacquez F, Baker CR. Cultural Health Attributions, Beliefs, and Practices: Effects on Healthcare and Medical Education. *Open Med Edu J* (2009) 2:64–74. doi:10.2174/1876519x00902010064
25. Simpkin LA, Robertson CL, Barber SV, Young DJ. Modifiable Factors Influencing Relative's Decision to Offer Organ Donation, Systematic Review. *Br Med J* (2009) 338:991. doi:10.1136/bmj.b991
26. Van Embden S, Sprangers MAG, de Haes HCJM. *Factors Affecting Willingness to Donate and Donor Registration: An Intercultural Comparison*. Amsterdam: PABST (2008).
27. NHSBT. *Organ Donation and Transplantation 2030: Meeting the Need*. United Kingdom: NHS Blood and Transplant (2023). Available from: https://www.odt.nhs.uk/odt-structures-and-standards/key-strategies/meeting-the-need-2030/ (Accessed January 10, 2023).
28. Pedder-Jones C, Papadopoulos C, Randhawa G. Who's Opting-In? A Demographic Analysis of the U.K. NHS Organ Donor Register. *PLoS One* (2019) 14(1):e0209161. doi:10.1371/journal.pone.0209161

POINT OF VIEW
published: 26 January 2024
doi: 10.3389/ti.2024.11658

# Systems Connected to Inequities in Access to Kidney Transplantation and the Value of Intersectionality

*Camilla W. Nonterah*[1,2]*

[1]*Department of Psychology, University of Richmond, Richmond, VA, United States,* [2]*Department of Psychiatry, Virginia Commonwealth University Health System, Richmond, VA, United States*

Patients from minoritized backgrounds based on race/ethnicity, gender, sexuality, and other social identities are more likely to experience inequities in access in kidney transplantation. Although these inequities have been reported over the decades, limited research focuses on the experiences of patients with intersecting minoritized social statuses and the mechanisms that contribute to their reduced access to transplantation. Intersectionality, a framework for understanding the ways in which multiple social identities represent interacting systems of oppression and privilege, offers a nuanced approach for understanding the experiences of patients diagnosed with end-stage organ disease with intersecting social identities. This article outlines complex systems that perpetuate inequities by highlighting the value of intersectionality in studying disparate outcomes to transplant and providing recommendations for the transplant community. This article aligns with the ESOT call for action to promote equity in transplantation worldwide.

**Keywords: intersectionality, inequities, transplant access, kidney transplant, health disparities**

Point of View

OPEN ACCESS

***Correspondence**
*Camilla W. Nonterah,*
*cnontera@richmond.edu*

***Received:*** *07 June 2023*
***Accepted:*** *10 January 2024*
***Published:*** *26 January 2024*

***Citation:***
*Nonterah CW (2024) Systems Connected to Inequities in Access to Kidney Transplantation and the Value of Intersectionality. Transpl Int 37:11658. doi: 10.3389/ti.2024.11658*

## BACKGROUND

Global estimates for Chronic Kidney Disease (CKD) indicate that approximately 10% of the population have a known diagnosis, with diabetes mellitus and hypertension discovered as significant contributors to the development of this condition. This is particularly concerning given high mortality rates associated with the disease [1]. In the US in 2020, it was estimated that 807,920 people had End-Stage Kidney Disease (ESKD). The majority of patients used hemodialysis as their primary form of renal replacement therapy relative to peritoneal dialysis or transplantation [2]. Approximately 30,000 people in the UK were reported as receiving dialysis in 2023, with a yearly rate of 3,000 transplant recipients [3]. Inequities in access to renal transplantation, the optimal form of renal replacement therapy, have been documented for decades [4–8]. These imbalances have been associated with sociocultural factors such as gender, race/ethnicity, income status, and immigrant status. These elements of a patient's identity often interact with biological and psychological factors resulting in barriers to accessing care [4, 9–13]. Hurdles occur along the steps to transplant, such as referral to transplant, pre-transplant evaluation, being waitlisted, and successful receipt of a deceased or live donor transplant [5, 14]. Insurance issues, financial constraints, limited health literacy, obesity, lack of referrals, reports of discrimination are examples of typical obstacles faced by patients diagnosed with ESKD who seek a transplant [5, 7, 13, 14]. Many patients encounter multiple barriers that interact with each other to affect their successful access to transplantation.

**TABLE 1 |** Key terms and definitions.

| Term | Definition |
|---|---|
| Allostatic load | Cumulative long-term effects of exposure to chronic stress and its impact on an individual's physical and psychological health |
| Cultural competence | The ability to understand, value, and respect people's culture, customs, and belief systems as well as how they vary among individuals or groups |
| Cultural humility | An ongoing process and commitment to self-reflection of one's beliefs and assumptions, and an openness to learning from others. It also entails a recognition of power differentials between individuals due to privilege and oppression |
| Cultural safety | Creating and cultivating an environment that values the cultural background and physical, social, and emotional safety of others. It involves an awareness of one's personal culture and the ways in which this interacts with the culture of others |
| Cisgender | A person's whose gender identity matches their sex assigned at birth. For example, an individual who was assigned female at birth and self-identifies and lives as a woman |
| Interpersonal racism | Discrimination or bias towards an individual based on their skin tone and/or hair texture. This form of racism occurs between individuals and can be intentional or unintentional |
| Implicit bias | Having negative beliefs or assumptions about a social group that one is not consciously aware of |
| Gender identity | One's personal conception or sense of who they are in relation to their gender. Some people may self-identify as a man, woman, a combination of both, neither, or somewhere along the gender spectrum |
| Microaggressions | Daily verbal and nonverbal slights, insults, or invalidations that are intentional or unintentional and communicate prejudice towards a person from a specific social group. For example, refusing to call a transgender man by his preferred pronoun, him and instead insisting on using her |
| Personal pronouns | This is a way of referring to an individual without their actual name. Using the appropriate pronouns for an individual shows respect for their gender identity regardless of what your assumptions may be about them |
| Socioecological models of health | This model proposes that health is an interaction between multiple environments of an individual such as the person's individual beliefs or personal characteristics (intrapersonal), exchanges with family, friends, and other support systems (interpersonal), organizations (e.g., health care systems, workplaces), and other systems. All of these different aspects of an individual's social environment influence their health behaviors and outcomes |
| Structural racism | Societal expectations, laws, and systems that disadvantage or discriminate against certain racial/ethnic groups, thereby limiting their access to resources such as education, employment, healthcare, and housing |
| Transgender | A general term for individuals whose gender identity, expression, or behaviors are different from the prototype of the sex they were assigned at birth. For example, an individual who was assigned female at birth but self-identifies and lives as a man |

This underscores the importance of identifying underlying mechanisms associated with inequities in access to transplantation. The objective of this viewpoint is to highlight complex systems that perpetuate these inequities, discuss the role of intersectionality in examining disparate outcomes to transplant, and provide recommendations to the transplant community. **Table 1** provides a list of some key terms and definitions used in the article.

## SOURCES OF INEQUITIES ALONG THE STEPS TO TRANSPLANT

Multiple theories have been implicated in the quest to identify the causes of inequities in access to renal transplantation. Socioecological models account for the interaction between multiple aspects of the individual, for example, at the intrapersonal, interpersonal, institutional, and societal level to affect health outcomes [15, 16]. This model has been used to examine disparities along the steps to kidney transplantation [7, 17]. The role of social determinants of health (i.e., non-medical aspects of an individual's life such as where they live, are raised, engage in recreational activities, and their vocation) has been established in the literature. Given that these determinants of health overlap with each other as well as biological, sociocultural and political factors, it is important that researchers interrogate these issues and the extent to which they contribute to health inequities.

### Race

In the United States, the origin of many health inequities has been connected to race and racism. Purnell et al. [18] provide examples of the manifestation of racism in the transplant process, specifically for patients with African ancestry who identify as Black. For instance, institutional racism (i.e., implicit or explicit discriminatory practices within the field of transplantation) may be displayed in cultural differences in communication, resulting in provider perception of a patient as non-compliant or uninterested in pursuing transplantation [18]. Race-based modifications for estimating glomerular filtration rate (e-GFR) for Black patients is another example, especially as the removal of these practices indicate positive outcomes for reducing bias [19–21].

### Gender

Transplant data indicates that women are underrepresented in referrals for transplant, more likely to be living donors, less likely to be recruited for clinical trials that investigate immunosuppression and rejection outcomes or receive a transplant [22–25]. Data from the United Network for Organ Sharing and Eurotransplant show disparate outcomes for waitlisting, with women being underrepresented on both kidney waitlists [9].

### Socioeconomic Status

Socioeconomic status has been continuously documented as a barrier to transplant which may be symbolic of classism [4, 5].

Evidence of the role of classism may be especially prominent in countries with universal healthcare or when federally funded programs are offered to patients with ESKD as they continue to experience barriers [8, 26]. Acknowledging that these systems of oppression contribute to inequities in access to transplantation is the first step towards parity and should be an integral part of the work conducted within the transplant community.

## THE IMPORTANCE OF IDENTIFYING UNDERLYING MECHANISMS

An individual's minoritized status based on race, gender, class, and/or sexuality among others has been connected to physiological and psychological outcomes. One's social identity can be accompanied with stressors when this identity is disenfranchised in any form, preventing the individual from receiving social benefits afforded to others. As an example, people of European descent tend to have more social benefits and power relative people of African or Asian descent. Race-related stress, a consequence of one's minoritized status has been connected to persistent occurrences of racism and microaggressions that tax the body's stress response, resulting in an increase in allostatic load [27, 28]. This rise in allostatic load (refer to **Table 1**) is linked with a sequela of conditions such as hypertension, depression, and kidney dysfunction, in the absence of adaptive coping approaches to buffer against these stressors [27, 29, 30]. The minority stress model is another example of a theory that has been used to explain the ways in which one's minoritized status affects their health outcomes. This theory postulates that stigma, prejudice, and discrimination foster stressful social environments for people with a minority status based on their race/ethnicity, gender, and sexuality. This can be compounded by socioeconomic stressors due to poverty, to produce poor mental health outcomes [31, 32]. Concerns about discrimination and risks for depression and anxiety have been documented among transgender and gender non-conforming individuals seeking pharmaceutical care, thereby affecting their health and treatment outcomes [33]. Given the evidence of racism, sexism, transphobia, and other systems of oppression in medicine and how they propagate inequities, ignoring these issues would be a severe disservice to patients with ESKD and other organ diseases.

Social justice initiatives provide a means for empowering transplant professionals and patients invested in health equity. This is in fact an essential part of health equity work if we are to tackle the underlying systems and structures behind these differences rather than proximal estimates such as race/ethnicity, sex, and income status [34]. As the world becomes more diverse through globalization and immigration, the field of transplantation has to evolve to recognize the value of diversity in science. The demographics in the US have changed significantly over the last few decades, a trend that is expected to continue, with more people identifying as Asian, Hispanic/Latine/x or multiracial [35]. Similar trends are apparent in the UK with an increase in the number of people who identify as Asian or Black [36]. Such changes in demographics are accompanied with a multitude of cultural experiences and practices as well as linguistic diversity which must be considered to practice good science [7, 37]. To better support patients, we cannot continue to use color-blind ideological approaches centered on Eurocentric, heteronormative (i.e., perception of heterosexuality as normal and standard), and cisnormative (refer to **Table 1**) values [37]. This necessitates an all-encompassing transplant science. Decreasing inequities in access to transplantation also comes with a global societal benefit. Diseases weaken an individual's ability to showcase their talents and make innovative contributions to our society.

## THE VALUE OF INTERSECTIONALITY

A term generated by Kimberlé Crenshaw, intersectionality posits that multiple social identities such as race, gender, sexuality, and disability status can converge at the microlevel of an individual. This could be presented as interlacing systems of privilege and oppression, such as racism, sexism, homophobia, transphobia, classism, and ableism [38]. Bowleg [39] conveyed the significance of applying an intersectionality framework in public health, noting that research focused solely on women or racial/ethnic minorities disregards the intersection of both identities and does not cater to the multidimensional nature of the term, minority. Intersectionality is proposed as valuable for comprehending structural inequalities that pertain to racism, sexism, classism, and other structures to produce health inequities [40–42]. This framework allows researchers to understand the experiences of patients from minoritized groups from their vantage point and actual social realities [40].

Specific to the field of nephrology and transplantation, advocates for intersectionality highlight benefits for eradicating inequities for lesbian, gay, bisexual, transgender, and queer (LGBTQ+) individuals [42, 43]. Other studies have performed statistical analyses that investigate interactions between factors such as gender and race with no direct reference to employing an intersectionality framework. Findings revealed fewer living donor evaluations for Black women, while White and Latino/Hispanic men finalized their pre-transplant evaluation sooner than their women counterparts [44, 45]. Altogether, the literature signifies a paucity of research on intersectionality in transplantation. When intersectional analyses are conducted without implementing an intersectionality framework, these studies do not assess for roots causes of inequities (e.g., racism, sexism, classism) but instead focus on proxies such as race, gender, and income status. The implementation of an intersectionality framework to address health inequities in access to transplantation could provide a nuanced understanding of the experiences of certain groups. For example, published research in the US indicates that people who identify as Black experience more barriers in access to transplant with some associations to institutional racism. Other intersectional questions to consider include: how do the experiences of Black men and women differ? How does the ethnic background, immigration status, and income of a Black individual play a role in access to transplantation? Given the potential for scientific gains in addressing inequities along the steps to transplant, the transplant community is encouraged to be intentional about executing this framework in research and practice.

## RECOMMENDATIONS FOR RESEARCH AND PRACTICE

One of the first steps in executing an intersectionality framework is to forgo the standardization of research on Eurocentric, cisgender, heterosexual men. Although we have made strides in improving the gender distribution of participants for clinical trials and other research methodologies, many of the surveys used in research are limiting [22]. The inclusion of simple demographical questions about ethnicity, sexuality, gender identity, and disability status could provide substantive information and facilitate intersectional analyses relative to focusing on race and sex. Moreover, most studies do not distinguish between biological sex (based on chromosomes and reproductive traits), and gender (socially constructed templates for men and women), making it harder to capture the experiences of people who do not subscribe to the gender binary or those who are intersex [9]. Race, a sociopolitical construct, is often used as an indicator for a biological construct even though genetic ancestry is a better measure. Racial differences in access to renal transplantation have been reported for decades yet little research has focused on varying forms of racism (e.g., interpersonal or institutional racism, microaggressions) accounting for some of these differences [18]. Of note, scholars are encouraged to be thoughtful in their use of social variables such as race and gender. Providing a rationale for using these variables and explicitly stating limitations (e.g., gender differences studied did not account for gender diverse individuals) as well as collecting data central to the research question, is useful for improving our scientific understanding of the role of social identities. This also reduces the exploitation of participants, especially when the questions contain personal and/or confidential information.

When examining intersections between aspects of a person's identity, it is advisable to use measures that explore the root causes of these differences. The literature consists of a plethora of measures that assess constructs such as homophobia, racism, sexism, and transphobia. Sample measures with good psychometric properties include, The Gendered-Racial Microaggressions Scale for Black Women [46], the Lesbian, Gay, Bisexual, and Transgender People of Color Microaggressions Scale [47], The Expectations of Racism Scale [48–50], Everyday Discrimination Scale [51], The Neosexism Scale [52], and Attitudes toward Transgender Men and Women [53]. Studies aimed at exploring the role of these underlying mechanisms can make use of such measures. Many of the measures have already been validated in health populations, including patients with CKD [29, 54, 55]. Understudied areas such as the role of ableism, ageism, and xenophobia warrant more attention and may offer a wider range of understanding of the complexities associated with a patient's multiple social statuses. Thom et al. [56] suggest that inequities may be apparent for patients with impaired decision-making (e.g., intellectual disability, cognitive impairment due to a condition) pursuing transplant.

Qualitative and quantitative guidelines for implementing an intersectionality framework such as an investigation of power and inequality already exist in the literature [57–59]. In many cases, a combination of both methodologies (i.e., a mixed-methods approach) could provide a deeper understanding of a research question [60]. Intersectionality workshops are also available via the Intersectionality Training Institute.

Strength-based approaches focused on the patient's strengths and abilities instead of deficiencies can be extremely beneficial. These approaches offer an opportunity for providers to learn from their patients who are the experts of their experiences about the strategies already implemented to navigate the barriers they face. This can also be empowering for patients as they are able to contribute to social justice initiatives related to their health. Community-based participatory research and qualitative research designs are examples of research methodologies that enable patients' role as co-creators of scientific knowledge. Targeted research questions and interventions (e.g., an intervention focused on Asian immigrant women) will also facilitate in-depth examination of an inequity for a specific group with intersecting identities. Scholars interested in implementing intersectionality in their work should dedicate the time to develop the appropriate proficiency for conducting this work and/or collaborate with other researchers that are already undertaking this work. Diverse research teams with members who possess the minoritized statuses being studied can reduce the potential for enacting additional harms and promote quality research [34]. Awareness of the appropriate terminology such as cisgender versus transgender, personal pronouns, and phrases that may be reflective of microaggressions is crucial to prevent harms on groups that already experience social oppression. Cultivating diverse research teams also promotes social justice given that people from minoritized backgrounds have been reported to receive less extramural funding to support their work in comparison to those from more privileged backgrounds [34]. Interdisciplinary work with professionals from backgrounds such as social work, psychology, and sociology would also strengthen the transplant community's efforts towards health equity. **Figure 1** provides a graphical representation of the different recommendations for research.

Specific to practice, curricula changes are needed to promote a more nuanced understanding of the role of intersectionality in patient care. This includes basic knowledge of the intersectionality framework, and instruction that incorporates clinical case studies with patients with intersecting identities, caution should be taken to ensure that these clinical cases do not perpetuate stereotypes but instead allow trainees to engage in critical thinking about the ways in which systems of oppression disenfranchise certain groups. Sabik [61] developed an intersectionality toolkit for public health education which can be tailed to nephrology populations for pedagogical purposes. To get to the root causes of inequities in transplantation, we cannot focus solely on implicit or unconscious bias training or diversity

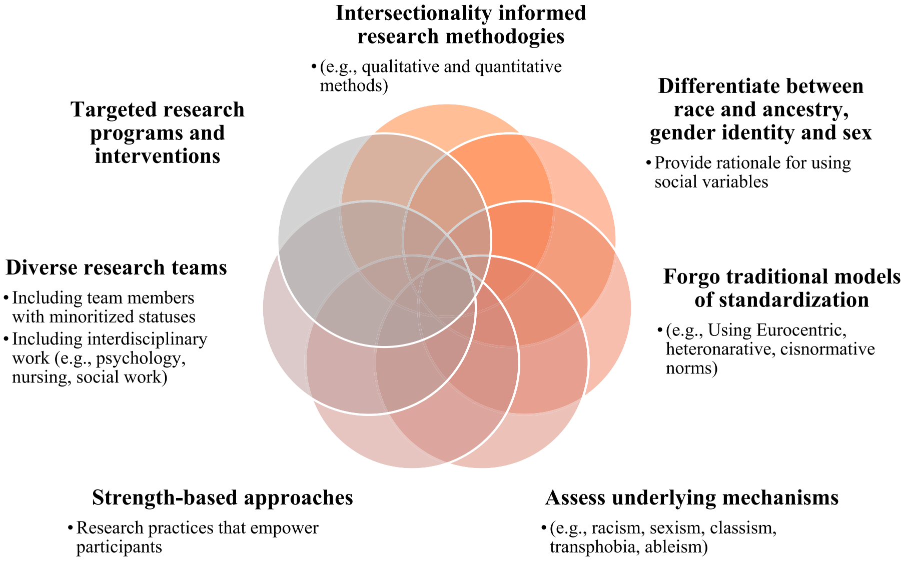


**FIGURE 1 |** Recommendations for incorporating intersectionality in research.

and inclusion initiatives as many of them fail to empower individuals with the necessary tools to combat bias and oppression [62]. Effective trainings use proactive approaches that empower individuals to identify and dismantle systems that allow injustices to persist. The most efficacious trainings comprehend the value of prioritizing the concerns of the most disenfranchised groups, in addition to cultivating environments that promote safety and belonging [62].

Another aspect of practicing intersectionality is basic knowledge of the sociocultural components of social groups and identities, combined with self-reflection. Some of the terms used to describe this process include cultural competence, cultural humility, and cultural safety [63]. Cultural competence and cultural humility are commonly used within the U.S. whereas cultural safety is typically used in New Zealand, Australia, and Canada [63]. The transplant community is encouraged to consider keys elements of these concepts in their application of any form of culturally relevant care. First, healthcare professionals should cater to the sociocultural needs of the patient group, part of which requires education about the group(s). Second, providers must engage in reflective exercises that entail learning new information and unlearning previously held knowledge, confronting and challenging personal biases and worldviews as well as the ways in which they may conflict or align with other worldviews or experiences. Third, awareness of power structures and differentials that may interfere with the patient-provider relationship and recognition of the ways in which colonization, racism, sexism, and other forms of discrimination contribute to health inequities. Finally, to truly invest in health equity, transplant professionals must recognize that patients are the experts of their own experiences. Therefore, providers should be transparent about their limitations in knowledge and devote themselves to a lifetime of learning [63, 64].

Another extension of administering intersectionality is by expanding the workforce with providers whose identities match those of their patients [65]. This is often the first step in decreasing medical mistrust and fears of discrimination among patients with intersecting minoritized identities. Diversity in transplant personnel improves our aptitude for offering culturally relevant interventions given the personal and professional expertise of these providers. Many associations within the field of transplant such as the American Society of Transplantation (AST) and the European Society for Organ Transplantation (ESOT) have already established a range of diversity initiatives. These include objectives focused on increasing the number of professionals from underrepresented groups and eliminating systemic racism. Other actionable steps could entail advocating for policy changes that mandate medical facilities to report on the demographics of their staff relative to that of their patient populations. Hospitals with complimentary statistics can be incentivized whereas those with little to no diversity can be educated on the significance of enhancing diversity within their institution, including specific instruction on intersectionality. Additionally, healthcare facilities with gaps in diversity could be required to cultivate, for example, a 5-year plan to improve their statistics. As part of their advocacy for policy changes, organizations like the ESOT and AST can outline the multiple health and social benefits of enhanced diversity, including increased revenue and innovation for healthcare systems [66].

Practical efforts towards health equity through an intersectional lens include institutional changes. Examples comprise but are not limited to inclusive in-take forms that account for the reporting of multiple forms of social identities and improved e-GFR guidelines for transgender and gender diverse ESKD patients who have undergone gender affirming hormone therapy. Finally, allyship, is an essential part of health equity and comprises practices and actions undertaken by people

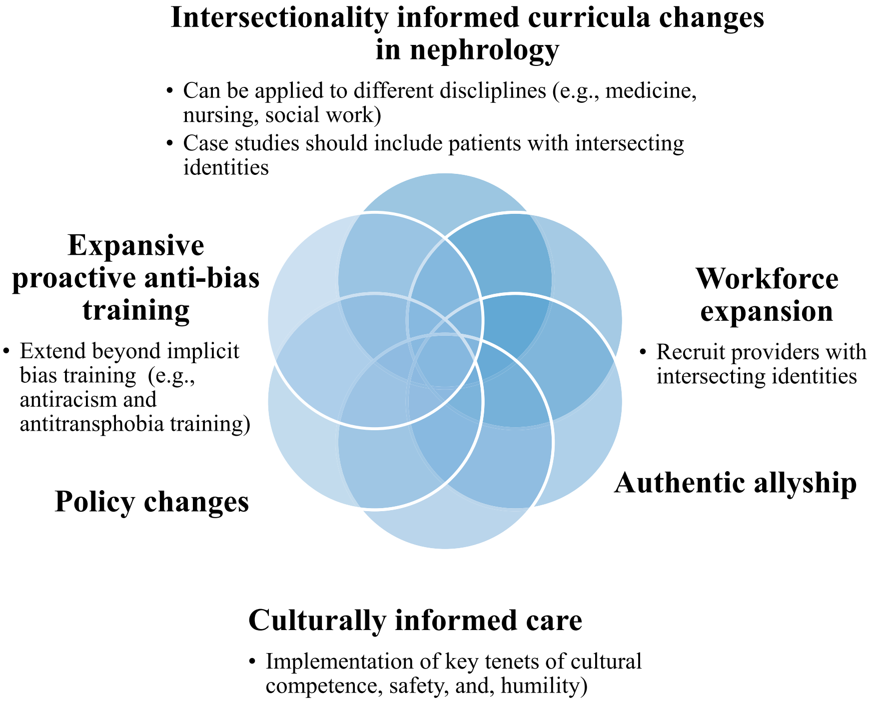


**FIGURE 2** | Recommendations for incorporating intersectionality in practice.

with privilege as they advocate for those who are susceptible to systems of oppression. Key tenets of authentic allyship require openness to criticism and constructive feedback, humility, advocacy, and consciousness of one's power. An essential component of authentic allyship is the amplify the voices of people with marginalized identities without taking up space from those same voices [67]. See **Figure 2** for a pictorial view of these recommendations.

## CONCLUSION

Intersectionality offers a valuable opportunity for the transplant community to make advancements towards parity in access to kidney transplantation. It requires multifaceted approaches and dedicated transplant professionals invested in improving outcomes for all patients.

## DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

## AUTHOR CONTRIBUTIONS

CN conceptualized and wrote the manuscript.

## CONFLICT OF INTEREST

The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

## REFERENCES

1. Kovesdy CP. Epidemiology of Chronic Kidney Disease: An Update 2022. *Kidney Int Suppl* (2022) 12(1):7–11. doi:10.1016/j.kisu.2021.11.003
2. United States Renal Data System. *USRDS Annual Data Report: Epidemiology of Kidney Disease in the United States*. Bethesda: National Institutes of Health, National Institute of Diabetes and Digestive and Kidney Diseases (2022). Available From: https://usrds-adr.niddk.nih.gov/202 (Accessed May 28, 2023).
3. Kidney Research UK. *The Health Economics of Kidney Disease to 2033* (2023). Available From: https://www.kidneyresearchuk.org/wp-content/uploads/2023/06/Economics-of-Kidney-Disease-full-report_accessible.pdf (Accessed August 23, 2023).
4. Elrggal ME, Gokcay Bek S, Shendi AM, Tannor EK, Nlandu YM, Gaipov A. Disparities in Access to Kidney Transplantation in Developing Countries. *Transplantation* (2021) 105(11):2325–9. doi:10.1097/TP.0000000000003585
5. Harding JL, Perez A, Snow K, Retzloff S, Urbanski M, White MS, et al. Non-Medical Barriers in Access to Early Steps of Kidney Transplantation in the United States – A Scoping Review. *Transplant Rev (Orlando)* (2021) 35(4): 100654. doi:10.1016/j.trre.2021.100654
6. Udayaraj U, Ben-Shlomo Y, Roderick P, Casula A, Dudley C, Johnson R, et al. Social Deprivation, Ethnicity, and Access to the Deceased Donor Kidney

Transplant Waiting List in England and Wales. *Transplantation* (2010) 90(3): 279–85. doi:10.1097/TP.0b013e3181e346e3

7. Grossi AA, Ouoti F, Masiero L, Troni A, Cianchi T, Maggiore U, et al. Inequities in Organ Donation and Transplantation Among Immigrant Populations in Italy: A Narrative Review of Evidence, Gaps in Research and Potential Areas for Intervention. *Transpl Int* (2023) 36:11216. doi:10.3389/ti.2023.11216
8. Boulware LE, Ephraim PL, Ameling J, Lewis-Boyer L, Rabb H, Greer RC, et al. Effectiveness of Informational Decision Aids and a Live Donor Financial Assistance Program on Pursuit of Live Kidney Transplants in African American Hemodialysis Patients. *BMC Nephrol* (2018) 19(1):107. doi:10.1186/s12882-018-0901-x
9. Melk A, Babitsch B, Borchert-Mörlins B, Claas F, Dipchand AI, Eifert S, et al. Equally Interchangeable? How Sex and Gender Affect Transplantation. *Transplantation* (2019) 103(6):1094–110. doi:10.1097/TP.0000000000002655
10. Nonterah CW, Gardiner HM. Pre-Transplant Evaluation Completion for Black/African American Renal Patients: Two Theoretical Frameworks. *Patient Educ Couns* (2020) 103(5):988–98. doi:10.1016/j.pec.2019.11.005
11. Ramadan OI, Naji A, Levine MH, Porrett PM, Dunn TB, Nazarian SM, et al. Kidney Transplantation and Donation in the Transgender Population: A Single-Institution Case Series. *Am J Transpl* (2020) 20(10):2899–904. doi:10.1111/ajt.15963
12. Sheikh SS, Locke JE. Gender Disparities in Transplantation. *Curr Opin Organ Transpl* (2021) 26(5):513–20. doi:10.1097/MOT.0000000000000909
13. Sullivan C, Leon JB, Sayre SS, Marbury M, Ivers M, Pencak JA, et al. Impact of Navigators on Completion of Steps in the Kidney Transplant Process: A Randomized, Controlled Trial. *Clin J Am Soc Nephrol* (2012) 7(10):1639–45. doi:10.2215/CJN.11731111
14. Nonterah CW, Utsey SO, Gupta G, Wilkins S, Gardiner HM. A Nominal Group Technique Study of Patients Who Identify as Black or African American and Access to Renal Transplantation. *Prog Transpl* (2023) 33(2): 141–9. doi:10.1177/15269248231164164
15. McLeroy KR, Steckler A, Bibeau D, Glanz K. An Ecological Perspective on Health Promotion Programs. *Health Educ Q* (1988) 15(4):351–77. doi:10.1177/109019818801500401
16. Stokols D. Translating Social Ecological Theory Into Guidelines for Community Health Promotion. *Am J Health Promot* (1996) 10(4):282–98. doi:10.4278/0890-1171-10.4.282
17. Waterman AD, Rodrigue JR, Purnell TS, Ladin K, Boulware LE. Addressing Racial and Ethnic Disparities in Live Donor Kidney Transplantation: Priorities for Research and Intervention. *Semin Nephrol* (2010) 30(1):90–8. doi:10.1016/j.semnephrol.2009.10.010
18. Purnell TS, Simpson DC, Callender CO, Boulware LE. Dismantling Structural Racism as a Root Cause of Racial Disparities in COVID-19 and Transplantation. *Am J Transpl* (2021) 21(7):2327–32. doi:10.1111/ajt.16543
19. Bellini MI, Nozdrin M, Naesens M, Martins PN. Eliminating Race From eGFR Calculations: Impact on Living Donor Programs. *Transpl Int* (2022) 35:10787. doi:10.3389/ti.2022.10787
20. Boulware LE, Mohottige D, Maciejewski ML. Race-Free Estimation of Kidney Function: Clearing the Path Toward Kidney Health Equity. *JAMA* (2022) 327(23):2289–91. doi:10.1001/jama.2022.7310
21. Umeukeje EM, Koonce TY, Kusnoor SV, Ulasi II, Kostelanetz S, Williams AM, et al. Systematic Review of International Studies Evaluating MDRD and CKD-EPI Estimated Glomerular Filtration Rate (eGFR) Equations in Black Adults. *PLoS One* (2022) 17(10):e0276252. doi:10.1371/journal.pone.0276252
22. Park C, Jones MM, Kaplan S, Koller FL, Wilder JM, Boulware LE, et al. A Scoping Review of Inequities in Access to Organ Transplant in the United States. *Int J Equity Health* (2022) 21(1):22. doi:10.1186/s12939-021-01616-x
23. Ross LF, Thistlethwaite JR. Gender and Race/Ethnicity Differences in Living Kidney Donor Demographics: Preference or Disparity? *Transplant Rev (Orlando)* (2021) 35(3):100614. doi:10.1016/j.trre.2021.100614
24. Rota-Musoll L, Brigidi S, Molina-Robles E, Oriol-Vila E, Perez-Oller L, Subirana-Casacuberta M. An Intersectional Gender Analysis in Kidney Transplantation: Women Who Donate a Kidney. *BMC Nephrol* (2021) 22(1):59. doi:10.1186/s12882-021-02262-9
25. Vinson AJ, Ahmed SB. Representation of Women in Contemporary Kidney Transplant Trials. *Transpl Int* (2023) 36:11206. doi:10.3389/ti.2023.11206
26. Bailey PK, Caskey FJ, MacNeill S, Tomson CRV, Dor FJMF, Ben-Shlomo Y. Mediators of Socioeconomic Inequity in Living-Donor Kidney Transplantation: Results From a UK Multicenter Case-Control Study. *Transplant Direct* (2020) 6(4):e540. doi:10.1097/TXD.0000000000000986
27. Clark R, Anderson NB, Clark VR, Williams DR. Racism as a Stressor for African Americans. A Biopsychosocial Model. *Am Psychol* (1999) 54(10): 805–16. doi:10.1037//0003-066x.54.10.805
28. Harrell SP. A Multidimensional Conceptualization of Racism-Related Stress: Implications for the Well-Being of People of Color. *Am J Orthopsychiatry* (2000) 70(1):42–57. doi:10.1037/h0087722
29. Arriola KJ, Lewis TT, Pearce B, Cobb J, Weldon B, Valentin MIZ, et al. A Randomized Trial of Race-Related Stress Among African Americans With Chronic Kidney Disease. *Psychoneuroendocrinology* (2021) 131:105339. doi:10.1016/j.psyneuen.2021.105339
30. Cobb RJ, Thorpe RJ, Norris KC. Everyday Discrimination and Kidney Function Among Older Adults: Evidence From the Health and Retirement Study. *J Gerontol A Biol Sci Med Sci* (2020) 75(3):517–21. doi:10.1093/gerona/glz294
31. Brooks VR. *Minority Stress and Lesbian Women*. MA: Lexington Books (1981).
32. Meyer IH. Prejudice, Social Stress, and Mental Health in Lesbian, Gay, and Bisexual Populations: Conceptual Issues and Research Evidence. *Psychol Bull* (2003) 129(5):674–97. doi:10.1037/0033-2909.129.5.674
33. Lewis NJW, Batra P, Misiolek BA, Rockafellow S, Tupper C. Transgender/Gender Nonconforming Adults' Worries and Coping Actions Related to Discrimination: Relevance to Pharmacist Care. *Am J Health Syst Pharm* (2019) 76(8):512–20. doi:10.1093/ajhp/zxz023
34. Kelly C, Dansereau L, Sebring J, Aubrecht K, FitzGerald M, Lee Y, et al. Intersectionality, Health Equity, and EDI: What's the Difference for Health Researchers? *Int J Equity Health* (2022) 21(1):182. doi:10.1186/s12939-022-01795-1
35. Jones N, Marks R, Ramirez R, Rios-Vargas M. *2020 Census Illuminates Racial and Ethnic Composition of the Country*. United States: United States Census Bureau (2021). Available at: https://www.census.gov/library/stories/2021/08/improved-race-ethnicity-measures-reveal-united-states-population-much-more-multiracial.html (Accessed May 28, 2023).
36. Office for National Statistics (ONS). *Ethnic Group, England and Wales: Census 2021* (2022). Available From: https://www.ons.gov.uk/peoplepopulationandcommunity/culturalidentity/ethnicity/bulletins/ethnicgroupenglandandwales/census2021 (Accessed May 28, 2023).
37. Plaut VC. Diversity Science: Why and How Difference Makes a Difference. *Psychol Inq* (2010) 21(2):77–99. doi:10.1080/10478401003676501
38. Crenshaw K. Demarginalizing the Intersection of Race and Sex: A Black Feminist Critique of Antidiscrimination Doctrine, Feminist Theory and Antiracist Politics. *Univ Chicago Leg Forum* (1989) 1(8).
39. Bowleg L. The Problem With the Phrase Women and Minorities: Intersectionality-An Important Theoretical Framework for Public Health. *Am J Public Health* (2012) 102(7):1267–73. doi:10.2105/AJPH.2012.300750
40. Bowleg L. We're Not All in This Together: On COVID-19, Intersectionality, and Structural Inequality. *Am J Public Health* (2020) 110(7):917. doi:10.2105/AJPH.2020.305766
41. Heard E, Fitzgerald L, Wigginton B, Mutch A. Applying Intersectionality Theory in Health Promotion Research and Practice. *Health Promot Int* (2020) 35(4):866–76. doi:10.1093/heapro/daz080
42. Lett E, Logie CH, Mohottige D. Intersectionality as a Lens for Achieving Kidney Health Justice. *Nat Rev Nephrol* (2023) 19(6):353–4. doi:10.1038/s41581-023-00715-y
43. Mohottige D, Lunn MR. Advancing Equity in Nephrology: Enhancing Care for LGBTQ+ Patients and Our Workforce. *Clin J Am Soc Nephrol* (2019) 14(7): 1094–6. doi:10.2215/CJN.01950219
44. Gillespie A, Hammer H, Kolenikov S, Polychronopoulou A, Ouzienko V, Obradovic Z, et al. Sex Differences and Attitudes Toward Living Donor Kidney Transplantation Among Urban Black Patients on Hemodialysis. *Clin J Am Soc Nephrol* (2014) 9(10):1764–72. doi:10.2215/CJN.12531213
45. Monson RS, Kemerley P, Walczak D, Benedetti E, Oberholzer J, Danielson KK. Disparities in Completion Rates of the Medical Prerenal Transplant Evaluation by Race or Ethnicity and Gender. *Transplantation* (2015) 99(1):236–42. doi:10.1097/TP.0000000000000271
46. Lewis JA, Neville HA. Construction and Initial Validation of the Gendered Racial Microaggressions Scale for Black Women. *J Couns Psychol* (2015) 62(2): 289–302. doi:10.1037/cou0000062

47. Balsam KF, Molina Y, Beadnell B, Simoni J, Walters K. Measuring Multiple Minority Stress: The LGBT People of Color Microaggressions Scale. *Cultur Divers Ethnic Minor Psychol* (2011) 17(2):163–74. doi:10.1037/a0023244
48. Benkert R, Peters RM, Clark R, Keves-Foster K. Effects of Perceived Racism, Cultural Mistrust and Trust in Providers on Satisfaction With Care. *J Natl Med Assoc* (2006) 98(9):1532–40.
49. Lewis TT, Lampert R, Charles D, Katsz S. Expectations of Racism and Carotid Intima-Media Thickness in African American Women. *Psychosom Med* (2019) 81:759–68. doi:10.1097/PSY.0000000000000684
50. Mendoza-Denton R, Downey G, Purdie VJ, Davis A, Pietrzak J. Sensitivity to Status-Based Rejection: Implications for African American Students' College Experience. *J Pers Soc Psychol* (2002) 83(4):896–918. doi:10.1037//0022-3514.83.4.896
51. Williams DR, Yu Y, Jackson JS, Anderson NB. Racial Differences in Physical and Mental Health: Socioeconomic Status, Stress, and Discrimination. *J Health Psychol* (1997) 2(3):335–51. doi:10.1177/135910539700200305
52. Tougas F, Brown R, Beaton AM, Joly S. Neosexism: Plus Ça Change, Plus C'est Pareil. *Pers Soc Psychol Bull* (1995) 21(8):842–9. doi:10.1177/0146167295218007
53. Billard TJ. Attitudes Toward Transgender Men and Women: Development and Validation of a New Measure. *Front Psychol* (2018) 9:387. doi:10.3389/fpsyg.2018.00387
54. Dale SK, Nelson CM, Wright IA, Etienne K, Lazarus K, Gardner N, et al. Structural Equation Model of Intersectional Microaggressions, Discrimination, Resilience, and Mental Health Among Black Women With HIV. *Health Psychol* (2023) 42(5):299–313. doi:10.1037/hea0001275
55. Hamoda RE, McPherson LJ, Lipford K, Jacob Arriola K, Plantinga L, Gander JC, et al. Association of Sociocultural Factors With Initiation of the Kidney Transplant Evaluation Process. *Am J Transpl* (2020) 20(1):190–203. doi:10.1111/ajt.15526
56. Thom RL, Dalle-Ave A, Bunnik EM, Krones T, Assche KV, Ruck Keene A, et al. Inequitable Access to Transplants: Adults With Impaired Decision-Making Capacity. *Transplantation* (2022) 106(9S):10084–S92. doi:10.3389/ti.2022.10084
57. Bowleg L, Bauer G. Invited Reflection: Quantifying Intersectionality. *Psychol Women Q* (2016) 40(3):337–41. doi:10.1177/0361684316654282
58. Else-Quest NM, Hyde JS. Intersectionality in Quantitative Psychological Research: I. Theoretical and Epistemological Issues. *Psychol Women Q* (2016) 40(2):155–70. doi:10.1177/0361684316629797
59. Kelly C, Kasperavicius D, Duncan D, Etherington C, Giangregorio L, Presseau J, et al. 'Doing' or 'Using' Intersectionality? Opportunities and Challenges in Incorporating Intersectionality Into Knowledge Translation Theory and Practice. *Int J Equity Health* (2021) 20(1):187. doi:10.1186/s12939-021-01509-z
60. Watson-Singleton NN, Lewis JA, Dworkin ER. Toward a Socially Just Diversity Science: Using Intersectional Mixed Methods Research to Center Multiply Marginalized Black, Indigenous, and People of Color (BIPOC). *Cultur Divers Ethnic Minor Psychol* (2023) 29(1):34–42. doi:10.1037/cdp0000477
61. Sabik NJ. The Intersectionality Toolbox: A Resource for Teaching and Applying an Intersectional Lens in Public Health. *Front Public Health* (2021) 9:772301. doi:10.3389/fpubh.2021.772301
62. Asare JG. *What People Misunderstand About Anti-Racism Training*. New Jersey, U.S: Forbes (2022). Available at: https://www.forbes.com/sites/janicegassam/2022/01/04/what-people-misunderstand-about-anti-racism-training/?sh=771ab29243b5 (Accessed May 28, 2023).
63. Thompson PB, Taylor K. *A Cultural Safety Approach to Health Psychology*. Palgrave Macmillan Cham (2021). Available at: https://link.springer.com/10.1007/978-3-030-76849-2 (Accessed May 28, 2023).
64. Tervalon M, Murray-García J. Cultural Humility Versus Cultural Competence: A Critical Distinction in Defining Physician Training Outcomes in Multicultural Education. *J Health Care Poor Underserved* (1998) 9(2):117–25. doi:10.1353/hpu.2010.0233
65. Butler T, Cummings LS, Purnell TS. The Case for Prioritizing Diversity in the Transplantation Workforce to Advance Kidney Health Equity. *J Am Soc Nephrol* (2022) 33(10):1817–9. doi:10.1681/ASN.2022040429
66. Gomez LE, Bernet P. Diversity Improves Performance and Outcomes. *J Natl Med Assoc* (2019) 111(4):383–92. doi:10.1016/j.jnma.2019.01.006
67. Nonterah CW. Making Space When Black Voices Speak Their Truth. In: Small C, Fuller MF, editors. *Anti-Blackness, White Privilege and Authentic Allyship*. New York: Oxford University Press (2024).

REVIEW
published: 31 July 2023
doi: 10.3389/ti.2023.11310

# Taking a "Care Pathway/Whole Systems" Approach to Equality Diversity Inclusion (EDI) in Organ Donation and Transplantation in Relation to the Needs of "Ethnic/Racial/Migrant" Minority Communities: A Statement and a Call for Action

*Alessandra Agnese Grossi*[1,2], *Gurch Randhawa*[3], *Nichon Esther Jansen*[4] *and* *David Paredes-Zapata*[5,6,7]*

*[1]Center for Clinical Ethics, Department of Biotechnologies and Life Sciences, University of Insubria, Varese, Italy, [2]Department of Human Sciences, Innovation and Territory, University of Insubria, Como, Italy, [3]Institute for Health Research, University of Bedfordshire, Luton, United Kingdom, [4]Dutch Transplant Foundation, Leiden, Netherlands, [5]Donation and Transplant Coordination Section, Hospital Clínic, Barcelona, Spain, [6]Surgical Department, University of Barcelona, Barcelona, Spain, [7]Donation and Transplantation Institute Foundation, Barcelona, Spain*

International evidence shows variation in organ donation and transplantation (ODT) based upon a range of patient characteristics. What is less well understood is the impact of patient "ethnicity/race/immigration background," as these terms are defined and intended differently across countries. We also know that these characteristics do not operate in isolation but intersect with a range of factors. In this paper, we propose a framework that seeks to clarify the definition of the key terms "ethnicity/race/migrant" and to review how these communities are operationalized across European studies about inequities in ODT. Further, patients and the public wish to see Equality Diversity Inclusion (EDI) approaches in their everyday lives, not just in relation to ODT. We propose a 'care pathway/whole-systems' approach to ODT encompassing culturally competent public health interventions for a) the prevention and management of chronic diseases, b) improvements in public engagement for the promotion of the culture of ODT and enhancements in end-of-life care, through to c) enhanced likelihood of successful transplant among migrant/ethnic minority communities. Our framework recognizes that if we truly wish to take an EDI approach to ODT, we need to adopt a more social, human and holistic approach to examining questions around patient ethnicity.

**Keywords: organ donation, organ transplantation, migrants, ethnic minorities, inequities**

***Correspondence:**
*David Paredes-Zapata*
*dparedes@clinic.cat*

***Received:*** *26 February 2023*
***Accepted:*** *13 July 2023*
***Published:*** *31 July 2023*

***Citation:***
*Grossi AA, Randhawa G, Jansen NE and Paredes-Zapata D (2023) Taking a "Care Pathway/Whole Systems" Approach to Equality Diversity Inclusion (EDI) in Organ Donation and Transplantation in Relation to the Needs of "Ethnic/Racial/Migrant" Minority Communities: A Statement and a Call for Action. Transpl Int 36:11310. doi: 10.3389/ti.2023.11310*

---

**Abbreviations:** BAME, Black, Asian and Minority Ethnic; EDI, equality diversity inclusion; ESKD, end stage kidney disease; HLA, human leukocyte antigen; KTEI, kidney transplant equity index; LDKT, living donor kidney transplantation; ODT, organ donation and transplantation; UK, United Kingdom; US, United States; WL, waiting list.

## INTRODUCTION

There is a plethora of evidence in most countries across the world showing variation in organ donation and transplantation (ODT) based upon a range of patient characteristics. These include—but are not limited to—age, gender, ethnicity, income, educational level, cultural beliefs, and religiosity [1–3]. As highlighted recently within important documents published by the European Kidney Health Alliance and the European Society for Organ Transplantation [4–6], the prevention and elimination of inequities related to these aspects is emergent in ODT in Europe. However, relative to other factors, what is less well understood is the impact of patient "ethnicity" and/or "race" and/or "immigration background," as these terms are defined and intended differently across countries [7]. It is well known that these communities are highly heterogeneous as there can be great variations even within ethnic minority groups depending on the individual reasons for and circumstances of migration, the time elapsed since immigration, the number of generations they have spent in a given country (i.e., first- [foreign-born of foreign-born parents], second- [native-born of foreign-born parents], or even third-/fourth-generation migrants), immigration history of host countries, integration policies, availability of culturally competent healthcare services, and other such characteristics [8–11]. According to the European Commission, in 2022, 447.2 million inhabitants are living in the EU. Of these, 23.7 million are non-EU citizens (5.3% of the EU's total population), and 37.5 million people were born outside the EU (8.4% of all EU inhabitants) [12].

Pilot studies which have sought to examine these aspects in relation to ODT have shown that "ethnicity" and/or "race" and/or "immigration background" do not operate in isolation but intersect with a range of other socioeconomic factors at the individual level, and with other factors at the interpersonal and societal level [13, 14]. Therefore, to improve data comparability in Europe and to enable the effective development and subsequent implementation of interventions against inequities, there is a need for consensus on how these communities are conceptualized and what data should be collected when research is performed on these populations in ODT [6, 8]. Besides, research suggests that patients and the public do not wish to see Equality Diversity Inclusion (EDI) approaches only in relation to ODT but in their everyday lives (i.e., by improved education for the prevention and early treatment of chronic conditions that have the potential to lead to organ disease or failure). Yet, only few if any public health interventions in ODT have been framed so [8, 15].

To fill these gaps, this study aims to clarify the definition of the key terms "ethnicity," "race," and "migrant" and to review how these communities are operationalized in studies addressing inequities in ODT in Europe. Second, it puts forward a proposal for a "care pathway/whole-systems" approach to ODT encompassing culturally competent public health interventions for a) the prevention and management of chronic diseases, b) improvements in public engagement for the promotion of the culture of ODT and enhancements in end-of-life care, through to c) enhanced likelihood of successful transplant among migrant/ethnic minority communities.

## "ETHNIC/RACIAL/MIGRANT" MINORITY COMMUNITIES: WHAT OPERATIONALIZATION IN RELATION TO ORGAN DONATION AND TRANSPLANTATION ACROSS EUROPE?

The terms "ethnicity," "race" and "migrant" are often considered synonymous; however, they are not interchangeable. For instance, although they are interconnected, there are substantial specific features related to each that require consideration [7]. "Ethnicity" is defined as "the social group a person belongs to, and either identifies with or is identified with by others, as a result of a mix of cultural and other factors including language, diet, religion, ancestry, and physical features" [16] that are shared by individuals in the same group [7]. Similarly—although we acknowledge that "there is only one race—the human race," to quote Rosa Parks (civil rights activist US [1913–2005])—but still, differently, "race" is "the group [. . .] a person belongs to as a result of a mix of physical features such as skin color and hair texture, which reflect ancestry and geographical origins, as identified by others or, increasingly, as self-identified" [16]. In contrast, a "migrant" is "any person who is outside a State of which he or she is a citizen or national, or, in the case of a stateless person, his or her State of birth or habitual residence. The term includes migrants who intend to move permanently or temporarily, and those who move in a regular or documented manner as well as migrants in irregular situations" [17]. At the European level, the European Commission stresses that the immigrant category does not include persons who travel for tourism or business purposes and excludes intra-European Union mobility [18]. Research has noted that immigrant status cuts across the traditional social determinants of health and has the potential to amplify them at multiple levels which influence a person's health. These include biological factors (i.e., age, sex, constitutional factors), individual lifestyle factors, social and community influences, living and working conditions, and the general socioeconomic, cultural, and environmental conditions [19]. Similarly, although it is well-established that ethnicity is a social construct that may vary over time within individuals and across generations, and according to political, cultural and societal features, an individual's ethnicity can provide clinical clues that may be of value for medical purposes and for studying differences in populations that may be relevant to health. These include geographic origin and immigrant status, housing conditions and employment patterns, dietary habits, cultural and environmental factors, and genetic ancestry [20]. It follows that immigrant status diverges from ethnicity and race, but simultaneously includes elements of both. These features can be present at various intensities across the composition of different ethnic minority groups. However, while ethnicity in the United States (US) is mostly self-perceived, the operationalization of ethnicity in Europe is heterogeneous in that it is broadly defined by surrogate variables (i.e., country of birth, citizenship, former citizenship, etc.) [7]. Studies have stressed that lack of consensus surrounding these concepts extends to studies in ODT [6]. However, formal research regarding this aspect is lacking. To fill this gap, we reviewed studies assessing inequities among these communities at the different stages of the ODT process and confirmed that, in the European context, these populations are categorized in a heterogeneous fashion. Besides, we found that most, except few, studies are retrospective (i.e., not always adjusted for potential confounders and unable to determine the impact of the factors associated with ethnicity and immigrant status on inequities at the different phases of the ODT process), and focused on kidney transplantation (**Supplementary Table S1**). Studies performed in the UK categorize these individuals according to broad ethnicity categories such as Black, Asian/South Asian and other minority ethnic groups [8, 21–25]. The reason why the majority of studies does not provide any formal explanation of how ethnicity is determined is likely due to ethnicity data being available in either electronic patient records [25] or registry databases [24]. Yet, one study highlighted that, where ethnicity was not available, South Asian origin was derived by name screening [21], whereas another one explained that Black ethnicity was attributed to individuals that are genetically of Sub-Saharan African origin (mostly African Caribbean or West African) [23]. Studies from other European countries beyond the UK define these populations as first-generation migrants/ethnic minority populations based on country of birth alone [26–28], nationality and place of birth [29], citizenship and country of birth of patients and their families to allow the collection of more detailed data regarding migration history [30], and other unspecified factors [31]. Only one review article—which does define these populations as “migrants and ethnic minorities”—states that the data was missing by ethnic group [32], whereas another study classifies kidney transplant patients according to their racial background (i.e., Black) based on country of origin [33]. Most [34–37], but not all studies [38] of the pediatric patient population in the kidney transplant setting categorize these subjects as born of immigrant parents. The immigration background of parents is derived from at least one parent being a non-native speaker [36], one or both parents being born in a non-Western European country [37] or, more generically, being born of immigrant families [34, 35]. In contrast, one study classifies children based on their racial background according to the broader geographical area of origin [38].

Studies have noted that lack of consideration of within-group variations like cultures, language(s), religious affiliation, number of generations spent in the host country, time elapsed since immigration for first-generation migrants, socioeconomic status, and specific Human Leukocyte Antigen (HLA) types may lead to failure of considering the features with the potential to provide valuable insights into the heterogeneity of different ethnic minority groups and enable the development of more targeted interventions accordingly [8, 25, 39].

The European Public Health Association acknowledges the controversial definition and categorization of “ethnic minorities” in Europe. However, it stresses that, regardless of how these populations are defined and categorized, the features related to “ethnicity” are frequently rather independent of ‘immigrant status’ [40]. Besides, individuals who have migrated from other countries or who are from ethnic minorities in Europe are likely to experience similar health inequities [40, 41], biological features vary among ethnic groups [42], and individuals belonging to “visible” ethnic minorities may experience more significant inequities [43]. Therefore, we contend that both the features related to “ethnicity” (including country of origin or descent) and “immigrant status” (or immigration history) should be considered for the purposes of studies in relation to ODT. Additionally, the intersection with the multiple factors associated to each requires further research.

## Prevention and Treatment of Long-Term Conditions at Risk of Organ Disease or Failure

The World Health Organization suggests that 80% of non-communicable diseases including premature heart disease, stroke and diabetes may be prevented by intervening on risk factors (i.e., tobacco use, physical inactivity, unhealthy diet, and alcohol abuse) through behavior change interventions [44]. However, migrant and ethnic minority populations are disproportionately affected by chronic conditions like diabetes, hypertension, and obesity, and also communicable diseases such as hepatitis B and C [45, 46] which all have the potential to lead to end stage organ failure.

For example, in the United Kingdom (which has a longer-standing immigration history relative to other European countries), kidney dysfunction is a problem that disproportionately affects Black, Asian and Minority Ethnic individuals (BAME). Although BAME people represent only 11% of the UK population, they accounted for 24% of patients dependent on renal replacement therapy in 2017. BAME people are more likely to develop chronic kidney disease than white people, and those who have chronic kidney disease experience faster decline in kidney function than white people. There is some emerging evidence from the UK Biobank that HLA alleles may have an impact upon kidney function [47]. Understanding the genetic causes of kidney dysfunction in BAME people in the UK and elsewhere could play an important role in reducing these inequities [47]. Such as the case of genetic susceptibility to kidney disease, particularly for variants in the APOL1 gene that are associated with kidney disease. Research suggests that the presence of two of these APOL1 variants was significantly associated with increased progression of CKD candidates with sub-Saharan African ancestry, including African American and Caribbean populations [48].

Additionally, some important factors to consider is how mortality rates for patients undergoing dialysis differ by ethnicity. A study from the United States (US) exploring this aspect found substantial differences by ethnicity across the 50 states. After matched analyses for comparable age and risk factors, mortality risk no longer differed for Whites or Blacks but remained much greater for territory-dwelling Hispanics and Asians [49]. It should be emphasized that certain blood and HLA groups are common among certain ethnic minorities and rare among the proportionately more numerous Caucasian donors. In kidney transplantation, and particularly in the case of young recipients, poor HLA class II matching is more frequent for patients from certain ethnic minorities and unfortunately highly detrimental for graft outcome. Therefore, it is important to inform people of the interest of being all organ donors after their death, regardless of ethnicity and to better understand the implication of reduced HLA class II matching policies in kidney allocation and reconsideration of best practices to reduce inequalities while optimizing patient outcomes [50]. Since organ allocation rules are national and transparent, only the blood group and not the HLA group must be taken into account for liver, lung or heart transplants and access to transplants should be almost comparable for those patients actively registered on the waiting list (WL), regardless of their ethnic origin and whether or not they are migrants.

## Why the Shortage of Organ Donors

Shortage of *post mortem* organ donors in relation to the number of patients on the WL for transplantation is seen in many countries, although there are differences [51]. When taking a closer look at WLs, ethnic minorities appear to be disproportionately represented [8]. As illustrated previously, this is due to the high prevalence of chronic disease conditions among these populations [45]. For instance, data from Europe (including the United Kingdom) and North America show that many migrant and ethnic minority communities have a higher risk of developing end stage organ disease (especially kidney disease), are disproportionately represented in the patient population requiring renal replacement therapy and wait longer to receive a kidney transplant, compared with the “white” population [8, 52]. However, the number of post-mortem organ donors from migrant and ethnic minority communities is low for several reasons. First, there is a strong association between patient race/ethnicity and increased use of life-prolonging treatments, longer hospital stays, and intensive care units as a location of death. The Ethicus-2 study showed that end-of-life care practices vary among intensive care units worldwide [53]. On the other hand, the availability of tools to support end-of-life decision-making with patients and families from ethnocultural minority backgrounds is largely unknown [54]. Prolonged life treatments, religious beliefs and cultural perspectives, including language, can form barriers to discuss organ donation as part of end-of-life care.

Second, when looking at the organ donor register, for example, in the UK, more people identifying as white are present on the donor register than all other ethnic groups [55]. Reasons for the lack of sign up in these groups include lower donation knowledge, inferior likelihood to discuss donation and their wishes with family members, unacceptability due to religious beliefs and lack of trust in healthcare professionals.

Third, when donation is requested to a donor family the consent rate among ethnic minorities (blacks, Hispanics, and Asians) is lower than in whites [56]. As the authors’ stated, lower consent rates may be due in part to personal, cultural, or religious beliefs. However, portions of these differences are due to disproportionate miscommunication, misinformation, or lack of trust among migrant and ethnic minorities.

As a result, there is a need for end-of-life care which meets the needs of this group of patients. Providing end-of-life care to patients from different cultures is a challenge for services as there can be barriers to communication in the form of language, delegated decision-making within families, and reluctance to discuss about death [57–59]. It is important that solutions to EDI in end-of-life care are taken synchronously with developing culturally competent approaches to organ donation [57, 58].

## Likelihood of Transplant Accessibility and Successful Outcomes

There are substantial variations in kidney transplant incidence, prevalence, availability, accessibility, and quality worldwide, with the lowest rates evident in low- and lower-middle income countries. Understanding these inequities will inform efforts to increase awareness and the adoption of practices that will ensure that high-quality kidney transplant care is provided around the world [60].

Despite increasing interest in equitable healthcare, inequities in access to solid organ transplantation, especially among “ethnic/racial/migrant” minority patients are documented. In the UK, non-white ethnic minorities—mainly of Indian, Pakistani and Caribbean descent—comprise 11% of the population, 7% of organ donors, 35% of people awaiting a kidney transplant, and 21% of people who died on the WL. Norway has an increasingly diverse population. Many non-white migrant and ethnic minority groups, largely of Somali, Pakistani, Syrian, Iraqi and Eritrean descent, share many of the same risk factors for end stage kidney disease (ESKD), though currently protected by a younger age demographic. Little is known about ethnicity and organ donation in Norway because ethnicity data is not routinely collected, and where this is done only country of birth is recorded. Blood and tissue types differ between ethnic groups but are more often shared by close family members and people of the same ethnicity. Ideally, donors should be as diverse as the recipient population [32].

A review of inequities in access to heart, lung, liver, pancreas and kidney transplantation based on the social determinants of health (race, income, education, geography, insurance status, health literacy and engagement) in the US found that racial and ethnic minorities, women, and patients in lower socioeconomic status groups are less likely to be referred, evaluated, and registered on the transplant WL. Yet, the quality of the data describing these inequities was variable across the transplant literature and overwhelmingly focused on kidney transplantation [1], similar to studies in Europe (**Supplementary Table S1**).

Beyond kidney transplantation, most studies on ethnicity-based outcomes in pancreas transplantation are from the United States, where healthcare delivery is predominantly insurance-based. There is no equivalent data from the

United Kingdom, where the healthcare system is publicly funded. A recent article published in 2022 reported the first single center experience on ethnicity-based outcomes of pancreas transplantation from the United Kingdom. A retrospective analysis was performed of all patients who received pancreas transplantation ($n$ = 171; Caucasians = 118/BAME = 53) from 2006 to 2020 (median follow-up = 80 months). Pancreas graft and patient survival were equivalent in both groups. BAME recipients had a higher prevalence of type-2 diabetes mellitus pretransplant (BAME = 30.19% vs. Caucasians = 0.85%, $p < 0.0001$), and waited for a similar time to transplantation once waitlisted, although pre-emptive simultaneous pancreas–kidney transplantation rate was higher for Caucasian recipients (Caucasians = 78.5% vs. BAME = 0.85%, $p < 0.0001$). Despite equivalent rejections and steroid usage, BAME recipients gained more weight (BAME = 7.7% vs. Caucasians = 1.8%, $p = 0.001$), but had similar HbA1c (functioning grafts) at 3-, 12-, 36-, and 60-months post-transplant [61].

There are several social determinants that need to be supported to both reduce the rates of organ failure, as well as increasing the rates of transplantation, particularly in at-risk populations. Some of these determinants overlap, including finances, transportation, psychosocial issues, and family support. However, given that uncontrolled high blood pressure and diabetes are the leading causes of chronic kidney disease, primary care infrastructure, access to culturally competent preventative health services, combined with health-disadvantaged lifestyles and environment lead to kidney failure often prevent people from remaining on the transplant WL [62] Intersecting patient-, provider- and healthcare system-related factors may have negative downstream effects on the subsequent phases of the transplant process, including access to the WL and, later in the timeline, transplant outcomes [52]. Late referral for transplantation is common among migrant and ethnic minority populations, especially among individuals who are younger, with diabetes, and with a higher degree of social deprivation [21]. Further, the health status during the waiting phase may be more impaired due to delayed access to appropriate care. Or, once transplanted, they cannot maintain the required lifestyle. It is likely that transplant outcomes could be improved in at-risk populations if the social determinants of health were addressed [63]. Besides, studies of patients who are in the transplant process suggest that some important steps are required to address the social determinants of health and race-related inequities in kidney transplantation. Education, community-based workshops, and awareness campaigns may increase the number of Black people who receive living and deceased donor organ transplantation. Similar to individuals who are already in the transplant process, it is likely that many patients on dialysis would be great transplant candidates if they had more education and support [64].

Collection of national surveillance data on early transplant steps, as well as routinely captured data on upstream social determinants of health—including the measurement of patients' perceived discrimination [65] rather than race *per se*—is necessary to enhance understanding of the barriers to referral and evaluation. A multipronged approach (i.e., targeted and systemwide interventions, and policy change) implemented at multiple levels of the healthcare system will be necessary to reduce inequities in early transplant steps [66].

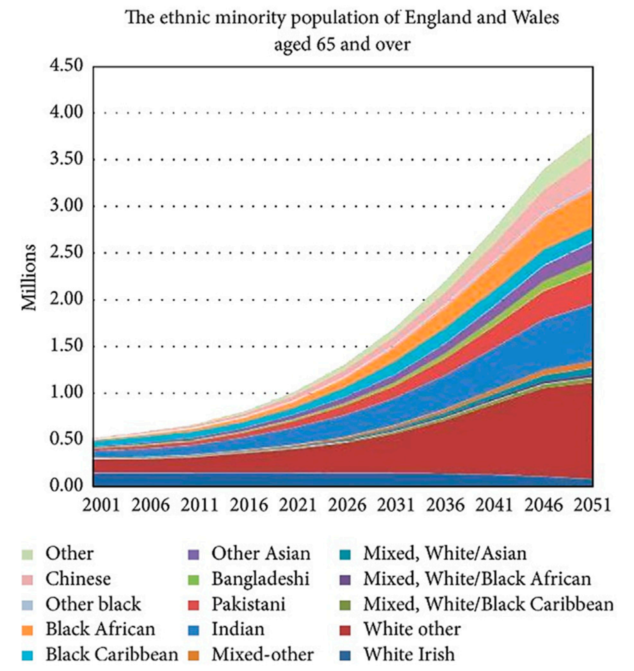


**FIGURE 1 |** Ethnic minority population projections to 2051 in England and Wales. Source: Leveley 2010 [69].

Further, although living donor kidney transplantation (LDKT) is the best renal replacement therapy for patients with ESKD providing survival advantages over dialysis and deceased donor kidney transplant, studies report diminished uptake of LDKT among migrant and ethnic minority populations [22, 24–26, 31]. This has the potential to lead to inferior outcomes among migrant and ethnic minority kidney transplant recipients [31]. A focus group study including 50 ESKD patients in the Netherlands explored modifiable hurdles to LDKT. They found that, although nearly all patients were in favor of LDKT (96%), multiple factors played a role in considering LDKT. These included inadequate patient education, impeding cognitions and emotions, restrictive social influences, and suboptimal communication. With regard to solutions to address the factors that influence equality in access to LDKT, they found that most patients (88%) were open to home-based group education about renal replacement therapy options. The study highlights the need for sensitivity and awareness of the influence of cultural factors on decision-making when discussing living donation with culturally diverse populations [67].

From 2013 to 2018, custom datasets from the United States Renal Data System and the United Network for Organ Sharing were merged to calculate the Kidney Transplant Equity Index (KTEI), defined as the number of minority patients transplanted at a center relative to the prevalence of minority patients with ESKD in each center's health service area. Markers of

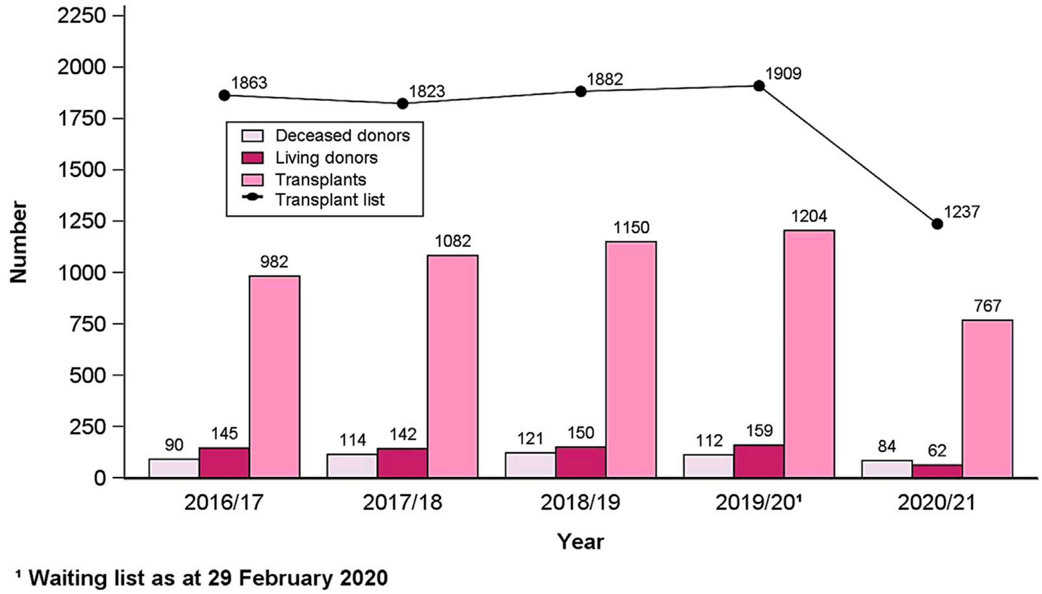


**FIGURE 2 |** BAME deceased and living donors and BAME transplants in the United Kingdom, 1 April 2016 to 31 March 2021, and patients on the active transplant list at 31st March each year. Source: NHS Blood and Transplant [70].

socioeconomic status and recipient outcomes were compared between high and low KTEI centers. The KTEI is the first metric to quantify minority access to kidney transplant incorporating the prelisting ESKD prevalence individualized to transplant centers. KTEIs uncover significant national variation in transplant practices and identify highly equitable centers. This novel metric should be used to disseminate best practices for ESKD patients from ethnic minority groups and with inferior socioeconomic status [68].

## TAKING A “CARE PATHWAY/WHOLE SYSTEMS” APPROACH TO ORGAN DONATION AND TRANSPLANTATION

Most countries are seeing life expectancy increase; however, this is not the case for all ethnic groups. As populations grow older, the demographics will change. For example, in the United Kingdom, most ethnic minorities comprise a younger demographic than the white British population. Yet, by 2051, this pattern will change with “Other White,” “Chinese,” “Other Asian,” “Indian,” “Other,” and “White Irish” alongside “White British” all being the ethnic groups with the highest representation aged 50 and over (**Figure 1**). By the mid-2050s, ethnic minorities will make up nearly half of the UK population. This illustrates the need for all countries with increasingly diverse ethnic populations to invest in the development of a whole-system approach to commissioning preventative and transplant services to satisfy the future requirements of an increasingly multi-ethnic older population [15]. For instance, a broad body of evidence shows that migrant and ethnic minority groups experience health inequities in many countries. This phenomenon can be observed in ODT services too, with significant variation in relation to demand for, access to, and waiting times for these services—especially among migrant and minority ethnic groups. Demand for transplantation can largely be reduced if there is a sustained commitment to public health interventions and culturally competent approaches implemented in the management of long-term conditions, recognizing the heterogeneity of diverse migrant and ethnic minority populations. Improved access to transplantation and reduced waiting times can be achieved if there are concerted and adequately resourced efforts to increase the number of organ donors from minority ethnic groups. This vision of equity and inclusion can only be realized by adopting a culturally competent approach to systems-wide working in organ donation in four core areas: public engagement; disease management; staff training; and transplant services [8]. The UK provides an interesting example where the recent positive trajectory in the numbers of organ donors and transplants from minority communities cannot be attributed to a single intervention but points to the emerging policy recognition, over the last 20 years, that ODT inequities exist in the UK, and that they need to be addressed by taking a systemic approach (**Figure 2**) [8].

Data show that transplant inequities persist for migrant and ethnic minority communities across the world, including the countries where these populations benefit from universal healthcare coverage in the European area (**Supplementary Table S1**). A system-wide approach—that is cognizant of the immediate urgency of increasing organ donors from all communities, whilst balancing the longitudinal approach to reduce the need for organ transplantation—is the only sustainable pathway to EDI. Many governments do not currently commission prevention and treatment services in this "system-wide" approach, leaving transplant services and prevention strategies on parallel paths, whereas points of convergence would be much more efficient and culturally competent in meeting population-health needs. There is scope to learn from initiatives such as Peer Educators, Living Transplant Initiative, and the Community Investment Scheme—whereby minority communities in the UK have been engaged in a discourse around both disease prevention, treatment options, and organ donation [8, 71]. The challenge is to evaluate such initiatives to understand the context in which they took place, the processes employed, as well as assessing the impact on organ donation rates. This will enable us to develop community-specific and context-specific approaches to EDI across the world.

## LIMITATIONS AND STRENGTHS

The main limitation of this work lies in the inconsistency of how migrant and ethnic minority populations are defined in European studies, which may result in a biased analysis. However, one of the goals of our study was precisely to examine how individuals from these communities are categorized in relation to ODT in Europe. Therefore, what seems to be a major limitation of the study is rather a strength in its ability to point out the need for clarification of terms and definitions to be addressed and harmonized across Europe, as noted by earlier European reviews on migrants' health [72]. Further, the number of studies assessing inequities in ODT among migrant and ethnic minority populations residing in Europe is limited, and most have a retrospective design, challenging the opportunity to adjust outcomes for all the potentially confounding variables. Besides, although this is in line with prior reviews of inequities in organ transplantation [1], existing studies in Europe focus chiefly on ESKD and kidney transplant. Furthermore, we acknowledge that the macroeconomic context, different healthcare policies, social security systems and legislation varying among (and sometimes even within) countries may influence accessibility, quality and outcomes of care. The European Deprivation Index (i.e., a standardized measure of socioeconomic level across Europe for improved understanding and comparability of the mechanisms and causes of health inequalities) may be a valid measure for the development, implementation and assessment of new policies to address inequities across countries [73]. Future studies should include consideration of these factors. Besides, in contrast with previous studies from the United States, research examining deceased organ donation rates among migrant and ethnic minority populations are lacking.

This study has also several strengths, lying primarily in its ability to highlight the multiple gaps in research of inequities in ODT among migrant and ethnic minority populations in Europe. Further, it succeeds to stress on the need for engagement of a more coordinated European framework to enable harmonization of definitions across Europe. This may lead to improved consistency of data collection to allow better data reporting, interpretation and cross-country comparisons. Finally, while not denying cross-country variations, it points out the need for a shared, coordinated approach to these vulnerable communities.

## CONCLUSION

The prevention and elimination of inequities related to patient characteristics is currently emergent in ODT in Europe. What requires clarification is the impact of patient "ethnicity" and/or "race" and/or "immigration background" on inequities in ODT, as these terms are defined and intended differently across countries. We contend that both the features related to "ethnicity" and "immigrant status"—and the intersection with the multiple factors associated to each–should be considered to identify the modifiable factors for targeted interventions to improve equity in the ODT process for these populations. However, evidence shows that, in the European context, these populations are categorized in a heterogeneous fashion and that most, except few studies are retrospective (i.e., not always adjusted for potential confounders and unable to determine the impact of the factors associated with ethnicity and immigrant status on inequities at the different phases of the ODT process), and focused on kidney transplantation. Because inequities are documented among migrant and ethnic minority populations in the entire ODT process, a "care pathway/whole-systems" approach to ODT encompassing culturally competent public health interventions is needed for improved a) prevention and management of chronic diseases, b) public engagement for the promotion of the culture of ODT and enhanced end-of-life care, through to c) enhanced likelihood of successful transplant among migrant/ethnic minority communities. Our framework recognizes that if we truly wish to take an EDI approach to organ donation and transplantation—we need to adopt a more social, human and holistic approach to examining questions around patient ethnicity.

## AUTHOR CONTRIBUTIONS

AAG addressed the operationalization of "ethnic/racial/migrant" minority communities, performed the review of the literature regarding this aspect in relation to inequities in organ donation and transplantation (ODT), introduced the section on the prevention of chronic conditions, and wrote the article; GR conceived the idea of a "care pathway/whole systems" approach to ODT, prepared the overall framework, and contributed to writing the article; NEJ developed the section on the shortage of organ donors and end-of-life care, and contributed to writing the article; DP-Z developed the sections on the prevention of chronic conditions, likelihood of transplant success, and contributed to writing the article. All authors contributed to the article and approved the submitted version.

## CONFLICT OF INTEREST

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

## SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontierspartnerships.org/articles/10.3389/ti.2023.11310/full#supplementary-material

## REFERENCES

1. Park C, Jones MM, Kaplan S, Koller FL, Wilder JM, Boulware LE, et al. A Scoping Review of Inequities in Access to Organ Transplant in the United States. *Int J Equity Health* (2022) 21(1):22–0. doi:10.1186/s12939-021-01616-x
2. Wakefield CE, Watts KJ, Homewood J, Meiser B, Siminoff LA. Attitudes Toward Organ Donation and Donor Behavior: A Review of the International Literature. *Prog Transpl* (2010) 20(4):380–91. doi:10.1177/152692481002000412
3. Gordon EJ, Ladner DP, Caicedo JC, Franklin J. Disparities in Kidney Transplant Outcomes: A Review. *Semin Nephrol* (2010) 30(1):81–9. doi:10.1016/j.semnephrol.2009.10.009
4. European Society of Organ Transplantation (ESOT). *Tackling Inequalities in Organ Transplantation: A Pathway Forward*. The European Society for Organ Transplantation (2022). Available From: https://esot.org/wp-content/uploads/2022/10/EM012518_ESOT_ActionDay_ThinkTankReport_2201005_v0-8_FH.pdf (Accessed July 17, 2023).
5. European Kidney Health Alliance. *A Shared Vision for Improving Organ Donation and Transplantation in the EU* (2019). Available From: https://ekha.eu/wp-content/uploads/FINAL_14.01.2020_Joint-Statement-of-the-Thematic-Network-on-Organ-Donation-and-Transplantation.pdf (Accessed July 17, 2023).
6. Grossi AA, Paredes D, Palaniswami V, Jansen N, Picozzi M, Randhawa G. One Size Does Not Fit All in Organ Donation and Transplantation: Targeting and Tailoring Communication for Migrant and Ethnic Minority Populations. *Commun Med* (2023) 2023:21434. doi:10.1558/cam.21434
7. Farkas L. European Commission Directorate-General for Justice and Consumers. *Analysis and Comparative Review of Equality Data Collection Practices in the European Union: Data Collection in the Field of Ethnicity* (2020). Available From: https://data.europa.eu/doi/10.2838/447194 (Accessed February 10, 2023).
8. Randhawa G, Gardiner D. Tackling Organ Donation Among Minority Ethnic Communities in the UK—A Whole Systems Approach. *Br Med Bull* (2022) 142(1):4–14. doi:10.1093/bmb/ldac008
9. Cattacin S, Chiarenza A, Domenig D. Equity Standards for Healthcare Organisations: A Theoretical Framework. *Divers Equal Heal Care* (2013) 10:249–58.
10. Wickramage K, Vearey J, Zwi AB, Robinson C, Knipper M. Migration and Health: A Global Public Health Research Priority. *BMC Public Health* (2018) 18(1):987. doi:10.1186/s12889-018-5932-5
11. Giannoni M, Franzini L, Masiero G. Migrant Integration Policies and Health Inequalities in Europe. *BMC Public Health* (2016) 16:463. doi:10.1186/s12889-016-3095-9
12. European Commission. *Overall Figures of Immigrants in European Society*. Statistics on Migration to Europe (2022). Available From: https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/promoting-our-european-way-life/statistics-migration-europe_en#overall-figures-of-immigrants-in-european-society (Accessed May 28, 2023).
13. Vincent BP, Randhawa G, Cook E. Barriers Towards Organ Donor Registration and Consent Among People of Indian Origin Living Globally: A Systematic Review and Integrative Synthesis-Protocol. *BMJ Open* (2020) 10(6):e035360. doi:10.1136/bmjopen-2019-035360
14. Sharp C, Randhawa G. The Potential Role of Social Capital in the Willingness to Be a Deceased Organ Donor: A Case Study of UK Polish Migrants. *Transpl Proc* (2016) 48(3):680–8. doi:10.1016/j.transproceed.2015.10.063
15. Wilkinson E, Waqar M, Sinclair A, Randhawa G. Meeting the Challenge of Diabetes in Ageing and Diverse Populations: A Review of the Literature From the UK. *J Diabetes Res* (2016) 2016:8030627–15. doi:10.1155/2016/8030627
16. Bhopal R. Glossary of Terms Relating to Ethnicity and Race: for Reflection and Debate. *J Epidemiol Community Health* (2004) 58(6):441–5. doi:10.1136/jech.2003.013466
17. International Organization for Migration (IOM). *Glossary on Migration* (2019). Available From: https://publications.iom.int/system/files/pdf/iml_34_glossary.pdf (Accessed January 20, 2023).
18. European Commission. *Migrant Definition* (2023). Available From: https://home-affairs.ec.europa.eu/pages/glossary/migrant_en (Accessed February 20, 2023).
19. Matlin SA, Depoux A, Schütte S, Flahault A, Saso L. Migrants' and Refugees' Health: Towards an Agenda of Solutions. *Public Health Rev* (2018) 39(1):27–55. doi:10.1186/s40985-018-0104-9
20. Witzig R. The Medicalization of Race: Scientific Legitimization of a Flawed Social Construct. *Ann Intern Med* (1996) 125(8):675–9. doi:10.7326/0003-4819-125-8-199610150-00008
21. Udayaraj U, Ben-Shlomo Y, Roderick P, Casula A, Dudley C, Johnson R, et al. Social Deprivation, Ethnicity, and Access to the Deceased Donor Kidney Transplant Waiting List in England and Wales. *Transplantation* (2010) 90(3):279–85. doi:10.1097/TP.0b013e3181e346e3
22. Wu DA, Robb ML, Watson CJE, Forsythe JLR, Tomson CRV, Cairns J, et al. Barriers to Living Donor Kidney Transplantation in the United Kingdom: A National Observational Study. *Nephrol Dial Transpl* (2017) 32(5):890–900. doi:10.1093/ndt/gfx036
23. Ng FL, Holt DW, Chang RWS, Macphee IAM. Black Renal Transplant Recipients Have Poorer Long-Term Graft Survival Than CYP3A5 Expressers From Other Ethnic Groups. *Nephrol Dial Transpl* (2010) 25(2):628–34. doi:10.1093/ndt/gfp530
24. Udayaraj U, Ben-Shlomo Y, Roderick P, Casula A, Dudley C, Collett D, et al. Social Deprivation, Ethnicity, and Uptake of Living Kidney Donor Transplantation in the United Kingdom. *Transplantation* (2012) 93(6):610–6. doi:10.1097/TP.0b013e318245593f
25. Khalil K, Brotherton A, Moore S, Evison F, Gallier S, Hodson J, et al. Interaction Between Socioeconomic Deprivation and Ethnicity for Likelihood of Receiving Living-Donor Kidney Transplantation. *BMC Nephrol* (2022) 23(1):113–1. doi:10.1186/s12882-022-02742-6
26. Grossi AA, Puoti F, Fiaschetti P, Di Ciaccio P, Maggiore U, Cardillo M. Kidney Transplantation and Withdrawal Rates Among Wait-Listed First-Generation Immigrants in Italy. *Eur J Public Health* (2022) 32(3):372–8. doi:10.1093/eurpub/ckac027
27. Grossi AA, Maggiore U, Puoti F, Grossi PA, Picozzi M, Cardillo M. Association of Immigration Background with Kidney Graft Function in a Publicly Funded Health System: A Nationwide Retrospective Cohort Study in Italy. *Transpl Int* (2020) 33(11):1405–16. doi:10.1111/tri.13688
28. Mérida E, Rodríguez A, Hernandez G, Huerta A, Gonzalez J, Hernández A, et al. Renal Transplantation in Emigrants From Africa in Spain: Similar Results but Different Infectious Profile Compared with Spanish People. *Transpl Proc* (2009) 41(6):2363–5. doi:10.1016/j.transproceed.2009.05.005
29. Cantrelle C, Laurens C, Luciolli E, Loty B, Tuppin P. Access to Kidney Transplantation in France of Non-French Patients and French Patients Living in Overseas Territories. *Transplantation* (2006) 81(8):1147–52. doi:10.1097/01.tp.0000205182.96861.3a
30. Bucher JN, Koenig M, Schoenberg MB, Thomas M, Crispin A, Angele MK, et al. Liver Transplantation in Patients with a History of Migration-A German Single Center Comparative Analysis. *PLoS One* (2019) 14(10):e0224116. doi:10.1371/journal.pone.0224116
31. Laging M, Kal-van Gestel JA, van de Wetering J, Ijzermans JNM, Weimar W, Roodnat JI. Understanding the Influence of Ethnicity and Socioeconomic

Factors on Graft and Patient Survival After Kidney Transplantation. *Transplantation* (2014) 98(9):974–8. doi:10.1097/TP.0000000000000164

32. Bhopal A, Wium C, Reisæter AV, Bhala N, Kumar B. Organ Donation for Migrants and Ethnic Minorities. *Tidsskr den Nor Laegeforening* (2019) 139(13). doi:10.4045/tidsskr.19.0406
33. Pallet N, Thervet E, Alberti C, Emal-Aglae V, Bedrossian J, Martinez F, et al. Kidney Transplant in Black Recipients: Are African Europeans Different From African Americans. *Am J Transpl* (2005) 5(11):2682–7. doi:10.1111/j.1600-6143.2005.01057.x
34. Oztek FZ, Tekin P, Herle M, Mueller T, Arbeiter K, Aufricht C. Does Immigration Background Influence Outcomes After Renal Transplantation? *Pediatr Nephrol* (2011) 26(2):309–15. doi:10.1007/s00467-010-1685-9
35. Oztek FZ, Ipsiroglu O, Mueller T, Aufricht C. Outcome After Renal Transplantation in Children From Native and Immigrant Families in Austria. *Eur J Pediatr* (2009) 168(1):11–6. doi:10.1007/s00431-008-0698-x
36. Oztek-Celebi FZ, Herle M, Ritschl V, Kaltenegger L, Stamm T, Aufricht C, et al. High Rate of Living Kidney Donation to Immigrant Children Despite Disparities- An Epidemiological Paradox? *Front Pediatr* (2019) 7:25. doi:10.3389/fped.2019.00025
37. Tromp WF, Cransberg K, van der Lee JH, Bouts AH, Collard L, Van Damme-Lombaerts R, et al. Fewer Pre-Emptive Renal Transplantations and More Rejections in Immigrant Children Compared to Native Dutch and Belgian Children. *Nephrol Dial Transpl* (2012) 27(6):2588–93. doi:10.1093/ndt/gfr628
38. Tjaden LA, Noordzij M, Van Stralen KJ, Kuehni CE, Raes A, Cornelissen EAM, et al. Racial Disparities in Access to and Outcomes of Kidney Transplantation in Children, Adolescents, and Young Adults: Results From the ESPN/ERA-EDTA (European Society of Pediatric Nephrology/European Renal Association-European Dialysis and Transplant Association) Registry. *Am J Kidney Dis* (2016) 67(2):293–301. doi:10.1053/j.ajkd.2015.09.023
39. Wong K, Owen-Smith A, Caskey F, Macneill S, Tomson CRV, Dor FJMF, et al. Investigating Ethnic Disparity in Living-Donor Kidney Transplantation in the UK: Patient-Identified Reasons for Non-Donation Among Family Members. *J Clin Med* (2020) 9(11):3751–15. doi:10.3390/jcm9113751
40. EUPHA. *Migration, Ethnicity and Health. Statement Drafted by the Section for Migration, Ethnicity and Health of the European Public Health Association (EUPHA)* (2018). Available From: https://ephconference.eu/repository/sections/migr/EUPHA_statement_9th_May_2018a_revised.pdf (Accessed January 15, 2023).
41. Bhopal RS. *Migration, Ethnicity, Race, and Health in Multicultural Societies*. 2nd ed. Oxford, UK: Oxford University Press (2014).
42. Gordon EJ, Ladner DP, Caicedo JC, Franklin J. Disparities in Kidney Transplant Outcomes: A Review. *Semin Nephrol* (2010) 30(1):81–9. doi:10.1016/j.semnephrol.2009.10.009
43. Llácer A, Zunzunegui MV, Del Amo J, Mazarrasa L, Bolůmar F. The Contribution of a Gender Perspective to the Understanding of Migrants' Health. *J Epidemiol Community Health* (2007) 61(2):ii4–i10. doi:10.1136/jech.2007.061770
44. World Health Organization. *Noncommunicable Diseases (NCD)*. Global Health Observatory (GHO) data [website] (2018). Available From: https://www.who.int/data/gho/data/themes/noncommunicable-diseases (Accessed February 5, 2023).
45. Bratton C, Chavin K, Baliga P. Racial Disparities in Organ Donation and Why. *Curr Opin Organ Transpl* (2011) 16(2):243–9. doi:10.1097/MOT.0b013e3283447b1c
46. WHO Regional Office for Europe. *Report on the Health of Refugees and Migrants in the WHO European Region. No Public Health Without Refugee and Migrant Health*. Copenhagen, DK: WHO Regional Office for Europe (2018). Available From: https://apps.who.int/iris/bitstream/handle/10665/311347/9789289053846-eng.pdf?sequence=1&isAllowed=y (Accessed January 15, 2023).
47. Lowe M, Payton A, Verma A, Gemmell I, Worthington J, Hamilton P, et al. Human Leukocyte Antigen Associations with Renal Function Among Ethnic Minorities in the United Kingdom. *HLA* (2020) 96(6):697–708. doi:10.1111/tan.14078
48. Tedla FM, Yap E. Apolipoprotein L1 and Kidney Transplantation. *Curr Opin Organ Transpl* (2019) 24(1):97–102. doi:10.1097/mot.0000000000000600
49. Yan G, Shen JI, Harford R, Yu W, Nee R, Clark MJ, et al. Racial and Ethnic Variations in Mortality Rates for Patients Undergoing Maintenance Dialysis Treated in US Territories Compared with the US 50 States. *Clin J Am Soc Nephrol* (2020) 15(1):101–8. doi:10.2215/CJN.03920319
50. Tambur AR, Kosmoliaptsis V, Claas FHJ, Mannon RB, Nickerson P, Naesens M. Significance of HLA-DQ in Kidney Transplantation: Time to Reevaluate Human Leukocyte Antigen-Matching Priorities to Improve Transplant Outcomes? An Expert Review and Recommendations. *Kidney Int* (2021) 100(5):1012–22. doi:10.1016/j.kint.2021.06.026
51. EDQM Council of Europe. *Transplant Newsletter: International Figures on Donation and Transplantation* (2022). Available From: https://freepub.edqm.eu/publications/PUBSD-87/detail.
52. Ladin K, Rodrigue JR, Hanto DW. Framing Disparities Along the Continuum of Care From Chronic Kidney Disease to Transplantation: Barriers and Interventions. *Am J Transpl* (2009) 9(4):669–74. doi:10.1111/j.1600-6143.2009.02561.x
53. Avidan A, Sprung CL, Schefold JC, Ricou B, Hartog CS, Nates JL, et al. Variations in End-Of-Life Practices in Intensive Care Units Worldwide (Ethicus-2): a Prospective Observational Study. *Lancet Respir Med* (2021) 9(10):1101–10. doi:10.1016/S2213-2600(21)00261-7
54. Nayfeh A, Conn LG, Dale C, Kratina S, Hales B, GuptaDas T, et al. The Effect of End-Of-Life Decision-Making Tools on Patient and Family-Related Outcomes of Care Among Ethnocultural Minorities: A Systematic Review. *PLoS One* (2022) 17(8):e0272436. doi:10.1371/journal.pone.0272436
55. Pedder Jones C, Papadopoulos C, Randhawa G. Who's Opting-In? A Demographic Analysis of the U.K. NHS Organ Donor Register. *PLoS One* (2019) 14(1):e0209161. doi:10.1371/journal.pone.0209161
56. Goldberg DS, Halpern SD, Reese PP. Deceased Organ Donation Consent Rates Among Racial and Ethnic Minorities and Older Potential Donors. *Crit Care Med* (2013) 41(2):496–505. doi:10.1097/CCM.0b013e318271198c
57. Kentish-Barnes N, Siminoff LA, Walker W, Urbanski M, Charpentier J, Thuong M, et al. A Narrative Review of Family Members' Experience of Organ Donation Request After Brain Death in the Critical Care Setting. *Intensive Care Med* (2019) 45(3):331–42. doi:10.1007/s00134-019-05575-4
58. Morgan M, Kenten C, Deedat S, Farsides B, Newton T, Randhawa G, et al. Increasing the Acceptability and Rates of Organ Donation Among Minority Ethnic Groups: A Programme of Observational and Evaluative Research on Donation, Transplantation and Ethnicity (DonaTE). *Program Grants Appl Res* (2016) 4(4):1–196. doi:10.3310/pgfar04040
59. Deedat S, Kenten C, Morgan M. What Are Effective Approaches to Increasing Rates of Organ Donor Registration Among Ethnic Minority Populations: A Systematic Review. *BMJ Open* (2013) 3(12):e003453. doi:10.1136/bmjopen-2013-003453
60. Mudiayi D, Shojai S, Okpechi I, Christie EA, Wen K, Kamaleldin M, et al. Global Estimates of Capacity for Kidney Transplantation in World Countries and Regions. *Transplantation* (2022) 106(6):1113–22. doi:10.1097/TP.0000000000003943
61. Gopal JP, McLean A, Crane J, Herbert P, Papalois V, Dor FJMF, et al. Pancreas Transplantation in Black, Asian and Minority Ethnic Patients-Single Centre Experience in the UK. *Transpl Int* (2022) 35:10490. doi:10.3389/ti.2022.10490
62. Phillips K, Hazlehurst JM, Sheppard C, Bellary S, Hanif W, Karamat MA, et al. Inequalities in the Management of Diabetic Kidney Disease in UK Primary Care: A Cross-Sectional Analysis of A Large Primary Care Database. *Diabet Med* (2023) 2023:e15153. doi:10.1111/dme.15153
63. Fox M. Barriers to Kidney Transplantation in Racial/Ethnic Minorities. *Clin J Am Soc Nephrol* (2021) 16(2):177–8. doi:10.2215/CJN.19371220
64. Wesselman H, Ford CG, Leyva Y, Li X, Chang CCH, Dew MA, et al. Social Determinants of Health and Race Disparities in Kidney Transplant. *Clin J Am Soc Nephrol* (2021) 16(2):262–74. doi:10.2215/CJN.04860420
65. Atkins R Instruments Measuring Perceived Racism/Racial Discrimination: Review and Critique of Factor Analytic Techniques. *Int J Heal Serv* (2014) 44(4):711–34. doi:10.2190/HS.44.4.c
66. Harding JL, Perez A, Patzer RE. Nonmedical Barriers to Early Steps in Kidney Transplantation Among Underrepresented Groups in the United States. *Curr Opin Organ Transpl* (2021) 26(5):501–7. doi:10.1097/MOT.0000000000000903
67. Ismail SY, Claassens L, Luchtenburg AE, Roodnat JI, Zuidema WC, Weimar W, et al. Living Donor Kidney Transplantation Among Ethnic Minorities in

the Netherlands: A Model for Breaking the Hurdles. *Patient Educ Couns* (2013) 90(1):118–24. doi:10.1016/j.pec.2012.08.004

68. Delman AM, Turner KM, Silski LS, Quillin RC, Estrada M, Lemon K, et al. The Kidney Transplant Equity Index: Improving Racial and Ethnic Minority Access to Transplantation. *Ann Surg* (2022) 276(3):420–9. doi:10.1097/SLA.0000000000005549
69. Lievesley N. *Older BME People and Financial Inclusion Report. The Future Ageing of the Ethnic Minority Population in England and Wales* (2010). Available From: http://www.cpa.org.uk/information/reviews/thefutureageingoftheethnicminoritypopulationofenglandandwales.pdf (Accessed February 1, 2023).
70. NHS Blood and Transplant. *Organ Donation and Transplantation data for Black, Asian, Mixed Race and Minority Ethnic (BAME) communities*: Report for 2020/21 (1 April 2016 - 31 March 2021), Page 12. Available at: https://nhsbtdbe.blob.core.windows.net/umbraco-assets-corp/25529/bame-report-final-2020_2021.pdf (Accessed July 20, 2023)
71. Morgan M, Sims J, Jain N, Randhawa G, Sharma S, Kirit M. Who Waits Longest for a Kidney?: Inequalities in Access to Kidney Transplantation Among Black and Asian Minority Ethnic (BAME) Groups in the UK. *Br J Ren Med* (2015) 20(1):4–7.
72. Lebano A, Hamed S, Bradby H, Gil-Salmerón A, Durá-Ferrandis E, Garcés-Ferrer J, et al. Migrants' and Refugees' Health Status and Healthcare in Europe: A Scoping Literature Review. *BMC Public Health* (2020) 20(1):1039–22. doi:10.1186/s12889-020-08749-8
73. Guillaume E, Pornet C, Dejardin O, Launay L, Lillini R, Vercelli M, et al. Development of a Cross-Cultural Deprivation Index in Five European Countries. *J Epidemiol Community Health* (2016) 70(5):493–9. doi:10.1136/jech-2015-205729

REVIEW
published: 11 August 2023
doi: 10.3389/ti.2023.11216

# Inequities in Organ Donation and Transplantation Among Immigrant Populations in Italy: A Narrative Review of Evidence, Gaps in Research and Potential Areas for Intervention

*Alessandra Agnese Grossi*[1,2]*, *Francesca Puoti*[3], *Lucia Masiero*[3], *Alessia Troni*[3], *Tiziana Cianchi*[3], *Umberto Maggiore*[4] *and Massimo Cardillo*[3]

*[1]Center for Clinical Ethics, Department of Biotechnologies and Life Sciences, University of Insubria, Varese, Italy, [2]Department of Human Sciences, Innovation and Territory, University of Insubria, Como, Italy, [3]Italian National Transplant Center (CNT), Istituto Superiore di Sanità, Rome, Italy, [4]Nephrology Unit, Dipartimento di Medicina e Chirurgia, Università di Parma, Parma, Italy*

Immigrants from outside Europe have increased over the past two decades, especially in Southern European countries including Italy. This influx coincided with an increased number of immigrants with end-stage organ diseases. In this narrative review, we reviewed evidence of the gaps between native-born and immigrant populations in the Organ Donation and Transplantation (ODT) process in Italy. Consistent with prior studies, despite the availability of a publicly funded health system with universal healthcare coverage, non-European-born individuals living in Italy are less likely to receive living donor kidney transplantation and more likely to have inferior long-term kidney graft function compared with EU-born and Eastern European-born individuals. While these patients are increasingly represented among transplant recipients (especially kidney and liver transplants), refusal rates for organ donation are higher in some ethnic groups compared with native-born and other foreign-born referents, with the potential downstream effects of prolonged waiting times and inferior transplant outcomes. In the process, we identified gaps in relevant research and biases in existing studies. Given the Italian National Transplant Center's (CNT) commitment to fighting inequities in ODT, we illustrated actions taken by CNT to tackle inequities in ODT among immigrant communities in Italy.

**Keywords: organ donation, organ transplantation, migrants, ethnic minorities, inequities**

***Correspondence:**
*Alessandra Agnese Grossi*
*aa.grossi@uninsubria.it*

***Received:** 24 January 2023*
***Accepted:** 19 July 2023*
***Published:** 11 August 2023*

***Citation:**
*Grossi AA, Puoti F, Masiero L, Troni A, Cianchi T, Maggiore U and Cardillo M (2023) Inequities in Organ Donation and Transplantation Among Immigrant Populations in Italy: A Narrative Review of Evidence, Gaps in Research and Potential Areas for Intervention. Transpl Int 36:11216. doi: 10.3389/ti.2023.11216*

## INTRODUCTION

"Diversity, equity and inclusion" are emergent issues in transplantation healthcare. Studies, including a manifesto of the European Society for Organ Transplantation (ESOT), have emphasized the ethical duty to reduce inequities among the most vulnerable and/or socially deprived communities, including immigrant groups [1–4]. Europe ranks first globally as host for

---

**Abbreviations:** CNT, Italian National Transplant Center; ESKD, End Stage Kidney Disease; EU, European Union; HCP, Healthcare Professional; ICU, Intensive Care Unit; KT, Kidney Transplant; LDKT, Living Donor Kidney Transplant; ODT; Organ Donation and Transplantation; UK, United Kingdom; WL, waiting list.

international immigrants (82 million) [5]. In Europe, most individuals with an immigration background are regular residents who benefit from consolidated healthcare coverage. Although evidence remains limited in Europe, inequities have been described in end stage kidney disease (ESKD) treatment [6], waiting list (WL) accessibility [7–9], likelihood of preemptive and living donor kidney transplant (LDKT) [10–14] and outcomes (i.e., graft survival and function) of kidney transplant (KT) among immigrant populations relative to their European-born referents [6, 15, 16]. Studies have also noted that these populations are increasingly represented among patients requiring transplantation. At the same time, these groups have higher rates of refusal for deceased organ donation when compared to native-born and other foreign-born counterparts, with the potential for detrimental effects on waiting times and outcomes of transplantation [17–19].

Immigrants are a heterogeneous group. Features may vary among individuals as a result of the reasons for and circumstances of migration, migration pathways, and across countries depending on migration history, immigration policies, social security systems, and other societal features [20]. However, these populations are often exposed to structural inequities. Structural inequities may increase health risks at each stage of the migration process, namely, before migration takes place, during the migration process, during integration, and after return to the home country. Risks may increase because of cultural, linguistic and relational difficulties, diminished socioeconomic conditions, discrimination, inferior knowledge of healthcare systems and administrative regulations in host countries, and the lack of culturally competent healthcare services [3, 21–25]. The interplay among these factors may lead to inequities in healthcare accessibility and quality, even in countries with universal healthcare coverage [26, 27].

Italy ranks third in Europe in the total number of regular residents with non-EU citizenship (5.2 million) [28]. Of these, the most numerous are the Romanian, Albanian, Moroccan, and Chinese communities (see resident immigrant groups based on citizenship in **Supplementary Table S1**). Given the recent surge in immigration, adult immigrant and ethnic minority groups in Italy overlap [29].

In Italy, immigrant populations are generally identified as vulnerable groups. For instance, non-European-born individuals in Italy are more likely to be socioeconomically disadvantaged, with difficulties in oral and written communication, and, relative to individuals who have migrated to other EU countries, with a lower educational level [26, 30]. Most immigrants are younger and healthier when compared to native-born referents. Similar to European data [31–33], a large segment of first-generation immigrants in high migratory pressure areas in Italy has ESKD (7.6%–35%) [34–36] and liver disease (9.2%) [37]. Studies reveal that these populations present significantly higher rates of diabetes, obesity (especially among subjects of South-east Asian and Northern African origin) and other risk factors (i.e., hypertension) for the progression toward organ failure (especially ESKD) requiring replacement therapies [27, 38, 39]. Italy has a universal healthcare system which guarantees organ transplantation regardless of ethnicity, immigration background, religious beliefs, gender, socio-economic status, health literacy, linguistic difficulties, or cultural diversity. However, evidence from other healthcare settings has shown inequities in accessibility, quality and outcomes of care among immigrant populations [26, 27]. Equity is a major principle in organ transplantation; ensuring equity in ODT requires to first examine whether inequities are present. Tackling inequities is critical to ensure that all people achieve the best possible health outcomes, and addressing inequities is key for the trustworthiness and transparency of transplant systems [40].

The objective of this narrative review is to determine whether gaps exist between immigrants and native-born populations in ODT in Italy. In the process, we seek to identify gaps in research and potential areas for intervention, and illustrate actions that CNT has undertaken thus far to tackle inequities in ODT among immigrant communities in Italy.

# METHODS

## Search Strategy

We searched PubMed for case-control studies, retrospective and prospective cohort studies, and cross-sectional studies addressing inequities in ODT in immigrant populations in Italy. We searched for articles written in English and Italian published between 1st January 2000 and 28th March 2023 using the following search string: (immigrants OR migrants OR immigration) AND ("organ don*" OR "organ transplant*" OR transplant*) AND (Italy OR Italian). The references of the selected articles were scrutinized for additional references.

## Definitions

For the purposes of this narrative review, we adopt the following definitions of key terms:

Health inequities: "potentially avoidable differences in health, or in health risks that policy can influence, between groups of people who are more or less advantaged socially, *which* … systematically place socially disadvantaged groups at further disadvantage on health" [41]. This definition, grounded in ethical and human rights principles, emphasizes the subcategory of health differences indicative of social injustice, which distinguishes health inequities from other health differences.

Migrant: "any person who is outside a State of which he or she is a citizen or national, or, in the case of a stateless person, his or her State of birth or habitual residence. The term includes migrants who intend to move permanently or temporarily, and those who move in a regular or documented manner as well as migrants in irregular situations" [42]. According to the European Commission, the migrant category excludes persons who travel for tourism or business purposes and excludes intra-EU mobility [43].

Ethnicity: "the social group a person belongs to, and either identifies with or is identified with by others, as a result of a mix of cultural and other factors including language, diet, religion, ancestry, and physical features" that are shared by individuals in the same group [44].

**TABLE 1 |** Current evidence of inequities in organ donation and transplantation among immigrant and ethnic minority populations in Italy.

| | Study ID | Italian area | Study design and analysis | Countries of origin/ Ethnicity | Age group | Main estimates | Comment |
|---|---|---|---|---|---|---|---|
| ESKD treatment | [47] | Nationwide | Retrospective cohort study (2007–2016); on native-born (*n* = 328) and RFPs (*n* = 120). Logistic regression analysis | South America [mother (10%); father (7.5%)]; Asia [mother (15%); father (14.2%)]; North Africa [mother (25.8%); father (27.5%)]; Central Africa [mother (10%); father (10%)]. 82.5% of mothers and 80% of fathers of immigrant children came from low- or medium-income countries | Pediatric | RFPs increased from 23% to 30.3% (*p* = 0.08) [period 1 (2007–2011) vs. period 2 (2012–2016)]. RFPs were younger (6.7 vs. 9.4 years, *p* = 0.025) and less often treated with preemptive KT (3.3% vs. 13.4%, *p* = 0.009) than native-born Pts. The percentage of preemptive KT increased from period 1 to 2 in RFPs only (8.4%–18.6%, *p* = 0.006) | 5-Year Pt survival [RFPs vs. native-born (87.4% vs. 89.7%, *p* = 0.35)], waiting time to KT (2.2 vs. 2.4 years as a median, *p* = 0.45), and dialysis modality survival did not differ between native-born and RFPs |
| | [36] | Lombardy | Survey study (2015) of Pts with ESKD (*n* = 7,463) of whom 8.41% (*n* = 628) were non-EU-born. Unadjusted descriptive analysis | Eastern Europe (14.9%), North Africa (25.5%), Sub-Saharan Africa (17%), Latin America (11.8%), Asia (30.4%), Oceania (0.5%) | Adult | Relative to EU-born Pts, non-EU-born Pts were younger (Aged 41–40 vs. 61–80), more often on HD (93.1% vs. 87.7%, *p* < 0.001) and less on PD (6.9% vs. 12.3%, *p* < 0.001), and late referral [6 months prior to dialysis (48%), 1–6 months (20.2%), over the last 30 days (30.8%)] | The distribution of ethnicity of immigrant Pts was different from the total foreign population as reported by census data. Data were not adjusted for potential confounders |
| | [34] | Lazio | Retrospective cohort study (2004–2012); KT eligibility and WL registration rates of immigrant (*n* = 365) and native (*n* = 4,411) Pts with ESKD. Unadjusted descriptive analysis | Romania [*n* = 39 (10.7%)], Philippines [*n* = 38 (10.4%)], Egypt [*n* = 23 (6.3%)], Libya [*n* = 16 (4.4%)], Tunisia [*n* = 15 (4.1%)], Ethiopia [14 (3.8%)], Albania [12 (3.3%)], Bangladesh [12 (3.3%)], Morocco [12 (3.3%)], France [11 (3.0%)], Serbia-Montenegro [10 (2.7%)], Nigeria [10 (2.7%)], other (<10 Pts) [153 (41.9%)] | Adult | Compared with Italians, immigrant Pts were younger (53.8 ± 16.3 vs. 68.7 ± 13.6), more frequently women (42.7% vs. 37.7%), HbsAg-positive (18.1% vs. 13.9%), not vaccinated if HBV susceptible (26.8% vs. 20.9%), late referral (34.9% vs. 18.9%, *p* < 0.001), suitable for KT (21.7% vs. 9.9%), with.higher survival probability at 1 (91.9% vs. 84.7%) and 5 years (74.6% vs. 51.5%) since dialysis start (HR = 0.71; CI 95%: 0.58–0.87) | Only mortality risk was adjusted for multiple potential confounders |
| | [35] | Piedmont | Survey study across 19/ 25 dialysis facilities; on immigrant Pts (*n* = 93) with ESKD on chronic dialysis treatment. Unadjusted descriptive analysis | Morocco (*n* = 26), Albania (*n* = 15), Romania (*n* = 9), Senegal (*n* = 7), Nigeria (*n* = 5), other (<5) (*n* = 31) | Adult | At presentation, most Pts were young (mean age 46 ± 14 years), on HD (87%); late referral (38%) or starting dialysis in emergency (17%). No difference in HCV, HBV and HIV incidence relative to natives. Most Pts had low-level knowledge of Italian (56%), were regular foreign citizens (69%), temporary foreign workers (19%), or had a residence permit (9%) | Social and relational problems are more challenging than clinical aspects and call for new organizational models to manage this growing population with ESKD. Rates were not adjusted and the study did not report control group data. A national cohort study controlling for potential confounders is missing |

(Continued on following page)

**TABLE 1 |** (*Continued*) Current evidence of inequities in organ donation and transplantation among immigrant and ethnic minority populations in Italy.

| | Study ID | Italian area | Study design and analysis | Countries of origin/ Ethnicity | Age group | Main estimates | Comment |
|---|---|---|---|---|---|---|---|
| | [48] | Lombardy | Retrospective single center study (1994–2001) on Pts ($n$ = 12) from developing countries and 59 native Pts with ESKD. Unadjusted descriptive analysis | Philippines ($n$ = 5), Egypt ($n$ = 4), Morocco, Mauritius, Sri Lanka ($n$ = 1) | Adult | Pts from developing countries on dialysis differ from the native dialysis population in younger age, causes of kidney failure, late referral, higher infection rates (67%), and clinical complications due to Pts' visits to home countries. At follow-up (45.3 ± 32.0 months), 5 Pts continued on HD, 2 were on PD, and 4 received KT and 1 a KT and LT. | Data were not adjusted for potential confounders |
| Access to the transplant waiting list | [36] | Lombardy | Survey study (2015) of Pts with ESKD ($n$ = 7,463) of whom 8.41% ($n$ = 628) were non-EU-born. Unadjusted descriptive analysis | Eastern Europe (14.9%), North Africa (25.5%), Sub-Saharan Africa (17%), Latin America (11.8%), Asia (30.4%), Oceania (0.5%) | Adult | WL registration (34.8% vs. 18%, $p < 0.01$) non-EU-born vs. EU-born | Data were not adjusted for potential confounders |
| | [34] | Lazio | Retrospective cohort study (2004–2012); of KT eligibility and WL registration rates of immigrant and native Pts with ESKD. Unadjusted descriptive analysis | Romania [$n$ = 39 (10.7%)], Philippines [$n$ = 38 (10.4%)], Egypt [$n$ = 23 (6.3%)], Libya [$n$ = 16 (4.4%)], Tunisia [$n$ = 15 (4.1%)], Ethiopia [14 (3.8%)], Albania [12 (3.3%)], Bangladesh [12 (3.3%)], Morocco [12 (3.3%)], France [11 (3.0%)], Serbia-Montenegro [10 (2.7%)], Nigeria [10 (2.7%)], other (<10 Pts) [153 (41.9%)] | Adult | Unadjusted KT eligibility (31.2% vs. 29.5%, $p$ = 0.57) and WL registration (93.9% vs. 91.6%, $p$ = 0.43) of immigrant and native Pts | Unadjusted rates do not account for immigrants being younger and with lower prevalence of comorbidities compared to EU counterparts. A national cohort study controlling for potential confounders is not available yet. |
| | [35] | Piedmont | Survey study across 19/ 25 dialysis facilities; on immigrant Pts ($n$ = 93) with ESKD on chronic dialysis treatment. Unadjusted descriptive analysis | Morocco ($n$ = 26), Albania ($n$ = 15), Romania ($n$ = 9), Senegal ($n$ = 7), Nigeria ($n$ = 5), other (<5) ($n$ = 31) | Adult | Active status on the WL (27%); in the process of being evaluated (23%); inactive (2%); not yet considered for KT (46%) | The study did not report control group data |
| Likelihood of transplantation | [49] | Nationwide | Retrospective cohort study (2010–2020); on EU-born ($n$ = 21,624), Eastern European-born ($n$ = 606) and non-European-born ($n$ = 1,944). Competing risk analysis | Asian [614 (31.6%)], Hispanic [297 (15.3%)], Sub-Saharan Africa [525 (27%)], North Africa and Middle East [508 (26.1%)] | Adult | LDKT adjusted relative probability of non-European-born vs. Eastern European-born 0.51 (95% CI: 0.33–0.79; $p$ = 0.002); of non-European-born vs. EU-Born: 0.65 (95% CI: 0.47–0.82; $p$ = 0.001) | Immigration status did not affect the rate of DDKT or permanent WL withdrawal |
| | [47] | Nationwide | Retrospective cohort study (2007–2016); on native-born ($n$ = 328) and RFPs ($n$ = 120). Logistic regression analysis | South America [mother (10%); father (7.5%)]; Asia [mother (15%); father (14.2%)]; North Africa [mother (25.8%); father (27.5%)]; Central Africa [mother (10%); father (10%)]. 82.5% of mothers and 80% of fathers of immigrant children came from low- or medium-income countries | Pediatric | Belonging to the RFPs group was associated with a significantly lower probability of receiving a preemptive KT [ RFPs vs. native-born (3.3% vs. 13.4%, $p$ = 0.009)] | 5-Year Pt survival [RFPs vs. native-born (87.4% vs. 89.7%, $p$ = 0.35)], waiting time to KT (2.2 vs. 2.4 years as a median, $p$ = 0.45), and dialysis modality survival did not differ between native-born and RFPs |

(Continued on following page)

**TABLE 1 |** (*Continued*) Current evidence of inequities in organ donation and transplantation among immigrant and ethnic minority populations in Italy.

|  | Study ID | Italian area | Study design and analysis | Countries of origin/ Ethnicity | Age group | Main estimates | Comment |
|---|---|---|---|---|---|---|---|
| Outcomes of transplantation | [50] | Nationwide | All adult deceased KTR in Italy (2010–2015) followed-up until death, dialysis or 5-Years post-transplantation: EU-born (*n* = 6,346), Eastern European-born (*n* = 161), and non-European-born (*n* = 490). Joint longitudinal survival analysis | Asian [142 (29.0%)], Hispanic [68 (13.9)], African [135 (27.6%)], North Africa and Middle East [144 (29.4%)] | Adult | Compared to EU-born KTRs, in non-European-born KTRs adjusted average yearly eGFR decline was −0.96 mL/min/year (95% confidence interval: −1.48 to −0.45; $p < 0.001$), whereas it was similar in Eastern European-born KTRs [+0.02 mL/min/year (−0.77 to +0.81; $p = 0.96$)] | Adjusted 5-Year transplant survival did not statistically differ between non-European-born, Eastern European-born, and EU-born. In those surviving beyond 1-Year, it was 91.8% in EU-born (95% CI: 87.1–96.8), 92.5% in Eastern European-born (86.1–99.4), and 89.3% in non-European-born KTRs (83.0–96.0) |
| Transplantation and non-refusal rate to deceased donation | [51] | Piedmont | Retrospective cohort study (2004–2011) of brain deaths and non-refusal rates among immigrant groups in Piedmont: 126/178L (7%) brain deaths among immigrant groups from 43 different countries. 222/2,914 (7%) Tx were performed for immigrants including liver (*n* = 66), kidney (*n* = 130), heart (*n* = 21), and lung (*n* = 5). Unadjusted descriptive analysis | Unspecified | Adult | The Romanian community was the most favourable towards donation (78.8%), vs. Moroccan (25%) and Albanian (33%) which were the least favourable | Not all individuals with an immigration background have the same non-refusal rates. In contrast, non-refusal rates are lower in some ethnic minority groups relative to others. Studies are missing regarding refusal rates at the national level in Italy by immigration background and ethnicity. Studies should determine the multiple intersecting factors underlying this phenomenon |

*DDKT, deceased donor kidney transplant; eGFR, estimated Glomerular Filtration Rate; ESKD, end stage kidney disease; EU, European Union; KT, kidney transplant; KTR, kidney transplant recipient; LDKT, living donor kidney transplant; LT, liver transplant; PD, peritoneal dialysis; RFP, resident foreign patient; WL, waiting list.*

As recommended by prior reports [45], both the features related to "ethnicity" (including country of origin or descent) and "immigrant status" (or family history of immigration) should be considered for the purposes of studies in relation to ODT [45]. For instance, the European Public Health Association contends that, although immigration includes also elements of ethnicity, "visible minorities" are likely to experience more significant inequities relative to their White referents, similar to immigrants [46].

## Eligibility Criteria

We included articles meeting the following criteria: addressing organ donation and/or transplantation and including individuals with an immigration background residing in Italy. We excluded articles addressing non-organ transplantation (i.e., tissue, blood or cell donation), systematic reviews, literature reviews, and case reports.

## Data Extraction

Following identification of eligible articles, the following data were extracted and included in a descriptive table presenting: authors and publication year, age group, Italian area where studies were performed, study design and analysis, main estimates, and comment to study findings.

# RESULTS

The PubMed search yielded 66 articles. Of these, 59 were excluded after screening of title and abstract as not matching the inclusion criteria. Following full text review, the remaining 7 articles were assessed for eligibility and were included in the review. One article was included from the reference section of a selected article.

## Study Characteristics

The descriptive details and main findings of the eight included articles are summarized in **Table 1**. The period of data collection varied between 1994–2001 [48] and 2010–2020 [49]. Studies were published between 2004 and 2022. There were two survey studies

[35, 36] but most had a retrospective design [34, 47–51]. Of these, five were cohort studies based on national [47, 49, 50] and regional registries [34, 51], and one was a single center study [48]. Articles were categorized according to the following time-points of the ODT process, as described below:

- ESKD treatment,
- access to the transplant waitlist (WL),
- likelihood of transplant,
- outcomes of transplant,
- transplantation and refusal rates to deceased organ donation.

## Main Findings of Included Studies

### End Stage Kidney Disease Treatment

There were five studies on the treatment of ESKD. Of these, most addressed the adult patient population [34–36, 48], except one that focused on pediatric patients [47]. With the exception of two survey studies [35, 36], the remaining articles had a retrospective design [34, 47, 48], of which two were based on a regional [34] and national registry [47]. Only three studies specified the patients' countries of origin beyond broader ethnicity categories [34, 35, 48]. All studies reported that immigrant patients with ESKD on chronic dialysis treatment are younger relative to their native-born referents, have a regular residency permit, and most frequently originate from Northern Africa and Asia (where this was explicitly stated, patients from Northern Africa originated mostly from Egypt, Morocco, Libya, and Tunisia; patients from Asia chiefly from the Philippines and Bangladesh) [34, 35, 48]. In adults, referrals were more often delayed [34–36, 48], whereas this information was missing in the pediatric study [47]. The 1- (74.6% vs. 51.5%) and 5-year (91.9% vs. 84.7%) patient survival after dialysis start was significantly higher among immigrants in Lazio [34]; no differences were detected between the children born of immigrant parents and their native-born counterparts (87.4% vs. 89.7%, $p = 0.35$) [47]. Two studies noted a higher rate of clinical complications following visits to home communities [35, 48]. There were no national cohort studies (prospective or retrospective) controlling for potential confounders.

### Access to the Transplant Waiting List

Studies examining the association between immigrant status and access to the transplant WL ($n = 3$) were focused on adult patients pursuing KT in the Italian North-Western (Lombardy and Piedmont) [35, 36] and Central areas (Lazio) [34]. The studies from Lombardy and Piedmont were surveys. The study from Piedmont found that, irrespective of the younger age and better clinical conditions relative to natives, a large proportion of immigrant patients with ESKD is not yet considered for KT (46%), is in the process of being evaluated (23%) or is inactive (2%). The study reported that, in many cases (40%), language barriers compromise patient-provider communication, leading to impairment of informed consent and reducing adherence to prescribed medical and dietary regimens. Pending regularization status and other socioeconomic factors including poverty and poor housing quality are reported as factors with the potential to reduce the chance for these patients to be waitlisted. Periodic visits to home countries and associated exposures to endemic infections and/or undertreatment of ESKD are commonly observed [35]. KT eligibility (31.2% vs. 29.5%, $p = 0.57$) and WL registration (93.9% vs. 91.6%, $p = 0.43$) rates are comparable between immigrants and natives in Lazio [34]; WL registration is significantly higher among patients from non-EU countries relative to EU-born referents in Lombardy (34.8% vs. 18%, $p < 0.01$) [36]. National cohort studies controlling for potential confounders are missing.

### Likelihood of Transplant

Two retrospective national cohort studies of the adult and pediatric populations examined the association between immigration background and likelihood of KT [47, 49]. Competing risk analysis of adult patients waitlisted for KT revealed that non-European immigration background (i.e., from non-EU countries beyond Eastern Europe - excluding North America and Oceania) is associated with a diminished likelihood to receive LDKT [adjusted relative probability of non-European-born vs. Eastern European-born 0.51 (95% CI: 0.33–0.79; $p = 0.002$); of non-European-born vs. EU-Born: 0.65 (95% CI: 0.47–0.82; $p = 0.001$)]. In contrast, the study found that immigrant status does not affect the rate of deceased donor KT or permanent WL withdrawal [49]. The study of pediatric patients found that belonging to the immigrant group is associated with a significantly lower probability to receive a preemptive KT (OR 0.25, 95% CI 0.08–0.72, $p = 0.011$), whereas waiting time to KT does not differ between native-born and immigrant patients (2.2 vs. 2.4 years median, $p = 0.45$) [47]. This study was unique in highlighting that the majority of mothers (82.5%) and fathers (80%) of immigrant children originated from low- or medium-income countries.

### Outcomes of Transplantation

A retrospective cohort study of the Italian National Transplantation Network assessed the association of immigration background with KT outcomes [50]. The study found that non-European immigration background (i.e., from non-EU countries beyond Eastern Europe—excluding North America and Oceania) is associated with worse long-term kidney graft function decline following KT relative to EU-born and Eastern-European born counterparts. Compared to EU-born KT recipients, in non-European-born KT recipients, the adjusted average yearly eGFR decline was −0.96 mL/min/year (95% CI: −1.48 to −0.45; $p < 0.001$), whereas it was +0.02 mL/min/year (−0.77 to +0.81; $p = 0.96$) in Eastern European-born KT recipients. There were no statistically significant differences in transplant survival beyond 1 year after KT [it was 91.8% in EU-born (95% CI: 87.1–96.8); 92.5% in Eastern European-born (86.1–99.4); and 89.3% in non-European-born recipients (83.0–96.0)].

### Transplantation and Non-Refusal Rates to Deceased Organ Donation

Only one regional study from Piedmont assessed transplantation and non-refusal rates to deceased organ donation among immigrant family members in intensive care units (ICU) [51]. Between 2004 and 2011, out of 2,914 transplants, first-generation immigrants [$n$ = 222 (7%)] received liver ($n$ = 66), kidney ($n$ = 130), heart ($n$ = 21) and lung ($n$ = 5) transplantation. Acceptance of deceased organ donation was lower in some ethnic groups, regardless of immigration background. Families originating from Romania had the most favorable attitude towards organ donation (78.8%), whereas families of Moroccan and Albanian origin were the least favorable (25% and 33%, respectively) [51]. These data were not adjusted for any potential confounding factors.

## DISCUSSION

ODT is a complex process with many clinical, psychosocial, and cultural factors that may be associated with immigrant status. Patient and family education and informed consent are keys to equitable care for vulnerable populations throughout the ODT process. Shared decision-making is the most desirable and ethical model of informed consent at all stages of ODT [52] but may be impeded by multiple factors at the level of patients, providers, the clinical encounter, the healthcare system, and the broader societal context. "The ethical foundation of informed consent can be traced to the promotion of two values: personal wellbeing and self-determination." This can be achieved only when the informed consent process is "based upon mutual respect and participation, not a ritual to be equated with reciting the contents of a form . . . " [53]. Our study newly shows that, despite a publicly funded health system with universal healthcare coverage, non-European-born individuals living in Italy are less likely to receive LDKT and more likely to have inferior long-term kidney graft function compared with EU-born and Eastern European-born individuals. Further, while immigrant patients are increasingly represented among transplant recipients (especially kidney and liver transplants), refusal rates for organ donation are higher in some ethnic groups compared with native-born and other foreign-born referents. However, existing literature based on regional and national registries focuses on KT with descriptive analyses not adjusted for all potential confounding variables. Qualitative studies assessing the perspectives of relevant stakeholders, the lay public, bereaved family members, patients pursuing transplant, (potential) living donors from immigrant communities, and transplant centers and ICU healthcare professionals (HCP) are missing. Such studies would inform on the potential barriers to transplant care at the individual, interpersonal, and the societal level to identify potential areas for intervention [1]. In addition, evidence is lacking of the patient experience throughout the various stages of the ODT pathway (from end stage organ disease onset through to post-transplant follow-up). These studies could provide insights into the factors which may have negative downstream effects on the outcomes of transplantation for individuals with an immigration background. The higher refusal rates and reduced live donation among ethnic minority populations have the potential to increase the waiting time for transplantation [18, 54]. The inability to match donor and recipient ethnicity may negatively impact on patient and graft survival [55, 56].

Discrepancy between transplantation and refusal rates to organ donation [18, 19] are not indicative of a lack of reciprocity or unequal contribution to organ donation among immigrant populations. Rather, as for the other phases of the ODT process, they are likely a reflection of multiple, intersecting factors [17, 18, 33, 57–60]. Among immigrant populations, the lack of knowledge regarding ODT, varied cultural and religious beliefs, low health literacy, lack of trust towards the healthcare system and HCPs in the host country, a systemic inability to communicate about ODT in a culturally sensitive fashion, and the background framework of ODT in the country of origin with fear of organ trafficking, unfairness, lack of transparency, or general mistrust towards the healthcare system may contribute to negative attitudes towards organ donation in some immigrant groups [17, 18, 33, 57–60].

Studies from across Europe have drawn attention to the association of immigrant and/or ethnic minority status with inequities in ODT. An incident cohort study of 11,299 ESKD patients from the United Kingdom (UK) (9,602 White, 1,178 South Asian, 519 Black) [9] found that individuals of South Asian and Black ethnicity are younger, more socially deprived, and have more diabetes. Such individuals are more likely to be referred later to a nephrologist relative to White referents ($p$ = 0.01). After adjusting for patient characteristics, social deprivation, and center effects, South Asian patients were more likely to be wait-listed compared with White patients, whereas no differences were noted between patients of Black and White ethnicity [9]. The ethnic composition of this patient cohort was different from that of Italian studies (i.e., in all three Italian studies on waitlisting, the immigrant category comprised patients of both White and non-White ethnicity), and no data were available of the patients' immigration background or family history of migration. Besides, ethnic diversity presents substantial differences between Italy and the UK. Yet, the findings of delayed nephrological referral in the UK and Italy are similar. Despite the UK and Italy having a universal healthcare system, it is possible that the lower use of primary and specialist care among individuals from ethnic and immigrant minority communities may explain a portion of delayed referrals [26, 61]. WL accessibility is higher or equal in immigrant groups when compared with their non-immigrant counterparts in Lombardy and Lazio, respectively, but lower in Piedmont. Italy and the UK provide lifelong transplant care which may dampen the adverse effect of the patient's insurance status or socioeconomic deprivation level on WL enrollment [62]. However, the Italian healthcare and welfare systems are decentralized, and each region is in charge of organizing and delivering healthcare, social care and social welfare services to the population [63]. Therefore, in Italy, systemic regional differences may account as potentially confounding factors and may explain a portion of existing differences among regions. Besides, although socioeconomic deprivation is common amongst immigrant communities in Italy [30], none of the studies included in this review explored the interplay between immigrant status, ethnicity and socioeconomic deprivation.

Other studies have noted the association of immigrant status and/or ethnicity with reduced likelihood of preemptive or LDKT

[10, 12, 14, 15], although some - including the study included in this review—did not account for socioeconomic status [10, 49]. In the UK [12], socioeconomic deprivation ($p < 0.001$) and ethnicity ($p = 0.005$) are significant, independent and interactive predictors. This translates into a marked difference in the proportions of LDKTs between White and non-White recipients in the most socioeconomically deprived groups (39.5% versus 19.3%), but not among the least deprived segments (48.5% versus 51.9%) [12]. One single center retrospective cohort study of 77 pediatric patients [32 born of immigrant families (10 from former Yugoslavia, 10 from Turkey, 10 from other countries]) from Austria [64] contradicted this finding, despite the presence of multiple migration-related inequities (i.e., information delay, limited communication, low levels of knowledge, and self-reported conflicting beliefs) [64]. However, this was largely a White, Eastern European cohort with a longer standing immigration history [46]. Inferior likelihood of LDKT may result from the interplay among various factors at the level of patients, potential living donors, providers, and the healthcare system. These may include personal, religious or cultural beliefs, limited health literacy, lack of family members living close enough to be evaluated for donation, lack of support, inability to take time off work for potential living donors, inadequate communication, suboptimal patient/living donor education, providers' biases or concerns about non-resident donors' follow-up, and lack of healthcare policies for coverage of travel and medical fees for living-donor surgery and follow-up of non-resident donors [22, 24, 49, 65–71].

Most studies of the outcomes of transplantation among immigrants and/or ethnic minority communities [11, 15, 16, 72–76] find no statistically significant differences in patient or graft survival. The study by Grossi et al. included in this review is the only study which found an association between immigration background with worse kidney graft function decline following KT [50]. One single center retrospective cohort study of 555 (50 Black, 505 non-Black) KT recipients from the UK found that, independent of CYP3A5 expresser status, Black KT recipients have poorer long-term outcomes relative to those from other ethnic groups [16]. Similarly, a pediatric study from the Netherlands found higher rejection rates among immigrant KT recipients when compared to non-immigrant referents [10]. As access to care is provided in these regions, it is possible that inequities in earlier stages of transplant care play a role. Late referrals, inferior rates of preemptive and/or LDKT, inadequate patient education, and inability to address socioeconomic and cultural factors associated with immigrant status are some examples [15, 77]. Immigration may also contribute to different exposures to opportunistic infections. Ethnicity may be associated with higher alloreactive immune reactions or metabolism of immunosuppressive medications [10, 15, 75, 78]. The impacts of social determinants of health associated with immigration may also account for a portion of unfavorable trends in KT outcomes [31, 79].

## Interventions

Current approaches to communication, patient education and management are less likely to be effective with subjects from immigrant and/or ethnic minority groups. Targeted/tailored interventions to meet the needs of these populations remain limited in Europe. Studies have advocated for a coordinated approach to empower these individuals at all stages of the process by encouraging participation and inclusion [1]. Studies in the UK [59], Spain [80], and the Netherlands [81] have attempted to improve dialogue with diverse ethnic and faith communities to empower HCPs to deliver more culturally competent and family-centered approaches regarding organ donation and LDKT [57, 80]. Culturally and linguistically competent websites or transplant-center based education to empower specific ethnic minority groups by targeting their needs may also prove useful [82, 83].

In Italy, multilingual donation-related informative material and courses on ODT for cultural mediators and other HCPs involved in organ procurement in some centers have improved the cultural appropriateness of end-of-life care [84, 85]. CNT has initiated a project titled "*Fostering And Improving equity, participation and inclusion in Transplantation Healthcare*" (FAITH) [86] consistent with ESOT policies [4] to adapt ODT communicative, educational and management processes to the needs of immigrant communities, families and individuals (**Figure 1**) (a more detailed description of the research protocol and agenda is reported in the **Supplementary Box SA**).

It is possible that gaps may persist because of inequalities at the broader societal level and biological variations in some ethnic groups. However, considering the portion of inequities engrained in modifiable factors is a compelling ethical duty.

## Limitations and Strengths

Studies of inequities in ODT among immigrant populations residing in Italy included individuals with extreme diversity of cultural, religious, social and immigration backgrounds. These are major limitations as these aspects may significantly bias the interpretation of the results and the potential for intervention. Besides, we acknowledge that there can be no "one size fits all approach" to immigrant populations. For instance, because there can be great within-group variation, future studies should collect data to enable better understanding of the many factors intersecting with immigration. Potentially confounding factors include, but are not limited to, socio-economic status, educational and occupational background, country of origin or descent, reasons for and circumstances of migration, time elapsed since immigration as a proxy for acculturation and integration, language proficiency, local integration policies, and other systemic features which may vary among regions. Another limitation lies in the small number, size, and limited quality of studies. Studies are focused only on ESKD and KT. Yet, this is consistent with prior reviews of inequities in organ transplantation [87]. None investigated possible differences in the need for organ transplants among resident versus more vulnerable immigrant groups (i.e., refugees, asylum seekers, undocumented immigrants). However, studies have shown that the need for KT in these vulnerable groups is infrequent in Europe [88], and most immigrants in Italy are regular residents (5.7 million regular versus 519,000 irregular migrants in 2021) [89]. Italian findings might not apply to immigrant populations

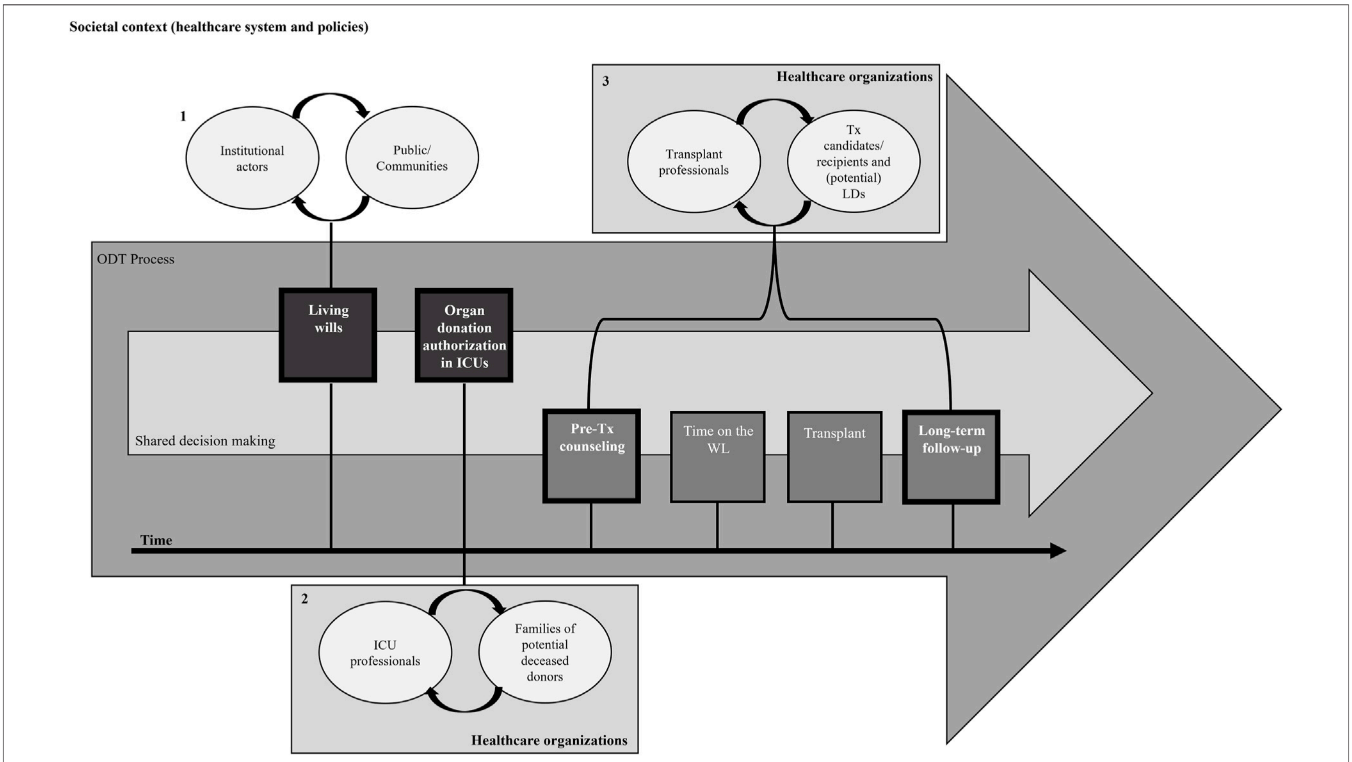


**FIGURE 1 |** Conceptual model of the FAITH project of the Italian National Transplant Center. The figure illustrates the centrality of shared decision making at all stages of the organ donation and transplantation process. The first communication process refers to the relationship between institutional actors and the general public/communities (1), the second to the relationship between healthcare professionals in ICUs and the family members of potential deceased donors (2), and the third to the relationship between transplant professionals and transplant candidates/recipients/(potential) living donors (3). The figure also points out that, to enable the prevention of inequities, interventions should be implemented to target not only communities and/or individuals with an immigration background, but also those who relate with them, namely, institutional actors (1), ICU (2) and transplant centers' HCPs (3), and the contexts where these processes respectively occur [i.e., the societal context (especially relative to the healthcare system—with a focus on healthcare organizations for stages 2 and 3—and policies)]. HCP, Healthcare Professionals; ICU, Intensive Care Unit; LD, Living Donor; MEM, Migrant and Ethnic Minority; Tx, Transplant; WL, Waiting List. *Adapted and modified from Grossi and Cardillo [86].

residing in countries with a different healthcare and social security system, with longer standing immigration history, or to second- or third-generation immigrants (i.e., subjects who were native-born of foreign-born families). As noted in prior reports, consensus is lacking about the categorization of these populations in Europe [1, 45]. This applies also to the studies included in our review. Because ethnicity-related statistics are not allowed in the Italian Census, immigrant status is identified by surrogates like citizenship, place of birth, former citizenship for Italians, and citizenship of parents [37], challenging data interpretation, reporting, and comparisons. Within-country and cross-country comparisons are further challenged by the immigrant category not always distinguishing between individuals who have migrated from EU and non-EU countries, and between people from non-EU countries (i.e., Eastern European countries vs. other non-European/non-Western countries) and between ethnicities. However, the greatest strength of this work is that, when compared to prior evidence from the UK and the US that consider broader ethnicity or racial categories (i.e., Hispanic, Asian or Black) [18, 33], data from Italy may provide additional insights related to immigrant status and country of birth to provide better understanding of trends and target actions [18]. The Italian pathway against inequities in ODT provided in the **Supplementary Appendix** may inform future similar initiatives in other countries. The findings derived from the preliminary feedback of key stakeholders in the ODT process (**Supplementary Tables S2, S3**) may contribute to targeted interventions on modifiable barriers to meet the needs of immigrant populations and provide more equitable transplant care among individuals from these communities.

## AUTHOR CONTRIBUTIONS

AAG: coordinated the FAITH project, developed the conceptual framework, performed the review, collected, analyzed and reported the data, and wrote the article. FP: critically revised and approved the article. LM: calculated the samples sizes and designed the data analyses framework for the FAITH protocol, critically revised and approved the article. AT: developed and drafted the data protection regulation of the FAITH project, critically revised and approved the article. TC: critically revised and approved the article. UM: supervised the study, critically revised and approved the article. MC: promoted and actively participated in the FAITH project, critically revised and approved the article. All authors contributed to the article and approved the submitted version.

## CONFLICT OF INTEREST

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

## ACKNOWLEDGMENTS

Gratitude goes out to all the stakeholder representatives who are actively participating in the FAITH project: Drs. Anna Guermani, Marco Grosso and Anita D'Aprile (Regional Transplant Coordination organization [RTC] Piemonte); Drs. Giuseppe Piccolo, Francesca Ferri and Alessandra Spinelli (RTC Lombardia), Drs. Roberto Peressutti and Francesca Fiorillo (RTC Friuli-Venezia Giulia); Drs. Giuseppe Feltrin, Rossana Schiavo and Chiara Cavalli (RTC Veneto); Drs. Nicola Alvaro, Gabriela Sangiorgi and Marta Cecchetti (RTC Emilia-Romagna); Drs. Adriano Peris, Maria Luisa Migliaccio, Lara Entani, Maria Materno and Mojgan Azadegan (RTC Toscana); Drs. Mariano Feccia, Aldo Giovannelli and Gianfranco Teti (RTC Lazio); Drs. Giorgio Battaglia and Chiara Coticchio (RTC Sicilia); Drs. Annarita Cacciotti and Angelo Maietta (ASL Latina); Dr. Renzo Pegoraro (PAV, Pontifical Academy for Life); Dr. Rosanna Supino (AME, Jewish Medical Association); Dr. Ilham Allah Chiara Ferrero (COREIS, Italian Islamic Religious Community); Drs. Shuddhananda Giri and Svamini Hamsananda Ghiri (UII, Italian Hindu Union); Dr. Giuseppe Vanacore (ANED, Italian Association for Hemodialysis and Transplant Patients); Dr. Flavia Petrin (AIDO, Italian Society for Organ, Tissue and Cell Donation); Dr. Camillo Ripamonti (Centro Astalli, Jesuit Refugee Service Italy); Dr. Cristina Tantardini (Italian Society of Migration Medicine); patient representatives; Drs. Simone Esposito and Manuela Trerotola (CNT Communication Office); Dr. Mimosa Cavicchi (CNT Educational Unit); and Drs. Sara Zuccante, Gaia Bedeschi, Silvia Trapani, Rita Visini, Maria Francesca Arrivi, and Silvia Pisanu (CNT). Gratitude goes out also to Prof. Gurch Randhawa (University of Bedfordhsire, United Kingdom), Dr. David Paredes (Hospital Clinic, Barcelona, Spain), Dr. Nichon Jansen (Dutch Transplant Foundation, Leiden, Netherlands), Prof. Mohammed Khalid Rhazzali (University of Padova, Italy), Prof. Stefano Bonometti (University of Insubria, Varese, Italy), and Prof. Mario Picozzi (Center for Clinical Ethics, University of Insubria, Varese, Italy) for their invaluable inputs and supports to the FAITH project. We thank Prof. Jay Fishman (Harvard Medical School) for editing. Gratitude goes out also to three Reviewers for the provision of multiple substantial inputs and feedback for improvement of this work.

## SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontierspartnerships.org/articles/10.3389/ti.2023.11216/full#supplementary-material

## REFERENCES

1. Grossi AA, Paredes D, Palaniswami V, Jansen N, Picozzi M, Randhawa G. 'One Size Does Not Fit All' in Organ Donation and Transplantation: Targeting and Tailoring Communication for Migrant and Ethnic Minority Populations. *Commun Med* (2023) 18(3):241–57. doi:10.1558/cam.21434
2. Vanholder R, Domínguez-Gil B, Busic M, Cortez-Pinto H, Craig JC, Jager KJ, et al. Organ Donation and Transplantation: A Multi-Stakeholder Call to Action. *Nat Rev Nephrol* (2021) 17(8):554–68. doi:10.1038/s41581-021-00425-3
3. European Kidney Health Alliance. *A Shared Vision for Improving Organ Donation and Transplantation in the EU* (2019). Available from: https://ekha.eu/blog/updated-final-version-of-the-joint-statement-on-organ-donation-and-transplantation-now-available/ (Accessed July 25, 2023).
4. European Society of Organ Transplantation (ESOT). *Tackling Inequalities in Organ Transplantation: A Pathway Forward* (2022). Available from: https://esot.org/wp-content/uploads/2022/10/EM012518_ESOT_ActionDay_ThinkTankReport_2201005_v0-8_FH.pdf (Accessed January 18, 2023).
5. European Commission. *Competence Centre on Foresight. Developments and Forecasts on Increasing Significance of Migration* (2018). [Internet] Available from: https://knowledge4policy.ec.europa.eu/foresight/topic/increasing-significance-migration/more-developments_en (Accessed March 15, 2023).
6. Schoenmaker NJ, Tromp WF, van der Lee JH, Adams B, Bouts AH, Collard L, et al. Disparities in Dialysis Treatment and Outcomes for Dutch and Belgian Children With Immigrant Parents. *Pediatr Nephrol* (2012) 27(8):1369–79. doi:10.1007/s00467-012-2135-7
7. Pruthi R, Robb MWL, Oniscu GC, Tomson C, Bradley A, Forsythe JL, et al. Inequity in Access to Transplantation in the United Kingdom. *Clin J Am Soc Nephrol* (2020) 15(6):830–42. doi:10.2215/CJN.11460919
8. Cantrelle C, Laurens C, Luciolli E, Loty B, Tuppin P. Access to Kidney Transplantation in France of Non-French Patients and French Patients Living in Overseas Territories. *Transplantation* (2006) 81(8):1147–52. doi:10.1097/01.tp.0000205182.96861.3a
9. Udayaraj U, Ben-Shlomo Y, Roderick P, Casula A, Dudley C, Johnson R, et al. Social Deprivation, Ethnicity, and Access to the Deceased Donor Kidney Transplant Waiting List in England and Wales. *Transplantation* (2010) 90(3):279–85. doi:10.1097/TP.0b013e3181e346e3
10. Tromp WF, Cransberg K, van der Lee JH, Bouts AH, Collard L, Van Damme-Lombaerts R, et al. Fewer Pre-Emptive Renal Transplantations and More Rejections in Immigrant Children Compared to Native Dutch and Belgian Children. *Nephrol Dial Transpl* (2012) 27(6):2588–93. doi:10.1093/ndt/gfr628
11. Tjaden LA, Noordzij M, Van Stralen KJ, Kuehni CE, Raes A, Cornelissen EAM, et al. Racial Disparities in Access to and Outcomes of Kidney Transplantation in Children, Adolescents, and Young Adults: Results From the ESPN/ERA-EDTA (European Society of Pediatric Nephrology/European Renal Association-European Dialysis and Transplant Association) Registry. *Am J Kidney Dis* (2016) 67(2):293–301. doi:10.1053/j.ajkd.2015.09.023
12. Khalil K, Brotherton A, Moore S, Evison F, Gallier S, Hodson J, et al. Interaction Between Socioeconomic Deprivation and Ethnicity for Likelihood of Receiving Living-Donor Kidney Transplantation. *BMC Nephrol* (2022) 23(1):113–1. doi:10.1186/s12882-022-02742-6
13. Wu DA, Robb ML, Watson CJE, Forsythe JLR, Tomson CRV, Cairns J, et al. Barriers to Living Donor Kidney Transplantation in the United Kingdom: A

National Observational Study. *Nephrol Dial Transpl* (2017) 32(5):890–900. doi:10.1093/ndt/gfx036

14. Udayaraj U, Ben-Shlomo Y, Roderick P, Casula A, Dudley C, Collett D, et al. Social Deprivation, Ethnicity, and Uptake of Living Kidney Donor Transplantation in the United Kingdom. *Transplantation* (2012) 93(6): 610–6. doi:10.1097/TP.0b013e318245593f
15. Laging M, Kal-van Gestel JA, van de Wetering J, Ijzermans JNM, Weimar W, Roodnat JI. Understanding the Influence of Ethnicity and Socioeconomic Factors on Graft and Patient Survival After Kidney Transplantation. *Transplantation* (2014) 98(9):974–8. doi:10.1097/TP.0000000000000164
16. Ng FL, Holt DW, Chang RWS, MacPhee IAM. Black Renal Transplant Recipients Have Poorer Long-Term Graft Survival Than CYP3A5 Expressers From Other Ethnic Groups. *Nephrol Dial Transpl* (2010) 25(2):628–34. doi:10.1093/ndt/gfp530
17. Ríos Zambudio A, Carrillo J, López-Navas AI, Ayala-García MA, Alconchel F, Iniesta-Sepúlveda M, et al. African Immigrants Living in Spain: Awareness Toward Organ Donation and the Need for Specific Awareness Campaigns. *Exp Clin Transpl* (2022) 20(2):199–208. doi:10.6002/ect.2021.0480
18. Randhawa G, Gardiner D. Tackling Organ Donation Among Minority Ethnic Communities in the UK-A Whole Systems Approach. *Br Med Bull* (2022) 142(1):4–14. doi:10.1093/bmb/ldac008
19. Bhopal A, Wium C, Reisæter AV, Bhala N, Kumar B. Organ Donation for Migrants and Ethnic Minorities. *Tidsskr den Nor Laegeforening* (2019) 139(13). doi:10.4045/tidsskr.19.0406
20. Douglas P, Cetron M, Spiegel P. Definitions Matter: Migrants, Immigrants, Asylum Seekers and Refugees. *J Trav Med* (2019) 26(2):taz005. doi:10.1093/jtm/taz005
21. Wickramage K, Vearey J, Zwi AB, Robinson C, Knipper M. Migration and Health: A Global Public Health Research Priority. *BMC Public Health* (2018) 18(1):987. doi:10.1186/s12889-018-5932-5
22. Poulakou G, Len O, Akova M. Immigrants as Donors and Transplant Recipients: Specific Considerations. *Intensive Care Med* (2019) 45(3):401–3. doi:10.1007/s00134-019-05534-z
23. Chiarenza A, Dauvrin M, Chiesa V, Baatout S, Verrept H. Supporting Access to Healthcare for Refugees and Migrants in European Countries Under Particular Migratory Pressure. *BMC Health Serv Res* (2019) 19(1):513. doi:10.1186/s12913-019-4353-1
24. Van Biesen W, Vanholder R, Ernandez T, Drewniak D, Luyckx V. Caring for Migrants and Refugees With End-Stage Kidney Disease in Europe. *Am J Kidney Dis* (2018) 71(5):701–9. doi:10.1053/j.ajkd.2017.10.015
25. Sever MŞ, Jager KJ, Vanholder R, Stengel B, Harambat J, Finne P, et al. A Roadmap for Optimizing Chronic Kidney Disease Patient Care and Patient-Oriented Research in the Eastern European Nephrology Community. *Clin Kidney J* (2021) 14(1):23–35. doi:10.1093/ckj/sfaa218
26. Di Napoli A, Ventura M, Spadea T, Giorgi Rossi P, Bartolini L, Battisti L, et al. Barriers to Accessing Primary Care and Appropriateness of Healthcare Among Immigrants in Italy. *Front Public Heal* (2022) 10:817696. doi:10.3389/fpubh.2022.817696
27. Ballotari P, Caroli S, Ferrari F, Romani G, Marina G, Chiarenza A, et al. Differences in Diabetes Prevalence and Inequalities in Disease Management and Glycaemic Control by Immigrant Status: A Population-Based Study (Italy). *BMC Public Health* (2015) 15:87. doi:10.1186/s12889-015-1403-4
28. Eurostat. *Migrant Population: 23.7 Million Non-EU Citizens Living in the EU on 1 January 2021* (2022). [Internet] Available from: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Migration_and_migrant_population_statistics#Migrant_population:_23.7_million_non-EU_citizens_living_in_the_EU_on_1_January_2021 (Accessed December 1, 2022).
29. Italian National Institutes of Statistics (ISTAT). *Identità e Percorsi di Integrazione Delle Seconde Generazioni in Italia. Rome* (2020). Available from: https://www.istat.it/it/archivio/240930 (Accessed July 25, 2023).
30. ISMU. *The Twenty-Fourth Italian Report on Migrations 2018* (2019). Fondazione ISMU Available from: https://www.ismu.org/en/the-twenty-fourth-italian-report-on-migrations-2018/ (Accessed March 10, 2023).
31. Wändell P, Carlsson AC, Li X, Gasevic D, Ärnlöv J, Sundquist J, et al. End-Stage Kidney Diseases in Immigrant Groups: A Nationwide Cohort Study in Sweden. *Am J Nephrol* (2019) 49(3):186–92. doi:10.1159/000497063
32. Hounkpatin HO, Fraser SDS, Honney R, Dreyer G, Brettle A, Roderick PJ. Ethnic Minority Disparities in Progression and Mortality of Pre-Dialysis Chronic Kidney Disease: A Systematic Scoping Review. *BMC Nephrol* (2020) 21(1):217–4. doi:10.1186/s12882-020-01852-3
33. Bratton C, Chavin K, Baliga P. Racial Disparities in Organ Donation and Why. *Curr Opin Organ Transpl* (2011) 16(2):243–9. doi:10.1097/MOT.0b013e3283447b1c
34. Di Napoli A, Lapucci E, Baglio G, Di Giulio S, Registro Regionale Dialisi e Trapianto del. Lazio Dialysis Registry: Natives vs Foreigners. *G Ital Di Nefrol* (2015) 32(3):gin/32.3.8.
35. Forneris G, Boero R, Massara C, Quarello F. Immigrants and Dialysis: A Survey in Piedmont. *G Ital Di Nefrol* (2011) 28(3):314–8.
36. Corghi E, Conte F, Esposito V, Galassi A, Galli EG, La Rocca E, et al. Non-EU Patients in Dialysis Centers in Lombardy [I Pazienti Extracomunitari Nei Centri Dialisi Della Lombardia]. *G Ital Di Nefrol* (2016) 33(67).
37. Affronti M, Affronti A, Soresi M, Giannitrapani L, Campagna E, Tramuto F, et al. Distribution of Liver Disease in a Cohort of Immigrants in Sicily: Analysis of Day-Hospital Admissions in a Migration Medicine Unit. *Le Infez Med* (2014) 3:200–5.
38. Buja A, Gini R, Visca M, Damiani G, Federico B, Francesconi P, et al. Prevalence of Chronic Diseases by Immigrant Status and Disparities in Chronic Disease Management in Immigrants: A Population-Based Cohort Study, Valore Project. *BMC Public Health* (2013) 13:504. doi:10.1186/1471-2458-13-504
39. Gibertoni D, Mammana L, Gherardi G, Baschieri E, Minora F, Santoro A. Presentation and Outcome of Chronic Kidney Disease in Italian and Immigrant Citizens: Results From the Emilia-Romagna PIRP Project. *J Nephrol* (2022) 35(1):179–90. doi:10.1007/s40620-021-00984-5
40. National Academies of Sciences, Engineering and Medicine. Confronting and Eliminating Inequities in the Organ Transplantation System. In: Hackmann M, English R, Kizer K, editors. *Realizing the Promise of Equity in the Organ Transplantation System*. Washington, DC: The National Academies Press (2022). p. 85–115.
41. Braveman P. Health Disparities and Health Equity: Concepts and Measurement. *Annu Rev Public Health* (2006) 27:167–94. doi:10.1146/annurev.publhealth.27.021405.102103
42. International Organization for Migration (IOM). *Glossary on Migration* (2019). Available from: https://publications.iom.int/system/files/pdf/iml_34_glossary.pdf (Accessed January 10, 2023).
43. European Commission. *"Migrant" Definition* (2023). [Internet]. Available from: https://home-affairs.ec.europa.eu/pages/glossary/migrant_en (Accessed January 10, 2023).
44. Bhopal R. Glossary of Terms Relating to Ethnicity and Race: For Reflection and Debate. *J Epidemiol Community Health* (2004) 58(6):441–5. doi:10.1136/jech.2003.013466
45. Grossi AA, Randhawa G, Jansen NE, Paredes D. Taking a "Care Pathway/whole Systems" Approach to Equality Diversity Inclusion (EDI) in Organ Donation and Transplantation in Relation to the Needs of "Ethnic/racial/migrant" Minority Communities:A Statement and a Call for Action. *Transpl Int* (2023) 36. doi:10.3389/ti.2023.11310
46. EUPHA. *Migration, Ethnicity and Health. Statement Drafted by the Section for Migration, Ethnicity and Health of the European Public Health Association (EUPHA)* (2018). Available from: https://ephconference.eu/repository/sections/migr/EUPHA_statement_9th_May_2018a_revised.pdf (Accessed March 3, 2023).
47. Paglialonga F, Consolo S, Vidal E, Parolin M, Minale B, Giordano M, et al. Resident Foreign Patients Receive Adequate Dialysis but Fewer Preemptive Transplantations: Data From the Italian Pediatric Dialysis Registry. *Pediatr Nephrol* (2021) 36(3):639–47. doi:10.1007/s00467-020-04730-0
48. Fogazzi GB, Castelnovo C. Maintenance Dialysis in Patients From Developing Countries: The Experience of an Italian Center. *J Nephrol* (2004) 17(4):552–8.
49. Grossi AA, Puoti F, Fiaschetti P, Di Ciaccio P, Maggiore U, Cardillo M. Kidney Transplantation and Withdrawal Rates Among Wait-Listed First-Generation Immigrants in Italy. *Eur J Public Health* (2022) 32(3):372–8. doi:10.1093/eurpub/ckac027
50. Grossi AA, Maggiore U, Puoti F, Grossi PA, Picozzi M, Cardillo M. Association of Immigration Background With Kidney Graft Function in a

Publicly Funded Health System: A Nationwide Retrospective Cohort Study in Italy. *Transpl Int* (2020) 33(11):1405–16. doi:10.1111/tri.13688

51. Guermani A, Potenza R, Isnardi D, Peluso M, Bosco R, Donadio P. Organ Donation and Transplantation in Migrants: Piedmont Reality From 2004 to 2011. *Transpl Proc* (2013) 45(7):2591–3. doi:10.1016/j.transproceed.2013.07.031
52. Suurmond J, Seeleman C. Shared Decision-Making in an Intercultural Context: Barriers in the Interaction Between Physicians and Immigrant Patients. *Patient Educ Couns* (2006) 60(2):253–9. doi:10.1016/j.pec.2005.01.012
53. Michigan Law Review. Making Health Care Decisions: A Report on the Ethical and Legal Implications of Informed Consent in the Patient-Practitioner Relationship: Volume One. *Mich L Rev* (1984) 82(4):839–42. Available from: https://repository.law.umich.edu/mlr/vol82/iss4/21/ (Accessed January 11, 2023).
54. Morgan M, Sims J, Jain N, Randhawa G, Sharma S, Kirit M. Who Waits Longest for a Kidney?: Inequalities in Access to Kidney Transplantation Among Black and Asian Minority Ethnic (BAME) Groups in the UK. *Br J Ren Med* (2015) 20(1):4–7.
55. Kanter KR, Berg AM, Mahle WT, Vincent RN, Kilgo PD, Kogon BE, et al. Donor-Recipient Race Mismatch and Graft Survival After Pediatric Heart Transplantation. *Ann Thorac Surg* (2009) 87(1):204–9. doi:10.1016/j.athoracsur.2008.09.074
56. Allen JG, Weiss ES, Merlo CA, Baumgartner WA, Conte JV, Shah AS. Impact of Donor-Recipient Race Matching on Survival After Lung Transplantation: Analysis of Over 11,000 Patients. *J Hear Lung Transpl* (2009) 28(10):1063–71. doi:10.1016/j.healun.2009.06.012
57. Morgan M, Kenten C, Deedat S, Farsides B, Newton T, Randhawa G, et al. Increasing the Acceptability and Rates of Organ Donation Among Minority Ethnic Groups: A Programme of Observational and Evaluative Research on Donation, Transplantation and Ethnicity (DonaTE). *Program Grants Appl Res* (2016) 4(4):1–196. doi:10.3310/pgfar04040
58. Kentish-Barnes N, Siminoff LA, Walker W, Urbanski M, Charpentier J, Thuong M, et al. A Narrative Review of Family Members' Experience of Organ Donation Request After Brain Death in the Critical Care Setting. *Intensive Care Med* (2019) 45(3):331–42. doi:10.1007/s00134-019-05575-4
59. Randhawa G, Neuberger J. Role of Religion in Organ Donation-Development of the United Kingdom Faith and Organ Donation Action Plan. *Transpl Proc* (2016) 48(3):689–94. doi:10.1016/j.transproceed.2015.10.074
60. El Hangouche AJ, Alaika O, Rkain H, Najdi A, Errguig L, Doghmi N, et al. Knowledge, Attitudes, and Practice of Organ Donation in Morocco: A Cross-Sectional Survey. *Saudi J Kidney Dis Transpl* (2018) 29(6):1358–65. doi:10.4103/1319-2442.248301
61. Lebano A, Hamed S, Bradby H, Gil-Salmerón A, Durá-Ferrandis E, Garcés-Ferrer J, et al. Migrants' and Refugees' Health Status and Healthcare in Europe: A Scoping Literature Review. *BMC Public Health* (2020) 20(1):1039–22. doi:10.1186/s12889-020-08749-8
62. Zhang X, Melanson TA, Plantinga LC, Basu M, Pastan SO, Mohan S, et al. Racial/ethnic Disparities in Waitlisting for Deceased Donor Kidney Transplantation 1 Year After Implementation of the New National Kidney Allocation System. *Am J Transpl* (2018) 18(8):1936–46. doi:10.1111/ajt.14748
63. de Belvis A, Meragaglia M, Morsella A, Adduci A, Perilli A, Cascini F, et al. *Italy: Health System Review. Vol. 24, Health Systems in Transition* (2022). Available from: https://eurohealthobservatory.who.int/publications/i/italy-health-system-review-2022 (Accessed July 18, 2023).
64. Oztek-Celebi FZ, Herle M, Ritschl V, Kaltenegger L, Stamm T, Aufricht C, et al. High Rate of Living Kidney Donation to Immigrant Children Despite Disparities- An Epidemiological Paradox? *Front Pediatr* (2019) 7:25. doi:10.3389/fped.2019.00025
65. Sandal S, Charlebois K, Fiore JF, Wright DK, Fortin MC, Feldman LS, et al. Health Professional–Identified Barriers to Living Donor Kidney Transplantation: A Qualitative Study. *Can J Kidney Heal Dis* (2019) 6:2054358119828389. doi:10.1177/2054358119828389
66. Ismail SY, Massey EK, Luchtenburg AE, Claassens L, Zuidema WC, Busschbach JJV, et al. Religious Attitudes Towards Living Kidney Donation Among Dutch Renal Patients. *Med Health Care Philos* (2012) 15(2):221–7. doi:10.1007/s11019-011-9326-z
67. Timmerman L, Ismail SY, Luchtenburg AE, Zuidema WC, Ijzermans JNM, Busschbach JJV, et al. Exploring Knowledge About Dialysis, Transplantation, and Living Donation Among Patients and Their Living Kidney Donors. *Int J Behav Med* (2015) 22(5):580–9. doi:10.1007/s12529-015-9461-7
68. Ismail SY, Claassens L, Luchtenburg AE, Roodnat JI, Zuidema WC, Weimar W, et al. Living Donor Kidney Transplantation Among Ethnic Minorities in the Netherlands: A Model for Breaking the Hurdles. *Patient Educ Couns* (2013) 90(1):118–24. doi:10.1016/j.pec.2012.08.004
69. Taylor DM, Bradley JA, Bradley C, Draper H, Dudley C, Fogarty D, et al. Limited Health Literacy Is Associated With Reduced Access to Kidney Transplantation. *Kidney Int* (2019) 95(5):1244–52. doi:10.1016/j.kint.2018.12.021
70. Ladin K, Rodrigue JR, Hanto DW. Framing Disparities Along the Continuum of Care From Chronic Kidney Disease to Transplantation: Barriers and Interventions. *Am J Transpl* (2009) 9(4):669–74. doi:10.1111/j.1600-6143.2009.02561.x
71. Massie AB, Muzaale AD, Luo X, Chow EKH, Locke JE, Nguyen AQ, et al. Quantifying Postdonation Risk of ESRD in Living Kidney Donors. *J Am Soc Nephrol* (2017) 28(9):2749–55. doi:10.1681/ASN.2016101084
72. Bucher JN, Koenig M, Schoenberg MB, Thomas M, Crispin A, Angele MK, et al. Liver Transplantation in Patients With a History of Migration-A German Single Center Comparative Analysis. *PLoS One* (2019) 14(10):e0224116. doi:10.1371/journal.pone.0224116
73. Oztek FZ, Tekin P, Herle M, Mueller T, Arbeiter K, Aufricht C. Does Immigration Background Influence Outcomes After Renal Transplantation? *Pediatr Nephrol* (2011) 26(2):309–15. doi:10.1007/s00467-010-1685-9
74. Oztek FZ, Ipsiroglu O, Mueller T, Aufricht C. Outcome After Renal Transplantation in Children From Native and Immigrant Families in Austria. *Eur J Pediatr* (2009) 168(1):11–6. doi:10.1007/s00431-008-0698-x
75. Mérida E, Rodríguez A, Hernandez G, Huerta A, Gonzalez J, Hernández A, et al. Renal Transplantation in Emigrants From Africa in Spain: Similar Results but Different Infectious Profile Compared With Spanish People. *Transpl Proc* (2009) 41(6):2363–5. doi:10.1016/j.transproceed.2009.05.005
76. Pallet N, Thervet E, Alberti C, Emal-Aglae V, Bedrossian J, Martinez F, et al. Kidney Transplant in Black Recipients: Are African Europeans Different From African Americans. *Am J Transpl* (2005) 5(11):2682–7. doi:10.1111/j.1600-6143.2005.01057.x
77. Skelton SL, Waterman AD, Davis LSA, Peipert JD, Fish AF. Applying Best Practices to Designing Patient Education for Patients With End-Stage Renal Disease Pursuing Kidney Transplant. *Prog Transpl* (2015) 25(1):77–84. doi:10.7182/pit2015415
78. Gordon EJ, Ladner DP, Caicedo JC, Franklin J. Disparities in Kidney Transplant Outcomes: A Review. *Semin Nephrol* (2010) 30(1):81–9. doi:10.1016/j.semnephrol.2009.10.009
79. Campostrini S, Carrozzi G, Severoni S, Masocco M, Salmaso S, Balestra F, et al. Migrant Health in Italy: A Better Health Status Difficult to Maintain - Country of Origin and Assimilation Effects Studied From the Italian Risk Factor Surveillance Data. *Popul Health Metr* (2019) 17(1):14–1. doi:10.1186/s12963-019-0194-8
80. Generalitat de Catalunya. *Donació I Religions* (2022). [Internet]. Available from: https://trasplantaments.gencat.cat/ca/la_donacio/donacio-i-religions/ (Accessed January 15, 2023).
81. Ismail SY, Luchtenburg AE, Timman R, Zuidema WC, Boonstra C, Weimar W, et al. Home-Based Family Intervention Increases Knowledge, Communication and Living Donation Rates: A Randomized Controlled Trial. *Am J Transpl* (2014) 14(8):1862–9. doi:10.1111/ajt.12751
82. Gordon EJ, Feinglass J, Carney P, Vera K, Olivero M, Black A, et al. A Culturally Targeted Website for Hispanics/latinos About Living Kidney Donation and Transplantation: A Randomized Controlled Trial of Increased Knowledge. *Transplantation* (2016) 100(5):1149–60. doi:10.1097/TP.0000000000000932
83. Gordon EJ, Caicedo JC, Ladner DP, Reddy E, Abecassis MM. Transplant Center Provision of Education and Culturally and Linguistically Competent Care: A National Study. *Am J Transpl* (2010) 10(12):2701–7. doi:10.1111/j.1600-6143.2010.03304.x
84. Potenza R, Guermani A, Peluso M, Casciola A, Ginosa I, Sperlinga R, et al. Effectiveness of an Education Program on Donation and Transplant Aimed at

Students of the Nursing Degree Course. *Transpl Proc* (2015) 47(7):2097–101. doi:10.1016/j.transproceed.2014.11.074

85. Potenza R, Guermani A, Grosso M, Fossarello L, Fontaneto C, Casciola A, et al. Organ and Tissue Donation in Migrants: Advanced Course for Cross-Cultural Mediators. *Transpl Proc* (2013) 45(7):2584–6. doi:10.1016/j.transproceed.2013.07.029
86. Grossi AA, Cardillo M. Il Progetto Migrant and Ethnic Minority Education on Transplantation and Organ Donation and Process Optimization (ME TOO). *Trapianti* (2021) 25(3):73–85. doi:10.1709/3687.36736
87. Park C, Jones MM, Kaplan S, Koller FL, Wilder JM, Boulware LE, et al. A Scoping Review of Inequities in Access to Organ Transplant in the United States. *Int J Equity Health* (2022) 21(1):22–0. doi:10.1186/s12939-021-01616-x
88. Van Biesen W, Vanholder R, Vanderhaegen B, Lameire N, Wanner C, Wiecek A, et al. Renal Replacement Therapy for Refugees With End-Stage Kidney Disease: An International Survey of the Nephrological Community. *Kidney Int Suppl* (2016) 6(2):35–41. doi:10.1016/j.kisu.2016.09.001
89. ISMU (Iniziative e Studi sulla MUltietnicità). *XXVII Rapporto Sulle Migrazioni 2021* (2021). [XXVII Migration report 2021]. Available from: https://www.ismu.org/xxvii-rapporto-sulle-migrazioni-2021-comunicato-stampa-11-2-2022/ (Accessed July 20, 2023).

LETTER TO THE EDITOR
published: 07 September 2023
doi: 10.3389/ti.2023.11674

# Refusal Rates to Organ Donation in Intensive Care Units Among Immigrant Populations in Italy

*Alessandra Agnese Grossi*[1,2]*, *Francesca Puoti*[3], *Umberto Maggiore*[4] *and Massimo Cardillo*[3]

*[1]Center for Clinical Ethics, Department of Biotechnologies and Life Sciences, University of Insubria, Varese, Italy, [2]Department of Human Sciences, Innovation and Territory, University of Insubria, Como, Italy, [3]Italian National Transplant Center (CNT), Istituto Superiore di Sanità, Rome, Italy, [4]Nephrology Unit, Dipartimento di Medicina e Chirurgia, Università di Parma, Parma, Italy*

**Keywords: organ donation, organ transplantation, migrants, immigrants, ethnic minorities**

Dear Editors,

Immigration is an ongoing and emergent phenomenon worldwide. With 82 million subjects who have migrated from other countries, Europe is currently first at the global level as host of international migrants [1]. In Europe, Italy stands third in the number of regular residents from outside the European Union (EU) (5.2 million). Over the past 20 years, Italy has become an increasingly diverse country. Given the recency of the immigration phenomenon, adult immigrant and ethnic minority groups in Italy coincide. Ethnic minorities originate mostly from Eastern Europe (Romania, Albania, Ukraine, and Moldova), Northern Africa (Morocco and Egypt), Asia (China) and South Asia (India, Philippines, Bangladesh and Pakistan) [2], with Eastern European populations having the longer-standing immigration history.

It is well known that the attitude toward post-mortem organ donation is complex and multifactorial and may be influenced by many intersecting factors requiring a socio-ecological approach (i.e., considering the factors intervening at the individual, interpersonal and societal levels) to enable understanding. This is especially relevant when it comes to considering the factors underlying the attitude of individuals who have migrated from other countries or who are from ethnic minorities. At the individual level, many factors may play a role. These factors include cultural and religious beliefs, language proficiency, socioeconomic status, and low health literacy. Further, lack of knowledge of organ donation and transplantation, lack of trust toward the healthcare system and healthcare professionals (HCP), and lack of familiarity with the complexity of the healthcare system may be influential. Additional factors may include also the individual reasons for and circumstances of migration, time elapsed since immigration as a potential proxy for acculturation and/or integration, and organ trafficking or corruption in healthcare systems being widespread practices in countries of origin. Besides, HCPs' lack of training for the development of intercultural competences and communicative/relational abilities, and interpersonal dynamics between potential donors' families and HCPs in intensive care units (ICU) may equally account for a portion of attitudes among immigrant donors' families in ICUs. At the healthcare system level, the inability of institutional actors to communicate about organ donation and transplantation in a culturally sensitive fashion among the public and to reach out effectively to these communities by improved participation and involvement of local faith/community representatives may equally play a role. Availability of culturally competent and, more broadly, diversity sensitive healthcare services, administrative difficulties, poor care coordination among the actors involved, and other features at organizational, local levels and, finally, the broader societal context

***Correspondence:**
*Alessandra Agnese Grossi*
*grossiaa@gmail.com*

**Received:** *12 June 2023*
**Accepted:** *14 August 2023*
**Published:** *07 September 2023*

**Citation:**
*Grossi AA, Puoti F, Maggiore U and Cardillo M (2023) Refusal Rates to Organ Donation in Intensive Care Units Among Immigrant Populations in Italy. Transpl Int 36:11674. doi: 10.3389/ti.2023.11674*

---

**Abbreviations:** CNT, Italian National Transplant Center; EU, European Union; HCP, Healthcare Professional; ICU, Intensive Care Unit.

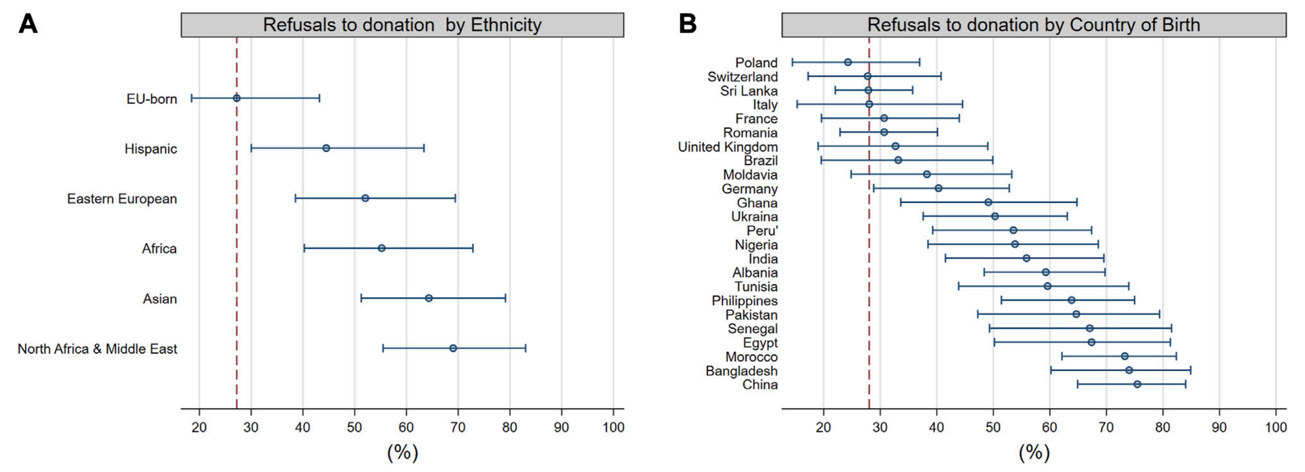


**FIGURE 1 |** Proportion of refusals to donation according to ethnicity **(A)** and country of birth **(B)**. The circles represent the mean, the horizontal bars the 95 percent credible intervals. A dotted vertical bar is drawn at the mean of the referent group, namely, EU-Born **(A)** and Italy **(B)**. A 95% percent credible interval that does not cross the vertical red bars suggests a low probability (i.e., less than 5%) that the refusal propensity of the group is alike the referent group. We included only groups that were represented by at least 30 subjects. The plots results from fitted Bayesian regression models that were adjusted for Italian region of donation.

(i.e., integration and migration policies, discrimination) also have the potential to stand among the contributing factors [3].

We have extracted data on 24,222 donors between 1 January 2012 and 31 December 2021 from the Transplant Information System (SIT) of the Italian National Transplant Center (CNT). As in earlier studies [4, 5], non-EU-born individuals were categorized as Eastern European-born and non-European-born as distinguished from EU-born (see the **Supplementary Appendix** for additional details) and included groups that were represented by at least 30 subjects. Out of 24,222 donors, 1,077 (4.4%) were non-EU-born and 1,771 (7.3%) were foreign-born. We estimated refusal rates along with 95% credible intervals (95% CI) based on Bayesian logistic models that was adjusted for Italian region of donation (The Stata and R Stan code for the statistical analyses are freely available at[1]; see the **Supplementary Appendix** for more details on the size of each group and on the distribution across Italian region of donation). As shown in **Figure 1**, refusal rates varied greatly according to both donor's ethnicity (**Figure 1A**), and donor's country of birth (**Figure 1B**). Compared to the native-born Italian population, the refusal rates were higher across virtually every immigrant group and mostly originating from non-Western countries, with the exception of individuals from Sri Lanka. The mean probability of refusal ranged from 27.2% (95% CI: 18.5%–42.3%) for EU-born donors to 69% (95% CI: 55.5–83.0) for North African and Middle-Eastern donors (**Figure 1A**); from 24.3% (95% CI: 14.5%–37.0%) for donors from Poland to 75.5 (95% CI: 64.9–84.0) for donors from China (**Figure 1B**). Studies on refusal rates among individuals who have migrated from other countries are scarce in Europe. To the best of our knowledge, there are only two reports, one from the UK and the other from Norway that have examined refusal rates according to ethnicity and/or immigration status. Consistent with our findings, they have both reported higher refusal rates among migrant and ethnic minority individuals relative to their native-born or White referents [6, 7]. However, the UK report was unable to present the detailed data of refusal rates according to countries of origin and referred only to broad ethnicity categories (i.e., Black, Asian and other minority ethnic groups) [6]. In contrast, the Norwegian article did not provide any data of either ethnicity or immigrant status as these data are not routinely collected in Norway. Therefore, the article only provided a general overview of the problem [7].

We contend that it is an ethical duty and responsibility to foster shared decision-making (i.e., "a relational process … *allowing* decisions to develop over time by jointly respecting clinical indications and individual … subjective considerations, values, needs, preferences, life circumstances and goals") [8] to enable free and informed choices surrounding organ donation among these populations. Consideration of the informative, cultural, and psychosocial needs of these communities in relation to deceased organ donation and end-of-life care; understanding of the difficulties and educational gaps among HCPs and of the deficiencies at the organizational level allowing to communicate in a culturally sensitive fashion with bereaved family members in ICUs, and the promotion of an ongoing dialogue among all stakeholders (including representatives from minority, migrant and faith communities) are critical for the subsequent development of interventions directed towards these populations [9, 10]. The CNT has recently initiated a project named Fostering And Improving equity, participation and inclusion in Transplantation Healthcare (FAITH) to address the existing gaps in the entire organ donation and transplantation pathway (i.e., promotion of the culture of organ donation and transplantation among the public/communities, relational processes in ICUs, and relational/educational processes at transplant centers with transplant recipients and, when this applies, their potential living donors) to enable the implementation of shared decision-making across the entire process [9]. Future studies will examine whether simultaneous interventions on the modifiable factors at the different levels may improve the ability of the transplantation system to

---

[1] https://github.com/UMaggiore/Refusal-Rates

respond effectively to the needs of an increasingly diverse and multicultural society.

## DATA AVAILABILITY STATEMENT

The datasets presented in this study can be found in online repositories. The names of the repository/repositories and accession number(s) can be found in the article/**Supplementary Material**.

## ETHICS STATEMENT

Ethical approval was not required for the study involving humans in accordance with the local legislation and institutional requirements. Written informed consent to participate in this study was not required from the participants or the participants' legal guardians/next of kin in accordance with the national legislation and the institutional requirements.

## AUTHOR CONTRIBUTIONS

AAG: developed the conceptual framework, interpreted the data, and wrote the letter. FP: extracted and provided the data, critically revised and approved the letter. UM: designed the statistical framework, performed statistical analyses, critically revised and approved the letter. MC: provided the data, critically revised and approved the letter.

## CONFLICT OF INTEREST

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

## ACKNOWLEDGMENTS

Gratitude goes out to all the donors and their families. We thank also the Italian National Transplantation Network for the provision of the data collected in the SIT database.

## SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontierspartnerships.org/articles/10.3389/ti.2023.11674/full#supplementary-material

## REFERENCES

1. Competence Centre on Foresight. *Developments and Forecasts on Increasing Significance of Migration. European Commission* (2018). Available From: https://knowledge4policy.ec.europa.eu/foresight/topic/increasing-significance-migration/more-developments_en (Accessed March 15, 2023).
2. Eurostat. *Migrant Population: 23.7 Million Non-EU Citizens Living in the EU on 1 January 2021* (2022). Available From: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Migration_and_migrant_population_statistics#Migrant_population:_23.7_million_non-EU_citizens_living_in_the_EU_on_1_January_2021 (Accessed December 1, 2022).
3. Grossi AA, Paredes D, Palaniswami V, Jansen N, Picozzi M, Randhawa G. "One Size Does Not Fit All" in Organ Donation and Transplantation: Targeting and Tailoring Communication for Migrant and Ethnic Minority Populations. *Commun Med* (2023) 18(3):241–57. doi:10.1558/cam.21434
4. Grossi AA, Puoti F, Fiaschetti P, Di Ciaccio P, Maggiore U, Cardillo M. Kidney Transplantation and Withdrawal Rates Among Wait-Listed First-Generation Immigrants in Italy. *Eur J Public Health* (2022) 32(3):372–8. doi:10.1093/EURPUB/CKAC027
5. Grossi AA, Maggiore U, Puoti F, Grossi PA, Picozzi M, Cardillo M. Association of Immigration Background With Kidney Graft Function in a Publicly Funded Health System: A Nationwide Retrospective Cohort Study in Italy. *Transpl Int* (2020) 33(11):1405–16. doi:10.1111/tri.13688
6. Randhawa G, Gardiner D. Tackling Organ Donation Among Minority Ethnic Communities in the UK-A Whole Systems Approach. *Br Med Bull* (2022) 142(1):4–14. doi:10.1093/BMB/LDAC008
7. Bhopal A, Wium C, Reisæter AV, Bhala N, Kumar B. Organ Donation for Migrants and Ethnic Minorities. *Tidsskr den Nor Laegeforening* (2019) 139(13). doi:10.4045/TIDSSKR.19.0406
8. Grossi AA, Nicoli F, De Feo TM, Cardillo M, Biffa G, Pegoraro R, et al. The 3-T Model of Informed Consent for Non-Standard Risk Donors: A Proposal for Transplant Clinical Practice. *Transpl Direct* (2021) 7(11):e782. doi:10.1097/TXD.0000000000001238
9. Grossi AA, Puoti F, Masiero L, Troni A, Cianchi T, Maggiore U, et al. Inequities in Organ Donation and Transplantation Among Immigrant Populations in Italy: A Narrative Review of Evidence, Gaps in Research and Potential Areas for Intervention. *Transpl Int Published Online* (2023) 36. doi:10.3389/ti.2023.11216
10. Grossi AA, Randhawa G, Jansen NE, Paredes D. Taking a "Care Pathway/Whole Systems" Approach to Equality Diversity Inclusion (EDI) in Organ Donation and Transplantation in Relation to the Needs of "Ethnic/Racial/Migrant" Minority Communities: A Statement and a Call for Action. *Transpl Int* (2023) 36. doi:10.3389/ti.2023.11310

ORIGINAL RESEARCH
published: 23 August 2023
doi: 10.3389/ti.2023.11331

# Equity, Diversity and Inclusion (EDI) in Organ Transplantation: An ESOT Survey About EDI Within ESOT as an Organization and its Educational Activities, and Transplantation Research and Science

**L. H. M. Pengel[1,2]*, M. Kaisar[3], S. Benjamens[4], M. Ibrahim[5], V. Ricci[6], M. I. Bellini[7], A. C. Breithaupt-Faloppa[8], C. Falk[9], H. Maple[10], L. Marson[11], F. Ortiz[12], V. Papalois[13], D. Paredes[14] and A. Forsberg[15,16]**

*[1]Erasmus MC Transplant Institute, University Medical Center, Rotterdam, Netherlands, [2]Peter Morris Centre for Evidence in Transplantation, Nuffield Department of Surgical Sciences, University of Oxford, Oxford, United Kingdom, [3]Nuffield Department of Surgical Sciences, University of Oxford, Oxford, United Kingdom, [4]Department of Surgery, Ikazia Hospital, Rotterdam, Netherlands, [5]Manchester Royal Infirmary, Manchester, United Kingdom, [6]European Society for Organ Transplantation, Padua, Italy, [7]Department of Surgery, Sapienza University of Rome, Rome, Italy, [8]LIM-11, Hospital das Clinicas da Faculdade de Medicina da Universidade de Sao Paulo, Sao Paulo, Brazil, [9]Institut für Transplantationsimmunologie, Medizinische Hochschule Hannover, Hannover, Germany, [10]Guy's and St Thomas' NHS Foundation Trust, London, United Kingdom, [11]The Edinburgh Transplant Centre, Royal Infirmary of Edinburgh, Edinburgh, United Kingdom, [12]Abdominal Center Unit, Nephrology, Helsinki University Hospital, Helsinki, Finland, [13]Imperial College Renal and Transplant Centre, Hammersmith Hospital, Imperial College Healthcare NHS Trust, London, United Kingdom, [14]Donation and Transplant Coordination Unit, Hospital Clinic Barcelona, University of Barcelona, Barcelona, Spain, [15]Department of Health Sciences, Lund University, Lund, Sweden, [16]Department of Thoracic Surgery, Skane University Hospital, Lund, Sweden*

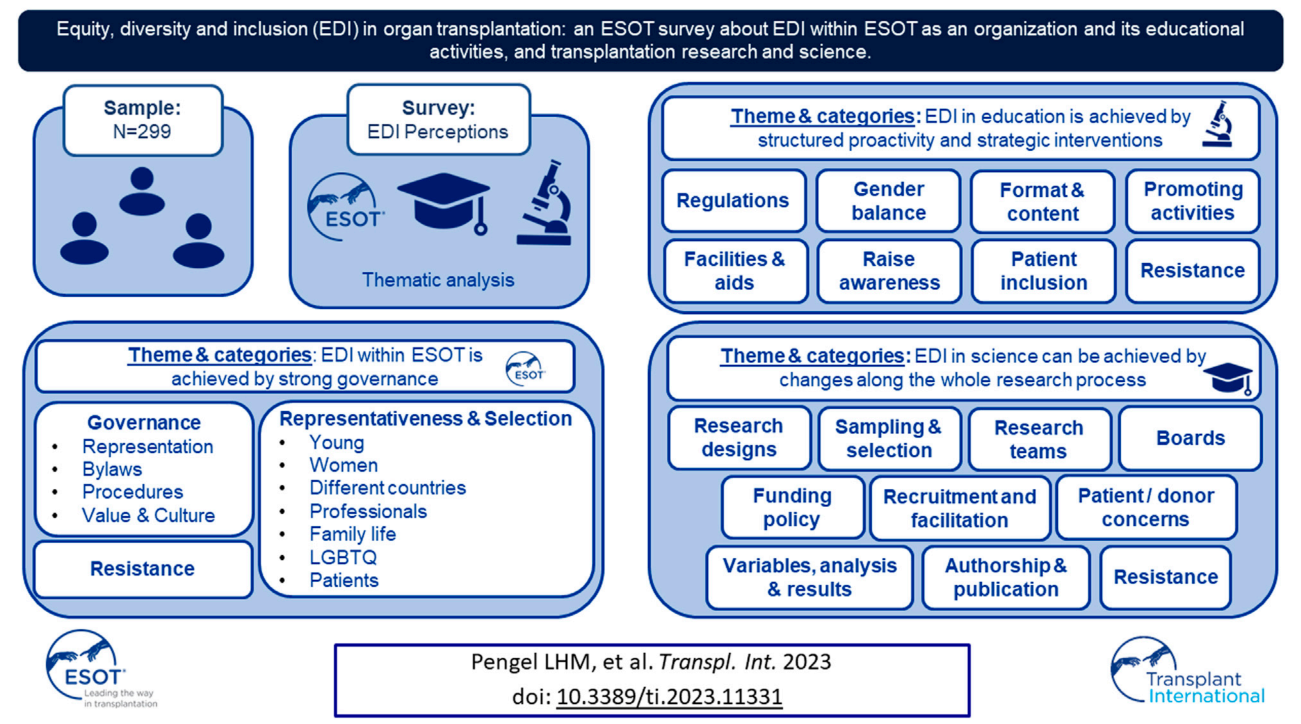
***Correspondence:**
*L. H. M. Pengel*
*l.pengel@erasmusmc.nl*

***Received:** 03 March 2023*
***Accepted:** 31 July 2023*
***Published:** 23 August 2023*

***Citation:**
*Pengel LHM, Kaisar M, Benjamens S, Ibrahim M, Ricci V, Bellini MI, Breithaupt-Faloppa AC, Falk C, Maple H, Marson L, Ortiz F, Papalois V, Paredes D and Forsberg A (2023) Equity, Diversity and Inclusion (EDI) in Organ Transplantation: An ESOT Survey About EDI Within ESOT as an Organization and its Educational Activities, and Transplantation Research and Science. Transpl Int 36:11331. doi: 10.3389/ti.2023.11331*

The European Society of Organ Transplantation (ESOT) strives to promote equity, diversity, and inclusion (EDI) across all its activities. We surveyed the transplant community's experiences and perspectives regarding EDI within ESOT as an organization and its educational activities, and research in general. A total of 299 respondents completed the questionnaire. About half agreed that ESOT's Executive Committee, Council, and Sections/Committees are diverse and inclusive (51%) and that ESOT promotes EDI in its live and digital educational activities (54%). Forty percent of respondents agreed that scientific and clinical trials in the field of transplantation are diverse and inclusive. Despite the wide distribution of the survey, most of the respondents self-identified as White and were either physician or surgeon. However, the results contribute a unique insight into the experiences and perspectives of the transplantation community regarding EDI. Whilst ESOT is committed to the principles of EDI, perceptions and the high number of proposals show the apparent need to prioritize efforts to embed EDI across ESOT and transplantation science. These data should constitute a starting point for change and provide guidance for future efforts to promote EDI within the transplantation community.

**Keywords: diversity and inclusion, equity, solid organ transplant, survey, transplantation professionals**



Equity, diversity and inclusion (EDI) in organ transplantation: an ESOT survey about EDI within ESOT as an organization and its educational activities, and transplantation research and science.

**Sample:** N=299

**Survey:** EDI Perceptions

Thematic analysis

**Theme & categories:** EDI in education is achieved by structured proactivity and strategic interventions

- Regulations
- Gender balance
- Format & content
- Promoting activities
- Facilities & aids
- Raise awareness
- Patient inclusion
- Resistance

**Theme & categories:** EDI within ESOT is achieved by strong governance

**Governance**
- Representation
- Bylaws
- Procedures
- Value & Culture

**Resistance**

**Representativeness & Selection**
- Young
- Women
- Different countries
- Professionals
- Family life
- LGBTQ
- Patients

**Theme & categories:** EDI in science can be achieved by changes along the whole research process

- Research designs
- Sampling & selection
- Research teams
- Boards
- Funding policy
- Recruitment and facilitation
- Patient / donor concerns
- Variables, analysis & results
- Authorship & publication
- Resistance

Pengel LHM, et al. *Transpl. Int.* 2023
doi: 10.3389/ti.2023.11331

**GRAPHICAL ABSTRACT |**

## INTRODUCTION

Societal evolution has increased awareness of the challenges involved in achieving equity, diversity, and inclusion (EDI) in professional environments. Accordingly, many medical organizations have acknowledged their role in promoting and improving EDI to develop an inclusive workforce. Studies on EDI within clinical and academic transplantation have revealed alarming results. A survey conducted by the International Liver Transplant Society showed a low rate of female leadership (8.2%), a high rate of professionals who experienced racial and/or gender-related discrimination (34.7%), and a low rate of support after discrimination for the victims (43.7%) [1]. A retrospective analysis of transplant centers in the United States showed that only 8.5% of transplant surgical directors were female, 5% were Black and a majority were non-Hispanic White (55%) [2]. Gender disparity was also evident in scientific and clinical transplant research. Studies have shown a higher percentage of male first and last authorships (63.8% and 69.8%, respectively) in high-impact scientific publications, a higher percentage of male versus female editors in chief (82% and 18%, respectively), less female author citations, and less external funding awards to female researchers [3, 4].

A review of racial disparities in the US transplant surgery workforce showed minimal improvement from 2000 to 2013 [5]. The number of Black transplant surgeons increased from 2% to 5.5%, while the White to Non-White transplant workforce ratio increased by 35%. In the US heart transplant workforce, a small increase in the percentage of Non-White surgeons was seen between 2000 and 2020, where the percentage of Black surgeons changed from 0.7% to 2.0%, Hispanic surgeons from 2.3% to 4.4%, and Asian surgeons from 8.2% to 22.8% [6]. Failure to adhere to the principles of EDI harms scientists, trainees and patients, and leads to unequal access to leadership, career advancement opportunities and compensation [7, 8].

These data demonstrate that awareness and promotion of EDI within the field of organ transplantation are urgently needed. We therefore explored the EDI perceptions of the European transplant community to identify areas for improvement in promoting awareness of EDI.

## METHODS

The European Society for Organ Transplantation (ESOT) Diversity & Inclusion Advisory Group was formed to advance diversity and inclusion within ESOT. The Group consisted of ten members with various backgrounds and roles within ESOT from eight different countries both within and outside Europe. A questionnaire was designed to survey perceptions regarding the strategies required to promote EDI within ESOT. For the questionnaire EDI was broadly defined as concerning gender, sexual orientation, ethnic and racial background, immigration status, ability/disability, socio-economic status, and the patient perspective.

The questionnaire collected demographics and EDI perceptions regarding several topics (**Supplementary Table S1**). This paper presents the data on the following topics: 1) ESOT's promotion of

**TABLE 1 |** Demographics of the survey respondents (*n* = 299).

| Characteristics | Responses (%) |
|---|---|
| Age | |
| 18–24 years | 5 (1.7%) |
| 25–34 years | 47 (15.8%) |
| 35–44 years | 108 (36.2%) |
| 45–54 years | 83 (27.9%) |
| 55–64 years | 48 (16.1%) |
| 65+ years | 7 (2.4%) |
| Missing | 1 (0.3%) |
| Gender | |
| Female | 166 (55.5%) |
| Male | 130 (43.5) |
| Non-binary | 2 (0.7%) |
| Prefer not to say | 1 (0.3%) |
| Country (≥3 responses) | |
| United Kingdom | 101 (33.9%) |
| Spain | 43 (14.4%) |
| Italy | 26 (8.7%) |
| France | 17 (5.7%) |
| Netherlands | 15 (5.0%) |
| Switzerland | 10 (3.4%) |
| Belgium | 9 (3.0%) |
| Turkey | 7 (2.4%) |
| United States of America | 6 (2.0%) |
| Australia | 5 (1.7%) |
| Austria | 5 (1.7%) |
| Finland | 5 (1.7%) |
| Mexico | 5 (1.7%) |
| Brazil | 4 (1.3%) |
| Germany | 4 (1.3%) |
| Sweden | 4 (1.3%) |
| Hungary | 3 (1.0%) |
| India | 3 (1.0%) |
| Russian Federation | 3 (1.0%) |
| Ethnic background | |
| White | 248 (83.5%) |
| Asian: Indian | 10 (3.4%) |
| Mixed: White and Black African | 3 (1.0%) |
| Mixed: White and Black Caribbean | 2 (0.7%) |
| Mixed: White and Asian | 2 (0.7%) |
| Arab | 6 (2.0%) |
| Asian: Pakistani | 6 (2.0%) |
| Black/African/Caribbean | 5 (1.7%) |
| Asian: Chinese | 1 (0.3%) |
| Other / prefer to self-describe | 12 (4.0%) |
| Prefer not to say | 2 (0.7%) |
| Missing | 2 (0.7%) |
| Background | |
| Physician | 82 (27.4%) |
| Surgeon | 71 (23.7%) |
| Nurse including specialist nurse | 44 (14.7%) |
| Scientist | 27 (9.0%) |
| Transplant coordinator | 16 (5.4%) |
| Patient | 15 (5%) |
| Allied health care professional | 14 (4.7%) |
| Pharmacist | 3 (1.0%) |
| Patient advocate | 2 (0.7%) |
| Ethics | 2 (0.7%) |
| Caregiver | 1 (0.3%) |
| Living donor | 1 (0.3%) |
| Other | 21 (7.0%) |

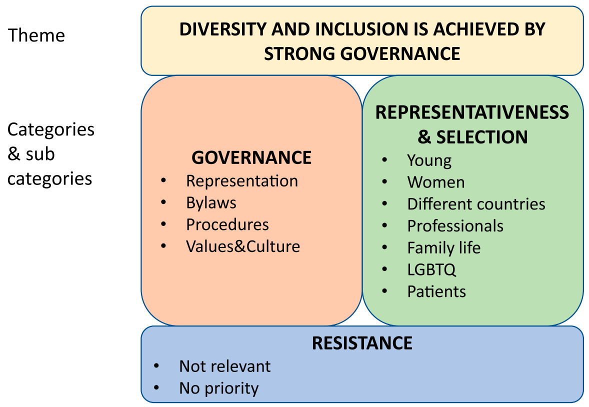


**FIGURE 1 |** The respondents' perspectives on how the European Society for Organ Transplantation (ESOT) can promote diversity and inclusion in the executive committee, council, and sections and committees, labelled according to overall theme, categories and subcategories.

EDI within the Executive Committee, Council, and Sections/Committees; 2) ESOT's promotion of EDI in its live and digital educational activities, scientific content, and attendance; and 3) EDI in clinical research and science. Perceptions were scored on a 5-point Likert Scale ranging from "strongly agree" to "strongly disagree." Open-ended questions collected up to three proposals for promoting EDI.

The online questionnaire was open from 5 May to 30 June 2021 and again from 1 October to 1 December 2021 to solicit further responses. The questionnaire was distributed through ESOT newsletters and various social media channels.

Data were analyzed according to qualitative research methods. Open-ended answers were analyzed by AF who conducted content analysis of the explicit written words and their meanings, symbolic qualities, and expressive content. In line with Krippendorff, the content analysis summarized surface features of the meaning units and interpreted the content [9]. Thus, the underlying meaning in each passage was illustrated by themes, while the manifest data were organized into categories and subcategories. First, every statement was read in detail, which provided a general sense of the content. Thereafter, the responses were divided into meaning units, i.e., single words, parts of, and whole sentences, and then condensed. The content of the condensed meaning units was formulated into categories and sub-categories. In line with qualitative research methods, numerical data were not presented for these categories and sub-categories. The interpretations were based on a holistic analysis of the content in each category and included several themes. The themes can be seen as a thread of meaning that recurs in the content of the categories.

## RESULTS

Two hundred and ninety-nine respondents completed the questionnaire. Most respondents were aged 35–44 years

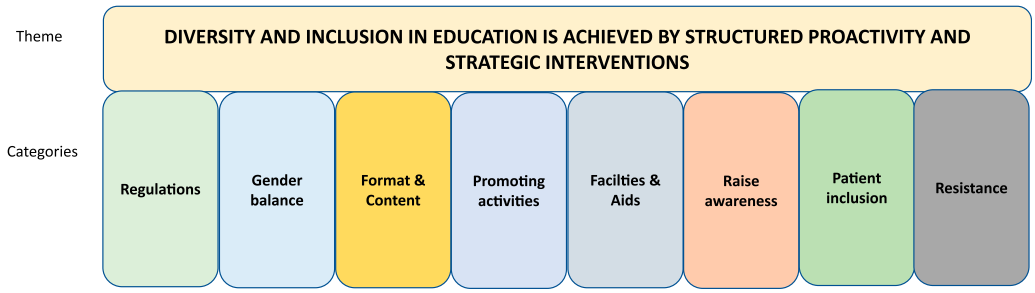


**FIGURE 2 |** The respondents' perspectives on how the European Society for Organ Transplantation (ESOT) can promote diversity and inclusion in its live and digital educational activities regarding/in terms of both the scientific program and attendance, labelled according to overall theme and categories.

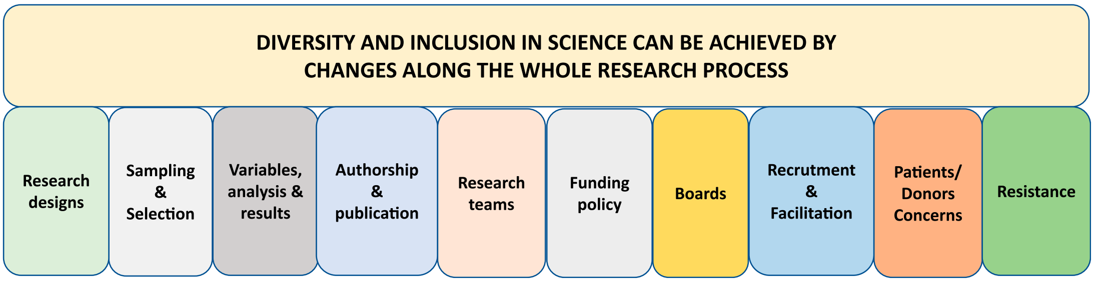


**FIGURE 3 |** The respondents' perspectives for change along the research process to achieve EDI in science and clinical trials, labelled according to overall theme and categories.

**TABLE 2 |** Examples of tools to raising awareness about equality, diversity and inclusion when planning learning, scientific meetings or communication.

**Five core questions when formulating cases for problem-based learning**

1. What is the learning outcome from the case?
2. What happens if the person/patient in the case has another sex? For example, changing from a man to a woman
3. What happens if the person/patient in the case has another name? For example, changing from Steve to Ahmed
4. What happens if the person/patient in the case has another next of kin? For example, changing from a female spouse as a caregiver to a male spouse
5. What happens if the person/patient in the case has another profession? For example, changing from an office executive to a carpenter or baker

**Five core questions when planning a scientific meeting or a webinar**

1. What is the learning outcome from the meeting?
2. Is there a balanced gender distribution among possible presenters and moderators? The gender balance should be at least 60%/40%
3. What happens if the keynote speaker is a woman instead of a man?
4. What happens if the person presenting research or keynote speaker has a profession other than that of a physician or surgeon? For example, changing from a physician or surgeon to a nurse or an allied health professional
5. Would it be possible to include patients in the programme? If not, what would be the reason for this?

**Five core questions when planning communication**

1. What is the key message in the communication regarding equality, diversity, and inclusion?
2. What happens if the person on the screen or providing the message has a different ethnicity than White?
3. What happens if the person on the screen or providing the message has another sex? For example, changing from a man to a woman
4. What happens if the person on the screen or providing the message is physically disabled or overweight?
5. What happens if a queer person delivers the message?

(36.2%), self-identified as White (83.5%), physician (27.4%), and described themselves as female (55.5%). Respondents came from 38 countries with the United Kingdom (33.9%), Spain (14.4%), Italy (8.7%), France (5.7%), Netherlands (5.0%), and Switzerland (3.4%) being the most frequently reporting countries (**Table 1**).

## EDI in the Executive Committee, Council, and Sections and Committees

Fifty-one percent of respondents either agreed or strongly agreed that ESOT is a diverse and inclusive organisation regarding its Executive Committee, Council, and Sections/Committees, 33% neither agreed or disagreed, and 15% either disagreed or strongly disagreed. The main theme among the proposed ideas was that EDI is achieved by strong governance, which consisted of the subthemes "Governance" and "Representativeness and Selection." "Governance" included, for example, bylaws and procedures and "Representativeness and Selection" young professionals, women and patients (**Figure 1**).

### Governance

The category "Governance" included perceptions and proposals regarding representation, where it was perceived as important to outline structures in an organic, open, and transparent way when recruiting Executive Committee members. It was suggested that senior management should always include at least one woman. Balanced gender representation was strongly emphasized and preferred in any selection process and may be achieved by quota, leadership training, and by giving extra points to women and/or ethnic minorities. Furthermore, observer positions on committees for trainees were welcomed. Governance also includes bylaws in which EDI regulations are outlined. Respondents stated that diversity should be visible in all layers of the organization and bylaws needed to reflect diversity goals for the whole organization, including Sections and Committees.

To support EDI, valid procedures are required. Awareness can be increased by monitoring EDI across Sections and Committees and making the data public. Other suggestions included increasing transparency in selection procedures, being mindful when evaluating candidates, anonymizing applications, and reaching out to persons outside of ESOT. It was felt that ESOT also needs to encourage and support applications from less established professionals. Using different languages in meetings, offering implicit bias training, limiting the tenure of Council members, and promoting a bottom-up instead of a top-down organization were also suggested.

Lastly, governance is about promoting values and building an inclusive culture. This can be done by ensuring diversity in award winners and highlighting diversity as a value of the organization. Young professionals should be nurtured by means of programs and ESOT should highlight initiatives for implementation of these programs, and for recruiting and developing talented professionals of all genders. Finally, the establishment of an EDI and outreach committee may ensure that EDI is always on the agenda.

### Representativeness and Selection

Several groups were highlighted as underrepresented or as minority groups within the ESOT community, which participants felt should be targets for selection and outreach activities. Young professionals are regarded as persons in need of support and promotion, and who should participate in working groups alongside more experienced professionals. The importance of approaching young professionals from outside the US and Europe. especially from lower income countries, was also stressed. A key message was that women in general, and non-White women in particular, should be encouraged to participate and apply for awards to achieve a 50/50 male-female ratio.

Recruitment of professionals from different countries, backgrounds, and ethnicities was also highlighted as an important area for improvement. Ethnic diversity means including professionals from Black, Asian, Minority Ethnic (BAME), Latin American and non-European backgrounds. Suggestions included grants which could be offered to non-European researchers to stimulate inclusion. One way to prevent bias would be to use blinded selection procedures and elections, which would simultaneously facilitate inclusion of professionals with disabilities. Improvements in diversity may be achieved by actively encouraging people of all backgrounds and genders to apply for positions within ESOT.

Professionals with families and young children need to be supported by initiatives that facilitate combining career and family life such as access to digital learning solutions, e.g., webinars and online courses. Furthermore, increased lesbian, gay, bisexual, transgender, queer and intersex (LGBTQI+) visibility and representation were requested to show ESOT's support of this group.

There is also a need for patient inclusion, in particular independent patients free of policy agendas. Accepting patients in the Council and Sections and Committees would enable them to contribute to decision-making processes. Finally, some respondents opposed the efforts to ensure EDI, arguing that EDI should not be promoted at all.

## EDI in ESOT's Live and Digital Educational Activities

Fifty-four percent of respondents either agreed or strongly agreed that ESOT promotes diversity and inclusion in its live and digital educational activities, 36% neither agreed or disagreed, and 10% either disagreed or strongly disagreed. The main theme among the proposed ideas was that EDI is achieved by structured proactivity and strategic interventions. Eight subthemes were identified which included "Regulations," "Gender balance," "Format and content," "Promoting activities," "Facilities and aids," "Raise awareness," "Patient inclusion" and "Resistance" (**Figure 2**).

### Regulations

Respondents felt that ESOT needed to develop policies and critically review whether the inclusion policies were truly representative. An EDI position statement might be useful as metrics for all types of committees.

### Gender Balance

There was a strong need for gender balance and ESOT should be encouraged to consider gender parity when setting up mixed working groups. Gender balance should be aimed for in all panels, session chairs, and should be ensured throughout the scientific programme.

### Format and Content

There are many suggestions for improving both the format and content of educational activities. These include more webinars, digital courses, online support for learning, and making use of, e.g., Twitter, which is easily accessible via smartphone. Respondents also requested specific EDI educational activities.

Educational videos on YouTube and face-to-face online sessions were also suggested.

Inclusion could be promoted by organizing congress hubs in Eastern Europe and emerging countries, which could be combined with lectures from different parts of Europe. Educational activities should be free of scientific jargon so that all those involved, e.g., patients, could understand the content, which may facilitate broader participation.

Diverse panels led by underrepresented members could be included at scientific meetings to generate discussion groups. Education on EDI is needed and ESOT should ensure that the scientific program reflects the diversity of the society membership. There could also be focused sessions on EDI at the ESOT congress to share good practice. Clear guidance on gender and ethnic participation in the scientific programs should be available during the planning and the topic of ethnic and social differences could be addressed at congresses.

### Promote Activities

Effective promotion of activities would facilitate attendance during various educational activities and the ESOT congress. The respondents highlighted the fact that participants have different backgrounds, which may not be the typical ones seen in transplantation medicine. There could also be a targeted quota for attendance or organizing committee membership of non-EU members. Low entrance fees for underrepresented groups, e.g., nurses, may stimulate their participation. More diverse moderators and speakers from different countries, avoidance of inviting the usual speakers and no events without female moderators and speakers were also requested. Respondents stress the importance of balancing the age, gender, and backgrounds of speakers while preserving the scientific value of the activity. This requires a conscious strategy regarding who to invite, e.g., speakers from Eastern Europe, non-ESOT members or leaders of the different minority groups.

Several respondents emphasized the importance of low registration fees to facilitate participation from underdeveloped or non-EU countries, trainees, young professionals, nurses, and allied health professionals. Extending invitations to, e.g., countries in Africa and Asia, would increase diversity and lead to new perspectives. To nurture the next-generation, the importance of their role in educational activities was emphasized, as was their need for support, targeted interventions, membership of scientific program committees, and invitations to chair meetings. In this context, social media could be utilized for broader dissemination and communication.

### Facilities and Aids

Specific facilities are needed for attendees with children. Provision of a quiet space should be mandatory at every meeting to allow breastfeeding or pumping, or for pregnant women to rest. Childcare facilities were also requested.

By using languages other than English at meetings the diversity of attendees would increase. To make the scientific program more accessible for people with limited health literacy, lay terms could be used in certain sessions and materials developed for audiences with specific needs.

### Strategies to Raise Awareness and Increase Inclusion

The respondents provided ample suggestions for how to raise awareness of EDI. ESOT should address LGBTQI+ issues and organize a task force to promote their inclusion in the community. Respondents also commented that transplant nurses are not represented in ESOT educational activities or reflected in the membership, which could be improved by creating education for nurses.

Targeted grants might be useful for engaging societies from countries in Africa, Asia, and the Middle East. Diverse role models are needed, and these should be highlighted through personal interviews and emphasizing their achievements. Furthermore, ESOT should utilize patients with medical skills and experience as public speakers, which would benefit the outreach to patients.

### Patient Inclusion

The call for patient participation is strong and respondents suggest that patients should be part of all ESOT activities. ESOT needs to reach out to different communities representing patient populations. Transplant care professionals and patients should interact for mutual learning and patients can assist with specific recommendations.

### Resistance

Some respondents persistently argued that ESOT should stop wasting time with surveys about EDI. In their opinion it is not the job of ESOT to promote EDI.

## EDI in Science and Clinical Trials

Forty percent of respondents either agreed or strongly agreed that science and clinical trials in the field of transplantation are diverse and inclusive, 28% neither agreed or disagreed, and 32% either disagreed or strongly disagreed. The main theme among the proposed ideas was that EDI can be achieved by changes along the whole research process. Ten subthemes were identified which included "Research designs," "Sampling and selection," "Variables, analysis and results," "Authorship and publication," "Research teams," "Funding policy," "Boards" and "Recruitment and facilitation," "Patient and Donor concerns" and "Resistance" (**Figure 3**).

### Research Designs

Respondents pointed out that studies pertaining to transplantation are prioritized over studies on donation and that more studies about inequalities are needed. Another area of research interest is pregnancy after transplantation, as reproductive health in relation to transplantation involves both gender and equity aspects.

Respondents suggested that each research project should describe how EDI will be implemented. Sex and gender balance should be addressed when designing trials as opposed to analyzed *post hoc*. ESOT could promote research in social and health sciences and encourage inclusion of baseline equity analytics in trial reports. Longitudinal surveys integrating all parameters would be welcomed as well as diversified trials that include all possible treatment groups. Common co-morbidities should be accepted as inclusion criteria and ESOT should also encourage qualitative research designs to complement traditional quantitative designs. Multicenter studies across continents will help to increase diversity in research. Finally, researchers are encouraged to consider niche studies for certain populations not represented in larger studies and diversity in case studies.

### Sampling and Selection

Diversity starts at patient recruitment and could be directed at oversampling disadvantaged groups and gender balance. Animal research should balance sex in studies. Overall, there was a need to include marginalized populations and focus on those disadvantaged in society, e.g., Black and Asian ethnicity, and economically or educationally disadvantaged participants. Recruitment of minority staff would help to increase diversity among study populations. Incentives for patients show appreciation of their time and experience. Longitudinal designs should ensure that gender, race, and socio-economic status are reported baseline characteristics. Informants also raised that entirely European studies will always be partly biased.

### Variables, Analysis and Results

Subgroup analyses by gender and race should be reported and the impact on BAME patients commented on. Possible biological diversity among women and various ethnic minorities needs to be considered. Finally, some low-income countries cannot afford certain treatments, which limits the worldwide application of results.

### Authorship and Publication

Reviewer bias could be minimized by removing information that could identify the gender or ethnicity of authors. Respondents feel that access to publishing in high quality journals should be based on the quality of the manuscript, not on the country of origin. To promote publications from young researchers, journals may consider reduced publication fees. Respondents suggest developing appropriate peer review and publishing standards, e.g., justification of non-representative samples.

### Research Teams

There were proposals about how to organize research teams and that promotion of women or minorities in clinical trial teams should be mandatory. A way to increase inclusion would be to create overseas committees as well as develop and practice EDI guidelines for forming research teams.

### Funding Policy

There were many proposals to enable funding policies that promote EDI. One suggestion was to increase funding for projects originating outside of prestigious transplant centers and funding for principal investigators from underrepresented ESOT members. Another was to provide grants that address scientific questions related to EDI. In line with this, it was also suggested that grants should be made available for transplant surgeons and physicians from developing countries. It was specifically mentioned that both trainees and women would benefit from more funding options and that fellowships should be evenly distributed between male and female applicants. A sustainable funding framework could be developed by critically reviewing the funding allocation system and robustly assessing barriers to minority or underrepresented groups. Such a system should also provide grants to returning caregivers, scientists, and clinicians after a career break.

### Boards

Research boards have the potential to influence the conduct of research and ensure adaptation of EDI principles in studies. It was stressed that research boards should not be all male or White panels and should include women to achieve representative steering committees. ESOT should organize a working group to focus on studies where EDI is the main subject and issue a public statement regarding their EDI policy. By offering bias training in the educational program, awareness would increase and established norms can be scrutinized and questioned. In general, it is considered important to create an inclusive research culture.

### Staff Recruitment and Collaboration

The variety of proposals and comments on recruitment and collaboration was extensive and highlighted the importance of EDI awareness when recruiting staff. Online and offline interactions between ESOT and other society members from across the globe could facilitate collaboration, especially with non-continental and Eastern Europe, and exchange programs could also be established.

Opening ESOT membership to other specialties, e.g., anesthesia, was also suggested. Transplant surgeons and physicians from outside Europe and from underrepresented countries could be invited by ESOT to take part in scientific activities and clinical trials and be offered authorship. More scientific options for transplant coordinators, nurses, and allied health professionals (AHPs) are requested as they are underrepresented in scientific activities.

There were many options identified to enable research in real-world practice. Respondents suggested that ESOT may simplify access to resources, e.g., publications or journals, for young scientists and offer funding for scientists or researchers to become principal investigators. Information about ongoing or potential research projects could be shared via social media or other channels. Knowledge exchange is highly appreciated and gender equity leadership in research should be promoted. Meetings between researchers and clinicians promote exchange of ideas. A career path program would be helpful as well as facilitating staff mobility across Europe through a mentorship program that promotes EDI.

Respondents feel that sex and gender research should be regarded as high-profile and that ESOT should actively support and engage in clinical research that investigates gender, BAME or other diverse characteristics. The respondents suggest that professionals from low-income countries should participate in editorial groups to facilitate real-world clinical guidelines and trials.

ESOT could organize an EDI hub focusing on how to improve questionnaires studying this topic in relation to transplantation, donation, and different minorities, as well as considering the impact of religion on transplantation. EDI research could be a mandatory session at scientific meetings.

### Patient/Donor (Living and Deceased) Concerns

Understanding issues from patient perspectives and embracing the patients' point of view or concerns, e.g., whether strong medications are right for them, were considered important. A diverse pool of patients to support clinical trials could be created and patients should be involved from the early stages of trial design. There is a need for wider representation of both donors and recipients in trials, e.g., both the donating and non-donating families should be represented, as well as trials on the impact of donor-recipient mismatch. Finally, it was highlighted that research should aim for quality not quantity in organ allocation and improve outcomes in kidney transplantation by giving this solid organ transplantation life-saver status. Absence of this status prevents the initiation of new drug trials, often immunosuppression, and supports the idea of dialysis as a back-up, to the detriment of the patient.

### Resistance

There were perceptions that promoting EDI is not at all essential for the goals of ESOT. The commitment should be to science and not to promoting EDI. There were also suggestions of racism against White people as well as sexism against men. Focusing on EDI was considered completely unnecessary.

## DISCUSSION

The survey presented in this article attracted many responses and suggestions. Around half of respondents feel that ESOT promotes diversity. Nonetheless, half of the respondents do not agree that ESOT promotes diversity. The data demonstrate an EDI imbalance within ESOT and within transplantation science and clinical trials in general, and it appears clear that a significant proportion of respondents are dissatisfied with the current culture and lack of initiatives to increase EDI.

Despite this situation, EDI is not at the centre of the conversation within ESOT. Thus, we should reflect on the reasons for this. The ESOT culture is characterized by a strong drive for innovation and by a professional, collegial, and friendly climate. The latter could be described as a culture of "niceness," a feature which, understood in conventional terms, is obviously very important for the functioning of a social group. At the same time, however, if the wish to be nice (or the expectation that people should be nice) makes it difficult for some people to speak up when there is a problem, then "niceness" can have problematic implications.

According to Sommers [9], niceness is our "most fundamental social dysfunction"; in organizations with high ambitions, it can be toxic and disabling insofar as the imperative to be nice can potentially silence those who are not in power and thus maintain the *status quo*. Furthermore, niceness is powerfully reinforced by spoken and unspoken discourses that control who can speak and when, and whether this voice will be heard and responded to. Niceness could create barriers to honest and potentially uncomfortable conversations [10]—precisely the type of conversations needed to address the lack of EDI. Our data show that respondents feel that these conversations are needed to ensure that women, patients, professionals from BAME backgrounds, nurses and AHPs are equally represented within ESOT, in science and clinical trials. A small part of the results demonstrated the need to maintain the *status quo* through resistance to EDI and the overall purpose of this survey.

Questioning EDI imbalances is often viewed as disruptive, which in turn is considered the opposite of "being nice." Encouraging others to "be nice" and not to "rock the boat," however, can serve to ensure that people remain silent when they should speak out and to avoid addressing the issues they raise. By conducting this survey, a voice was potentially given to the whole transplantation community, which *per se* promoted inclusion and diversity. In order to embrace and benefit from EDI, people have to engage in uncomfortable conversations. This requires the development of skills in initiating and facilitating respectful discussions, and inclusive leadership to drive change [11].

In environments shaped by niceness, speaking out can involve considerable personal risk: challenging the *status quo* can be taken as breaching the code of niceness, causing the exclusion or marginalization of those who speak out. The survey responses were confidential; thus, no codes could be violated. However, the lack of representativeness among the respondents might reflect a culture in ESOT where underrepresented groups perceive a barrier to speaking up.

The literature suggests that cultures of niceness disproportionately affect people from minority groups. Perlow [12] argues that niceness is not harmless or benign and instead positions niceness as a racialized and gendered tool used to disguise power relationships and a powerful means to silence and oppress people of color. This should be evident to many healthcare professionals because, despite the mantras of EDI that are often prominent in the statements of professional healthcare organizations, we still see widespread inequity and lack of inclusion.

The findings of this survey are mainly in line with previous research [1, 5]. Thus, it might be fair to argue that we have a clear picture of the challenges related to EDI in the transplant community. Deliberate actions are warranted to address the *status quo*, including encouraging honest (and sometimes uncomfortable) conversations to promote a culture change within the Society; addressing the lack of diversity in the Society's leadership at all levels, with particular attention to the Executive Committee; developing easy and accessible tools to maintain persistent awareness of EDI as well as to prevent unnecessary bias as presented in **Table 2**.

This study has several limitations. In the context of EDI, it is problematic that most respondents identified themselves as White and that minority groups were underrepresented. We did not ask if respondents were ESOT members or whether they were familiar with ESOT as an organization. Respondents unfamiliar with ESOT may have opted to skip the question or respond neutrally (neither agreed or disagreed). Even so, EDI concerns were clearly outlined by the respondents. Despite the option of providing open-ended answers there was limited room for in-depth elaboration of perceptions or statements. Nevertheless, the data were rich and provided an extensive number of meaning units illustrating the engagement for EDI aspects in ESOT. Almost 300 professionals from 38 countries might also be viewed as a strength, providing a broad representation of healthcare cultures. To be true to the qualitative method we deliberately chose not to quantify the number of perceptions in each category to emphasize the quality of the content. One purpose of the survey was to increase awareness and create engagement and as such the aim can be considered achieved.

In conclusion, this survey provided ample suggestions on how to raise awareness about EDI in ESOT. The number of proposals on how to improve the current situation suggests a strong motivation in the transplant community to work in a context where EDI is consistently on the agenda. Since the survey was held in 2021, ESOT has made efforts to improve EDI, for example, by ensuring gender balance in the scientific program committee and faculty of the upcoming 2023 ESOT congress. ESOT's vision statement includes aspirations to "promote scientific advancement," "deliver career advancement opportunities to all healthcare professionals" and "promote equitable access to transplantation and related therapeutic strategies." Therefore, we feel that ESOT has a moral obligation to not only adhere to the EDI principles within all levels and activities of its organization but to also take a leading role in creating awareness and drive further change regarding EDI. This change requires a collective change of beliefs, values and attitudes within the transplantation community.

## DATA AVAILABILITY STATEMENT

The raw data supporting the conclusion of this article will be made available by the authors, without undue reservation.

## AUTHOR CONTRIBUTIONS

LP: design of the survey, data analysis, data interpretation, drafting the article; MK: design of the survey, data interpretation, drafting the article; SB: data interpretation, drafting the article; MI: data interpretation, drafting the article; VR: design of the survey, data interpretation, drafting the article; MB: design of the survey, data interpretation, critical revision of the article; AB-F: design of the survey, data interpretation, critical revision of the article; CF: design of the survey, data interpretation, critical revision of the article; HM: design of the survey, data interpretation, critical revision of the article; LM: design of the survey, data interpretation, critical revision of the article; FO: design of the survey, data interpretation, critical revision of the article; VP: design of the survey, data interpretation, critical revision of the article; DP: design of the survey, data interpretation, critical revision of the article; AF: design of the survey, data analysis, data interpretation, drafting the article. All authors contributed to the article and approved the submitted version.

## CONFLICT OF INTEREST

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

## SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontierspartnerships.org/articles/10.3389/ti.2023.11331/full#supplementary-material

## REFERENCES

1. Aguilera V, Andacoglu O, Francoz C, Berlakovich G, Pai SL, Adelmann D, et al. Gender and Racial Disparity Among Liver Transplantation Professionals: Report of a Global Survey. *Transpl Int* (2022) 35:10506. doi:10.3389/ti.2022.10506
2. Choubey AP, Bullock B, Choubey AS, Pai K, Ortiz AC, Khan SA, et al. Transplant Surgery Departmental Leaders Do Not Represent Workforce Demographics Especially Among Women and Underrepresented Minorities - A Retrospective Analysis. *Am J Surg* (2022) 224(1):153–9. doi:10.1016/j.amjsurg.2021.11.008
3. Benjamens S, Banning LBD, van den Berg TAJ, Pol RA. Gender Disparities in Authorships and Citations in Transplantation Research. *Transpl Direct* (2020) 6(11):e614. doi:10.1097/TXD.0000000000001072
4. Verran D, Weissenbacher A, Paredes-Zapata D, Ortiz F. Reply To-Gender Distribution Among Transplant Journal Editorial Members. *Transpl Int* (2022) 35:10262. doi:10.3389/ti.2022.10262
5. Valbuena VSM, Obayemi JE, Purnell TS, Scantlebury VP, Olthoff KM, Martins PN, et al. Gender and Racial Disparities in the Transplant Surgery Workforce. *Curr Opin Organ Transpl* (2021) 26(5):560–6. doi:10.1097/MOT.0000000000000915
6. Walkowiak OA, Hardy WA, Huckaby LV, Kavarana MN, Mokashi SA, Rajab TK. Diversity in the Adult and Pediatric Heart Transplant Surgeon Workforce Between 2000 and 2020. *Healthcare (Basel)* (2022) 10(4):611. doi:10.3390/healthcare10040611
7. Aulivola B, Mitchell EL, Rowe VL, Smeds MR, Abramowitz S, Amankwah KS, et al. Ensuring Equity, Diversity, and Inclusion in the Society for Vascular Surgery: A Report of the Society for Vascular Surgery Task Force on Equity, Diversity, and Inclusion. *J Vasc Surg* (2021) 73(3):745–56.e6. doi:10.1016/j.jvs.2020.11.049
8. Ruzycki SM, Ahmed SB. Equity, Diversity and Inclusion Are Foundational Research Skills. *Nat Hum Behav* (2022) 6(7):910–2. doi:10.1038/s41562-022-01406-7
9. Sommers EK. *Tyranny of Niceness: Unmasking the Need for Approval.* Toronto: Dundurn Group (2005).
10. Walker K. Dangerous Liaisons: Thinking, Doing, Nursing. *Collegian* (1997) 4(2):4–14. doi:10.1016/s1322-7696(08)60214-0
11. Coe IR, Wiley R, Bekker LG. Organisational Best Practices Towards Gender Equality in Science and Medicine. *Lancet* (2019) 393(10171):587–93. doi:10.1016/S0140-6736(18)33188-X
12. Perlow ON. Gettin' Free: Anger as Resistance to White Supremacy Within and Beyond the Academy. In: Perlow DIW ON, Bethea SL, Scott BM, editors. *Black Women's Liberatory Pedagogies Resistance, Transformation, and Healing Within and Beyond the Academy*. Cham, Switzerland: Palgrave Macmillan Cham (2018).

BRIEF RESEARCH REPORT
published: 14 February 2023
doi: 10.3389/ti.2023.10888

# The Effect of Language on Access to Timely COVID-19 Vaccination of Solid Abdominal Organ Transplant Recipients

**Claire M. de Crescenzo, Ya-Wen Chen, David C. Chang and Heidi Yeh***

*Massachusetts General Hospital and Harvard Medical School, Boston, MA, United States*

In dynamic healthcare environments including the COVID-19 pandemic, it is paramount to communicate health recommendations expediently and clearly. Research has shown social determinants of health affect the impact of COVID-19 on abdominal transplant recipients, but there has been less research on the effect of language proficiency. This is a cohort study of time to first COVID-19 vaccination among abdominal organ transplant recipients in an academic medical center in Boston, MA between 18 December 2020, and 15 February 2021. Cox proportional hazards analysis of time to vaccination by preferred language were adjusted for race, age group, insurance, and transplanted organ. Among 3001 patients, 53% were vaccinated during the study period. Language preference other than English was independently associated with delay to vaccination (0.64, $p = 0.001$), on adjusted analysis. In addition, Black, Hispanic and other race patients were less likely to be vaccinated than white patients (0.58, 0.67, 0.68 vs. reference, all $p < 0.03$). Language preference other than English is an independent barrier to solid abdominal organ transplant recipients' access to timely COVID-19 vaccination. Equity in care should be improved by providing targeted services to minority language speakers.

**Keywords: transplant recipients, COVID-19 vaccination, healthcare access, language, disparities**

***Correspondence:**
*Heidi Yeh*
*hyeh@mgh.harvard.edu*

***Received:** 05 September 2022*
***Accepted:** 31 January 2023*
***Published:** 14 February 2023*

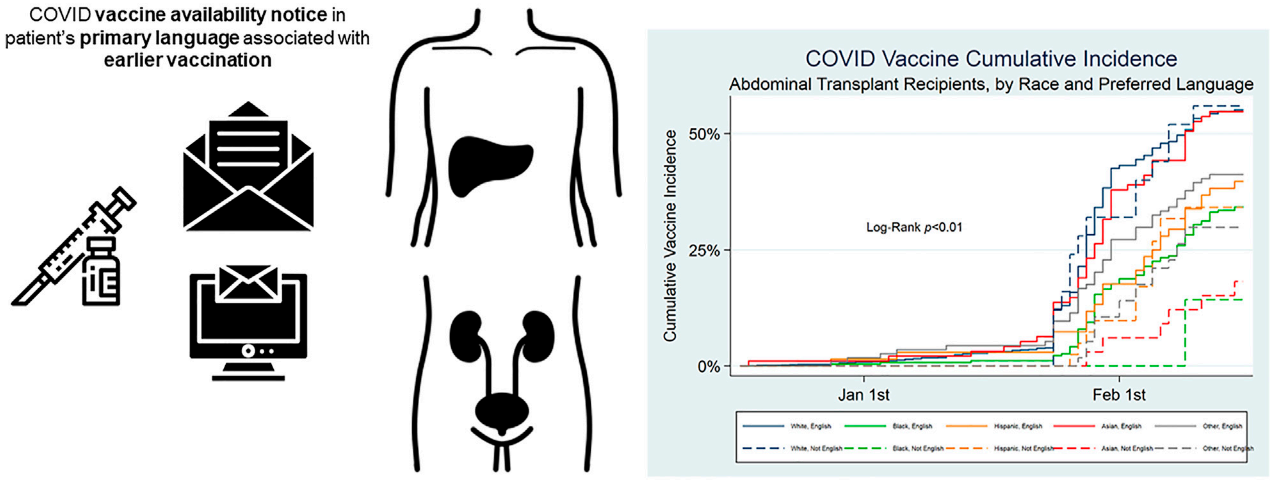
***Citation:***
*de Crescenzo CM, Chen Y-W, Chang DC and Yeh H (2023) The Effect of Language on Access to Timely COVID-19 Vaccination of Solid Abdominal Organ Transplant Recipients. Transpl Int 36:10888. doi: 10.3389/ti.2023.10888*

## INTRODUCTION

Limited English proficiency (LEP) is increasingly recognized as an independent barrier to timely healthcare access and optimal outcomes (1–3). In the context of the dynamic COVID-19 pandemic, healthcare communication with the public is vital for timely access to testing, treatment, and vaccination. Prior research has established that patients with LEP, even within racial groups, have increased risk of contracting COVID-19, and of needing hospitalization after a positive COVID-19 test (4–6). A rubric has been proposed for improving clinical care of patients with LEP who test positive for COVID (7). However, it can be difficult to determine the contributory effect from various social determinants of health as patients with LEP may also have socioeconomic barriers to accessing timely healthcare.

Solid organ transplant recipients have been shown to have an elevated risk of testing positive for COVID-19, and of morbidity and mortality from the effects of the virus (8,9). Fortunately, these patients often receive long-term follow-up care from their transplant institution and thus are connected to a healthcare institution and hence more likely than the general population to receive targeted healthcare communication. Vaccinations against COVID-19 received U.S. Food and Drug Administration Emergency Use Authorization on 11 December 2020, but doses were limited.

**The Effect of Language on Access to Timely COVID-19 Vaccination of Solid Abdominal Organ Transplant Recipients**



COVID **vaccine availability notice** in patient's **primary language** associated with **earlier vaccination**

de Crescenzo, C et al. *Transpl. Int.* 2023
doi: 10888 /ti.2023.10888

**GRAPHICAL ABSTRACT |**

Abdominal solid organ recipients were identified early as a priority group to vaccinate. Abdominal organ transplant recipients receiving care at an academic medical center in Boston, MA were notified of their eligibility by email notice from their transplant team at the medical center in English and Spanish on 22nd January 2021, and paper notices were mailed, starting the same day. These vaccine doses were available for administration only *via* the academic medical center, as this was prior to vaccine availability in community-based vaccination centers. This study analyzes factors that affected time to vaccination for solid organ transplant patients upon vaccine eligibility, to assess for a disparity in access to timely vaccination among this immunosuppressed population who has established care with the transplant care team.

# MATERIALS AND METHODS

## Data Source, Inclusion, and Exclusion Criteria

Abdominal organ (kidney or liver) transplant recipients receiving care at an academic medical center in Boston, MA were examined through the institutional electronic medical record (EMR) in this study. Patients were included who had a liver transplant, kidney transplant, or both organs. Patients were excluded if they did not have contact with the transplant care team in the past year or have missing data.

## Primary Variables

Patients' preferred language was the primary independent variable and was divided into two groups, English or language other than English. Date of first dose was used as the primary end point. Start day was the date the first participant in the study population received their first vaccination dose, 18th December 2020. In Massachusetts, COVID vaccinations began 15th December 2020 with healthcare workers, then were extended in stages to care facility residents, elderly and those with certain medical conditions including solid organ transplant recipients. Institutional medical interpreters were overloaded with clinical interpreting for the high census of inpatient COVID patients at the time, but the transplant clinic wanted to share this availability with patients as soon as possible. Bilingual clinic staff translated the notice into Spanish as this was the most commonly spoken non-English language among this population. Patients were notified of the availability of COVID-19 vaccine doses and their eligibility *via* dual language email and paper notices sent in both English and Spanish on 22nd January 2021. These vaccine doses were available for administration only *via* the academic medical center, as this was prior to vaccine availability in community-based vaccination centers. Patients were censored on 15th February 2021, which coincided with an institutional pause in vaccination due to decrease in supply.

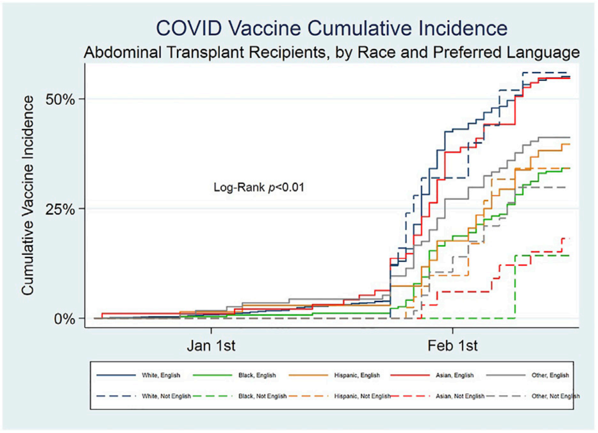


**FIGURE 1 |** Cumulative incidence of COVID-19 first vaccination among abdominal transplant recipients, by race and preferred language.

## Statistical Analysis

Factors associated with prolonged time to first vaccination in days were adjusted by the cox proportional hazard model, including sex, race, age group, insurance, and organ transplanted. Races were grouped into white, Black, Hispanic, Asian or other race. The other group includes patients who identified as other, multiracial and those whose race was unavailable. Patients' primary insurance was grouped into private, Medicare or Medicaid. Significance levels were all set at $p < 0.05$, two-tailed. Statistical analyses were performed using Stata software, version 15.1 (StataCorp, College Station, TX).

## RESULTS

There were 3,001 patients that met criteria for inclusion. Nearly 7% of patients had LEP, and the most commonly preferred language other than English among those patients was Spanish (60%) (data not shown). Just over half of the study population (53%) was vaccinated during the study duration. Median date of vaccination was 29th January 2021, 7 days after notification and 42 days after the first patient in the cohort was vaccinated; presumably the few patients vaccinated prior to notification were part of another eligible group such as healthcare providers. The marked increase in vaccination rate then coincides with notifications (**Figure 1**).

On unadjusted analysis, patients not yet vaccinated were significantly more likely to have LEP, be younger, have Medicaid insurance, and identify as a race other than white (**Table 1**). The cox proportional hazard model of vaccination during the study period demonstrated that patients with a preferred language other than English were less likely to be vaccinated (0.64, $p = 0.001$) during the study duration, even after adjustment for race (**Table 2**). Black, Hispanic and other race patients were less likely to be vaccinated compared to the white group (0.58, 0.67, 0.68; all $p$-value<0.03). When the population is split into groups by race, there is a trend to reduced access among non-white patients with LEP (**Figure 2**). This is most pronounced in the Black, Asian and other race groups, though the 95% confidence intervals overlap in all but the Asian group. A difference between LEP and EP (English proficient) patients' likelihood of vaccination was not observed among Hispanic patients.

## DISCUSSION

This analysis demonstrates that LEP is an additive barrier to accessing timely COVID vaccination that exacerbates the well-documented disparities related to race. Since at the time of this study vaccines were only available *via* the medical institution, and this population has established care with this institution, there is less heterogeneity than with community-based vaccination and

**TABLE 1 |** Unadjusted comparisons of study population.

| | ***n* = 3,001** | **Not Vaccinated** | **Vaccinated** | ***p*-value** |
|---|---|---|---|---|
| | | ***n* = 1,496** | ***n* = 1,505** | |
| Preferred Language not English | | 130 (8.7%) | 63 (4.2%) | <0.001 |
| Female | | 606 (40.5%) | 571 (37.9%) | 0.15 |
| Race | White | 999 (66.8%) | 1,192 (79.2%) | <0.001 |
| | Black | 196 (13.1%) | 113 (7.5%) | |
| | Hispanic | 73 (4.9%) | 42 (2.8%) | |
| | Asian | 88 (5.9%) | 79 (5.2%) | |
| | Other/Multi | 140 (9.4%) | 79 (5.2%) | |
| Age | <45 | 310 (20.7%) | 211 (14.0%) | <0.001 |
| | 45–64 | 669 (44.7%) | 659 (43.8%) | |
| | 65–74 | 389 (26.0%) | 501 (33.3%) | |
| | 75+ | 128 (8.6%) | 134 (8.9%) | |
| Insurance | Private | 727 (48.6%) | 780 (51.8%) | <0.001 |
| | Medicare | 667 (44.6%) | 667 (44.3%) | |
| | Medicaid | 102 (6.8%) | 58 (3.9%) | |
| Organ | Kidney | 1,100 (73.5%) | 1,120 (74.4%) | 0.81 |
| | Liver | 354 (23.7%) | 347 (23.1%) | |
| | Both | 42 (2.8%) | 38 (2.5%) | |

**TABLE 2 |** Adjusted regression, likelihood of vaccination during the study time.

| | *n* = 3,001 | Hazard ratio | *p*-value | 95% CI |
|---|---|---|---|---|
| Preferred Language not English | | 0.64 | 0.001 | 0.5 to 0.8 |
| Female | | 0.95 | 0.31 | 0.9 to 1.1 |
| Race | White | Reference | | |
| | Black | 0.58 | <0.001 | 0.5 to 0.7 |
| | Hispanic | 0.67 | 0.02 | 0.5 to 0.9 |
| | Asian | 0.93 | 0.57 | 0.7 to 1.2 |
| | Other/Multi | 0.68 | 0.001 | 0.5 to 0.9 |
| Age | <45 | Reference | | |
| | 45–64 | 1.24 | 0.008 | 1.1 to 1.4 |
| | 65–74 | 1.51 | <0.001 | 1.3 to 1.8 |
| | 75+ | 1.3 | 0.02 | 1.0 to 1.6 |
| Insurance | Private | Reference | | |
| | Medicare | 0.87 | 0.02 | 0.8 to 1.0 |
| | Medicaid | 0.76 | 0.05 | 0.6 to 1.0 |
| Organ | Kidney | Reference | | |
| | Liver | 0.91 | 0.15 | 0.8 to 1.0 |
| | Both | 0.87 | 0.42 | 0.6 to 1.2 |

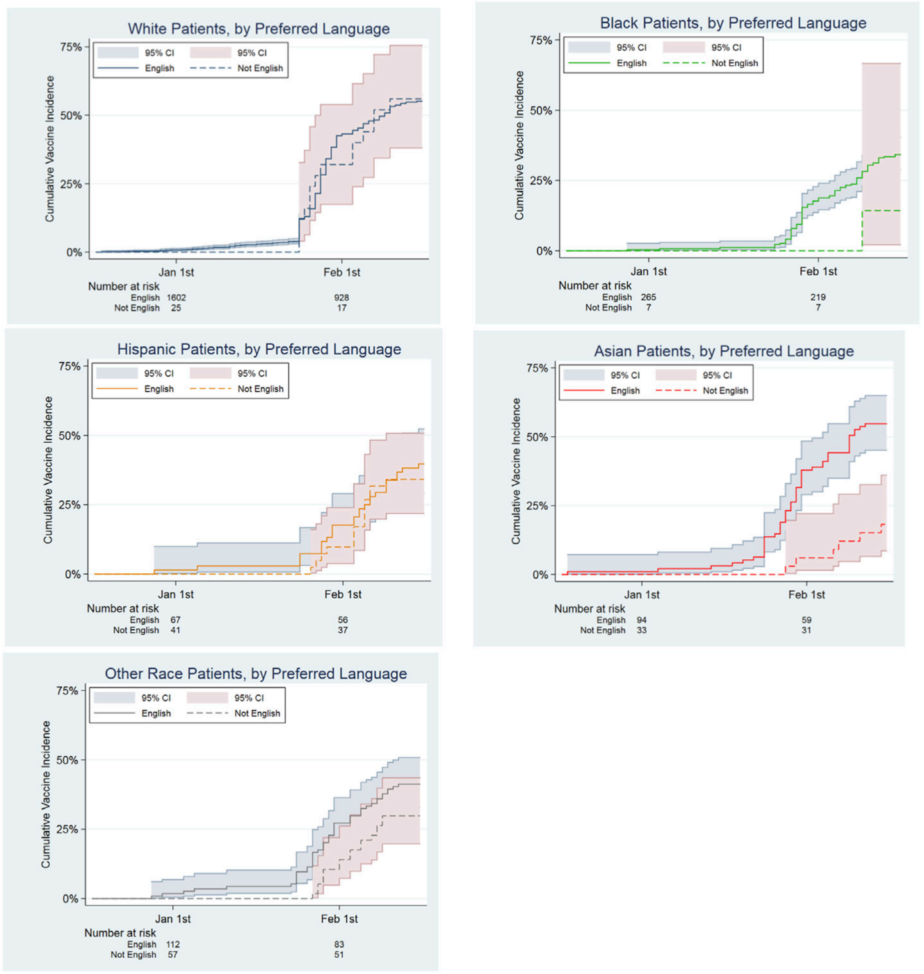


**FIGURE 2 |** Hazard Ratios of Time to First COVID Vaccination by Race among Abdominal Transplant Recipients, comparing English as Preferred Language to Other Language Preferred.

the general community. Undergoing the process of transplantation and follow-up care can provide a degree of healthcare literacy (10) that further decreases the heterogeneity of social determinants of health in this population. While social determinants of health can be difficult to change, our study suggests a potential intervention by the medical community to address the disparities experienced by patients with LEP. Greater than 95% of the LEP Hispanic patients in this study speak Spanish (data not shown), the authors speculate that the reduced disparity among Hispanic abdominal transplant recipients compared to the other non-white races may reflect the impact from the notice being emailed out in Spanish as well as English. This observation suggests the possibility that language support could ameliorate the impact of racial disparity in this population. The potential impact of language support is further suggested in Asian patients, who did not receive language concordant notices. In that case, Asian patients with LEP were less likely to be vaccinated than EP Asian patients and white patients. This suggests that outreach expanded to provide language concordant communication to these patients could improve timely access to care. Though the number of white patients with LEP was small, there was no difference in time to vaccination compared to white patients who speak English, raising concerns that the disparity related to language proficiency predominantly disadvantages transplant patients who are not white. As prior research has argued, there is an onus on the health system to improve access for these patients in an effort to reduce disparities, with potential methods including patient navigators reaching out with medical interpreters, language concordant communication materials, and involving community organizations to develop outreach to these underserved patients (11). The effects of race and language are likely to be even greater in the general population, compared to the post-transplant population in this study. Vaccine availability has improved in the United States, but remains limited in many areas of the world, and these findings suggest attention to the impact of limited proficiency in the local primary language on access to timely vaccination in global communities. These findings regarding disparities in access to timely care merit broader study to determine if there is an exacerbating impact of language proficiency as an independent barrier to access to other important components of healthcare for patients who do not speak the local majority language. In the meantime, efforts should be expanded to provide patients consistent communication in their preferred language.

## DATA AVAILABILITY STATEMENT

The raw data supporting the conclusion of this article will be made available by the authors, without undue reservation.

## ETHICS STATEMENT

The studies involving human participants were reviewed and approved by MGH Institutional Review Board. Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements.

## AUTHOR CONTRIBUTIONS

CMC participated in research design, writing of the paper, the performance of the research, the data analysis and the interpretation of results. YWC participated in the data analysis and the interpretation of results. DC participated in the data analysis and the interpretation of results. HY participated in research design, access to and interpretation of the data used, the data analysis and the interpretation of results.

## CONFLICT OF INTEREST

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

## ACKNOWLEDGMENTS

The authors would like to acknowledge the transplant clinic team for their work assisting and tracking transplant recipients' COVID vaccinations.

## REFERENCES

1. Karliner LS, Jacobs EA, Chen AH, Mutha S. Do professional Interpreters Improve Clinical Care for Patients with Limited English Proficiency? A Systematic Review of the Literature. *Health Serv Res* (2007) 42(2):727–54. doi:10.1111/j.1475-6773.2006.00629.x
2. Biswas S, Seman M, Cox N, Neil C, Brennan A, Dinh D, et al. Impact of Limited English Proficiency on Presentation and Outcomes of Patients Undergoing Primary Percutaneous Coronary Intervention for ST-Elevation Myocardial Infarction. *Intern Med J* (2018) 48(4):457–61. doi:10.1111/imj.13751
3. Sentell T, Chang A, Ahn HJ, Miyamura J. Maternal Language and Adverse Birth Outcomes in a Statewide Analysis. *Women Health* (2016) 56(3):257–80. doi:10.1080/03630242.2015.1088114
4. Rozenfeld Y, Beam J, Maier H, Haggerson W, Boudreau K, Carlson J, et al. A Model of Disparities: Risk Factors Associated with COVID-19 Infection. *Int J Equity Health* (2020) 19(1):126. doi:10.1186/s12939-020-01242-z
5. Kim HN, Lan KF, Nkyekyer E, Neme S, Pierre-Louis M, Chew L, et al. Assessment of Disparities in COVID-19 Testing and Infection across Language Groups in Seattle, Washington. *JAMA Netw Open* (2020) 3(9): e2021213. doi:10.1001/jamanetworkopen.2020.21213
6. Ingraham NE, Purcell LN, Karam BS, Dudley RA, Usher MG, Warlick CA, et al. Racial/Ethnic Disparities in Hospital Admissions from COVID-19 and Determining the Impact of Neighborhood Deprivation and Primary Language. *medRxiv* (2020) 09(2):20185983. doi:10.1101/2020.09.02.20185983
7. Diamond LC, Jacobs EA, Karliner L. Providing Equitable Care to Patients with Limited Dominant Language Proficiency amid the COVID-19 Pandemic. *Patient Educ Couns* (2020) 103(8):1451–2. doi:10.1016/j.pec.2020.05.028

8. Coll E, Fernández-Ruiz M, Sánchez-Álvarez JE, Martinez-Fernandez JR, Crespo M, Gayoso J, et al. COVID-19 in Transplant Recipients: The Spanish Experience. *Am J Transpl* (2021) 21(5):1825–37. doi:10.1111/ajt.16369
9. Azzi Y, Bartash R, Scalea J, Loarte-Campos P, Akalin E. COVID-19 and Solid Organ Transplantation: A Review Article. *Transplantation* (2021) 105(1): 37–55. doi:10.1097/TP.0000000000003523
10. Dahl KG, Wahl AK, Urstad KH, Falk RS, Andersen MH. Changes in Health Literacy during the First Year Following a Kidney Transplantation: Using the Health Literacy Questionnaire. *Patient Educ Couns* (2021) 104(7):1814–22. doi:10.1016/j.pec.2020.12.028
11. Fuchs JR, Fuchs JW, Tietz SE, Lum HD. Older Adults with Limited English Proficiency Need Equitable COVID-19 Vaccine Access. *J Am Geriatr Soc* (2021) 69(4):888–91. doi:10.1111/jgs.17069

ESOT Transplant International

REVIEW
published: 08 February 2023
doi: 10.3389/ti.2023.10800

# Implementation of Blockchain Technology Could Increase Equity and Transparency in Organ Transplantation: A Narrative Review of an Emergent Tool

**Alessandro Anselmo**[1], **Marco Materazzo**[1]*, **Nicola Di Lorenzo**[1], **Bruno Sensi**[1], **Camilla Riccetti**[1], **Maria Teresa Lonardo**[1], **Marco Pellicciaro**[1], **Francesco D'Amico**[2], **Leandro Siragusa**[1] **and Giuseppe Tisone**[1]

*[1]Department of Surgical Science, University of Rome "Tor Vergata", Rome, Italy, [2]Transplantation and Hepatobiliary Surgery, University of Padova, Padova, Italy*

In the last few years, innovative technology and health care digitalization played a major role in all medical fields and a great effort worldwide to manage this large amount of data, in terms of security and digital privacy has been made by different national health systems. Blockchain technology, a peer-to-peer distributed database without centralized authority, initially applied to Bitcoin protocol, soon gained popularity, thanks to its distributed immutable nature in several non-medical fields. Therefore, the aim of the present review (PROSPERO N° CRD42022316661) is to establish a putative future role of blockchain and distribution ledger technology (DLT) in the organ transplantation field and its role to overcome inequalities. Preoperative assessment of the deceased donor, supranational crossover programs with the international waitlist databases, and reduction of black-market donations and counterfeit drugs are some of the possible applications of DLT, thanks to its distributed, efficient, secure, trackable, and immutable nature to reduce inequalities and discrimination.

**Keywords: transplants, blockchain, delivery of health care, electronic health records, transplantation conditioning, social justice, equality**

***Correspondence:**
*Marco Materazzo*
*marco.materazzo@ptvonline.it*
*mrcmaterazzo@gmail.com*
*marco.materazzo@alumni.uniroma2.eu*

***Received:** 26 July 2022*
***Accepted:** 02 January 2023*
***Published:** 08 February 2023*

***Citation:***
*Anselmo A, Materazzo M, Di Lorenzo N, Sensi B, Riccetti C, Lonardo MT, Pellicciaro M, D'Amico F, Siragusa L and Tisone G (2023) Implementation of Blockchain Technology Could Increase Equity and Transparency in Organ Transplantation: A Narrative Review of an Emergent Tool. Transpl Int 36:10800. doi: 10.3389/ti.2023.10800*

## INTRODUCTION

Since the first kidney transplantation in 1957, transplantation emerged as a novel exciting discipline focused on innovative encompassing drug design, translational medicine, surgery, and ethics (1).

Besides medical innovation, in the last few years, innovative technology and healthcare digitalization played a major role in all medical fields. For instance, electronic medical records

---

**Abbreviations:** COVID-19, Coronavirus Disease 2019; DLT, distribution ledger technology; EMR, electronic medical records; GDPR, general data protection regulation; HLA, human leukocyte antigen; INR, international normalized ratio; IoT, internet of things; KPD, kidney paired donation; M2M, machine-to-machine communication; MELD, model for end-stage liver disease; NFT, non-fungible tokens; NHS, national health system; PACS, picture archiving and communication system; PoW, proof-of-work; PRA, panel reactive antibody; PRISMA, preferred reporting items for systematic reviews and meta-analyses; TTP, trustable third party.

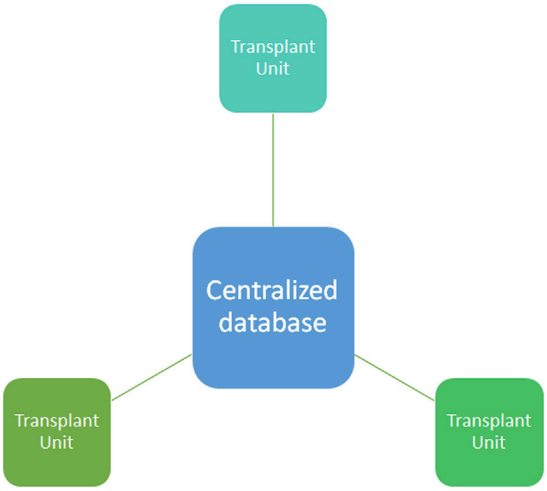


**FIGURE 1 |** Centralized database system. In a centralized database system all the information are stored in the centralized database where the different transplant units (nodes) upload the data from donors, recipients, and clinical outcome. Centralized database are more prone than other technology to cyberattacks and hacking.

(EMR) changed daily practice, providing the future chance for big data analysis and artificial intelligence application (2). To ease this digital revolution, a great effort has to be made by the national health system (NHS) to manage this large amount of sensitive data, paying maximum attention to security and digital privacy, a novel human right recognized by the United Nations (3). Among all patients, the security and digital privacy of the people on the transplant waiting list and also post-transplantation is even more urgent due to the amount and nature of the data (e.g., donor data). Moreover, this cohort of patients represent a population small enough to safely evaluate the application of novel technology in clinical care.

In light of this, a great effort has been made by the local transplant program coordinator to design a transparent and fair organ allocation system and to overcome illegal practice (4) with a centralized system and centralized data storage (**Figure 1**). Despite cryptography, centralized database systems are more prone to cyberattacks and hacking, like the last ransomware attack on COVID-19 vaccination registration portal in 2021 in Lazio (an Italian region) (5). Moreover, COVID-19 itself determined a further decentralization and increase in telehealth assessment (6–11). In order to solve some of these issues, blockchain technology has been proposed as a possible solution by several authors (12).

Blockchain technology, designed by a mysterious author named Satoshi Nakamoto in 2008, defines a peer-to-peer distributed database without centralized authority (3). Initially applied to the Bitcoin protocol, blockchain technology offered trustable decentralized electronic cash transactions without any validation from trustable third party (TTP) institutions.

Specifically, a blockchain is a record of a peer-to-peer transaction made by linked transaction blocks that are immutable and shared in a network. Every node of the network has a copy of the distribution ledger, defined as "a type of database which is shared, replicated, and synchronized among members of a network. The distribution ledger records the transaction, such as assets or data, among the participants of the network."

Blockchain can be classified according to the accessibility of the distribution ledger as public, private, and permissioned blockchains. A public blockchain is anonymous and any user can have a copy and participate in confirming a transaction, whereas, in a private blockchain, the distribution ledger is controlled by the owner who regulates all the aspects of the network and can even change the content of the blockchain itself. Permissioned blockchain represents an intermediate solution where an organization supervises the admission of the individuals, the allocation of the distribution ledger to individuals, and the permission to confirm transactions.

**Figure 2** shows a simple distribution ledger (blockchain) made by N blocks. Every single block contains data (N) (e.g., money transactions, supply chain data, medical data, etc.) with timestamps, a hash of the previous block (n−1), and a hash of what is contained in the block (hash n−1 plus data of n). The security of this protocol lies in the hash that links one block to the next one. If any data is changed in the block, then the hash created for the block and the next one will be incorrect. Due to the distributed nature of the blockchain, if any data modification is made, any node that has a copy of the chain should modify accordingly to maintain coherence in the sequence, a highly unlikely situation in the public and permissioned blockchain (high Byzantine fault tolerance). Finally, the sequence is secured by another mechanism: Proof-of-work (POW) consensus. PoW consensus represents a time-consuming mathematical function that is required prior to validation of the block as a deterrent for malicious access. After blockchain spread several different alternative to PoW have been designed to reduce energy and/or time consumption (13). **Figure 3** shows all the workflow required to add a block to the distributed ledger.

Beyond the birth of several cryptocurrencies emulating the Bitcoin experience (14), several non-medical industries started to apply the blockchain technology in several fields, thanks to the sustainability, and the lack of central agency in several supply chains in perishable goods, such as fish, or non-perishable goods such as diamonds (15). Regarding medical data, the promising experience of the Estonian NHS to secure EMR with blockchain technology demonstrates its technical applicability in medical fields.

Taking into account these non-medical and medical experiences, the aim of the present review is to establish the future role of blockchain and distribution ledger technology (DLT) in the organ transplantation field. In order to help transplant physicians to familiarize the DLT technology. **Table 1** summarizes some of the non-medical vocabulary used.

# MATERIALS AND METHODS

## Search Strategy

A systematic review was designed to analyze all the early experiences of DLT in trasplantology and was conducted

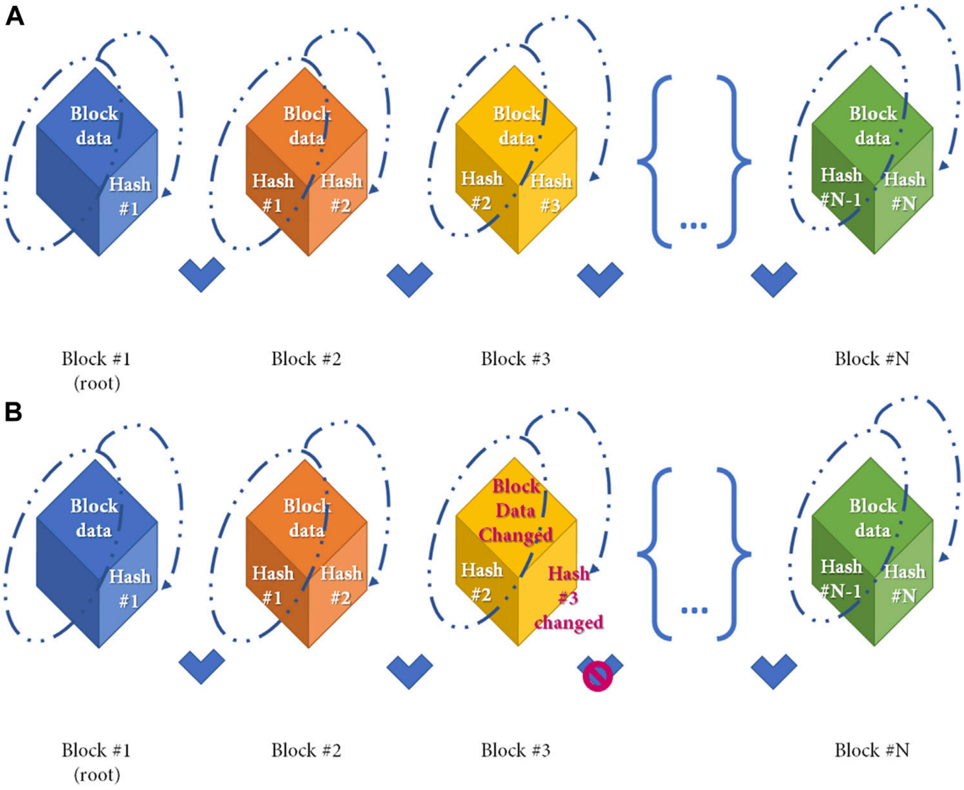


**FIGURE 2 |** Simple Blockchain model. Distribution ledger technology (DLT) is a type of database which is shared, replicated, and synchronized among members of a network. DLT is made by single different blocks which contains the data recorded in the DLT. **(A)** Simple Blockchain model. Every cube represents a different block. Any single block after the first is made by 2 different hashes and the data, as shown in the figure. A hash function is any function that can be used to map data of arbitrary size to fixed-size values and is produced during the Proof-of-Work to ensure sequentality of DLT. Any block from the DLT contains the hash from the previous block and the hash of itself. Block hash is calculated by the data contained in the block, and the previous hash (as shown in dotted line) **(B)** If the data contained in the block is changed (e.g., Block#3) the block hash (hash#3) will change with a denial of the block based on the incorrect association between blocks.

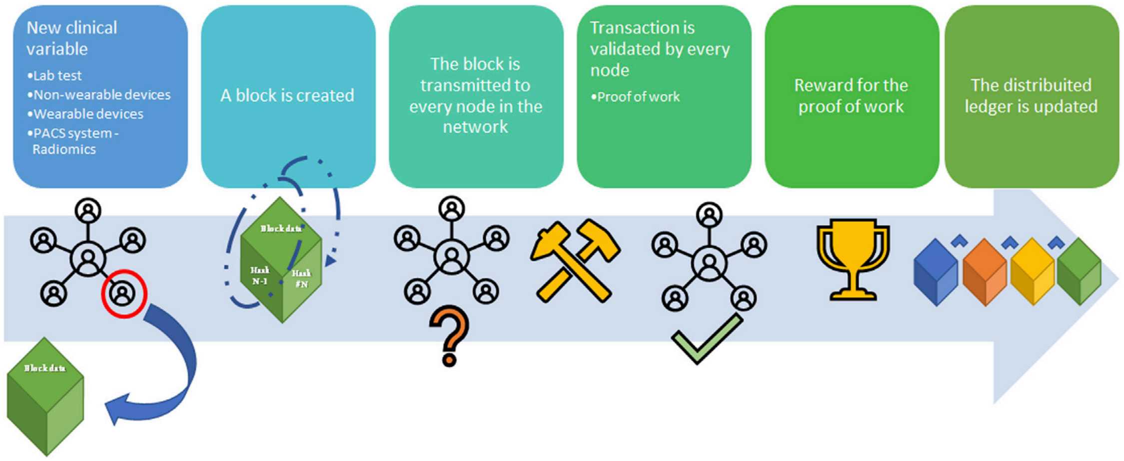
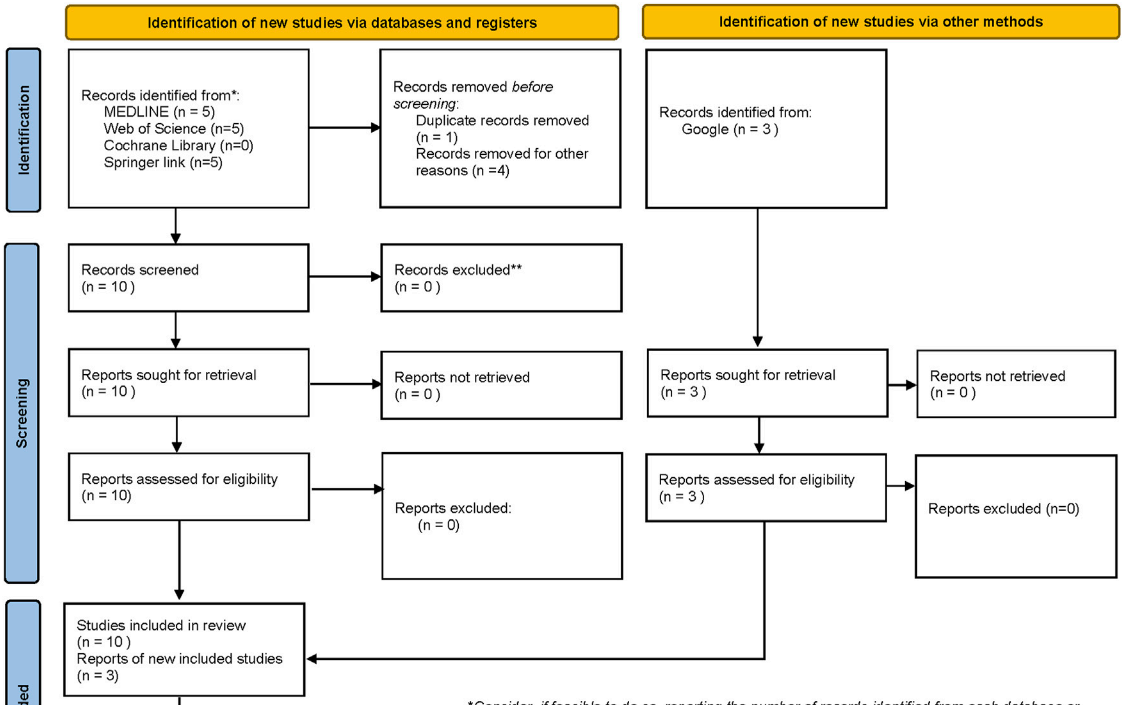


**FIGURE 3 |** Blockchain workflow sample (from left to right). A node in the blockchain submits the request to create a new block with an amount of data (supply chain; cryptocurrency transaction; medical record), namely Block (n). Block (n) is made by the node to contain the hash from Block (n–1), hash (n–1), and the data. Block (n) is transmitted to every node of the network without hash (n). Hash (n) for Block (n) is calculated from the data in the block [hash (n-1) plus the data] in every single node through the Proof-of-Work (PoW) (so-called mining) to avoid malicious entities. Every node validates the new block Every node receives the reward for the PoW and the Block (n) is added to the blockchain.

**TABLE 1 |** Non-medical vocabulary used in review.

**Blockchain:** Blockchain is a record of a peer-to-peer transaction made by linked transaction blocks that are immutable and shared in a network.
**Distribution ledger:** a type of database which is shared, replicated, and synchronized among members of a network. The distribution ledger records the transaction, such as assets or data, among the participants of the network.
**Hash:** A hash function is any function that can be used to map data of arbitrary size to fixed-size values. In the blockchain technology is used to ensure the sequentiality of the data in the blockchain.
**Internet of thing (IoT) technology:** a network of physical things linked to each other by means of the Internet (16),
**Machine-to-machine communication (M2M):** a particular system network where machines communicate without human involvement, avoiding human manipulation and securing organ allocation system (18).
**Non-fungible Token (NFT):** is a unique digital identifier that cannot be copied, substituted, or subdivided, that is recorded in a blockchain, and that is used to certify authenticity and ownership.
**Proof-of-work (PoW) consensus:** a time-consuming mathematical function that is required prior to validation of the block as a deterrent for malicious access. **Figure 3** shows all the workflow required to add a block to the distributed ledger.
**Ransomware:** is a type of malware from cryptovirology that threatens to publish the victim's personal data or permanently block access to it unless a ransom is paid.
**Trustable third party (TTP):** an entity which facilitates interactions between two parties who both trust the third party; the Third Party reviews all critical transaction communications between the parties, based on the ease of creating fraudulent digital content.



**Consider, if feasible to do so, reporting the number of records identified from each database or register searched (rather than the total number across all databases/registers).*
***If automation tools were used, indicate how many records were excluded by a human and how many were excluded by automation tools.*

*From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372:n71. doi: 10.1136/bmj.n71.* For more information, visit: http://www.prisma-statement.org/

**FIGURE 4 |** Preferred Reporting Items of Systematic Reviews and Meta-Analyses (PRISMA) flow diagram demonstrating the process of study selection in the review.

according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (16). The protocol of this systematic review was registered in PROSPERO (CRD42022316661). A systematic literature search of Medline, Web of Science, and Cochrane databases with the following search string: ("blockchain" or "distributed ledger technology") AND ("transplant" OR "graft") was carried out on 29th April of 2022, and additional manuscripts were retrieved from reference lists of included studies and relevant reviews. Moreover, a grey literature search was performed through Google to find other resources available.

Results have been imported in Mendeley 1.19.8 (Elsevier, Netherlands) to remove duplicates. Bibliographic citations of included studies have been manually searched to identify other studies that filled the review's inclusion criteria.

## Selection of Studies

Two reviewers (MM and MP) worked independently to screen the titles and abstracts of identified citations, and subsequently, the full texts of potentially eligible studies. Disagreements between reviewers were resolved by discussion and with the help of a senior adjudicator (AA).

## Data

Eligible studies were all English manuscripts regarding DLT application in organ and tissue transplant, even partially. Manuscripts regarding other specialties were excluded from the study.

# RESULTS

## Literature Search and Study Characteristics

The systematic search strategy identified a total of 13 publications that were included in the narrative review (**Figure 4**). None of the publications enlisted were registered as clinical trials. Therefore, due to the lack of a clinical outcome and paucity of data, a narrative review was designed to underline both already designed and putative future applications of DLT in transplant care.

## Preoperative Assessment

### Deceased Donor Organ Allocation, DLT, and the Internet of Thing (IoT)

Organ allocation systems encompass all the processes involved in organ distribution across a region to ensure fair and ethical distribution across patients on the waiting lists (17–19). Currently, to our knowledge, at least six different models of DLT for organ allocation were described in the literature by Jain, Ranjan et al., Dajim et al., Lamba et al., Alandjani, and Daniel et al., (14, 20–24). In their manuscript, Jain focused his work on different DLT models (OrganChain) for organ allocation namely Scheme A (Matching organ inside the Blockchain) and Scheme B (Matching organ inside the Blockchain), with Scheme A resulting in superior generating fewer blocks (22). To evaluate the performance of their blockchain-based system, four variables were evaluated: maxed batch time out, max block size, endorsement policy, and transaction rate (25).

Another peer-to-peer and secure protocol network was presented by Ranjan et Al. and called Interplanetary File System (IPFS). IPFS aimed at reducing the price of uploading donors' and patients' EMRs. DLT presented was secured with double hashing (14).

Notably, Dajim et al. focused their work on overwhelming the issue of their current donation and transplantation system in Saudi Arabia (lack of transparency, data security, and privacy) (23). Prevention of black-marketing issues in organ donation and transplantation was the main objective of the model provided by Lamba et al. (24).

The other studies published by Alandjani, and Daniel et al., focused their work on the development of DLT and their evaluation on IoT, consumption, scalability, and gas consumption (20, 21). All the distributed allocation systems are designed on Hyperledger fabric, a Linux Foundation open source project (26), or Ethereum, a decentralized, open-source blockchain with smart contract functionality. DLT applications in organ allocation are summarized in **Table 2**.

# DISCUSSION

## Deceased Donor Organ Allocation, DLT, and the Internet of Thing (IoT)

Organ allocation systems encompass all the processes involved in organ distribution across a region to ensure fair and ethical distribution across patients on the waiting lists (18, 19). The importance of ethical organ allocation lies in the huge number of patients in the waiting list; it has been calculated that every 12 min a new name is added to the organ waiting lists and that an average of 21 patients die due to lack of organ availability every day (21). Due to the increasing demand for organs and the inadequacy of organ procurement, every country designs its own allocation rules trying to balance inequality among patients (utility model) and transplant benefit (net life-years gained) (19).

For instance, in Italy, deceased kidney donor allocation includes a regional level where several factors such as waiting time, age, human leukocyte antigen (HLA) match, % of panel reactive antibody (PRA), defined regional-based or national-based renal urgency, combined transplant, and pediatric priority are taken into consideration (18).

Another example of deceased organ allocation is the model for deceased liver distribution among countries in the Eurotransplant program. In the Eurotransplant model, liver donors are allocated first internationally to high urgency status patients or to those with an approved combined organ status, and then on a national basis, where allocation is recipient-driven or center-driven, depending on local rules (27). In the latter case, "match MELD," AB0 blood group rules, predefined center, and donor profile criteria (age, weight, virology, split, etc.) for a particular recipient, and time from the listing are all taken into account prior to organ offering (27). "Match MELD" consists of the highest value between "lab MELD" or "exceptional MELD." "Lab MELD" is calculated according to the Model for End-Stage Liver Disease (MELD) (28) with international normalized ratio (INR), bilirubin level, and serum creatinine. The latter, exceptional MELD, can be requested under certain circumstances when patient severity is not well described by lab MELD with the disease list repeatedly revised (27).

However, despite the wide application of complex allocation system, in some countries, the lack of a connecting platform could ease illegal practices or illegitimate methods in some hospitals (14). It has been calculated that 5%–10% of kidney transplants performed annually are currently through illegal practices, such as organ trade, and organ tourism (29). Moreover, illegal organ donation lacks all the preoperative assessment of recipient and donor to reduce possible side effects, oncological and infective risks (30, 31). Under these circumstances, fair organ allocation is an ethically compelling need in order to prevent harm to patients and on transplant program reliability worldwide.

Hence, DLT technology could provide a useful tool to resolve these issues, providing an efficient, secure, distributed, trackable,

**TABLE 2 |** Summary of the Organ allocation system developed.

| Authors | DLT used | Contributions |
|---|---|---|
| Jain (22) | Hyperledger Fabric | OrganChain prototype to discover the performance of a blockchain-based OPTN |
| Ranjan et al. (14) | Ethereum | InterPlanetary File System (IPFS) to Reduce the cost to upload donor and patient data<br>Double hashing technique for proving security and privacy for donor's and patient's data |
| Dajim et al. (23) | Ethereum | Overcoming the limitations of Saudi Arabia's transplantation system (lack of transparency, data security, and privacy) |
| Lamba et al. (24) | Hyperledger Fabric and Hyperledger Composer | Prevention of organ black-market |
| Alandjani (21) | — | Scalability<br>IoT application in DLT technology |
| Daniel et al. (20) | Ethereum | Scalability and gas consumption |

*DLT, distribution ledger technology; OPTN, Organ procurement transplant network; IoT, Internet-of-Thing.*

and immutable framework to promote organ allocation and donation (14, 21). Firstly, the DLT model through decentralization and without a centralized source could determine a sharing model to cope with such security threats and anonymity of data transactions (21, 22). A possible model for DLT in organ allocation and listing may be represented by a permissioned blockchain network where regulatory authority can easily control the access in the network. Permissioned blockchain rely on a governance structure (in this case regulatory authority) that controls access and enforces rules. In this specific blockchain network commonly are implemented alternative computationally intensive consensus mechanisms compared to PoW, because of the degree of trust among the different nodes. In a permissioned DLT, regulatory authority, as in centralized network, are in charge of responding to incident including cyber threats and as in a centralized network they can control access (13).

Due to the nature of the DLT, this model could determine other advantages in the organ procurement process in terms of auditability, which is immutable and can be easily reviewed by government auditors (22). However, while some authors may argue that the immutability of DLT could represent a limitation of this system in case of data entry errors, eventual data entry error may be correct by regulatory authority in private/permissioned blockchain (15). Moreover, Data entry error may be easily reduced by application of Internet of thing (IoT) technology, and machine-to-machine communication (M2M) (21). IoT is defined as a network of physical things linked to each other by means of the Internet (32), while M2M is a particular system where machines communicate without human involvement, avoiding human manipulation and securing organ allocation system (21). In fact, some of the above-mentioned organ allocation systems require biochemical variables such as PRA, INR, and bilirubin level, which can be updated directly from the laboratory in the distributor ledger, while clinical variables could be updated by medical wearable devices (21, 33), or radiological or radiomics variables could be directly uploaded from Picture archiving and communication system (PACS) (**Figure 5**). Finally, another potentiality of DLT decentralized nature is the lack of TTP institution for its legitimacy, leading to a real international DLT-based organ procurement network, not restricted to national borders (22). **Table 3** describes the pros and cons of different systems to manage organ allocation in a centralized network, public DLT, and private/permissioned DLT (23).

Limitations of the current application are social perceptions about DLT in the medical fields, the possible conflict with European legislation, and the lack of standardization of EMR among different facilities (34). In fact, despite the promising application of DLT technology in the Estonian NHS, application of DLT in EMR is limited and scares, therefore further evidence are needed. Regarding the latter limitation, EMR standardization among different facilities could promote some benefits in terms of sharing information between different centers, and enhancing medical information migration between different providers besides transplantation (22). Finally, European privacy legislation may represent a limitation for the implementation of DLT technology in medical information technology. The General Data Protection Regulation (GDPR) is a European Union law applied from May 2018 to safeguard personal data, and privacy of European citizens (35). GDPR regulation, which was written when DLT were mostly used in cryptocurrencies and their further application were not applied in medical or other uses, introduces the "right to be forgotten" (13). In order to solve this dilemma several authors and companies are currently working to solve this paradox, with different solutions from a legal agreement between participants in a private/permissioned blockchain or improving anonymization of the data in the DLT (13).

## Expanding Living Donor Pool Through the Application of Blockchain on Crossover Programs

Despite the application of expanded criteria, deceased donors or marginal kidneys in dual kidney procedures (36, 37), it has been calculated that fewer than 25% of the waitlisted patients are transplanted because of organ shortage (38). To overcome the chronic organ shortage, kidney donation is routinely performed in one-third of patients from living donors. Moreover, besides increasing the donor pool, kidney donation from living donor determines better recipient and graft survival (39).

Despite these benefits, up to 30% of patients with a possible willing living donor are not compatible with their donor, due to blood type incompatibility and previous sensitization against

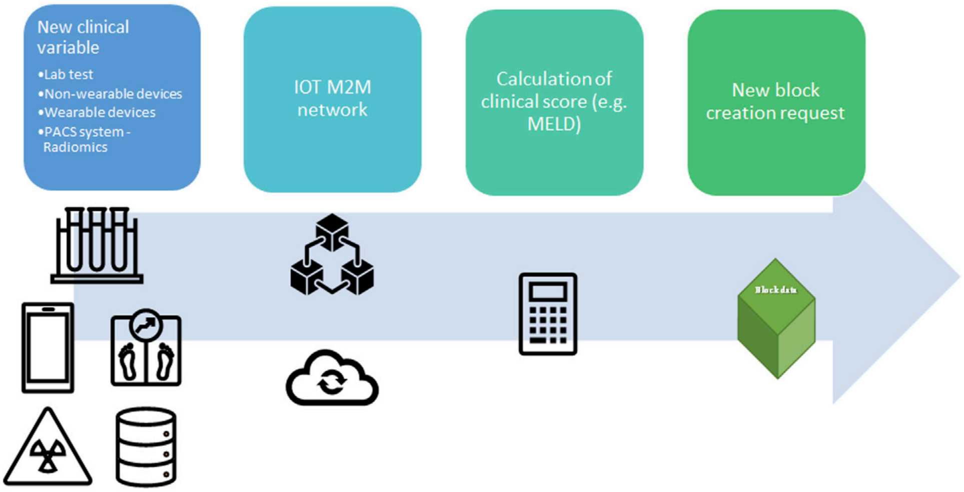


**FIGURE 5 |** Application of Internet-of-Things (IoT) and Machine-to-machine (M2M) protocol to update the clinical value for organ allocation and patients' waiting list. A new clinical variable is collected from wearable devices, non-wearable devices, hospital laboratory, Picture archiving and communication system (PACS), or any other facility in the hospital. The new data is transmitted in the local network between two different nodes (machine) without human interaction (M2M communication). Prior a new block request the clinical variable is integrated in clinical score (e.g., MELD score). Lab, laboratory; PACS, Picture archiving and communication system; IOT, Internet-of-Things; M2M, Machine to Machine; MELD, Model for End stage Liver Disease.

**TABLE 3 |** Different characteristics among Centralized, public DLT, and Permissioned DLT.

| System | Centralized network | Public DLT | Permissioned/Private DLT |
|---|---|---|---|
| Costly | Yes | No | No |
| Ease of use | No | Yes | Yes |
| Speed | Current standard | Moderate | Faster than public DLT |
| Scalability | No | Yes | Yes |
| Security | Current standard | Less than current standard | More than current standard |
| Reliability | Yes | No | Yes |
| Permanent | No | Yes, DLT cannot be modified in case of data error entry. | Yes. In some cases, the owner could modify in case of data error entry. |
| Transparency | No | Yes | Yes |
| Accessibility | No | Yes | Only who is authorized by the owner (e.g., local authority) of the DLT could join. |

*DLT, distribution ledger technology.*

donor HLA (39). To overcome these limitations, different strategies have been developed as kidney paired donation (KPD). In KPD programs, an incompatible donor-recipient pair is matched with one or more pairs. In the simplest form, two incompatible pairs are matched to each other. More complex transplant chains involve a deceased transplant donor which can initiate a donation cluster. The organ is returned to the deceased donor waiting list patient at the end of the donation cluster (**Figure 6**). In this scenario, larger a database is needed to identify multiple pairs to increase potential transplant leading to a logistically challenging organization.

Under these circumstances, DLT could represent a great opportunity to create an international waitlist database to increase the chance of a KPD and to activate kidney donor chain (2). DLT decentralization could guarantee transparency, trustworthiness, and auditability by any node of the network (21).

## Supply Chain

### Drugs

Immunosuppressive therapy after allograft solid organ transplantation is required to prevent rejection and preserve organ function (40–43). Various combinations of currently approved agents are needed to obtain the patients' tailored regimens to balance adequate immunosuppression with drugs' side effects (44–47) through continuous titration to reduce their side effects due to their narrow therapeutic index (48–51). In this light, a reliable drug supply chain is even more urgent due to the risk of counterfeit medications.

Counterfeit medications represent a major public health concern that severely impacts human lives and treatment outcomes besides transplantation. It has been calculated that, one out of ten medicines in developed countries and 1%–2% of all the drugs consumed in developed nations are counterfeit.

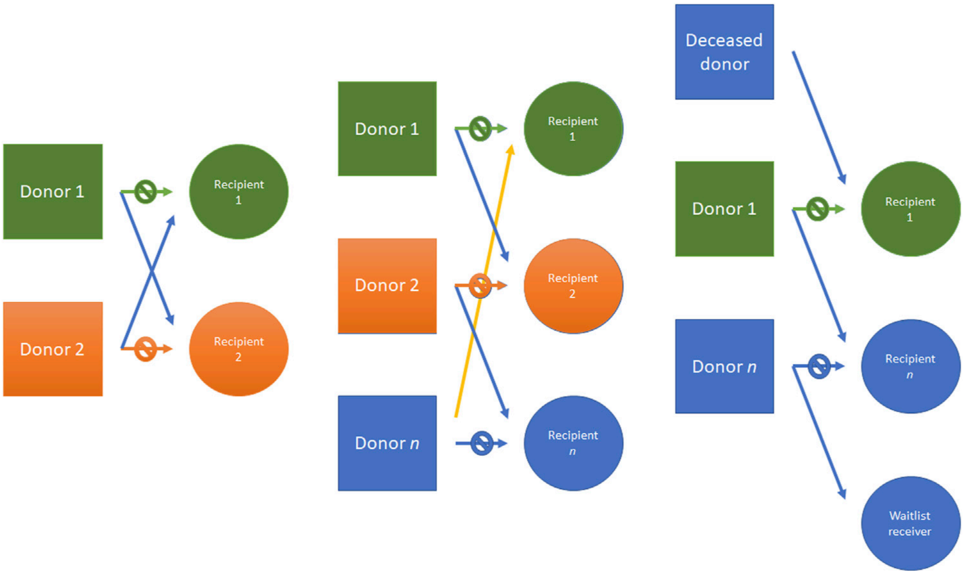


**FIGURE 6 |** Kidney donor paired (KDP) program example. From left to right: an incompatible pair is matched with another pair; three different incompatible pairs are matched; another example is made with a deceased donor which can initiate chain donation, donating to a transplant cluster. The donation cluster may end at another donation cluster or at the deceased donor waiting list, with the end of the donor chain. KDP, Kidney donor paired.

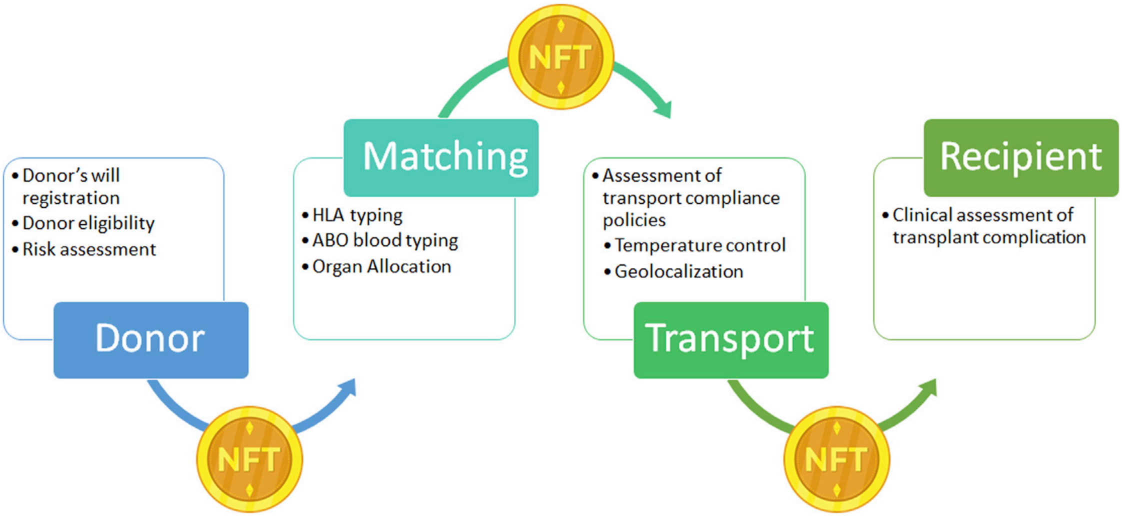


**FIGURE 7 |** Example of Non-fungible Token (NFT) application on donor organ supply chain. NFT: is a unique digital identifier that cannot be copied, substituted, or subdivided, that is recorded in a blockchain, and that is used to certify authenticity and ownership. In the present case NFT ownership is tracked to record the different phases of the supply chain from the donor to the recipients. After registration of the donor's will, the donor's clinical information is registered and NFT is generated and linked to the organ donor. During the transport NFT ownership is transferred through the supply chain with the organ, to obtain a real time tracking. NFT, Non-fungible Token.

The World Health Organization (WHO) includes products in counterfeit medications if those products are deliberately and fraudulently mislabeled with respect to source and/or identity with a difference in the package, without active ingredients, with different declared dosage, with toxic excipients or contaminants, and if active ingredients are not declared on the label or not authorized (52, 53). These factors could easily determine toxic and irreversible effects on the body and reduced graft survival.

A pharmaceutical supply chain comprehends several nodes in an end-to-end process arising from the active medication ingredients through manufacturing and delivery to patients (48, 54). As for other applications, DLT could represent a valuable opportunity to design a shared, permissioned, trusted, and decentralized platform that guarantees security, privacy, accessibility, transparency, and scalability for supply chain stakeholders (53). DLT application in drugs supply chain traceability could determine real-time tracking, improve inventory management, minimize courier costs, identify issues faster along the supply chain, and reduce errors (15).

### Organ Transport

As for the drugs supply chain, donated organs could be considered a unique, high-value item. Moreover, organs as for blood products or other medical products, require stringent transport characteristics such as transport time, temperature for transport, and regulatory transport compliance policies which can be tracked in a DLT (15, 54). A proposal to apply DLT to the organ supply chain is the link of the organ with a Non-fungible Token (NFT). NFT is a non-replicable token that relies on a DLT to prove its unicity and authenticity, enabling the chance to obtain a real-time auditability and trackability of organ donor in the path from the donor to the recipient (**Figure 7**) as theorized for blood transplant by Booth et al. (55).

## CONCLUSION

In the XX century, transplantation arose as a stimulating and innovative medical field, which required an enormous effort in various medical disciplines (immunology, infectious disease, genetics, molecular biology, surgical technology, intensive care, etc.). Improvements in transplant outcomes have brought about numerous clinical and ethical dilemmas, and their solutions allowed development in medical knowledge even beyond the transplantation field (56). It is, therefore an ethical duty of the transplant community to continue to embrace innovation and overcome the limits of current systems in every medical aspect.

Currently, medical digitalization is a reality that requires all transplant personnel to play a leading role. Among the several innovations that Information and Communication Technologies could bring to transplant clinical practice, DLT could soon become of pivotal importance in overcoming some limitations of transplant programs. DLT technology, thanks to its security and scalability, could boost transplants' programs and the reduce black market, allowing a real integration between different national health systems with real-time auditability, thanks to its distributed, efficient, secure, trackable, and immutable nature.

It is safe to assume that government-backed institutions could be extremely prudent regarding an innovation such as DLT. A supranational-based initiative by transplant physicians is needed to raise attention to the several innovations DLT could bring into transplant programs, with dedicated study groups to unveil the DLT pandora's box. It has been calculated that 55% of healthcare applications will have adopted DLT for commercial deployment by 2025 (13). Being competitive in the future will not only be a matter of keeping pace with clinical and translational research, but also a matter of becoming leaders of technological advancement. The transplant community should thrive to get involved in the action; hence, we believe that we should not only familiarize ourselves with DLT but also look for alternative solutions to data management to drive the innovation that DLT can offer.

## AUTHOR CONTRIBUTIONS

Participated in research design: MM and AA; participated in the writing of the paper: BS and ML; participated in the performance of the research: AA; participated in data analysis: MP, FD'A, LS, CR, and GT; all authors have read and agreed to the version of the manuscript.

## CONFLICT OF INTEREST

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

## ACKNOWLEDGMENTS

The authors sincerely acknowledge all the people involved in fighting inequality and discrimination in any form.

## REFERENCES

1. Merrill JP, Murray JE, Harrison JH, Guild WR. Successful homotransplantation of the human kidney between identical twins. *J Am Med Assoc* (1956) 160:277–82. doi:10.1001/jama.1956.02960390027008
2. Carrano FM, Sileri P, Batt S, Di Lorenzo N. Blockchain in surgery: are we ready for the digital revolution? *Updates Surg* (2022) 74:3–6. doi:10.1007/s13304-021-01232-y
3. Koh A, Swanepoel DW, Ling A, Ho BL, Tan SY, Lim J. Digital health promotion: promise and peril. *Health Promot Int* (2021) 36:i70–i80. doi:10.1093/heapro/daab134
4. Chornous Y, Pylypenko S, Vakulyk O, Bidniak H, Ostapchuk A. Current challenges of international cooperation in the area of human trafficking countering. *Int J Adv Sci Technol* (2020) 29:2344–2353.
5. HHS Cybersecurity program. Ransomware Attack on COVID-19 Vaccination Registration Portal in Italy's Lazio Region Possibly Involved Two Ransomware Variants (RansomEXX and LockBit2.0) (2021). Available from: https://www.hhs.gov/sites/default/files/lazio-ransomware-attack.pdf (Accessed January 31, 2022).
6. Vanni G, Materazzo M, Santori F, Pellicciaro M, Costesta M, Orsaria P, Cattadori F, Pistolese CA, Perretta T, Chiocchi M, et al. The Effect of Coronavirus (COVID-19) on Breast Cancer Teamwork: A Multicentric Survey. *Vivo* (2020) 34:1685–94. doi:10.21873/invivo.11962
7. Aldrighetti L, Boggi U, Falconi M, Giuliante F, Cipriani F, Ratti F, Torzilli G, Abu Hilal M, Andrianello S, Anselmo A, et al. Perspectives from Italy during the COVID-19 pandemic: nationwide survey-based focus on minimally invasive HPB surgery. *Updates Surg* (2020) 72:241–7. doi:10.1007/S13304-020-00815-5
8. Koval CE, Eltemamy M, Poggio ED, Schold JD, Wee AC. Comparative Outcomes for Over 100 Deceased Donor Kidney Transplants From SARS-CoV-2 Positive Donors: A Single-Center Experience. *Am J Transplant* (2022) 22:2903–11. doi:10.1111/AJT.17203
9. Hirschfeld CB, Shaw LJ, Williams MC, Lahey R, Villines TC, Dorbala S, Choi AD, Shah NR, Bluemke D, Berman DS, et al. Impact of COVID-19 on

Cardiovascular Testing in the United States Versus the Rest of the World. *JACC Cardiovasc Imaging* (2021) 14:1787–1799. doi:10.1016/J.JCMG.2021.03.007

10. Oldani C, Vanni G, Buonomo OC. COVID-19 Unintended Effects on Breast Cancer in Italy After the Great Lockdown. *Front public Heal* (2020) 8:601748. doi:10.3389/fpubh.2020.601748
11. Vanni G, Tazzioli G, Pellicciaro M, Materazzo M, Paolo O, Cattadori F, Combi F, Papi S, Pistolese CA, Cotesta M, et al. Delay in Breast Cancer Treatments During the First COVID-19 Lockdown. A Multicentric Analysis of 432 Patients. *Anticancer Res* (2020) 40:7119–25. doi:10.21873/ANTICANRES.14741
12. Dameff C, Pfeffer MA, Longhurst CA. Cybersecurity implications for hospital quality. *Health Serv Res* (2019) 54:969–70. doi:10.1111/1475-6773.13202
13. Chavez N, Kendzierskyj S, Jahankhani H, Hosseinian A. Securing transparency and governance of organ supply chain through blockchain. *Adv Sci Technol Secur Appl* (2020) 97–118. doi:10.1007/978-3-030-50613-1_4
14. Ranjan P, Srivastava S, Gupta V, Tapaswi S, Kumar N. Decentralised and distributed system for organ/tissue donation and transplantation. *Institute of Electrical and Electronics Engineers Inc* (2019). doi:10.1109/CICT48419.2019.9066225
15. Gaynor M, Tuttle-Newhall J, Parker J, Patel A, Tang C. Adoption of blockchain in health care. *J Med Internet Res* (2020) 22:e17423. doi:10.2196/17423
16. Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, Shamseer L, Tetzlaff JM, Akl EA, Brennan SE, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ* (2021) 372:n71. doi:10.1136/BMJ.N71
17. Anselmo A, Iaria G, Pellicciaro M, Sforza D, Parente A, Campisi A, et al. Native Nephrectomy in Patients With Autosomal Dominant Polycystic Kidney Disease Evaluated for Kidney Transplantation. *Transplant Proc* (2019) 51:2914–6. doi:10.1016/J.TRANSPROCEED.2019.08.010
18. Heemann U, Oberbauer R, Sprangers B, Gökalp C, Bemelman F. Deceased donor kidney allocation schemes and international exchange. *Curr Opin Organ Transplant* (2020) 25:66–73. doi:10.1097/MOT.0000000000000720
19. Gimson A. Development of a UK liver transplantation selection and allocation scheme. *Curr Opin Organ Transplant* (2020) 25:126–31. doi:10.1097/MOT.0000000000000743
20. Daniel IA, Pop C, Anghel I, Antal M, Cioara T. A Blockchain based solution for Managing Transplant Waiting Lists and Medical Records. In: 2020 IEEE 16TH Int Conf Intell Comput Commun Process (ICCP 2020) (2020)505-510 WE-Conference Proceedings Citation Inde (2020).
21. Alandjani G. BLOCKCHAIN BASED AUDITABLE MEDICAL TRANSACTION SCHEME FOR ORGAN TRANSPLANT SERVICES. *3C Tecnol* (2019) 41–63. Emerging Sources Citation Index (ESCI). doi:10.17993/3ctecno.2019.specialissue3.41-63
22. Jain U. Using Blockchain Technology for The Organ Procurement and Transplant Network. *Master's Theses* (2019). doi:10.31979/etd.g45p-jtuy
23. Dajim LA, Al-Farras SA, Al-Shahrani BS, Al-Zuraib AA, Mathew RM. Organ Donation Decentralized Application Using Blockchain Technology. In: 2019 2nd Int Conf Comput Appl \& Inf Secur (2019). p. 1–4.
24. Lamba R, Gupta Y, Kalra S, Sharma M. Preventing Waiting List Manipulation And Black Marketing of Donated Organs Through Hyperledger Fabric. In: 2019 International Conference on Computing, Communication, and Intelligent Systems (ICCCIS) (2019). p. 280–285. doi:10.1109/ICCCIS48478.2019.8974526
25. Niyigena C, Seol S, Lenskiy A. IEEE. Survey on Organ Allocation Algorithms and Blockchain-based Systems for Organ Donation and Transplantation. In: 11TH Int Conf ICT Converg DATA, NETWORK, AI AGE UNTACT (ICTC 2020) (2020)173-178 WE-Conference Proceedings Citation Inde (2020).
26. Fabric Hyperledger Foundation. Open, Proven, Enterprise-grade DLT.
27. Jochmans I, Van Rosmalen M, Pirenne J, Samuel U. Adult Liver Allocation in Eurotransplant. *Transplantation* (2017) 101:1542–50. doi:10.1097/TP.0000000000001631
28. Malinchoc M, Kamath PS, Gordon FD, Peine CJ, Rank J, Ter Borg PCJ. A model to predict poor survival in patients undergoing transjugular intrahepatic portosystemic shunts. *Hepatology* (2000) 31:864–71. doi:10.1053/HE.2000.5852
29. Budiani-Saberi DA, Delmonico FL, Budiani-Saberi DA. Organ trafficking and transplant tourism: a commentary on the global realities. *Am J Transplant* (2008) 8:925–9. doi:10.1111/j.1600-6143.2008.02200.x
30. Garg AX, Levey AS, Kasiske BL, Cheung M, Lentine KL. Application of the 2017 KDIGO Guideline for the Evaluation and Care of Living Kidney Donors to Clinical Practice. *Clin J Am Soc Nephrol* (2020) 15:896–905. doi:10.2215/CJN.12141019
31. Ielpo B, Mazzetti C, Venditti D, Buonomo O, Petrella G. A case of metachronous splenic metastasis from renal cell carcinoma after 14 years. *Int J Surg* (2010) 8:353–5. doi:10.1016/j.ijsu.2010.04.006
32. Sadoughi F, Behmanesh A, Sayfouri N. Internet of things in medicine: A systematic mapping study. *J Biomed Inform* (2020) 103:103383. doi:10.1016/J.JBI.2020.103383
33. Vanni G, Materazzo M, Pellicciaro M, Caspi J, Capacci A, Merra G, Capaci A, Merra G. Access to health care after COVID-19 pandemic: is it time for Telemedicine? *Eur Rev Med Pharmacol Sci* (2020) 24:9778–9. doi:10.26355/eurrev_202010_23185
34. Mertz L. (Block) Chain Reaction: A Blockchain Revolution Sweeps into Health Care, Offering the Possibility for a Much-Needed Data Solution. *IEEE Pulse* (2018) 9:4–7. doi:10.1109/MPUL.2018.2814879
35. The European Parliament and the Council of the European Union. REGULATION (EU) 2016/679 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation) (2022). Available from: https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32016R0679 (Accessed November 6, 2022).
36. Stratta RJ, Harriman D, Gurram V, Gurung K, Sharda B. The use of marginal kidneys in dual kidney transplantation to expand kidney graft utilization. *Curr Opin Organ Transplant* (2022) 27:75–85. doi:10.1097/MOT.0000000000000946
37. Hwang JK, Park SC, Kwon KH, Choi BS, Kim JI, Yang CW, Kim YS, Moon IS. Long-term outcomes of kidney transplantation from expanded criteria deceased donors at a single center: comparison with standard criteria deceased donors. *Transplant Proc* (2014) 46:431–6. doi:10.1016/J.TRANSPROCEED.2013.11.061
38. Lin Y-Q, Wang L-R, Pan L-L, Wang H, Zhu G-Q, Liu W-Y, et al. Kidney Bioengineering in Regenerative Medicine: An Emerging Therapy for Kidney Disease. *Cytotherapy* (2016) 18:186–97. doi:10.1016/j.jcyt.2015.10.004
39. Lee LY, Pham TA, Melcher ML. Living Kidney Donation: Strategies to Increase the Donor Pool. *Surg Clin North Am* (2019) 99:37–47. doi:10.1016/J.SUC.2018.09.003
40. Holt CD. Overview of Immunosuppressive Therapy in Solid Organ Transplantation. *Anesthesiol Clin* (2017) 35:365–80. doi:10.1016/J.ANCLIN.2017.04.001
41. Heinze G, Oberbauer R, Kainz A, Mitterbauer C, Koppelstaetter C, Hörl WH, Mayer G. Calcineurin inhibitor-based immunosuppressive therapy, donor age, and long-term outcome after kidney transplantation. *Transplantation* (2009) 87:1821–9. doi:10.1097/TP.0B013E3181A66CFC
42. Piazza A, Adorno D, Poggi E, Borrelli L, Buonomo O, Pisani F, Valeri M, Torlone N, Camplone C, Monaco PI, et al. Flow cytometry crossmatch: a sensitive technique for assessment of acute rejection in renal transplantation. *Transplant Proc* (1998) 30:1769–71. doi:10.1016/s0041-1345(98)00423-0
43. Iaria G, Anselmo A, De Luca L, Manuelli M, Lucchesi C, Tariciotti L, Monaco A, Sforza D, Nigro F, Abruzzese E, et al. Conversion to Rapamycin Immunosuppression for Malignancy After Kidney Transplantation: Case Reports. *Transplant Proc* (2007) 39:2036–7. doi:10.1016/j.transproceed.2007.05.046
44. Kurdi A, Martinet W, de Meyer GRY. mTOR inhibition and cardiovascular diseases: Dyslipidemia and atherosclerosis. *Transplantation* (2018) 102:S44–S46. doi:10.1097/TP.0000000000001693
45. Vergès B. mTOR and Cardiovascular Diseases: Diabetes Mellitus. *Transplantation* (2017) 102(2):S47–S49. doi:10.1097/TP.0000000000001722
46. Angelico M, Nardi A, Romagnoli R, Marianelli T, Corradini SG, Tandoi F, et al. A Bayesian Methodology to Improve Prediction of Early Graft Loss After Liver Transplantation Derived From the Liver Match Study. *Dig Liver Dis* (2014) 46:340–47. doi:10.1016/J.DLD.2013.11.004
47. Tisone G, Angelico M, Vennarecci G, Palmieri G, Buonomo O, Negrini S, Casciani CU. Metabolic findings after liver transplantation within a randomised trial with or without steroids. *Transplantation Proceedings* (1998) 30:1447–1448. Elsevier USA. doi:10.1016/S0041-1345(98)00310-8

48. Jaksch P, Görzer I, Puchhammer-Stöckl E, Bond G. Integrated Immunologic Monitoring in Solid Organ Transplantation: the Road Towards Torque Teno Virus-guided Immunosuppression. *Transplantation* (2022) 106(10): 1940–1951. doi:10.1097/TP.0000000000004153
49. Angelico M, Tisone G, Baiocchi L, Palmieri G, Pisani F, Negrini S, et al. One-Year Pilot Study on Tauroursodeoxycholic Acid as an Adjuvant Treatment After Liver Transplantation. *Ital J Gastroenterol Hepatol* (1999) 31:462–468.
50. Bhat M, Pasini E, Patel P, Yu J, Baciu C, Kurian SM, Levitsky J. Achieving Tolerance Modifies Cancer Susceptibility Profiles in Liver Transplant Recipients. *Cancer Med* (2022) [Epub ahead of print]. doi:10.1002/CAM4.5271
51. Sarno G, Schiavo L, Calabrese P, Álvarez Córdova L, Frias-Toral E, Cucalón G, et al. The Impact of Bariatric-Surgery-Induced Weight Loss on Patients Undergoing Liver Transplant: A Focus on Metabolism, Pathophysiological Changes, and Outcome in Obese Patients Suffering NAFLD-Related Cirrhosis. *J Clin Med* (2022) 11(18):5293. doi:10.3390/jcm11185293
52. Mackey TK, Liang BA. The global counterfeit drug trade: patient safety and public health risks. *J Pharm Sci* (2011) 100:4571–9. doi:10.1002/JPS.22679
53. Uddin M, Salah K, Jayaraman R, Pesic S, Ellahham S. Blockchain for drug traceability: Architectures and open challenges. *Health Informatics J* (2021) 27: 14604582211011228. doi:10.1177/14604582211011228
54. Bocek T, Rodrigues BB, Strasser T, Stiller B. Blockchains everywhere - A use-case of blockchains in the pharma supply-chain. In: Proc IM 2017 - 2017 IFIP/ IEEE Int Symp Integr Netw Serv Manag, IEEE (2017). p. 772–777. doi:10.23919/INM.2017.7987376
55. Booth GS, Gehrie EA. Non-fungible tokens: Stem cell transplantation in the blockchain. *Transfus Apher Sci* (2021) 60:103196. doi:10.1016/J.TRANSCI.2021.103196
56. Gandini R, Konda D, Tisone G, Pipitone V, Anselmo A, Simonetti G. Bronchobiliary Fistula Treated by Self-Expanding ePTFE-Covered Nitinol Stent-Graft. *Cardiovasc Intervent Radiol* (2005) 28:828–31. doi:10.1007/S00270-004-0201-7

REVIEW
published: 02 June 2023
doi: 10.3389/ti.2023.11240

# Addressing the Burden and Management Strategies for Disparities and Inequities Among Liver Transplant Professionals: The ILTS Experience

**Oya Andacoglu[1]*†, Manhal Izzy[2]*†, Dieter Adelmann[3], Victoria Aguilera[4], Chiara Becchetti[5], Marina Berenguer[4], Gabriella A. Berlakovich[6], Simantika Ghosh[7], Emmanouil Giorgakis[8], Nyingi Kemmer[9], Keri E. Lunsford[10], Iman F. Montasser[11], Martin I. Montenovo[12], Anna Mrzljak[13], Sher-Lu Pai[14], Irene Scalera[15] and Nazia Selzner[16]**

*[1]Division of Transplantation, Department of Surgery, The University of Oklahoma College of Medicine, University of Oklahoma, Oklahoma City, OK, United States, [2]Division of Gastroenterology, Hepatology, and Nutrition, Vanderbilt University Medical Center, Nashville, TN, United States, [3]Department of Anesthesia and Perioperative Care, UCSF School of Medicine, University of California, San Francisco, San Francisco, CA, United States, [4]Hepatology and Liver Transplant Unit, IIS La Fe and CIBER-EHD, University of Valencia, Universitary and Politecnic Hospital La Fe, Valencia, Spain, [5]University Clinic for Visceral Surgery and Medicine, Inselspital, University Hospital of Bern, Bern, Switzerland, [6]Division of Transplantation, Medical University of Vienna, Vienna, Austria, [7]Department of Anesthesiology, Narayana Health, Narayana, India, [8]Department of Surgery, University of Arkansas for Medical Sciences, Little Rock, AR, United States, [9]Division of Gastroenterology, Tampa General Hospital, Tampa, FL, United States, [10]Department of Surgery, Division of Transplant and HPB Surgery, Rutgers New Jersey Medical School, Newark, NJ, United States, [11]Department of Tropical Medicine, Ain Shams University, Cairo, Egypt, [12]Division of Hepatobiliary Surgery and Liver Transplant, Vanderbilt University Medical Center, Nashville, TN, United States, [13]Department of Gastroenterology and Hepatology, University Hospital Center Zagreb, Zagreb, Croatia, [14]Department of Anesthesiology and Perioperative Medicine, Mayo Clinic, Jacksonville, FL, United States, [15]Division of Hepatobiliary Surgery and Liver Transplant, University Hospital Policlinic of Bari, Bari, Italy, [16]Ajmera Transplant Center, University of Toronto, Toronto, ON, Canada*

***Correspondence:**
*Oya Andacoglu*
*oya-andacoglu@ouhsc.edu*
*Manhal Izzy*
*manhal.izzy@vumc.org*

*†These authors share first authorship*

***Received:** 31 January 2023*
***Accepted:** 14 April 2023*
***Published:** 02 June 2023*

***Citation:***
*Andacoglu O, Izzy M, Adelmann D, Aguilera V, Becchetti C, Berenguer M, Berlakovich GA, Ghosh S, Giorgakis E, Kemmer N, Lunsford KE, Montasser IF, Montenovo MI, Mrzljak A, Pai S-L, Scalera I and Selzner N (2023) Addressing the Burden and Management Strategies for Disparities and Inequities Among Liver Transplant Professionals: The ILTS Experience. Transpl Int 36:11240. doi: 10.3389/ti.2023.11240*

Medical professional environments are becoming increasingly multicultural, international, and diverse in terms of its specialists. Many transplant professionals face challenges related to gender, sexual orientation or racial background in their work environment or experience inequities involving access to leadership positions, professional promotion, and compensation. These circumstances not infrequently become a major source of work-related stress and burnout for these disadvantaged, under-represented transplant professionals. In this review, we aim to 1) discuss the current perceptions regarding disparities among liver transplant providers 2) outline the burden and impact of disparities and inequities in the liver transplant workforce 3) propose potential solutions and role of professional societies to mitigate inequities and maximize inclusion within the transplant community.

**Keywords: liver transplantation, equity, diversity, inclusion, professional societies**

---

**Abbreviations:** ILTS, International Liver Transplant Society; EDI, Equity, Diversity, and Inclusion; LT, Liver Transplantation; USA, United States of America; YIs, Young Investigators.

## INTRODUCTION

Over the last few years, medical professional environments have seen a change with increasing workforce diversity due to immigration as well as exponential growth of women and minority populations among medical trainees. The positive impact of diversity is well recognized, and it is promising to see the evolving knowledge and research in this area (1–28)[1]; yet, many professionals continue to face discriminations related to gender, racial background, sexual orientation, or inequities in terms of access to leadership positions, compensation, or professional promotions. Active plans are thus needed by transplant stakeholders both at global and institutional scales to reduce discrimination and to promote female and minorities access to leadership positions. The current review focuses on the burden and impact of disparities and proposes potential solutions to mitigate these inequities.

## CURRENT PERCEPTIONS ABOUT EQUITY, DIVERSITY, AND INCLUSION AMONG LIVER TRANSPLANTATION PROFESSIONALS AND THE IMPACT OF DISPARITY AND INEQUITY AMONG LIVER TRANSPLANTATION WORKFORCE

According to a recent survey by the Equity, Diversity, and Inclusion (EDI) Committee of the International Liver Transplantation Society (ILTS), 35% of liver transplantation (LT) professionals reported a form of discrimination (1). The reasons for very low rates of woman leadership are consistent across the reports (2–5). A survey by the ILTS EDI Committee, which included 243 transplant centers globally, reported that only 32 (13.2%) had at least 1 woman as the director of LT, chief of transplant surgery, or chief of transplant hepatology (6) while another survey found that woman leadership was present in only 8% of 856 transplant programs globally (1) (**Figure 1**). Lowest woman leadership was in transplant surgery followed by hepatology and anesthesia (14.2% vs. 20% vs. 32.1% respectively, $p = 0.046$) (1). Disparities are also notable in the academic sphere, affecting the proportion of female professionals and minorities represented in senior authorship and transplant journals' editorial boards (7, 8).

Female surgeons face obstacles, not only in leadership but also advancing their technical skills; as surgeons they are more commonly assigned as assistant surgeon as opposed to being primary surgeon for complex cases; consequently, they end-up having overall less case numbers within the same specialty or less cases for complex cases (9–11). They also face obstacles based on societal perceptions and not having supportive systems for an equitable career growth (9–11). In relation to these issues, the high incidence of attrition experienced by early-career abdominal transplant surgeons is concerning (12). Similarly, while there is wide variety in hepatology workflow and compensation, a burn out percent of 35% among trainees pursuing careers in transplant hepatology is alarming (13).

### Effect of Race and Country of Origin on a Career in Liver Transplant

There is evidence to suggest that African American and Hispanic individuals are underrepresented in the field of medicine compared to their representation in the general population (14–16)[1]. For example, in the United States (US), African American and Hispanic individuals make up approximately 31% of the overall US population. Yet, the American Medical Association (AMA) reported in 2020, that approximately only 7% of all active physicians in the US identified as African American, and approximately 8% identified as Hispanic or Latino (14–16)[1]. On the other hand, among the surgical directors of LT programs, only 16% were Hispanic or African American (4). This disparity can be due to a range of factors, including social and economic disadvantages, lack of equitable access to educational and training opportunities compared to other groups, and discrimination. It is also possible that a person's country of origin could impact their potential career in LT, depending on the availability of educational and training programs in that country and the existence of LT in the healthcare system. However, recent initiatives by multiple transplant societies to recognize transplant training of international graduates and offer them equal opportunity for training and certification processes would help to mitigate the disparities among international trainees. The impact of complete or relative lack of EDI in the field of LT can be quite consequential in hindering career development, limiting creativity and innovation among providers affected by this unfortunate reality. Therefore, it is important to recognize and address these issues to promote diversity and inclusion in the field of LT and ensure that individuals from all backgrounds have equal opportunities to enter and excel in this field for the betterment of LT as a specialty, us as a scientific community and importantly our patients.

## HIGHLIGHTS OF THE ILTS EXPERIENCE

In reviewing the ILTS data, over the last 5 years (2017–2022), the female participation rate was 25%–31%, highest years being 2021 and 2022 at 31%. For the 2022 conference, although 21% did not specify their field, female participation was 45% in hepatology, 44% anesthesia and critical care followed by 20% rate in surgery. With the leadership and society efforts, female moderator and female speaker rates went up gradually and annually from 20% to 37% and 21% and 36%, respectively, between 2017–2022 (**Figures 2**, **3**). Similarly, gender distribution of accepted abstracts reached 30% in the last year (**Figure 4**). Given 30% of total female attendance to the entire conference, speaker and moderator rates of 30% is a clear demonstration of the equitable representation of female participants in ILTS meetings which should be taken as a role model for all professional societies. Regarding country representation, six countries (USA, China, Republic of Korea, Turkey, United Kingdom, and

---

[1] US Census data. *Explore Census Data: Learn about America's People, Places, and Economy* (2020). Available from: https://data.census.gov/ (Accessed December 15, 2022).

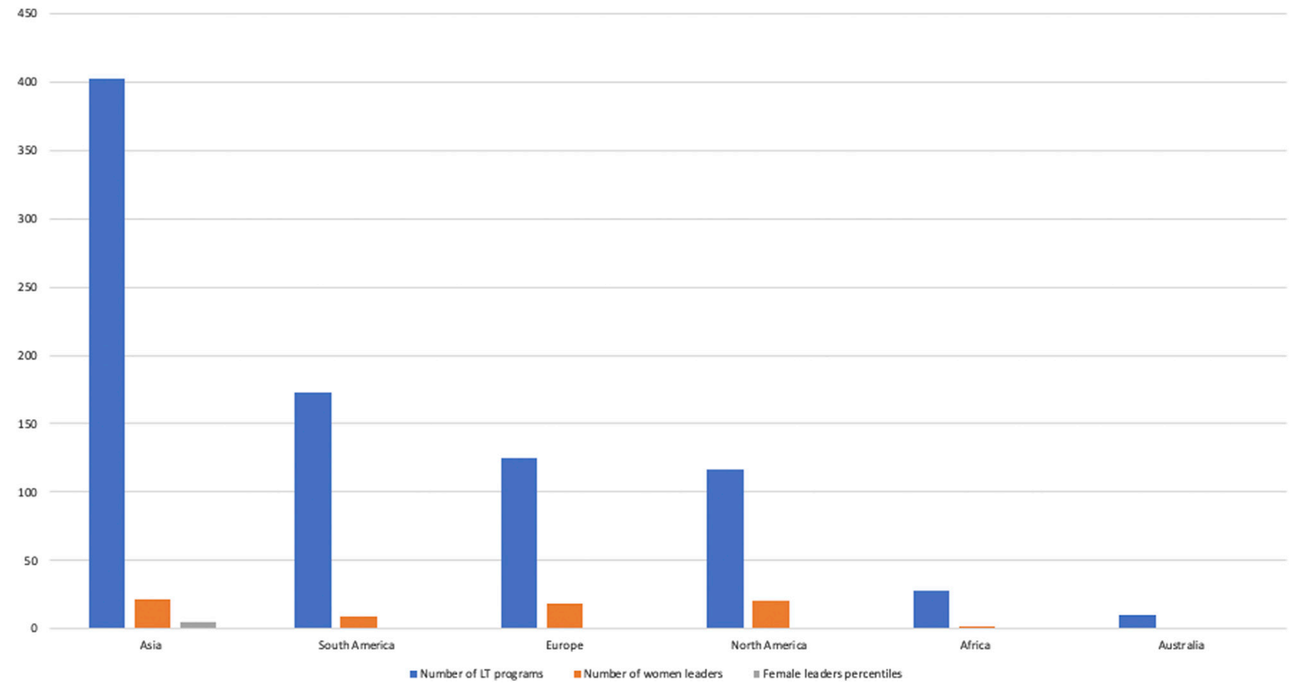


**FIGURE 1 |** Global distribution of woman leadership in liver transplantation—adapted from Aguilera V et al. (1).

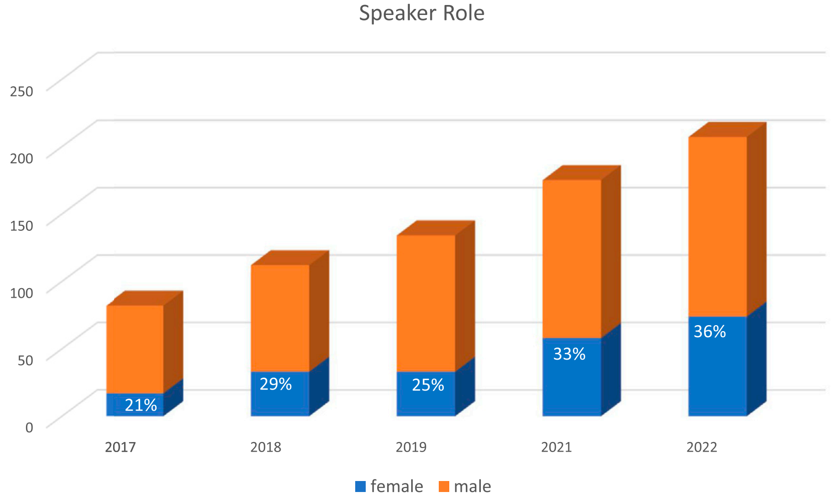


**FIGURE 2 |** Gender Distribution of ILTS congresses speaker roles.

India) accounted for between 50% and 57% of the total attendance in the previous 5 years (2017–2022), which may be reflecting limited access from underdeveloped countries to international medical conferences. Obviously, size of the country and total number of transplant programs would directly impact the participation to meetings. Regardless, attendance from Africa or the rest of the Asian continent remained low relative to North America and Europe. This is one of the areas ILTS and EDI committee is currently working on. For instance, in 2020, ILTS conducted an educational outreach initiative to help develop educational activities focused on the needs of specific regions around the world. The initiative is called the ILTS Regional Expansion of Advanced Learning (REAL) project. The aim of this initiative is to reach out to the different regions, mainly underdeveloped areas, where LT education

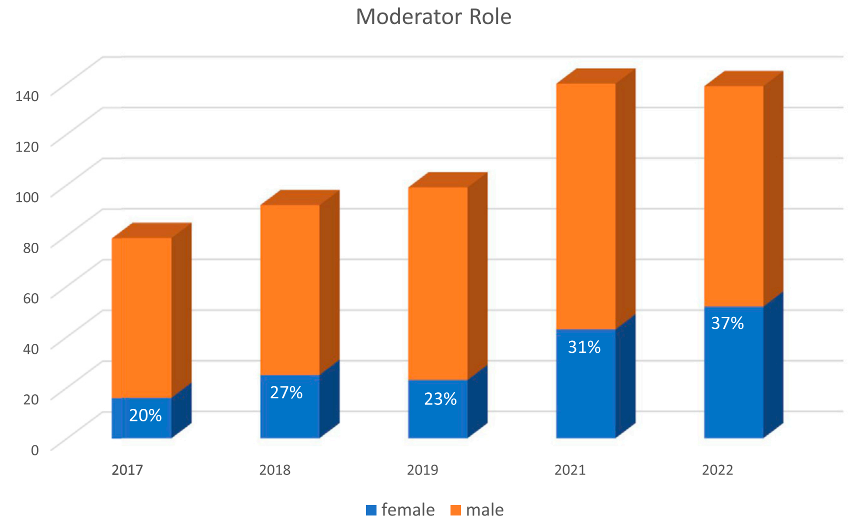


**FIGURE 3 |** Gender Distribution of ILTS congresses moderator roles.

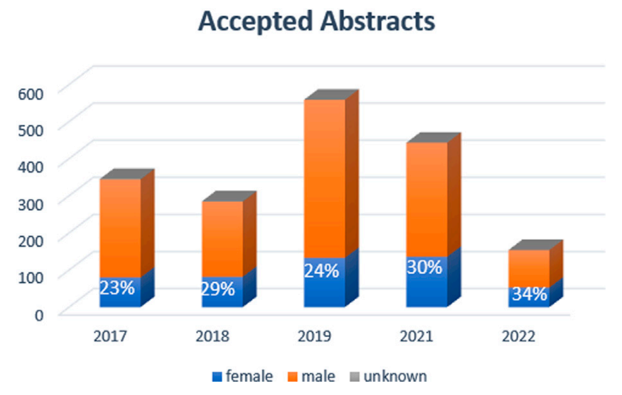


**FIGURE 4 |** Gender Distribution of ILTS congresses accepted abstracts.

is much needed, *via* educational programs tailored to what the key opinion leaders expressed (in prior surveys) as topics or areas of needed learning in their regions. REAL Asia was launched in 2020, REAL Latin America in 2021 and more recently REAL Africa 2022; representing a good example of the collaboration between the educational committee and EDI committee to maximize inclusiveness in educational initiatives.

Representation of women participants can be augmented both by encouraging more female professionals to participate in scientific events as well as encouraging the professional societies to be more inclusive of women in organizing committees and nominating them for moderator or chairperson roles and encouraging male professionals to recognize the achievements made by women in this challenging field. It is not a question of gender but a question of having the same unbiased opportunities within the given field.

## STRATEGIES TO INCLUDE YOUNG PROFESSIONALS IN TRANSPLANT SOCIETIES

With increased representation of younger members in the field (17), they seem to be integrating into medical societies by creating subgroups or specific subcommittees in the various specialties. This can provide a good opportunity for younger members to establish their footprint as well as gain leadership skills. This would also serve to rejuvenate professional societies with new creative ideas. On the other hand, there needs to have mentors at the society level who can understand the expectations and needs of these of young members (18). ILTS founded the Young Investigators (YIs) subcommittee bringing together a variety of specialties that have expertise and training background in LT.

Online surveys have proven to be a tool used and appreciated by younger age groups (19). Despite several limitations in health epidemiology, they remain a valuable instrument for exploring trends (20). The role of online resources has become prominent in recent years and YIs rely upon online clinical resources in their practice (21). Even the use of social media has become very popular in the field of liver disease (22). In this respect, ILTS offers a wide range of online resources for its affiliates, stratified by macro-areas of interest (anesthesia, surgery, hepatology). Specifically, ILTS has promoted the Vanguard Committee. This committee’s mission is to promote the participation of younger members of the LT community in all ILTS activities, and to guide the society in responding to their educational and professional needs. Scopes of the committee include: to organize the part of the annual congress dedicated to YIs; to select the best published clinical and basic science research papers during the calendar year for the Vanguard Awards; to contribute to the Scientific Content in the monthly ILTS Newsletter; to assist in

**TABLE 1** | Proposed international society initiatives to decrease disparities.

1. Acknowledge the existence of disparities at multiple levels
2. Prioritize society membership recruitment towards underrepresented groups
3. Modify the open-ended text field for members to accurately define their gender and ethnicity/race identity
4. Ensure adequate representation of gender and racial minorities for society participation including committee appointments, leadership positions, conference session speakers
5. Initiate mentorship programs, with focuses on trainees and junior physicians
6. Continue to increase awareness on EDI topics at the international level and collaborate with local EDI committees
7. Study disparities physician compensation
8. Promote adequate parental leave policies
9. Publish gathered data in international journals to increase visibility of EDI topics with recommendations on how to incorporate changes at local, national, and international levels
10. Journals to promote more women and under-represented groups to be included in editorial boards

social media profile management and to lead monthly ILTS Vanguard Webinars on complex cases in LT.

## Solutions to Mitigate Inequities and Maximize Inclusion Within the Transplant Community

Multiple medical professional societies have initiated programs to improve diversity, equity, and inclusiveness for physicians and allied health professionals in recent years. These ongoing efforts have been developed as disparities ranging from work compensation (23, 24), manuscript publication conference speaker representation, academic promotion, to leadership position have all been identified in the field of medicine (25–28). The heightened awareness on racial and gender disparities has urged professional societies to be the physicians' voice and organize the physicians to unite in the front of combating discriminations. In the field of LT, ILTS is no exception on being a driving force to fight against disparities and inequities.

LT is a unique medical field that integrates various medical specialties, and ILTS serves as a unifying entity that encourages collaborations between these physicians from different countries all over the world. In 2017, the ILTS created the Equity, Diversity, and Inclusion Committee to promote equity, diversity, and inclusion in LT. Since 2017, the committee has been utilizing the DMAIC (Define, Measure, Analyze, Improve, Control) (28) approach of Six Sigma to overcome the complex tasks of finding impactful EDI initiatives to reduce disparities among women and other racial or gender minorities.

When issues were raised after gathering feedback from the ILTS members, the EDI Committee defined the opportunities for improvement. Once the focus of each EDI project was identified, granular data were gathered to provide measurements of the existing issue. Subsequently, the data were analyzed to understand the scope of the problem and to determine the root causes of the issue. From each EDI project, the data gave ILTS the insight on how to reduce disparities and improve diversity. Whenever an initiative was put forward, ILTS EDI Committee continued to monitor progress after each project implementation to ensure success and look for other routes to further increase project impact. The data obtained from the EDI committee initiatives resulted in series of recommendations aiming to mitigate gender and racial disparities in LT practices (**Table 1**).

## CONCLUSION

Significant disparities exist in the field of LT at multiple levels from leadership to training to societal representation. These disparities can have a remarkable impact on career development of the affected LT professionals. As ILTS and other international societies continue to provide initiatives, the support should be extended to local institutions aiming to mitigate inequities, strengthen the networking among underrepresented providers, and enhance optimal clinical practice, academic promotion, and leadership development in the field of LT.

## AUTHOR CONTRIBUTIONS

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

## FUNDING

MB received grants from IISCarlos III (INT20/00061, PI19/01360). Ciberehd is partially funded by IISCarlos III.

## CONFLICT OF INTEREST

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

# REFERENCES

1. Aguilera V, Andacoglu O, Francoz C, Berlakovich G, Pai SL, Adelmann D, et al. Gender and Racial Disparity Among Liver Transplantation Professionals: Report of a Global Survey. *Transpl Int* (2022) 35:10506. doi:10.3389/ti.2022.10506
2. Dwyer KM, Clark CJ, MacDonald K, Paraskeva MA, Rogers N, Ryan J, et al. Gender Equity in Transplantation: A Report from the Women in Transplantation Workshop of the Transplantation Society of Australia and New Zealand. *Transplantation* (2017) 101:2266–70. doi:10.1097/TP.0000000000001900
3. Giner R, Spanish Hepatologist Women Group GEMHEP. Spanish Hepatologist Women G. Spanish Women Hepatologists: Breaking the Glass Ceiling? *Am J Gastroenterol* (2018) 113:622–3. doi:10.1038/ajg.2018.32
4. Choubey AP, Bullock B, Choubey AS, Pai K, Ortiz AC, Khan SA, et al. Transplant Surgery Departmental Leaders Do Not Represent Workforce Demographics Especially Among Women and Underrepresented Minorities – A Retrospective Analysis. *Am J Surg* (2022) 224:153–9. doi:10.1016/j.amjsurg.2021.11.008
5. Agawu A, Fahl C, Alexis D, Diaz T, Harris D, Harris MC, et al. The Influence of Gender and Underrepresented Minority Status on Medical Student Ranking of Residency Programs. *J Natl Med Assoc* (2019) 111:665–73. doi:10.1016/j.jnma.2019.09.002
6. de Rosner-van Rosmalen M, Adelmann D, Berlakovich GA, Francoz C, Selzner N, Berenguer M, et al. Women Leadership in Liver Transplantation-Results of an International Survey. *Transplantation* (2022) 106:1699–702. doi:10.1097/TP.0000000000004034
7. Jordan S, Emamaullee J. Gender Equity in Surgical Literature Authorship: Are We There yet? *Am J Surg* (2022) 224:1215–6. doi:10.1016/j.amjsurg.2022.06.008
8. Lim WH, Quek J, Tay PWL, Ng CH, Vathsala A, Muthiah MD. Gender Distribution Among Transplant Journal Editorial Members: a Call to Empower Women in Academic Medicine. *Transpl Int* (2021) 34:2897–8. doi:10.1111/tri.14117
9. Malik M, Inam H, Janjua MBN, Martins RS, Zahid N, Khan S, et al. Factors Affecting Women Surgeons' Careers in Low-Middle-Income Countries: An International Survey. *World J Surg* (2021) 45(2):362–8. doi:10.1007/s00268-020-05811-9
10. Kono E, Isozumi U, Nomura S, Okoshi K, Yamamoto H, Miyata H, et al. Surgical Experience Disparity between Male and Female Surgeons in Japan. *JAMA Surg* (2022) 157(9):e222938. doi:10.1001/jamasurg.2022.2938
11. Lucidi D, Parini S, Reale M, Azzolina D, Verdi D, Spolverato G. Women in Surgery Italia: what Are the Opportunities in the Operatory Room? Results from a Nationwide Interdisciplinary Survey. *Updates Surg* (2022) 74(3):803–16. doi:10.1007/s13304-022-01304-7
12. Delman AM, Kassam AF, Turner KM, Ammann AM, Lynch C, Morris MC, et al. Incidence of Attrition Among Early-Career Abdominal Transplant Surgeons. *Surgery* (2022) S0039-6060(22):1113–9. doi:10.1016/j.surg.2022.08.017
13. Kriss M, Te HS, Verna EC, VanWagner LB, Scott FI, Lai JC. National Early Career Transplant Hepatologist Survey: Compensation, Burnout, and Job Satisfaction. *Hepatol Commun* (2021) 5(4):701–12. doi:10.1002/hep4.1666
14. Association of American Medical Colleges. *Physician Specialty Data Report* (2023). Available from: https://www.aamc.org/data-reports/workforce/report/physician-specialty-data-report (Accessed January 31, 2023).
15. Association of American Medical Colleges. *Press Release: New AMA Policy Recognizes Racism as a Public Health Threat* (2022). Available from: https://www.ama-assn.org/press-center/press-releases/new-ama-policy-recognizes-racism-public-health-threat (Accessed January 2023).
16. Association of American Medical Colleges. *Diversity in Medicine: Facts and Figures* (2019). Available from: https://www.aamc.org/data-reports/workforce/report/diversity-medicine-facts-and-figures-2019 (Accessed January 31, 2023).
17. Ianiro G, Castro V, Dolak W, Ilie M, Holleran G, Salaga M, et al. The Organisation and Needs of Young Sections Belonging to UEG National Societies: Results of a Europe-wide Survey. *United Eur Gastroenterol J* (2017) 5:750–5. doi:10.1177/2050640617713936
18. Skuja V, Nakov R, van Herwaarden Y, Rodriguez-Lago I, Acedo P, Mikolasevic I, et al. How to Start a Young GI Section in Your Country: A Cookbook. *United Eur Gastroenterol J* (2020) 8:355–8. doi:10.1177/2050640620912635
19. Greenlaw C, Brown-Welty S. A Comparison of Web-Based and Paper-Based Survey Methods: Testing Assumptions of Survey Mode and Response Cost. *Eval Rev* (2009) 33:464–80. doi:10.1177/0193841X09340214
20. Safdar N, Abbo LM, Knobloch MJ, Seo SK. Research Methods in Healthcare Epidemiology: Survey and Qualitative Research. *Infect Control Hosp Epidemiol* (2016) 37:1272–7. doi:10.1017/ice.2016.171
21. Chong HT, Weightman MJ, Sirichai P, Jones A. How Do Junior Medical Officers Use Online Information Resources? A Survey. *BMC Med Educ* (2016) 16:120. doi:10.1186/s12909-016-0645-x
22. Mikolajczyk AE, Ufere N, Breu AC, Parikh ND, Garcia-Tsao G, Tapper EB. #LiverTwitter: An Emerging Tool for Liver Education and Research. *Hepatol Commun* (2020) 4:1229–33. doi:10.1002/hep4.1539
23. Association of American Medical Colleges. *Exploring Faculty Salary Equity at U.S. Medical Schools by Gender and Race/Ethnicity* (2021). Available from: https://www.aamc.org/data-reports/workforce/report/exploring-faculty-salary-equity-us-medical-schools-gender-and-race/ethnicity (Accessed September 6, 2022).
24. Hertzberg LB, Miller TR, Byerly S, Rebello E, Flood P, Malinzak EB, et al. Gender Differences in Compensation in Anesthesiology in the United States: Results of a National Survey of Anesthesiologists. *Anesth Analg* (2021) 133(4):1009–18. doi:10.1213/ANE.0000000000005676
25. Krstacic JE, Carr BM, Yaligar AR, Kuruvilla AS, Helali JS, Saragossi J, et al. Academic Medicine's Glass Ceiling: Author's Gender in Top Three Medical Research Journals Impacts Probability of Future Publication success. *PLoS One* (2022) 17(4):e0261209. doi:10.1371/journal.pone.0261209
26. Association of American Medical Colleges. *Data & Report, Table F: Faculty by Gender, Rank, and Age Group, 2020 (Excel)* (2020). Available from: https://www.aamc.org/media/54811/download (Accessed September 6, 2022).
27. Pai SL. Top 10 Things Women Anesthesiologists Must Do for Academic Promotion. *Int Anesthesiol Clin* (2018) 56(3):96–109. doi:10.1097/AIA.0000000000000196
28. American society for Quality. *The Define, Measure, Analyze, Improve, Control (DMAIC) Process* (2022). Available from: https://asq.org/quality-resources/dmaic (Accessed September 6, 2022).

# Transplant International

Official journal of the European Society for Organ Transplantation

**Editorial Office**

Avenue du Tribunal Fédéral 34
CH – 1005 Lausanne
Switzerland

Tel +41 (0)21 510 17 40
Fax +41 (0)21 510 17 01

tieditorialoffice@frontierspartnerships.org
frontierspartnerships.org/journals/transplant-international

frontiers | Publishing Partnerships