Kidney transplantation and withdrawal rates among wait-listed first-generation immigrants in Italy

Alessandra Agnese Grossi 1,2, Francesca Puoti3, Pamela Fiaschetti3, Paola Di Ciaccio3, Umberto Maggiore 4,*, Massimo Cardillo3,*

1 Department of Human Sciences, Innovation and Territory, University of Insubria, Como, Italy
2 Center for Clinical Ethics, Department of Biotechnologies and Life Sciences, University of Insubria, Varese, 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

Correspondence: Alessandra Agnese Grossi, Department of Human Sciences, Innovation and Territory, University of Insubria, Contrada S. Abbondio 12, 21122 Como, Italy, Tel: +39 0332 393075, Fax: +39 0332 278580, e-mail: aa.grossi@uninsubria.it

*Co-senior.

Background: Multiple barriers diminish access to kidney transplantation (KT) in immigrant compared to non-immigrant populations. It is unknown whether immigration status reduces the likelihood of KT after wait-listing despite universal healthcare coverage with uniform access to transplantation. Methods: We retrospectively collected data of all adult waiting list (WL) registrants in Italy (2010–20) followed for 5 years until death, KT in a foreign center, deceased-donor kidney transplant (DDKT), living-donor kidney transplant (LDKT) or permanent withdrawal from the WL. We calculated adjusted relative probability of DDKT, LDKT and permanent WL withdrawal in different immigrant categories using competing-risk regression models. Results: Patients were European Union (EU)-born (n = 21 624), Eastern European-born (n = 606) and non-European-born (n = 1944). After controlling for age, sex, blood type, dialysis vintage, case-mix and sensitization status, non-European-born patients had lower LDKT rates compared to other immigrant categories: 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. Conclusions: Among EU WL registrants, non-European immigration background is associated with reduced likelihood of LDKT but similar likelihood of DDKT and permanent WL withdrawal. Wherever not available, new national policies should enable coverage of travel and medical fees for living-donor surgery and follow-up for non-resident donors to improve uptake of LDKT in immigrant patients, and provide KT education that is culturally competent, individually tailored and easily understandable for patients and their potential living donors.

Introduction

Migrants comprise a growing minority population in the European Union (EU). In January 2020, there were 23 million subjects from outside the EU living in EU countries. This has resulted in an increase of non-European migrants with end-stage kidney disease (ESKD), accounting for more than 20% of patients on dialysis or enrolled in kidney transplant programs. Kidney transplantation (KT) is the gold standard renal replacement therapy (RRT) for eligible patients with ESKD providing improved length and quality of life relative to dialysis. Because equity is a major principle in organ transplantation, recommendations to address potential biological, socioeconomic, cultural, relational and administrative barriers to KT among immigrant populations in Europe have been proposed by EU scholars, transplant organizations and institutional administrators. In the USA, disparities in deceased-donor kidney transplantation (DDKT) and living-donor kidney transplantation (LDKT) for individuals who are from ethnic minorities are well described. Outside the USA and other Northern European countries, immigration from non-EU countries beyond Eastern Europe is relatively recent and extensive in Southern Europe, where adult ethnic minorities are largely first-generation (i.e. foreign-born) migrants of non-European origin. However, although most health systems in the EU guarantee equal access to KT, most but not all EU studies demonstrate disparities similar to those in the USA, especially regarding LDKT. Research on the association between immigration background and likelihood of KT remains limited in Europe and none has assessed KT likelihood after wait-listing. We performed a retrospective cohort study of adult waiting list (WL) registrants in Italy to assess the probability of WL outcomes (death; KT in a foreign country) including DDKT, LDKT and permanent withdrawal from the WL based on immigration background. To our knowledge, this is the first European study examining whether non-EU-born adult WL registrants experience inferior likelihood of KT compared to EU-born referents.

Methods

We examined a retrospective cohort of adult patients (≥18 years of age) wait-listed for KT from 1 January 2010, through 31 December 2020 in Italy. Among EU member states, Italy is third in non-national residents (5.1 million), most of whom were born outside the EU (3.5 million). The increasing number of non-EU-born migrants in Italy has led to an increase of the prevalent adult migrant population on RRT, representing up to 35% in some centers in Northern areas. The Italian National Health System (NHS) is a regionally based system providing free healthcare to all individuals. Regular migrants must register within the NHS to enjoy medical rights under the same conditions as nationals. Migrants who do not hold a valid residency permit, whose permit has expired for more than 60 days, or are pending regularization are required to be assigned a special code (the so-called ‘STP, Temporarily Present
To access essential and emergency care, including KT and post-transplant regimens. Most non-European-born subjects in Italy are socioeconomically disadvantaged, with lower levels of education, and with difficulties in oral and written communication. In fact, although Italy has a publicly funded health system with universal coverage, prior research has shown that non-European immigration background is associated with reduced kidney graft function following KT. 18

Non-EU-born individuals were categorized as Eastern European-born and non-European-born as distinguished from EU-born. Geographical distribution of patients is shown in detail in Supplementary figure S1 and Supplementary table S1. Eastern European-born patients included subjects from Albania, Moldavia, former Yugoslavian countries, Ukraine and other countries of the Eastern European and Balkans area. Non-European-born patients included individuals from Asian, Latin American, Northern African and Middle Eastern and Sub-Saharan African countries. Because they are less likely socially disadvantaged, KT registrants born in North America or Oceania were excluded. The EU-born category included all patients from EU member states, including the UK and Switzerland. Further, to determine whether ethnic minority subgroups might elucidate any relationship between immigration status and likelihood of KT, we classified non-European-born registrants according to the four ethnic subgroups, namely Asian (South-East and North-East Asia), Hispanic (Latin America), African (Sub-Saharan Africa) and Other (Northern Africa and Middle-East). 19

Data were collected from the Transplant Information System (SIT) regarding patients’ demographics, ethnic origin, dialysis modality, ABO blood type, maximum panel reactive antibody (PRA) value, patient case-mix score (the case-mix calculator is reported in the Supplementary box S1), re-transplantation, transplant center, dialysis vintage, date of censoring, death on the WL, permanent WL withdrawal, DDKT or LDKT. To avoid potential confounding, we limited our analyses to first-time WL registrants and considered primary center listing for patients with multiple registrations. Patients listed for re-transplantation were excluded.

**Statistical analyses**

All analyses were performed using the Stata Statistical Software package, Release 17.0. (StataCorp. 2021, College Station, TX, USA). The follow-up time was calculated from time of first wait-listing date to DDKT, LDKT, permanent withdrawal from the WL, death on the WL, KT in a foreign country or 5 years of follow-up, whichever came first. Competing risk analyses were carried out in order to calculate the following estimates: (i) non-parametric crude cumulative probability and 95% confidence interval (95% CI) of DDKT, LDKT and permanent withdrawal from the WL in different immigrant categories. 2021 (ii) Adjusted subhazard ratios of DDKT, LDKT and of permanent withdrawal from the WL, which we calculated based on competing-risks multiple regression models according to the method of Fine and Gray. 22 The subhazard ratio estimates can be interpreted as relative increase (decrease) of the rate of a given WL outcome. For example, a subhazard ratio for LDKT of non-European-born vs. EU-born of 0.65, means that the rate of LDKT was 35% lower in non-European-born compared to EU-born; accordingly, by reversing the index to the reference category, a subhazard ratio of EU-born vs. non-European-born of 1.54 (1/0.65 = 1.54) means that the rate of LDKT was 54% higher in EU-born compared to non-European-born. To facilitate the interpretability of subhazard ratio estimates of each wait-listing outcome, we referred to them as ‘relative probability’ throughout the text.

Multiple regression models were adjusted for age (included as polynomial variate), gender, blood type, dialysis vintage (log-transformed), sensitization status (indicator variate for CDC-PRA >10%) and the case-mix classification status (see Supplementary box S1). We performed supplementary analyses to verify whether there were differences between ethnicities within the non-European-born group. Because results did not develop any statistically significant differences these results are reported in the Supplementary appendix (Supplementary figure S2 and Supplementary table S2 and S3). The Stata code for all of the analyses is freely available at https://github.com/UMaggiore/Transplantation-Probability-in-Wait-Listed-Immigrants.

This retrospective study was approved by the Italian National Transplantation Center and included patients’ data that were already anonymized and de-identified in the Italian SIT database before extraction for the analysis. Therefore, the subjects may not be identified and, according to Italian legal regulations (D.L. 196/2003, art. 110–24 July 2008, art. 13), the study did not require Ethics Committee approval. The study was carried out in accordance with the ethical principles of the Declaration of Helsinki (with amendments).

**Results**

**Baseline characteristics**

Between 1 January 2010 and 31 December 2020, 24,174 WL registrants were eligible for this study. We excluded 764 patients who were <18 years old at time of wait-listing, 32 patients who had North-American or Oceanian origins and 209 patients with identification codes that could not be merged between databases and/or that were listed for re-transplantation. Baseline patient characteristics and risk factors are summarized in table 1 (patient representation and characteristics according to ethnicity are reported in Supplementary figure S1 and Supplementary table S1). Patients were EU-born (n=21,624), Eastern European-born (n=606) and non-European-born (n=1944). Eastern European-born and non-European-born KT registrants were younger at time of wait-listing relative to their EU-born referents. Eastern European-born and non-European-born patients were less likely to receive preemptive KT when compared to EU-born patients. Sensitization status (CDC-PRA >10%) was comparable between groups. Patients with blood type O were more likely to be EU-born and non-European-born compared to Eastern European-born. Eastern European-born and non-European-born patients were less likely to be high-risk candidates relative to their EU-born counterparts.

**Wait-list outcomes**

After a follow-up of 56,640 person-years (median 2.0 years, maximum 5.0 years), 14,801 patients underwent DDKT, 1272 underwent LDKT, 2346 were withdrawn from the WL, 1292 patients died on the WL, 43 received KT at a foreign center and 4420 were still active on the WL. Crude cumulative probability of each outcome in different immigrant categories since initial wait-listing are reported in figure 1 (crude cumulative probability of each outcome in different ethnicity categories is indicated in Supplementary figure S2); the corresponding numerical values of 5-year probability are reported in table 2. There was a numerical trend of Eastern European-born patients of having the highest 5-year probability of LDKT [7.9% (95% CI: 5.9–10.3)], and of DDKT [65.7% (61.4–69.0)], and also the lowest rate of withdrawal from the WL [4.4% (2.8–6.5)]; of EU-born of having the highest rate of withdrawal from the WL [6.7% (6.3–7.0)]; and of non-European-born of having the lowest rates of LDKT [4.0% (3.2–5.0)] (figure 1 and table 2). Because the comparison between these cumulative probability estimates could be confounded by uneven distribution of determinants of transplantation rate between immigrant categories, we performed adjusted analyses. The results of the adjusted analyses are reported in table 3 in the form of adjusted ratio of transplantation rate in the index relative to the reference category (named as ‘adjusted relative probability’). After controlling for age, sex, blood type, dialysis vintage, case-mix and sensitization status, the only statistically significant
difference was that the non-European-born had lower LDKT rates compared to the other two immigrant categories: LDKT adjusted relative probability of non-European-born vs. Eastern European-born 0.51 (0.33–0.79; \(P = 0.002\)); of non-European-born vs. EU-born: 0.65 (0.47–0.82; \(P = 0.001\)).

Table 1 Baseline characteristics of adult patients wait-listed for KT in Italy (2010–20)

|                  | Total   | EU-born | Eastern European-born | Non-European-born | \(P\)-value |
|------------------|---------|---------|-----------------------|-------------------|-------------|
| \(N\)            | 24 174  | 21 624  | 606                   | 1944              | –           |
| Pt age at wait-listing—years | 51.0 (12.4) | 51.9 (12.2) | 42.9 (12.1) | 43.6 (11.4) | <0.001      |
| Recipient’s ethnic origin | <0.001 |         |                       |                   |             |
| European         | 22 230 (92.0) | 21 624 (100) | 606 (100)           |                   |             |
| Asian            | 614 (2.5)               | –          | –                     | 614 (31.6)       |             |
| Hispanic         | 297 (1.2)               | –          | –                     | 297 (15.3)       |             |
| African          | 525 (2.2)               | –          | –                     | 525 (27)         |             |
| Other            | 508 (2.1)               |            |                       | 508 (26.1)       |             |
| Male gender—%    | 15 513 (64.2%)          | 13 975 (64.6%) | 334 (55.2%) | 1204 (61.9%) | <0.001      |
| Dialysis vintage—years | 2.0 (3.1)  | 2.0 (3.2) | 2.2 (2.9)            | 2.2 (2.3)        | 0.000       |
| Dialysis modality| <0.001 |         |                       |                   |             |
| Preemptive       | 1505 (13.9)             | 1432 (14.8) | 26 (9.2)             | 47 (5.4)        |             |
| HD               | 7408 (68.2)             | 6474 (66.7) | 220 (77.5)          | 714 (82.0)      |             |
| PD               | 1947 (17.9)             | 1799 (18.5) | 38 (13.4)           | 110 (12.6)      |             |
| CDC-PRA>0%       | 5785 (23.9)             | 5127 (23.7) | 146 (24.1)          | 512 (26.3)      | 0.034       |
| Blood type       | <0.001 |         |                       |                   |             |
| 0                | 11 340 (46.9)           | 10 174 (47.0) | 240 (39.6) | 926 (47.6)   |             |
| A                | 8764 (36.3)             | 8002 (37.0) | 224 (37.0)          | 538 (27.7)      |             |
| B                | 3089 (12.8)             | 2598 (12.0) | 98 (16.2)           | 393 (20.2)      |             |
| AB               | 937 (3.9)               | 808 (3.7)  | 43 (7.1)            | 86 (4.4)        |             |
| NA               | 44 (0.2)                | 42 (0.2)   | 1 (0.2)             | 1 (0.1)         |             |
| Case-mix         | <0.001 |         |                       |                   |             |
| Standard risk    | 5602 (27.4)             | 4860 (26.7) | 192 (36.2) | 550 (33.0)   |             |
| Low risk         | 3938 (19.3)             | 3390 (18.6) | 125 (23.5) | 423 (25.4)   |             |
| Intermediate risk| 4248 (20.8)             | 3854 (21.1) | 102 (19.2) | 292 (17.5)   |             |
| High risk        | 6641 (32.5)             | 6128 (33.6) | 112 (21.1) | 401 (24.1)   |             |

Notes: EU, European Union; Eastern European-born, born in Eastern Europe or Balkans; HD, hemodialysis; PD, peritoneal dialysis; PRA, panel reactive antibody; CDC-PRA, complement-dependent cytotoxicity panel reactive antibody.

Figure 1 Non-parametric crude cumulative probability of wait-list outcomes in different immigrant categories since wait-listing. Cumulative probability was estimated using non-parametric competing risk estimation. DDKT, deceased-donor kidney transplant; EU, European Union; KT, kidney transplant; LDKT, living-donor kidney transplant; WL, waiting list.

Discussion

To the best of our knowledge, this is the first study assessing the association of immigration background with likelihood of KT among adult WL registrants in Europe. Our study provides the first
References

1. Evidence that non-European immigration background is associated with a slight but significantly decreased likelihood of receiving LDKT, but not with a diminished probability of DDKT or higher likelihood of permanent WL withdrawal. We performed this study in Italy, where, in the Italian context, immigration is a proxy for disadvantaged socioeconomic condition and cultural diversity. In fact, as in other Southern European countries, immigration is a fairly recent and emergent phenomenon in Italy and adult ethnic minority individuals generally overlap with first-generation migrants. Our findings show that, relative to EU-born and Eastern European-born patients, non-European-born registrants reported a lower likelihood of LDKT. While similar studies have been performed previously, most focus on ethnic or racial background or pediatric patient populations, and do not assess immigration background or examine the likelihood of KT after waitlisting. Like our findings, prior studies of adult and pediatric RRT patients in the EU and Canada (which has a similar healthcare system to Italy) have shown that Black, Asian and other ethnic minority patients are all less likely than their White referents to receive LDKT. However, these studies did not assess immigration background and explored likelihood of KT since RRT start or referral for KT, but not since WL registration. Further, because EU studies focus on racial or ethnic background, we were unable to distinguish between EU-born and non-EU-born White individuals.

2. Interaction among multiple determinants at the level of patients, donors, providers and the healthcare system may play a role in the diminished likelihood of LDKT in non-European-born patients. Unique barriers to LDKT that these populations may experience include limited language proficiency; lack of knowledge of LDKT; inferior health literacy levels; lack of confidence to ask questions due to insufficiently tailored and/or understandable educational material; fears, anxieties and misunderstandings of the procedure; personal, religious, spiritual and cultural beliefs preventing discussions with potential living donors; negative influences of social networks when communicating about RRT; less favorable attitudes toward LDKT in some ethnic groups, and uncertainty about the attitude of their community toward organ transplantation and living donation. As for donor-related factors, different religious interpretations, culture, beliefs, family influences and other socioeconomic factors including financial concerns, inability to take time off work,....
absence of family members living sufficiently close to enable the identification of a potential living donor at the time of first KT assessment and ABO mismatch between potential living donors and KT registrants may all contribute to delay and/or hinder access to LDKT. Further, at the provider-level physicians may present individual biases and concerns about non-resident donors’ medical follow-up, risk of donor coercion and higher risk of developing long-term kidney-related conditions and risk factors for the progression toward ESKD (i.e. hypertension) in certain ethnic minority living-donor categories. As for healthcare system-related factors, it is unlikely that transplant services in Italy are equipped with adequate resources to deliver KT education that is individually tailored, easily understandable, and culturally competent. Although the NHS covers all expenses for KT, in some Italian Regions, non-resident donors must pay travel and medical fees for living-donor surgery and follow-up with the potential to diminish the likelihood to pursue LDKT among these socioeconomically disadvantaged populations. We could not determine the influence of these factors on the likelihood of LDKT, although it is likely that universal healthcare coverage per se is not an independent determinant of LDKT.

Our study has several limitations. First, this is a retrospective study based on data derived from the Italian SIT registry which, while reliable, does not include all potential confounding variables. No data were available regarding patients’ socioeconomic status, educational level, health literacy, language proficiency, time elapsed since immigration as a proxy for acculturation (i.e. the degree of adaptation to/acquisition of the host country’s culture) and the presence of family members living sufficiently close to enable LDKT. No data of the ancestries of EU-born patients can be retrieved. Yet, since immigration from non-EU countries beyond Eastern Europe is rather recent in Italy, it seems plausible that only few adult EU-born KT registrants had non-European ancestries. Further, although we were unable to distinguish between different immigrant categories, KT in more vulnerable groups of patients (i.e. undocumented immigrants, asylum seekers and refugees) is infrequent in Europe. Also, the analysis was performed on patients wait-listed for DDKT, representing a subgroup of patients with ESKD eligible for KT. Therefore, disparities in KT eligibility at the time of wait-listing could not be explored. Besides, while no data were available of patients’ comorbidities, the patient case-mix score mitigates this deficiency. Finally, the findings of this study may not apply to other countries with different healthcare and/or social security systems.

Since immigration is likely to increase in Europe and elsewhere, future studies including socioeconomic, sociocultural, relational, psychosocial, transplant providers’ and transplant system’s (inter)cultural competence and KT education data are needed to better describe the causal mechanisms linking immigration and ethnicity with access to LDKT. These may enable the identification of potential areas for intervention on modifiable factors. At the level of patients and their potential living donors, linguistically and culturally competent KT care (i.e. home-based educational interventions, patient-decision aids and other culturally tailored educational sessions) may be an effective means to improve knowledge, communication, decision capacity, understanding of complex medical information and attitudes toward available treatment alternatives (including LDKT) among patients and their potential living donors. Further, training in cultural competence for transplant professionals may enhance providers’ intercultural communicative abilities, social history taking and enable the prevention of preconceived biases and concerns. Besides, at the healthcare system level, specific programs addressing priorities for immigrant populations, adaptation of processes and services and improved care coordination among healthcare providers all have the potential to provide a more effective response to the diverse needs of patients with an immigration background. In addition, wherever they are not already available, new national policies should enable coverage of travel and medical fees for living-donor surgery and follow-up for non-resident donors to improve uptake of LDKT in immigrant patients. Future studies will explore the effectiveness of targeted and/or tailored interventions on modifiable barriers to meet the needs of immigrant populations and guarantee provision of equitable transplant care in this vulnerable group of patients.

Supplementary data
Supplementary data are available at EURPUB online.

Acknowledgments
We thank the patients and the staff of all the transplant units that have contributed data by their local registries: Presidio Ospedaliero Umberto I (Ancona): A. Ranghino; AOU Consorziale Policlinico di Bari (Bari): L. Gesualdo; ASST Papa Giovanni XXIII (Bergamo): P.L. Ruggenenti; Policlinico S. Orsola-Malpighi (Bologna): G. La Manna; ASST Spedali Civili (Brescia): N. Bossini; AO G. Brotzu (Cagliari): A. Pani; AOU Catania (Catania): P. Veroux; Presidio Ospedaliero Annunziata (Cosenza): T. Papalia; AOU Careggi (Firenze): S. Serni; IRCCS AO Universitaria San Martino (Genova): I. Fontana; Ospedale Civile San Salvador (L’Aquila): F. Piasini; AO Vito Fazzi (Lecce): E. Buongiorno; IRCCS Ca’ Granda - Ospedale Maggiore Policlinico (Milano): P. Messa, M. Ferrareso, G. Castellano; ASST Grande Ospedale Metropolitano Niguarda (Milano): E. Minetti; IRCCS Ospedale San Raffaele (Milano): A. Secchi; AOU Policlinico Modena (Modena): Prof Gabriele Donati; AO Federico II (Napoli): V. D’Alessandro; AOU Maggiore della Carità (Novara): V. Cantaluppi; AO Padova (Padova): P. Rigotti, E. Benetti; ISMETT IRCCS (Palermo): S. Piazza; PO Civico e Benfratelli (Palermo): A. Amato; Ospedale Maggiore (Parma): U. Maggiore; Fondazione IRCCS Policlinico San Matteo (Pavia): T. Rampino; AO Perugia (Perugia): R.M. Fagugli; AO Pisana (Pisa): U. Boggi, F. Vistoli; AO Bianchi-Melaccino-Morelli (Reggio Calabria): F. Mallamaci; AO San Camillo-Forlanini (Roma): P. De Paolis; Ospedale Pediatrico Bambino Gesù (Roma): L. Dello Stroolo; Policlinico Universitario A. Gemelli (Roma): F. Citterio; Policlinico Umberto I (Roma): M. Rossi; AOU Policlinico Tor Vergata (Roma): G. Tisone; OO.RR. San Giovanni di Dio e Ruggi d’Aragona (Salerno): P. De Rosa; AOU Senese—S.M. Alle Scotte (Siena): A. Rosati; AOU Città della Salute—PO S.G. Battista (Torino): L. Biancone; AO Universitaria Città della Salute—PO ORM (Torino): B. Gianoglio; Ospedale Ca’ Foncello (Treviso): M. Nordio; AO S.M. Misericordia (Udine): Dr. Giuliano Boscutti; Ospedale di Circolo e Fondazione Macchi (Varese): G. Carcano, G. Rombolda; Ospedale Civile Maggiore (Verona): L. Boschiero; Ospedale San Bortolo (Vicenza): F. Gastaldon. We thank also Prof. Jay Fishman (Harvard Medical School) for editing and for providing additional insights to this work.

Funding
The authors declare no funding.

Conflicts of interest: None declared.
Key points

- It is unknown whether among adult kidney transplant candidates, in countries with universal healthcare coverage and where immigration is a recent phenomenon, immigration background (as opposed to ethnic/racial background) affects the probability of kidney transplantation (KT).
- We retrospectively followed-up for 5 years since time from wait-listing (which allows a fair comparison between immigration categories) 24,174 transplant candidates from the Italian National Transplantation Network until they received deceased-donor kidney transplantation (DDKT), living-donor kidney transplantation (LDKT) and permanent wait-list (WL) withdrawal.
- This study newly shows that non-European-born patients have lower LDKT rates compared to other immigrant categories, and to EU-born patients, whereas immigration status does not affect the rate of DDKT or permanent WL withdrawal since WL registration.
- Wherever they are not already available, new national policies should enable coverage of travel and medical fees for living-donor surgery and follow-up for non-resident donors to improve uptake of LDKT in immigrant patients, and provide KT education that is culturally competent, individually tailored and easily understandable for patients and their potential living donors.

References

1. Eurostat. Migration and Migrant Population Statistics - Statistics Explained. 2020. Available at: https://ec.europa.eu/eurostat/statistics-explained/index.php/Migration_and_migrant_population_statistics (20 January 2021, date last accessed).
2. Tjaden LA, Noordzij M, Van Straalen K, et al; ESPERA-EDTA Registry Study Group. Racial disparities in access to and outcomes of kidney transplantation in children, adolescents, and young adults: results from the ESPERA-EDTA (European Society of Pediatric Nephrology/European Renal Association-European Dialysis and Transplant Association) registry. Am J Kidney Dis 2016;67:293–301.
3. Tonelli M, Wiebe N, Knoll G, et al. Systematic review: kidney transplantation compared with dialysis in clinically relevant outcomes. Am J Transplant 2011;11:2093–109.
4. Van Biesen W, Vanholder R, Ernandez T, et al. Caring for migrants and refugees with end-stage kidney disease in Europe. Am J Kidney Dis 2018;71:701–9.
5. European Kidney Health Alliance. A Shared Vision for Improving Organ Donation and Transplantation in the EU. 2019. Available at: https://ec.europa.eu/health/sites/health/files/policies/docs/jv_echsa_en.pdf (17 March 2022, date last accessed).
6. Poulakou G, Len O, Akova M. Immigrants as donors and transplant recipients: specific considerations. Intensive Care Med 2019;45:401–3.
7. Vanholder R, Dominguez-Gil B, Busse M, et al. Organ donation and transplantation: a multi-stakeholder call to action. Nat Rev Nephrol 2021;17:554–68.
8. Ladin K, Rodrigue JR, Hanto DW. Framing disparities along the continuum of care from chronic kidney disease to transplantation: barriers and interventions. Am J Transplant 2009;9:669–74.
9. De La Ria C, Glitz A, Ortega R. Immigration in Europe: Trends, Policies and Empirical Evidence. Bonn: Institute for the Study of Labor (IZA), 2013. Available at: http://ftp.iza.org/dp7778.pdf (17 March 2022, date last accessed).
10. Tromp WF, Cranberg K, van der Lee JL, et al. Fewer pre-emptive renal transplantations and more rejections in immigrant children compared to native Dutch and Belgian children. Nephrol Dial Transplant 2012;27:2588–93.
11. Udyanaray U, Ben-Shlomo Y, Roderick P, et al. Social deprivation, ethnicity, and uptake of living donor kidney transplantation in the United Kingdom. Transplantation 2012;93:610–6.
12. Laging M, Kal-van Gestel IA, van de Wetering J, et al. Understanding the influence of ethnicity and socioeconomic factors on graft and patient survival after kidney transplantation. Transplantation 2014;98:974–8.
37 Chiarenza A, Dauvrin M, Chiesa V, et al. Supporting access to healthcare for refugees and migrants in European countries under particular migratory pressure. *BMC Health Serv Res* 2019;19:513.

38 Van Biesen W, Vanholder R, Vanderhaegen B, et al. Renal replacement therapy for refugees with end-stage kidney disease: an international survey of the nephrological community. *Kidney Int Suppl (2011)* 2016;6:35–41.

39 Axelrod DA, Kynard-Amerson CS, Wojcicikowski D, 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:e12944.

40 Ismail SY, Luchtenburg AE, Timman R, et al. Home-based family intervention increases knowledge, communication and living donation rates: A randomized controlled trial. *Am J Transplant* 2014;14:1862–9.