ESOT | Transplant International

TYPE Meeting Report
PUBLISHED 01 July 2026
DOI 10.3389/ti.2026.16548

Check for updates

OPEN ACCESS

*CORRESPONDENCE
Andreas Kousios,
andreaskousios@gmail.com

RECEIVED 10 March 2026
REVISED 29 May 2026
ACCEPTED 15 June 2026
PUBLISHED 01 July 2026
CORRECTED 28 September 2026

CITATION
Kousios A, Baas M, Manonelles A, Ortiz F, Rista E, Thomas R, Lefaucheur C, Akin EB and Marson L (2026) Landscape of current practices and future perspectives in living donor kidney donation in Europe: proceedings of a pan-European symposium by the European kidney transplant association section of the European Society for Organ Transplantation.
Transpl. Int. 39:16548.
doi: 10.3389/ti.2026.16548

COPYRIGHT
© 2026 Kousios, Baas, Manonelles, Ortiz, Rista, Thomas, Lefaucheur, Akin and Marson. This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY). The use, distribution or reproduction in other forums is permitted, provided the original author(s) and the copyright owner(s) are credited and that the original publication in this journal is cited, in accordance with accepted academic practice. No use, distribution or reproduction is permitted which does not comply with these terms.

Landscape of current practices and future perspectives in living donor kidney donation in Europe: proceedings of a pan-European symposium by the European kidney transplant association section of the European Society for Organ Transplantation

Andreas Kousios[1,2]*, Marije Baas[3], Anna Manonelles[4], Fernanda Ortiz[5], Elvana Rista[6], Rachel Thomas[7], Carmen Lefaucheur[8], Emin Baris Akin[9] and Lorna Marson[7]

[1]School of Medicine, European University Cyprus, Nicosia, Cyprus, [2]Nefrontida Medical Centre, Nicosia, Cyprus, [3]Department of Nephrology, Radboud University Medical Center, Radboud Universiteit, Nijmegen, Netherlands, [4]Renal Transplant Unit, Nephrology Department, Bellvitge University Hospital, Barcelona, Spain, [5]Abdominal Unit, Nephrology, Helsinki University Hospital, Helsinki, Finland, [6]Department of Nephrology, Dialysis, and Kidney Transplantation, Hygeia International Hospital, Tirana, Albania, [7]Edinburgh Transplant Centre, Royal Infirmary of Edinburgh, Edinburgh, United Kingdom, [8]Saint Louis Hospital, Assistance Publique- Hopiteux de Paris and Université Paris Cité, Paris, France, [9]Department of General Surgery, Demiroglu Bilim University and Group Florence Nightingale Hospital, Istanbul, Türkiye

Living donor kidney transplantation (LDKT) offers superior outcomes for most patients with end-stage kidney disease (ESKD), yet its uptake across Europe remains highly variable. This proceedings article summarizes key themes from a pan-European symposium held in November 2025 in Prague, organized by the European Kidney Transplant Association (EKITA) in collaboration with the DESCaRTES Working Group. Discussions highlighted substantial heterogeneity in LDKT activity across Europe, driven by differences in healthcare capacity, legal frameworks, donor evaluation practices, and access to kidney exchange programmes. Marked inequities persist between regions, particularly in the Balkans and Western Balkans, for women those who are socioeconomically disadvantaged, ethnic minority populations, paediatric and elderly patients and individuals with obesity. The symposium identified wide variation in donor selection criteria, risk assessment, informed consent practices, and long-term donor follow-up, despite existing international guidelines. Emerging strategies to address these challenges include harmonisation of donor evaluation and consent, expansion of paired and cross-border kidney exchange programmes, increased use of unspecified kidney donation, and adoption of innovative surgical and immunological approaches to safely broaden donor eligibility. Advances in outcome measurement, including validated surrogate endpoints, machine learning methods, and integrated, harmonised transplant registries, were discussed as critical tools to improve quality, transparency, and research efficiency. Collectively, the proceedings underscore the need for coordinated

clinical, policy, and data-driven solutions to reduce inequities and unlock the full potential of LDKT across Europe, with implications for international transplant practice.

KEYWORDS

cross-border organ exchange, donor evaluation and safety, equity in transplantation, living donor kidney transplantation, transplant registry harmonisation

Introduction

Living donor kidney transplantation (LDKT) provides the best outcomes for most patients with end-stage kidney disease (ESKD), particularly when performed pre-emptively before dialysis initiation [1, 2], yet its uptake across Europe remains highly variable. Differences in clinical practice, legal frameworks, donor evaluation, and access to kidney exchange continue to drive inequities in LDKT across Europe. Reflecting the need for coordinated European action, EKITA has identified promotion of LDKT as a strategic priority for 2026–2027. This proceedings article summarizes key themes from a pan-European symposium held in Prague in November 2025, organized by EKITA and the DESCaRTES Working Group, highlighting current practice, unmet needs, and future strategies to improve equitable access to LDKT in Europe.

Variation in living donation across Europe

Across the continent, LDKT activity remains unevenly distributed. The overall living donor transplant rate is approximately 13 per million population (pmp), compared with ~27 pmp for deceased donor transplantation, with extremes ranging from negligible to non-existent activity in some countries such as Moldova, Slovenia and Serbia with ~0 pmp rates, to ~39 pmp in Turkey. Countries such as the Netherlands and parts of Scandinavia demonstrate high LDKT activity, supported by mature national and kidney exchange programs, whereas many Western, Central, and Southern European countries, including Poland, France, Italy, and much of Central Europe, exhibit comparatively lower rates. In Central Europe, 2024 LDKT rates ranged from 0.95 pmp in Slovenia and 2.18 pmp in Poland to 7.59 pmp in Germany, despite well-developed transplant infrastructures (Figure 1) [3].

Disparities are even more pronounced in the Balkans and Western Balkans, where living donation often compensates for underdeveloped deceased donor programs. Living donation rates range from 0.3 to 0.5 pmp in Bulgaria to 2.8–2.9 pmp in Romania, with Greece representing a regional outlier at approximately 10 pmp. In the Western Balkans, Albania (~9.3 pmp), Bosnia and Herzegovina (~9.7 pmp), and North Macedonia (~9 pmp) rely predominantly on living donation, whereas Serbia demonstrates critically low activity and Kosovo lacks a domestic transplant program. Overall, fewer than 25% of patients with ESKD in the Western Balkans receive a kidney transplant, compared with ~40% across the European Union, highlighting persistent inequities driven by healthcare capacity, cultural factors, and limited regional integration.

Analysis of European practices in living kidney donor evaluation

Thorough assessment of living kidney donors is essential to ensure donor safety. Despite the availability of multiple national and international guidelines for living donor evaluation [4–6], substantial variation in clinical practice persists across Europe. In the first Europe-wide survey conducted by the DESCaRTES and EKITA working groups (124 centers in 16 countries, representing ~45% of European centers and ~3,700 living kidney donations annually), marked heterogeneity was observed in donor evaluation and follow-up practices (Table 1) [7]. Low-consensus areas included kidney function assessment, nephrolithiasis, albuminuria, microscopic haematuria, and BMI thresholds, highlighting the need for harmonised donor assessment criteria across Europe (Table 1). Practice variation reflects not only differences between countries but also centre-level policies and organisation. For example, a recent UK survey demonstrated marked variation in donor acceptance criteria, evaluation timelines, and follow-up practices despite a shared healthcare system and excellent outcomes [8].

Equally important is protecting potential donors from prolonged evaluation processes and avoiding unnecessary investigations, especially those which are invasive. Unnecessarily prolonged processes can lead to frustration, psychological burden and increase withdrawal rates from donation [9–12]. From the recipient perspective, delays reduce the opportunity to perform transplantation pre-emptively, thereby exposing recipients to dialysis-related morbidity and potentially diminishing the clinical benefits associated with timely LKDT [1, 2]. Incidental findings during the evaluation process, particularly on imaging, are common (reported prevalence range from 6%–75%) [13–15] but most are benign and clinically insignificant, with transmitted donor-derived malignancies being exceedingly rare [16]. Common incidental findings include renal cysts, angiomyolipomas, nephrolithiasis, and microscopic haematuria, for which guideline recommendations are often ungraded due to limited evidence.

Finally, the role of genetic testing in CKD and consequently in living donor evaluation is rapidly evolving. Genetic testing identifies a monogenic cause in ~10% of adults with CKD and up to 40%–60% in selected groups, often changing diagnosis and management [17, 18]. Targeted genetic testing is most informative in biologically related donors and those with early-onset or unexplained CKD, extrarenal features, or high-risk ancestry (e.g., APOL1). When combined with counseling, it improves risk stratification and donor safety, although challenges remain due to limited guidance, variable expertise, uncertain variant interpretation, access to counseling, and cost.

Over the last decade, living donor selection in several European countries has gradually shifted from fixed exclusion criteria toward more individualised, risk-based assessment. This is now reflected in contemporary guidelines [5] but the impact of these changes is difficult to assess at a European level because donor selection policies, data collection, and follow-up practices remain heterogeneous. Nonetheless, the total number of living donor kidney transplants performed in Europe has increased, exceeding

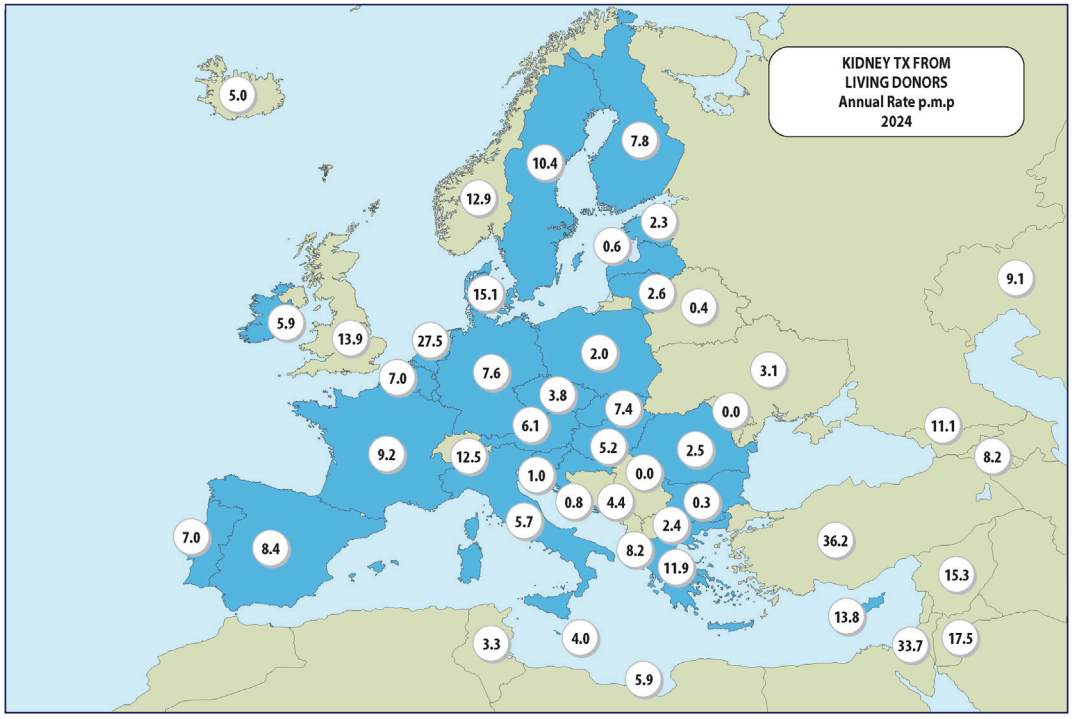


FIGURE 1
Living donor kidney transplantation rates (per million population) across Europe in 2024. Source: European Directorate for the Quality of Medicines and Healthcare (EDQM). Reproduced from EDQM/Council of Europe and Organización Nacional de Trasplantes (2025), Newsletter Transplant - International figures on donation and transplantation 2024, vol. 30, available at https://go.edqm.eu/nltransplant.

7,000 procedures across Council of Europe countries in 2024, compared with the mid-2010s when annual numbers were generally reported at around 5000–6000 LDKT [3].

Donor safety, ethics and outcomes

Ethical dilemmas between potential donors and transplant teams remain common. KDIGO guidelines recommend frameworks to protect donors while recognising that being declined, particularly when labelled "marginal," may undermine autonomy and cause distress [4, 19–21]. In keeping with contemporary terminology, such candidates are better described as potential donors with expanded criteria. However, respect for donor autonomy does not override the responsibility of transplant teams to prioritise donor safety and clinical judgement.

Autonomous informed consent requires ensuring donor understanding and freedom from coercion. Transplant programmes should clearly define and communicate how decisions are made and offer second opinions to minimise paternalism [21–25]. A systematic review of informed consent in living kidney donation demonstrated substantial variation across transplant centres and highlighted the need for a standardized yet flexible approach to ensure equitable donor education and decision-making [26]. To address this gap, the DESCaRTES Working Group proposed a 3-Step Model for informed consent in living kidney donation [27], adapted from the Three-Talk Model of shared decision-making [28]. This framework defines consent as a longitudinal process-team, option, and decision talk-standardizing timing and risk communication while allowing individualization based on donor values and understanding (Figure 2).

Living donor evaluation also poses challenges in the interpretation and communication of long-term risk, particularly for the risk of ESKD [29]. Landmark cohort studies by Mjøen et al. and Muzaale et al. demonstrated that, while living kidney donors have a higher relative risk of ESKD compared with healthy controls, the absolute risk remains low (~0.5% and 0.31% at ~15 years) [30, 31]. These findings were reinforced by a recent meta-analysis estimating an absolute risk of ESKD of approximately 0.5 cases per 1,000 donor-years. Therefore the attributable risk, which is the excess risk that may be associated with donation itself, remains very small in absolute terms [32]. Interpreting these data requires careful consideration of study design, comparator selection, duration of follow-up, and the extent to which study populations reflect the characteristics of contemporary donor candidates in individual transplant programmes. Healthcare professionals should therefore understand the distinction between relative, absolute, and attributable risk and communicate these concepts clearly to potential donors and recipients, so that risk is interpreted in an accurate and clinically meaningful context.

The high cardiovascular mortality associated with dialysis is well recognised and closely related to the duration of ESKD, with kidney transplantation representing the most effective strategy to reduce this risk [33]. Concerns remain regarding the long-term cardiovascular effects of living kidney donation; however, unlike other unilaterally nephrectomised, often comorbid individuals, living kidney donors generally retain adequate renal functional

TABLE 1 Summary table of key findings Living Kidney Donation Practices in Europe: A Survey of DESCaRTES and EKITA Transplantation Working Groups (ref).

Domain	Key finding	Interpretation/Consensus
Survey scope	125 respondents from 124 transplant centers in 16 European countries, representing ~45% of European transplant centers and ~3,700 living donor transplants annually	
Kidney function assessment	56% use eGFR (CKD-EPI); 34% use 24-h creatinine clearance; 41% use combined cystatin c and creatinine; 70% use measured GFR (mGFR)	Low consensus/Substantial heterogeneity
GFR thresholds	64% use age-dependent GFR thresholds; 26% of fixed-threshold centers use 80 mL/min/1.73 m^2	Most centers individualize thresholds according to donor age
Age criteria	63% have no upper age limit; 53% use 18 years as the lower age limit	Age alone is not considered an absolute contraindication
BMI cut-offs	BMI ≥30 kg/m^2 used by 39%; BMI ≥35 kg/m^2 by 42%	Obesity management varies considerably across centers
Weight-loss support	74% offer weight-loss interventions, mainly dietary support (67%), endocrinological evaluation/medications 23% and bariatric surgery 11%	Most centers attempt optimization before excluding overweight donors
Diabetes screening	Exclusion thresholds include HbA1c ≥ 53 mmol/mol (46%), fasting glucose ≥7 mmol/L (57%), or OGTT glucose ≥11.1 mmol/L (59%)	Strong consensus on excluding overt diabetes
Hypertension	91% exclude uncontrolled hypertension/end-organ damage; 78% exclude candidates using ≥3 antihypertensives	High consensus regarding hypertension-related exclusions
Albuminuria/ Proteinuria	Only 38% assess both spot and 24-h urine	Marked variability in testing strategies and thresholds
Microscopic hematuria	57% accept donors if both urological evaluation and kidney biopsy are normal	Donation often permitted after negative work-up
ApoL1 testing	27% routinely test donors of African ancestry	ApoL1 testing is not standard practice in most European centers
Nephrolithiasis	Most centers accept low-risk stone history; only 2% reject any history of stones	Stone history is acceptable when recurrence risk is low
Risk calculators	54% do not use online ESKD risk calculators	Clinical judgment remains the primary assessment tool
Informed consent	95% obtain written consent for donation; 65% for data registration	Donation consent is nearly universal
Follow-up duration	83% offer lifelong follow-up, usually annually	Long-term donor surveillance is strongly supported
Follow-up components	Includes blood pressure (98%), eGFR (94%), spot urine (75%), medication review (70%)	Focuses on kidney function and cardiovascular risk

reserve capacity to support compensatory hyperfiltration [29, 34]. Long-term studies suggest that eGFR trajectories remain stable or improve over time after donation [35], and that eGFR<50 mL/min/1.72m2 is uncommon [36]. Although donors have a higher incidence of hypertension and diabetes, most studies have not demonstrated increased overall mortality or major cardiovascular events [37–42]. A Norwegian cohort reported higher long-term mortality and cardiovascular risk factors, but these findings should be interpreted cautiously given the ethnically homogeneous population, absence of smoking data, and historical donor selection and management practices [30, 43]. Overall, these findings highlight the importance of long-term follow-up, cardiovascular risk reduction, and healthy lifestyle measures after donation.

Women with CKD are at risk of adverse pregnancy outcomes. In living kidney donors, a systematic review found that the risk of preeclampsia increased from 1% to 4%; however, despite the relative increase, the absolute risk remains low and comparable to that of the general obstetric population, with higher BMI and pre-existing hypertension increasing risk [44]. Importantly, there is limited evidence of increased adverse fetal or neonatal outcomes, and post-donation pregnancy has not been associated with accelerated decline in kidney function compared with pre-donation pregnancy. Women who develop gestational hypertension or pre-eclampsia after donation are at increased risk of future hypertension and should receive long-term follow-up [45, 46]. This represents an important opportunity for the transplant community to lead through accurate, evidence-based risk communication. Pregnancy-related risks should be interpreted in the context of study design and individual donor characteristics, with clear distinction between relative and absolute risk. Improved professional education and collaboration with obstetric specialists are essential to ensure balanced counselling and to avoid unnecessarily discouraging suitable women from living kidney donation.

Research on motivations for living kidney donation has identified themes including altruism, family dynamics, and perceived personal benefit [47, 48]. These findings support structured psychosocial screening to identify potential donors who may require additional support, particularly those with

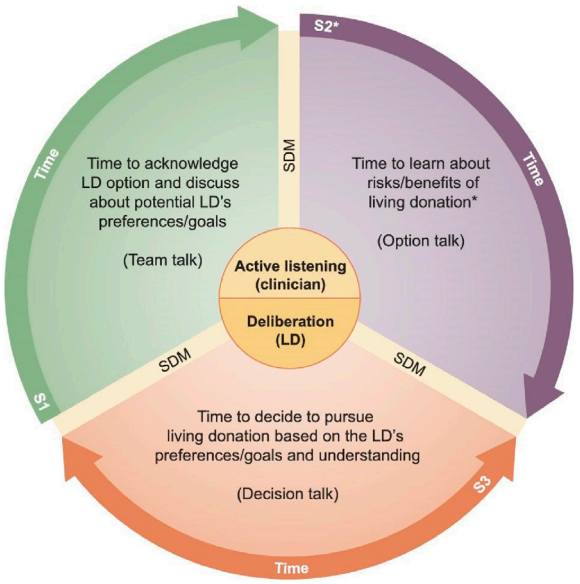


FIGURE 2
Shared decision-making should start with the primary nephrologist prior to the need for kidney replacement therapy or at the local dialysis unit (S1), and, at the transplant center, with transplant clinicians and surgeons throughout the process of evaluation (S2) and prior to nephrectomy (S3).

limited social support, financial stress, or major caregiving responsibilities. Donors reporting poorer outcomes often described inadequate pre-donation information, highlighting the importance of thorough informed consent, appropriate reassurance and ongoing psychological follow-up [49–52].

Reducing inequalities

The UK ATTOM study recruited 2055 patients from all 23 transplant centres in the UK and demonstrated that recipients of living donor kidney transplantation were more likely to be young, white, married, and socioeconomically advantaged, with no sex difference in access [53]. Moreover, broader evidence indicates that women are more likely to donate but less likely to receive living donor transplants, particularly in spousal settings independently of HLA factors [54, 55]. Marked ethnic disparities persist, with non-white patients substantially underrepresented among LDKT recipients in both adult and paediatric populations [56–58]. Older patients may be less likely to be referred because of perceived frailty or assumptions regarding limited benefit, while individuals with obesity may face additional barriers related to eligibility criteria and surgical concerns [1, 59–61].

Barriers to LDKT include cultural, geographic, educational, and financial factors, with ethnic minority patients facing additional challenges such as overseas donors, language barriers, and reported discrimination. Improving access requires culturally competent care, including translation services and peer support within transplant programmes [62–64].

Access to LDKT is reduced among less well-educated patients and is closely linked to lower health literacy. Many patient information leaflets and consent documents exceed the average reading age of 11 years [65]. Improving communication, understanding patient perspectives, and using peer educators from diverse communities may help improve engagement and access to living donation. Financial barriers play an important role and may contribute to sex disparities in living donation, as loss of income may disproportionately affect men in some households. Effective reimbursement policies for living donors are therefore essential and economically justified given the long-term cost savings of transplantation over dialysis.

Against this backdrop of inequality, system-level innovations offer opportunities to improve access. Kidney exchange programmes are among the most effective strategies, enabling incompatible donor-recipient pairs to swap donors with other pairs. In Europe, these programmes are typically coordinated by national transplant organisations with multidisciplinary teams responsible for donor-recipient matching, immunological assessment, registry management, logistics, and regulatory oversight. Building on the 2023 Global Convergence in Transplantation recommendation to expand paired donor exchange, the EURO-KEP program was developed, aiming to support national programmes by harmonising eligibility criteria, matching algorithms, and governance frameworks with the goal to establish a pan-European kidney exchange network under common rules [66]. A European exchange programme is considered feasible through stepwise harmonisation of clinical protocols, legal frameworks, interoperable registries, and pilot cross-border collaborations. By enlarging the donor pool, it could improve access for highly sensitised patients and recipients with uncommon blood groups, thereby reducing inequities in LDKT across Europe.

An additional strategy to increase living donation, adopted particularly in the UK and the Netherlands, is unspecified kidney donation to a stranger [67, 68]. Since legalisation in 2006, over 1,000 such transplants have been performed in the UK, with 83 unspecified donors enabling 119 living donor kidney transplants in 2022/23, accounting for 13% of UK living donor transplant activity [69]. Unspecified donation requires careful psychosocial and ethical assessment, robust informed consent, and appropriate management of donor expectations. The BOUnD study showed outcomes comparable to specified donors, without higher rates of withdrawal, regret, or healthcare costs, and estimated that a 10% increase in unspecified donation could save at least £5 million nationally [70]. Long-term Dutch experience has also demonstrated high donor satisfaction [68]. Wider implementation requires experienced multidisciplinary teams, consistent protocols, and greater public and professional awareness [71]. In highly selected cases, unspecified donation has also been performed by individuals with serious life-limiting illnesses or benign renal conditions requiring nephrectomy, illustrating additional opportunities to expand living donation safely and ethically [72, 73].

Highlighting equity in pediatric transplantation is essential. Paediatric access to transplantation in Europe is limited by capacity, variability, and legislation. Addressing these issues requires local initiatives, advocacy, and consideration of broader factors [74]. Care models vary across regions, with

differences in demand, surgeon availability, and reliance on mobile or virtual teams. Avoiding ongoing inequity for future generations remains a priority.

Surgical influences

Minimally invasive surgery can increase donor willingness not only by offering better cosmetic results and quick recovery, but also by increasing safety after donor nephrectomy. Effective surgeon–donor communication and comprehensive informed consent, including clear explanations of risks (e.g., the low mortality rate (<0.01% in the USA, 0.03% in meta-analysis), morbidity 2.3% (intra-op), 7.3% (post-op)) and available surgical options, are essential for improving transplant quality [75, 76]. Most centers still perform hand-assisted laparoscopic donor nephrectomy (57.4%), followed by laparoscopic donor nephrectomy (40.8%) [77]. Retroperitoneal access is underutilized, even though it avoids contact with intra-abdominal organs and colonic mobilization, which can prevent mesenteric or intra-abdominal organ injuries during surgery, as well as adhesions that can cause intestinal obstruction and possible infertility in the long term [78, 79]. Even though several publications show no significant difference between minimally invasive donor nephrectomy surgical techniques, others focus on the benefit of retroperitoneal access in avoiding intra-abdominal complications [80, 81]. Tailored surgical techniques for nephrectomy can reduce barriers and increase safety and satisfaction while expanding donor eligibility for living-donor kidney transplantation. Some examples are: Hand-assisted surgery to increase safety for donors who are obese or have challenging anatomical variations, while donors with low BMI may benefit from a pure laparoscopic or robotic approach. Vaginal extraction of the kidney or single-port techniques can improve cosmesis [82–85]. Retroperitoneal access can be a good alternative to prevent intestinal adhesions for donors with previous abdominal surgery or gastrointestinal motility complaints. Surgeons can be reluctant to perform a right donor nephrectomy because of technical challenges [86]. Hand-assisted retroperitoneal access may also allow more liberal use of the right kidney due to technical advantages, thereby improving donor safety by always preserving the better kidney [78, 87]. Robotic assistance, offering superior precision and ergonomics, may offer benefits over laparoscopy in nephrectomies involving right-sided or complex vasculature donors [88, 89]. The major indication for kidney transplantation with robotic assistance is improved short- and long-term patient and graft survival by decreased wound complications [90]. Avoiding lower abdominal incisions and improved wound outcome is offering a chance for a kidney transplantation without having to first achieve weight loss and therefore, reducing dropout secondary to dialysis-related morbidity and mortality [91, 92]. Robotic approaches are also focused on offering lower analgesic requirements and a shorter learning curve compared to laparoscopic techniques. Enhanced Recovery After Surgery (ERAS) protocols for kidney transplant donors and recipients are also offering important contributions to daily practice. ERAS protocols in kidney transplantation enable optimizing pain control with minimal opioids and promote early mobilization, which have also contributed to faster recovery and increased satisfaction. ERAS offers similar readmission rates, morbidity, and mortality while reducing length of stay, post-operative complications, and postoperative pain [93–95].

Transplanting incompatible pairs

National opportunities for living donor kidney transplantation for ABO incompatible pairs and highly HLA sensitized patients in Europe differ greatly. Mainly due to a variable access to exchange programs or desensitization strategies.

Although not available everywhere, ABO-incompatible transplantation is widely practiced, with rituximab and antigen-specific immunoadsorption protocols yielding outcomes comparable to ABO-compatible transplants, though infectious complications and higher rejection rates remain concerns [96].

The European Guideline for the Management of sensitized kidney transplant patients proposes a clear approach to a highly sensitized patient [97]. Kidney exchange programs play an important role in this plan.

Successful living donor exchange programs exist on national levels including in the United Kingdom, the Netherlands, South Alliance and Scandiatransplant [98]. In the United Kingdom Living Donor Kidney Sharing Scheme (UKLDKSS) > 70% of the recipients are transplanted making up 23% of the total living donor program. The large number of participants (>250 per run), the inclusion of non-directed altruistic donors (NDAD) and compatible pairs, and allowing ABO incompatible transplants, are, amongst others, contributing to its success. Recent data from the Dutch national kidney exchange programme further support this approach, demonstrating that long-term graft survival after kidney exchange is equivalent to that of direct living donor transplantation, with similar 10-year death-censored graft survival (91.6% vs. 91.9%) [99]. In addition donors participating in KEPs, have similar physical and mental health-related quality of life (HRQoL) outcomes to donors donating directly [100]. These findings support broader adoption of kidney exchange programmes and international collaboration.

Unfortunately, a group of very highly sensitized patients will most probably never receive a graft via these programs and will not be suitable for desensitization strategies. Imlifidase is not available in living donor transplantation. Deceased-donor allocation in acceptable mismatch programs, could offer a solution to these patients yielding long-term graft survival rates comparable to non-sensitized recipients [101], but compromised when compared to LDKT.

Focus on expanding LDKT national exchange programs with more compatible pairs, promoting the participation of NDAD, allowing for ABOi transplantation and by international collaborations (i.e., EURO-KEP), will result in a larger donor pool and a higher chance for the highly sensitized patients to be transplanted in the future [102].

An innovative national strategy in Italy uses deceased-donor initiated chains to overcome immunological incompatibility in living donor kidney transplantation, whereby a deceased-donor kidney enables transplantation for an incompatible pair and triggers a chain of living donor transplants [101]. Early experience demonstrates that, with appropriate ethical oversight and algorithm-based allocation, this approach substantially increases transplant rates among incompatible pairs, reduces

waiting times, and improves the efficiency of paired exchange programmes while benefiting waitlisted patients through high-quality chain-ending grafts.

In summary, the integration of risk stratification, advanced antibody testing, individualized allocation strategies and successful and innovative exchange programs are essential to optimize outcomes for HLA and ABO incompatible LDKT pairs across Europe.

Measuring outcomes in kidney transplantation: New challenges and priorities

The heterogeneous outcomes reported in organ transplant studies prevent comparisons of results across studies and transplant programmes, analysis of international registers and data synthesis in meta-analyses. An increasingly attractive solution that can improve outcome reporting is to use a 'core outcome set' (COS), which is an agreed minimum set of outcomes that have to be measured and reported in all studies of a given disease. For example, the Standardized Outcomes in Nephrology-Kidney Transplantation (SONG-Tx) initiative has established a consensus-based COS in kidney transplantation based on the shared priorities of all stakeholders [103, 104].

In the setting of improving short-term transplant outcomes and declining early graft failure, validated surrogate endpoints are increasingly important to evaluate optimization strategies and inform timely clinical and research decisions. The iBox (integrative box) score [105], which combines functional, immunological, and histological parameters to estimate individualized risk of long-term graft loss, has been qualified by the European Medicines Agency as a secondary endpoint for kidney transplant trials and is undergoing further evaluation in a European randomized controlled study [106]. By enabling early assessment of treatment effects and risk stratification, iBox supports personalized post-transplant care and enhances the efficiency of clinical trials [107], with parallel recognition through the FDA biomarker qualification pathway.

A meta-analysis of studies which used machine learning (ML) models in the prediction of kidney graft survival showed that ML-based models had a significantly higher performance than traditional statistical models [107]. ML methods are able to predict delayed graft function using donor maintenance-related variables [108], graft rejection [109] or the development of *de novo* donor-specific antibodies [110]. An unsupervised learning method integrating clinical, immune, and outcome variables revealed five transplant glomerulopathy associated with distinct causes and allograft survival profiles [111]. ML models in transplantation are limited by data quality, representativeness, interpretability, and overfitting, necessitating high-quality datasets, rigorous external validation, fair evaluation across populations, and further consensus to identify the most reliable and generalizable approaches for clinical use.

Europe hosts multiple national and international transplantation registries, and recent initiatives highlight the need for harmonised, high-quality data collection to support robust clinical and epidemiological research. The EDITH project and Council of Europe recommendations advocate for standardized, prospective datasets across all solid organ transplants, leveraging existing electronic systems to improve data completeness, comparability, and analytical value [112, 113]. The European Health Data Space Regulation, effective from March 2025, provides a major opportunity to enable secure, interoperable, and cross-border data sharing while ensuring data protection and patient control. Complementary initiatives, such as the BRAVEST project [114], further underscore the importance of resilient and coordinated data infrastructures. Established systems like Eurotransplant and Scandiatransplant demonstrate how harmonised, interoperable registries can enhance allocation transparency, cross-border collaboration, and ultimately transplant outcomes across Europe.

Strategies to improve living donation through education and advocacy

From the donor perspective, emotional and psychological barriers often outweigh medical concerns in living donation, including guilt, fear of harm, financial worries, limited knowledge or social networks, and cultural or religious factors. Targeted support and improved education empower patients to engage proactively with potential donors and participate confidently in shared decision-making. Patient organizations help by providing education, support, advocacy, and a sense of community. Established in 2019, the ESOT-ETPO Alliance brings together healthcare professionals and transplant recipients. The ESOT Patient Inclusion Initiative promotes partnership and empowerment to improve knowledge and advocate for patient-centered care [115].

Raising public awareness, building trust among stakeholders, promoting equitable access, removing financial barriers, and encouraging policy changes to improve donation rates, quality, and outcomes for patients and donors drive advocacy initiatives. The European Kidney Health Alliance (EKHA) is a strategic alliance of European non-profit organizations, including patient groups, nephrologists, researchers, and allied health professionals. Its mission is to influence EU health strategies and advocate for harmonized standards of care across Europe [116]. In December 2024, the European Council released conclusions on enhancing organ donation and transplantation, inviting the European Commission to continue work under the proposed action plan to increase donor organ availability and coordinate, promote, and strengthen cooperation between Member States [117]. EKHA and ESOT are working together to achieve this call to action.

Raising awareness about living donor kidney transplantation can be effectively achieved through home outreach programs, like REACH Transplant in the UK [118] and the KRT program in the Netherlands [119]. These initiatives address attendees' understanding of CKD, facilitate open discussion, support advocacy, and provide signposting to appropriate resources. Data from the Scottish Renal Registry illustrates significant socio-economic disparities in access to pre-emptive transplantation, with the most deprived patients markedly less likely to receive such interventions compared to their more affluent counterparts.

TABLE 2 Key recommendations, implementation priorities, and future research directions.

Key recommendations	
Domain	**Recommendations**
A. Harmonise donor evaluation and informed consent	• Develop common minimum standards for donor assessment, risk communication, informed consent, and follow-up • Standardise written information materials and consent processes while allowing individualised donor-recipient decision-making
B. Strengthen donor protection	• Protect donors from unnecessarily prolonged evaluation processes and investigations, particularly invasive, with efficient, timely and well-coordinated assessments • Ensure long-term medical and psychosocial follow-up for all living donors • Prevent financial disadvantage by reimbursing travel, accommodation, childcare, loss of income, and post-donation healthcare costs • Adopt minimally invasive, donor-tailored surgical approaches and enhanced recovery after surgery (ERAS) protocols to improve donor safety, accelerate recovery, and expand access to living donor kidney transplantation
C. Expand kidney exchange programmes	• Support development of national kidney exchange programmes in countries where these are absent or limited • Progressively link national programmes through EURO-KEP or similar frameworks to enable cross-border exchange under shared clinical, legal, ethical, and data-governance standards • Consider developing unspecified kidney donation programmes integrated with kidney exchange schemes and supported by robust psychosocial assessment, informed consent, and multidisciplinary follow-up
D. Reduce inequities in access	• Implement culturally competent education, translation services, peer-support models, and early referral pathways • Prioritise underserved groups, including ethnic minority, socioeconomically disadvantaged, female, paediatric, and geographically remote populations • Promote pre-emptive living donor kidney transplantation through early referral, timely donor evaluation, and targeted interventions to reduce socioeconomic and geographic disparities in access
E. Improve data infrastructure	• Establish harmonised national and European registries for living donor activity, outcomes, and follow-up • Include equity metrics, donor-reported outcomes, and long-term donor safety outcomes in routine data collection
Implementation Priorities	
• Agree on a European core dataset for living donor evaluation and outcomes • Map current reimbursement and donor-protection policies across countries • Expand cross-border kidney exchange between countries with compatible regulatory frameworks • Support countries with low LDKT activity to develop sustainable programmes • Integrate validated risk tools, digital education platforms, and outcome measures into clinical pathways	
Future research directions	
• Define acceptable risk thresholds for expanded donor criteria • Validate donor risk-prediction tools across diverse European populations • Evaluate psychosocial, financial, pregnancy-related, and long-term medical outcomes after donation • Assess the impact of kidney exchange, unspecified donation, genetic testing, digital tools, and minimally invasive surgery on transplant activity, donor safety, and recipient outcomes	

Conclusion

Living donor kidney transplantation remains the most effective renal replacement therapy for many patients with ESKD, yet access across Europe remains highly inequitable. Key priorities emerging from the symposium include harmonisation of donor assessment and informed consent, stronger donor protection and long-term follow-up, expansion of kidney exchange programmes including cross-border and unspecified donation, and targeted strategies to reduce social, financial, ethnic, and gender-based disparities. Advances in surgical techniques, immunological risk stratification, and digital tools offer important opportunities to improve donor and recipient outcomes but must be implemented within equitable and well-resourced systems of care (Table 2).

The EURO-KEP programme and development of a pan-European kidney exchange network represent important opportunities to improve equitable access to living donor transplantation. Achieving sustained progress will require collaboration among clinicians, policymakers, patient organisations, and professional societies, supported by legal reform and investment in education and infrastructure. These priorities align with EKITA's 2026–2027 action plan, which identifies promotion of LDKT as a core European objective.

Author contributions

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

Funding

The author(s) declared that financial support was received for this work and/or its publication. The meeting on which this manuscript is based was organised by ESOT.

Acknowledgements

The authors would like to thank: DESCaRTES members for their contribution: Cristophe Mariat, Ilaria Gandolfini, Rachel Hellemans, Arzu Velioglu, Annelies de Weerd and other speakers at the symposium including: Gabriel Oniscu, Jen Lumsdaine, Ondrej Viklicky, Leonor Fayos de Arizon, Luuk Hilbrands, David Cucchiari, William Plan, Geir Mjoen, Luciano Potena, Laura Skinner, David Paredes-Zapata, Beatriz Dominguez-Gil, Hannah Maple, Eline Bunnik, Lucrezia Furian, Frank J.M.F. Dor, Jose Oberholzer, Ikka Helantera, Lisa Burnapp, Manuel Podesta, Jelena Stajanovic, Jenni Kippola, Orla Hobson. The authors would also like to thank patient advocate and national advocacy and projects manager with the Irish Kidney association Colin White and the General manager of EKHA Amanda Harvey-Dehaye. The authors are very grateful to Silvia Valls, EKITA Section Coordinator for the support and coordination.

Conflict of interest

The author(s) declared that this work was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Correction note

A correction has been made to this article. Details can be found at: 10.3389/ti.2026.17772.

Generative AI statement

The author(s) declared that generative AI was not used in the creation of this manuscript.

Any alternative text (alt text) provided alongside figures in this article has been generated by Frontiers with the support of artificial intelligence and reasonable efforts have been made to ensure accuracy, including review by the authors wherever possible. If you identify any issues, please contact us.

References

1. Kim I, 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 Public Health* (2023) 11:1124453. doi:10.3389/fpubh.2023.1124453

2. Rana MR, Knight SR, Maggiore U, Lafranca JA, Dor FJMF, Pengel LHM. What are the benefits of preemptive versus non-preemptive kidney transplantation? A systematic review and meta-analysis. *Transplant Rev* (2023) 37(4):100798. doi:10.1016/j.trre.2023.100798

3. European Directorate for the Quality of Medicines & HealthCare (EDQM). *Newsletter Transplant 2025 – Transparency, Ethical Governance and Equitable Access*. Available online at: https://www.edqm.eu/en/-/newsletter-transplant-2025-transparency-ethical-governance-and-equitable-access (Accessed March 6, 2026).

4. 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(8S):S7–S105. doi:10.1097/TP.0000000000001769

5. Claisse G, Gaillard F, Mariat C. Living kidney donor evaluation. *Transplantation* (2020) 104(12):2487–96. doi:10.1097/TP.0000000000003242

6. BTS/RA Living Donor Kidney Transplantation Guidelines 2018. *Guidelines for Living Donor Kidney Transplantation*. Available online at: https://bts.org.uk/wp-content/uploads/2018/07/FINAL_LDKT-guidelines_June-2018.pdf (Accessed January 16, 2026).

7. Van Londen M, Gaillard F, Zaza G, Oniscu GC, Gandolfini I, Furian L, et al. Living kidney donation practices in Europe: a survey of DESCaRTES and EKITA transplantation working groups. *Transpl Int* (2025) 38:14802. doi:10.3389/ti.2025.14802

8. Nightingale K, Stephenson J, Sivaprakasam R, Brown T, Inston N, Hamsho A, et al. The variation in practice of the living donor kidney transplant pathway in the UK: results of a national survey. *Transpl Int* (2025) 38:15341. doi:10.3389/ti.2025.15341

9. Sanner MA. The donation process of living kidney donors. *Nephrol Dial Transplant* (2005) 20(8):1707–13. doi:10.1093/ndt/gfh861

10. Lunsford SL, Simpson KS, Chavin KD, Menching KJ, Miles LG, Shilling LM, et al. Racial disparities in living kidney donation: is there a lack of willing donors or an excess of medically unsuitable candidates? *Transplantation* (2006) 82(7):876–81. doi:10.1097/01.tp.0000232693.69773.42

11. Lapasia JB, Kong S, Busque S, Scandling JD, Chertow GM, Tan JC. Living donor evaluation and exclusion: the stanford experience. *Clin Transplant* (2011) 25(5):697–704. doi:10.1111/j.1399-0012.2010.01336.x

12. Graham JM, Courtney AE. The adoption of a one-day donor assessment model in a living kidney donor transplant program: a quality improvement project. *Am J Kidney Dis* (2018) 71(2):209–15. doi:10.1053/j.ajkd.2017.07.013

13. The Department of Radiology, Beaumont Hospital, Dublin, Ireland, O'Neill DC, Davis NF, Lee MJ, Little D, Morrin MM. Prevalence of incidental findings on multidetector computed tomography in potential nephrectomy donors: a prospective observational study. *Exp Clin Transpl* (2019) 17(2):177–82. doi:10.6002/ect.2017.0340

14. Tan N, Charoensak A, Ajwichai K, Gritsch HA, Danovitch G, Schulam P, et al. Prevalence of incidental findings on abdominal computed tomography angiograms on prospective renal donors. *Transplantation* (2015) 99(6):1203–7. doi:10.1097/TP.0000000000000486

15. De Marco E, Corona D, Origlio F, Giuffrida G, Gioco R, Palermo C, et al. Impact of incidental findings during the evaluation of live kidney donors on post-transplant outcomes: a single center analysis. *Transplant Proc* (2019) 51(9):2906–9. doi:10.1016/j.transproceed.2019.04.097

16. Kaul DR, Vece G, Blumberg E, La Hoz RM, Ison MG, Green M, et al. Ten years of donor-derived disease: a report of the disease transmission advisory committee. *Am J Transplant* (2021) 21(2):689–702. doi:10.1111/ajt.16178

17. Groopman EE, Marasa M, Cameron-Christie S, Petrovski S, Aggarwal VS, Milo-Rasouly H, et al. Diagnostic utility of exome sequencing for kidney disease. *N Engl J Med* (2019) 380(2):142–51. doi:10.1056/NEJMoa1806891

18. Connaughton DM, Kennedy C, Shril S, Mann N, Murray SL, Williams PA, et al. Monogenic causes of chronic kidney disease in adults. *Kidney Int* (2019) 95(4):914–28. doi:10.1016/j.kint.2018.10.031

19. 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

20. Patel K, Brotherton A, Chaudhry D, Evison F, Nieto T, Dabare D, et al. Survival advantage comparing older living donor *versus* standard criteria donor kidney transplants. *Transpl Int* (2024) 37:12559. doi:10.3389/ti.2024.12559

21. Mamode N, Van Assche K, Burnapp L, Courtney A, van Dellen D, Houthoff M, et al. Donor autonomy and self-sacrifice in living organ donation: an ethical legal and psychological aspects of transplantation (ELPAT) view. *Transpl Int* (2022) 35:10131. doi:10.3389/ti.2022.10131

22. Martin DE. 7. Deciding about living organ donation: balancing risk management and autonomy. In: Hansen SL, Schicktanz S, editors. *Bioethik/Medizinethik*. 3. 1st ed. Bielefeld, Germany: Transcript Verlag (2021). p. 133–50. doi:10.14361/9783839446430-009

23. Simmons RG, Marine SK, Simmons RL. *Gift of Life: The Effect of Organ Transplantation on Individual, Family, and Societal Dynamics*. New Brunswick, NJ: Transaction Publishers (1988).

24. Makins N. Patients, doctors and risk attitudes. *J Med Ethics* (2023) 49(11):737–41. doi:10.1136/jme-2022-108665

25. Tong A, Chapman JR, Wong G, Craig JC. Living kidney donor assessment: challenges, uncertainties and controversies among transplant nephrologists and surgeons. *Am J Transplant* (2013) 13(11):2912–23. doi:10.1111/ajt.12411

26. Kortram K, Lafranca JA, Ijzermans JNM, Dor FJMF. The need for a standardized informed consent procedure in live donor nephrectomy: a systematic review. *Transplantation* (2014) 98(11):1134–43. doi:10.1097/TP.0000000000000518

27. Grossi AA, Sever MS, Hellemans R, Mariat C, Crespo M, Watschinger B, et al. The 3-Step model of informed consent for living kidney donation: a proposal on behalf of the DESCaRTES working group of the european renal association. *Nephrol Dial Transplant* (2023) 38(7):1613–22. doi:10.1093/ndt/gfad022

28. Elwyn G, Durand MA, Song J, Aarts J, Barr PJ, Berger Z, et al. A three-talk model for shared decision making: multistage consultation process. *BMJ* (2017) 6:j4891. doi:10.1136/bmj.j4891

29. Ortiz F, Marson L, Thomas R, Kousios A, Rista E, Lefaucheur C, et al. Evaluating risk in kidney living donors. *Transpl Int* (2025) 38:14024. doi:10.3389/ti.2025.14024

30. Mjøen G, Hallan S, Hartmann A, Foss A, Midtvedt K, Øyen O, et al. Long-term risks for kidney donors. *Kidney Int* (2014) 86(1):162–7. doi:10.1038/ki.2013.460

31. Muzaale AD, Massie AB, Wang MC, Montgomery RA, McBride MA, Wainright JL, et al. Risk of end-stage renal disease following live kidney donation. *JAMA* (2014) 311(6):579–86. doi:10.1001/jama.2013.285141

32. O'Keeffe LM, Ramond A, Oliver-Williams C, Willeit P, Paige E, Trotter P, et al. Mid- and long-term health risks in living kidney donors: a systematic review and meta-analysis. *Ann Intern Med* (2018) 168(4):276–84. doi:10.7326/M17-1235

33. Meier-Kriesche HU, Schold JD, Srinivas TR, Reed A, Kaplan B. Kidney transplantation halts cardiovascular disease progression in patients with end-stage renal disease. *Am J Transpl* (2004) 4(10):1662–8. doi:10.1111/j.1600-6143.2004.00573.x

34. Santos AH, Ibrahim H, Alquadan K, Belal A, Leghrouz M, Mehta R, et al. Risk factors for one-year post-nephrectomy decline in renal function of living kidney donors: quantile regression analysis based on estimated glomerular filtration rate reduction percentiles. *Transpl Int* (2025) 38:14749. doi:10.3389/ti.2025.14749

35. Kasiske BL, Anderson-Haag T, Israni AK, Kalil RS, Kimmel PL, Kraus ES, et al. A prospective controlled study of living kidney donors: three-year follow-up. *Am J Kidney Dis* (2015) 66(1):114–24. doi:10.1053/j.ajkd.2015.01.019

36. Almeida M, Reis Pereira P, Silvano J, Ribeiro C, Pedroso S, Tafulo S, et al. Longitudinal trajectories of estimated glomerular filtration rate in a European population of living kidney donors. *Transpl Int* (2024) 37:13356. doi:10.3389/ti.2024.13356

37. Ferro CJ, Townend JN. Risk for subsequent hypertension and cardiovascular disease after living kidney donation: is it clinically relevant? *Clin Kidney J* (2022) 15(4):644–56. doi:10.1093/ckj/sfab271

38. Holscher CM, Bae S, Thomas AG, Henderson ML, Haugen CE, DiBrito SR, et al. Early hypertension and diabetes after living kidney donation: a national cohort study. *Transplantation* (2019) 103(6):1216–23. doi:10.1097/TP.0000000000002411

39. Krättli J, Buess D, Diebold M, Wehmeier C, Sidler D, Golshayan D, et al. Metabolic risk after living kidney donation: an analysis of the Swiss organ living-donor health registry. *Swiss Med Wkly* (2025) 155(6):4513. doi:10.57187/s.4513

40. The Department of Nephrology, University of Health Sciences, Izmir Bozyaka Education and Research Hospital, Izmir, Turkey, Tatar E, Karataş M, Tercan IC, Okut G, Usoğlu B Onset of hypertension in living kidney donors after donor nephrectomy: our 20 years of experience. *Exp Clin Transpl* (2019) 17(Suppl. 1):156–8. doi:10.6002/ect.MESOT2018.P32

41. Chaudry M, Gislason GH, Fosbøl EL, Køber L, Gerds TA, Torp-Pedersen C. Hypertension, cardiovascular disease and cause of death in Danish living kidney donors: matched cohort study. *BMJ Open* (2020) 10(11):e041122. doi:10.1136/bmjopen-2020-041122

42. Munch P, Christiansen CF, Birn H, Erikstrup C, Nørgaard M. Is the risk of cardiovascular disease increased in living kidney donors? A Danish population-based cohort study. *Am J Transplant* (2021) 21(5):1857–65. doi:10.1111/ajt.16384

43. Mjøen G, Maggiore U, Kessaris N, Kimenai D, Watschinger B, Mariat C, et al. Long-term risks after kidney donation: how do we inform potential donors? A survey from DESCARTES and EKITA transplantation working groups. *Nephrol Dial Transplant* (2021) 36(9):1742–53. doi:10.1093/ndt/gfab035

44. Pippias M, Skinner L, Noordzij M, Reisæter AV, Abramowicz D, Stel VS, et al. Pregnancy after living kidney donation, a systematic review of the available evidence, and a review of the current guidance. *Am J Transplant* (2022) 22(10):2360–80. doi:10.1111/ajt.17122

45. van Buren MC, Meinderts JR, Oudmaijer CAJ, de Jong MFC, Groen H, Royaards T, et al. Long-term kidney and maternal outcomes after pregnancy in living kidney donors. *Transpl Int* (2023) 36:11181. doi:10.3389/ti.2023.11181

46. Palzer EF, Helgeson ES, Evans MD, Vock DM, Matas AJ. Long-term outcomes associated with post–kidney donation pregnancy complications. *Transplantation* (2023) 107(7):1615–23. doi:10.1097/TP.0000000000004540

47. Lennerling A, Forsberg A, Meyer K, Nyberg G. Motives for becoming a living kidney donor. *Nephrol Dial Transplant* (2004) 19(6):1600–5. doi:10.1093/ndt/gfh138

48. Tong A, Chapman JR, Wong G, Kanellis J, McCarthy G, Craig JC. The motivations and experiences of living kidney donors: a thematic synthesis. *Am J Kidney Dis* (2012) 60(1):15–26. doi:10.1053/j.ajkd.2011.11.043

49. Menjivar A, Torres X, Manyalich M, Fehrman-Ekholm I, Papachristou C, de Sousa-Amorim E, et al. Psychosocial risk factors for impaired health-related quality of life in living kidney donors: results from the ELIPSY prospective study. *Sci Rep* (2020) 10(1):21343. doi:10.1038/s41598-020-78032-8

50. Menjivar A, Torres X, Paredes D, Avinyo N, Peri JM, De Sousa-Amorim E, et al. Assessment of donor satisfaction as an essential part of living donor kidney transplantation: an eleven-year retrospective study. *Transpl Int* (2018) 31(12):1332–44. doi:10.1111/tri.13334

51. Torres X, Menjivar A, Baillès E, Rangil T, Delgado I, Musquera M, et al. The Spanish version of the fear of kidney failure questionnaire: validity, reliability, and characterization of living donors with the highest fear of kidney failure. *Transplant Direct* (2021) 7(2):e655. doi:10.1097/TXD.0000000000001100

52. Shi Y, Zhang H, Nie Z, Fu Y. Quality of life, anxiety and depression symptoms in living related kidney donors: a cross-sectional study. *Int Urol Nephrol* (2023) 55(9):2335–43. doi:10.1007/s11255-023-03542-z

53. 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

54. Cozzi E, Álvarez M, Carmona M, Mahíllo 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

55. Zimmerman D, Donnelly S, Miller J, Stewart D, Albert SE. Gender disparity in living renal transplant donation. *Am J Kidney Dis* (2000) 36(3):534–40. doi:10.1053/ajkd.2000.9794

56. Hart A, Lentine KL, Smith JM, Miller J, Skeans M, Prentice M, et al. OPTN/SRTR 2019 annual data report: Kidney. *Am J Transpl* (2021) 21(Suppl. 2):21–137. doi:10.1111/ajt.16502

57. Amaral S, McCulloch CE, Black E, Winnicki E, Lee B, Roll GR, et al. Trends in living donation by race and ethnicity among children with end-stage renal disease in the United States, 1995–2015. *Transplant Direct* (2020) 6(7):e570. doi:10.1097/TXD.0000000000001008

58. Al Ammary F, Yu Y, Ferzola A, Motter JD, Massie AB, Yu S, et al. The first increase in live kidney donation in the United States in 15 years. *Am J Transpl* (2020) 20(12):3590–8. doi:10.1111/ajt.16136

59. Singh P, Ng YH, Unruh M. Kidney transplantation among the elderly: challenges and opportunities to improve outcomes. *Adv Chronic Kidney Dis* (2016) 23(1):44–50. doi:10.1053/j.ackd.2015.11.002

60. Benes B, Langewisch ED, Westphal SG. Kidney transplant candidacy: addressing common medical and psychosocial barriers to transplant. *Adv Kidney Dis Health* (2024) 31(5):387–99. doi:10.1053/j.akdh.2024.03.002

61. Oganesova Z, MacLaughlin HL, McCafferty K, Potthoff S, Greenwood S, Vickerstaff V, et al. Patient and clinician perspectives on the management of obesity in kidney failure prior to kidney transplantation: a mixed-methods systematic review. *eClinicalMedicine* (2026) 91:103649. doi:10.1016/j.eclinm.2025.103649

62. 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

63. Zhang C, Mathur AK. 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* (2023) 36:11455. doi:10.3389/ti.2023.11455

64. 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

65. Chisholm-Burns MA, Spivey CA, Pickett LR. Health literacy in solid-organ transplantation: a model to improve understanding. *Patient Prefer Adherence* (2018) 12:2325–38. doi:10.2147/PPA.S183092

66. Participants to the Global Summit in Transplantation, organized by the Organización Nacional de Trasplantes under the Spanish Presidency of the Council of the European Union, the European Directorate for the Quality of Medicines and Healthcare–Council of Europe, the European Society for Organ Transplantation, and The Transplantation Society, co-sponsored by the World Health Organization and supported by the International Society of Nephrology in Santander, Spain, November

9 and 10, 2023. Santander statement: towards global convergence in transplantation: sufficiency, transparency, and oversight. *Transplantation* (2025) 109(1):7–9. doi:10.1097/TP.0000000000005286

67. Dor FJMF, Massey EK, Frunza M, Johnson R, Lennerling A, Lovén C, et al. New classification of ELPAT for living organ donation. *Transplantation* (2011) 91(9):935–8. doi:10.1097/TP.0b013e3182129236

68. Pronk MC, Zuidema WC, Weimar W, Van De Wetering J, Ismail SY, Massey EK. Twenty years of unspecified kidney donation: unspecified donors looking back on their donation experiences. *Transpl Int* (2023) 36:10959. doi:10.3389/ti.2023.10959

69. NHS Blood Transplant. Organ and tissue donation and transplantation - activity report 2022/23 (2026). Available online at: https://nhsbtdbe.blob.core.windows.net/umbraco-assets-corp/30198/activity-report-2022-2023-final.pdf?utm_source=chatgpt.com (Accessed May 10, 2026).

70. Mamode N, Norton S, McCrone P, Chilcot J, Draper H, Gogalniceanu P, et al. Barriers to and outcomes of unspecified kidney donation in the UK: bound, a mixed-methods study. *Health Soc Care Deliv Res* (2025) 13(20):1–43. doi:10.3310/RTEW9328

71. Burnapp L, Van Assche K, Lennerling A, Slaats D, Van Dellen D, Mamode N, et al. Raising awareness of unspecified living kidney donation: an ELPAT* view. *Clin Kidney J* (2020) 13(2):159–65. doi:10.1093/ckj/sfz067

72. Ceuppens S, Kimenai HJ, Klop KW, Zuidema WC, Betjes MGH, Weimar W, et al. Unspecified live kidney donation by urological patients. *WJT* (2020) 10(8):215–22. doi:10.5500/wjt.v10.i8.215

73. Rakké YS, Zuidema WC, Hilhorst MT, Erdman RAM, Massey EK, Betjes MGH, et al. Seriously ill patients as living unspecified kidney donors: Rationale and justification. *Transplantation* (2015) 99(1):232–5. doi:10.1097/TP.0000000000000281

74. Van Zwieten A, Wong G. Inequities in pediatric kidney transplantation: time for upstream action to tackle inequities in power, money, and resources. *Kidney360* (2025) 6(6):889–91. doi:10.34067/KID.0000000804

75. Massie AB, Motter JD, Snyder JJ, Levan ML, Segev DL. Thirty-year trends in perioperative mortality risk for living kidney donors. *JAMA* (2024) 332(12):1015–7. doi:10.1001/jama.2024.14527

76. Kortram K, Ijzermans JNM, Dor FJMF. Perioperative events and complications in minimally invasive live donor nephrectomy: a systematic review and meta-analysis. *Transplantation* (2016) 100(11):2264–75. doi:10.1097/TP.0000000000001327

77. Lentine KL, Smith JM, Lyden GR, Miller JM, Booker SE, Dolan TG, et al. OPTN/SRTR 2023 annual data report: Kidney. *Am J Transplant* (2025) 25(2):S22–S137. doi:10.1016/j.ajt.2025.01.020

78. Akin EB, Soykan Barlas I, Dayangac M. Hand-assisted retroperitoneoscopic donor nephrectomy offers more liberal use of right kidneys: lessons learned from 565 cases – a retrospective single-center study. *Transpl Int* (2021) 34(3):445–54. doi:10.1111/tri.13806

79. Banga N, Nicol D. Techniques in laparoscopic donor nephrectomy. *BJU Int* (2012) 110(9):1368–73. doi:10.1111/j.1464-410X.2012.11058.x

80. Özdemir-van Brunschot DMD, Koning GG, Van Laarhoven KCJHM, Ergün M, van Horne SBCE, Rovers MM, et al. A comparison of technique modifications in laparoscopic donor nephrectomy: a systematic review and meta-analysis. *PLoS ONE* (2015) 10(3):e0121131. doi:10.1371/journal.pone.0121131

81. Elmaraezy A, Abushouk AI, Kamel M, Negida A, Naser O. Should hand-assisted retroperitoneoscopic nephrectomy replace the standard laparoscopic technique for living donor nephrectomy? A meta-analysis. *Int J Surg* (2017) 40:83–90. doi:10.1016/j.ijsu.2017.02.018

82. He B, Bremner A, Han Y, Hamdorf JM. Determining the superior technique for living-donor nephrectomy: the laparoscopic intraperitoneal *versus* the retroperitoneoscopic approach. *Exp Clin Transpl* (2016) 14(2):129–38. doi:10.6002/ect.2015.0237

83. Karayagiz AH, Ozdemir E, Besli S, Polatkan SAV, Yilmaz G, Erturk T, et al. Comparison of long-term outcomes of standard and transvaginal kidney extraction in laparoscopic living donor nephrectomy. *J Laparoendoscopic & Adv Surg Tech* (2021) 31(11):1309–14. doi:10.1089/lap.2020.0949

84. Abdessater M, Champy CM, Da Costa JB, Courcier J, Yiou R, Hoznek A, et al. Comparison of the iliac, vaginal and umbilical graft extraction in robot-assisted laparoscopic living donor nephrectomy. *World J Urol* (2021) 39(7):2783–8. doi:10.1007/s00345-020-03462-y

85. Chin CP, Levy M, Awan M, Palese M. Single-port and multi-port robotic donor nephrectomy. *J Endourology* (2025) 39(S1):S66–S71. doi:10.1089/end.2024.0421

86. Serrano OK, Kirchner V, Bangdiwala A, Vock DM, Dunn TB, Finger EB, et al. Evolution of living donor nephrectomy at a single center: long-term outcomes with 4 different techniques in greater than 4000 donors over 50 years. *Transplantation* (2016) 100(6):1299–305. doi:10.1097/TP.0000000000001251

87. Klop KWJ, Kok NFM, Dols LFC, Dor FJMF, Tran KTC, Terkivatan T, et al. Can right-sided hand-assisted retroperitoneoscopic donor nephrectomy be advocated above standard laparoscopic donor nephrectomy: a randomized pilot study. *Transpl Int* (2014) 27(2):162–9. doi:10.1111/tri.12226

88. Spaggiari M, Garcia-Roca R, Tulla KA, Okoye OT, Di Bella C, Oberholzer J, et al. Robotic assisted living donor nephrectomies: a safe alternative to laparoscopic technique for kidney transplant donation. *Ann Surg* (2022) 275(3):591–5. doi:10.1097/SLA.0000000000004247

89. Musquera M, Prudhomme T, Ajami T, Martínez C, Carbonell E, Munni M, et al. Living-donor kidney transplantation: comparison of robotic-assisted *versus* conventional open technique. *Transpl Int* (2025) 38:14953. doi:10.3389/ti.2025.14953

90. Lynch RJ, Ranney DN, Shijie C, Lee DS, Samala N, Englesbe MJ. Obesity, surgical site infection, and outcome following renal transplantation. *Ann Surg* (2009) 250(6):1014–20. doi:10.1097/SLA.0b013e3181b4ee9a

91. Oberholzer J, Giulianotti P, Danielson KK, Spaggiari M, Bejarano-Pineda L, Bianco F, et al. Minimally invasive robotic kidney transplantation for Obese patients previously denied access to transplantation. *Am J Transplant* (2013) 13(3):721–8. doi:10.1111/ajt.12078

92. Tzvetanov IG, Spaggiari M, Tulla KA, Di Bella C, Okoye O, Di Cocco P, et al. Robotic kidney transplantation in the obese patient: 10-year experience from a single center. *Am J Transpl* (2020) 20(2):430–40. doi:10.1111/ajt.15626

93. Atherton SW, Massey MS, Nguyen T, Wang DW, Subramaniam K, Abdelwahid E, et al. Evaluating a unique enhanced recovery protocol in laparoscopic donor nephrectomy: a single center experience. *Clin Transplant* (2023) 37(10):e15051. doi:10.1111/ctr.15051

94. Byrne MHV, Mehmood A, Summers DM, Hosgood SA, Nicholson ML. A systematic review of living kidney donor enhanced recovery after surgery. *Clin Transplant* (2021) 35(7):e14384. doi:10.1111/ctr.14384

95. Thomas RAB, Chalmers HK, Usher HME, Pestrin O, Simpson-Dent EJ, Webb MI, et al. Positive impact of ERAS programme on living and deceased donor renal transplant recipients during COVID-19 pandemic. *Transpl Int* (2025) 38:14238. doi:10.3389/ti.2025.14238

96. Scurt FG, Ewert L, Mertens PR, Haller H, Schmidt BMW, Chatzikyrkou C. Clinical outcomes after ABO-incompatible renal transplantation: a systematic review and meta-analysis. *The Lancet* (2019) 393(10185):2059–72. doi:10.1016/S0140-6736(18)32091-9

97. Mamode N, Bestard O, Claas F, Furian L, Griffin S, Legendre C, et al. European guideline for the management of kidney transplant patients with HLA antibodies: by the European Society for organ transplantation working group. *Transpl Int* (2022) 35:10511. doi:10.3389/ti.2022.10511

98. Klimentova X, Domínguez-Gil B, Viana A, Manlove D, Andersson T, Ashkenazi T, et al. International kidney paired donation programs: Evolution and practices of 4 large collaborations. *Transplantation* (2025) 110:e1209–e1219. doi:10.1097/TP.0000000000005602

99. Van De Laar SC, De Weerd AE, Bemelman FJ, Idu MM, de Vries AP, Alwayn IP, et al. Favorable living donor kidney transplantation outcomes within a national kidney exchange program: a propensity score–matching analysis. *Clin J Am Soc Nephrol* (2025) 20(3):440–50. doi:10.2215/CJN.0000000611

100. Van De Laar SC, Wiltschut BW, Oudmaijer CAJ, Muller K, Massey EK, Porte RJ, et al. Health-related quality of life in living kidney donors participating in kidney exchange programmes. *Clin Kidney J* (2025) 18(2):sfae374. doi:10.1093/ckj/sfae374

101. Furian L, Nicolò A, Di Bella C, Cardillo M, Cozzi E, Rigotti P. Kidney exchange strategies: new aspects and applications with a focus on deceased donor-initiated chains. *Transpl Int* (2020) 33(10):1177–84. doi:10.1111/tri.13712

102. EURO-KEP. European kidney paired exchange programme. Available online at: www.hnbts.hu/euro-kep/european-kidney-paired-exchange-programme-euro-kep (Accessed March 8, 2026).

103. Tong A, Budde K, Gill J, Josephson MA, Marson L, Pruett TL, et al. Standardized outcomes in nephrology-transplantation: a global initiative to develop a core outcome set for trials in kidney transplantation. *Transplant Direct* (2016) 2(6):e79. doi:10.1097/TXD.0000000000000593

104. Tong A, Gill J, Budde K, Marson L, Reese PP, Rosenbloom D, et al. Toward establishing core outcome domains for trials in kidney transplantation: report of the standardized outcomes in nephrology—kidney transplantation consensus workshops. *Transplantation* (2017) 101(8):1887–96. doi:10.1097/TP.0000000000001774

105. Loupy A, Aubert O, Orandi BJ, Naesens M, Bouatou Y, Raynaud M, et al. Prediction system for risk of allograft loss in patients receiving kidney transplants: international derivation and validation study. *BMJ* (2019) 17:l4923. doi:10.1136/bmj.l4923

106. Raynaud M, Aubert O, Divard G, Reese PP, Kamar N, Yoo D, et al. Dynamic prediction of renal survival among deeply phenotyped kidney transplant recipients using artificial intelligence: an observational, international, multicohort study. *The Lancet Digital Health* (2021) 3(12):e795–e805. doi:10.1016/S2589-7500(21)00209-0

107. Ravindhran B, Chandak P, Schafer N, Kundalia K, Hwang W, Antoniadis S, et al. Machine learning models in predicting graft survival in kidney transplantation: meta-analysis. *BJS Open* (2023) 7(2):zrad011. doi:10.1093/bjsopen/zrad011

108. Costa SD, De Andrade LGM, Barroso FVC, Oliveira CMCd., Daher EDF, Fernandes PFCBC, et al. The impact of deceased donor maintenance on delayed kidney allograft function: a machine learning analysis. *PLoS ONE* (2020) 15(2):e0228597. doi:10.1371/journal.pone.0228597

109. Minato ACDS, Hannun PGC, Barbosa AMP, da Rocha NC, Machado-Rugolo J, Cardoso MMd. A, et al. Machine learning model to predict graft rejection after kidney transplantation. *Transplant Proc* (2023) 55(9):2058–62. doi:10.1016/j.transproceed.2023.07.021

110. Nita GE, Rothwell A, Howse M, Ridgway D, Hammad A, Mehra S, et al. Using machine learning to examine pre-transplant factors influencing *de novo* HLA-specific antibody development post-kidney transplant. *Transpl Immunol* (2025) 92:102269. doi:10.1016/j.trim.2025.102269

111. Aubert O, Higgins S, Bouatou Y, Yoo D, Raynaud M, Viglietti D, et al. Archetype analysis identifies distinct profiles in renal transplant recipients with transplant glomerulopathy associated with allograft survival. *J Am Soc Nephrol* (2019) 30(4): 625–39. doi:10.1681/ASN.2018070777

112. EDITH. *EDITH Project. Final Report* (2022). Available online at: www.dso.de/SiteCollectionDocuments/EDITH-Final-Layman-s-brochure.pdf (Accessed March 20, 2024).

113. Council of Europe Recommendation CM/Rec. 7 of the committee of ministers to member states on establishing national harmonised organ transplant registries with a view to facilitating international data sharing (2023). Available online at: https://rm.coe.int/0900001680ac62af (Accessed March 20, 2024).

114. BRAVEST. Building resilience against crisis: a systematic and global approach to adVancE organ safety and supply in transplantation (2024). Available online at: www.bravest-project.eu/ (Accessed March 20, 2024).

115. Jansen N, Maple H, Forsberg A, Loud F, McColaugh L, Murphy M, et al. Building a bridge between patients and transplant healthcare professionals – a descriptive study. *Transpl Int* (2021) 34(11):2098–105. doi:10.1111/tri.14111

116. Vanholder R, Stel VS, Jager KJ, Lameire N, Loud F, Oberbauer R, et al. How to increase kidney transplant activity throughout Europe—An advocacy review by the european kidney health alliance. *Nephrol Dial Transplant* (2019) 34(8):1254–61. doi:10.1093/ndt/gfy390

117. INIT. Council conclusions on enhancing organ donation and transplantation - council of the european union - december 2024. Available online at: https://data.consilium.europa.eu/doc/document/ST-16568-2024-INIT/en/pdf (Accessed January 18, 2026).

118. Hobson O, Lumsdaine J, Sherif A, Oniscu GC. A home education service to increase knowledge of treatment options and improve attitudes to living donor kidney transplantation. *Prog Transpl* (2023) 33(1):95–9. doi:10.1177/15269248221145041

119. Redeker S, Ismail S, Eeren HV, Massey EK, Weimar W, Oppe M, et al. A dynamic Markov model to assess the cost-effectiveness of the kidney team at home intervention in the Netherlands. *Eur J Health Econ* (2022) 23(4):597–606. doi:10.1007/s10198-021-01383-0