

Confronting complexities of uterus transplantation: balancing innovation, risk, and access

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Uterus transplantation (UTx) has evolved from an experimental procedure to an increasingly established infertility treatment for women with absolute uterine-factor infertility. Despite procedural progress, UTx remains a very complex infertility treatment. Here, we examine key complexities and challenges that will shape the future of UTx.

Donor-related considerations include selection criteria for both live and deceased donors to maximize the likelihood of transplantation success. The implications of exposing healthy live donors to risks of postoperative complications, organ availability, and logistical challenges with deceased donation are also explored. Recipient-related challenges encompass the historically high risk of graft failure, immunosuppression risks, pregnancy complications, and reproductive planning to prepare for and optimize the chances of achieving the desired family size.

The potential expansion of UTx to additional patient populations introduces ethical concerns. Access to UTx remains limited by the need for specialized multidisciplinary expertise and substantial financial resources, resulting in significant geographic and socioeconomic disparities. Comparisons with the alternative pathway of gestational surrogacy provide important context for discussions of value and resource allocation. The ethical analysis highlights tensions surrounding acceptable risk in a non-life-saving transplant, protection of live donors, equitable access, and the balance between reproductive autonomy and societal responsibility.

By drawing on perspectives from multidisciplinary UTx-experts, this Views and Reviews article concludes that UTx is an effective and ethically acceptable infertility treatment. Continued accumulation of clinical experience, registry-based outcomes, technological advances, and broader healthcare engagement will be essential to improve safety and efficacy and support the integration of UTx into clinical practice. (Fertil Steril® 2026;126:603–11. ©2026 by American Society for Reproductive Medicine.)

Key Words: Uterus transplantation, donor and recipient, access and cost, ethical dimensions

Over the past 20 years, uterus transplantation (UTx) has emerged as a remarkable extension of reproductive medicine, offering individuals with absolute uterine-factor infertility (AUI) the possibility of gestation. Since the first live birth after UTx in 2014 (1), the field has progressed from experimental innovation to a cautiously expanding clinical endeavor. Yet, unlike other reproductive medicine treatments,

UTx is uniquely complex: it combines major transplant surgery, long-term immunosuppression, and in vitro fertilization (IVF) into a single therapeutic pathway, raising intertwined medical, logistical, and ethical questions that remain incompletely resolved.

Central to these complexities are issues surrounding both donors and recipients. Donor selection remains debated, particularly the balance

between live and deceased donation. Live donors (LDs) allow for planned surgery and detailed preoperative assessment but expose otherwise healthy individuals to significant surgical risks. Deceased donors (DDs) avoid this ethical burden but introduce logistical challenges and potentially greater ischemic injury to the graft. On the recipient side, clinical decision-making is equally nuanced. Candidates must undergo major pelvic surgery followed by immunosuppression, with uncertain long-term risks. Fundamental questions remain: how long should the graft be maintained in situ? Should transplantation be viewed as a temporary intervention limited to one or two pregnancies, or could longer-term graft survival be

Received June 25, 2026; accepted June 25, 2026; published online July 4, 2026.

No funding was obtained for this work.

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Fertil Steril® Vol. 126, No. 4, October 2026 0015-0282/\$36.00

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<https://doi.org/10.1016/j.fertnstert.2026.06.032>

justified? Closely linked are reproductive planning considerations—how many oocytes should be retrieved before transplantation, when stimulation should occur, and whether preimplantation genetic testing for aneuploidy (PGT-A) should be routinely employed to optimize outcomes and minimize time under immunosuppression.

Access to UTx remains limited. The procedure is available only in a small number of specialized centers, requiring multidisciplinary expertise in transplantation, reproductive medicine, and high-risk obstetrics. The financial burden is substantial, and in almost all settings, UTx is not covered by public or private insurance, raising concerns about equity and the potential for this technology to remain accessible only to a limited subset of patients. These clinical and logistical challenges are inseparable from broader ethical considerations. Uterus transplantation is not a life-saving procedure but a quality-of-life intervention, prompting debate over acceptable risk thresholds for donors and recipients alike. Questions of resource allocation, informed consent, reproductive autonomy, and the welfare of resulting offspring further complicate its integration into standard practice.

Given these layered uncertainties and despite the complex issues associated with UTx (Fig. 1; yellow balloons), the procedure is advancing in scope and in technological improvements through increased collection and analyses of registry data as well as clinical experience. The procedure is likely to continue to garner interest by policy makers

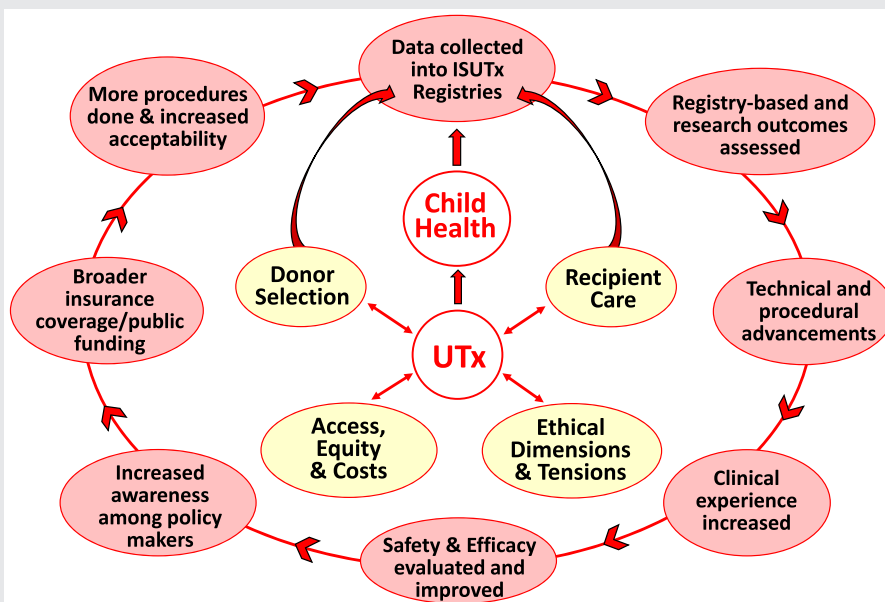
and healthcare providers so that insurance coverage broadens, access and acceptability increase, and more procedures are performed (Fig. 1; rose balloons).

Overall, this “Views and Reviews” is both timely and necessary. By bringing together diverse expert perspectives from both the United States and Europe, we believe that such a piece will move beyond reporting outcomes to critically examine the unresolved questions that will shape the future of UTx. Addressing these complexities will provide guidance for responsible clinical expansion, informing policy, and ultimately ensuring that this transformative technology continues to develop in both a scientifically rigorous and ethically sound framework.

Complexities associated with the uterus donor

A historical perspective of the current predominance of live donation. Although successful uterus transplants have been performed from both LDs and DDs, the majority (approximately 75%) of UTx recipients to date have received a graft from an LD (2–4). The prevalence and precedence of live donation in UTx are unusual in solid organ transplantation, and multiple factors have contributed to the historical dominance of this donor type. First, the UTx field was pioneered by physicians in obstetrics and gynecology who had limited access to the infrastructure needed for DD transplantation; it was thus a logical and pragmatic approach to repurpose a common and familiar

FIGURE 1



The complexities and expected future developments for uterus transplantation. Despite the complex issues associated with uterus transplantation (discussed in this Views and Reviews article and shown in the yellow balloons), the procedure is advancing in scope and in technological improvements through increased collection and analyses of registry data as well as clinical experience. The procedure is likely to continue to garner interest by policy makers and healthcare providers so that insurance coverage broadens, access and acceptability increase, and more procedures are performed (shown in rose balloons). ISUTx = International Society for Uterus Transplantation; UTx = uterus transplantation.

Brännström. Complexities of uterus transplantation. *Fertil Steril* 2026.

surgical procedure (i.e., hysterectomy) for transplantation. Second, whereas the first live birth in the world occurred from an LD graft from a mother to her daughter (1), earlier efforts using a graft from a DD had not met with reproductive success at the time (5, 6), propagating fears that longer ischemic times or the pathophysiology of brain death may hamper outcomes. Third, the elective nature of live donation eased the logistics of organ procurement, provided the opportunity for thorough donor evaluation, and enabled surgeons skilled in the technique to travel to other sites and disseminate the knowledge necessary to establish new programs (7–11).

Uterus transplantation from brain-dead DDs was subsequently pursued to overcome potential complications in LDs. Although no mortality has yet been reported among uterus LDs, the rate of Clavien-Dindo III complications ranges from 12.5% to 25% in contemporary series (8, 9, 12–14), with ureteral or bladder complications necessitating intervention reported by many groups performing the procedure (8, 9, 12–15). The prevalence of urinary tract complications is likely because of the challenging dissection of the ureters from the uterine veins, which must be preserved for transplantation, and with dissection from above the crossing of the uterine artery to the bladder inlet. Although complication rates in LDs have decreased as center experience with the procedure has increased (14), the proximity of the ureters to critical vascular structures and the fragility of the ureteral blood supply are anatomic facts that cannot be altered. Consequently, there is likely a hard limit to how low the urinary tract complication rate can be reduced, even at very experienced centers. In contrast, the risk of complications to a DD is zero.

Why does live donation currently prevail? Given that live donation carries significant risk to the donor, yet reproductive and surgical outcomes for the recipient are similar between donor types (2, 4, 8, 16, 17), it begs the question of why live donation continues to dominate the modern era. Although some groups have suggested that the supply of DDs may not meet demand (18, 19), accurate estimates of both demand for UTx and the supply of DDs complicate interpretation of these studies (20). Further, liberalization of selection criteria for DDs to include nulliparous donors, as well as donation after cardiac death donors, may further expand the deceased donor pool (21).

A more robust explanation for the ongoing enthusiasm for live donation in the current UTx era is logistical ease, combined with the benefits of the additional time afforded by live donation. With respect to logistics, the timing and location of the DD procurement are often not under the control of the procurement surgeons. Surgical procurements may thus occur at odd times and may require travel by the procurement team. Despite these challenges, a DD hysterectomy can be successfully performed in any hospital setting, albeit by surgeons with UTx experience and anatomical knowledge of the complex uterine vasculature because there is no need for special surgical equipment beyond that used for any abdominal surgical procedure. Moreover, portable

hysteroscopes allow thorough gynecologic evaluation for potential pathologic conditions that may preclude donation.

With respect to the benefits of an extended timetable for evaluation, a transplant team has days to weeks to complete donor testing in the elective setting of live donation vs. the time-constrained environment of deceased donation, where testing must be completed within hours to days. To illustrate this point, consider the development of vaginal dysplasia in a recent DD UTx recipient due to human papilloma virus (HPV) infection, which may have been of donor origin. Notably, the HPV status of the DD was unknown because testing of the DD could not be completed before organ retrieval (P. Porrett, personal communication). Although HPV testing can be performed within hours using widely available polymerase chain reaction (PCR)-based assays, given the relative rarity of these cases (22), a transplant center may be unable to justify the investment of resources to expedite results within the time frame necessary to fully evaluate a DD. However, unlike the hard constraint of LD anatomy, time constraints on DD testing are surmountable through the construction of more robust transplant infrastructure.

In concept, the logistical and administrative hurdles presented by DD UTx can be overcome with a strong infrastructure that supports many transplant centers around the world. However, the reality is that there is significant complexity in orchestrating teams of UTx providers with the required expertise for DD procurement and transplantation. Moreover, the infrequent nature of UTx cases and a lack of appreciation for the benefits of UTx may deter transplant center leaders from enhancing existing transplant infrastructure. The advantages of LDs with respect to logistics are thus considerable and appear to be a major ongoing motivator for the use of this donor type. Easing the logistics of deceased donation is clearly an area of opportunity for the field as it continues to grow, because the expansion of deceased donation has the potential to grow the number of available organs to meet demand, as well as limit complications for LDs.

Complexities associated with donor selection: obstetric and surgical history. Donor selection criteria vary considerably around the globe and often reflect the individual transplant center's risk tolerance as well as its ability to overcome logistic barriers to donor testing as discussed earlier. In addition to variability in donor selection based on infectious disease history, transplant centers have varied in their approach to other key elements of donor selection, including the role of parity as well as cesarean section (CS) history. Repeated pregnancies and deliveries promote uterine remodeling, which may impact uterine graft function, and grand multiparity (i.e., at least 5 previous deliveries) has been associated with increased rates of obstetric complications (23). Moreover, a previous CS conveys an increased risk of abnormally invasive placenta, which rises further with multiple CSs. Importantly, IVF is an independent risk factor for abnormally invasive placenta (24). Together, these observations present challenging issues when considering the suitability of a potential donor in UTx. At present, donor selection at many centers is thus restricted to donors with fewer than five

previous deliveries and no more than one or two previous CSs. Expectedly, these criteria will evolve over time as experience continues to grow.

Complexities associated with the uterus recipient

Challenges associated with risk of graft failure. A successful UTx is ultimately defined by a live birth from the uterine graft, which normally occurs at least 1 year after transplantation. Before that, surgical success is defined by the occurrence of spontaneous menstruation, reflecting adequate blood flow and endometrial cyclicality. Most graft failures occur within 3 months after UTx and are typically caused by impaired uterine perfusion secondary to thrombosis or other vascular technical complications involving the arterial inflow and/or venous outflow vasculature (25). Experience to date shows that graft failure occurred within the first few months in 26% of cases, predominant causes being thrombosis and uterine hypoperfusion (2). However, these data include initial cases from newly established centers, and UTx is known to be associated with a steep surgical learning curve. In experienced centers, current graft failure rates are below 5%, likely reflecting both accumulated surgical expertise and more stringent donor selection criteria, particularly regarding donor age and smoking exposure.

Challenges associated with immunosuppression burden and long-term health. Uterus transplantation is unique among solid organ and vascularized tissue allografts, being an ephemeral transplantation, with graft removal after the desired number of children or after no live birth after multiple embryo transfers (ETs). Maintenance immunosuppression (IS), most commonly tacrolimus with azathioprine and/or steroids in UTx (2), comes with well-described long-term side effects such as renal dysfunction, hypertension, diabetes, and malignancy risk. As the allograft is usually removed within 5 to 7 years, this relatively short IS exposure (vs. other types of allogeneic transplants) substantially reduces the risk for serious side effects, although slight, nonreversible reductions in kidney function were reported in some patients retaining uterine grafts for approximately 8 years (26). As recently reported from registry data (2), the three most prevalent IS-related complications during the first posttransplantation year were creatinine levels above 100 $\mu\text{mol/L}$ (6.7%), hematological cytopenia (4.4%), and diabetes (3.3%). To date, a single case of lymphoproliferative disorder, a serious and rare complication of allogeneic transplantation, has been reported in a UTx recipient, who developed malignant lymphoma 3 months after transplantation. The patient achieved complete remission after graft hysterectomy, discontinuation of IS, and rituximab therapy (J. Ekberg, personal communication).

Reassuringly, a study of seven women demonstrated good overall health during the first 4 years after transplantation (27). Nevertheless, longer follow-up and larger study populations are required to fully evaluate long-term health outcomes, particularly regarding renal function and other complications associated with IS therapy.

Challenges associated with high-risk pregnancy and risk of maternal complications. Pregnancy after UTx is the culmination of a lengthy and highly complex treatment pathway that includes technically challenging donor surgery, uterine ischemia-reperfusion injury, vascular anastomosis surgery, IVF and ET, and fetal exposure to maternal IS. Collectively, these factors may contribute to an increased risk of adverse pregnancy outcomes. A recent systematic review, including 40 live births after UTx, found substantially increased risks of maternal complications during pregnancy and perinatal complications of the newborn, although no increased risk of malformations (28). Maternal complications occurring in more than 5% of pregnancies included preeclampsia, premature rupture of membranes, gestational hypertension, gestational diabetes, and placenta previa, with the combined rate of hypertensive disorders of pregnancy being as high as 25%. The reported rate of prematurity (delivery before gestational week 37) at 72.5% was markedly high, but this is partly explainable by planned CS around gestational week 35–36 in many of the elective CS deliveries. An increased rate of mild respiratory distress syndrome was observed in newborns, and this was most likely a consequence of the high prematurity rate.

Challenges associated with how many oocytes, when to retrieve and whether to use PGT-A. Uterus transplantation does not involve transplantation of the fallopian tubes because of the high risk of ischemic injury and subsequent scarring, resulting in a substantial risk of ectopic tubal pregnancy. Furthermore, surgical management of an ectopic pregnancy in a UTx recipient could be particularly challenging due to extensive postoperative adhesions and altered pelvic anatomy, including the repositioning of ureters and vascular structures. Consequently, IVF with cryopreservation of blastocysts is recommended before UTx to obtain embryos with high implantation potential before transplantation. However, if additional embryos are required after UTx to achieve the desired family size, IVF can be performed posttransplantation (27). In such cases, special precautions should be taken to minimize the risks of pelvic infection and bleeding associated with oocyte retrieval, given that recipients are immunosuppressed and have altered pelvic vascular anatomy.

The recommended number of embryos or cryopreserved oocytes will depend on the woman's age and the desired family size. Regarding the 44 singleton births of the International Society for Uterus Transplantation (ISUTx) registry, over 70% achieved a live birth by ET numbers 1 to 3, with an overall live birth rate per ET of 30% (2). Whether to perform PGT-A in the UTx setting presents challenges (reviewed by Brännström et al. [29]). The UTx recipients tend to be young (median age of 30 years; range 21–42 years [2]) and evidence from the general IVF population shows that the technology significantly reduces the cumulative live birth rate among individuals aged <35 years (30). However, there are unique pressures to reduce the time to live birth in UTx patients, and therefore the use of PGT-A in UTx candidates should be individualized rather than routinely recommended.

Challenges associated with duration of graft retention. The recommended time for uterine graft retention is influenced by several factors. These include the number of children desired, overall medical and psychological health, IS therapy tolerance and its associated adverse effect, graft function, the frequency and severity of rejection episodes, reproductive age and fertility considerations, and patient preferences regarding the balance between the benefits of graft retention and the risks associated with prolonged IS, particularly nephrotoxicity. In the original Swedish trial, the maximum duration of uterine graft retention was 7 years, during which the recipient delivered two children before graft removal (27). The first recipient in the Turkish trial retained the graft for more than 9 years, and it was removed immediately after CS delivery of the first child (31).

Expansion to new types of recipients. To date, the most common indication for UTx has been Mayer-Rokitansky-Küster-Hauser syndrome, with more than 85% of recipients in the ISUTx registry having congenital absence of the uterus (2). Other indications have included hysterectomy due to cervical cancer or postpartum hemorrhage, as well as severe Asherman syndrome, in which the native uterus was considered nonfunctional.

Going forward, the spectrum of uterine-factor infertility conditions considered suitable for UTx is likely to expand to include women with functionally inadequate uteri unable to support fetal development to neonatal viability. Other future candidates may include women with severe uterine malformations, extensive adenomyosis, large or multiple inoperable adenomyomas or leiomyomas, and radiation-induced uterine damage. However, UTx in such patients should only be considered after all reasonable medical and surgical treatment options have been exhausted and after repeated unsuccessful attempts to achieve pregnancy, including multiple ETs. Although not without controversy, UTx may eventually be extended to other groups, including genetically XY individuals, women with androgen insensitivity syndrome, and transgender women. In such cases, pregnancy would necessarily be achieved with donor oocytes.

Complexities regarding access to UTx and cost

Although clinical experience with UTx continues to expand, questions surrounding access, cost, and long-term implementation are becoming increasingly important to the future development of the field.

Challenges associated with access to UTx. The limited availability of UTx reflects the considerable infrastructure and multidisciplinary expertise required to establish and sustain a clinical program. Unlike most solid organ transplantations, UTx spans multiple phases of care, from transplantation and assisted reproduction to pregnancy and delivery, and therefore requires close coordination among several disciplines, including transplant surgery, gynecology, reproductive medicine, social/support counseling, transplant immunology, anesthesiology, obstetrics, and neonatal care (32). Consequently, UTx remains concentrated within a small number of highly specialized centers world-

wide (32, 33), which creates significant geographic disparities in access.

Complexities associated with cost for UTx. Even for patients able to navigate the logistical demands of treatment, questions of financing remain a significant obstacle. Although successful pregnancies and live births have increasingly been reported worldwide, most UTx procedures are still performed within research protocols or highly specialized institutional programs, and reimbursement pathways remain poorly defined in many healthcare systems (32). Estimated total costs range from approximately USD 200,000 to 500,000 per treatment cycle across the continuum of care, from transplantation and assisted reproduction to pregnancy and posttransplant management in a US setting (34). However, in a European setting, the cost will be substantially lower, as indicated by the calculations of cost per live birth of approximately EUR 125,000 in the original trial in Sweden, with cost calculations also including graft failures during the learning phase of the procedure and extra procedural costs because of the research setting (35). In some European programs, such as that in Sweden, UTx is now conducted within publicly funded universal healthcare systems covering the entire treatment pathway (27). In contrast, reimbursement by public or private insurers remains uncommon in the United States, where UTx is still largely regarded as an experimental procedure (33). In selected programs, treatment has been offered outside formal clinical trials, creating the possibility of self-funded care (36); however, data regarding the extent and structure of patient self-payment remain limited and are largely derived from individual program reports rather than systematic analyses (32).

Challenges associated with equity, resource allocation, and alternative pathways to parenthood. These differences in funding models and access pathways also raise broader questions regarding equity and resource allocation (37). Patients living in countries with publicly funded programs may have access to treatment regardless of personal financial means, whereas in settings where UTx remains unfunded, access may be limited primarily to those who can afford substantial out-of-pocket costs. Such disparities risk creating a situation in which access to UTx is influenced by socioeconomic circumstances as much as by medical eligibility.

Questions of cost and access also inevitably prompt comparisons with alternative pathways to parenthood, most notably gestational surrogacy, where legally available. In the United States, surrogacy is generally associated with lower direct costs, typically ranging from USD 100,000 to 150,000 per pregnancy (38). However, a purely economic comparison may fail to capture the motivations underlying patients' interest in UTx. For many individuals with AUI, the opportunity to experience pregnancy, childbirth, and the gestational relationship with their child represents a meaningful quality-of-life and bonding benefit that cannot be replicated through surrogacy (36). Consequently, assessments of value based solely on financial costs may underestimate the unique reproductive and psychosocial benefits that UTx could provide. However, the significance of this comparison depends on whether gestational surrogacy is a

realistic alternative in a given setting. Access to surrogacy varies considerably across jurisdictions, ranging from permissive systems to complete prohibition (37). In a great majority of countries, surrogacy remains highly restricted or unavailable, limiting its practical role as an alternative pathway to parenthood. Accordingly, the perceived value and attractiveness of UTx may differ substantially across legal and healthcare environments.

Ultimately, expansion of UTx will require more than continued surgical success and improved clinical outcomes. The future development of the field will depend on whether healthcare systems, insurers, and policymakers consider UTx to have progressed beyond an experimental intervention toward an established procedure (33). This transition presents a circular challenge: broader insurance coverage may depend on demonstrating long-term safety, efficacy, and cost-effectiveness, yet the generation of such evidence requires wider clinical implementation and inclusion of diverse patient populations. If access remains restricted to highly selected research cohorts or self-funded patients, the ability to evaluate UTx as a mature clinical therapy may itself be limited. Addressing questions of reimbursement, infrastructure, and equitable access will therefore be essential for the responsible integration of UTx into routine reproductive healthcare.

Ethical issues associated with UTx

Challenges regarding acceptable risk in non-life-saving transplantation. Much debate has focused on the risk threshold at which it is acceptable to offer and perform UTx, as this is a non-life-saving procedure (39–42). The first point to note is that the risk is not that of a one-time surgical procedure but rather of the whole treatment course, from transplant to pregnancy to graft hysterectomy. And there are also short and long-term risks associated with IS, a treatment necessary for the duration of the graft (43).

The concept of acceptable risk for a non-life-saving transplant is based on the complementary ethical principles of nonmaleficence, beneficence, and respect for autonomy. Nonmaleficence requires that physicians “do no harm”. It is recognized that performing surgical procedures and other invasive interventions will result in pain, scarring, and potential complications. Nonmaleficence in the case of surgical interventions is therefore reframed to require that these procedures do not exclusively result in harm. In the case of UTx, the 44 singleton live births after UTx, with 8 being second births, demonstrate that UTx is both successful and reproducible (2). Moreover, qualitative studies have found that UTx recipients derive value from their experiences with this procedure (44–46). From both clinical and qualitative perspectives, UTx can successfully meet the goals and expectations of recipients and should therefore not be viewed as an exclusively harmful procedure with no potential for benefit.

The concept of beneficence requires weighing the risks and benefits of a procedure to determine whether the balance is acceptable. To date, complications associated with UTx include graft failure, bleeding, rejection, and

pregnancy-related complications such as preeclampsia; however, there have been no deaths associated with this procedure (2, 8, 33, 47). In a qualitative study of UTx recipients in the US, participants reported finding significant value with UTx, and all would undergo the procedure again (46). Even those who did not have a technically successful transplant felt that the experience was worth the risk and complications.

Finally, the acceptability of risk also comes down to informed consent and respect for the autonomy of the potential UTx recipient. Because UTx is still a relatively new field, long-term risks cannot fully be known. However, early complications, risks of graft failure, and the risks associated with IS are established and can be communicated to the potential recipient. Even in an early clinical trial, information on known and potential risks, and unknown risks and potential benefits were disclosed to participants who felt that they had received adequate information to make an informed decision about trial participation, resulting in their experiences being in line with their expectations (45).

Complexities concerning risk to donors vs. benefit to recipients. When LDs are involved in transplantation, further ethical analysis requires determining if the risks of live donation are proportional to the benefits. Much has been debated about the appropriateness of live donation for UTx, given that it is a non-life-saving transplant (48–51).

Rather than balancing the risk to the donor with the benefit to the recipient, there has been a more recent move in bioethics to treat the LD as a patient with potential vulnerabilities (52, 53). This framework can be applied to live uterus donation both for a general assessment of the procedure’s acceptability and for a case-based analysis (54). Overall, the most important message about live donation is that LD risk and potential vulnerabilities need to be independently assessed and discussed without regard to the potential benefit to the recipient. Given that this is not a life-saving transplant, there should not be undue pressure on the potential donor, and due diligence to mitigate or eliminate potential vulnerabilities is essential.

Ethical Issues relating to resource allocation, equity, and disparities. In addition to the ethical evaluation of the acceptability of uterus donation at a clinical and qualitative level are societal considerations for the acceptability of the procedure itself. Specifically, there have been arguments that, as a non-life-saving transplant with high costs, risks, etc., UTx should not be a procedure in which society invests and that resources should be put toward other procedures (55–57). Although UTx is expensive and is not generally covered by private insurance or government health systems, there are women with AUI who have elected to pay for this procedure rather than for adoption or surrogacy, both of which can also be costly. For women who have AUI and want to pursue motherhood, all options will come with costs, risks, and challenges. Moreover, infertility is considered a disease by the World Health Organization, and UTx is the exclusive clinical treatment for AUI. Unfortunately, in most countries, the current landscape of payments for UTx limits access to

those who can afford it, but this is also the case for surrogacy and adoption. However, limited access alone should not be a reason that UTx cannot be offered as a clinical procedure. On the contrary, the only way to increase access, support equity, and decrease disparities is to demonstrate sustained clinical excellence.

Challenges relating reproductive autonomy vs. societal responsibility. A final ethical tension that has been raised within the context of UTx is the balance between reproductive autonomy and societal responsibility (57–60). Specifically, the argument is that if UTx is offered to women with AUI, they will be unduly pressured to undergo this procedure rather than to take a different pathway to parenthood. Those who make this argument follow it to the conclusion that UTx should not be offered at all because of the potential for undue pressure on women with AUI. The opposing argument is that UTx expands the options for women with AUI who desire parenthood and that it should be offered to allow for reproductive autonomy. Moreover, UTx is the only option for women with AUI to have both gestational and biological motherhood, something that they could not achieve with surrogacy and adoption. Thus, not only does it expand reproductive freedom, but it also provides a unique option for women who may value these aspects of motherhood.

CONCLUSION

The opinions put forward in this Views and Reviews article by four experts on UTx highlight the delicate balance among the risks, benefits, access, equity, and ethics of this remarkable innovation (Fig. 1). Reporting to date shows that, despite the challenges intrinsic to such a complex non-life-saving transplantation procedure, UTx is becoming established as an effective infertility treatment that fills a unique niche for women suffering from AUI. Critically, it is access to both donor types that will ultimately enhance access to this life-enhancing care.

As experience increases and, importantly, as more data are collected through both the established ISUTx transplantation registry and the upcoming reproduction-pregnancy-child-adolescent-UTx registry, quality control assessments and further research opportunities will be possible.

Further reductions in graft failure rates can reasonably be anticipated; the safety and efficacy for the LD, recipient, and child will continue to improve, and costs will likely decrease. Further, as more clinical procedures are performed with ongoing safety monitoring and management resulting in further successful outcomes, efforts to secure coverage for expanded access to these procedures can be pursued.

Although UTx is debated among medical ethicists, it is generally agreed that it meets the ethical principles of non-maleficence, beneficence, and respect for people. Although it is likely that such debate will probably continue as new patient groups are found eligible for the procedure, the accumulated findings and analyses of ongoing trials and scientific developments within the field may pave the way for this burgeoning technology to continue its transition

from a pioneering innovation to become accepted clinical practice for the treatment of AUI.

CRedit Authorship Contribution Statement

Mats Brännström: Data curation, Writing – original draft, Writing – review & editing. **Stefan G. Tullius:** Data curation, Writing – original draft, Writing – review & editing. **Paige Porrett:** Data curation, Writing – original draft, Writing – review & editing. **Anji Wall:** Data curation, Writing – original draft, Writing – review & editing. **Catherine Racowsky:** Conceptualization, Data curation, Writing – original draft, Writing – review & editing.

Declaration of Interests

M.B. is Treasurer International Society of Uterus Transplantation (unpaid). S.G.T. has nothing to disclose. P.P. reports funding from National Institutes of Health (NIH, [R01AI177369]); PI: Porrett; awarded to the Institution, (NIH, [U19AI181105]); PI: Lund, Project 2 lead: Porrett; awarded to the Institution (NIH, [R01CA208353]); PI: Freud; Co-investigator: Porrett; awarded to the Institution (NIH, [R01AI145905]); MPI: Porrett; awarded to the Institution outside the submitted work; consulting fees from Kerna Ventures; honorarium from Cornell University Schwartz Visionary Grant Panelist; travel support for Palladino Lecture, West Virginia University; Organ Procurement and Transplantation Network Vascularized Composite Allograft Committee Committee Vice-Chair (unpaid); and International Society of Uterus Transplantation President (unpaid). A.W. reports American Society of Transplantation Ethics committee chair; American Association for the Study of Liver Diseases Counselor at large; and Medical Director at Regional Perfusion Services, LLC. C.R. reports royalties from Cambridge University Press and Wolters Kluwer; consulting fees from Igxyos Pharma and IBSA Pharma SAS; honorarium from Gedeon-Richter; and is Chair, Reproductive Medicine Committee of the French Foundation for Medical Research (unpaid).

REFERENCES

1. Brännström M, Johannesson L, Bokström H, Kvarnström N, Mölne J, Dahm-Kähler P, et al. Livebirth after uterus transplantation. *Lancet* 2015;385:607–16.
2. Brännström M, Racowsky C, Wiik J, Tullius SG, Deans R, Porrett PM, et al. Second report of registry of the International Society of Uterus Transplantation (ISUTx): international activities 2000–2024. *Hum Reprod* 2026;41:541–51.
3. Johannesson L, Richards E, Reddy V, Walter J, Olthoff K, Quintini C, et al. The first 5 years of uterus transplant in the US: a report from the United States uterus transplant consortium. *J Am Med Assoc Surg* 2022;157:790–7.
4. Porrett PM, Johannesson L. A Decade of Progress in Uterus Transplantation in the United States: Results From the World Transplant Congress 2025. Transplantation Published online May 6, 2026.
5. Erman Akar M, Ozkan O, Aydinuraz B, Dirican K, Cincik M, Mendilcioglu I, et al. Clinical pregnancy after uterus transplantation. *Fertil Steril* 2013;100:1358–63.
6. Ozkan O, Akar ME, Erdogan O, Ozkan O, Hadimioglu N. Uterus transplantation from a deceased donor. *Fertil Steril* 2013;100:e41.
7. Testa G, McKenna GJ, Gunby RT Jr, Anthony T, Koon EC, Warren AM, et al. First live birth after uterus transplantation in the United States. *Am J Transplant* 2018;18:1270–4.

8. Chmel R, Novackova M, Janousek L, Matecha J, Pastor Z, Maluskova J, et al. Revaluation and lessons learned from the first 9 cases of a Czech uterus transplantation trial: four deceased donor and 5 live donor uterus transplantations. *Am J Transplant* 2019;19:855–64.
9. Brucker SY, Strowitzki T, Taran F-A, Rall K, Schöller D, Hoopmann M, et al. Living-donor uterus transplantation: pre-, intra-, and postoperative parameters relevant to surgical success, pregnancy, and obstetrics with live births. *J Clin Med* 2020;9:2485.
10. Deans R, Pittman J, Gerstl B, Haghighi K, Pleass H, Kähler PD, et al. The first Australian uterus transplantation procedure: a result of a long-term Australian-Swedish research collaboration. *Aust N Z J Obstet Gynaecol* 2023;63:418–24.
11. Tan HK, Kee TYS, Tan BK, Dahm-Kähler P, Kvarnström N, Nadarajah R, et al. Live donor uterus transplant research project in Singapore: progress of the first case. *Acta Obstet Gynecol Scand* 2025;104:548–58.
12. Ramani A, Testa G, Ghouri Y, Koon EC, Di Salvo M, McKenna GJ, et al. DUETS (Dallas UtErus Transplant Study): complete report of 6-month and initial 2-year outcomes following open donor hysterectomy. *Clin Transplant* 2020;34:e13757.
13. Dahm-Kähler P, Kvarnström N, Brännström M. Robotic live donor hysterectomy. *Curr Opin Organ Transplant* 2021;26:640–5.
14. Jacques A, Testa G, Johannesson L. Robotic live donor hysterectomy for uterus transplantation: an update on donor and recipient outcomes. *J Clin Med* 2024;13:4186.
15. Fageeh W, Raffa H, Jabbar H, Marzouki A. Transplantation of the human uterus. *Int J Gynaecol Obstet* 2002;76:245–51.
16. Ejzenberg D, Andraus W, Baratelli Carelli Mendes LR, Ducatti L, Song A, Tanigawa R, et al. Livebirth after uterus transplantation from a deceased donor in a recipient with uterine infertility. *Lancet* 2019;392:2697–704.
17. Flyckt R, Falcone T, Quintini C, Perni U, Eghesad B, Richards EG, et al. First birth from a deceased donor uterus in the United States: from severe graft rejection to successful cesarean delivery. *Am J Obstet Gynecol* 2020;223:143–51.
18. Kristek J, Johannesson L, Testa G, Chmel R, Olausson M, Kvarnström N, et al. Limited availability of deceased uterus donors: a transatlantic perspective. *Transplantation* 2019;103:2449–52.
19. Dion L, Santin G, Nyangoh Timoh K, Boudjema K, Jacquot Thierry L, Gauthier T, et al. Procurement of uterus in a deceased donor multi-organ donation national program in France: a scarce resource for uterus transplantation? *J Clin Med* 2022;11:730.
20. Pittman J, Abbott J, Cavazzoni E, Pleass H, Brännström M, Rogers N, et al. Deceased donor availability for uterus transplantation in Australia. *Aust N Z J Obstet Gynaecol* 2023;63:780–5.
21. Jones BP, Saso S, Quiroga I, Yazbek J, Smith JR. Limited availability of deceased uterus donors: a UK perspective. *Transplantation* 2020;104:e250–1.
22. Adhikari I, Kataria I, Bhandari P, Siddiqui M, Basu P, Abraham P, et al. Systematic review and meta-analysis of cervico-vaginal high-risk human papillomavirus prevalence in India prior to nationwide human papillomavirus vaccination. *Arch Public Health* 2026;84:120.
23. DeBolt CA, Rao MG, Limaye MA, London V, Sagaram D, Roman AS, et al. Grand multiparity and obstetric outcomes in a contemporary cohort: the role of increasing parity. *Am J Perinatol* 2024;41:815–25.
24. Iacovelli A, Liberati M, Khalil A, Timor-Trisch I, Leombroni M, Buca D, et al. Risk factors for abnormally invasive placenta: a systematic review and meta-analysis. *J Matern Fetal Neonatal Med* 2020;33:471–81.
25. Karlsson CC, Dahm-Kähler P, Kvarnström N, Mölne J, Broecker V, Brännström M. Hysterectomy after uterus transplantation and detailed analyses of graft failures. *Acta Obstet Gynecol Scand* 2022;101:355–63.
26. Ekberg J, Hjelmberg M, Norén Å, Brännström M, Herlenius G, Baid-Agrawal S. Long-term course of kidney function in uterus transplant recipients under treatment with tacrolimus and after transplantectomy: results of the first clinical cohort. *Transplant Direct* 2023;9:e1525.
27. Brännström M, Dahm-Kähler P, Kvarnström N, Enskog A, Olofsson JJ, Olausson M, et al. Reproductive, obstetric, and long-term health outcome after uterus transplantation: results of the first clinical trial. *Fertil Steril* 2022;118:576–85.
28. Brännström M, Bokström H, Hagberg H, Carlsson Y. Maternal and perinatal outcomes of live births after uterus transplantation: a systematic review. *Acta Obstet Gynecol Scand* 2025;104:559–78.
29. Brännström M, Racowsky C, Carbonnel M, Wu J, Gargiulo A, Adashi EY, et al. Uterus transplantation: from research, through human trials and into the future. *Hum Reprod Update* 2023;29:521–44.
30. Harris BS, Acharya KS, Unnithan S, Neal SA, Mebane S, Truong T, et al. Success rates with preimplantation genetic testing for aneuploidy in good prognosis patients are dependent on age. *Fertil Steril* 2025;123:428–38.
31. Ozkan O, Ozkan O, Dogan NU, Bahceci M, Mendilcioglu I, Boynukalin K, et al. Birth of a healthy baby 9 years after a surgically successful deceased donor uterus transplant. *Ann Surg* 2022;275:825–32.
32. Johannesson L, Fischbach C, Walker O, Testa G. Past, present, and future: a review of uterus transplant. *Transpl Int* 2025;38:15325.
33. Testa G, McKenna GJ, Wall A, Bayer J, Gregg AR, Warren AM, et al. Uterus transplant in women with absolute uterine-factor infertility. *J Am Med Assoc* 2024;332:817–24.
34. Polk H, Johannesson L, Testa G, Wall AE. The future of uterus transplantation: cost, regulations, and outcomes. *Clin Obstet Gynecol* 2022;65:101–7.
35. Brännström M, Ekberg J, Sandman L, Davidson T. The costs per live birth after uterus transplantation: results of the Swedish live donor trial. *Hum Reprod* 2025;40:310–8.
36. Wall AE, Brännström M, Lotz M, Racowsky C, Stock P, Järholm S, et al. Evolving ethical challenges after a decade of uterus transplantation: recommendations from the International Society of Uterus Transplantation Ethics Committee. *Transplantation* 2025;109:1836–44.
37. Brännström M, Dahm Kähler P, Greite R, Mölne J, Díaz-García C, Tullius SG. Uterus transplantation: a rapidly expanding field. *Transplantation* 2018;102:569–77.
38. Ethics Committee of the American Society for Reproductive Medicine. Consideration of the gestational carrier: an ethics committee opinion. *Fertil Steril* 2023;119:583–8.
39. Woessner JR, Blake VK, Arora KS. Ethical considerations in uterus transplantation. *Medicolegal and Bioethics* 2015;5:81–8.
40. Mabel H, Farrell RM, Tzakis AG. On gender and reproductive decision-making in uterine transplantation. *Am J Bioethics* 2018;18:3–5.
41. Catsanos R, Rogers W, Lotz M. The ethics of uterus transplantation. *Bioethics* 2013;27:65–73.
42. da Graca B, Johannesson L, Testa G, Wall A. Uterus transplantation: ethical considerations. *Curr Opin Organ Transplant* 2021;26:664–8.
43. Johannesson L, Wall A, Warren AM, Gregg AR, Testa G. Decisions on second pregnancy after uterus transplantation and timing for removal of the uterus-DUETS (Dallas UtErus Transplant Study). *Br J Obstet Gynaecol* 2021;128:1610–4.
44. Järholm S, Enskog A, Hammarling C, Dahm-Kähler P, Brännström M. Uterus transplantation: joys and frustrations of becoming a ‘complete’ woman—a qualitative study regarding self-image in the 5-year period after transplantation. *Hum Reprod* 2020;35:1855–63.
45. Wall AE, Johannesson L, Sok M, Warren AM, Gordon EJ, Testa G. Decision making and informed consent in uterus transplant recipients: a mixed-methods study of the Dallas uterus transplant study (DUETS) participants. *Am J Surg* 2021;222:819–24.
46. Wall AE, Johannesson L, Sok M, Warren AM, Gordon EJ, Testa G. The journey from infertility to uterus transplantation: a qualitative study of the perspectives of participants in the Dallas Uterus Transplant Study. *Br J Obstet Gynaecol* 2022;129:1095–102.
47. Testa G, McKenna GJ, Bayer J, Wall A, Fernandez H, Martinez E, et al. The evolution of transplantation from saving lives to fertility treatment: DUETS (Dallas UtErus Transplant Study). *Ann Surg* 2020;272:411–7.
48. Wall A, Testa G. Live donation, listing, and prioritization in uterus transplantation. *Am J Bioeth* 2018;18:20–2.
49. Dion L, Tardieu A, Garbin O, Ayoubi JM, Agostini A, Collinet P, et al. Should brain-dead or live donors be used for uterus transplantation? A statement

- by the CNGOF French Uterus Transplantation Committee (CETUF). *J Gynecol Obstet Hum Reprod* 2019;48:9–10.
50. Kvarnström N, Enskog A, Dahm-Kähler P, Brännström M. Live versus deceased donor in uterus transplantation. *Fertil Steril* 2019;112:24–7.
51. Robertson JA. Other women's wombs: uterus transplants and gestational surrogacy. *J Law Biosci* 2016;3:68–86.
52. Ross LF, Thistlethwaite JR Jr. *The living organ donor as patient: theory and practice*. Oxford, United Kingdom: Oxford University Press; 2021.
53. Perera MT. The living organ donor as patient. *Lancet Gastroenterol Hepatol* 2022;7:990.
54. Wall AE, Testa G. Live donor ethics and uterus transplantation. *Perspect Biol Med* 2023;66:195–209.
55. Blake VK. Financing uterus transplants: the United States context. *Bioethics* 2018;32:527–33.
56. Davidson T, Ekberg J, Sandman L, Brännström M. The costs of human uterus transplantation: a study based on the nine cases of the initial Swedish live donor trial. *Hum Reprod* 2021;36:358–66.
57. Sandman L. The importance of being pregnant: on the healthcare need for uterus transplantation. *Bioethics* 2018;32:519–26.
58. O'Donovan L. Pushing the boundaries: uterine transplantation and the limits of reproductive autonomy. *Bioethics* 2018;32:489–98.
59. Alghrani A. Uterus transplantation: does procreative liberty encompass a right to gestate? *J Law Biosci* 2016;3:636–41.
60. McTernan E. Uterus transplants and the insufficient value of gestation. *Bioethics* 2018;32:481–8.