# How Do You Donate Life When People Are Not Dying: Transplants in the Age of Autonomous Vehicles

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Bruno and Arora (2018) raise novel ethical concerns regarding uterine transplants, including issues relating to living versus dead donors, and existing allocation complications given the limited supply of organs. The situation, unfortunately, will likely get worse before it gets better.

How? While there are differences of opinion as to when autonomous or self-driving cars will actually invade our roads—some car manufacturers are predicting consumer-ready self-driving cars as early as 2021—there is broad consensus that their inevitability is assured. And while there are clear positive social consequences that will result from self-driving cars and trucks, there are also a number of often less appreciated negative externalities. Balanced against the saved lives, minimized commutes, reduction in pollution, and general decrease in daily stress are the driving-related job losses and the reality that there will be fewer organ donors.

It is estimated that nearly 20% of organ donors come from car accidents. The vast majority of these accidents are the result of human error, error that will be progressively minimized as autonomous vehicles increasingly come online and traffic accidents become rarer (Lipson and Kurman 2016). This imminent arrival of autonomous vehicles over the next decade will put huge strains on already strained national organ donor systems.

This impending shortage will force some reassessment of how the even-now-limited supply of organs will be allocated. Moreover, it could further limit the transfer of non-life-dependent organs, like uteri, due in part to the triage of lifesaving donations over other types of donations.

Nevertheless, we cannot lay all the blame for the diminishing stock of donatable organs on the hoods of autonomous vehicles. Longer lives, drones that can provide necessary and lifesaving drugs on demand, other technological innovations in medicine, and even advances in car safety systems all eat away at an already limited donor population that, by some estimates, currently underprovides the putative recipient population by more than an order of magnitude (Giwa 2017).

There are no quick fixes, and current laws already place significant restrictions on the organ acquisition process. Buying and selling organs is nearly universally objectionable, unethical, and illegal (Participants in the International Summit on Transplant Tourism and Organ Trafficking Convened by The Transplantation Society and International Society of Nephrology 2008). Some countries even ban any benefit, or any form of valuable consideration whatsoever, in exchange for an organ (Caulfield et al. 2014). Some jurisdictions go even beyond this altruistic-only donor requirement, and allow live donations only among blood relatives (India 1994).

However, even these universal attitudes have some specific exceptions: In many countries, blood donors are paid, and sperm and egg donors can receive thousands of dollars in remuneration. But just because a handful of tissue donations have been commodified (albeit sometimes obfuscated as gifts with financial consideration), it is not clear that this cash for contribution system will expand anytime soon to include other types of living donations, such as liver lobes or kidneys. To wit: While New York sperm donors can make more than a thousand dollars a month (Lewinnov 2016), surrogacy contracts are still void and unenforceable by law (New York 2014).

Nevertheless, in light of the need for organs, a number of jurisdictions have tried to indirectly incentivize donation, either through financial or non-financial mechanisms. Such incentives include paying for funeral costs of non-living donors, or for the out-of-pocket expenses

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directly associated with transplantation (Organ Donation and Recovery Improvement Act 2004).

Israel, for example has initiated both financial and nonfinancial incentives. It provides reimbursement for all medical costs resulting from the donation process for live donations (e.g., kidney), as well as reimbursements for any lost work and travel costs for the donor. In many other jurisdictions, the organ recipient, or his or her insurance, will cover these costs.

The Israeli government also exempts donors, in the short term, from paying the medical tax levied on all citizens for access to universal health care, and even throws in free admission to all national parks (Ministry of Health, State of Israel). In terms of nonfinancial benefits, for both living and nonliving donors, Israel provides priority on transplants lists for former living donors, for the first-degree relatives of nonliving donors and even for those who simply sign up to donate.

These unorthodox methods have already begun to pay off for recipients. The year 2017 saw a 35% increase in donations over the previous year (Siegel Itzkovich 2018). The incentives have also paid off for donors and potential donors: 37% of those receiving organs in 2017 were prioritized on the transplant list simply because they themselves had registered as donors.

While incidental incentives seem to help increase organ donations, some scholars have suggested more direct incentives, potentially through a government- or insurance-run marketplace (Hansmann 1989). These are not necessarily unachievable. While economist Alvin Roth identifies organ sales as currently universally repugnant, he notes that like other formerly 'repugnant' transactions, such as charging interest on loans, indentured servitude, and selling horsemeat, changing values and social mores change the acceptability of such transactions over time (Kessler and Roth 2014).

Perhaps we are even starting to see such changes in on organ transactions: In the United States, the law once explicitly forbade any valuable consideration for a transplanted organ (42 U.S. Code § 274e). More recently, however, the law has excepted donor exchanges, wherein pairs of incompatible donor and recipients provide a compatible transplant to the corresponding and compatible recipient in another pair (42 U.S. Code § 274e(c)(4)).

Nevertheless, social policies and the economics of organ trade will take a long time to evolve. However, just as technology can exacerbate the organ shortage problem, technological innovations can also be used to mollify the situation perhaps more quickly than innovative policies, and also in different ways.

Broadly, innovations in robotics and three-dimensional (3D) printing may provide for the creation of new organs, or their substitutes, relieving stress on an already strained supply.

More specifically, while more simple hollow organs have long been created artificially, recent developments in regenerative medicine have expanded the ability of researchers to adeptly create even solid organs. This includes research into growing chimera organs in other species, or to 3D printing organs with innovative biomaterials and pluripotent stem cells (Murphy and Atala 2014), or even in space (NASA 2017). Scientists can even grow organs in vivo (Marx 2015), using optimally proportioned humanoid robot bodies as bioreactors (Mouthuy and Carr 2017). Other groups have created robot organs, or robots that help to revitalize incapacitated organs (Park 2014).

Not only will technology increase the number of available organs, but it will also increase the likelihood of current organs not going to waste. Examples here include helping to preserve organs until optimal matches can be located, or by bypassing the donor matching problem—wherein available organs are discarded when no matching recipient is available—through growing biocompatible recipient stem cells on decellularized incompatible organs that already have an intact and complete organ architecture and vasculature system (Damania 2017).

We don't even have to wait for the fantastic future of autonomous vehicles and robots: One group has overcome some of the difficulties in creating viable organs by employing a cotton candy machine to spin a tissue-like structure (Lee 2016). ■

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# Experience and Ethics at the "Cutting Edge": Lessons From Maternal–Fetal Surgery for Uterine Transplantation

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Bruno and Arora (2018) present a range of important ethical issues emerging from the development of procedures for uterine transplant (UT). They approach those issues by drawing on parallels to other deceased and living donor transplant procedures. While helpful, this approach is incomplete. To complement and add to the valuable insights from these parallels, in particular the moral justifications and procedural coherence needed to ensure robust informed consent protections for living donors, we suggest that additional parallels and significant lessons may be learned from the experimental phase of another complex, highly valenced surgical procedure regarding reproductive care: maternal–fetal surgery for spina bifida (MFSSB).

Both UT and MFSSB are elective, experimental, technically complex surgical procedures. Both aim toward creating alternatives with respect to pregnancy: In UT, the very possibility of a pregnancy is created; in MFSSB, the possibility of a lessened (or different) disability for the existing pregnancy is created. For both surgeries, this aim entails a patient dyad: in UT, a living donor and a recipient; in MFSSB, a pregnant woman and a fetus/baby. Both surgeries also demand a complex appraisal of risks and potential benefits for both parties in the dyad. In UT, the potential risks and physical harms to the donor are justified by the chance of psychological, social, and other nonphysiological, nonmedical benefits to the donor as well as by the potential physiological (and psychological, social, and other nonmedical) benefits to the recipient (Bruno and Arora 2018). In MFSSB, the potential risks and physical harms to the pregnant woman are justified by the psychological, social, and other nonphysiological, nonmedical benefits to the pregnant woman as well as by potential physiological (and perhaps psychological and social) benefits to the fetus/baby (Bartlett 2010). Finally, both procedures emerge within deeply contested and complex constellations of social, religious, and moral values around reproductive health and pregnancy, highlighting that biological motherhood is often granted special normative weight (Shanner 1996). Such constellations of values also influence the medico-technological responses—responses that contribute to

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