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Out of Sequence Offers: Towards Efficient, Equitable Organ Allocation

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Organs for transplant are very scarce compared to the need, and so the allocation of organs from deceased donors raises questions about both efficiency and fairness. Because offers of organs take time to consider, and because the viability of organs from deceased donors decreases over time, efficiency sometimes requires increasing the chance of reaching a patient who will accept the organ while it remains viable. So fairness and efficiency, concerning who gets to consider the next offer, and the probability that the organ on offer will be accepted in time for it to be transplanted, may sometimes be in conflict, or at least appear to be. And even the appearance of unfairness may undercut trust in the system of organ donation and transplantation.

This conflict between fairness and efficiency has resulted in controversy about offers made “out of sequence” (Covered in a lead article in the NYT article (Times 2025)). The issues require some description of how organs are presently allocated and what happens when there is concern that an organ that could have been transplanted will be wasted.

As soon as an organ from a deceased donor becomes available for transplant, a priority order is generated over eligible potential recipients of that particular organ who are active on the waiting list, compatible with that organ, and haven’t indicated in advance (through filters filed by their transplant center) that this organ would not be accepted and should not be offered to them. Preliminary offers of the organ may be made even before it has been recovered from the deceased donor (Guan et al. 2025). In principle, the organ will be offered to each potential recipient in priority order, until it is accepted for some patient or until it has been rejected for all patients. But offers take time, and an organ that has been rejected many times after being recovered accumulates cold ischemia time (CIT). Too much CIT will render the organ unfit to transplant (Debout et al. 2015; Peters-Sengers et al. 2019), and so as time passes,

there is increased urgency to offer it to a patient on whose behalf it will be accepted (Barah et al. 2022; Guan et al. 2025).

Presently, the priority order can depend on organ quality estimated before organ recovery. For example, younger candidates (or candidates with a high expected post-transplant survival score) are given priority for kidneys with a lower risk index, captured by the Kidney Donor Percentile Index (KDPI), determined from data about the deceased donor prior to organ recovery. (Note that lower KDPI is a sign of higher organ quality.) But additional informative signals about organ quality, including biopsy results, and reasons that prior offers of this organ were refused, arrive during the allocation process. This information can be helpful in reevaluating an organ’s quality and risk of not being utilized (Barah and Mehrotra 2021; Guan et al. 2025). For instance, an organ from a young donor with poor biopsy results no longer looks like a high quality organ, but is presently still offered to young candidates prioritized for low KDPI kidneys. Patients and their surgeons who are offered such organs may choose to decline and wait for higher quality organs. These offers add to the congestion that delays finding a candidate who will accept the organ (Roth 2008).

Allocation ‘out of sequence’ refers to offering an organ out of the priority order generated for that organ before the first offer was made. Organ Procurement Organizations (OPOs) have been increasingly placing organs out of sequence to combat increases in the number of non-utilized organs (King et al. 2022; Liyanage et al. 2025). Reasons associated with this are a large increase in the recovery of marginal quality organs (Bae et al. 2025; Bradbrook et al. 2025) and a corresponding increase in the number of offers per organ (Cron et al. 2023).

Out of sequence allocations are currently often made through open offers to transplant centers. Open offers permit the center to choose which of their

patients will receive the organ, perhaps out of sequence. How and when out of sequence offers are made varies across OPOs, so the decision to skip some patients who might have received offers is not transparent and raises equity concerns.

Expediting organs could be done in a transparent way by developing protocols for generating a new priority list as new information on organ quality becomes available. An adaptive list would determine the next patient to whom an offer should be made, based on existing information after the latest offer is refused. The next offer would not skip patients in a preexisting priority order: it would depend on information available when the offer was made.

IDENTIFYING HARD-TO-PLACE ORGANS

One ingredient for an adaptive policy is gathering real time information about organ quality. Centers interested in an organ typically wait for medical indicators after the organ is recovered. Guan et al. (2025) find that refusals due to biopsy reasons arrive at least 2 hours after organ recovery, and a substantial increase in refusals due to CIT is notable 4 hours after recovery (by this time an organ at risk, i.e. from a donor for which one kidney was eventually unutilized, will have been offered to fewer than 17 centers on average). Beyond these informative indicators, Guan et al. (2025) finds that reasons recorded accompanying organ refusals even prior to recovery can assist with the decision to expedite the placement of an organ. They document that centers often decline an offer to more than one of their patients at the same time (69% of offer refusals were part of center multi-patient refusals in 2022–2023 and 26% of center refusals arrived before organ recovery) and find that just a few multi-patient refusals by centers even before organ recovery indicates a substantial increase in the risk of the organ not being utilized. (One multi-patient refusal before recovery increases the non-utilization rate from 28% to 35% and five center refusals increases this likelihood to 88%). Moreover, kidneys from donors with KDPI < 20 (top 20%) with at least three multi-patient refusals before recovery had a similar placement pattern to kidneys from donors with much lower estimated quality (KDPI between 61% and 85%).¹

¹Notably, the utilization likelihood increases with single-patient refusals. For example, non-utilization was reduced from 28% to 12% following one single-patient refusal before organ recovery. This may arise for instance if surgeons first review a kidney to see if it is suitable to transplant into any patient, and only if it is do they consider the particular patient to whom it is being offered.

PREFERENCES

Eliciting preferences of patients as well as transplant centers can also help to allocate hard to match organs expeditiously. Preferences would help with expediting by making it easier to identify patients for whom an offer would likely be accepted, or rejected. This might have to be accompanied by appropriate risk adjustment for centers so that they could accept kidneys with a lower than 90% 1-year graft survival (as in the old donors for old recipients program in France). Currently centers can screen out offers by setting acceptance criteria for organs (e.g. patients need to provide consent for being transplanted with kidneys with KDPI > 85.). However, many organs, even transplanted ones, are still offered to hundreds and thousands of patients (Agarwal et al. 2021; Cron et al. 2023), i.e. they pass through centers' filters but are still rejected. Tools for predicting offer refusals could recommend additional filters to transplant centers based on their historical pattern of rejections.

During the offering process, upon declining an organ, the associated center can also be asked whether it is still interested in the organ and for which patients (and so which of its additional patients do not need to receive an offer). Moreover, each center can prepare a small group of patients who have indicated they are ready to receive transplants of expedited organs with marginal quality. This is especially helpful when centers keep a larger group of patients nominally active (but potentially not ready) on the waitlist.

Knowing patients' preferences will also help with accurate prescreening, reducing congestion. A potential challenge is that patients' preferences may change over time. But it would be helpful to know patients' preferences between waiting a long time for a high quality organ or quickly accepting a lower quality organ.

FURTHER THOUGHTS FOR EXPEDITING ORGAN PLACEMENT

Once an organ is identified to be of marginal quality, there are different ways an adaptive priority can be implemented to expedite its placement. Below we discuss several principles and strategies that can be tested over time and in different regions to help place marginal quality organs.

1. Both utilization and equity should play a role in expediting offers. Centers and patients vary substantially in their risk preferences and currently out of sequence transplants are highly

concentrated in a small number of centers (Liyanage et al. 2025). While preferences would help with placing marginal organs, accounting for them should be done in a transparent and equitable way. For example, some centers may refuse to take an organ 10 hours after recovery, but would accept it had it been offered quickly. We should form expectations about their likelihood of accepting an organ for different types of patients (based on its updated quality including its CIT). When we get to the point of the offer process where we think there's a substantial risk that a transplantable organ will go unused, we shouldn't necessarily make the next offer to the patient or center most likely to accept, but neither should we plan to make offers to a sequence of centers that are very likely to reject.

2. Simultaneous offers of a hard-to-place organ can be made to multiple patients on the list. The benefit is reaching many patients quickly. The drawback is increasing the burden surgeons bear by evaluating offers that they may not be able to transplant even if they accept, if the offer is also accepted for a higher priority patient.
3. Open offers to transplant centers allow centers to use their information about patients but also raise the possibility that they allocate to favored patients out of sequence. An alternative might be to expedite offers to multiple centers at a time, with the center which accepts on behalf of a higher priority patient getting the organ. The fast-track system in the UK is a special case of this approach: it makes an open offer to all centers after a few organ related refusals. In the UK, however, there are only 12 transplant centers in comparison to more than 200 transplant centers in the US. So it will be helpful to manage the batch size to make it likely that centers who are likely to accept would be able receive the organ.
4. While the current system prioritizes younger patients for high quality organs it does not prioritize older patients for receiving offers of marginal quality organs. One possibility is to add priority points to the current system so that such organs would reach older patients more quickly.

DATA AND EXPERIMENTATION

Collecting data is essential for both efficiency and transparency. It is unfair to future patients not to have transparent allocation systems that can be studied with precision (with causal inference from

experimentation), so that it can be improved over time. It is also unfair to future patients who will join increasingly congested waiting lists as a result of the failure to utilize a large number of transplantable organs.

Public data about transplant centers' performance and patients' waiting times would further allow patients to choose, based on their own preferences, a transplant center that fits their need.

Comprehensive organ allocation data would allow policies to be well analyzed. Data regarding all offers should be collected. Presently the times at which primary offers (offers following provisional acceptances) are made are not recorded. Also open offers that are not accepted are not recorded. Reasons for rejecting an offer (which are chosen from a fixed menu) could be made more informative (presently some, such as 'organ size', could reflect either a judgment of the organ quality or of the suitability for a particular patient).

Achieving and maintaining efficient and equitable allocation will benefit from regular, ongoing experimentation with different policies and parameters, particularly as patients, centers, and OPOs change their behavior in response to policy changes.² And different policies may work differently in different regions of the country, which have different patient populations and different numbers and density of transplant centers.

Policies to expedite the placement of marginal quality organs that can be tested over time and studied with experiments include when to determine an organ is hard-to-place and when and how to adapt the priority list.

In summary, it is sometimes desirable to expedite an organ that risks being unused, by offering it to a patient or transplant center that is likely to accept it if the offer is received in a timely way. But it is important to make sure that this flexibility does not promote unfairness to patients or transplant centers. Increasing the transparency and efficiency of the system for expediting organs can address both these issues.

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No potential conflict of interest was reported by the author(s).

²It is important to account for updated organ quality and patient status. For example, a center declining an offer of an organ for a patient with high priority does not imply that the center will not accept the organ if it is offered quickly to a patient with a long expected waiting time. Presently, acceptance models used for policy design do not model CIT explicitly (see <https://www.srtr.org/tools/offer-acceptance/>).

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