Accelerating Kidney Allocation: Simultaneously Expiring Offers

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Article type :Original Article

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This article has been accepted for publication and undergone full peer review but has not been through the copyediting, typesetting, pagination and proofreading process, which may lead to differences between this version and the Version of Record. Please cite this article as doi: 10.1111/ajt.15396

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Abbreviations

KAS, Kidney Allocation System

KDPI, Kidney Donor Risk Index

OPTN, Organ Procurement and Transplantation Network

KPSAM, Kidney-Pancreas Simulated Allocation Model

SRTR, Scientific Registry of Transplant Recipients

DSA, Donation Service Area

KFTS, Kidney Fast-Track Scheme

DBD, donor after brain death

DCD, donor after cardiac death

PODD, Probability of Discard or Delay

OPO, organ procurement organization

DGF, delayed graft function

ABSTRACT

Placing non-ideal kidneys quickly might reduce discard. We studied changing kidney allocation to eliminate sequential offers, instead making offers to multiple centers for all non-locally allocated kidneys, so that multiple centers must accept or decline within the same one hour. If more than one center accepted an offer, the kidney would go to the highest-priority accepting candidate. Using 2010 KPSAM-SRTR data, we simulated the allocation of 12,933 kidneys, excluding locally allocated and zero-mismatch kidneys. We assumed that each hour of delay decreased the probability of acceptance by 5%, and that kidneys would be discarded after 20 hours of offers beyond the local level. We simulated offering kidneys simultaneously to small, medium, and large batches of centers. Increasing the batch size increased the percentage of kidneys accepted and shortened allocation times. Going from small to large batches increased the number of kidneys accepted from 10,085 (92%) to 10,802 (98%) for low-KDPI, and from 1,257 (65%) to 1,737 (89%) for high-KDPI kidneys. The average number of offers a center received each week was 10.1 for small batches and 16.8 for large batches. Simultaneously expiring offers might allow faster allocation and decrease the number of discards, while still maintaining an acceptable screening burden.

INTRODUCTION

With the implementation of the Kidney Allocation System (KAS), there were concerns that increased regional and national sharing would lead to increased cold ischemia time and increased discards. In the two years since KAS implementation, kidney discards from donors with KDPI above 85%, donors with diabetes, and donors 65 years and greater have increased. Prolonged delays in the allocation of kidneys, particularly non-ideal kidneys, make these organs increasingly more difficult to allocate as cold time accumulates (1).

To improve the efficiency of organ placement, the OPTN implemented a new policy in May 2018 that reduced the time limit for responding to an organ offer and established a new time limit for the primary transplant center to make a final decision on an organ offer (2). Now, after receiving an initial organ offer notification, a transplant center has one hour to submit a provisional yes or to refuse the offer. Once the transplant center has received all required deceased donor information, it has one hour to either accept or refuse the offer. Under the previous policy, there was no time limit for accepting an offer.

Prior to a final acceptance from the transplant center for the primary candidate, other transplant centers can evaluate the offer and enter a no or a provisional yes. If the primary transplant center refuses the offer, a new primary candidate is determined. The transplant center of the new primary candidate has thirty minutes to either accept or decline the offer. The new time limits for review and acceptance of organ offers demonstrate the OPTN's intent to reduce delays in the organ offer process. The offers still expire sequentially, though, so each transplant center could add significant cold ischemia time as the placement process continues (Figure 1A).

We propose an alternative system of making simultaneously expiring offers to batches of multiple centers for kidneys. All centers in the batch receiving those offers would have one hour to make a final decision (Figure 1B). If more than one center accepts the offer, it goes to the center with the highest priority candidate. If none of the centers accepts the offer, then it is offered to another batch of centers with a simultaneously expiring one hour time limit. In this system, centers that accept a kidney and later decline it should be able to demonstrate that exceptional circumstances required this reversal. This system might increase workload by forcing centers to evaluate more offers, but it might accelerate the allocation of kidneys and decrease discards, so we examined tuning this tradeoff.

We simulated making simultaneously expiring offers of regionally and nationally shared kidneys to varying numbers of transplant centers in small, medium, or large batches. For low (<=85%) and high KDPI (> 85%) kidneys, we quantified placement time and discard. We measured the increased workload from evaluating more offers by quantifying the average number of offers received by a center each week. We hypothesized that increasing the batch size would decrease the time needed for placement and decrease the likelihood of discard.

METHODS

Model Specifications

Inputs for our simulation were obtained from the 2010 Kidney-Pancreas Simulated Allocation Model (KPSAM) (3) developed by the Scientific Registry of Transplant Recipients (SRTR). This study used data from the Scientific Registry of Transplant Recipients (SRTR). The SRTR data system includes data on all donor, wait-listed candidates, and transplant recipients in the US, submitted by the members of the Organ Procurement and Transplantation Network (OPTN), and has been described elsewhere (4). The Health Resources and Services Administration (HRSA), U.S. Department of Health and Human Services provides oversight to the activities of the OPTN and SRTR contractors.

Using KPSAM, for each kidney, we generated a ranked list of matching candidates at both the regional and national level of allocation. We excluded 0-MM kidneys and kidneys that were allocated locally by KPSAM. The probability of acceptance for each kidney-candidate pair was obtained from KPSAM (5). We assumed that kidneys were offered after cross-clamp, and that for each additional hour of simultaneous offers, the acceptance probability was 5% lower than the initial value calculated by KPSAM. We also performed a sensitivity analysis, adjusting the decrease in acceptance probability to 3% and 7%.

Batching Procedure

We simulated making simultaneously expiring kidney offers to multiple centers in batches of varying sizes. An example of the batching procedure for a batch size of 3 is shown in Table 1. The first column contains a ranked list of candidates, and the second column shows their corresponding transplant center. For a batch size of 3, we include the highest priority candidates from three centers (patients one through six). Patient 7 is excluded from the first batch because they are listed at center D, and only candidates from three centers (A, B, and C) are allowed with a batch size of three. If the kidney is not accepted by any of the centers in the first batch, it will be offered again in the second batch to candidates from three new centers (D, E, and F). Ranked candidates from centers A, B, and C are also included in the second batch, but this does not increase the surgeons' screening burden because these centers are already familiar with the offer from the first batch.

Geographic Level of Allocation

Our simulation excludes kidneys allocated locally by KPSAM to focus our study on accelerating the allocation of harder-to-place kidneys. If a kidney is not placed locally, it is offered regionally in batches according to that region's ranked candidate list. The kidney is offered sequentially in batches until the kidney is accepted by a center, or until the regional list is exhausted. If the regional list is exhausted, then the kidney is offered nationally in batches according to the national ranked candidate list. We assumed a kidney is discarded after 20 batching rounds, which is equivalent to 20 hours of non-local (i.e. regional or national level) placement time since each round is one hour.

For example, if a kidney is not placed locally in Baltimore's DSA, it will then be offered to the ranked candidate list of Region 2 in sequential batches. If the batch size is 3 and there are 35 transplant centers in region 2, then the kidney will be offered in no more than twelve batches before the regional list is exhausted. If the regional list is exhausted, the kidney is then offered nationally. We defined a kidney as discarded if it is not accepted after being offered in twenty sequential batches. In this example, since the kidney was offered in twelve batches at the regional level, it can be offered in at most eight batches at the national level before we classify it as discarded.

Quantifying the Burden of Increased Offers

Offering kidneys to multiple transplant centers simultaneously will increase workload due to an increased number of offers each center must evaluate. We quantified the burden of increased offers in three ways. The first measure is the average number of non-local offers to a center per week. In the scenario shown in Table 1, we counted one offer for each of centers A, B, C, D, E, and F during the two rounds of batching. Even though center A had three candidates in the first batch, we counted this as one offer since it is one organ being evaluated. For the patient in the second batch from center A, we did not count this as an additional offer because center A was already familiar with the offer from the first batch, so it would have imposed minimal additional burden.

The second measure is the average number of centers that received an offer per kidney. This was calculated by taking the total number of centers that received an offer and dividing it by the number of kidneys that were offered. For example, if 8,000 center-level offers were made for 100 kidneys, then the average number of center-offers made per kidney is 80. We calculated this at both the regional and national level.

The third measure is the disappointment probability defined as the percent of cases when a center accepted an offer, but it went to a higher ranked candidate at a different transplant center. The disappointment probability was calculated as one minus one divided by the number of centers who accepted an offer (A) during a batching round, 1-(1/A). For example, in Table 1 during the first batching round, if centers A and C accepted the offer, the disappointment probability is 50% (1 – ½).

Batching Scenarios

We simulated three different scenarios with small, medium and large size batches of centers that receive simultaneously expiring offers. In the small batch scenario, we used a batch size of 2 centers at the regional level and 5 centers at the national level. In the medium batch scenario, we used a batch size of 5 centers at the regional level and 10 centers at the national level. In the large batch scenario, we used a batch size of 10 centers at the regional level and 20 centers at the national level.

RESULTS

Study Population

From KPSAM, match runs for 12,933 kidneys were input into our simulation. Of these, KPSAM predicted that 9,536 would be placed locally and 251 would be discarded after being offered to more than 200 local candidates. We used the remaining 3,146 kidneys in our simulation of simultaneously expiring offers at the regional and national level. From the 9,536 kidneys that were placed locally, only 8.9% had KDPI > 85%. Of the 251 kidneys that were discarded at the local level, 47.4% had KDPI > 85%. Of the 3,146 kidneys that we used to simulate simultaneously expiring offers at the regional and national levels, 30.8% had KDPI > 85%.

Cumulative Acceptance Percentage

Table 2 shows the cumulative acceptance percentage as each kidney went from local to regional to national offers. At the regional level, changing the batch size had little impact on the cumulative acceptance with a range of 90-91% for low KDPI and 59-61% for high KDPI. For offers at the national level, large batch sizes had a considerable impact on the cumulative acceptance percentage. For low KDPI kidneys, cumulative acceptance after national offers was 92% for small batches and 98% for large batches. For high KDPI kidneys, cumulative acceptance after national offers was 65% for small batches and 89% for large batches.

Placement Time

For low and high KDPI kidneys, figures 2A and 2B show the cumulative percentage of kidneys accepted by each hour of batching. The first column shows the percentage of kidneys that were locally accepted (LA). Kidneys not accepted locally were offered in simultaneously expiring batches of offers at the regional and then national level. Figure 2A shows that after 10 hours, the cumulative percentage of low KDPI kidneys that were placed with small/medium/large batches was 89%/93%/98%. After 20 hours of batching, the cumulative percentage of low KDPI kidneys that were placed with small/medium/large batches was 92%/97%/98%. Figure 2B shows that after 10 hours of batching of high KDPI kidneys, the cumulative percentage that were placed with small/medium/large batches was 58%/73%/89%. After 20 hours of batching, the cumulative percentage of high KDPI kidneys that were placed with small/medium/large batches was 65%/85%/89%.

Workload

Table 3 shows the average number of offers directed to each center per week. For myriad reasons, these numbers are not likely to be representative of any particular center's actual number of offers, but this count allows comparisons that illustrate the increased offer screening burden as batch size increases. Regardless of batch size, the average number of regional offers for all kidneys was about 3 offers per week. Going from small to large batch sizes doubled the average number of national offers per week for high KDPI kidneys from 3.0 to 6.1. In total, for low and high KDPI kidneys, the average number of offers each center received per week using small/medium/large batch sizes was 10.1/14.1/16.8.

Table 4 shows the average number of centers that received an offer for each kidney. Regionally, using large batches versus small batches meant that a slightly higher number of centers received an offer per kidney. For low KDPI kidneys the number of centers receiving an offer increased from 10.8 to 11.4, and for high KDPI kidneys it increased from 16.8 to 17.4. Nationally, for high KDPI kidneys, changing the batch size from small to large increased the number of offers per kidney from 44.7 to 107.6. Nationally, for low KDPI kidneys, changing the batch size from small to large increased the number of offers per kidney from 40.3 to 97.2.

Table 5 shows the disappointment probability of accepting but not receiving a kidney for each batch size. Regionally, the disappointment probability was higher for low KDPI kidneys than for high KDPI kidneys because low KDPI kidneys have a higher probability of acceptance, making it more likely that multiple centers in a batch will accept the same kidney. Nationally, for low and high KDPI kidneys, increasing the batch size increased the disappointment probability. For high KDPI kidneys offered nationally, the disappointment probability for small batches was 1.0%, and for large batches it was 12.6%.

Sensitivity Analysis

In our simulation, each hour of delay decreased the acceptance probability by 5%. To test the sensitivity of our 5% estimate, we varied this assumption by 40% (to 3% and 7%). Setting the hourly decrease in the probability of acceptance to 3% makes all centers more likely to accept a kidney, and setting the hourly decrease in the probability of acceptance to 7% makes all centers less likely to accept a kidney. The final cumulative acceptance percentage for low KDPI kidneys after national offers in large batches in the 3%, 5%, and 7% scenarios was 98%, 98%, and 96%. The final cumulative acceptance percentage for high KDPI kidneys after national level offers in large batches in the 3%, 5%, and 7% scenarios was 90%, 89%, and 79%, respectively. In all of the scenarios tested, increasing the batch size led to faster allocation and fewer discards.

Discussion

At present kidneys are offered sequentially, one at a time, to the primary potential transplant recipient, possibly accumulating delays with each offer. To accelerate allocation and decrease discards, we simulated allocating 3,146 kidneys with simultaneously expiring offers, to multiple candidates at the same time, using small, medium, and large batch sizes. Determining the ideal batch size for simultaneous offers is a balance between accelerating the allocation process to decrease discards and limiting the number of offers that centers must screen. In our simulation, simultaneous offers in large batches decreased discards and placed kidneys faster. For low KDPI kidneys, going from small to large batches rescued 717 of 10,987 (6.5%) low KDPI kidneys from being discarded and resulted in an additional 10% of kidneys placed within 10 hours. For high KDPI kidneys, going from small to large batches rescued 480 of 1,945 (24.7%) high KDPI kidneys from being discarded and resulted in an additional 30% of kidneys being placed within 10 hours. Simultaneously expiring offers with large batches rescued a greater percentage of high KDPI than low KDPI kidneys (24.7% vs. 6.5%); numerically, more low KDPI kidneys were rescued because the vast majority of kidneys simulated were low KDPI (717 low KDPI kidneys rescued vs. 480 high KDPI). We conclude simultaneously expiring offers accelerate kidney allocation and reduce discards when applied to kidneys of any KDPI level.

A faster allocation system that reduces cold ischemia time would yield numerous benefits including decreased delayed graft function (DGF), shorter hospital length of stay, lower transplant costs, and less acute rejection. For every 5 hour increase in cold ischemia time, a model combining patient and center-level characteristics found an adjusted odds of 1.18 for the development of DGF (6). DGF has been associated with a 60% increase in the average length of stay after transplant at an estimated cost of $3,422 per additional day (7). The risk of acute rejection is 13% higher in kidneys with CIT ≥ 24 hours compared to CIT < 12 hours (8).

To quantify the screening burden that simultaneous offers would impose, we measured the average number of offers a center received each week. Going from small to large batches, the average number of offers increased from 10.1 to 16.8 per week, with almost all of that increase being additional national-level offers. Centers concerned about the screening burden from simultaneous offers could limit the number of offers they receive by using DonorNet® to set screening criteria for kidneys they are unwilling to accept (9).

The Kidney Fast-Track Scheme (KFTS), a system similar to the one that we simulated in this study, was introduced in 2012 in the United Kingdom (10). In the KFTS, kidneys at risk for discard are simultaneously offered to all 12 centers that elect to participate (half of the country's kidney transplant centers). Once an offer is made, participating centers have 45 minutes to respond, and then the kidney is allocated to the accepting center with the highest ranked candidate. Even though the kidneys that went into KFTS were lower quality than the ones that went into the standard allocation system, one-year death censored graft survival and median glomerular filtration rate were similar (11). Moreover, when KFTS was compared to the previous system that offered kidneys at risk for discard sequentially to the centers that had agreed to consider these grafts, simultaneously expiring offers through KFTS increased the acceptance rate from 39% to 59% (12).

A critical difference between the KFTS and our simulation is that we used simultaneously expiring offers for all kidneys, not just kidneys at risk for discard. We found that simultaneously expiring offers prevent discards for both high KDPI and low KDPI kidneys. Using large batch size instead of small batch size prevented the discard of 717 low KDPI kidneys and 480 high KDPI kidneys. Because in our simulation simultaneous offers apply to all kidneys, all kidney transplant centers would receive simultaneous offers; in the KFTS only some centers participate and the non-participating centers are understood to have declined all offers of kidneys at risk for discard.

The effect of simultaneous offers was seen primarily at the national level rather than the regional level. For high KDPI kidneys, the cumulative acceptance percentage at the regional level for small, medium, and large batches was 59%, 61%, and 61%, respectively (Table 2). At the national level, the cumulative acceptance percentage for small, medium, and large batches was 65%, 85%, and 89%, respectively.

The difference in effect size at the regional vs national level is related to the size of the waiting list at each level. For example, if there are 10 different centers at the regional level, the time required to exhaust the regional list in the small, medium, and large batch scenarios would be 5, 2, and 1 hours, respectively. Even the small batch scenario exhausts the regional list before discard occurs at 20 hours, so cumulative regional acceptance is similar between small and large batch scenarios (59% vs 61%). At the national level, the waiting list is too long to be exhausted, so the kidney will either be accepted or discarded after 20 hours of offers. Kidneys offered in large batches rather than small not only reach national level offers sooner, they are placed with less cold time (Figure 2). Since we assume probability of acceptance declines by 5% per hour, reaching national level offers earlier and offering to more centers changes the cumulative acceptance percentage for high KDPI kidneys from 65% vs 89% for small versus large batches.

There are several limitations to our study. First, many centers can evaluate an offer in less than one hour, but conversely centers might need more than one hour if crossmatch delays and other difficulties occur. Because the time for one center to evaluate an offer is likely less than one hour, simulating a batch size of one would not correspond to the current sequential offering system. Second, KPSAM provides a kidney acceptance probability that is determined from donor and candidate characteristics, but acceptance probability also depends on whether a kidney is offered before or after cross-clamp. For kidneys that are after cross-clamp, the cold ischemia time accumulated at offer has a significant influence on kidney acceptance probability (12). We assumed all kidneys offered beyond the local level were after cross-clamp because the OPTN does not release data about whether offers were made prior to or after cross-clamp. To model the increasing difficulty of placing a kidney as cold ischemia time accumulates, we assumed that each hour decreases the acceptance probability by 5%. This and other aspects of our model cannot be compared to the current allocation policy due to lack of available data. For example, the OPTN data do not capture the time that a center received an offer, do not capture how long each center took to enter a final accept or decline decision, and do not even accurately reflect how many centers evaluated each organ offered. Third, our study used KPSAM which relies on historical data and does not capture differences in practices between OPOs and centers (6). The model assumes that all centers have identical acceptance behavior, but some centers exhibit an “aggressive phenotype” and are more willing to accept suboptimal kidneys (13). Fourth, we assumed that kidneys were discarded after 20 hours of offers beyond the local level, however, the size of the local donation service area is highly variable. If a kidney was already post cross-clamp at the local level, the amount of cold ischemia time it had by the time it reached the regional level could be significantly greater if it came from a DSA with many centers than if it came from a DSA with only a few centers.

Overall, our study was forced to make a number of assumptions due to lack of available data that we could use for modelling. The goal of our study was not to predict the exact number of kidneys that would be accepted under simultaneous offers, but rather to show the direction of change that would occur if we made offers to more centers simultaneously (small vs. large batches).

In contrast to the status quo in which offers expire sequentially one at a time, we simulated an allocation system in which offers are made and expire simultaneously for small, medium, or large batches of centers. Using large batch size instead of small batch size, for the 12,977 kidneys that we simulated, resulted in reduced cold ischemia times and prevented the discard of 1,197 kidneys, while requiring centers to screen about 67% more non-local offers per week. Changing the allocation system by allowing simultaneously expiring offers might result in faster allocation of kidneys and decrease the number of discards, while still maintaining an acceptable screening burden.

ACKNOWLEDGEMENTS

This work was supported by grant number R01DK111233 from the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK). Michal A. Mankowski was supported by King Abdullah University of Science and Technology (KAUST). Martin Kosztowski was supported by National Institute of Diabetes, Digestive, and Kidney Diseases (T32DK007732). The data reported here have been supplied by the Hennepin Healthcare Research Institute (HHRI) as the contractor for the Scientific Registry of Transplant Recipients (SRTR). The interpretation and reporting of these data are the responsibility of the authors and in no way should be seen as an official policy of or interpretation by the SRTR, UNOS/OPTN, or the US Government.

DISCLOSURE

The authors of this manuscript have no conflicts of interest to disclose as described by the *American Journal of Transplantation*.

DATA AVAILABILITY STATEMENT

The study used data from the Scientific Registry of Transplant Recipients (SRTR). The SRTR data system includes data on all donor, wait-listed candidates, and transplant recipients in the US, submitted by the members of the Organ Procurement and Transplantation Network (OPTN), and has been described elsewhere (13). The Health Resources and Service Administration (HRSA), U.S. Department of Health and Human Services provides oversight to the activities of the OPTN and SRTR contractors.

FIGURE LEGENDS

Figure 1. Current and Proposed Allocation Systems. A.) The current system where offers expire sequentially after 1h for a primary center and after 30 minutes for all other centers that entered a provisional yes. B.) Proposed simultaneously expiring offers system where all centers in a batch must answer within the same hour.

Figure 2. Cumulative percentage of low KDPI (A) and high KDPI (B) kidneys accepted, across hours of allocation time. The first column in the histograms show the percentage of kidneys that were locally accepted (LA). The following columns show the percentage of kidneys that were accepted non-locally by each hour of offering using simultaneously expiring offers. Using large batches, most kidneys were placed early in the batching process with 98.2% (10,795) of low KDPI and 89.3% (1,737) of high KDPI being placed after 10 hours. The final acceptance percentage after 20 hours in large batches was 98.3% (10,802) for low KDPI and 89.3% (1,737) for high KDPI kidneys.

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Figure 1. Current and Proposed Allocation Systems. A.) The current system where offers expire sequentially after 1h for a primary center and after 30 minutes for all other centers that entered a provisional yes. B.) Proposed simultaneously expiring offers system where all centers in a batch must answer within the same hour.

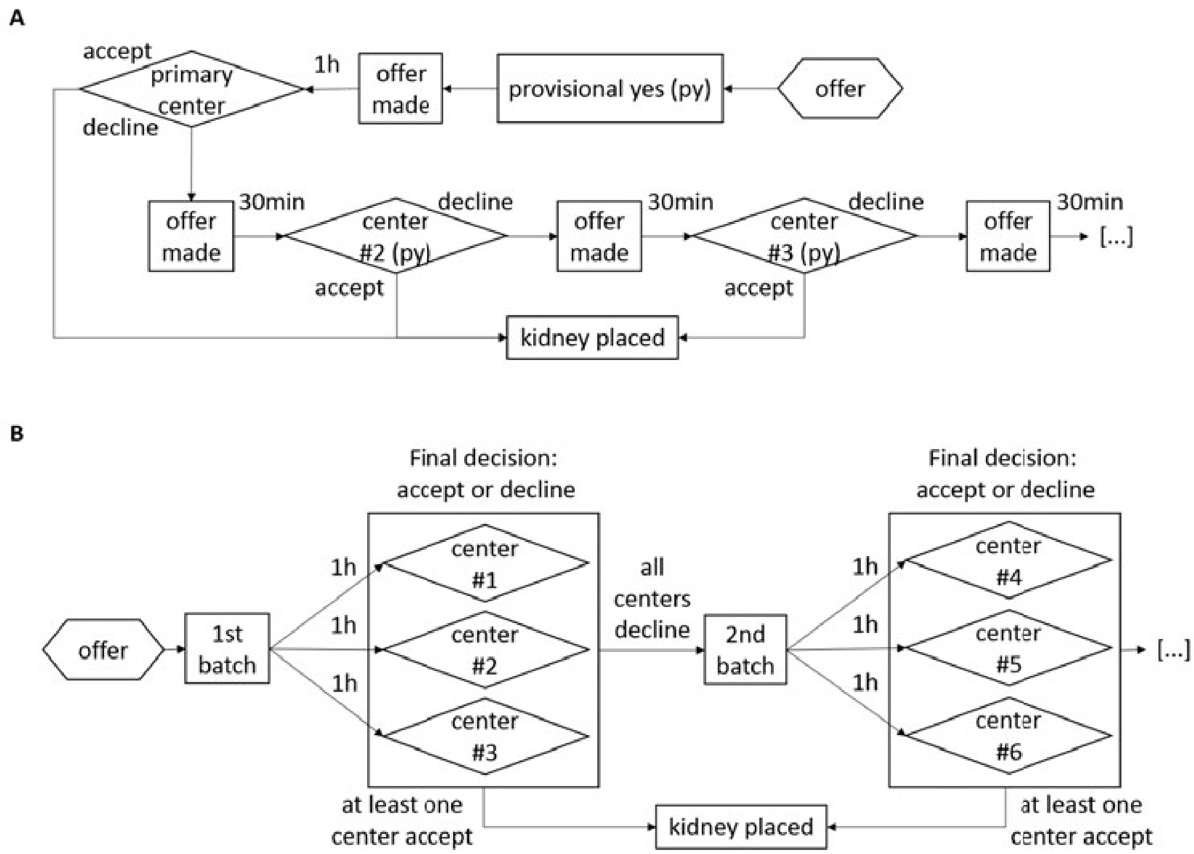

Figure 2. Cumulative percentage of low KDPI (A) and high KDPI (B) kidneys accepted, across hours of allocation time. The first column in the histograms show the percentage of kidneys that were locally accepted (LA). The following columns show the percentage of kidneys that were accepted non-locally by each hour of offering using simultaneously expiring offers. Using large batches, most kidneys were placed early in the batching process with 98.2% (10,795) of low KDPI and 89.3% (1,737) of high KDPI being placed after 10 hours. The final acceptance percentage after 20 hours in large batches was 98.3% (10,802) for low KDPI and 89.3% (1,737) for high KDPI kidneys.

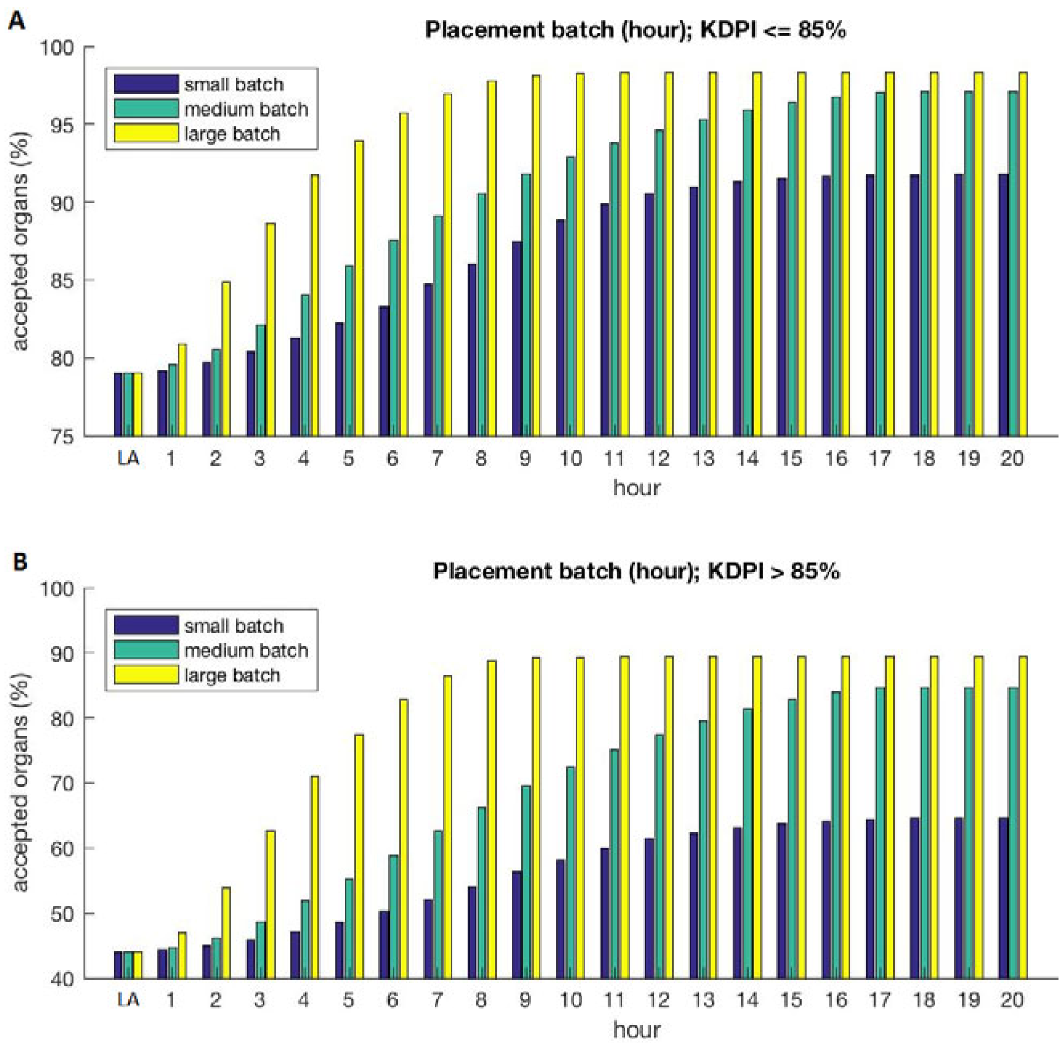

Table 1. Example of the batching process. The first column contains a ranked list of candidates, and the second column shows their corresponding transplant center. For a batch size of 3, we include the highest priority candidates from three centers (patients one through six). If the kidney is not accepted by any of the centers in the first batch, it will be offered again in the second batch to candidates from three new centers (D, E, and F). Candidate 11 from center A was also included in the second batch because the transplant centers are already familiar with this candidate from the first batch, so it does not increase the screening burden if it is included in the second batch.

	Ranking Match list	center
First batch	candidate #1	A
	candidate #2	A
	candidate #3	B
	candidate #4	A
	candidate #5	C
	candidate #6	B
Second batch	candidate #7	D
	candidate #8	E
	candidate #9	C
	candidate #10	F
	candidate #11	A
	candidate #12	E
	candidate #13	G
	candidate #14	A

Table 2. Number of kidneys accepted and cumulative acceptance percentage as kidneys progress from local to regional to national offers. Small batches used a batch size of two at the regional level and five at the national level. Medium batches used a batch size of five at the regional level and ten at the national level. Large batches used a batch size of ten at the regional level and twenty at the national level.

	Low KDPI (<= 85%)			High KDPI (> 85%)		
	Local	Regional	National	Local	Regional	National
Small batch	8680 (79%)	9885 (90%)	10085 (92%)	856 (44%)	1144 (59%)	1257 (65%)
Medium batch	8680 (79%)	9972 (91%)	10665 (97%)	856 (44%)	1183 (61%)	1646 (85%)
Large batch	8680 (79%)	9995 (91%)	10802 (98%)	856 (44%)	1195 (61%)	1737 (89%)

Table 3. The average number of offers for kidneys of each type, from each level of allocation, received by a center each week.

	Low KDPI (<= 85%)		High KDPI (> 85%)		All Kidneys		
	Regional	National	Regional	National	Regional	National	Total
Small batch	1.9	3.9	1.3	3.0	3.2	6.9	10.1
Medium batch	1.9	6.1	1.3	4.7	3.2	10.8	14.1
Large batch	2.0	7.4	1.4	6.1	3.3	13.5	16.8

Table 4. The average number of centers that received an offer per kidney, for kidneys of each type, at each level of allocation.

	Low KDPI (<= 85%)		High KDPI (> 85%)	
	Regional	National	Regional	National
Small batch	10.8	40.3	16.8	44.7
Medium batch	11.0	77.8	17.0	82.2
Large batch	11.4	97.2	17.4	107.6

Table 5. Disappointment probability of having multiple centers in a batch accept the same offer. The kidney goes to the center with highest priority candidate. We defined disappointment probability as the percent of center offers a surgeon accepted that went to another center with a higher ranked candidate, calculated as one minus one divided by the number of centers who accepted an offer (A) during a batching round, 1-(1/A).

	Low KDPI (<= 85%)		High KDPI (> 85%)	
	Regional	National	Regional	National
Small batch	7.2%	1.1%	2.8%	1.0%
Medium batch	13.4%	4.6%	5.5%	4.7%
Large batch	20.1%	13.0%	7.8%	12.6%