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Accelerating kidney allocation: Simultaneously expiring offers

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Using nonideal kidneys for transplant quickly might reduce the discard rate of kidney transplants. We studied changing kidney allocation to eliminate sequential offers, instead making offers to multiple centers for all nonlocally allocated kidneys, so that multiple centers must accept or decline within the same 1 hour. If more than 1 center accepted an offer, the kidney would go to the highest-priority accepting candidate. Using 2010 Kidney-Pancreas Simulated Allocation Model–Scientific Registry for Transplant Recipients 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-size, 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–Kidney Donor Risk Index kidneys and from 1257 (65%) to 1737 (89%) for high–Kidney Donor Risk Index kidneys. The average number of offers that 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.

KEYWORDS
clinical research/practice, delayed graft function (DGF), health services and outcomes research, kidney transplantation/nephrology, mathematical model, organ allocation, organ procurement and allocation, Scientific Registry for Transplant Recipients (SRTR)

Abbreviations: DSA, donation service area; DGF, delayed graft function; KAS, Kidney Allocation System; KDPI, Kidney Donor Risk Index; KFTS, Kidney Fast-Track Scheme; KPSAM, Kidney-Pancreas Simulated Allocation Model; OPTN, Organ Procurement and Transplantation Network; SRTR, Scientific Registry of Transplant Recipients.

Michal A. Mankowski and Martin Kosztowski are co-first authors.

1 | 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 2 years since KAS implementation, kidney discards from donors with a Kidney Donor Risk Index (KDPI) of >85%, donors with diabetes, and donors aged ≥65 years have increased. Prolonged delays in the allocation of kidneys, particularly nonideal kidneys, make these organs increasingly more difficult to allocate as cold time accumulates.[1]

To improve the efficiency of organ placement, the Organ Procurement and Transplantation Network (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 1 hour to submit a provisional yes or to refuse the offer. Then, once the transplant center has received all required deceased donor information, it has 1 hour to either accept or refuse the offer. Under the previous policy, there was no time limit for accepting an offer.

Before 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 30 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 1 hour to make a final decision (Figure 1B). If >1 center accepts the offer, it goes to the center with the highest-priority candidate. If none of the centers accept the offer, then the kidney is offered to another batch of centers with a simultaneously expiring 1-hour time limit. In this

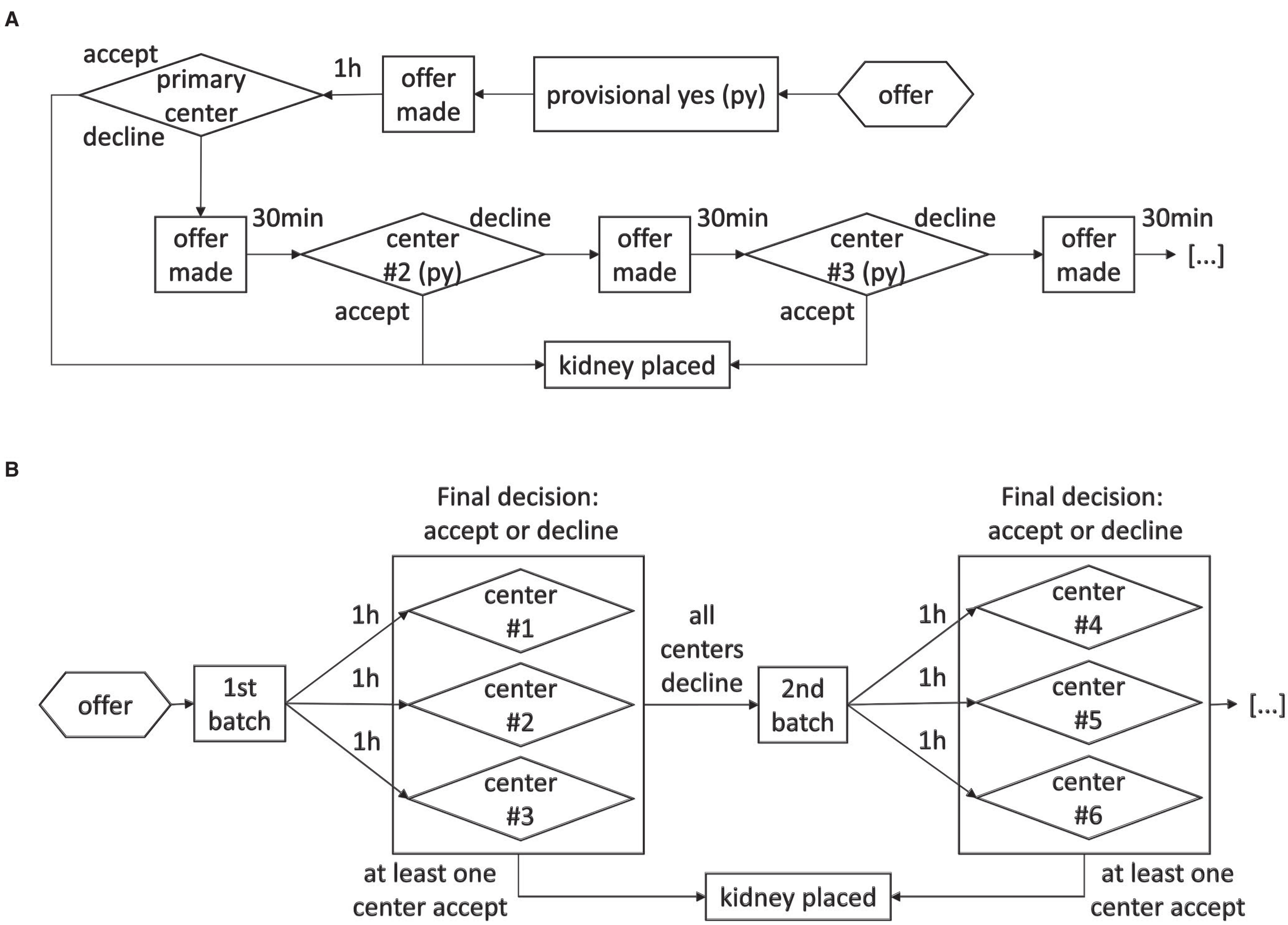

FIGURE 1 Current and proposed allocation systems. A, Current system in which offers expire sequentially after 1 hour for a primary center and after 30 minutes for all other centers that entered a provisional yes. B, Proposed simultaneously expiring offers system where all centers in a batch must answer within the same hour

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-size, or large batches. For low-KDPI (≤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.

2 | METHODS

2.1 | 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 SRTR. The SRTR data system includes data on all donor, waitlisted candidates, and transplant recipients in the United States, submitted by the members of the OPTN, and has been described elsewhere.[4] The Health Resources and Services Administration, US 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 levels 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%.

2.2 | 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 3 centers (patients 1 through 6). Patient 7 is excluded from the first batch because the patient was listed at center D, and only candidates from 3 centers (A, B, and C) are allowed with a batch size of 3. 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 3 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.

2.3 | 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 nonlocal (i.e., regional or national level) placement time because each round has a time of 1 hour.

For example, if a kidney is not placed locally in Baltimore's donation service area (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 12 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 20 sequential batches. In this example, because the kidney was offered in 12 batches at the regional level, it can be offered in 8 batches at the most at the national level before we classify it as discarded.

2.4 | Quantifying the burden of increased offers

Offering kidneys to multiple transplant centers simultaneously will increase workload because of the increased number of offers each center must evaluate. We quantified the burden of increased offers in 3 ways. The first measure is the average number of nonlocal offers to a center per week. In the scenario shown in Table 1, we counted 1 offer for each of centers A, B, C, D, E, and F during the 2 rounds of batching. Even though center A had 3 candidates in the first batch, we counted this as 1 offer because it is 1 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 8000 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 levels.

The third measure is the disappointment probability defined as the percentage 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 1 minus 1 divided by the number of centers that accepted an offer (A) during a batching

TABLE 1 Example of the batching process

Batch	Ranking match list	Center
First	Candidate 1	A
	Candidate 2	A
	Candidate 3	B
	Candidate 4	A
	Candidate 5	C
	Candidate 6	B
Second	Candidate 7	D
	Candidate 8	E
	Candidate 9	C
	Candidate 10	F
	Candidate 11	A
	Candidate 12	E
	Candidate 13	G
	Candidate 14	A

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 1 through 6). 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 3 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.

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).

2.5 | Batching scenarios

We simulated 3 different scenarios with small, medium-size, and large 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-size–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.

3 | RESULTS

3.1 | Study population

From KPSAM, match runs for 12 933 kidneys were input into our simulation. Of these, KPSAM predicted that 9536 would be placed locally and 251 would be discarded after being offered to >200 local candidates. We used the remaining 3146 kidneys in our simulation of simultaneously expiring offers at the regional and national levels. From the 9536 kidneys that were placed locally, only 8.9% had a KDPI of >85%. Of the 251 kidneys that were discarded at the local level, 47.4% had a KDPI of >85%. Of the 3146 kidneys that we used to simulate simultaneously expiring offers at the regional and national levels, 30.8% had a KDPI of >85%.

3.2 | 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% to 91% for low-KDPI kidneys and 59% to 61% for high-KDPI kidneys. 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.

3.3 | Placement time

For low- and high-KDPI kidneys, Figure 2A,B shows 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-size, and large batches was 89%, 93%, and 98%, respectively. After 20 hours of batching, the cumulative percentage of low-KDPI kidneys that were placed with small, medium-size, and large batches was 92%,

TABLE 2 Number of kidneys accepted and cumulative acceptance percentage as kidneys progress from local to regional to national offers

	Low KDPI (≤85%)			High KDPI (>85%)		
	Local	Regional	National	Local	Regional	National
Small batch	8680 (79%)	9885 (90%)	10 085 (92%)	856 (44%)	1144 (59%)	1257 (65%)
Medium-size batch	8680 (79%)	9972 (91%)	10 665 (97%)	856 (44%)	1183 (61%)	1646 (85%)
Large batch	8680 (79%)	9995 (91%)	10 802 (98%)	856 (44%)	1195 (61%)	1737 (89%)

KDPI, Kidney Donor Risk Index.
Small batches used a batch size of 2 at the regional level and 5 at the national level. Medium-size batches used a batch size of 5 at the regional level and 10 at the national level. Large batches used a batch size of 10 at the regional level and 20 at the national level.

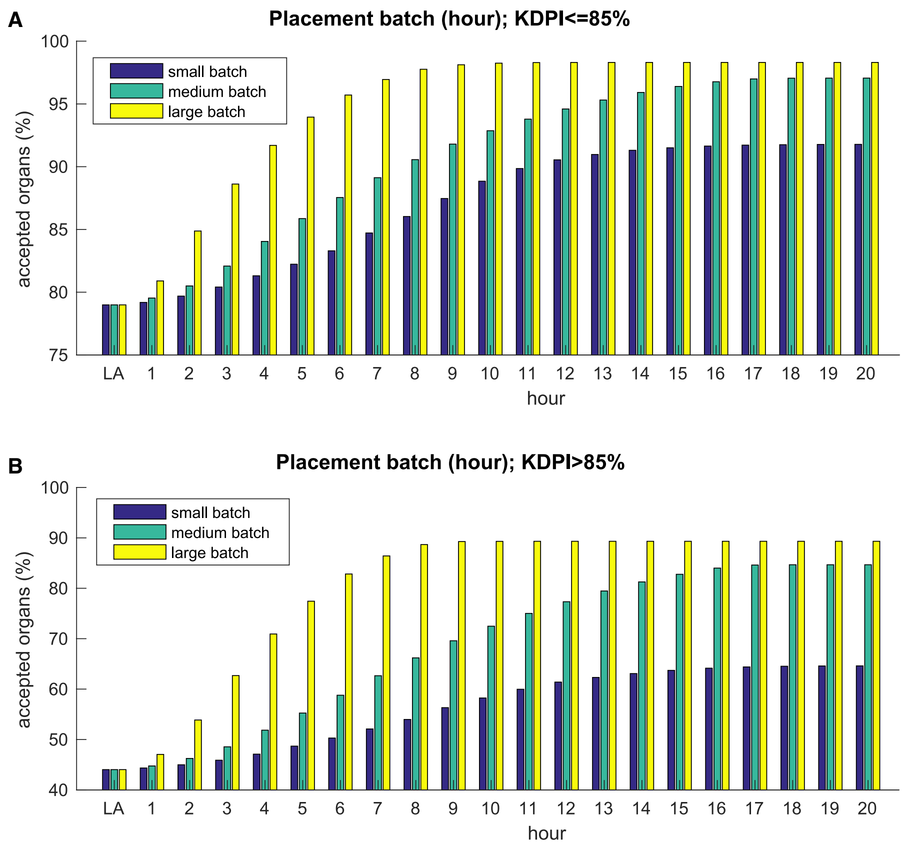

FIGURE 2 Cumulative percentage of low-KDPI (A) and high-KDPI (B) kidneys accepted, across hours of allocation time. The first column in the histograms shows the percentage of kidneys that were locally accepted (LA). The following columns show the percentage of kidneys that were accepted nonlocally by 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 kidneys and 89.3% (1737) of high-KDPI kidneys being placed after 10 hours. The final acceptance percentage after 20 hours in large batches was 98.3% (10 802) for low-KDPI kidneys and 89.3% (1737) for high-KDPI kidneys. KDPI, Kidney Donor Risk Index

97%, and 98%, respectively. Figure 2B shows that after 10 hours of batching of high-KDPI kidneys, the cumulative percentage of kidneys that were placed with small, medium-size, and large batches was 58%, 73%, and 89%, respectively. After 20 hours of batching, the cumulative percentage of high-KDPI kidneys that were placed with small, medium-size, and large batches was 65%, 85%, and 89%, respectively.

3.4 | 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,

TABLE 3 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-size 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

KDPI, Kidney Donor Risk Index.

TABLE 4 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-size batch	11.0	77.8	17.0	82.2
Large batch	11.4	97.2	17.4	107.6

KDPI, Kidney Donor Risk Index.

TABLE 5 Disappointment probability of having multiple centers in a batch accept the same offer

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

KDPI, Kidney Donor Risk Index.
The kidney goes to the center with highest priority candidate. We defined disappointment probability as the percentage of center offers a surgeon accepted that went to another center with a higher ranked candidate, calculated as 1 minus 1 divided by the number of centers who accepted an offer (A) during a batching round: 1 − (1/A).

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-size, and large batch sizes was 10.1, 14.1, and 16.8, respectively.

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%.

3.5 | 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%, respectively. 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.

4 | DISCUSSION

At present, kidneys are offered sequentially, 1 at a time, to the primary potential transplant recipient, possibly accumulating delays with each offer. To accelerate allocation and decrease discards, we simulated allocating 3146 kidneys with simultaneously expiring offers to multiple candidates at the same time, using small, medium-size, and large batch sizes of centers. 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 (6.5%) of 10 987 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 (24.7%) of 1945 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 kidneys). We conclude that 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 $3422 per additional day.[7] The risk of acute rejection is 13% higher in kidneys with a cold ischemia time of ≥24 hours compared with a cold ischemia time of <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, 1-year death censored graft survival and median glomerular filtration rate were similar.[11] Moreover, when KFTS was compared with 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 nonparticipating 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 at the regional level. For high-KDPI kidneys, the cumulative acceptance percentage at the regional level for small, medium-size, and large batches was 59%, 61%, and 61%, respectively (Table 2). At the national level, the cumulative acceptance percentage for small, medium-size, and large batches was 65%, 85%, and 89%, respectively.

The difference in effect size at the regional versus 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-size, 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 in small batches not only reach national-level offers sooner, but also are placed with less cold ischemia time (Figure 2). Because we assume probability of acceptance declines by 5% per hour, reaching national-level offers earlier and offering to more centers change the cumulative acceptance percentage for high-KDPI kidneys from 65% to 89% for small versus large batches.

There are several limitations to our study. First, many centers can evaluate an offer in <1 hour, but conversely, centers might need >1 hour if crossmatch delays and other difficulties occur. Because the time for 1 center to evaluate an offer is likely <1 hour, simulating a batch size of 1 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 before 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 with the current allocation policy because of a 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 organ procurement organizations 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 DSA 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 because of a 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 1 at a time, we simulated an allocation system in which offers are made and expire simultaneously for small, medium-size, or large batches of centers. For the 12 977 kidneys that we simulated, the use of large batch size instead of small batch size resulted in reduced cold ischemia times and prevented the discard of 1197 kidneys, while requiring centers to screen about 67% more nonlocal 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.

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 SRTR. The SRTR data system includes data on all donor, waitlisted candidates, and transplant recipients in the United States, submitted by the members of the OPTN, and has been described elsewhere.[13] The Health Resources and Service Administration, US Department of Health and Human Services provide oversight to the activities of the OPTN and SRTR contractors.

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