Early Experience with the New Kidney Allocation System
A Perspective from UNOS

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Introduction
December 4, 2014 marked the long-awaited overhaul to the system that allocates the limited supply of deceased donor kidneys in the United States to the nearly 100,000 patients on the kidney transplant waiting list. System performance has been monitored closely (1). Although the kidney allocation system (KAS) has clearly achieved some of its goals, progress toward others remains either elusive or unclear.

KAS was conceived by mandate from the Organ Procurement and Transplantation Network (OPTN) board of directors in 2003 to improve an outdated system driven predominantly by waiting time instead of medical criteria, and it was born after 12 years in committee, two public forums, and two formal requests for comment from the public. With input from many stakeholders, KAS evolved into an amalgamation of elements addressing the many needs of a highly diverse patient population. KAS also instituted, for the first time, a uniform national policy devoid of the numerous regional policy variances that previously rendered system improvements cumbersome and costly.

KAS has been criticized as being “schizophrenic,” in the sense of having multiple personalities instead of consistently aiming toward one overarching goal. Gauging the successfulness of KAS has indeed proven controversial, because the OPTN’s mandate to balance equity and utility has resulted in years of dialysis before listing, arguably increasing fairness. Some have contended, however, that this new policy penalizes conscientious candidates who have made prudent health care decisions and that national post-transplant outcomes could suffer.

Ethnic minority candidates are disproportionately affected by delayed referrals, and the switch to dialysis date for accruing waiting time has sharply increased the number of transplants in some minority populations. Transplant access for blacks (33% of the kidney waiting list and 37% of transplant recipients) and Hispanic candidates (20% of the kidney waiting list and 20% of transplant recipients) is now on par with that for whites (37% of the kidney waiting list and 37% of transplant recipients) (2). However, blood group B and O candidates still have reduced access. This could be improved by broader adoption of the KAS provision, allowing donor subtype A2 kidneys to be allocated to consenting and eligible B candidates, who are often ethnic minorities.

The OPTN kidney transplantation committee considered adopting a utility-centric system (3) aimed at maximizing the cumulative graft survival achieved from the available supply of kidneys but with the projected cost of sharply reduced access for older candidates. Subsequently, the committee selected a “longevity-matching” approach believed to strike a better balance between equity and utility, where kidneys expected to last longer are preferentially allocated to recipients with longer expected post-transplant survival. Access to transplants has improved for younger compared with older adults under KAS, but concerns about drastically reduced access for older patients have not proven warranted: candidates age 65 years old or older, who account for 22% of the waiting list, still receive about 20% of transplants under KAS (2).

Under KAS, the waiting time clock now starts on the basis of documented medical need—when a patient first begins chronic dialysis—even if inadequate education about treatment options or delayed referral resulted in years of dialysis before listing, arguably increasing fairness. Some have contended, however, that this new policy penalizes conscientious candidates who have made prudent health care decisions and that national post-transplant outcomes could suffer.

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Equity/Fairness
A primary goal of KAS was to increase equity in allocation, in particular for allosensitized patients and ethnic minorities. The most visible success of KAS has, in fact, been to increase transplant opportunities for highly sensitized patients. Although the most highly sensitized (calculated panel reactive antibodies [CPRAs] of 99%–100%) candidates represented about 8% of the waiting list, they received only 2% of deceased donor kidney transplants before KAS but now account for 10% of transplants (1,2). Before KAS, many of these recipients had little or no realistic expectation for receiving a deceased donor kidney transplant.

Under KAS, the percentage of transplants going to pediatric candidates (age <18 years old), who represent about 1% of the waiting list, dropped from 4.2% to 3.7% in the most recent data (1,2). Although they maintain a transplant rate four times higher than adults, additional transplants could be directed to pediatrics by...
(1) imposing top of the list priority to only the subset of 100% sensitized candidates truly in need of national kidney access (4); and/or
(2) increasing the pool of kidneys (currently the highest quality 35%) for which pediatrics receive priority.

Reducing geographic disparity in access to transplantation was not an explicit goal of KAS, and stark differences in access to transplant across donor service areas (DSAs) remain. In fact, although geographic disparities may have declined slightly with KAS, a recent OPTN study found that the candidate factor contributing the most to differences in timely access to transplants is the candidate’s DSA of listing. Disparities associated with DSA of listing now exceed even those associated with candidate blood type and CPRA (5). Because KAS has shown the transplant network’s ability to successfully distribute kidneys more broadly, in particular through regional and national allocation to patients with high CPRA, future policy changes aimed at reducing geographic inequities may be achievable.

**Kidney Utilization**

A goal of KAS was to reduce the kidney discard rate and broaden the pool of recovered kidneys. Although the number of deceased donor kidney transplants has risen 9% per year since the start of KAS, the percentage of kidneys recovered but not used (also known as the “discard rate”) reached 20% annually for the first time in 2016 (Figure 1). Analyses suggest that this rise is not due to organ procurement organizations recovering kidneys from a broader pool of donors, such as was the case in the past. The greatest rise in the discard rate has been for suboptimal kidneys, which are now distributed via combined local/regional allocation. Decreased pumping of these kidneys may have contributed to the increase (6).

It was speculated that candidates without priority for the best kidneys might become more inclined to accept a suboptimal kidney, but this has not happened. Offer refusal rates remain high, and every turned down offer has the potential to increase a kidney’s cold ischemic time and stigmatize an organ as undesirable. KAS may have exacerbated system inefficiencies by elevating the sickest patients (e.g., long duration on dialysis) to the top of the list, especially for suboptimal kidneys, for which candidates are rank ordered exclusively on the basis of waiting time. Centers might be averse to transplanting a lower-quality kidney into a patient with high dialysis time due to outcome concerns (7). Furthermore, these patients may have little incentive to accept a less than ideal kidney given that they also receive high-waiting time priority for better kidneys.

Although new policy proposals are being developed to improve efficiency of dual and en bloc kidney allocation, more change is needed. We believe that the transplant community is ready to consider paradigm-changing revisions aimed at maximally using the available supply of donated kidneys. Candidates at the top of the list for kidneys at high risk of discard should be those most willing to accept them due to perceived benefit, not necessarily those who have waited the longest. As in Germany’s implementation of the Eurotransplant’s Senior Program, a bifurcation that provides suitable candidates with a choice—a short waiting time for a good kidney or a much longer wait for a better kidney—may improve utilization.

In tandem, models, like the OPTN’s facilitated pancreas allocation, Eurotransplant’s rescue allocation (8), and/or the United Kingdom’s Fast Track allocation (9), could be evaluated and adapted for KAS. After the likelihood of organ discard through the usual sequential process eclipses an empirically derived threshold, allocation could proceed first to candidates at centers with a recent history of using similar kidneys.

![Figure 1. Long-run and post–kidney allocation system (post-KAS) trends in the kidney discard rate.](image-url)
Graft Survival

The central aim of KAS was to increase the national aggregate years of post-transplant graft survival by reducing organ/recipient longevity mismatches and transplanting more patients expected to survive the longest after transplant. Simulations projected that KAS would increase the annual number of graft survival years by 2750 (10).

Under KAS’s longevity-matching provision, 30% of the highest-quality kidneys are going to recipients of ages 18–34 years old compared with 12.5% previously, portending fewer returns to the waiting list due to early graft failure. Furthermore, <5% of these longest-lasting kidneys are being transplanted into age ≥65-year-old recipients, which should reduce instances of death with years of unrealized graft function (2).

These gains in longevity matching along with the overall increase in transplants to younger recipients are expected to improve post-transplant outcomes under KAS. However, these projected gains could be offset by the following post-KAS realities.

Fewer preemptive transplants.
More sicker, higher-risk recipients due to lengthy durations on dialysis.
More extremely sensitized recipients, who may carry increased risk of graft rejection.
Fewer zero-antigen mismatches.
Higher cold ischemic times due to increased shipping of kidneys outside the local recovery area.

Although each of these potential counterweights could reduce graft longevity, the 1-year estimated graft survival rate for transplants performed in the first year of KAS remains excellent at 93.6% (2). This represents only a slight decline from pre-KAS (94.1%; \( P = 0.07 \)), despite the first post-KAS year of transplants being dominated by bolus effects, most notably a sharp influx of high dialysis duration and/or extremely sensitized recipients. The combined effect of better longevity matching and the aforementioned counterweights on longer-term (e.g., 3- and 5-year) outcomes under KAS in steady state remains to be seen.

Although short-term graft and patient survival rates have changed little, the percentage of recipients experiencing delayed graft function has risen from just under 25% to over 30%, driven largely by the increase in transplants to patients with high dialysis duration (1). The delayed graft function rate has declined somewhat as this bolus effect has tapered (2).

In summary, KAS has improved equity and longevity matching, but challenges with organ utilization warrant exploration of significant changes in allocation policy to improve efficiency. More time is needed to learn whether the post-transplant survival gains forecasted for KAS will come to fruition.

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