

The New Kidney Allocation System (KAS): The First Year

Prepared for
OPTN Kidney Transplantation Committee
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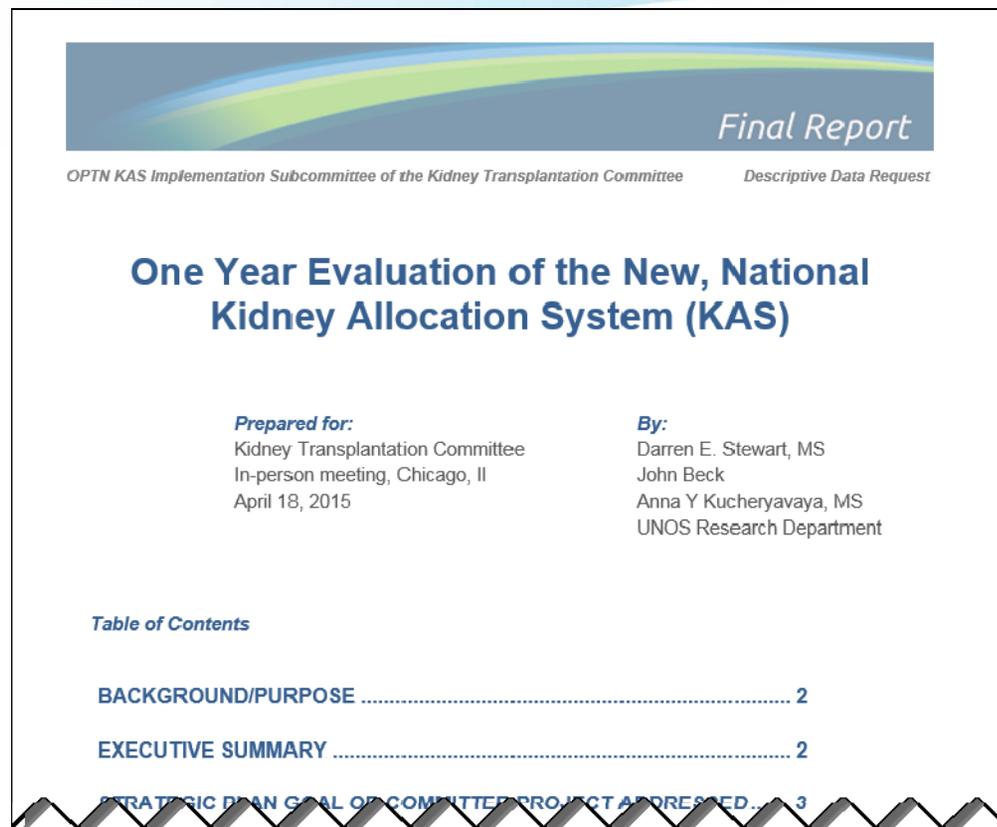
Background

- KAS implemented Dec 4, 2014
- Key goals:
 - Make better use of available kidneys
 - Increase transplant opportunities for difficult-to-match patients (increased equity)
 - Increase fairness by awarding waiting time points based on dialysis start date
 - Have minimal impact on most candidates

Background

- Performance tracked monthly through June (“out of the gate” reports)
- Six month report completed Sep 2015
- One-year analysis now completed
 - Pre-KAS period: Dec 4, 2013 – Dec 3, 2014 (12 months)
 - Post-KAS period: Dec 4, 2014 – Dec 3, 2015 (12 months)
 - *New*: Six month graft and patient survival rates
 - *New*: Recipient serum creatinine at six months
 - *New*: Waiting list mortality rates

Background



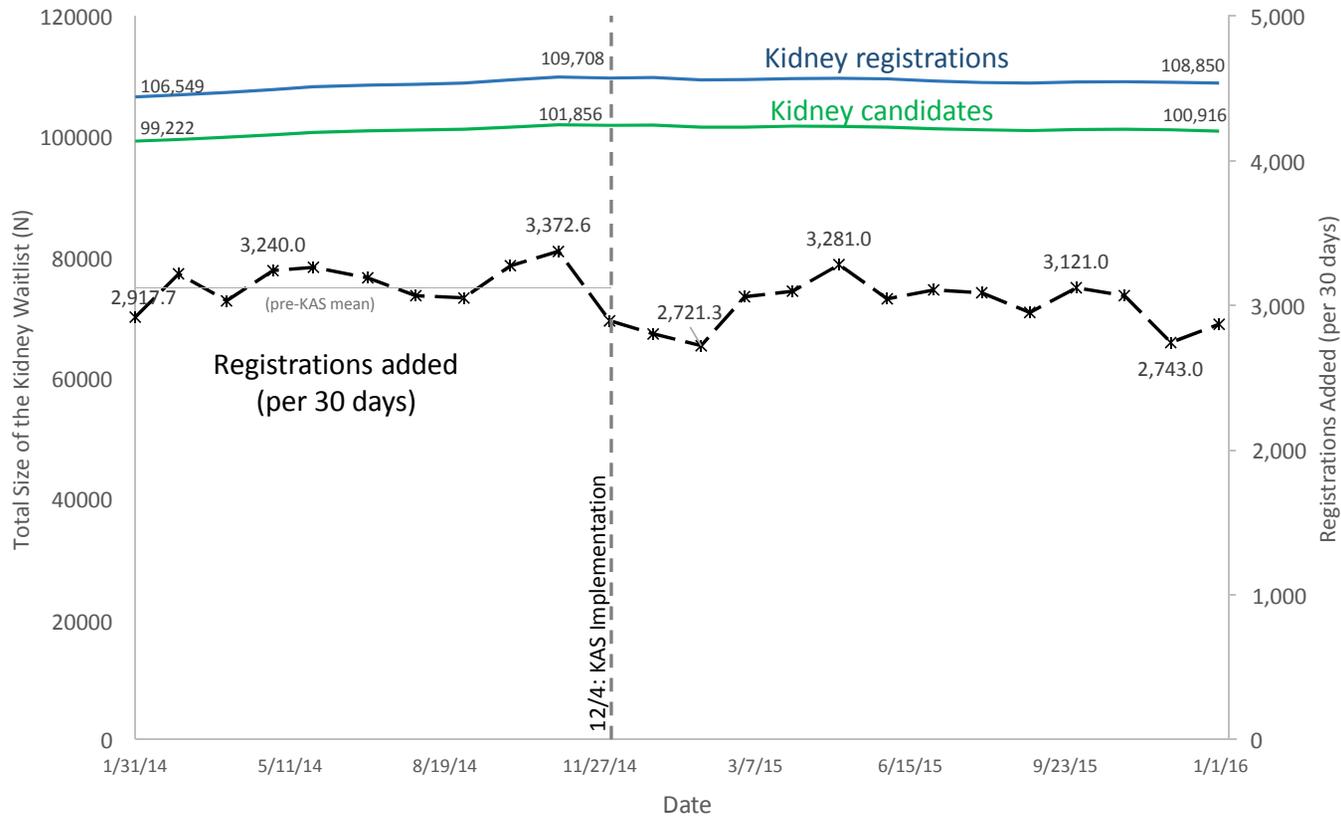
- Full, detailed report available to the committee or upon request.



Kidney waiting list trends

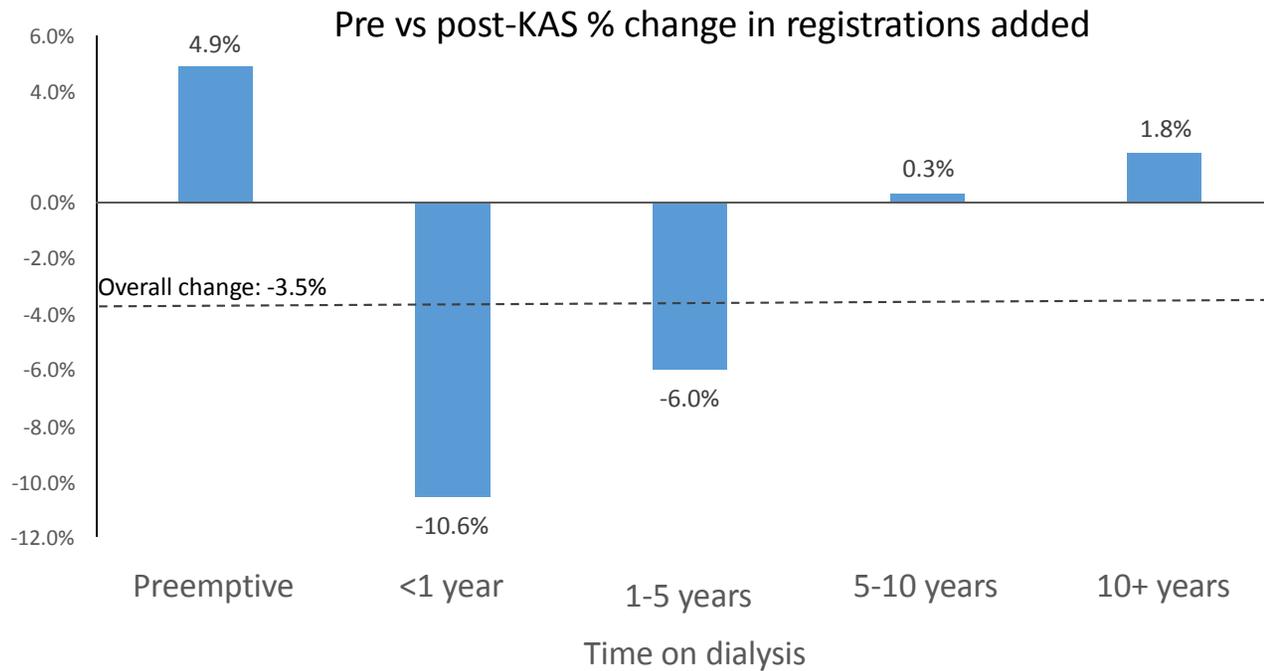
Trends in the kidney waiting list

Pre/Post-KAS Growth in the Kidney Waiting List
Jan 1, 2014 through Dec 31, 2015



- The size of the kidney waiting list has decreased slightly post-KAS.
- 3.5% fewer new kidney registrations added post-KAS.

Changes in listing patterns

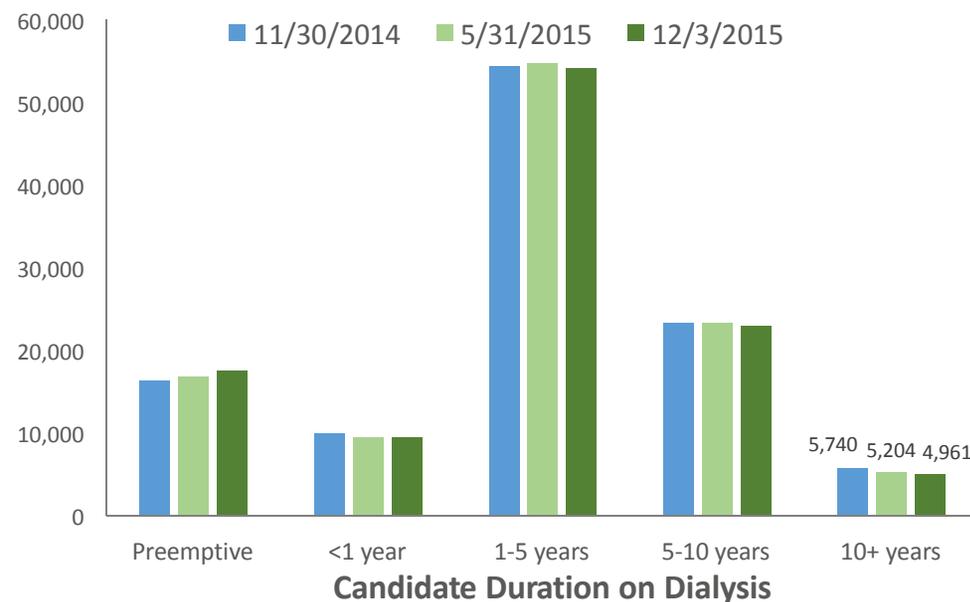
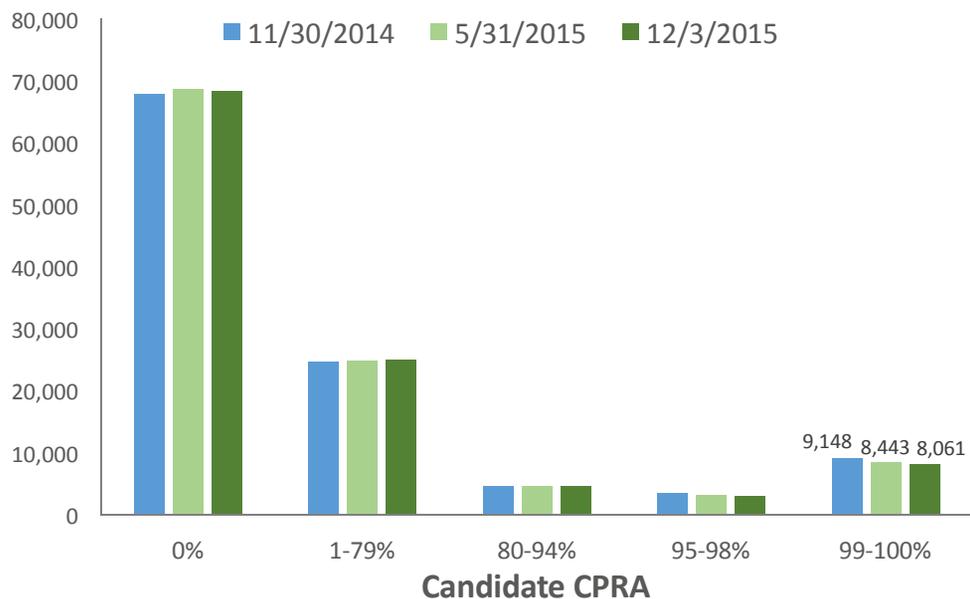


Pre-KAS: 12/4/13-12/3/14
Post-KAS: 12/4/14-12/3/15

- Preemptive listings have increased
- Sharp drops in listings of candidates with short dialysis times

Trends in the kidney waiting list

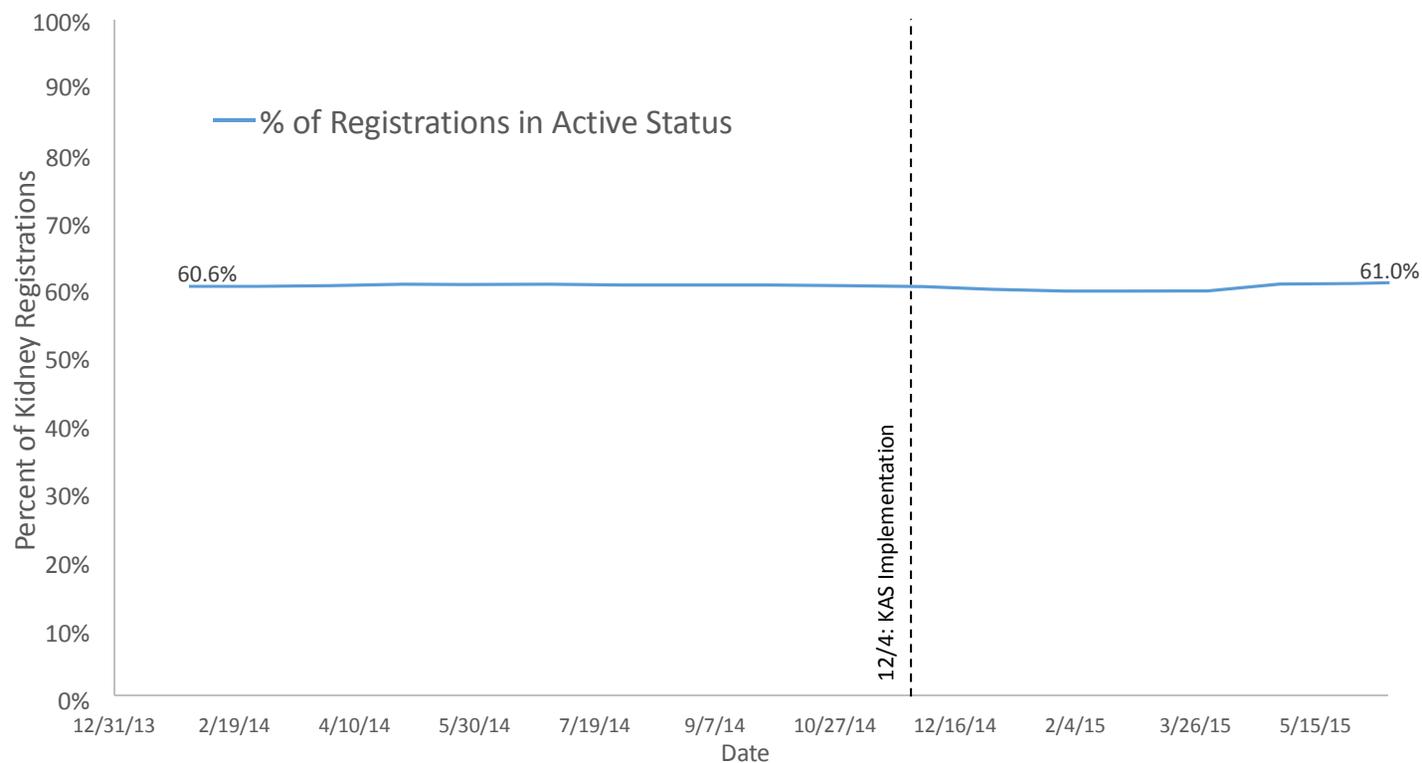
Comparing 3 month-end “snapshots” by candidate CPRA and dialysis duration



- The distribution of registrations on the waiting list by most factors (age, race/ethnicity, diagnosis) has changed little.
- Moderate changes observed by CPRA and dialysis duration.

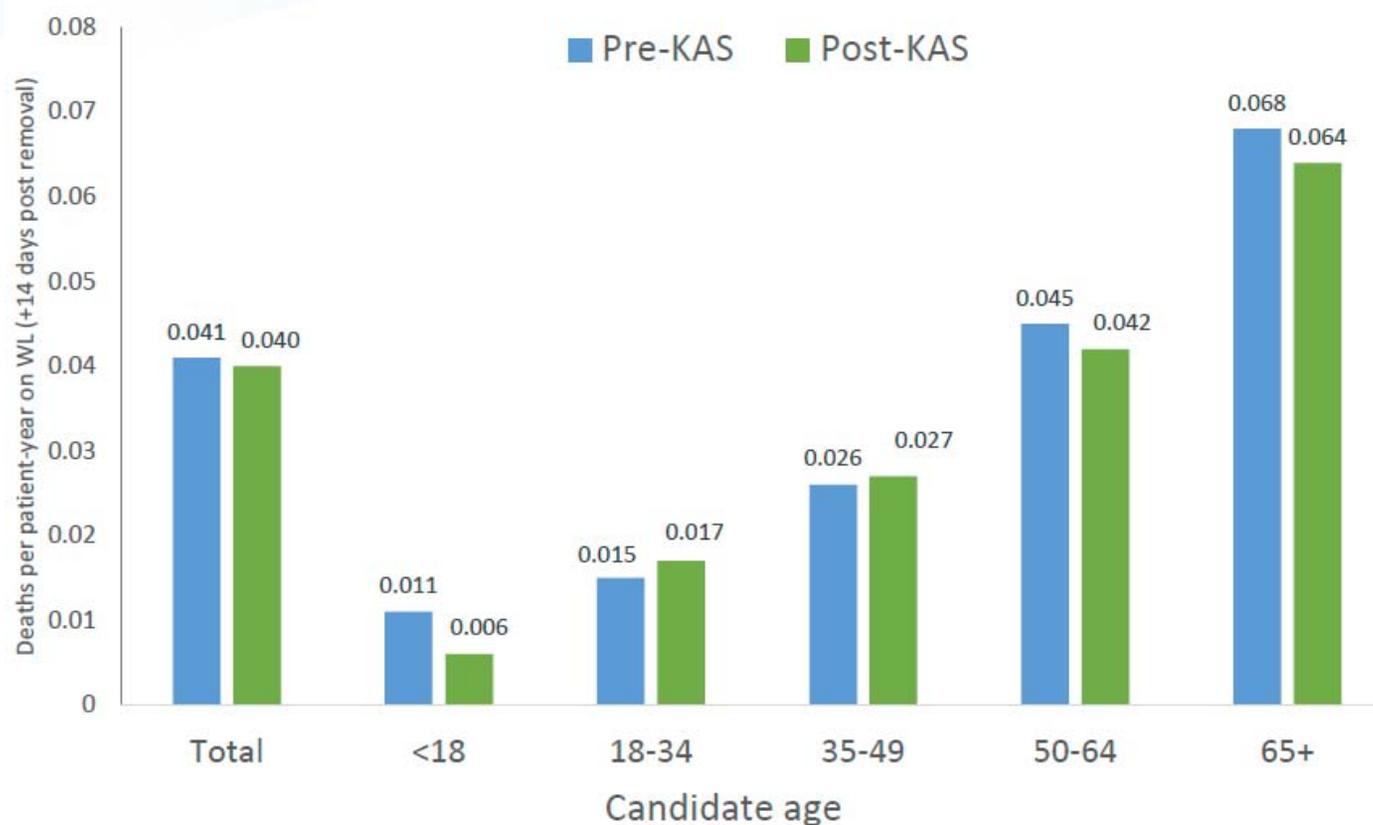
Trends in the kidney waiting list

Month-end “snapshots”

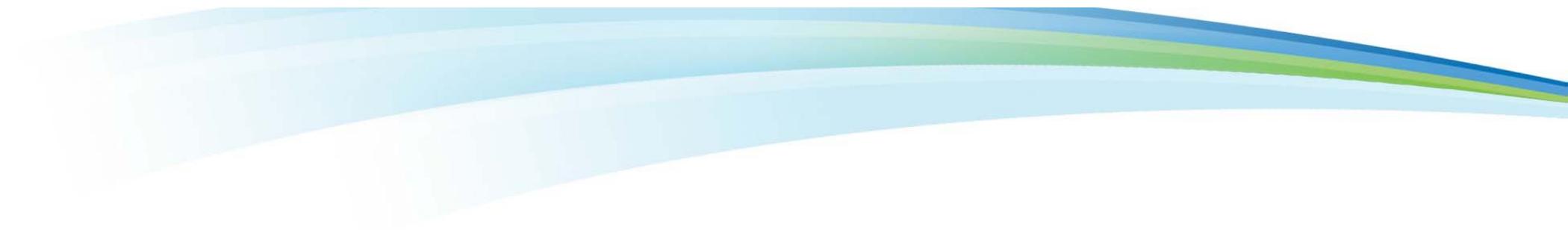


- The % of registrations on the kidney waiting list in active status has remained relatively constant at about 61%.

Waiting list mortality rates



- Waiting list mortality rates have remained virtually unchanged.
- (Pediatric drop not statistically significant)

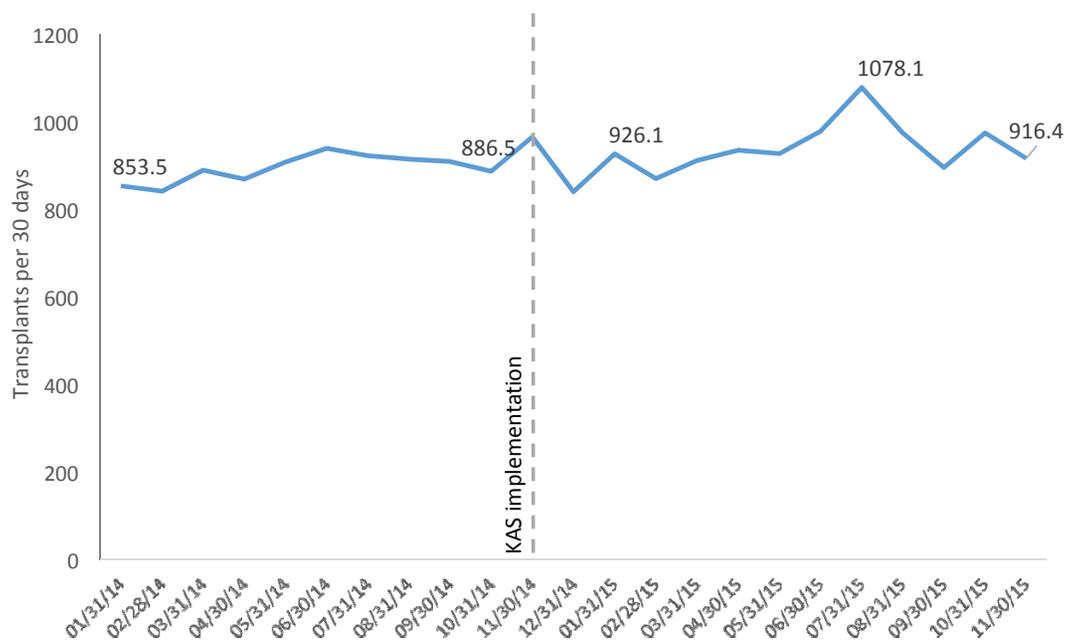


Deceased donor kidney transplants

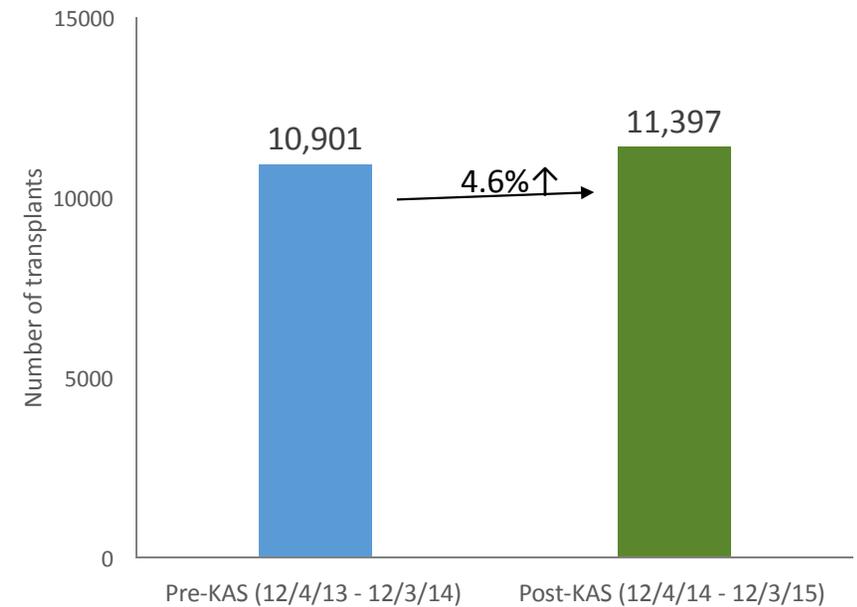
Solitary deceased donor transplants under KAS

Pre vs. post-KAS trends

Over time (per 30 days)



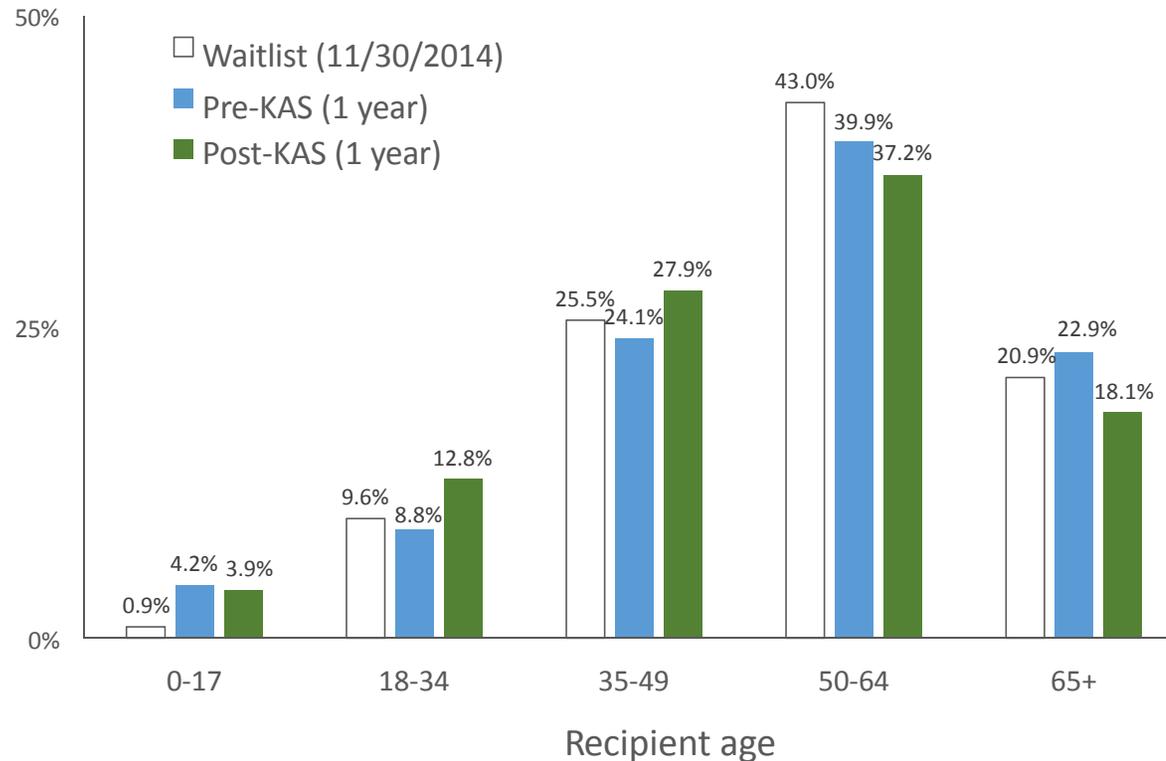
In total (per year)



- Transplant volume increased 4.6%.
- Increase from 896.0 to 936.7 per month.

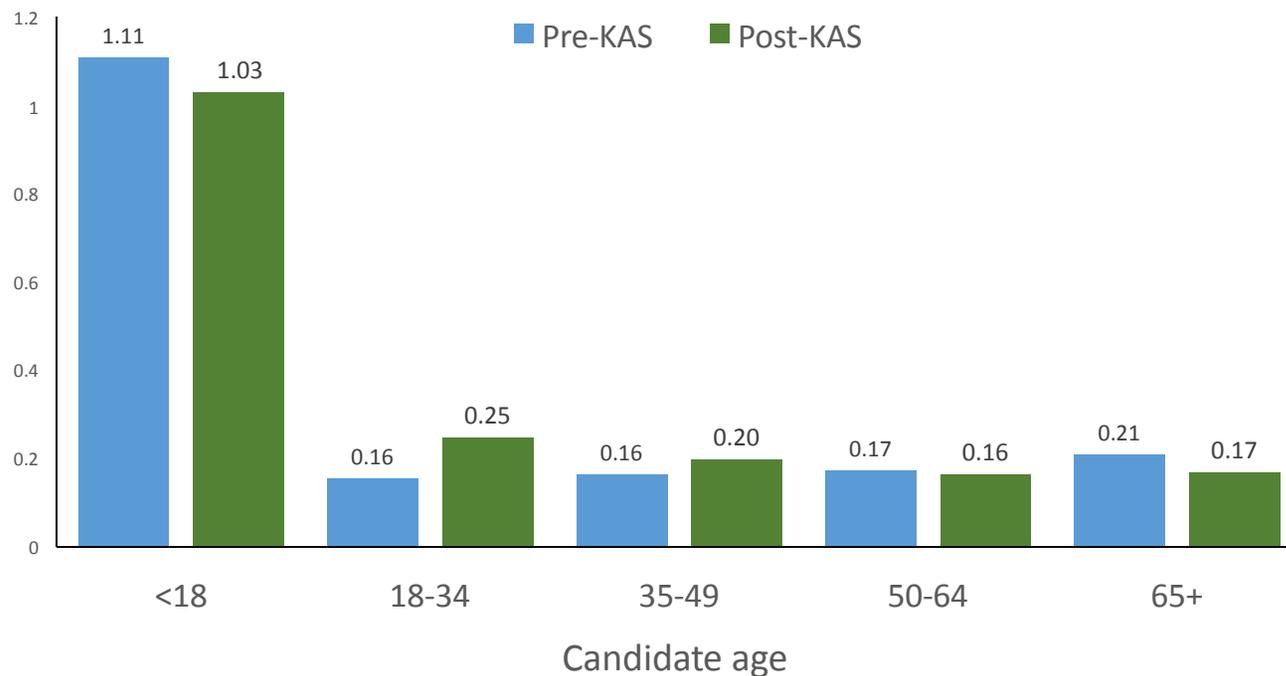
Who's getting transplanted under KAS?

Percentage of Deceased Donor Kidney Transplants by Recipient Age



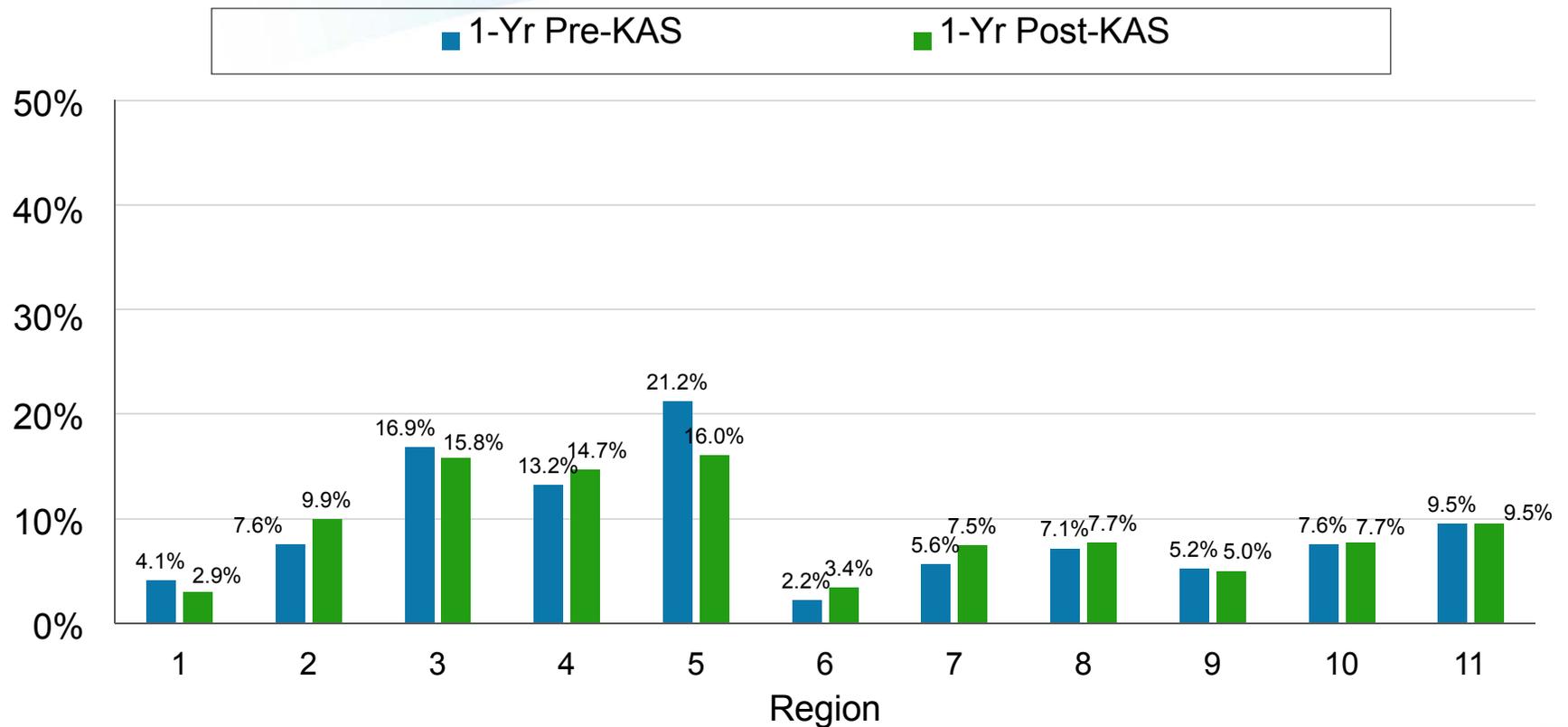
- More young candidates (18-49) are receiving kidney transplants.
- Transplants to pediatrics rebounded in 2nd six months

Transplant rates (per active patient-year) by candidate age



- Pediatric transplant rate fell slightly. Difference is not statistically significant. Rate is still 5 times higher than for adults.
- Transplant rate increase for 18-34 and 35-49, decreased for older patients.

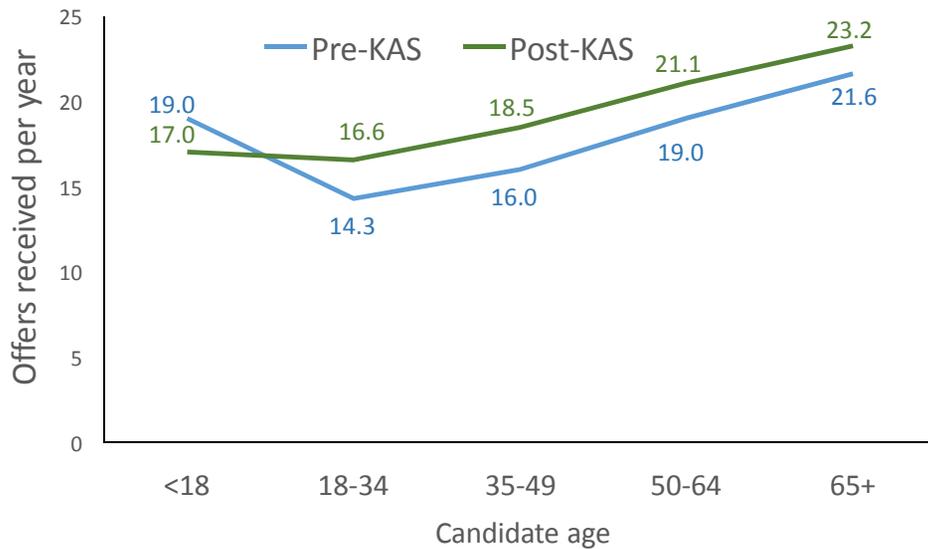
Geographic distribution of pediatric kidney transplants



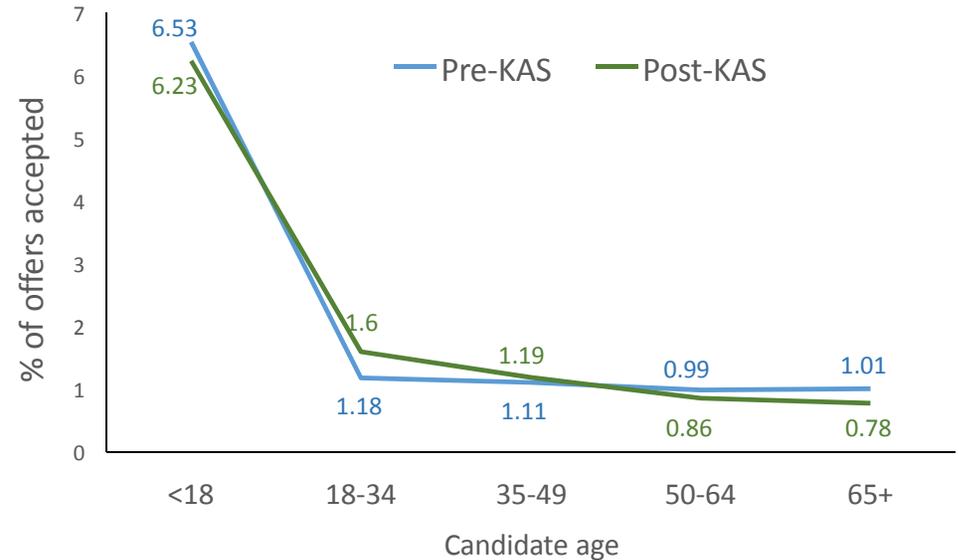
- Most regions had higher or similar percent of pediatric transplants except for Region 1 or 5.

Rates of receiving and accepting offers by candidate age

Offers received



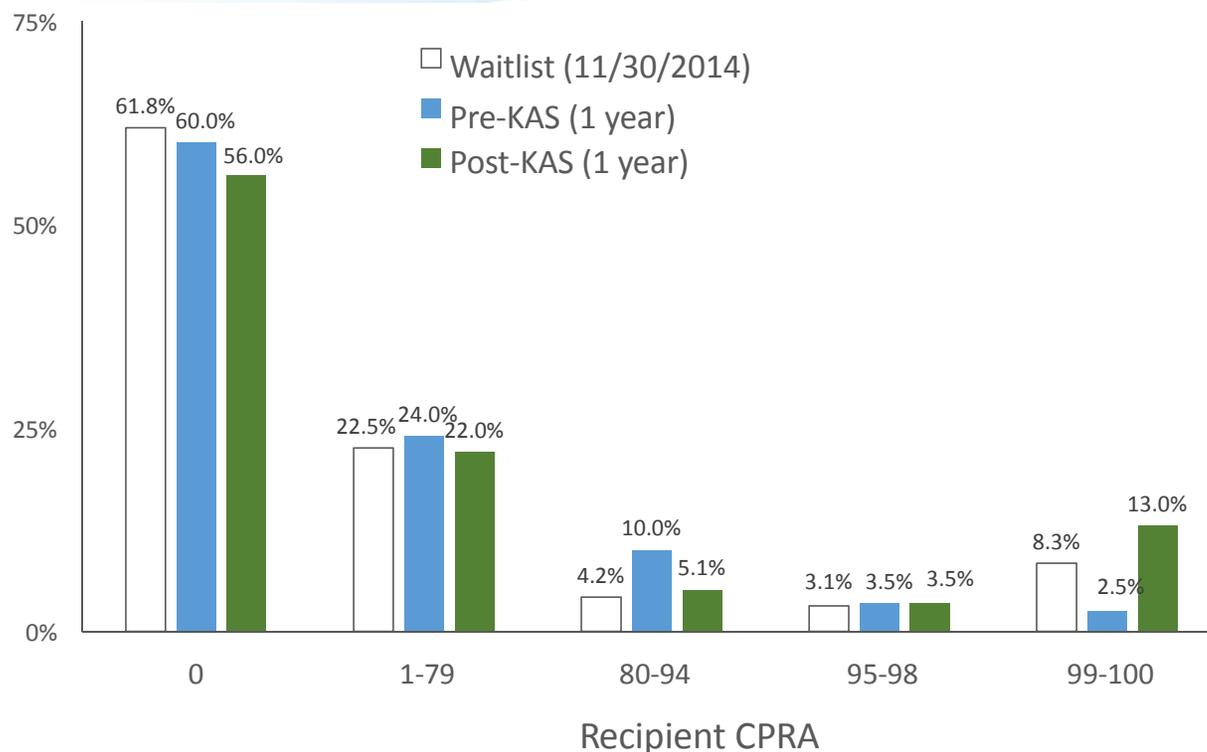
Acceptance rates



- Offer rates dropped post-KAS for pediatrics, but acceptance rates remained relatively high. Donor quality increased for pediatric offers (avg KDPI↓).
- Offer acceptance rates dropped for older patients and increased for younger adults, most likely due to organ quality (KDPI) differences.

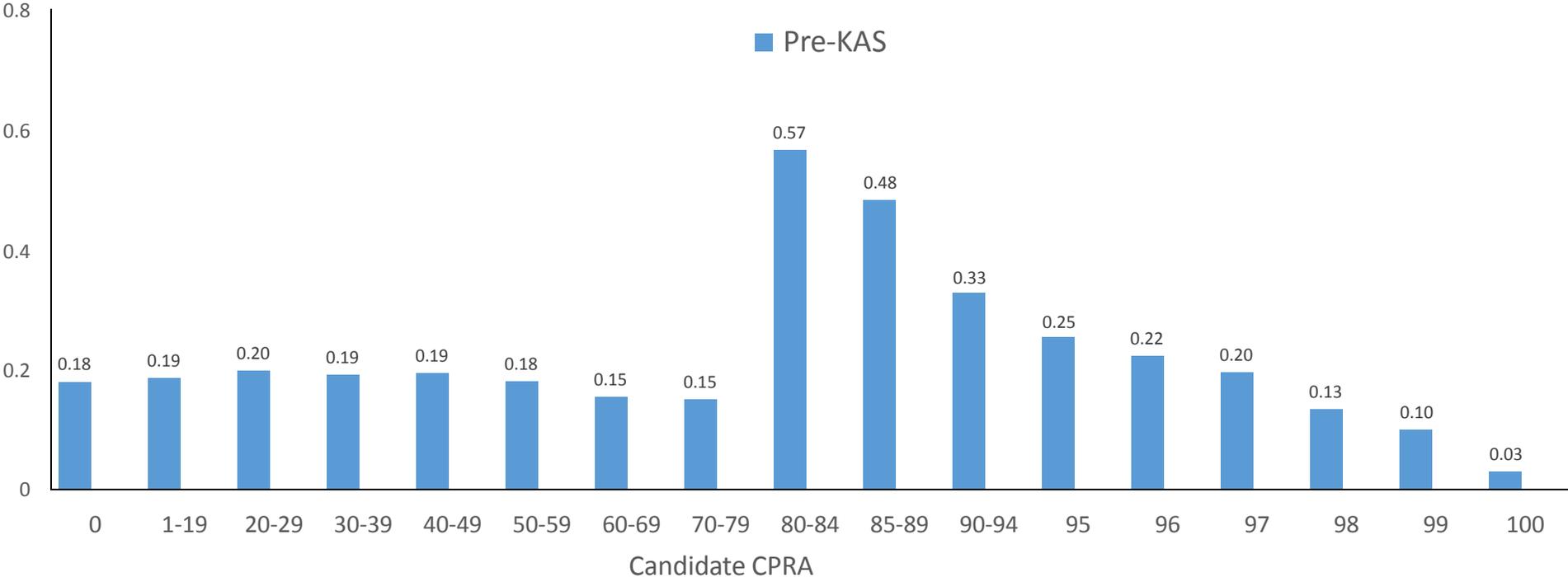
Who's getting transplanted under KAS?

Percentage of Deceased Donor Kidney Transplants by Recipient CPRA



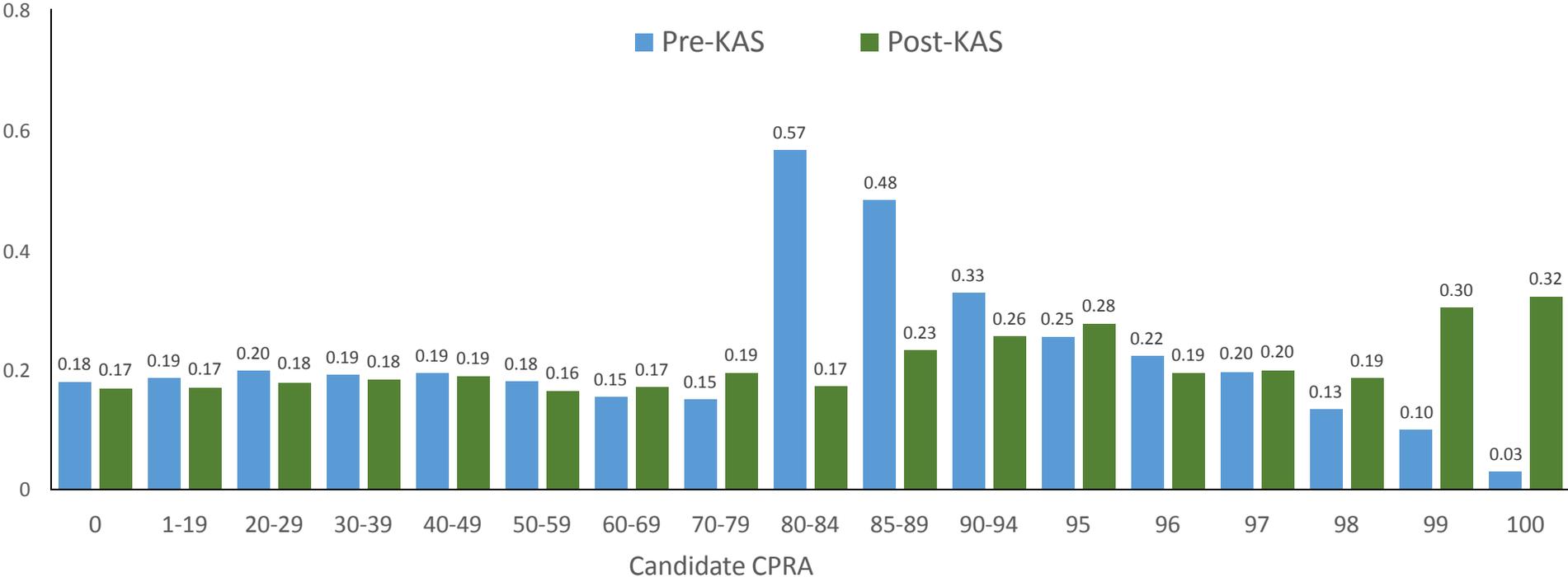
- Transplants increased sharply for CPRA 99-100% patients but have tapered during the 2nd six months.
- Pre-KAS 12.2% of recipients had a prior transplant; this rose to 15.8% of transplants.

Transplant rates (per active patient-year) by candidate CPRA



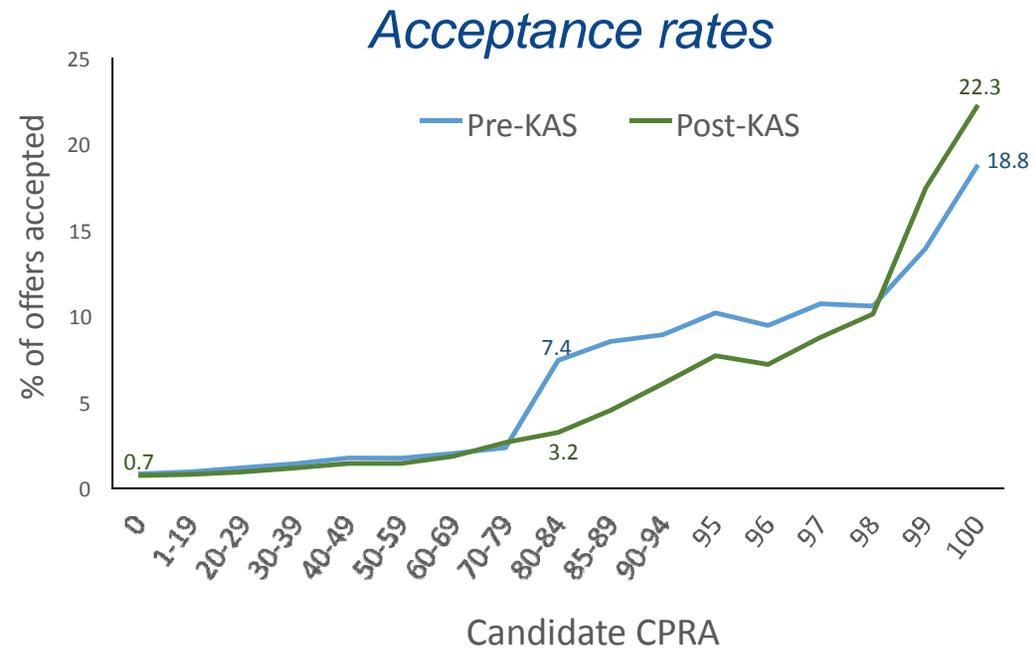
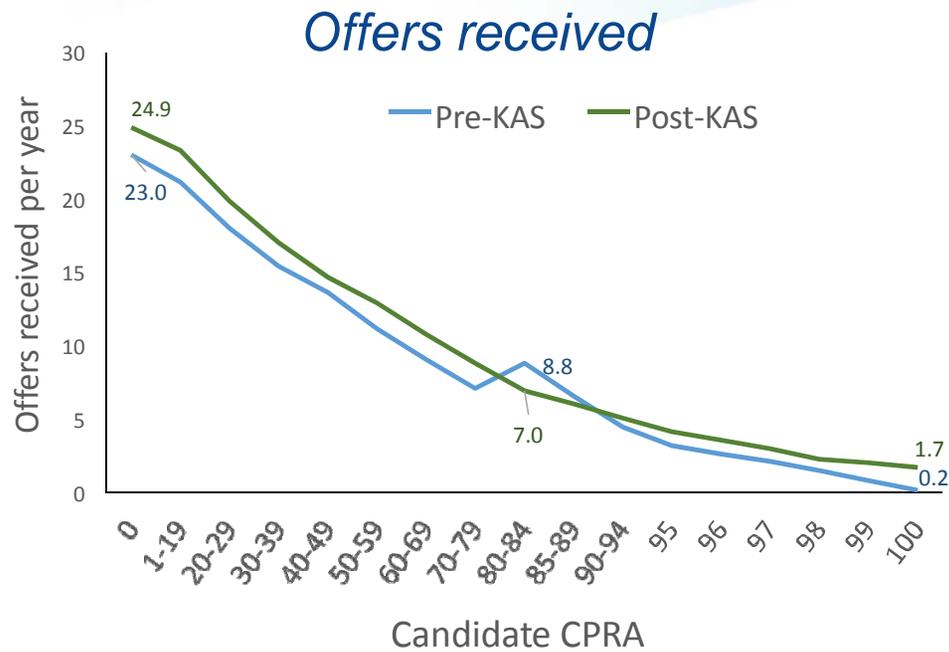
- Pre-KAS, candidates with CPRA just over 80% had a marked advantage in access to transplantation.
- CPRA 99-100% patients had very little access.

Transplant rates (per active patient-year) by candidate CPRA



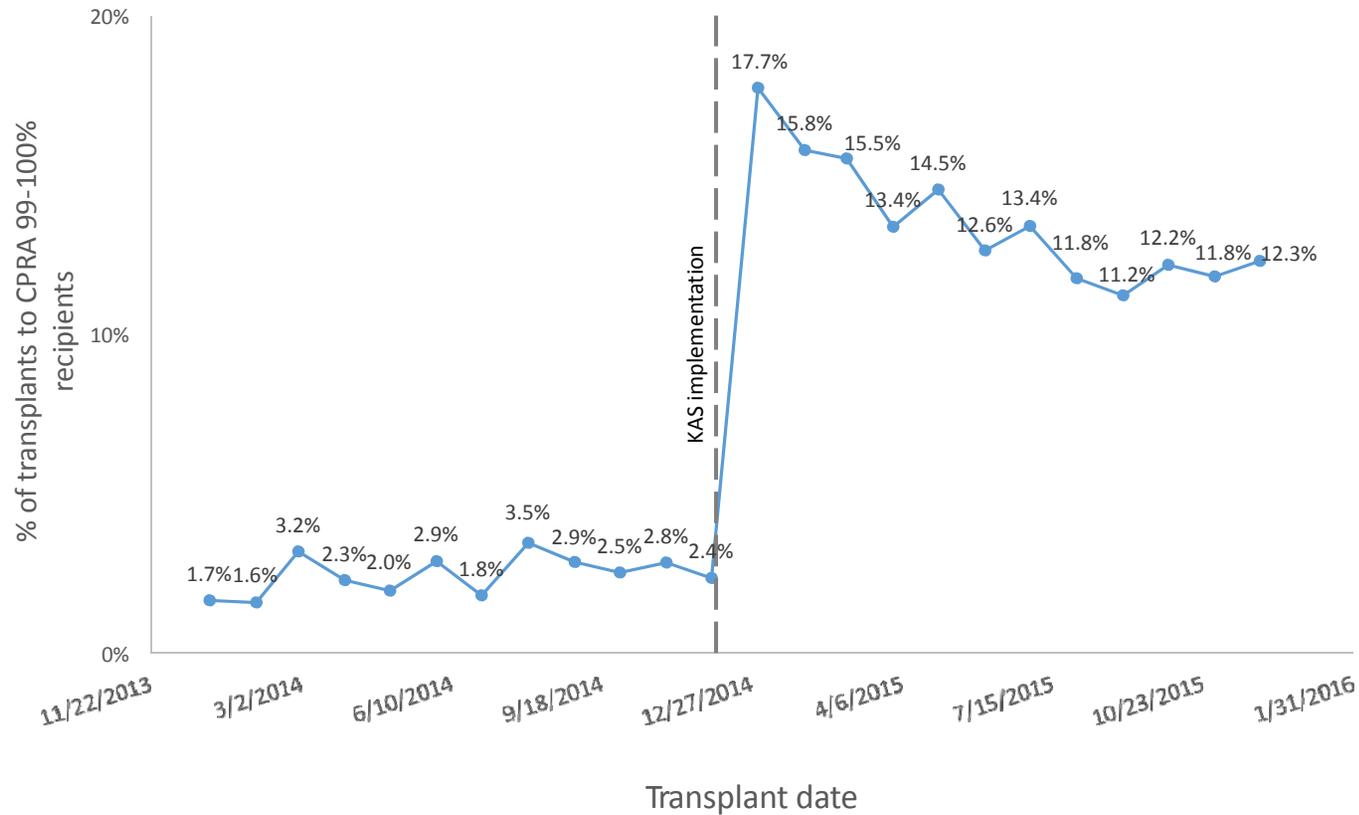
- Post-KAS, transplant rates decreased markedly for CPRA 80-94 candidates.
- Sharp increases for CPRA 99-100 candidates.

Offer & accept. rates by candidate CPRA



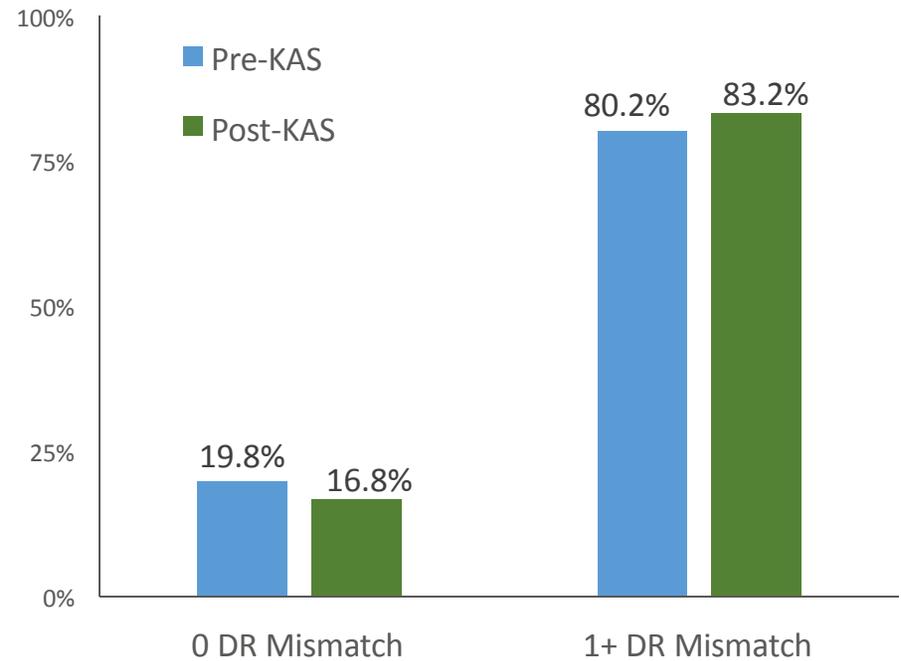
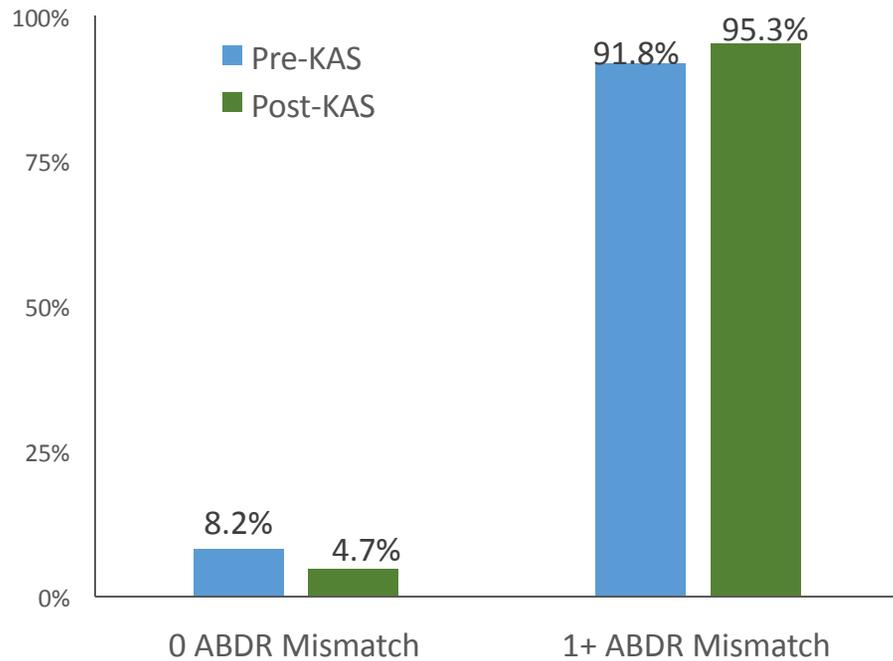
- Offer rate curve smoother post-KAS, and higher for CPRA > 95% patients.
- Offer acceptance rates increase as CPRA increases.

CPRA 99-100% recipient “bolus effect”



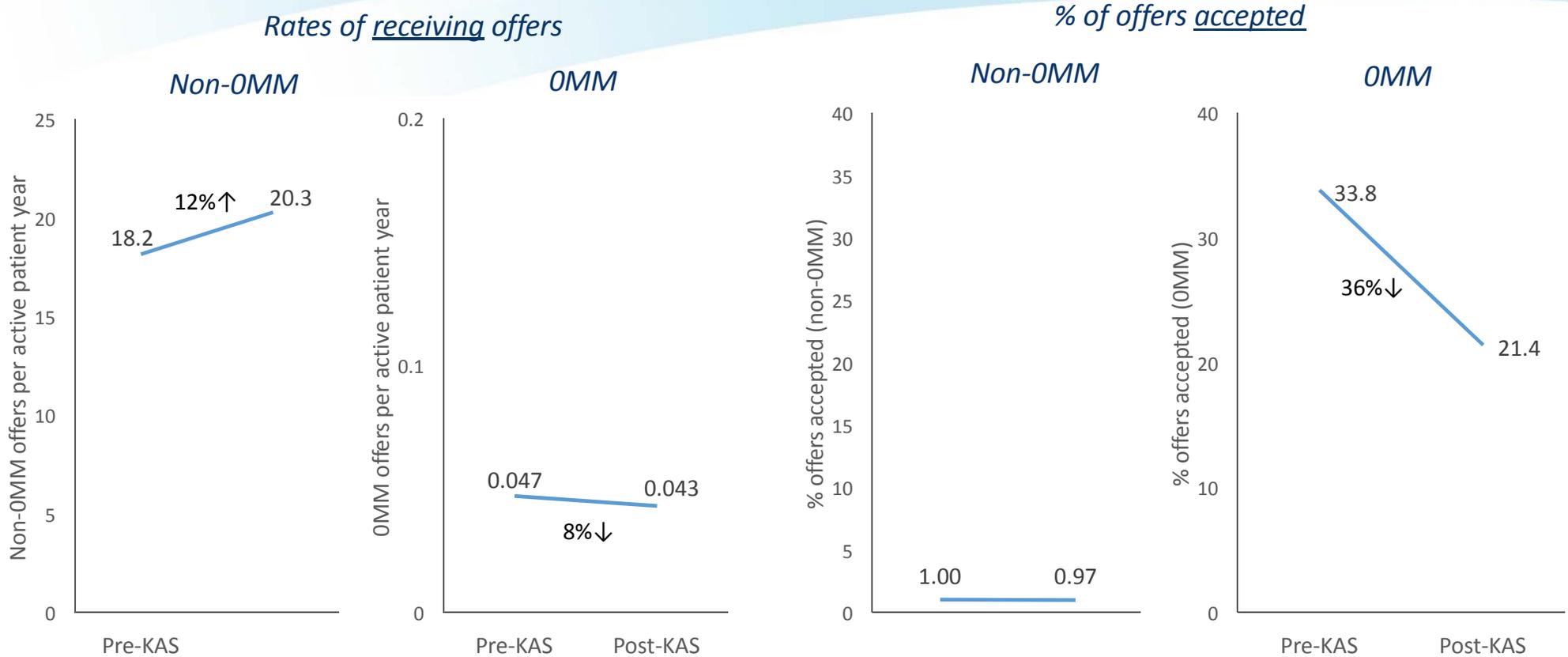
- Transplants to CPRA 99-100% patients rose sharply after KAS but have tapered to around 11-12%.

Transplants by HLA mismatch level



- Fewer 0-ABDR and 0-DR mismatch transplants occurred in the post-KAS period.

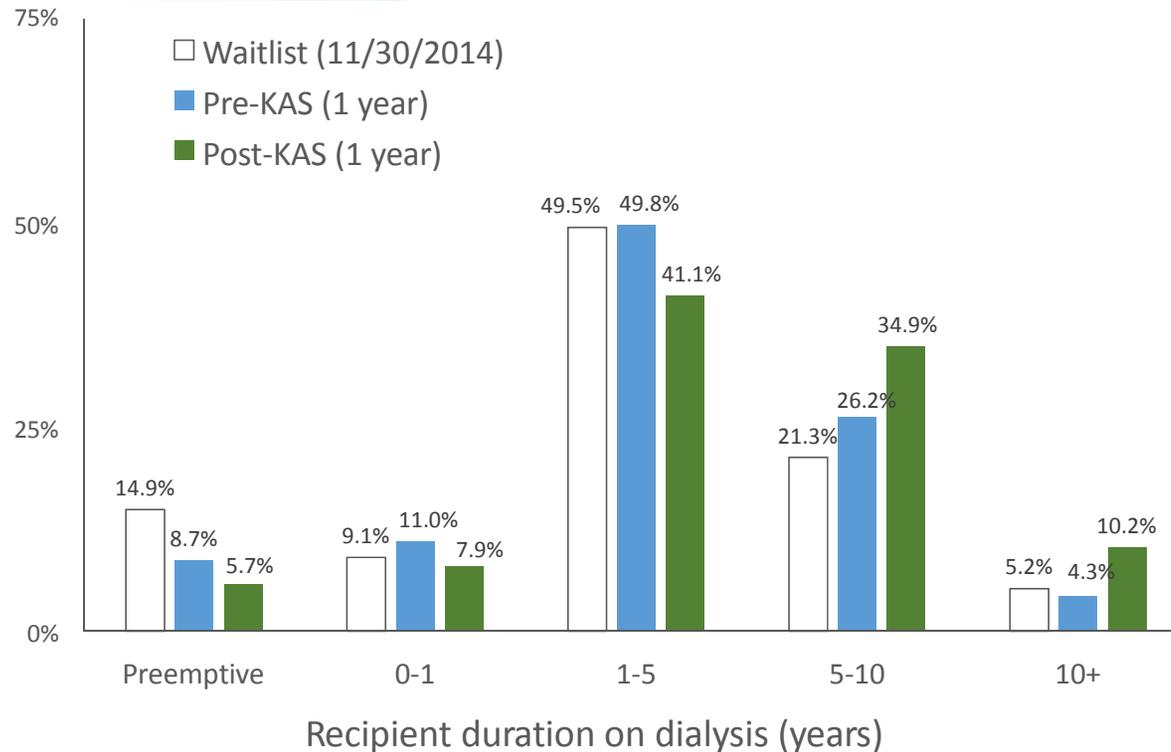
Offer rates and acc. rates by HLA mismatch level



- OMM offers decreased 8% post-KAS.
- Acceptance rates for OMM offers dropped by 36%.

Who's getting transplanted under KAS?

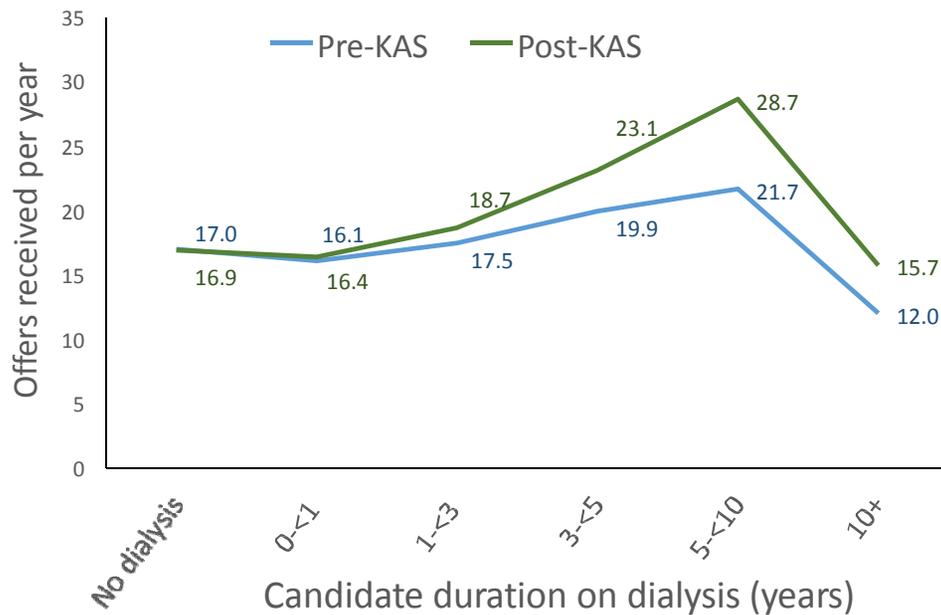
Percentage of Deceased Donor Kidney Transplants by Recipient Duration on Dialysis



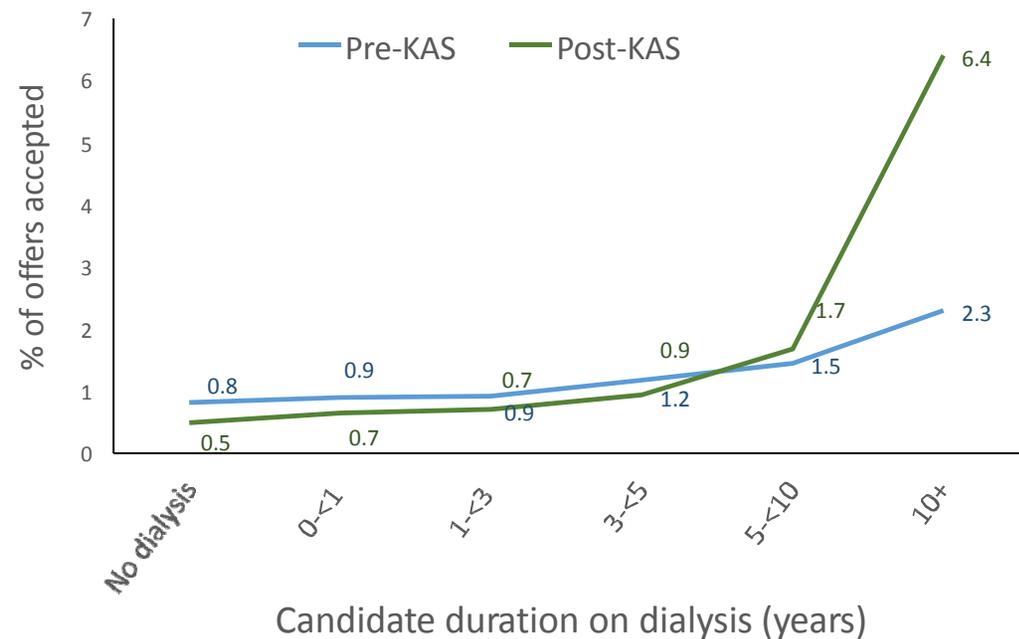
- More transplants are going to long dialysis duration recipients.
- Fewer preemptive (before dialysis) transplants.

Offer & accept. rates by candidate time on dialysis

Offers received

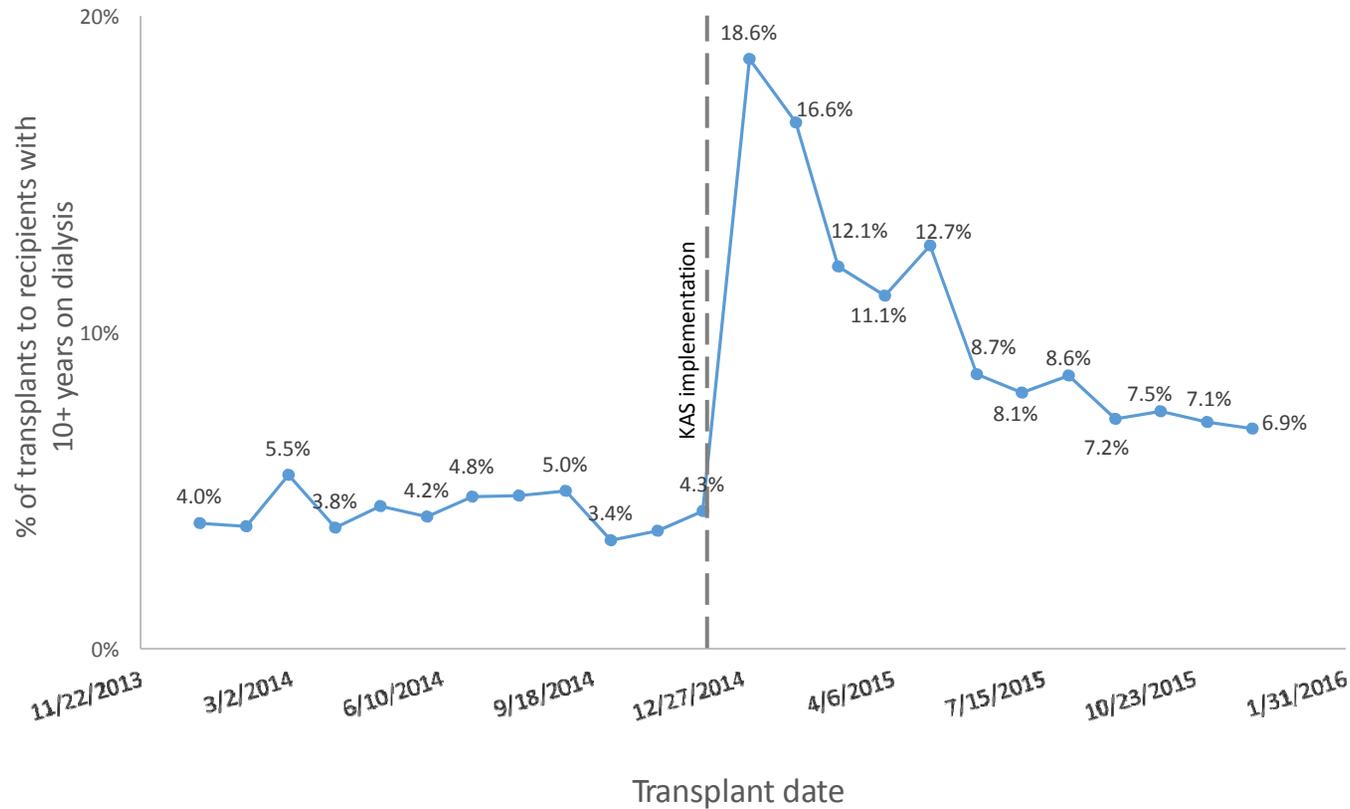


Acceptance rates



- Offer rates increased post-KAS for high dialysis time patients.
- Offer acceptance rates rose sharply for candidates with 10+ years on dialysis and dropped for preemptive patients.

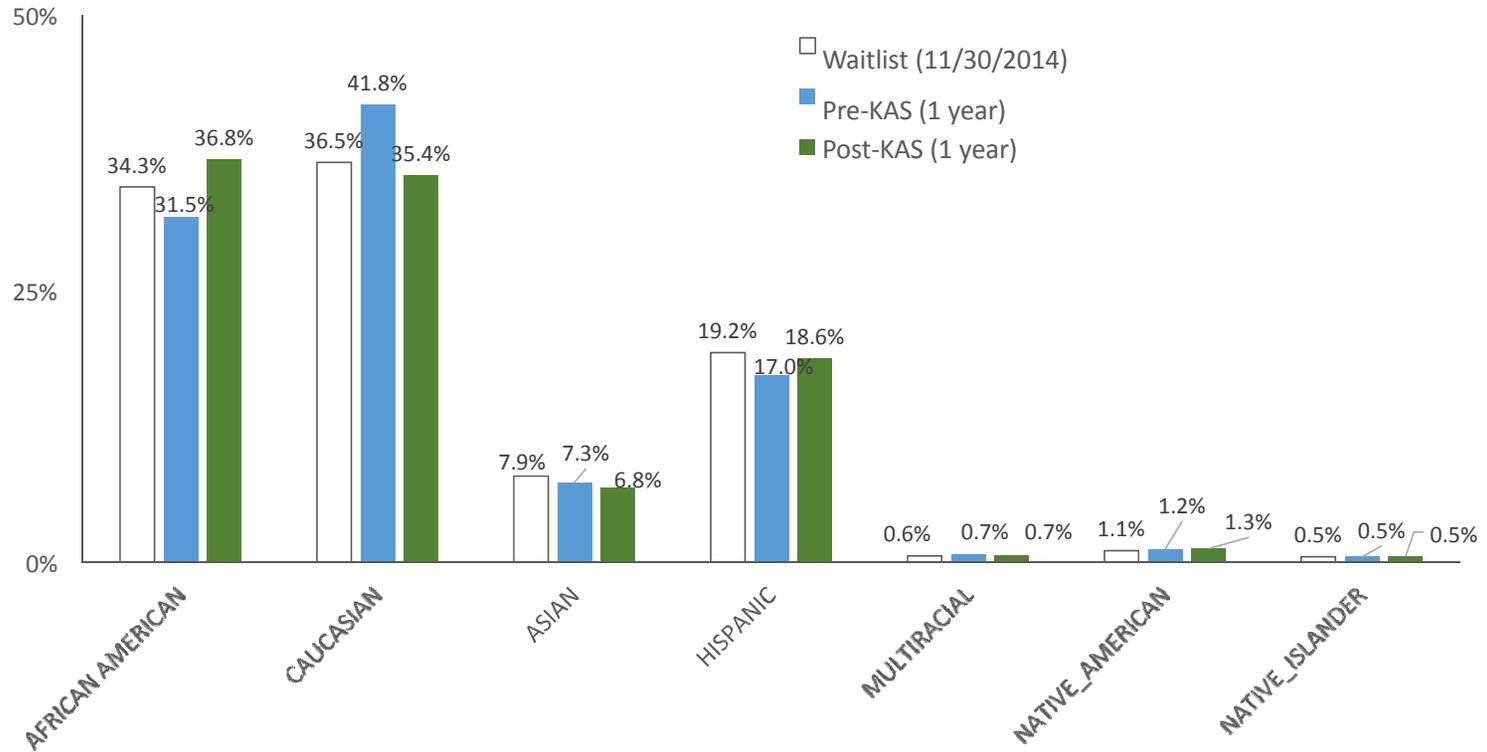
High dialysis time recipient “bolus effect”



- Transplants to recipient with 10+ years of dialysis rose sharply after KAS but have tapered substantially.

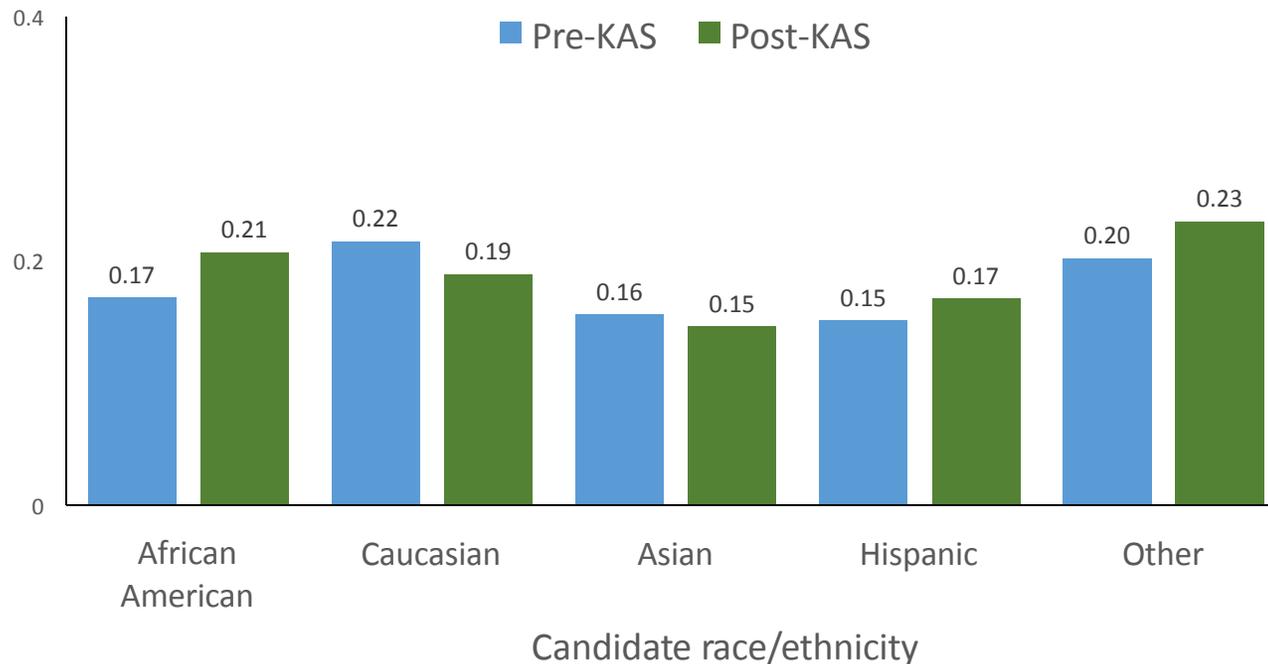
Who's getting transplanted under KAS?

Percentage of Deceased Donor Kidney Transplants by Recipient Race/ethnicity



- More African Americans are receiving kidney transplants, although less so during the 2nd six months.

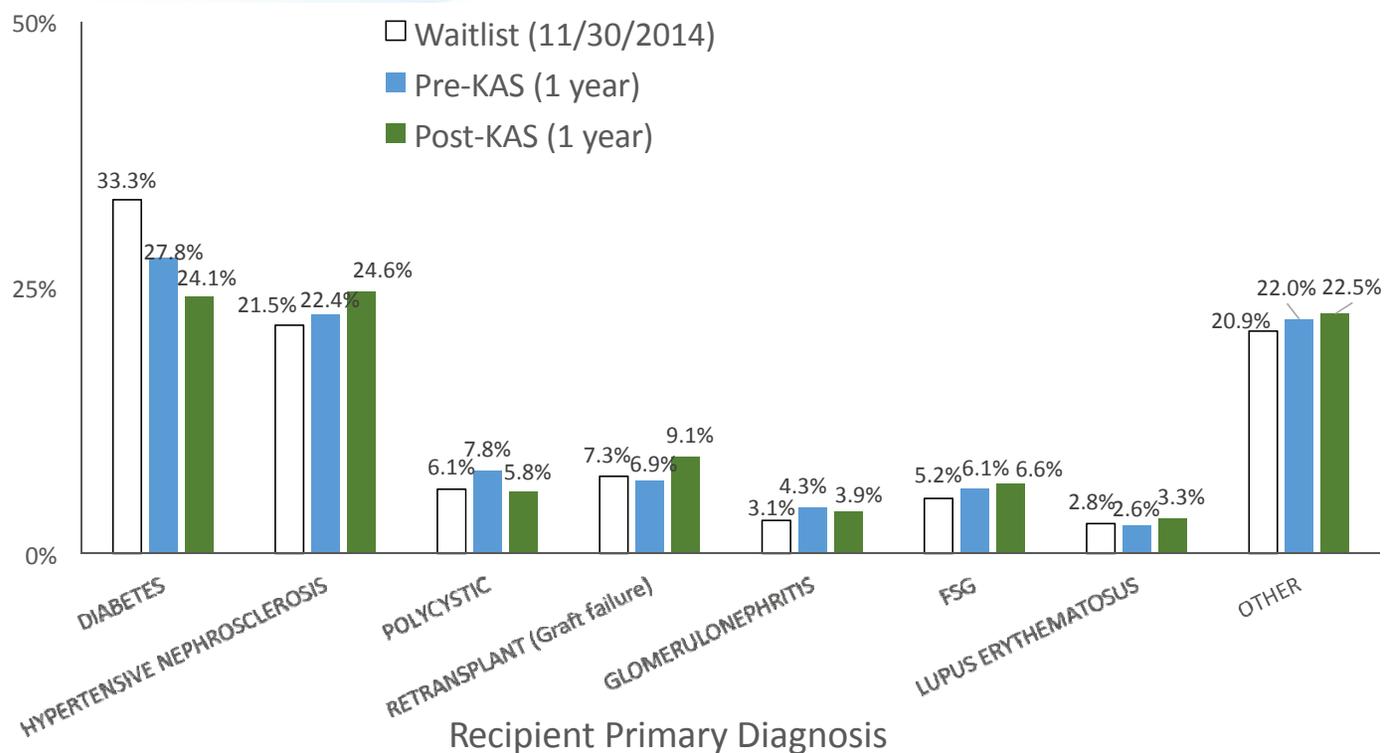
Transplant rates (per active patient-year) by candidate race/ethnicity



- Statistically significant increase in transplant rates for African American (AA) and Hispanic candidates.
- Offer rates up 20% and acceptance rates up 4% for AA candidates.

Who's getting transplanted under KAS?

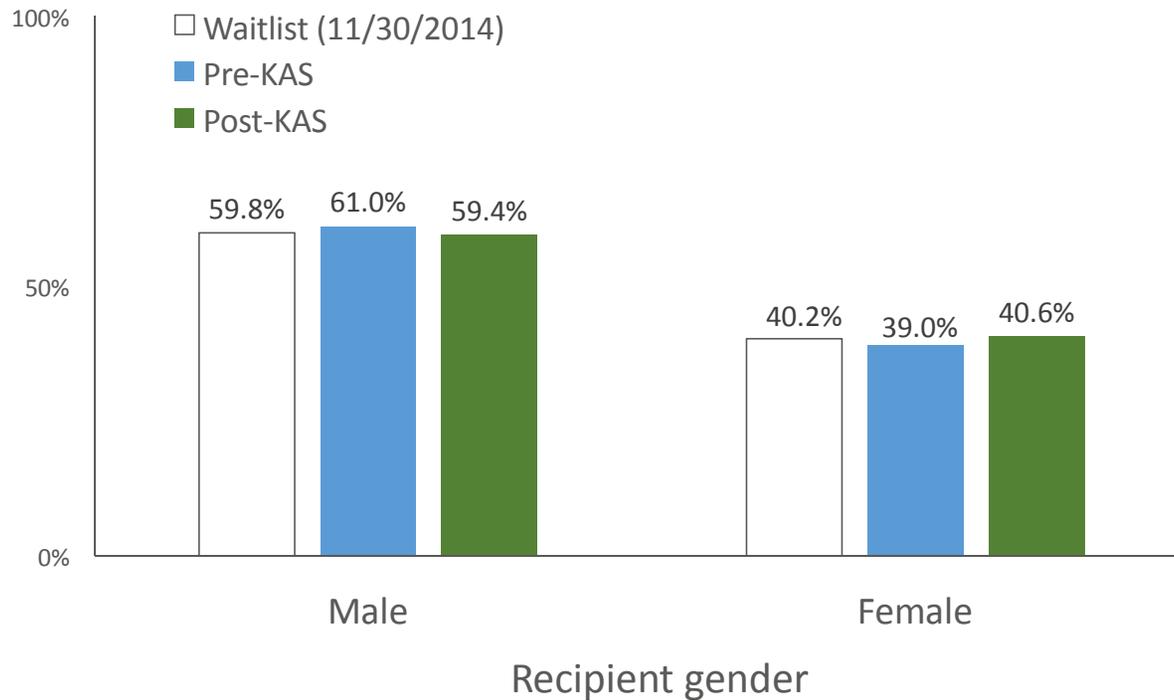
Percentage of Deceased Donor Kidney Transplants by Recipient Primary Diagnosis



- More transplants for hypertensive nephrosclerosis and retransplant patients.
- Fewer transplants for diabetics and polycystic kidney disease patients.

Who's getting transplanted under KAS?

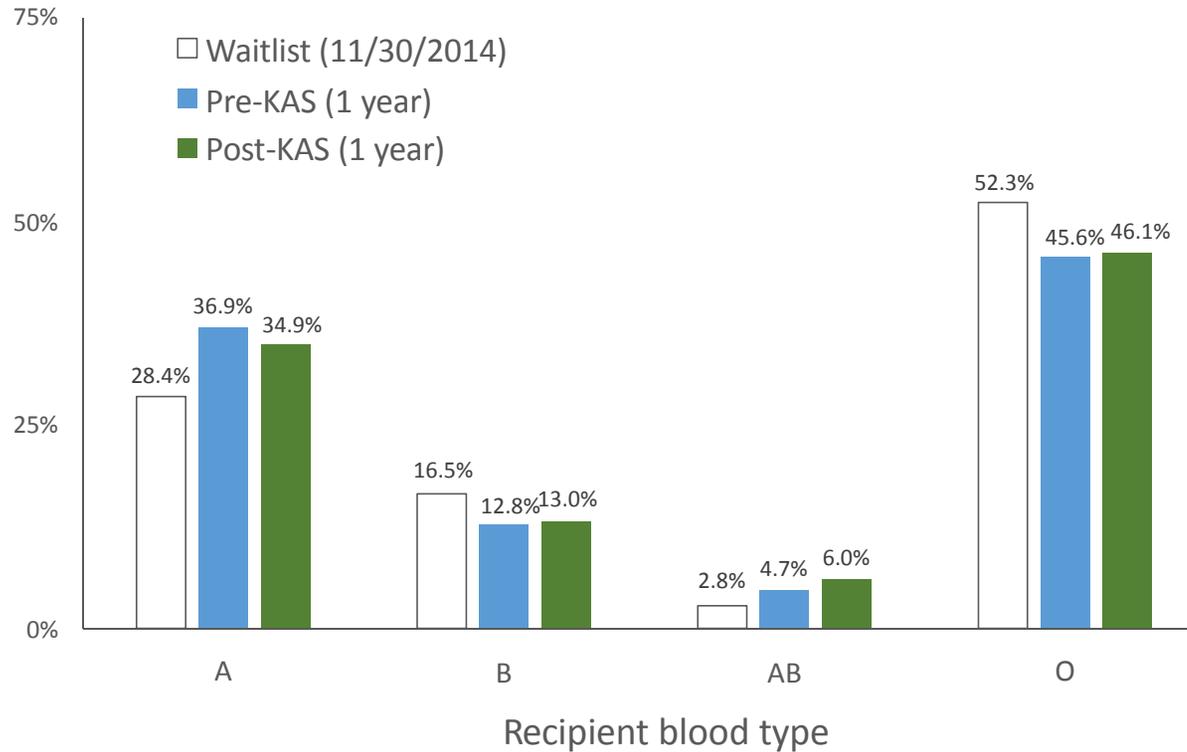
Percentage of Deceased Donor Kidney Transplants by Recipient Gender



- Transplants to female recipients increased slightly under KAS.
- Highly sensitized patients tend to more often be female.

Who's getting transplanted under KAS?

Percentage of Deceased Donor Kidney Transplants by Recipient Blood Type



- The distribution of transplants has changed little by recipient ABO.
- Slight increases for blood type B and AB patients.

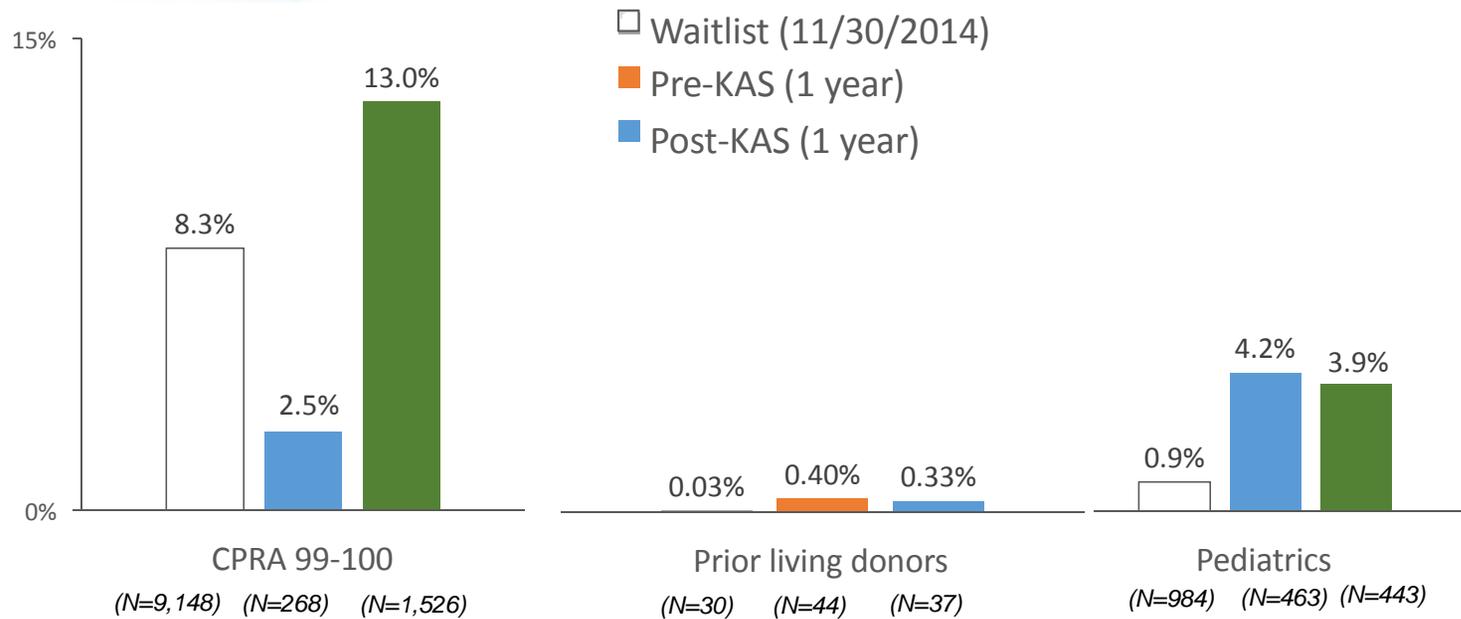
A2/A2B subtype to blood type B recipients

Pre vs post-KAS summary

Metric	PRE-KAS	POST-KAS
A2/A2B transplants	19	109
% of transplants	0.2%	1.0%

- A2/A2B→B transplants have increased 5-fold.
- Occurred at 34 different programs.

Pediatrics, Highly Sensitized, and Prior Living Donors

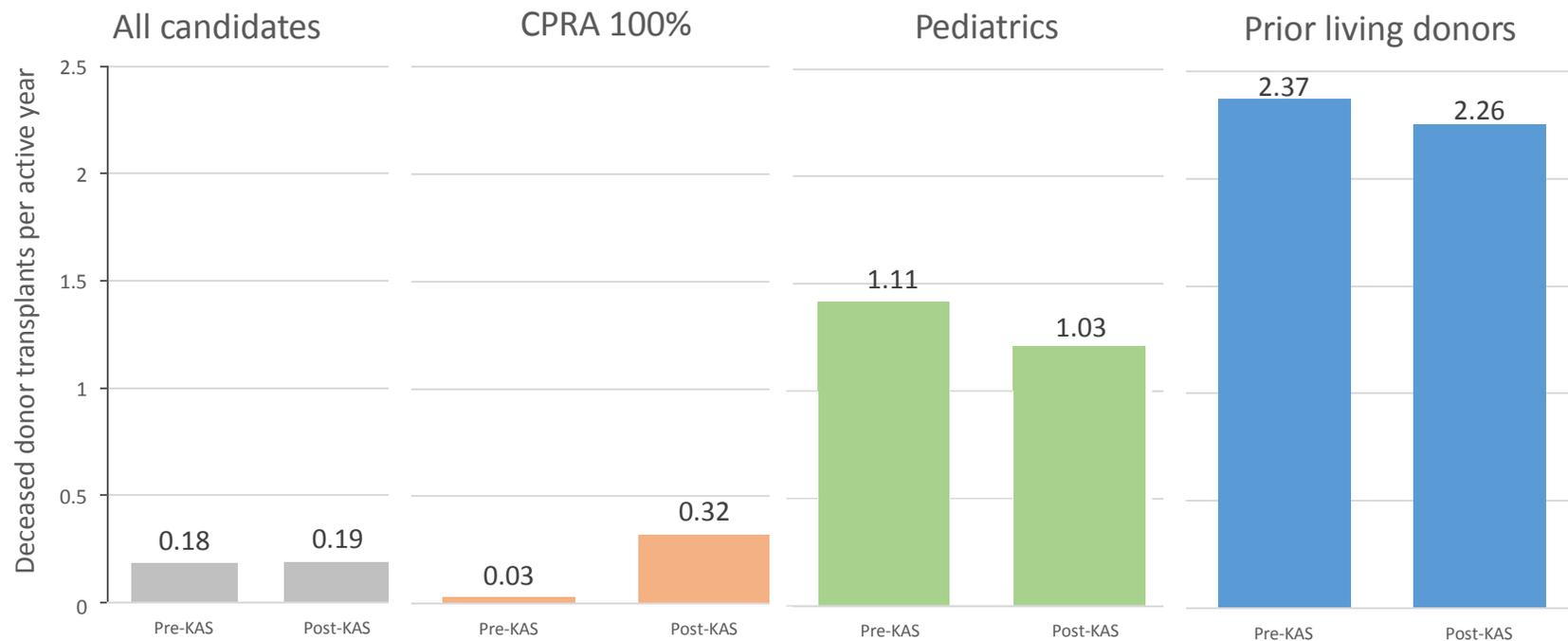


- Proportion of transplants relative to WL prevalence under KAS:

➤ CPRA 99-100: $13.0/8.3 = \mathbf{1.6}$ PLDs: $0.30/0.028 = \mathbf{11}$ Pediatrics: $3.6/0.9 = \mathbf{4.3}$

Prior living donors' access to transplants

Deceased donor transplant rates per active patient-year on the WL



- Transplant rates for prior living donors are similar pre vs. post KAS and much greater than all other kidney candidate populations.

Single vs. Dual vs. En bloc kidney transplants

Pre vs post-KAS summary

Metric	PRE-KAS N	PRE-KAS %	POST-KAS N	POST-KAS %
Single	10614	97.4%	11109	97.5%
Dual	96	0.9%	63	0.6%
En-bloc	191	1.8%	225	2.0%

OPTN | UNOS ■ Fewer dual kidney transplants post-KAS.

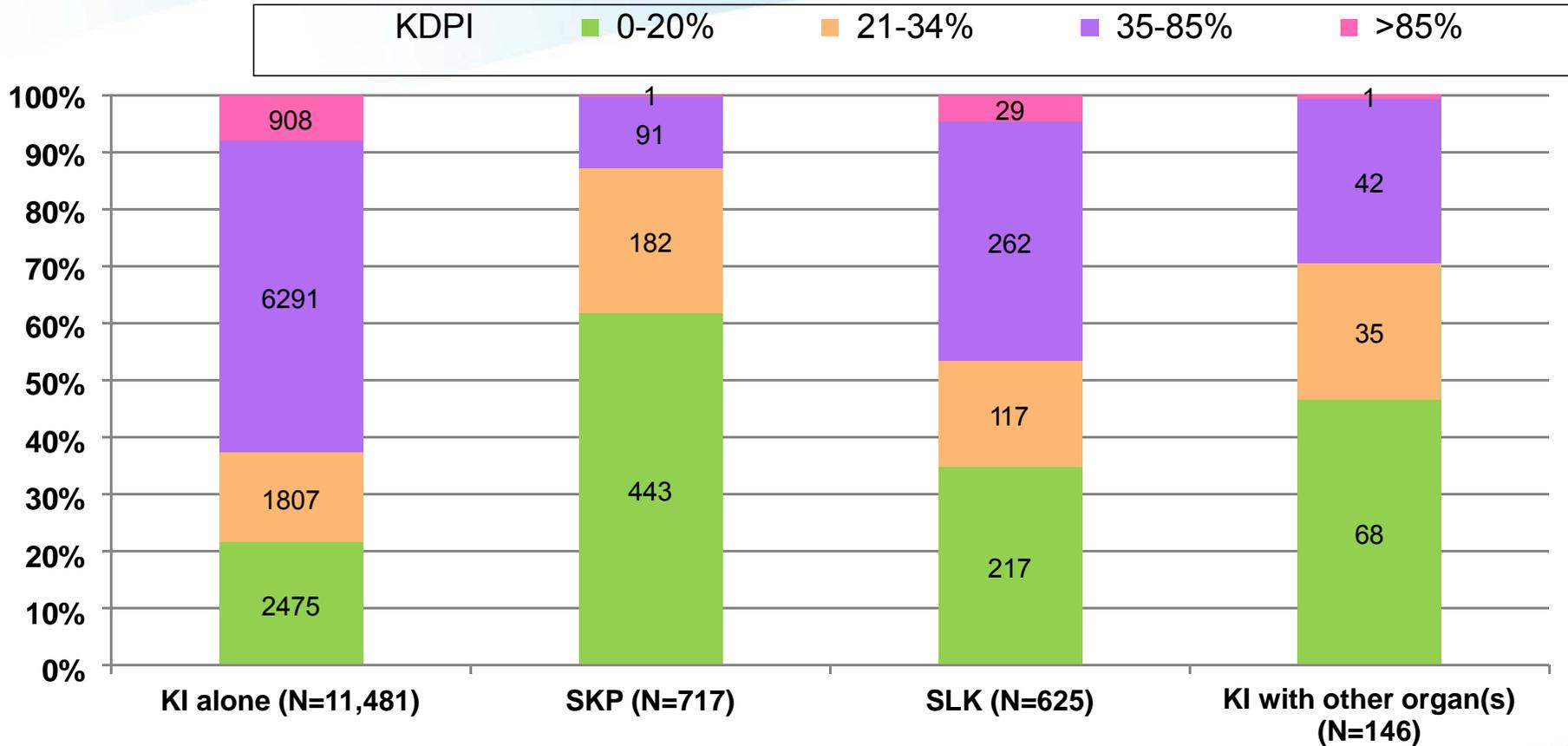
Multi-organ kidney transplants

Pre vs post-KAS summary

Multi-organ kidney transplant type	PRE-KAS N	PRE-KAS %	POST-KAS N	POST-KAS %
All	1,370	11.2%	1,471	11.4%
Heart-Kidney	112	0.9%	134	1.0%
Kidney-Pancreas	702	5.7%	705	5.5%
Liver-Kidney (SLK)	542	4.4%	625	4.9%
Other	14	0.1%	7	0.1%

- The proportion of transplanted deceased donor kidneys used in multi-organ transplants has changed little.

KDPI distribution among deceased donor kidney transplants in 2015



OPTN | UNOS ■ Multi-organ kidney tx tend to have low KDPI.

Slide courtesy of Wida Cherikh and Anna Kucheryavaya, UNOS

Longevity-matching under KAS

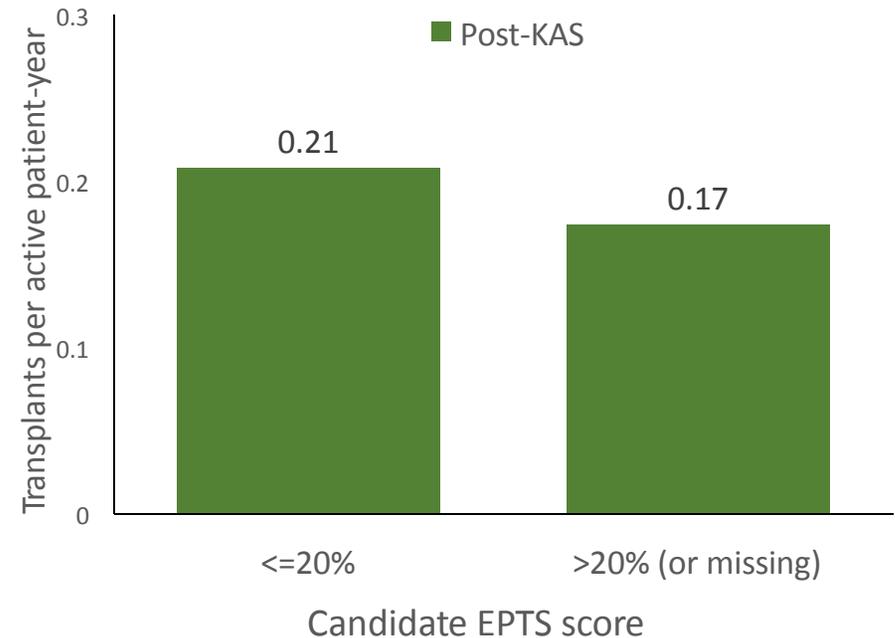
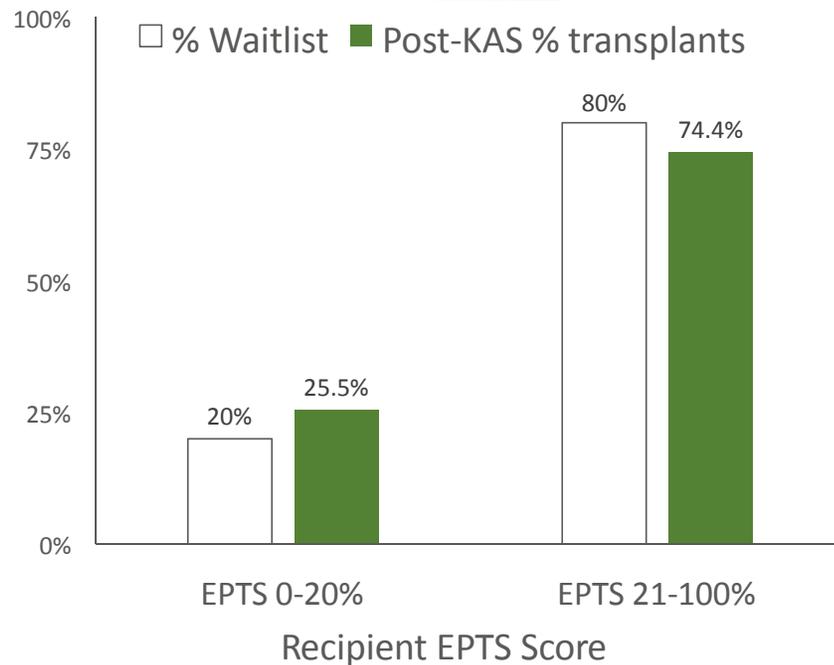
Percentage of Deceased Donor Kidney Transplants by KDPI and Recipient Age

Recip age	Pre-KAS				
	KDPI				ALL
	0-20	21-34	35-85	86-100	
0-17	13.4%	4.9%	1.1%	0.2%	4.2%
18-34	12.5%	11.5%	7.7%	1.3%	8.8%
35-49	26.4%	27.8%	24.6%	8.3%	24.1%
50-64	33.0%	38.8%	42.2%	45.3%	39.9%
65 Plus	14.6%	17.0%	24.4%	44.9%	22.9%
All	100.0%	100.0%	100.0%	100.0%	100.0%

Recip age	Post-KAS				
	KDPI				ALL
	0-20	21-34	35-85	86-100	
0-17	11.7%	6.8%	0.3%	0.0%	3.9%
18-34	30.4%	12.8%	7.2%	1.2%	12.8%
35-49	38.7%	28.2%	26.2%	8.6%	27.9%
50-64	14.3%	37.8%	45.1%	47.8%	37.3%
65 Plus	4.8%	14.5%	21.2%	42.4%	18.1%
All	100.0%	100.0%	100.0%	100.0%	100.0%

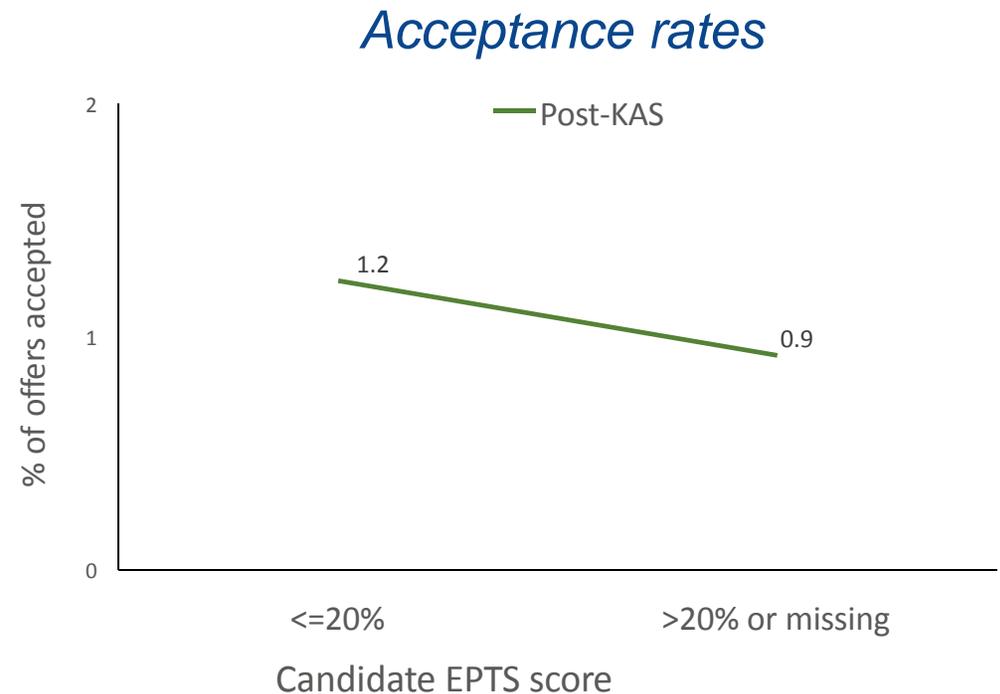
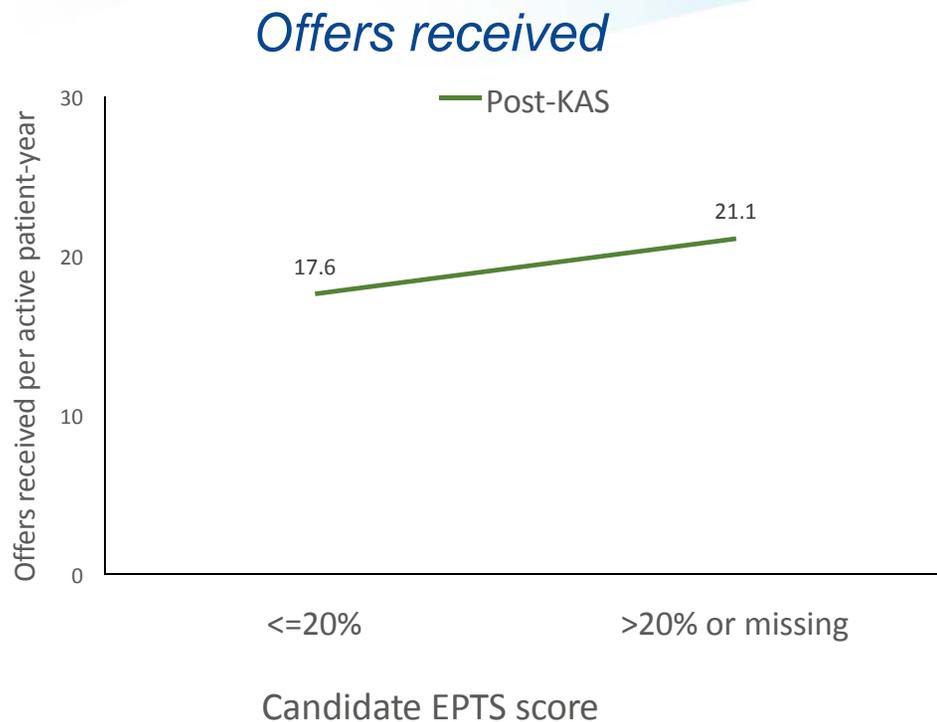
- Of KDPI 0-20% transplants, far more going to age 18-49 recipients, far fewer to age 50+.

Post-KAS access to transplants by EPTS score



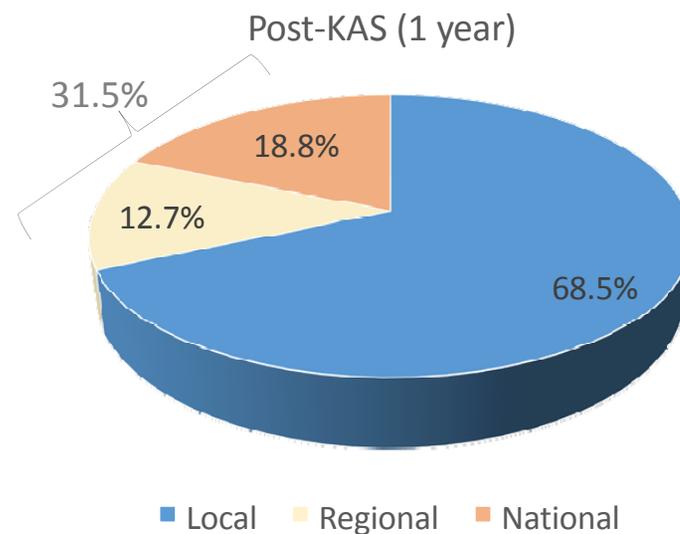
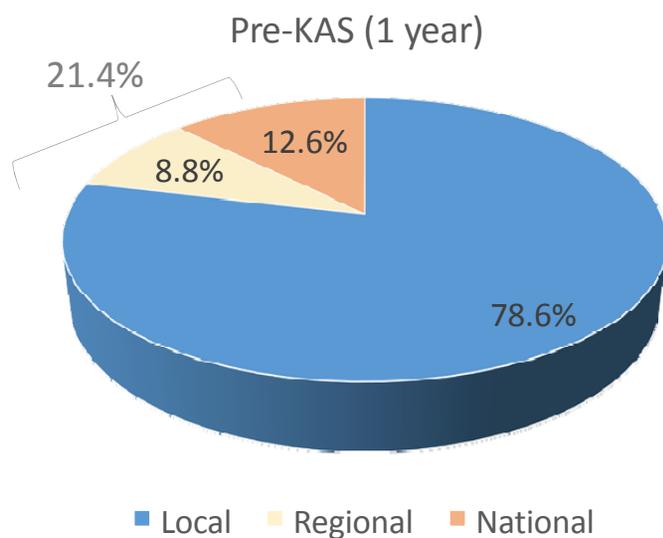
- EPTS 0-20% candidates have moderately higher access to transplants than EPTS 21-100% candidates under KAS, including 20% higher transplant rates.

Post-KAS offer and accept. rates by EPTS score



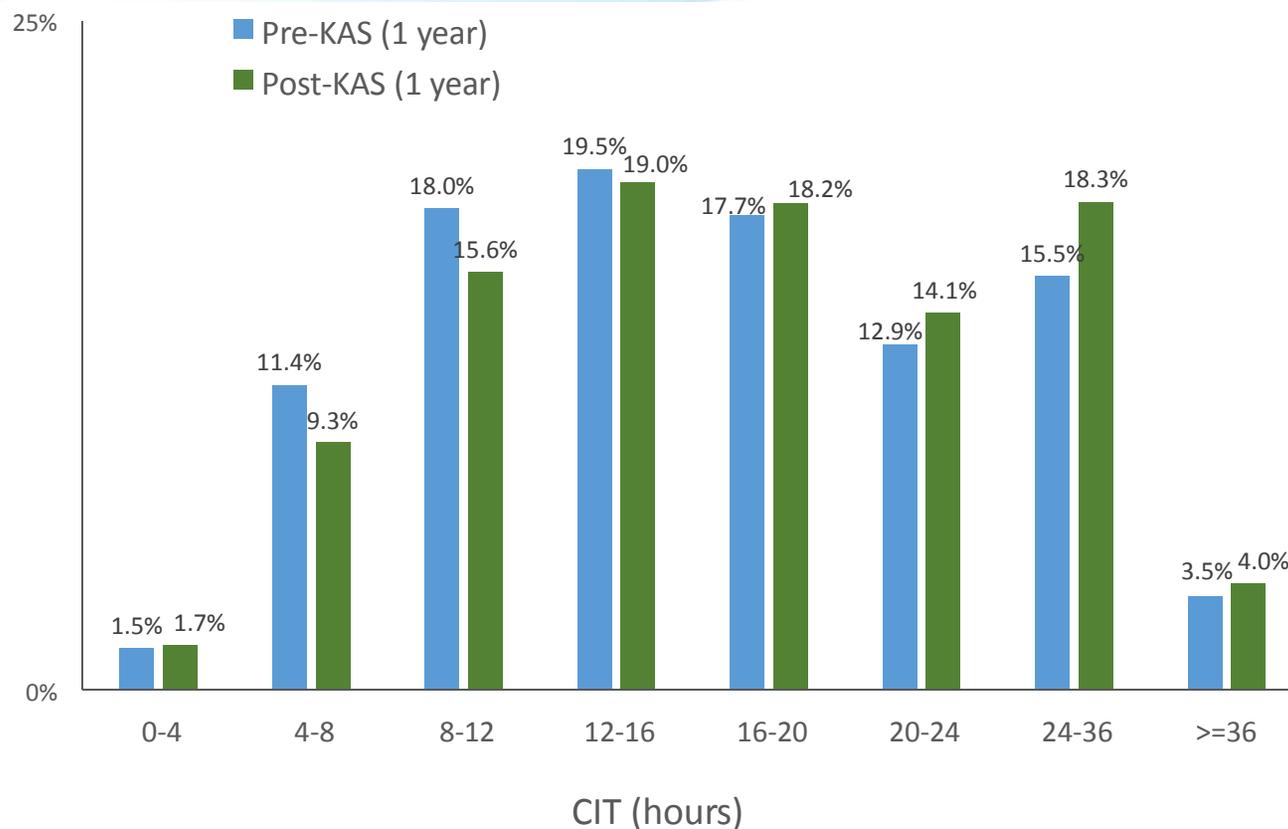
- Perhaps counterintuitively, offer rates were lower for EPTS 0-20% patients.
- However, organ quality was better (lower average KDPI) and acceptance rates for EPTS 0-20% patients were 30% higher than for EPTS 21-100% patients.

Geographic distribution of kidney transplants



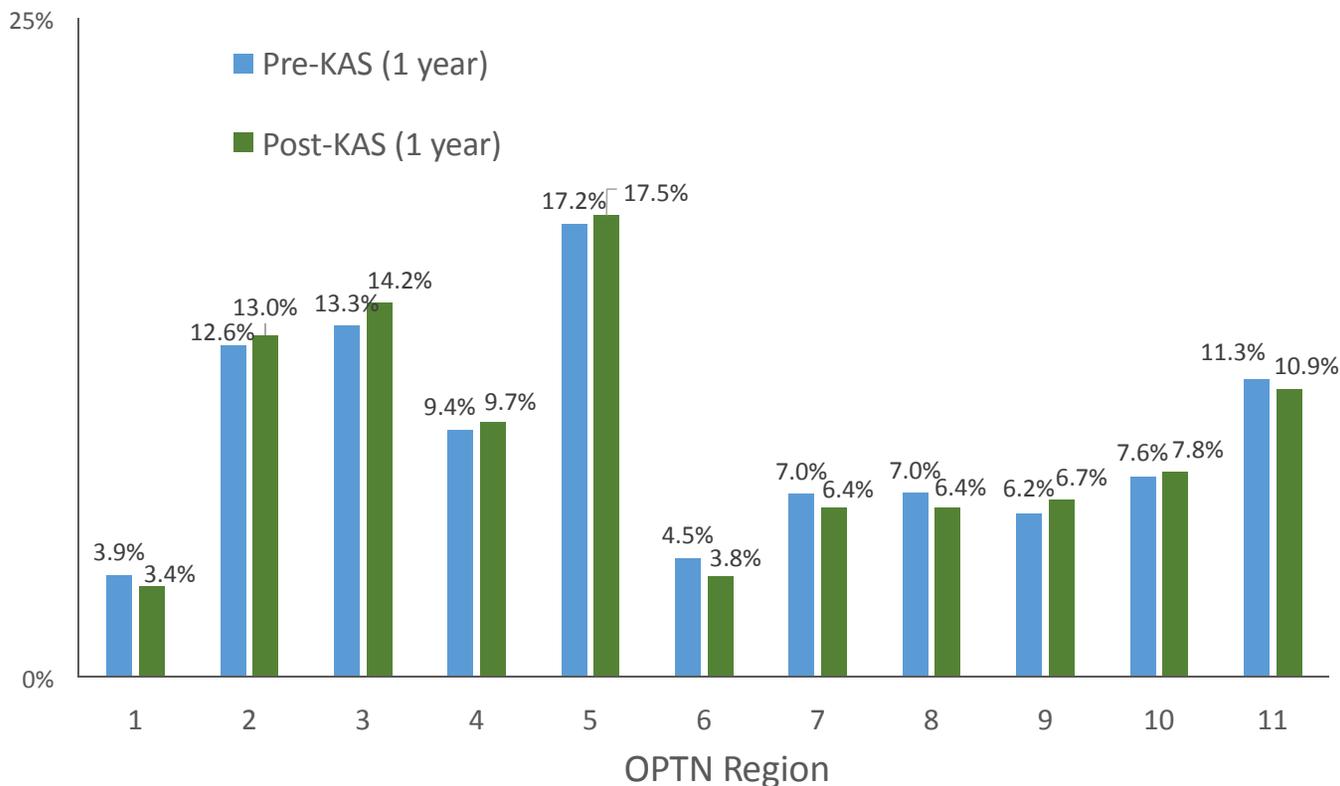
- More kidneys are being distributed outside recovery OPO's DSA.

Cold ischemic times for transplanted kidneys



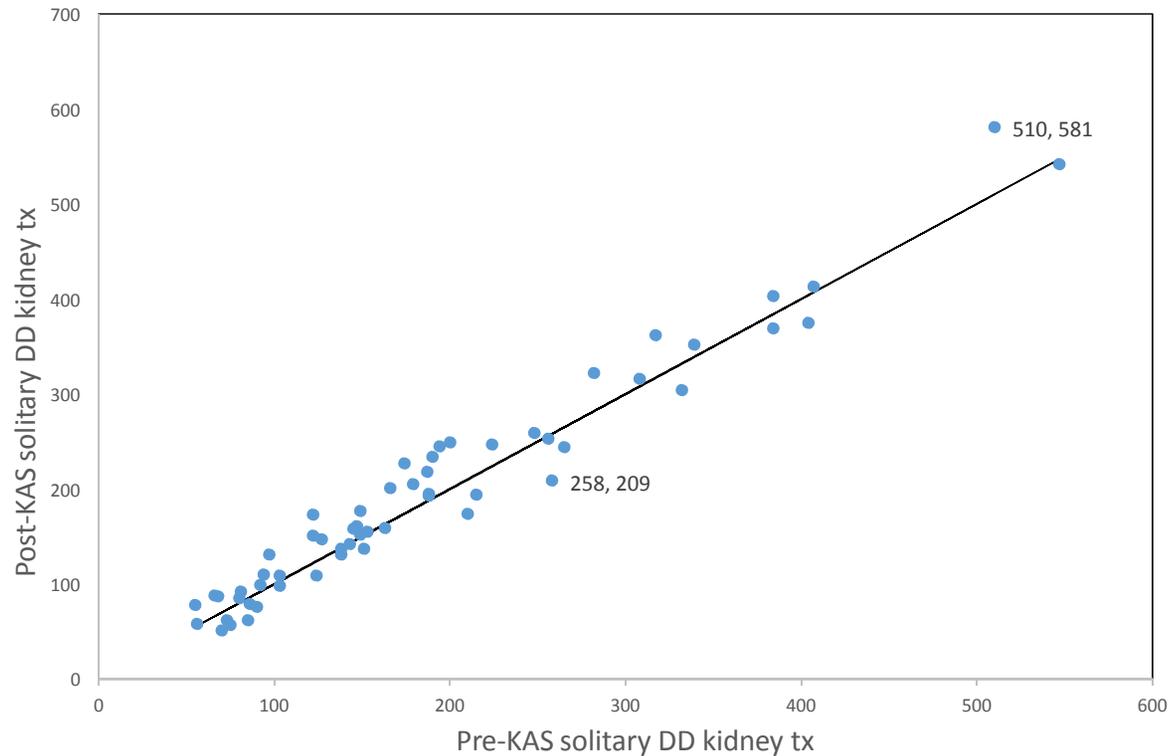
- Average CIT increased 6% from 17.0 to 17.9 hours
- CIT > 24 hours - Pre-KAS: 19.0%, Post-KAS: 22.3%

Geographic distribution of kidney transplants



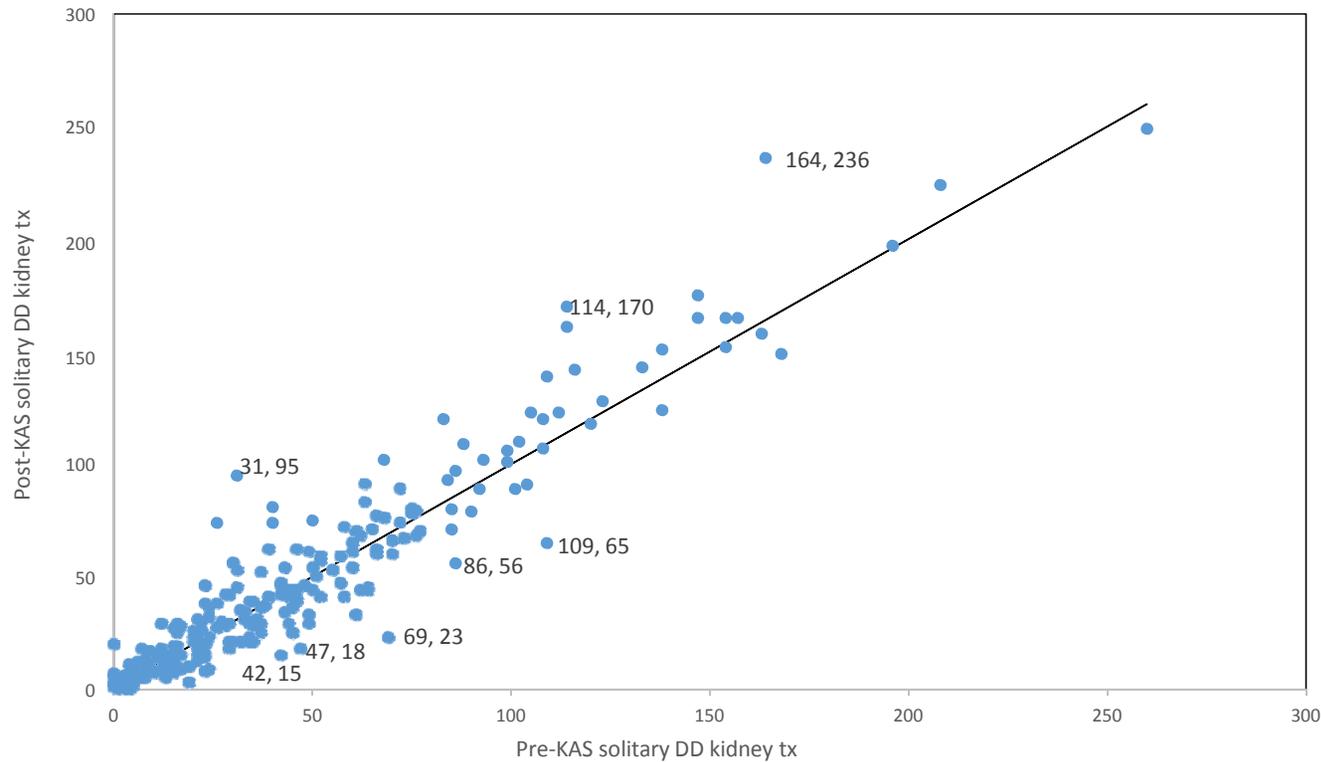
- No substantial changes in most Regions.
- Largest % increase: Region 9; Largest % decrease: Region 6

Transplant volume by DSA, pre vs. post-KAS



- N=36 (62%) of 58 DSAs had an increase in volume post-KAS.
- One large DSA saw a 14% increase, from 510 to 581.

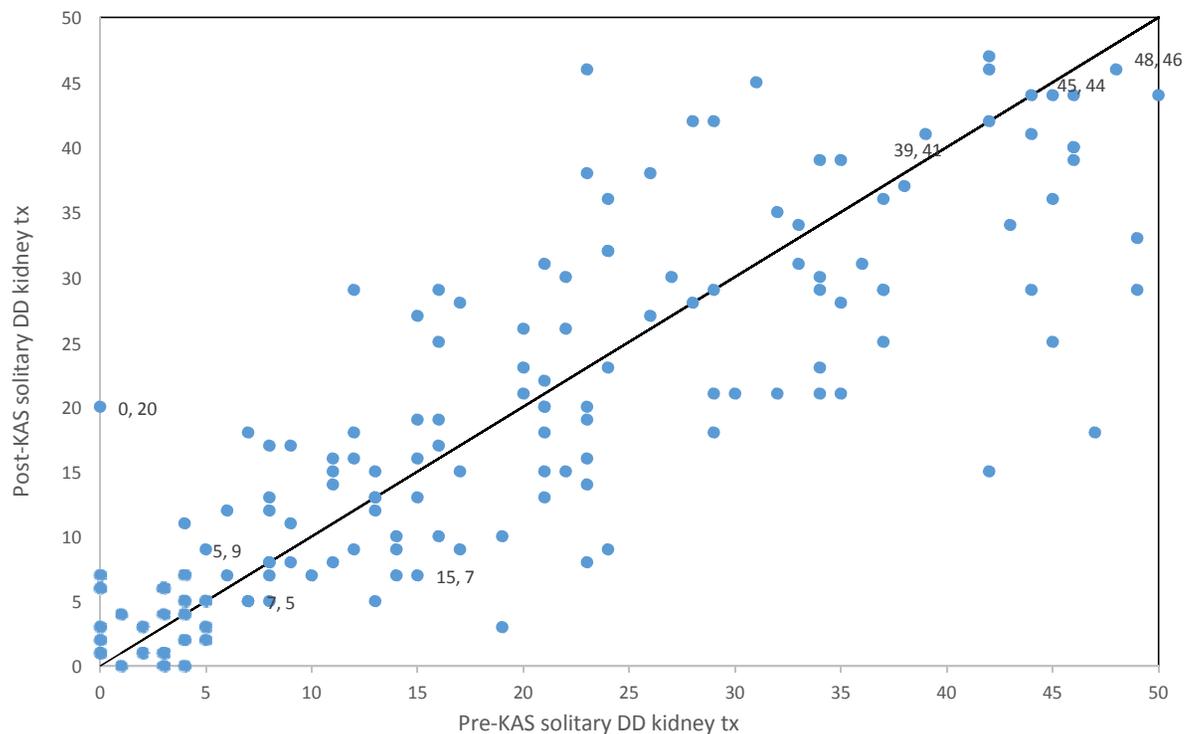
Transplant volume by center, pre vs. post-KAS



- N=124 (54%) of 230 programs had an increase or no change in volume.
- One large center performed 72 (44%) more transplants post-KAS.
- Many possible reasons for changes: (a) KAS + patient mix, (b) acceptance practices, (c) OPO performance, (d) random variation, etc.

Transplant volume by center, pre vs. post-KAS

Small-volume centers (<50 transplants per year)



- Substantial pre vs. post-KAS variability among small programs
- Small-N center volume more likely to be affected by random variation

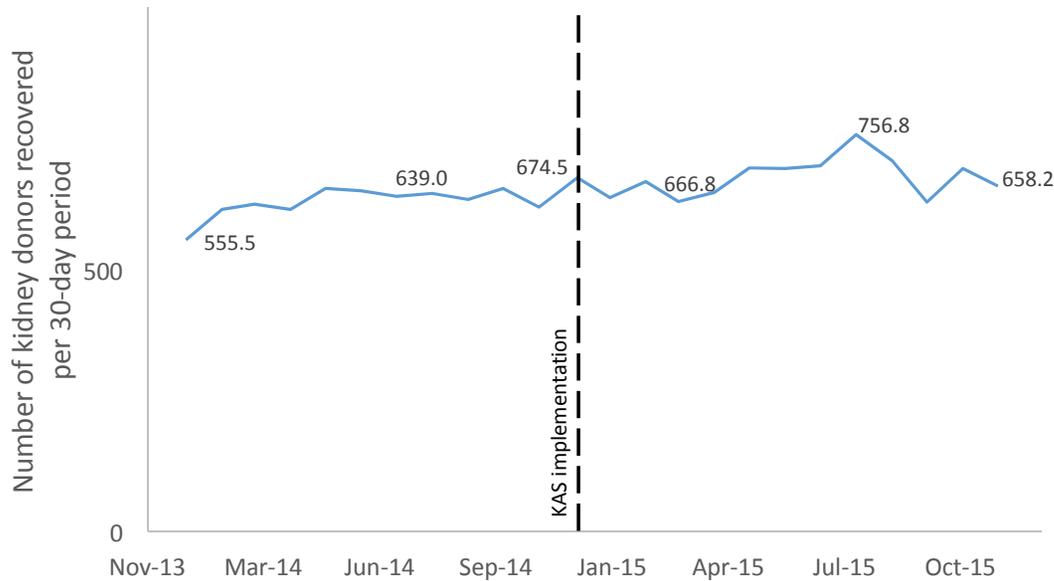


Decreased donor kidney recovery and utilization

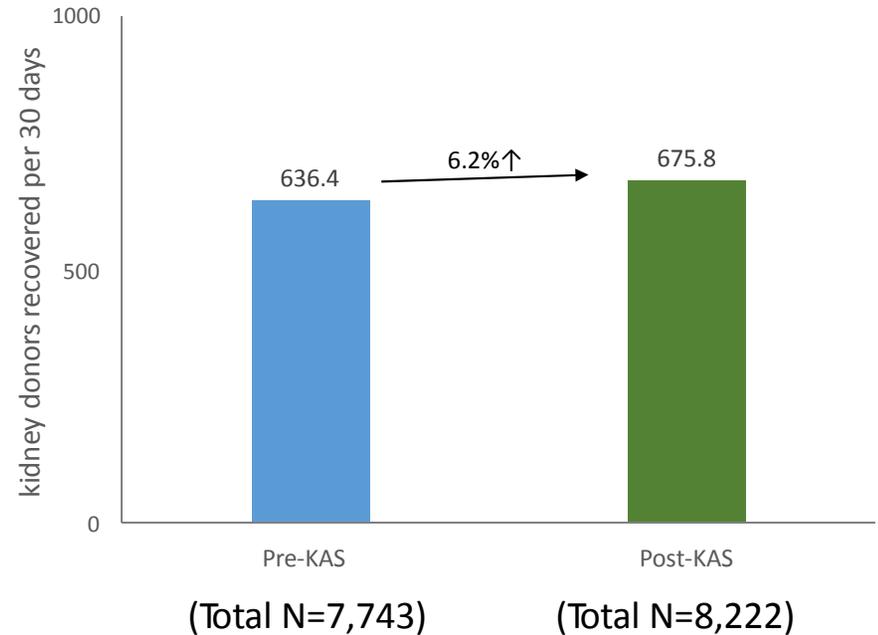
Deceased kidney donors recovered under KAS

Pre vs. post-KAS trends

Over time (per 30 days)



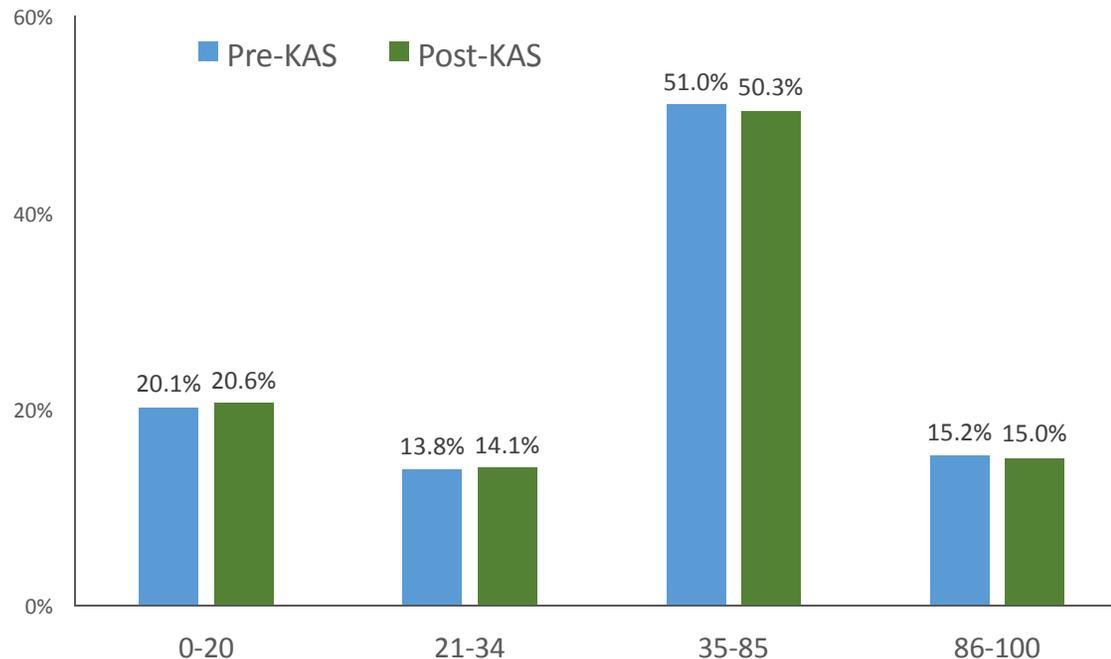
On average



- Recovered kidney donor volume increased 6% post-KAS.

Kidney recovery & utilization under KAS

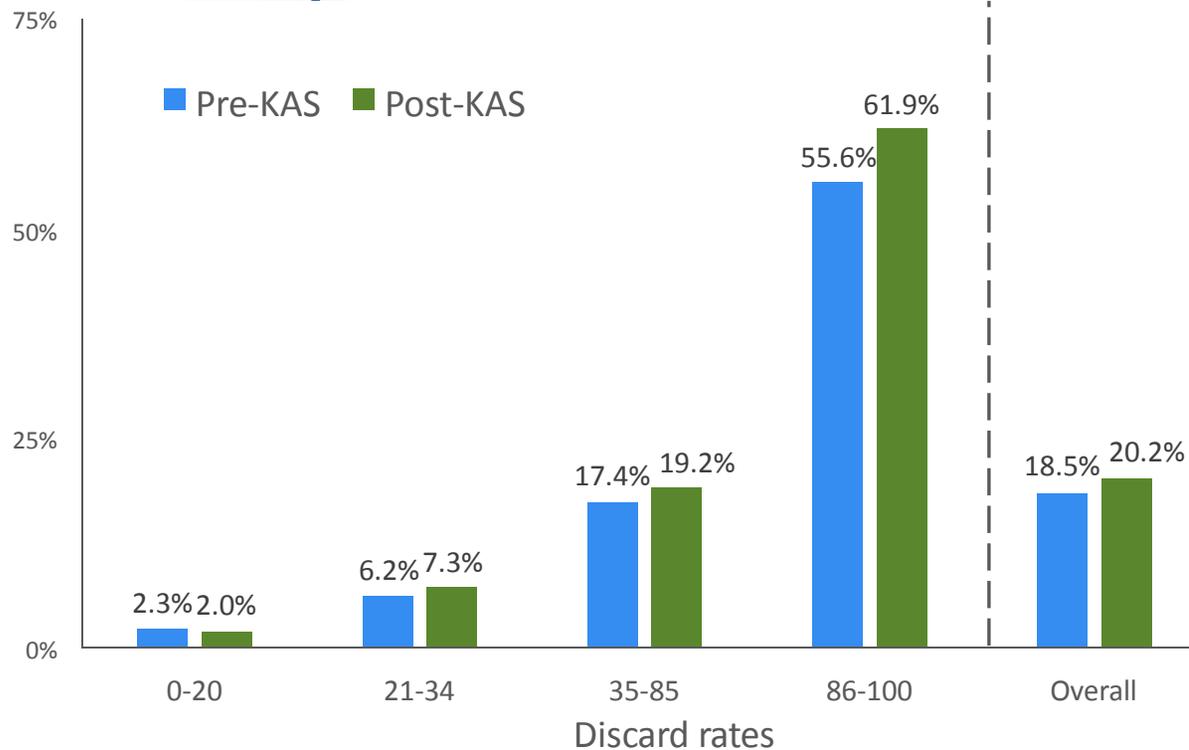
Percentage of Recovered Deceased Kidney Donors by KDPI



- Total kidney donors recovered per month increased 6.2% (636.4 to 675.8).
- However, the distribution by KDPI has remained very similar.

Kidney recovery & utilization under KAS

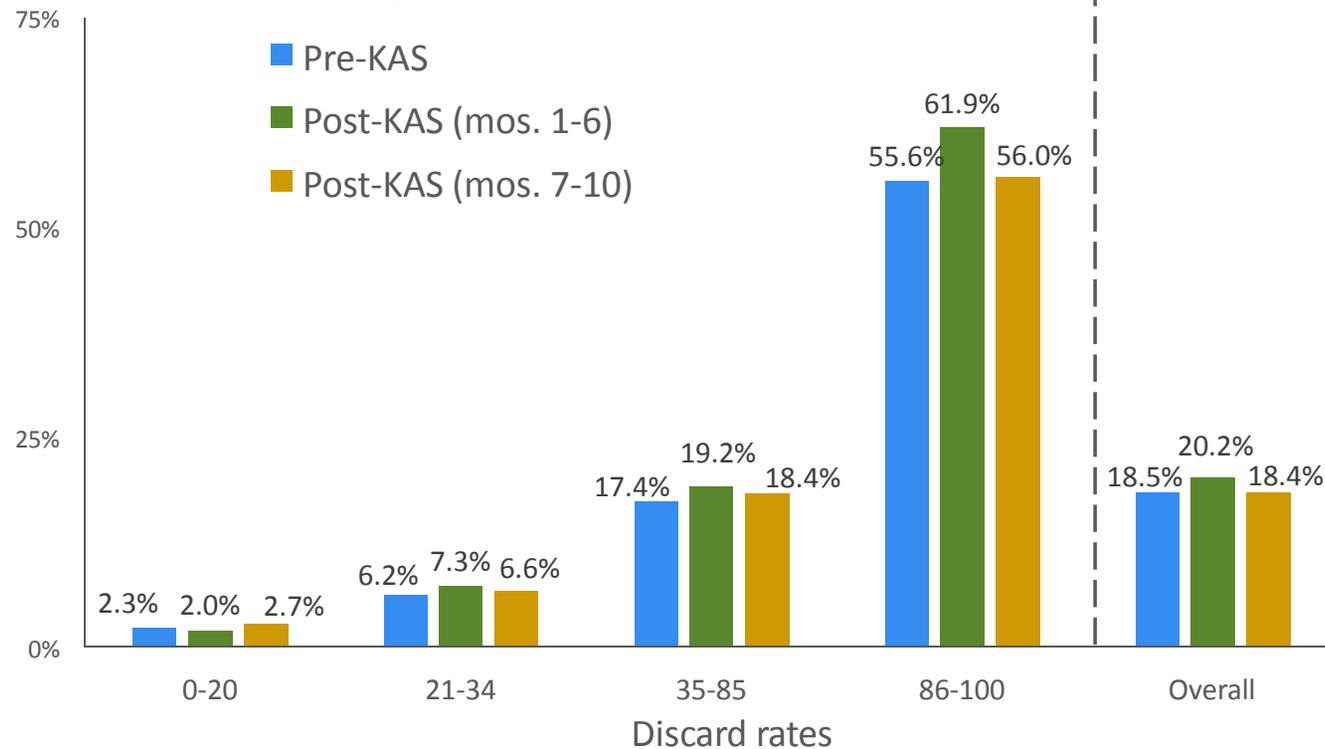
Kidney Discard Rate by KDPI – first six months



- Kidney discard rates increased by 1.7% points (about 10%).
- Increase largest for, but not limited to, KDPI>85% kidneys.

Kidney recovery & utilization under KAS

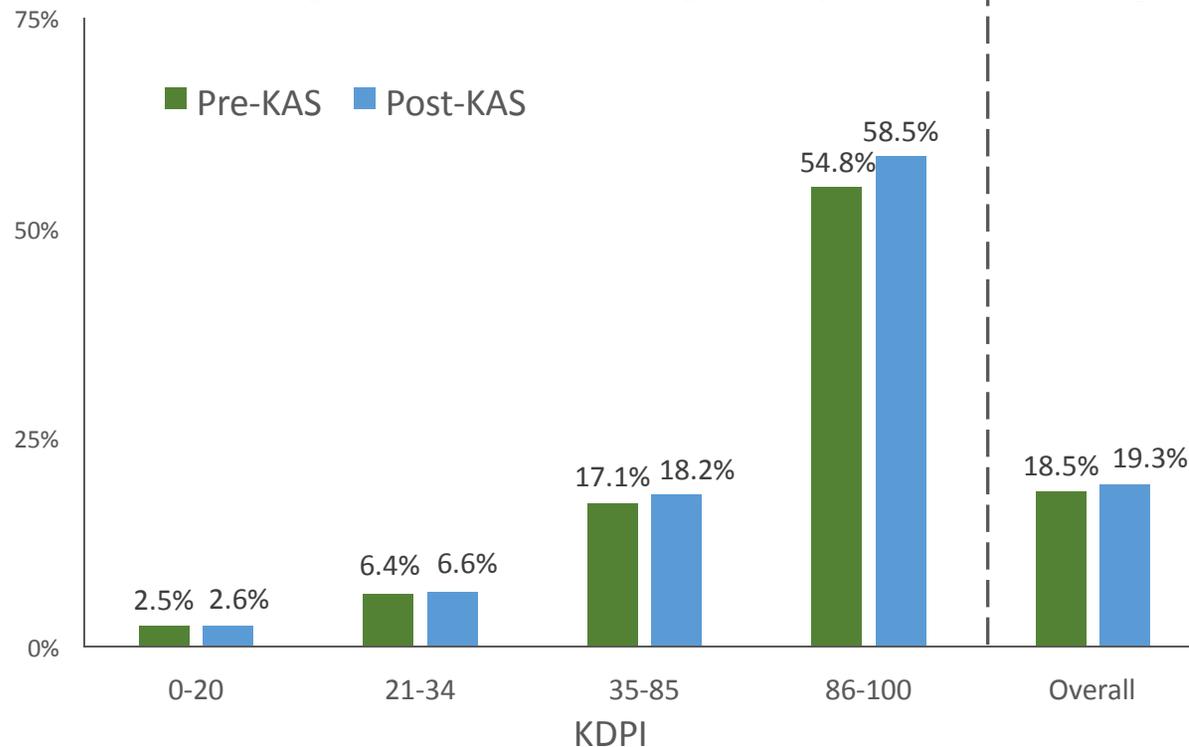
Kidney Discard Rate by KDPI -- *including months 7-10 (Jun – Sep '15)*



- Discard rates have returned to pre-KAS levels in recent months.

Kidney recovery & utilization under KAS

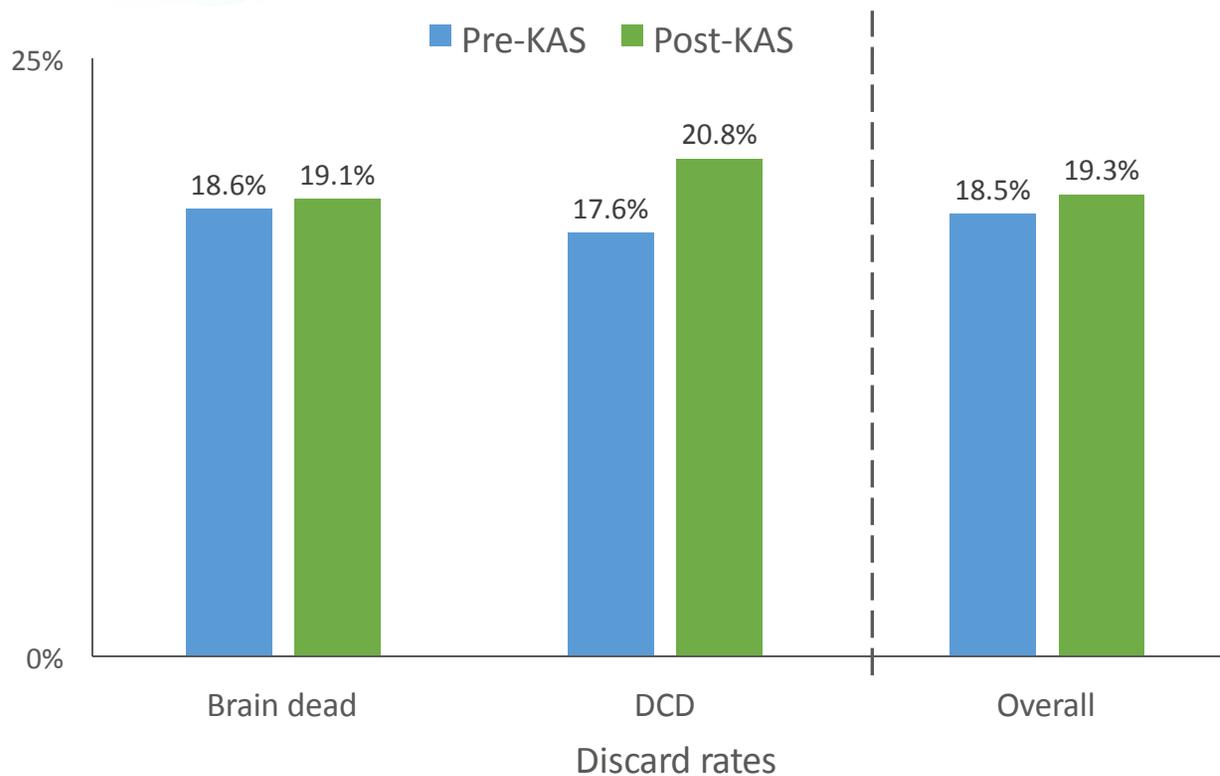
Kidney Discard Rate by KDPI – one year pre vs. one year post-KAS



- For the full year, discard rates rose from 18.5% to 19.3%. The increase was most evident for KDPI 86-100 kidneys.

Kidney recovery & utilization under KAS

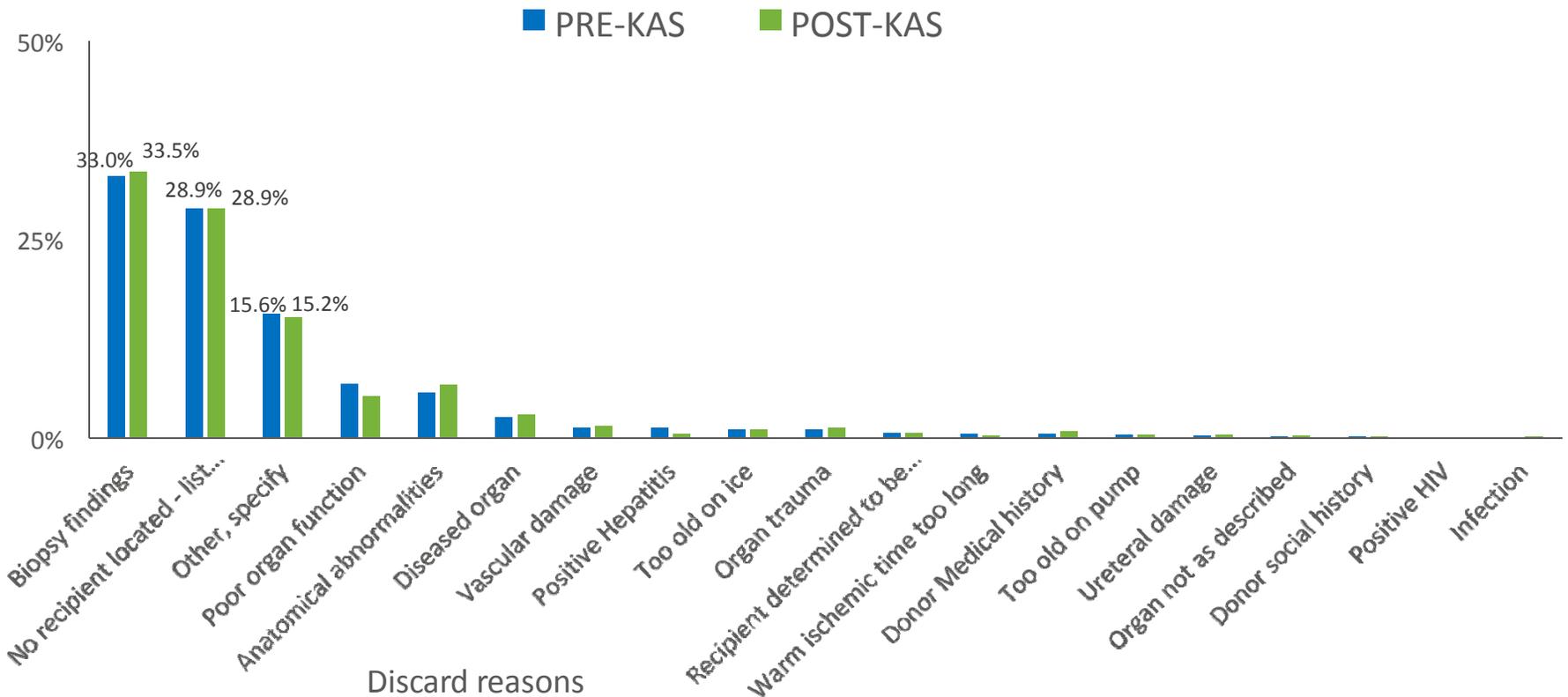
Kidney Discard Rate by DCD vs. BD



OPTN | UNOS ■ The discard rate increased more for DCD donor kidneys.

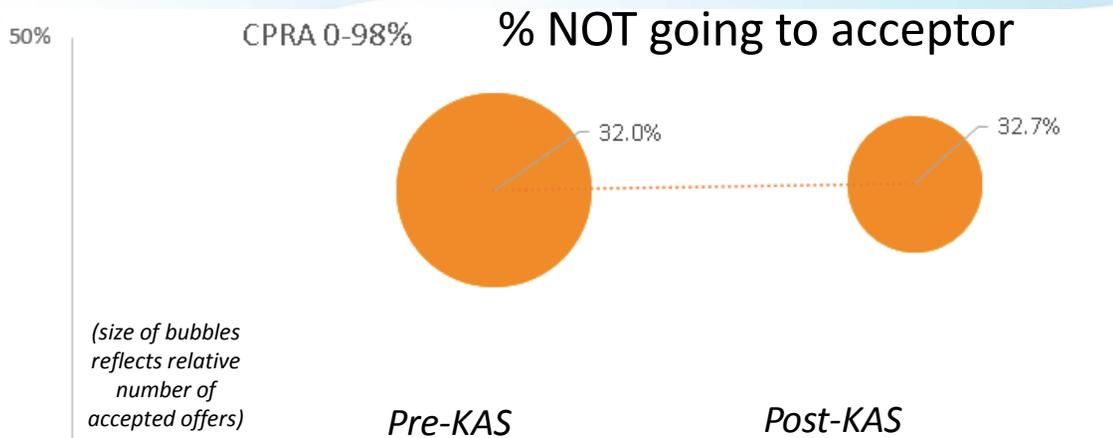
Kidney recovery & utilization under KAS

Kidney Discard Reasons

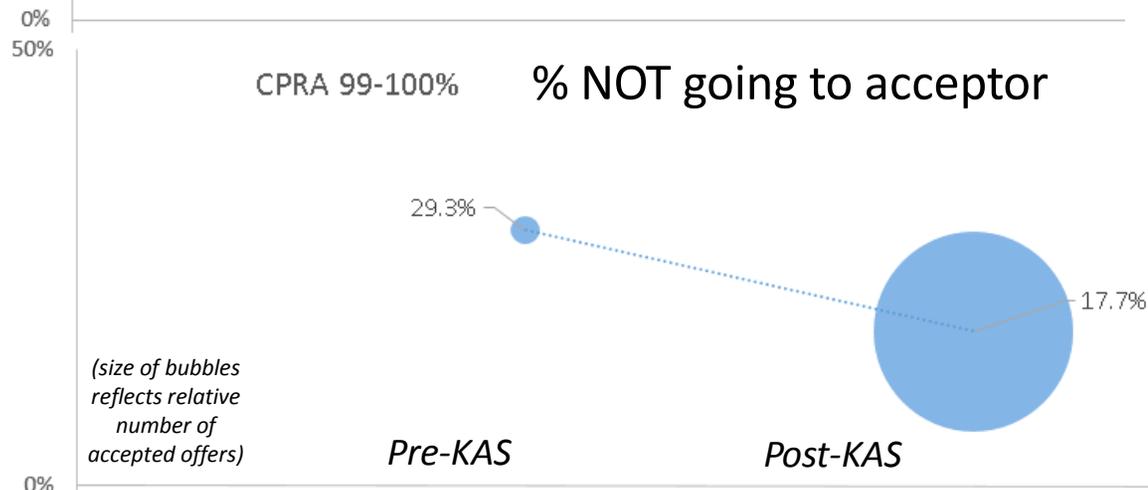


- Reasons for discard similar pre vs post-KAS.

Disposition of offers accepted non-locally*



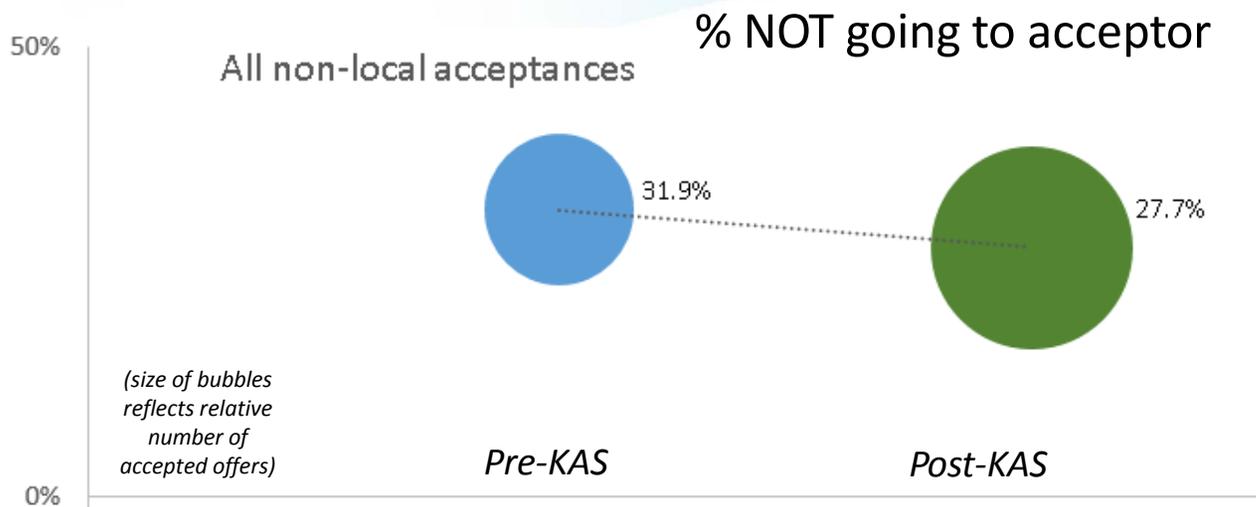
- ✓ Fewer non-local acceptances are for CPRA 0-98 patients under KAS (size of bubble)
- ✓ Of these acceptances, about 1/3 have not gone to acceptor, pre and post-KAS



- ✓ Dramatic increase in number of non-local acceptances for CPRA 99-100% patients (size of bubble)
- ✓ DECREASE in % of kidneys not transplanted to these acceptors

Disposition of offers accepted non-locally*

All non-local acceptances

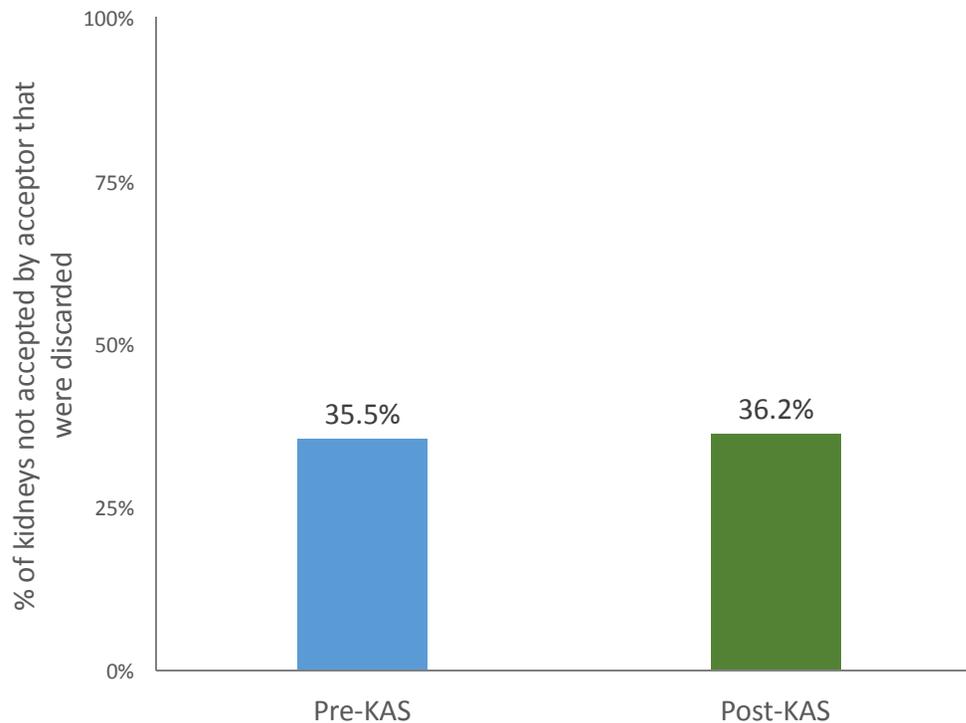


- ✓ Increase in number of non-local acceptances
- ✓ Decrease in % of kidneys not transplanted to these acceptors

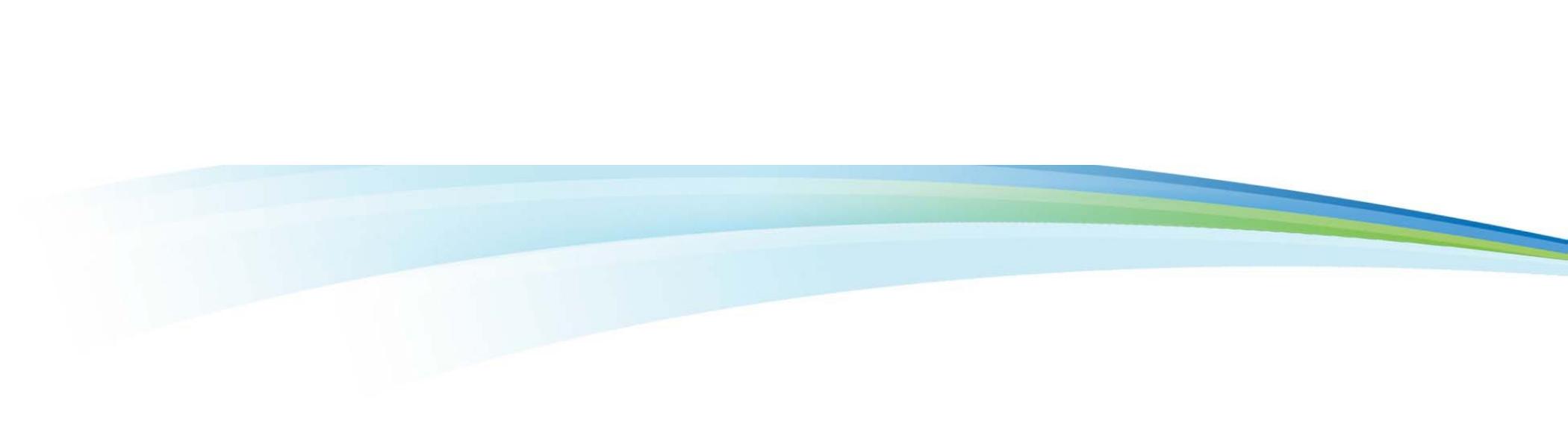
Net effects:

- Increase from 92 to 114 per month in # non-local acceptances not going to acceptor
- Six programs accounted for over half of post-KAS cases.

Non-Locally Accepted Offers Not Txed to the Acceptor Percent Discarded

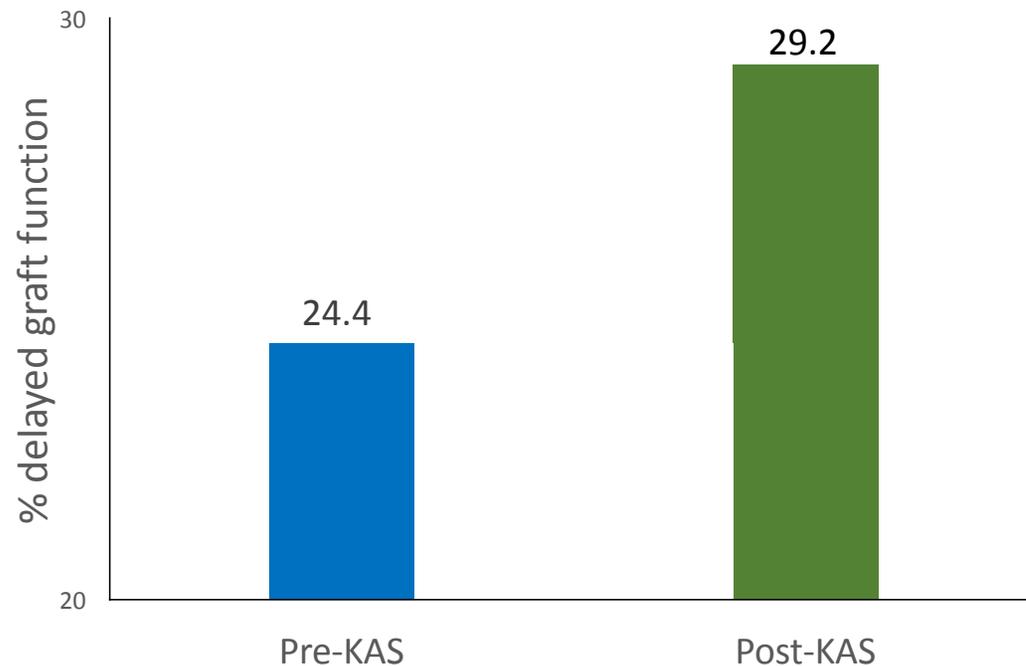


- Just over a third of kidneys accepted but not transplanted to the accepting patient were discarded, pre and post-KAS.
- The remaining two-thirds were transplanted into another recipient.



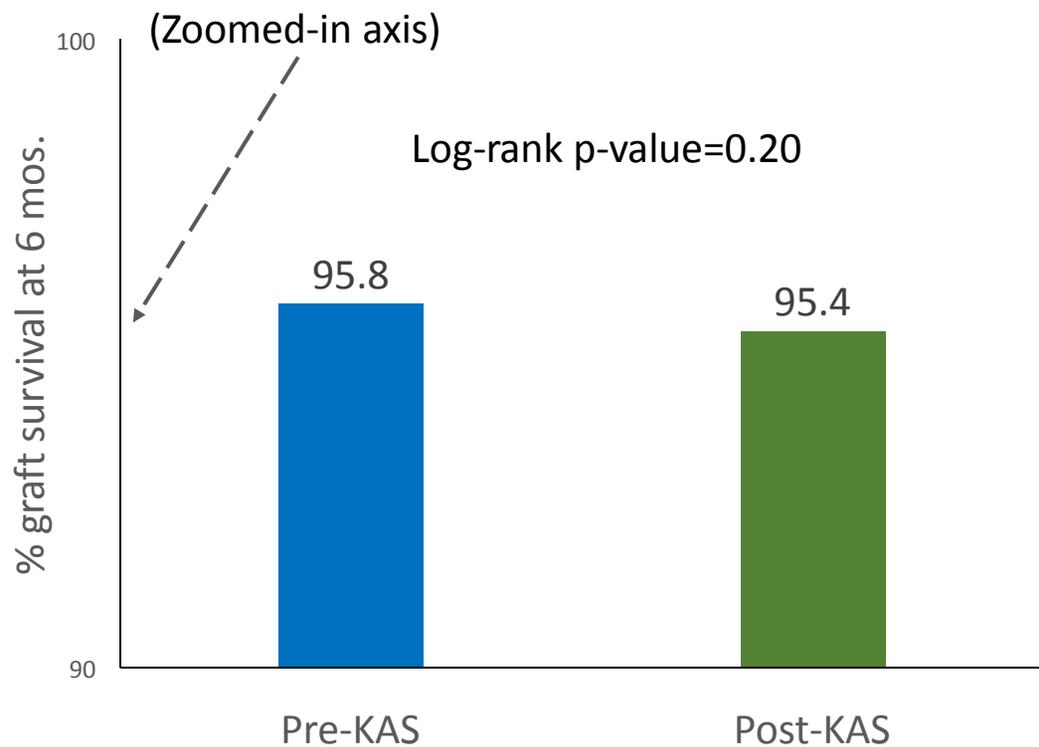
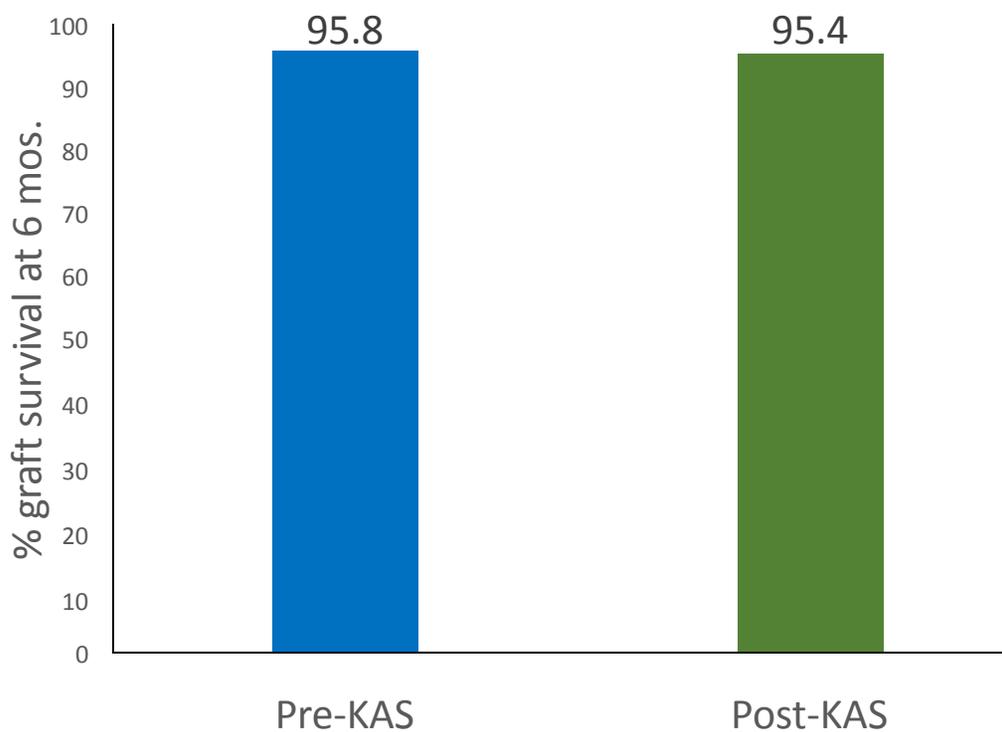
Early recipient outcomes

Delayed graft function (DGF) rates



- The percentage of recipients requiring dialysis within the first week after transplant increased from 24.4% pre-KAS to 29.2% after KAS.
- Increase appears to be driven mostly by more high dialysis time recipients.

Six Month Graft Survival



- Six month graft survival rate slightly lower but statistically no different from pre-KAS.

Other Early Outcomes

- Six-month patient survival rates
 - Pre-KAS: 98.04% (P-value=0.14)
 - Post-KAS: 97.68%
- Six-month recipient serum creatinine
 - Pre-KAS: median=1.30, p75=1.60
 - Post-KAS: median=1.32, p75=1.70

Summary: First Year of KAS

- Overall – KAS is meeting key goals
 - Decrease in longevity mismatches
 - Increase in the number of transplants among very highly sensitized patients
 - Increase in access to transplant for African Americans candidates
- “Bolus effects”: the percent of transplants to CPRA 99-100% and dialysis>10 years recipients are both tapering post-KAS
- Increase in A2/A2B→B transplants, but still room for growth
- Transplant volume up 4.6%

Summary: First Year of KAS (cont'd)

- No change in waiting list mortality rates
- Six-month graft and patient survival rates similar to pre-KAS
- Several trends deserve further attention:
 - Fewer OMM transplants
 - Slight drop in pediatric transplants will continue to be tracked closely
 - Logistical challenges in allocation
 - Increased CIT and DGF
 - Increase in discard rates, particularly KDPI>85% kidneys.

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