

The New Kidney Allocation System: What You Need to Know

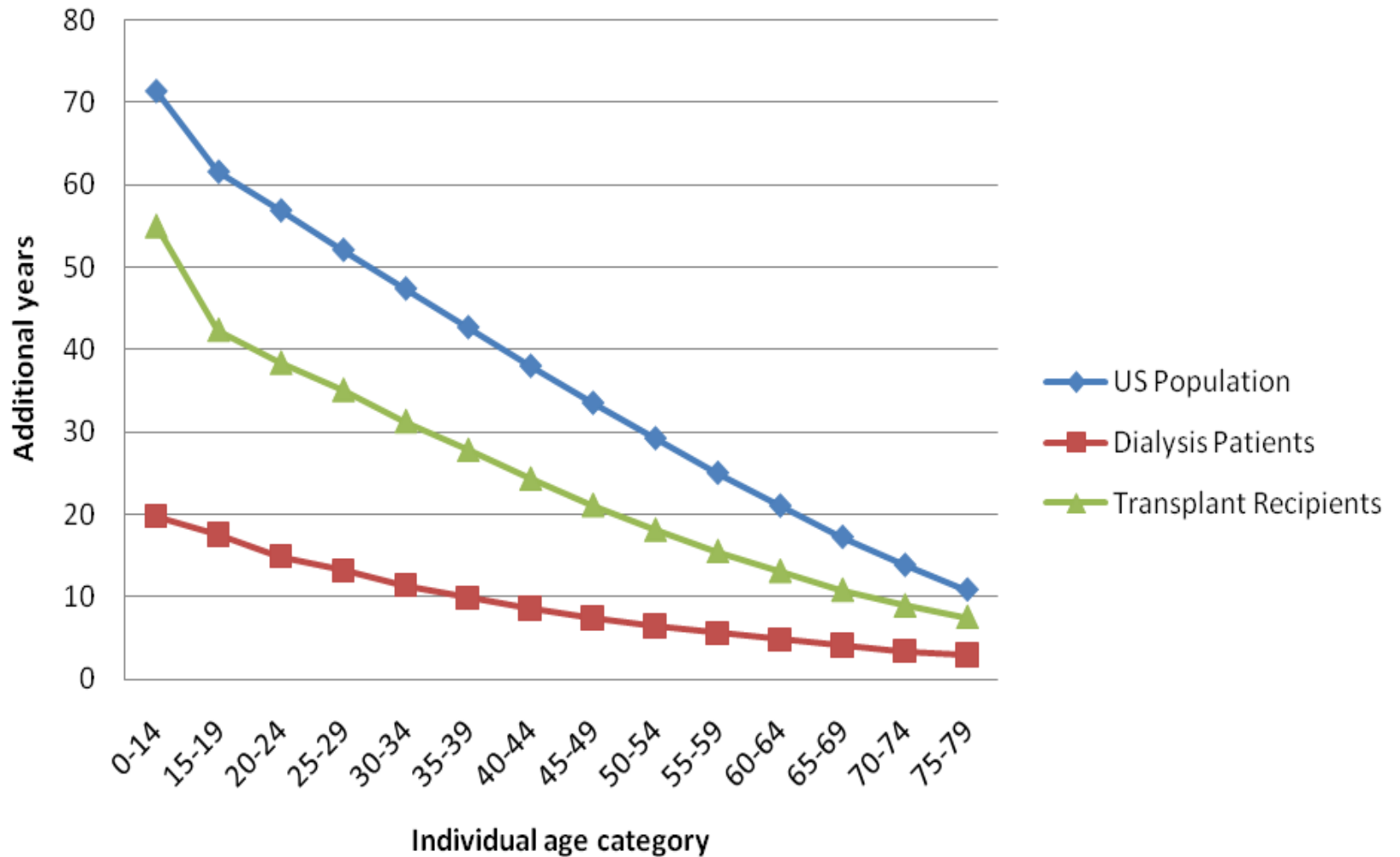
Anup Patel, MD

Clinical Director

Renal and Pancreas Transplant Division

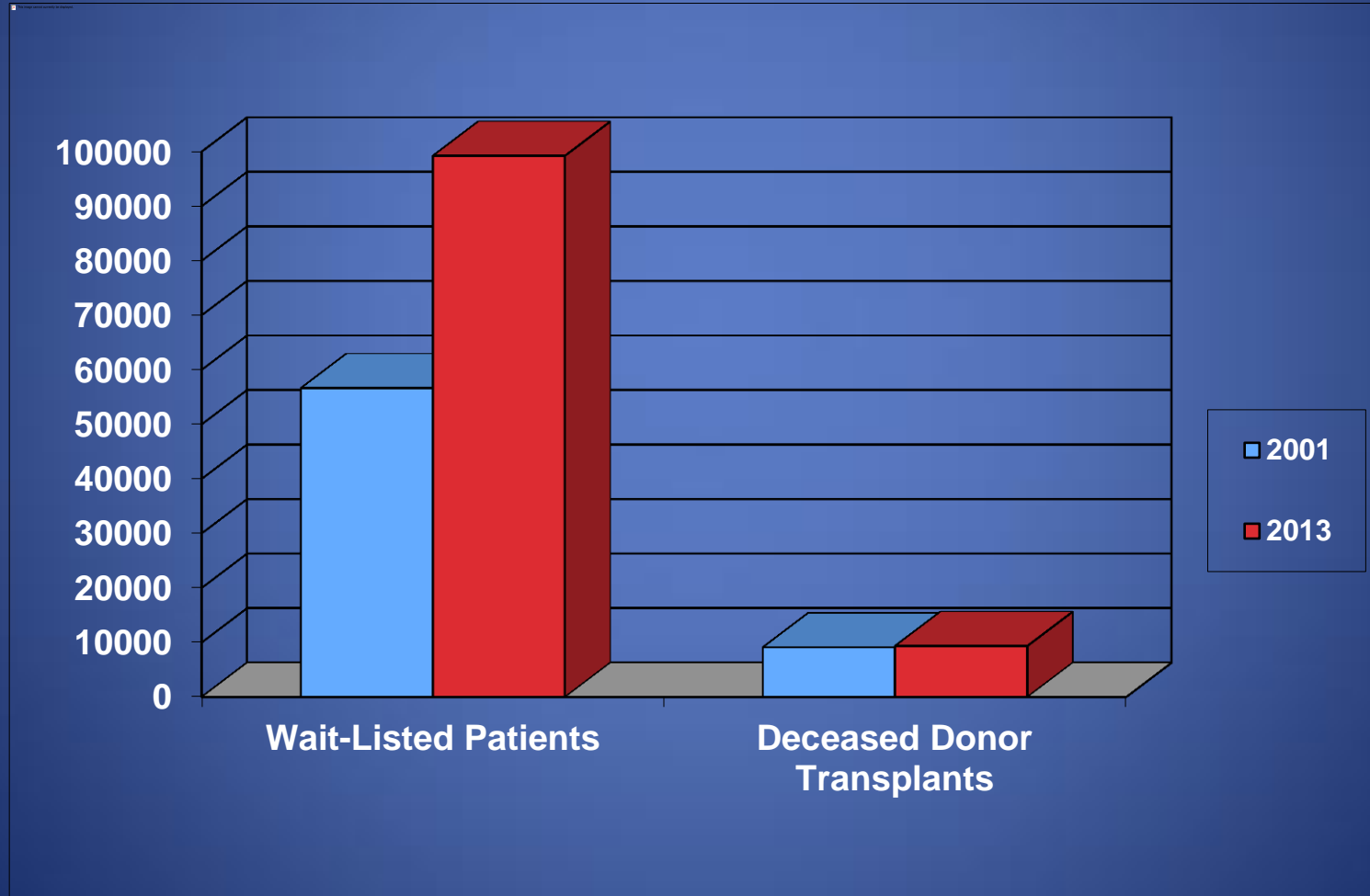
Barnabas Health

Expected Remaining Lifetimes

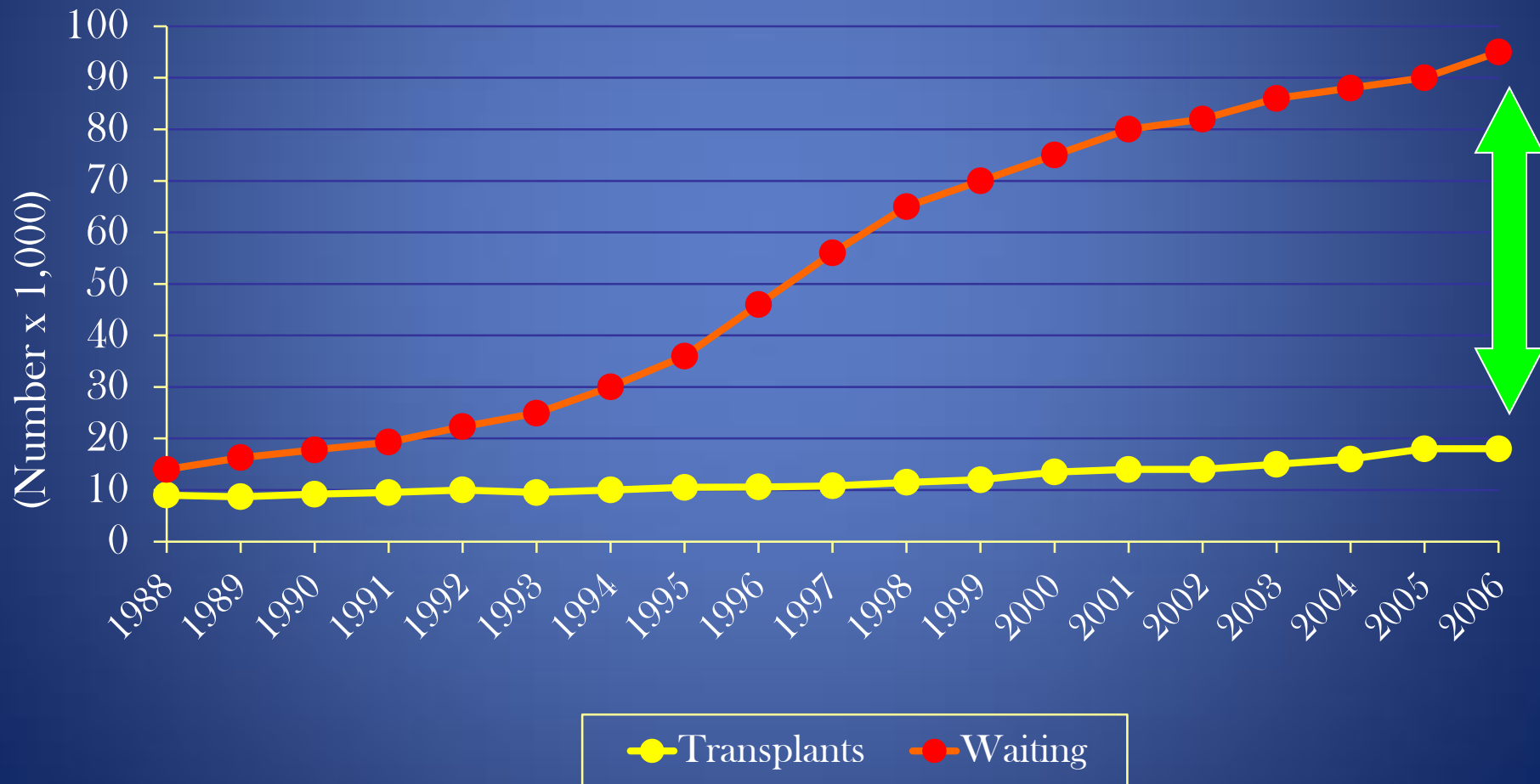


~6% of patients die each year on the deceased donor waiting list

Average waiting time for a deceased donor kidney transplant in USA
> 4 years



Annual Transplant Activity Vs. Waiting List [USA]



Transplantation in patients \geq age 50 has more than doubled in the past two decades

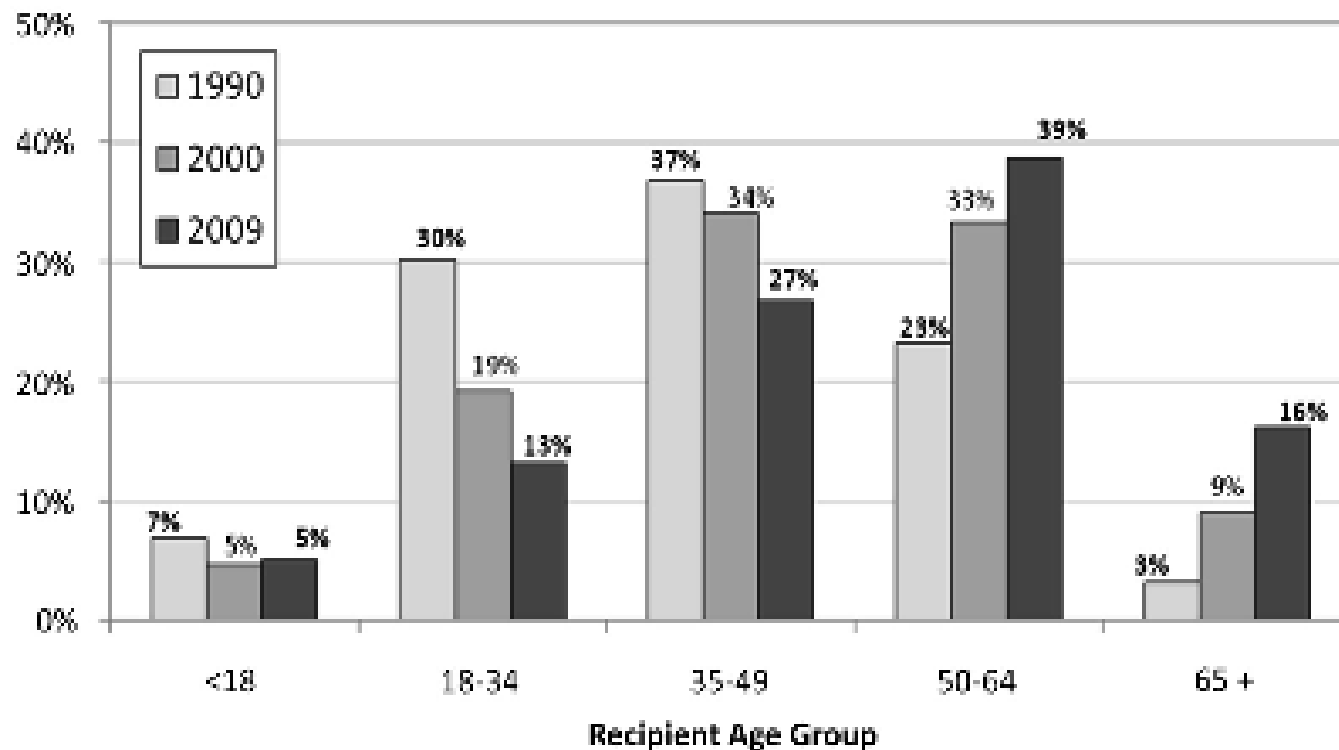
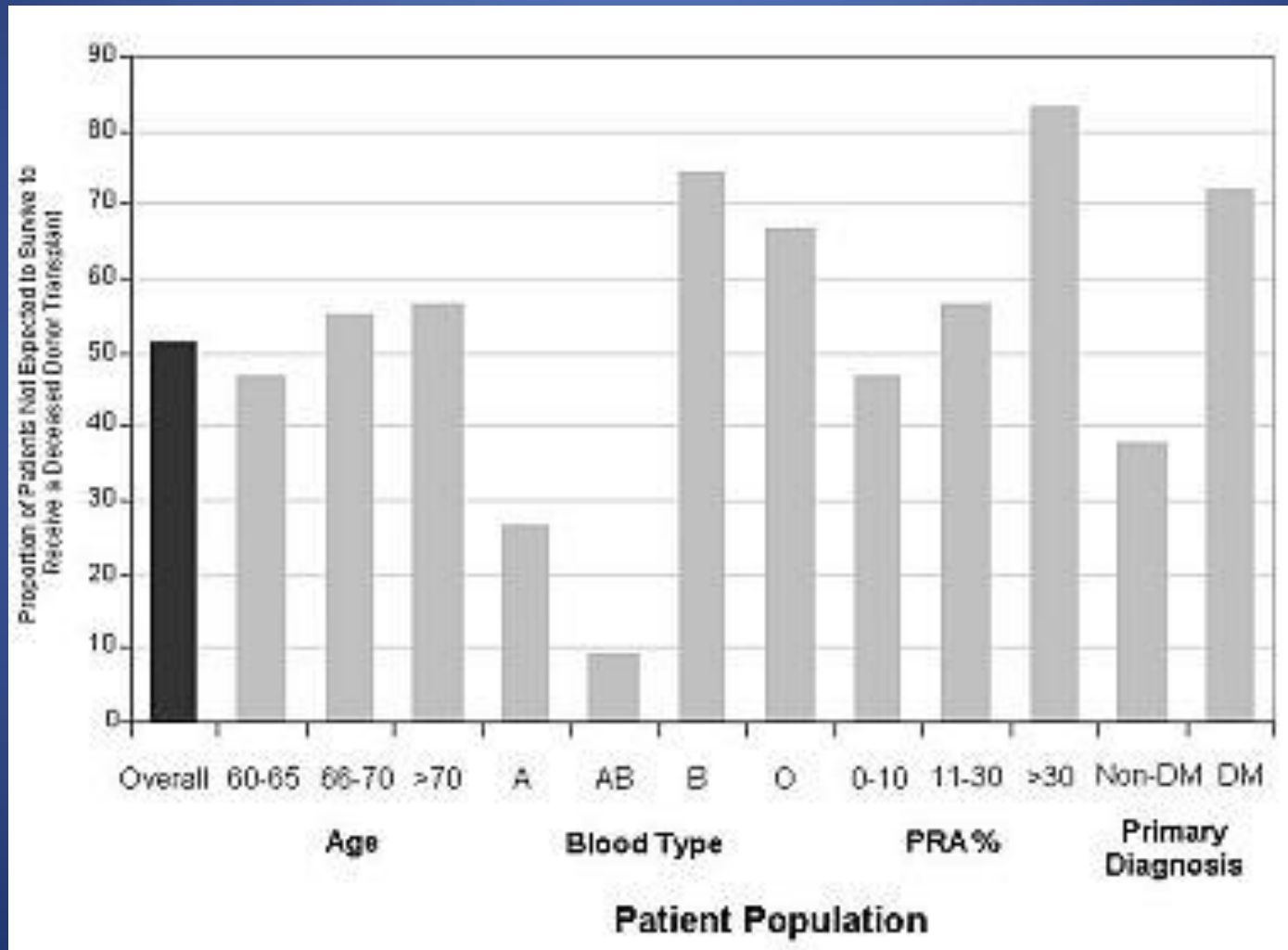


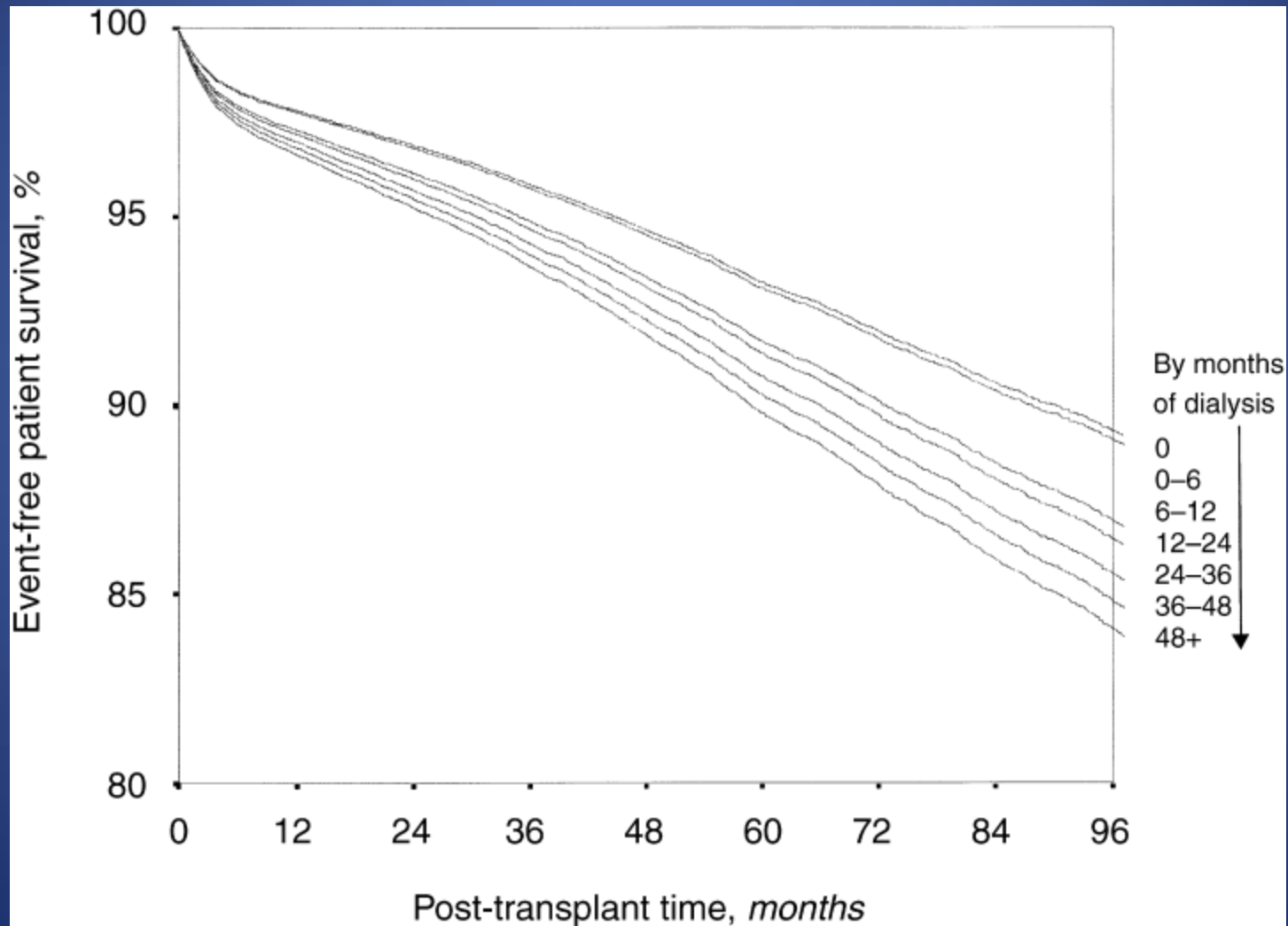
Fig. 5. Recipient age distribution for kidney transplants, United States, 1990, 2000, and 2009. (Data from Organ Procurement and Transplantation Network as of November 6, 2009.)

In 2006, > 52% of candidates with age >60 years were expected to die prior to receiving a deceased donor transplant



ATC Abstract #241 (2008). Schold JD et al.

Increased time spent on dialysis is associated with worse outcomes after transplant



“Old” UNOS Point System

Algorithm for organ allocation

Category

Points

HLA Antigen matching

0 mismatch

Mandatory share

0BDR mismatch

7

1BDR mismatch

5

2BDR mismatch

2

PRA

>80%

4

<80%

0

Waiting time

1/year (others fraction based on position on waiting list)

Pediatric

<11 years old

3

>11 years old

2

Old Allocation System

Points regardless of:

- 1) Recipient age
- 2) Dialysis time
- 3) Life year benefit
- 4) Donor characteristics

Goals of the new allocation system

- Increase the long-term benefit of transplantation
- Increase the transplant rate in difficult-to-match candidates
 - Highly sensitized
 - Minorities
 - Rare blood type
- Reduce the discard rate of organs

Increasing the long-term benefit of transplantation

- Lifespan of kidney allograft not maximized in current system
 - Example: 70 year old diabetic recipient receives a kidney from a 21 year old donor who passed away in a MVA
 - Expected survival of recipient: <8 years
 - Expected survival of donor organ: >40 years
 - *Need to reduce rate of death with a functioning allograft*
 - Example: 21 year old recipient receives a kidney from a 49 year old donor who passed away from a CVA
 - Expected survival of recipient: >40 years
 - Expected survival of donor organ: <20 years
 - *Need to reduce rate of re-transplantation*

Increasing the long-term benefit of transplantation

- Need to improve the matching of donor organ “quality” to recipient “quality”
- Donor quality
 - Old categories
 - Expanded criteria donor (ECD)
 - Age >60 or age 50-59 with two of the following three: HTN, terminal Cr >1.5, or CVA
 - Standard criteria donor (SCD)
 - ~8/10 ECD vs. 9/10 SCD organs will be functioning at one year
 - New Category
 - Kidney Donor Profile Index (KDPI)

Kidney Donor Profile Index (KDPI)

- All deceased donor organs will be assigned a KDPI score
 - Reflects the risk of allograft failure after transplantation
 - Continuous variable
 - Score range 0-100%
 - Lower score reflects increased survival

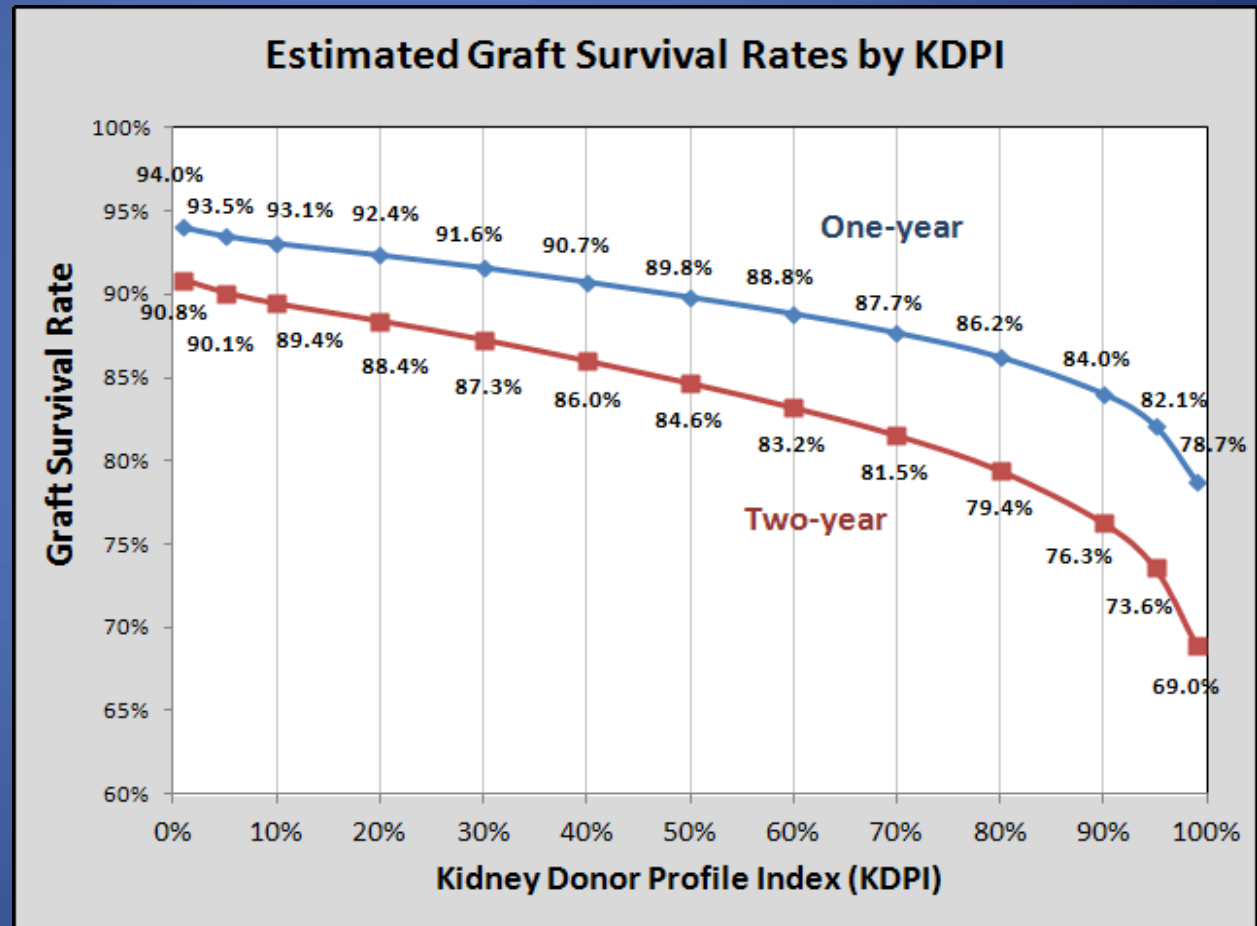
Kidney Donor Profile Index (KDPI)

- Factors used to calculate KDPI
 - Donor age
 - Donor height and weight
 - Donor HTN status
 - Donor diabetes status
 - Donor hepatitis C status
 - Donor ethnicity
 - Donor cause of death
 - Donor donation after cardiac death (DCD)
 - Donor terminal creatinine

Kidney Donor Profile Index (KDPI)

KDPI Variables

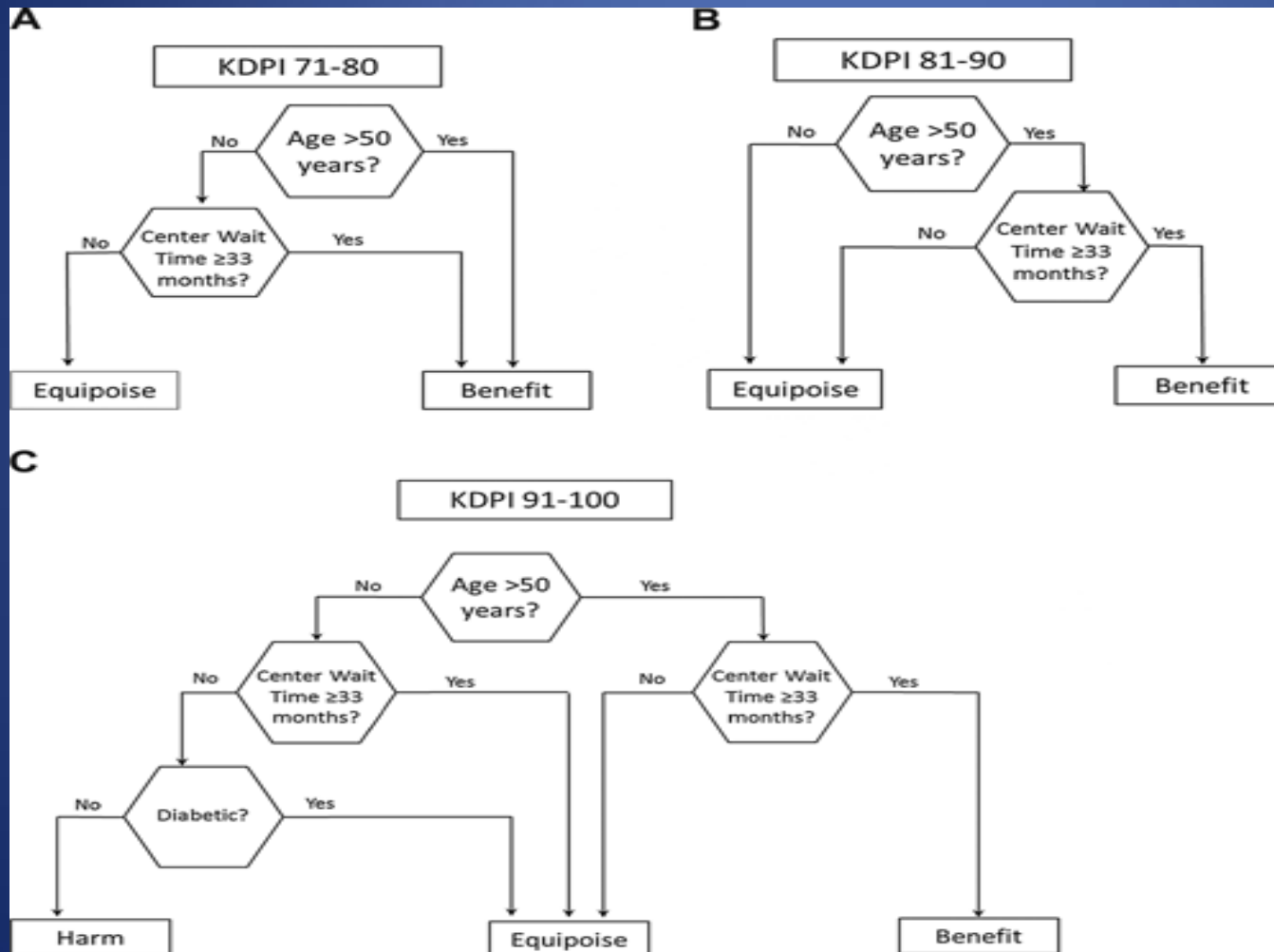
- Donor age
- Height
- Weight
- Ethnicity
- History of Hypertension
- History of Diabetes
- Cause of Death
- Serum Creatinine
- HCV Status
- DCD Status



Kidney Donor Profile Index (KDPI)

- KDPI of >85% approximates ECD organs
 - Patients consented for ECD organs were automatically listed for organs with a KDPI >85%
- Patients and referring nephrologists can choose a maximum KDPI that they will accept
 - 25yo with CKD due to PCKD may choose maximum KDPI of 80%
 - 70yo with ESRD due to NIDDM may choose maximum KDPI of 100%

Survival Benefit of Primary Deceased Donor Transplantation With High-KDPI Kidneys



Median wait-time:

1)SBMC: 58 months

2)Region: 75 months

3)USA: 70 month

Which KDPI do I choose for my patient at *initial listing*?

- KDPI ≤ 80
 - All patients should probably benefit from these organs
- KDPI 81-100
 - All patients >50 years old should probably benefit from these organs
 - Patients ≤ 50 years old will have equivalent outcomes whether they accept these organs or not

Increasing the long-term benefit of transplantation

- Need to improve the matching of donor organ “quality” to recipient “quality”
- Recipient quality
 - Old categories
 - None
 - New category
 - Estimated Post Transplant Survival (EPTS)

Estimated Post Transplant Survival (EPTS)

- All recipients will be assigned an EPTS score
- Predicts patient survival after kidney transplantation
 - Continuous variable
 - Score range 0-100%
 - Lower score reflects increased survival

Estimated Post Transplant Survival (EPTS)

- Factors used to calculate EPTS
 - Recipient age
 - Recipient time spent on dialysis
 - Recipient diabetes status
 - # of previous solid organ transplants

Increasing the long-term benefit of transplantation

- We now have estimates for the “quality” of the donor organ (KDPI) and recipient (EPTS)
- To maximize the life-years of a kidney transplant, the new allocation system will match the top 20% donor organs (KDPI 0-20%) with the top 20% recipients (EPTS 0-20%)

Implications for the nephrologist

- Preference is for patient to receive an organ with a KDPI of 0-20%
 - Preferentially will only be offered to patient with EPTS score of 0-20%
 - Recipient age
 - Recipient diabetes status
 - # of previous solid organ transplants
 - *Recipient time spent on dialysis*
 - Recipient time spent on dialysis is the only modifiable factor in the EPTS calculation
 - Early referral for transplant listing is essential

Increasing the long-term benefit of transplantation

- 46 year male with ESRD due to IgA nephropathy
 - Referred to transplant center and *listed at the time he started HD*
 - EPTS=21%; *would not qualify* for KDPI 0-20% organ
- 46 year male with ESRD due to IgA nephropathy
 - Referred to transplant center and *listed one year before he started HD*
 - EPTS<20%; *would qualify* for KDPI 0-20% organ

Increasing the transplant rates in difficult to match candidates

- Highly sensitized
- Minorities
- Rare blood group type

Highly sensitized patients

- Measurement of HLA antibodies
- Reported as the Panel Reactive Antibody (PRA)
 - Represents the % of donors in the general population that a potential recipient has antibodies against
 - Example: PRA=80% means that the recipient will react against 4 out of 5 potential donors

Highly sensitized patients

Peak PRA	Registrations Added	Median Wait Time (days)
0-9%	27943	1329
10-79%	3826	1924
80+%	1508	3065

11.5% of newly listed patients in 2001-2002 will have a waiting time of 5.3 years

4.5% of newly listed patients in 2001-2002 will have a waiting time of 8.4 years

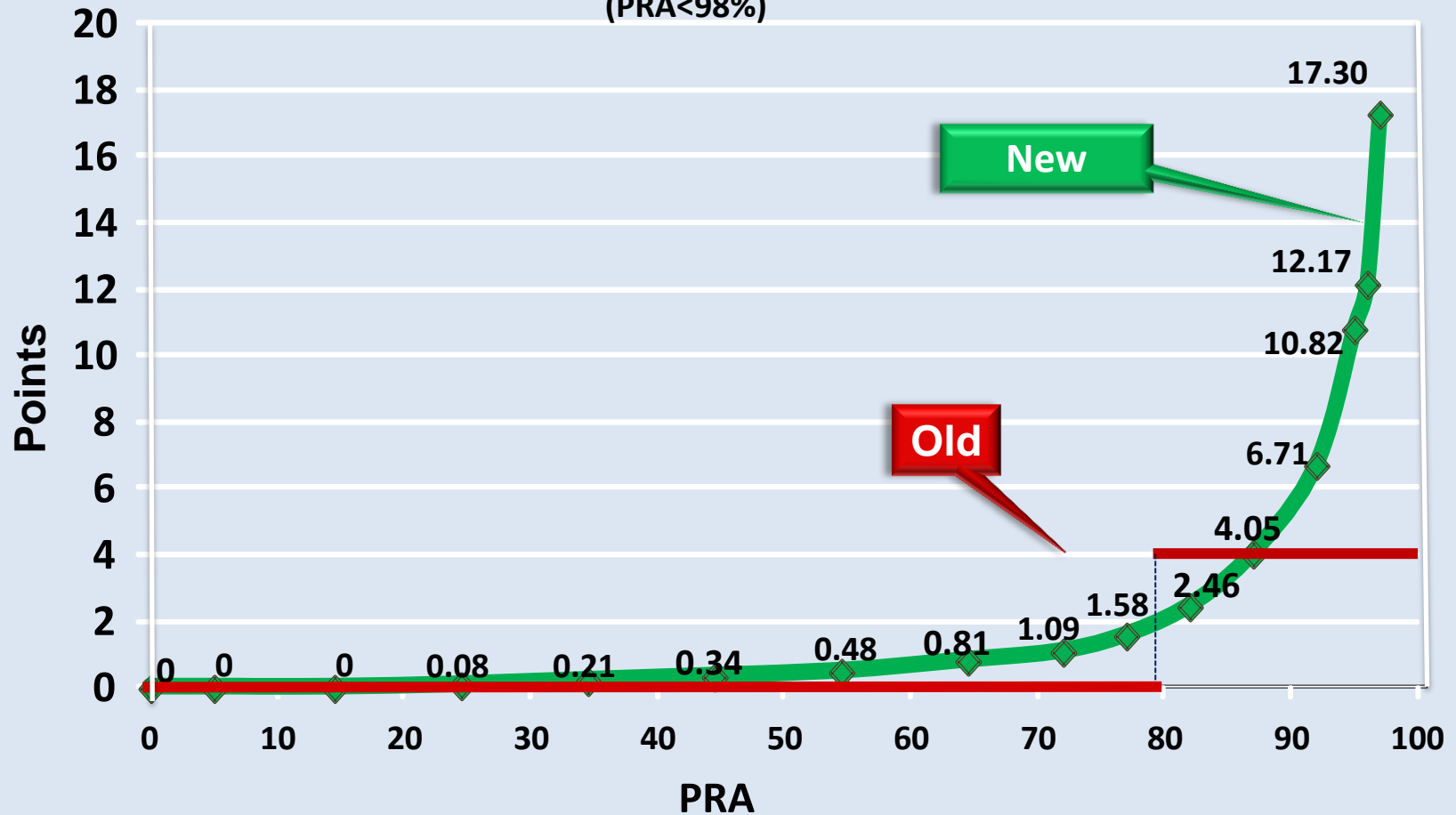
Highly sensitized candidates

- Old allocation system
 - If PRA $\geq 80\%$: 4 points awarded
 - If PRA $< 80\%$: 0 points awarded
- New allocation system
 - Points will be assigned based on a sliding scale starting at PRA $\geq 20\%$
 - Patients with a PRA of 98%, 99%, or 100% will receive local, regional, and national priority

Highly sensitized patients

PRA Sliding Scale (Allocation Points)

(PRA < 98%)



Minorities

- Less access to living donation¹
 - Blacks with relative risk of receiving a LDKT of 0.67 vs. non-blacks
- Minorities are less likely to be referred for transplant preemptively vs. non-minorities
 - Unaware of the option of transplantation
 - Unaware of the importance of preemptive listing

¹Weng FL, Reese PP, Mulgaonkar S, Patel AM. Clin J Am Soc Nephrol. 2010 Dec;5(12):2338-47

Revised waiting time calculation

Old

Waiting time begins at/after registration with GFR ≤ 20 ml/min **or** on dialysis

New

Waiting time points awarded for dialysis prior to registration (pediatric and adults)

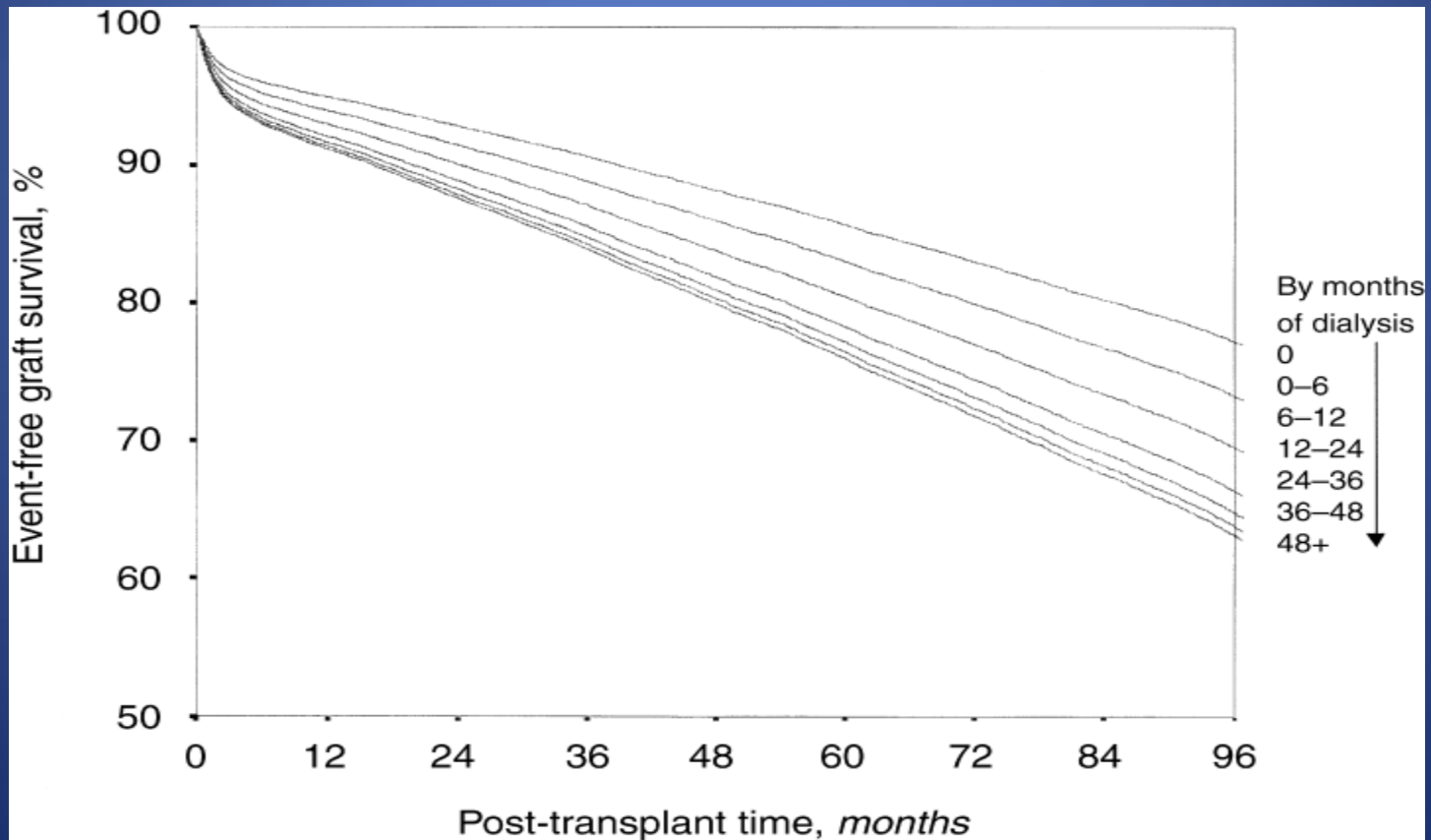
- Recognizes time spent with ESRD as basis for priority

Revised wait-time calculation

- Wait-list time will start to accumulate when:
 - The date a patient is listed preemptively when the calculated GFR is $< 20\text{cc/min}$, or
 - The date renal replacement therapy started in an individual who is not listed preemptively
- Example: Patient is listed for a transplant after already receiving HD for three years
 - Old allocation system: wait-time = 0 days
 - New allocation system: wait-time = 3 years

Revised wait-time calculation

- Helps kidney transplant access for “under-served” patients
- Helps maximize transplant life years since dialysis duration negatively correlates with transplant outcome



Rare blood group type

- 36% chance that any two individuals will be ABO incompatible
- Waiting time by blood group:

Blood Group	Year	Registrations	Waiting Times (days)
O	2005	14108	1626
A	2005	9637	818
B	2005	4236	1777
AB	2005	1159	527

Recipient blood group type B

- More common in Blacks
- Old allocation system: only can receive organs from O or B donors
- New allocation system: can receive organs from O, B, A2, and A2B organs (if anti-A2 titer is low)
- No extra desensitization needed for A2/A2B to B transplant
 - 10 year graft survival¹
 - A2/A2B to B: 72%
 - B to B: 69%

¹ Bryan CF et al. Clin Transpl. 2004: 127-133.

Reducing discard rates

- Very common reason organs are declined is due to a prolonged cold ischemic time (CIT)
- Defining a maximum KDPI for each listed patient should reduce the amount of organ offers that are turned down
 - KDPI (continuous variable) vs. ECD (dichotomous variable)
- Donor organs with a KDPI $>85\%$ will automatically be offered at the regional level rather than local level to increase chances that they are accepted quickly

Example: Organ with KDPI 0-20%

- Highly sensitized
- 0 antigen mismatch with EPTS 0-20%
- Prior living donor
- Local pediatric cases
- Local EPTS 0-20%
- 0 antigen mismatch (national)
- Local list
- Regional pediatric cases
- Regional EPTS 0-20%
- Regional (all)
- National pediatric cases
- National EPTS 0-20%
- National (all)

Example: Organ with KDPI >85%

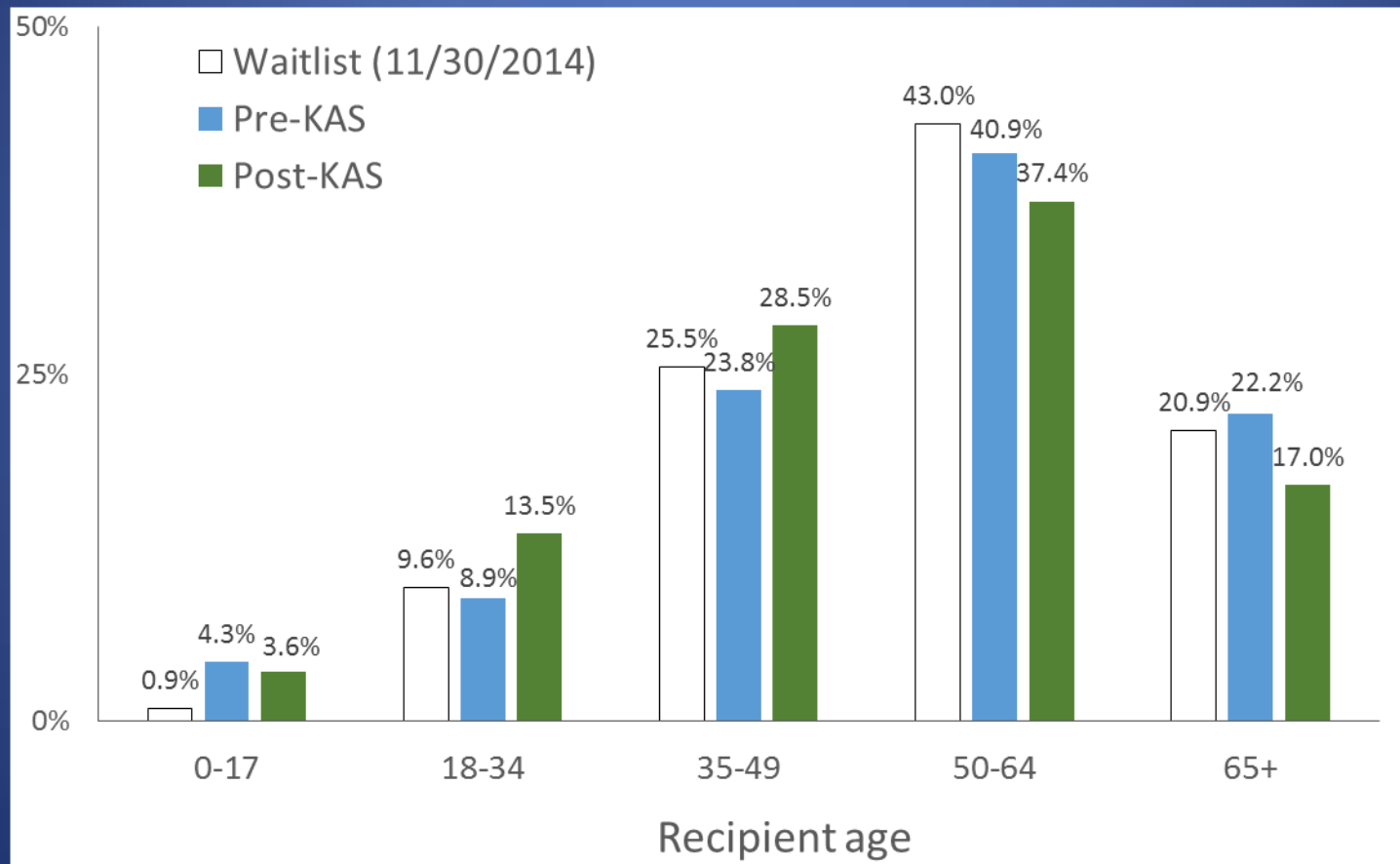
- Highly sensitized
- 0 antigen mismatch
- Local and regional list
- National list

Is the new allocation system working?

The First 6 Months

Who's getting transplanted under KAS?

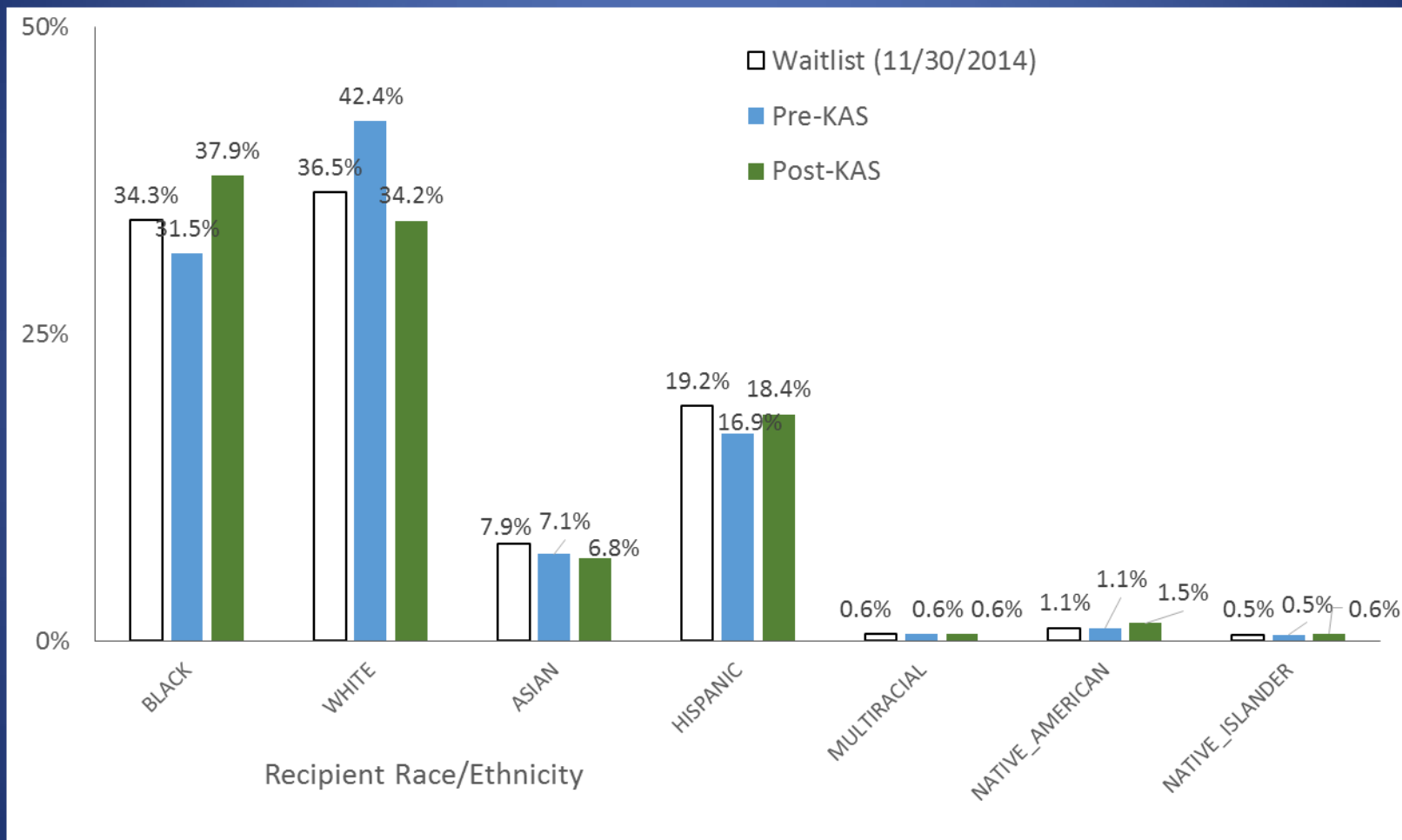
% of Deceased Donor Kidney Transplants by Recipient Age



More young candidates (18-49) are receiving kidney transplants

Who's getting transplanted under KAS?

% of Deceased Donor Kidney Transplants by Recipient Race

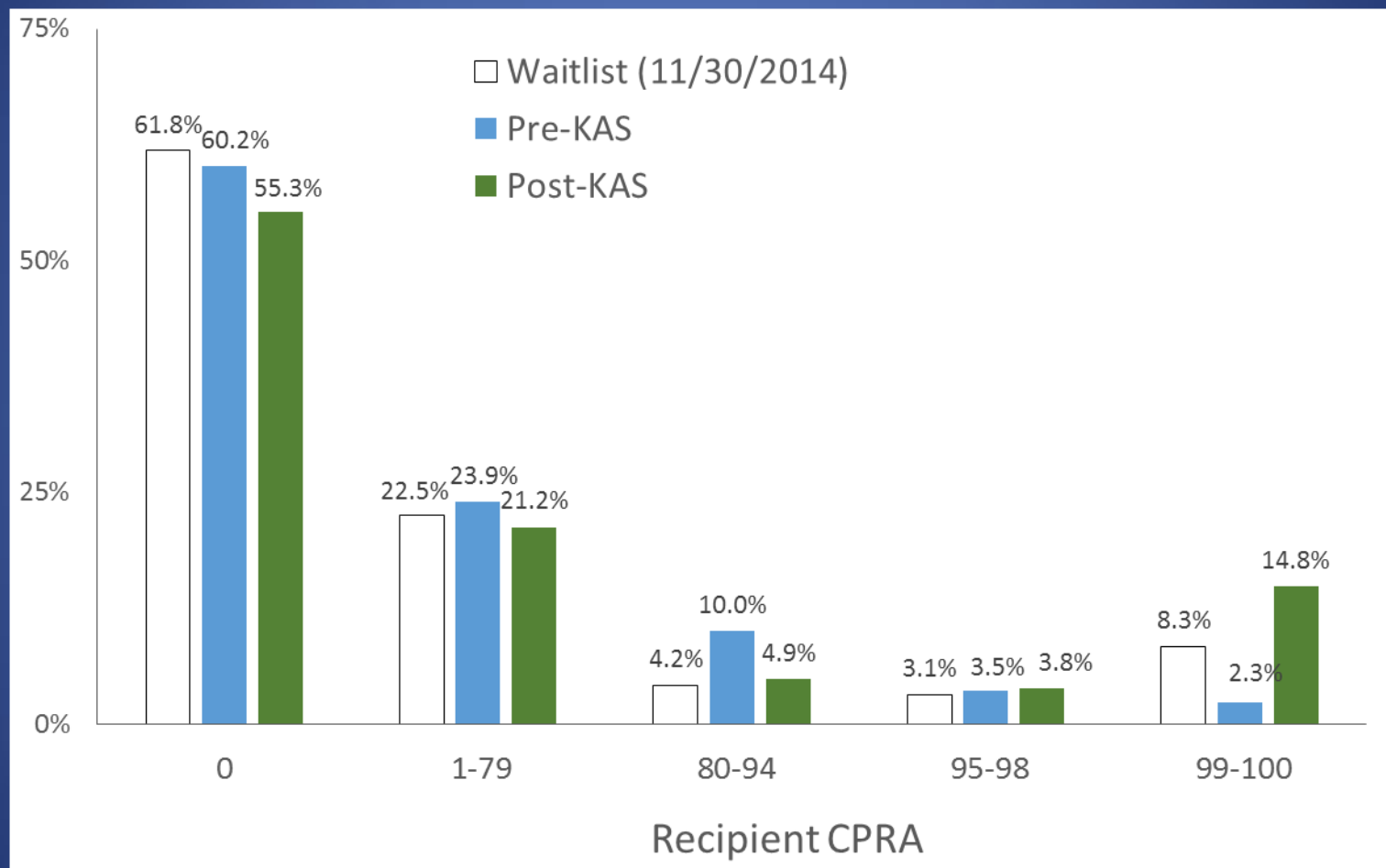


More African Americans are receiving kidney transplants

Four-fold increase in A2/A2B→B transplants (22 → 95 per year)

Who's getting transplanted under KAS?

% of Deceased Donor Kidney Transplants by Recipient CPRA

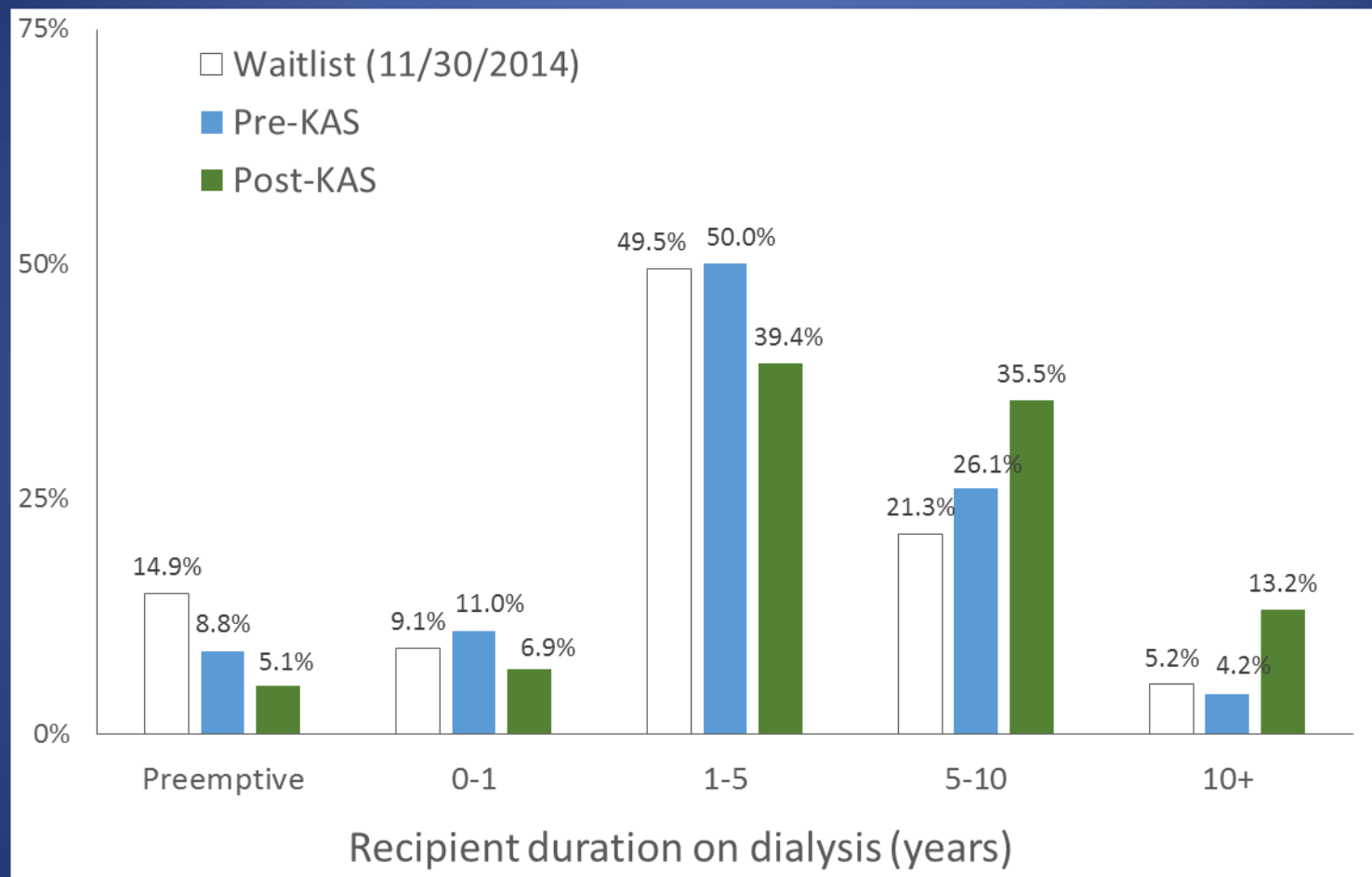


Transplants have increased sharply for CPRA 99-100% patients

Is this what we want if we are concerned about making better use of a scarce resource?

Who's getting transplanted under KAS?

% of Deceased Donor Kidney Transplants by Recipient Duration on Dialysis



More transplants are going to long dialysis duration recipients

Fewer preemptive (before dialysis) transplants

Is this what we want if we are concerned about making better use of a scarce resource?

Longevity-matching under KAS

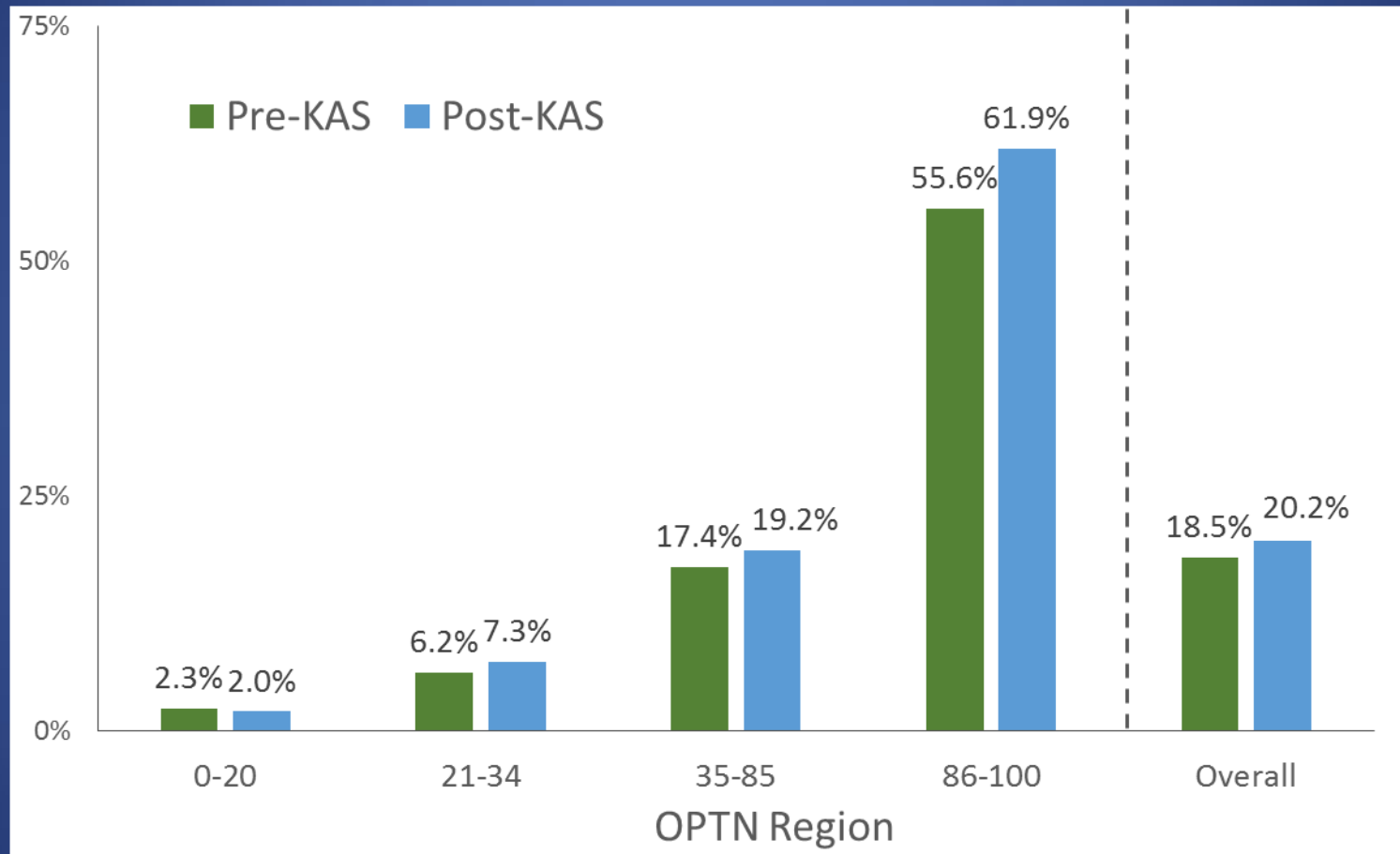
% of Deceased Donor Kidney Transplants by KDPI and Recipient Age

PRE-KAS (6/1/2013-12/3/2014)						POST-KAS (12/4/2014-5/31/2015)					
AGE	KDPI				All	AGE	KDPI				All
	KDPI 0-20	KDPI 21-34	KDPI 35-85	KDPI 86-100			KDPI 0-20	KDPI 21-34	KDPI 35-85	KDPI 86-100	
	%	%	%	%	%		%	%	%	%	
0-17	2.9	0.8	0.6	0.0	4.3	0-17	2.5	0.9	0.2	0.0	3.6
18-34	2.5	1.9	4.4	0.1	8.9	18-34	↑ 6.7	2.4	4.3	0.1	13.5
35-49	5.5	4.5	13.2	0.6	23.8	35-49	7.3	4.7	15.9	0.6	28.5
50-64	7.1	6.5	23.6	3.7	40.9	50-64	↓ 2.8	6.0	25.4	3.3	37.4
65 Plus	2.9	2.6	13.1	3.6	22.2	65 Plus	↓ 1.0	2.2	10.9	3.0	17.0
All	20.9	16.2	54.8	8.1	100.0	All	20.3	16.2	56.5	7.0	100.0

- Transplants with KDPI 0-20% and recipient age 18-34:
 - Pre-KAS: 2.5% of transplants / Post-KAS: 6.7% of transplants
- Transplants with KDPI 0-20% and recipient age 50+:
 - Pre-KAS: 10% of transplants / Post-KAS: 4% of transplants

Kidney recovery & utilization under KAS

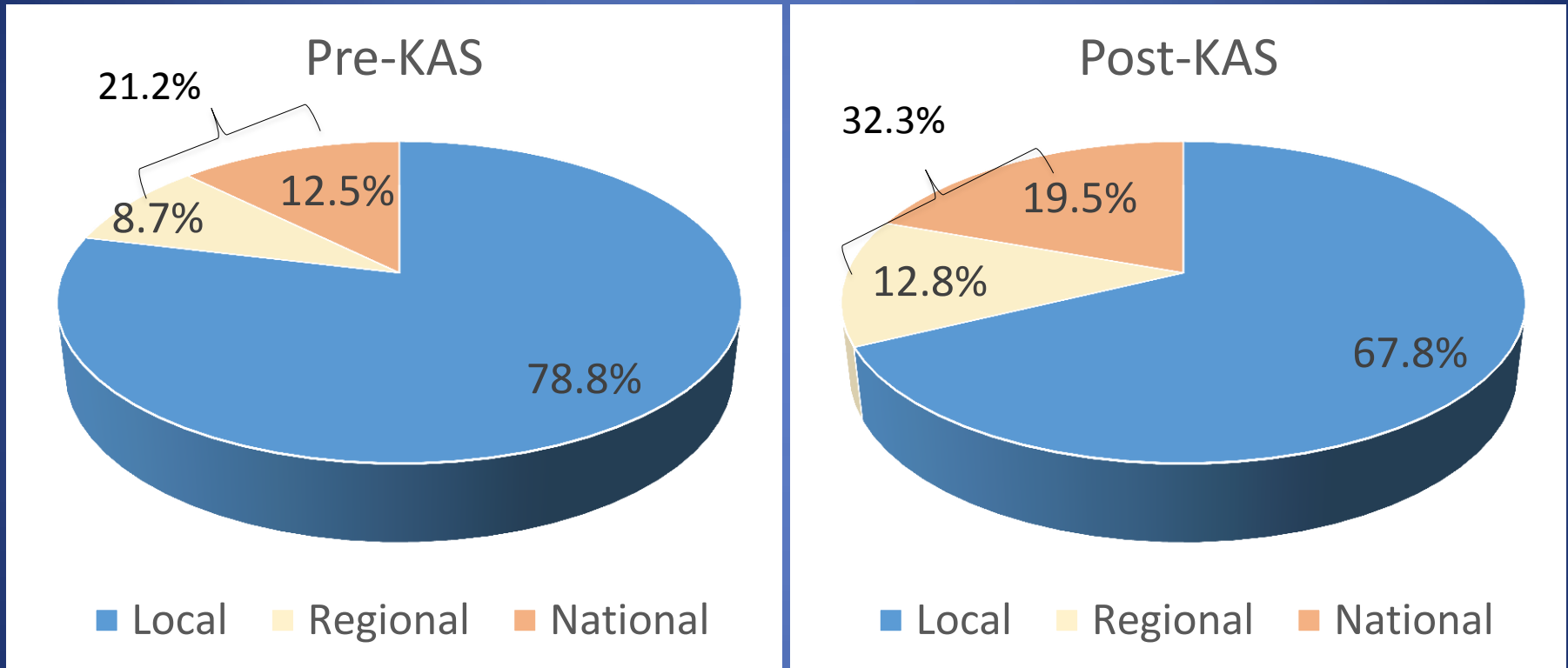
Kidney Discard Rate by KDPI



Kidney discard rates have increased by about 10%

Delayed graft function (DGF) rates increased from 25% to 31%

Geographic distribution of kidney transplants



More kidneys are being distributed outside recovery OPO's DSA

CIT>24 hours: Pre-KAS 18.1%, Post-KAS 22.1%