Kidney Transplantation: Changes in Allocation System

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Example: KDPI = 10%

Allocate by survival matching 20% of kidneys

GROUP A: All candidates EPTS Longest 20%

GROUP B: Everyone else

Allocate by age matching 80% of kidneys
Example: KDPI = 60%

55 year old donor

Allocate by survival matching 20% of kidneys

Allocate by age matching 80% of kidneys

GROUP A: All candidates +/- 15 years of donor’s age

40 to 70 year old candidates

GROUP B: Everyone else

<40 and >70 year old candidates

KDPI 0%

KDPI 20%

60%

KDPI 100%
Kidney Allocation

- Local (donor service area), then Regional, then National
- Transplant Candidates prioritized by time waiting
- Priority for sensitized patients and prior kidney donors
Kidney Transplant: Supply and Demand

- Kidney Transplant is routinely successful
- Cost efficient
- Improves Patient Survival and Quality of life
- Limited Only by Donor Availability
Renal Allograft Quality

- Existing System: *Standard criteria* donor vs *Extended Criteria* donor. 4 factors give Binary score (yes/no)

- Newer Score: *KDPI*, Kidney Donor Profile Index. 10 donor factors lead to continuous score
## Kidney Allocation

### Current System

- Kidneys meeting expanded criteria donor (ECD) thresholds are allocated first to candidates willing to accept these kidneys.

- Kidneys not meeting ECD thresholds are allocated to all candidates on the waiting list as standard criteria donor (SCD) kidneys.

### Proposed System

- Kidneys with a KDPI >20% are allocated first to candidates who are between 15 years older and 15 years younger than the donor.

- Kidneys with a Donor Profile Index (KDPI) score <=20% are allocated first to candidates with the longest 20% estimated post-transplant survival (EPTS).
NEW KIDNEY ALLOCATION CONCEPT

Step 1: Estimate longevity of donor kidney (KDPI)

Step 2: Divide candidates into broad groups (Group A & B)

Step 3: Rank order candidates within each group (Points)
KDPI: Donor Characteristics

- age
- race/ethnicity
- hypertension
- diabetes
- creatinine
- cerebrovascular cause of death
- height
- weight
- donor after cardiac death
- hepatitis c
Estimated Post-Transplant Survival (EPTS)

- candidate age
- length of time on dialysis
- any prior organ transplant
- diabetes status
### Renal Donor Allocation

#### Current Allocation Sequence
- Zero-antigen mismatches
- Local prior living organ donor
- Highly sensitized local
- Payback debts
- Local pediatric (donor age <35)
- Local all candidates
- Regional pediatric (donor age <35)
- Regional all candidates
- National pediatric (donor age <35)
- National

#### Proposed Allocation Sequence
- Group A zero-antigen mismatches
- Local prior living organ donor
- Local pediatric (donor age <35, this may change to KDPI range)
- Local Group A
- Group B zero antigen mismatches
- Local Group B (All remaining local candidates)
- Regional pediatric (donor age <35)
- Regional Group A
- Regional Group B (All remaining Regional Candidates)
- National pediatric (donor age <35)
- National Group A
- National Group B (All remaining Candidates)
Current Rank Ordering of Listed Transplant Candidates

• 1 point per year since listing (waiting time),
• 4 points if CPRA >=80%
• 4 points if candidate is a prior living donor (very few candidates are prior living organ donors)
• 1 point for 1 DR HLA mismatch, 2 points for 0 DR HLA mismatch
Estimated Life Span, Post Transplant
KDPI, Risk of Renal Graft Failure
Donor Age v. KDPI

2005-2007 Kidneys Removed for Transplant

KDPI overlaps substantially for donors from most age categories.
Kidney-alone Recipient Age

- **Baseline (2009 + extras)**
- **Proposed (top 20%, then within 15)**

<table>
<thead>
<tr>
<th>Recipient Age</th>
<th>Baseline</th>
<th>Proposed</th>
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</thead>
<tbody>
<tr>
<td>&lt;18</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>18-34</td>
<td>11</td>
<td>18</td>
</tr>
<tr>
<td>35-49</td>
<td>27</td>
<td>31</td>
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<tr>
<td>50-64</td>
<td>41</td>
<td>35</td>
</tr>
<tr>
<td>65+</td>
<td>16</td>
<td>11</td>
</tr>
</tbody>
</table>
Expected Remaining Lifetimes

- **US Population**
- **Dialysis Patients**
- **Transplant Recipients**

### Axes:
- **Y-axis**: Additional years
- **X-axis**: Individual age category

### Data Points:
- **0-14 years**: US Population = around 70 years, Dialysis Patients = around 20 years, Transplant Recipients = around 55 years
- **15-19 years**: US Population = around 65 years, Dialysis Patients = around 18 years, Transplant Recipients = around 50 years
- **20-24 years**: US Population = around 60 years, Dialysis Patients = around 16 years, Transplant Recipients = around 45 years
- **25-29 years**: US Population = around 55 years, Dialysis Patients = around 14 years, Transplant Recipients = around 40 years
- **30-34 years**: US Population = around 50 years, Dialysis Patients = around 12 years, Transplant Recipients = around 35 years
- **35-39 years**: US Population = around 45 years, Dialysis Patients = around 10 years, Transplant Recipients = around 30 years
- **40-44 years**: US Population = around 40 years, Dialysis Patients = around 8 years, Transplant Recipients = around 25 years
- **45-49 years**: US Population = around 35 years, Dialysis Patients = around 6 years, Transplant Recipients = around 20 years
- **50-54 years**: US Population = around 30 years, Dialysis Patients = around 4 years, Transplant Recipients = around 15 years
- **55-59 years**: US Population = around 25 years, Dialysis Patients = around 2 years, Transplant Recipients = around 10 years
- **60-64 years**: US Population = around 20 years, Dialysis Patients = around 1 year, Transplant Recipients = around 5 years
- **65-69 years**: US Population = around 15 years, Dialysis Patients = around 0.5 years, Transplant Recipients = around 2.5 years
- **70-74 years**: US Population = around 10 years, Dialysis Patients = around 0.1 years, Transplant Recipients = around 1 year
- **75-79 years**: US Population = around 5 years, Dialysis Patients = around 0.05 years, Transplant Recipients = around 0.5 years

### Interpreting the Graph:
- The graph illustrates the expected remaining lifetimes for different age categories and populations.
- The US Population generally has a higher expected remaining lifetime compared to Dialysis Patients and Transplant Recipients.
- As age increases, the expected remaining lifetime decreases for all groups, with Dialysis Patients and Transplant Recipients having significantly lower lifetimes compared to the US Population.

### Conclusion:
- Understanding the expected remaining lifetimes for different age categories and populations is crucial for healthcare planning and resource allocation.
- The data suggests that older age groups have a significantly lower expected remaining lifetime, highlighting the importance of targeted healthcare interventions.
Recipient Age Distribution for U.S. Kidney Transplants
1990, 2000, and 2009

Based on OPTN data as of November 6, 2009
Recipient Age Distribution for U.S. Kidney Transplants
20-Year Average vs. (KPSAM) Simulation Results

Based on OPTN data as of November 6, 2009 and Jan 27, 2010 SRTR KPSAM Results
**KDPI: Kidney Donor Profile Index**

<table>
<thead>
<tr>
<th>KDPI</th>
<th>Estimated Kidney Graft Survival Rates</th>
</tr>
</thead>
<tbody>
<tr>
<td>1%</td>
<td>94.0% 90.8% 87.8% 80.6% 68.8%</td>
</tr>
<tr>
<td>5%</td>
<td>93.5% 90.1% 86.8% 79.1% 66.6%</td>
</tr>
<tr>
<td>10%</td>
<td>93.1% 89.4% 85.9% 77.8% 64.7%</td>
</tr>
<tr>
<td>20%</td>
<td>92.4% 88.4% 84.5% 75.7% 61.7%</td>
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<tr>
<td>30%</td>
<td>91.6% 87.3% 83.1% 73.6% 58.8%</td>
</tr>
<tr>
<td>40%</td>
<td>90.7% 86.0% 81.5% 71.2% 55.5%</td>
</tr>
<tr>
<td>50%</td>
<td>89.8% 84.6% 79.7% 68.7% 52.2%</td>
</tr>
<tr>
<td>60%</td>
<td>88.8% 83.2% 77.9% 66.1% 48.7%</td>
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<tr>
<td>70%</td>
<td>87.7% 81.5% 75.7% 63.1% 45.0%</td>
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<tr>
<td>80%</td>
<td>86.2% 79.4% 73.1% 59.5% 40.6%</td>
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<tr>
<td>90%</td>
<td>84.0% 76.3% 69.2% 54.4% 34.7%</td>
</tr>
<tr>
<td>95%</td>
<td>82.1% 73.6% 65.9% 50.1% 30.2%</td>
</tr>
<tr>
<td>99%</td>
<td>78.7% 69.0% 60.4% 43.4% 23.5%</td>
</tr>
</tbody>
</table>

Based on OPTN data as of April 13, 2012 including primary, solitary, adult kidney transplants from 2000-2007. These survival rates are for single kidney-alone transplants; survival rates are generally higher for en bloc or double kidney transplants. These rates were not adjusted for recipient characteristics, but instead reflect the expected survival averaged across the broad spectrum of adult recipients. The survival rates for any particular recipient will depend on specific characteristics of that recipient. Survival rates were estimated using a Cox regression model with log(KDRI) as the sole independent variable and graft failure defined as loss of graft or patient death. Donor reference population: all kidney donors recovered in 2011.