Proposed Kidney Offering Scheme

Lisa Mumford
On behalf of the Kidney Offering Scheme working group

BTS Congress, March 2018
Outline

- Background
- Donor and Recipient risk indexes
- Proposed kidney offering scheme
- Simulation results
- Additional considerations
• Kidney Advisory Group reviewed 2006 Kidney Allocation Scheme to identify if a change was needed

• Three working groups were set up to look at:
  – Design and review of Kidney Offering scheme
  – Philosophy of Allocation
  – HLA Working group

• Donor and Recipient Risk index have been developed to inform future scheme
Summary of the 2006 KAS

All donors after brain death kidneys allocated by national rules -

Tier A – 000 mismatch paediatric (<18yrs) patients : priority patients*

Tier B – 000 mismatch paediatric patients : others

Tier C – 000 mismatch adult patients : priority patients*

Tier D – 000 mismatch adult patients : others
   + favourably matched (100,010,110) paediatric patients

Tier E – All other eligible patients (75% kidneys)

Pancreas Matching run

Defaulted antigens, Restricted blood group compatible matches,
No level 4 mismatches (2 B & 1 DR mm or 2 DR mm grafts)
High offer decline rates

Offer decline rates vary from 24% at Leeds to 69% at Leicester.

Source: Annual Report on Kidney Transplantation 2016/17, NHS Blood and Transplant
Long waiting times for difficult to match patients

Matchability score:

Number in last 10,000 donors

- blood group identical and HLA compatible (calculated Reaction Frequency)
- 000, 100, 010, 110, 200, 210, 001, 101, 201 mismatch (Level 1 or 2).
- All patients on the waiting list are then divided into deciles.
- 1 = easy to match, 10 = difficult to match
Long waiting times for difficult to match patients

- Median waiting time for Easy patients: 829 days
- Median waiting time for Difficult patients: 2665 days
Design and Review of Kidney Offering Scheme

Lorna Marson (Chair)  Rachel Johnson  Gabriel Oniscu
Chris Callaghan      Stephen Marks   Nick Torpey
Peter Friend         Phil Mason      Chris Watson
Sue Fuggle           Adam McLean     Colin Wilson
Paul Gibbs           Lisa Mumford
Design and Review of Kidney Offering Scheme

Key Recommendations:

• Consider removing current Tier system so that 000 mismatched patients do not receive absolute priority

• Introduce the use of matchability score for long waiting and difficult to match patients

• Match graft life expectancy with patient life expectancy to decrease the incidence of offer declines
<table>
<thead>
<tr>
<th>Name</th>
<th>Chair</th>
<th>Heather Draper</th>
<th>Bernadette Li</th>
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<tbody>
<tr>
<td>Rachel Hilton</td>
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<td>Rommel Ravanan</td>
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<td>Mandy Venters</td>
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<td>Chris Watson</td>
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<td>Diana Wu</td>
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Philosophy of allocation

Key Recommendations:

• Highly sensitised patients should receive prioritisation

• Age should be a continuous factor and not a cut-off at 18 years

• Waiting time should be calculated from the earliest of starting dialysis or activation on the waiting list
<table>
<thead>
<tr>
<th>HLA Working group</th>
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<tbody>
<tr>
<td>Sue Fuggle (Co-Chair)</td>
<td>Rachel Johnson</td>
<td>Linda Shelper</td>
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<tr>
<td>Dave Turner (Co-Chair)</td>
<td>Vasilis Kosmoliaptsis</td>
<td>Craig Taylor</td>
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<td>Martin Barnardo</td>
<td>Nizam Mamode</td>
<td>Nick Torpey</td>
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<td>Richard Battle</td>
<td>Derek Middleton</td>
<td>Bob Vaughan</td>
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<td>David Briggs</td>
<td>Lisa Mumford</td>
<td>Chris Watson</td>
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<td>Chloe Brown</td>
<td>Carmelo Puliatti</td>
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<td>Sian Griffin</td>
<td>Tracey Rees</td>
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HLA Working group

Key Recommendations:

• The repertoire for donor HLA Typing should be extended *(including HLA-DPB1, DPA1 and DQA1)*

• Where HLA matching is deemed appropriate, all loci should be considered as part of the allocation *(A, B, Cw, DR, DQ)*

• Offers to long waiting patients and highly sensitised patients should be flagged with the Transplant Units

• There should be no automatic exclusion criteria based on HLA antigen matching for difficult to match sensitised patients
Key Objectives

• Unify DBD and DCD offering with all DBD and DCD kidneys allocated through the scheme
• More effective ‘quality’ matching between donor and recipient
• Better tailored HLA matching by age
• Geographical equity of access
• Avoid prolonged waiting times that are predictable
• Waiting time from earliest of start of dialysis or activation on the list
• Age should be a continuous factor
Matching donor and recipient more effectively
Developing a donor and recipient risk index

Cohort

- 7,628 first deceased donor kidney only transplants in the UK
- Transplanted between 2006 – 2012
- Adult recipients
- Adult donors
## Donor Risk Index (DRI) Validation dataset

<table>
<thead>
<tr>
<th>Donor Factor</th>
<th>Hazard Ratio</th>
<th>p-value</th>
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<tbody>
<tr>
<td>Age</td>
<td>1.02</td>
<td>&lt;0.0001</td>
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<tr>
<td>Height</td>
<td>0.86</td>
<td>0.0005</td>
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<tr>
<td>Hypertension</td>
<td>1.15</td>
<td>0.1</td>
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<tr>
<td>CMV</td>
<td>1.20</td>
<td>0.02</td>
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<tr>
<td>Hospital stay</td>
<td>1.02</td>
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<tr>
<td>eGFR</td>
<td>0.98</td>
<td>0.02</td>
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<tr>
<td>Female</td>
<td>0.83</td>
<td>0.04</td>
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**C-statistic = 0.64**

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Drag Increased Risk

- **D1**: 92 (90-94)
- **D2**: 88 (86-90)
- **D3**: 84 (82-87)
- **D4**: 81 (78-83)
## Recipient Risk Index (RRI)
### Validation dataset

<table>
<thead>
<tr>
<th>Recipient Factor</th>
<th>Hazard Ratio</th>
<th>p-value</th>
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<tbody>
<tr>
<td>Age (≤25)</td>
<td>1.00</td>
<td>0.9</td>
</tr>
<tr>
<td>Age (&gt;25)</td>
<td>1.02</td>
<td>&lt;0.001</td>
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<tr>
<td>Dialysis</td>
<td>1.43</td>
<td>&lt;0.001</td>
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<tr>
<td>Diabetic</td>
<td>1.32</td>
<td>0.003</td>
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<tr>
<td>Time on dialysis (years)</td>
<td>1.03</td>
<td>0.004</td>
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C-statistic = 0.64
Offer decline rates by combination of DRI & RRI groups

DBD donor kidney offers to named patients

D4 donors

D1 donors
5 year survival by combination of DRI and RRI group

Patient survival

Graft survival

R1 recipients

R4 recipients
Graft vs Patient survival

**D1-R1**
- Graft: 70%
- Patient: 86%

**D1-R4**
- Graft: 73%
- Patient: 37%

**D4-R1**
- Graft: 42%
- Patient: 78%

**D4-R4**
- Graft: 35%
- Patient: 9%

Patient survival from dialysis from UK Renal Registry
Proposed kidney offering scheme
Simulating a new Kidney Offering Scheme

- Computer simulations used to investigate different offering scheme algorithms.
- Using standard pools of real kidney donors and listed patients in each of the simulations.
- Each simulation represents four years of kidney transplant activity.
- Each simulation assumes activity will remain constant over the four-year period.
Previous simulations have predicted quite well in the past

- 2006 kidney allocation scheme
- 2010 pancreas allocation scheme
Summary of basic principles

All **deceased** donor kidneys are allocated through scheme:

**Tier A**  Patients with matchability score = 10 or 100% cRF or ≥7 years
*Allow blood group O to B, HLA level 4 transplants*

**Tier B**  All other patients
*Allow HLA level 4 transplants for matchability score 8 and 9 only*

Within Tier A; patients prioritised by waiting time from dialysis only
Within Tier B, patients prioritised by point score

Factors included in points score:
Donor and recipient risk index match (D1-D4, R1-R4),
Waiting time from earliest of start of dialysis or activation date on the list,
HLA match & age points combined,
Total mismatch points,
Location points,
Matchability points,
Blood group points
Simulation results
Comparing alternative schemes

Different possible schemes simulated and results compared according to

• characteristics of simulated transplant pool
  – Patient age, blood group, ethnicity, waiting time etc
  – HLA mismatch levels
  – predicted survival rates

• characteristics of patients on list at end of simulation

Need to find best compromise between competing objectives
The proposed scheme

- Transplants more difficult to match and highly sensitised patients
- Reduces the variability in waiting time
The proposed scheme

- Transplants more BAME patients in line with new registrations
- Reduces the variability of waiting time between white and BAME patients
Results - Recipient age

The proposed scheme
- Treats age as a continuous factor
- Keeps transplant rates, number of patients on the waiting list and waiting time to transplant similar to the current scheme
- Older patients still wait longer for a transplant
Results - HLA Group

The proposed scheme

• allows HLA Level 4 transplants to select patients
• Reduces HLA matching for older patients
• Does not prioritise 000 mismatched transplants and as such reduces the overall number

Current scheme

Proposed scheme
Results - Donor quality

The proposed scheme

- Reduces the number of transplants with a greater than 25 year age difference
- Matches donor and recipient more effectively with few D4 kidneys being offered to R1 recipients
Results – Transplant location

The proposed scheme

• Allows few national transplants of DCD donor kidneys to patients that need it

• Reduces shipping where it is not needed
## Predicted 5 year graft and patient survival

<table>
<thead>
<tr>
<th>5yr Patient survival</th>
<th>Current scheme</th>
<th>Proposed scheme</th>
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<tr>
<td>90.8%</td>
<td>90.8%</td>
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<table>
<thead>
<tr>
<th>RRI Grp</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
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<tr>
<td>95.8%</td>
<td>92.8%</td>
<td>88.4%</td>
<td>76.6%</td>
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<tr>
<td>96.1%</td>
<td>93.1%</td>
<td>87.9%</td>
<td>74.7%</td>
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<table>
<thead>
<tr>
<th>5yr Graft survival</th>
<th>Current scheme</th>
<th>Proposed scheme</th>
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<tr>
<td>86.2%</td>
<td>86.3%</td>
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<table>
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<tr>
<th>RRI Grp</th>
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<th>2</th>
<th>3</th>
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<tbody>
<tr>
<td>88.8%</td>
<td>87.0%</td>
<td>85.5%</td>
<td>83.3%</td>
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<tr>
<td>89.7%</td>
<td>87.6%</td>
<td>84.6%</td>
<td>80.4%</td>
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Additional considerations

- D4 kidneys from donors over the age of 70 to be offered for centre choice as either a dual or single kidney transplant.

- SPK patients with matchability score = 10 to be considered in Tier A of proposed scheme.

- SPK patients with matchability score <10 to be considered after Tier A.

- Fast Track scheme to remain in place with review after scheme introduced.
Summary

- Working groups were formed to consider recommendations for a new kidney offering scheme

- Donor and Recipient risk indices were developed to match donor and recipients more effectively

- Simulations have been produced to identify the best solution for the next Kidney Offering Scheme in line with key recommendations

- Consultation period
Acknowledgements

Kidney Offering Scheme Working Group

Chris Watson (Chair)  
Chris Dudley  
Sue Fuggle  
John Forsythe  
Peter Friend  
Rachel Hilton

Rachel Johnson  
Lorna Marson  
Phil Mason  
Lisa Mumford  
Keith Rigg  
David Turner