NHS
Blood and Transplant

Kidney offering scheme – 3 month review

Matthew Robb

Caring Expert Quality

Overview

NHS Blood and Transplant

- Background to new scheme
- Principles and details of new scheme
- 3 month activity
- Early discussion points

History of kidney allocation schemes in the UK

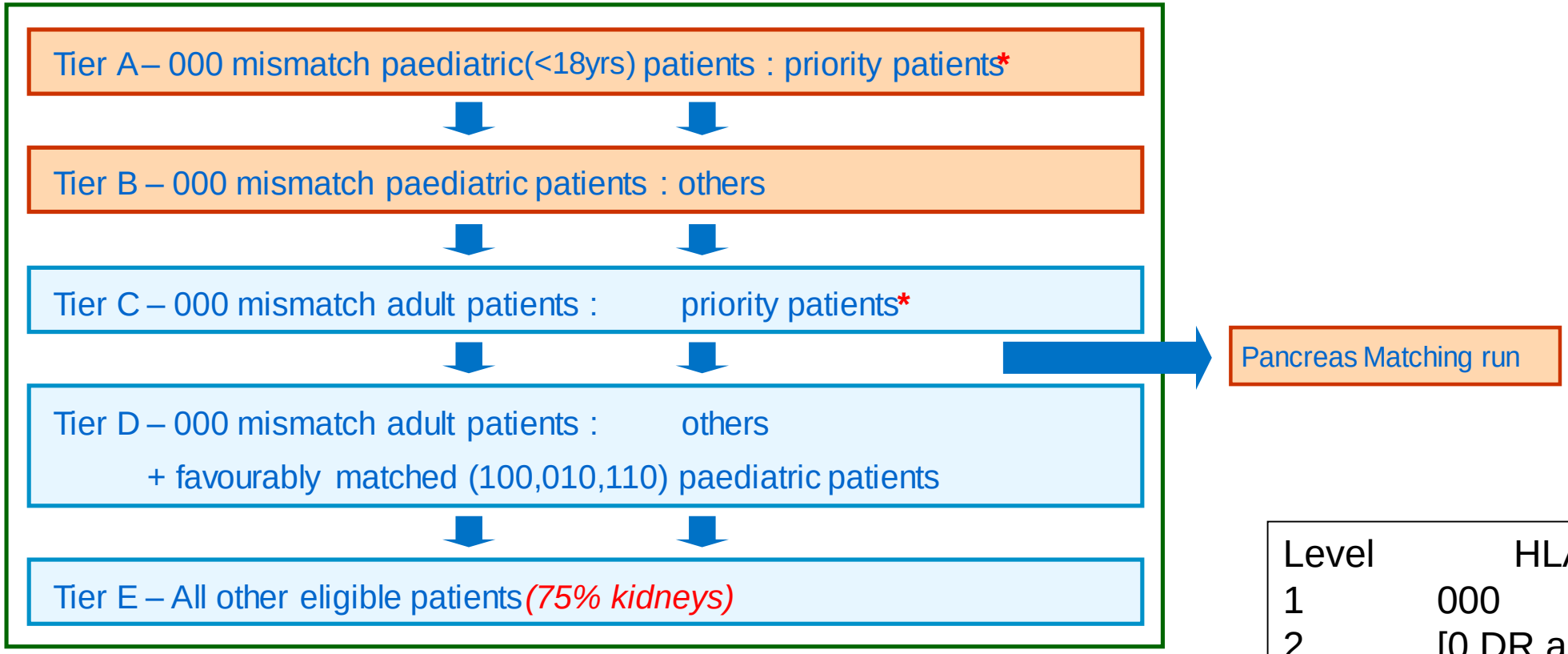
NHS Blood and Transplant

1989	National sharing of one kidney from each DBD donor for a ‘beneficial’ (HLA-A,B,DR = 000,100 or 010) matched patient.
1998	Both kidneys from DBD donor allocated nationally for 000 mismatched adult and 000, 100, 010, 110 mismatched paediatric patients.
2006	National sharing for all DBD donor kidneys. Priority for all 000 mismatched patients. Novel form of scoring introduced to rank patients.
2014	National sharing of one kidney from DCD donors aged between 5 and 49 using 2006 DBD scheme principals

Summary of the 2006 KAS

NHS Blood and Transplant

All donors after brain death kidneys allocated by national rules -



Level	HLA mismatch
1	000
2	[0 DR and 0/1 B]
3	[0 DR and 2 B] or [1 DR and 0/1 B]
4	[1 DR and 2 B] or [2 DR]

Restricted blood group compatible matches,
No level 4 mismatches

Summary of the 2014 DCD KAS

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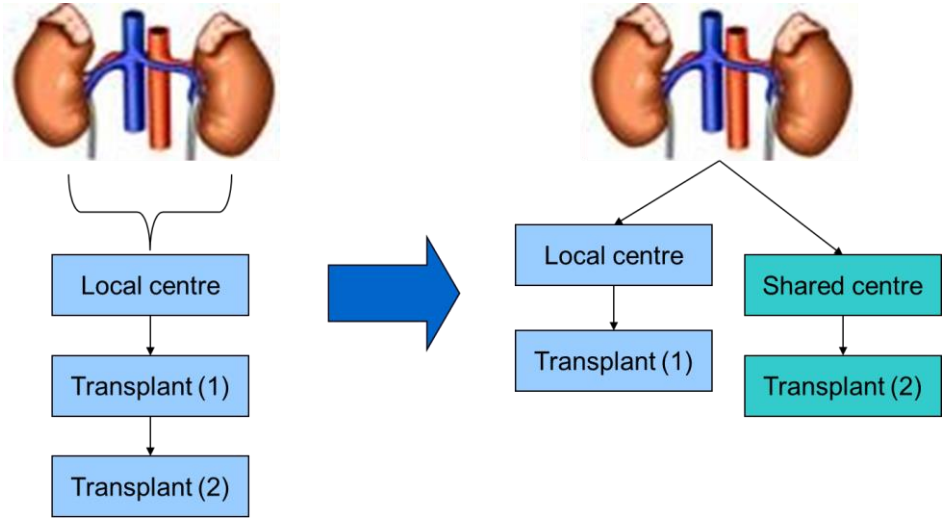
- One kidney retained locally, second kidney shared regionally within four pre-defined regions
- Kidneys allocated according to the 2006 DBD donor kidney allocation scheme principles
- Initially, this included donors aged 5-49, but was gradually increased to 5-64



Introduction

NHS Blood and Transplant

Key objectives of a new scheme

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

New Kidney Offering Scheme September 2019

NHS Blood and Transplant

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

Within Tier A; patients prioritised by matchability score and waiting time from dialysis

Tier B All other patients

Allow HLA level 4 transplants for matchability score 8 and 9 only

Within Tier B; patients prioritised by point score

New Kidney Offering Scheme September 2019

NHS Blood and Transplant

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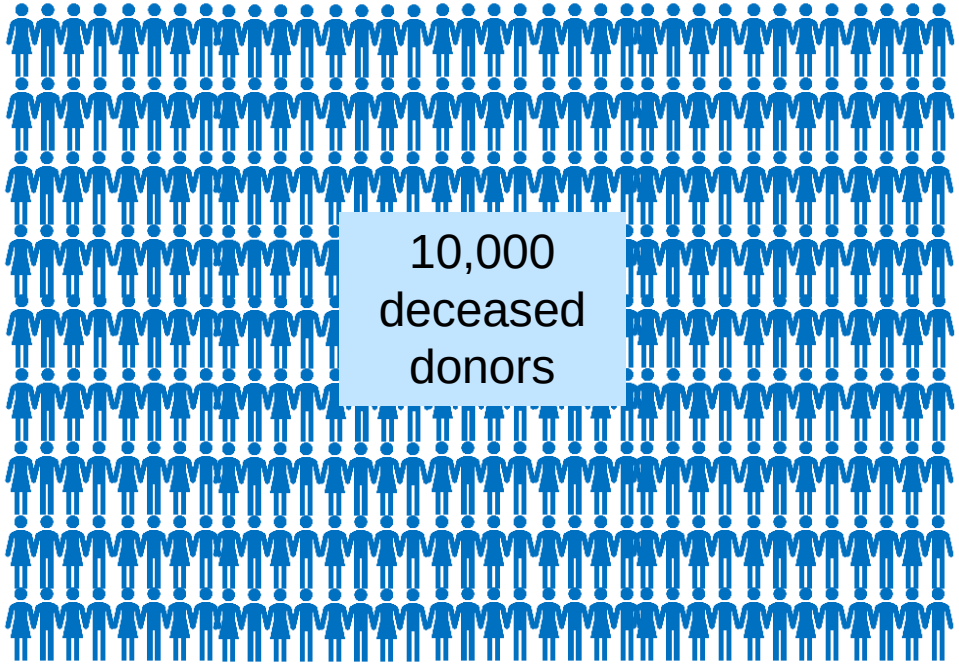
Identify matches at level 1 and 2 mismatch

Level	HLA mismatch
1	000
2	[0 DR and 0/1 B] [1 DR and 0 B]



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NHS Blood and Transplant

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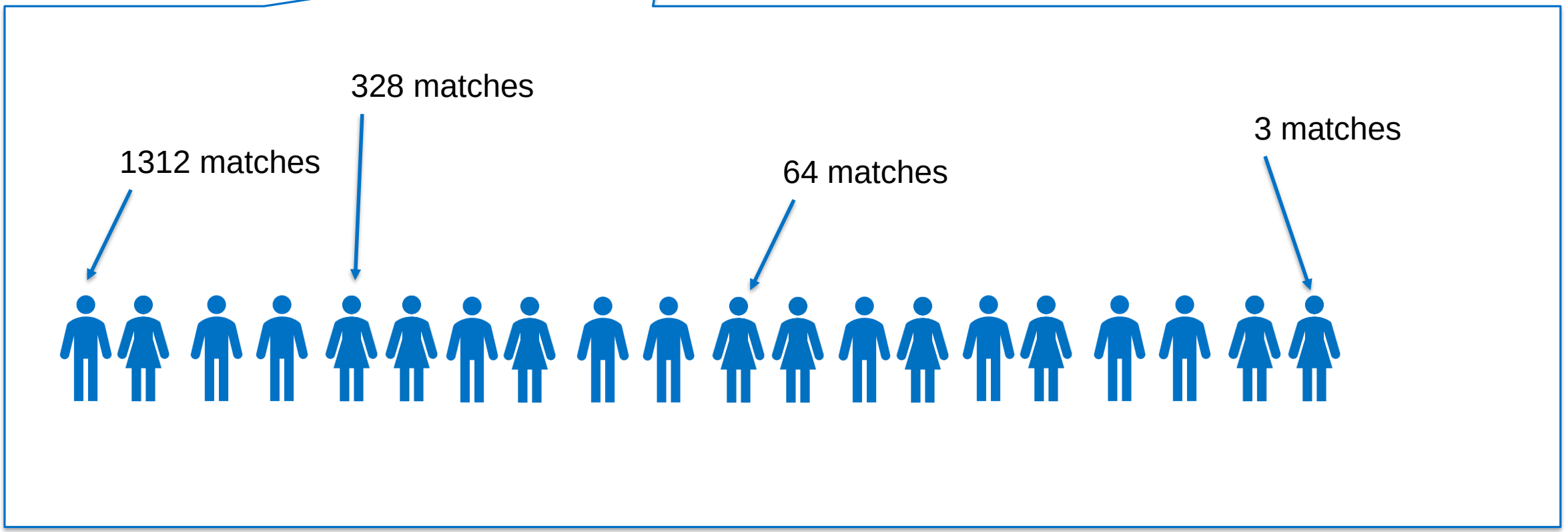

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NHS Blood and Transplant

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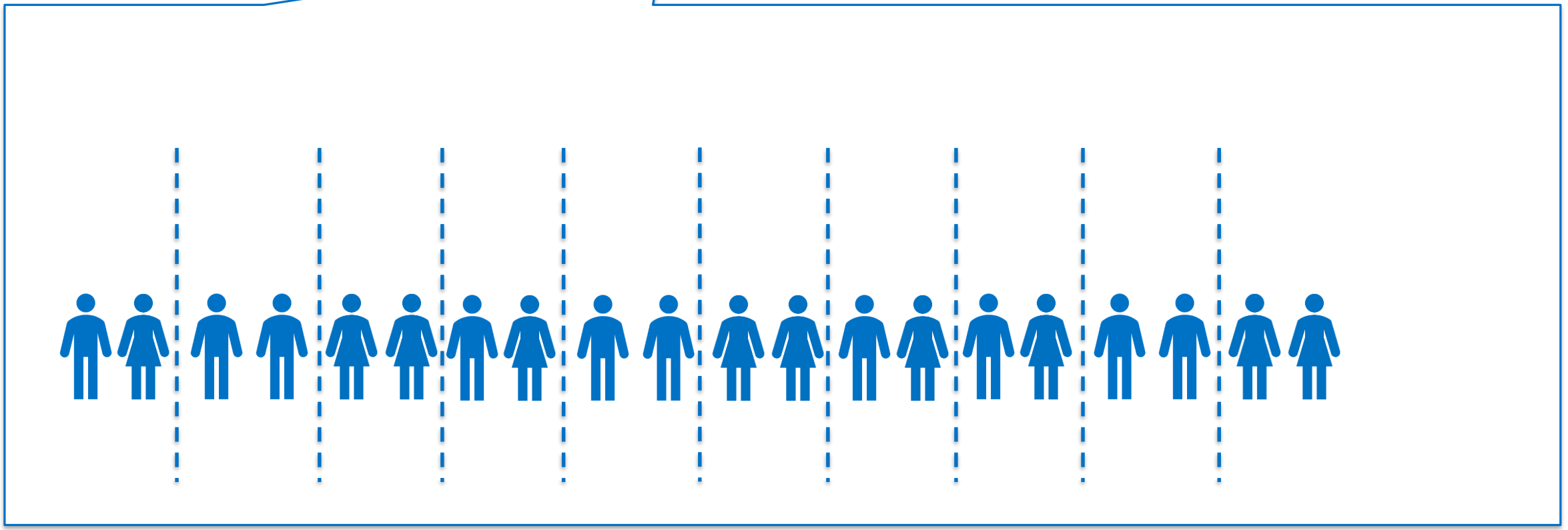

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NHS Blood and Transplant

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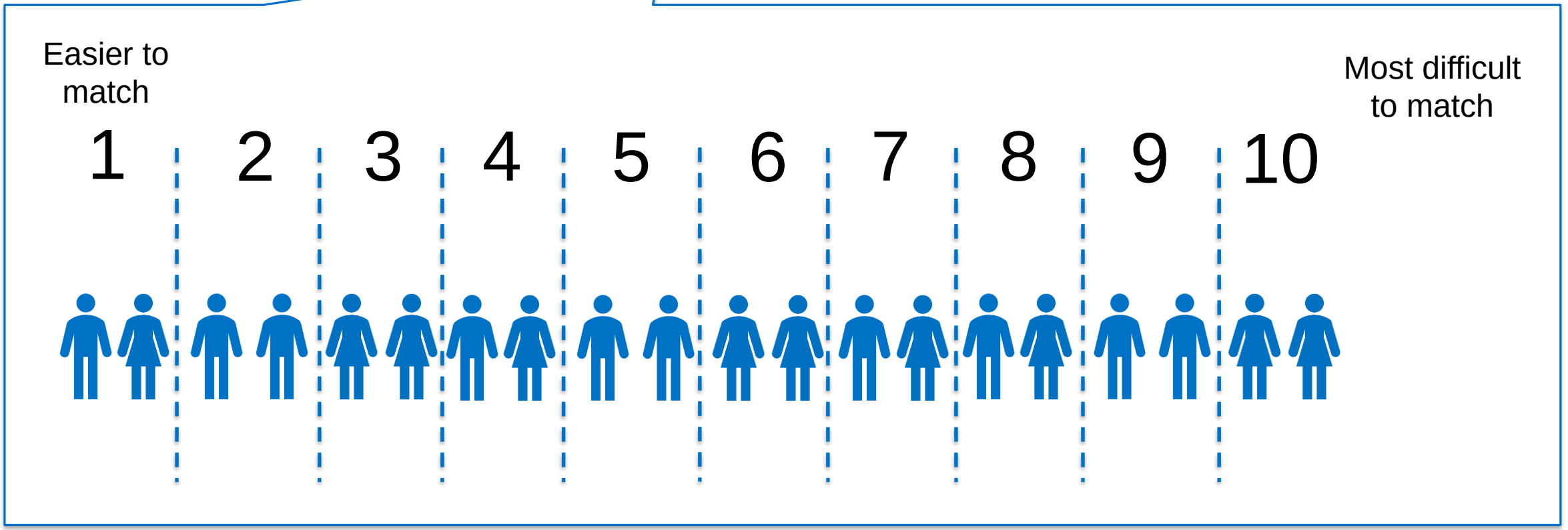

New Kidney Offering Scheme September 2019

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Tier A Patients with matchability score = 10 or 100% cRF or ≥7 years

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Within Tier A; patients prioritised by matchability score and waiting time from dialysis

Tier B All other patients

Allow HLA level 4 transplants for matchability score 8 and 9 only

Within Tier B; patients prioritised by point score

Points score

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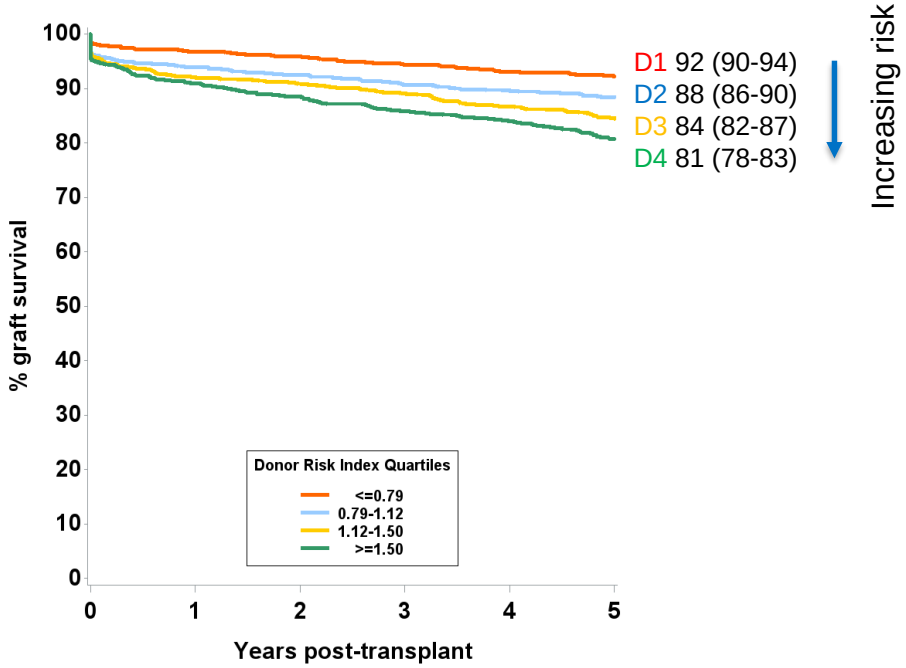
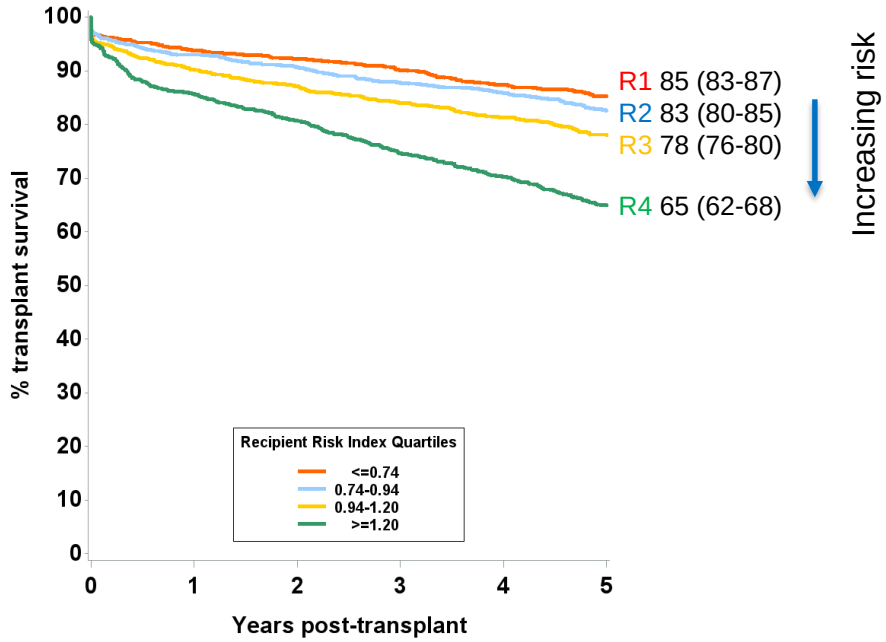
Donor Risk Index
Cox model: 5 year graft survival

Donor Factor	Hazard Ratio	p-value
Age	1.02	<0.0001
Height	0.86	0.0005
Hospital stay	1.02	0.006
CMV	1.2	0.02
eGFR	0.98	0.02
Female	0.83	0.04
Hypertension	1.15	0.1



Recipient Risk Index
Cox model: 5 year transplant survival

Recipient Factor	Hazard Ratio	p-value
Age (≤25)	1.00	0.9
Age (>25)	1.02	<0.001
Dialysis status	1.43	<0.001
Diabetic	1.32	0.003
Time on dialysis (years)	1.03	0.004



Points score

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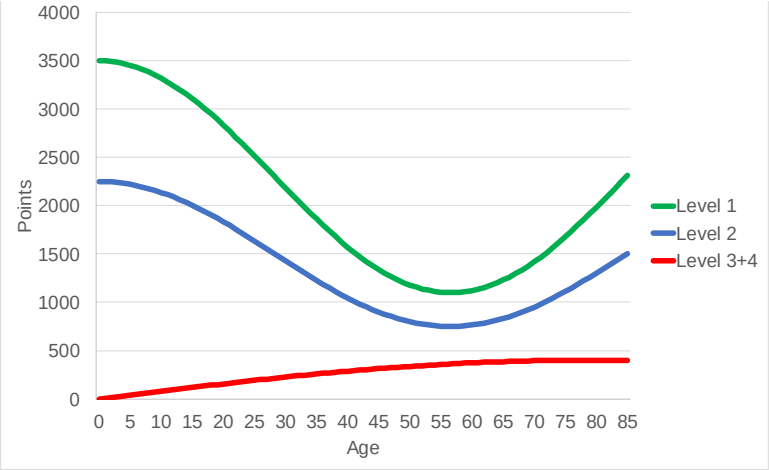
Donor and recipient risk index match

Donor Risk group	Recipient Risk Group			
	R1	R2	R3	R4
D1	1000	700	350	0
D2	700	1000	500	350
D3	350	500	1000	700
D4	0	350	700	1000

HLA and age combined points



Level 1 1200*cos(r-age/18)+2300
Level 2 750*cos(r-age/18)+1500
Level 3+4 400*sin(r-age/50)

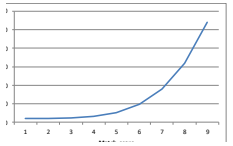
Waiting time points from dialysis

1 point will be awarded for every day

Location points

DCD within region 1000 points
DBD within region 500 points
DCD within centre 1250 points

Matchability points



$40 * (1 + \text{matchability score} / 4.5)^{4.7}$

Total mismatch points (HLA-A,B,Cw,DR,DQ)

=1 -100 points = 4-8 -250 points
=2-3 -150 points = 9-10 -500 points

Age difference points

$-½ (\text{donor-recipient age difference})^2$

Local allocation of kidneys

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Kidneys will still be available through the scheme for centres to use in a patient of their choice:

- Kidneys from donors aged 2 - 5 will be offered to centres en-bloc
- Kidneys from D4 donors > 70 years will be offered to centres to use as dual or individually
- Kidneys dispatched but reallocated because intended patient cannot subsequently receive transplant, assuming no Tier A recipients are identified
- Kidneys offered through the Fast Track Scheme

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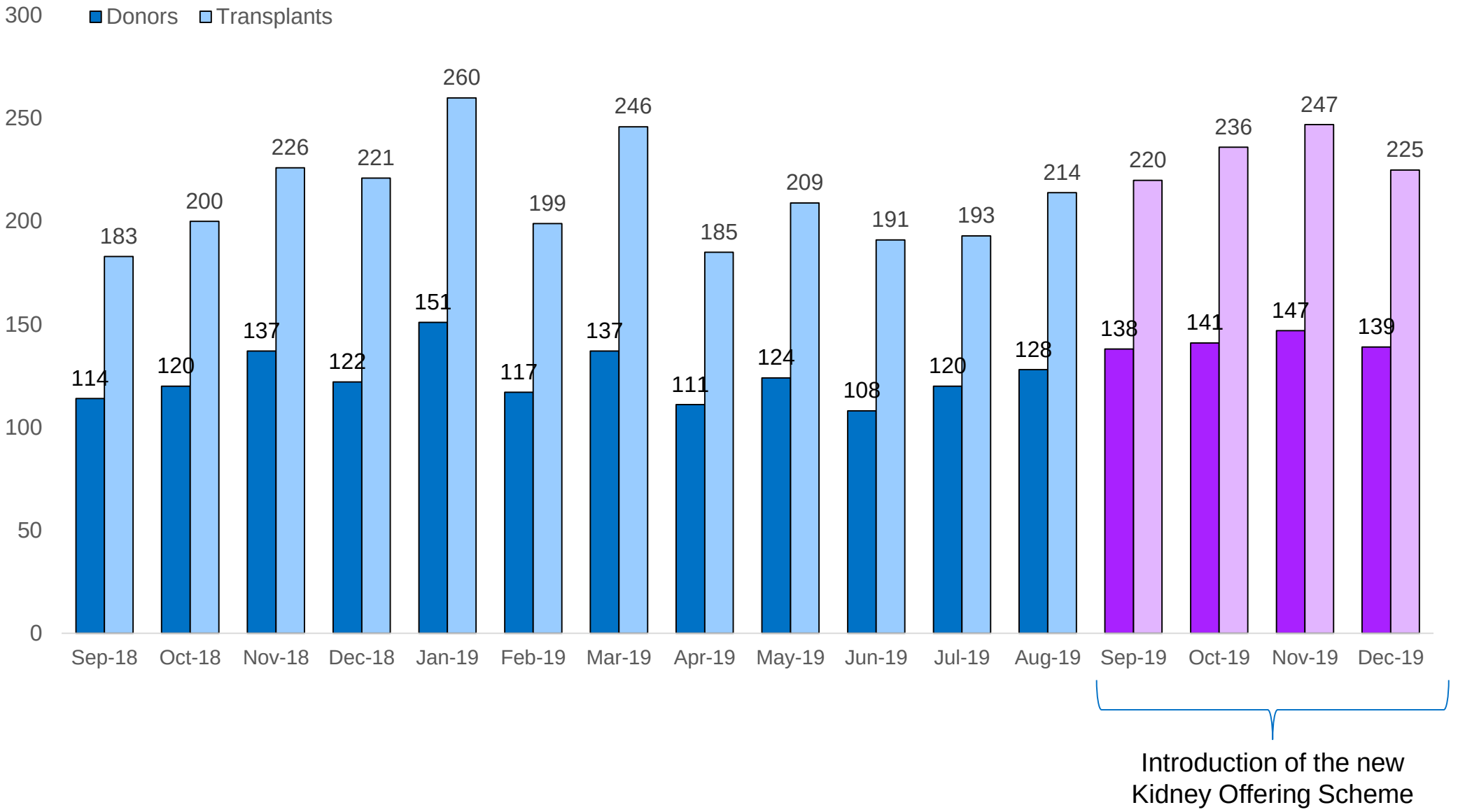
Summary of the first three months

Deceased Donor Kidney Activity

NHS Blood and Transplant

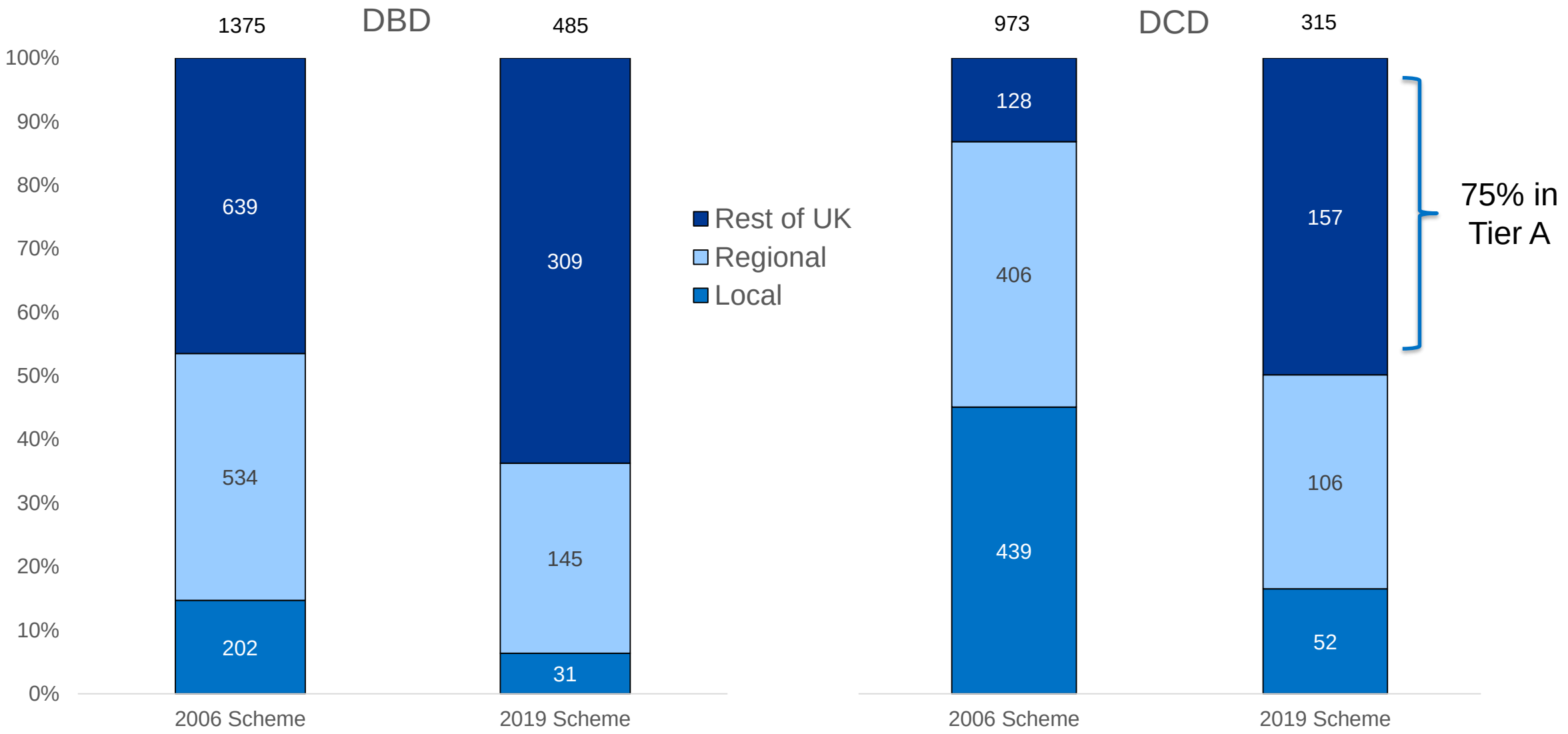


Transplant Activity - Region

NHS Blood and Transplant

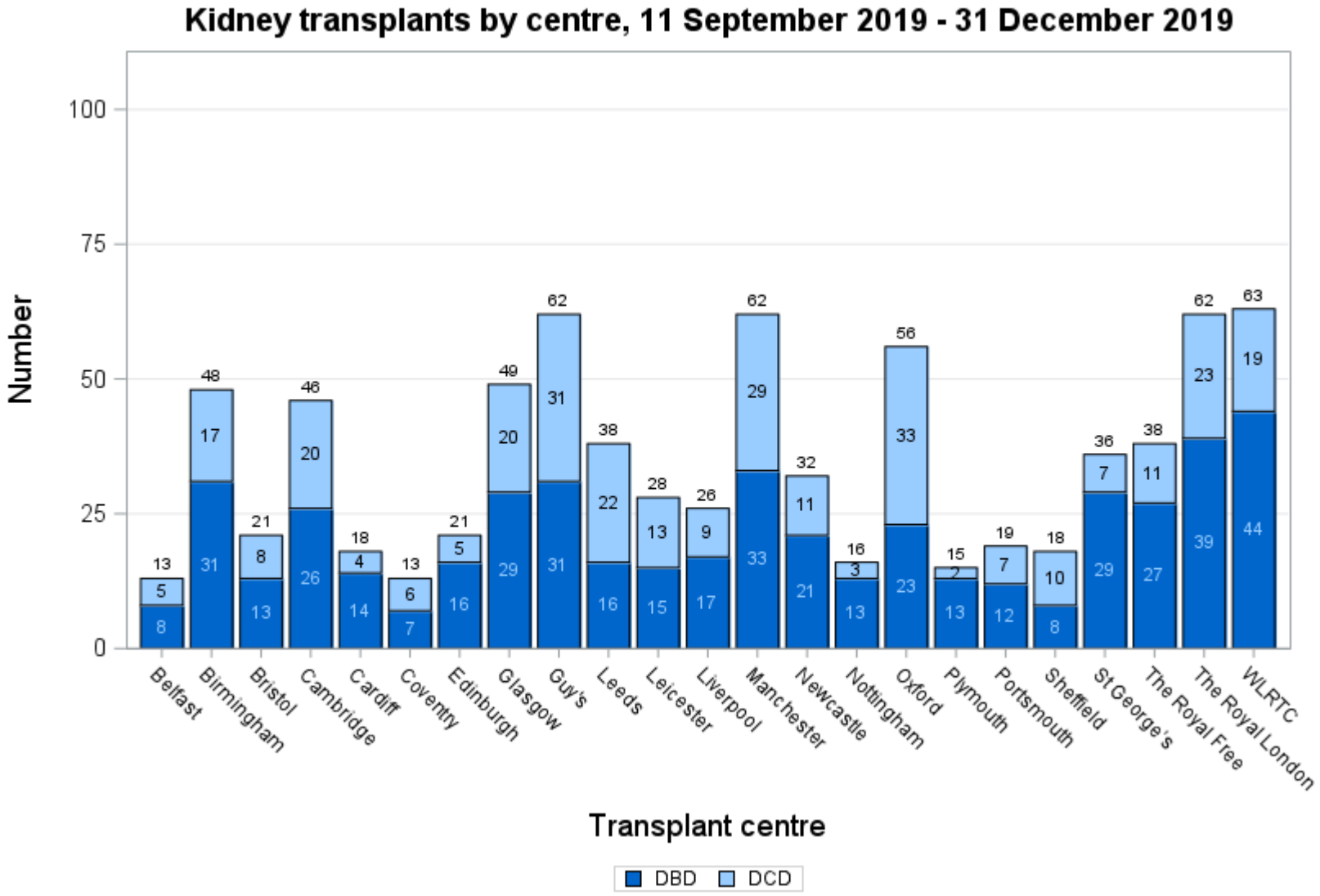
2006 Scheme: 1 Sep 2018 – 10 Sep 2019

2019 Scheme: 11 Sep – 31 Dec 2019



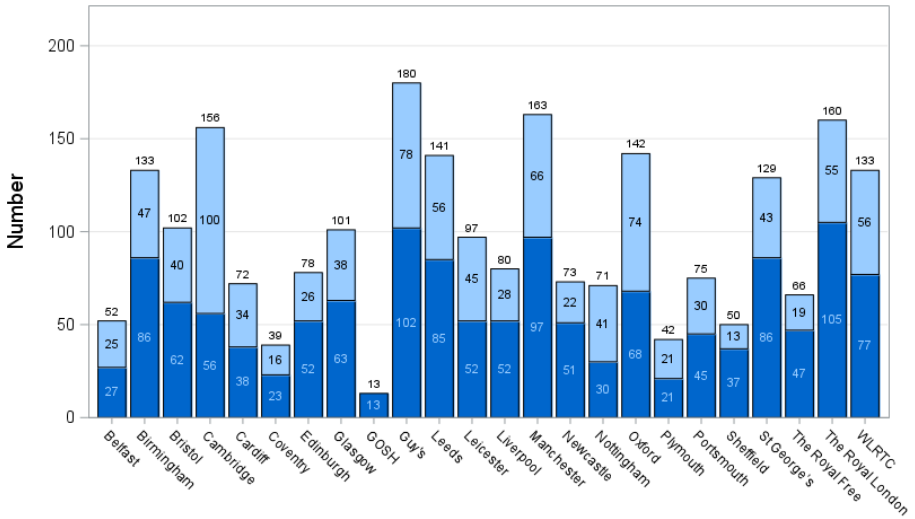
Transplant Activity by Centre

NHS Blood and Transplant

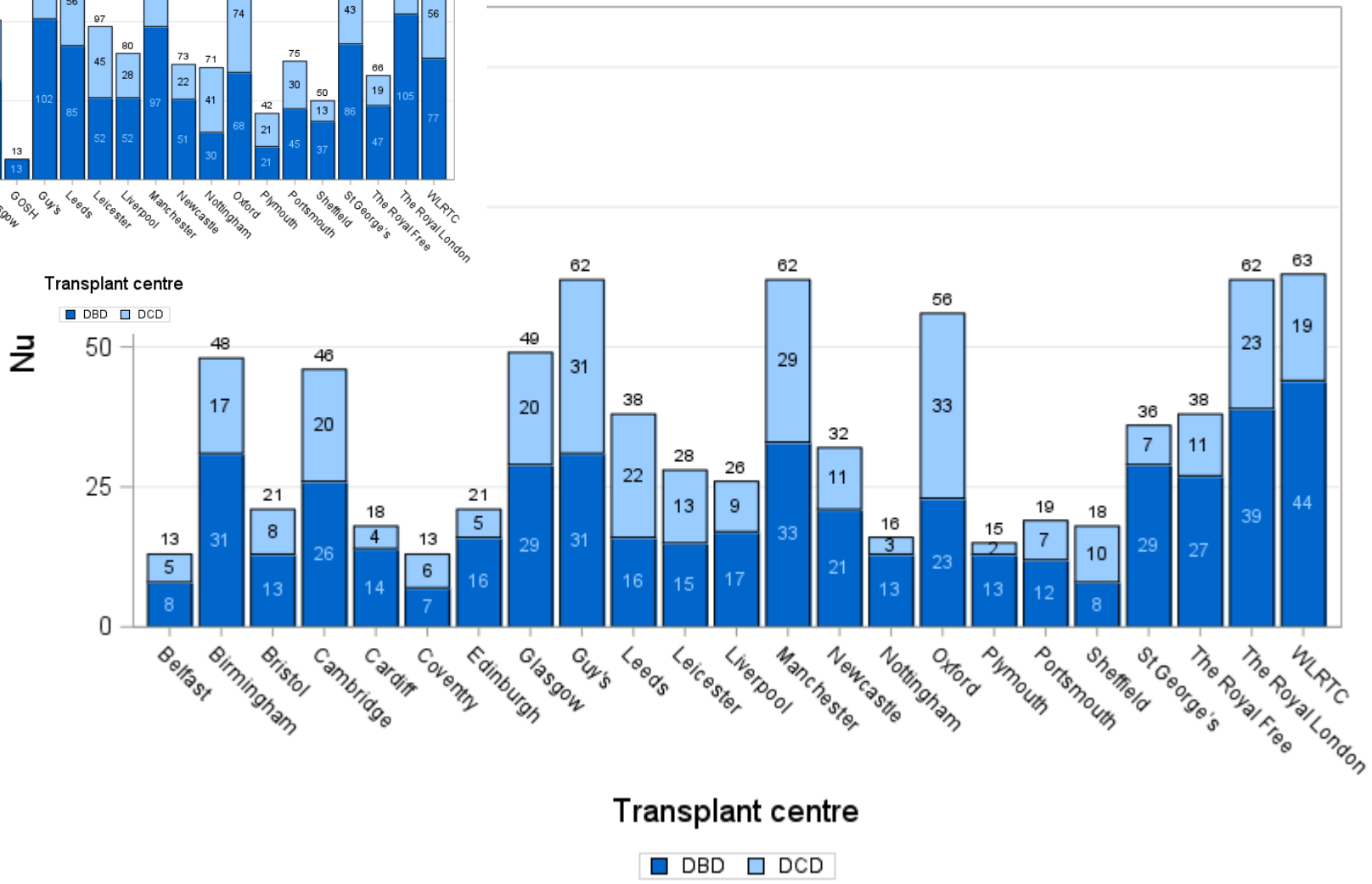


ctivity by Centre

Blood and Transplant



by centre, 11 September 2019 - 31 December 2019



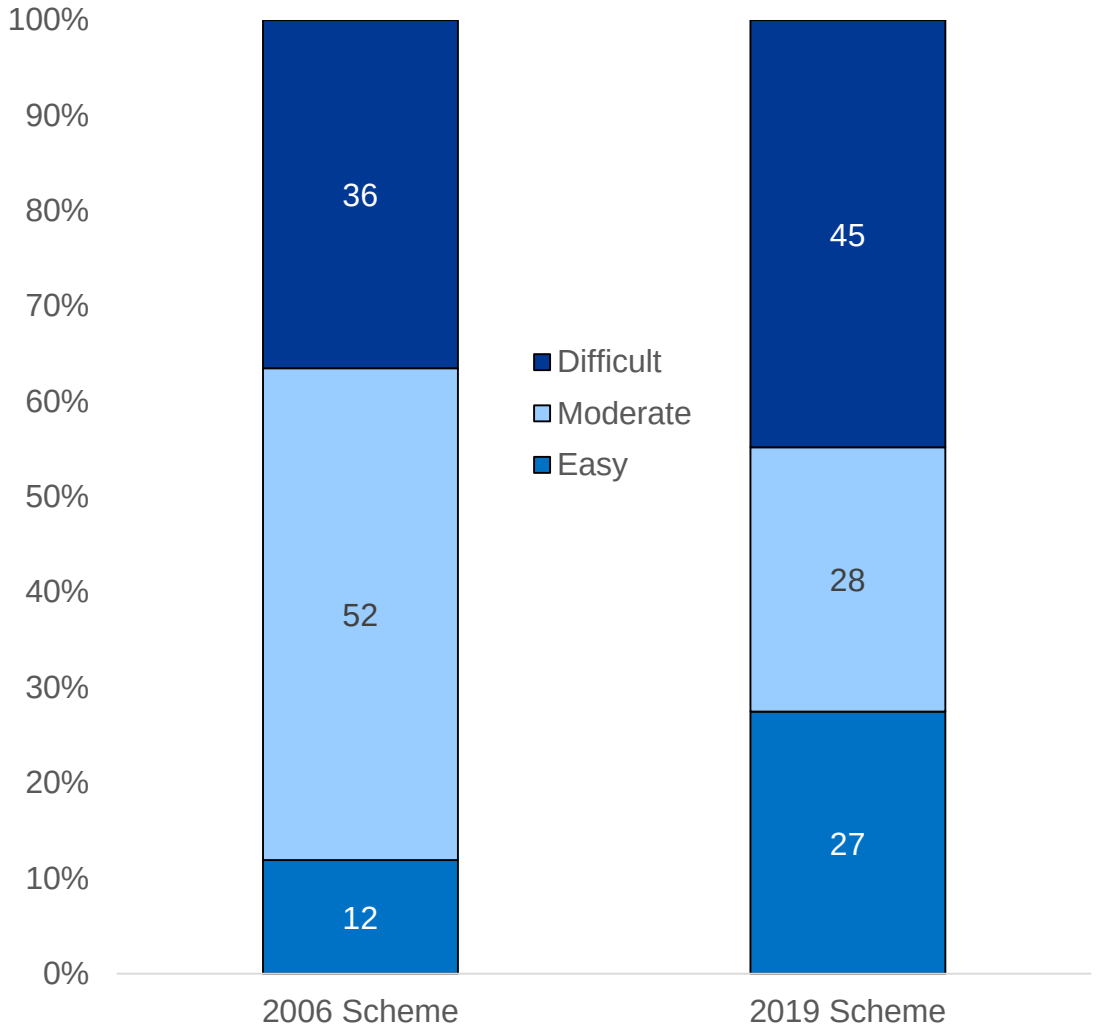
Transplant Activity - Demographics

NHS Blood and Transplant

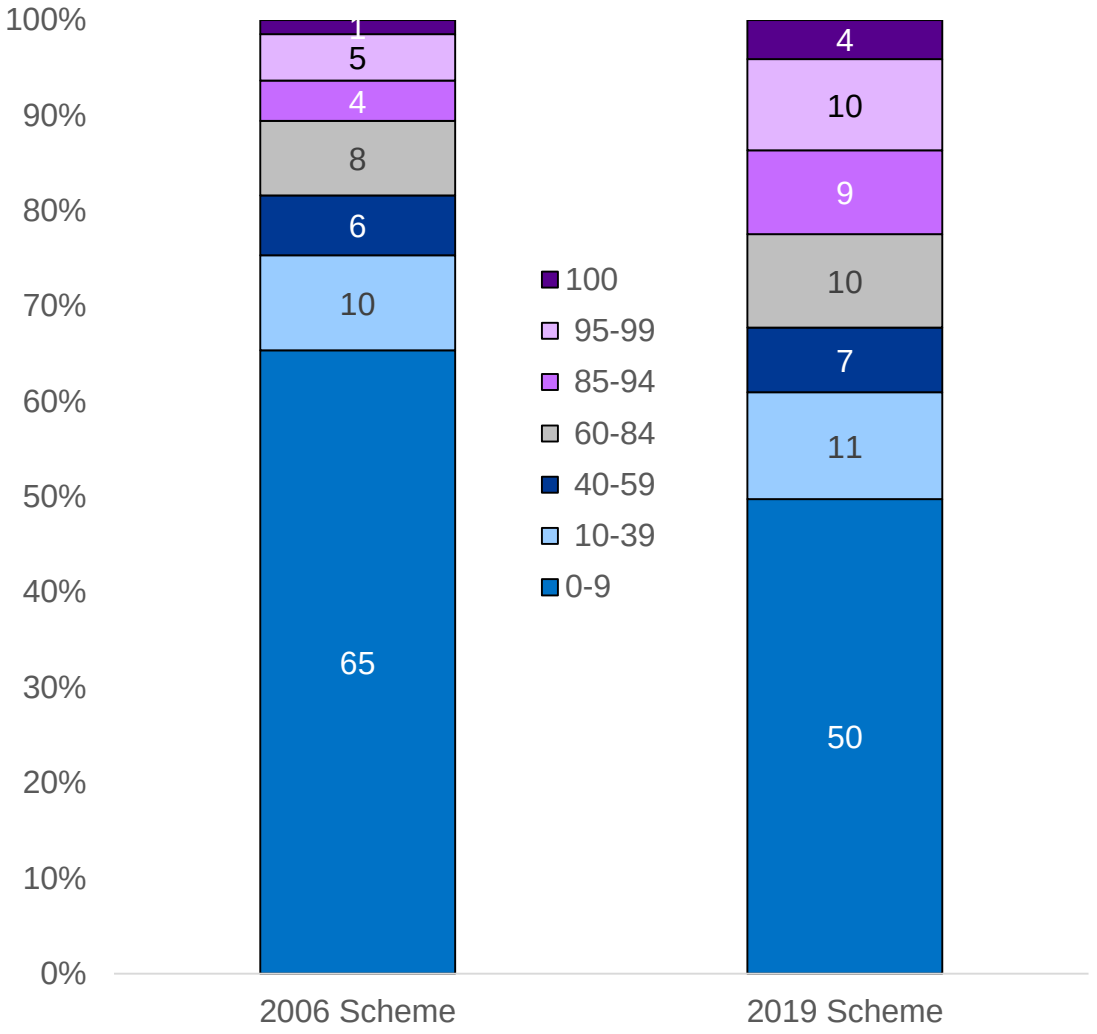
2006 Scheme: 1 Sep 2018 – 10 Sep 2019

2019 Scheme: 11 Sep – 31 Dec 2019

Matchability



Sensitisation



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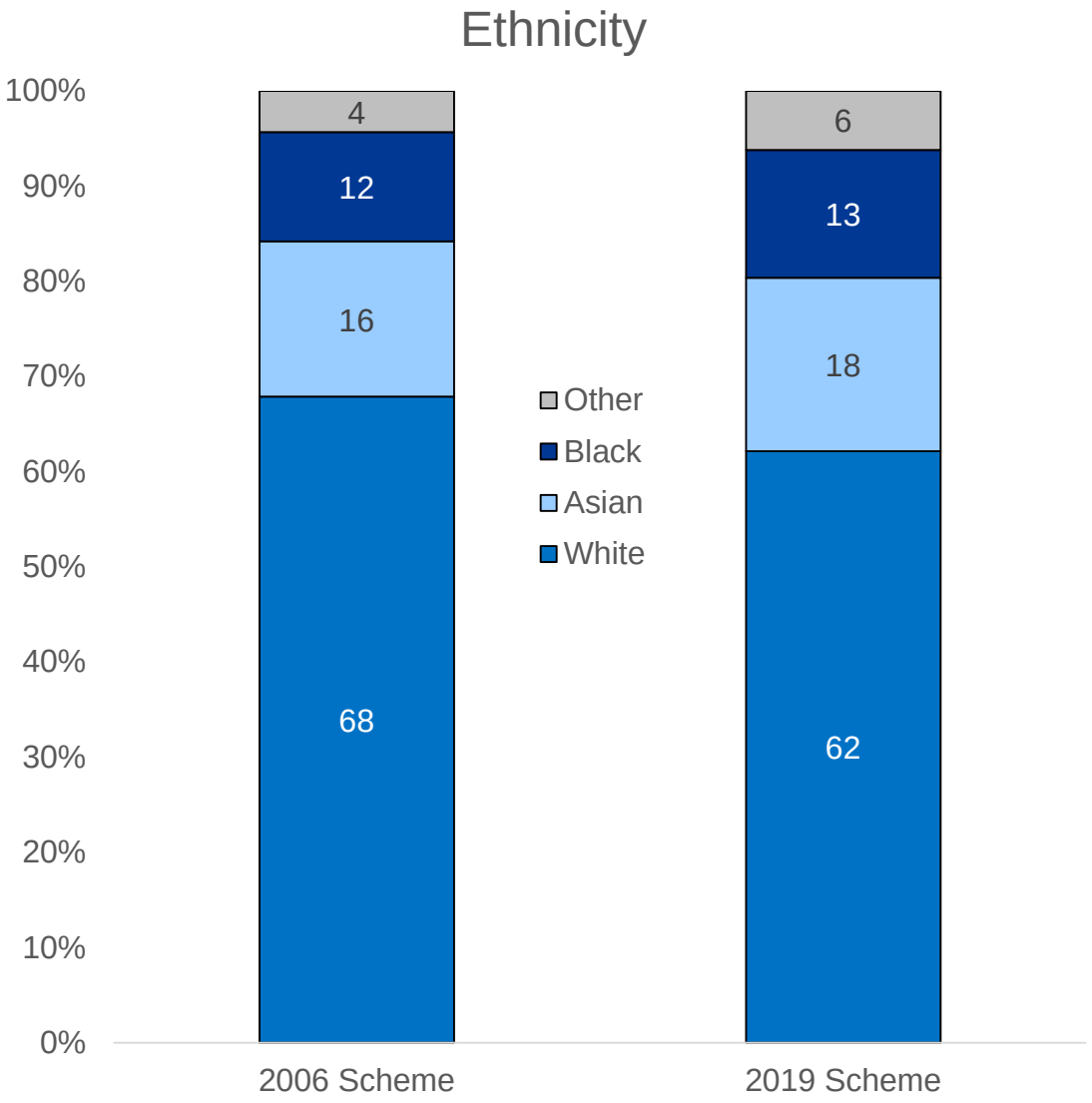

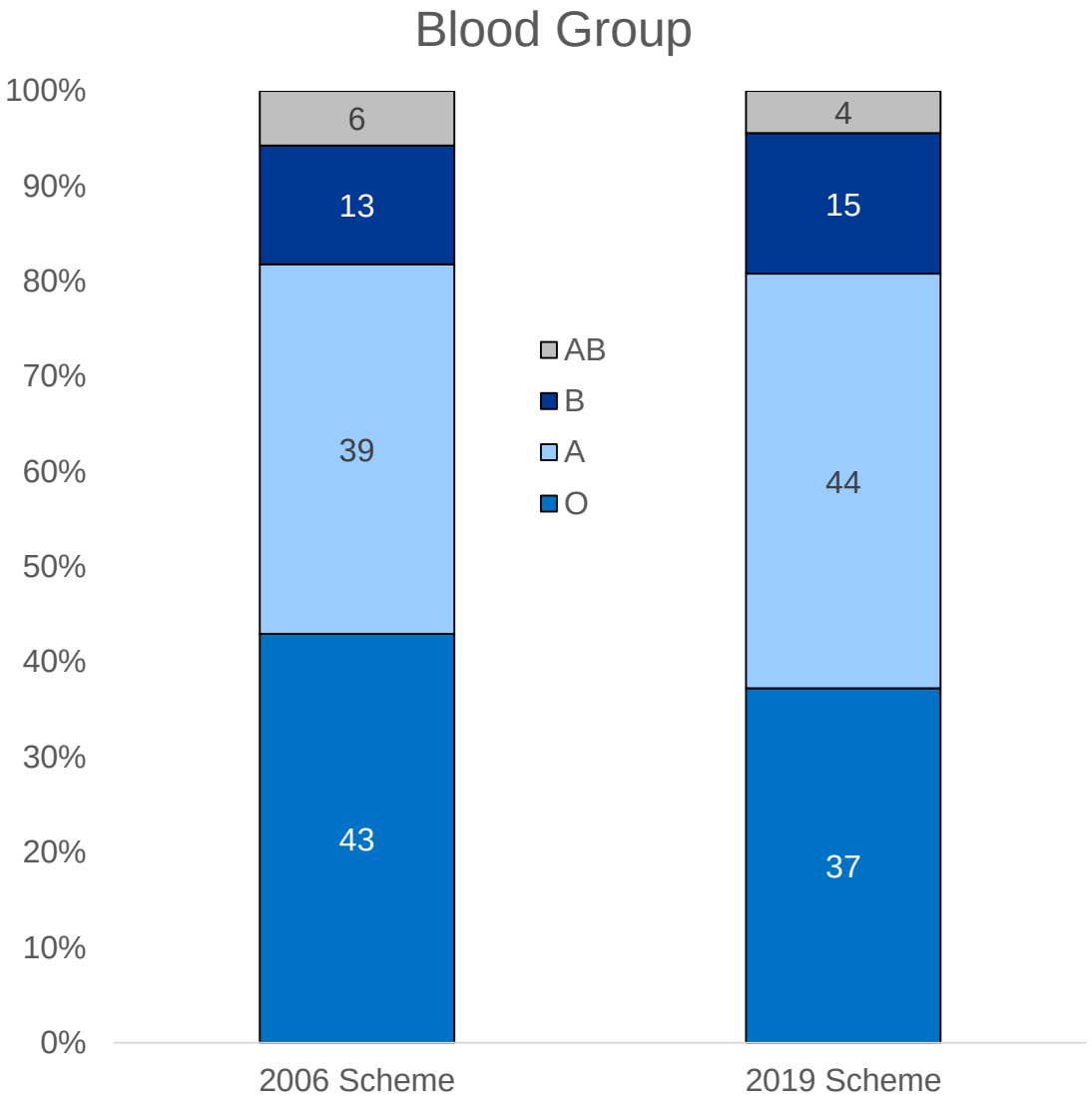

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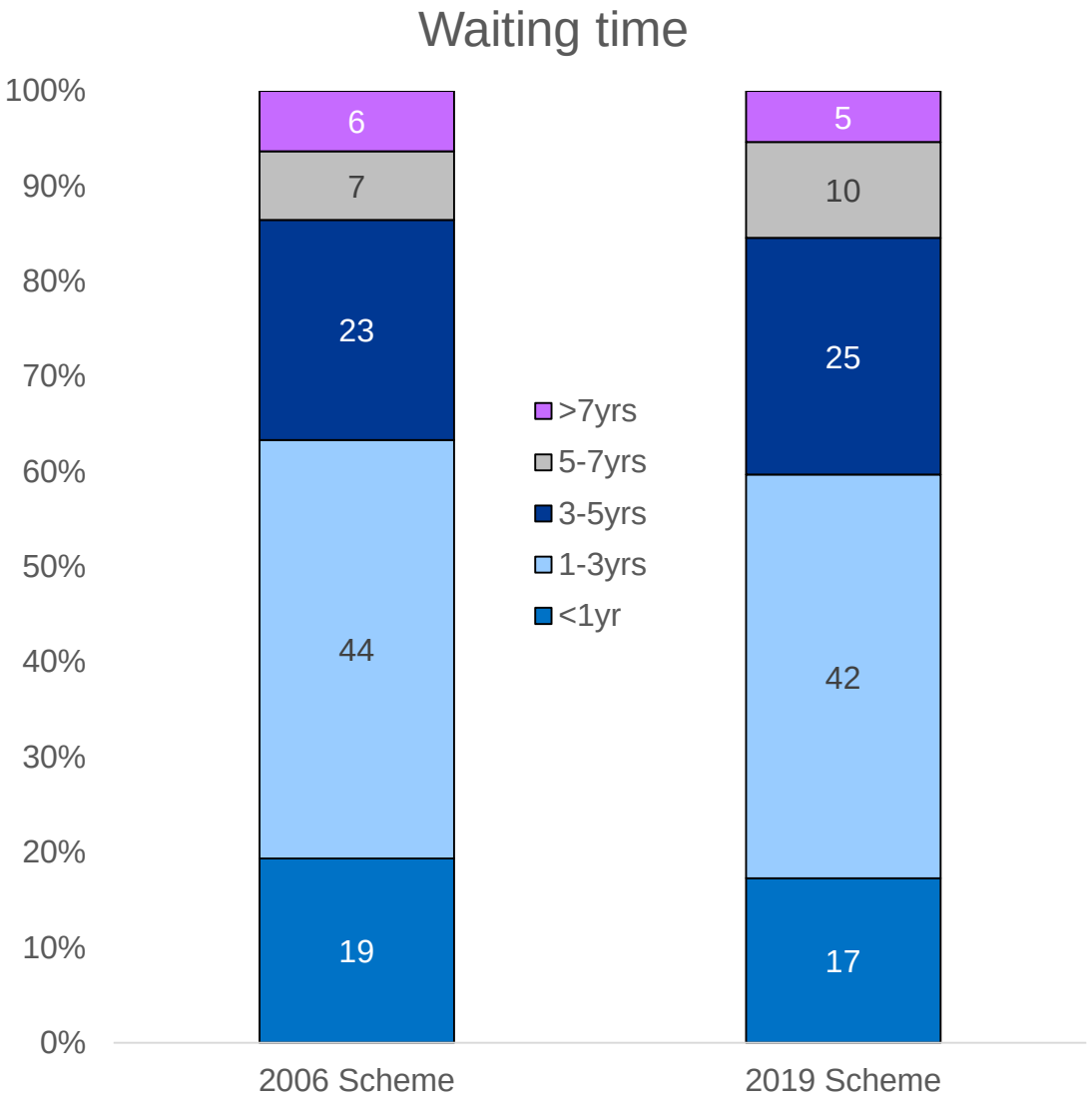
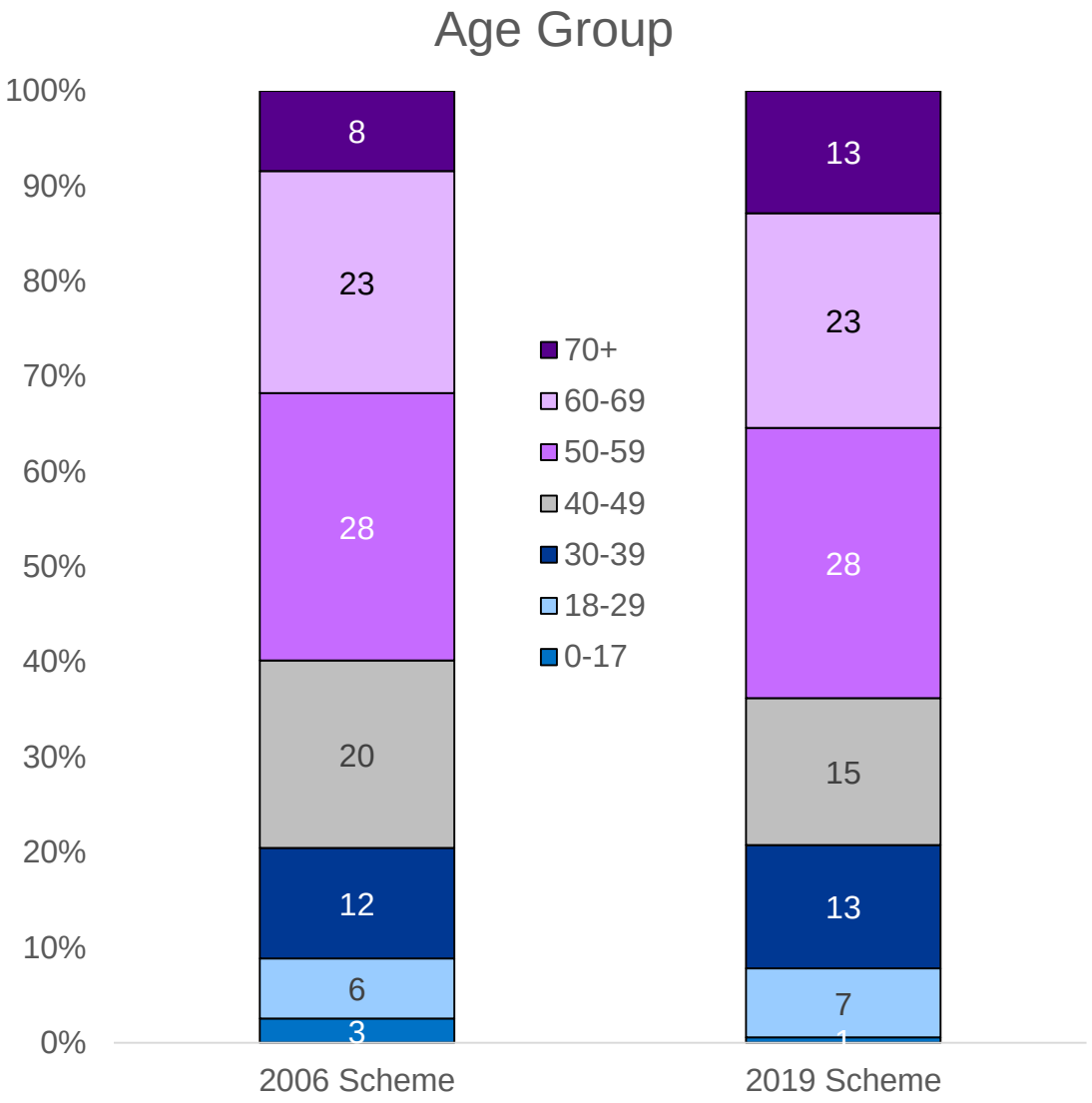
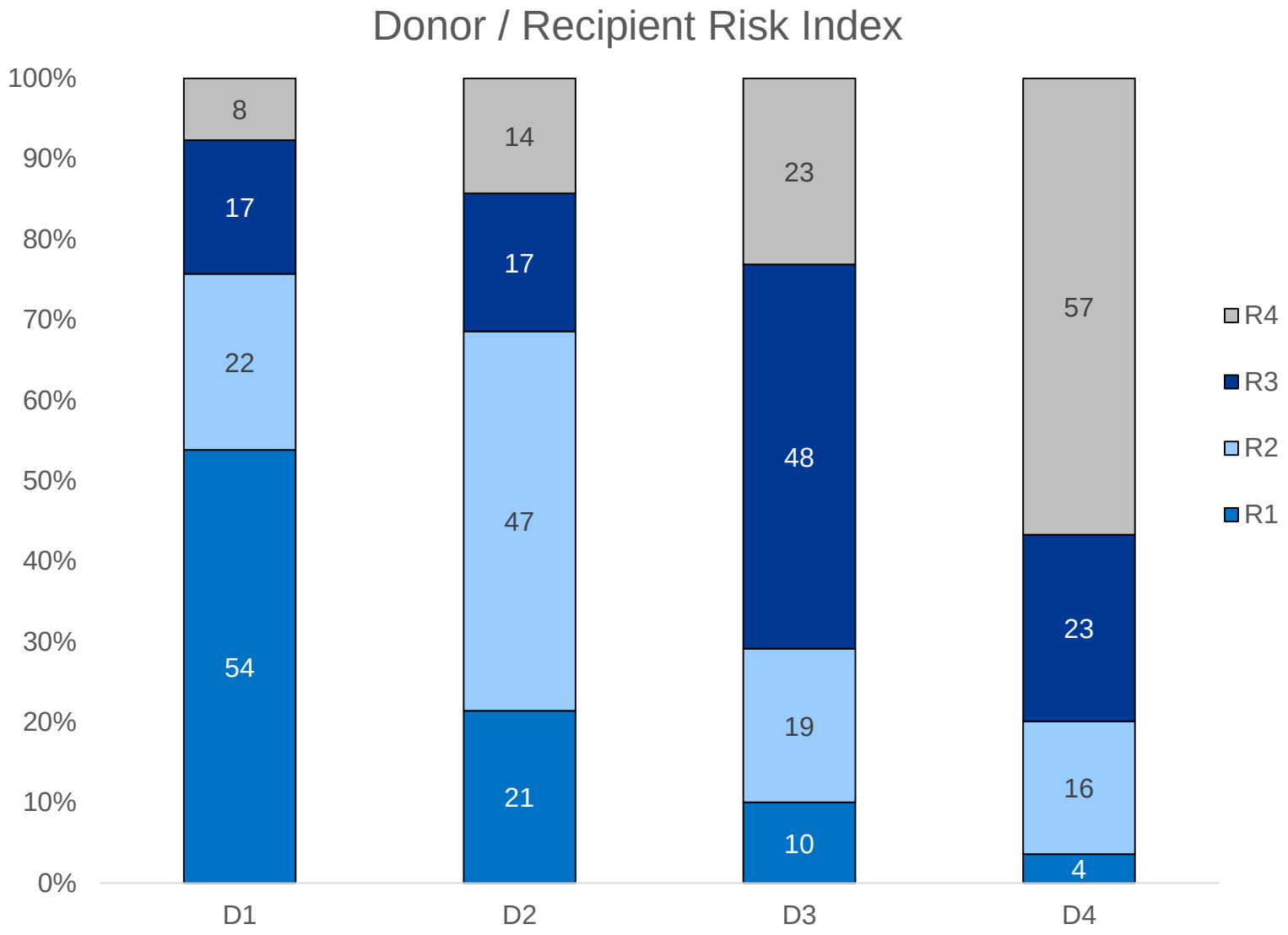




Transplant Activity - Demographics

Blood and Transplant

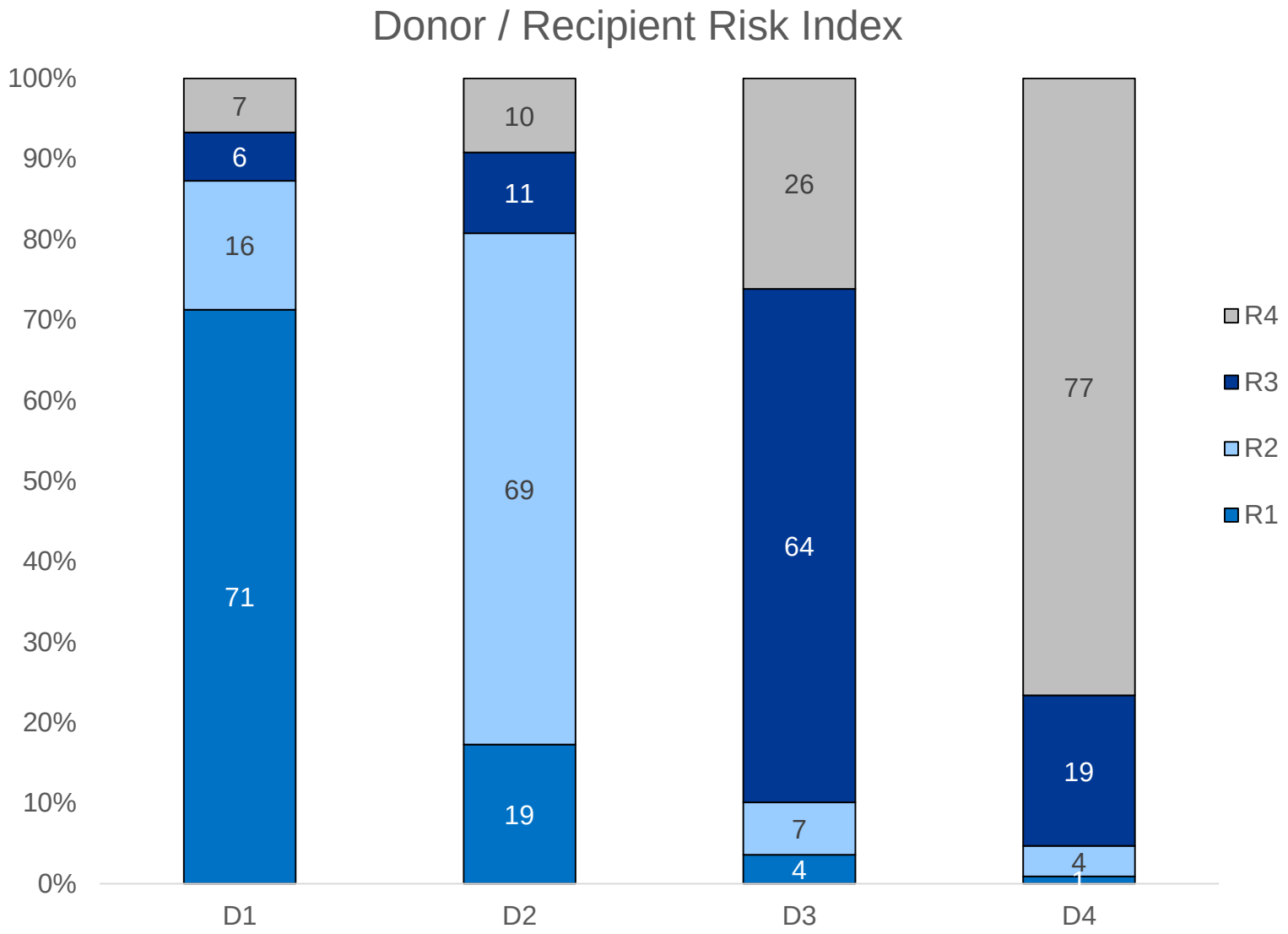
2019 Scheme: 11 Sep – 31 Dec 2019



Transplant Activity - Demographics

Blood and Transplant

Simulations

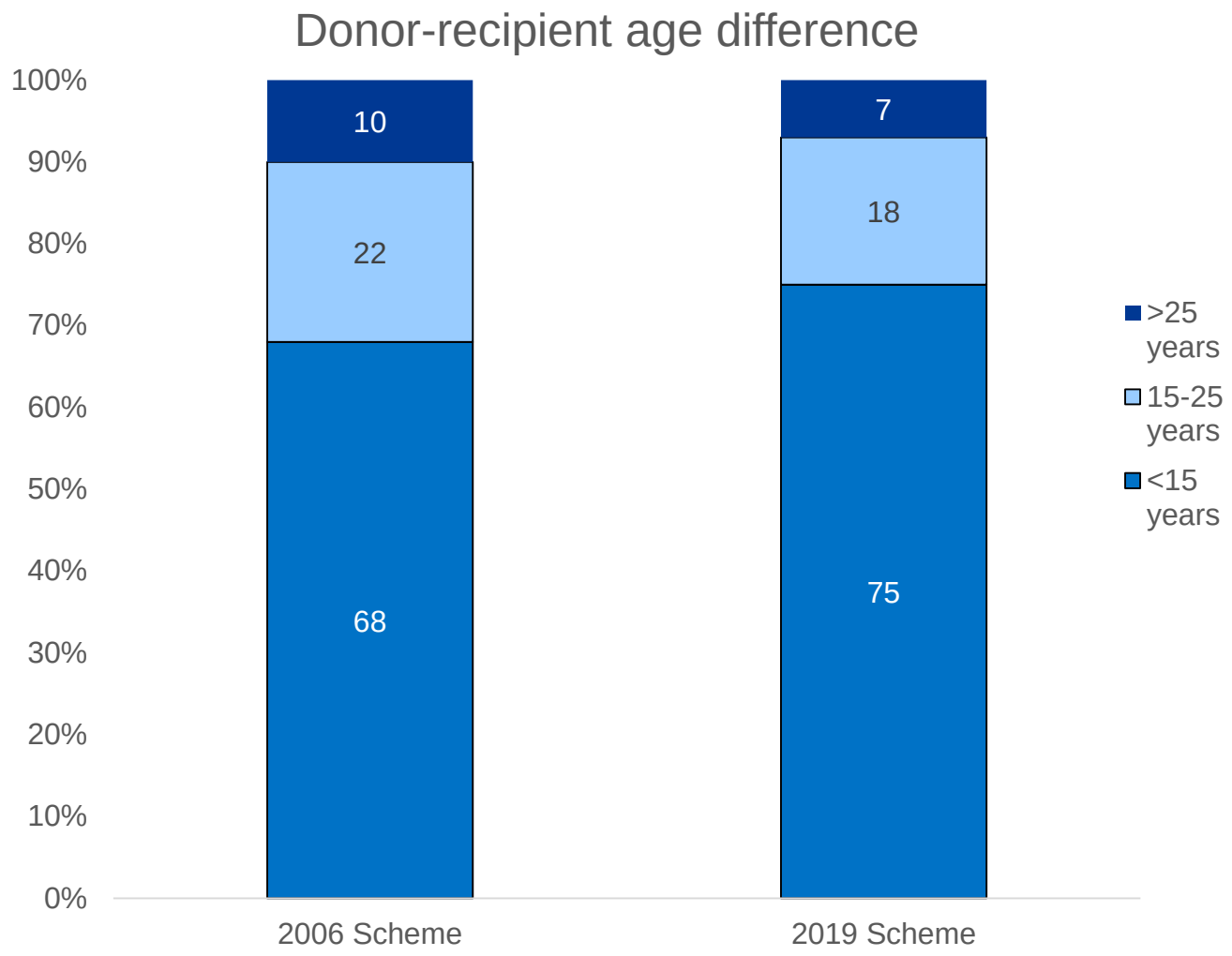


Transplant Activity - Demographics

NHS Blood and Transplant

2006 Scheme: 1 Sep 2018 – 31 Aug 2019

2019 Scheme: 11 Sep – 31 Dec 2019



Offer Activity

Blood and Transplant

2019 Scheme: 11 Sep – 31 Dec 2019

Summary of kidney offers for named patients made through the 2019 scheme

1512 Offers:

- 588 (39%) Offers accepted and used
- 312 (21%) Offers accepted, not used in intended patient
- 612 (40%) Offers declined

Offer Declines

Blood and Transplant

All patients – reason for decline of kidney offer, 11 September 2019 to 21 December 2019

262 (43%) Donor related reasons:

209 (34%) Recipient related reasons:

39 (6%) Organ related reasons

11 (2%) Centre related reasons

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Discussion Points

- Delisting antibodies
- Level 4 mismatch offers
- Offers to paediatric patients

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Delisting Antibodies

Delisting Antibodies

NHS Blood and Transplant

- Patients with cRF of 100% appear in Tier A

- Delisting antibodies may lead to a decrease in cRF and possibly moving into Tier B

How many more donors can a patient expect to match with by removing antibodies?

Delisting Antibodies – 10,000 donor pool

NHS Blood and Transplant

- cRF is calculated using tissue types of the last 10,000 deceased donors, which is updated annually
- This number of donors equates to ~ 7 years in the scheme

- The most recent pool contains
    - 47% blood group O donors
    - 40% blood group A
    - 10% blood group B
    - 3% blood group AB

Delisting Antibodies – 10,000 donor pool

NHS Blood and Transplant

- Example: Recipient blood group O, cRF 100%

Delisting Antibodies – 10,000 donor pool

NHS Blood and Transplant

- Example: Recipient blood group O, cRF 100%

HLA Summary Statistics

Allows for defaulting of rare antigens

NHS Blood and Transplant

STEP (1) PATIENT BLOOD GROUP

Blood group

STEP (2) HLA TYPE

HLA-A

HLA-A19 Split

HLA-B

HLA-DR

Clear all data

STEP (3) UNACCEPTABLE ANTIGENS

ADD PATIENT UNACCEPTABLE ANTIGENS

SENSITISATION

Number of declared unacceptable antigens	0
Calculated Reaction Frequency (Sensitisation)	

MATCHABILITY

Matchability Score	0
Matchability Points	
Matchability Grade	

HLA Level	10000 Pool N	10000 Pool %	HLA compatible, ABO identical N	HLA compatible, ABO identical %
Level 1				
Level 2				
Level 3				
Level 4				
Total				

HLA Level	10000 Pool N	10000 Pool %	HLA compatible, ABO identical N	HLA compatible, ABO identical %
000				
Favourable				
Non-Favourable				
Total				

PLEASE ENTER THE PATIENTS UNACCEPTABLE HLA-ANTIGENS

Home Screen | Antigens declared: 0 | cRF%:

A		B		B		C		D	
A1		B5		B21		CW1		DR1	
A2		B51		B49		CW2		DR2	
A203		B52		B50		CW3		DR15	
A210		B5102		B4005		CW9		DR16	
A3		B5103		B22		CW10		DR3	
A9		B7		B54		CW4		DR17	
A23		B703		B55		CW5		DR18	
A24		B8		B56		CW6		DR4	
A2403		B12		B27		CW7		DR5	
A10		B44		B2708		CW8		DR11	
A25		B45		B35		CW12		DR12	
A26		B13		B37		CW13		DR6	
A34		B14		B40		CW14		DR13	
A66		B64		B60		CW15		DR14	
A11		B65		B61		CW16		DR1403	
A19		B15		B41		CW17		DR1404	
A29		B62		B42		CW18		DR7	
A30		B63		B46				DR8	
A31		B75		B47				DR9	
A32		B76		B48				DR10	
A33		B77		B53				DR103	
A74		B16		B59				DR51	
A28		B38		B67				DR52	
A68		B39		B70				DR53	
A69		B3901		B71				DQ1	
A36		B3902		B72				DQ5	
A43		B17		B73				DQ6	
A80		B57		B78				DQ2	
		B58		B81				DQ3	
		B18		B82				DQ7	
				B83				DQ8	
				BW4				DQ9	
				BW6				DQ4	

Clear data

Super Broads	Broads with splits	Broads no splits	Splits

Available at https://www.odt.nhs.uk/transplantation/tools-policies-and-guidance/calculators/

Delisting Antibodies – Online Calculator

NHS Blood and Transplant

HLA Summary Statistics

Allows for defaulting of rare antigens

NHS Blood and Transplant

STEP (1) PATIENT BLOOD GROUP

Blood group	O

STEP (2) HLA TYPE

HLA-A	A19	A19
HLA-A19 Split	A33	A29
HLA-B	B67	B37
HLA-DR	DR103	DR103

Clear all data

STEP (3) UNACCEPTABLE ANTIGENS

ADD PATIENT UNACCEPTABLE ANTIGENS

SENSITISATION

Number of declared unacceptable antigens	28
Calculated Reaction Frequency (Sensitisation)	100%

MATCHABILITY

Matchability Score	0
Matchability Points	10
Matchability Grade	Difficult

HLA Level	10000 Pool		HLA compatible, ABO identical	
	N	%	N	%
Level 1	0	0.0	0	0.0
Level 2	38	0.4	0	0.0
Level 3	831	8.3	6	27.3
Level 4	9131	91.3	16	72.7
Total	10000	100	22	100

22 matches

HLA Level	10000 Pool		HLA compatible, ABO identical	
	N	%	N	%
000	0	0.0	0	0.0
Favourable	19	0.2	0	0.0
Non-Favourable	9981	99.8	22	100.0
Total	10000	100	22	100

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Delisting Antibodies – Online Calculator

NHS Blood and Transplant

HLA Summary Statistics

Allows for defaulting of rare antigens

NHS Blood and Transplant

STEP (1) PATIENT BLOOD GROUP

Blood group	O

STEP (2) HLA TYPE

HLA-A	A19	A19
HLA-A19 Split	A33	A29
HLA-B	B67	B37
HLA-DR	DR103	DR103

Clear all data

STEP (3) UNACCEPTABLE ANTIGENS

ADD PATIENT UNACCEPTABLE ANTIGENS

SENSITISATION

Number of declared unacceptable antigens	25
Calculated Reaction Frequency (Sensitisation)	99%

MATCHABILITY

Matchability Score	0
Matchability Points	10
Matchability Grade	Difficult

HLA Level	10000 Pool		HLA compatible, ABO identical	
	N	%	N	%
Level 1	0	0.0	0	0.0
Level 2	38	0.4	0	0.0
Level 3	831	8.3	8	13.3
Level 4	9131	91.3	52	86.7
Total	10000	100	60	100

HLA Level	10000 Pool		HLA compatible, ABO identical	
	N	%	N	%
000	0	0.0	0	0.0
Favourable	19	0.2	0	0.0
Non-Favourable	9981	99.8	60	100.0
Total	10000	100	60	100

1% reduction in cRF

60 matches

~ 5 additional matches per year

Available at https://www.odt.nhs.uk/transplantation/tools-policies-and-guidance/calculators/

Delisting Antibodies – Online Calculator

NHS Blood and Transplant

HLA Summary Statistics

Allows for defaulting of rare antigens

NHS Blood and Transplant

STEP (1) PATIENT BLOOD GROUP

Blood group	O

STEP (2) HLA TYPE

HLA-A	A19	A19
HLA-A19 Split	A33	A29
HLA-B	B67	B37
HLA-DR	DR103	DR103

Clear all data

STEP (3) UNACCEPTABLE ANTIGENS

ADD PATIENT UNACCEPTABLE ANTIGENS

SENSITISATION

Number of declared unacceptable antigens	24
Calculated Reaction Frequency (Sensitisation)	95%

MATCHABILITY

Matchability Score	0
Matchability Points	10
Matchability Grade	Difficult

HLA Level	10000 Pool		HLA compatible, ABO identical	
	N	%	N	%
Level 1	0	0.0	0	0.0
Level 2	38	0.4	0	0.0
Level 3	831	8.3	32	14.5
Level 4	9131	91.3	189	85.5
Total	10000	100	221	100

HLA Level	10000 Pool		HLA compatible, ABO identical	
	N	%	N	%
000	0	0.0	0	0.0
Favourable	19	0.2	0	0.0
Non-Favourable	9981	99.8	221	100.0
Total	10000	100	221	100

5% reduction in cRF

221 matches

~ 28 additional matches per year

Available at https://www.odt.nhs.uk/transplantation/tools-policies-and-guidance/calculators/

Delisting Antibodies – 10,000 donor pool

NHS Blood and Transplant

- The effect of delisting antibodies on the chance of receiving an offer will be different for each patient
- It will depend on the HLA type and antibodies listed for the individual but will likely match the patient with more donors and possibly lead to more offers
- If the patient has a matchability score of 10 or has been waiting >7 years, they will still appear in Tier A
- While delisting may result in a patient moving from Tier A to Tier B, the patient may still be ranked highly in Tier B depending on other characteristics
    - For example, patients with high matchability score will still place highly in Tier B

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Level 4 Mismatch Offers

Level 4 mismatch Offers

NHS Blood and Transplant

- Level 4 mismatch offers are now available to named patients for the first time under the new scheme

- These offers are possible for patients in Tier A, and to patients with a mismatch score of 8 or 9 in Tier B

- Since the introduction of the new offering scheme, there have been 365 level 4 offers to named patients that been declined (48%)

Level 4 mismatch Offers

NHS Blood and Transplant

- Of those declined:
  - 35% were to patients with matchability score 10
  - 21% waiting more than 7 years
  - 9% with cRF of 95% or above

  - 59% of these patients have now been transplanted
    - 70% were level 4 mismatch transplants

Level 4 mismatch offers – 10,000 donor pool

NHS Blood and Transplant

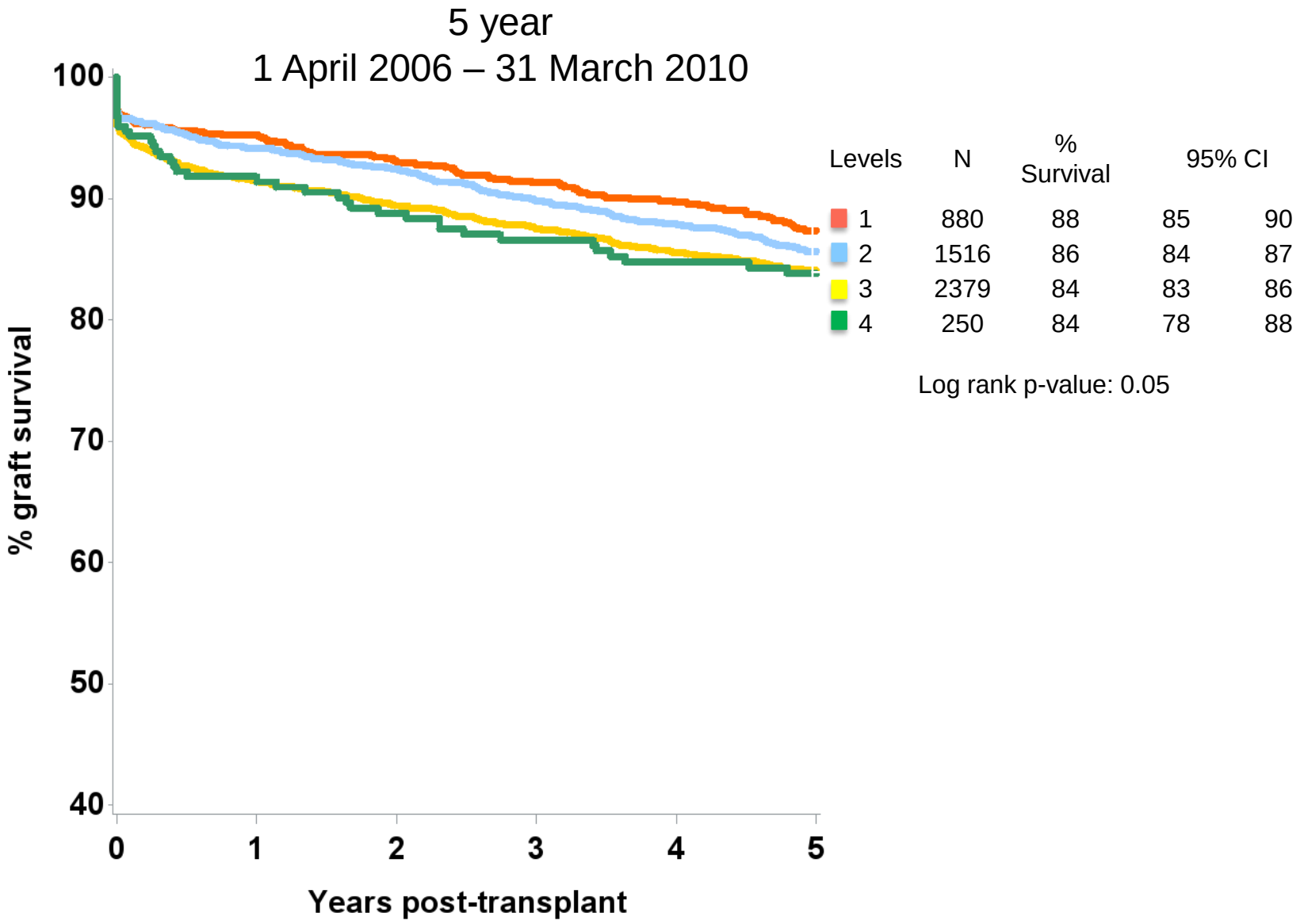
- Median number of matches in 10,000 donor pool for patients actively listed January 9th 2020

Matches	Matchability Score		
	8	**9**	**10**
Level 1	0	0	0
Level 2	40	7	0
Level 3	151	17	0
Level 4	709	19	0

- NHSBT is able to provide transplant centres with details on all patients listed with matchability score 8, 9 and 10 along with the number of matches in the 10,000 donor pool

Level 4 mismatch offers – Outcomes

Blood and Transplant



Levels	N	% Survival	95% CI	
1	880	88	85	90
2	1516	86	84	87
3	2379	84	83	86
4	250	84	78	88

Log rank p-value: 0.05

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Offers to Paediatric Patients

Offers to paediatric patients

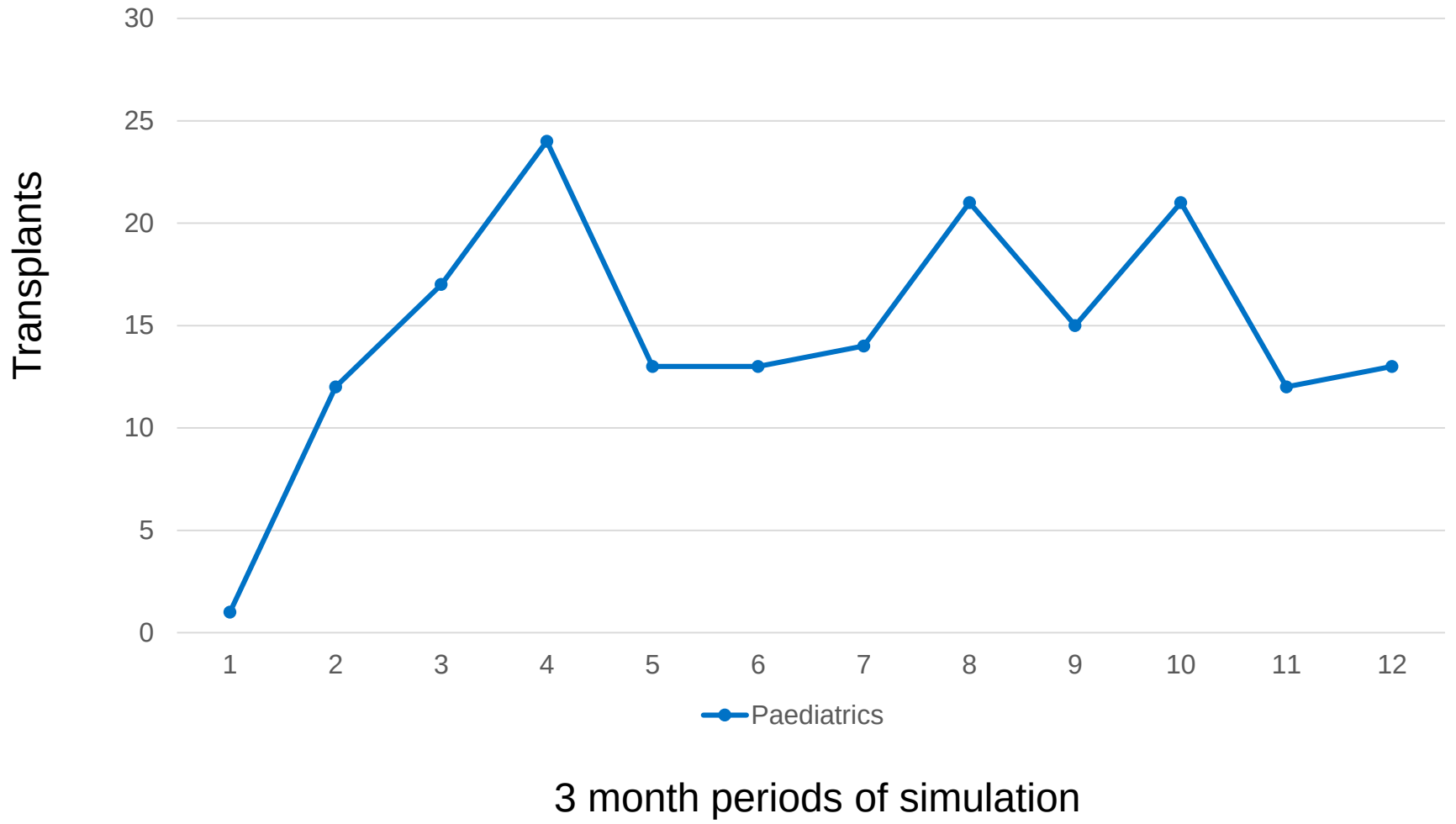
NHS Blood and Transplant

- Between 11th September and 31st December 2019, there were 14 offers to paediatric patients, resulting in 5 transplants

- During the same period in 2018, there were 41 offers resulting in 15 transplants

Offers to paediatric patients

- Simulations predicted a reduction in offers to paediatric patients early in the scheme due to higher number of patients in Tier A, which is expected to reduce over time



Summary

NHS Blood and Transplant

- Designed to
  - Improve equity of access to a national resource
  - More effective ‘longevity’ matching between the donor and recipient
  - Avoid long waiting times that are predictable
- Scheme went live on 11th September 2019
- No impact on kidney activity
- Highly sensitised, difficult to match, and BAME patients have improved access to transplant
  - 35 100% cRF patients received a transplant, 13 have been waiting more than 5 years
- Overall, the scheme has met expectations of the first few months
- Transplant outcomes to follow in 6 month review at KAG

Acknowledgments

Kidney Offering Scheme Working Group

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