



Blood and Transplant

ANNUAL REPORT ON LIVING DONOR KIDNEY TRANSPLANTATION

**REPORT FOR 2016/2017
(1 APRIL 2002 – 31 MARCH 2017)**

PUBLISHED OCTOBER 2017



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Executive Summary

This report presents key figures about living donor kidney transplantation in the UK. The period reported covers 15 years of transplant data, from 1 April 2002. The report presents information on the number of transplants, follow-up data and survival analysis on a national and centre-specific basis.

Key findings

- There were 926 adult living donor kidney transplants performed in the UK in 2016/17 a decrease of 18 transplants compared to 2015/16. Of these, 421 (447 in 2015/16) were related, 232 (220 in 2015/16) were unrelated, 18 (27 in 2015/16) were HLAi, 65 (51 in 2015/16) were ABOi, 109 (118 in 2015/16) were paired/pooled and 81 (81 in 2015/16) were altruistic donor transplants. The equivalent number of paediatric transplants was 72, an 8% decrease from the previous year.
- The proportion of living donors across the UK being prescribed anti-hypertensive drugs is 5% at one year, 8% at five years and 12% at ten years post donation.
- Serum creatinine for living donors in the UK is 103 (IQ-range 90-120) at one year, 96 (84-111) at five years and 93 (81-107) at ten years post donation.
- The UK rate of graft survival five years after adult living donor kidney transplant by type is; unrelated 94%, related 92%, HLAi 80%, ABOi 89%, Paired exchange 93% and Altruistic 94%.
- 31% of registered patients are identified in a match and 70% of identified transplants proceed.

Use of the contents of this report should be acknowledged as follows:
Annual Report on Living Donor Kidney Transplantation 2016/17. NHS Blood and Transplant

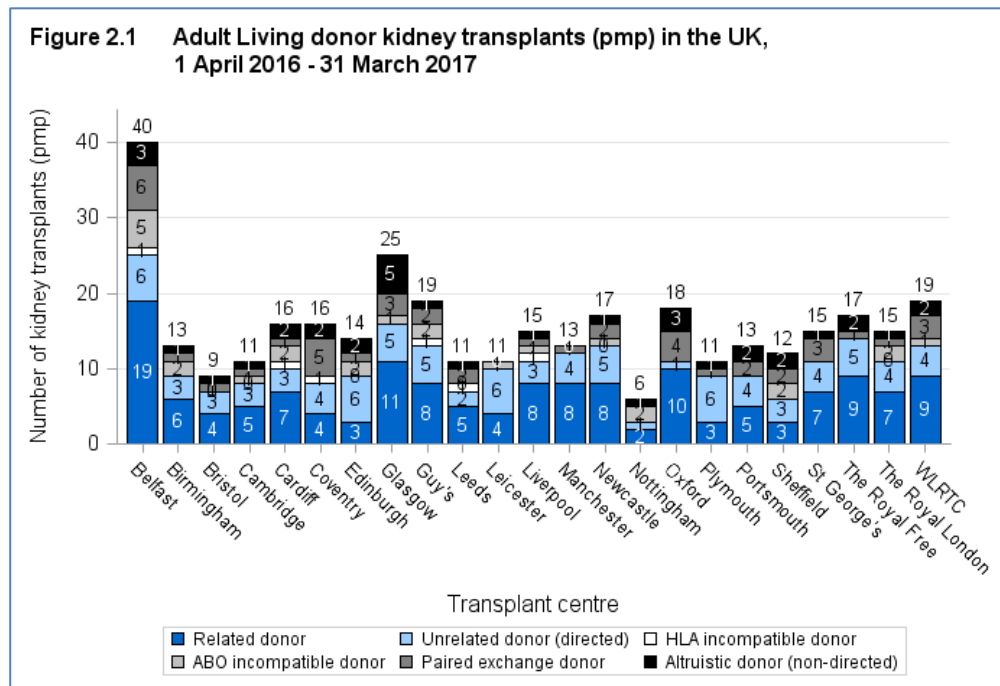
Introduction

This report presents information on transplant activity between 1 April 2002 and 31 March 2017, for all 24 centres performing living donor kidney transplantation in the UK. Data were obtained from the UK Transplant Registry, at NHS Blood & Transplant, that holds information relating to donors, recipients and outcomes for all kidney transplants performed in the UK.

Graft and patient survival estimates are reported at one-year post transplant for the period 1 April 2012 to 31 March 2016 and five-year post-transplant for the period 1 April 2008 to 31 March 2012. Results are described separately according to the type of donor.

Throughout this report West London Renal and Transplant Centre is labeled as WLRTC and Great Ormond Street Hospital is labeled as GOSH.

Figure 2.1 shows the number of adult living donor kidney transplants per million population (pmp) that were performed in 2016/17 in each transplant centre. Belfast had the highest rate of adult living donor kidney transplants per million population.



ADULT

Figure 2.2 shows the number of adult living donor kidney transplants performed in the UK between 1 April 2002 and 31 March 2017. The number of transplants increased from 333 in 2002/03 to 926 in 2016/17.

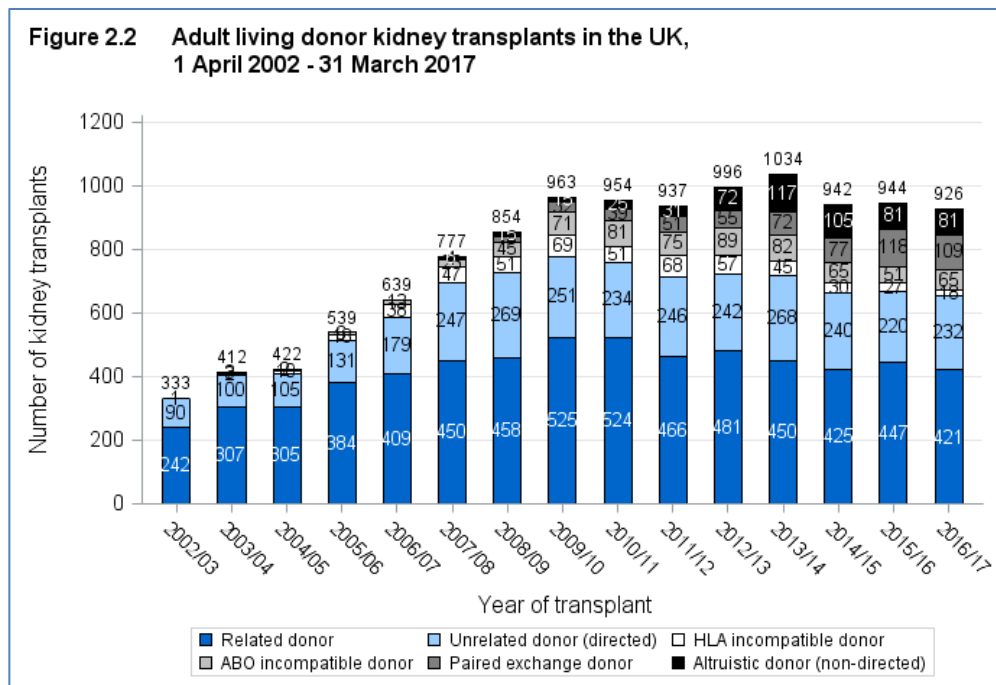


Figure 2.3 and **Table 2.1** show the number of adult living donor kidney transplants performed in 2016/17 in each transplant centre. Belfast performed the most adult living donor kidney transplants last year with 74 patients receiving a transplant. All centres perform non-directed altruistic kidney donation and participate in the UK Living Kidney Sharing Schemes. 16 centres (18 centres in 2015/16) performed ABO incompatible (ABOi) transplants and 11 centres (11 centres in 2015/16) performed HLA incompatible (HLAi) transplants in 2016/17.

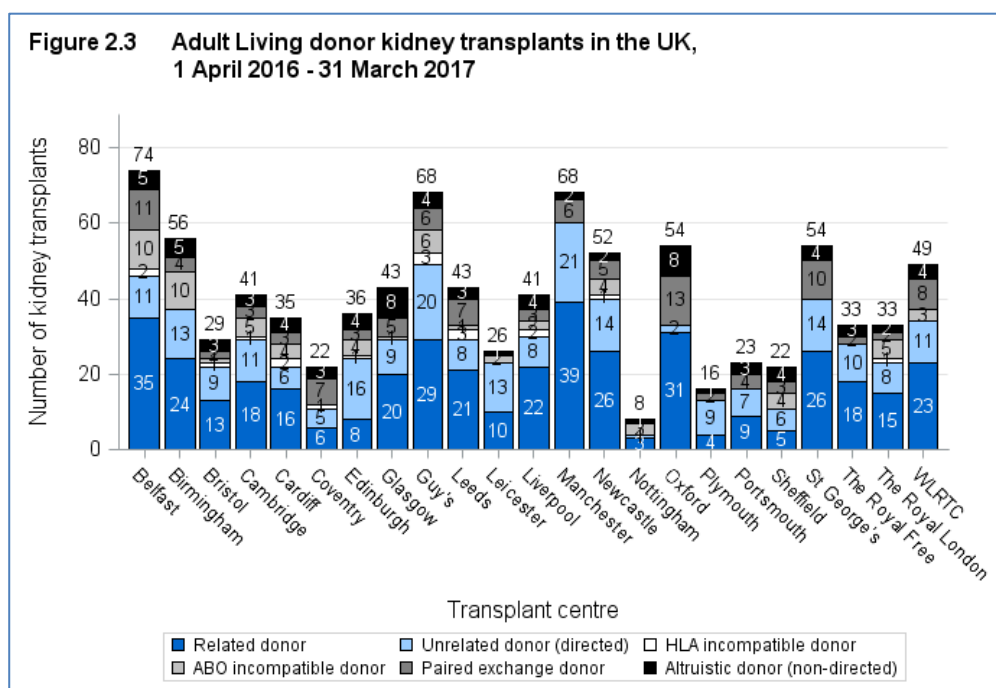


Table 2.1 Adult living donor kidney transplants in the UK, 1 April 2016 - 31 March 2017

Transplant Centre	Donor type					
	Related donor	Unrelated donor (directed)	HLA incompatible donor	ABO incompatible donor	Paired exchange donor	Altruistic donor (non-directed)
Belfast	35	11	2	10	11	5
Birmingham	24	13	0	10	4	5
Bristol	13	9	1	1	2	3
Cambridge	18	11	1	5	3	3
Cardiff	16	6	2	4	3	4
Coventry	6	5	1	0	7	3
Edinburgh	8	16	1	4	3	4
Glasgow	20	9	0	1	5	8
Guy's	29	20	3	6	6	4
Leeds	21	8	3	1	7	3
Leicester	10	13	0	2	0	1
Liverpool	22	8	2	2	3	4
Manchester	39	21	0	0	6	2
Newcastle	26	14	1	4	5	2
Nottingham	3	1	0	3	0	1
Oxford	31	2	0	0	13	8
Plymouth	4	9	0	0	2	1
Portsmouth	9	7	0	0	4	3
Sheffield	5	6	0	4	3	4
St George's	26	14	0	0	10	4
The Royal Free	18	10	0	0	2	3
The Royal London	15	8	1	5	2	2
WLRTC	23	11	0	3	8	4

Figure 2.4 shows the proportion of adult living donor kidney transplants by donor type and centre in 2016/17.

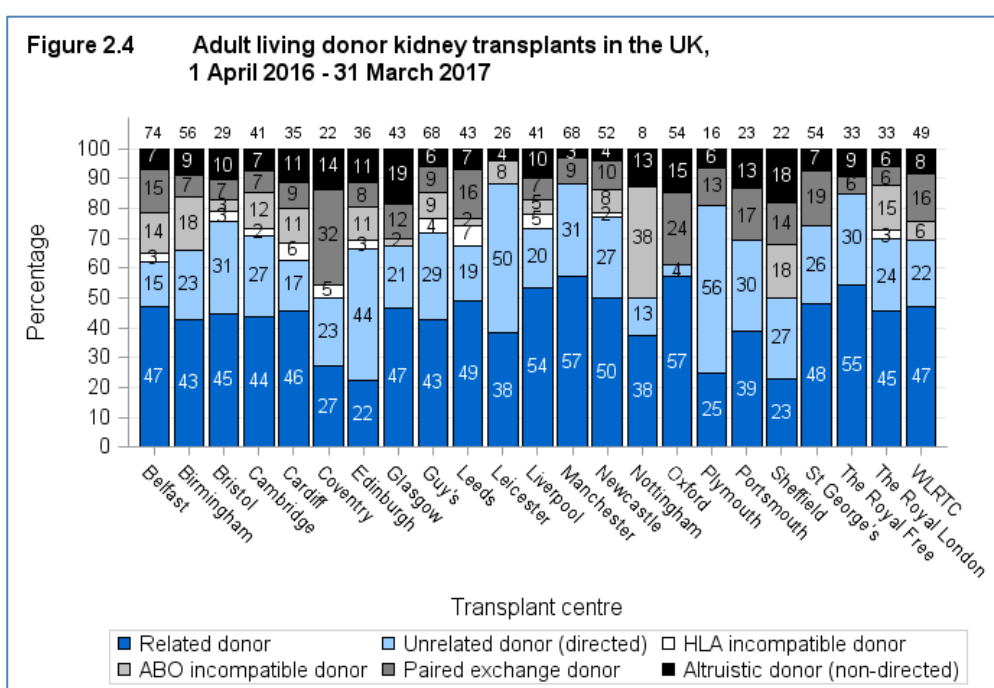
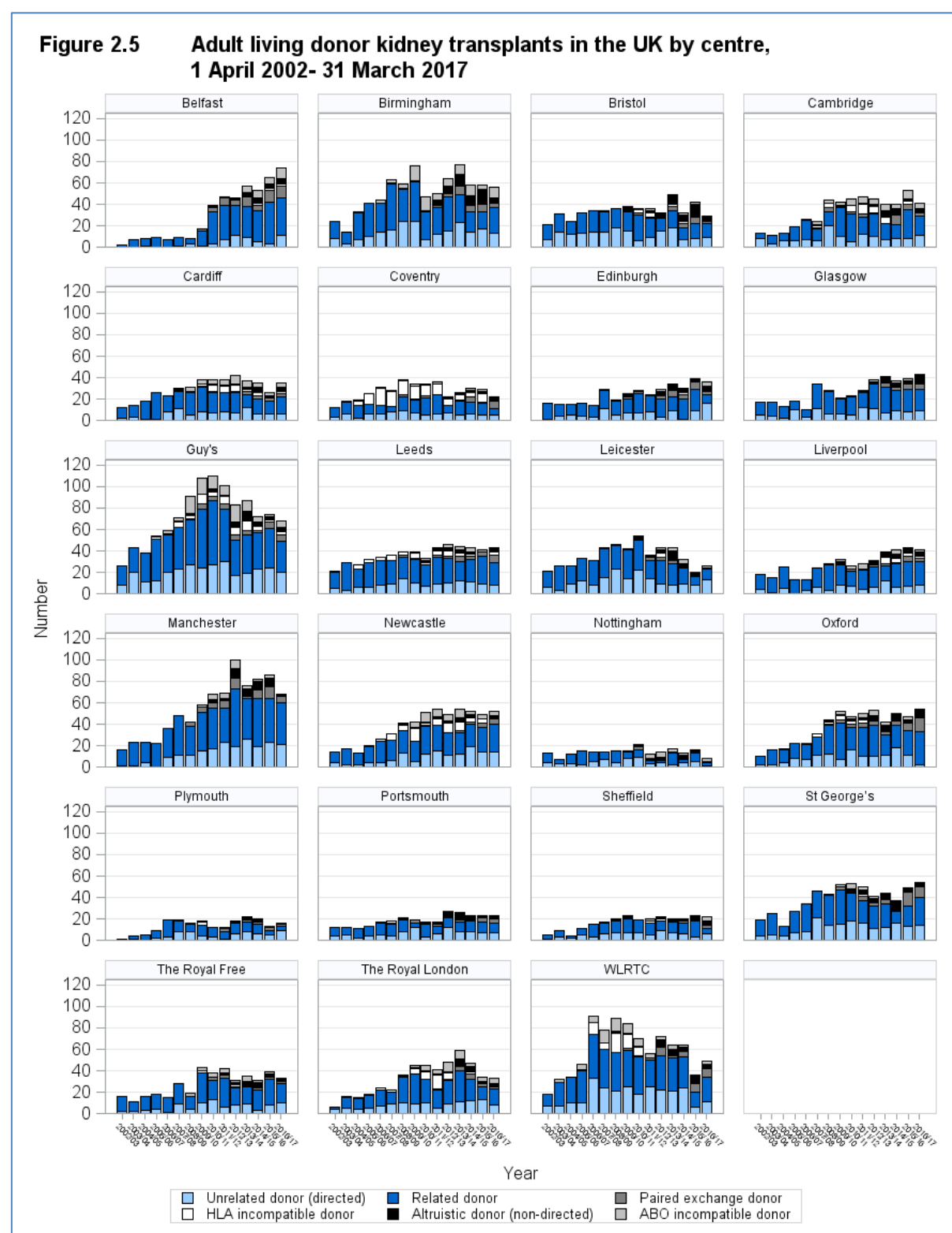


Figure 2.5 shows the number of adult living donor kidney transplants by donor type and centre between 1 April 2002 and 31 March 2017.



PAEDIATRIC

Figure 2.6 shows the number of paediatric living donor kidney transplants performed in the UK between 1 April 2002 and 31 March 2017. The number of transplants increased from 42 in 2002/03 to 72 in 2016/17.

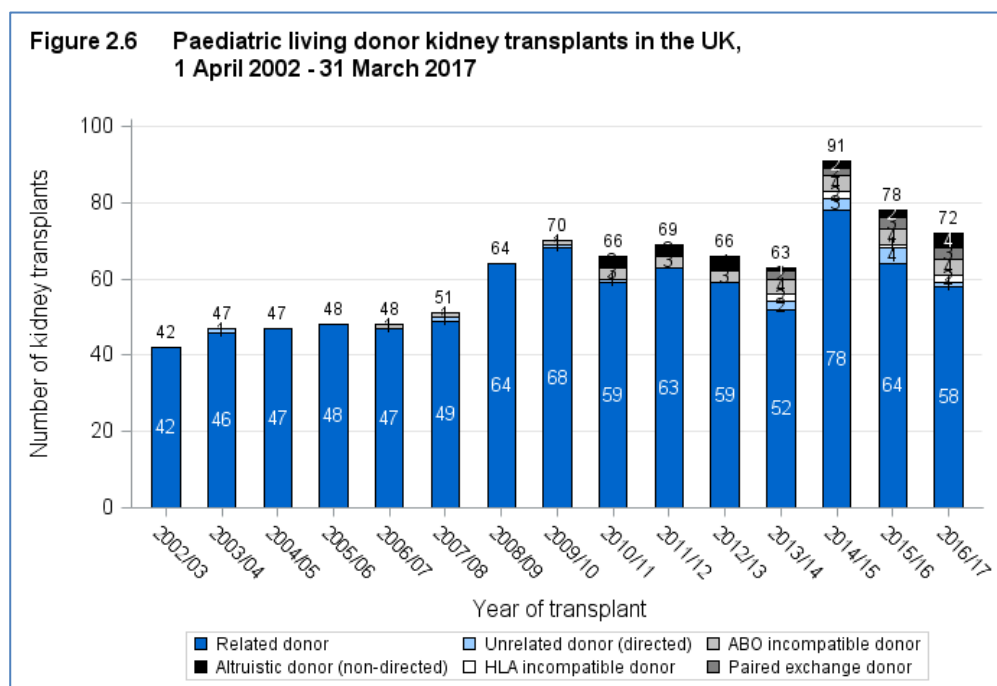


Figure 2.7 and **Table 2.2** show the number of paediatric living donor kidney transplants performed in 2016/17 in each transplant centre. Guy's transplant team performed the most living donor kidney transplants last year with 29 patients receiving a transplant (18 at GOSH and 11 at Guy's). Children are also benefitting from the UKLKSS and HLA and ABO antibody removal programmes to facilitate living donor transplants.

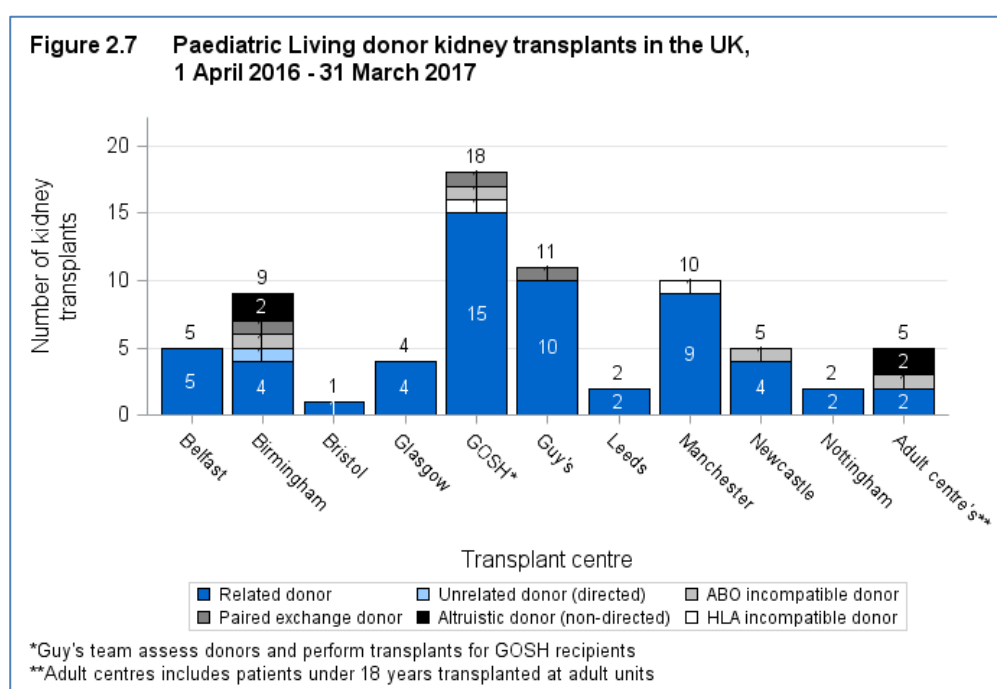


Table 2.2 Paediatric living donor kidney transplants in the UK, 1 April 2016 - 31 March 2017

Transplant Centre	Donor type					
	Related donor	Unrelated donor (directed)	HLA incompatible donor	ABO incompatible donor	Paired exchange donor	Altruistic donor (non-directed)
Adult centre's**	2	0	0	1	0	2
Belfast	5	0	0	0	0	0
Birmingham	4	1	0	1	1	2
Bristol	1	0	0	0	0	0
GOSH*	15	0	1	1	1	0
Glasgow	4	0	0	0	0	0
Guy's	10	0	0	0	1	0
Leeds	2	0	0	0	0	0
Manchester	9	0	1	0	0	0
Newcastle	4	0	0	1	0	0
Nottingham	2	0	0	0	0	0

*Guy's team assess donors and perform transplants for GOSH recipients
**Adult centres includes patients under 18 years transplanted at adult units

Figure 2.8 shows the proportion of paediatric living donor kidney transplants by donor type and centre in 2016/17.

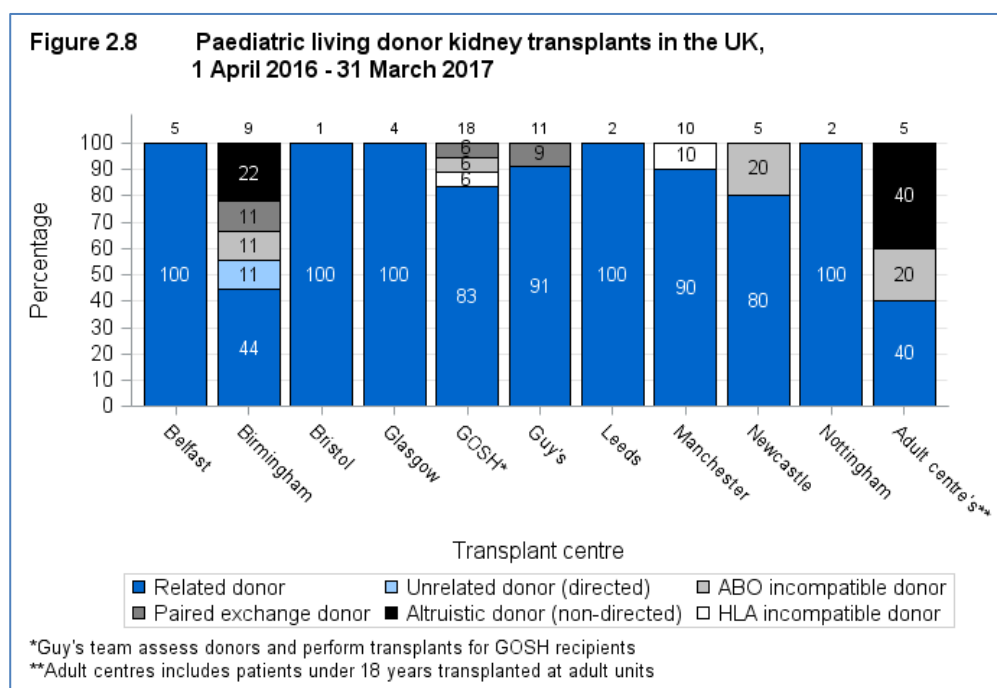
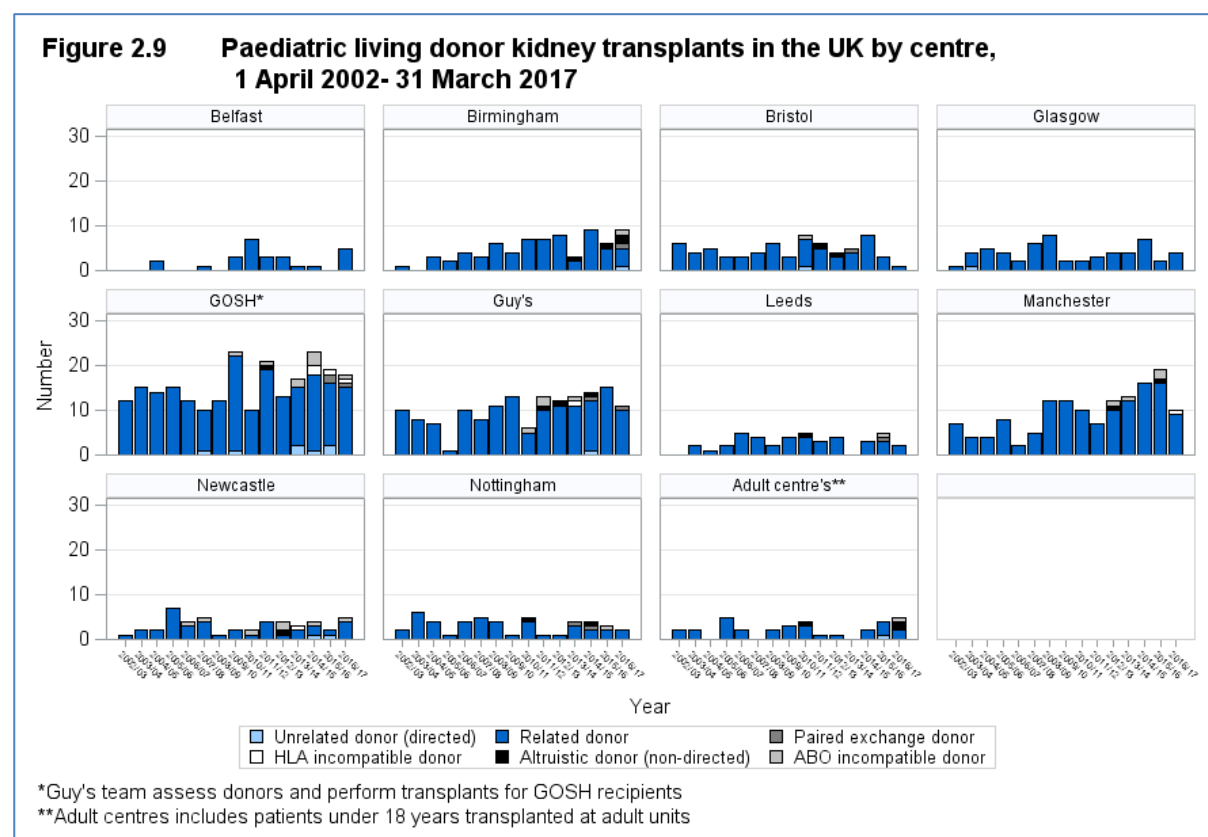


Figure 2.9 shows the number of paediatric living donor kidney transplants by donor type and centre between 1 April 2002 and 31 March 2017.



Demographic Characteristics

ADULT

The sex, ethnicity, age group, sensitisation (cRF), cRF by transplant type for HSP, blood group and dialysis status of donors and recipients of adult living donor kidney transplants are shown by centre in **Figure 3.1, 3.2, 3.3, 3.4, 3.5, 3.6 and 3.7**, respectively. Note that all percentages quoted are based only on data where relevant information was available.

83% of adult recipients of direct living donor kidney transplants are Caucasian and 17% are from Black, Asian or other minority ethnic groups (BAME). 1% of non-directed altruistic and 11% of paired/pooled donors are from BAME donors but 22% of adult BAME recipients receive a kidney from a non-directed altruistic donor and 17% from paired-pooled donors.

There is a higher proportion of non-directed altruistic kidney donors > 50 years of age in comparison with other donor groups.

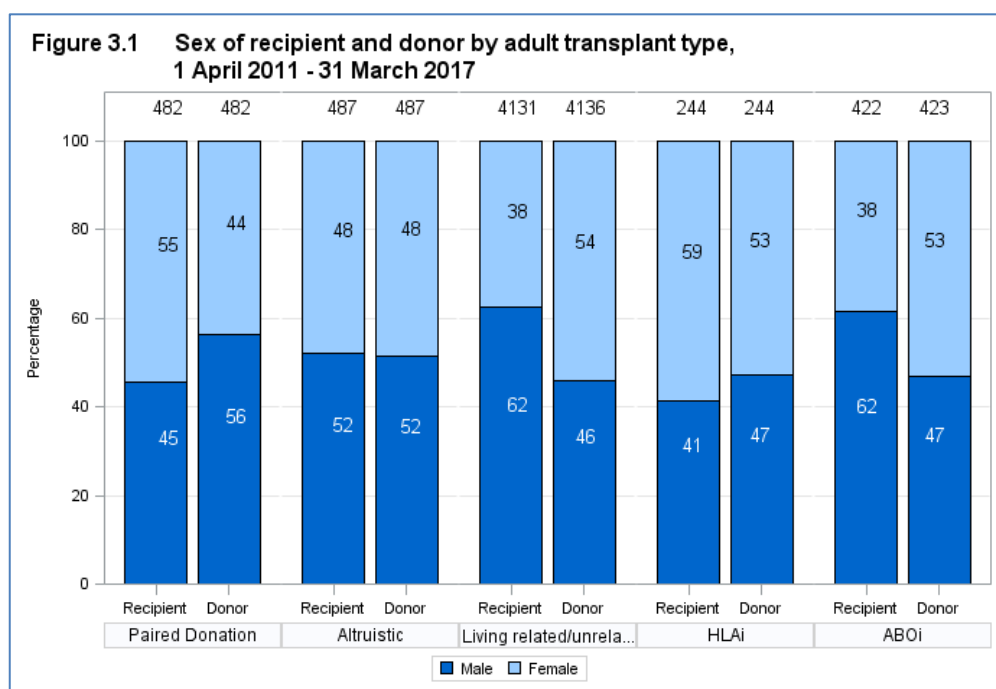


Figure 3.2 Ethnicity of recipient and donor by adult transplant type, 1 April 2011 - 31 March 2017

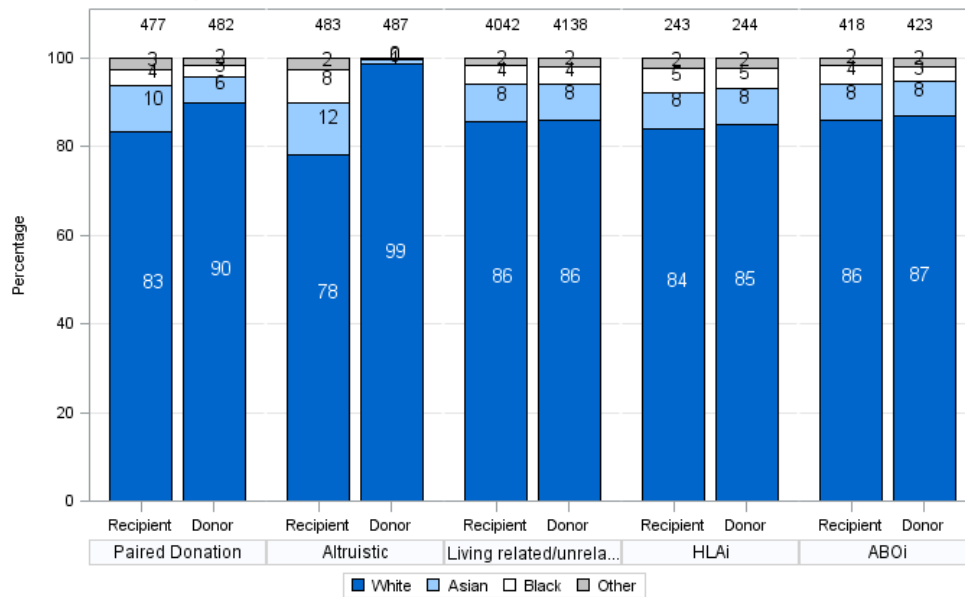
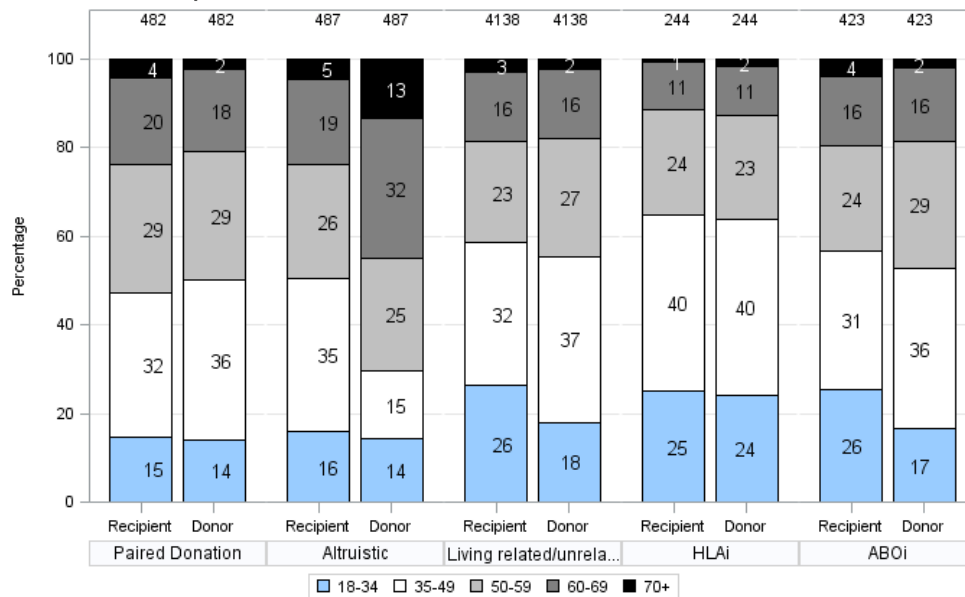
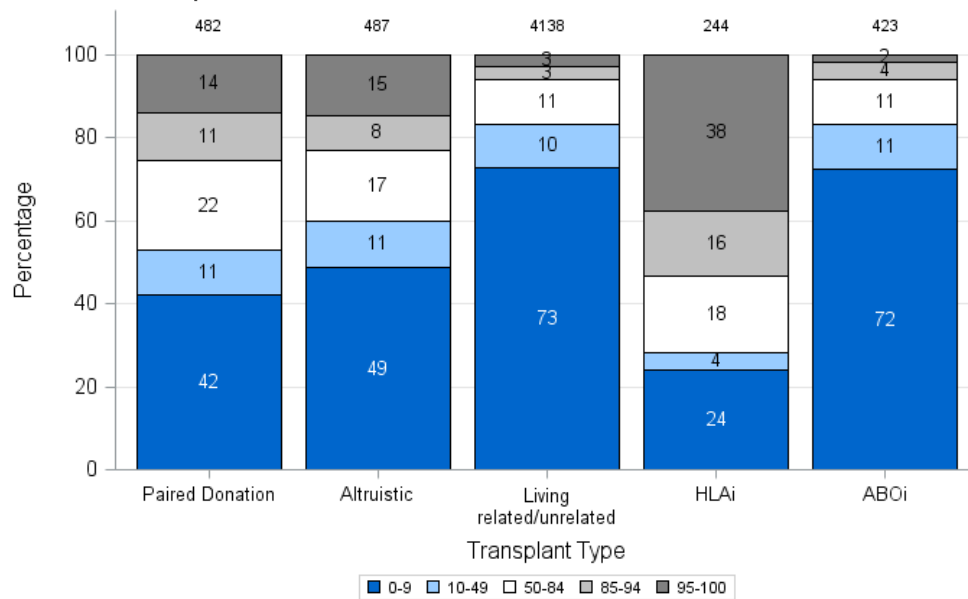


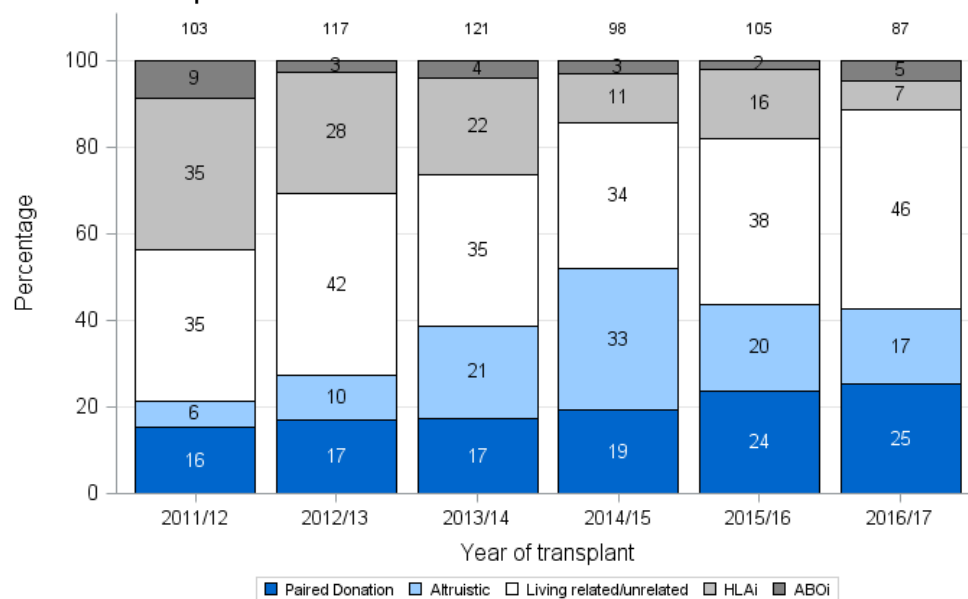
Figure 3.3 Age of recipient and donor by adult transplant type, 1 April 2011 - 31 March 2017



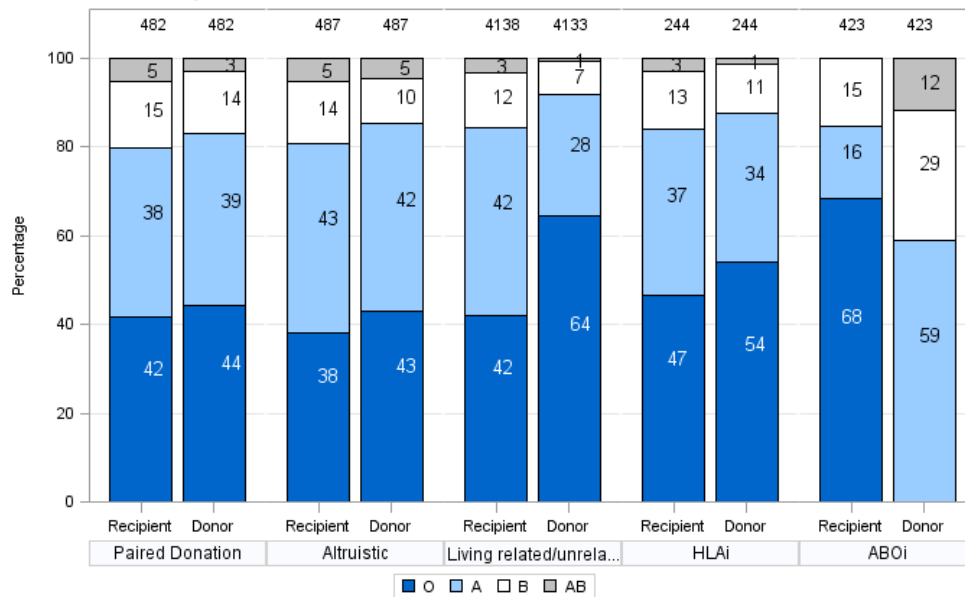
**Figure 3.4 Recipient Calculated Reaction Frequency by adult transplant type
1 April 2011 - 31 March 2017**



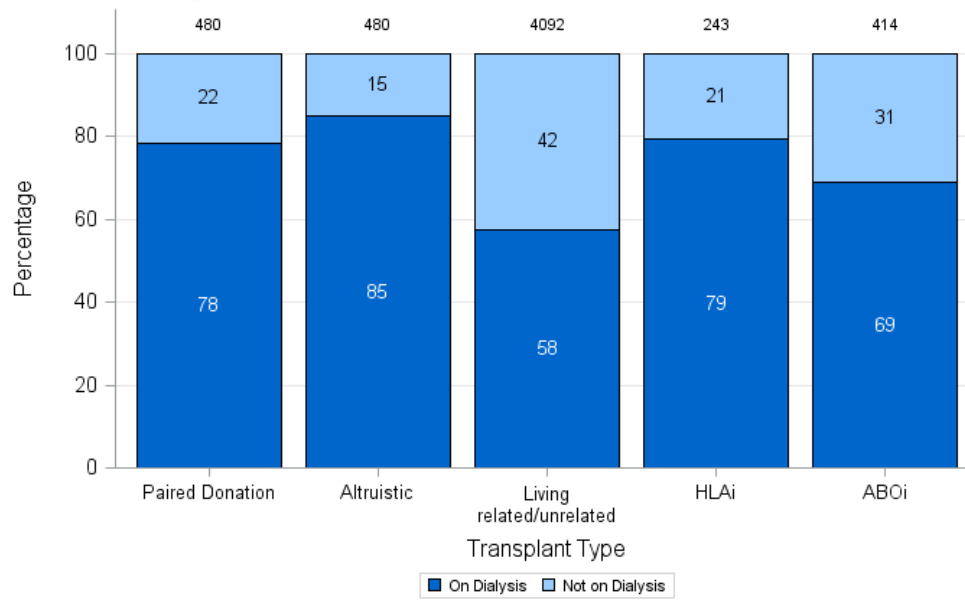
**Figure 3.5 Adult HSP by transplant type and year of transplant,
1 April 2011 - 31 March 2017**



**Figure 3.6 Recipient and donor blood group by adult transplant type,
1 April 2011 - 31 March 2017**



**Figure 3.7 Dialysis status at transplant by adult transplant type,
1 April 2011 - 31 March 2017**



PAEDIATRIC

The sex, ethnicity, age group, sensitisation (cRF), cRF by transplant type for HSP, blood group and dialysis status of donors and recipients of paediatric living donor kidney transplants are shown by centre in **Figure 3.8, 3.9, 3.10, 3.11, 3.12, 3.13, and 3.14**, respectively. Note that all percentages quoted are based only on data where relevant information was available.

70% of paediatric recipients of direct living donor kidney transplants are Caucasian and 30% are from Black, Asian or other minority ethnic groups (BAME). 6% of non-directed altruistic and 10% of paired/pooled donors are from BAME donors but 25% of paediatric BAME recipients receive a kidney from a non-directed altruistic donor and 30% from paired-pooled donors.

32% of children transplanted from a non-directed altruistic donor have a cRF ≥ 50 and 20% of children transplanted through the paired/pooled scheme have cRF ≥ 50 .

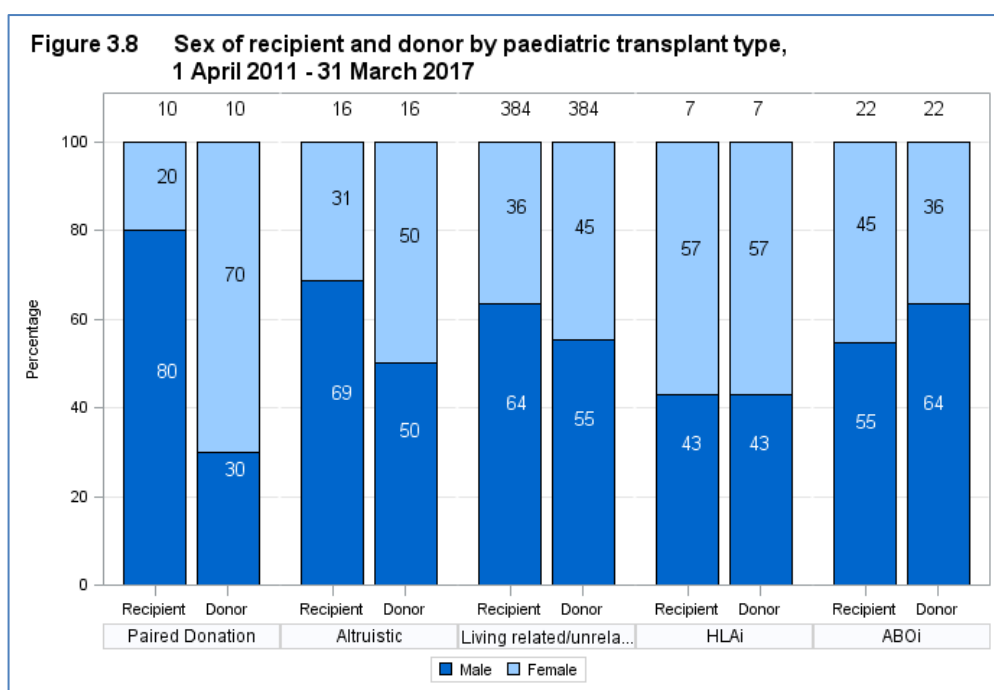


Figure 3.9 Ethnicity of recipient and donor by paediatric transplant type, 1 April 2011 - 31 March 2017

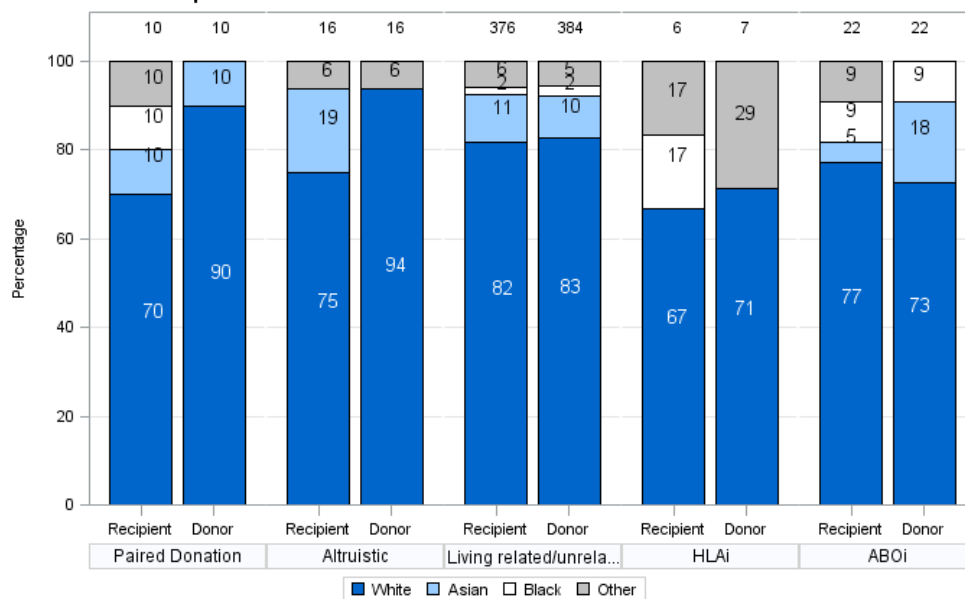
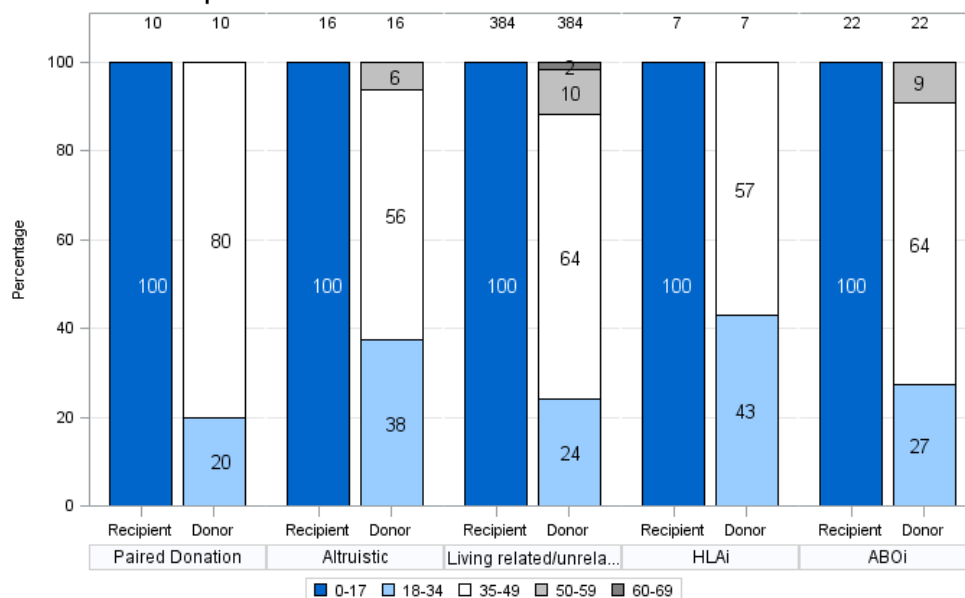
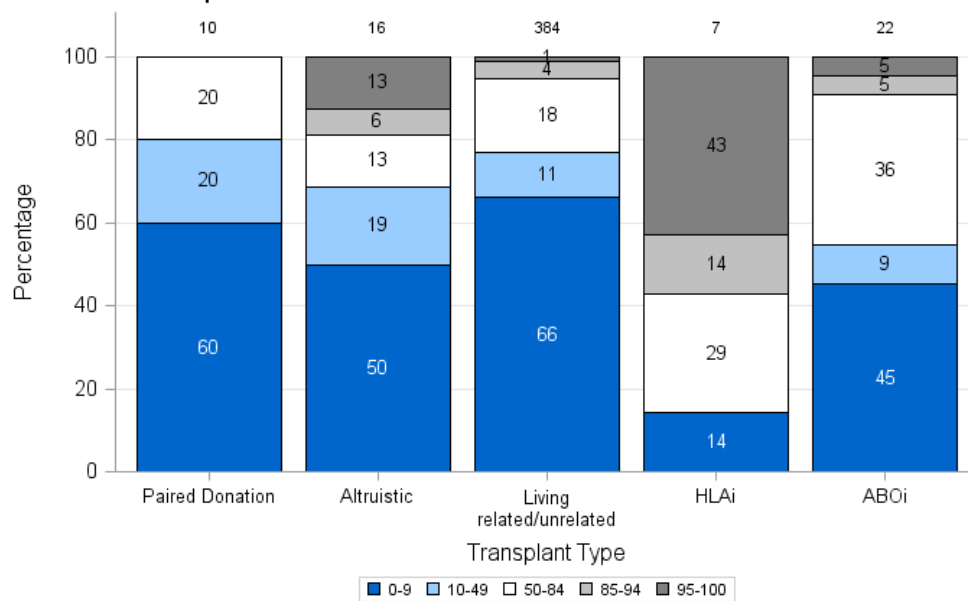


Figure 3.10 Age of recipient and donor by paediatric transplant type, 1 April 2011 - 31 March 2017



**Figure 3.11 Recipient Calculated Reaction Frequency by paediatric transplant type
1 April 2011 - 31 March 2017**



**Figure 3.12 Paediatric HSP by transplant type and year of transplant,
1 April 2011 - 31 March 2017**

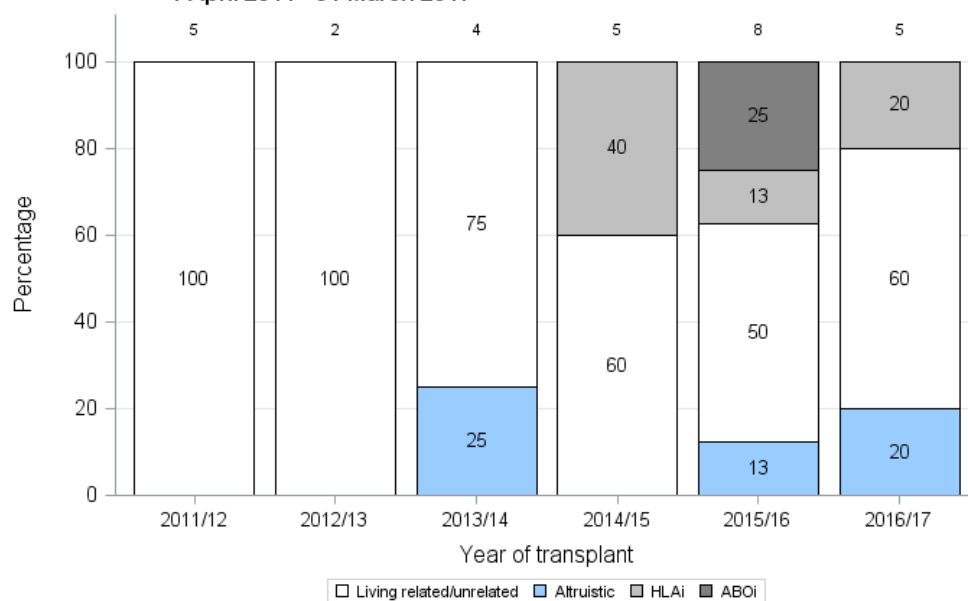


Figure 3.13 Recipient and donor blood group by paediatric transplant type, 1 April 2011 - 31 March 2017

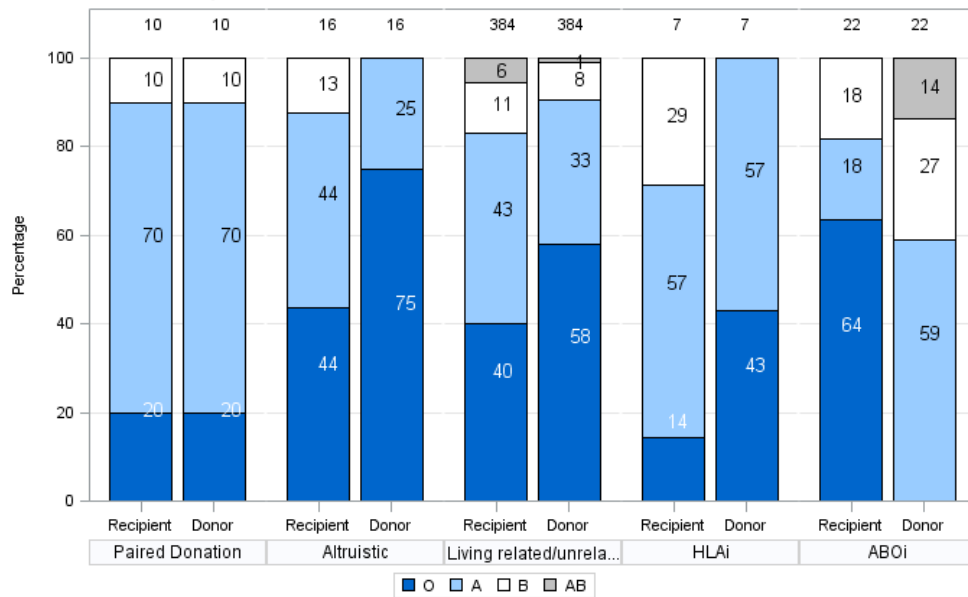
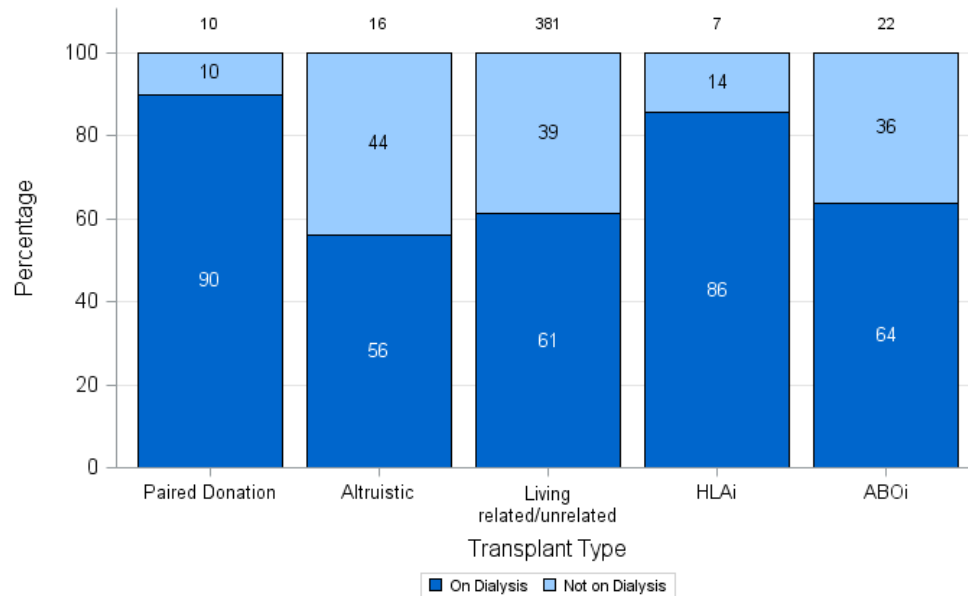


Figure 3.14 Dialysis status at transplant by paediatric transplant type, 1 April 2011 - 31 March 2017



UK Living Kidney Sharing Schemes

4.1 Paired Donation Scheme

4.1.1 Registrations: Matching Runs, 1 April 2011 – 31 March 2017

Figure 4.1 shows the number of patients included in matching runs from 1 April 2011 to 31 March 2017. The number of patients included has increased over this period with 163 in April 2011 to 242 in January 2017. Overall, there were 1,676 patients included in matching runs over this period. **Figure 4.2** shows the number of pairs included in each matching run, split by pair incompatibility.

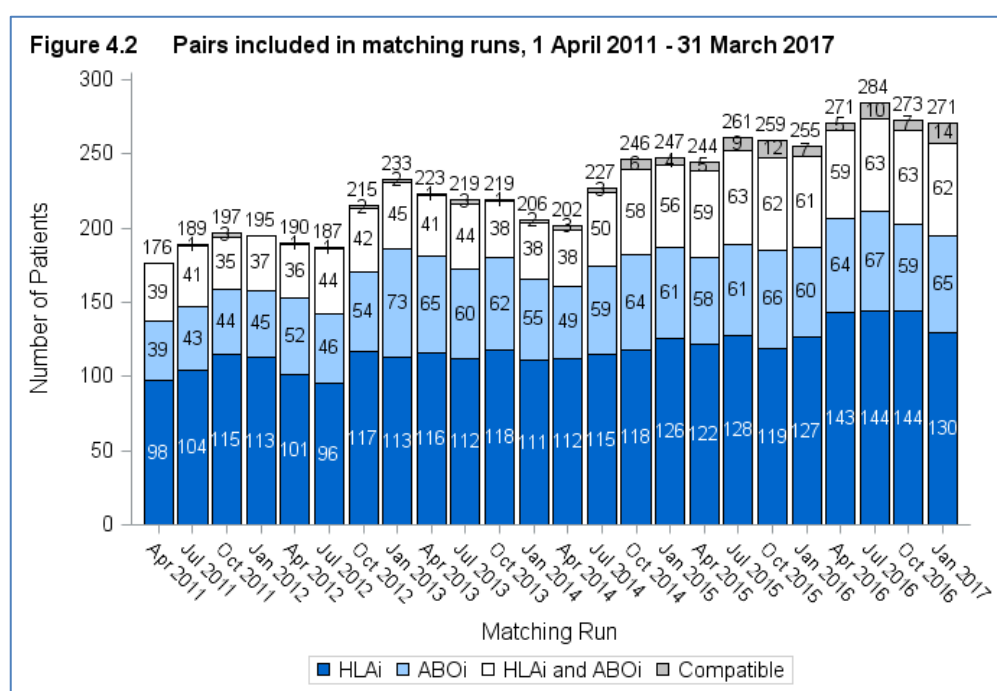
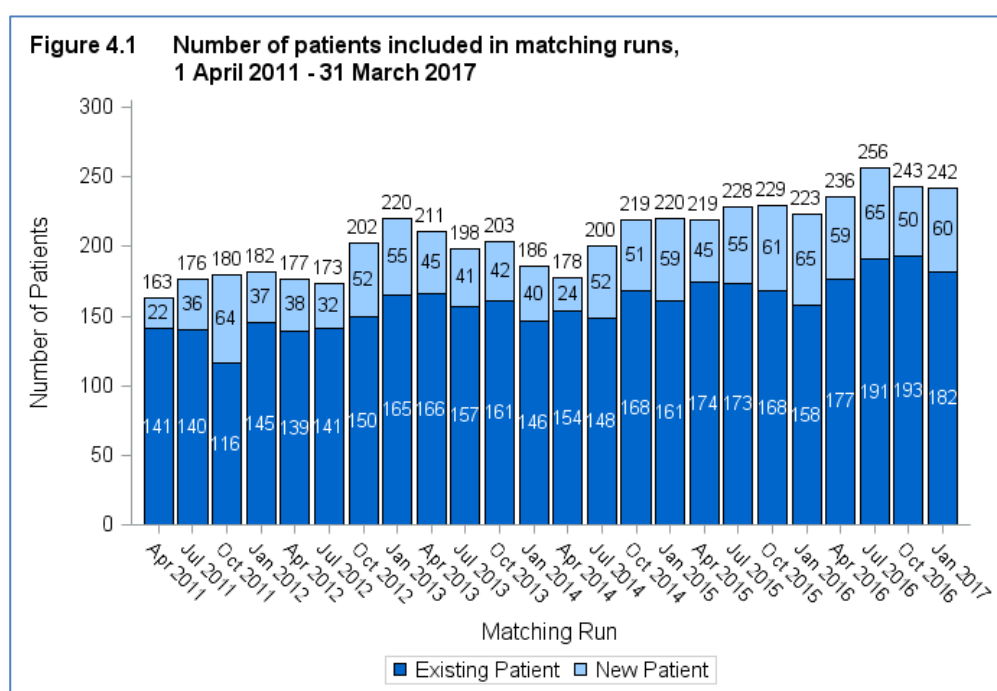


Figure 4.3 shows the number of patients included in matching runs from 1 April 2011 to 31 March 2017 by centre. This is broken down further by the nature of the incompatibility between the pair. It can be seen that Manchester has had the highest number of patients registered over this time period. Most pairs registered over this period were HLA incompatible (48%). This information is also shown in **Table 5.1**.

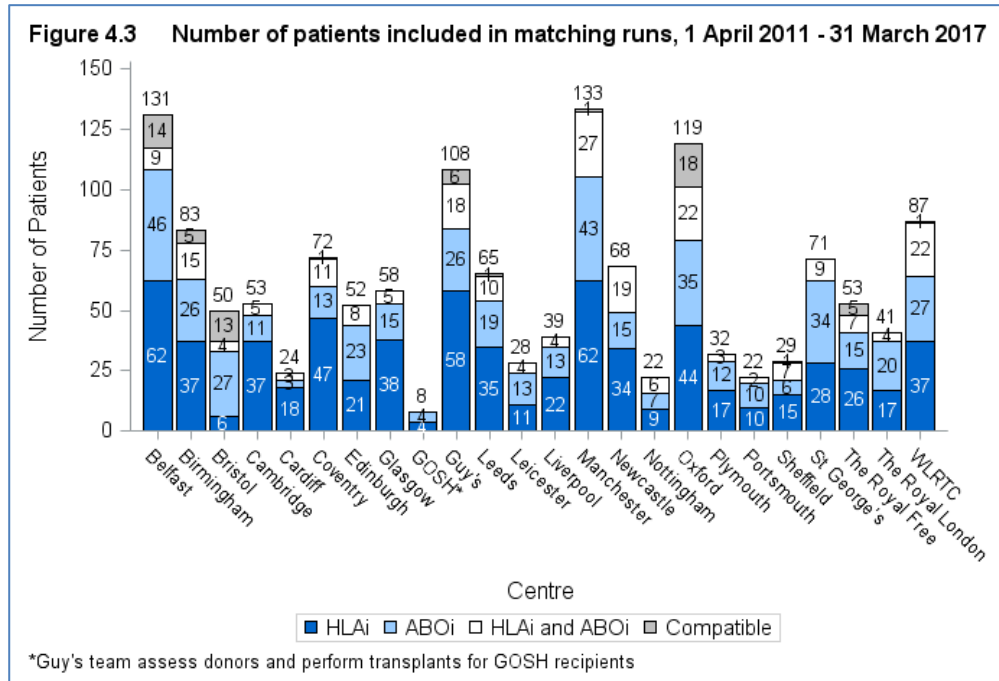


Table 4.1 **Pairs included in matching runs by compatibility and Centre, April 2011 - March 2017**

Centre	Number of pairs	HLAi	ABOi	HLAi and ABOi	Compatible
Belfast	131	62	46	9	14
Birmingham	83	37	26	15	5
Bristol	50	6	27	4	13
Cambridge	53	37	11	5	0
Cardiff	24	18	3	3	0
Coventry	72	47	13	11	1
Edinburgh	52	21	23	8	0
Glasgow	58	38	15	5	0
GOSH*	8	4	4	0	0
Guy's	108	58	26	18	6
Leeds	65	35	19	10	1
Leicester	28	11	13	4	0
Liverpool	39	22	13	4	0
Manchester	133	62	43	27	1
Newcastle	68	34	15	19	0
Nottingham	22	9	7	6	0
Oxford	119	44	35	22	18
Plymouth	32	17	12	3	0
Portsmouth	22	10	10	2	0
Sheffield	29	15	6	7	1
St George's	71	28	34	9	0
The Royal Free	53	26	15	7	5
The Royal London	41	17	20	4	0
WLRTC	87	37	27	22	1
UK	1448	695	463	224	66

*Guy's team assess donors and perform transplants for GOSH recipients

4.1.2 Outcomes: Matching Runs, 1 April 2013 – 31 March 2017

Figure 4.4 shows the outcomes of patients included in matching runs from 1 April 2013 to 31 March 2017, split by centre. Overall, 38% of patients registered have had a transplant through the paired donation scheme.

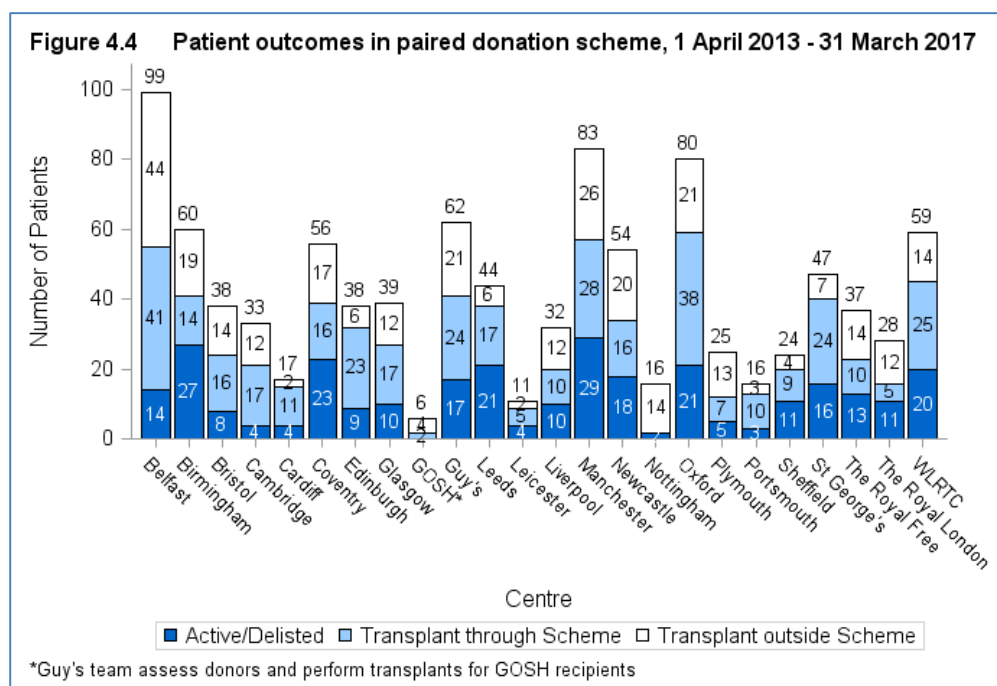
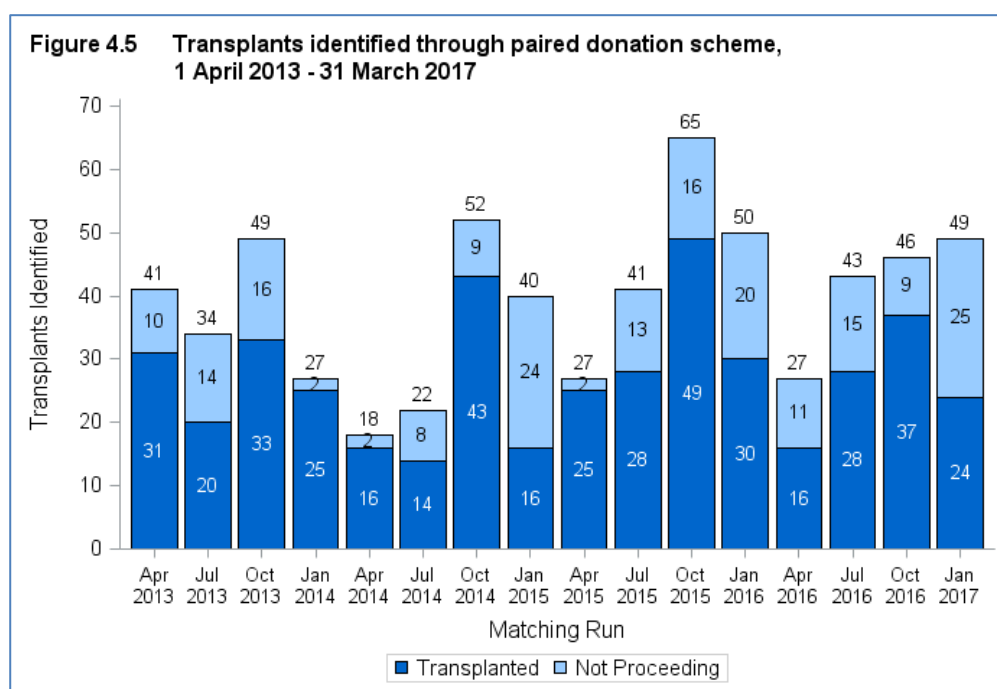


Figure 4.5 shows the transplants identified in each matching run from 1 April 2013 to 31 March 2017. The number of those that proceeded to transplant is also shown. Overall, 70% of transplants identified through the paired donation scheme have proceeded to transplant over this period.



Tables 4.2 and **4.3** show the number of transplants split by patient calculated reaction frequency and patient and donor blood group respectively.

Table 4.2 Transplants as a proportion of registered patients by calculated reaction frequency, 1 April 2013 - 31 March 2017			
Calculated Reaction Frequency	Patients Registered	Patients Transplanted	
		N	(%)
0-9%	294	132	(45)
10-84%	255	147	(58)
85-94%	115	53	(46)
95-99%	205	49	(24)
100%	135	4	(3)

Table 4.3 Transplants as a proportion of registered pairs by blood group, 1 April 2013 - 31 March 2017											
Donor Blood Group	Patient Blood Group (Patients Transplanted/Pairs Registered (%))										
	O			A			B			AB	
O	75/	229	(33%)	67/	109	(61%)	16/	29	(55%)	4/	8 (50%)
A	91/	335	(27%)	44/	154	(29%)	21/	41	(51%)	2/	11 (18%)
B	24/	82	(29%)	15/	36	(42%)	12/	35	(34%)	1/	5 (20%)
AB	4/	12	(33%)	6/	13	(46%)	3/	12	(25%)	0/	3 (0%)

Figure 4.6 shows the number of patients transplanted from matching runs between 1 April 2013 and 31 March 2017. This is split by centre and exchange type.

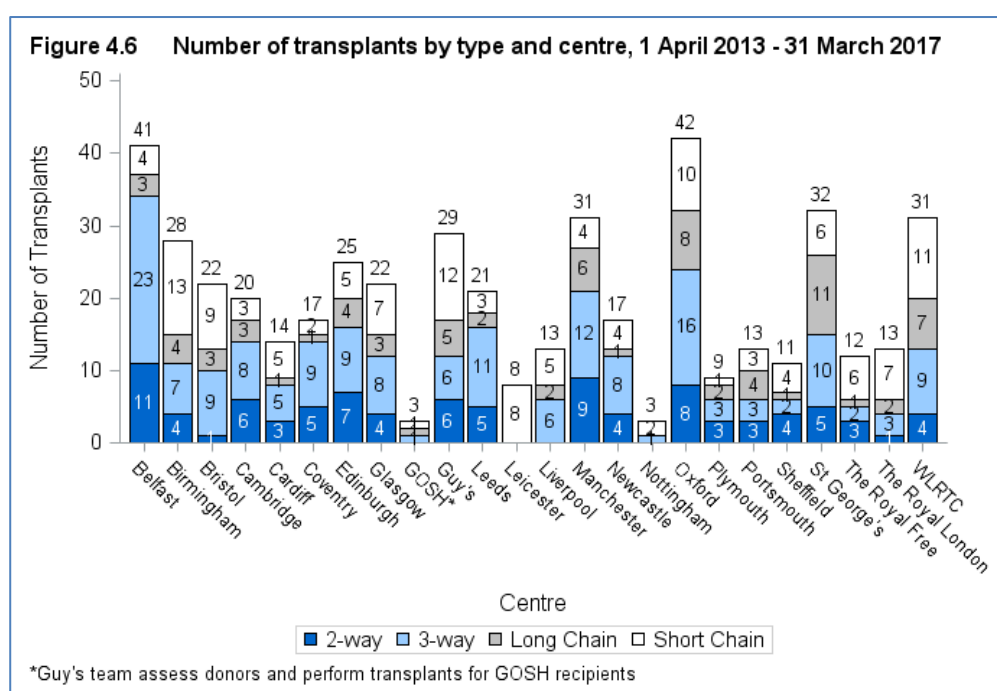


Figure 4.7 shows the patients transplanted from matching runs between 1 April 2013 and 31 March 2017. This is split by centre and the incompatibility of the patient with their registered donor. **Table 4.4** shows the percentage of pairs transplanted through paired donation given that they have been included in 1 or more, 2 or more or 5 or more matching runs. **Table 4.5** shows the average waiting time for transplant in the paired donation scheme. Data is censored if the patient received a transplant outside the scheme.

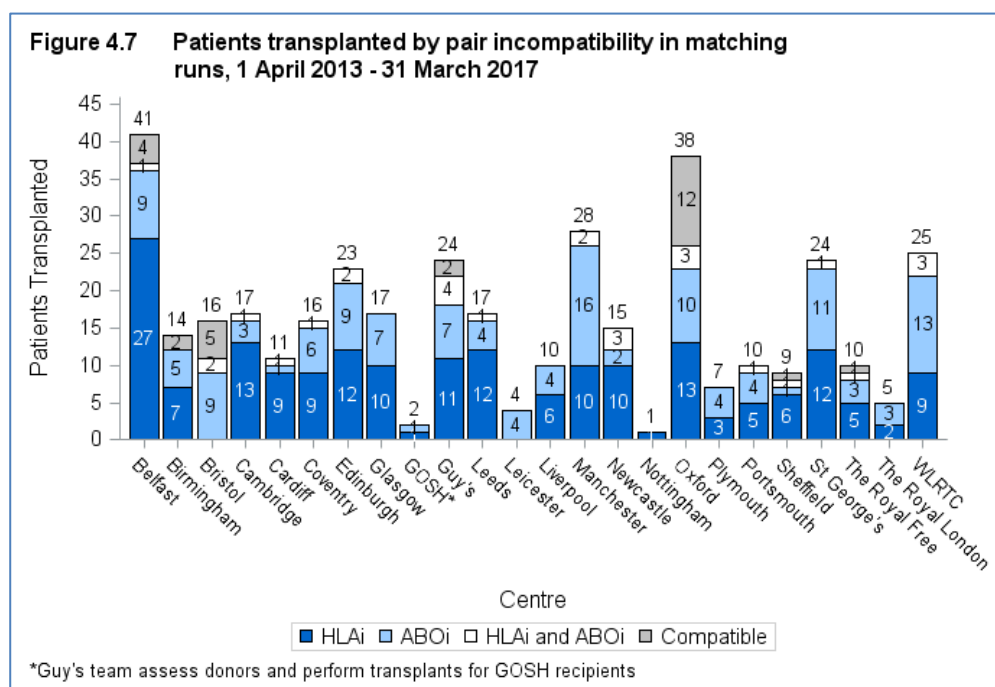


Table 4.4 Transplants by group type and Centre, 1 April 2013 - March 2017

Centre	Number of Transplants	2-way	3-way	Short Chain
Belfast	41	11	23	3
Birmingham	28	4	7	4
Bristol	22	1	9	3
Cambridge	20	6	8	3
Cardiff	14	3	5	1
Coventry	17	5	9	1
Edinburgh	25	7	9	4
Glasgow	22	4	8	3
GOSH*	3	0	1	1
Guy's	29	6	6	5
Leeds	21	5	11	2
Leicester	8	0	0	0
Liverpool	13	0	6	2
Manchester	31	9	12	6
Newcastle	17	4	8	1
Nottingham	3	0	1	0
Oxford	42	8	16	8
Plymouth	9	3	3	2
Portsmouth	13	3	3	4
Sheffield	11	4	2	1
St George's	32	5	10	11
The Royal Free	12	3	2	1
The Royal London	13	1	3	2
WLRTC	31	4	9	7
UK	477	96	171	75

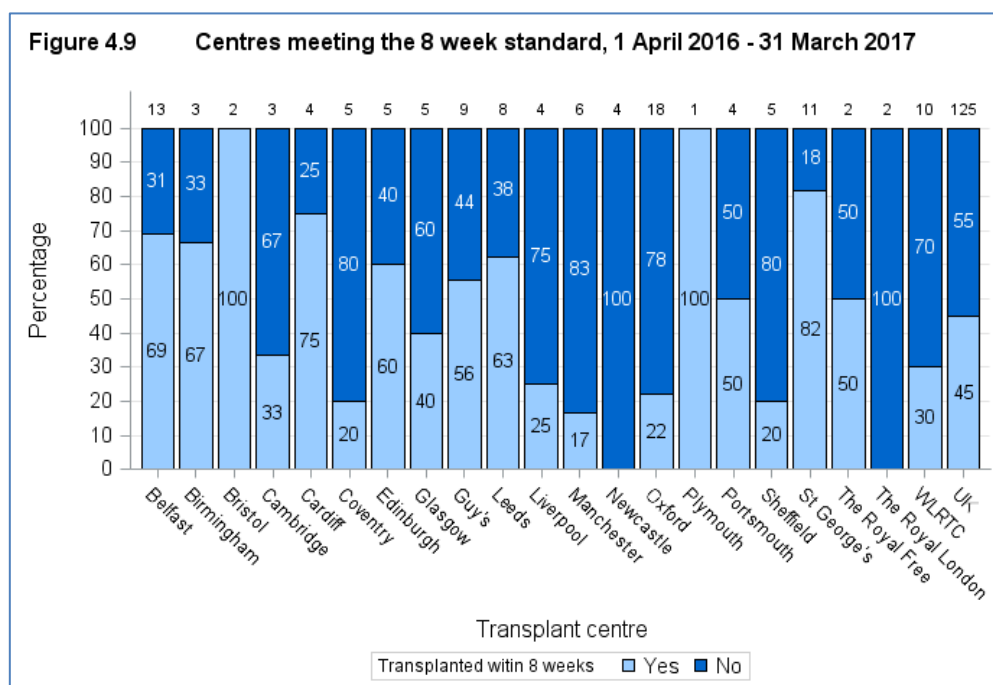
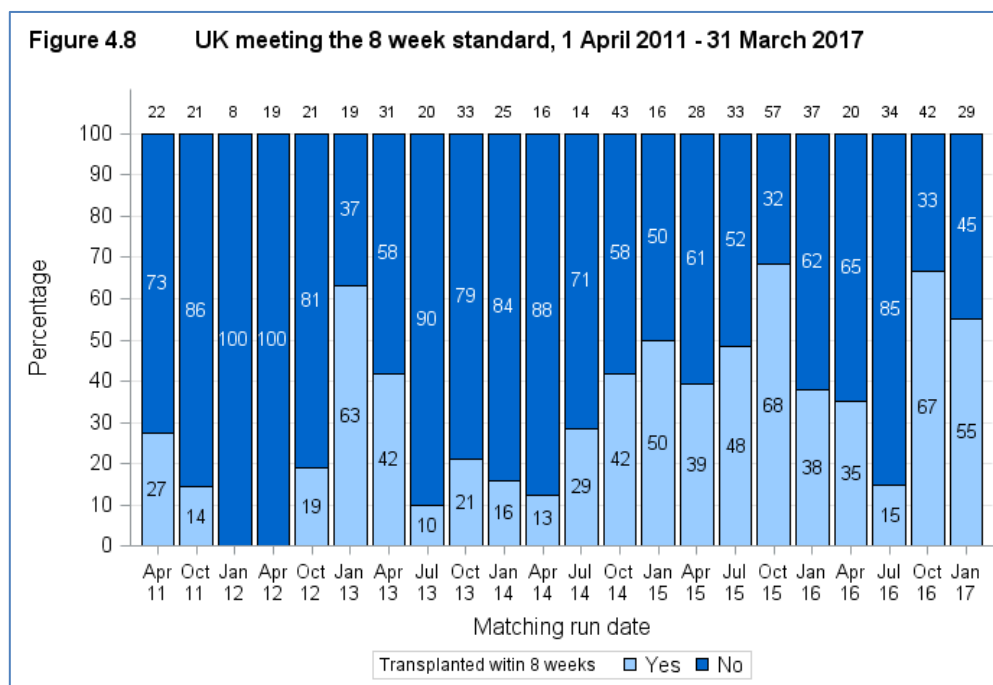
*Guy's team assess donors and perform transplants for GOSH recipients

Table 4.5 Median waiting time to paired donation kidney transplant in the UK, for patients registered 1 April 2007 - 31 March 2013

Pair Incompatibility	Number of patients registered	Waiting time (days)	
		Median	95% Confidence interval
HLAi	314	1147	679 - 1615
ABOi	246	771	615 - 927
All Pairs	665	1135	775 - 1495

4.1.3 Recipients transplanted within the 8 week standard, 1 April 2011 – 31 March 2017

Figures 4.8 and 4.9 shows the time from date of transplant identified to surgery, by matching run date and transplant centre, respectively.



Where centres have fallen outside the 8 week standard this may reflect other centres being unable to accommodate the required date of surgery rather than the centre itself.

4.2 Non-directed Altruistic Donation

4.2.1 Transplants, 1 April 2008 – 31 March 2017

Figure 4.10 shows the number of altruistic donor kidney transplants from 1 April 2008 to 31 March 2017. This is split by whether the donation was to the deceased donor waiting list or the paired donation scheme. The number of transplants has increased from 15 in 2008/09 to 85 in 2016/17.

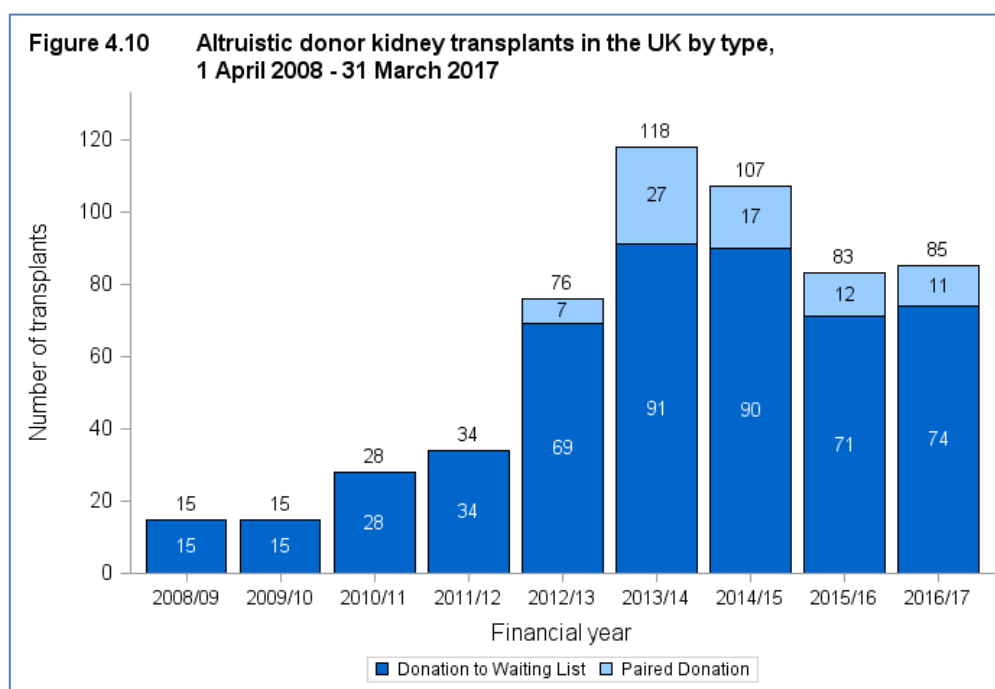
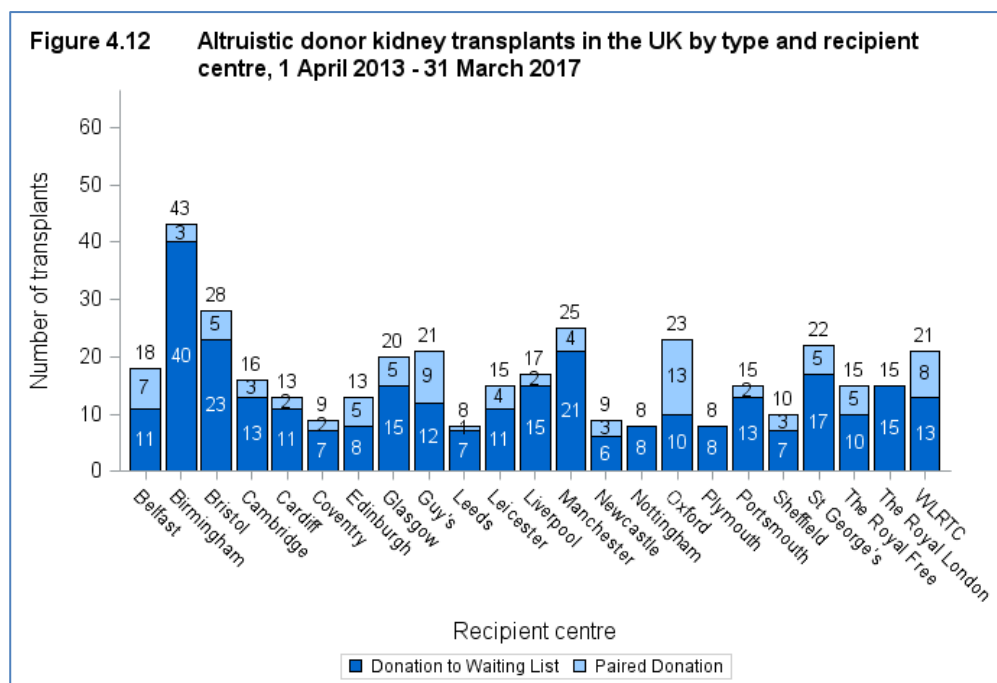
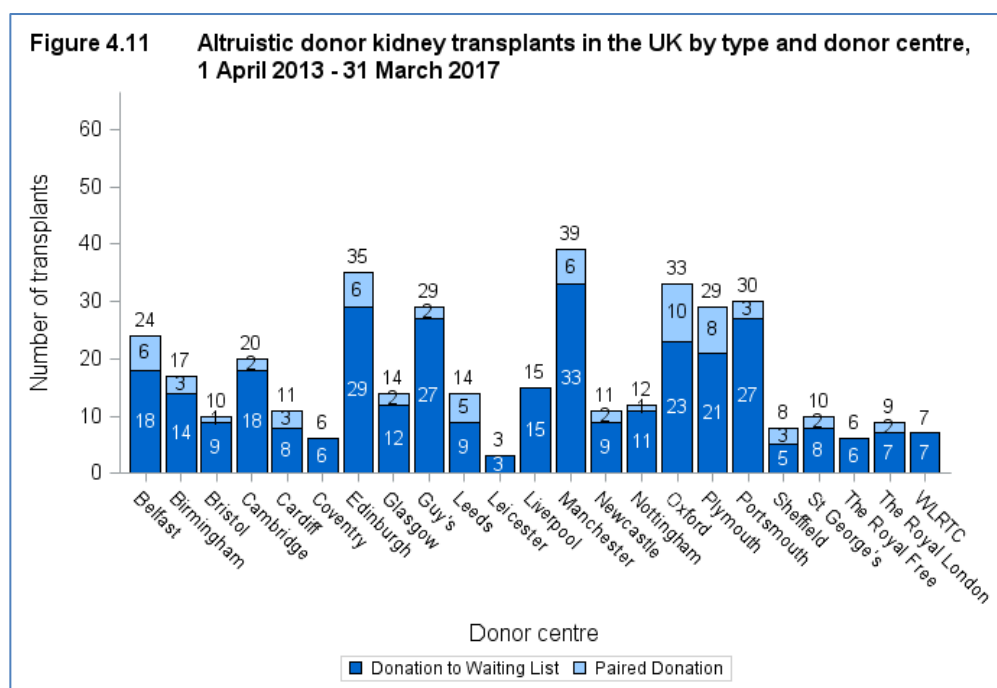
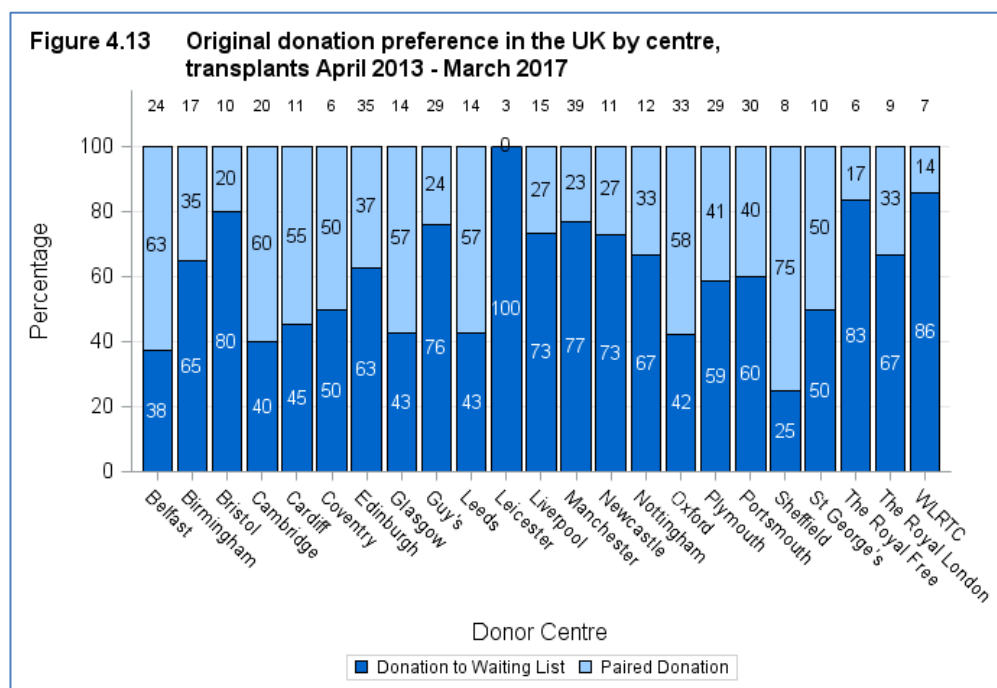


Figure 4.11 shows the number of altruistic donor kidney transplants from 1 April 2013 to 31 March 2017 by donor centre. Manchester had the highest number of altruistic donors. **Figure 4.12** shows the number of altruistic donor kidney transplant from 1 April 2013 to 31 March 2017 by recipient centre. Birmingham had the highest number of recipients of altruistic donors.



4.2.2 Donation Preference, 1 April 2013 – 31 March 2017

Figure 4.13 shows the original donation preference for altruistic donors from 1 April 2013 to 31 March 2017, by centre. The proportion indicating a preference for donating to the paired donation scheme varies from 0% in Leicester to 75% in Sheffield.



4.2.3 Time to donation, 1 April 2013 – 31 March 2017

Figure 4.14 shows the median time in months from notification to donation from 1 April 2013 to 31 March 2017, by centre. This ranged from 0 to 2 months. This data is shown further in **Table 4.6**. The boxplot shows the minimum, lower quartile, median, upper quartile and maximum values. The boxplots are used to show the variation in the data and indicate any outlying values, which are shown by the circles on the plot. The box itself shows the interquartile range and the line inside the box indicates the median value.

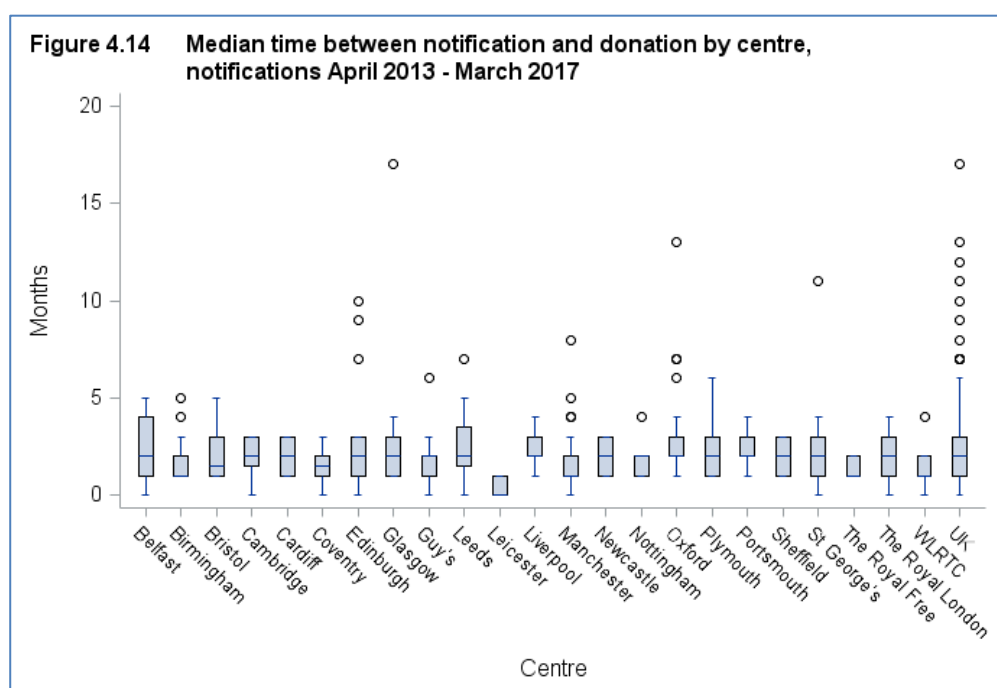


Table 4.6 **Median time between notification and donation
by Centre, Donations April 2013 - March 2017**

Centre	Number of donors	Median	Interquartile range
Belfast	23	2	1 - 4
Birmingham	17	1	1 - 2
Bristol	10	1	1 - 3
Cambridge	20	2	2 - 3
Cardiff	11	2	1 - 3
Coventry	6	1	1 - 2
Edinburgh	33	2	1 - 3
Glasgow	14	2	1 - 3
Guy's	27	2	1 - 2
Leeds	12	2	2 - 3
Leicester	3	0	0 - 1
Liverpool	14	2	2 - 3
Manchester	37	1	1 - 2
Newcastle	11	2	1 - 3
Nottingham	11	2	1 - 2
Oxford	29	2	2 - 3
Plymouth	24	2	1 - 3
Portsmouth	27	2	2 - 3
Sheffield	7	2	1 - 3
St George's	9	2	1 - 3
The Royal Free	6	1	1 - 2
The Royal London	9	2	1 - 3
WLRTC	7	1	1 - 2
UK	367	2	1 - 3

Antibody Incompatible Transplants

This section only includes living donor antibody incompatible kidney only transplants.

Antibody Incompatible transplant data is collected on the Antibody Incompatible Transplant Details form. **Figure 5.1** and **Table 5.1** show the form return rates by centre.

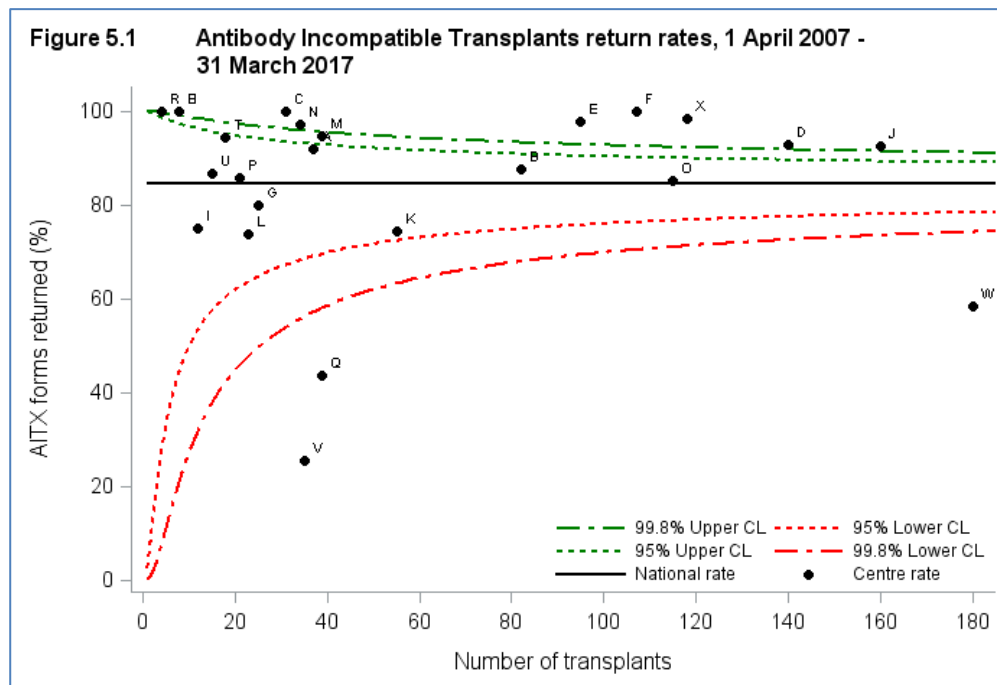


Table 5.1 **Antibody incompatible transplant form return rates,
1 April 2007 – 31 March 2017**

Transplant Centre	Code	Number of transplants	AITX forms returned	
			N	%
Belfast	A	38	29	76
Birmingham	B	82	70	85
Bristol	C	31	30	97
Cambridge	D	140	128	91
Cardiff	E	95	86	91
Coventry	F	108	105	97
Edinburgh	G	25	18	72
Glasgow	H	8	8	100
GOSH*	I	12	5	42
Guy's	J	161	148	92
Leeds	K	53	38	72
Leicester	L	23	17	74
Liverpool	M	39	37	95
Manchester	N	34	33	97
Newcastle	O	115	98	85
Nottingham	P	21	18	86
Oxford	Q	39	17	44
Plymouth	R	4	4	100
Portsmouth	S	8	8	100
Sheffield	T	18	16	89
St George's	U	15	13	87
The Royal Free	V	36	9	25
The Royal London	W	181	100	55
WLRTC	X	118	116	98
UK		1404	1151	82

*Guy's team assess donors and perform transplants for GOSH recipients

ADULT

Figures 5.2 and 5.3 show the number of living donor antibody incompatible kidney transplants by financial year and centre respectively. Activity has reduced from 146 antibody incompatible transplants in 2012/13 to 78 in 2015/16 before a slight increase to 83 in the latest financial year.

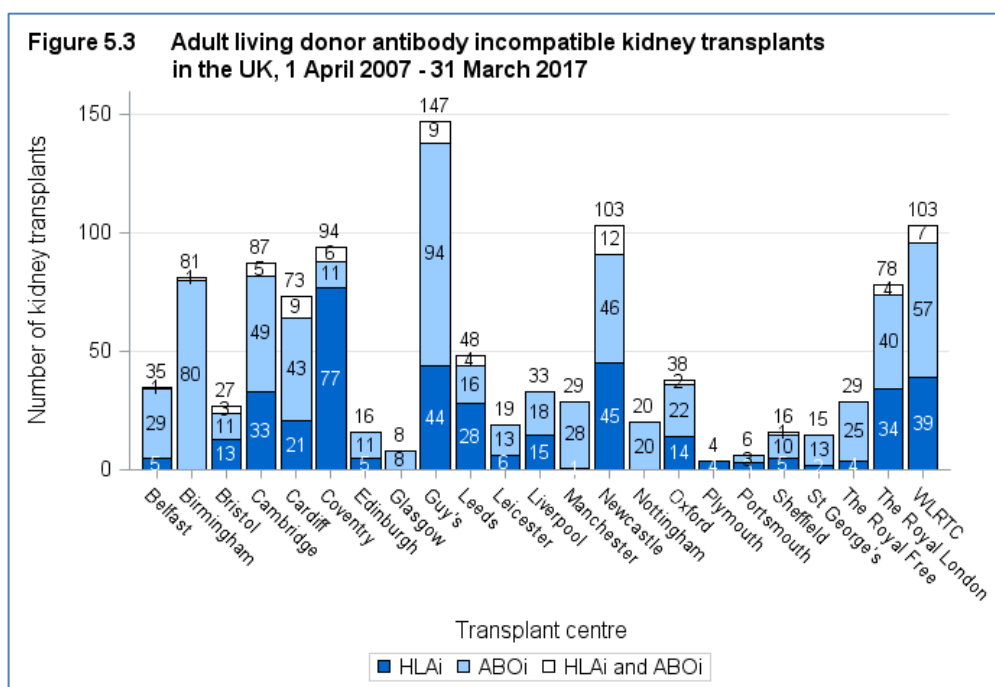
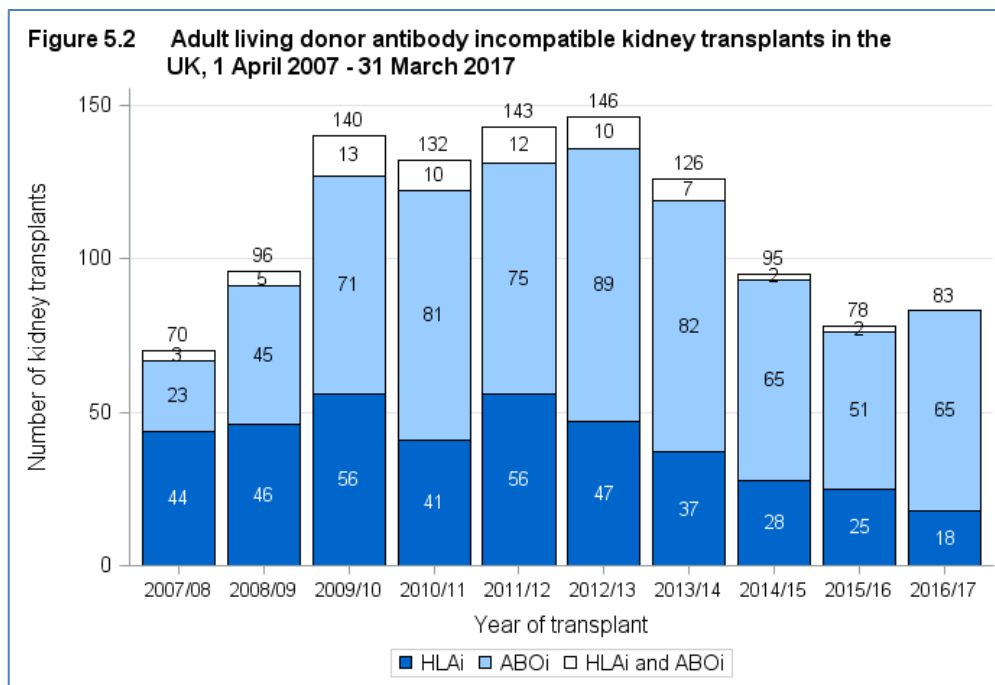


Table 5.2 shows the donor and recipient blood group for all ABOi transplants.

Table 5.2 Donor and recipient blood group for all adult ABOi transplants, 1 April 2007 - 31 March 2017						
Recipient blood group	Donor blood group					
	A		B		AB	
	N	(%)	N	(%)	N	(%)
A	1	(<1)	71	(10)	50	(7)
B	90	(13)	1	(<1)	32	(5)
O	320	(45)	128	(18)	11	(2)

Table 5.3 shows the donor and recipient ABO by recipient CRF at transplant.

Table 5.3 Donor and recipient ABO by recipient CRF at transplant, 1 April 2007 - 31 March 2017								
Donor-Recipient ABO	Recipient CRF at transplant							
	0-9		10-84		85-94		95-100	
	N	(%)	N	(%)	N	(%)	N	(%)
A-A	22	(2)	25	(2)	16	(1)	40	(4)
A-AB	2	(<1)	2	(<1)	1	(<1)	1	(<1)
A-B	60	(5)	15	(1)	4	(<1)	11	(1)
A-O	216	(20)	71	(6)	11	(1)	23	(2)
AB-A	35	(3)	10	(1)	3	(<1)	2	(<1)
AB-AB	1	(<1)	-		1	(<1)	3	(<1)
AB-B	25	(2)	4	(<1)	1	(<1)	2	(<1)
AB-O	9	(1)	-		1	(<1)	1	(<1)
B-A	53	(5)	10	(1)	3	(<1)	5	(1)
B-AB	1	(<1)	-		1	(<1)	1	(<1)
B-B	7	(1)	5	(1)	3	(<1)	9	(1)
B-O	84	(8)	33	(3)	6	(1)	5	(1)
O-A	21	(2)	16	(1)	7	(1)	17	(2)
O-AB	3	(<1)	1	(0)	-		-	
O-B	4	(<1)	11	(1)	1	(<1)	7	(1)
O-O	40	(4)	42	(4)	27	(2)	66	(6)

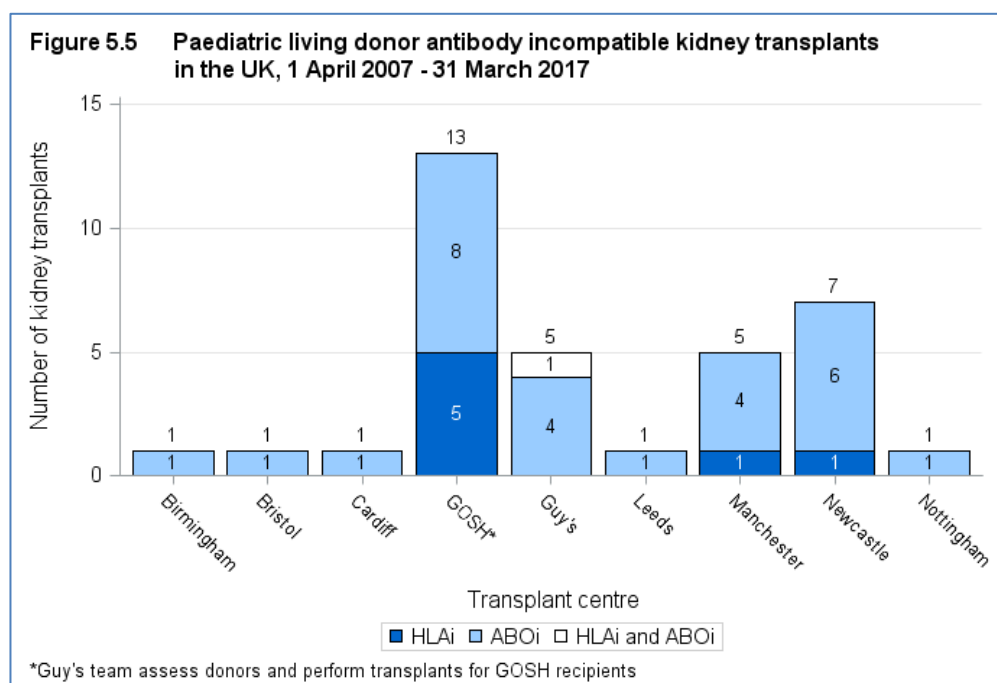
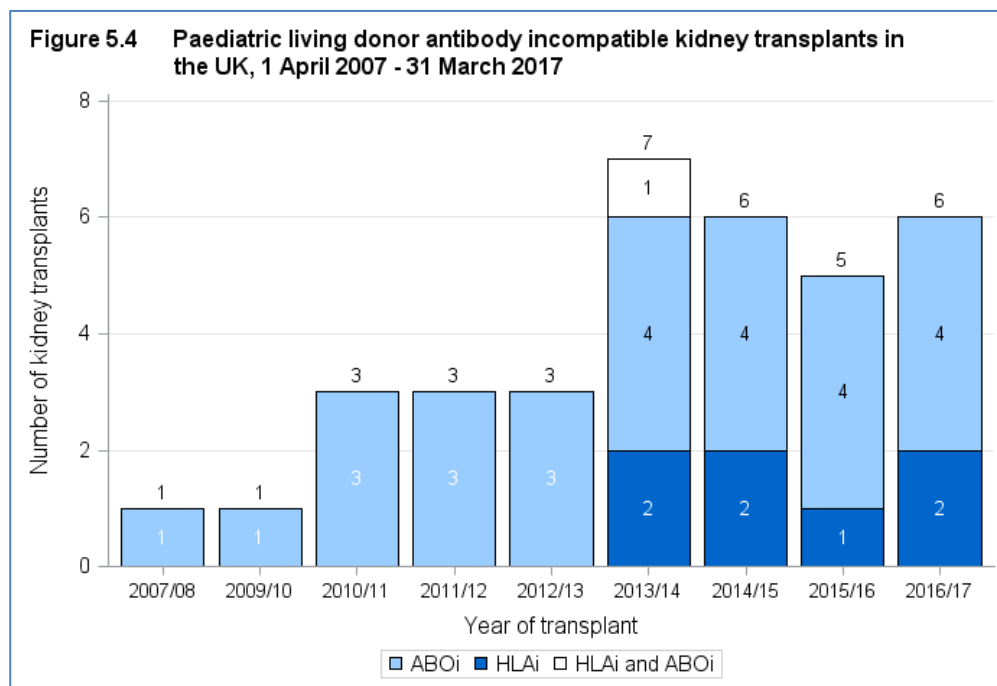
Table 5.4 shows the pre and at transplant level group for all HLAi transplants. Data are only presented for cases where an antibody incompatible form has been completed and returned. **Table 5.5** shows the calculated reaction frequency by incompatibility type.

Table 5.4 Pre and at transplant antibody level group for all adult HLAi transplants, 1 April 2007 - 31 March 2017											
Pre treatment antibody level group	At Transplant antibody level group										
	CDC pos, Flow pos, DSA SPA pos N (%)	CDC neg, Flow pos, DSA SPA pos N (%)	CDC neg, Flow neg, DSA SPA pos N (%)	CDC neg, Flow neg, DSA SPA neg N (%)	CDC NT, Flow pos, DSA SPA pos N (%)	Unknown N (%)					
CDC NT, Flow pos, DSA SPA pos	-	1 (<1)	22 (5)	2 (<1)	13 (3)	1 (<1)					
CDC neg, Flow neg, DSA SPA pos	-	1 (<1)	120 (26)	25 (5)	-	1 (<1)					
CDC neg, Flow pos, DSA SPA pos	-	95 (20)	56 (12)	44 (9)	-	19 (4)					
CDC pos, Flow pos, DSA SPA pos	15 (3)	21 (5)	13 (3)	6 (1)	1 (<1)	3 (1)					
Unknown	-	1 (<1)	-	1 (0)	-	10 (2)					

Table 5.5 At transplant calculated reaction frequency by incompatibility type, 1 April 2007 - 31 March 2017						
Calculated Reaction Frequency	ABOi		HLAi		HLAi and ABOi	
	N	%	N	%	N	%
0-9	479	(74)	94	(24)	11	(17)
10-84	128	(20)	101	(25)	16	(25)
85-94	22	(3)	58	(15)	7	(11)
95-100	18	(3)	145	(36)	30	(47)

PAEDIATRIC

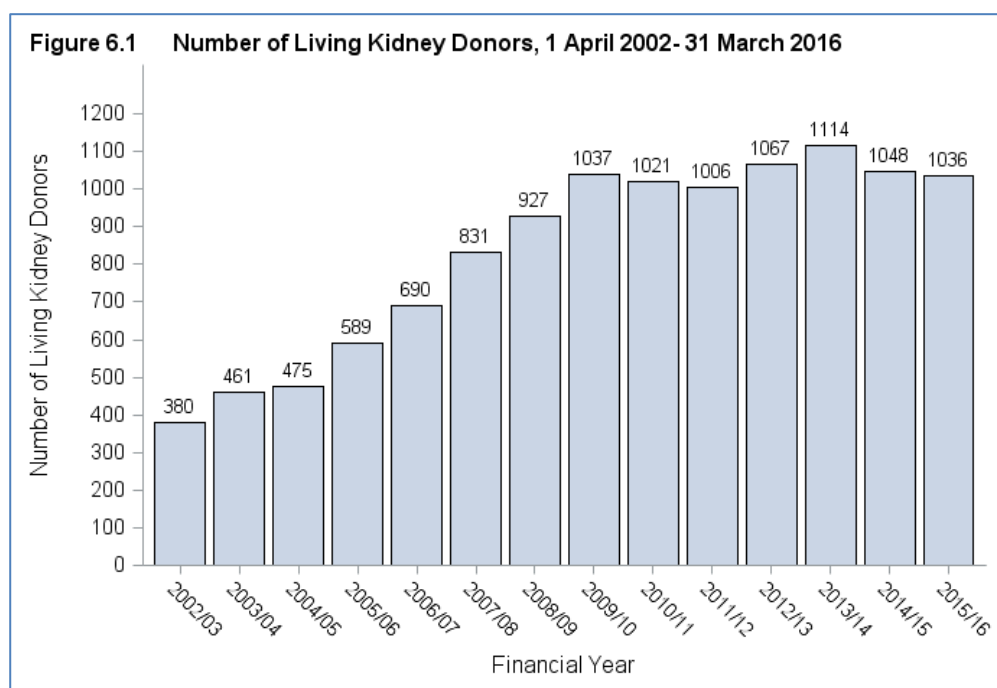
Figures 5.4 and 5.5 show the number of living donor antibody incompatible kidney transplants by financial year and centre respectively.



Living Donor Follow-Up

This section contains information on all living donors who have donated to both adult and paediatric recipients from 2002/03 to 2015/16. Percentages are omitted if the reported proportion of the data item at 1 year is less than 75%, at 5 years is less than 50% or at 10 years is less than 35% at each centre.

Figure 6.1 shows the number of living donor kidney donors by financial year from 2002/03 to 2015/16. The number of living donors has increased from 380 in 2002/03 to 1036 in 2015/16.



Of the living donors over this period, 64 deaths have been recorded. The causes of death are shown in **Table 6.1**. No donors have joined the kidney waiting list, although one has received a kidney transplant from a living donor.

Table 6.1 Cause of death for living donors 1 April 2002 – 31 March 2016		
Cause of Death	N	%
Cancer	28	44
Bowel	1	2
Breast	1	2
Colonic	1	2
Gastric	1	2
Liver	1	2
Lung	3	5
Oesophagus	3	5
Pancreatic	3	5
Prostate	1	2
Stomach	1	2
Throat	2	3
Uterus	2	3
Other	8	13
Brain Tumor	4	6
Intracranial hemorrhage	3	5
Myelodysplasia	1	2
Myocardial infarction	1	2
Parkinson's disease	1	2
Pulmonary embolism	1	2
Bronchopneumonia	2	3
Other	8	13
Unknown	15	23
TOTAL	64	100

6.1 Prescription of Antihypertensive drugs, 1 April 2002 – 31 March 2016

Figure 6.2, 6.3 and 6.4 show the proportion of living donor kidney donors where the donor has been prescribed antihypertensive drugs at 1, 5 and 10 year follow-up by centre, respectively. The same information is summarised in **Table 6.2**. The proportion of living donors across the UK being prescribed anti-hypertensive drugs is 5% at one year, 8% at five years and 12% at ten years post donation.

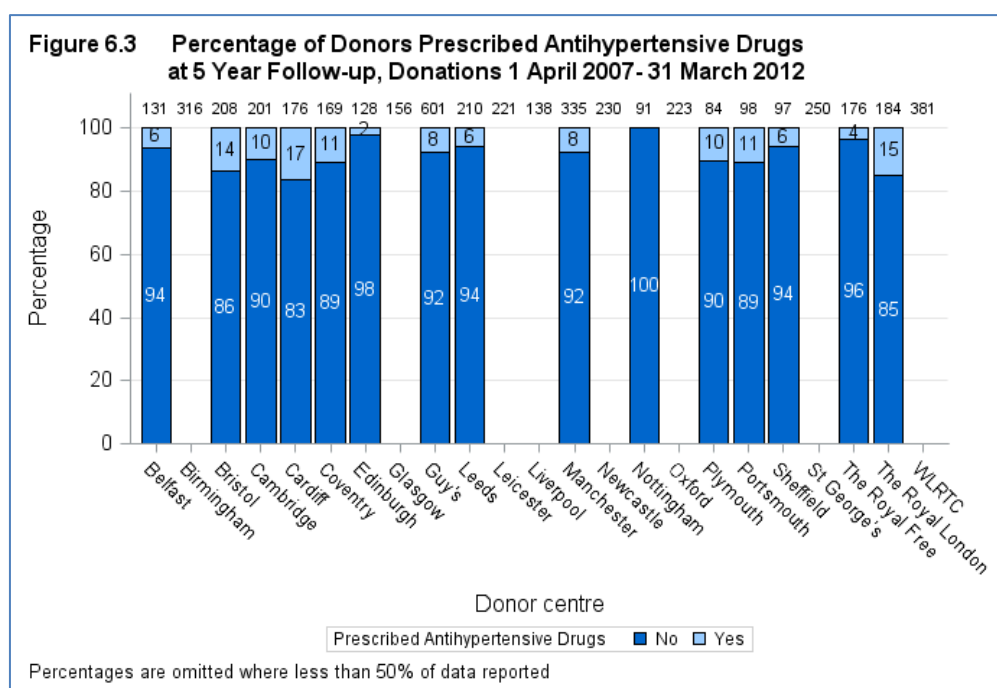
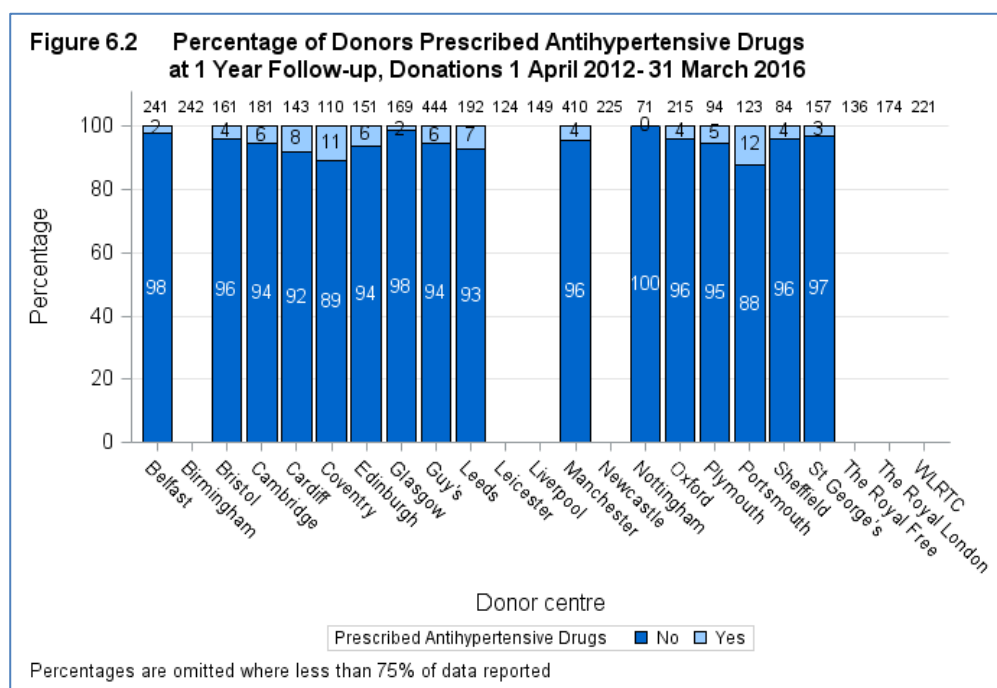


Figure 6.4 Percentage of Donors Prescribed Antihypertensive Drugs at 10 Year Follow-up, Donations 1 April 2002- 31 March 2007

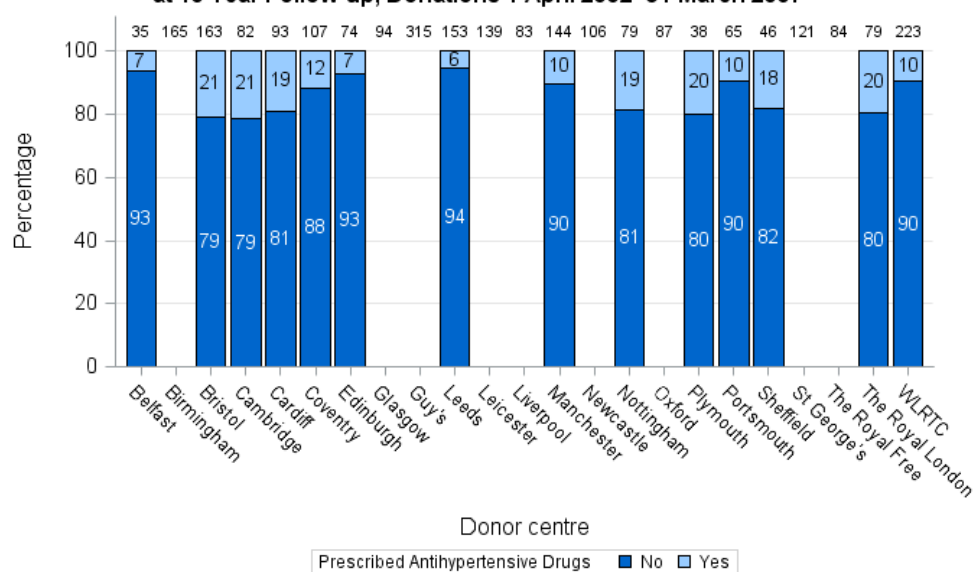


Table 6.2 Percentage of Donors Prescribed Antihypertensive Drugs by Centre, Donations April 2002 - March 2016

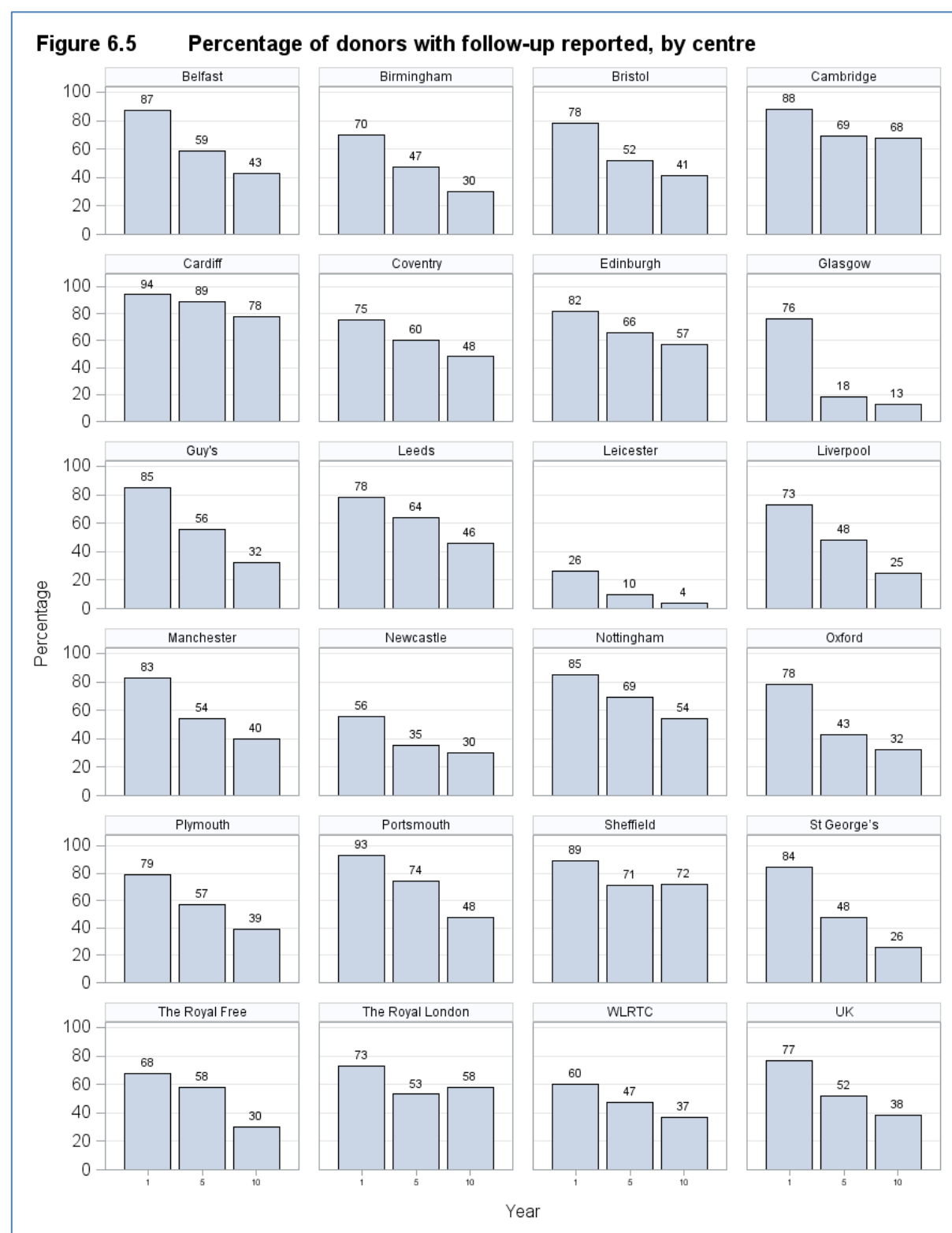
Centre	1 Year			5 Year			10 Year		
	N	% ¹	% ²	N	% ¹	% ²	N	% ¹	% ²
Belfast	241	87	2	131	59	6	35	43	-
Birmingham	242	70	-	316	47	-	165	30	-
Bristol	161	78	4	208	52	14	163	41	21
Cambridge	181	88	6	201	69	10	82	68	21
Cardiff	143	94	8	176	89	17	93	78	19
Coventry	110	75	11	169	60	11	107	48	12
Edinburgh	151	82	6	128	66	2	74	57	7
Glasgow	169	76	2	156	18	-	94	13	-
Guy's	444	85	6	601	56	8	315	32	-
Leeds	192	78	7	210	64	6	153	46	6
Leicester	124	26	-	221	10	-	139	4	-
Liverpool	149	73	-	138	48	-	83	25	-
Manchester	410	83	4	335	54	8	144	40	10
Newcastle	225	56	-	230	35	-	106	30	-
Nottingham	71	85	0	91	69	0	79	54	19
Oxford	215	78	4	223	43	-	87	32	-
Plymouth	94	79	5	84	57	10	38	39	-
Portsmouth	123	93	12	98	74	11	65	48	10
Sheffield	84	89	4	97	71	6	46	72	18
St George's	157	84	3	250	48	-	121	26	-
The Royal Free	136	68	-	176	58	4	84	30	-
The Royal London	174	73	-	184	53	15	79	58	20
WLRTC	221	60	-	381	47	-	223	37	10
UK	4217	77	5	4804	52	8	2575	38	12

¹% of donors with follow-up reported

²% of donors that have been prescribed antihypertensive drugs (where follow-up returned)

- Percentages are omitted where less than 75%, 50% or 35% of data reported at 1yr, 5yrs or 10yrs

Figure 6.5 shows the percentage of donors with follow-up reported by centre, for donations between April 2002 - March 2016.



6.2 Serum creatinine, 1 April 2002 – 31 March 2016

Figure 6.6, 6.7 and 6.8 show the median serum creatinine at 1, 5 and 10 year follow-up by centre, respectively. The same information is summarised in **Table 6.3**. Serum creatinine for living donors in the UK is 103 (IQ-range 90-120) at one year, 96 (84-111) at five years and 93 (81-107) at ten years post donation

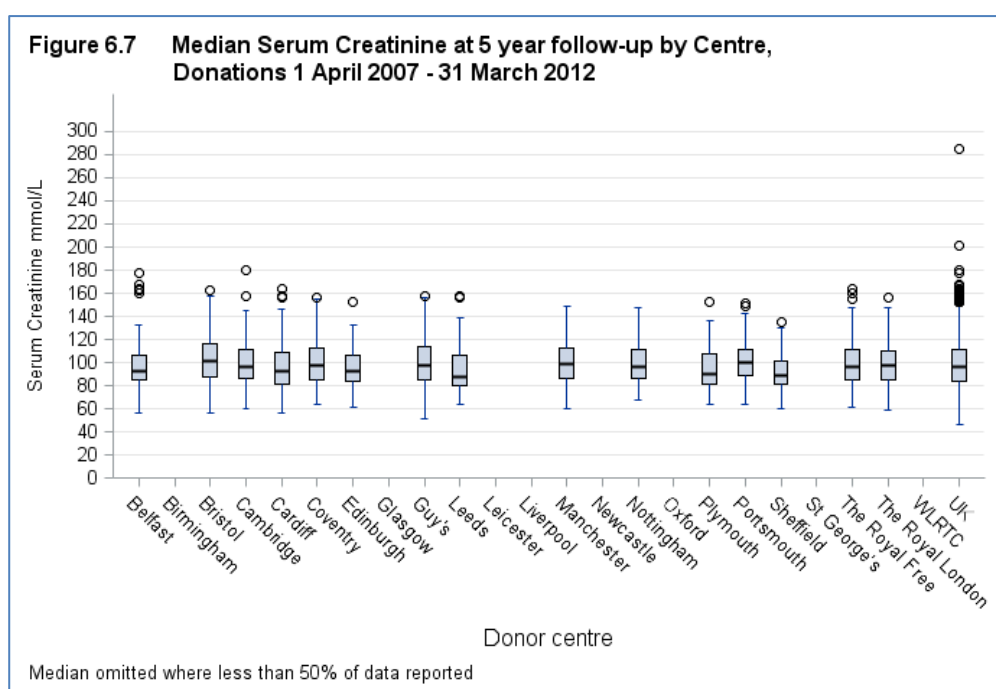
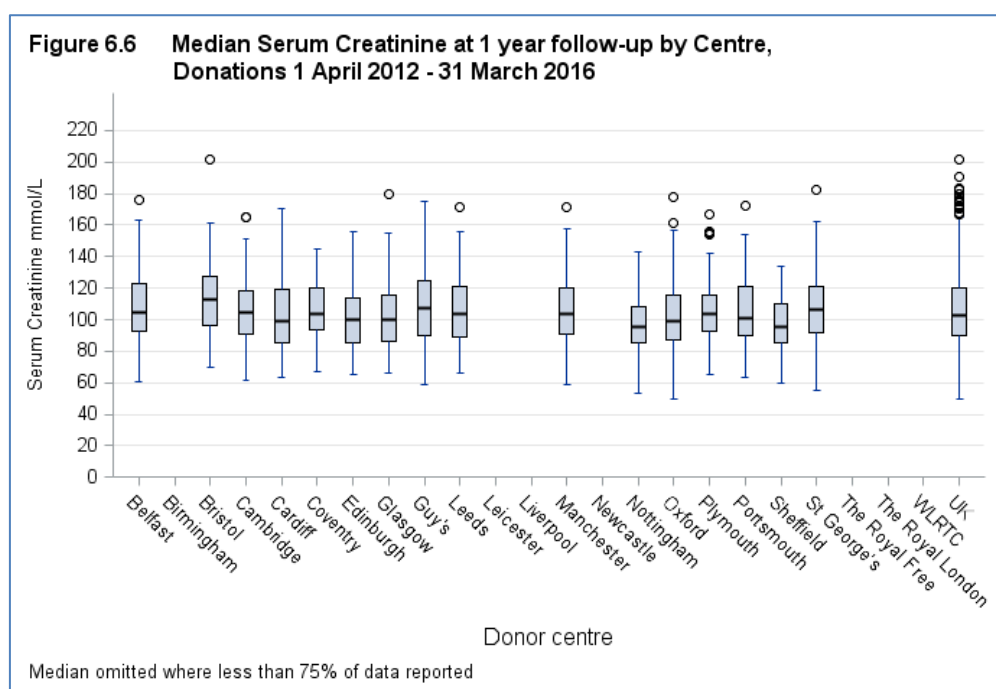


Figure 6.8 Median Serum Creatinine at 10 year follow-up by Centre,
Donations 1 April 2002 - 31 March 2007

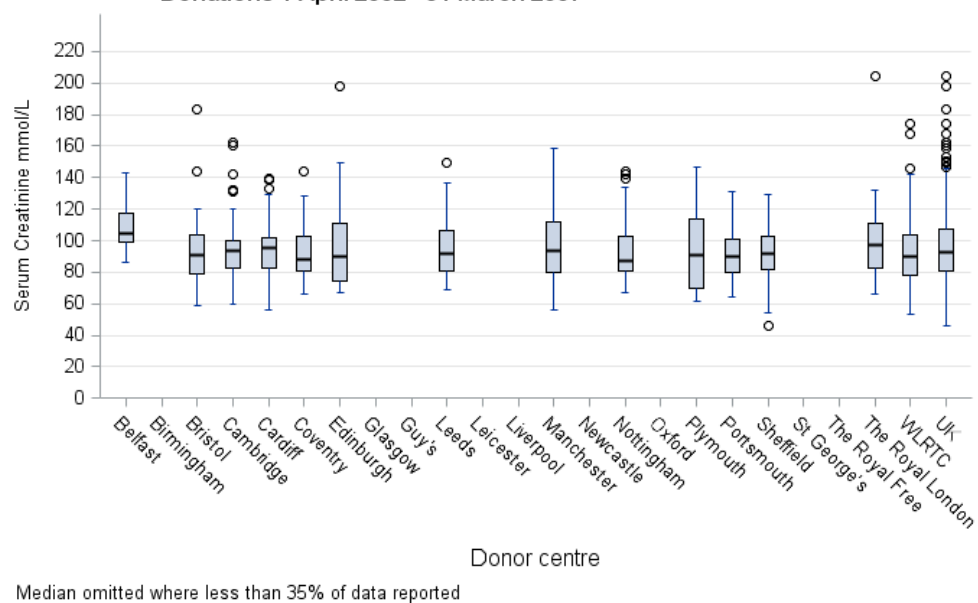


Table 6.3 Median Serum Creatinine at 1, 5 and 10 year follow up by Centre, Donations 1 April 2002 - 31 March 2016

Centre	1 Year			5 Year			10 Year		
	N	% ¹	Median (IQ range)	N	% ¹	Median (IQ range)	N	% ¹	Median (IQ range)
Belfast	241	87	105 (93-123)	131	59	93 (85-106)	35	43	105 (99-117)
Birmingham	242	69	- (---)	316	48	(-)	165	30	(-)
Bristol	161	77	112.5 (96-127.5)	208	51	102 (88-117)	163	40	90.5 (79-104)
Cambridge	181	87	104.5 (91-118)	201	68	97 (86-112)	82	68	94 (83-100)
Cardiff	143	94	99.5 (85-119)	176	89	93 (82-109)	93	78	95 (83-102)
Coventry	110	76	104 (94-120.5)	169	60	98 (85-113)	107	47	88 (81-103)
Edinburgh	151	81	100 (85-114)	128	65	93 (84-106)	74	57	89.5 (74-111)
Glasgow	169	76	100 (86-115.5)	156	18	(-)	94	13	(-)
Guy's	444	84	107 (90-125)	601	56	98 (85-114)	315	32	(-)
Leeds	192	77	104 (89-121)	210	63	88 (80-106)	153	46	92 (81-106)
Leicester	124	25	- (---)	221	10	(-)	139	4	(-)
Liverpool	149	65	- (---)	138	46	(-)	83	25	(-)
Manchester	410	83	104 (91-120)	335	53	99 (86-113)	144	40	93.5 (80-112)
Newcastle	225	56	- (---)	230	35	(-)	106	30	(-)
Nottingham	71	85	95 (85.5-108.5)	91	69	97 (86-112)	79	54	87 (81-103)
Oxford	215	77	99.5 (87-116)	223	43	(-)	87	32	(-)
Plymouth	94	79	104 (93-116)	84	57	90 (81.5-108)	38	39	91 (70-114)
Portsmouth	123	92	101 (90-121)	98	71	100.5 (89-112)	65	48	90 (80-101)
Sheffield	84	89	95 (85-110)	97	71	89 (81-101)	46	72	92 (82-103)
St George's	157	82	106 (92-121)	250	48	(-)	121	26	(-)
The Royal Free	136	68	- (---)	176	58	97 (85-112)	84	30	(-)
The Royal London	174	73	- (---)	184	53	98 (85-110)	79	58	97.5 (83-111)
WLRTC	221	60	- (---)	381	46	(-)	223	37	90 (78-104)
UK	4217	76	103 (90-120)	4804	52	96 (84-111)	2575	38	93 (81-107)

¹% of donors with follow-up reported

- Medians are omitted where less than 75%, 50% or 35% of data reported at 1yr, 5yrs or 10yrs

6.3 Return to normal activity, 1 April 2002 – 31 March 2016

Figure 6.9 shows the median time (in months) to return to normal activity after donation, by centre. The median ranged from 1 to 3 months post-transplant.

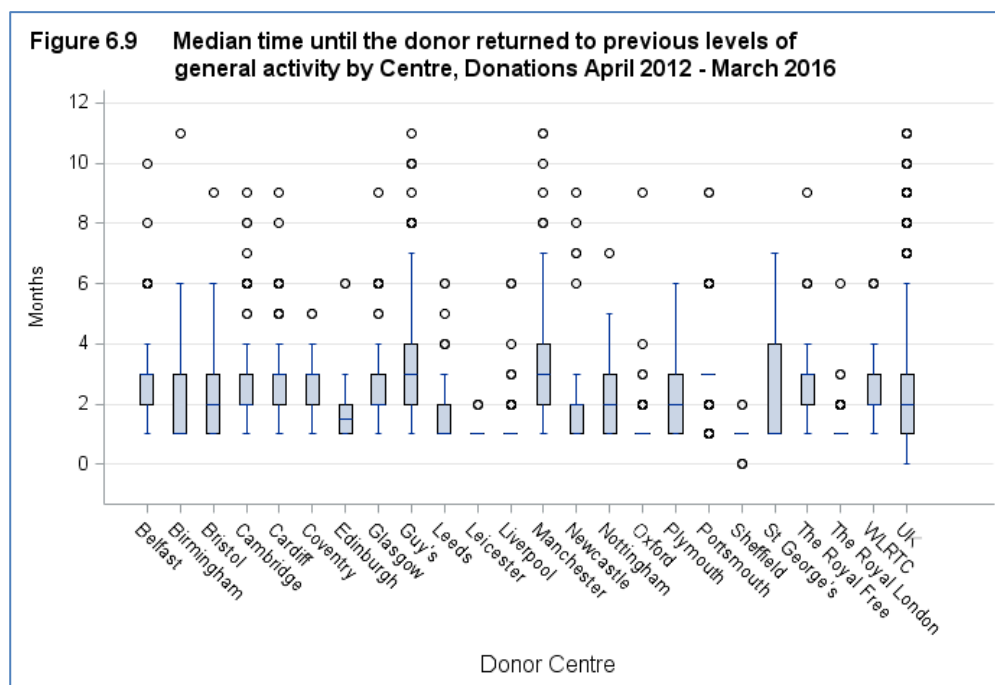
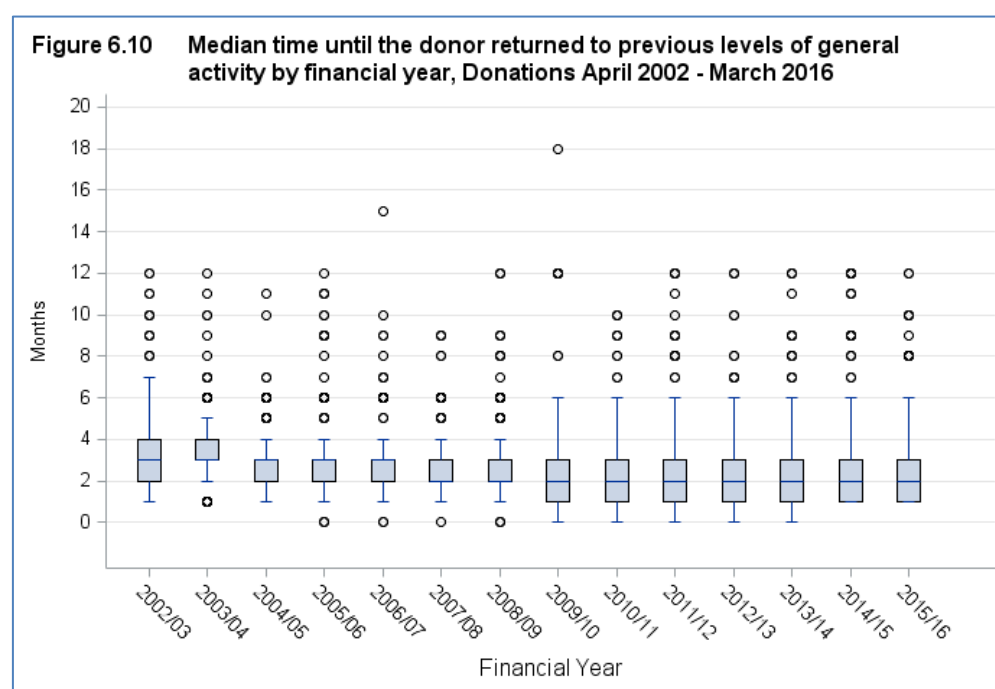


Figure 6.10 shows the median time (in months) to return to normal activity after donation in the UK, by financial year.



Recipient Graft and Patient survival

ADULT

One and five year graft and patient survival are shown in **Figures 7.1-7.4** following adult living donor kidney transplants by donor type. **Tables 7.1-7.4** show the survival rates and 95% confidence limits.

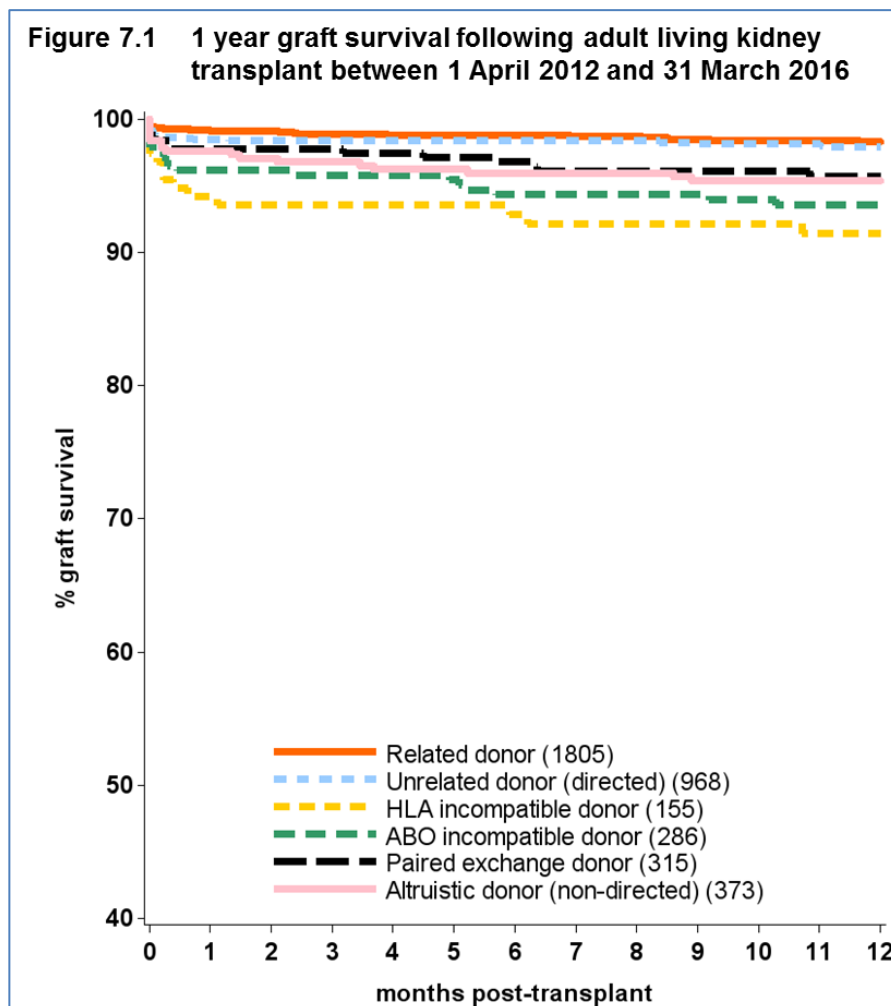


Table 7.1 1 year graft survival following living donor kidney transplant between 1 April 2012 and 31 March 2016 (p<0.0001)

Living Donors	No. at risk on day 0	% Graft survival	(95% confidence interval)
Related donor	1805	98.3	(98-99)
Unrelated donor (directed)	968	97.9	(97-99)
Paired exchange donor	315	95.7	(93-97)
Altruistic donor (non-directed)	373	95.4	(93-97)
ABO incompatible donor	286	93.6	(90-96)
HLA incompatible donor	155	91.4	(86-95)

Figure 7.2 5 year graft survival following adult living kidney transplant between 1 April 2008 and 31 March 2012

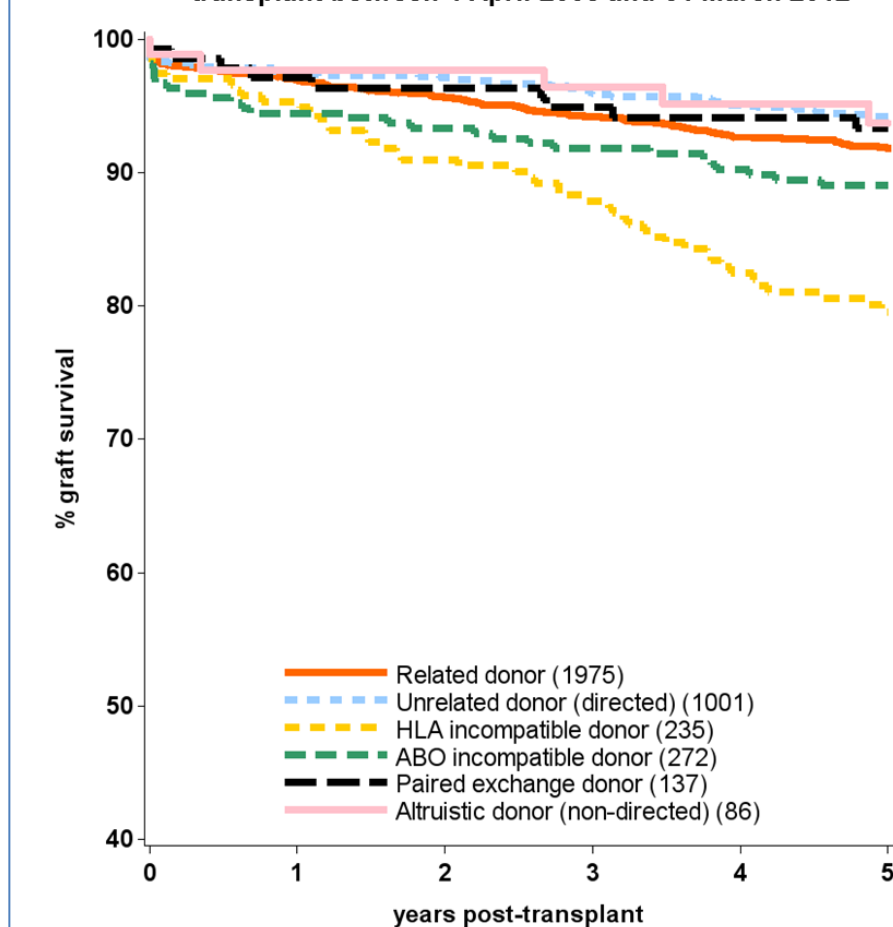


Table 7.2 5 year graft survival following living donor kidney transplant between 1 April 2008 and 31 March 2012 (p<0.0001)

Living Donors	No. at risk on day 0	% Graft survival	(95% confidence interval)
Unrelated donor (directed)	1001	94.2	(93-96)
Altruistic donor (non-directed)	86	93.7	(85-97)
Paired exchange donor	137	93.3	(88-96)
Related donor	1975	91.8	(90-93)
ABO incompatible donor	272	89.0	(85-92)
HLA incompatible donor	235	79.5	(74-84)

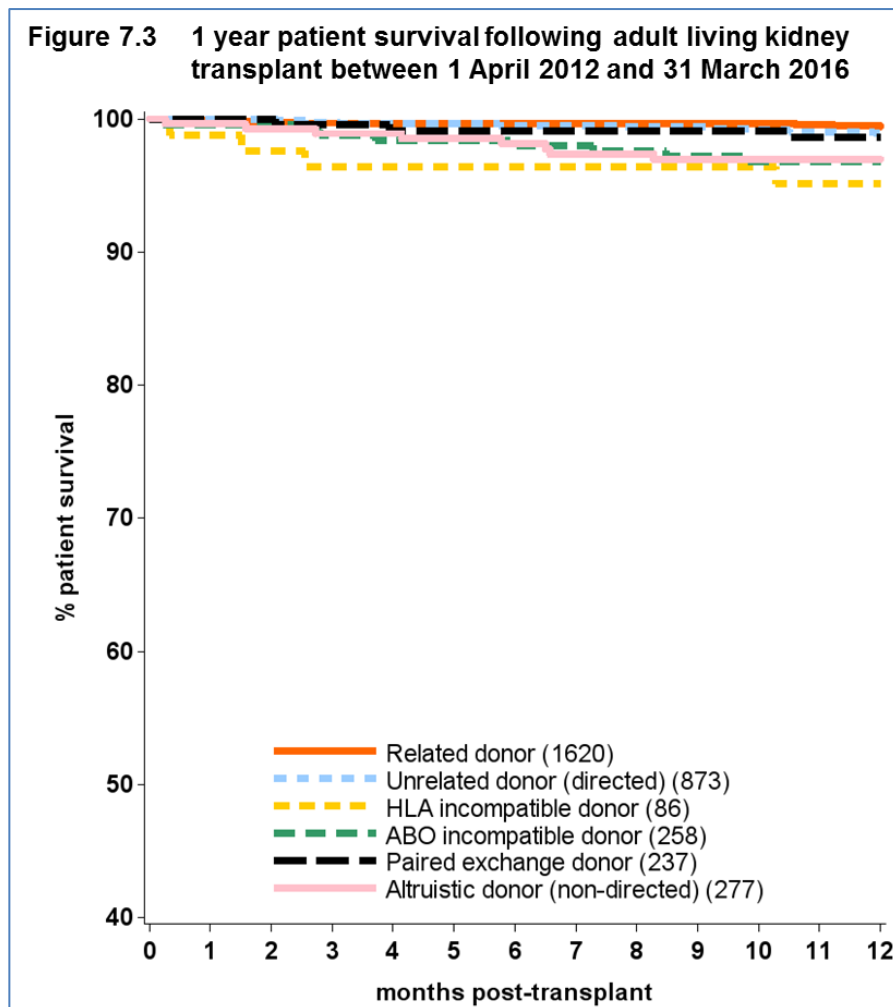


Table 7.3 1 year patient survival following living donor kidney transplant between 1 April 2012 and 31 March 2016 (p<0.0001)			
Living Donors	No. at risk on day 0	% Graft survival	(95% confidence interval)
Related donor	1620	99.4	(99-100)
Unrelated donor (directed)	873	98.9	(98-99)
Paired exchange donor	237	98.6	(96-100)
Altruistic donor (non-directed)	277	97.0	(94-98)
ABO incompatible donor	258	96.8	(94-98)
HLA incompatible donor	86	95.2	(88-98)

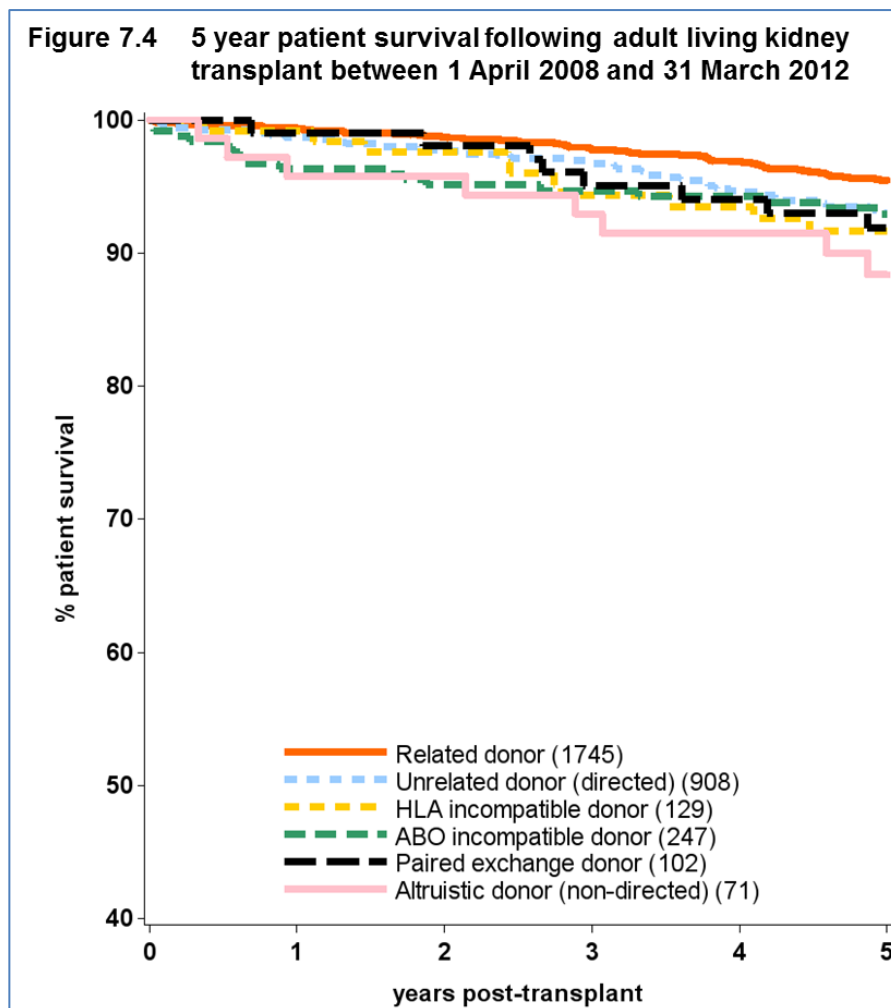


Table 7.4 5 year patient survival following living donor kidney transplant between 1 April 2008 and 31 March 2012 (p=0.0104)

Living Donors	No. at risk on day 0	% Graft survival	(95% confidence interval)
Related donor	1745	95.5	(94-96)
Unrelated donor (directed)	908	93.0	(91-94)
ABO incompatible donor	247	92.9	(89-96)
Paired exchange donor	102	91.9	(84-96)
HLA incompatible donor	129	91.6	(85-95)
Altruistic donor (non-directed)	71	88.4	(78-94)

We present a visual comparison of survival rates among centres that is based on a graphical display known as a funnel plot (1, 2). This display is used to show how consistent the rates of the different transplant units are with the national rate. Funnel plots show the survival rate plotted against the number of transplants for each centre, with the overall national survival rate (solid line), and its 95% (thin dotted lines) and 99.8% (thick dotted lines) confidence limits superimposed. Each dot in the plot represents one of the centres. Note that many patients return to local renal units for follow-up care after their transplant and although we report survival according to transplant unit, patients may in fact be followed up quite distantly from their transplant centre.

Interpreting the funnel plots

If a centre lies within all the limits, then that centre has a survival rate that is statistically consistent with the national rate. If a centre lies outside the 95% confidence limits, this serves as an alert that the centre may have a rate that is significantly different from the national rate. If a centre lies outside the 99.8% limits, then further investigations may be carried out to determine the reasons for the possible difference. When a centre lies above the upper limits, this indicates a survival rate that is higher than the national rate, while a centre that lies below the lower limits has a survival rate that is lower than the national rate. It is important to note that adjusting for patient mix through the use of risk-adjustment models may not account for all possible causes of centre differences. There may be other factors that are not taken into account in the risk-adjustment process that may affect the survival rate of a particular centre.

References

1. Tekkis PP, McCulloch P, Steger AC, Benjamin IS, Poloniecki JD. Mortality control charts for comparing performance of surgical units: validation study using hospital mortality data. *British Medical Journal* 2003; 326: 786 – 788.
2. Stark J, Gallivan S, Lovegrove J, Hamilton JRL, Monroe JL, Pollock JCS, Watterson KG. Mortality rates after surgery for congenital heart defects in children and surgeons' performance. *Lancet* 2000; 355: 1004 – 1007.

Figures 7.5 to 7.10 shows one year risk adjusted survival rates following adult living donor kidney transplants by centre for each donor type. **Table 7.5** shows the survival rates by centre and donor type.

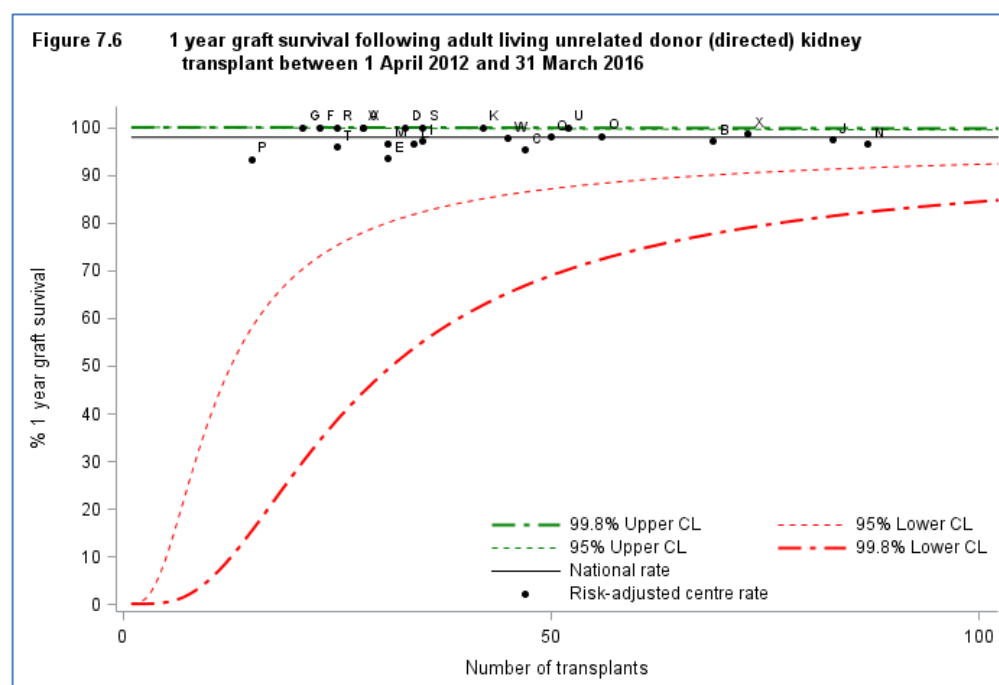
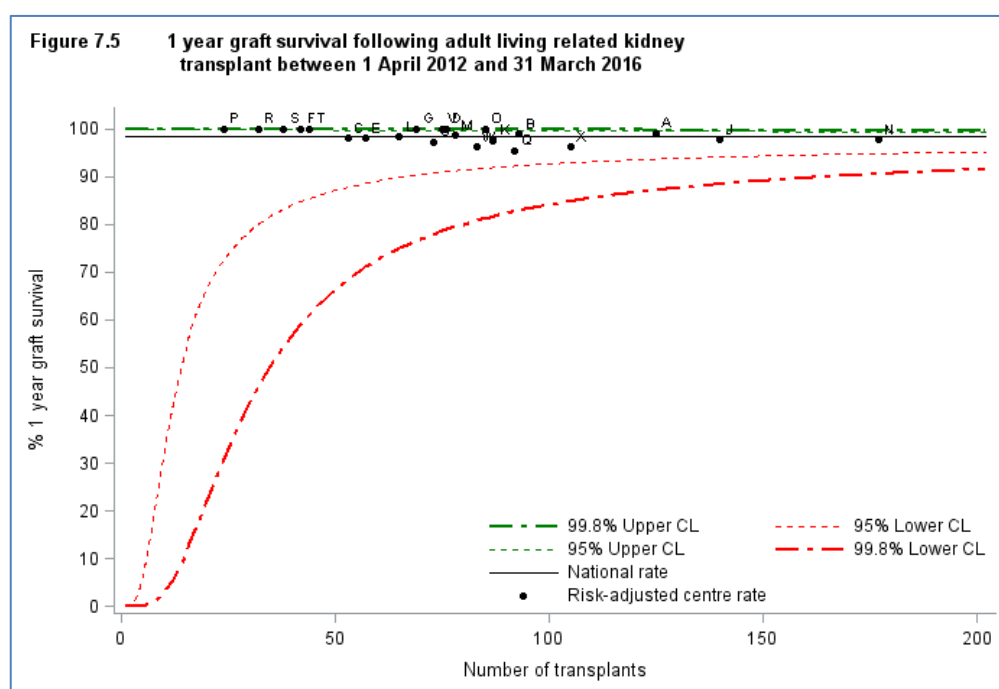


Figure 7.7 1 year graft survival following adult living HLAi donor kidney transplant between 1 April 2012 and 31 March 2016

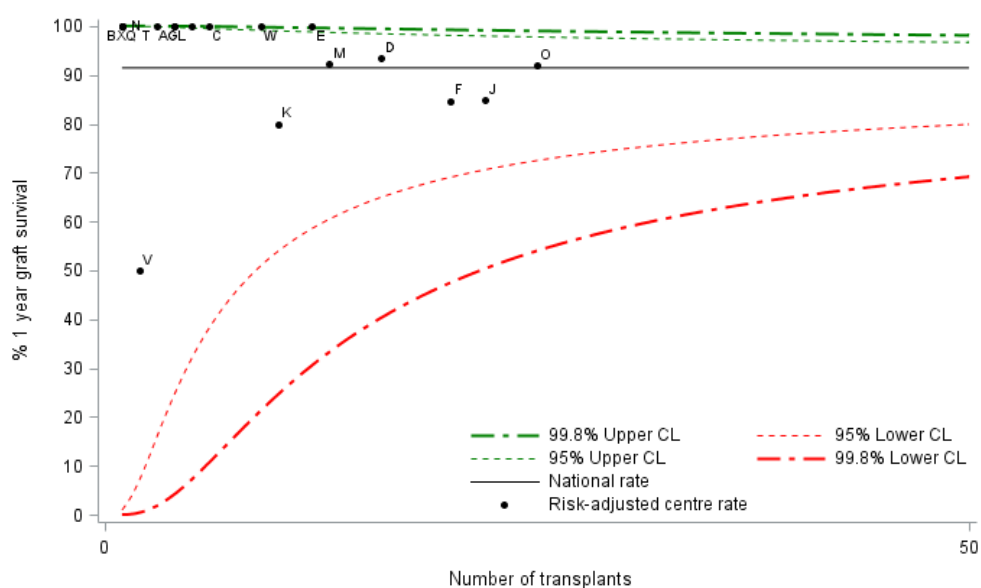


Figure 7.8 1 year graft survival following adult living ABOi donor kidney transplant between 1 April 2012 and 31 March 2016

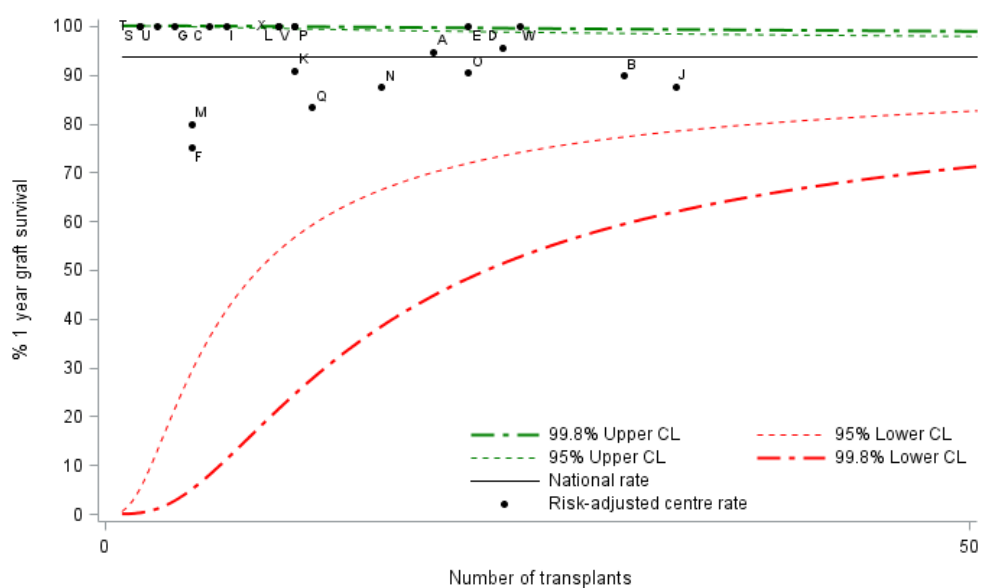


Figure 7.9 1 year graft survival following adult living paired exchange donor kidney transplant between 1 April 2012 and 31 March 2016

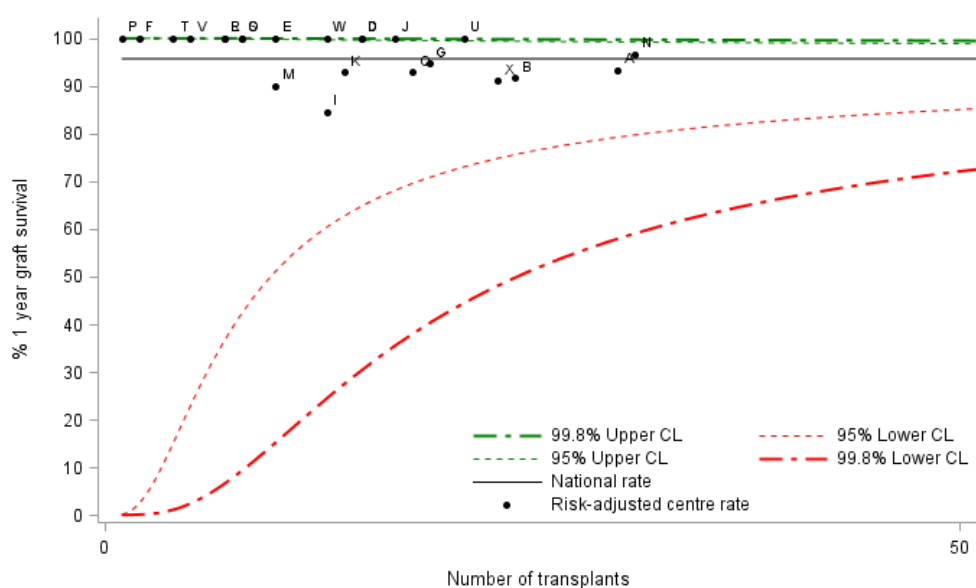


Figure 7.10 1 year graft survival following adult living altruistic donor (non-directed) kidney transplant between 1 April 2012 and 31 March 2016

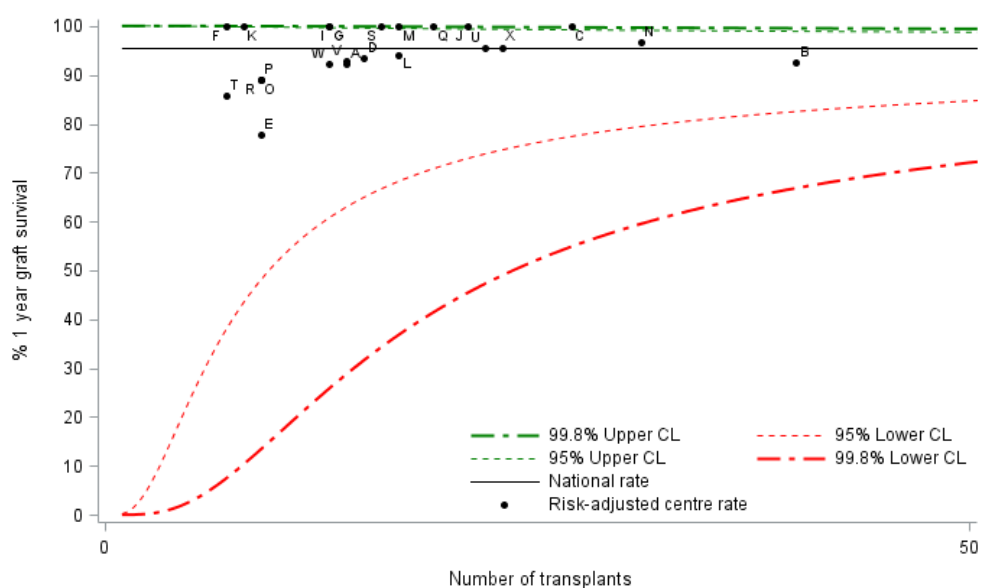


Table 7.5													
1 year graft survival following adult living donor kidney transplant between 1 April 2012 and 31 March 2016, by donor type and centre													
Centre	Code	Related		Unrelated		HLAi		ABOi		Paired		Altruistic	
		N	% ¹	N	% ¹	N	% ¹	N	% ¹	N	% ¹	N	% ¹
Belfast	A	125	99	28	100	4	100	19	95	30	93	14	92
Birmingham	B	93	99	69	97	1	100	30	90	24	92	40	93
Bristol	C	53	98	47	95	6	100	6	100	15	100	27	100
Cambridge	D	76	100	33	100	16	93	23	96	15	100	15	93
Cardiff	E	57	98	31	94	12	100	21	100	10	100	9	78
Coventry	F	42	100	23	100	20	85	5	75	2	100	7	100
Edinburgh	G	69	100	21	100	4	100	4	100	19	95	13	100
Glasgow	I	87	98	35	97	22	85	7	100	13	85	13	100
Guy's	J	140	98	83	97	10	80	33	88	17	100	21	100
Leeds	K	87	98	42	100	5	100	11	91	14	93	8	100
Leicester	L	65	98	34	97	13	92	10	100	7	100	17	94
Liverpool	M	78	99	31	97	1	100	5	80	10	90	17	100
Manchester	N	177	98	87	97	25	92	16	88	31	97	31	97
Newcastle	O	85	100	56	98	1	100	21	90	8	100	9	89
Nottingham	P	24	100	15	93	3	100	11	100	1	100	9	89
Oxford	Q	92	96	50	98	2	50	12	83	18	93	19	100
Plymouth	R	32	100	25	100	9	100	2	100	7	100	9	89
Portsmouth	S	38	100	35	100	1	100	2	100	8	100	16	100
Sheffield	T	44	100	25	96	4	100	3	100	4	100	7	86
St George's	U	73	97	52	100	1	100	11	100	21	100	22	95
The Royal Free	V	75	100	28	100	6	100	24	100	5	100	14	93
The Royal London	W	83	96	45	98	16	93	10	100	13	100	13	92
WLRTC	X	105	96	73	99	12	100	19	95	23	91	23	96
UK		1800	98	968	98	194	91	305	94	315	96	373	95
¹ % 1 year graft survival													

PAEDIATRIC

Numbers are too small to present paediatric graft and patient survival broken down by living donor transplant type. Overall living donor survival is presented in the Annual report on kidney transplantation.

Appendix

A1 Glossary of terms

ABO

The most important human blood group system for transplantation is the ABO system. Every human being is of blood group O, A, B or AB, or of one of the minor variants of these four groups. ABO blood groups are present on other tissues and, unless special precautions are taken, a group A kidney transplanted to a group O patient will be rapidly rejected.

Active transplant list

When a patient is registered for a transplant, they are registered on what is called the 'active' transplant list. This means that when a donor kidney becomes available, the patient is included among those who are matched against the donor to determine whether or not the kidney is suitable for them. It may sometimes be necessary to take a patient off the transplant list, either temporarily or permanently. This may be done, for example, if someone becomes too ill to receive a transplant. The patient is told about the decision to suspend them from the list and is informed whether the suspension is temporary or permanent. If a patient is suspended from the list, they are not included in the matching of any donor kidneys that become available.

Case mix

The types of patients treated at a unit for a common condition. This can vary across units depending on the facilities available at the unit as well as the types of people in the catchment area of the unit. The definition of what type of patient a person is depends on the patient characteristics that influence the outcome of the treatment. For example the case mix for patients registered for a kidney transplant is defined in terms of various factors such as the blood group, tissue type and age of the patient. These factors have an influence on the chance of a patient receiving a transplant.

Confidence interval (CI)

When an estimate of a quantity such as a survival rate is obtained from data, the value of the estimate depends on the set of patients whose data were used. If, by chance, data from a different set of patients had been used, the value of the estimate may have been different. There is therefore some uncertainty linked with any estimate. A confidence interval is a range of values whose width gives an indication of the uncertainty or precision of an estimate. The number of transplants or patients analysed influences the width of a confidence interval. Smaller data sets tend to lead to wider confidence intervals compared to larger data sets. Estimates from larger data sets are therefore more precise than those from smaller data sets. Confidence intervals are calculated with a stated probability, usually 95%. We then say that there is a 95% chance that the confidence interval includes the true value of the quantity we wish to estimate.

Confidence limit

The upper and lower bounds of a confidence interval.

Cox Proportional Hazards model

A statistical model that relates the instantaneous risk (hazard) of an event occurring at a given time point to the risk factors that influence the length of time it takes for the

event to occur. This model can be used to compare the hazard of an event of interest, such as graft failure or patient death, across different groups of patients.

Cross-match

A cross-match is a test for patient antibodies against donor antigens. A positive cross-match shows that the donor and patient are incompatible. A negative cross-match means there is no reaction between donor and patient and that the transplant may proceed.

Funnel plot

A graphical method that shows how consistent the survival rates of the different transplant units are compared to the national rate. The graph shows for each unit, a survival rate plotted against the number of transplants undertaken, with the national rate and confidence limits around this national rate superimposed. In this report, 95% and 99.8% confidence limits were used. Units that lie within the confidence limits have survival rates that are statistically consistent with the national rate. When a unit is close to or outside the limits, this is an indication that the centre may have a rate that is considerably different from the national rate.

Graft survival rate

The percentage of patients whose grafts are still functioning. This is usually specified for a given time period after transplant. For example, a five-year transplant survival rate is the percentage of transplants still functioning five years after transplant.

HLA mismatch

Human Leucocyte Antigen (HLA) antigens are carried on many cells in the body and the immune system can distinguish between those that can be recognised as 'self' (belonging to you or identical to your own) and those that can be recognised as 'nonself'. The normal response of the immune system is to attack foreign/non-self material by producing antibodies against the foreign material. This is one of the mechanisms that provide protection against infection. This is unfortunate from the point of view of transplantation as the immune system will see the graft as just another 'infection' to be destroyed, produce antibodies against the graft and rejection of the grafted organ will take place. To help overcome this response, it is recognised that 'matching' the recipient and donor on the basis of HLA (and blood group) reduces the chances of acute rejection and, with the added use of immunosuppressive drugs, very much improves the chances of graft survival. 'Matching' refers to the similarity of the recipient HLA type and donor HLA type. HLA mismatch refers to the number of mismatches between the donor and the recipient at the A, B and DR (HLA) loci. There can only be a total of two mismatches at each locus. For example, an HLA mismatch value of 000, means that the donor and recipient are identical at all three loci, while an HLA mismatch value of 210 means that the donor and recipient differ completely at the A locus, are partly the same at the B locus and are identical at the DR locus.

Inter-quartile range

The values between which the middle 50% of the data fall. The lower boundary is the lower quartile, the upper boundary the upper quartile.

Kaplan-Meier method

A method that allows patients with incomplete follow-up information to be included in estimating survival rates. For example, in a cohort for estimating one year patient survival rates, a patient was followed up for only nine months before they relocated. If we calculated a crude survival estimate using the number of patients who survived for at least a year, this patient would have to be excluded as it is not known whether or not the patient was still alive at one year after transplant. The Kaplan-Meier method allows information about such patients to be used for the length of time that they are followed-up, when this information would otherwise be discarded. Such instances of incomplete follow-up are not uncommon and the Kaplan-Meier method allows the computation of estimates that are more meaningful in these cases.

Live donor

A donor who is a living person and who is usually, but not always, a relative of the transplant patient. For example, a parent may donate one of their kidneys to their child.

Median

The midpoint in a series of numbers, so that half the data values are larger than the median, and half are smaller.

Multi-organ transplant

A transplant in which the patient receives more than one organ. For example, a patient may undergo a transplant of a kidney and liver.

National Kidney Allocation Scheme

A nationally agreed set of rules for sharing and allocating kidneys for transplant between transplant centres in the UK. The scheme is administered by NHS Blood and Transplant.

Patient survival rate

The percentage of patients who are still alive (whether the graft is still functioning or not). This is usually specified for a given time period after transplant. For example, a five-year patient survival rate is the percentage of patients who are still alive five years after their first transplant.

p value

In the context of comparing survival rates across centres, the p value is the probability that the differences observed in the rates across centres occurred by chance. As this is a probability, it takes values between 0 and 1. If the p value is small, say less than 0.05, this implies that the differences are unlikely to be due to chance and there may be some identifiable cause for these differences. If the p value is large, say greater than 0.1, then it is quite likely that any differences seen are due to chance.

Pre-emptive

Patients that are placed on the kidney transplant list or receive a transplant prior to the need for dialysis are termed as pre-emptive. Patients listed pre-emptively will usually require dialysis within six months of being placed on the transplant list.

Risk-adjusted survival rate

Some transplants have a higher chance than others of failing at any given time. The differences in expected survival times arise due to differences in certain factors, the risk factors, among patients. A risk-adjusted survival rate for a centre is the expected survival rate for that centre given the case mix of their patients. Adjusting for case mix in estimating centre-specific survival rates allows valid comparison of these rates across centres and to the national rate.

Risk factors

These are the characteristics of a patient, transplant or donor that influence the length of time that a graft is likely to function or a patient is likely to survive following a transplant. For example, when all else is equal, a transplant from a younger donor is expected to survive longer than that from an older donor and so donor age is a risk factor.

Unadjusted survival rate

Unadjusted survival rates do not take account of risk factors and are based only on the number of transplants at a given centre and the number and timing of those that fail within the post-transplant period of interest. In this case, unlike for risk-adjusted rates, all transplants are assumed to be equally likely to fail at any given time. However, some centres may have lower unadjusted survival rates than others simply because they tend to undertake transplants that have increased risks of failure. Comparison of unadjusted survival rates across centres and to the national rate is therefore inappropriate.

A2 Statistical methodology for survival rate estimation

Unadjusted estimates of patient and graft survival are given for each centre. Unadjusted rates give an estimate of what the survival rate at a centre is, assuming that all patients at the centre have the same chance of surviving a given length of time after transplant.

Computing unadjusted survival rates

Unadjusted survival rates were calculated using the Kaplan-Meier method, which allows patients with incomplete follow-up information to be included in the computation. For example, in a cohort for estimating one-year patient survival rates, a patient was followed up for only nine months before they relocated. If we calculated a crude survival estimate using the number of patients who survived for at least a year, this patient would have to be excluded, as it is not known whether or not the patient was still alive one year after transplant. The Kaplan-Meier method allows information about such patients to be used for the length of time that they are followed-up, when this information would otherwise be discarded. Such instances of incomplete follow-up are not uncommon in the analysis of survival data and the Kaplan-Meier method therefore allows the computation of survival estimates that are more meaningful.

Prepared by:

Statistics and Clinical Studies, NHS Blood and Transplant

Miss Laura Pankhurst

Mr Mathew Robb

Mrs Lisa Bradbury

Miss Chloe Brown