



Blood and Transplant

ANNUAL REPORT ON KIDNEY TRANSPLANTATION

**REPORT FOR 2013/2014
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Contents



1	Executive Summary.....	1
2	Introduction.....	3
	ADULT.....	8
3	Transplant list.....	8
3.1	Patients on the kidney transplant list as at 31 March, 2005 – 2014	9
3.2	Post-registration outcomes, 1 April 2010 – 31 March 2011.....	11
3.3	Demographic characteristics, 1 April 2013 – 31 March 2014.....	12
3.4	Patient waiting times for those currently on the list, 31 March 2014	13
3.5	Median waiting time to transplant, 1 April 2008 - 31 March 2011.....	14
3.6	Pre-emptive listing rates, 1 April 2012 - 31 March 2013.....	16
4	Response to kidney offers	17
4.1	Standard criteria offer decline rates, 1 April 2011 – 31 March 2014	19
4.2	Extended criteria offer decline rates, 1 April 2011 – 31 March 2014.....	21
4.3	Reallocation of kidneys, 1 April 2011 – 31 March 2014	23
5	Transplants.....	25
5.1	Kidney only transplants, 1 April 2004 – 31 March 2014	26
5.2	Pre-emptive transplant rates, 1 April 2013 - 31 March 2014.....	29
5.3	Kidney donor risk-index ¹ , 1 April 2011 – 31 March 2014	30
5.3	Cold ischaemia time, 1 April 2011 – 31 March 2014.....	34
6	Kidney outcomes.....	41
6.1	Deceased donor graft and patient survival.....	43
6.2	Living donor graft and patient survival.....	46
6.3	Graft and patient survival from listing	50
	PAEDIATRIC.....	52
8	Transplant list.....	52
8.1	Patients on the kidney transplant list as at 31 March, 2005 – 2014	53
8.2	Demographic characteristics, 1 April 2013 – 31 March 2014.....	55
8.3	Patient waiting times for those currently on the list, 31 March 2014	56
8.4	Median waiting time to transplant, 1 April 2008 - 31 March 2011.....	57
8.5	Pre-emptive listing rates, 1 April 2013 - 31 March 2014.....	59
9	Response to kidney offers	60
9.1	Standard criteria offer decline rates, 1 April 2011 – 31 March 2014	62
10	Transplants.....	63
10.1	Kidney only transplants, 1 April 2004 – 31 March 2014	64
10.2	Pre-emptive transplant rates, 1 April 2013 - 31 March 2014.....	66

11	Kidney outcomes.....	67
11.1	Deceased donor graft and patient survival.....	69
11.2	Living donor graft and patient survival.....	72
Appendix	75
A1	Glossary of terms.....	76
A2	Statistical methodology and risk-adjustment for survival rate estimation	80
A3	Factors used in risk-adjusted models for patient survival from listing	82

Executive Summary

This report presents key figures about kidney transplantation in the UK. The period reported covers 10 years of transplant data, from 1 April 2004. The report presents information on the number of transplants and survival analysis after first kidney only transplantation on a national and centre-specific basis.

Key findings

- On 31 March 2014, there were 5,590 adult patients on the UK active kidney [transplant list](#) which represents a 7% decrease in the number of patients a year earlier. The equivalent number of paediatric patients was 70, representing a 7% decrease from the previous year
- There were 2,930 adult kidney only transplants performed in the UK in 2013/14 an increase of 9% compared to 2012/13. Of these, 1,101 were from [DBD](#) donors, 779 were from [DCD](#) donors and 1,050 were from living donors. The equivalent number of paediatric transplants was 125 representing a 5% increase from the previous year.
- The national rate of [graft survival](#) five years after first adult deceased donor kidney only transplant is 86%. These rates vary between centres, ranging from 81% to 92% (risk-adjusted). The equivalent rate after first paediatric deceased donor kidney only transplant is 94%, ranging from 72% to 100%.
- The national rate of [graft survival](#) five years after first adult living donor kidney only transplant is 91%. These rates vary between centres, ranging from 84% to 97% (risk-adjusted). The equivalent rate after first paediatric living donor kidney only transplant is 94%, ranging from 85% to 100%.
- The national rate of ten year [patient survival](#) from listing for deceased donor kidney only transplants in adult patients is 75%. These rates vary between centres, ranging from 69% to 84% (risk-adjusted).

Introduction

This report presents information on transplant activity between 1 April 2004 and 31 March 2014, for all 24 centres performing 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 2009 to 31 March 2013 and five-year post-transplant for the period 1 April 2005 to 31 March 2009. Results are described separately according to the type of donor (deceased and living).

[Patient survival](#) from listing is reported at one, five and ten year post registration for a deceased donor adult kidney only transplant between 1 January 2002 and 31 December 2013.

The centre specific results for survival estimates are adjusted for differences in [risk factors](#) between the centres. The risk models used are described in the Appendix.

Patients requiring [multi-organ transplants](#) are excluded from all analyses and all results are described separately for adult (aged \geq 18years) and paediatric patients (aged $<$ 18 years) other than those presented in this Introduction section.

Throughout this report West London Renal and Transplant Centre is labeled as WLRTC.

Figure 2.1 shows the number of patients on the kidney [transplant list](#) at 31 March each year between 2005 and 2014. The number of patients actively waiting for a kidney transplant increased each year from 5,431 in 2005 to 7,190 in 2009 and has since been on the decline falling to 5,881 in 2014.

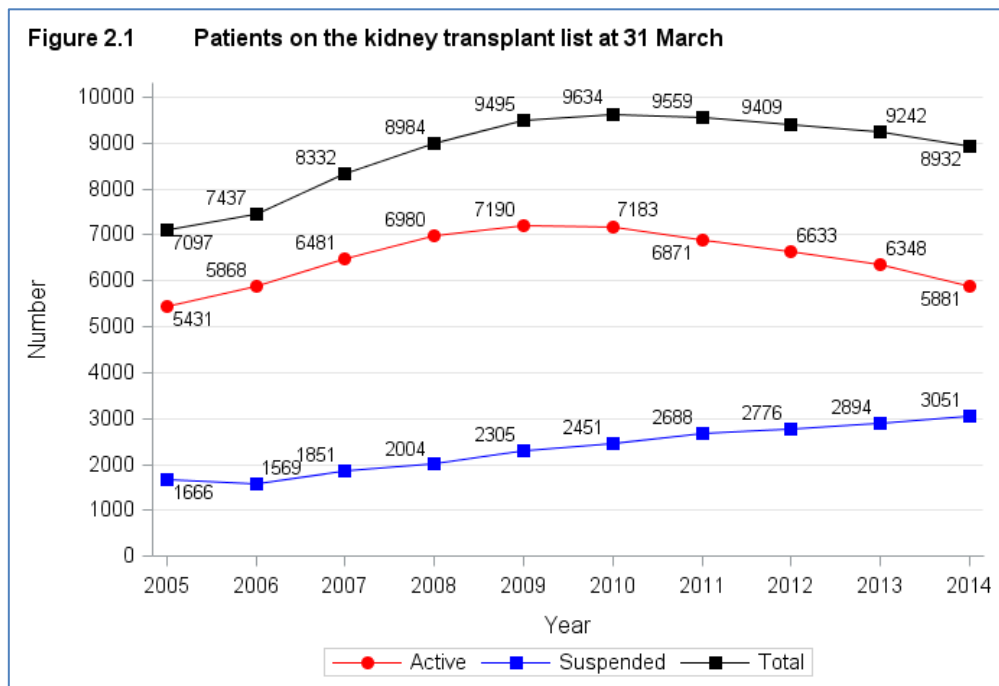


Figure 2.2 shows the number of patients on the kidney [transplant list](#) at 31 March 2014 for each transplant centre. Manchester has the largest active [transplant list](#) with 552 patients registered for a kidney transplant.

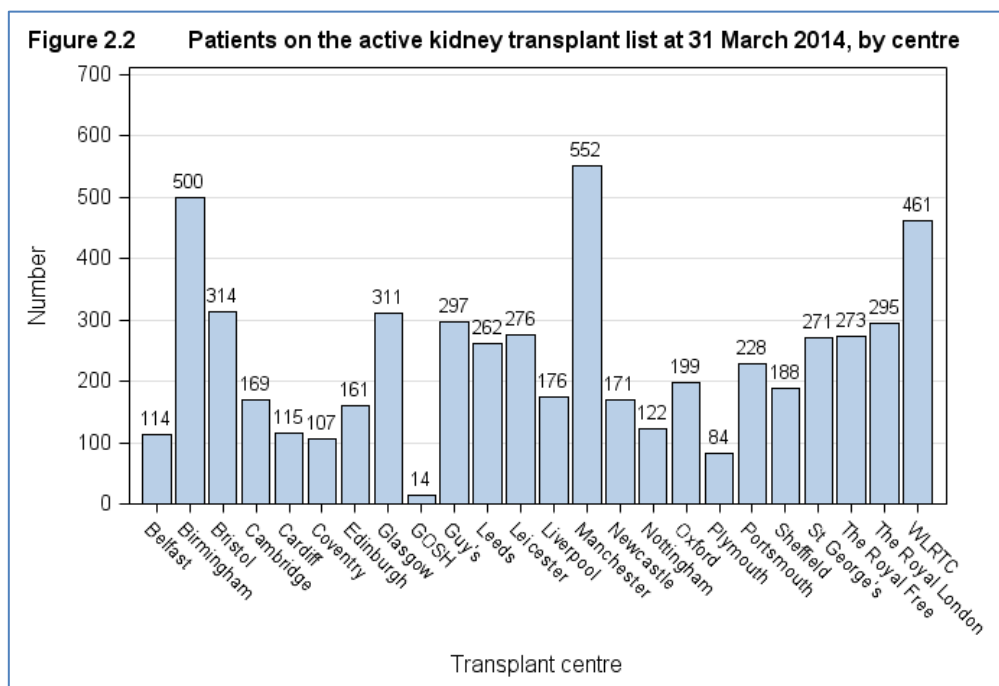


Figure 2.3 shows the total number of kidney transplants performed in the last ten years. The number of transplants has been steadily increasing each year from 1,783 in 2004/05 to 3,255 in 2013/14.

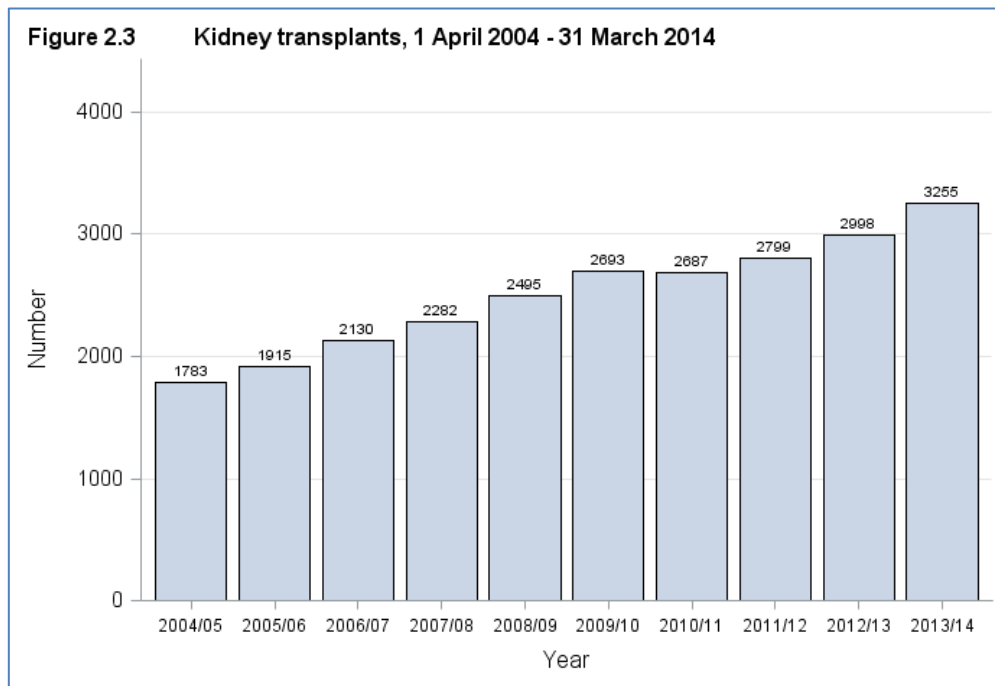


Figure 2.4 shows the total number of kidney transplants performed in 2013/14 at each transplant centre. Manchester performed the most kidney transplants last year with 274 patients receiving a transplant.

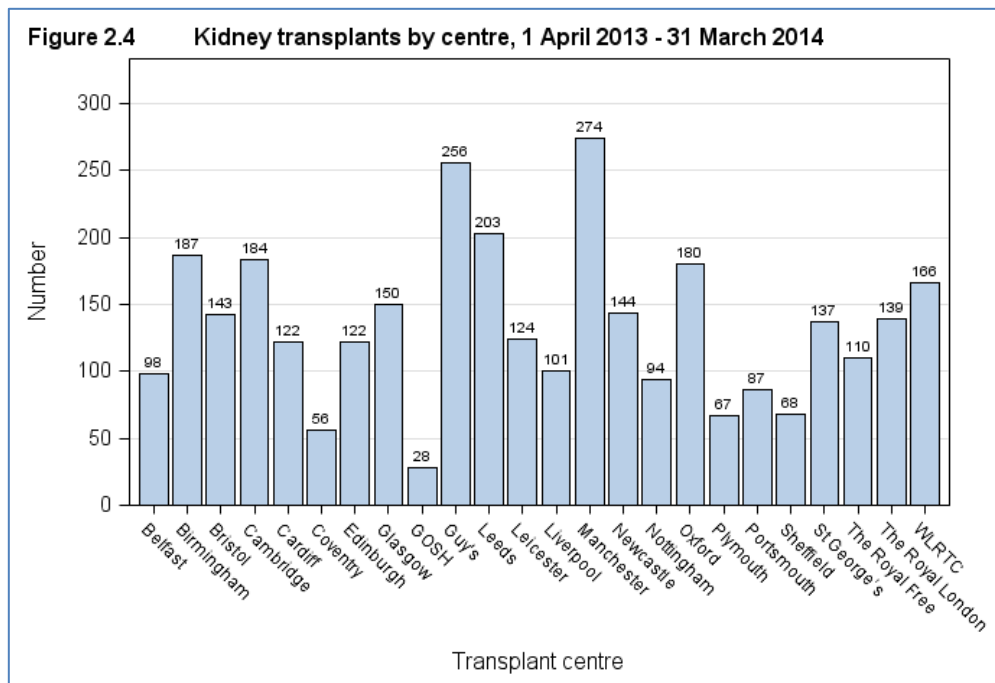
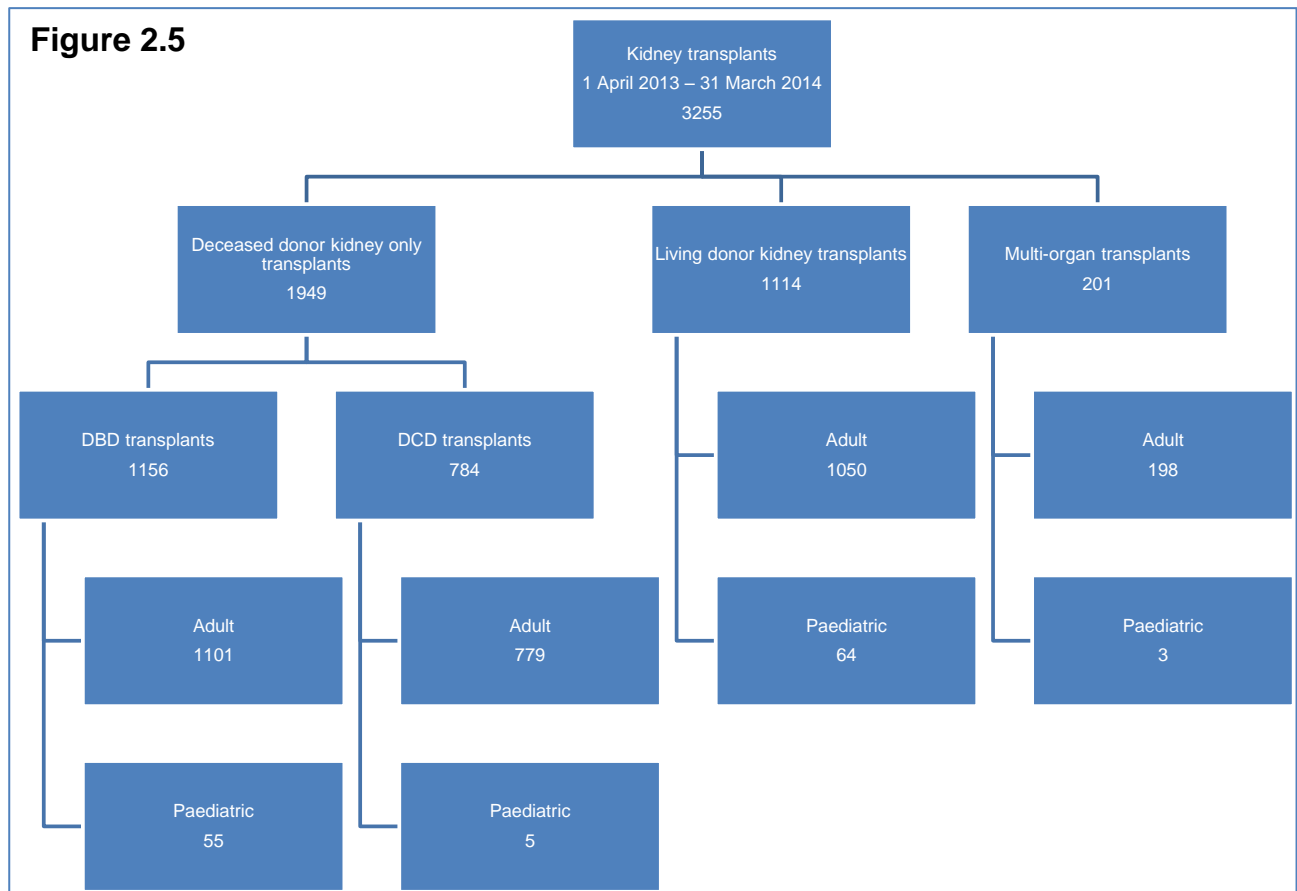


Figure 2.5 details the 3,255 kidney transplants performed in the UK between 1 April 2013 and 31 March 2014. Of these, 1,949 (60%) were deceased donor kidney only transplants and 1,114 (34%) were living donor kidney transplants. Of the 201 [multi-organ transplants](#), 188 were simultaneous kidney and pancreas transplants, 12 were kidney and liver transplants and 1 was a kidney and heart transplant.



Adult kidney transplant list

3.1 Patients on the kidney transplant list as at 31 March, 2005 – 2014

Figure 3.1 shows the number of adult patients on the kidney only [transplant list](#) at 31 March each year between 2005 and 2014. The number of patients actively waiting for a kidney transplant increased each year from 5,212 in 2005 to 6,813 in 2009 and has since been on the decline falling to 5,590 in 2014.

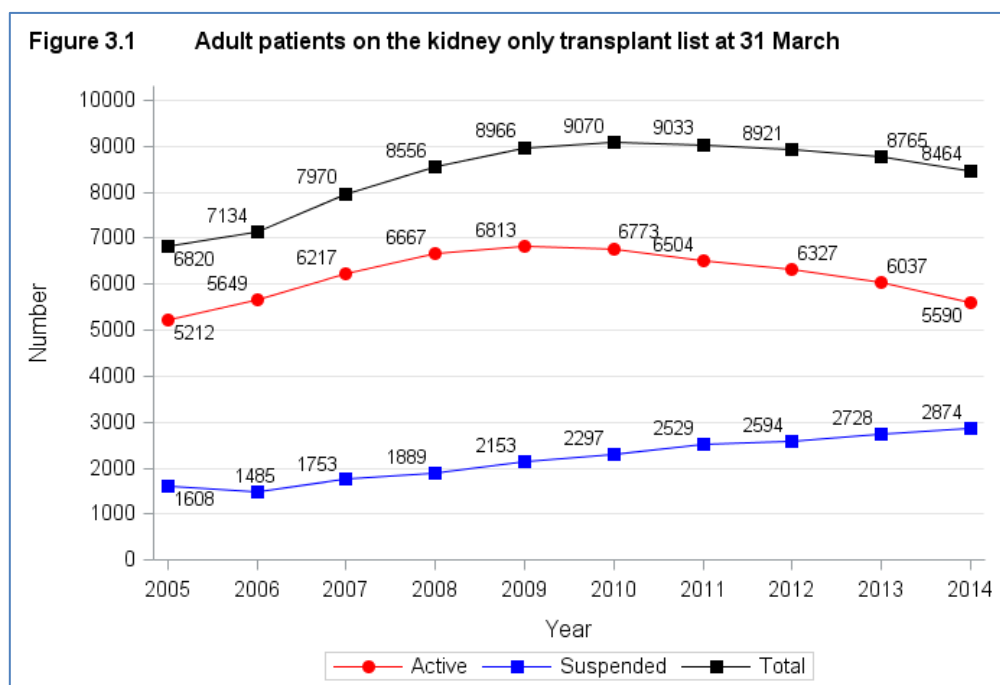


Figure 3.2 shows the number of adult patients on the active kidney only [transplant list](#) at 31 March 2014 by centre. In total, there were 5,590 adults patients. Manchester had the largest proportion of the [transplant list](#) (10%) and Plymouth had the smallest (2%).

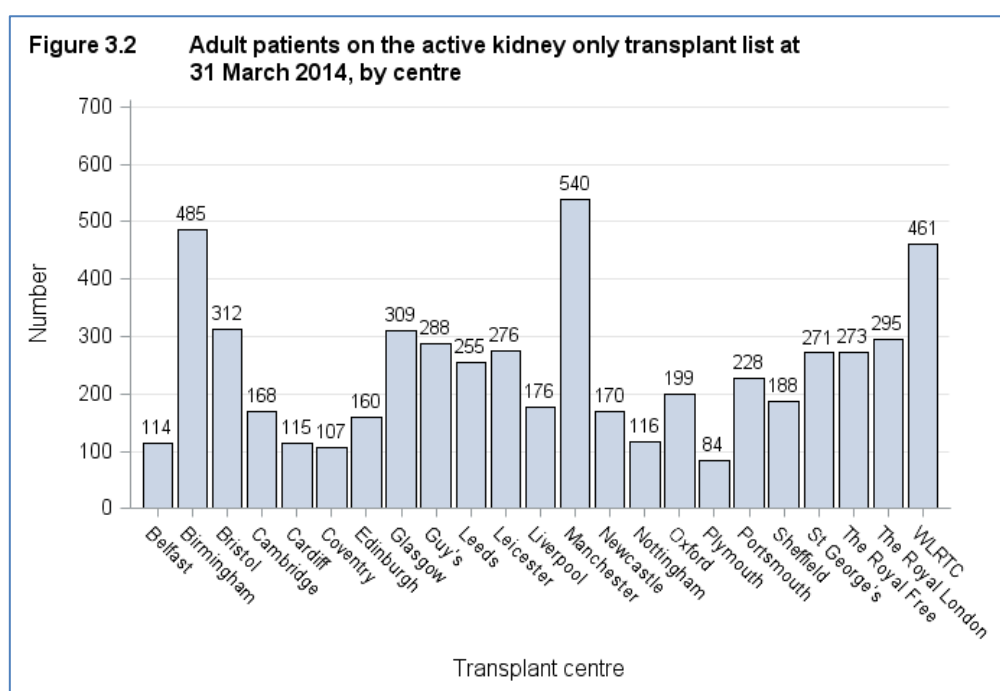
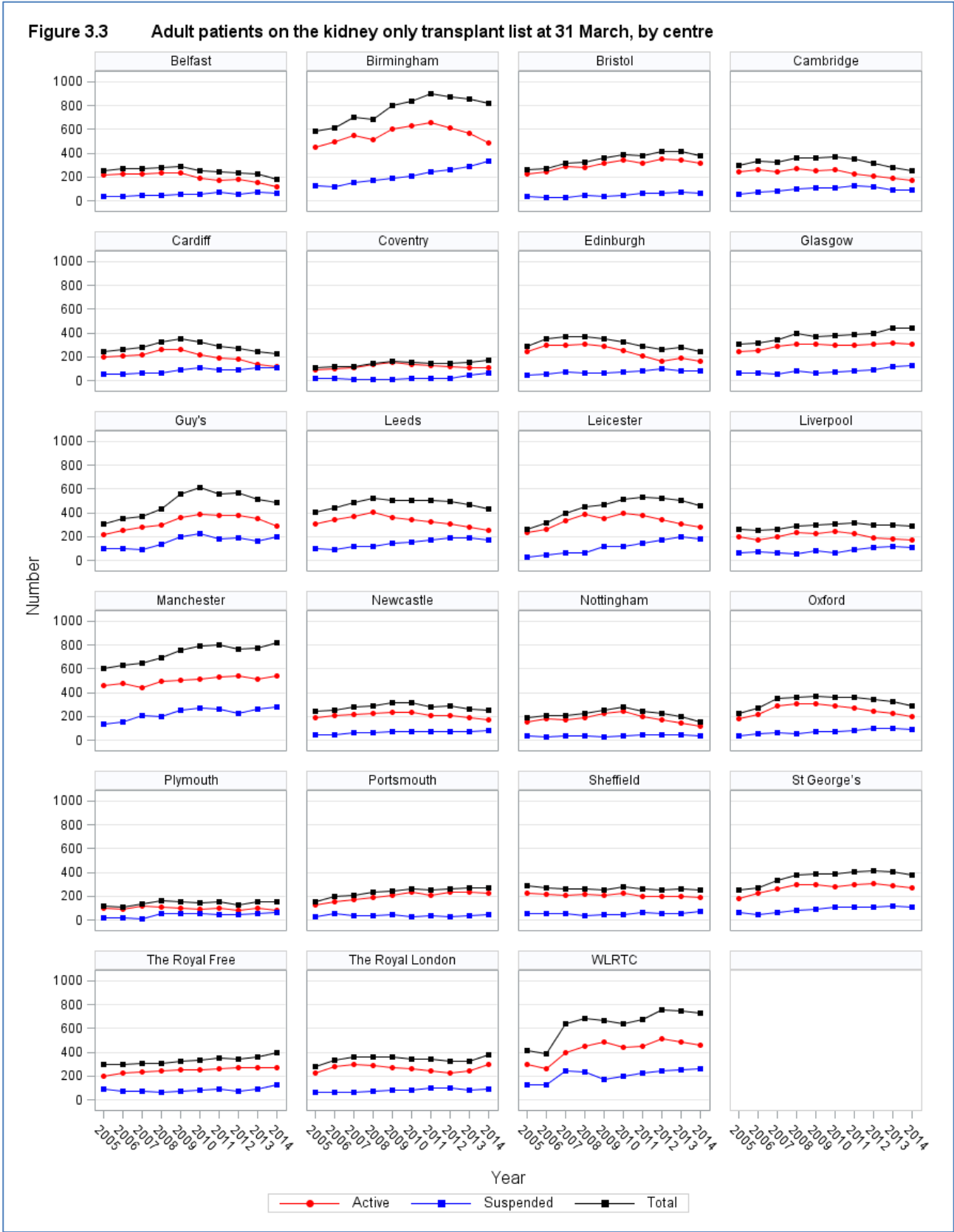


Figure 3.3 shows the number of adult patients on the [transplant list](#) at 31 March each year between 2005 and 2014 for each transplant centre.



3.2 Post-registration outcomes, 1 April 2010 – 31 March 2011

An indication of outcomes for patients listed for a kidney transplant is summarised in **Figure 3.4**. This shows the proportion of patients transplanted or still waiting one and three years after joining the list. It also shows the proportion removed from the [transplant list](#) (typically because they become too unwell for transplant) and those dying while on the [transplant list](#). Only 21% of patients are transplanted within one year, while three years after listing 52% of patients have received a transplant.

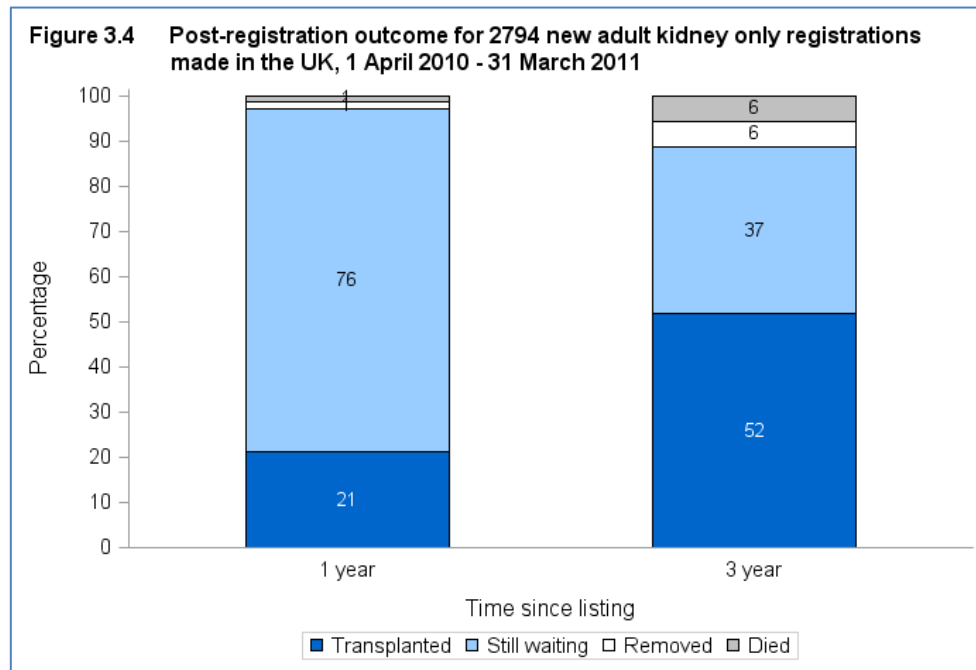
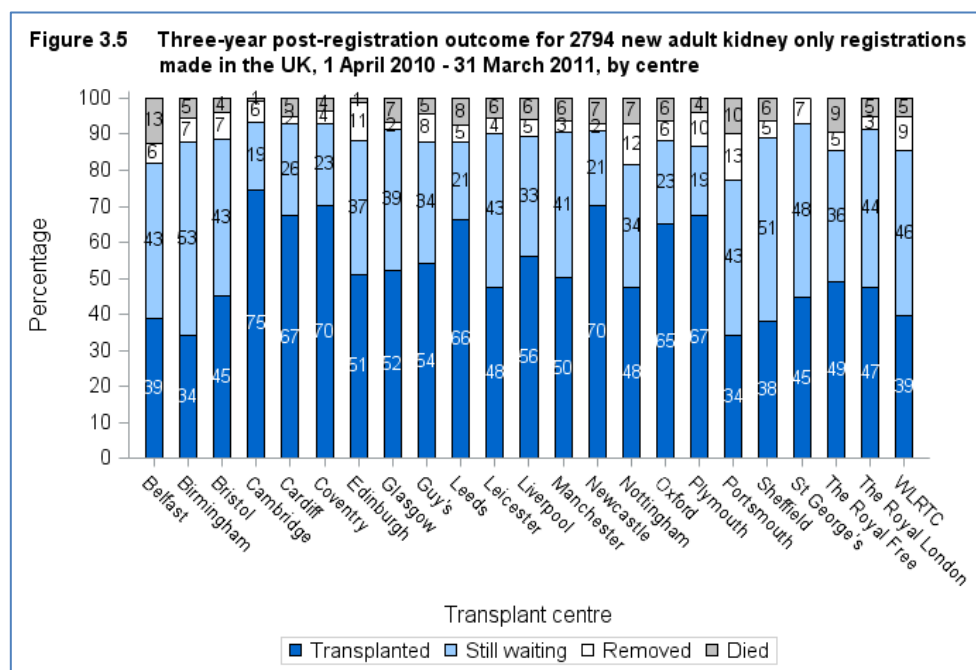
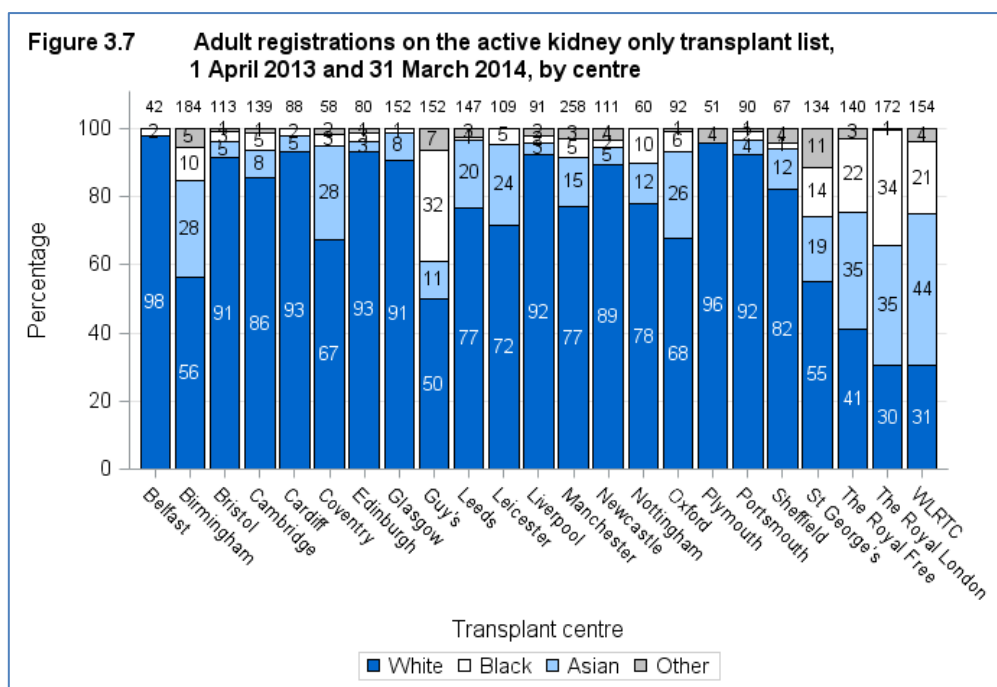
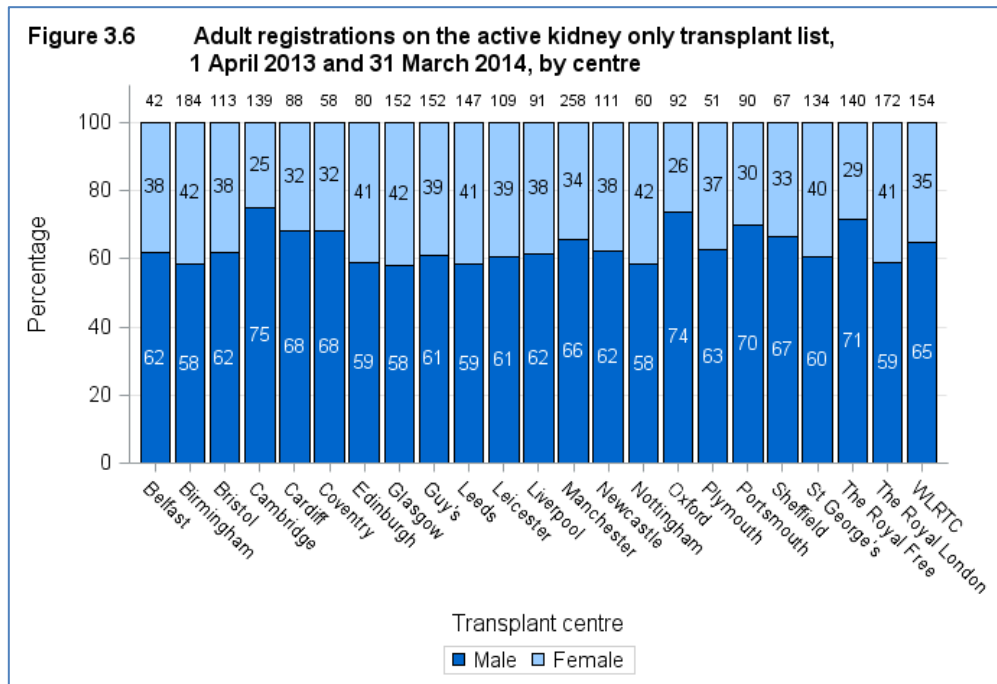


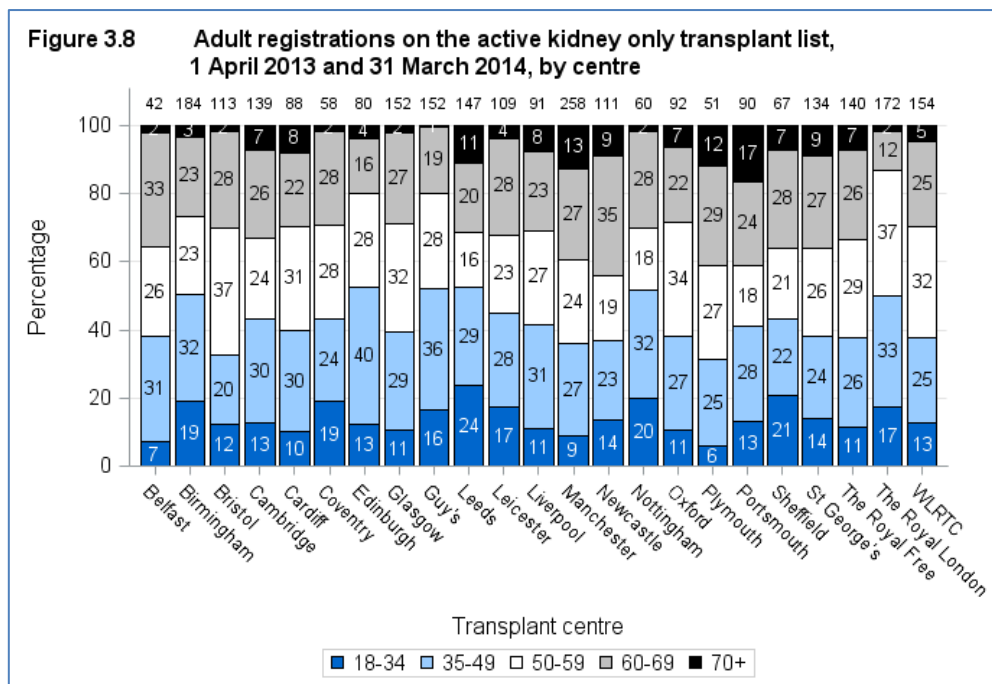
Figure 3.5 shows the proportion of patients transplanted or still waiting three years after joining the list by centre. The proportion of patients transplanted three years after listing at each centre ranges from 34% at Birmingham and Portsmouth to 75% at Cambridge. Higher proportions of transplanted patients can in part be attributed to strong [DCD](#) programmes within centres.



3.3 Demographic characteristics, 1 April 2013 – 31 March 2014

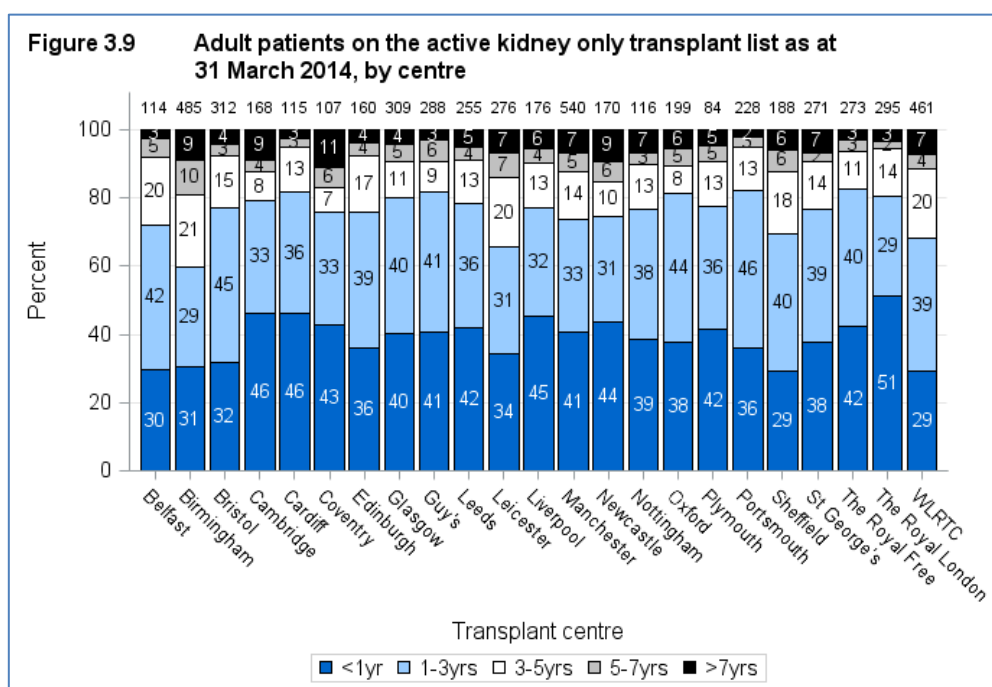
The sex, ethnicity and age group of patients on the transplant are shown by centre in **Figure 3.6, 3.7** and **3.8**, respectively. Note that all percentages quoted are based only on data where relevant information was available. Changes made to the Kidney Allocation Scheme in 2006 mean that tissue matching criteria between donor and recipient are less strict than previously and waiting time to transplant is now more important than it was in deciding kidney allocation. These changes have an indirect benefit for patients from ethnic minority groups, who are less often a good tissue match with the predominantly white donor pool. As a result, access to transplantation is becoming more equitable.





3.4 Patient waiting times for those currently on the list, 31 March 2014

Figure 3.9 shows the length of time patients have been waiting on the kidney only [transplant list](#) at 31 March 2014 by centre. A small proportion of patients have been waiting for a transplant for more than seven years, 98% of these are highly sensitised with a calculated reaction frequency (cRF) of 85% or higher. 69% have a cRF of 100% which makes these patients very difficult to match.



3.5 Median waiting time to transplant, 1 April 2008 - 31 March 2011

The length of time a patient waits for a kidney transplant varies across the UK. The [median](#) waiting time for adult deceased donor kidney only transplantation is shown in **Figure 3.10** and **Table 3.1** for patients registered at each individual unit. During this period local allocation arrangements were in place for [DCD](#) kidneys while [DBD](#) kidneys were allocated via the [National Kidney Allocation Scheme](#). The data shown are for all adult patients, joining the list within the time period shown, including those still awaiting a transplant on the day of analysis. Patients who received a [live donor](#) or [multi-organ transplant](#) are not included. The national allocation scheme introduced in April 2006 is slowly reducing the variability in deceased donor kidney waiting times across the country but currently some variability remains. Waiting times across centres continue to differ in a way that it is difficult for centres to control, given that the [National Kidney Allocation Scheme](#) determines allocation of all kidneys available for transplant from donors after brain death ([DBD](#)).

National Kidney Allocation Scheme

Only kidneys from donors after brain death were allocated via a national allocation scheme during the time period analysed. Kidneys from donations after circulatory death ([DCD](#)) were allocated to patients through local allocation arrangements and these vary across the country because some centres have a larger [DCD](#) programme than others. As of 3 September 2014 one kidney from [DCD](#) donors aged between 5 and 49 years will be allocated within four pre-defined regions using the 2006 [DBD](#) allocation principles and as such we should start to see further reductions in variability in waiting times across the country.

Kidneys from [DBD](#) are allocated to patients listed nationally through the Kidney Allocation Scheme. The Kidney Allocation Scheme introduced in April 2006 prioritises patients with ideal tissue matches (000 [HLA mismatches](#)) and then assigns points to patients based on the level of tissue match between donor and recipient, the length of time spent waiting for a transplant, age of the recipient (with a progressive reduction in points given after the age of thirty) and location points such that patients geographically close to the retrieval centre receive more points. The patients with the highest number of points for a donated kidney are preferentially offered the kidney, no matter where in the UK they receive their treatment.

The [median](#) waiting time to transplant for adult patients registered on the kidney only [transplant list](#) between 1 April 2008 and 31 March 2011 is 1082 days, just under 3 years. This ranged from 572 days at Cambridge to 1768 days at Leicester.

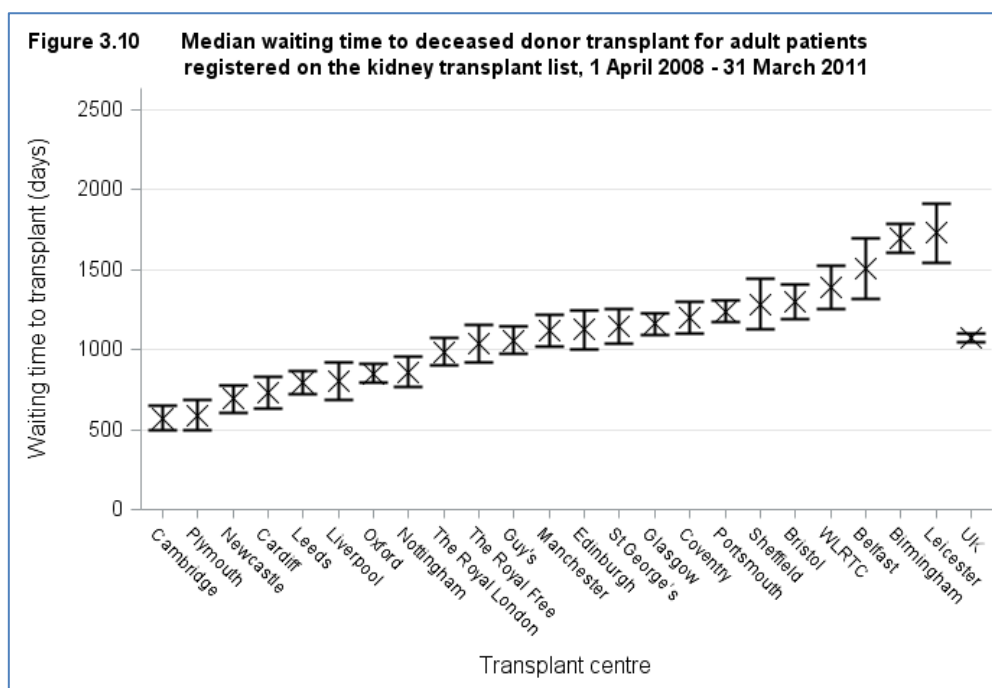
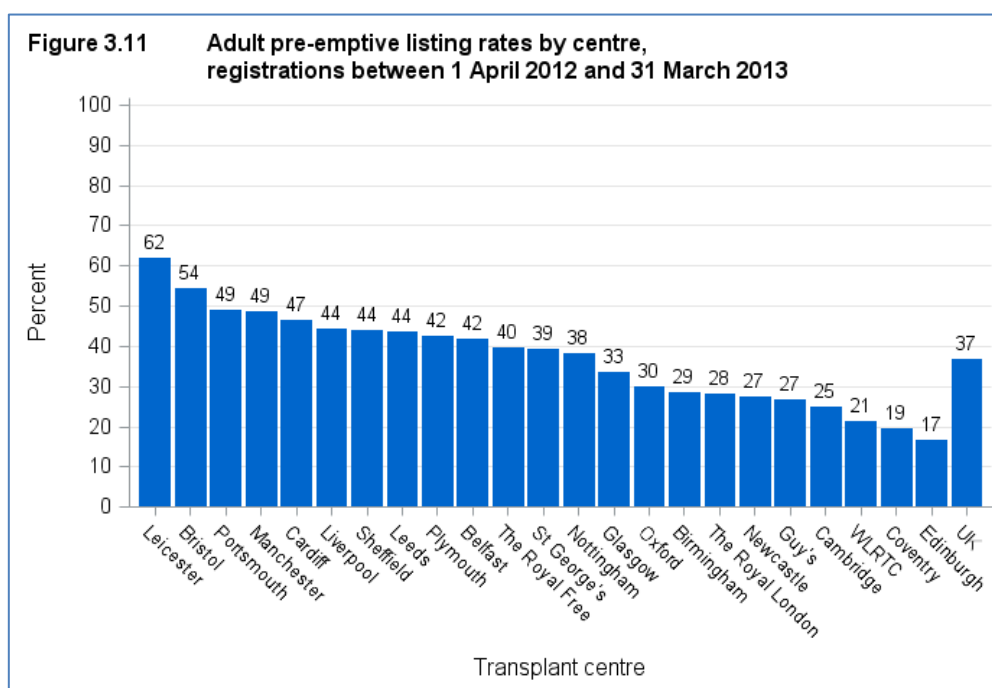


Table 3.1 [Median](#) waiting time to kidney only transplant in the UK, for adult patients registered 1 April 2008 - 31 March 2011

Transplant centre	Number of patients registered	Waiting time (days)	
		Median	95% Confidence interval
Adult			
Cambridge	367	572	491 - 653
Plymouth	168	599	510 - 688
Newcastle	261	694	608 - 780
Cardiff	249	747	652 - 842
Leeds	365	799	733 - 865
Liverpool	290	805	695 - 915
Oxford	303	852	795 - 909
Nottingham	241	863	761 - 965
The Royal London	280	988	893 - 1083
The Royal Free	264	1043	904 - 1182
Guy's	412	1060	974 - 1146
Manchester	528	1138	1036 - 1240
Edinburgh	200	1149	1024 - 1274
Glasgow	263	1162	1083 - 1241
St George's	268	1180	1070 - 1290
Coventry	95	1205	1108 - 1302
Portsmouth	231	1245	1173 - 1317
Sheffield	185	1285	1059 - 1511
Bristol	324	1322	1199 - 1445
WLRTC	457	1386	1246 - 1526
Belfast	126	1631	1363 - 1899
Birmingham	570	1735	1650 - 1820
Leicester	269	1768	1556 - 1980
UK	6716	1082	1055 - 1109

3.6 Pre-emptive listing rates, 1 April 2012 - 31 March 2013

Rates of [pre-emptive](#) kidney only listings are shown in **Figure 3.11** for adult patients joining the list between 1 April 2012 and 31 March 2013. Patients listed on the deceased donor [transplant list](#) prior to receiving a living donor transplant are excluded and in order to remove the effect of these patients an earlier cohort was selected. [Pre-emptive](#) listing accounted for 37% of all adult registrations across the UK ranging from 60% at Leicester to 19% at Edinburgh.



Response to adult kidney offers

Offer decline rates

Kidney-only offers from [DBD](#) donors who had at least one kidney retrieved, offered directly and on behalf of a named individual patient and resulted in transplantation are included in the analysis. Any offers made through the reallocation of kidneys, declined kidney or fast track schemes were excluded, as were offers of kidneys from donations after circulatory death donors.

In order to understand centre practices more fully, data are presented separately for standard and extended criteria donors (SCD & ECD). ECD have been defined as [DBD](#) donors aged ≥ 60 years at the time of death OR aged 50 to 59 years with at least two or three donor characteristics: hypertension, creatinine $> 130 \mu\text{mol/l}$ or death due to intracranial haemorrhage. SCD are [DBD](#) donors that did not meet the ECD criteria.

[Funnel plots](#) were used to compare centre specific offer decline rates and indicate how consistent the rates of the individual transplant centres are with the national rate. The overall national unadjusted offer decline rate is shown by the solid line while the 95% and 99.8% confidence lines are indicated via a thin and thick dotted line, respectively. Each dot in the plot represents an individual transplant centre. Centres that are positioned above the upper limits indicate an offer decline rate that is higher than the national rate, while centres positioned below the lower limits indicate an offer decline rate that is lower than the national rate. Patient [case mix](#) is known to influence the number of offers a centre may receive. In this analysis however only individual offers for named patients were considered which excluded any [ABO](#)- and HLA-incompatible patients. For this reason it was decided not to risk adjust for known centre differences in patient [case mix](#).

4.1 Standard criteria offer decline rates, 1 April 2011 – 31 March 2014

Figure 4.1 compares individual centre offer decline rates with the national rate for SCD over the time period, 1 April 2011 and 31 March 2014. Centres can be identified by the information shown in **Table 4.1**. Leicester, Birmingham, Belfast and the WLRTC have offer decline rates consistently higher than the national rate.

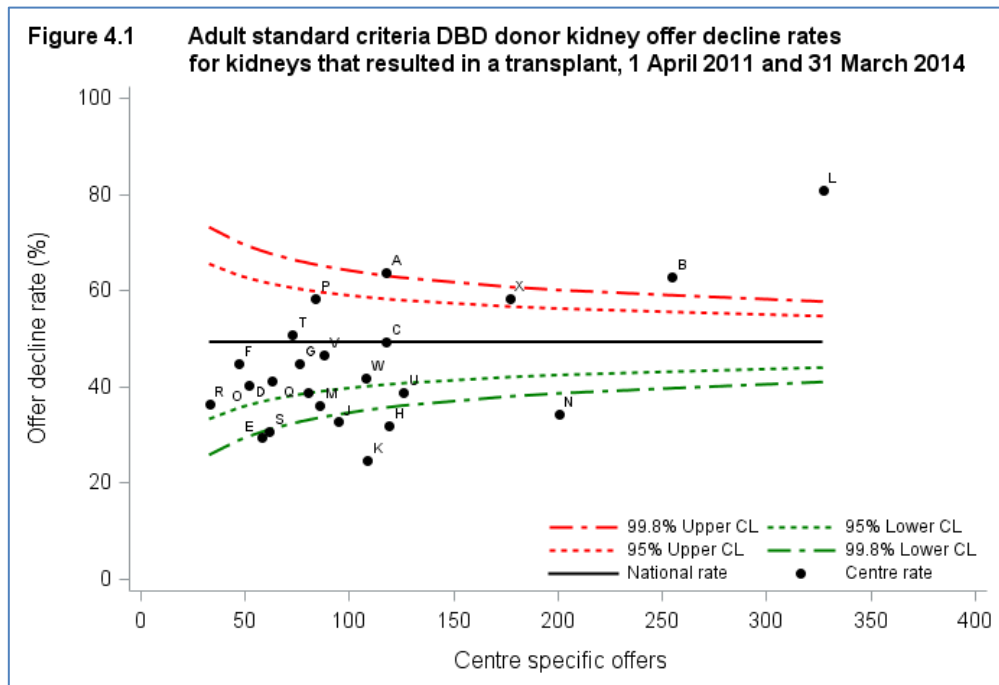


Table 4.1 compares individual centre offer decline rates for SCD over time by financial year. Birmingham, Belfast and the WLRTC have all shown improvements in their SCD offer decline rates over time. In the latest financial year (2013-2014), Belfast and the WLRTC now have an offer decline rate that is in line with the national rate. Leicester has had an offer decline rate that is consistently higher than national rate over the last three financial years; however their offer decline rate has improved from 81% in 2011-2012 to 72% in 2013-2014. Nottingham showed an increase in the proportion of offers declined over time and in the latest financial year now has a rate that is significantly higher than the national rate.

Table 4.1 Adult standard criteria <u>DBD</u> donor kidney offer decline rates by transplant centre, 1 April 2011 and 31 March 2014									
Centre	Code	2011/12		2012/13		2013/14		Overall	
		N	(%)	N	(%)	N	(%)	N	(%)
Belfast	A	47	(70)	33	(67)	40	(50)	120	(63)
Birmingham	B	67	(66)	87	(66)	101	(58)	255	(63)
Bristol	C	17	(47)	41	(49)	60	(50)	118	(49)
Cambridge	D	20	(45)	20	(40)	23	(39)	63	(41)
Cardiff	E	19	(26)	23	(30)	16	(31)	58	(29)
Coventry	F	12	(33)	11	(45)	24	(50)	47	(45)
Edinburgh	G	26	(31)	21	(48)	30	(53)	77	(44)
Glasgow	H	31	(32)	47	(36)	43	(26)	121	(31)
Guy's	J	27	(15)	44	(30)	24	(58)	95	(33)
Leeds	K	34	(15)	50	(28)	25	(32)	109	(25)
Leicester	L	89	(81)	125	(89)	113	(72)	327	(81)
Liverpool	M	26	(27)	33	(36)	28	(43)	87	(36)
Manchester	N	47	(28)	69	(46)	85	(28)	201	(34)
Newcastle	O	16	(38)	19	(42)	17	(41)	52	(40)
Nottingham	P	24	(42)	22	(59)	38	(68)	84	(58)
Oxford	Q	28	(46)	21	(29)	31	(39)	80	(39)
Plymouth	R	6	(0)	8	(38)	19	(47)	33	(36)
Portsmouth	S	15	(20)	26	(31)	21	(38)	62	(31)
Sheffield	T	15	(40)	25	(68)	33	(42)	73	(51)
St George's	U	30	(57)	44	(25)	52	(40)	126	(39)
The Royal Free	V	27	(52)	34	(59)	27	(26)	88	(47)
The Royal London	W	25	(44)	35	(54)	48	(31)	108	(42)
WLRTC	X	57	(65)	53	(62)	68	(49)	178	(58)
UK		705	(48)	891	(52)	966	(47)	2562	(49)

4.2 Extended criteria offer decline rates, 1 April 2011 – 31 March 2014

Figure 4.2 compares individual centre offer decline rates with the national rate for ECD over the time period, 1 April 2011 and 31 March 2014. Centres can be identified by the information shown in **Table 4.2**. Leicester, Belfast, Birmingham and the WLRTC have offer decline rates consistently higher than the national rate.

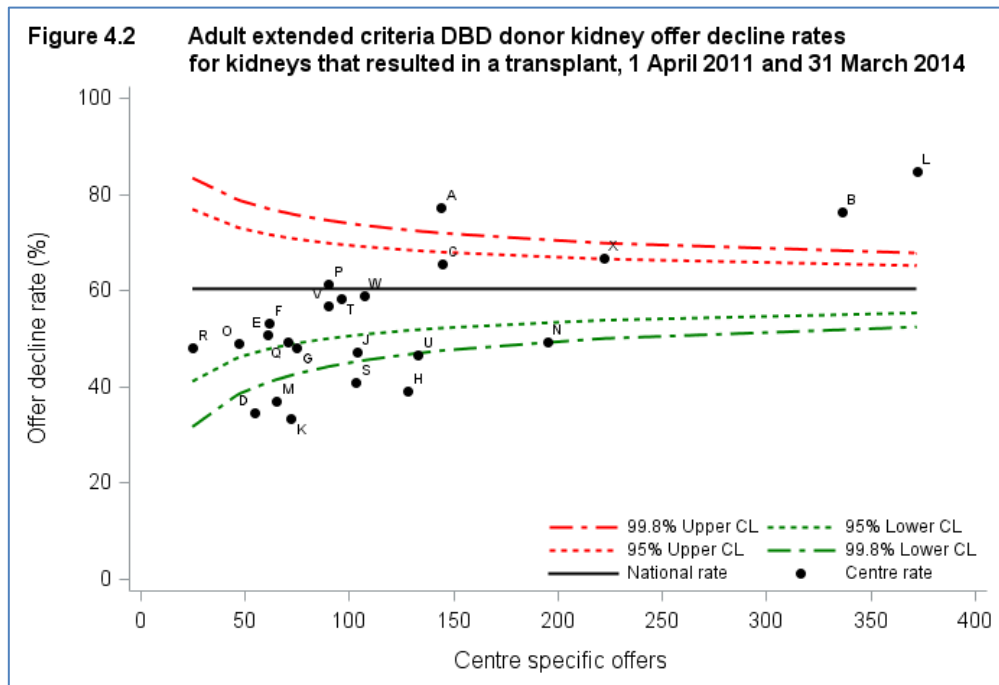


Table 4.2 compares individual centre offer decline rates for ECD over time by financial year. Belfast and the WLRTC have both shown improvements in their ECD offer decline rates over time. In the latest financial year (2013-2014), Belfast and the WLRTC now have an offer decline rate that is in line with the national rate. Leicester and Birmingham have had offer decline rates that are consistently higher than national rate over the last three financial years. Neither centre has had any improvements in their ECD offer decline rate over time.

Table 4.2 Adult extended criteria <u>DBD</u> donor kidney offer decline rates by transplant centre, 1 April 2011 and 31 March 2014									
Centre	Code	2011/12		2012/13		2013/14		Overall	
		N	(%)	N	(%)	N	(%)	N	(%)
Belfast	A	54	(85)	54	(81)	36	(58)	144	(77)
Birmingham	B	105	(72)	94	(76)	138	(79)	337	(76)
Bristol	C	28	(64)	54	(70)	62	(61)	144	(65)
Cambridge	D	15	(20)	20	(30)	20	(50)	55	(35)
Cardiff	E	17	(12)	20	(55)	24	(75)	61	(51)
Coventry	F	21	(52)	24	(63)	17	(41)	62	(53)
Edinburgh	G	26	(35)	18	(61)	31	(52)	75	(48)
Glasgow	H	54	(43)	43	(35)	31	(39)	128	(39)
Guy's	J	29	(41)	39	(44)	36	(56)	104	(47)
Leeds	K	31	(26)	23	(48)	18	(28)	72	(33)
Leicester	L	133	(80)	136	(91)	103	(82)	372	(85)
Liverpool	M	22	(36)	22	(41)	21	(33)	65	(37)
Manchester	N	59	(44)	58	(59)	78	(46)	195	(49)
Newcastle	O	15	(40)	11	(27)	21	(67)	47	(49)
Nottingham	P	24	(50)	27	(59)	40	(68)	91	(60)
Oxford	Q	28	(57)	25	(40)	18	(50)	71	(49)
Plymouth	R	5	(40)	5	(0)	15	(67)	25	(48)
Portsmouth	S	29	(28)	25	(56)	49	(41)	103	(41)
Sheffield	T	27	(52)	28	(61)	41	(61)	96	(58)
St George's	U	34	(53)	57	(49)	42	(38)	133	(47)
The Royal Free	V	28	(46)	39	(59)	24	(63)	91	(56)
The Royal London	W	20	(15)	30	(67)	56	(71)	106	(59)
WLRTC	X	50	(76)	87	(70)	87	(57)	224	(67)
UK		854	(56)	939	(64)	1008	(60)	2801	(60)

4.3 Reallocation of kidneys, 1 April 2011 – 31 March 2014

Since 3 April 2006 all kidneys from donation after brain death ([DBD](#)) donors have been allocated through the 2006 [National Kidney Allocation Scheme](#) (KAS). There are however certain situations when a kidney can be reallocated to an alternative patient of the centre's choice. This occurs when the kidney is accepted and dispatched to a named patient but is subsequently declined and there are no other patients listed nationally who fall within Tiers A to D of the kidney allocation scheme (000 mismatched adult and paediatric patients or favourably matched paediatric patients).

In this situation the centre in receipt of the kidney can reallocate the organ to a locally listed patient of their choice based on an individual centre matching run.

[Funnel plots](#) were used to compare centre specific reallocation rates and indicate how consistent the rates of the individual transplant centres are with the national rate. The overall national reallocation rate is shown by the solid line while the 95% and 99.8% confidence lines are indicated via a thin and thick dotted line, respectively. Each dot in the plot represents an individual transplant centre. Centres that are positioned above the upper limits indicate a reallocation rate that is higher than the national rate, while centres positioned below the lower limits indicates a reallocation rate that is lower than the national rate.

Figure 4.3 compares individual centre reallocation rates with the national rate over the time period, 1 April 2011 and 31 March 2014. Centres can be identified by the information shown in **Table 4.3**. Nationally 9% of all [DBD](#) kidney only transplants used kidneys that had been reallocated. The Royal Free and the WLRTC have reallocation rates consistently higher than the national rate.

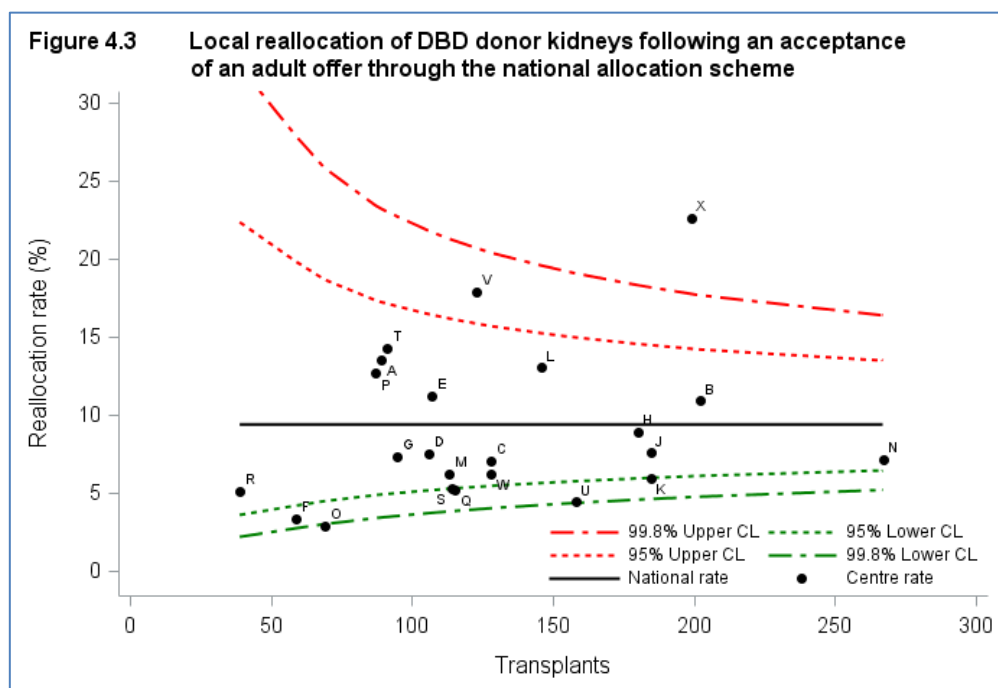


Table 4.2 compares individual reallocation rates over time by financial year. The Royal Free and the WLRTC have both shown improvements in their reallocation rates over time. In the latest financial year (2013-2014), they now have a reallocation rate that is in line with the national rate.

Table 4.3 Local reallocation of <u>DBD</u> donor kidneys following an acceptance of an adult offer through the national allocation scheme									
Centre	Code	2011/12		2012/13		2013/14		Overall	
		N	(%)	N	(%)	N	(%)	N	(%)
Belfast	A	26	(15)	26	(19)	37	(3)	89	(11)
Birmingham	B	61	(10)	62	(13)	79	(9)	202	(10)
Bristol	C	21	(10)	46	(7)	61	(7)	128	(7)
Cambridge	D	34	(9)	31	(6)	41	(7)	106	(8)
Cardiff	E	36	(8)	40	(15)	31	(10)	107	(11)
Coventry	F	22	(9)	15	(0)	22	(0)	59	(3)
Edinburgh	G	41	(7)	21	(10)	33	(3)	95	(6)
Glasgow	H	57	(9)	65	(8)	58	(7)	180	(8)
Guy's	J	48	(10)	90	(8)	47	(4)	185	(8)
Leeds	K	59	(3)	74	(7)	52	(8)	185	(6)
Leicester	L	53	(17)	31	(10)	62	(11)	146	(13)
Liverpool	M	37	(8)	37	(3)	39	(5)	113	(5)
Manchester	N	81	(10)	75	(9)	111	(4)	267	(7)
Newcastle	O	21	(5)	21	(0)	27	(4)	69	(3)
Nottingham	P	31	(16)	26	(4)	30	(17)	87	(13)
Oxford	Q	35	(11)	46	(4)	34	(0)	115	(5)
Plymouth	R	9	(0)	12	(8)	18	(6)	39	(5)
Portsmouth	S	36	(8)	34	(3)	44	(5)	114	(5)
Sheffield	T	23	(4)	27	(30)	41	(10)	91	(14)
St George's	U	32	(9)	67	(4)	59	(2)	158	(4)
The Royal Free	V	42	(24)	44	(20)	37	(5)	123	(17)
The Royal London	W	35	(3)	35	(6)	58	(9)	128	(6)
WLRTC	X	55	(36)	64	(25)	80	(9)	199	(22)
UK		895	(12)	989	(10)	1101	(6)	2985	(9)

Adult kidney transplants

5.1 Kidney only transplants, 1 April 2004 – 31 March 2014

Figure 5.1 shows the total number of adult kidney only transplants performed in the last ten years, by type of donor. The number of adult transplants from donors after circulatory death (DCD) has been steadily increasing over the time period to 779 in the last financial year. The number of adult transplants from donors after brain death (DBD) has increased in the last couple of years to 1,101 in 2013/2014 after remaining fairly constant for the previous four financial years. The number of adult living kidney transplants performed has also increased over the time period and 1,049 were performed in the last financial year.

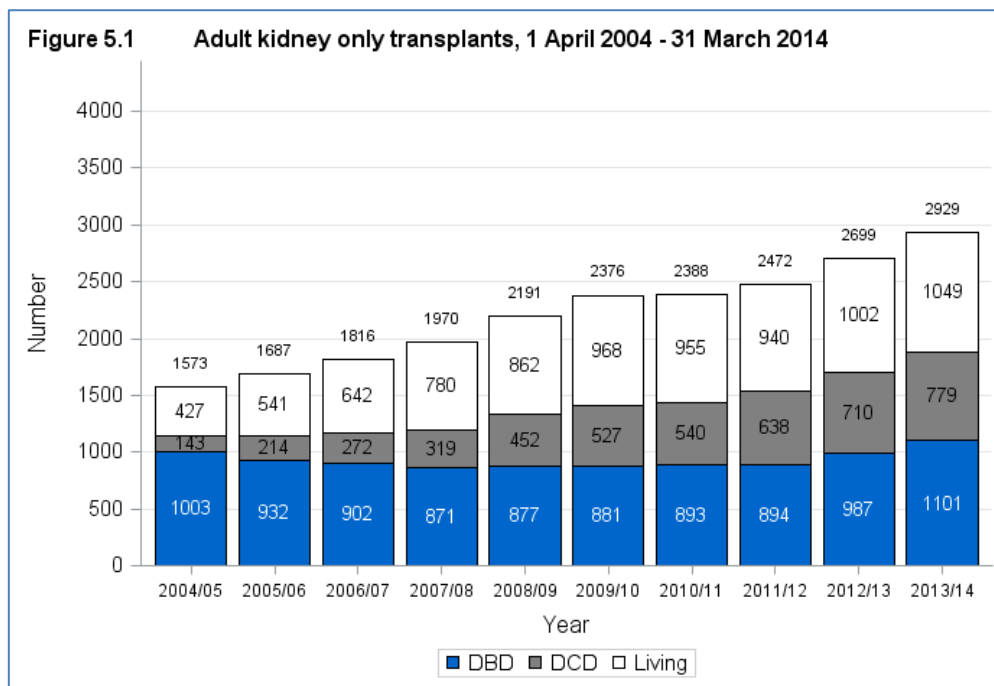


Figure 5.2 shows the total number of adult kidney only transplants performed in 2013/14, by centre and type of donor. The same information is presented in **Figure 5.3** but this shows the proportion of [DBD](#), [DCD](#) and living donor transplants performed at each centre.

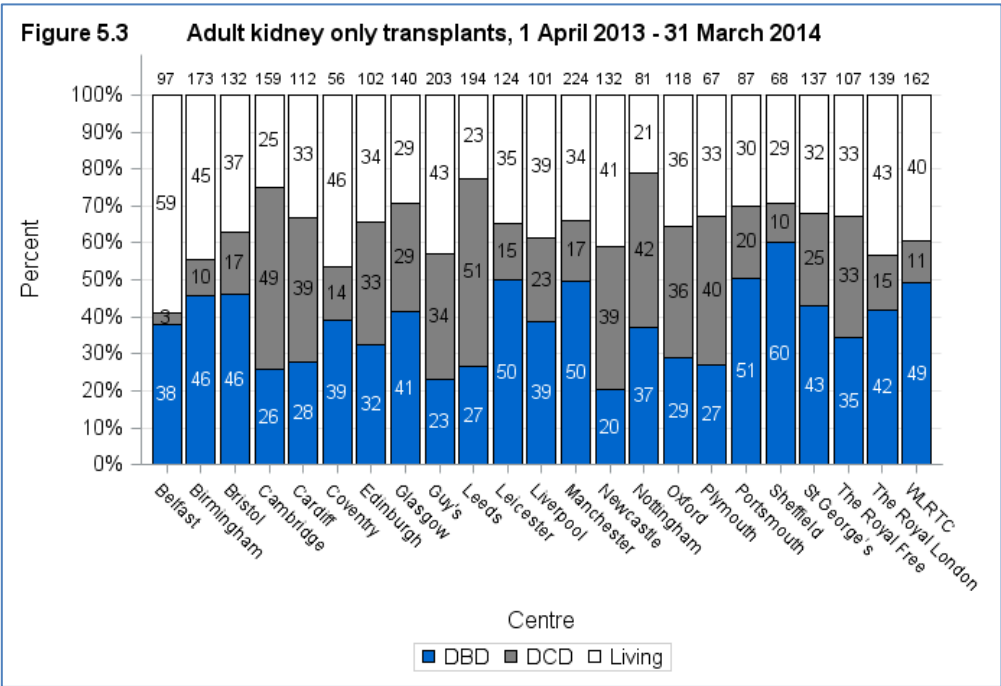
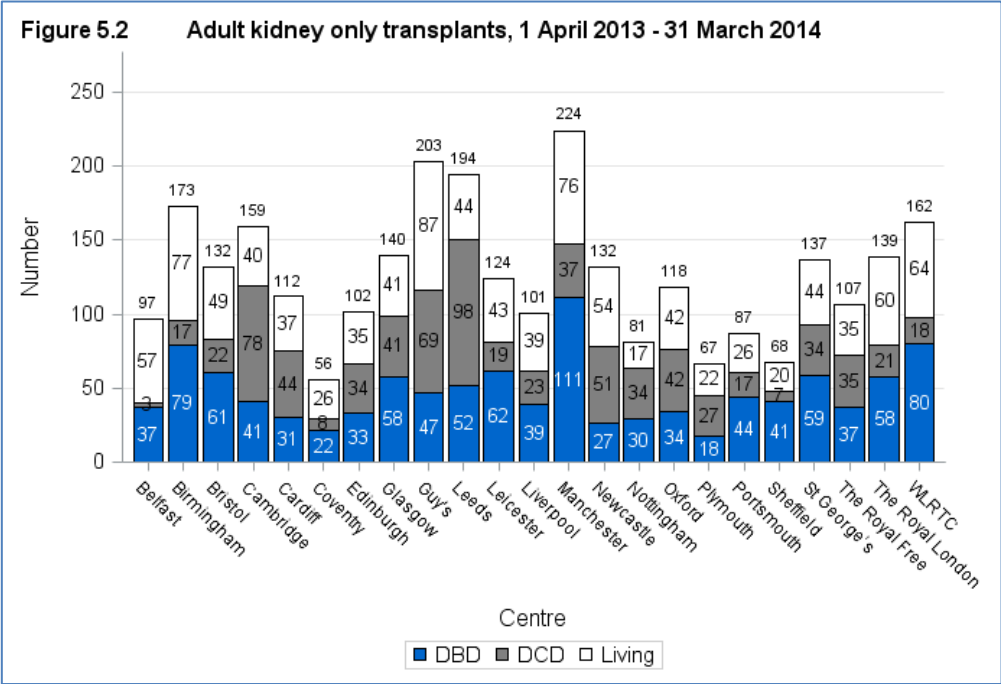
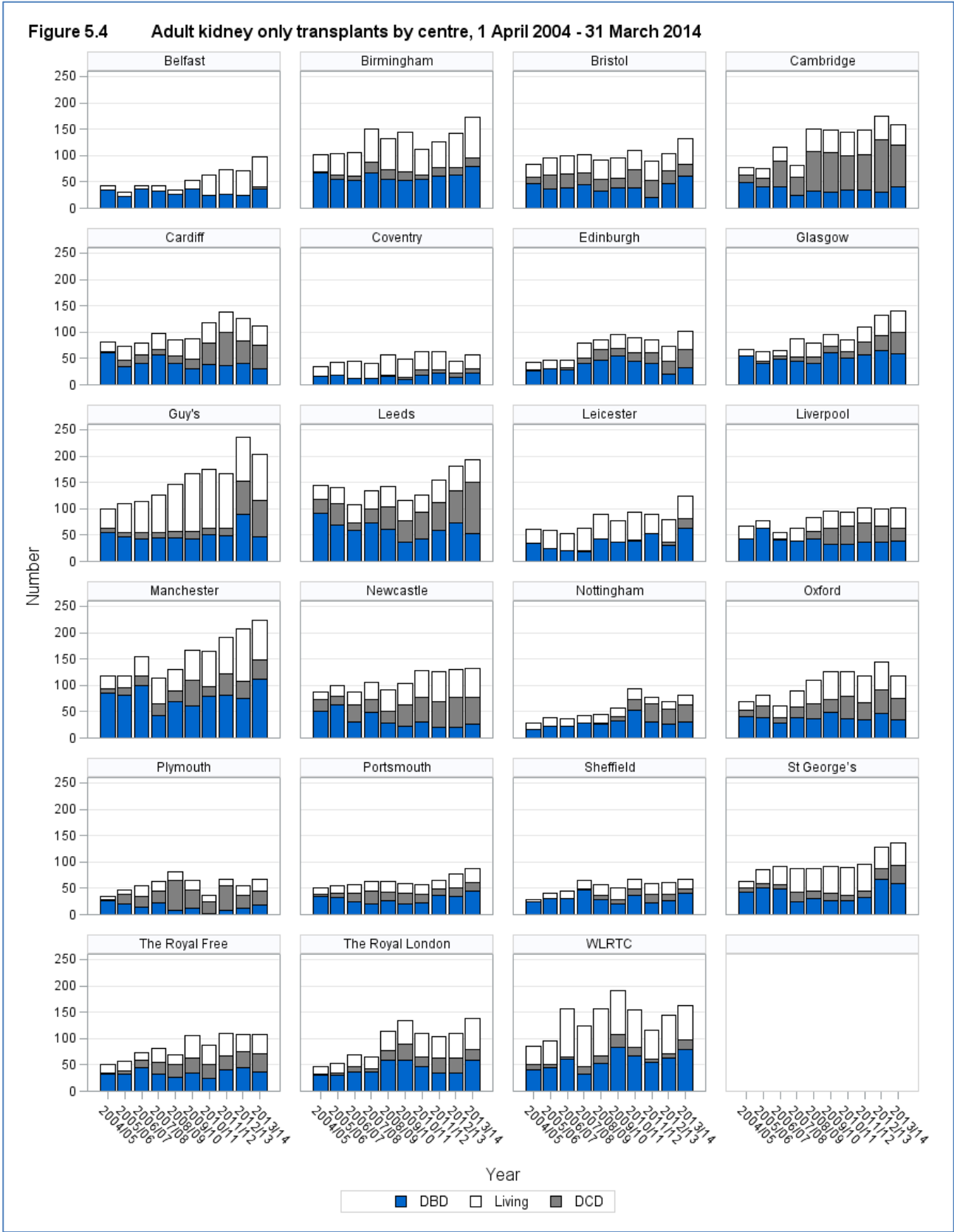
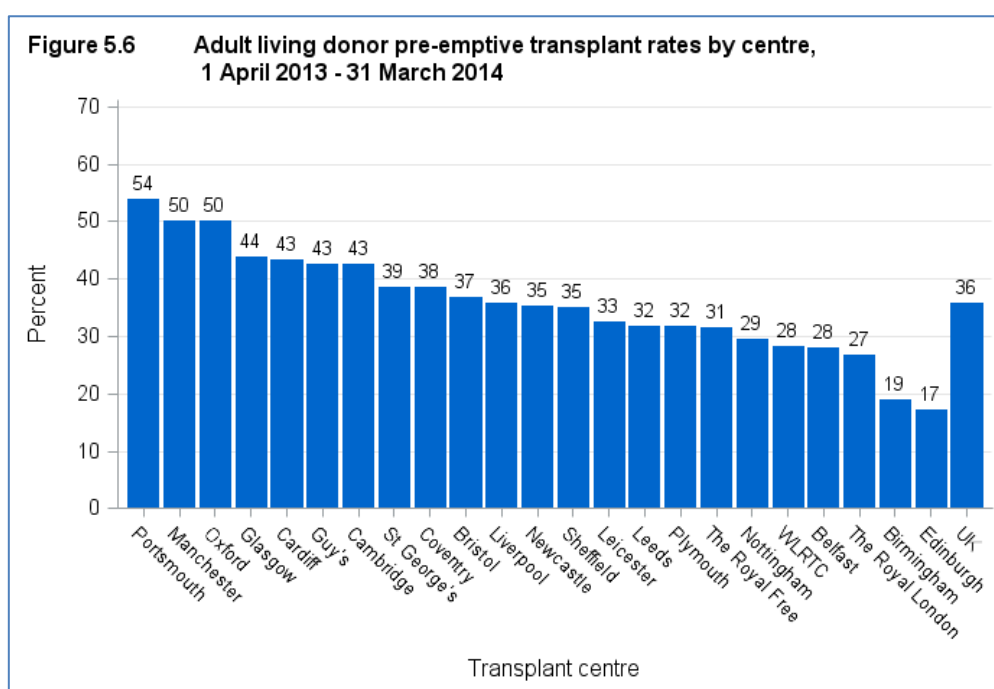
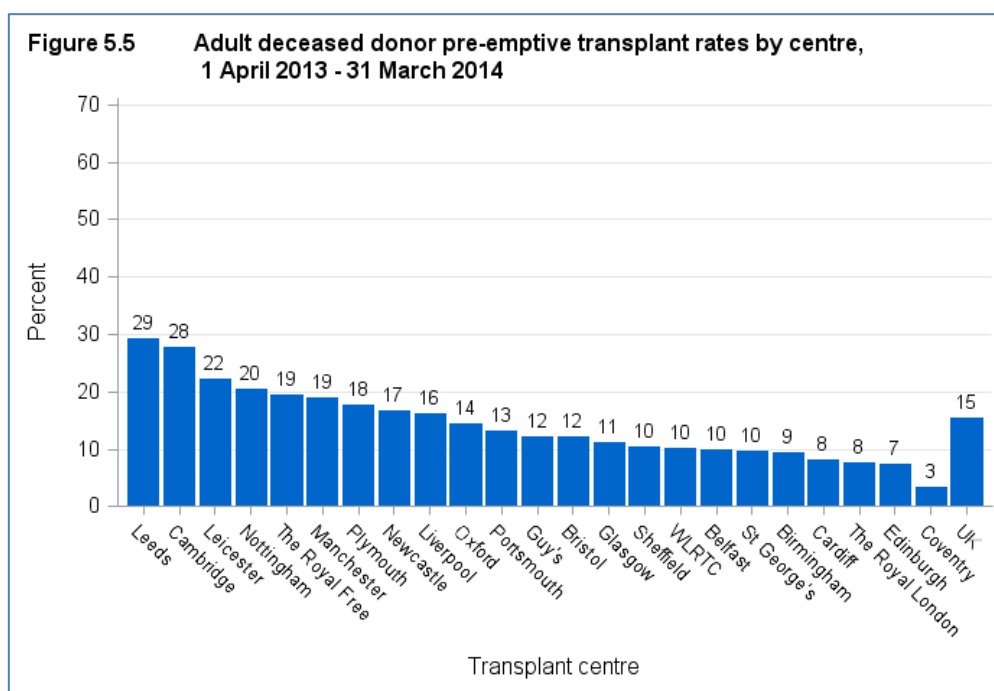


Figure 5.4 shows the total number of adult kidney only transplants performed in last ten years, by centre and type of donor.



5.2 Pre-emptive transplant rates, 1 April 2013 - 31 March 2014

Rates of [pre-emptive](#) kidney only transplantation are shown in **Figure 5.5** for adult deceased donor transplants and **Figure 5.6** for adult living donor transplants. Living donor transplants are more likely to be carried out before the need for dialysis than deceased donor transplants: 36% and 15% respectively. This is because a living donor transplant can often be carried out more quickly than a deceased donor kidney transplant as the latter often necessitates a long waiting time. Adult deceased donor [pre-emptive](#) transplant rates ranged from 29% at Leeds to 3% at Coventry. Adult living donor [pre-emptive](#) transplant rates ranged from 54% at Portsmouth to 17% at Edinburgh.



5.3 Kidney donor risk-index¹, 1 April 2011 – 31 March 2014

The severe shortage of deceased donor (DD) organs available for transplantation has led to increased use of kidneys from suboptimal donors with potentially less good transplant outcome. Categorising such kidneys according to anticipated outcome is important because it enables clinicians to be better informed when making decisions about organ allocation and allows appropriate counselling of potential recipients. Kidneys from suboptimal donors are variously referred to as marginal, extended criteria, or expanded criteria organs. Although categorising DD kidneys as either standard or expanded criteria has the advantage of simplicity, it does not adequately reflect the wide spectrum of donor kidney quality, and this has led to the development of more refined approaches to assessing the quality of DD kidneys. A donor risk index was developed by determining the factors that influence transplant survival, the time from transplant to the earlier of graft failure or patient death. A UK donor risk index was derived from the parameter estimates of the donor factors in the Cox model developed for overall transplant survival. This gives the following index:

$$\begin{aligned} \text{UKKDRI} = & \exp\{-0.245 \times (\text{donor age} < 40) + \\ & 0.396 \times (\text{donor age} \geq 60) + \\ & 0.265 \times (\text{history of hypertension}) + \\ & 0.0253 \times [\text{donor weight(kg)} - 75] / 10 + \\ & 0.00461 \times (\text{days in hospital}) + \\ & 0.0465 \times (\text{adrenaline})\} \end{aligned}$$

Reference

- 1 Watson CJE, Johnson RJ, Birch R, Collett D, Bradley JA. A simplified donor risk index for predicting outcome after deceased donor kidney transplantation. *Transplantation*, 2012; 93: 314-318

Figure 5.7 shows the number of transplanted [DBD](#) donor kidneys over the last ten financial years by kidney donor risk index group. In 2004/05 23% of all transplants were performed using kidneys from donors categorised as high risk (UK Donor risk index ≥ 1.35) compared with 36% in 2013/14.

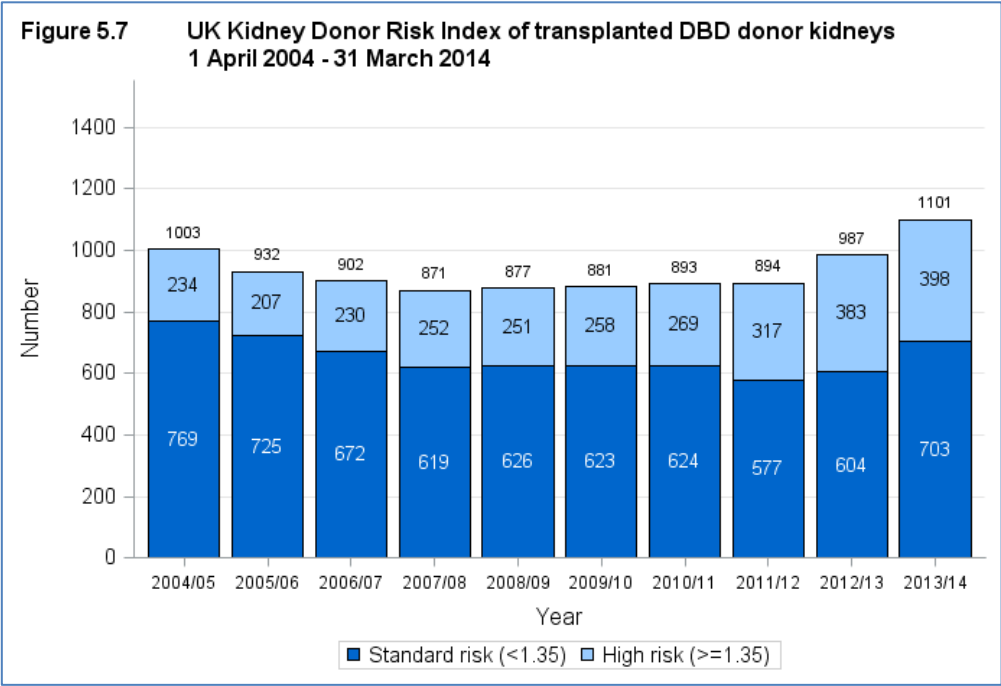
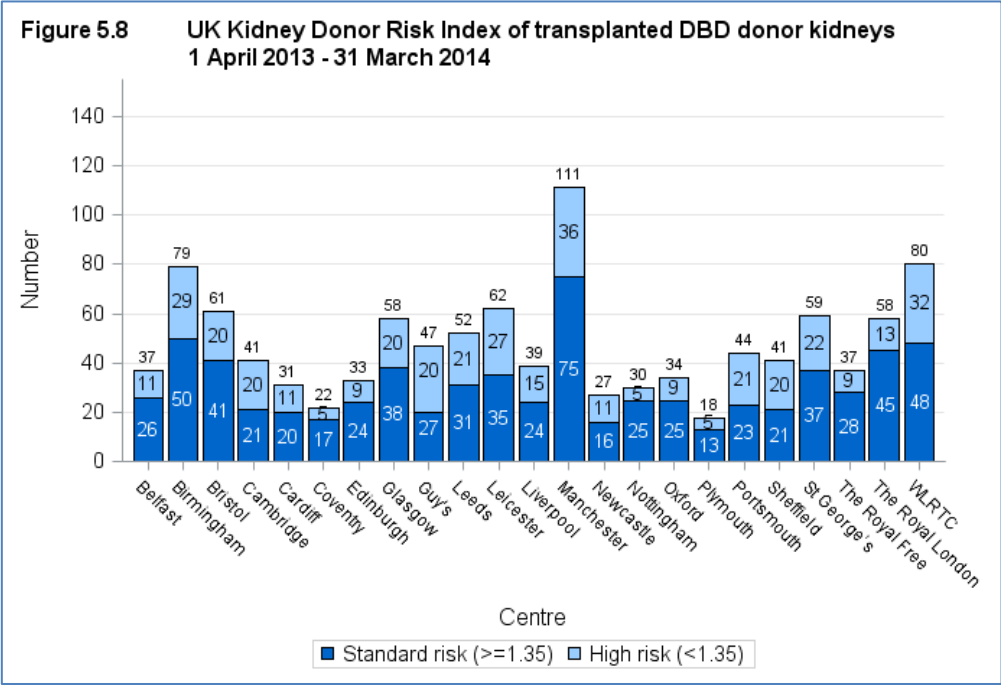


Figure 5.8 shows the number of transplanted [DBD](#) donor kidneys in 2013/14 by kidney donor risk index group for each transplant centre. The same information is presented in **Figure 5.9** but this shows the proportion of standard risk and high risk donor transplants performed at each centre.



**Figure 5.9 UK Kidney Donor Risk Index of transplanted DBD donor kidneys
1 April 2013 - 31 March 2014**

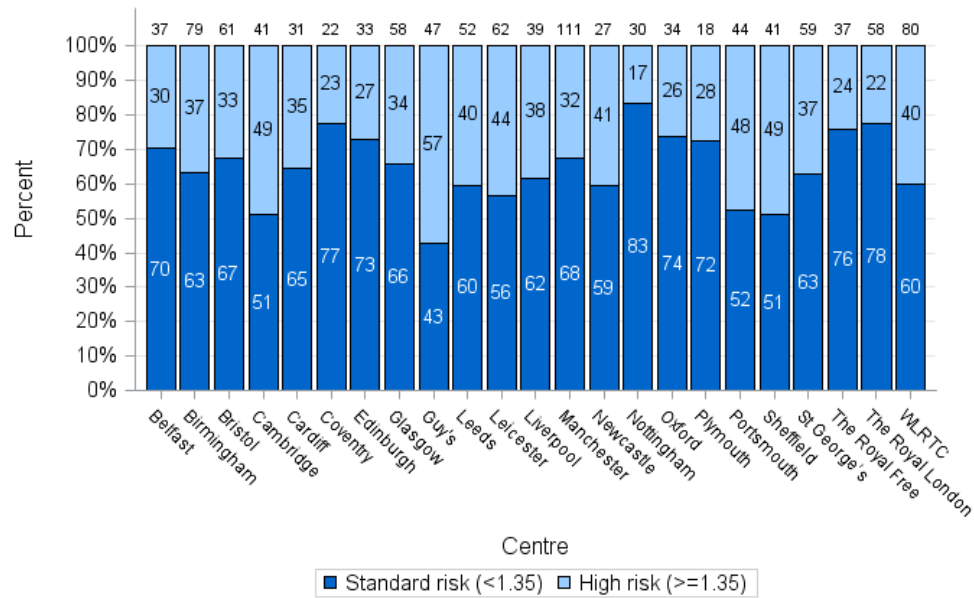
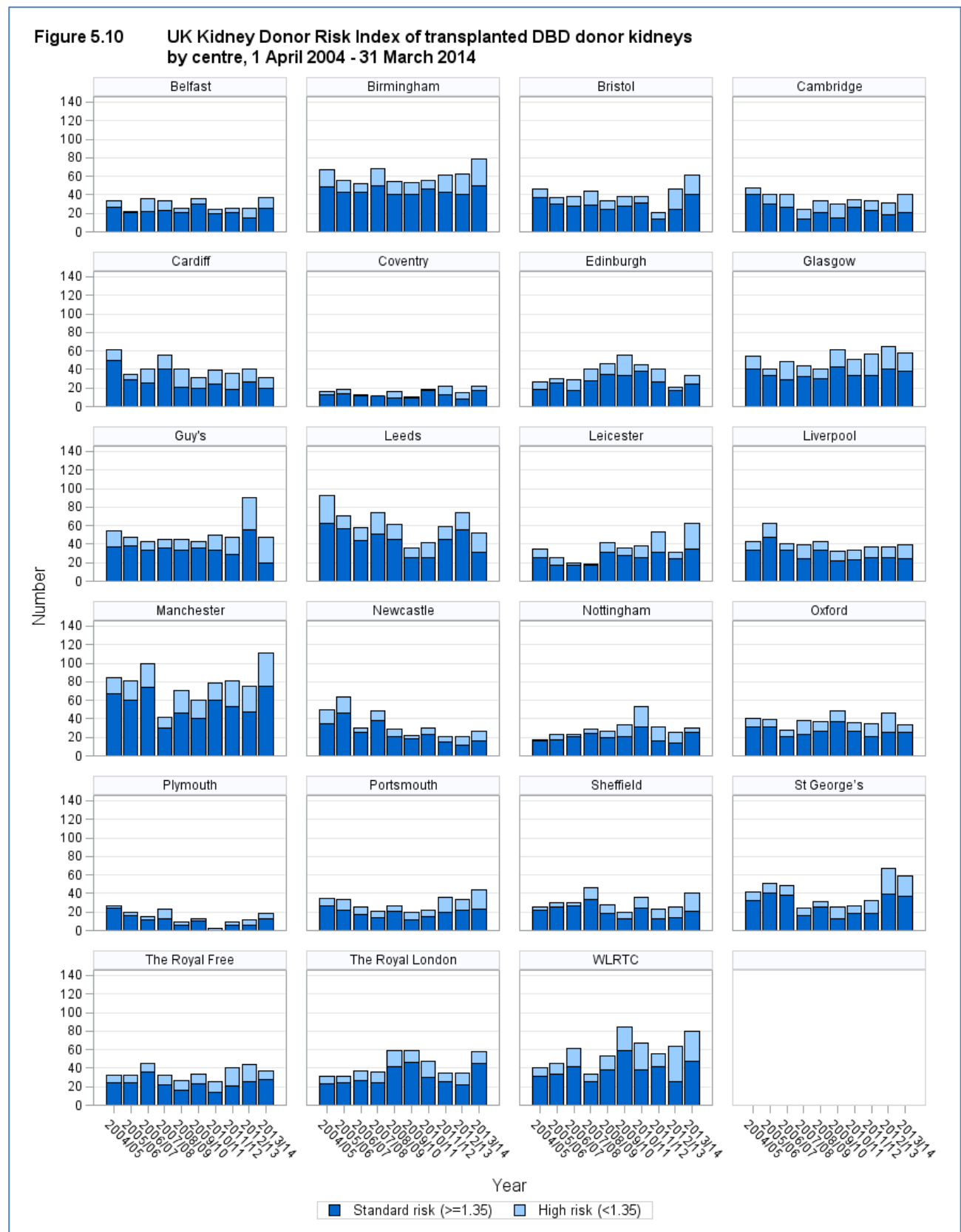


Figure 5.10 shows the number of transplanted [DBD](#) donor kidneys in the last ten years by kidney donor risk index group for each transplant centre.



5.3 Cold ischaemia time, 1 April 2011 – 31 March 2014

The length of time that elapses between a kidney being removed from the donor to its transplantation into the recipient is called the Cold Ischaemia Time (CIT). Generally, the shorter this time, the more likely the kidney is to work immediately and the better the long-term outcome. One of the reasons why [live donor](#) kidney transplantation is so successful is because the CIT is only one to two hours long. For deceased donor renal transplants, CIT can never be as short as this, but efforts are made to keep the time to a minimum. Evidence indicates that the outcome is only adversely affected when CIT is longer than 20 hours, although many deceased donor kidney transplants with a CIT of more than 20 hours have been very successful.

The factors which determine CIT include a) transportation of the kidney from the retrieval hospital to the hospital where the transplant is performed, b) the need to tissue type the donor and [cross-match](#) the donor and potential recipients, c) the occasional necessity of moving the kidney to another hospital if a transplant cannot go ahead, d) contacting and preparing the recipient for the transplant and e) access to the operating theatre.

[Median](#) CITs are shown in addition to [inter-quartile ranges](#). Fifty percent of the transplants have a CIT within the [inter-quartile range](#). There is some variation in average ([median](#)) CIT between different transplant centres although all centres continually try to reduce this time.

Figure 5.11 shows the [median](#) total ischaemia time in adult [DBD](#) donor kidney only transplants over the last 10 years. The [median](#) total ischaemia time has fallen over the last 10 years from 18 hours in 2004/05 to 14 hours in 2013/14.

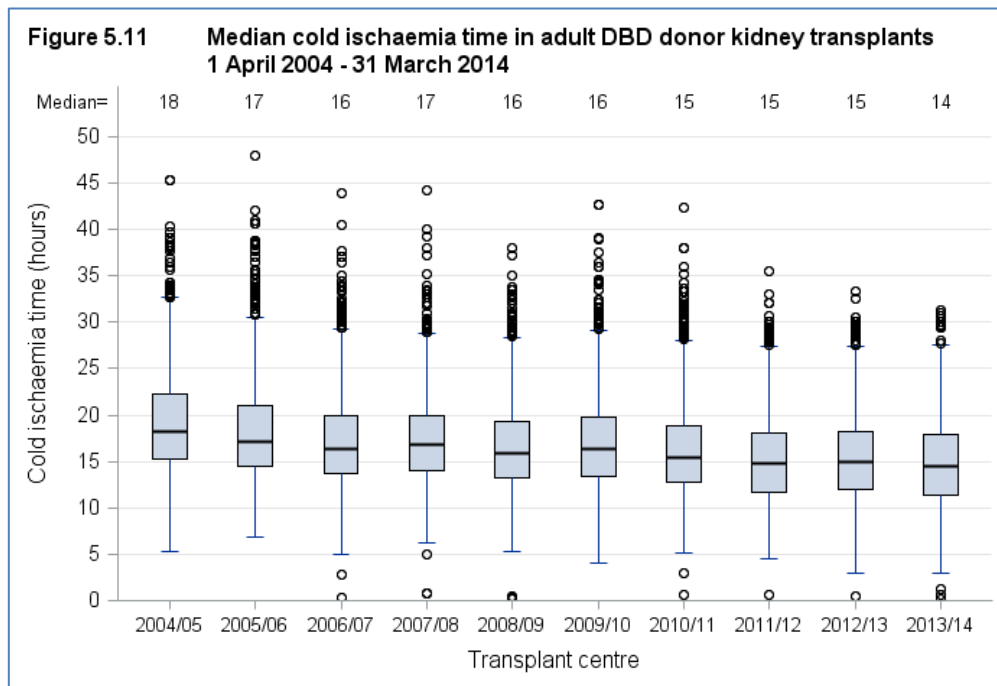


Figure 5.12 shows the [median](#) total ischaemia time in adult [DBD](#) donor kidney only transplants in 2013/14 for each transplant centre. Belfast had the longest [median](#) cold ischaemia time, 19 hours in 2013/14 compared with Leicester and St George's who had the shortest, 11 hours.

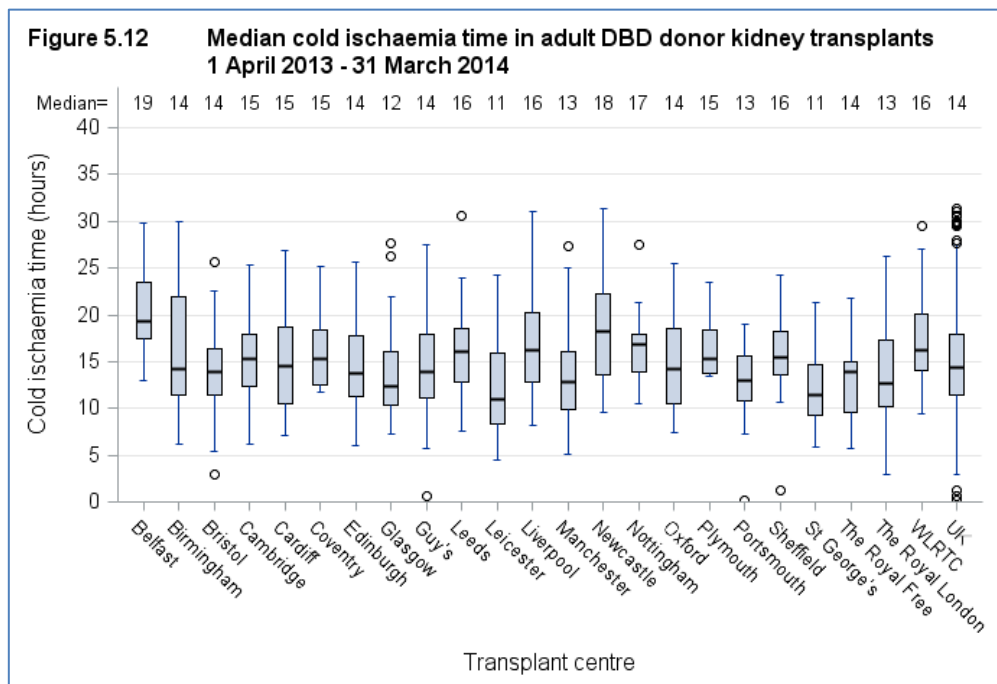


Figure 5.13 shows the median total ischaemia time in adult DBD donor kidney only transplants over the last ten years for each transplant centre.

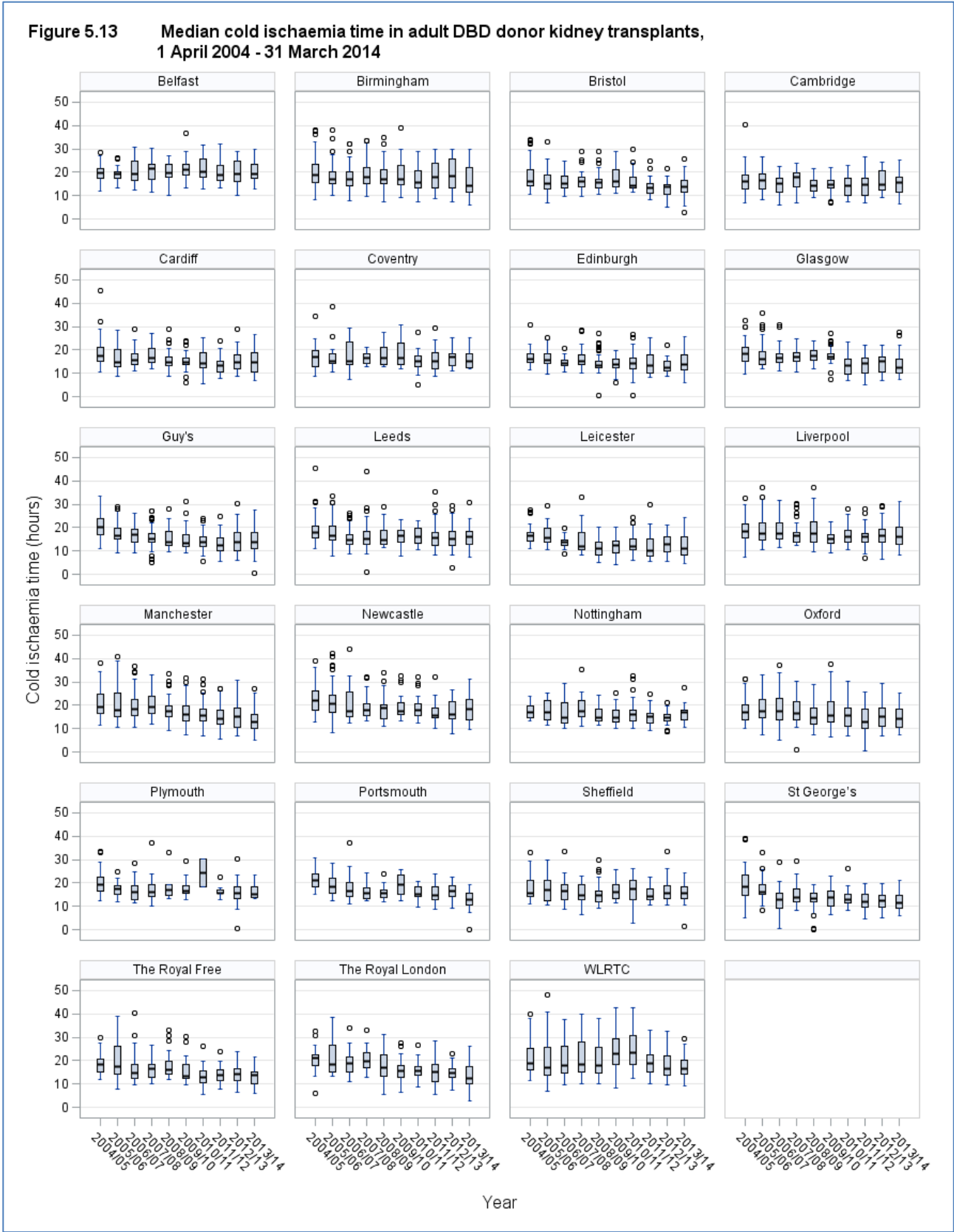


Figure 5.14 shows the [median](#) total ischaemia time in adult [DCD](#) donor kidney only transplants over the last 10 years. The [median](#) total ischaemia time has fallen over the last 10 years from 18 hours in 2004/05 to 13 hours in 2013/14.

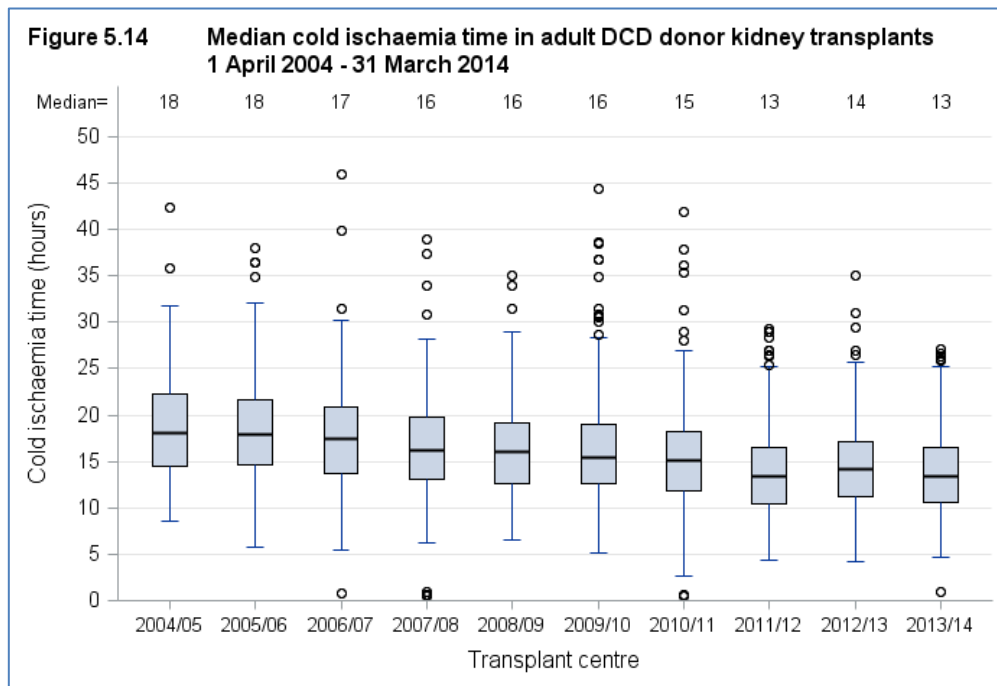


Figure 5.15 shows the [median](#) total ischaemia time in adult [DCD](#) donor kidney only transplants in 2013/14 for each transplant centre. WLRTC had the longest [median](#) cold ischaemia time, 17 hours in 2013/14 compared with Belfast who had the shortest, 8 hours.

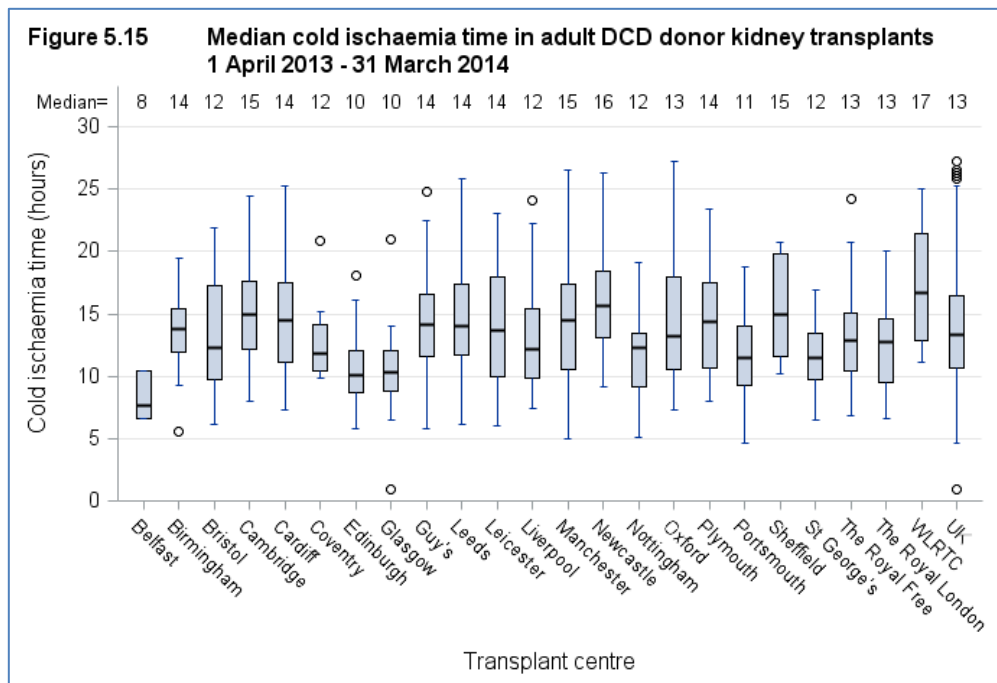


Figure 5.16 shows the [median](#) total ischaemia time in adult [DCD](#) donor kidney only transplants over the last ten years for each transplant centre.

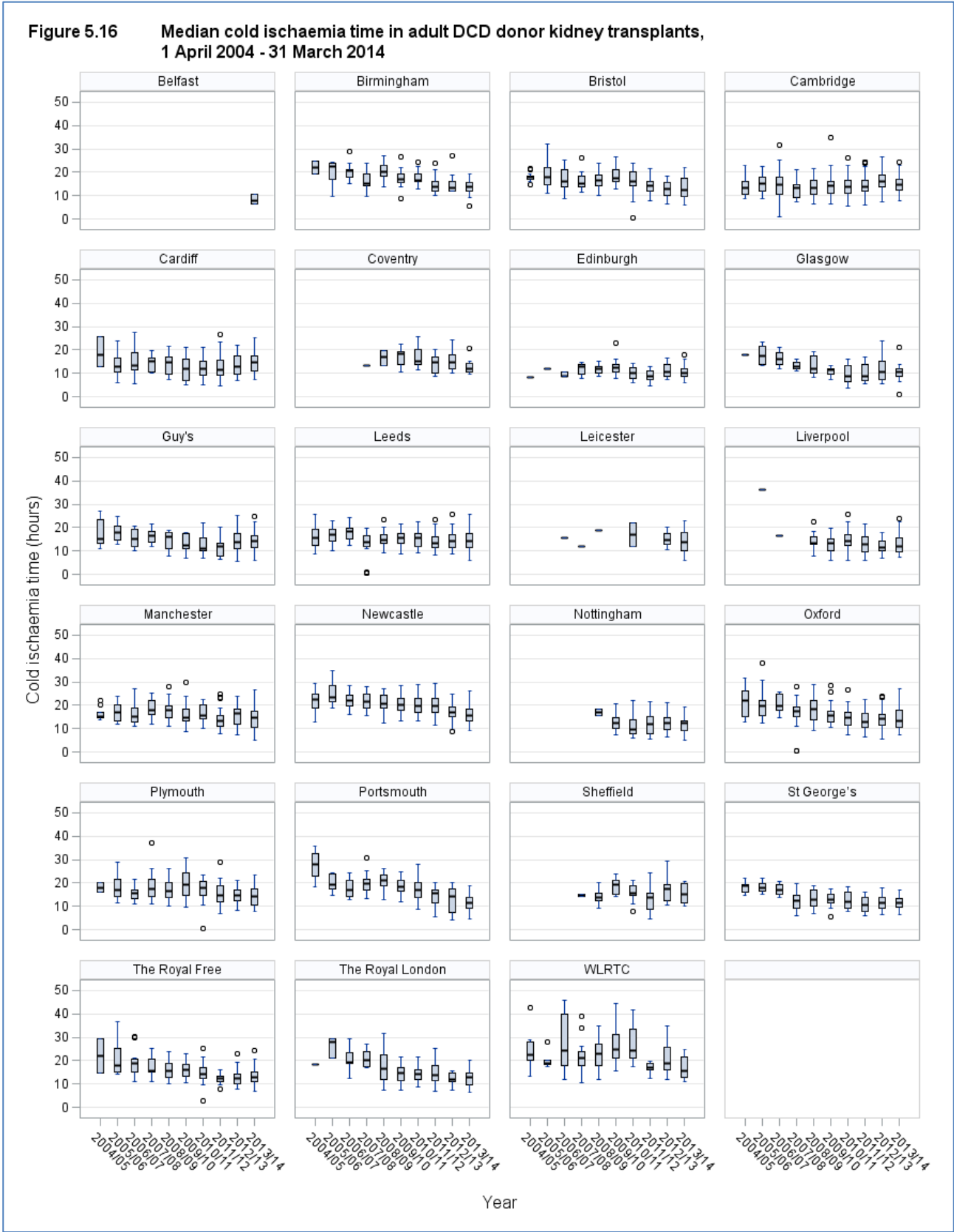


Figure 5.17 shows the [median](#) total ischaemia time in adult living donor kidney transplants over the last 10 years. The [median](#) total ischaemia time has remained fairly stable over the last ten years.

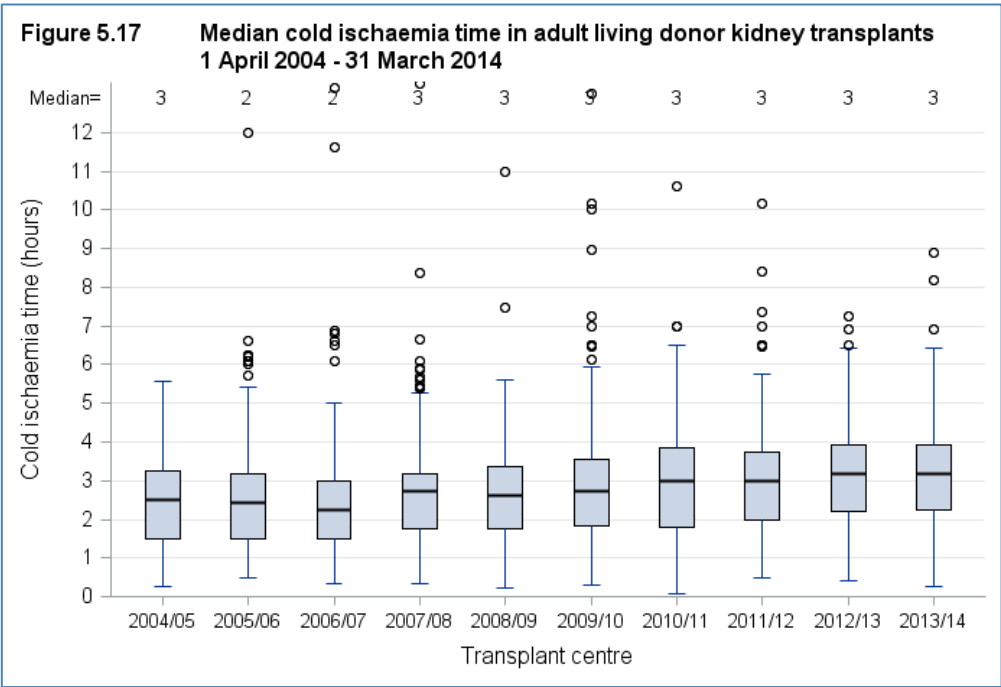


Figure 5.18 shows the [median](#) total ischaemia time in adult living donor kidney transplants in 2013/14 for each transplant centre.

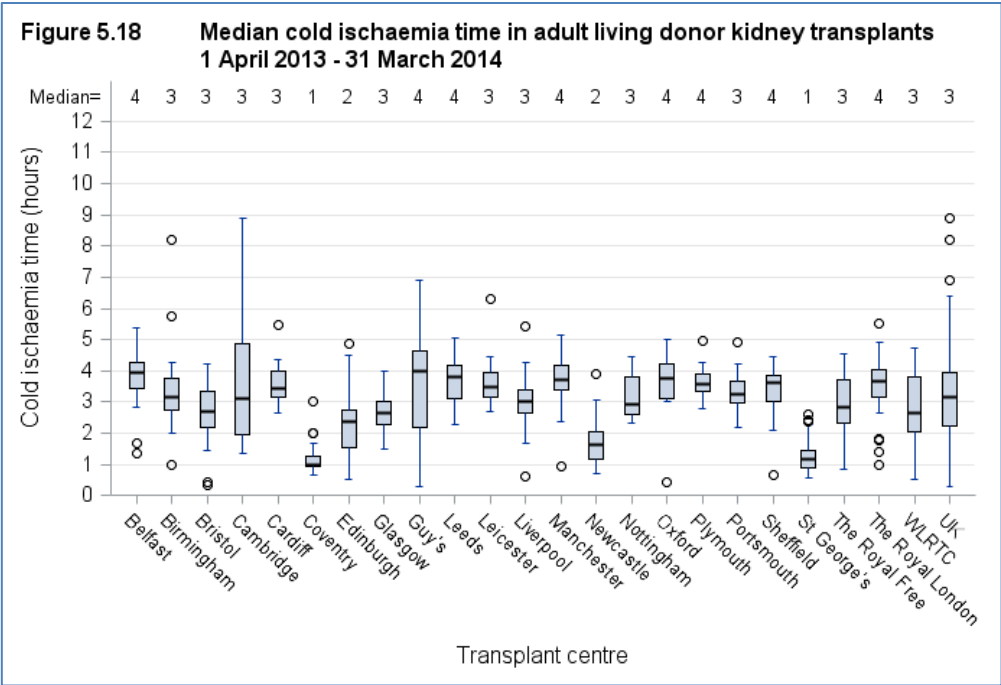


Figure 5.19 shows the [median](#) total ischaemia time in adult living donor kidney transplants over the last ten years for each transplant centre.



Adult kidney outcomes

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 [risk-adjusted survival rate](#) plotted against the number of transplants for each centre, with the overall national [unadjusted 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, Monro JL, Pollock JCS, Watterson KG. Mortality rates after surgery for congenital heart defects in children and surgeons' performance. *Lancet* 2000; 355: 1004 – 1007.

6.1 Deceased donor graft and patient survival

The [funnel plots](#) show that, for the most part, the centres lie within the [confidence limits](#). Some of the [funnel plots](#) show some centres lie outside the lower 99.8% [confidence limits](#), indicating that these centres have survival rates that are significantly lower than the national rate. Some of the [funnel plots](#) show some centres to be above the upper 99.8% [confidence limit](#). This suggests that these centres may have survival rates that are considerably higher than the national rate. Centres can be identified by the information shown in **Table 6.1**.

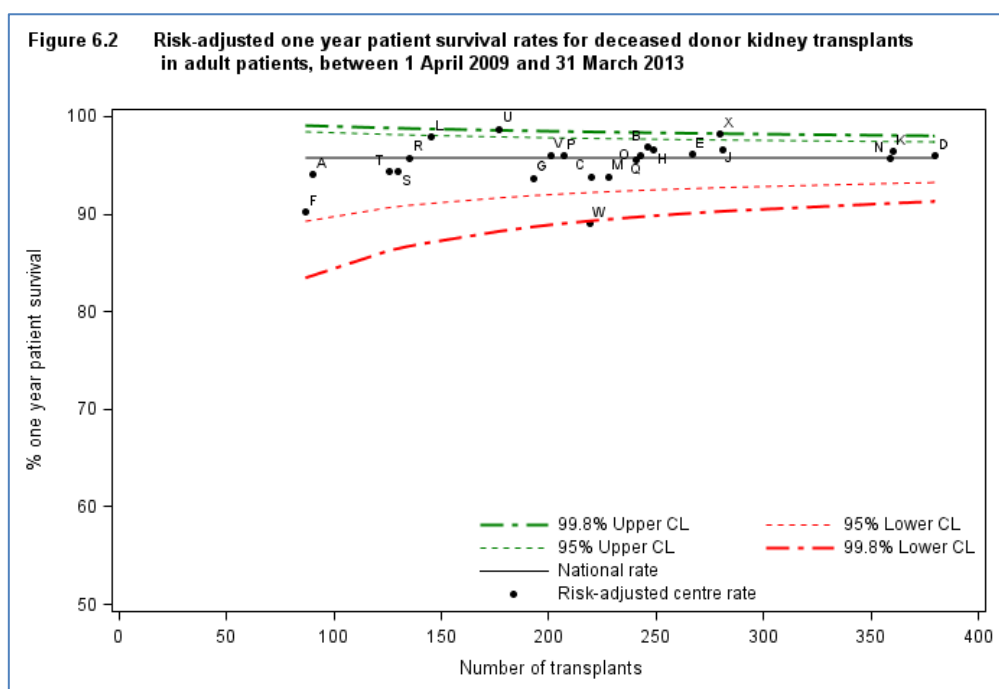
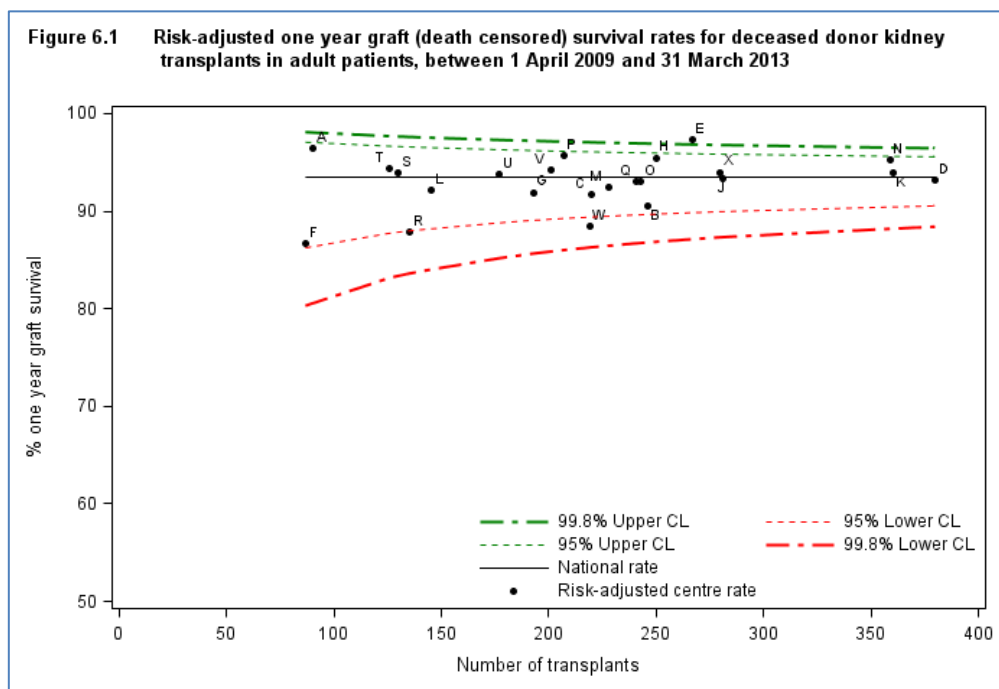


Figure 6.3 Risk-adjusted five year graft (death censored) survival rates for deceased donor kidney transplants in adult patients, between 1 April 2005 and 31 March 2009

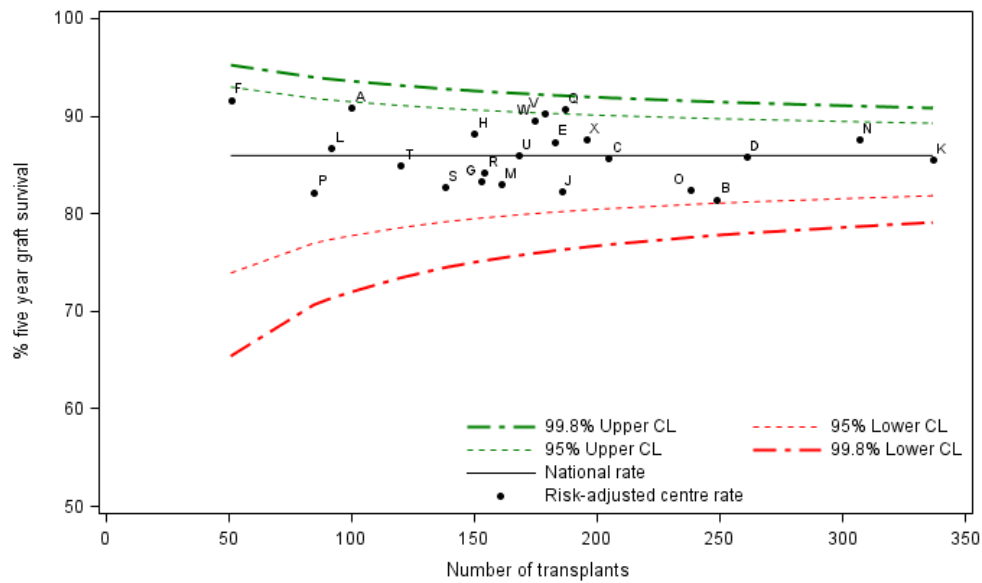


Figure 6.4 Risk-adjusted five year patient survival rates for deceased donor kidney transplants in adult patients, between 1 April 2005 and 31 March 2009

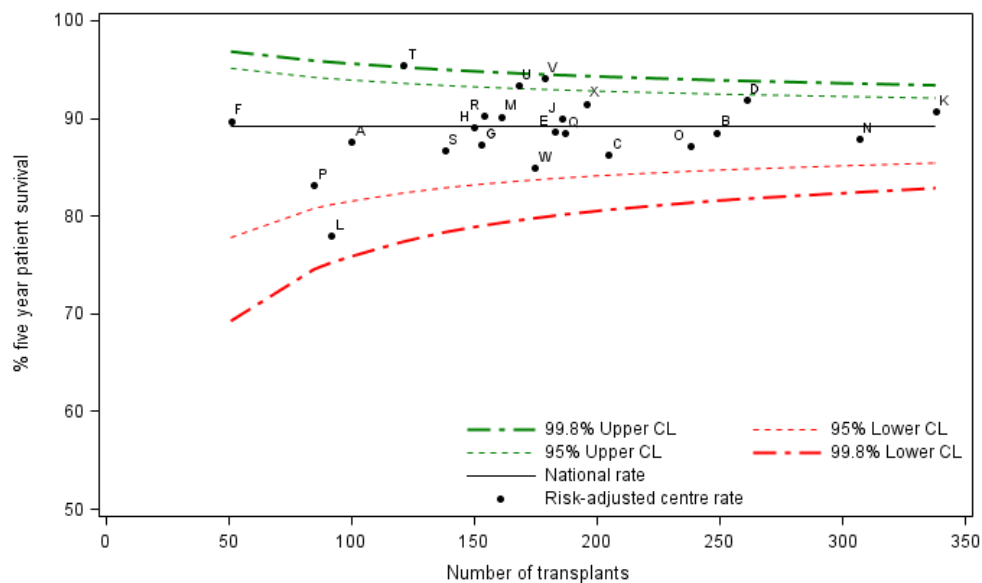


Table 6.1 One and five year adult kidney-only graft and patient survival using kidneys from deceased donors

Centre	Code	Kidney graft survival				Patient survival			
		One-year*		Five-year**		One-year*		Five-year**	
		%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)
Belfast	A	96	(89 - 99)	91	(82 - 96)	94	(86 - 98)	88	(77 - 94)
Birmingham	B	91	(86 - 94)	81	(75 - 86)	97	(94 - 99)	89	(83 - 93)
Bristol	C	92	(86 - 95)	86	(79 - 90)	94	(89 - 97)	86	(80 - 91)
Cambridge	D	93	(90 - 96)	86	(80 - 90)	96	(93 - 98)	92	(88 - 95)
Cardiff	E	97	(94 - 99)	87	(81 - 92)	96	(93 - 98)	89	(82 - 93)
Coventry	F	87	(76 - 93)	92	(78 - 98)	90	(81 - 96)	90	(76 - 97)
Edinburgh	G	92	(86 - 96)	83	(75 - 89)	94	(88 - 97)	87	(80 - 92)
Glasgow	H	95	(91 - 98)	88	(81 - 93)	97	(93 - 99)	89	(81 - 94)
Guy's	J	93	(90 - 96)	82	(75 - 88)	97	(94 - 98)	90	(83 - 94)
Leeds	K	94	(91 - 96)	86	(81 - 89)	96	(94 - 98)	91	(87 - 94)
Leicester	L	92	(86 - 96)	87	(76 - 93)	98	(94 - 100)	78	(65 - 87)
Liverpool	M	92	(88 - 96)	83	(75 - 89)	94	(89 - 97)	90	(83 - 95)
Manchester	N	95	(92 - 97)	88	(83 - 91)	96	(93 - 98)	88	(83 - 92)
Newcastle	O	93	(89 - 96)	82	(76 - 87)	96	(93 - 98)	87	(82 - 91)
Nottingham	P	96	(91 - 98)	82	(70 - 90)	96	(92 - 98)	83	(70 - 91)
Oxford	Q	93	(89 - 96)	91	(85 - 95)	96	(92 - 98)	88	(83 - 93)
Plymouth	R	88	(80 - 93)	84	(77 - 90)	96	(91 - 98)	90	(85 - 94)
Portsmouth	S	94	(87 - 98)	83	(74 - 89)	94	(89 - 97)	87	(80 - 92)
Sheffield	T	94	(88 - 98)	85	(76 - 91)	94	(89 - 98)	95	(90 - 98)
St George's	U	94	(88 - 97)	86	(78 - 91)	99	(95 - 100)	93	(88 - 97)
The Royal Free	V	94	(90 - 97)	90	(85 - 94)	96	(92 - 98)	94	(89 - 97)
The Royal London	W	88	(83 - 92)	89	(83 - 94)	89	(83 - 93)	85	(77 - 90)
WLRTC	X	94	(91 - 96)	88	(81 - 92)	98	(96 - 99)	91	(86 - 95)
UK		93	(93 - 94)	86	(85 - 87)	96	(95 - 96)	89	(88 - 90)

* Includes transplants performed between 1 april 2009 - 31 March 2013

** Includes transplants performed between 1 april 2005 - 31 March 2009

6.2 Living donor graft and patient survival

The [funnel plots](#) show that, for the most part, the centres lie within the [confidence limits](#). One of the [funnel plots](#) show one centre lies outside the lower 99.8% [confidence limits](#), indicating that this centre has a survival rate that is significantly lower than the national rate. Some of the [funnel plots](#) show some centres to be above the upper 99.8% [confidence limit](#). This suggests that these centres may have survival rates that are considerably higher than the national rate. Centres can be identified by the information shown in **Table 6.2**. Living donor antibody incompatible kidney transplants are included in the analysis and these transplants are known to have inferior graft survival rates. **Table 6.3** shows the number of such transplants performed by each centre for each of the time periods analysed.

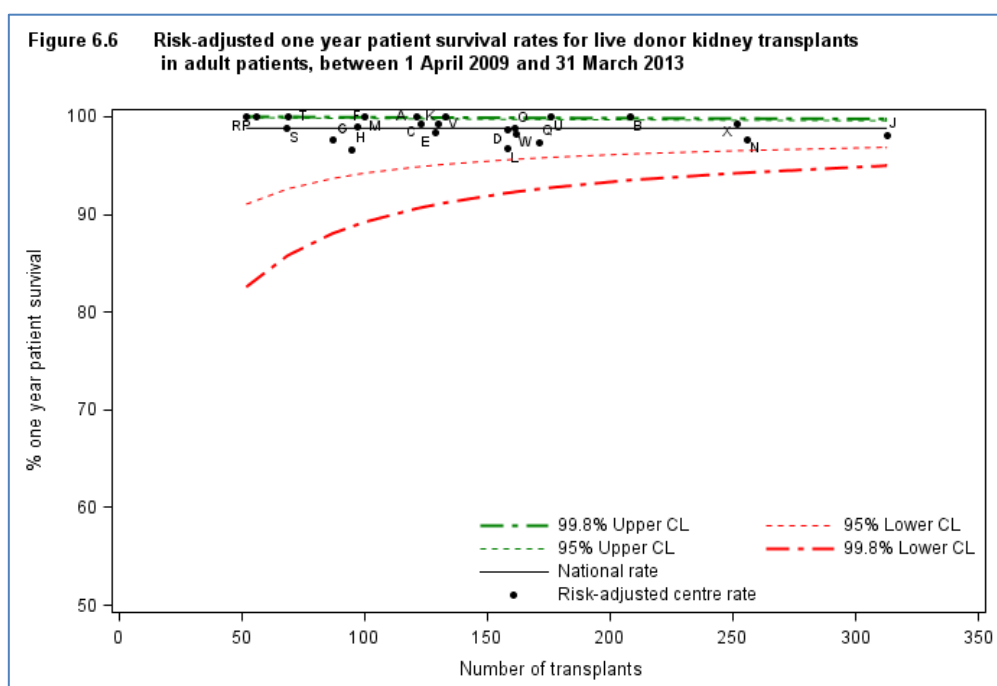
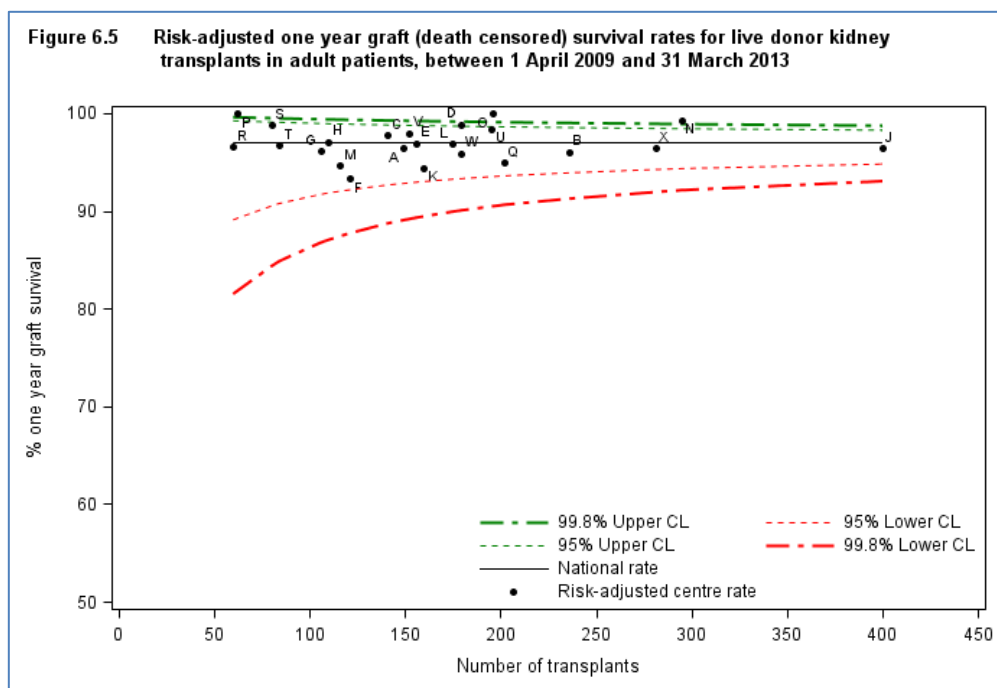


Figure 6.7 Risk-adjusted five year graft (death censored) survival rates for live donor kidney transplants in adult patients, between 1 April 2005 and 31 March 2009

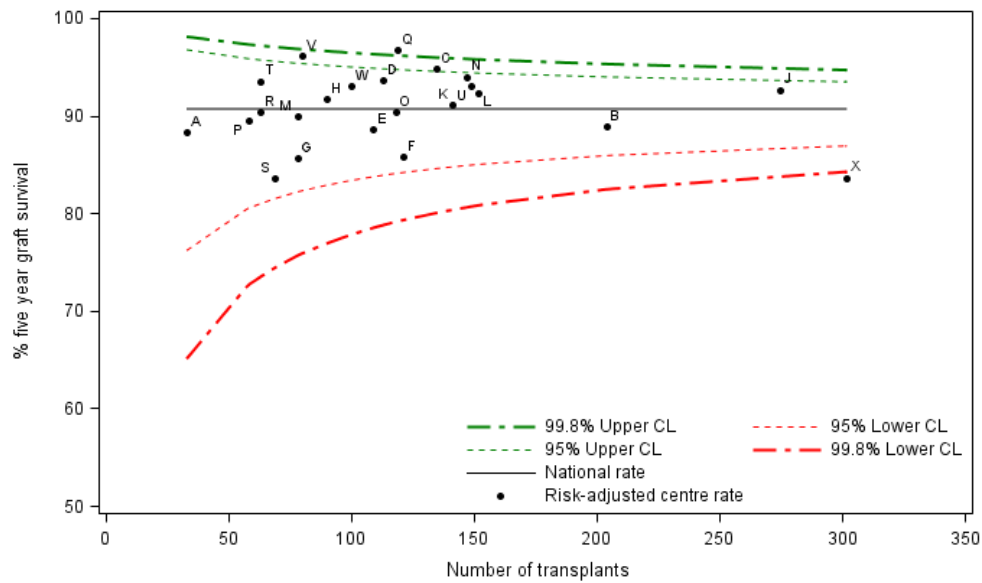


Figure 6.8 Risk-adjusted five year patient survival rates for live donor kidney transplants in adult patients, between 1 April 2005 and 31 March 2009

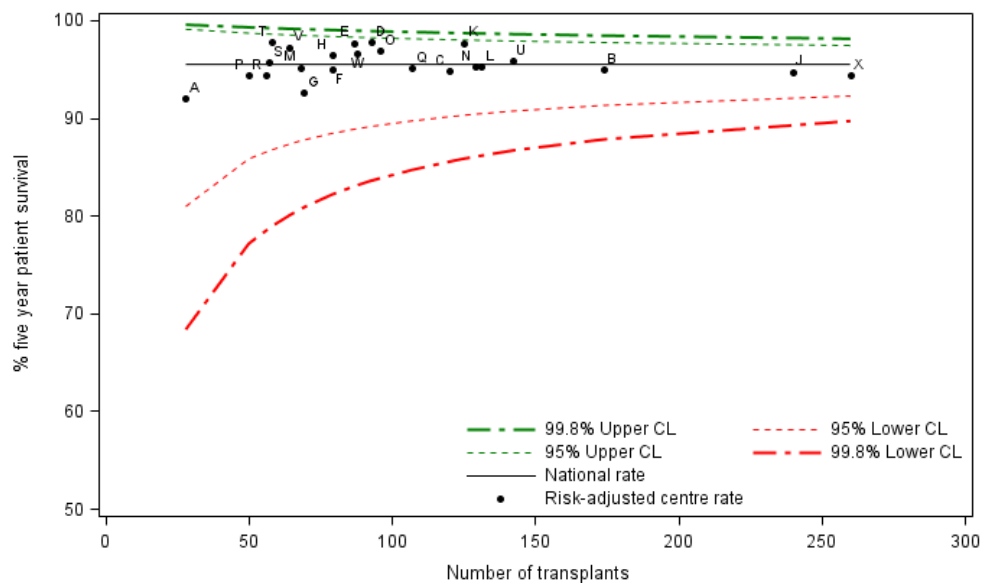


Table 6.2 One and five year adult kidney-only graft and patient survival using kidneys from living donors

Centre	Code	Kidney graft survival				Patient survival			
		One-year*		Five-year**		One-year*		Five-year**	
		%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)
Belfast	A	96	(92 - 99)	88	(70 - 97)	100	N/A	92	(71 - 99)
Birmingham	B	96	(93 - 98)	89	(83 - 93)	100	N/A	95	(90 - 98)
Bristol	C	98	(94 - 100)	95	(89 - 98)	99	(96 - 100)	95	(89 - 98)
Cambridge	D	99	(96 - 100)	94	(86 - 98)	99	(95 - 100)	98	(92 - 100)
Cardiff	E	97	(93 - 99)	89	(80 - 94)	98	(94 - 100)	98	(92 - 100)
Coventry	F	93	(87 - 97)	86	(77 - 92)	99	(94 - 100)	95	(87 - 99)
Edinburgh	G	96	(90 - 99)	86	(74 - 93)	98	(91 - 100)	93	(83 - 98)
Glasgow	H	97	(91 - 99)	92	(84 - 96)	97	(90 - 99)	96	(87 - 100)
Guy's	J	96	(94 - 98)	93	(88 - 96)	98	(96 - 99)	95	(91 - 97)
Leeds	K	94	(89 - 98)	91	(85 - 95)	100	N/A	98	(93 - 100)
Leicester	L	97	(93 - 99)	92	(86 - 96)	97	(92 - 99)	95	(90 - 98)
Liverpool	M	95	(88 - 98)	90	(79 - 96)	100	N/A	95	(83 - 99)
Manchester	N	99	(98 - 100)	94	(89 - 97)	98	(95 - 99)	95	(88 - 99)
Newcastle	O	100	N/A	90	(83 - 95)	99	(95 - 100)	97	(91 - 99)
Nottingham	P	100	N/A	90	(76 - 97)	100	N/A	94	(84 - 99)
Oxford	Q	95	(91 - 98)	97	(91 - 99)	97	(93 - 99)	95	(89 - 98)
Plymouth	R	97	(87 - 100)	90	(79 - 96)	100	N/A	94	(86 - 98)
Portsmouth	S	99	(93 - 100)	84	(71 - 92)	99	(93 - 100)	96	(84 - 99)
Sheffield	T	97	(90 - 99)	94	(83 - 98)	100	N/A	98	(87 - 100)
St George's	U	98	(95 - 100)	93	(87 - 97)	100	N/A	96	(90 - 99)
The Royal Free	V	98	(94 - 100)	96	(89 - 99)	99	(96 - 100)	97	(90 - 100)
The Royal London	W	96	(92 - 98)	93	(86 - 97)	98	(94 - 100)	97	(88 - 100)
WLRTC	X	96	(93 - 98)	84	(78 - 88)	99	(97 - 100)	94	(91 - 97)
UK		97	(96 - 97)	91	(89 - 92)	99	(98 - 99)	95	(95 - 96)

* Includes transplants performed between 1 april 2009 - 31 March 2013

** Includes transplants performed between 1 april 2005 - 31 March 2009

Table 6.3 Adult living kidney only antibody incompatible transplants by type, 1 April 2005 – 31 March 2013								
Centre	1 April 2009 – 31 March 2013				1 April 2005 – 31 March 2009			
	ABOi	HLAi	N	Total % of all living transplants	ABOi	HLAi	N	Total % of all living transplants
Belfast	0	0	0	0	0	0	0	0
Birmingham	40	1	41	17	10	0	10	5
Bristol	5	9	14	10	0	1	1	1
Cambridge	20	23	43	24	6	7	13	12
Cardiff	21	22	43	28	4	3	7	6
Coventry	6	39	45	36	2	54	56	46
Edinburgh	5	0	5	5	0	0	0	0
Glasgow	2	0	2	2	0	0	0	0
Guy's	52	28	80	20	23	11	34	12
Leeds	6	19	25	16	0	14	14	10
Leicester	3	5	8	5	0	0	0	0
Liverpool	10	0	10	9	1	0	1	1
Manchester	20	0	20	7	0	0	0	0
Newcastle	27	29	56	29	0	14	14	12
Nottingham	11	0	11	18	0	0	0	0
Oxford	14	11	25	12	1	7	8	7
Plymouth	0	4	4	7	0	0	0	0
Portsmouth	2	0	2	3	0	4	4	6
Sheffield	4	5	9	11	1	0	1	2
St George's	12	2	14	7	0	0	0	0
The Royal Free	14	4	18	12	3	0	3	4
The Royal London	20	35	55	31	0	7	7	7
WLRTC	23	26	49	17	35	36	71	23
UK	317	262	579	15	86	158	244	7

6.3 Graft and patient survival from listing

Survival from listing was analysed for all adult (≥ 18 years) patients registered for the first time for a kidney only between 1 January 2002 and 31 December 2013. Survival time was defined as the time from joining the [transplant list](#) to death, regardless of the length of time on the [transplant list](#), whether or not the patient was transplanted and any factors associated with such a transplant eg donor type. Survival time was censored at either the date of removal from the list, or at the last known follow up date post transplant when no death date was recorded, or at the time of analysis if the patient was still active on the [transplant list](#).

Renal patients may receive a [live donor](#) kidney without prior registration on the [transplant list](#), although centre practices differ in relation to listing of potential [live donor](#) recipients. Consequently, patients who received a [live donor](#) kidney transplant within 6 months of listing were excluded from the analysis to minimise centre bias.

Ten year [risk-adjusted survival rates](#) from the point of kidney transplant listing are shown by centre in **Figure 6.9**. Six centres were above the upper 99.8% [confidence limit](#) indicating that these centres have 10 year survival rates from listing that are considerably higher than the national rate. Leicester and Newcastle fell below the 99.8% lower [confidence limit](#). This suggests that 10 year survival from listing at Leicester and Newcastle may be significantly lower than the national rate.

Centres can be identified by the information shown in **Table 6.4**, which also shows one and five year [risk-adjusted survival rates](#) from the point of kidney transplant listing.

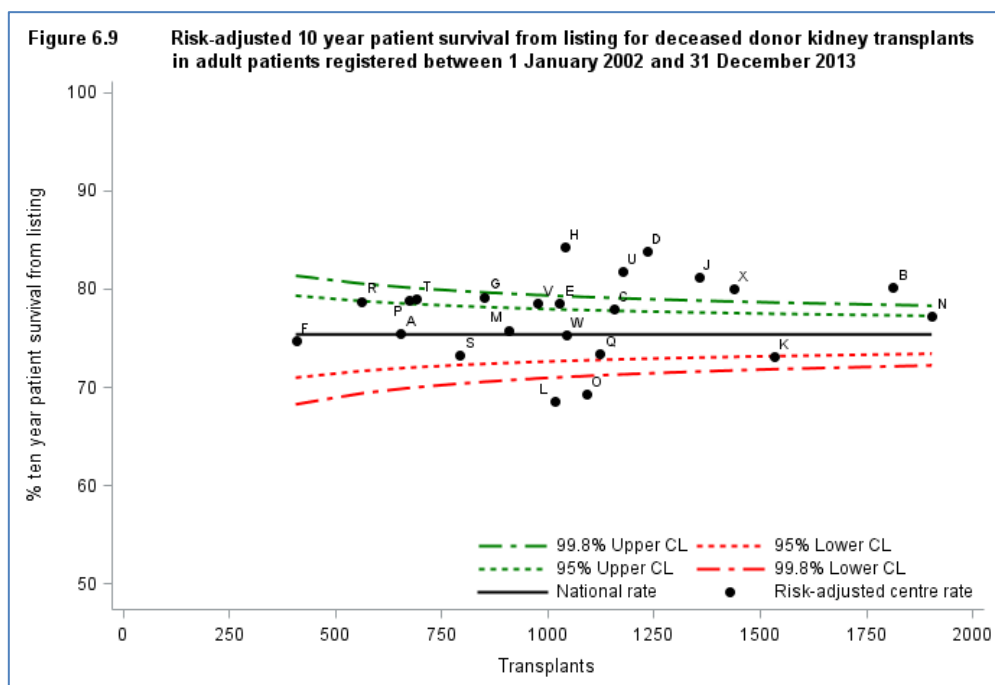


Table 6.4 Risk-adjusted 1, 5 and 10 year patient survival from listing for deceased donor kidney transplants in adult patients registered between 1 January 2002 and 31 December 2013

Centre	Code	One year		Five year		Ten year	
		N	(%)	N	(%)	N	(%)
Belfast	A	653	(98)	653	(88)	653	(76)
Birmingham	B	1814	(98)	1814	(90)	1814	(80)
Bristol	C	1156	(99)	1156	(90)	1156	(78)
Cambridge	D	1234	(99)	1234	(92)	1234	(84)
Cardiff	E	1029	(99)	1029	(90)	1029	(78)
Coventry	F	407	(98)	407	(89)	407	(75)
Edinburgh	G	852	(99)	852	(91)	852	(79)
Glasgow	H	1040	(99)	1040	(93)	1040	(84)
Guy's	J	1356	(99)	1356	(90)	1356	(81)
Leeds	K	1534	(99)	1534	(87)	1534	(73)
Leicester	L	1017	(98)	1017	(84)	1017	(69)
Liverpool	M	908	(98)	908	(88)	908	(76)
Manchester	N	1905	(98)	1905	(89)	1905	(77)
Newcastle	O	1093	(98)	1093	(84)	1093	(69)
Nottingham	P	673	(99)	673	(90)	673	(79)
Oxford	Q	1124	(99)	1124	(87)	1124	(73)
Plymouth	R	562	(98)	562	(89)	562	(79)
Portsmouth	S	792	(98)	792	(85)	792	(73)
Sheffield	T	692	(98)	692	(89)	692	(79)
St Georges	U	1178	(99)	1178	(91)	1178	(82)
The Royal Free	V	978	(98)	978	(90)	978	(79)
The Royal London	W	1045	(98)	1045	(88)	1045	(75)
WLRTC	X	1439	(99)	1439	(90)	1439	(80)
UK		24481	(98)	24481	(87)	24481	(75)

Paediatric kidney transplant list

8.1 Patients on the kidney transplant list as at 31 March, 2005 – 2014

Figure 8.1 shows the number of paediatric patients on the kidney only [transplant list](#) at 31 March each year between 2005 and 2014. The number of patients actively waiting for a kidney transplant has fallen from 112 in 2005 to 70 in 2014.

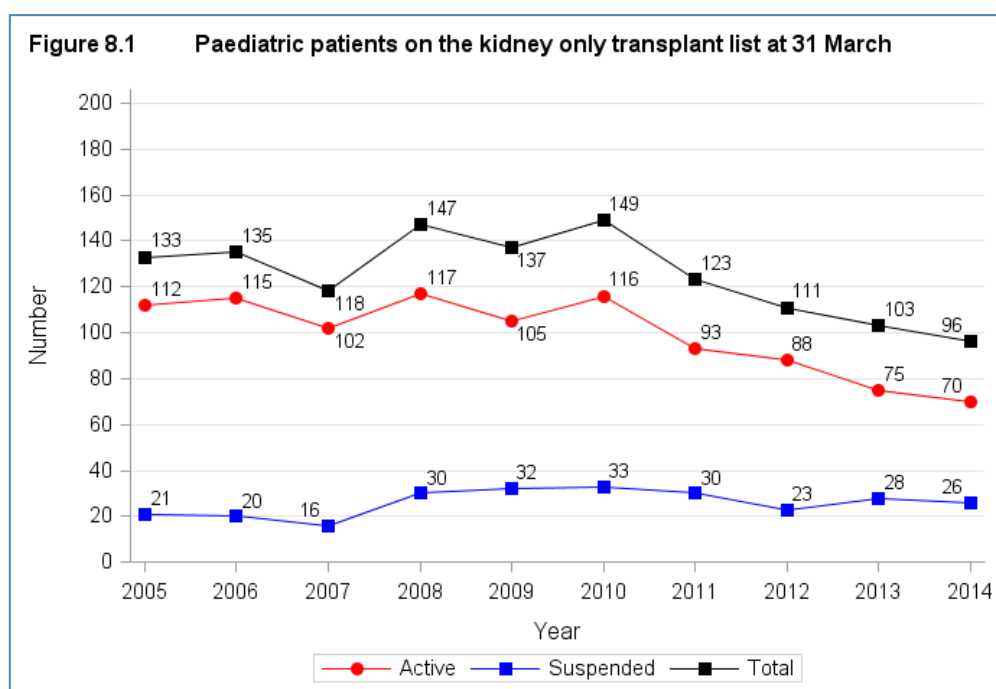


Figure 8.2 shows the number of paediatric patients on the active kidney only [transplant list](#) at 31 March 2014 by centre. In total, there were 70 paediatric patients. Birmingham had the largest proportion of the [transplant list](#) (21%) and Belfast had the smallest (0%).

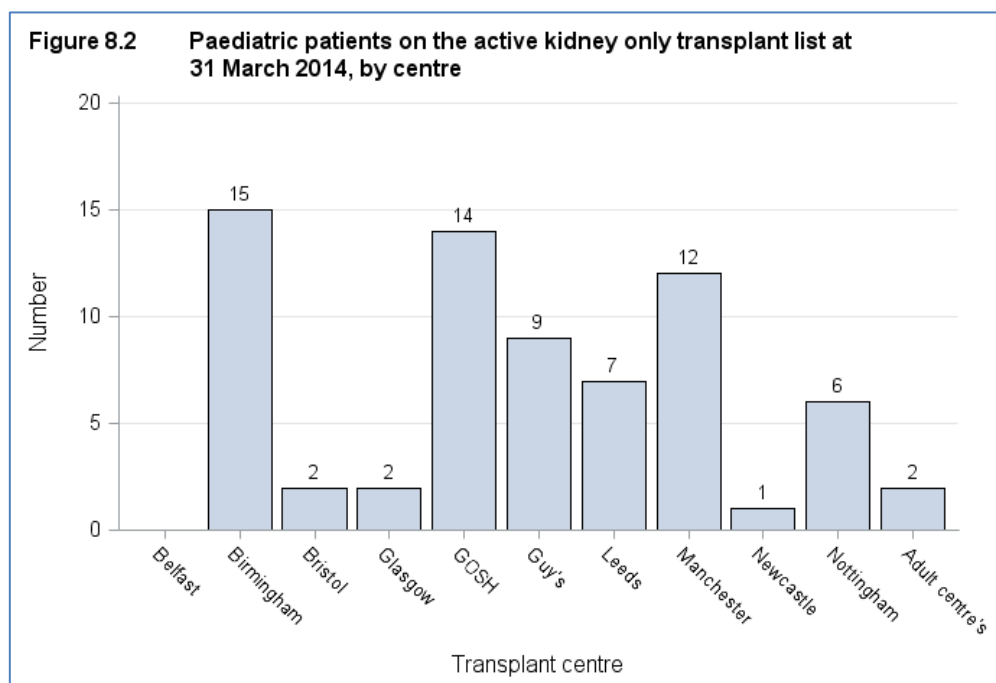
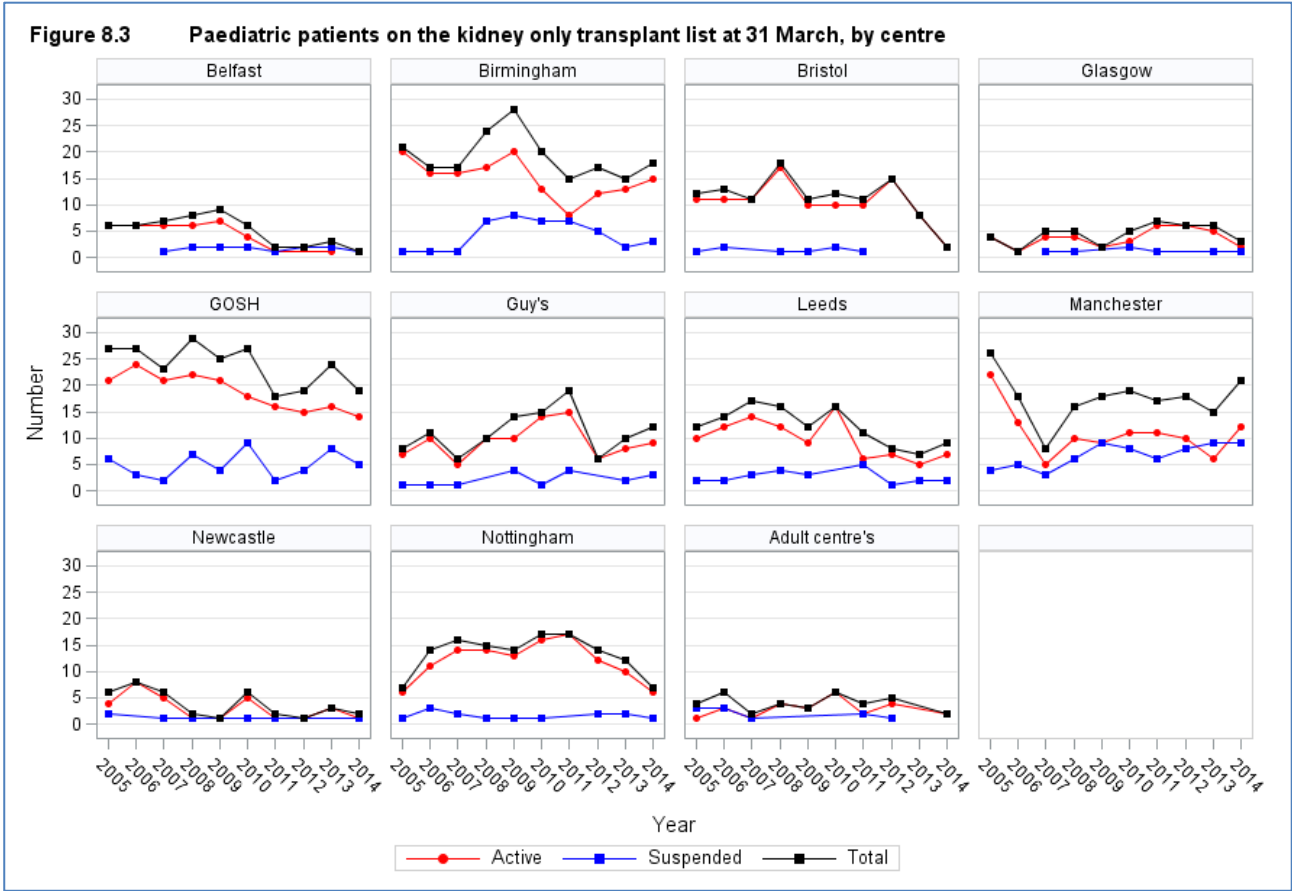
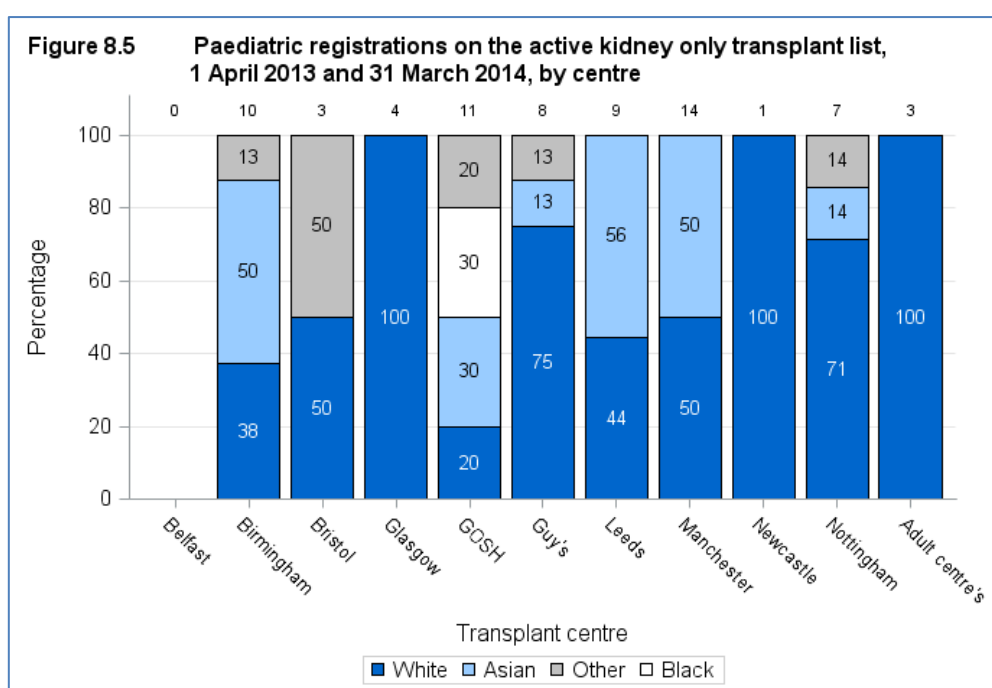
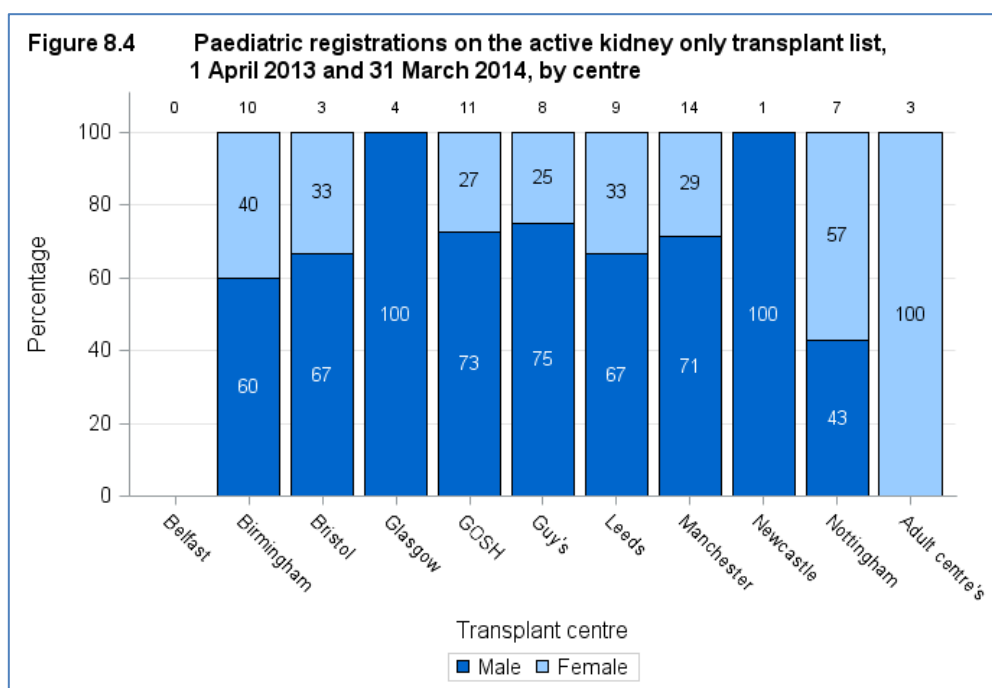


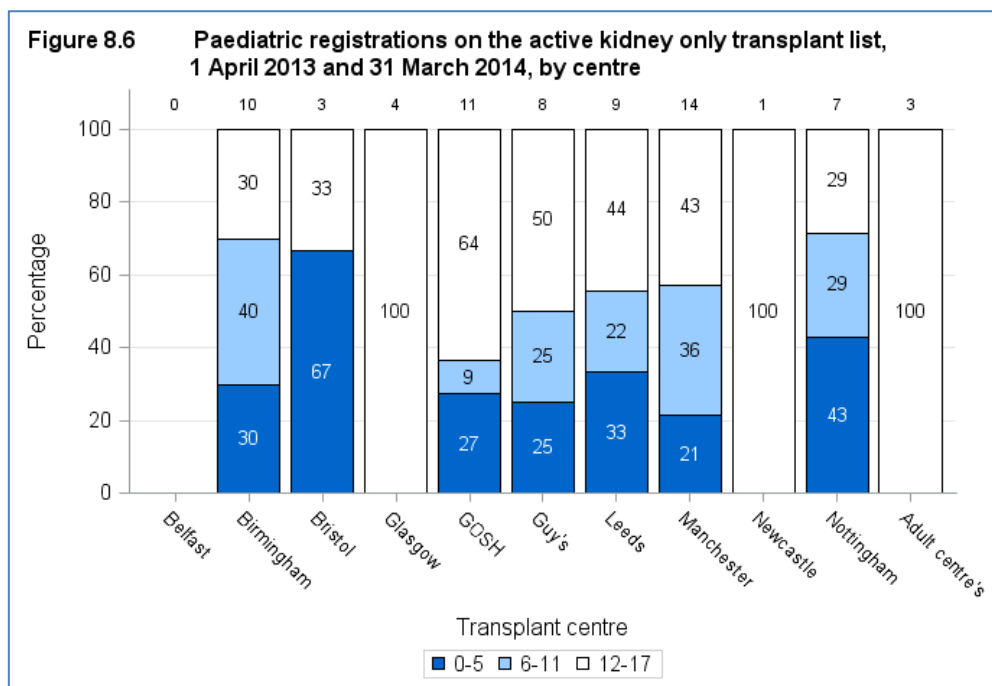
Figure 8.3 shows the number of paediatric patients on the [transplant list](#) at 31 March each year between 2005 and 2014 for each transplant centre.



8.2 Demographic characteristics, 1 April 2013 – 31 March 2014

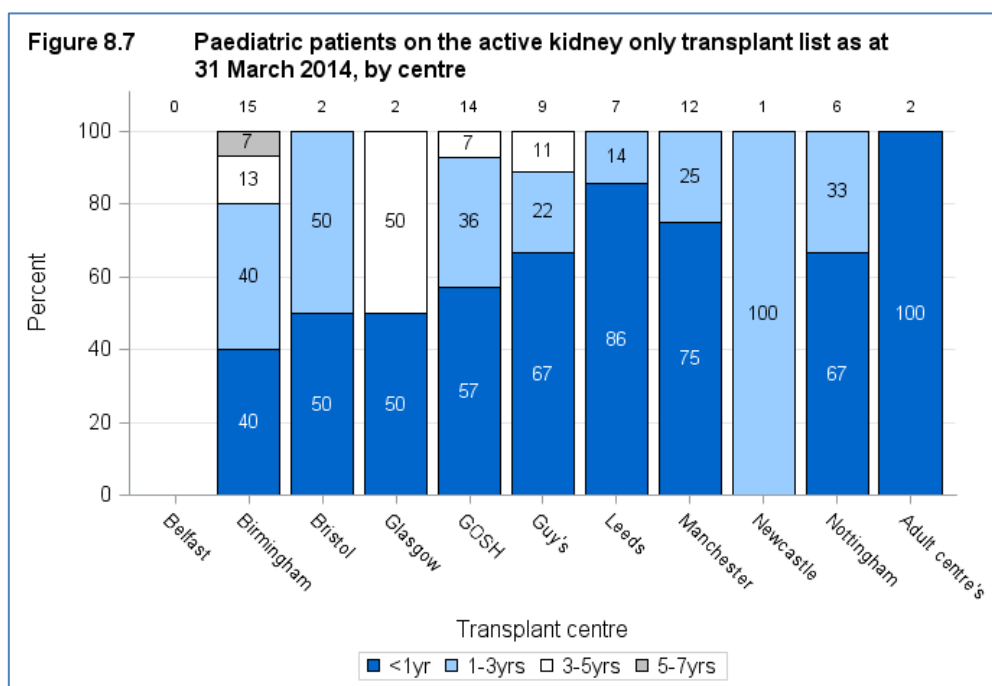
The sex, ethnicity and age group of patients on the transplant are shown by centre in **Figure 8.4**, **8.5** and **8.6**, respectively. Note that all percentages quoted are based only on data where relevant information was available. Changes made to the Kidney Allocation Scheme in 2006 mean that tissue matching criteria between donor and recipient are less strict than previously and waiting time to transplant is now more important than it was in deciding kidney allocation. These changes have an indirect benefit for patients from ethnic minority groups, who are less often a good tissue match with the predominantly white donor pool. As a result, access to transplantation is becoming more equitable.





8.3 Patient waiting times for those currently on the list, 31 March 2014

Figure 8.7 shows the length of time patients have been waiting on the kidney only [transplant list](#) at 31 March 2014 by centre.



8.4 Median waiting time to transplant, 1 April 2008 - 31 March 2011

The length of time a patient waits for a kidney transplant varies across the UK. The [median](#) waiting time for paediatric deceased donor kidney only transplantation is shown in **Figure 8.8** and **Table 8.1** for patients registered at each individual unit. During this period local allocation arrangements were in place for [DCD](#) kidneys while [DBD](#) kidneys were allocated via the [National Kidney Allocation Scheme](#). The data shown are for all paediatric patients, joining the list within the time period shown, including those still awaiting a transplant on the day of analysis. Patients who received a [live donor](#) or [multi-organ transplant](#) are not included. The national allocation scheme introduced in April 2006 is slowly reducing the variability in deceased donor kidney waiting times across the country but currently some variability remains. Waiting times across centres continue to differ in a way that it is difficult for centres to control, given that the [National Kidney Allocation Scheme](#) determines allocation of all kidneys available for transplant from donors after brain death ([DBD](#)).

National Kidney Allocation Scheme

Only kidneys from donors after brain death were allocated via a national allocation scheme during the time period analysed. Kidneys from donations after circulatory death ([DCD](#)) were allocated to patients through local allocation arrangements and these vary across the country because some centres have a larger [DCD](#) programme than others. As of 3 September 2014 one kidney from [DCD](#) donors aged between 5 and 49 years will be allocated within four pre-defined regions using the 2006 [DBD](#) allocation principles and as such we should start to see further reductions in variability in waiting times across the country.

Kidneys from [DBD](#) are allocated to patients listed nationally through the Kidney Allocation Scheme. The Kidney Allocation Scheme introduced in April 2006 prioritises patients with ideal tissue matches (000 [HLA mismatches](#)) and then assigns points to patients based on the level of tissue match between donor and recipient, the length of time spent waiting for a transplant, age of the recipient (with a progressive reduction in points given after the age of thirty) and location points such that patients geographically close to the retrieval centre receive more points. The patients with the highest number of points for a donated kidney are preferentially offered the kidney, no matter where in the UK they receive their treatment.

The [median](#) waiting time to transplant for paediatric patients registered on the kidney only [transplant list](#) between 1 April 2008 and 31 March 2011 is 342 days, just over 1 year. This ranged from 184 days at Bristol to 742 days at Manchester.

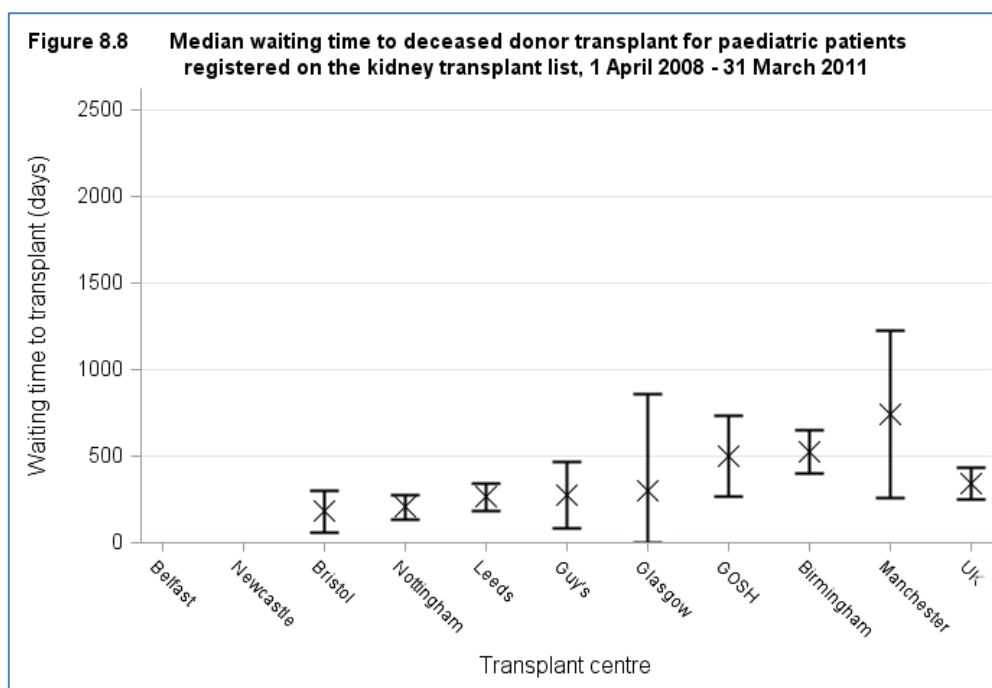
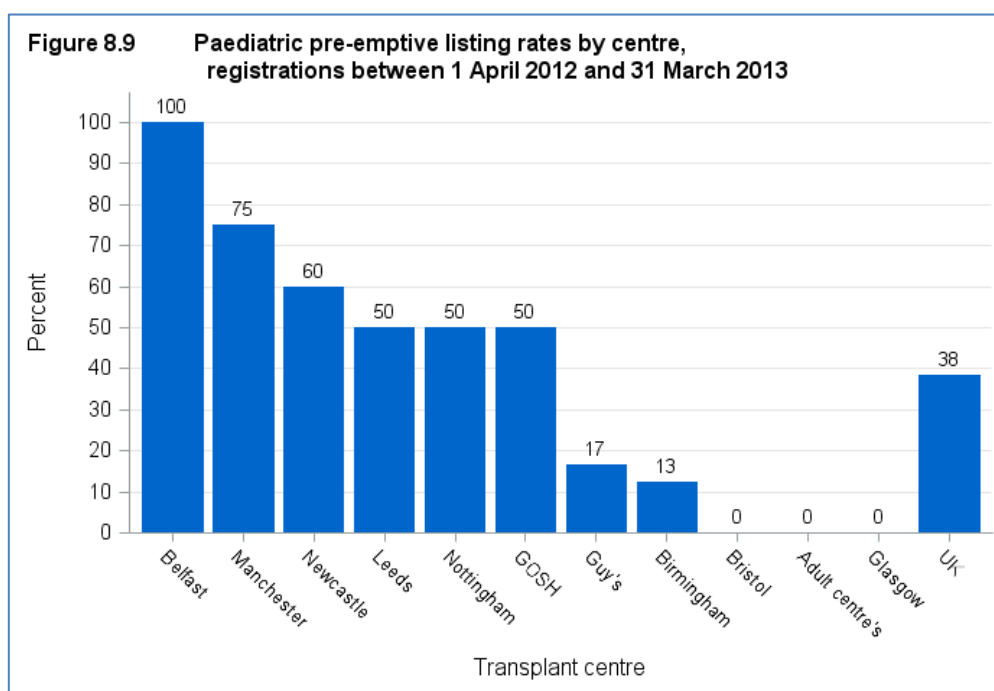


Table 8.1 Median waiting time to kidney only transplant in the UK, for paediatric patients registered 1 April 2008 - 31 March 2011

Transplant centre	Number of patients registered	Waiting time (days)	
		Median	95% Confidence interval
Paediatric			
Belfast	0	-	
Newcastle	0	-	
Bristol	23	184	63 - 305
Nottingham	49	208	137 - 279
Leeds	29	266	188 - 344
Guy's	19	277	88 - 466
Glasgow	16	300	0 - 862
GOSH	25	502	269 - 735
Birmingham	27	525	400 - 650
Manchester	21	742	261 - 1223
UK	246	342	249 - 435

8.5 Pre-emptive listing rates, 1 April 2013 - 31 March 2014

Rates of [pre-emptive](#) kidney only listings are shown in **Figure 8.9** for paediatric patients joining the list between 1 April 2012 and 31 March 2013. Patients listed on the deceased donor [transplant list](#) prior to receiving a living donor transplant are excluded and in order to remove the effect of these patients an earlier cohort was selected. [Pre-emptive](#) listing accounted for 40% of all paediatric registrations across the UK ranging from 100% at Belfast to 0% at Bristol and Glasgow.



Response to paediatric kidney offers

Offer decline rates

Kidney-only offers from [DBD](#) donors who had at least one kidney retrieved, offered directly and on behalf of a named individual patient and resulted in transplantation are included in the analysis. Any offers made through the reallocation of kidneys, declined kidney or fast track schemes were excluded, as were offers of kidneys from donations after circulatory death donors.

Data are presented for standard criteria donors (SCD). SCD are [DBD](#) donors aged <50 at the time of death.

[Funnel plots](#) were used to compare centre specific offer decline rates and indicate how consistent the rates of the individual transplant centres are with the national rate. The overall national unadjusted offer decline rate is shown by the solid line while the 95% and 99.8% confidence lines are indicated via a thin and thick dotted line, respectively. Each dot in the plot represents an individual transplant centre. Centres that are positioned above the upper limits indicate an offer decline rate that is higher than the national rate, while centres positioned below the lower limits indicate an offer decline rate that is lower than the national rate. Patient [case mix](#) is known to influence the number of offers a centre may receive. In this analysis however only individual offers for named patients were considered which excluded any [ABO](#)- and HLA-incompatible patients. For this reason it was decided not to risk adjust for known centre differences in patient [case mix](#).

9.1 Standard criteria offer decline rates, 1 April 2011 – 31 March 2014

Figure 9.1 compares individual centre offer decline rates with the national rate for SCD over the time period, 1 April 2011 and 31 March 2014. Centres can be identified by the information shown in **Table 9.1**. All centres have an offer decline rate that is in line with the national rate.

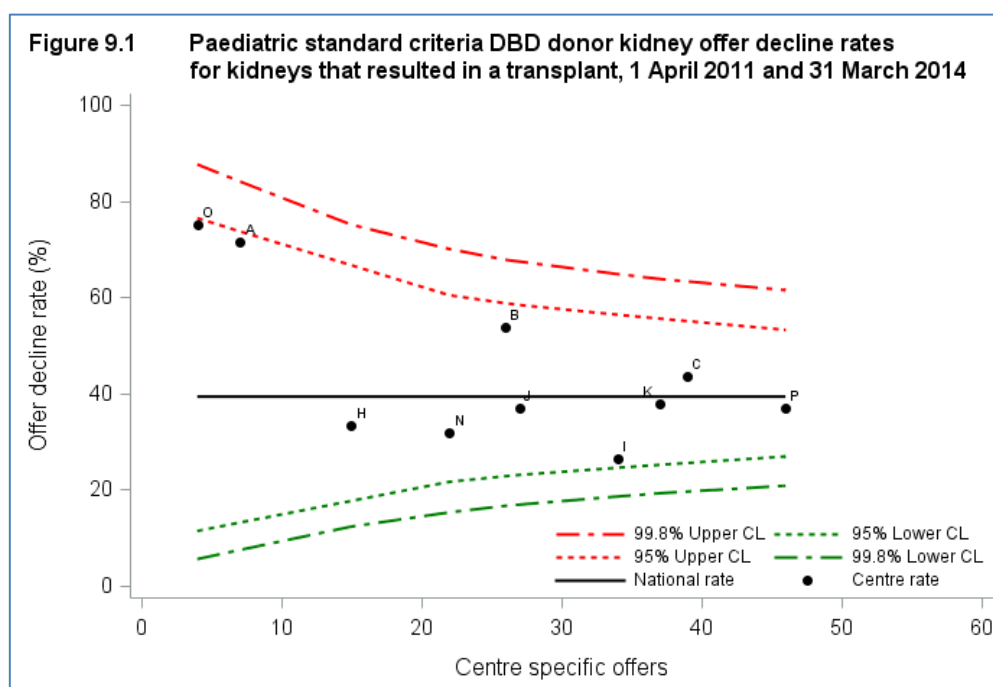


Table 9.1 compares individual centre offer decline rates for SCD over time by financial year.

Centre	Code	2011/12		2012/13		2013/14		Overall	
		N	(%)	N	(%)	N	(%)	N	(%)
Belfast	A	4	(75)	2	(50)	1	(100)	7	(71)
Birmingham	B	8	(63)	9	(56)	9	(44)	26	(54)
Bristol	C	10	(40)	17	(41)	12	(50)	39	(44)
GOSH	I	12	(33)	11	(18)	11	(27)	34	(26)
Glasgow	H	5	(60)	3	(33)	7	(14)	15	(33)
Guy's	J	13	(15)	6	(50)	8	(63)	27	(37)
Leeds	K	20	(35)	4	(25)	13	(46)	37	(38)
Manchester	N	8	(38)	9	(44)	5	(0)	22	(32)
Newcastle	O	2	(100)	1	(100)	1	(0)	4	(75)
Nottingham	P	20	(25)	16	(56)	10	(30)	46	(37)
UK		102	(37)	78	(44)	77	(38)	257	(39)

Paediatric kidney transplants

10.1 Kidney only transplants, 1 April 2004 – 31 March 2014

Figure 10.1 shows the total number of paediatric kidney only transplants performed in the last ten years, by type of donor. Only a small number of paediatric transplants use kidneys from donors after circulatory death ([DCD](#)), 5 in 2013/14.

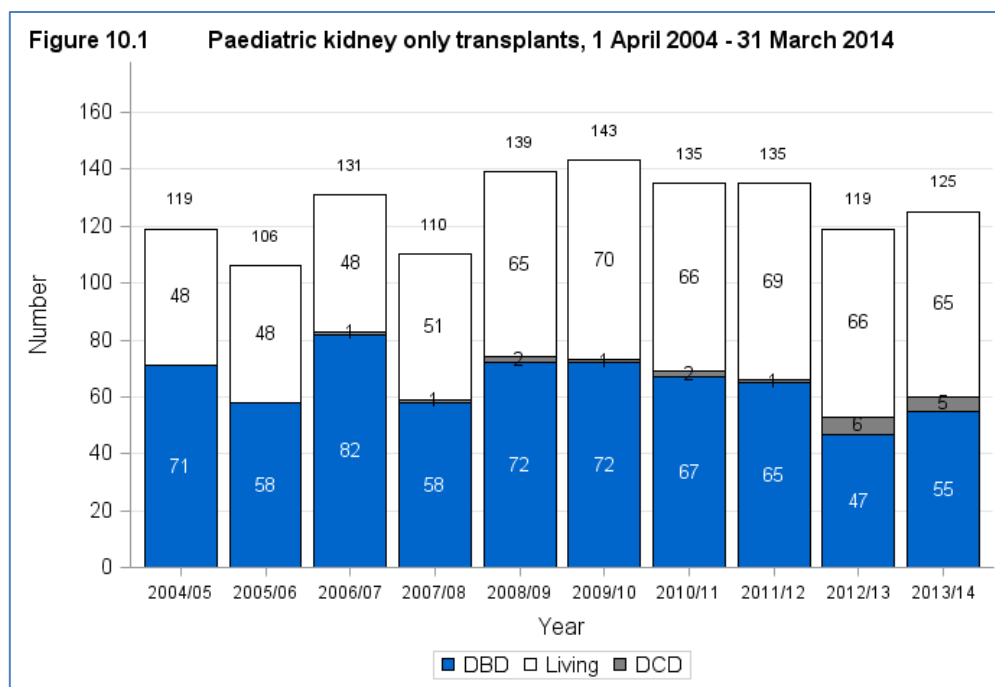
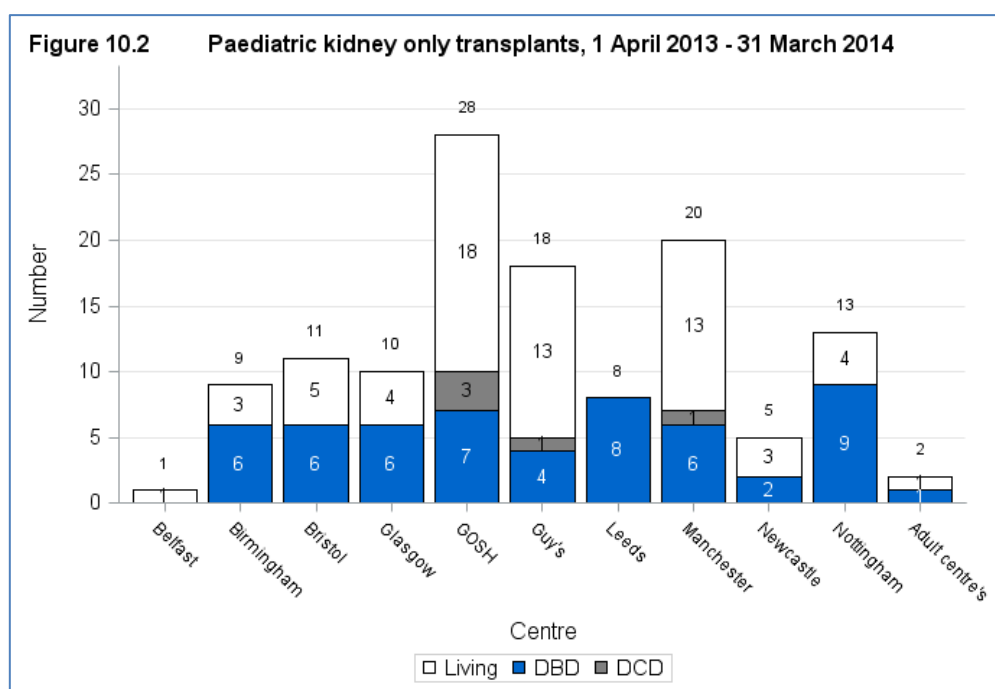


Figure 10.2 shows the total number of paediatric kidney only transplants performed in 2013/14, by centre and type of donor. The same information is presented in **Figure 10.3** but this shows the proportion of [DBD](#), [DCD](#) and living donor transplants performed at each centre.



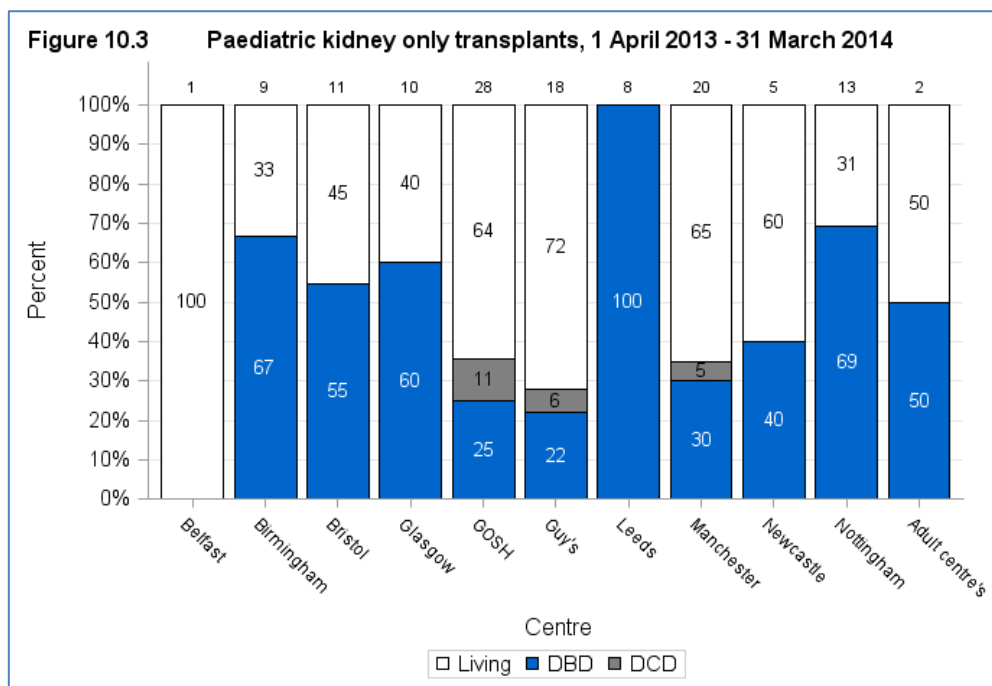
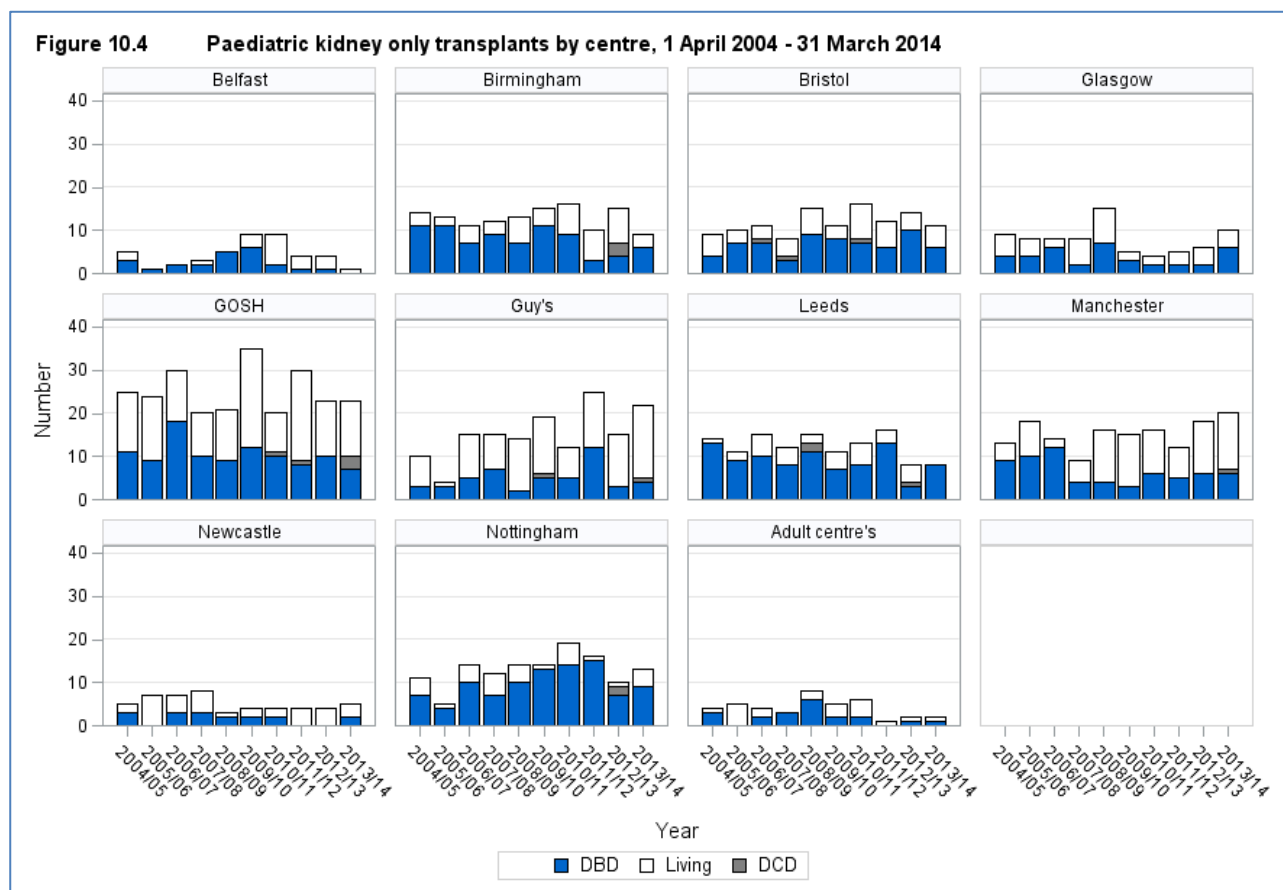
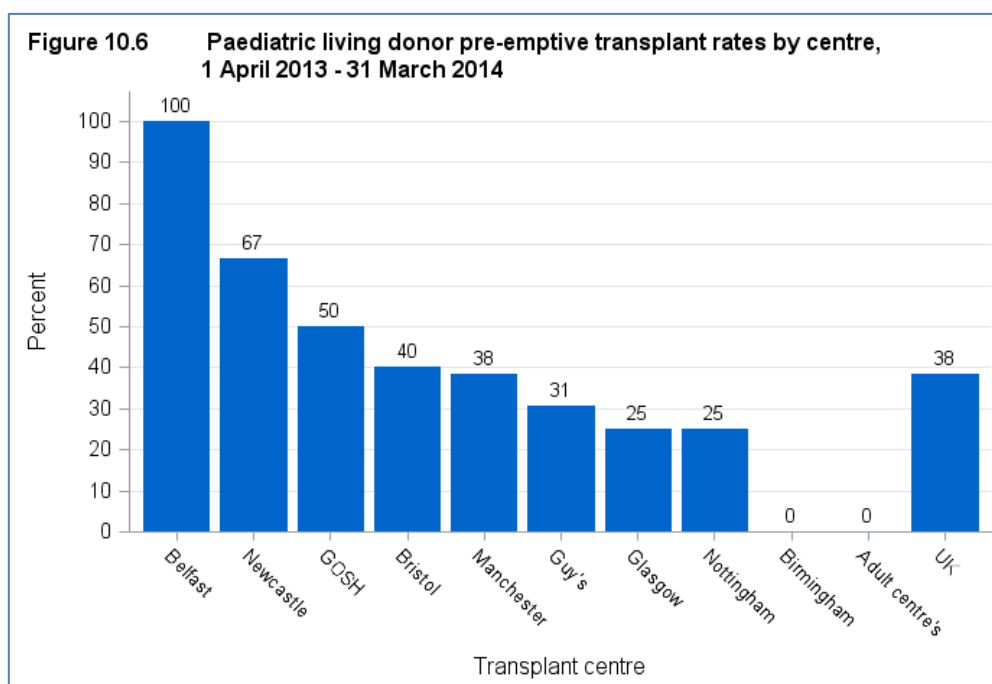
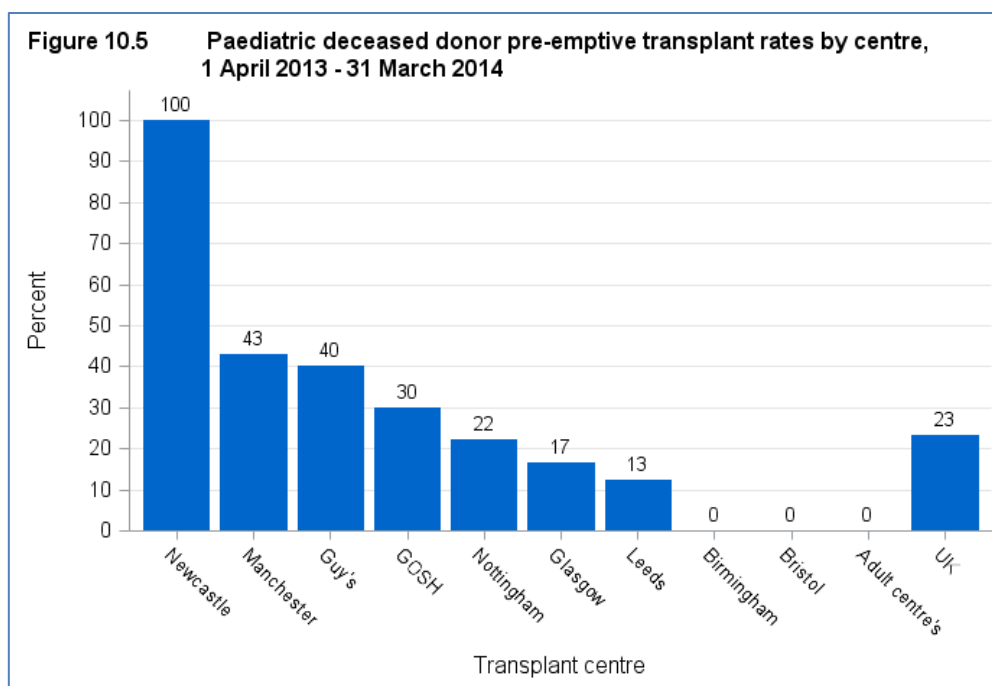


Figure 10.4 shows the total number of paediatric kidney only transplants performed in last ten years, by centre and type of donor.



10.2 Pre-emptive transplant rates, 1 April 2013 - 31 March 2014

Rates of [pre-emptive](#) kidney only transplantation are shown in **Figure 10.5** for paediatric deceased donor transplants and **Figure 10.6** for paediatric living donor transplants. Living donor transplants are more likely to be carried out before the need for dialysis than deceased donor transplants: 38% and 23% respectively. This is because a living donor transplant can often be carried out more quickly than a deceased donor kidney transplant as the latter often necessitates a long waiting time. Paediatric deceased donor [pre-emptive](#) transplant rates ranged from 100% at Newcastle to 0% at Birmingham and Bristol. Paediatric living donor [pre-emptive](#) transplant rates ranged from 100% at Belfast to 0% at Birmingham.



Paediatric kidney outcomes

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 [risk-adjusted survival rate](#) plotted against the number of transplants for each centre, with the overall national [unadjusted 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, Monro JL, Pollock JCS, Watterson KG. Mortality rates after surgery for congenital heart defects in children and surgeons' performance. *Lancet* 2000; 355: 1004 – 1007.

11.1 Deceased donor graft and patient survival

The [funnel plots](#) show that, for the most part, the centres lie within the [confidence limits](#). None of the [funnel plots](#) show any centres that lie outside the lower 99.8% [confidence limits](#). Some of the [funnel plots](#) show some centres to be above the upper 99.8% [confidence limit](#). This suggests that these centres may have survival rates that are considerably higher than the national rate. Centres can be identified by the information shown in **Table 11.1**.

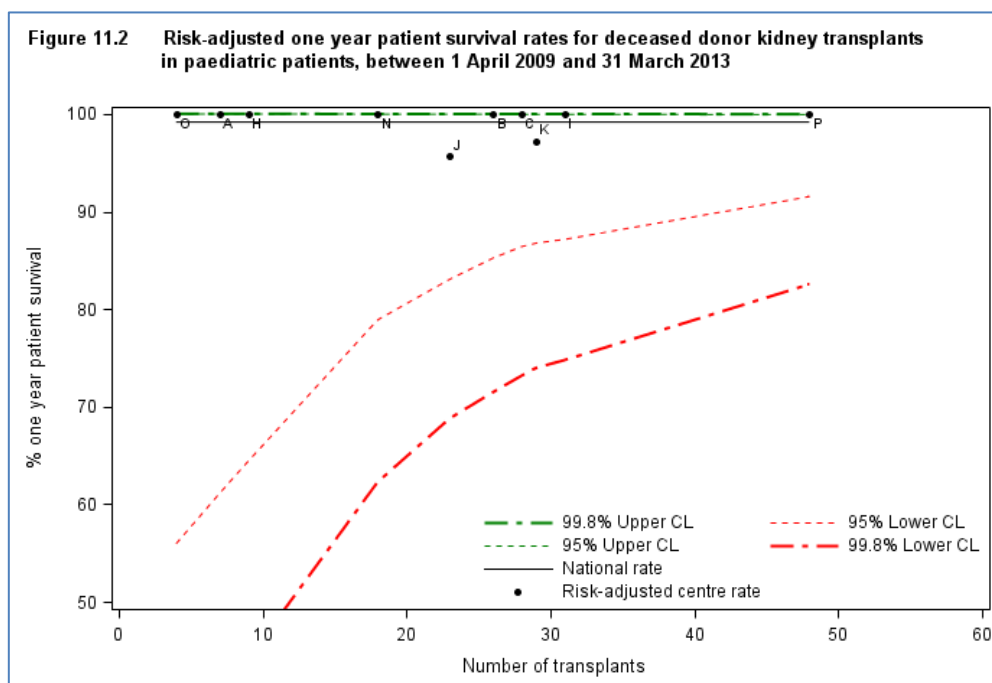
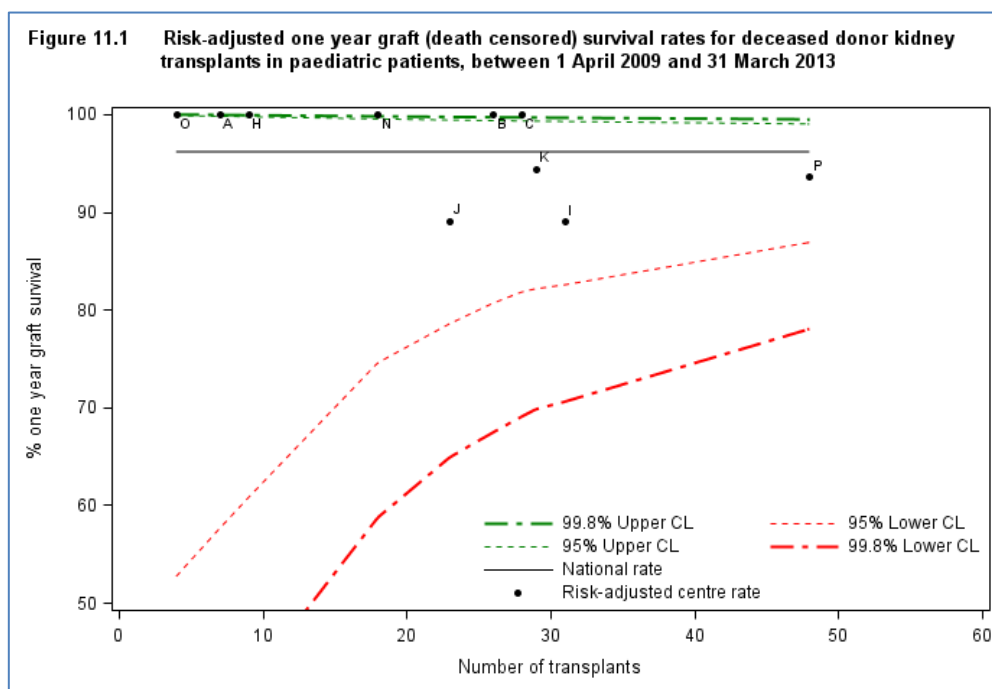


Figure 11.3 Risk-adjusted five year graft (death censored) survival rates for deceased donor kidney transplants in paediatric patients, between 1 April 2005 and 31 March 2009

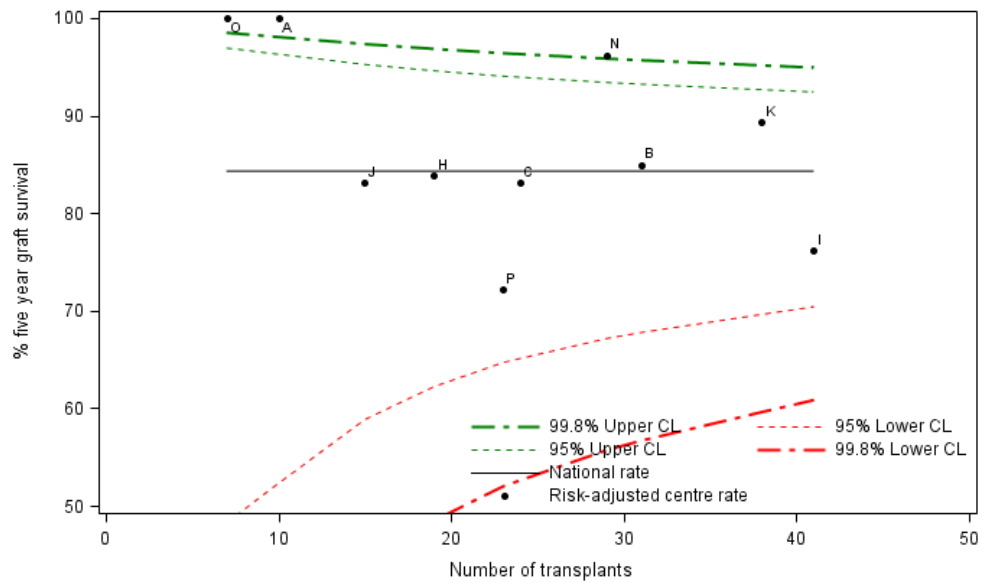


Figure 11.4 Risk-adjusted five year patient survival rates for deceased donor kidney transplants in paediatric patients, between 1 April 2005 and 31 March 2009

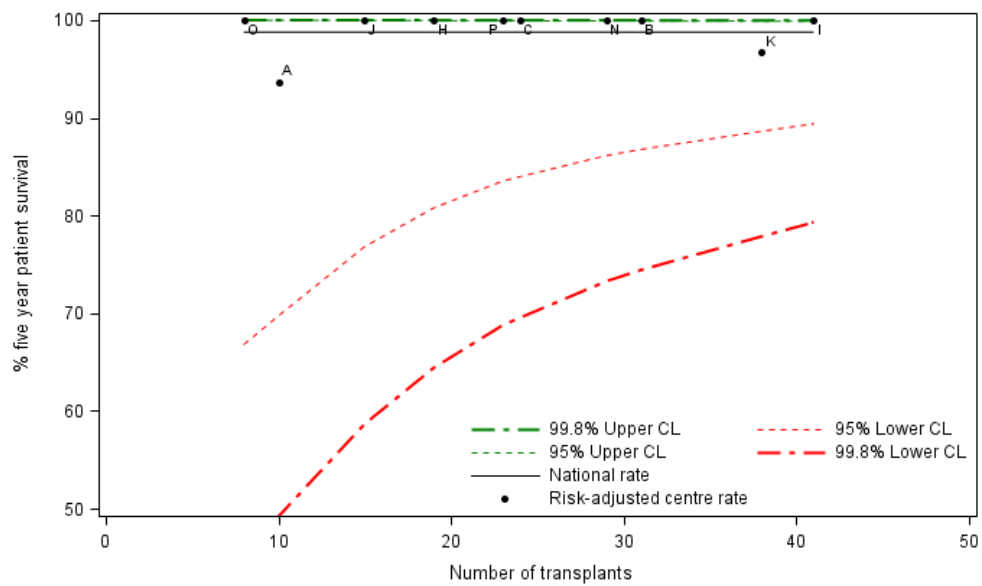


Table 11.1 One and five year paediatric kidney-only graft and patient survival using kidneys from deceased donors

Centre	Code	Kidney graft survival				Patient survival			
		One-year*		Five-year**		One-year*		Five-year**	
		%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)
Belfast	A	100	N/A	100	N/A	100	N/A	94	(65 - 100)
Birmingham	B	100	N/A	85	(61 - 96)	100	N/A	100	N/A
Bristol	C	100	N/A	83	(57 - 95)	100	N/A	100	N/A
GOSH	I	89	(60 - 99)	76	(56 - 89)	100	N/A	100	N/A
Glasgow	H	100	N/A	84	(53 - 97)	100	N/A	100	N/A
Guy's	J	89	(61 - 99)	83	(39 - 98)	96	(76 - 100)	100	N/A
Leeds	K	94	(69 - 100)	89	(73 - 97)	97	(84 - 100)	97	(82 - 100)
Manchester	N	100	N/A	96	(79 - 100)	100	N/A	100	N/A
Newcastle	O	100	N/A	100	N/A	100	N/A	100	N/A
Nottingham	P	94	(84 - 98)	72	(43 - 89)	100	N/A	100	N/A
UK		96	(93 - 98)	84	(79 - 88)	99	(97 - 100)	99	(96 - 100)

* Includes transplants performed between 1 april 2009 - 31 March 2013

** Includes transplants performed between 1 april 2005 - 31 March 2009

11.2 Living donor graft and patient survival

The [funnel plots](#) show that, for the most part, the centres lie within the [confidence limits](#). None of the [funnel plots](#) show any centres that lie outside the lower 99.8% [confidence limits](#). Some of the [funnel plots](#) show some centres to be above the upper 99.8% [confidence limit](#). This suggests that these centres may have survival rates that are considerably higher than the national rate. Centres can be identified by the information shown in **Table 11.2**.

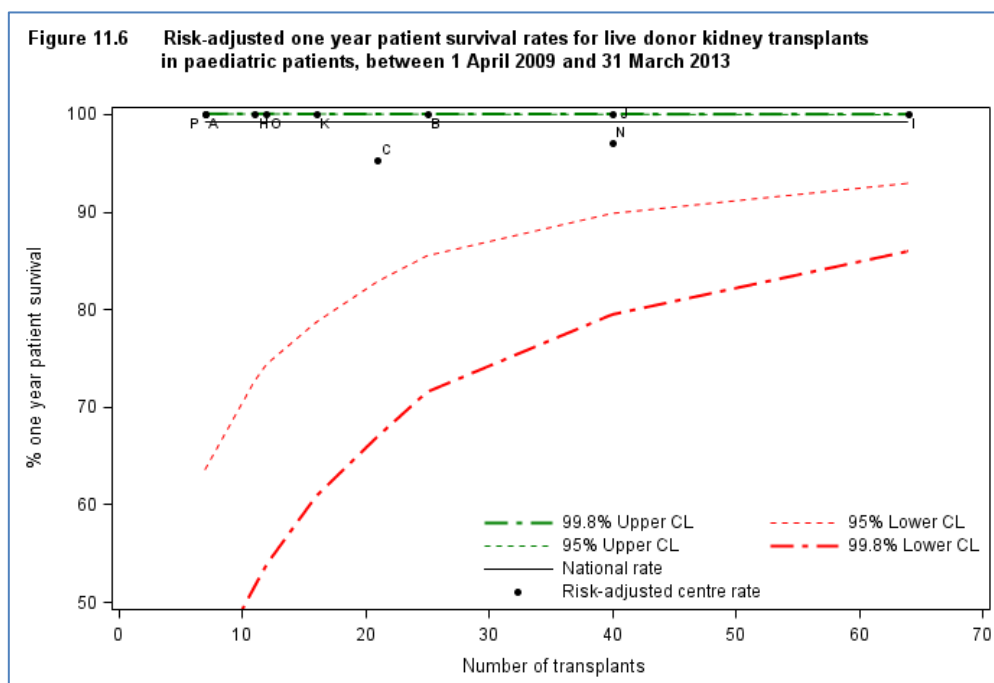
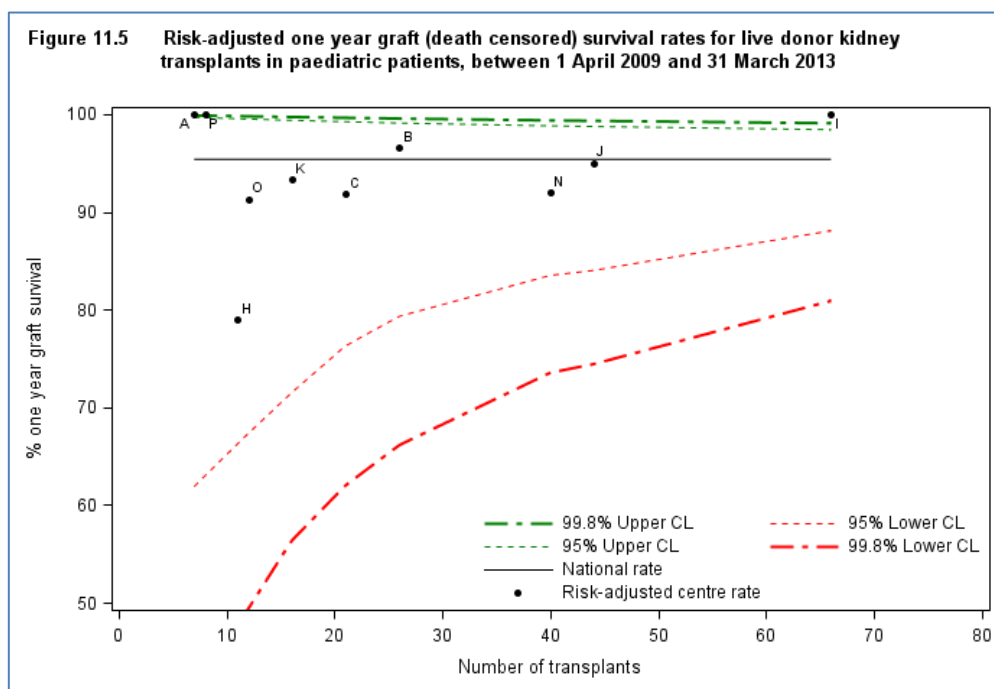


Figure 11.7 Risk-adjusted five year graft (death censored) survival rates for live donor kidney transplants in paediatric patients, between 1 April 2005 and 31 March 2009

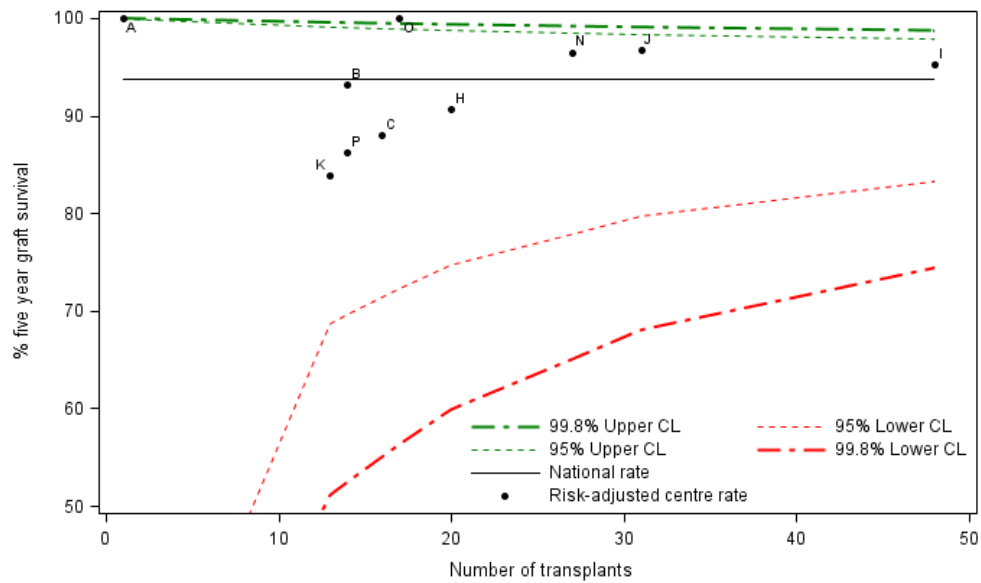


Figure 11.8 Risk-adjusted five year patient survival rates for live donor kidney transplants in paediatric patients, between 1 April 2005 and 31 March 2009

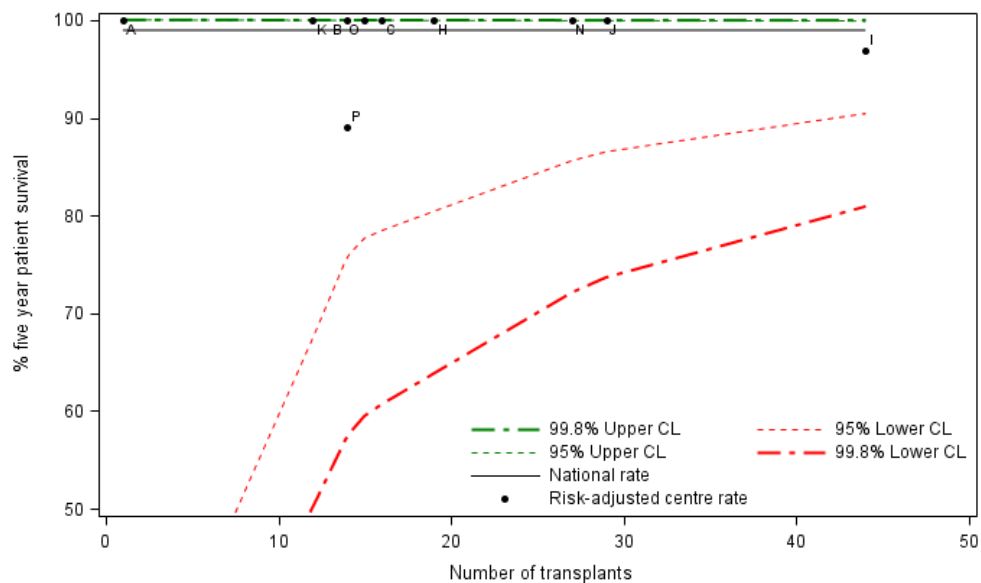


Table 11.2 One and five year paediatric kidney-only graft and patient survival using kidneys from living donors

Centre	Code	Kidney graft survival				Patient survival			
		One-year*		Five-year**		One-year*		Five-year**	
		%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)
Belfast	A	100	N/A	100	N/A	100	N/A	100	N/A
Birmingham	B	97	(81 - 100)	93	(62 - 100)	100	N/A	100	N/A
Bristol	C	92	(71 - 99)	88	(57 - 99)	95	(73 - 100)	100	N/A
GOSH	I	100	N/A	95	(83 - 99)	100	N/A	97	(83 - 100)
Glasgow	H	79	(24 - 97)	91	(66 - 99)	100	N/A	100	N/A
Guy's	J	95	(82 - 99)	97	(82 - 100)	100	N/A	100	N/A
Leeds	K	93	(63 - 100)	84	(42 - 98)	100	N/A	100	N/A
Manchester	N	92	(76 - 98)	96	(80 - 100)	97	(83 - 100)	100	N/A
Newcastle	O	91	(52 - 100)	100	N/A	100	N/A	100	N/A
Nottingham	P	100	N/A	86	(50 - 98)	100	N/A	89	(39 - 100)
UK		95	(92 - 97)	94	(89 - 96)	99	(97 - 100)	99	(96 - 100)

* Includes transplants performed between 1 april 2009 - 31 March 2013

** Includes transplants performed between 1 april 2005 - 31 March 2009

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.

Donor after brain death (DBD)

A donor whose heart is still beating when their entire brain has stopped working so that they cannot survive without the use of a ventilator. Organs for transplant are removed from the donor while their heart is still beating, but only after extensive tests determine that the brain cannot recover and they have been certified dead.

Donor after circulatory death (DCD)

A donor whose heart stops beating before their brain stops working and who is then certified dead. The organs are then removed.

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 and risk-adjustment for survival rate estimation

Unadjusted and risk-adjusted 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. In reality, patients differ and a risk-adjusted rate that allows for these differences would give a more meaningful estimate of survival.

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.

Computing risk-adjusted survival rates

A risk-adjusted survival rate is an estimate of what the survival rate at a centre would have been if they had had the same mix of patients as that seen nationally. The risk-adjusted rate therefore presents estimates in which differences in patient mix across centres have been removed as much as possible. For that reason, it is valid to only compare centres using risk-adjusted rather than unadjusted rates, as differences among the latter can be attributed to differences in patient mix.

Risk-adjusted survival estimates were obtained through indirect standardisation. A [Cox Proportional Hazards model](#) was used to determine the probability of survival for each patient based on their individual risk factor values. The sum of these probabilities for all patients at a centre gives the number, E, of patients or grafts expected to survive at least one year or five years after transplant at that centre. The number of patients who actually survive the given time period is given by O. The risk-adjusted estimate is then calculated by multiplying the ratio O/E by the overall unadjusted survival rate across all centres. The risk-adjustment models used were based on results from previous studies that looked at factors affecting the survival rates of interest. The factors included in the models are shown in the table below.

Risk adjustment factors

Adult patient transplants

First transplants from deceased donors

1 year graft survival	Donor age, donor type, donor cause of death, recipient age, waiting time to transplant, primary renal disease, HLA mismatch group, cold ischaemic time*, recipient ethnicity
1 year patient survival	Donor age, recipient age, waiting time to transplant, primary renal disease, HLA mismatch group, cold ischaemic time*
5 year graft survival	Graft year, donor age, donor type, donor cause of death, recipient age, waiting time to transplant, primary renal disease, HLA mismatch group, recipient ethnicity
5 year patient survival	Graft year, donor age, recipient age, waiting time to transplant, primary renal disease

Transplants from live donors

1 year graft survival	Donor age, recipient age, primary renal disease, number of HLA mismatches
1 year patient survival	Recipient age
5 year graft survival	Graft year, donor age, recipient age, primary renal disease, number of HLA mismatches
5 year patient survival	Recipient age, primary renal disease

Paediatric patient transplants

First transplants from deceased donors

1 year graft survival	Donor age, recipient age, HLA mismatch group, cold ischaemic time*
1 year patient survival	Recipient age
5 year graft survival	Donor age, recipient age, HLA mismatch group
5 year patient survival	Recipient age

Transplants from live donors

1 year graft survival	Donor age, recipient age
1 year patient survival	Recipient age
5 year graft survival	Donor age, recipient age
5 year patient survival	Recipient age

*Time between retrieval of kidney from the donor and time of transplant in the patient.

A3 Factors used in risk-adjusted models for patient survival from listing

Adult patient registrations

First registrations for deceased donor transplant

1, 5 and 10 year patient survival from listing age, gender, ethnicity, blood group, BMI, cRF*>85%, primary disease, dialysis status

* Calculated reaction frequency

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