



Blood and Transplant

ANNUAL REPORT ON KIDNEY TRANSPLANTATION

**REPORT FOR 2022/2023
(1 APRIL 2013 – 31 MARCH 2023)**

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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 2013. 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 2023, there were 5,251 adults on the UK active kidney [transplant list](#) which represents a 13% increase in the number of patients a year earlier. The equivalent number of paediatric patients was 102, representing an increase by 1 from the previous year.

There were 3,012 adult kidney only transplants performed in the UK in 2022/23 an increase of 4% compared to the previous year. Of these, 1,163 were from [DBD](#) donors, 1,001 were from [DCD](#) donors and 848 were from living donors. The equivalent number of paediatric transplants was 127 representing an 18% decrease from the previous year. Use of the contents of this report should be acknowledged as follows:
Annual Report on Kidney Transplantation 2022/23, NHS Blood and Transplant

Introduction

This report presents information on transplant activity between 1 April 2013 and 31 March 2023, 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 2018 to 31 March 2022 and five-year post-transplant for the period 1 April 2014 to 31 March 2018. 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 2011 and 31 December 2022.

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 adults (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.

On 11 September 2019, a new National Kidney Offering Scheme was introduced to offer kidneys from both donors after brain death and donors after circulatory death. This is a change from the previous system where kidneys from donors after circulatory death were offered under a different scheme than kidneys from donors after brain death. The scheme has two tiers with priority going to patients who are the most difficult to match or who have waited over 7 years for a transplant.

The COVID-19 pandemic has led to unprecedented challenges for UK transplantation. Concerns about the ability to care for transplant recipients, lack of access to resource because it is being used for patients in the pandemic, and the risk versus benefit for immunosuppressed transplant recipients, have resulted in a major reduction in the number of organ transplants undertaken.

Figure 2.1 shows the number of patients on the kidney [transplant list](#) on 31 March each year between 2014 and 2023. The number of patients actively waiting for a kidney transplant decreased from 5,881 in 2014 to 5,626 in 2023.

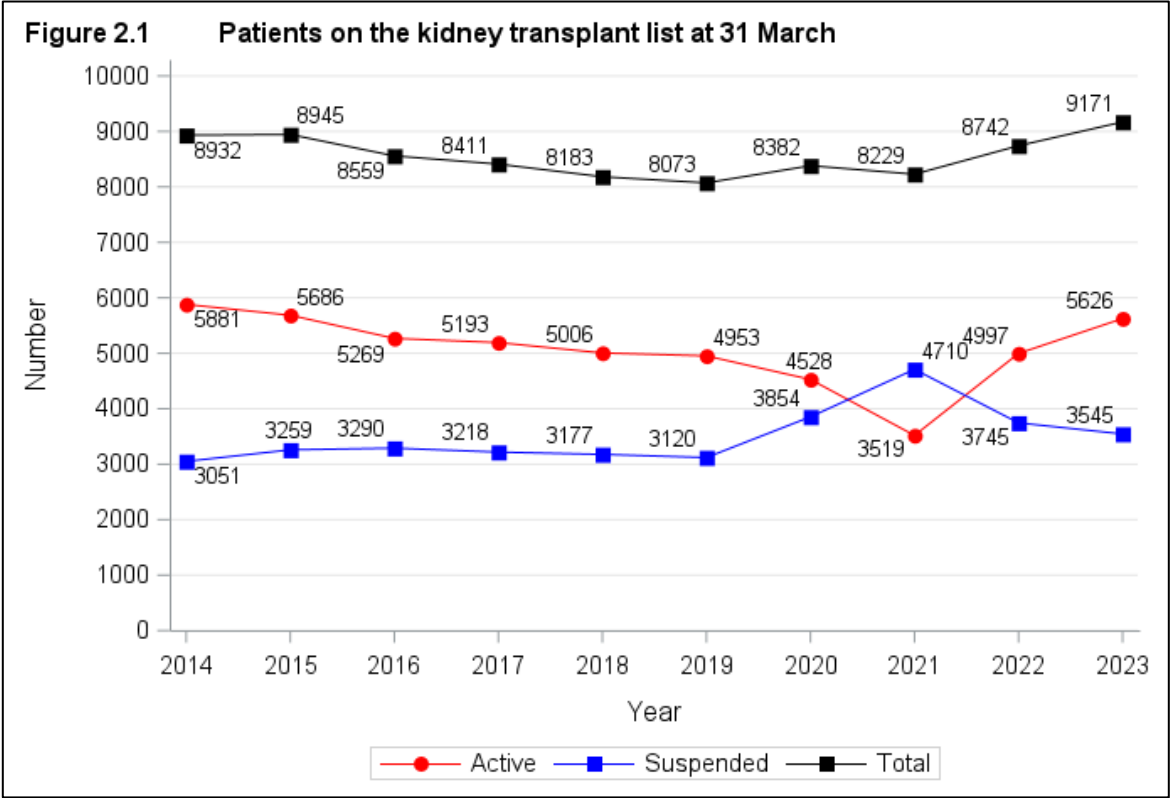


Figure 2.2 shows the number of patients on the kidney [transplant list](#) at 31 March 2023 for each transplant centre. Manchester has the largest active [transplant list](#) with 435 patients registered for a kidney transplant.

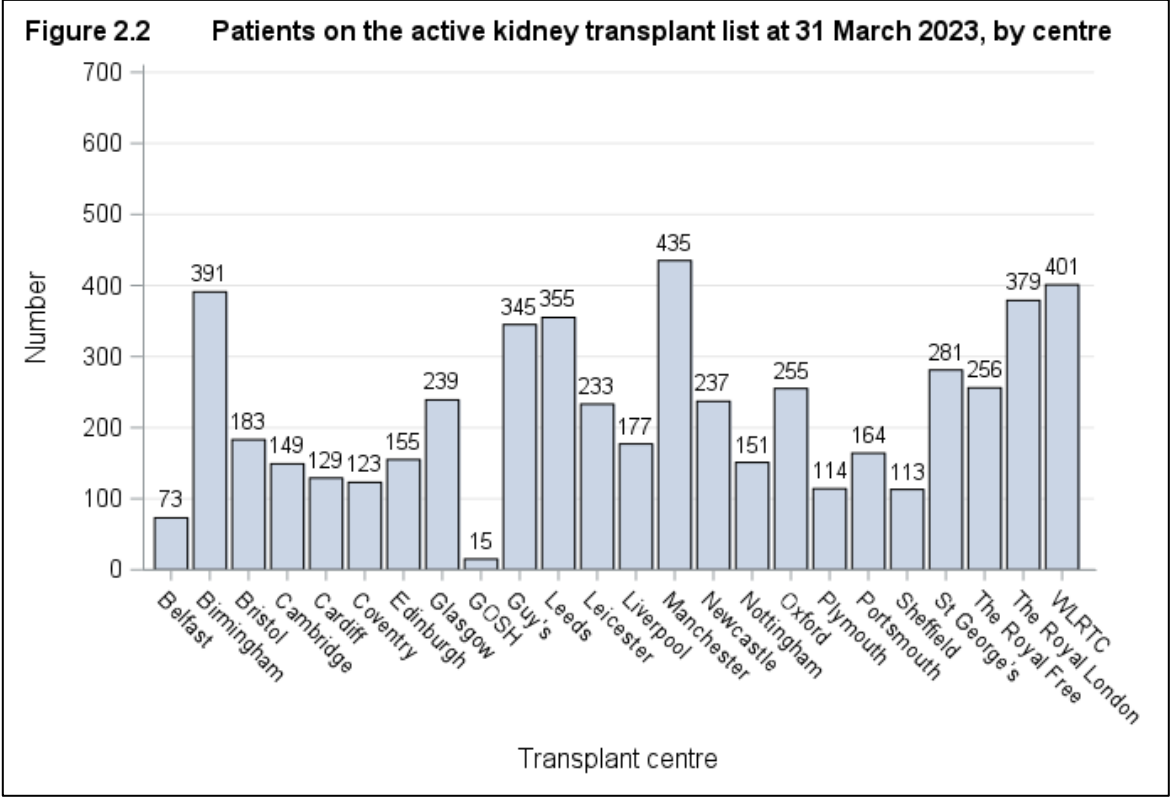


Figure 2.3 shows the total number of kidney transplants performed in the last ten years. The number of transplants has increased slightly overall from 3,259 in 2013/14 to 3,274 in 2022/23.

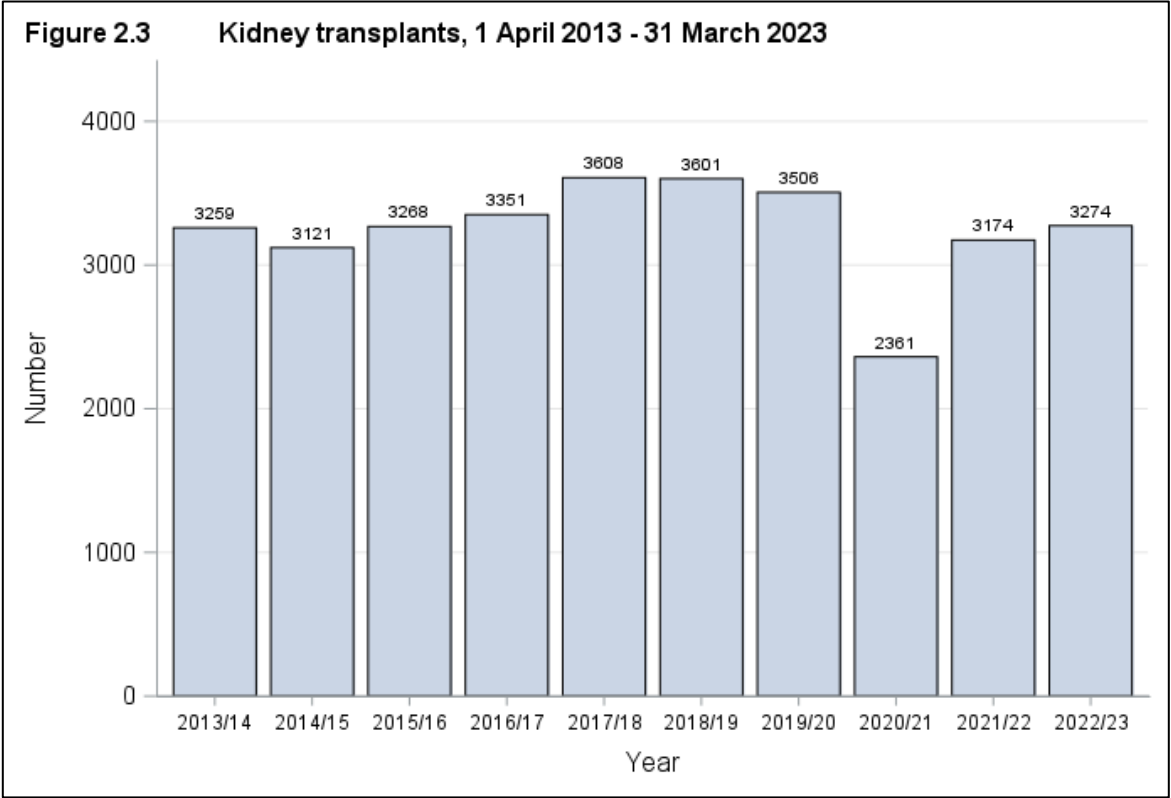


Figure 2.4 shows the total number of kidney transplants performed in 2022/23 at each transplant centre. Guy’s had the highest activity last year with 278 transplants performed.

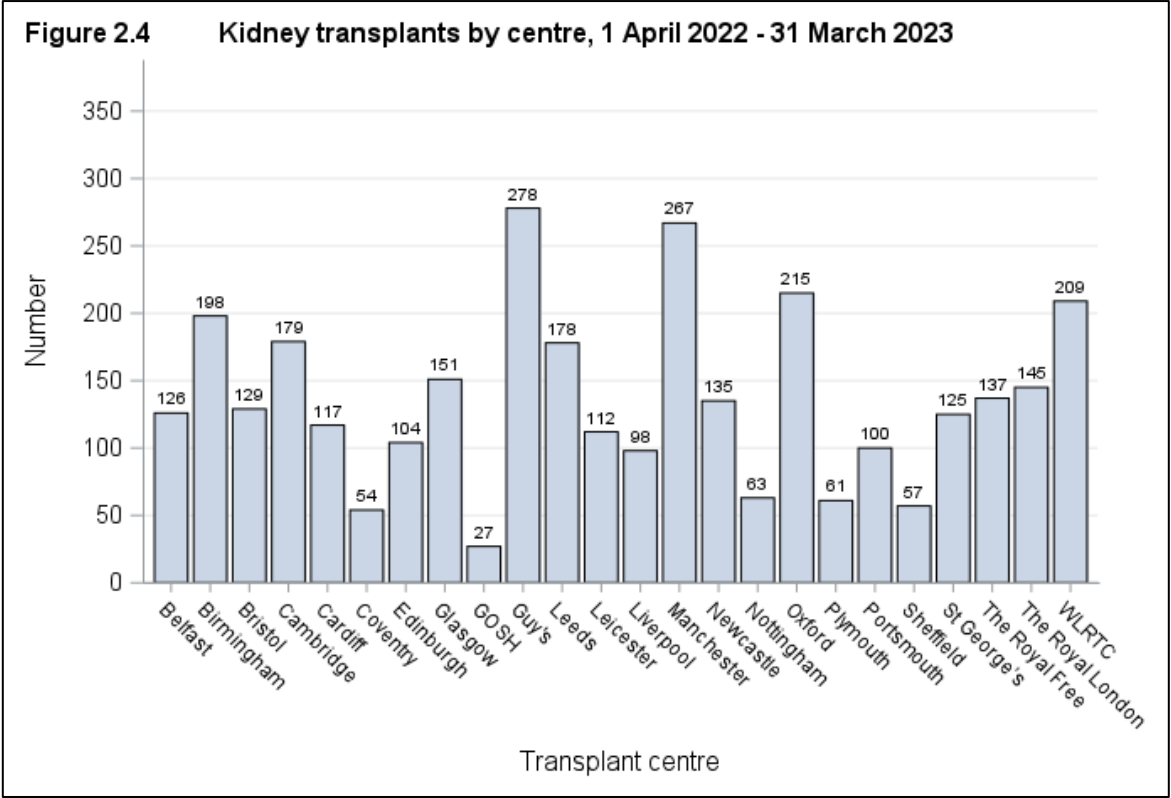


Figure 2.5 shows the total number of kidney transplants performed per million population in 2022/23 at each transplant centre. WLRTC had the highest number of adult deceased donor kidney transplants per million population.

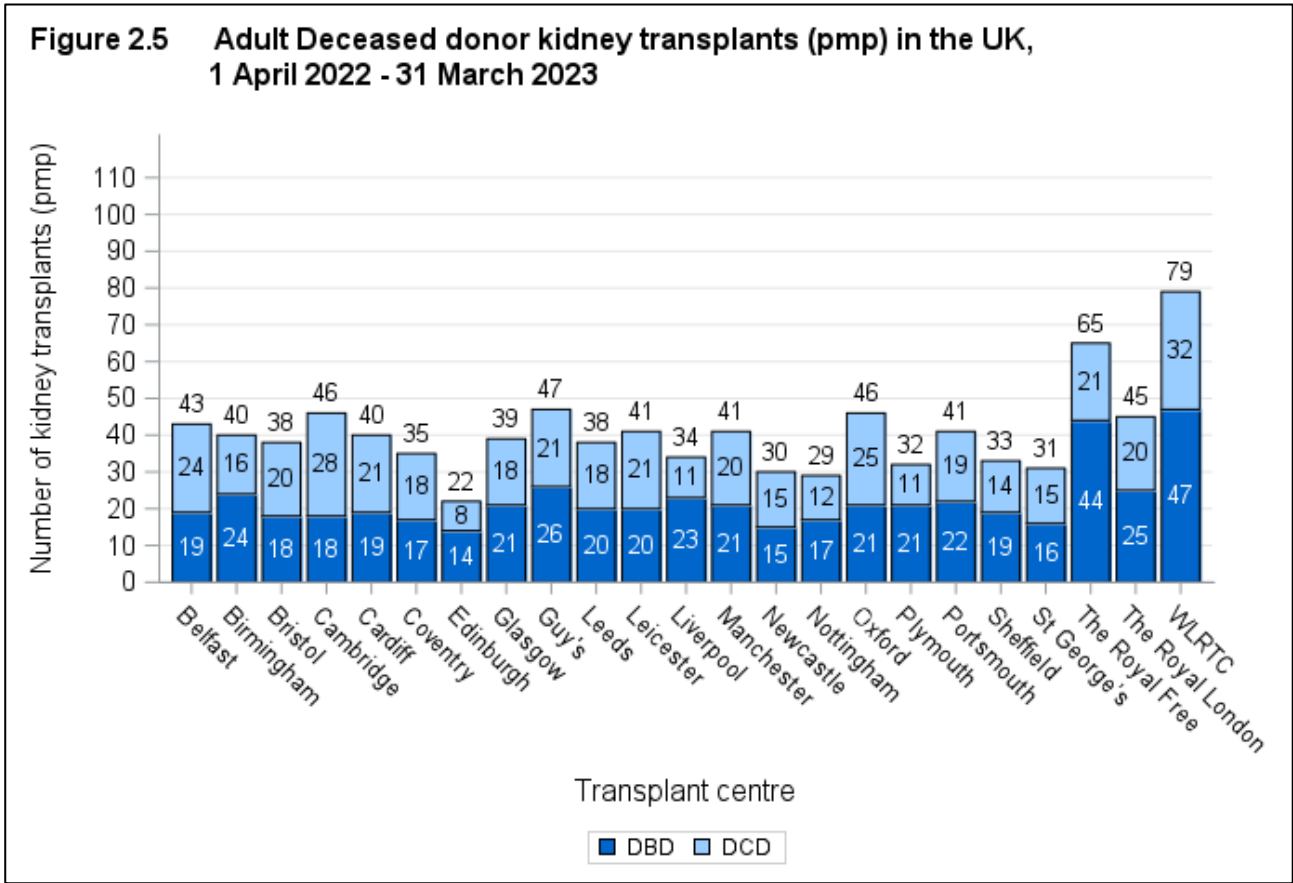
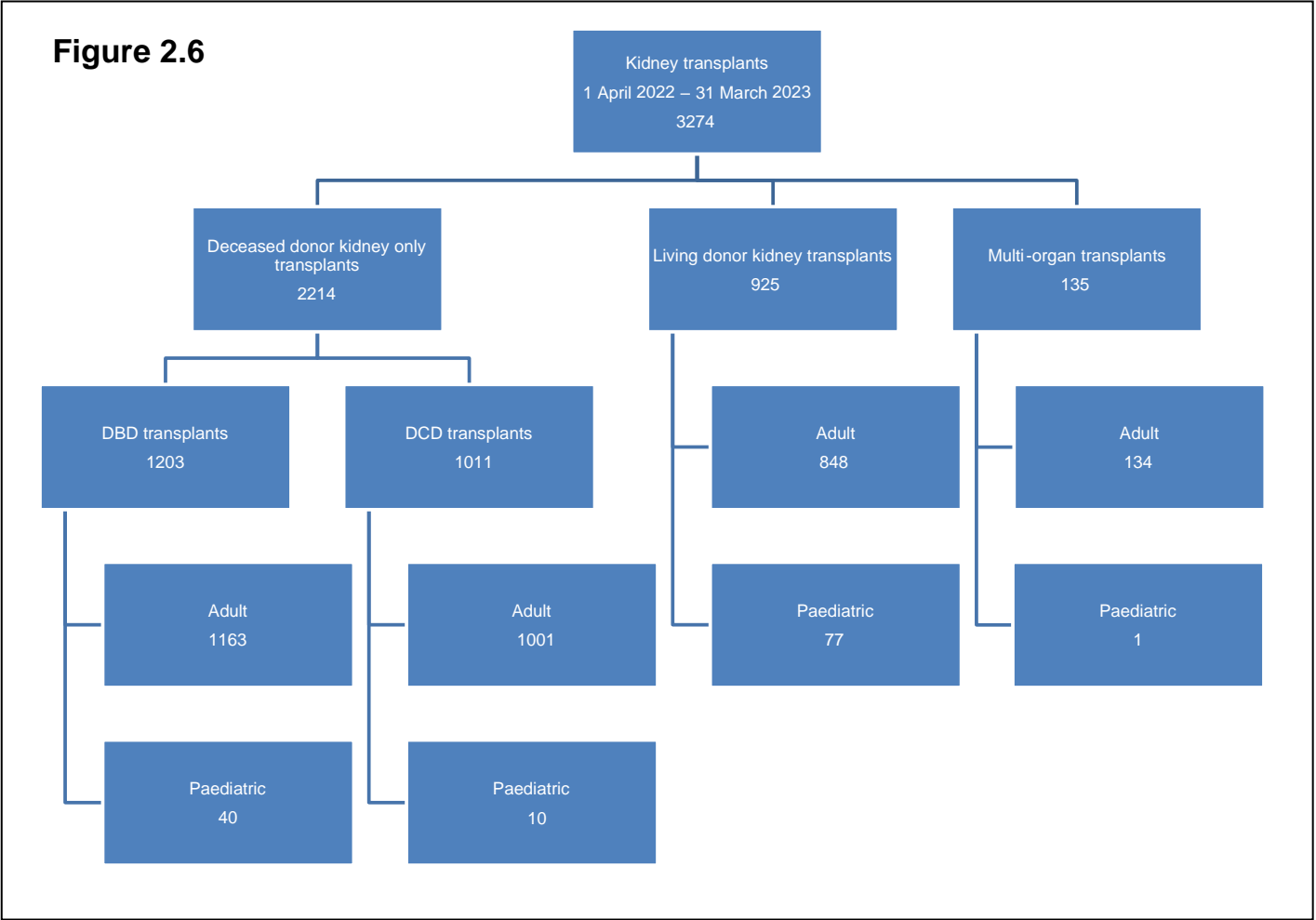


Figure 2.6 details the 3,274 kidney transplants performed in the UK between 1 April 2022 and 31 March 2023. Of these, 2,214 (68%) were deceased donor kidney only transplants and 925 (28%) were living donor kidney transplants. Of the 135 [multi-organ transplants](#), 121 were simultaneous kidney and pancreas transplants, 9 were kidney and liver transplants and 5 were simultaneous kidney and islet transplants.



Geographical variation in registration and transplant rates

Figure 2.7 shows rates of registration to the kidney only transplant list per million population (pmp) between 1 April 2022 and 31 March 2023 compared with deceased donor kidney only transplant rates pmp for the same time period, by recipient country/NHS region of residence. **Figure 2.8** shows the transplant rates pmp for living donor kidney only transplants in the same period. **Table 2.2** shows the breakdown of these numbers by recipient country/NHS region of residence. No adjustments have been made for potential demographic differences in populations. If a patient has had more than one registration/transplant in the period, each registration/transplant is considered. Note that this analysis only considered NHS Group 1 patients.

Since there will inevitably be some random variation in rates between areas, the systematic component of variation (SCV) was used to identify if the variation is more (or less) than a random effect for the different NHS regions in England only. Only first registrations and transplants in this period were considered. The larger the SCV the greater the evidence of a high level of systematic variation between areas. Registration, deceased donor transplant, and living donor transplant rates yielded an SCV of 0.0671 (p-value <0.001), 0.0663 (p-value <0.001), and 0.009 (p-value = 0.047) respectively. The p-value shows the probability that an SCV of this size (or higher) would be observed by chance if only random variation existed and therefore, strong evidence of geographical variation beyond what would be expected at random. No adjustment has been made for area-specific demographic characteristics that may impact the rates of registration to the transplant list and transplantation such as age and sex. Therefore, these results should be interpreted with caution.

Figure 2.7 Comparison of kidney registration rates (pmp) with deceased donor transplant rates (pmp) by recipient country/NHS region of residence

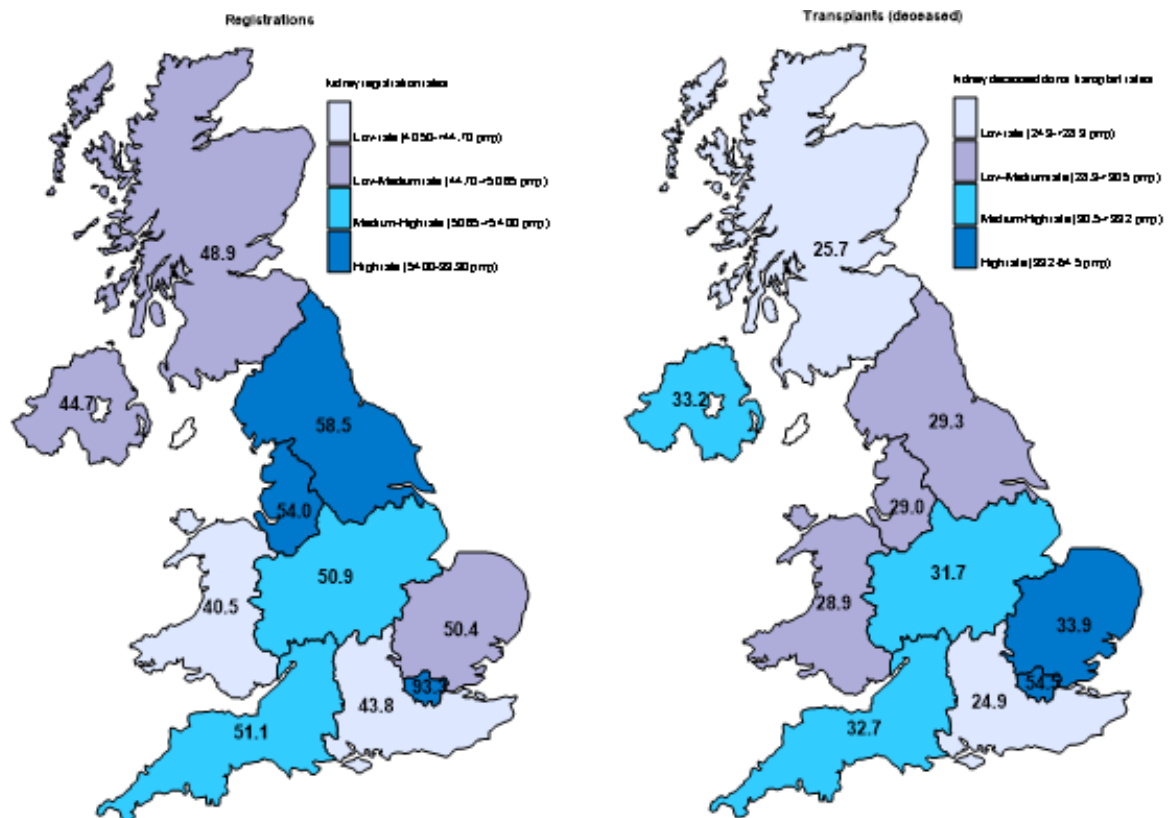


Figure 2.8 Living donor kidney transplant rates (pmp) by recipient country/NHS region of residence

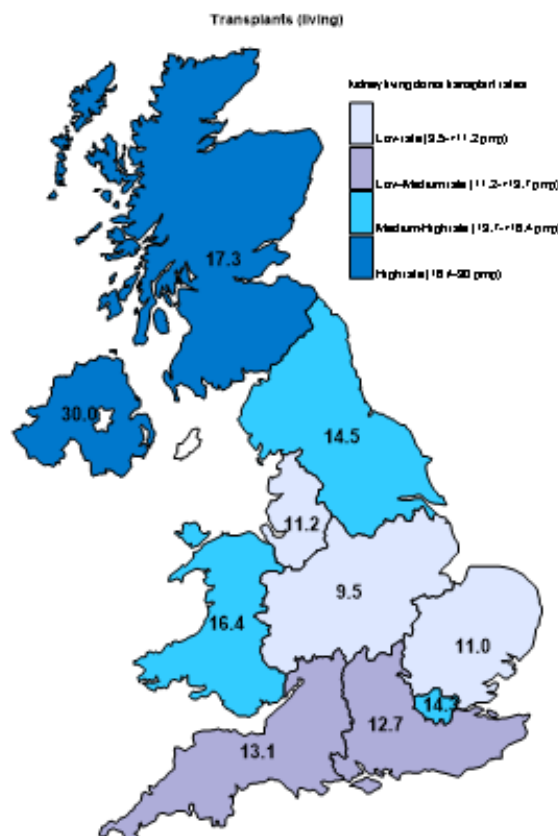


Table 2.2 Kidney registration and transplant rates per million population (pmp) in the UK, 1 April 2022 - 31 March 2023, by Country/NHS region

Country/ NHS region	Registrations (pmp)		Deceased Donor Transplants (pmp)		Living Donor Transplants (pmp)	
North East and Yorkshire	476	(58.5)	238	(29.3)	118	(14.5)
North West	401	(54)	215	(29)	83	(11.2)
Midlands	552	(50.9)	344	(31.7)	103	(9.5)
East of England	320	(50.4)	215	(33.9)	70	(11)
London	821	(93.3)	480	(54.5)	126	(14.3)
South East	407	(43.8)	231	(24.9)	118	(12.7)
South West	292	(51.1)	187	(32.7)	75	(13.1)
England	3269	(57.8)	1910	(33.8)	693	(12.3)
Isle of Man	9	(112.5)	3	(37.5)	4	(50)
Channel Islands	10	(58.8)	7	(41.2)	0	(0.0)
Wales	126	(40.5)	90	(28.9)	51	(16.4)
Scotland	268	(48.9)	141	(25.7)	95	(17.3)
Northern Ireland	85	(44.7)	63	(33.2)	57	(30)
TOTAL^{1,2}	3771	(56.3)	2214	(33)	903	(13.5)

¹ Registrations include 4 recipients whose postcode was unknown

² Living donor transplants include 3 recipients whose postcode was unknown and excludes 6 recipients who reside in the Republic of Ireland

Adult kidney transplant list

3.1 Adults on the kidney transplant list as at 31 March, 2014 – 2023

Figure 3.1 shows the number of adults on the kidney only [transplant list](#) at 31 March each year between 2014 and 2023. The number of adults actively waiting for a kidney transplant has decreased from 5,590 in 2014 to 5,251 in 2023.

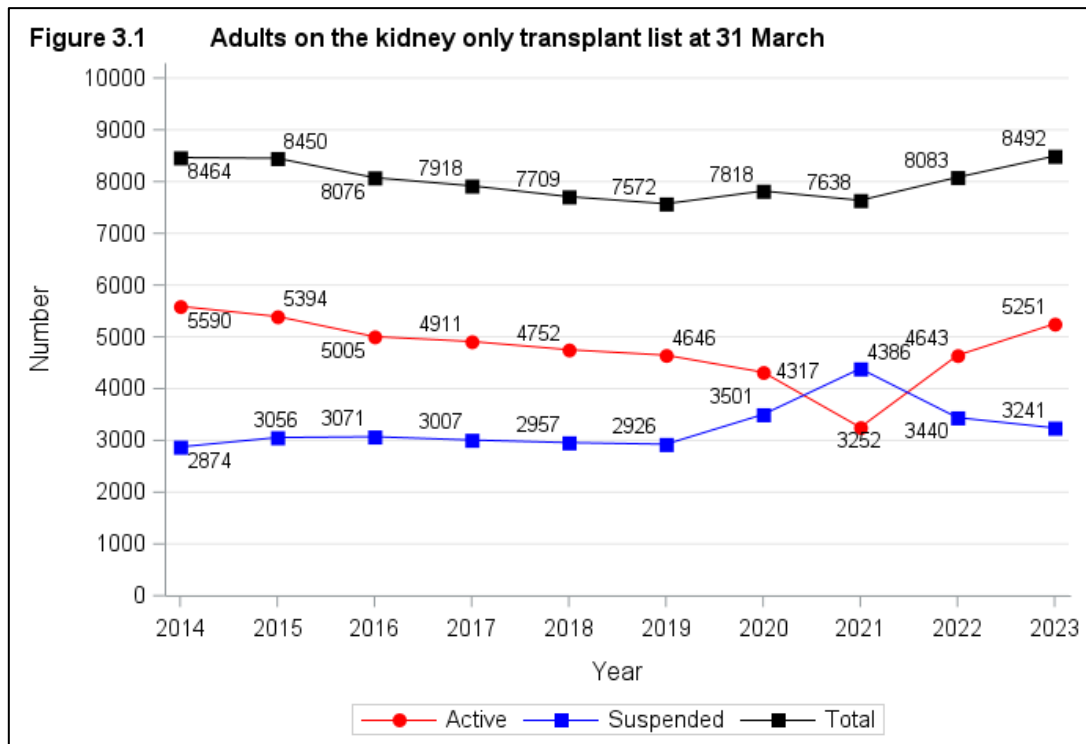


Figure 3.2 shows the number of adults on the active kidney only [transplant list](#) at 31 March 2023 by centre. In total, there were 5,251 adults active at this time. Manchester had the largest proportion of the [transplant list](#) (8%) and Belfast had the smallest (1%).

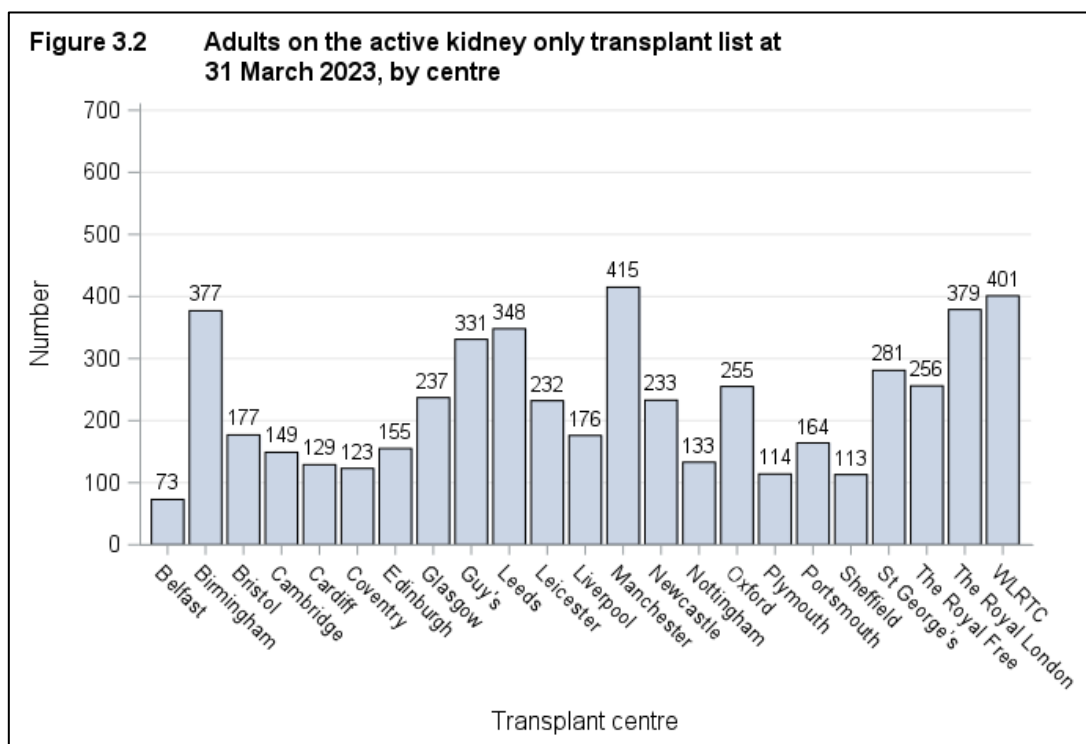


Figure 3.3 shows the number of adults on the suspended kidney only [transplant list](#) at 31 March 2023 by centre. In total, there were 3,241 adults suspended at this time. Manchester had the largest proportion of adults on the suspended [transplant list](#) (14%) and Plymouth had the smallest (1%).

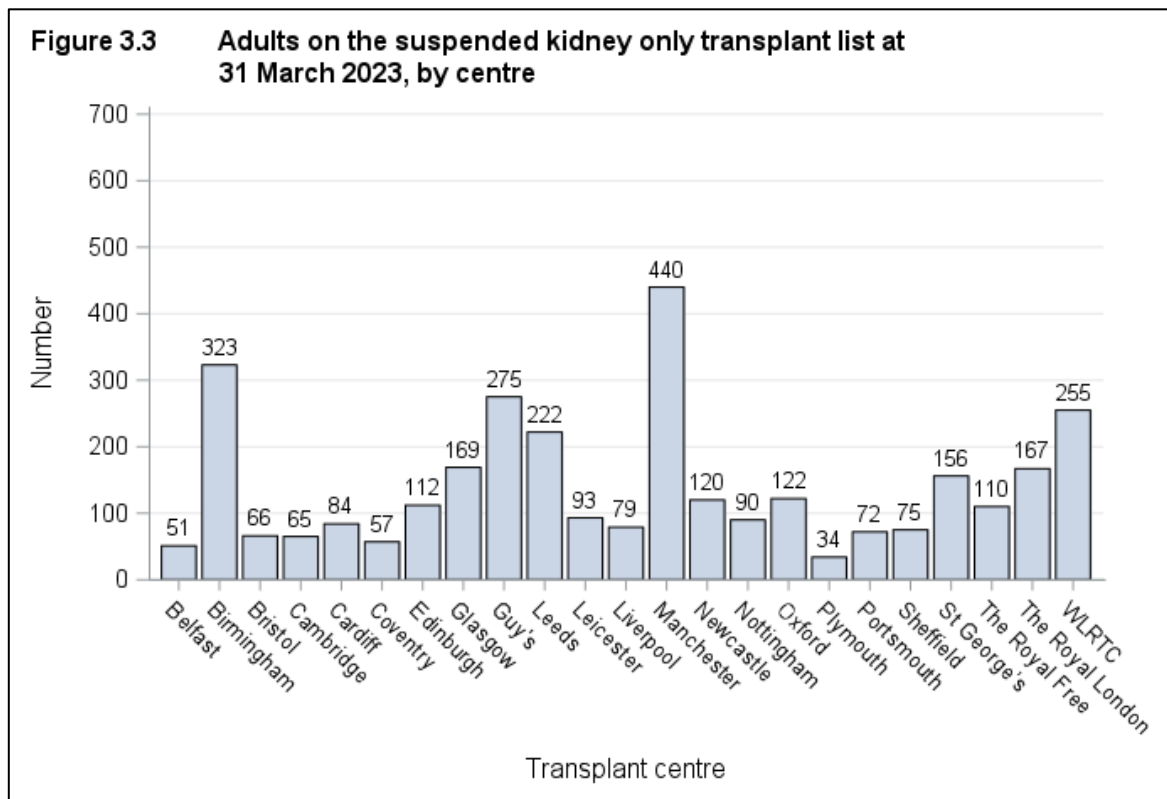
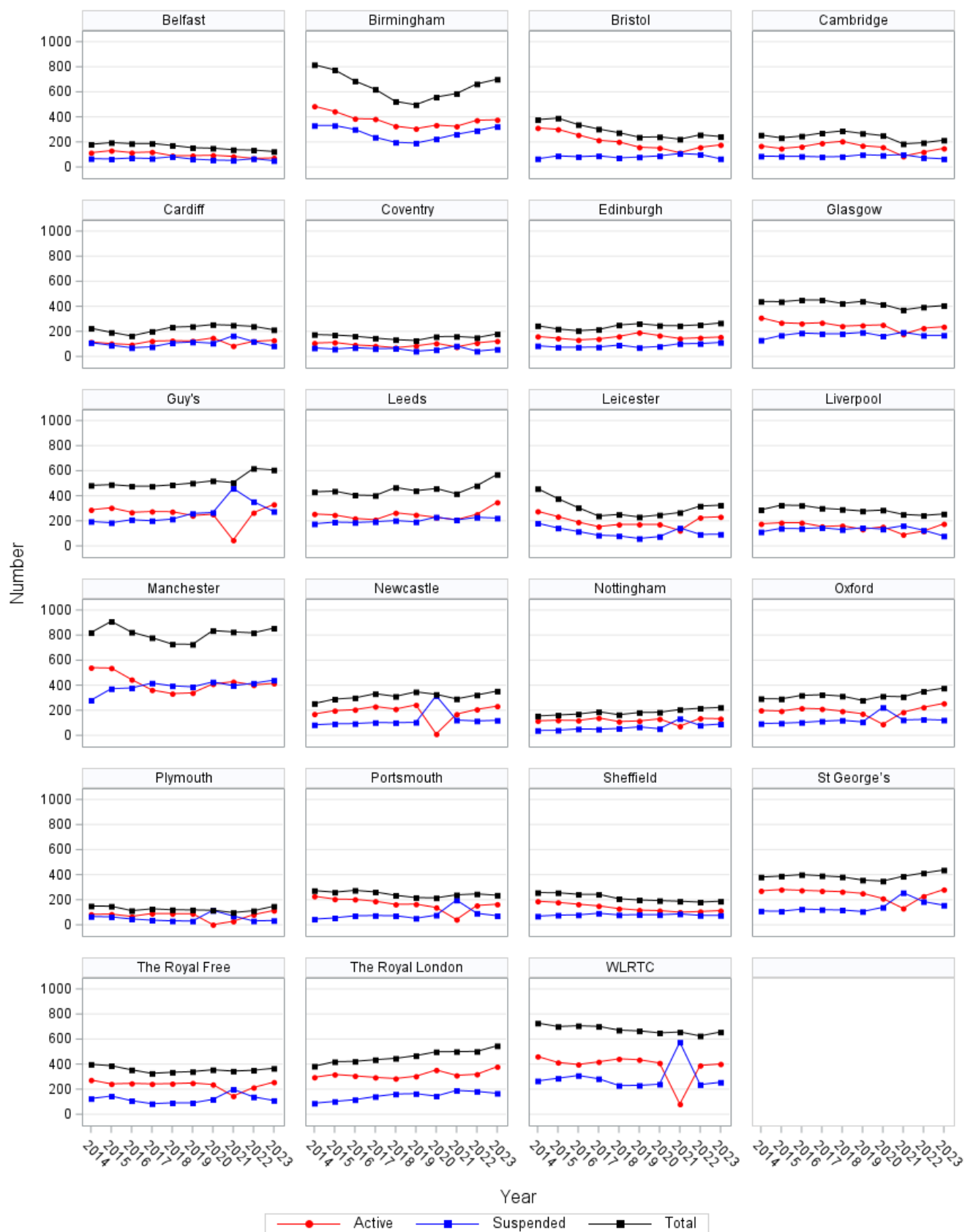


Figure 3.4 shows the number of adults on the [transplant list](#) at 31 March each year between 2014 and 2023 for each transplant centre.

Figure 3.4 Adults on the kidney only transplant list at 31 March, by centre



3.2 Post-registration outcomes, 1 April 2019 – 31 March 2020

An indication of outcomes for patients listed for a kidney transplant is summarised in **Figure 3.5**. 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 32% of patients are transplanted within one year, while three years after listing 61% of patients have received a transplant.

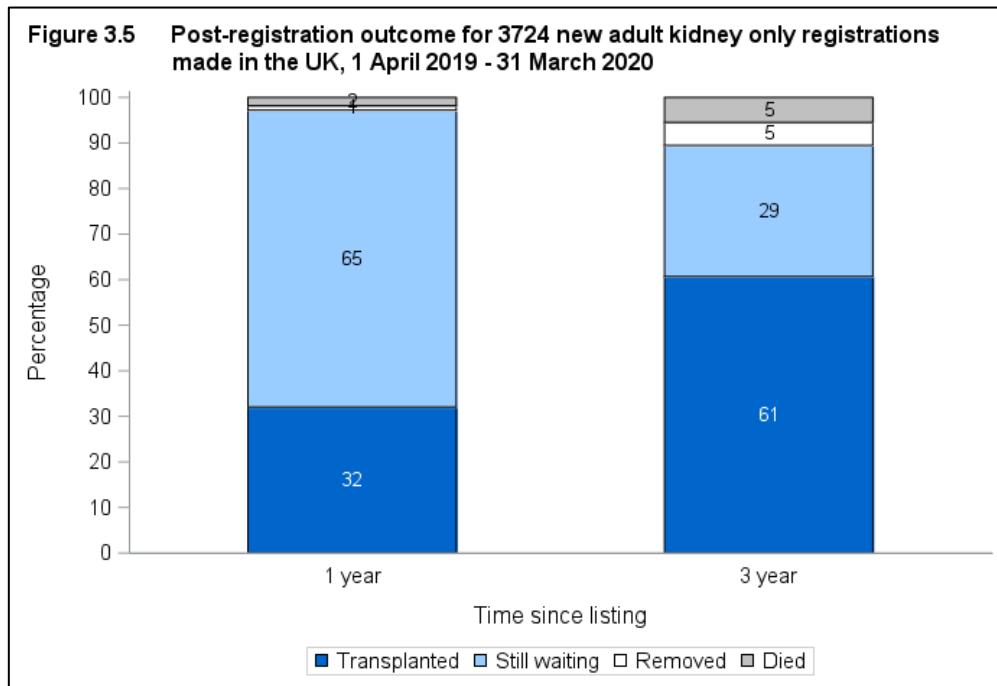
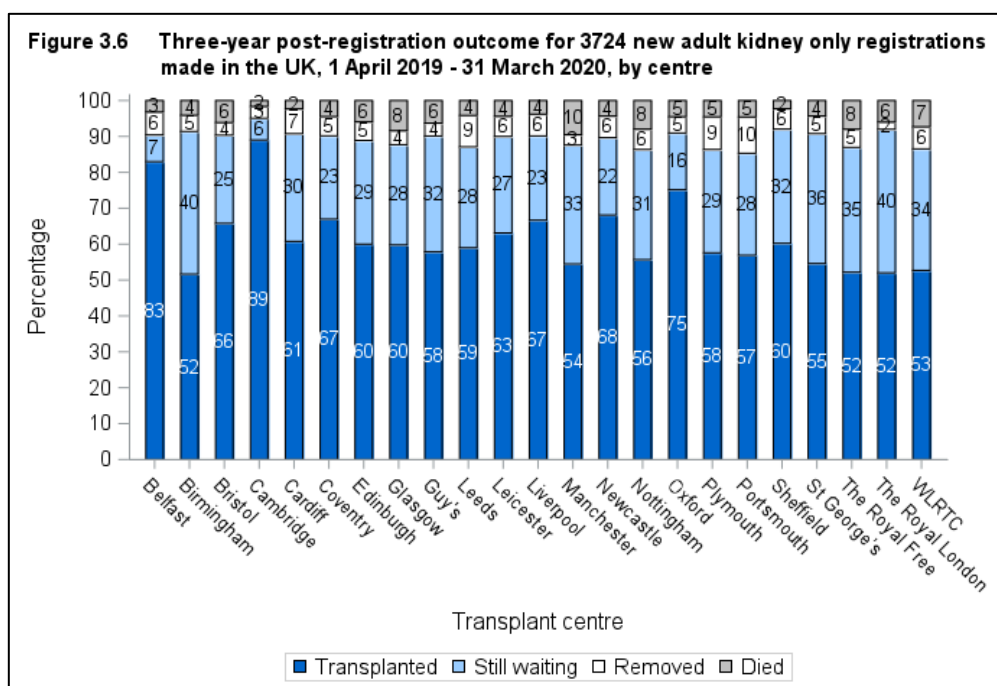


Figure 3.6 shows the proportion of patients transplanted or still waiting three years after joining the list by centre. The proportion of patients transplanted three years after listing at each centre ranges from 52% at Birmingham, Royal Free and Royal London to 89% at Cambridge.



3.3 Demographic characteristics, 1 April 2022 – 31 March 2023

The sex, ethnicity, age group, calculated reaction frequency and primary renal disease of patients on the transplant list are shown by centre in **Figure 3.7, 3.8, 3.9, 3.10 and 3.11**, respectively. Note that all percentages quoted are based only on data where relevant information was available. Data are not presented where the proportion of missing data was over 50%. Changes made to the Kidney Allocation Scheme in 2006, and the 2019 National Kidney Offering Scheme 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.

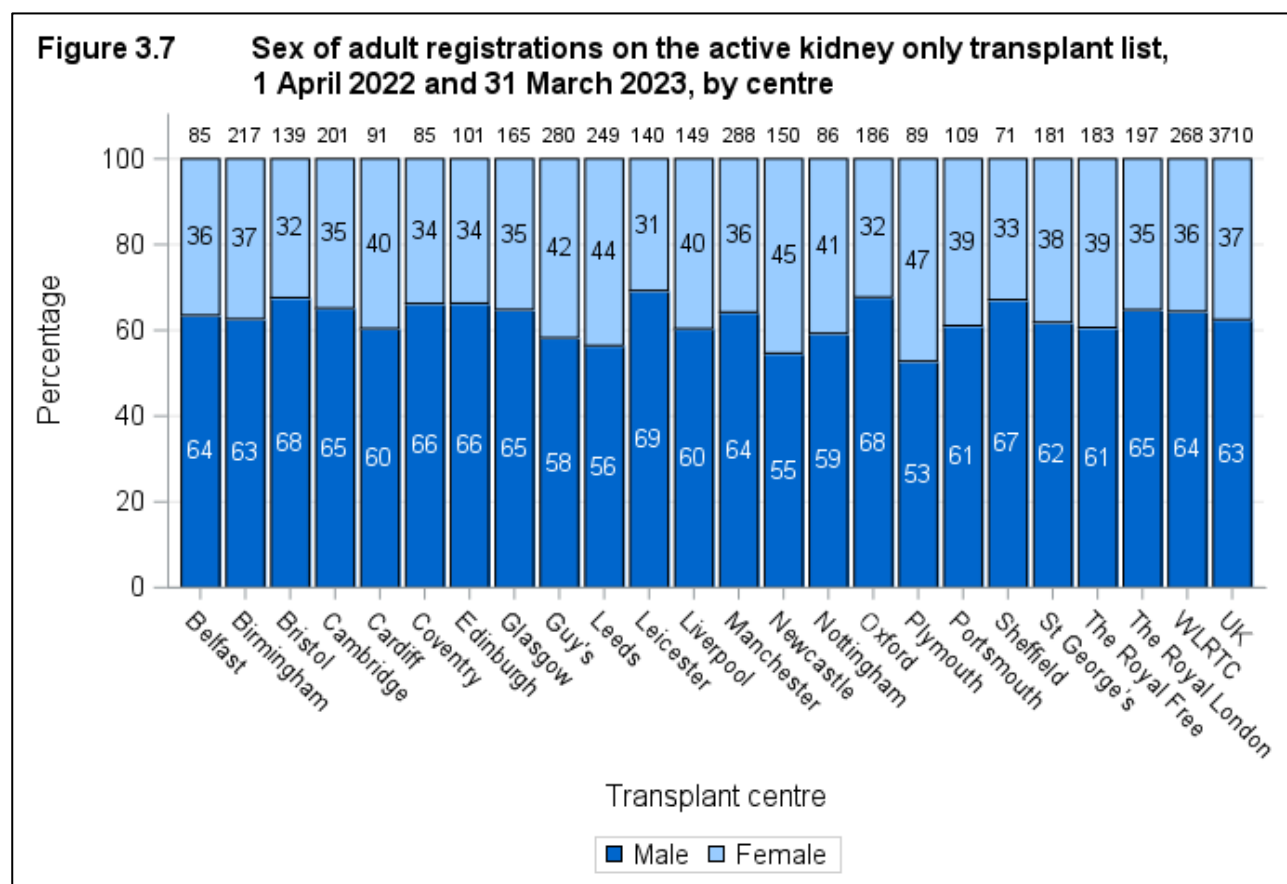


Figure 3.8 Ethnicity of adult registrations on the active kidney only transplant list, 1 April 2022 and 31 March 2023, by centre

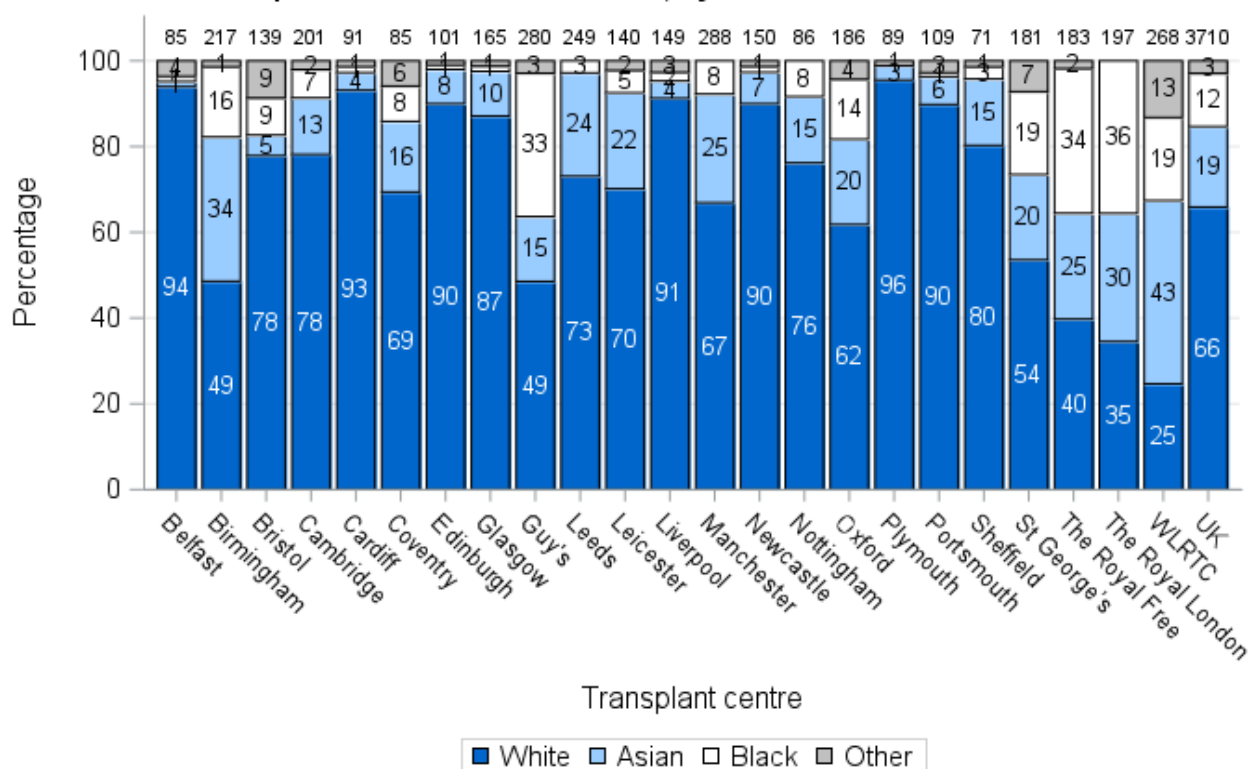


Figure 3.9 Age of adult registrations on the active kidney only transplant list, 1 April 2022 and 31 March 2023, by centre

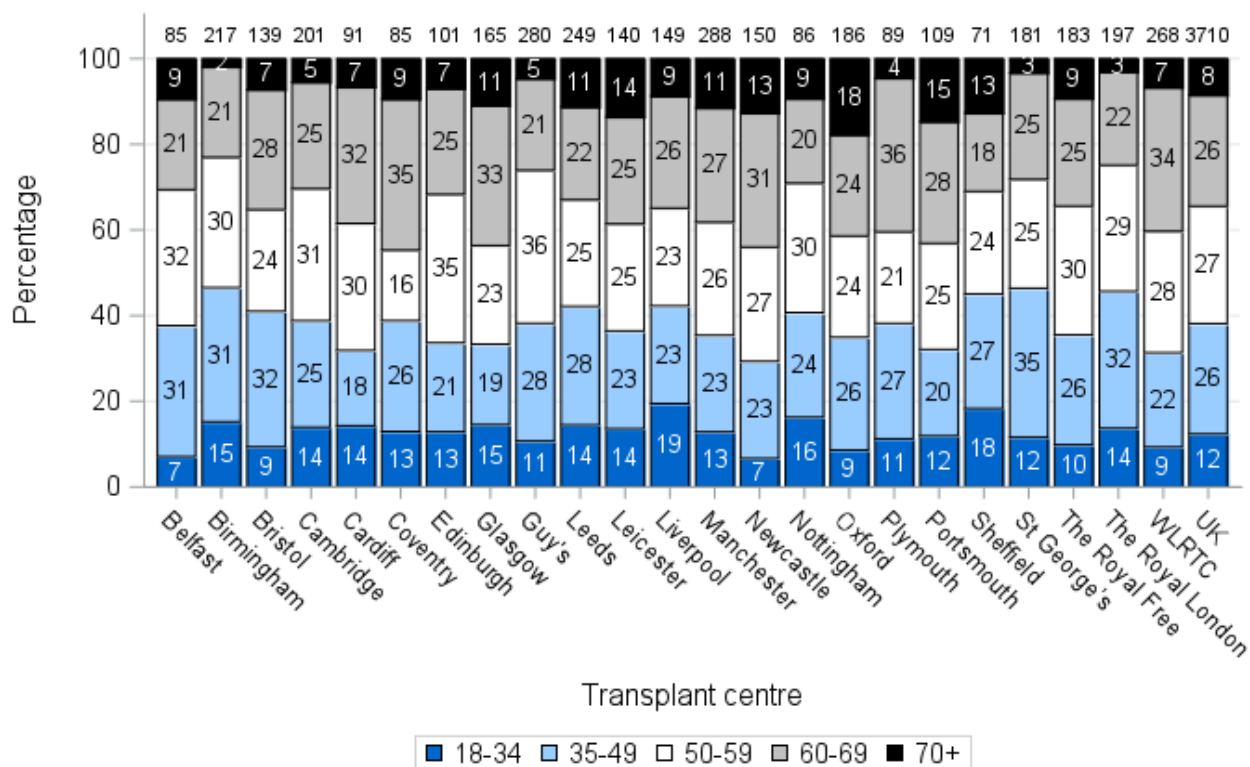


Figure 3.10 cRF of adult registrations on the active kidney only transplant list, 1 April 2022 and 31 March 2023, by centre

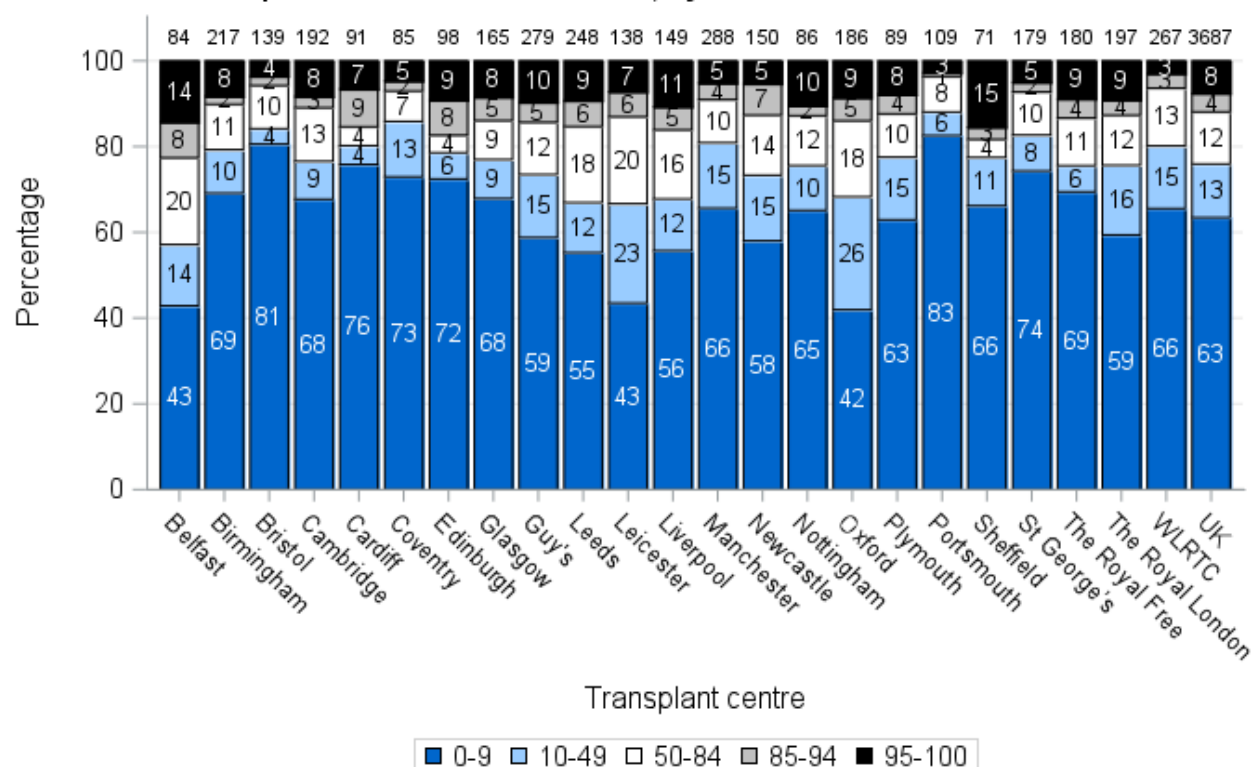
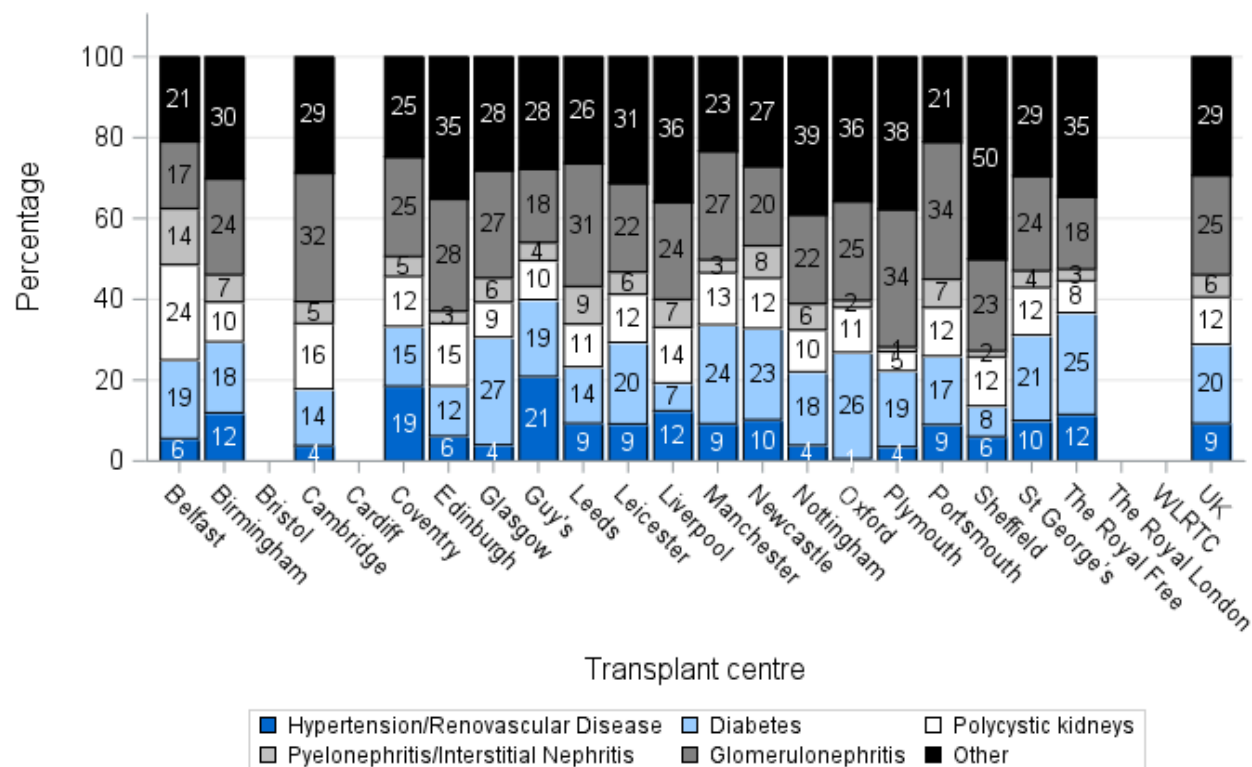
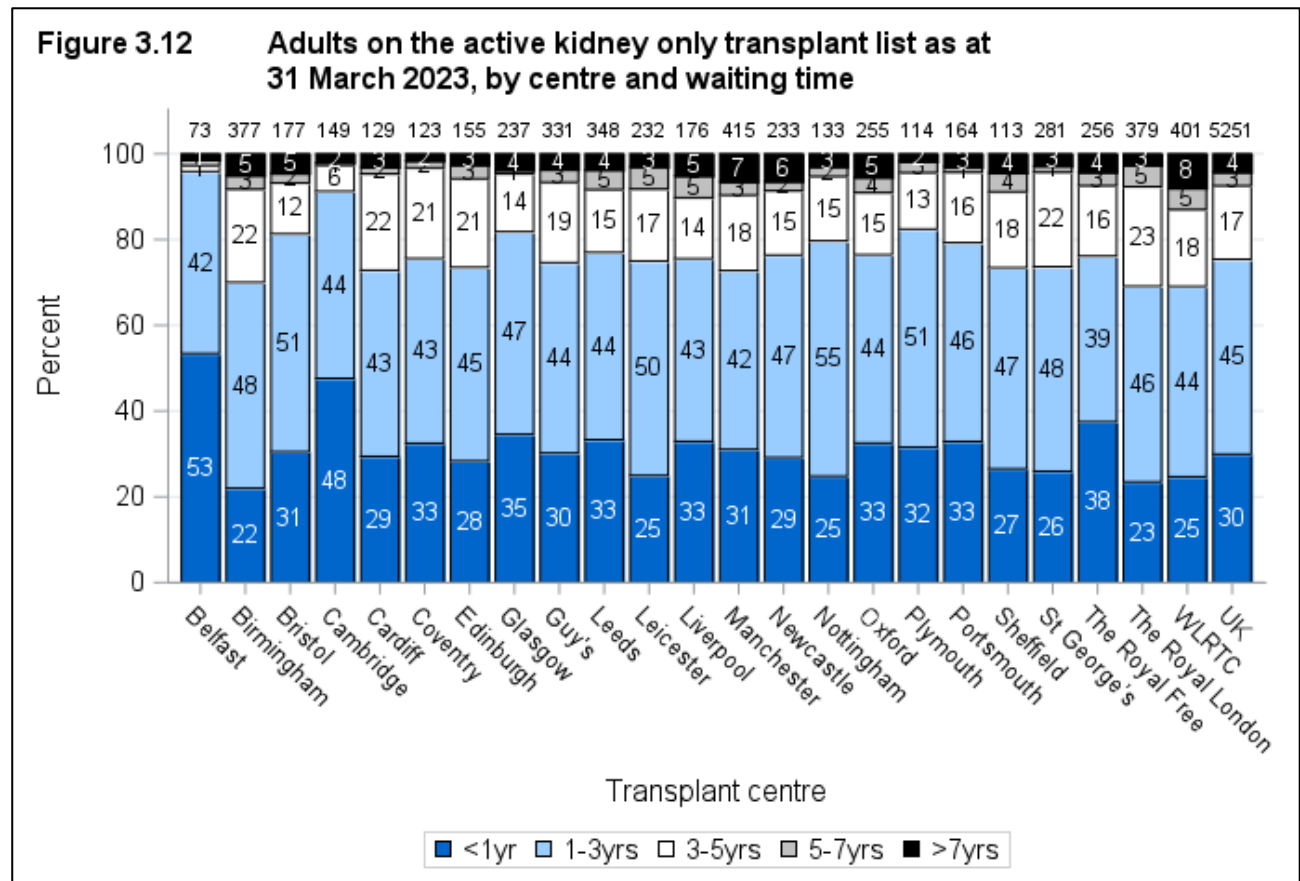


Figure 3.11 Primary renal disease of adult registrations on the active kidney only transplant list, 1 April 2022 and 31 March 2023, by centre



3.4 Adult waiting times for those currently on the list, 31 March 2023

Figure 3.12 shows the length of time adults have been waiting on the kidney only [transplant list](#) at 31 March 2023 by centre. A small proportion of adults have been waiting for a transplant for more than seven years, 99% of these adults are highly sensitised with a calculated reaction frequency (cRF) of 85% or higher. Of those waiting for more than seven years, 90% have a cRF of 100% which makes these adults very difficult to match.



3.5 Median waiting time to transplant, 1 April 2017 – 31 March 2020

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 3.13** and **Table 3.1** for patients registered at each individual unit. Risk-adjusted median waiting time to adult deceased donor kidney only transplantation is shown in **Figure 3.14** and **Table 3.1**. The data shown are for all adults, joining the list within the time period shown, including those still awaiting a transplant on the day of analysis. Active waiting time only is taken into account. Patients who received a [live donor](#) or [multi-organ transplant](#) are not included. The national allocation scheme introduced in April 2006 helped to reduce 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 2006 [National Kidney Allocation Scheme](#) determined allocation of all kidneys available for transplant from donors after brain death ([DBD](#)). This has continued following the introduction of the 2019 National Kidney Offering Scheme which determines allocation of all DBD kidneys and kidneys from donations after circulatory death (DCD).

2006 National Kidney Allocation Scheme

Only kidneys from donors after brain death were allocated via a national allocation scheme during the majority of the time period analysed. DCD kidneys were allocated to patients through local allocation arrangements and these vary across the country because some centres have a larger DCD programme than others. From 3 September 2014 one kidney from DCD donors aged between 5 and 49 years were allocated within four pre-defined regions using the 2006 DBD allocation principles and as such should reduce variability in waiting times across the country.

Kidneys from DBD are allocated to patients listed nationally through the 2006 Kidney Allocation Scheme. The 2006 Kidney Allocation Scheme introduced in April 2006 prioritised patients with ideal tissue matches (000 HLA mismatches) and then assigned 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 received more points. The patients with the highest number of points for a donated kidney were preferentially offered the kidney, no matter where in the UK they received their treatment.

2019 National Kidney Offering Scheme

The 2019 Kidney Offering Scheme was introduced on 11 September 2019 and this is a single scheme for offering all kidneys from deceased donors in the UK. This scheme prioritises patients who are difficult to match or have waited a long time for a transplant

We present a visual comparison of median waiting time to transplant 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 waiting times of the different transplant units are with the national rate accounting for different patient mix within centres. [Funnel plots](#) show the [risk-adjusted median waiting time to transplant](#) plotted against the number of patients registered at each centre, with the overall national [unadjusted waiting time to transplant](#) (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.

Interpreting the [funnel plots](#)

If a centre lies within all the limits, then that centre has a median waiting time to transplant 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 median waiting time to transplant 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 median waiting time to transplant that is higher than the national rate, while a centre that lies below the lower limits has a median waiting time to transplant 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 median waiting time to transplant 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.

The [median](#) waiting time to transplant for adults registered on the kidney only [transplant list](#) between 1 April 2017 and 31 March 2020 is 497 days. This ranged from 235 days at Oxford to 707 days at The Royal Free.

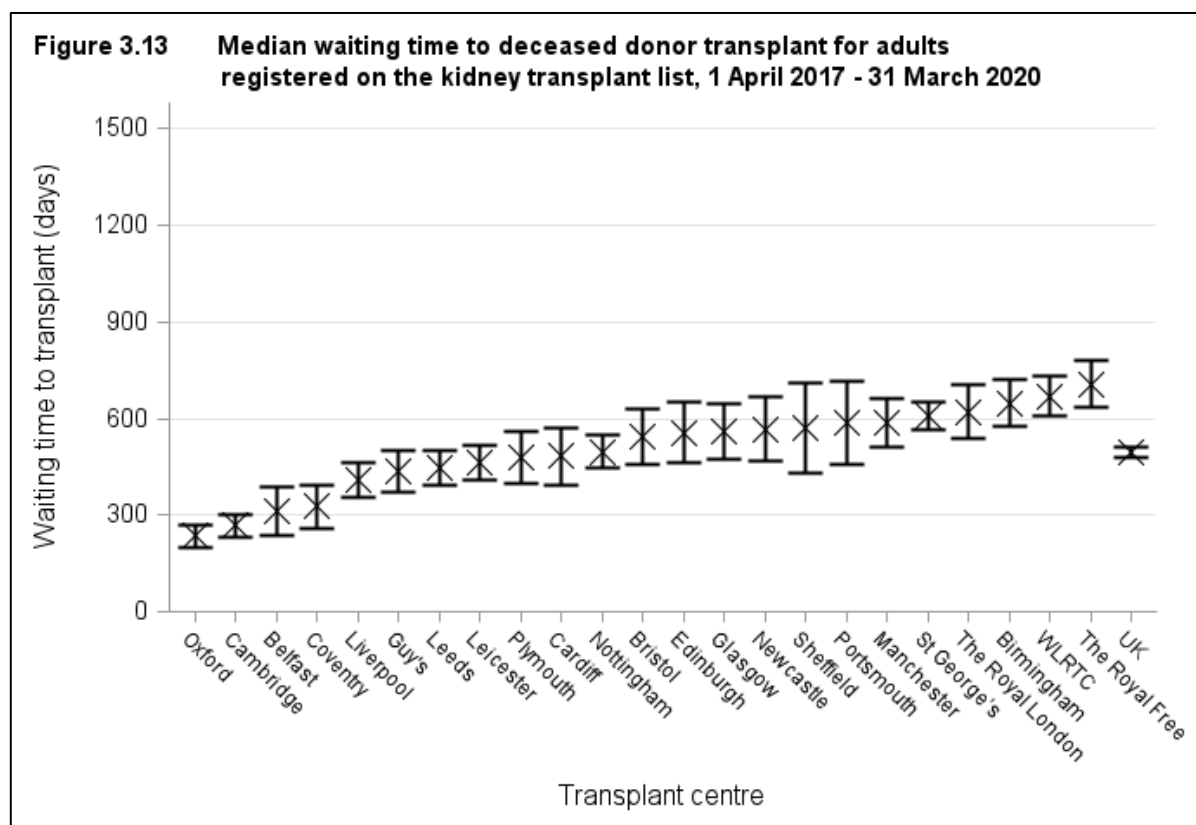
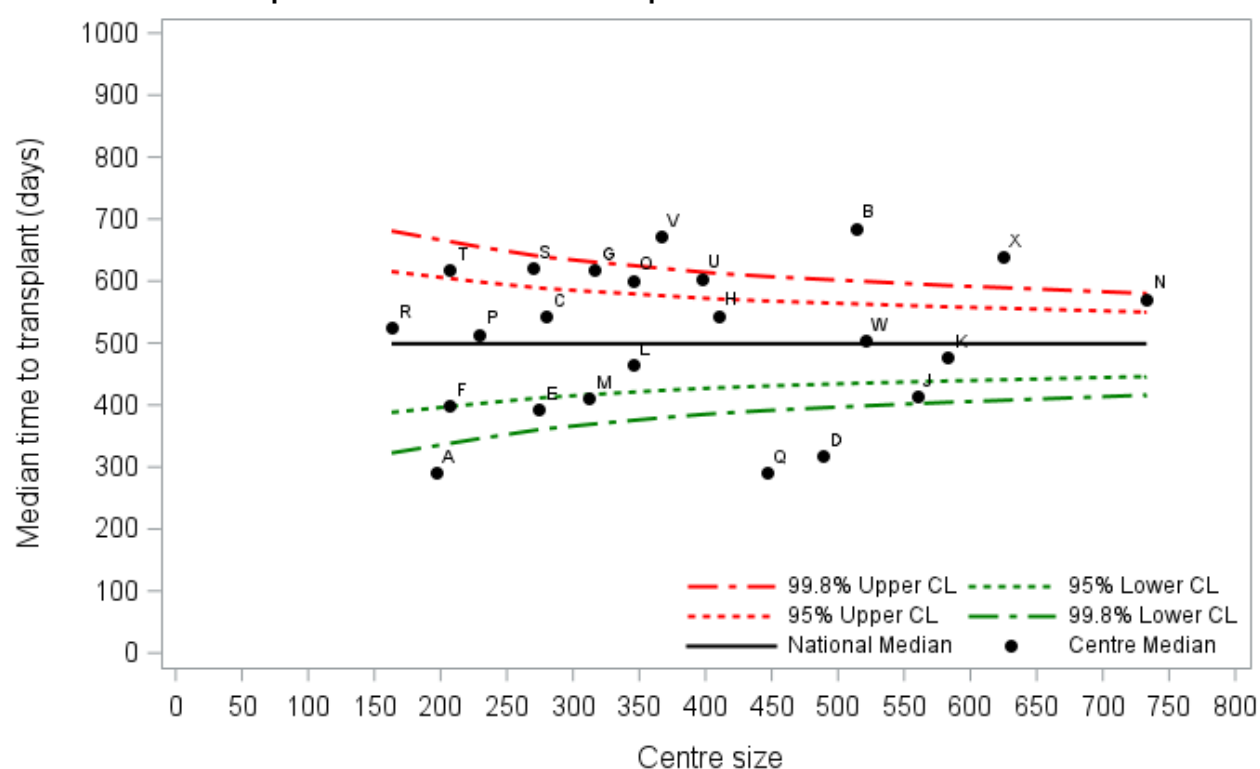


Figure 3.14 Adult risk-adjusted median waiting times
for patients listed between 1 April 2017 and 31 March 2020

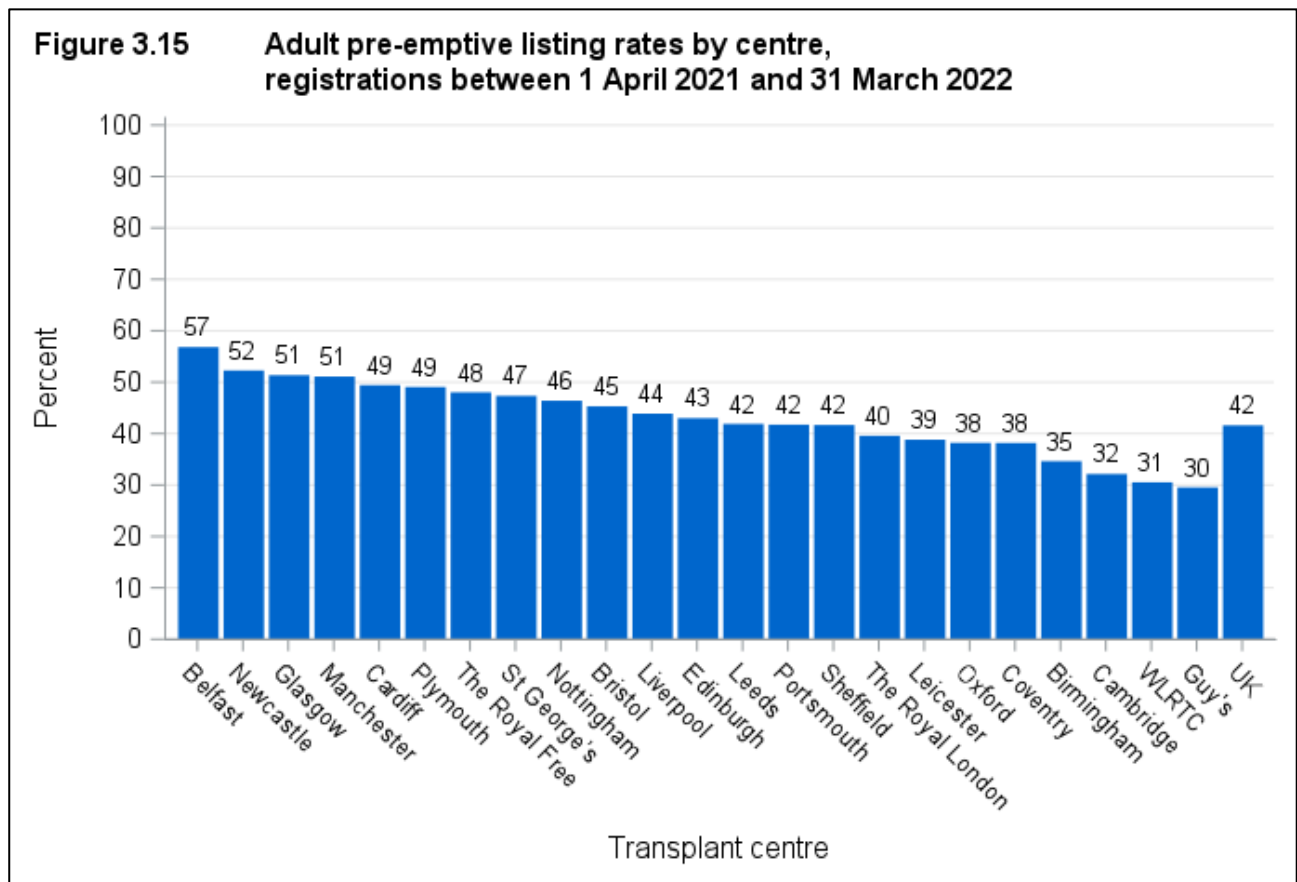


**Table 3.1 Median waiting time to kidney only transplant in the UK,
for adults registered 1 April 2017 - 31 March 2020**

Transplant centre	Code	Number of adults registered	Waiting time (days)		
			Unadjusted Median	95% Confidence interval	Risk-adjusted median
Oxford	Q	449	235	198 - 272	292
Cambridge	D	500	268	234 - 302	318
Belfast	A	198	314	239 - 389	292
Coventry	F	210	327	261 - 393	400
Liverpool	M	315	410	355 - 465	413
Guy's	J	563	437	372 - 502	414
Leeds	K	584	447	393 - 501	479
Leicester	L	356	462	407 - 517	466
Plymouth	R	169	481	400 - 562	525
Cardiff	E	295	483	393 - 573	394
Nottingham	P	232	498	447 - 549	515
Bristol	C	284	543	459 - 627	543
Edinburgh	G	320	557	462 - 652	619
Glasgow	H	416	561	474 - 648	545
Newcastle	O	347	567	468 - 666	602
Sheffield	T	212	571	432 - 710	618
Portsmouth	S	273	586	457 - 715	621
Manchester	N	739	587	513 - 661	572
St George's	U	404	608	564 - 652	605
The Royal London	W	543	620	536 - 704	504
Birmingham	B	525	647	574 - 720	686
WLRTC	X	630	668	607 - 729	639
The Royal Free	V	369	707	635 - 779	672
UK		8933	497	481 - 513	

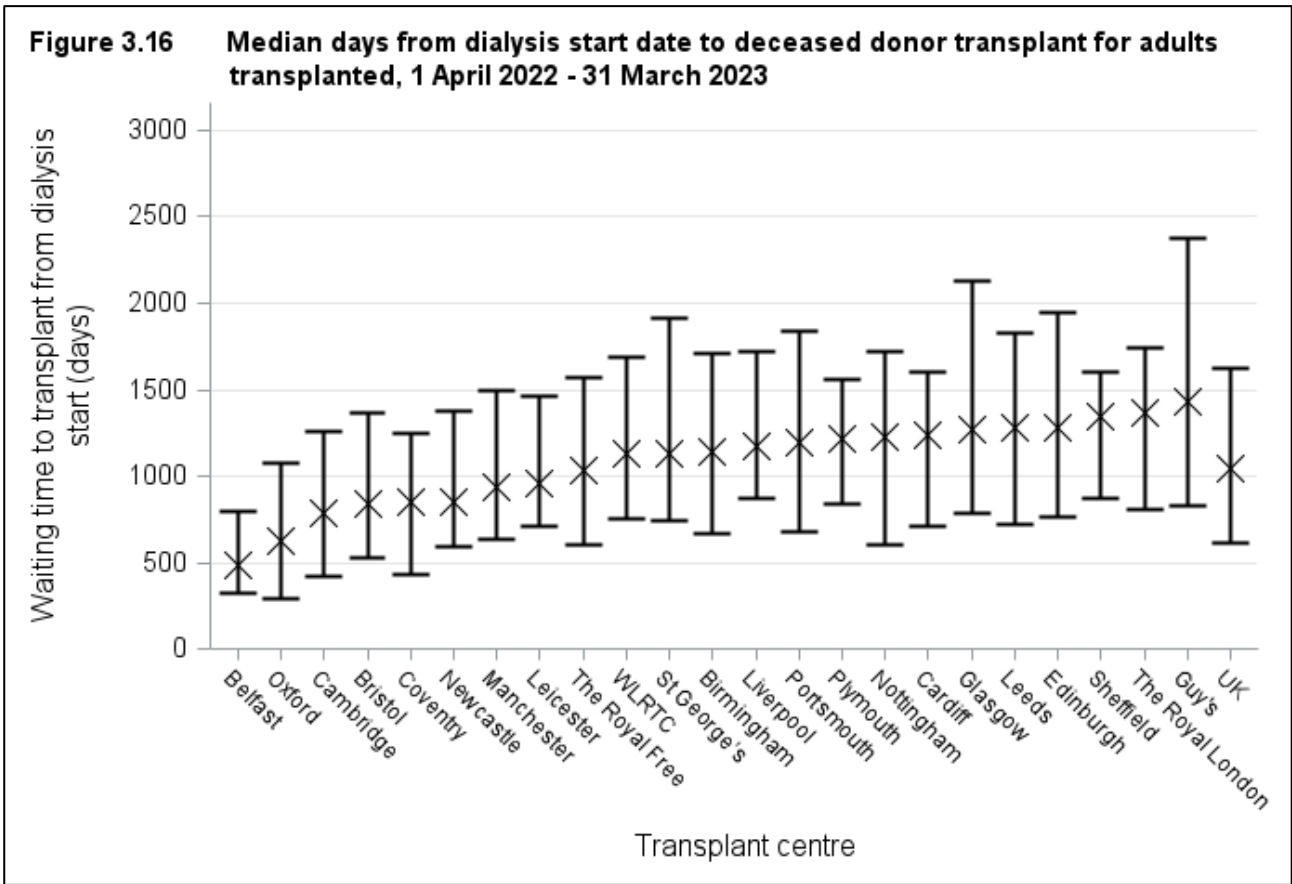
3.6 Pre-emptive listing rates, 1 April 2021 - 31 March 2022

Rates of [pre-emptive](#) kidney only listings are shown in **Figure 3.15** for adults joining the list between 1 April 2021 and 31 March 2022. 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 42% of all adult registrations across the UK ranging from 57% at Belfast to 30% at Guy's.



3.7 Median time from start of dialysis to transplant, 1 April 2022 - 31 March 2023

The median time from dialysis start date to deceased donor transplant for adults transplanted between 1 April 2022 and 31 March 2023 is shown in **Figure 3.16**. The UK [median](#) time is 1049 days. This ranged from 482 days at Belfast to 1434 days at Guy's.



3.8 2019 Kidney Offering Scheme Recipient Risk Index, 1 April 2022 – 31 March 2023

A Recipient Risk Score (RRI) was developed alongside the change in kidney offering scheme in 2019. The RRI is now calculated for each eligible patient using four risk factors. A recipient is then categorised into one of four groups (R1-R4) based on the risk score and by pre-determined cut-off values.

$$\begin{aligned} \text{RRI} = & \exp \{ 0 \times (\text{recipient age} \leq 25) - 75) & + \\ & 0.016 \times ((\text{recipient age} > 25) - 75) & + \\ & 0.361 \times (\text{recipient on dialysis at registration}) & + \\ & 0.033 \times ([\text{waiting time from dialysis} - 950] / 365.25) & + \\ & 0.252 \times (\text{Diabetic recipient}) \} \end{aligned}$$

R1 → RRI ≤ 0.74 (lowest risk)

R2 → RRI 0.74 - 0.94

R3 → RRI 0.94 – 1.20

R4 → RRI ≥ 1.20 (highest risk)

Table 3.2 presents the RRI groups and average scores for adults on the kidney only [transplant list](#) at 31 March 2023.

Table 3.2 Recipient Risk Index of adults active on the kidney only transplant list at 31 March 2023

Transplant centre	Recipient Risk Group				Avg. RRI
	R1	R2	R3	R4	
Belfast	32	26	11	4	0.81
Birmingham	138	92	82	65	0.9
Bristol	59	63	34	21	0.87
Cambridge	60	39	34	16	0.86
Cardiff	46	50	20	13	0.84
Coventry	35	38	32	18	0.92
Edinburgh	49	48	38	20	0.89
Glasgow	72	81	48	36	0.89
Guy's	118	85	83	45	0.9
Leeds	120	91	86	51	0.9
Leicester	74	66	54	38	0.92
Liverpool	62	56	37	21	0.86
Manchester	132	139	90	54	0.91
Newcastle	66	78	49	40	0.92
Nottingham	54	39	19	21	0.88
Oxford	67	67	61	60	0.97
Plymouth	36	36	23	19	0.9
Portsmouth	68	44	29	23	0.86
Sheffield	43	30	25	15	0.87
St George's	107	90	59	25	0.86
The Royal Free	84	82	57	33	0.88
The Royal London	144	114	95	26	0.85
WLRTC	113	106	84	98	0.98
UK	1779	1560	1150	762	0.9

Response to adult kidney offers

Offer decline rates

Kidney-only offers from [DBD](#) and [DCD](#) 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. Only offers through the [DCD](#) kidney allocation scheme are presented, all local [DCD](#) offers are excluded.

In order to understand centre practices more fully, data are presented separately for [DBD](#) and [DCD](#) standard and extended criteria donors (SCD & ECD). ECD have been defined as 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 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 DBD Standard criteria offer decline rates, 1 April 2020 – 31 March 2023

Figure 4.1 compares individual centre offer decline rates with the national rate for SCD over the time period, 1 April 2020 and 31 March 2023. Centres can be identified by the information shown in **Table 4.1**.

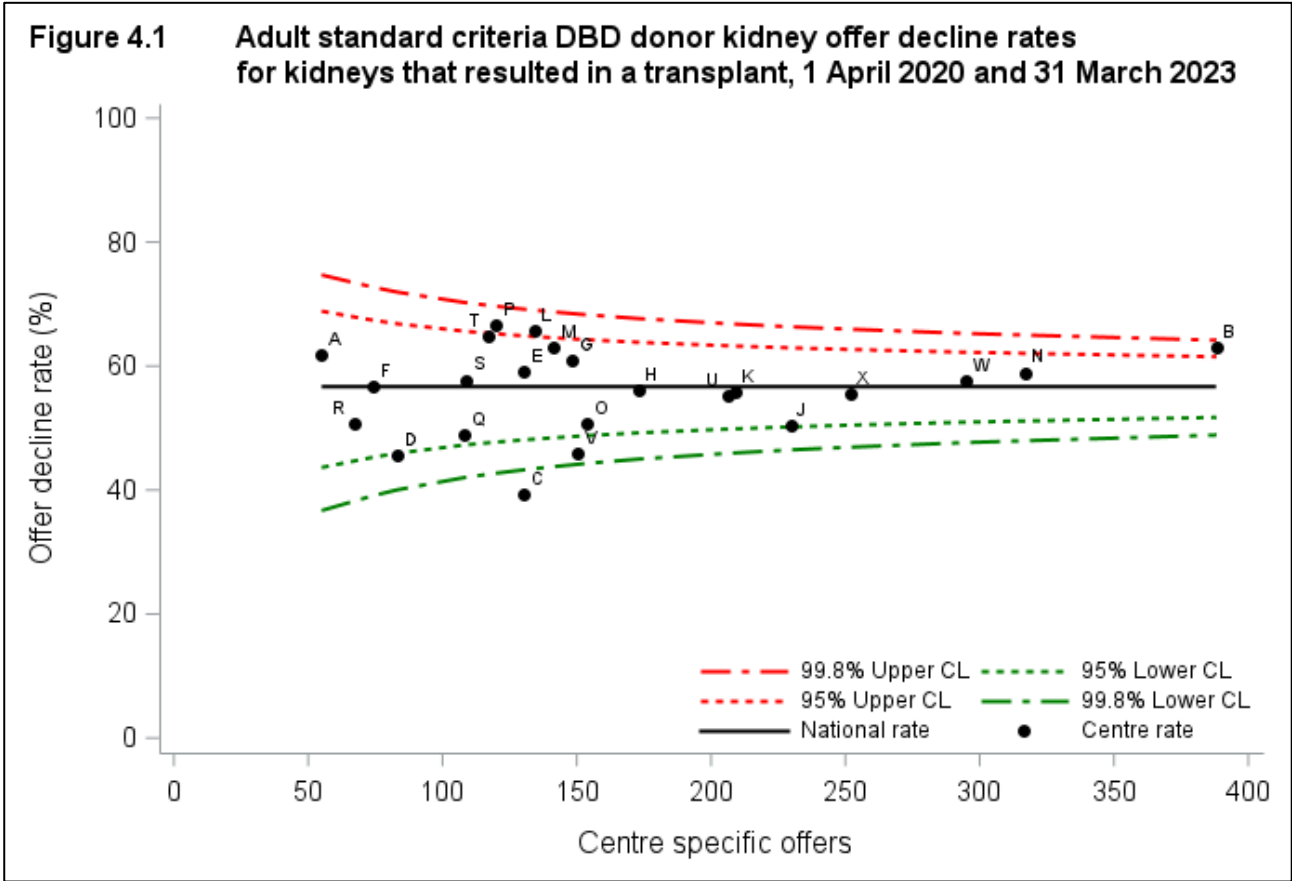


Table 4.1 compares individual centre offer decline rates for SCD over time by financial year.

Table 4.1 Adult standard criteria DBD donor kidney offer decline rates by transplant centre, 1 April 2020 and 31 March 2023									
Centre	Code	2020/21		2021/22		2022/23		Overall	
		N	(%)	N	(%)	N	(%)	N	(%)
Belfast	A	38	(76)	9	(33)	8	(25)	55	(62)
Birmingham	B	121	(69)	138	(66)	129	(55)	388	(63)
Bristol	C	55	(42)	36	(42)	39	(33)	130	(39)
Cambridge	D	31	(42)	30	(57)	22	(36)	83	(46)
Cardiff	E	47	(53)	38	(66)	45	(60)	130	(59)
Coventry	F	36	(61)	20	(60)	18	(44)	74	(57)
Edinburgh	G	77	(68)	39	(59)	32	(47)	148	(61)
Glasgow	H	83	(67)	40	(43)	50	(48)	173	(56)
Guy's	J	32	(56)	81	(41)	117	(56)	230	(50)
Leeds	K	75	(59)	54	(50)	80	(58)	209	(56)
Leicester	L	31	(58)	49	(71)	54	(65)	134	(66)
Liverpool	M	54	(76)	29	(48)	58	(59)	141	(63)
Manchester	N	137	(69)	90	(48)	90	(56)	317	(59)
Newcastle	O	82	(51)	31	(52)	41	(49)	154	(51)
Nottingham	P	29	(66)	44	(64)	47	(70)	120	(67)
Oxford	Q	43	(40)	32	(38)	33	(73)	108	(49)
Plymouth	R	25	(32)	19	(79)	23	(48)	67	(51)
Portsmouth	S	11	(55)	48	(60)	50	(56)	109	(58)
Sheffield	T	46	(72)	35	(54)	36	(67)	117	(65)
St George's	U	48	(67)	80	(55)	78	(49)	206	(55)
The Royal Free	V	64	(48)	37	(51)	49	(39)	150	(46)
The Royal London	W	72	(63)	130	(52)	93	(62)	295	(58)
WLRTC	X	75	(64)	100	(50)	77	(55)	252	(56)
UK		1312	(61)	1209	(54)	1269	(55)	3790	(57)
		Centre has reached the upper 99.8% confidence limit							
		Centre has reached the upper 95% confidence limit							
		Centre has reached the lower 95% confidence limit							
		Centre has reached the lower 99.8% confidence limit							

4.2 DBD Extended criteria offer decline rates, 1 April 2020 – 31 March 2023

Figure 4.2 compares individual centre offer decline rates with the national rate for ECD over the time period, 1 April 2020 and 31 March 2023. Centres can be identified by the information shown in **Table 4.2**.

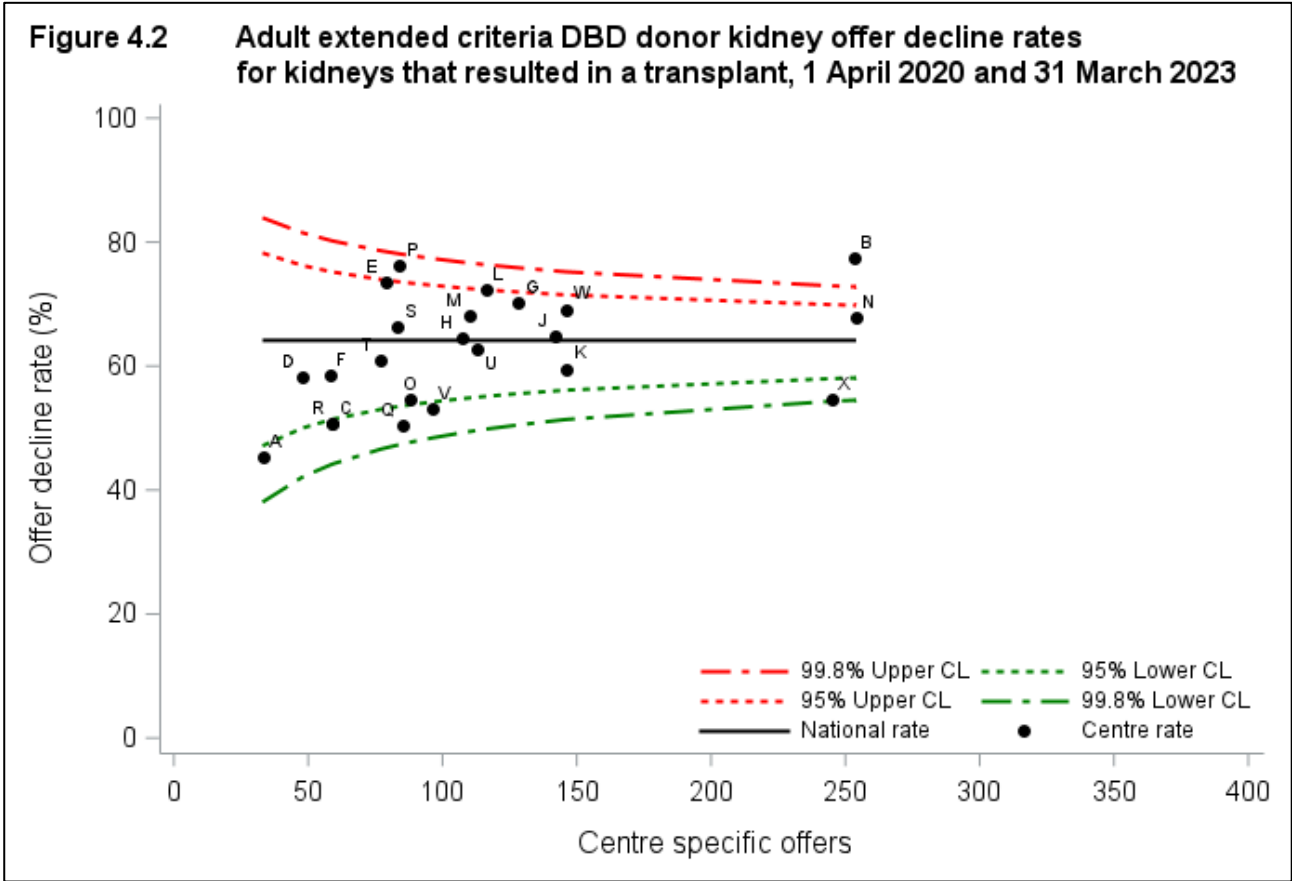


Table 4.2 compares individual centre offer decline rates for ECD over time by financial year.

Table 4.2 Adult extended criteria DBD donor kidney offer decline rates by transplant centre, 1 April 2020 and 31 March 2023									
Centre	Code	2020/21		2021/22		2022/23		Overall	
		N	(%)	N	(%)	N	(%)	N	(%)
Belfast	A	19	(63)	11	(27)	3	(0)	33	(45)
Birmingham	B	69	(87)	111	(75)	73	(73)	253	(77)
Bristol	C	22	(59)	20	(45)	17	(47)	59	(51)
Cambridge	D	18	(50)	17	(71)	13	(54)	48	(58)
Cardiff	E	26	(85)	27	(70)	26	(65)	79	(73)
Coventry	F	25	(76)	15	(40)	18	(50)	58	(59)
Edinburgh	G	67	(73)	34	(74)	27	(59)	128	(70)
Glasgow	H	46	(70)	31	(65)	30	(57)	107	(64)
Guy's	J	22	(50)	55	(67)	65	(68)	142	(65)
Leeds	K	56	(63)	49	(59)	41	(56)	146	(60)
Leicester	L	28	(68)	42	(81)	46	(67)	116	(72)
Liverpool	M	38	(68)	34	(65)	38	(71)	110	(68)
Manchester	N	129	(82)	73	(51)	52	(56)	254	(68)
Newcastle	O	53	(58)	18	(39)	17	(59)	88	(55)
Nottingham	P	16	(81)	32	(75)	36	(75)	84	(76)
Oxford	Q	23	(52)	19	(37)	43	(56)	85	(51)
Plymouth	R	20	(60)	15	(47)	24	(46)	59	(51)
Portsmouth	S	10	(50)	39	(67)	34	(71)	83	(66)
Sheffield	T	15	(67)	27	(59)	35	(60)	77	(61)
St George's	U	35	(63)	48	(56)	30	(73)	113	(63)
The Royal Free	V	37	(51)	25	(52)	34	(56)	96	(53)
The Royal London	W	26	(69)	61	(61)	59	(78)	146	(69)
WLRTC	X	73	(68)	106	(47)	66	(52)	245	(55)
UK		873	(69)	909	(61)	827	(63)	2609	(64)
		Centre has reached the upper 99.8% confidence limit							
		Centre has reached the upper 95% confidence limit							
		Centre has reached the lower 95% confidence limit							
		Centre has reached the lower 99.8% confidence limit							

4.3 DCD Standard criteria offer decline rates, 1 April 2020 – 31 March 2023

Figure 4.3 compares individual centre offer decline rates with the national rate for SCD over the time period, 1 April 2020 and 31 March 2023. Centres can be identified by the information shown in **Table 4.3**.

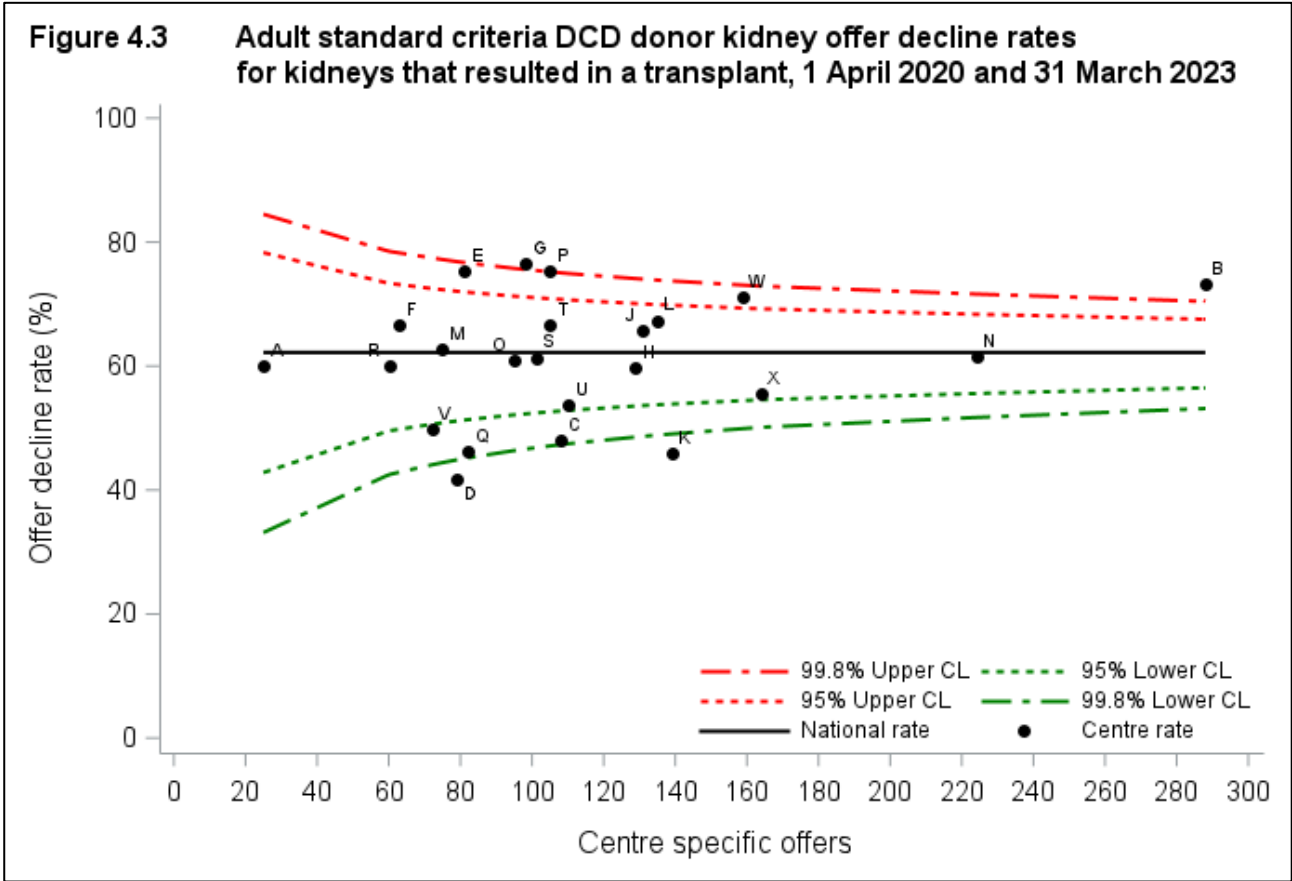


Table 4.3 compares individual centre offer decline rates for SCD over time by financial year.

Table 4.3 Adult standard criteria DCD donor kidney offer decline rates by transplant centre, 1 April 2020 and 31 March 2023									
Centre	Code	2020/21		2021/22		2022/23		Overall	
		N	(%)	N	(%)	N	(%)	N	(%)
Belfast	A	12	(83)	5	(60)	8	(25)	25	(60)
Birmingham	B	65	(82)	121	(74)	102	(67)	288	(73)
Bristol	C	39	(62)	31	(48)	38	(34)	108	(48)
Cambridge	D	29	(38)	28	(64)	22	(18)	79	(42)
Cardiff	E	26	(85)	18	(72)	37	(70)	81	(75)
Coventry	F	24	(79)	19	(58)	20	(60)	63	(67)
Edinburgh	G	55	(85)	25	(72)	18	(56)	98	(77)
Glasgow	H	54	(70)	45	(51)	30	(53)	129	(60)
Guy's	J	13	(62)	49	(61)	69	(70)	131	(66)
Leeds	K	49	(51)	45	(42)	45	(44)	139	(46)
Leicester	L	30	(60)	52	(77)	53	(62)	135	(67)
Liverpool	M	28	(68)	18	(61)	29	(59)	75	(63)
Manchester	N	82	(63)	77	(62)	65	(58)	224	(62)
Newcastle	O	47	(64)	20	(70)	28	(50)	95	(61)
Nottingham	P	32	(66)	36	(81)	37	(78)	105	(75)
Oxford	Q	19	(47)	21	(38)	42	(50)	82	(46)
Plymouth	R	21	(52)	16	(69)	23	(61)	60	(60)
Portsmouth	S	10	(90)	50	(54)	41	(63)	101	(61)
Sheffield	T	34	(71)	36	(61)	35	(69)	105	(67)
St George's	U	21	(81)	54	(50)	35	(43)	110	(54)
The Royal Free	V	20	(70)	34	(44)	18	(39)	72	(50)
The Royal London	W	25	(84)	61	(62)	73	(74)	159	(71)
WLRTC	X	46	(67)	74	(51)	44	(50)	164	(55)
UK		781	(68)	935	(61)	912	(58)	2628	(62)
		Centre has reached the upper 99.8% confidence limit							
		Centre has reached the upper 95% confidence limit							
		Centre has reached the lower 95% confidence limit							
		Centre has reached the lower 99.8% confidence limit							

4.4 Reallocation of kidneys, 1 April 2020 – 31 March 2023

Between 3 April 2006 and 11 September 2019 all kidneys from donation after brain death (DBD) donors have been allocated through the 2006 National Kidney Allocation Scheme. 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 adults 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.

Since 11 September 2019 all kidneys from deceased donors have been allocated through the 2019 National Kidney Offering Scheme. In a similar fashion to the 2006 scheme, if a kidney needs to be reallocated because the patient for whom the kidney has been accepted cannot subsequently receive the transplant then the kidney can be reallocated to an alternative patient of the centre's choice if the kidney has been dispatched to the transplant centre and there are no suitable patients in Tier A.

[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 4.4 compares individual centre reallocation rates with the national rate over the time period, 1 April 2020 and 31 March 2023. Centres can be identified by the information shown in **Table 4.4**. Nationally 3% of all [DBD](#) kidney only transplants used kidneys that had been reallocated.

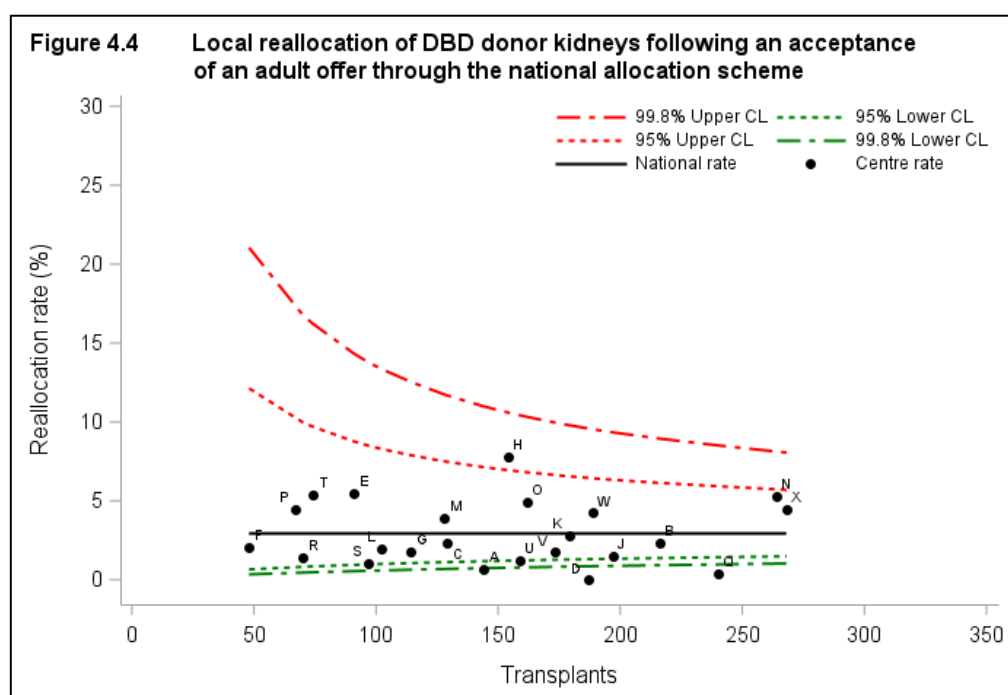


Table 4.4 compares individual reallocation rates over time by financial year.

Table 4.4 Local reallocation of DBD donor kidneys following an acceptance of an adult offer through the national allocation scheme									
Centre	Code	2020/21		2021/22		2022/23		Overall	
		N	(%)	N	(%)	N	(%)	N	(%)
Belfast	A	87	(0)	29	(3)	28	(0)	144	(1)
Birmingham	B	52	(4)	80	(4)	84	(0)	216	(2)
Bristol	C	49	(0)	39	(0)	41	(7)	129	(2)
Cambridge	D	82	(0)	49	(0)	56	(0)	187	(0)
Cardiff	E	29	(3)	29	(7)	33	(6)	91	(5)
Coventry	F	9	(11)	21	(0)	18	(0)	48	(2)
Edinburgh	G	51	(4)	32	(0)	31	(0)	114	(2)
Glasgow	H	63	(11)	44	(7)	47	(4)	154	(8)
Guy's	J	29	(0)	79	(3)	89	(1)	197	(2)
Leeds	K	66	(3)	50	(2)	63	(3)	179	(3)
Leicester	L	36	(0)	25	(4)	41	(2)	102	(2)
Liverpool	M	33	(3)	45	(4)	50	(4)	128	(4)
Manchester	N	75	(4)	105	(6)	84	(6)	264	(5)
Newcastle	O	88	(3)	35	(3)	39	(10)	162	(5)
Nottingham	P	16	(13)	26	(4)	25	(0)	67	(4)
Oxford	Q	124	(0)	59	(2)	57	(0)	240	(0)
Plymouth	R	26	(0)	16	(0)	28	(4)	70	(1)
Portsmouth	S	11	(0)	43	(0)	43	(2)	97	(1)
Sheffield	T	17	(0)	29	(7)	28	(7)	74	(5)
St George's	U	43	(0)	62	(2)	54	(2)	159	(1)
The Royal Free	V	58	(0)	45	(4)	70	(1)	173	(2)
The Royal London	W	35	(0)	96	(4)	58	(7)	189	(4)
WLRTC	X	57	(7)	115	(3)	96	(5)	268	(4)
UK		1136	(2)	1153	(3)	1163	(3)	3452	(3)
		Centre has reached the upper 99.8% confidence limit							
		Centre has reached the upper 95% confidence limit							
		Centre has reached the lower 95% confidence limit							
		Centre has reached the lower 99.8% confidence limit							

Adult kidney transplants

5.1 Kidney only transplants, 1 April 2013 – 31 March 2023

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](#)) increased from 783 in 2013/14 to 1001 in 2022/23. The number of adult transplants from donors after brain death ([DBD](#)) increased from 1097 in 2013/14 to 1379 in 2017/18 with a decrease to 1163 in 2022/23. The number of adult living kidney transplants performed has decreased from 1053 in 2013/14 to 848 in 2022/23.

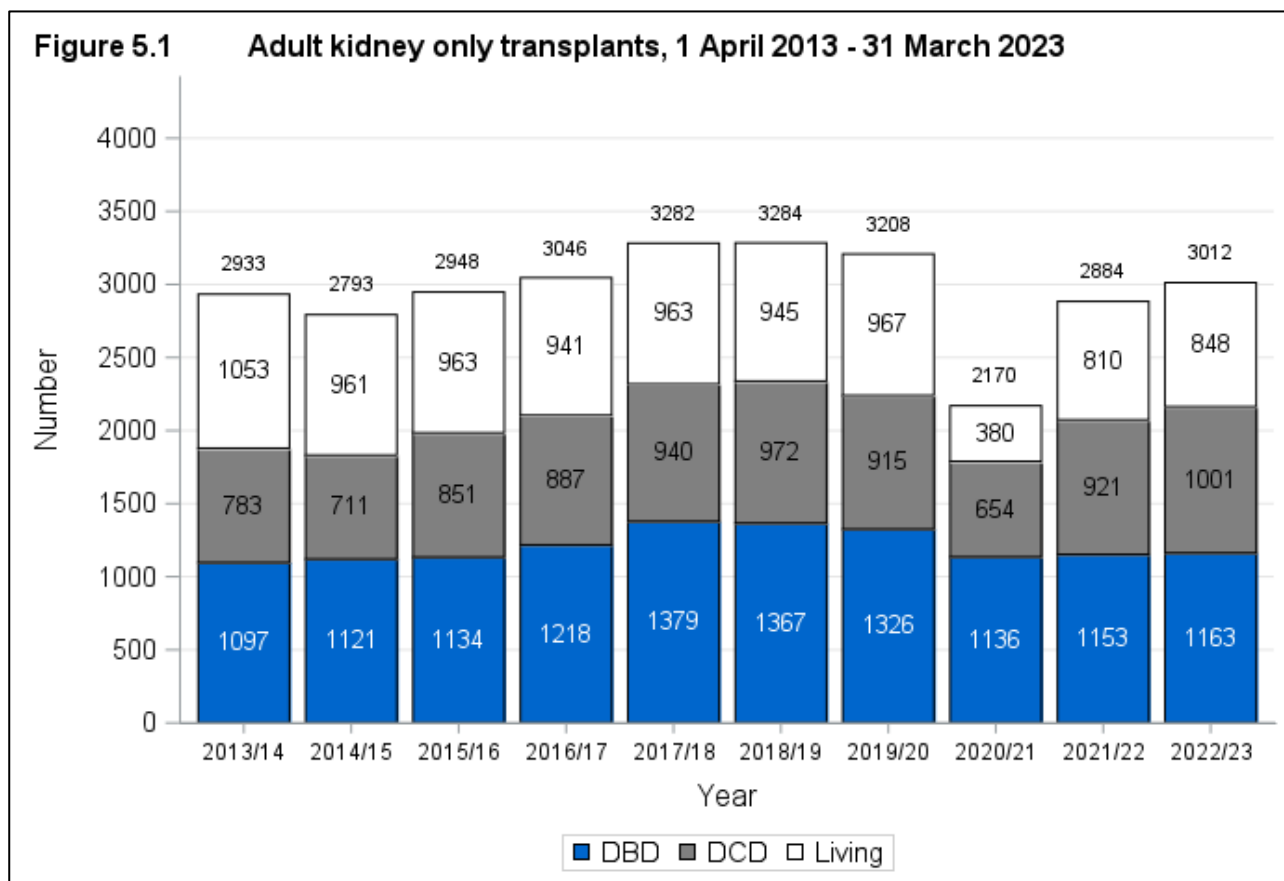


Figure 5.2 shows the total number of adult kidney only transplants performed in 2022/23, by centre and type of donor. The same information is presented in **Figure 5.3**, but this shows the proportion of [DBD](#), [DCD](#) and living donor transplants performed at each centre.

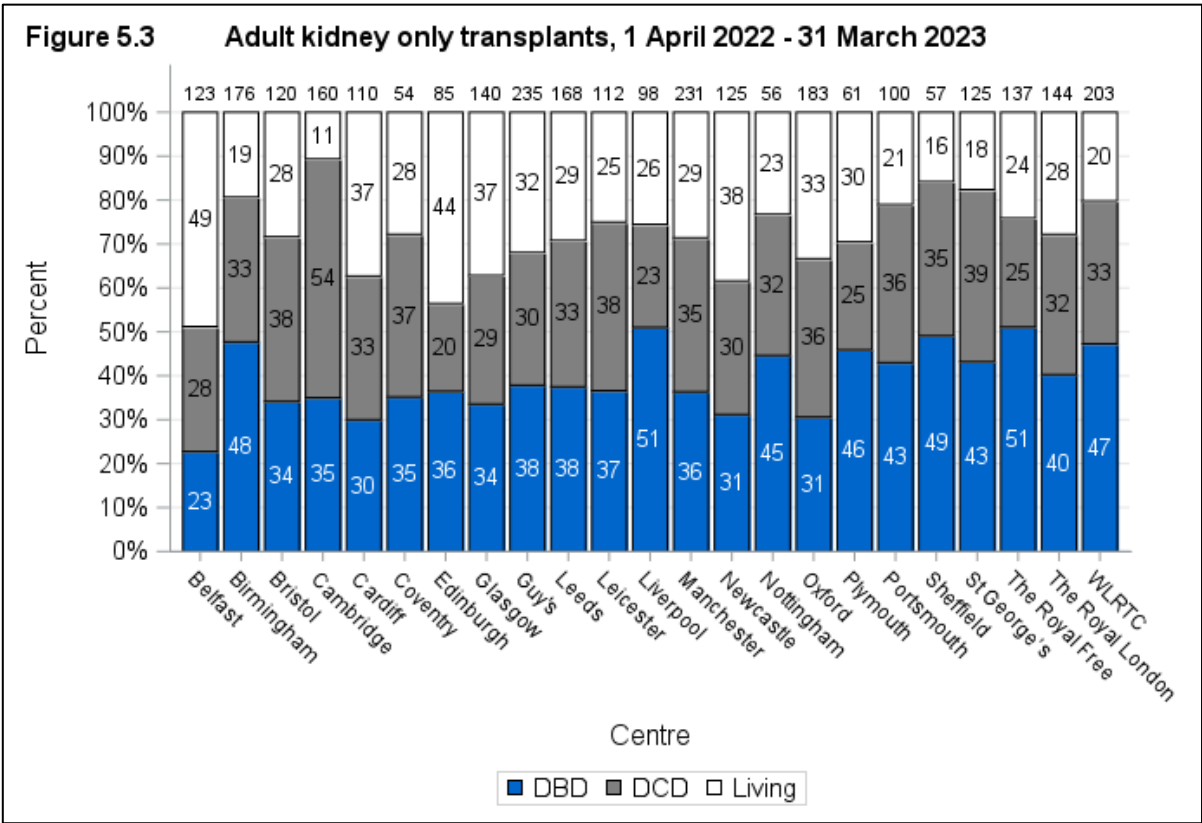
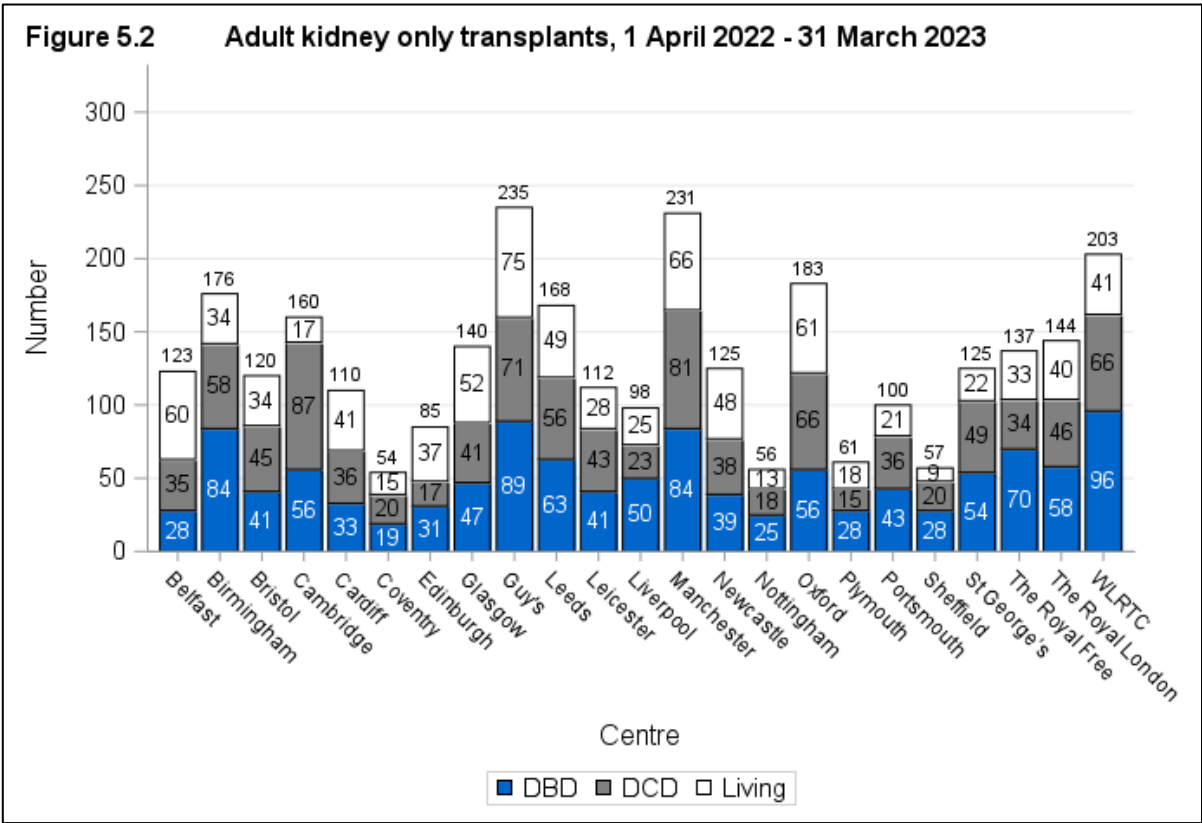
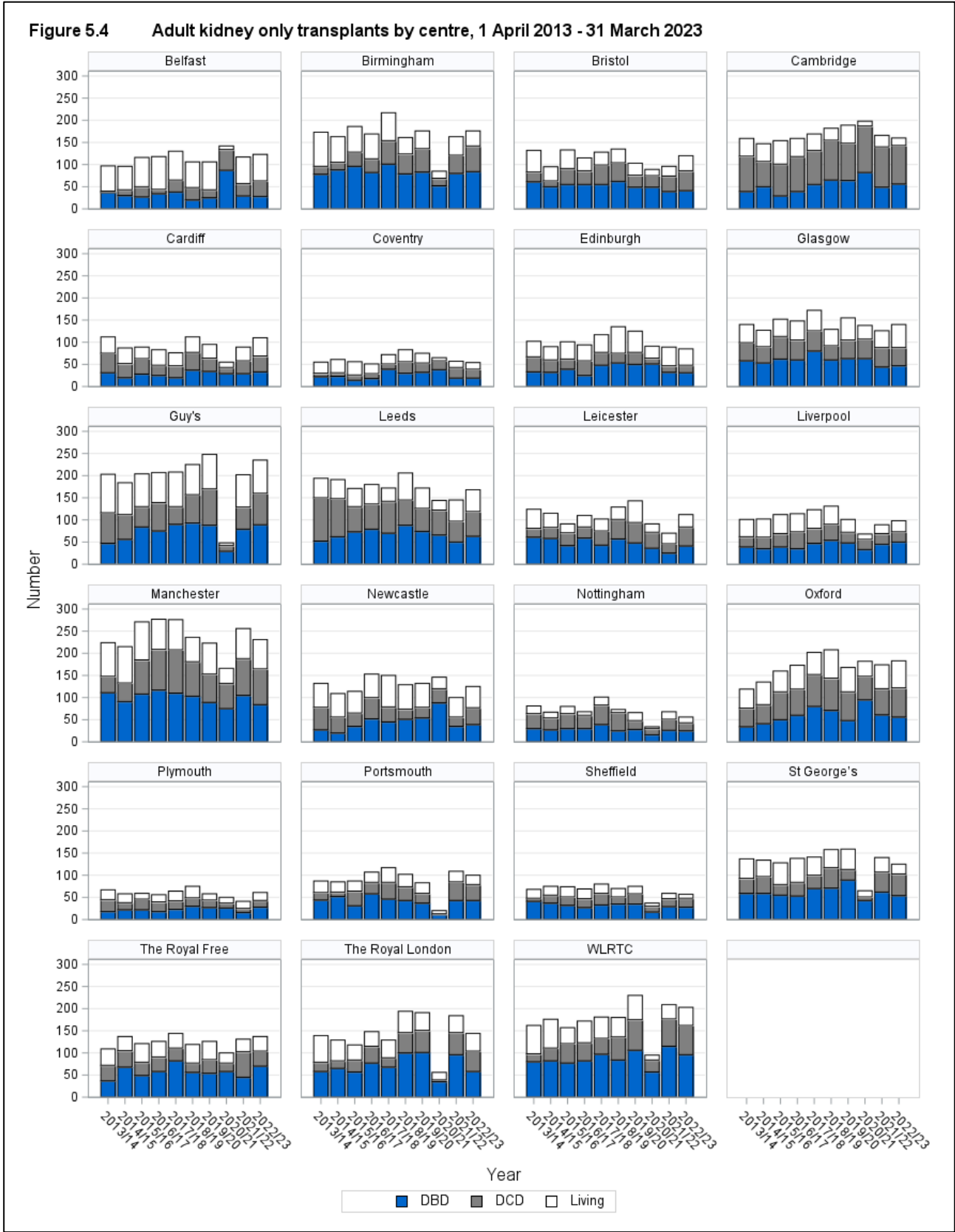


Figure 5.4 shows the total number of adult kidney only transplants performed in last ten years, by centre and type of donor.



5.2 Demographic characteristics of recipients, 1 April 2022 - 31 March 2023

The sex, ethnicity and age group of recipients who received a kidney only transplant are shown by centre in **Figure 5.5, 5.6 and 5.7**, respectively. Note that all percentages quoted are based only on data where relevant information was available.

Figure 5.5 Sex of adult kidney only transplant recipients, 1 April 2022 and 31 March 2023, by centre

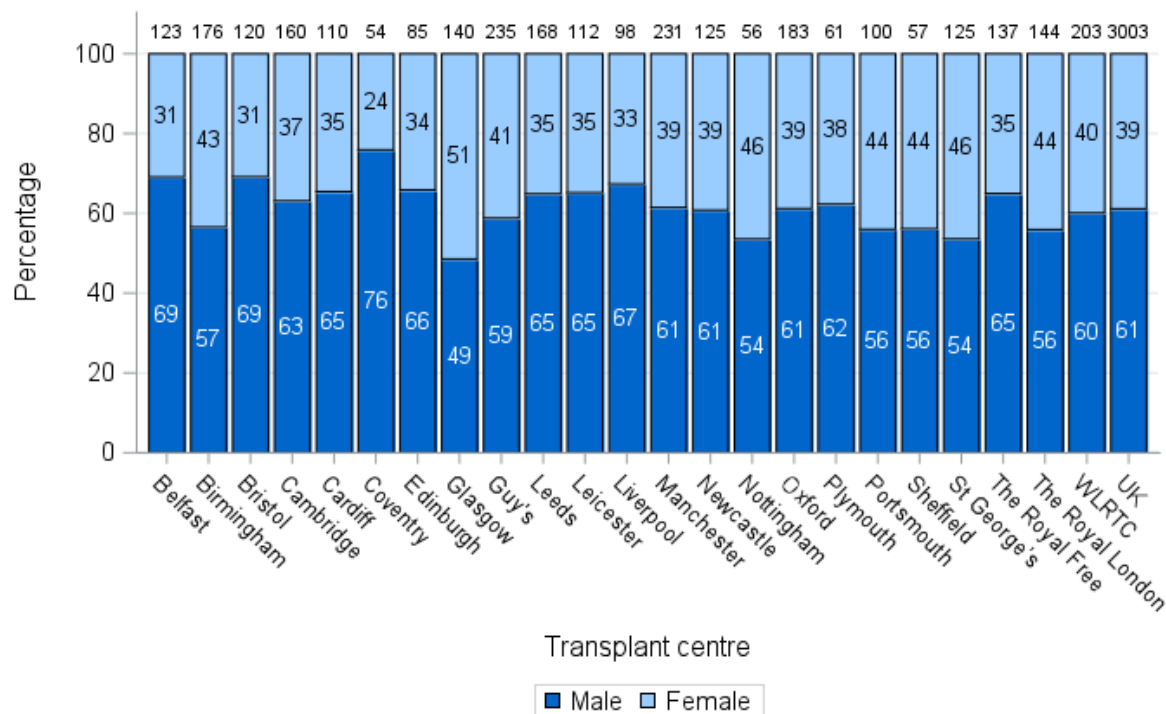


Figure 5.6 Ethnicity of adult kidney only transplant recipients, 1 April 2022 and 31 March 2023, by centre

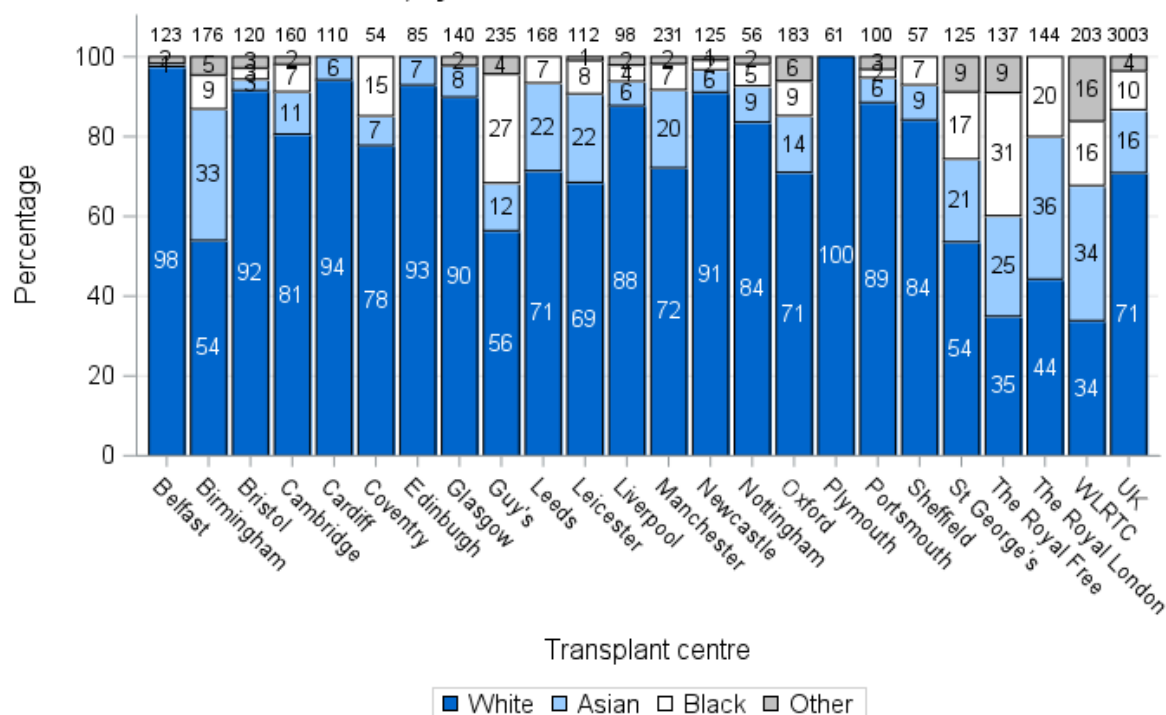
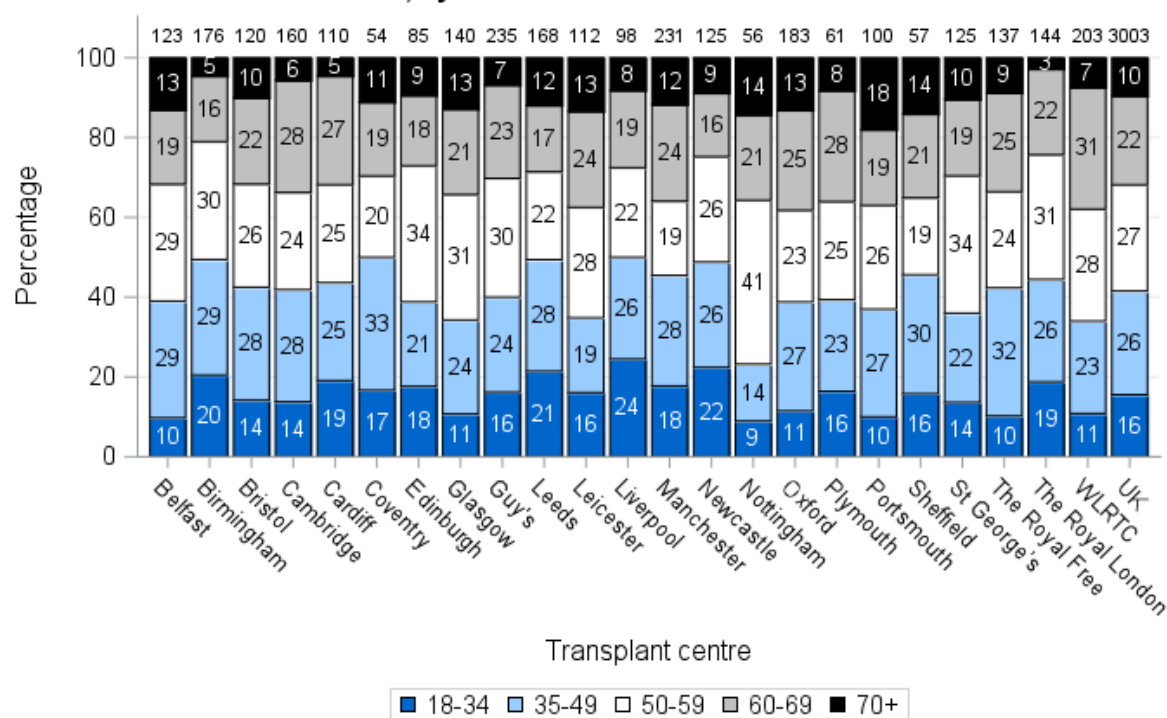
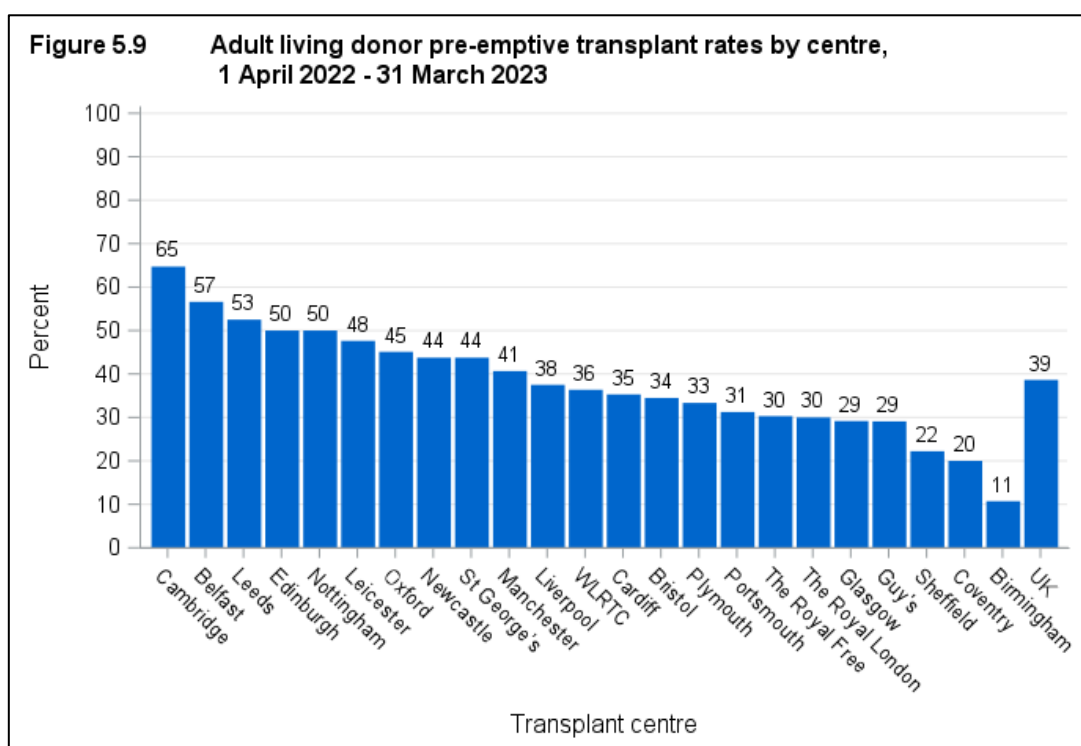
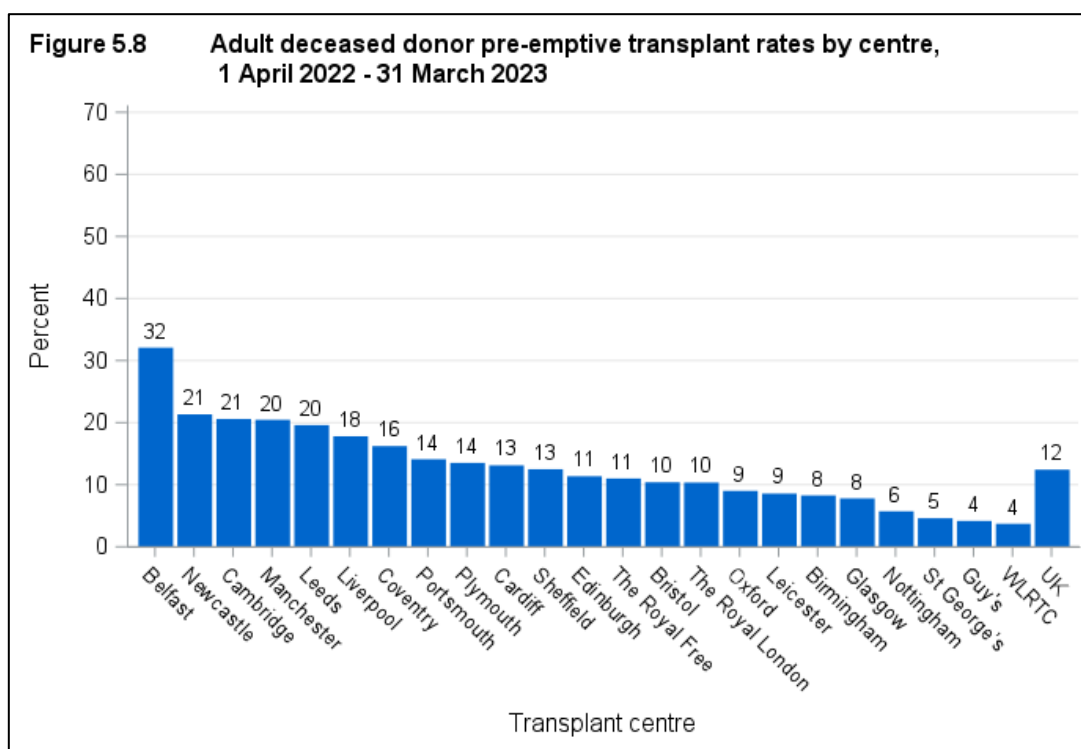


Figure 5.7 Age of adult kidney only transplant recipients, 1 April 2022 and 31 March 2023, by centre



5.3 Pre-emptive transplant rates, 1 April 2022 - 31 March 2023

Rates of [pre-emptive](#) kidney only transplantation are shown in **Figure 5.8** for adult deceased donor transplants and **Figure 5.9** for adult living donor transplants. Living donor transplants are more likely to be carried out before the need for dialysis than deceased donor transplants: 39% and 12% 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 32% at Belfast to 4% at WLRTC. Adult living donor [pre-emptive](#) transplant rates ranged from 65% at Cambridge to 11% at Birmingham.



5.4 Kidney donor risk-index¹

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 5.10 shows the number of transplanted [DBD](#) donor kidneys over the last ten financial years by kidney donor risk index group. In 2013/14 36% of all transplants were performed using kidneys from donors categorised as high risk (UK Donor risk index ≥ 1.35) compared with 35% in 2022/23.

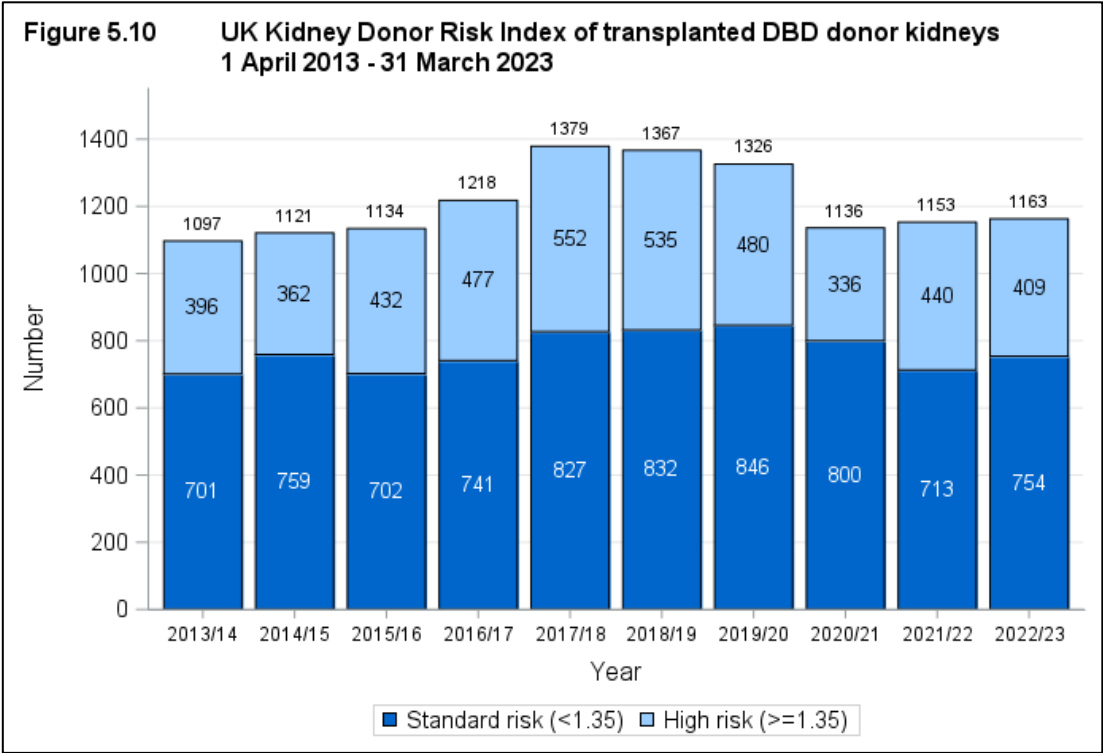
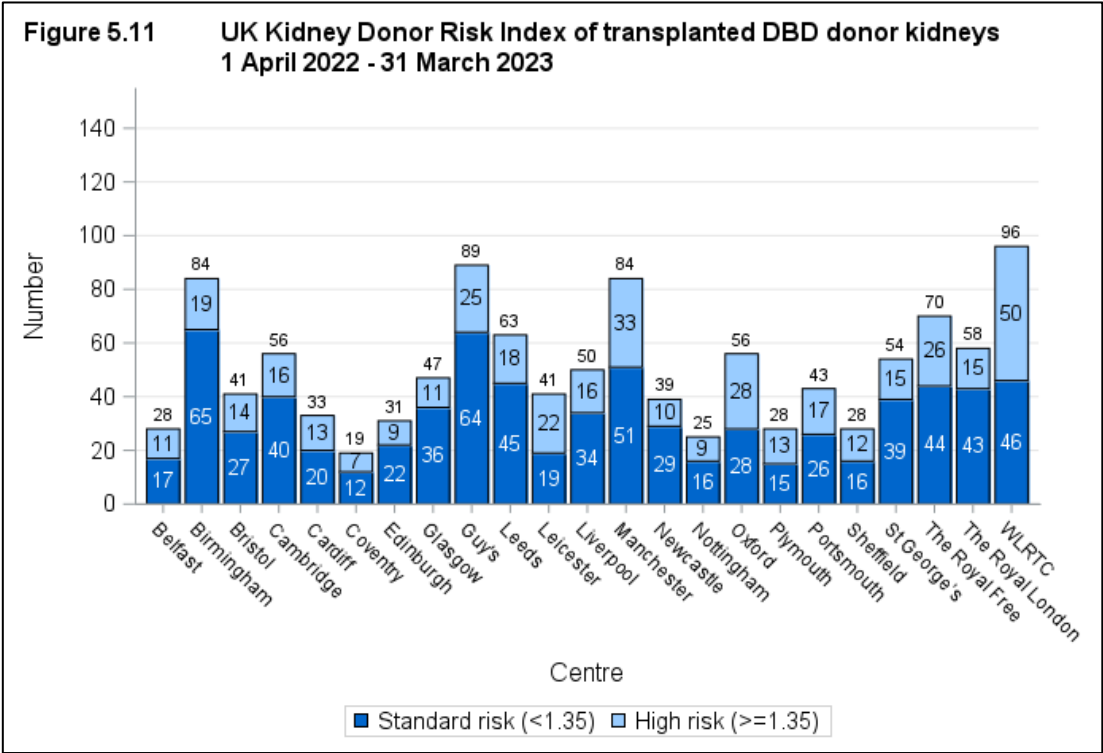


Figure 5.11 shows the number of transplanted [DBD](#) donor kidneys in 2022/23 by kidney donor risk index group for each transplant centre. The same information is presented in **Figure 5.12** but this shows the proportion of standard risk and high risk donor transplants performed at each centre.



**Figure 5.12 UK Kidney Donor Risk Index of transplanted DBD donor kidneys
1 April 2022 - 31 March 2023**

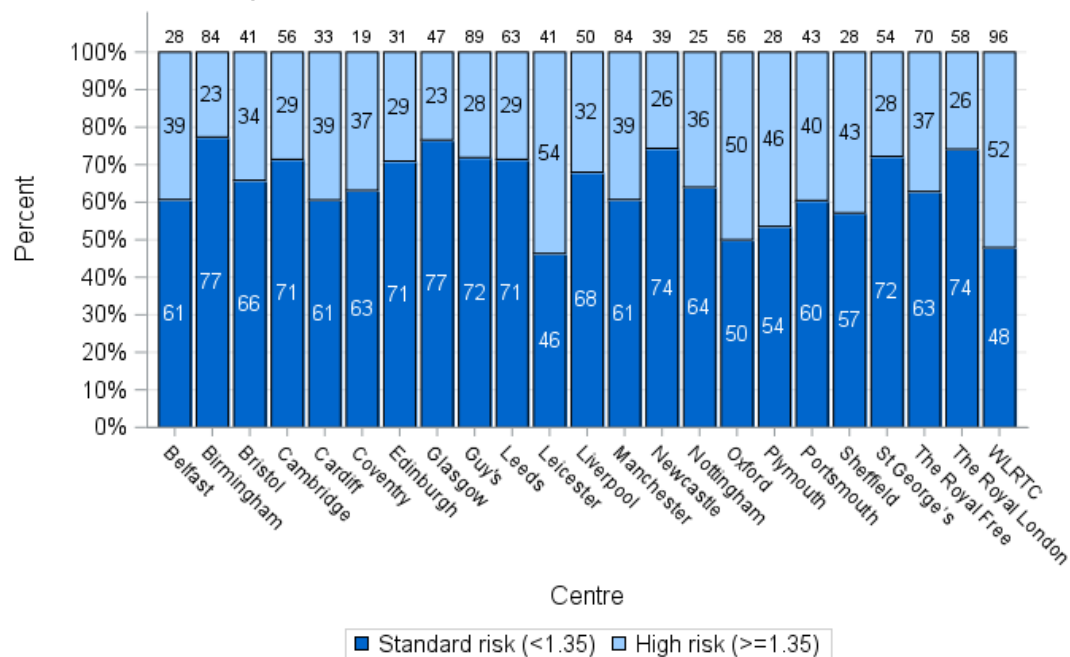
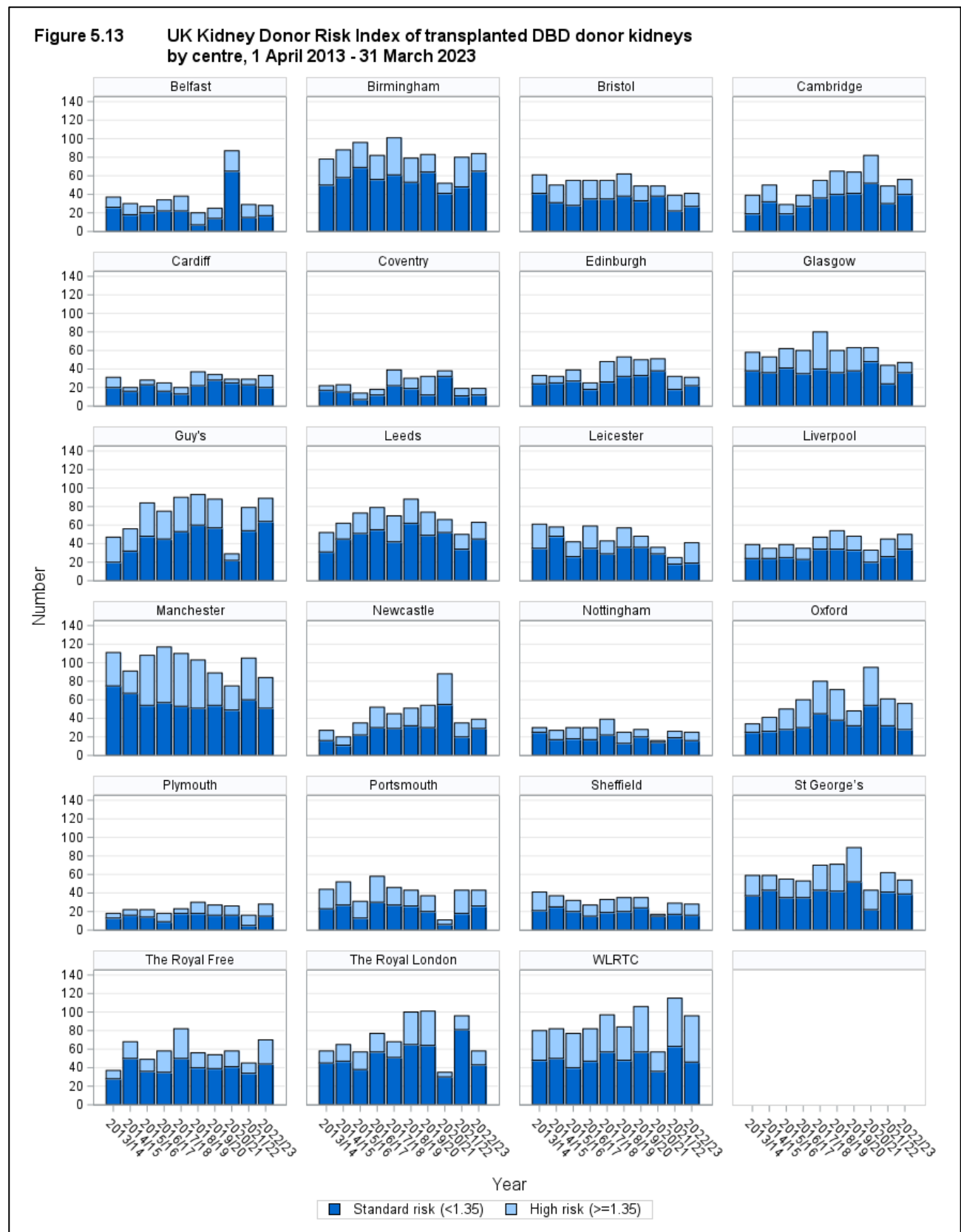


Figure 5.13 shows the number of transplanted [DBD](#) donor kidneys in the last ten years by kidney donor risk index group for each transplant centre.



5.5 2019 Kidney Offering Scheme Donor Risk Index and Recipient Risk Index, 1 April 2022 – 31 March 2023

A new Kidney Donor Risk Index (DRI) was developed for deceased donors alongside the change in kidney offering scheme in 2019. This DRI is calculated using seven risk factors. A donor is then categorised into one of four groups (D1-D4) based on the risk score and by pre-determined cut-off values.

$$\begin{aligned} \text{DRI} = & \exp \{ 0.023 \times (\text{donor age}-50) & + \\ & -0.152 \times ([\text{donor height}-170]/10) & + \\ & 0.149 \times (\text{history of hypertension}) & + \\ & -0.184 \times (\text{female donor}) & + \\ & 0.190 \times (\text{CMV +ve donor}) & + \\ & -0.023 \times ([\text{offer eGFR}-90]/10) & + \\ & 0.015 \times (\text{days in hospital}) \} \end{aligned}$$

D1 → DRI ≤ 0.79 (lowest risk)

D2 → DRI 0.79 – 1.12

D3 → DRI 1.12 – 1.50

D4 → DRI ≥ 1.50 (highest risk)

As discussed in Section 3.8 a Recipient Risk Score (RRI) was also developed alongside the 2019 offering scheme using four risk factors.

$$\begin{aligned} \text{RRI} = & \exp \{ 0 \times (\text{recipient age} \leq 25) - 75) & + \\ & 0.016 \times ((\text{recipient age} > 25) - 75) & + \\ & 0.361 \times (\text{recipient on dialysis at registration}) & + \\ & 0.033 \times ([\text{waiting time from dialysis}-950]/365.25) & + \\ & 0.252 \times (\text{Diabetic recipient}) \} \end{aligned}$$

A recipient is then categorised into one of four groups based on the risk score and pre-determined cut-off values.

R1 → RRI ≤ 0.74 (lowest risk)

R2 → RRI 0.74 - 0.94

R3 → RRI 0.94 – 1.20

R4 → RRI ≥ 1.20 (highest risk)

Table 5.1 presents the DRI and RRI groups and average scores for kidneys transplanted between 1 April 2022 and 31 March 2023.

Table 5.1 UK Kidney Donor Risk Index of transplanted deceased donor kidneys and Recipient Risk Index of those receiving them, 1 April 2022 - 31 March 2023

Transplant centre	Donor Risk Group				Avg. DRI	Recipient Risk Group				Avg. RRI
	D1	D2	D3	D4		R1	R2	R3	R4	
Belfast	9	17	21	16	1.25	18	15	18	11	0.92
Birmingham	57	45	36	19	1	59	44	29	25	0.89
Bristol	23	30	18	20	1.14	28	19	31	13	0.94
Cambridge	48	37	35	40	1.15	47	36	48	27	0.94
Cardiff	24	21	20	11	1.03	30	16	17	13	0.87
Coventry	6	8	14	4	1.12	8	10	9	5	0.95
Edinburgh	30	13	16	7	0.92	18	16	15	17	0.97
Glasgow	24	27	17	25	1.16	24	27	15	27	0.97
GOSH	6	2	0	0	0.72	8	0	0	0	0.55
Guy's	77	29	46	40	1.05	42	43	53	51	1.01
Leeds	40	28	26	28	1.11	35	33	22	32	0.99
Leicester	19	14	27	24	1.23	19	17	25	23	1.01
Liverpool	27	24	8	14	1.04	23	25	12	13	0.9
Manchester	63	37	42	48	1.13	62	42	43	44	0.95
Newcastle	28	26	23	8	1	19	31	24	11	0.92
Nottingham	8	15	10	11	1.21	8	9	16	11	1
Oxford	50	35	44	31	1.09	33	43	45	40	1
Plymouth	9	10	18	6	1.14	11	7	18	7	0.98
Portsmouth	20	17	13	29	1.26	18	18	26	17	0.99
Sheffield	13	13	10	12	1.14	9	20	11	8	0.94
St George's	23	33	23	24	1.2	27	25	25	26	1
The Royal Free	22	29	29	24	1.17	22	26	28	28	1.01
The Royal London	25	37	24	18	1.11	31	34	24	15	0.9
WLRTC	22	33	51	62	1.36	37	28	42	61	1.07
UK	673	580	571	521	1.13	636	584	596	525	0.97

5.6 Cold ischaemia time, 1 April 2020 – 31 March 2023

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 5.14 shows the [median](#) total cold ischaemia time in adult [DBD](#) donor kidney only transplants over the last 10 years. The [median](#) total cold ischaemia time has fallen over the last 10 years from 14 hours in 2013/14 to 13 hours in 2022/23.

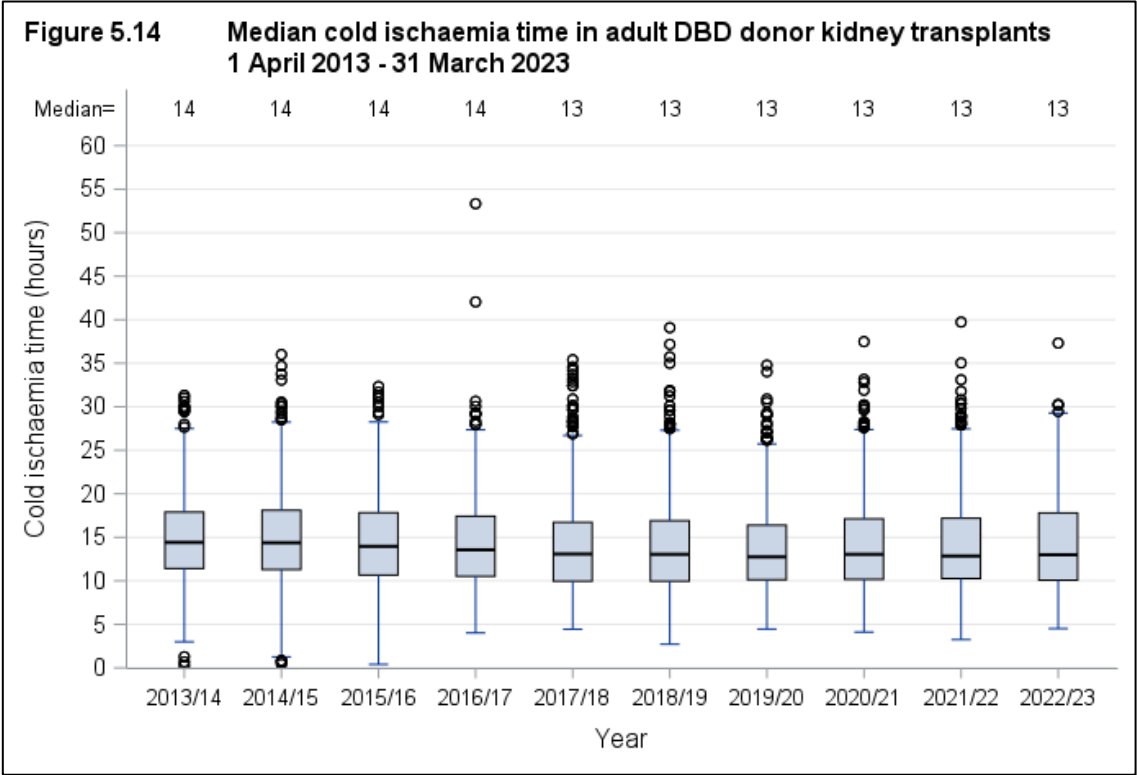


Figure 5.15 shows the [median](#) total cold ischaemia time in adult [DBD](#) donor kidney only transplants in 2022/23 for each transplant centre. Manchester had the longest [median](#) cold ischaemia time, 20 hours in 2022/23 compared with Nottingham who had the shortest, 9 hours.

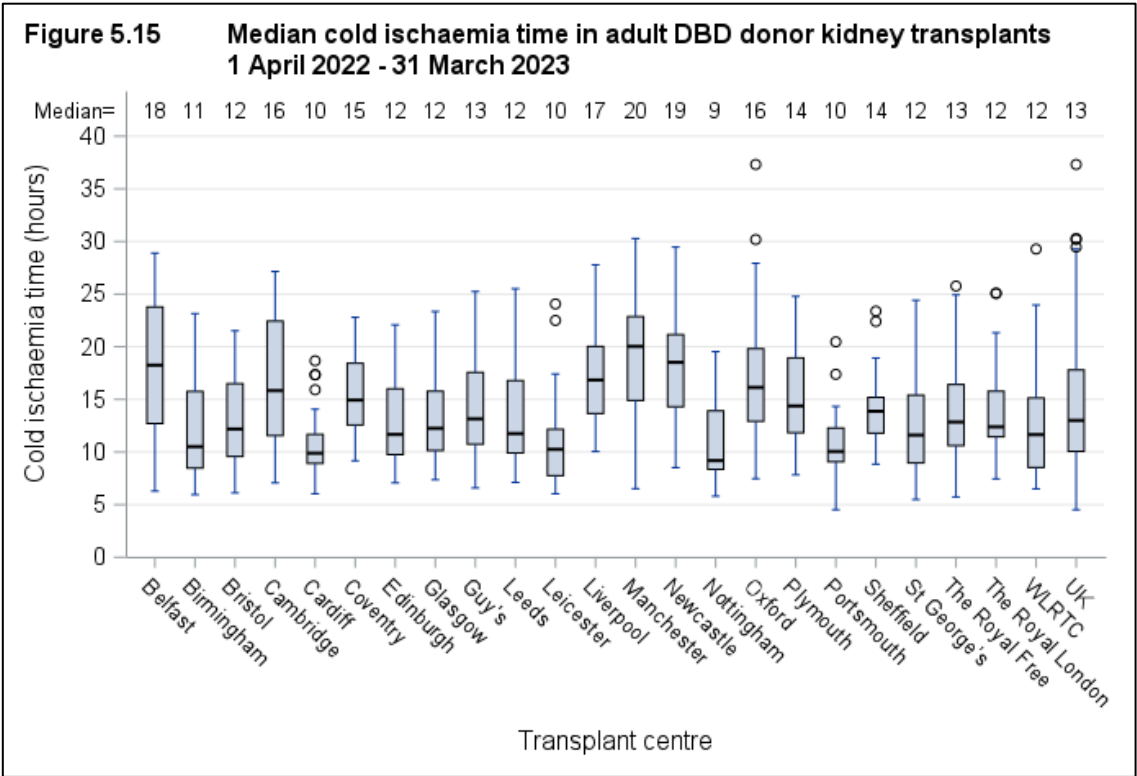


Figure 5.16 shows the [median](#) total cold ischaemia time in adult [DBD](#) donor kidney only transplants over the last ten years for each transplant centre.

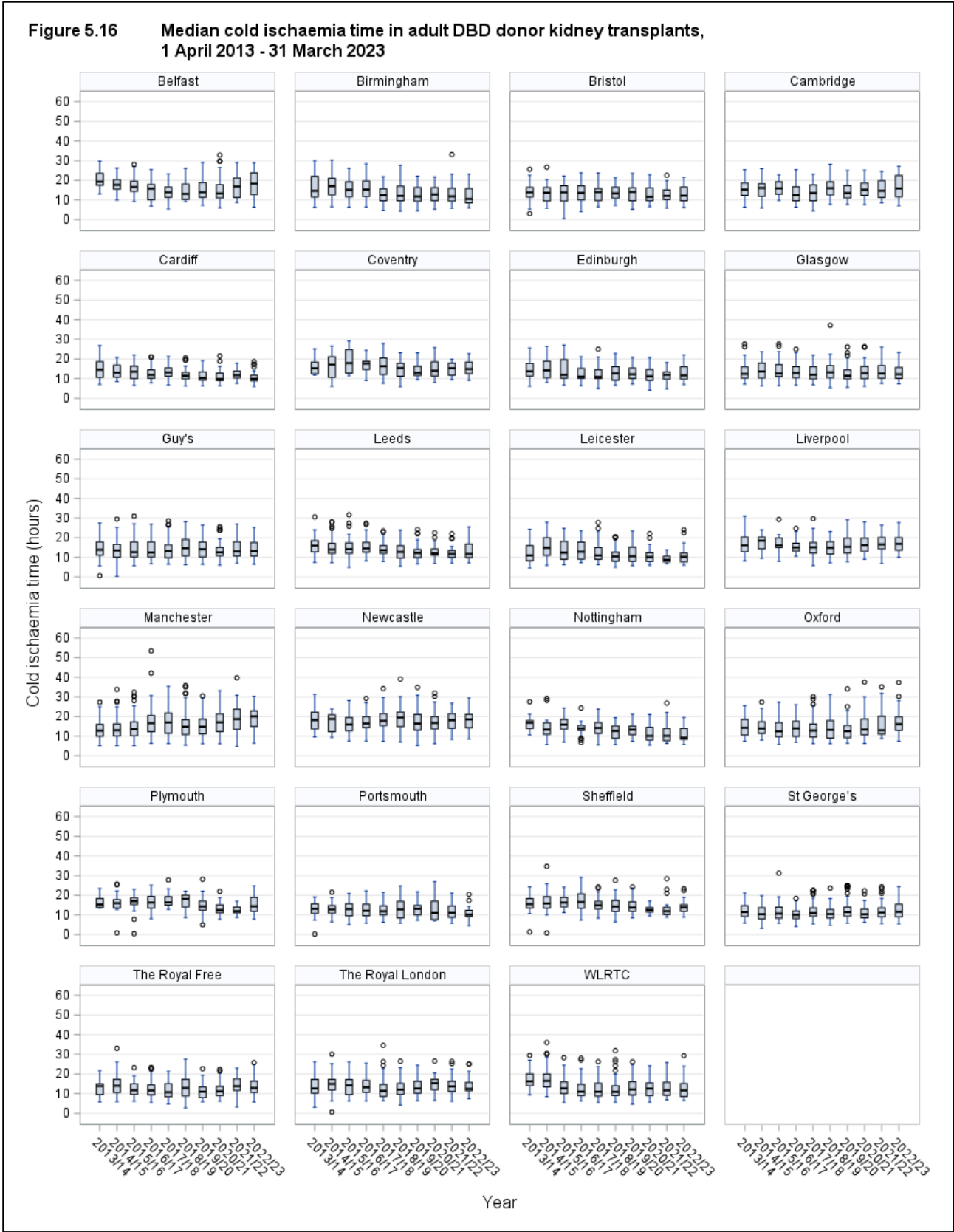


Figure 5.17 shows the proportion of adult [DBD](#) donor kidney only transplants in 2022/23 that have been performed within 18 hours of CIT for each transplant centre. All centres except Belfast, Manchester and Newcastle perform at least half of all [DBD](#) kidney only transplants within 18 hours CIT.

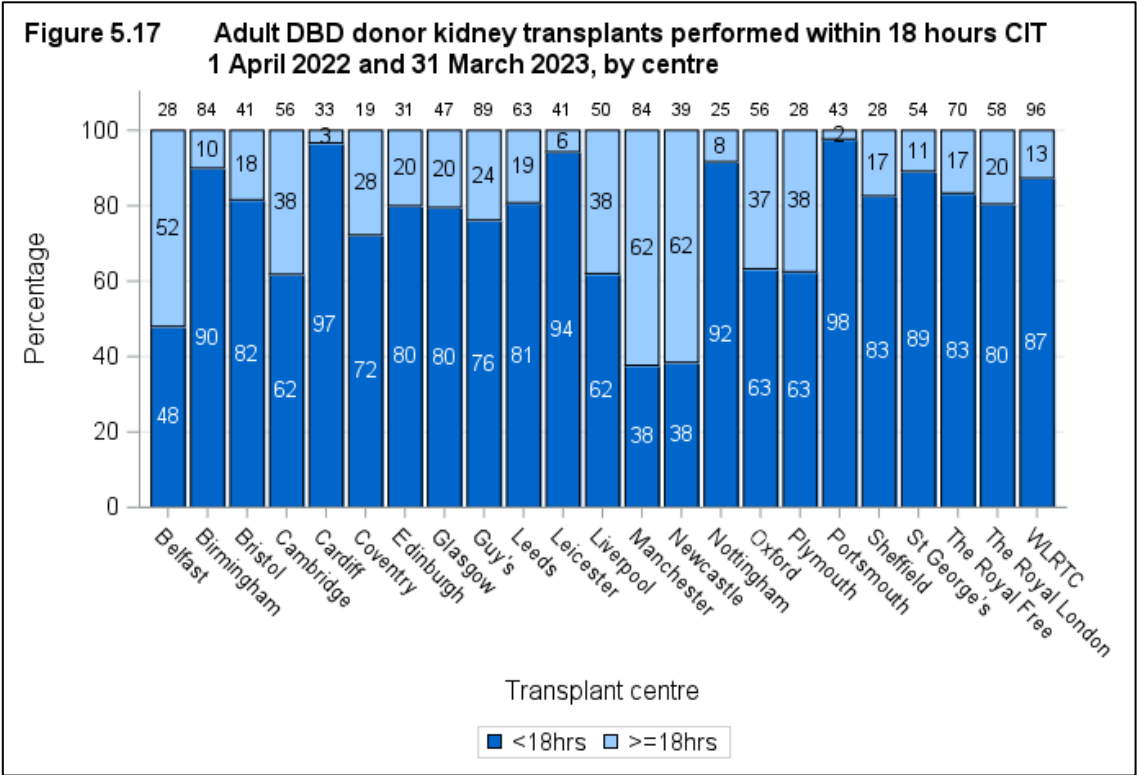


Figure 5.18 shows the [median](#) total cold ischaemia time in adult [DCD](#) donor kidney only transplants over the last 10 years. The [median](#) total ischaemia time has remained almost unchanged over the last 10 years.

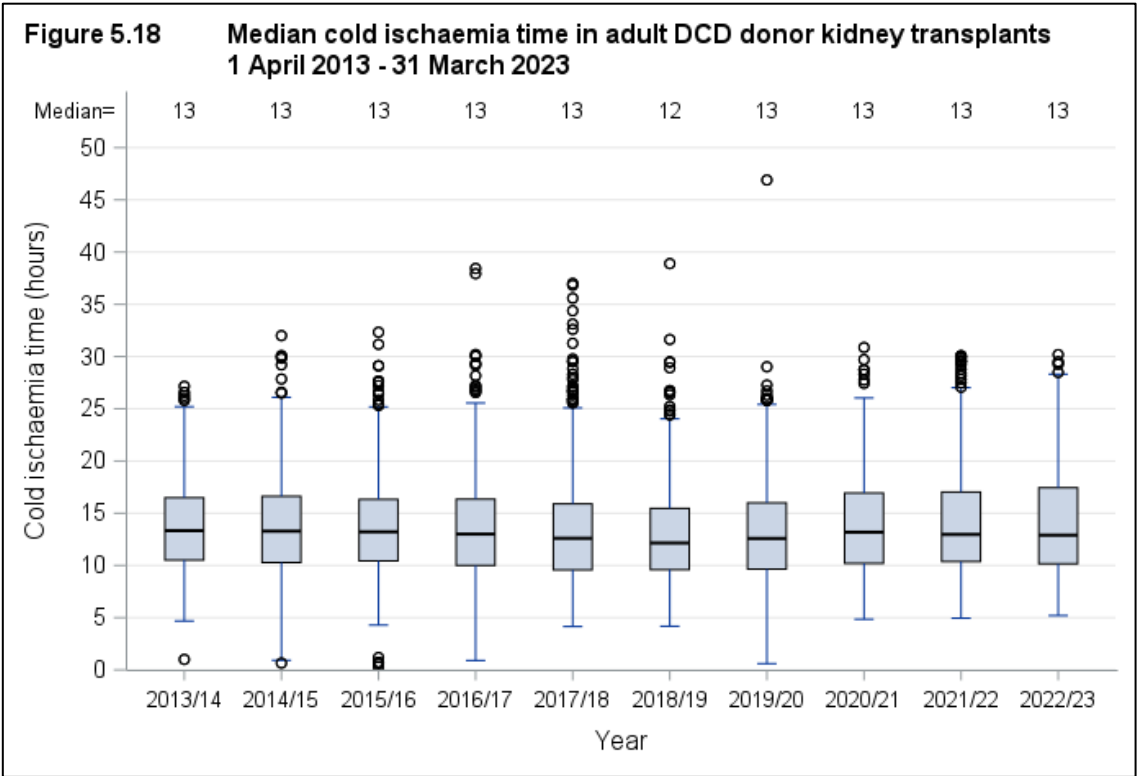


Figure 5.19 shows the [median](#) total cold ischaemia time in adult [DCD](#) donor kidney only transplants in 2022/23 for each transplant centre. Manchester had the longest [median](#) cold ischaemia time, 20 hours in 2022/23 compared with Leicester who had the shortest, 8 hours.

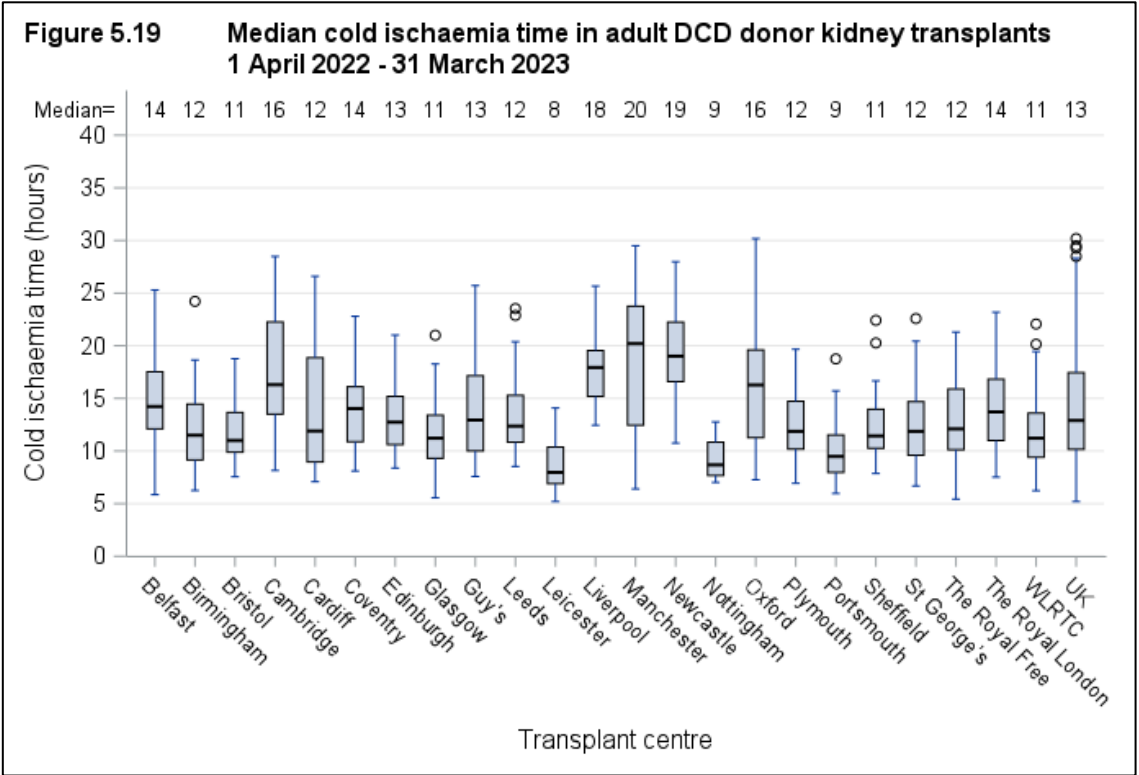


Figure 5.20 shows the [median](#) total cold ischaemia time in adult [DCD](#) donor kidney only transplants over the last ten years for each transplant centre.

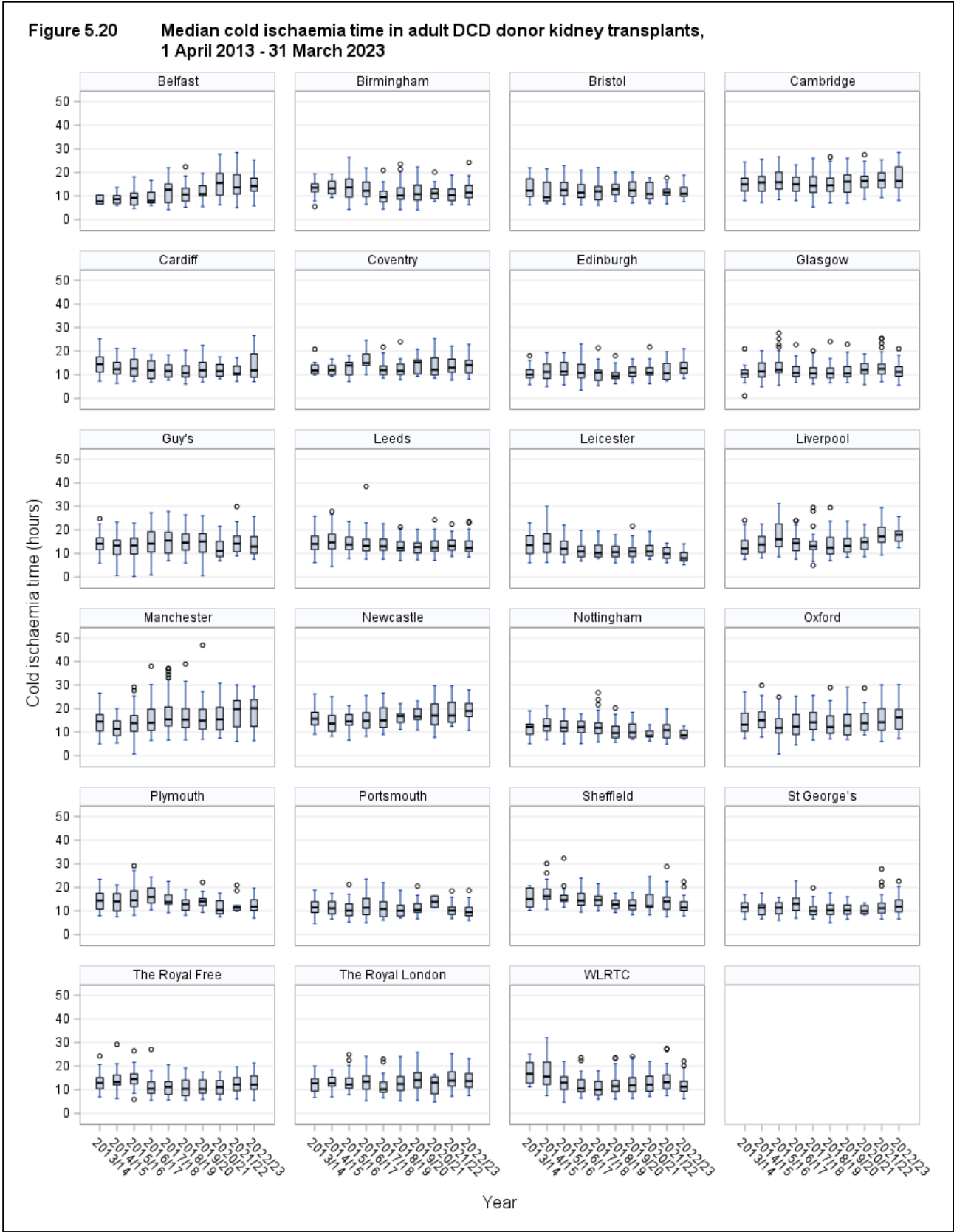


Figure 5.21 shows the proportion of adult [DCD](#) donor kidney only transplants in 2022/23 that have been performed within 12 hours of CIT for each transplant centre.

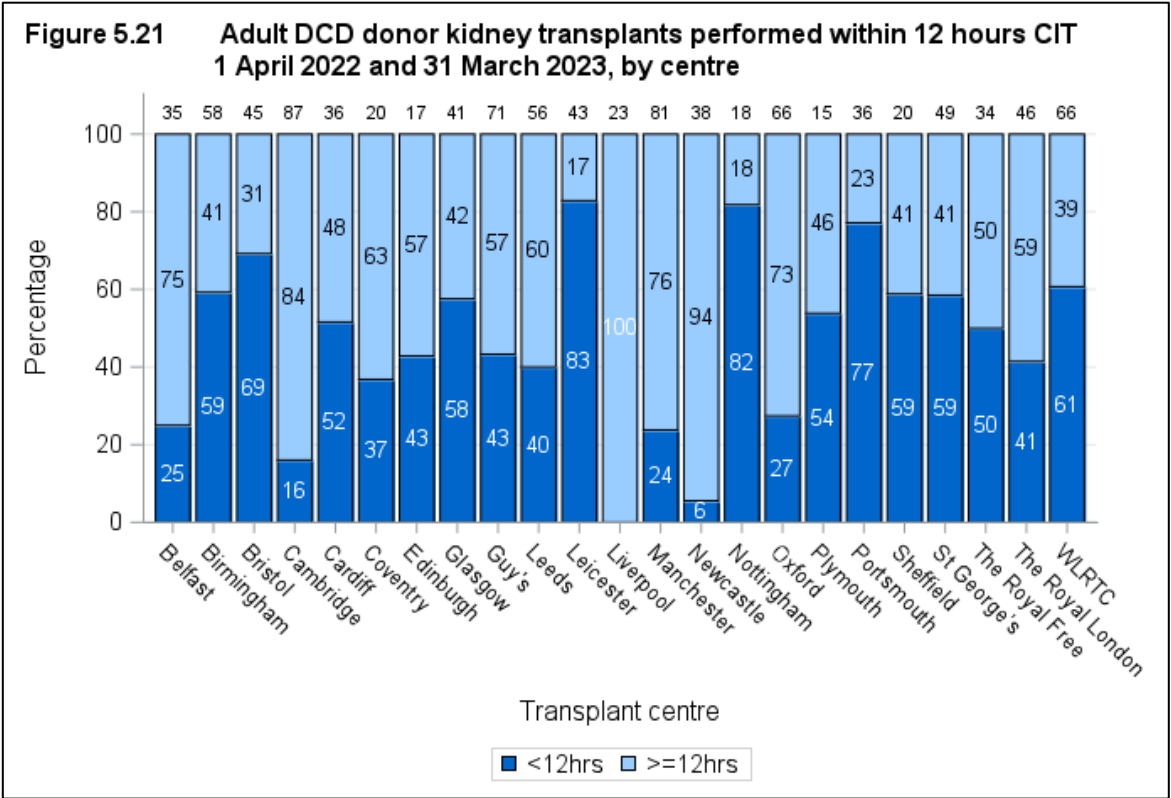


Figure 5.22 shows the [median](#) total cold ischaemia time in adult living donor kidney transplants over the last 10 years. The [median](#) total cold ischaemia time has increased marginally over the last ten years.

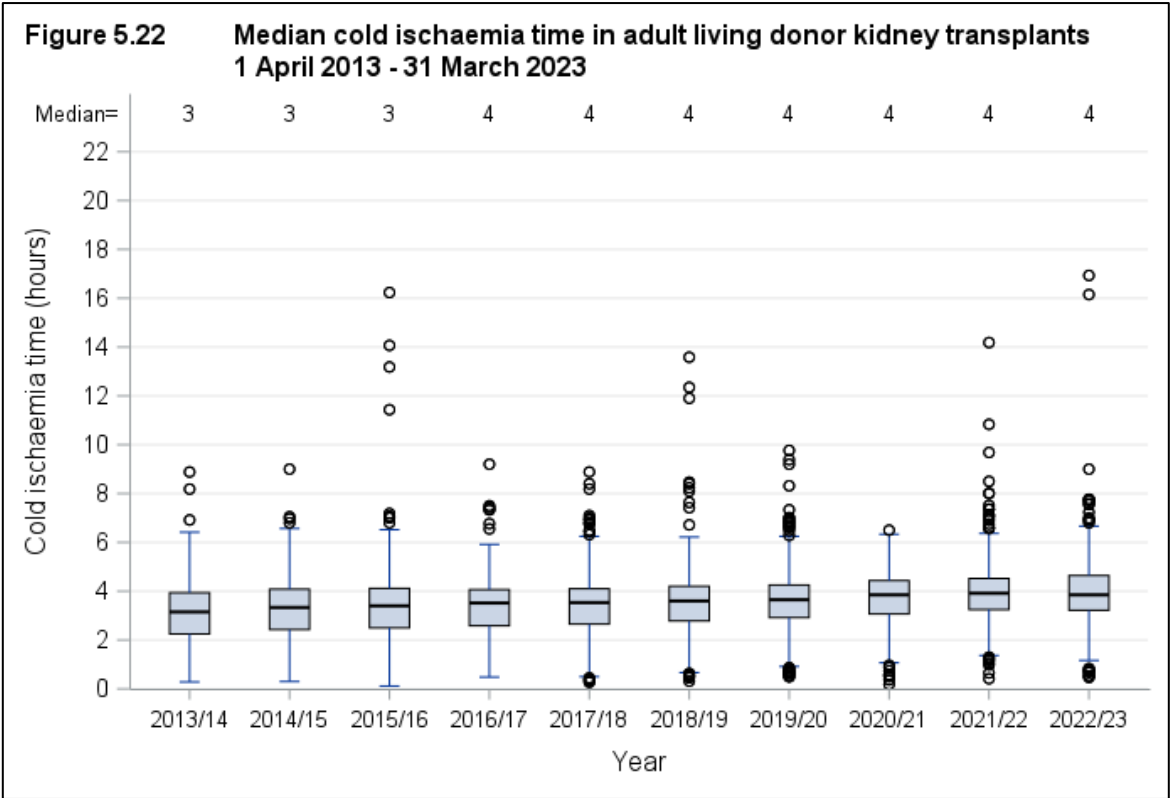


Figure 5.23 shows the [median](#) total cold ischaemia time in adult living donor kidney transplants in 2022/23 for each transplant centre.

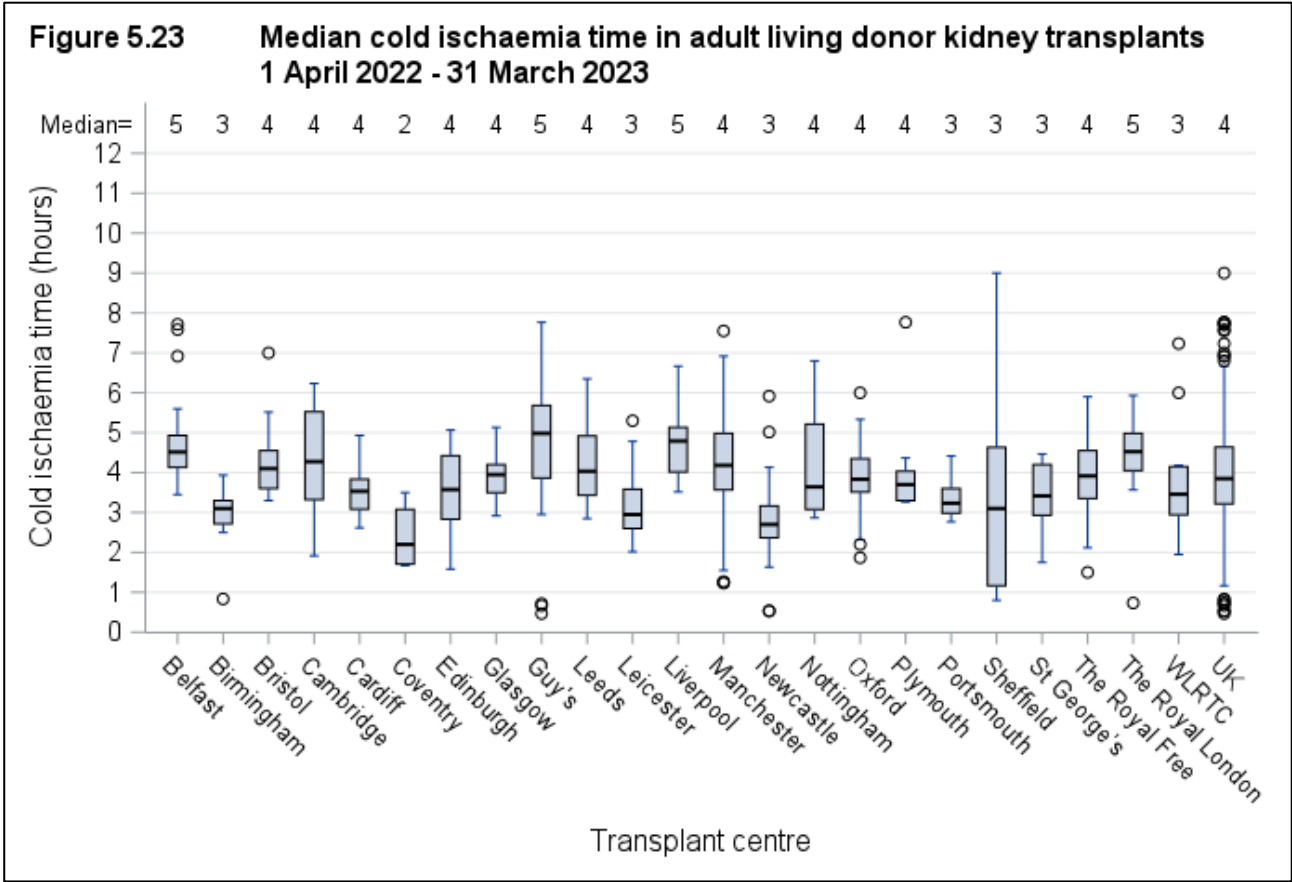


Figure 5.24 shows the [median](#) total cold ischaemia time in adult living donor kidney transplants over the last ten years for each transplant centre.



Adult kidney outcomes

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 95% [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**.

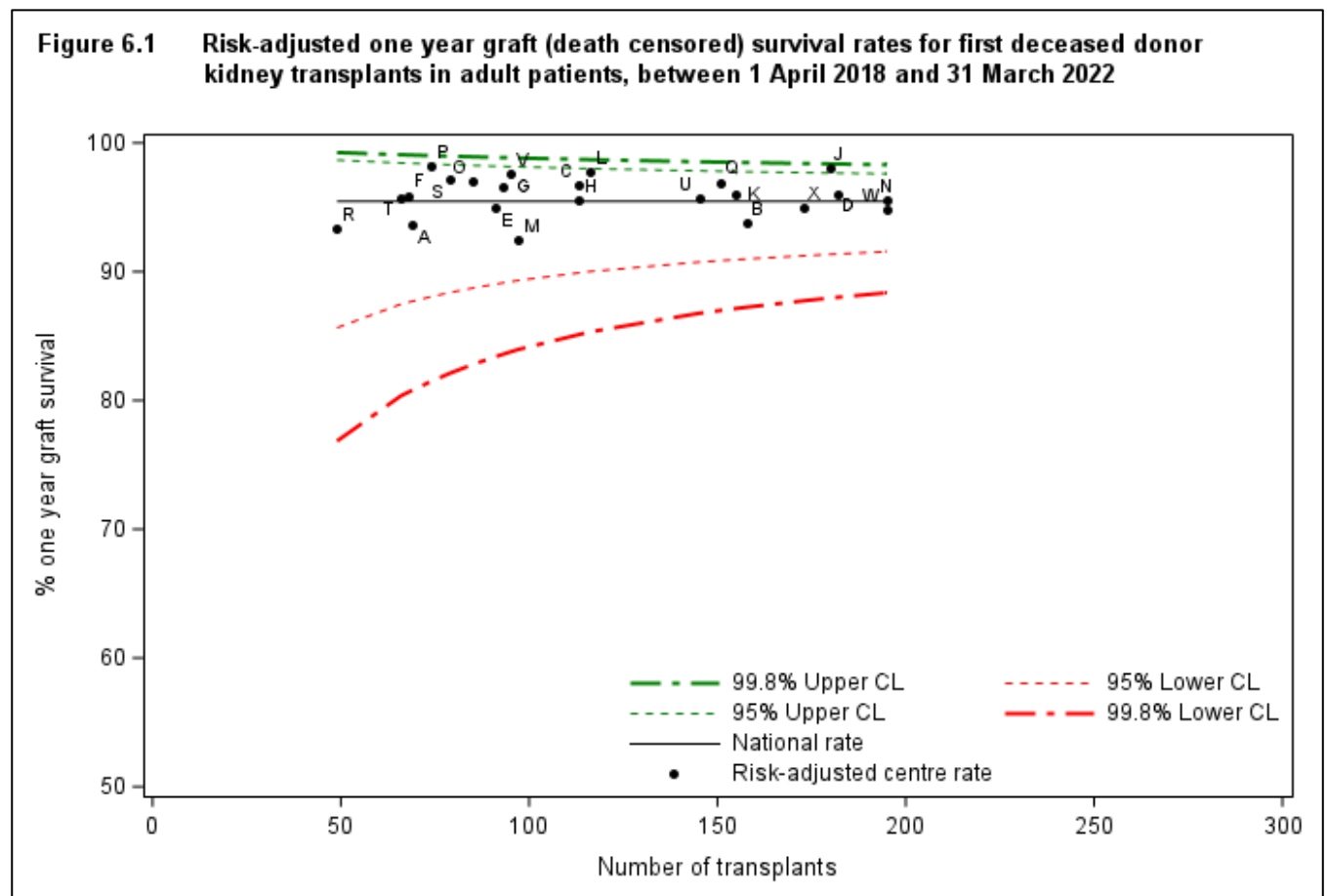


Figure 6.2 Risk-adjusted one year patient survival rates for first deceased donor kidney transplants in adult patients, between 1 April 2018 and 31 March 2022

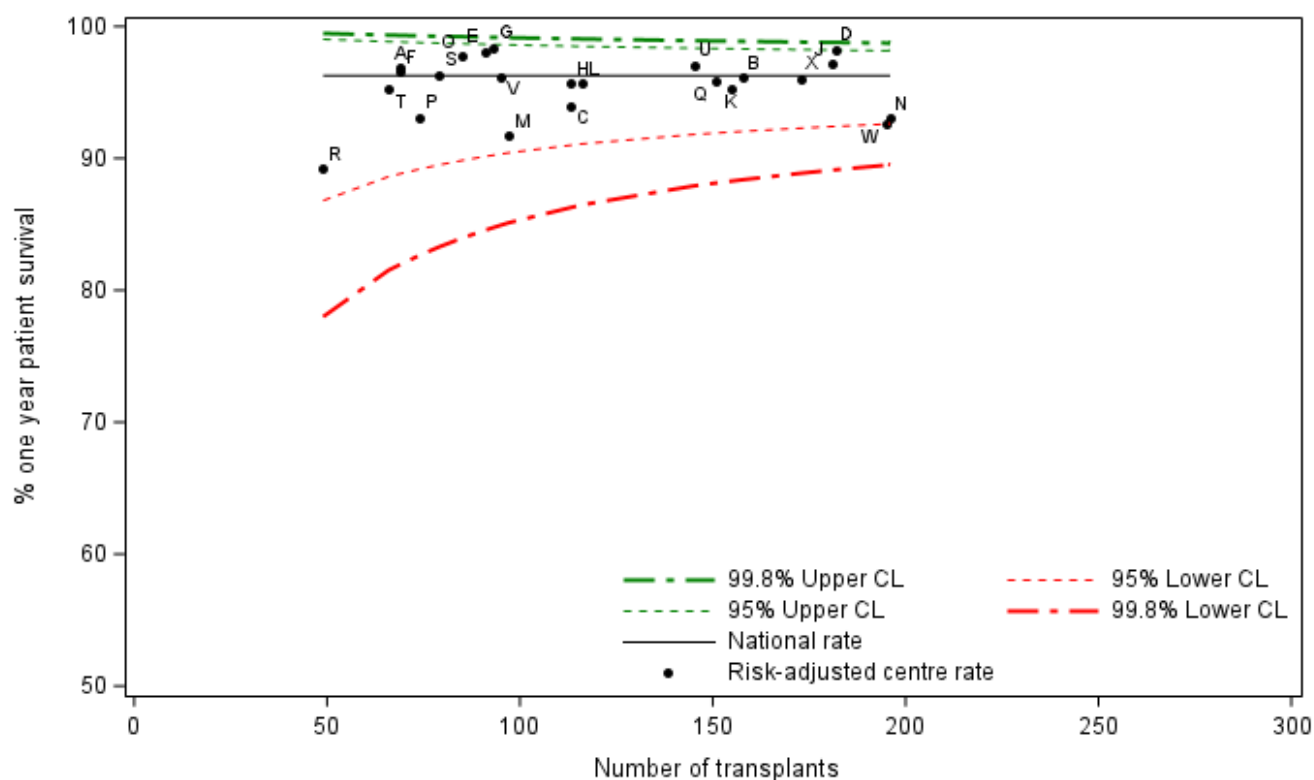


Figure 6.3 Risk-adjusted five year graft (death censored) survival rates for first deceased donor kidney transplants in adult patients, between 1 April 2014 and 31 March 2018

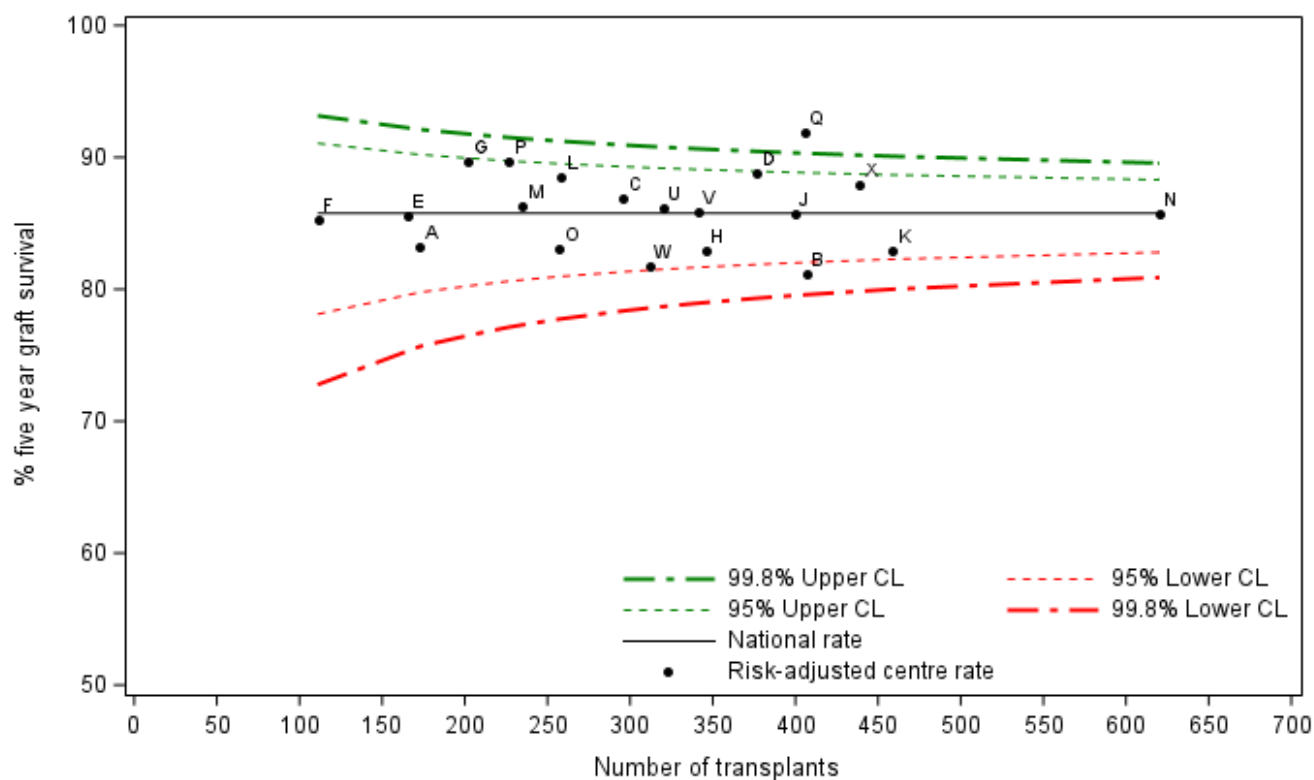


Figure 6.4 Risk-adjusted five year patient survival rates for first deceased donor kidney transplants in adult patients, between 1 April 2014 and 31 March 2018

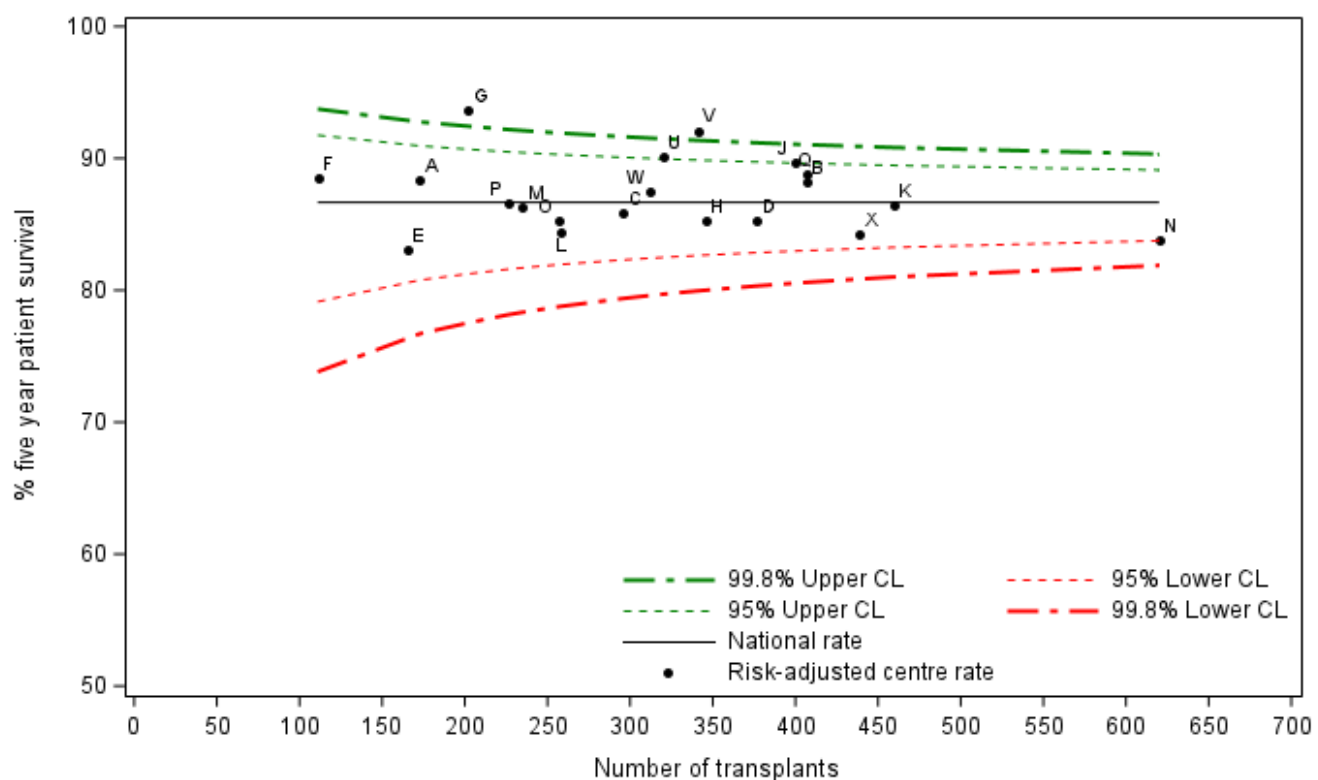


Table 6.1 One and five year first adult kidney-only graft and patient survival using kidneys from deceased donors

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	94	(89 - 96)	83	(75 - 89)	97	(92 - 99)	88	(82 - 93)
Birmingham	B	94	(91 - 96)	81	(76 - 85)	96	(92 - 98)	88	(84 - 92)
Bristol	C	97	(93 - 98)	87	(81 - 91)	93	(88 - 97)	86	(80 - 90)
Cambridge	D	96	(94 - 98)	89	(85 - 92)	98	(96 - 99)	85	(80 - 89)
Cardiff	E	95	(91 - 98)	86	(78 - 91)	98	(94 - 99)	83	(75 - 89)
Coventry	F	96	(92 - 98)	85	(76 - 92)	97	(92 - 99)	89	(79 - 94)
Edinburgh	G	97	(93 - 99)	90	(83 - 94)	98	(94 - 100)	94	(88 - 97)
Glasgow	H	96	(93 - 98)	83	(78 - 87)	96	(92 - 98)	85	(81 - 89)
Guy's	J	98	(96 - 99)	86	(81 - 89)	97	(94 - 99)	90	(86 - 93)
Leeds	K	96	(94 - 98)	83	(79 - 87)	96	(92 - 98)	87	(82 - 90)
Leicester	L	98	(95 - 99)	88	(83 - 92)	96	(92 - 98)	84	(79 - 89)
Liverpool	M	92	(88 - 96)	86	(80 - 91)	91	(85 - 95)	86	(80 - 91)
Manchester	N	96	(94 - 97)	86	(82 - 89)	93	(90 - 95)	84	(80 - 87)
Newcastle	O	97	(94 - 99)	83	(77 - 88)	98	(95 - 99)	85	(80 - 90)
Nottingham	P	98	(95 - 100)	90	(84 - 94)	94	(87 - 98)	87	(80 - 91)
Oxford	Q	97	(95 - 99)	92	(89 - 94)	96	(93 - 98)	89	(85 - 92)
Plymouth	R	93	(86 - 97)	N/A	N/A	89	(77 - 96)	N/A	N/A
Portsmouth	S	97	(93 - 99)	N/A	N/A	96	(91 - 99)	N/A	N/A
Sheffield	T	96	(91 - 98)	N/A	N/A	95	(90 - 98)	N/A	N/A
St George's	U	96	(93 - 98)	86	(81 - 90)	97	(93 - 99)	90	(85 - 94)
The Royal Free	V	98	(95 - 99)	86	(81 - 90)	97	(93 - 99)	92	(88 - 95)
The Royal London	W	95	(92 - 97)	82	(76 - 86)	92	(89 - 95)	88	(82 - 92)
WLRTC	X	95	(93 - 97)	88	(84 - 91)	96	(94 - 98)	84	(80 - 88)
UK		95	(95 - 96)	86	(85 - 87)	96	(96 - 97)	87	(86 - 88)
		Centre has reached the upper 99.8% confidence limit							
		Centre has reached the upper 95% confidence limit							
		Centre has reached the lower 95% confidence limit							
		Centre has reached the lower 99.8% confidence limit							

* Includes transplants performed between 1 April 2018 - 31 March 2022

** Includes transplants performed between 1 April 2014 - 31 March 2018

Centres have been omitted where less than 75% of data reported

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](#) shows a centre that lies outside the lower 95% [confidence limits](#), indicating that the centre has survival rates that are significantly lower than the national rate. Some of the [funnel plots](#) show some centres to be above the upper 95% [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.

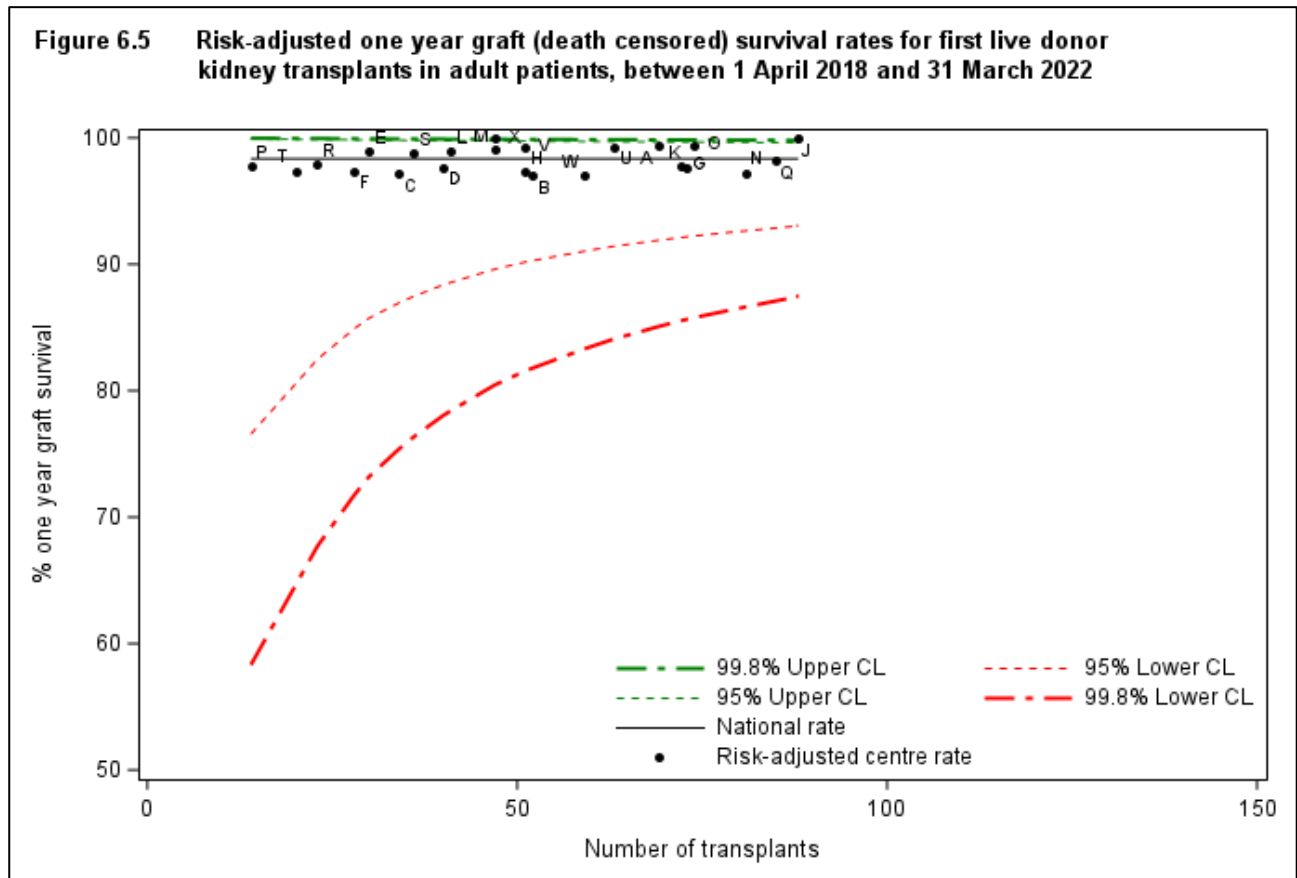


Figure 6.6 Risk-adjusted one year patient survival rates for first live donor kidney transplants in adult patients, between 1 April 2018 and 31 March 2022

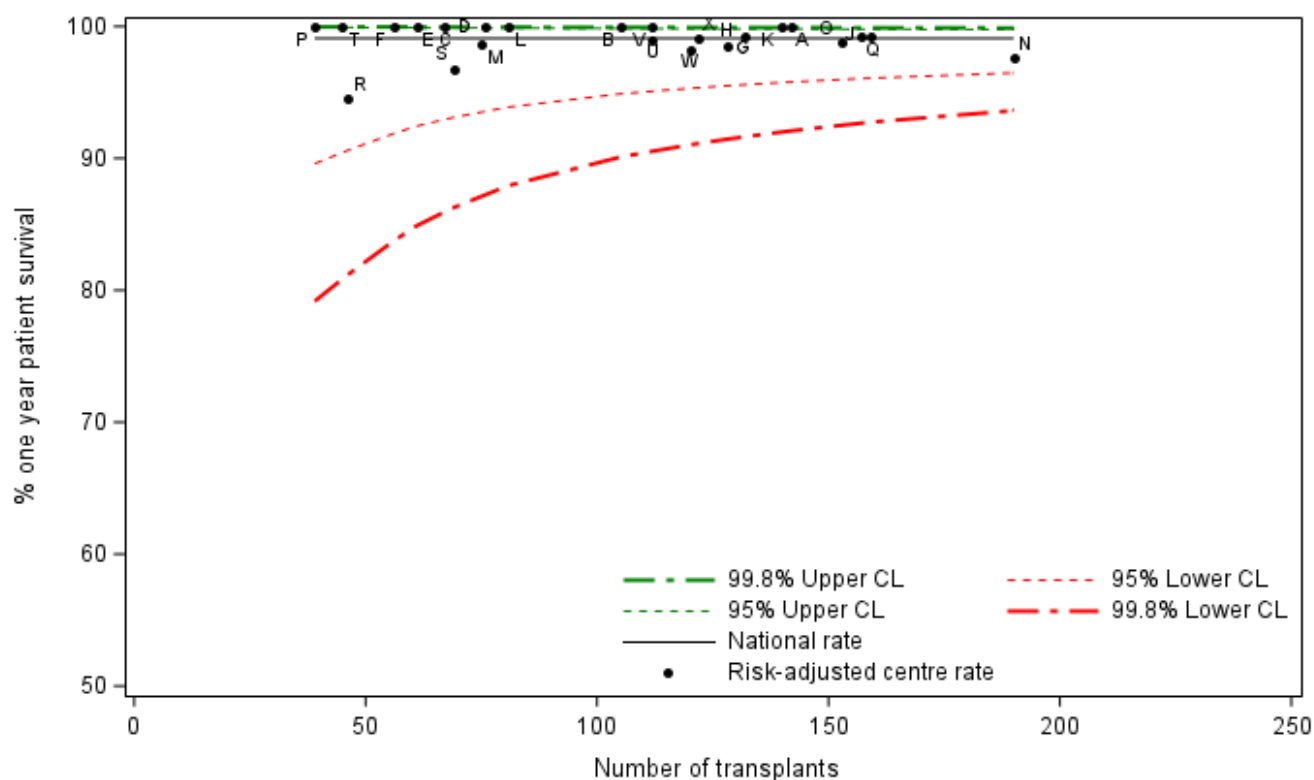


Figure 6.7 Risk-adjusted five year graft (death censored) survival rates for first live donor kidney transplants in adult patients, between 1 April 2014 and 31 March 2018

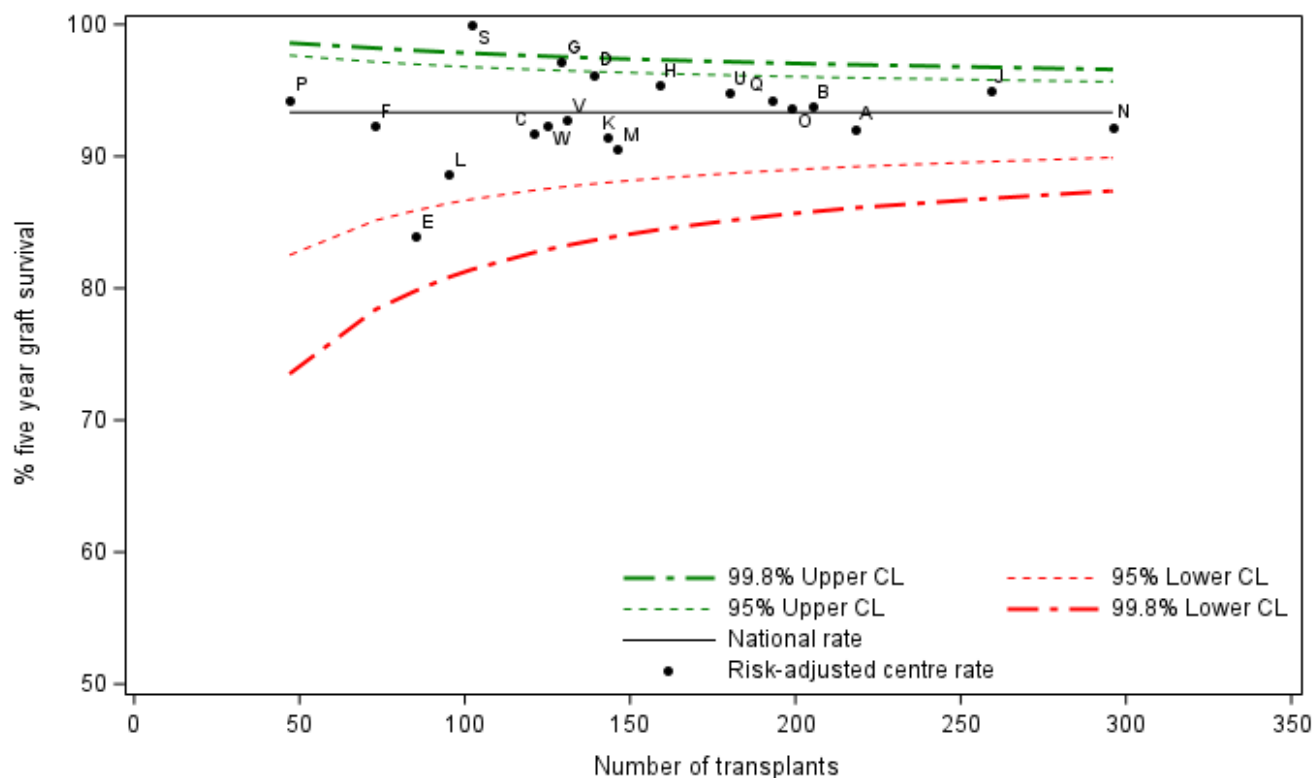


Figure 6.8 Risk-adjusted five year patient survival rates for first live donor kidney transplants in adult patients, between 1 April 2014 and 31 March 2018

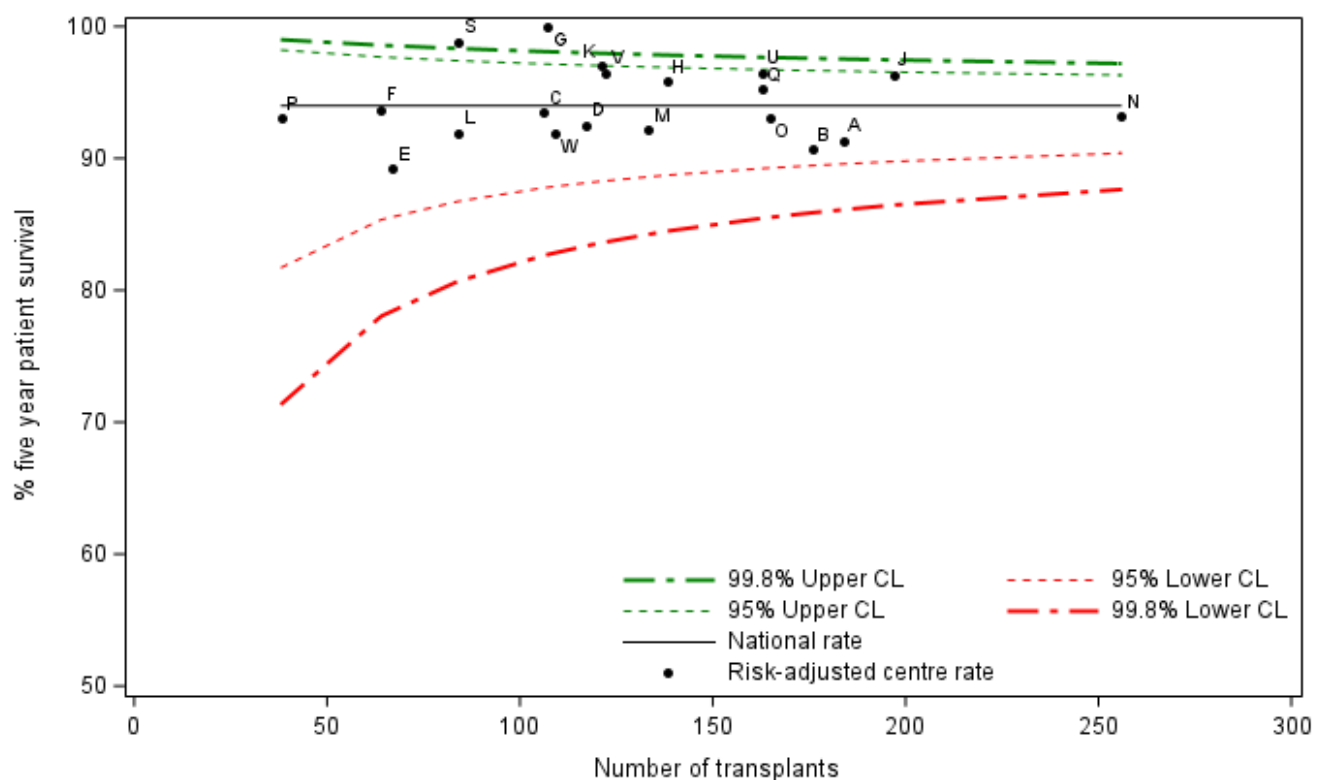


Table 6.2 One and five year first adult kidney-only graft and patient survival using kidneys from living donors

		Kidney graft survival				Patient survival			
Centre	Code	One-year*		Five-year**		One-year*		Five-year**	
		%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)
Belfast	A	99	(96 - 100)	92	(85 - 96)	100	N/A	91	(86 - 95)
Birmingham	B	97	(92 - 99)	94	(89 - 97)	100	N/A	91	(85 - 95)
Bristol	C	97	(91 - 99)	92	(84 - 96)	100	N/A	94	(86 - 98)
Cambridge	D	98	(91 - 100)	96	(91 - 99)	100	N/A	93	(84 - 97)
Cardiff	E	99	(93 - 100)	84	(71 - 92)	100	N/A	89	(77 - 96)
Coventry	F	97	(90 - 100)	92	(82 - 98)	100	N/A	94	(82 - 99)
Edinburgh	G	98	(94 - 100)	97	(92 - 99)	99	(96 - 100)	100	N/A
Glasgow	H	97	(92 - 99)	95	(91 - 98)	99	(95 - 100)	96	(90 - 99)
Guy's	J	100	N/A	95	(91 - 97)	99	(96 - 100)	96	(92 - 99)
Leeds	K	98	(94 - 99)	91	(85 - 96)	100	N/A	97	(91 - 99)
Leicester	L	99	(94 - 100)	89	(80 - 94)	100	N/A	92	(83 - 97)
Liverpool	M	99	(94 - 100)	91	(83 - 95)	99	(92 - 100)	92	(85 - 97)
Manchester	N	97	(94 - 99)	92	(88 - 95)	98	(94 - 99)	93	(89 - 96)
Newcastle	O	99	(97 - 100)	94	(89 - 97)	99	(96 - 100)	93	(88 - 96)
Nottingham	P	98	(88 - 100)	94	(83 - 99)	100	N/A	93	(75 - 99)
Oxford	Q	98	(95 - 99)	94	(89 - 97)	99	(96 - 100)	95	(90 - 98)
Plymouth	R	98	(86 - 100)	N/A	N/A	95	(80 - 99)	N/A	N/A
Portsmouth	S	99	(93 - 100)	100	N/A	97	(88 - 100)	99	(94 – 100)
Sheffield	T	97	(85 - 100)	N/A	N/A	100	N/A	N/A	N/A
St George's	U	99	(96 - 100)	95	(90 - 98)	99	(94 - 100)	96	(91 - 99)
The Royal Free	V	99	(96 - 100)	93	(86 - 97)	100	N/A	97	(90 - 99)
The Royal London	W	97	(93 - 99)	92	(85 - 96)	98	(94 - 100)	92	(83 - 97)
WLRTC	X	100	N/A	N/A	N/A	99	(95 - 100)	N/A	N/A
UK		98	(98 - 99)	93	(92 - 94)	99	(99 - 99)	94	(93 - 95)
	Centre has reached the upper 99.8% confidence limit								
	Centre has reached the upper 95% confidence limit								
	Centre has reached the lower 95% confidence limit								
	Centre has reached the lower 99.8% confidence limit								

* Includes transplants performed between 1 April 2018 - 31 March 2022

** Includes transplants performed between 1 April 2014 - 31 March 2018

6.3 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 2012 and 31 December 2023. 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 e.g. 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**. Eight 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. Glasgow, Leicester and Manchester fell below the 99.8% lower [confidence limit](#). This suggests that 10-year survival from listing at Glasgow, Leicester and Manchester may be significantly lower than the national rate.

Centres can be identified by the information shown in **Table 6.3**, which also shows one, five and ten year [risk-adjusted survival rates](#) from the point of kidney transplant listing.

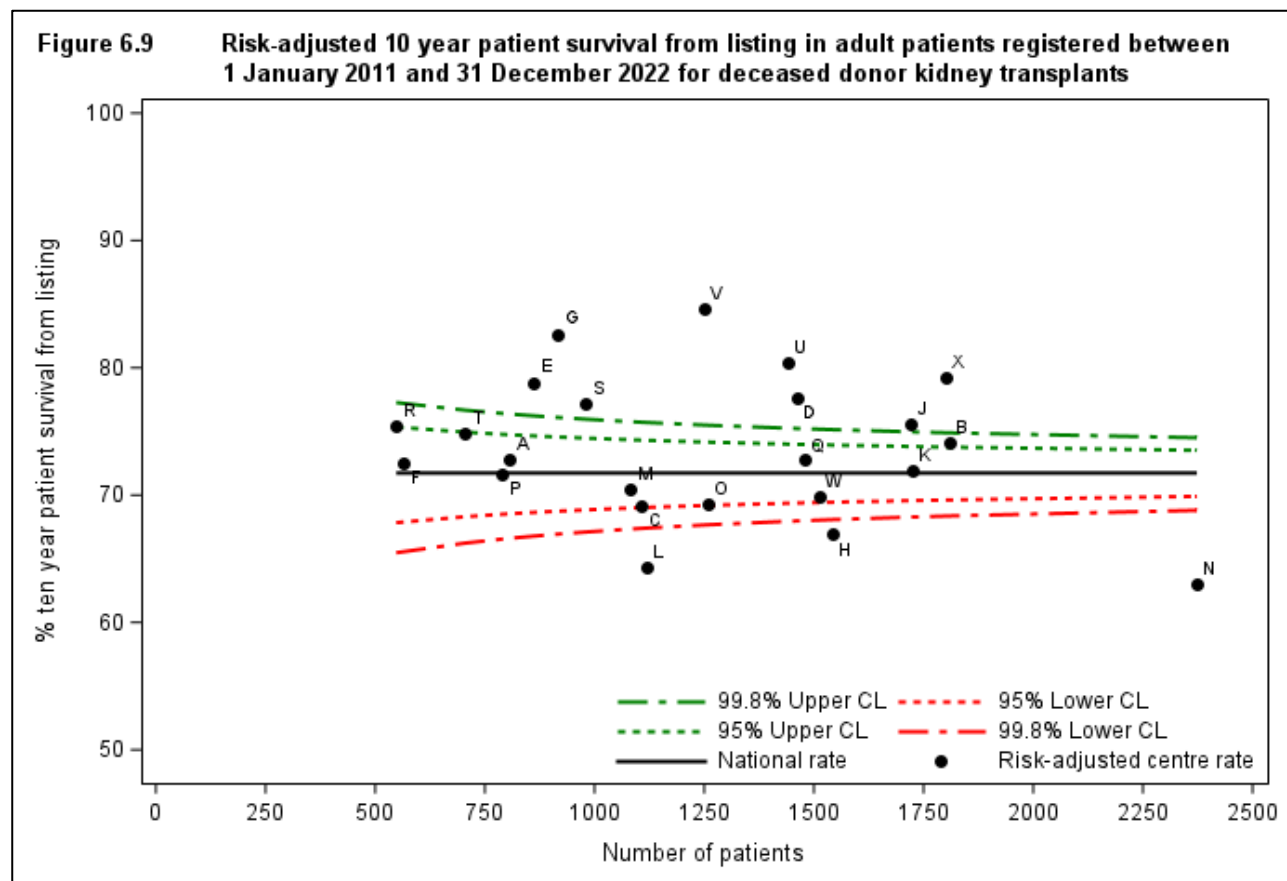


Table 6.3 Risk-adjusted 1, 5 and 10 year patient survival from listing for adult patients registered between 1 January 2011 and 31 December 2022 for deceased donor kidney transplants

Centre	Code	One year		Five year		Ten year	
		N	(%)	N	(%)	N	(%)
Belfast	A	805	(98)	805	(88)	805	(73)
Birmingham	B	1810	(99)	1810	(89)	1810	(74)
Bristol	C	1106	(99)	1106	(86)	1106	(69)
Cambridge	D	1461	(99)	1461	(90)	1461	(78)
Cardiff	E	862	(98)	862	(90)	862	(79)
Coventry	F	565	(98)	565	(87)	565	(73)
Edinburgh	G	915	(99)	915	(91)	915	(83)
Glasgow	H	1542	(98)	1542	(84)	1542	(67)
Guy's	J	1722	(99)	1722	(89)	1722	(76)
Leeds	K	1723	(98)	1723	(87)	1723	(72)
Leicester	L	1119	(98)	1119	(83)	1119	(64)
Liverpool	M	1079	(98)	1079	(87)	1079	(70)
Manchester	N	2373	(98)	2373	(82)	2373	(63)
Newcastle	O	1258	(98)	1258	(86)	1258	(69)
Nottingham	P	788	(98)	788	(87)	788	(72)
Oxford	Q	1479	(99)	1479	(87)	1479	(73)
Plymouth	R	548	(98)	548	(89)	548	(75)
Portsmouth	S	981	(99)	981	(89)	981	(77)
Sheffield	T	705	(98)	705	(88)	705	(75)
St George's	U	1442	(98)	1442	(89)	1442	(80)
The Royal Free	V	1250	(99)	1250	(93)	1250	(85)
The Royal London	W	1513	(98)	1513	(86)	1513	(70)
WLRTC	X	1799	(99)	1799	(91)	1799	(79)
UK		28845	(98)	28845	(87)	28845	(72)
		Centre has reached the upper 99.8% confidence limit					
		Centre has reached the upper 95% confidence limit					
		Centre has reached the lower 95% confidence limit					
		Centre has reached the lower 99.8% confidence limit					

Form Return Rates

7.1 Deceased donor form return rates, 1 April 2022 – 31 March 2023

Form return rates are reported in **Table 7.1** for the kidney transplant record, three month and one year follow up form, along with lifetime follow up (more than two years). These include all adult deceased donor kidney only transplants between 1 April 2022 and 31 March 2023 for the transplant record, and all requests for follow up forms issued in this time period. Centres highlighted are transplant centres.

Table 7.1 Deceased donor form return rates, 1 April 2022 and 31 March 2023								
Centre	TX RECORD		THREE MONTHS		ONE YEAR		LIFETIME	
	N	% returned	N	% returned	N	% returned	N	% returned
Aberdeen, Aberdeen Royal Infirmary							192	78
Airdrie, University Hospital Monklands							33	88
Bangor, Ysbyty Gwynedd District General Hospital							63	62
Basildon, Basildon Hospital							71	97
Belfast, Antrim Hospital							91	84
Belfast, Belfast City Hospital	63	100	62	89	52	60	308	89
Birmingham, Birmingham Heartlands Hospital							108	78
Birmingham, Queen Elizabeth Hospital Birmingham	143	98	151	95	114	89	683	98
Bodelwyddan, Glan Clwyd District General Hospital							53	92
Bradford, St Lukes Hospital							277	96
Brighton, Royal Sussex County Hospital							279	95
Bristol, Southmead Hospital	86	99	82	89	72	72	566	78
Cambridge, Addenbrooke's Hospital	143	100	145	99	136	96	638	100
Canterbury, Kent And Canterbury Hospital							265	87
Cardiff, University Of Wales Hospital	69	100	62	79	56	50	766	42
Carlisle, Cumberland Infirmary							97	85
Carshalton, St Helier Hospital							440	96
Chelmsford, Broomfield Hospital							76	99
County Down, Daisy Hill Hospital							95	92
Coventry, University Hospital	32	97	35	94	33	88	345	87
Derby, Royal Derby Hospital							189	99
Doncaster, Doncaster Royal Infirmary							73	100
Dorchester, Dorset County Hospital							270	15
Dudley, Russells Hall Hospital							84	81
Dulwich, King's College Hospital							429	45
Dundee, Ninewells Hospital							139	7
Dunfermline, Queen Margaret Hospital							60	77
Edinburgh, Royal Infirmary Of Edinburgh	48	96	48	94	42	83	376	91
Exeter, Royal Devon And Exeter Hospital (Wonford)							299	77
Glasgow, Queen Elizabeth University Hospital/ Western Infirmary	89	94	83	100	74	100	1118	88
Gloucester, Gloucestershire Royal Hospital							205	19
Great Yarmouth, James Paget Hospital							31	100

Table 7.1 Deceased donor form return rates, 1 April 2022 and 31 March 2023

Centre	TX RECORD		THREE MONTHS		ONE YEAR		LIFETIME	
	N	% returned	N	% returned	N	% returned	N	% returned
Hereford, The County Hospital							36	89
Hull, Hull Royal Infirmary							272	95
Inverness, Raigmore Hospital							83	93
Ipswich, Ipswich Hospital							168	43
Leeds, St James's University Hospital	119	97	108	97	99	98	808	91
Leicester, Leicester General Hospital	84	99	80	99	47	100	702	99
Liverpool, Royal Liverpool University Hospital	73	100	62	92	58	95	424	97
London, Guy's Hospital	160	98	157	96	128	87	592	95
London, Royal Free Hospital	104	96	108	97	98	87	946	81
London, St George's Hospital	103	99	116	93	106	75	419	3
London, The Royal London Hospital (Whitechapel)	104	91	111	97	133	95	729	95
London, West London Renal And Transplant Centre	162	94	182	100	170	96	985	1
Manchester, Manchester Royal Infirmary	165	93	167	98	164	98	753	96
Middlesbrough, The James Cook University Hospital							362	69
Newcastle, Freeman Hospital	77	100	76	95	53	89	404	100
Northampton, Northampton General Hospital							57	49
Norwich, Norfolk And Norwich University Hospital							276	93
Nottingham, Nottingham City Hospital	43	95	46	100	55	65	464	31
Omagh, Tyrone County Hospital							62	2
Oxford, Churchill Hospital	129	99	127	99	116	88	758	99
Plymouth, Derriford Hospital	43	91	38	47	24	46	209	40
Portsmouth, Queen Alexandra Hospital/ St Mary's Hospital	79	99	78	99	83	47	850	39
Preston, Royal Preston Hospital							440	97
Reading, Royal Berkshire Hospital							325	92
Salford, Salford Royal							428	98
Sheffield, Northern General Hospital	48	100	48	94	43	95	561	5
Shrewsbury, Royal Shrewsbury Hospital							94	96
St Helier, Jersey General Hospital							32	100
Stevenage, Lister Hospital							224	89
Stoke-On-Trent, Royal Stoke University Hospital							214	85
Sunderland, Sunderland Royal Hospital							163	87
Swansea, Morriston Hospital							155	98
Truro, Royal Cornwall Hospital (Treliske)							236	11
Westcliff On Sea, Southend Hospital							73	89
Wirral, Arrowe Park Hospital							141	1
Wolverhampton, New Cross Hospital							132	92
Wrexham, Maelor General Hospital							99	96
York, York District Hospital							203	92

7.2 Living donor form return rates, 1 April 2022 – 31 March 2023

Form return rates are reported in **Table 7.2** for the kidney transplant record, three month and one year follow up form, along with lifetime follow up (more than two years). These include all adult living donor kidney only transplants between 1 April 2022 and 31 March 2023 for the transplant record, and all requests for follow up forms issued in this time period. Centres highlighted are transplant centres.

Table 7.2 Living donor form return rates, 1 April 2022 and 31 March 2023								
Centre	TX RECORD		THREE MONTHS		ONE YEAR		LIFETIME	
	N	% returned	N	% returned	N	% returned	N	% returned
Aberdeen, Aberdeen Royal Infirmary							98	87
Bangor, Ysbyty Gwynedd District General Hospital							22	68
Basildon, Basildon Hospital							33	97
Belfast, Antrim Hospital							62	90
Belfast, Belfast City Hospital	60	97	55	95	62	71	294	90
Belfast, The Ulster Hospital							52	2
Birmingham, Birmingham Heartlands Hospital							40	83
Birmingham, Queen Elizabeth Hospital Birmingham	35	94	37	86	40	90	399	98
Bodelwyddan, Glan Clwyd District General Hospital							25	92
Bradford, St Lukes Hospital							62	95
Brighton, Royal Sussex County Hospital							185	93
Bristol, Southmead Hospital	34	97	33	94	19	84	299	76
Cambridge, Addenbrooke's Hospital	17	100	21	100	23	96	262	100
Canterbury, Kent And Canterbury Hospital							233	94
Cardiff, University Of Wales Hospital	41	98	39	82	29	52	402	42
Carlisle, Cumberland Infirmary							42	71
Carshalton, St Helier Hospital							278	96
Chelmsford, Broomfield Hospital							29	100
County Down, Daisy Hill Hospital							66	88
Coventry, University Hospital	18	94	14	100	13	92	232	86
Derby, Royal Derby Hospital							46	98
Doncaster, Doncaster Royal Infirmary							32	100
Dorchester, Dorset County Hospital							104	24
Dudley, Russells Hall Hospital							31	74
Dulwich, King's College Hospital							193	48
Dundee, Ninewells Hospital							82	17
Dunfermline, Queen Margaret Hospital							27	67
Edinburgh, Royal Infirmary Of Edinburgh	37	89	38	82	40	75	212	90
Exeter, Royal Devon And Exeter Hospital (Wonford)							146	83
Glasgow, Queen Elizabeth University Hospital							502	90
Glasgow, Western Infirmary	53	98	49	100	36	97		
Gloucester, Gloucestershire Royal Hospital							84	32
Hereford, The County Hospital							26	92
Hull, Hull Royal Infirmary							141	96
Inverness, Raigmore Hospital							49	100
Ipswich, Ipswich Hospital							59	32
Leeds, St James's University Hospital	49	96	53	92	49	98	281	90
Leicester, Leicester General Hospital	28	93	26	100	23	100	440	98

Table 7.2 Living donor form return rates, 1 April 2022 and 31 March 2023

Centre	TX RECORD		THREE MONTHS		ONE YEAR		LIFETIME	
	N	% returned	N	% returned	N	% returned	N	% returned
Liverpool, Royal Liverpool University Hospital	25	100	21	90	21	90	261	98
London, Guy's Hospital	75	96	69	99	74	80	460	95
London, Hammersmith Hospital	42	79	34	100	29	97		
London, Royal Free Hospital	33	100	36	92	27	81	478	77
London, St George's Hospital	22	91	20	100	33	73	176	3
London, The Royal London Hospital (Whitechapel)	40	80	40	98	39	92	347	97
London, West London Renal And Transplant Centre							539	0
Manchester, Manchester Royal Infirmary	66	94	66	98	68	96	379	96
Middlesbrough, The James Cook University Hospital							222	77
Newcastle, Freeman Hospital	48	85	48	96	41	100	263	98
Northampton, Northampton General Hospital							25	24
Norwich, Norfolk And Norwich University Hospital							73	93
Nottingham, Nottingham City Hospital	13	85	14	100	16	56	152	41
Omagh, Tyrone County Hospital							43	2
Oxford, Churchill Hospital	58	95	64	98	51	86	436	100
Plymouth, Derriford Hospital	18	100	15	47	15	33	92	42
Portsmouth, Queen Alexandra Hospital							362	42
Portsmouth, St Mary's Hospital	21	100	16	88	24	33		
Preston, Royal Preston Hospital							234	98
Reading, Royal Berkshire Hospital							107	92
Salford, Salford Royal							192	98
Sheffield, Northern General Hospital	9	100	6	100	12	83	253	3
Shrewsbury, Royal Shrewsbury Hospital							54	94
Stevenage, Lister Hospital							77	82
Stoke-On-Trent, Royal Stoke University Hospital							153	86
Sunderland, Sunderland Royal Hospital							87	95
Swansea, Morriston Hospital							51	100
Truro, Royal Cornwall Hospital (Treliske)							95	16
Westcliff On Sea, Southend Hospital							48	92
Wolverhampton, New Cross Hospital							54	89
Wrexham, Maelor General Hospital							42	95
York, York District Hospital							70	96

Paediatric kidney transplant list

8.1 Paediatric patients on the kidney transplant list as at 31 March, 2014 – 2023

Figure 8.1 shows the number of paediatric patients on the kidney only [transplant list](#) at 31 March each year between 2014 and 2023. The number of paediatric patients actively waiting for a kidney transplant increased from 70 in 2014 to 102 in 2023.

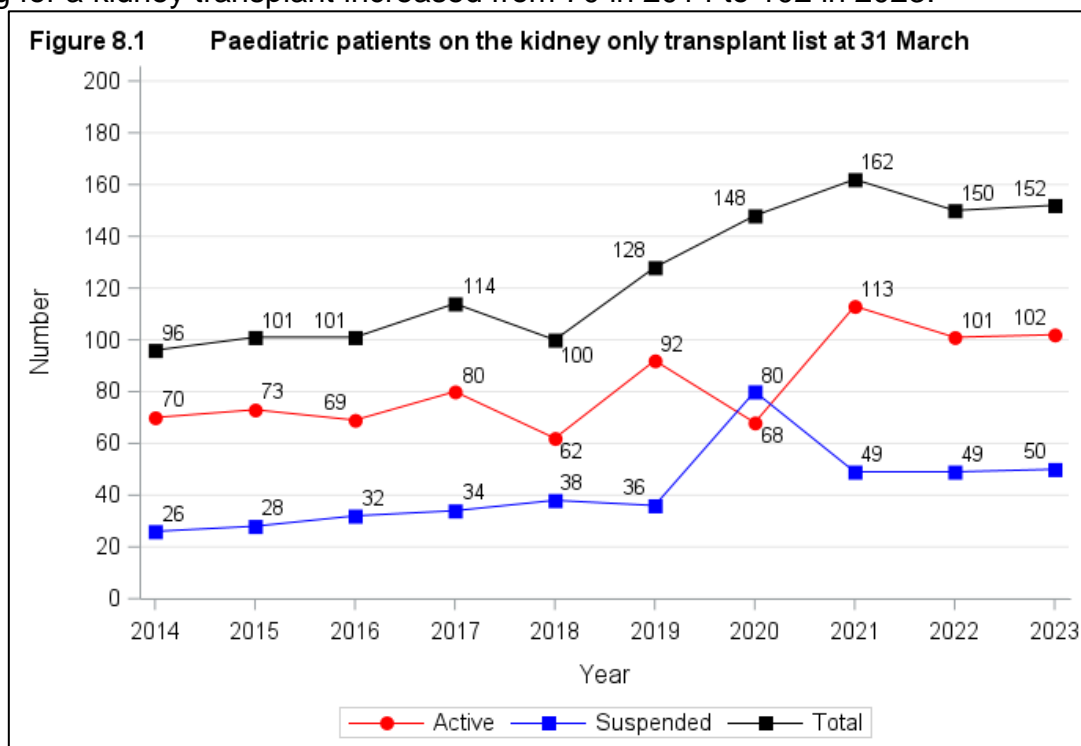


Figure 8.2 shows the number of paediatric patients on the active kidney only [transplant list](#) at 31 March 2023 by centre. Of the total 102 paediatric patients, Manchester had the largest proportion of the [transplant list](#) (20%) and Glasgow and adult centres had the smallest (2%); Belfast had 0 paediatric patients on the active list at 31 March.

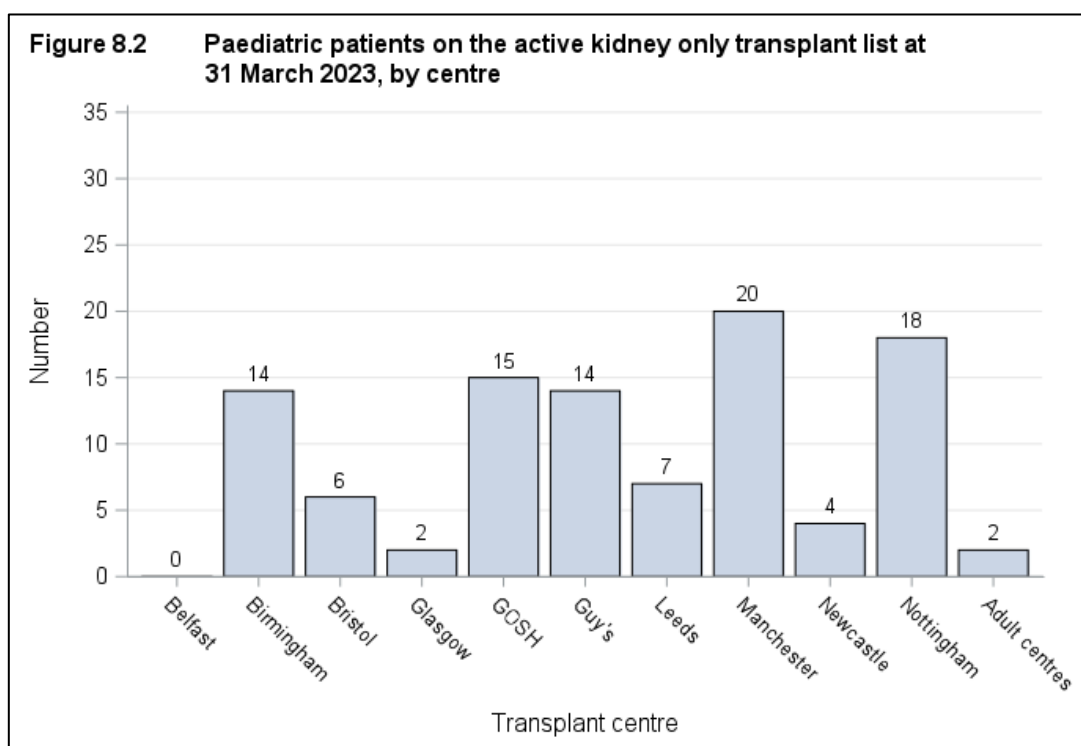


Figure 8.3 shows the number of paediatric patients on the suspended kidney only [transplant list](#) at 31 March 2023 by centre. Of the 50 suspended paediatric patients, GOSH had the largest proportion of the [transplant list](#) (20%) and adult centres had the smallest (6%); Belfast, Glasgow and Newcastle had 0 paediatric patients on the active list at 31 March.

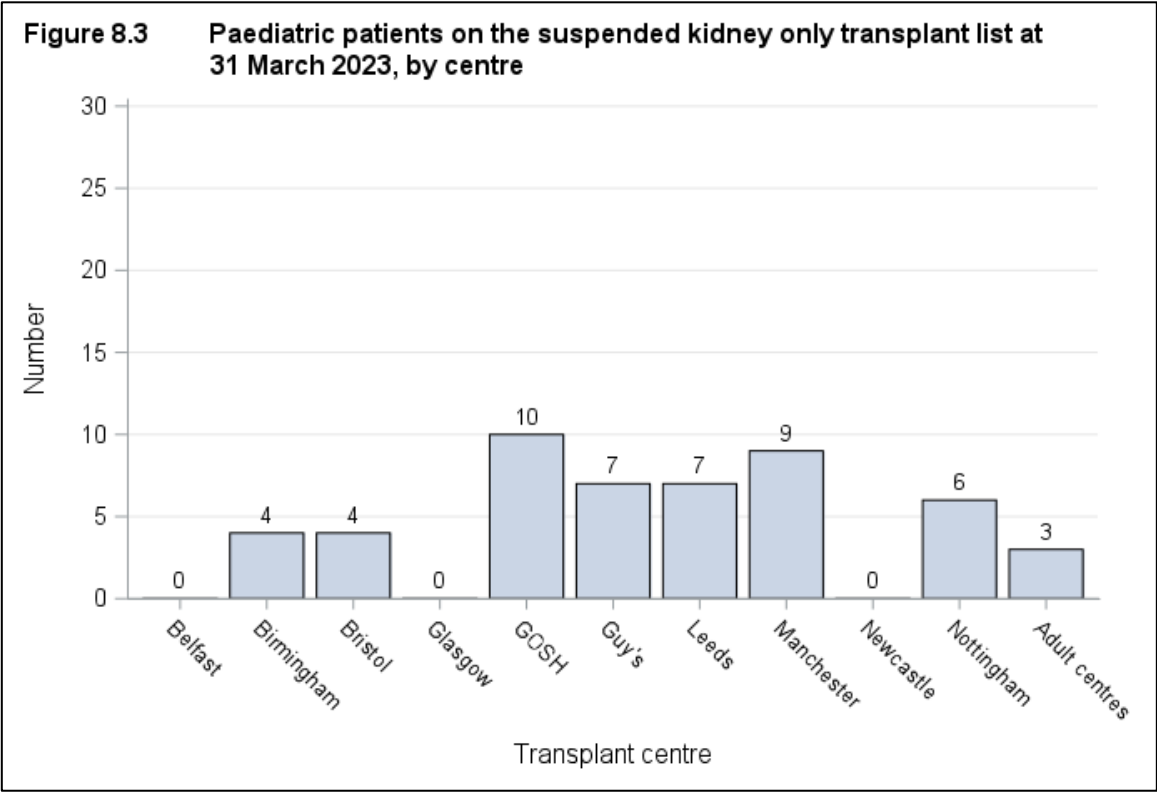
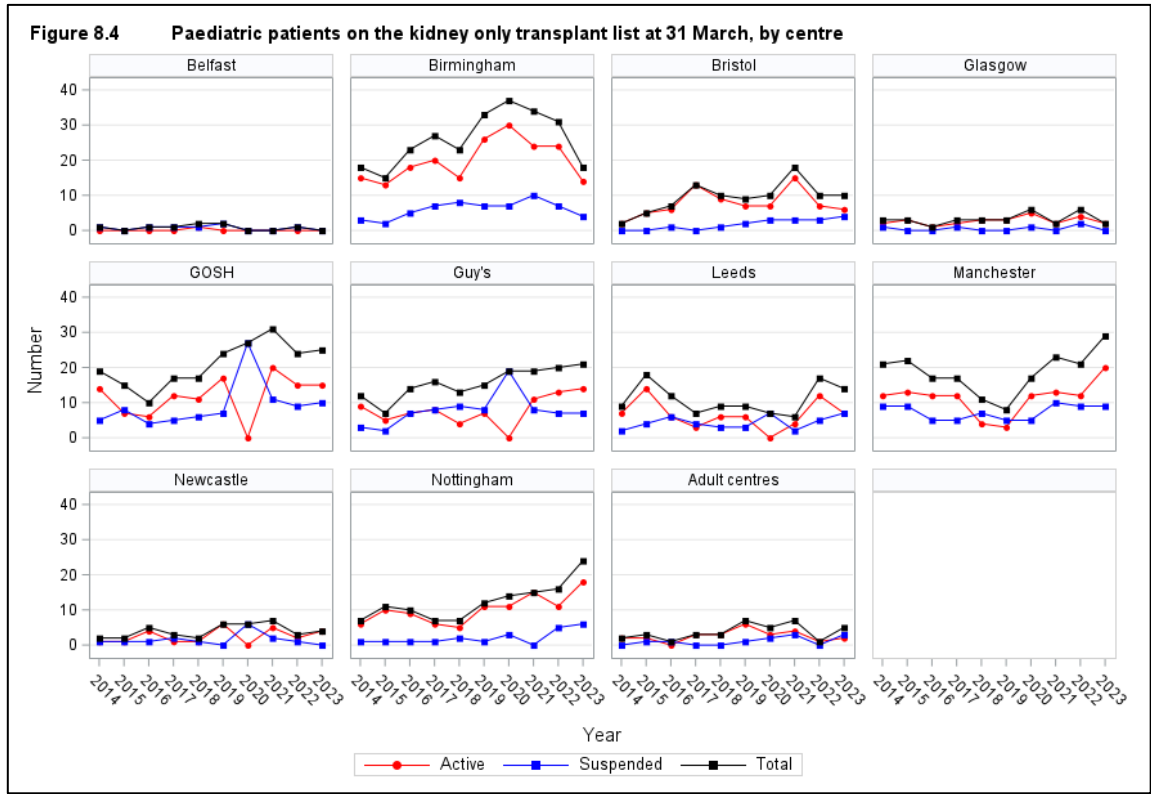


Figure 8.4 shows the number of paediatric patients on the [transplant list](#) at 31 March each year between 2014 and 2023 for each transplant centre.



8.2 Demographic characteristics, 1 April 2022 – 31 March 2023

The sex, ethnicity, age group and calculated reaction frequency of patients on the transplant list are shown by centre in **Figure 8.5, 8.6, 8.7 and 8.8**, 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 and the 2019 National Kidney Offering Scheme 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.

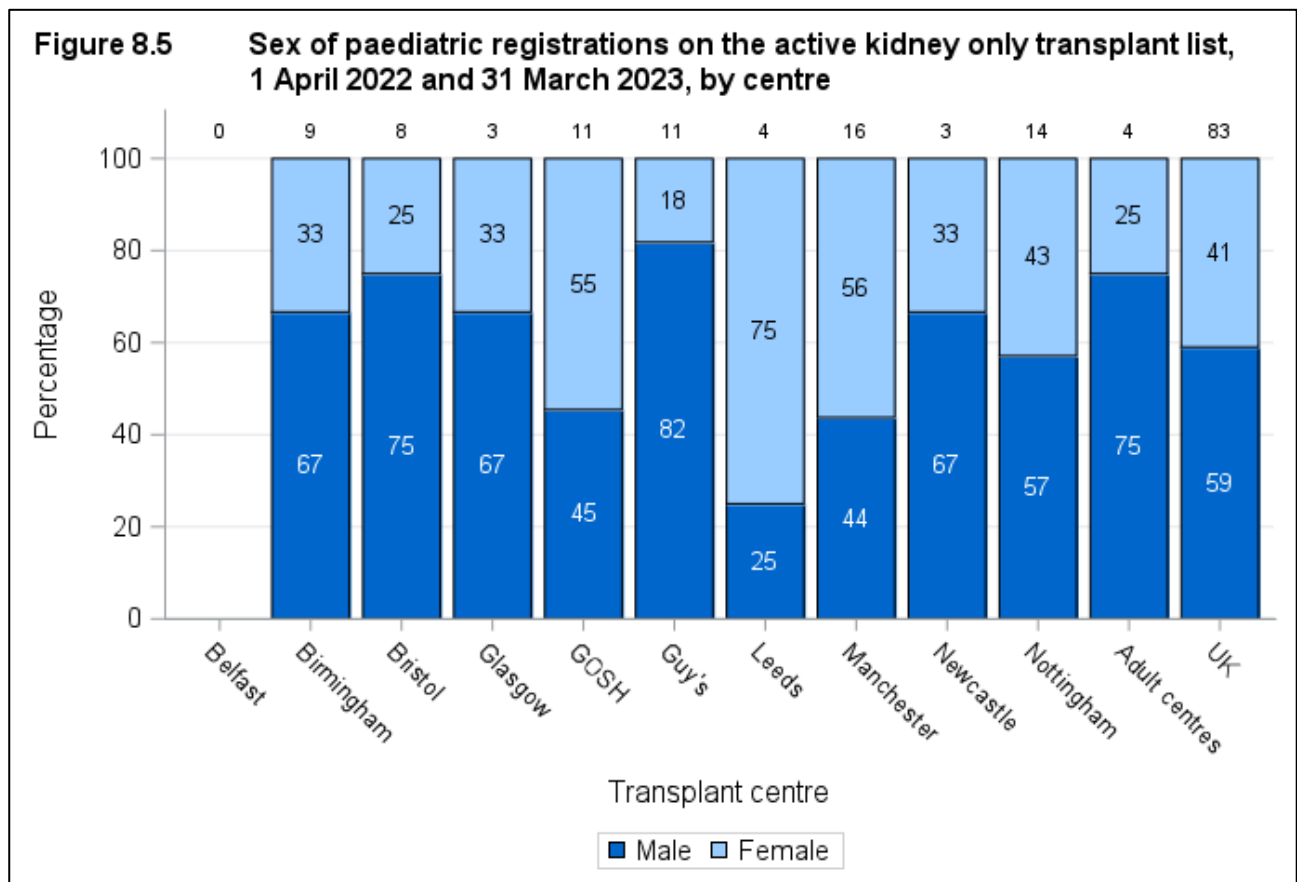


Figure 8.6 Ethnicity of paediatric registrations on the active kidney only transplant list, 1 April 2022 and 31 March 2023, by centre

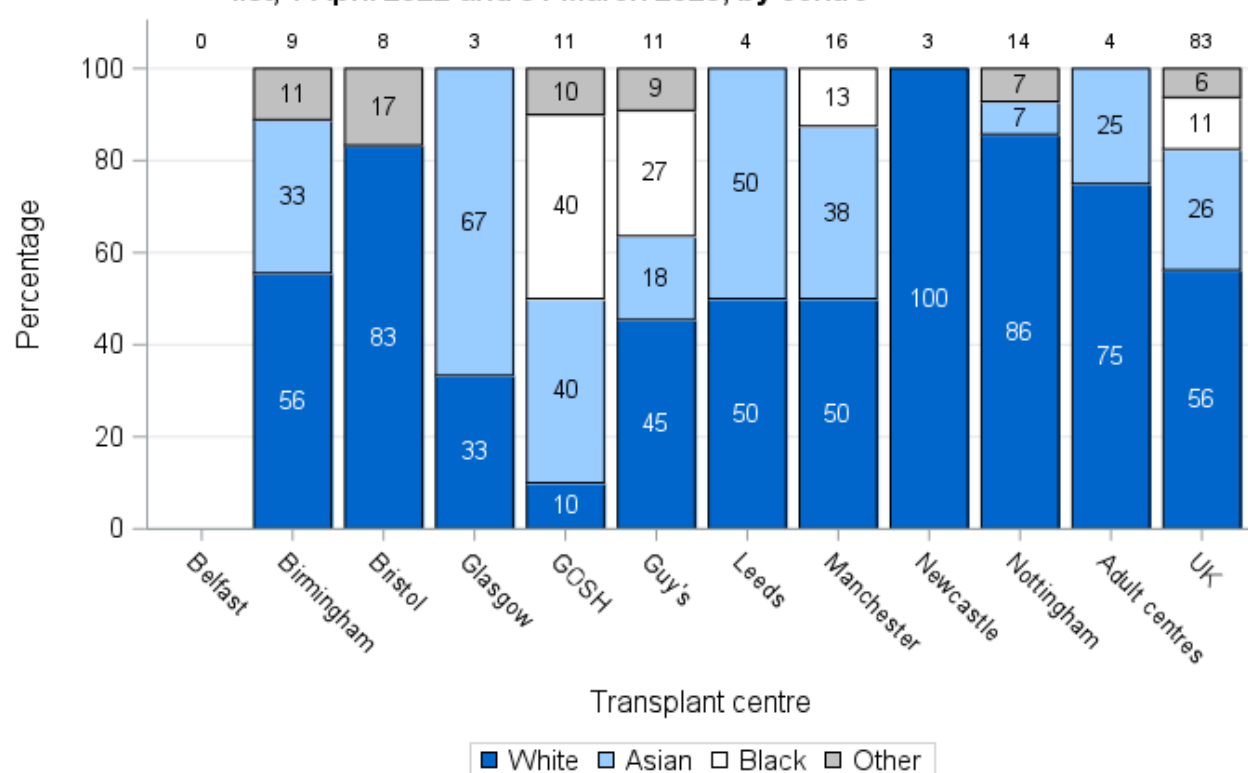


Figure 8.7 Age of paediatric registrations on the active kidney only transplant list, 1 April 2022 and 31 March 2023, by centre

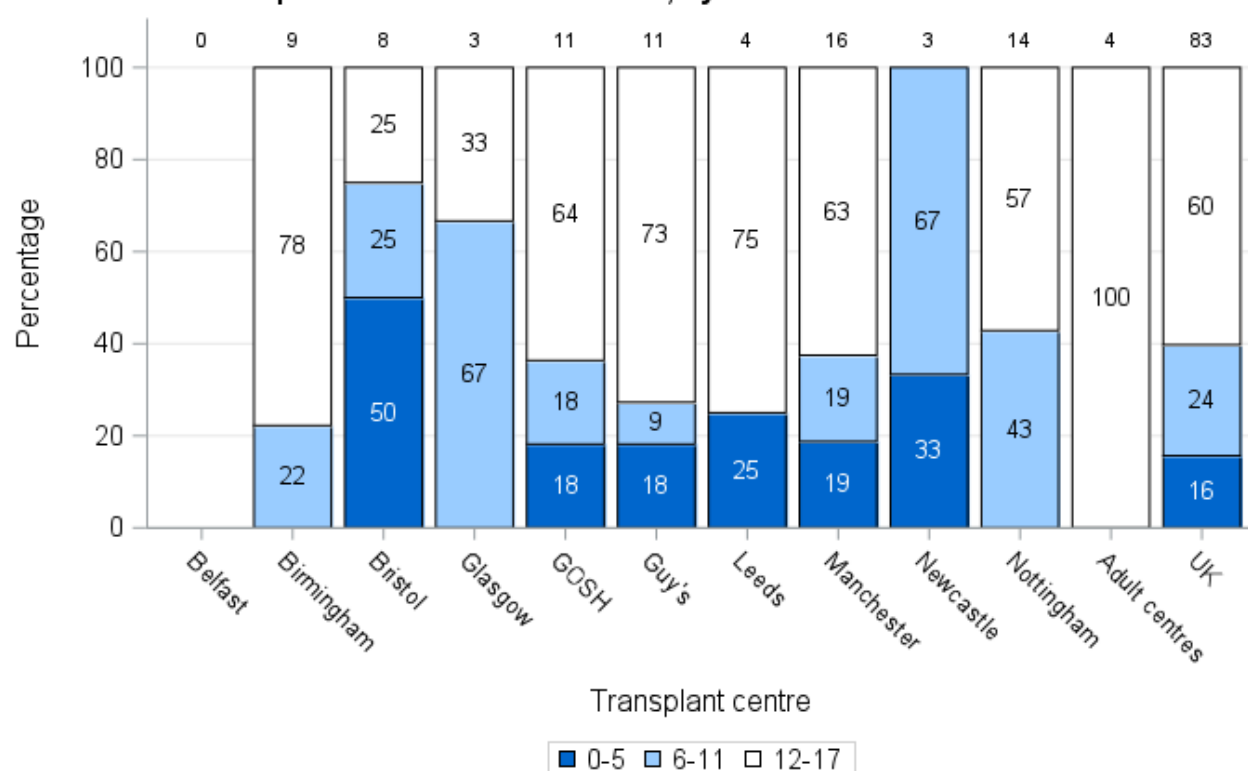
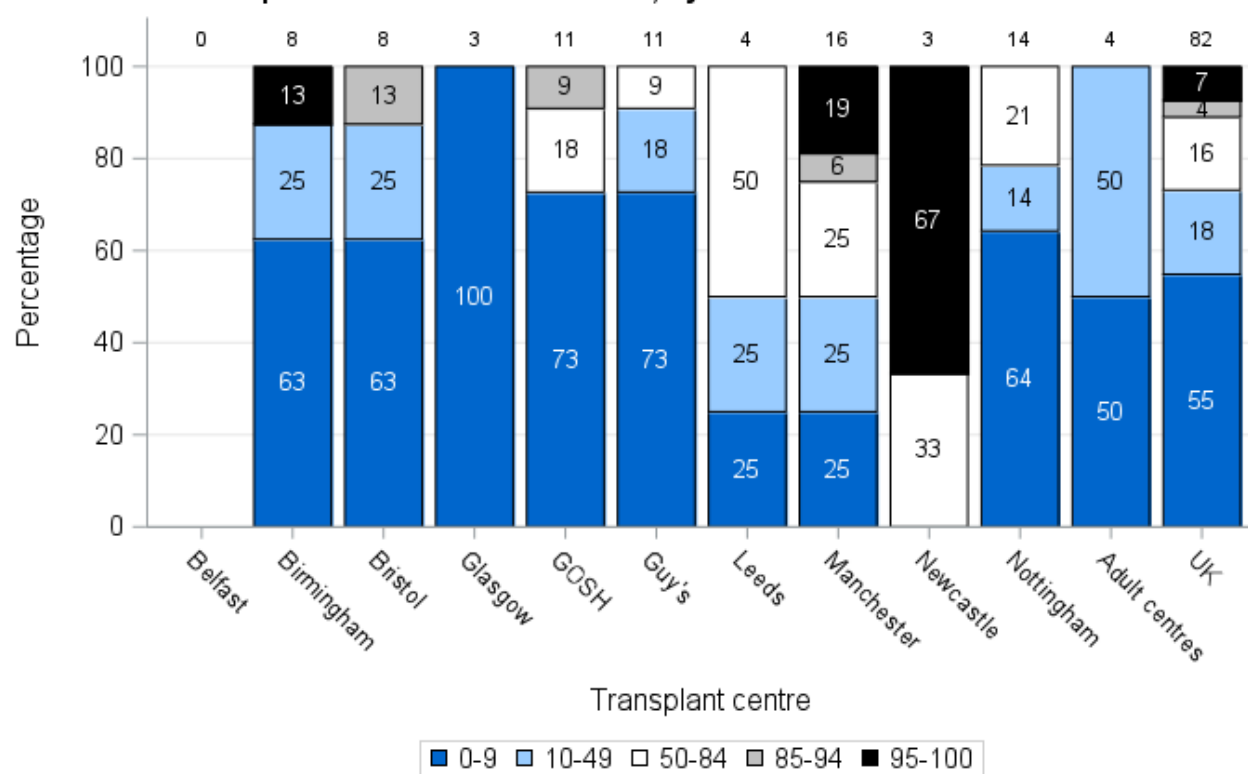
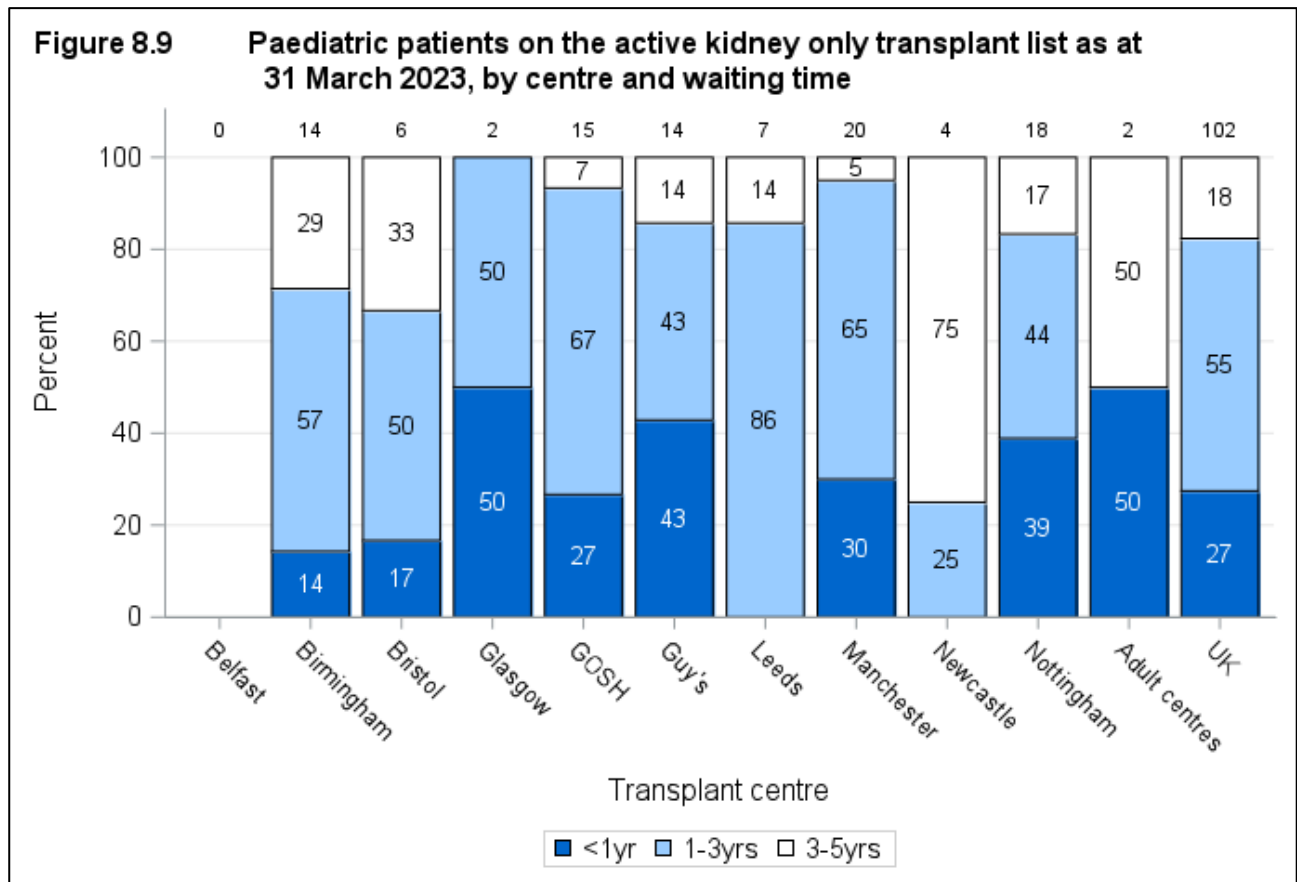


Figure 8.8 cRF of paediatric registrations on the active kidney only transplant list, 1 April 2022 and 31 March 2023, by centre



8.3 Paediatric waiting times for those currently on the list, 31 March 2023

Figure 8.9 shows the length of time paediatric patients have been waiting on the kidney only [transplant list](#) at 31 March 2023 by centre.



8.4 Median waiting time to transplant, 1 April 2017 - 31 March 2020

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 8.10** and **Table 8.1** for patients registered at each individual unit. 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 helped to reduce 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 2006 [National Kidney Allocation Scheme](#) determined allocation of all kidneys available for transplant from donors after brain death (DBD). This has continued following the introductions of the 2019 National Kidney Offering Scheme which determines allocation of all DBD kidneys and kidneys from donations after circulatory death (DCD).

2006 National Kidney Allocation Scheme

Only kidneys from donors after brain death were allocated via a national allocation scheme during the majority of the time period analysed. DCD kidneys were allocated to patients through local allocation arrangements and these vary across the country because some centres have a larger DCD programme than others. From 3 September 2014 one kidney from DCD donors aged between 5 and 49 years were allocated within four pre-defined regions using the 2006 DBD allocation principles and as such should reduce variability in waiting times across the country.

Kidneys from DBD are allocated to patients listed nationally through the 2006 Kidney Allocation Scheme. The 2006 Kidney Allocation Scheme introduced in April 2006 prioritised patients with ideal tissue matches (000 HLA mismatches) and then assigned 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 received more points. The patients with the highest number of points for a donated kidney were preferentially offered the kidney, no matter where in the UK they received their treatment.

2019 National Kidney Offering Scheme

The 2019 Kidney Offering Scheme was introduced on 11 September 2019 and this is a single scheme for offering all kidneys from deceased donors in the UK. This scheme prioritises patients who are difficult to match or have waited a long time for a transplant

The [median](#) waiting time to transplant for paediatric patients registered on the kidney only [transplant list](#) between 1 April 2017 and 31 March 2020 is 312 days. This ranged from 137 days at Guy's to 447 days at Leeds. Median values are not presented for Belfast and Newcastle as they had no paediatric patients registered and transplanted in the time period.

Figure 8.10 Median waiting time to deceased donor transplant for paediatric patients registered on the kidney transplant list, 1 April 2017 - 31 March 2020

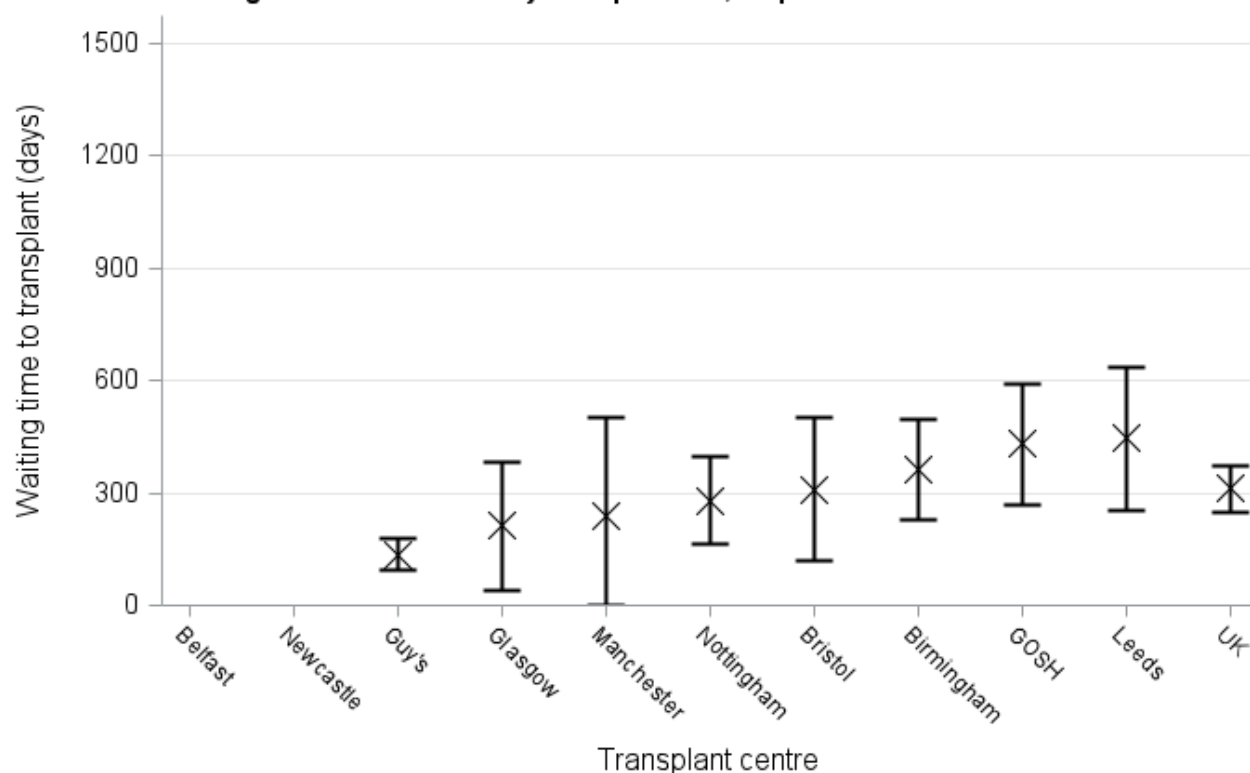
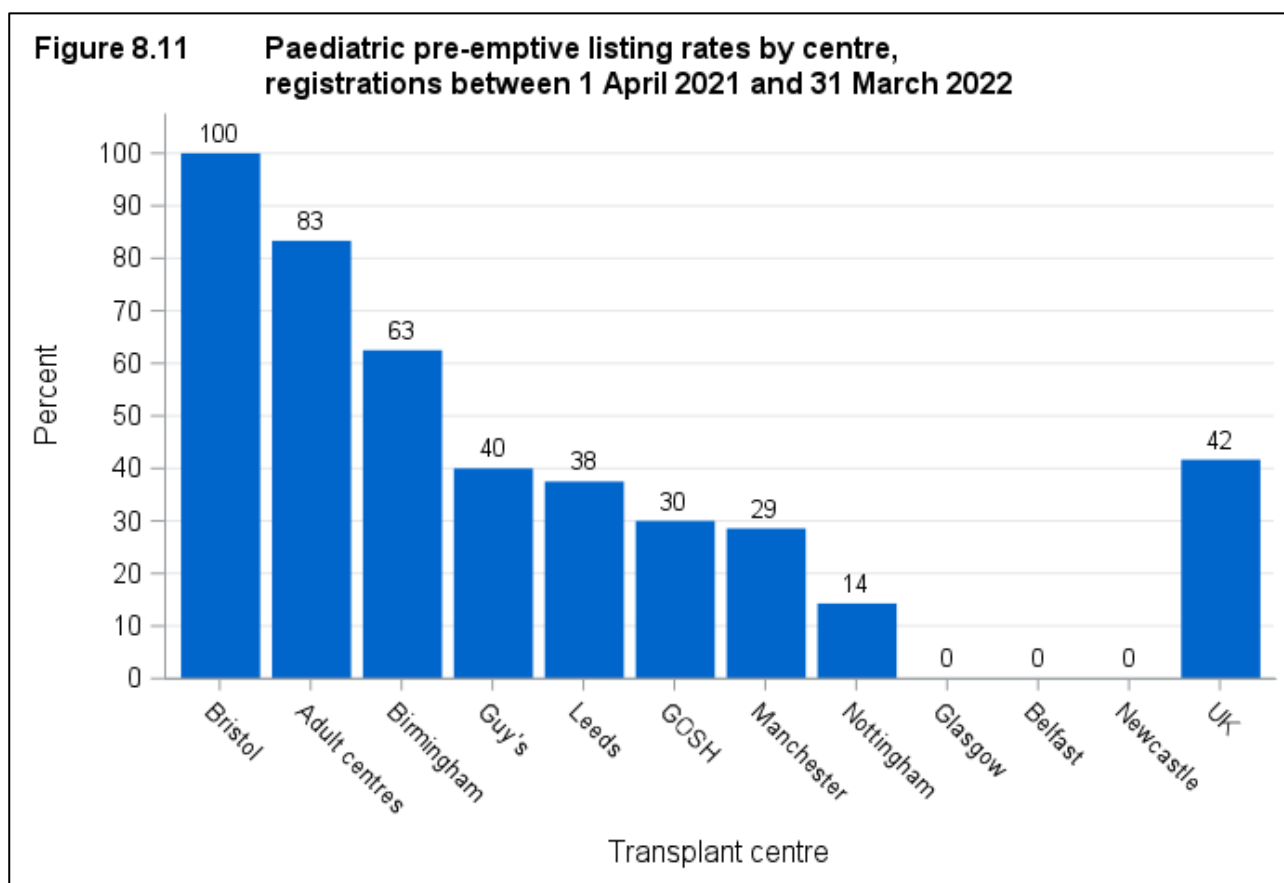


Table 8.1 Median waiting time to kidney only transplant in the UK, for paediatric patients registered 1 April 2017 - 31 March 2020

Transplant centre	Number of paediatric patients registered	Waiting time (days)	
		Median	95% Confidence interval
Belfast	0	-	
Newcastle	0	-	
Guy's	27	137	94 - 180
Glasgow	13	212	43 - 381
Manchester	24	240	0 - 503
Nottingham	24	281	163 - 399
Bristol	15	309	118 - 500
Birmingham	36	363	231 - 495
GOSH	30	432	271 - 593
Leeds	19	447	256 - 638
UK	224	312	251 - 373

8.5 Pre-emptive listing rates, 1 April 2021 - 31 March 2022

Rates of [pre-emptive](#) kidney only listings are shown in **Figure 8.11** for paediatric patients joining the list between 1 April 2021 and 31 March 2022. 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 42% of all paediatric registrations across the UK ranging from 100% at Bristol to 14% at Nottingham. No registrations at Glasgow were listed pre-emptively. Belfast and Newcastle had 0 registrations in the period.



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 2020 – 31 March 2023

Figure 9.1 compares individual centre offer decline rates with the national rate for SCD over the time period, 1 April 2020 and 31 March 2023. Centres can be identified by the information shown in **Table 9.1**. One centre has an offer decline rate that falls above the 95% upper confidence limit, suggesting this centre have rates different from the national rate.

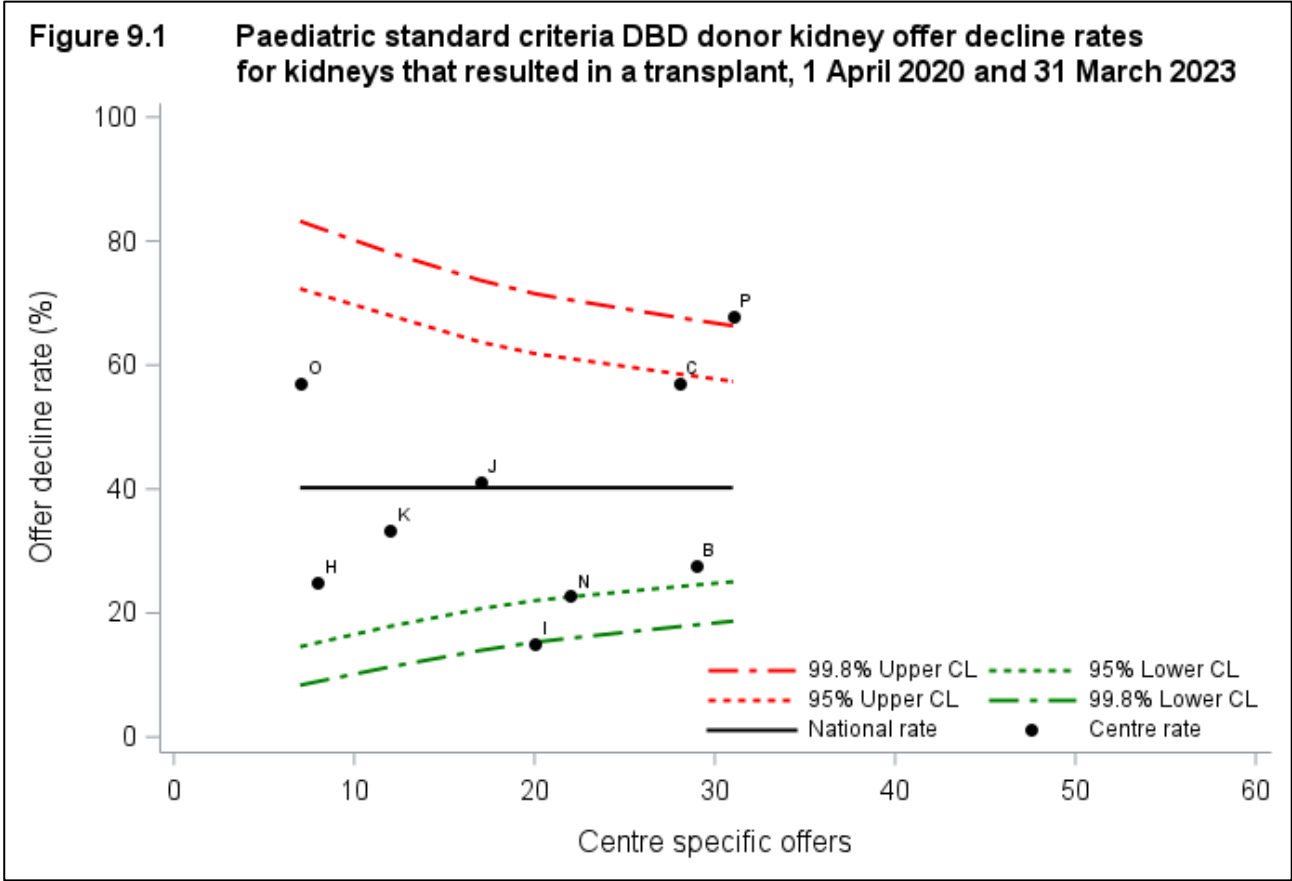


Table 9.1 compares individual centre offer decline rates for SCD over time by financial year.

Table 9.1 Paediatric standard criteria DBD donor kidney offer decline rates by transplant centre, 1 April 2020 and 31 March 2023									
Centre	Code	2020/21		2021/22		2022/23		Overall	
		N	(%)	N	(%)	N	(%)	N	(%)
Birmingham	B	9	(22)	7	(43)	13	(23)	29	(28)
Bristol	C	12	(75)	10	(50)	6	(33)	28	(57)
GOSH	I	6	(33)	7	(14)	7	(0)	20	(15)
Glasgow	H	2	(0)	1	(0)	5	(40)	8	(25)
Guy's	J	3	(67)	6	(50)	8	(25)	17	(41)
Leeds	K	6	(33)	2	(50)	4	(25)	12	(33)
Manchester	N	5	(40)	8	(0)	9	(33)	22	(23)
Newcastle	O	2	(50)	3	(33)	2	(100)	7	(57)
Nottingham	P	16	(69)	9	(56)	6	(83)	31	(68)
UK		61	(51)	53	(36)	60	(33)	174	(40)

Paediatric kidney transplants

10.1 Kidney only transplants, 1 April 2013 – 31 March 2023

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](#)), 10 in 2022/23.

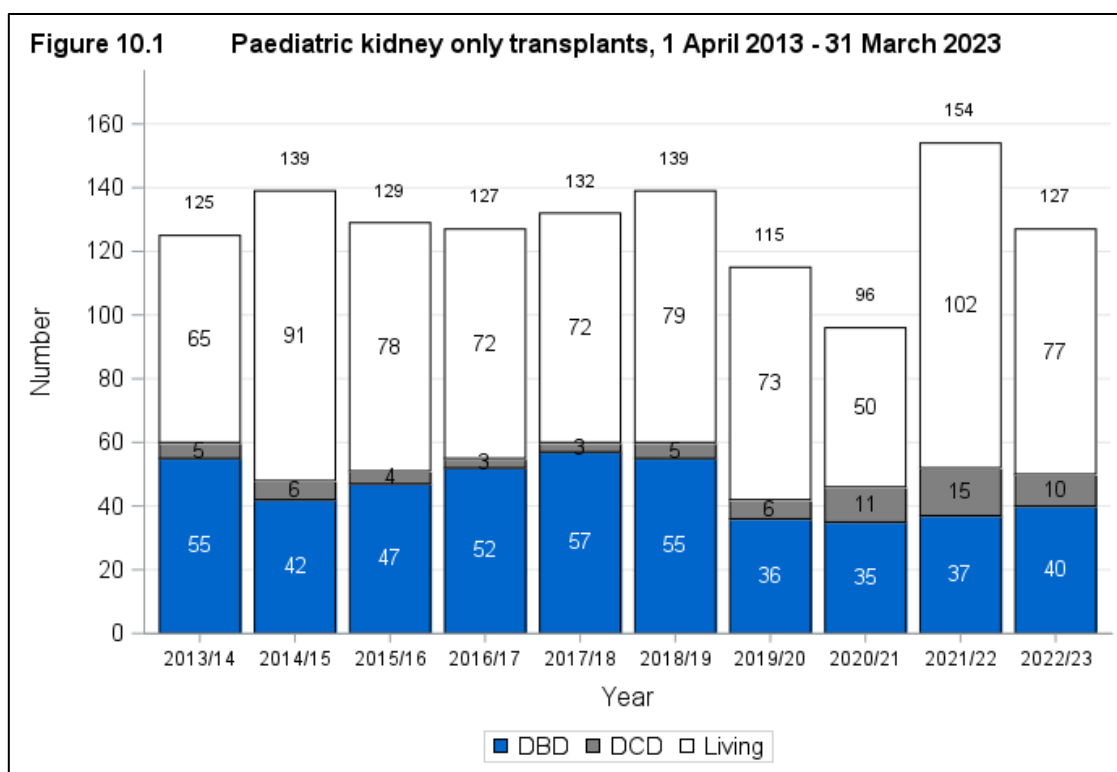


Figure 10.2 shows the total number of paediatric kidney only transplants performed in 2022/23, by centre and type of donor. The same information is presented in **Figure 10.3** but this shows the proportion of [DBD](#), [DCD](#) and living donor transplants performed at each centre.

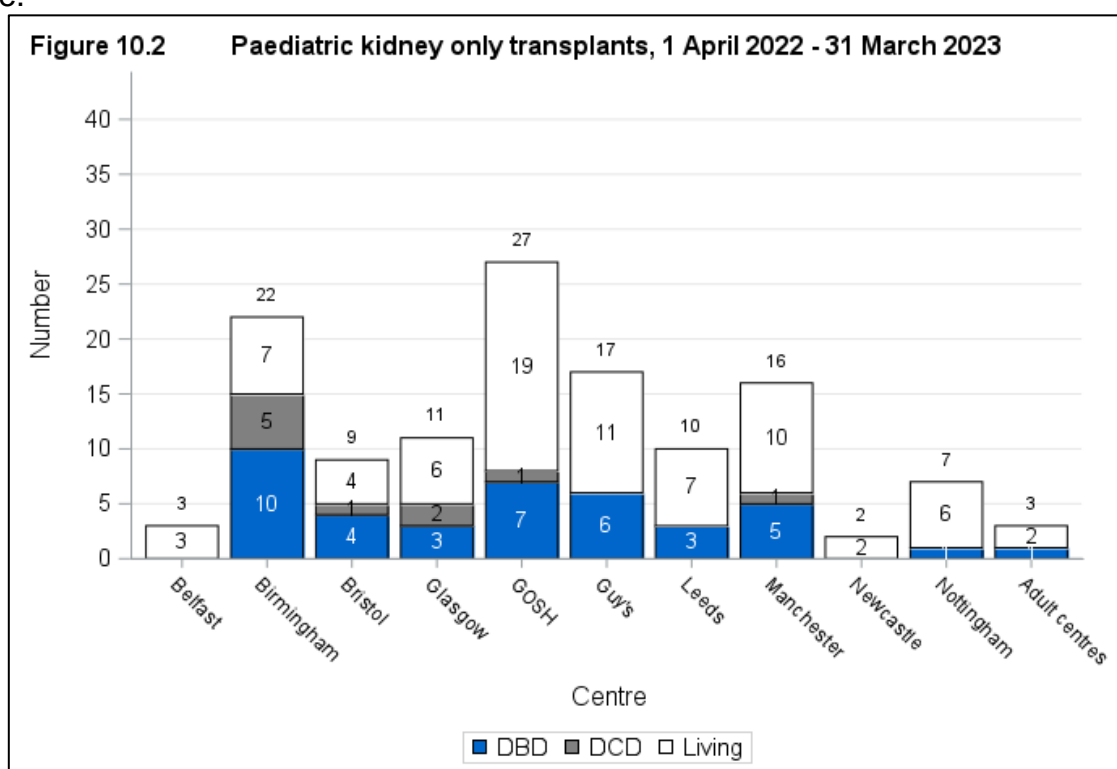


Figure 10.3 Paediatric kidney only transplants, 1 April 2022 - 31 March 2023

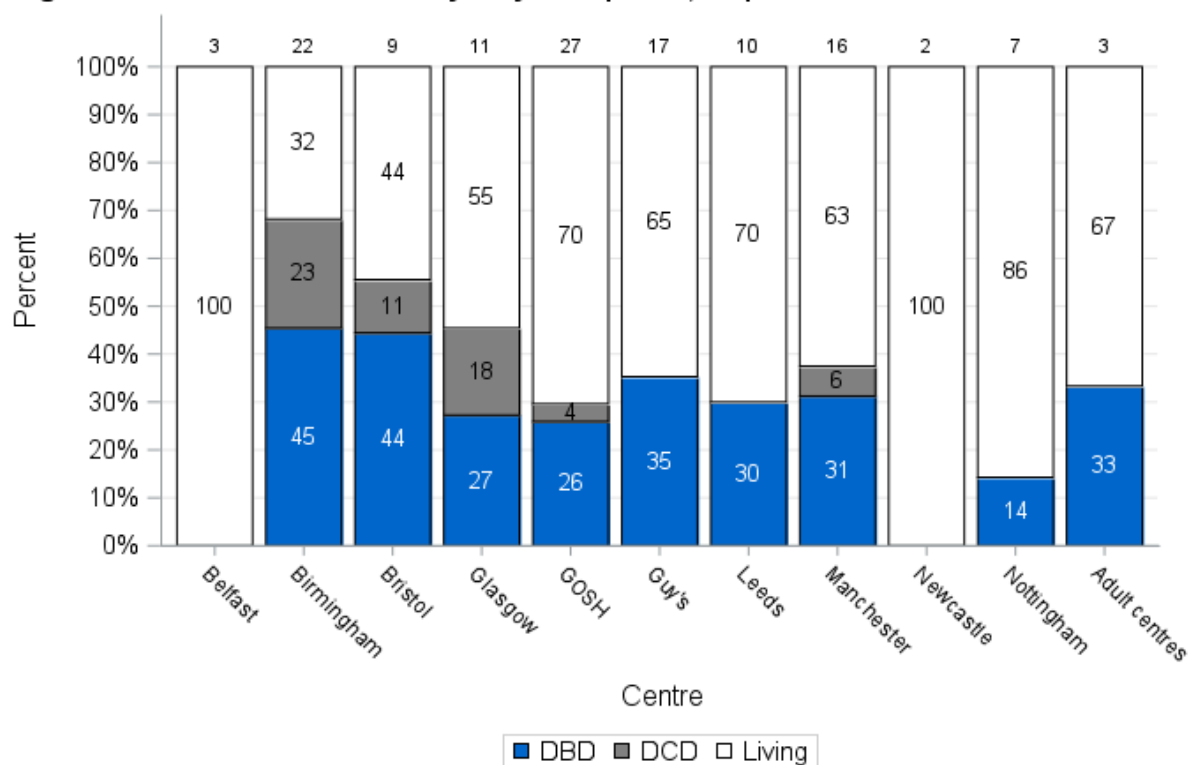
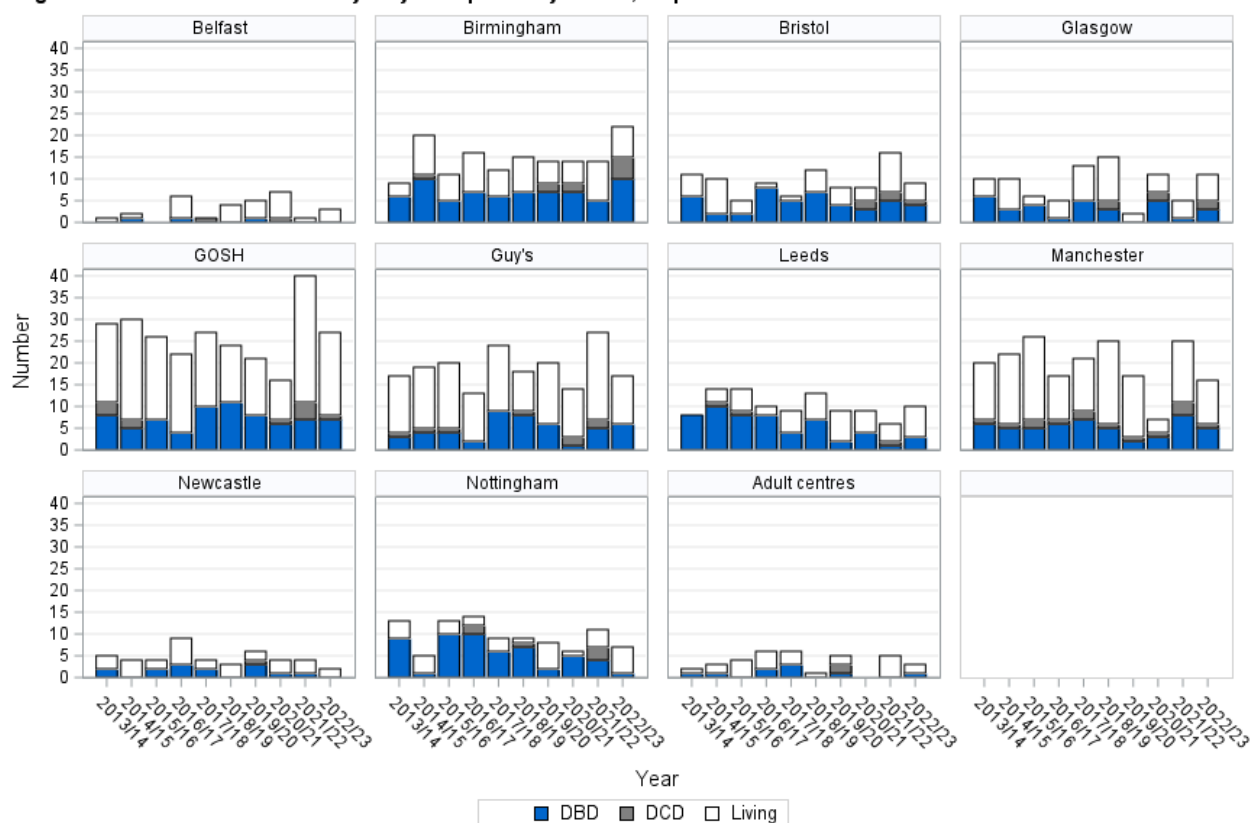


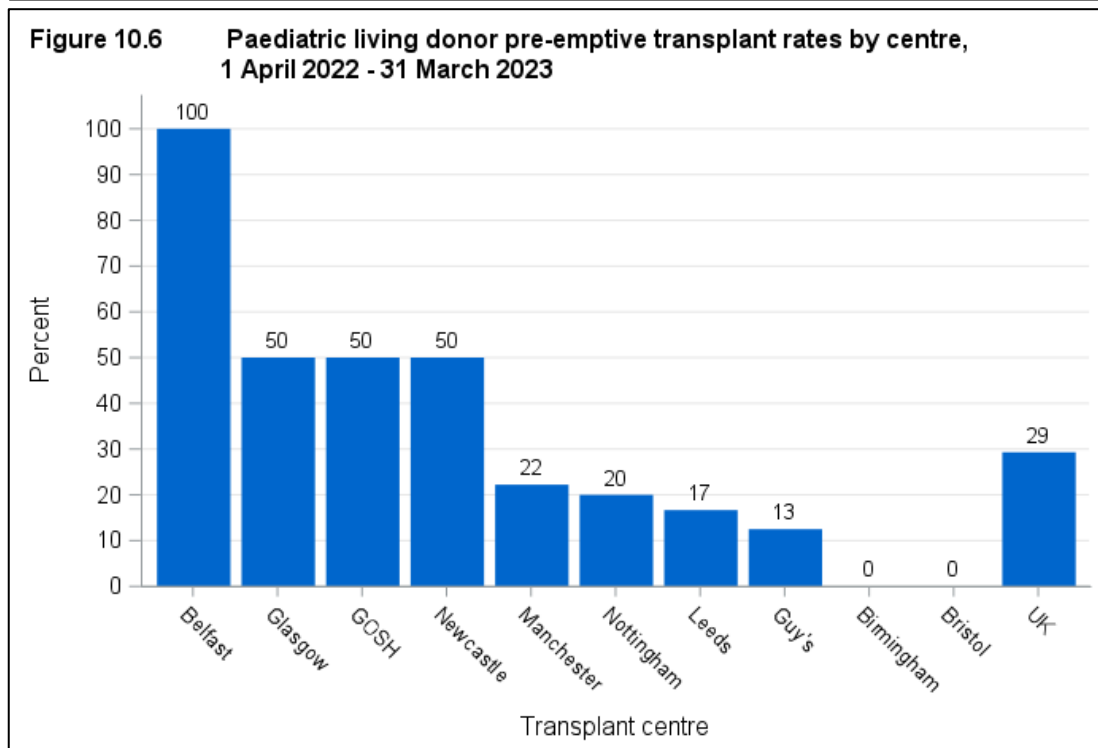
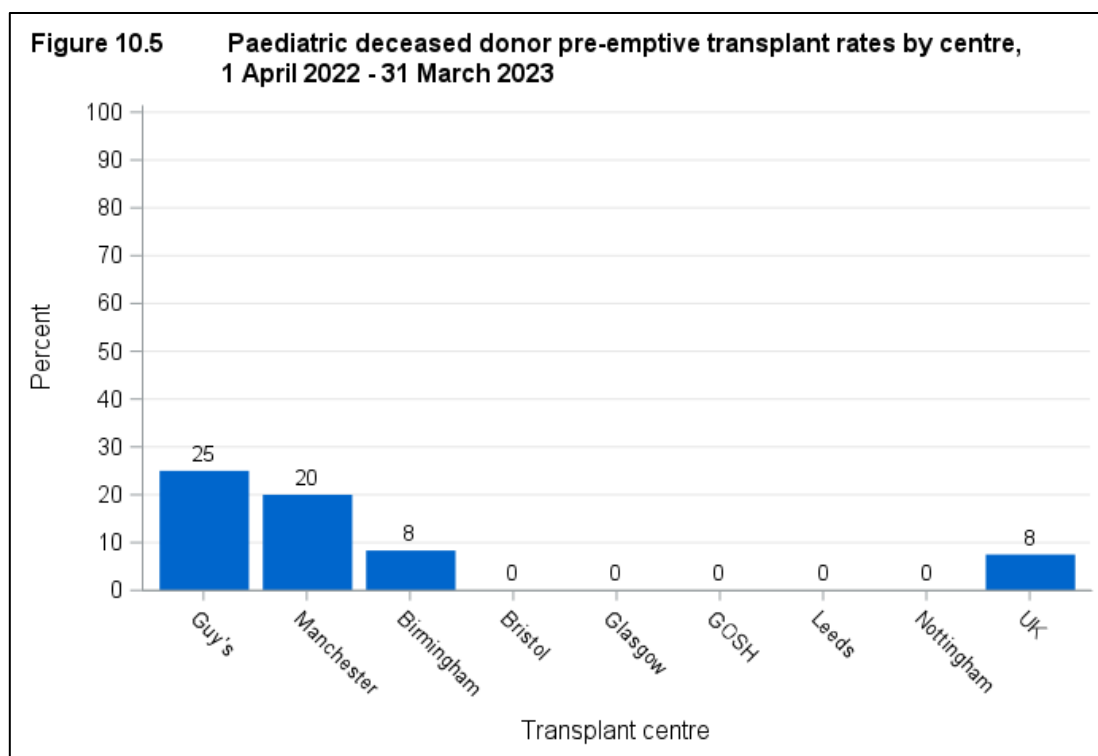
Figure 10.4 shows the total number of paediatric kidney only transplants performed in last ten years, by centre and type of donor.

Figure 10.4 Paediatric kidney only transplants by centre, 1 April 2013 - 31 March 2023



10.2 Pre-emptive transplant rates, 1 April 2022 - 31 March 2023

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: 29% and 8% 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 25% at Guy's to 0% at a number of centres. Paediatric living donor [pre-emptive](#) transplant rates ranged from 100% at Belfast to 0% at Birmingham and Bristol.



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 95% [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**.

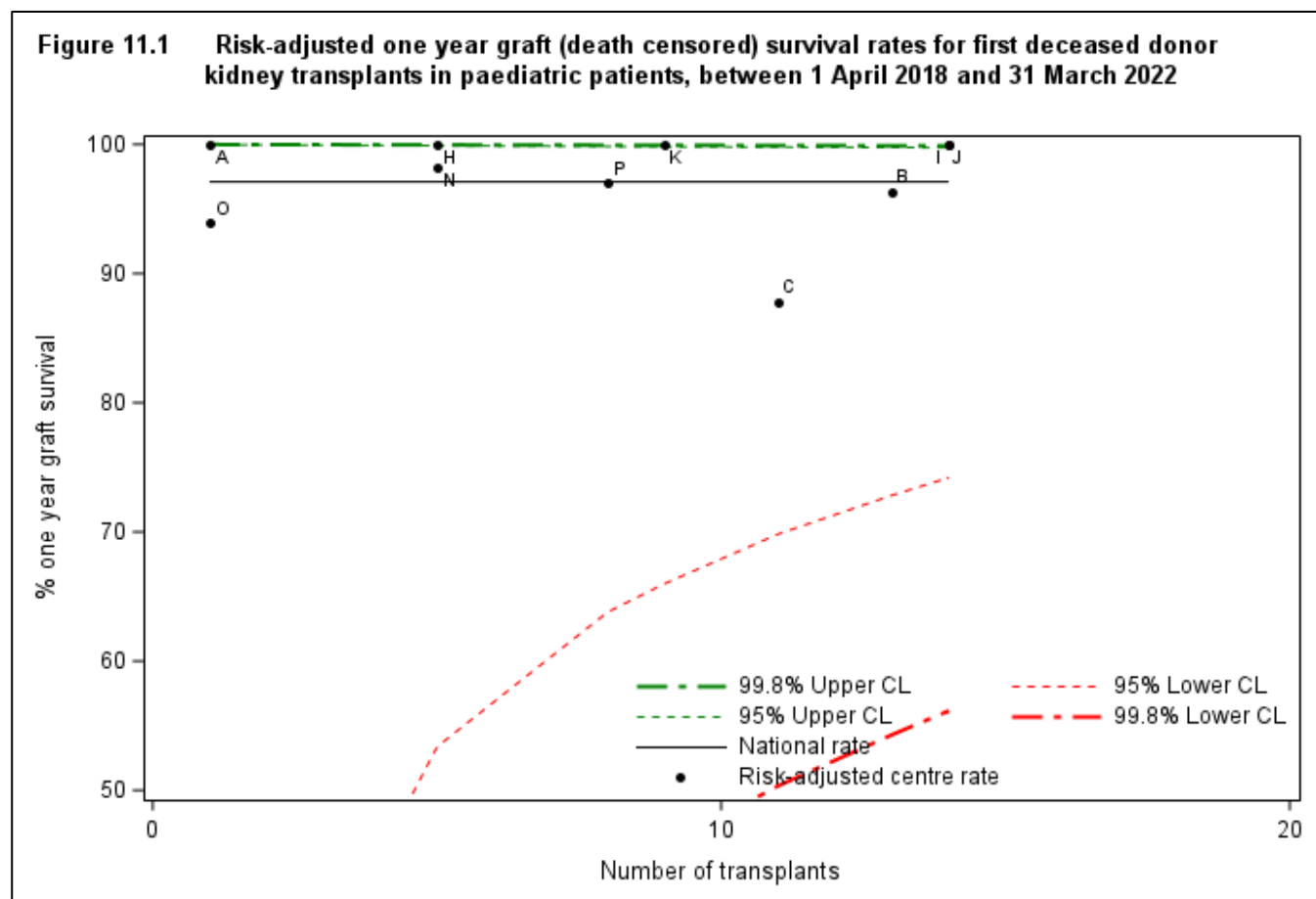


Figure 11.2 is not included. There were no one year patient mortalities for first paediatric kidney-only transplants using kidneys from deceased donors, for transplants between 1 April 2018 and 31 March 2022.

Figure 11.3 Risk-adjusted five year graft (death censored) survival rates for first deceased donor kidney transplants in paediatric patients, between 1 April 2014 and 31 March 2018

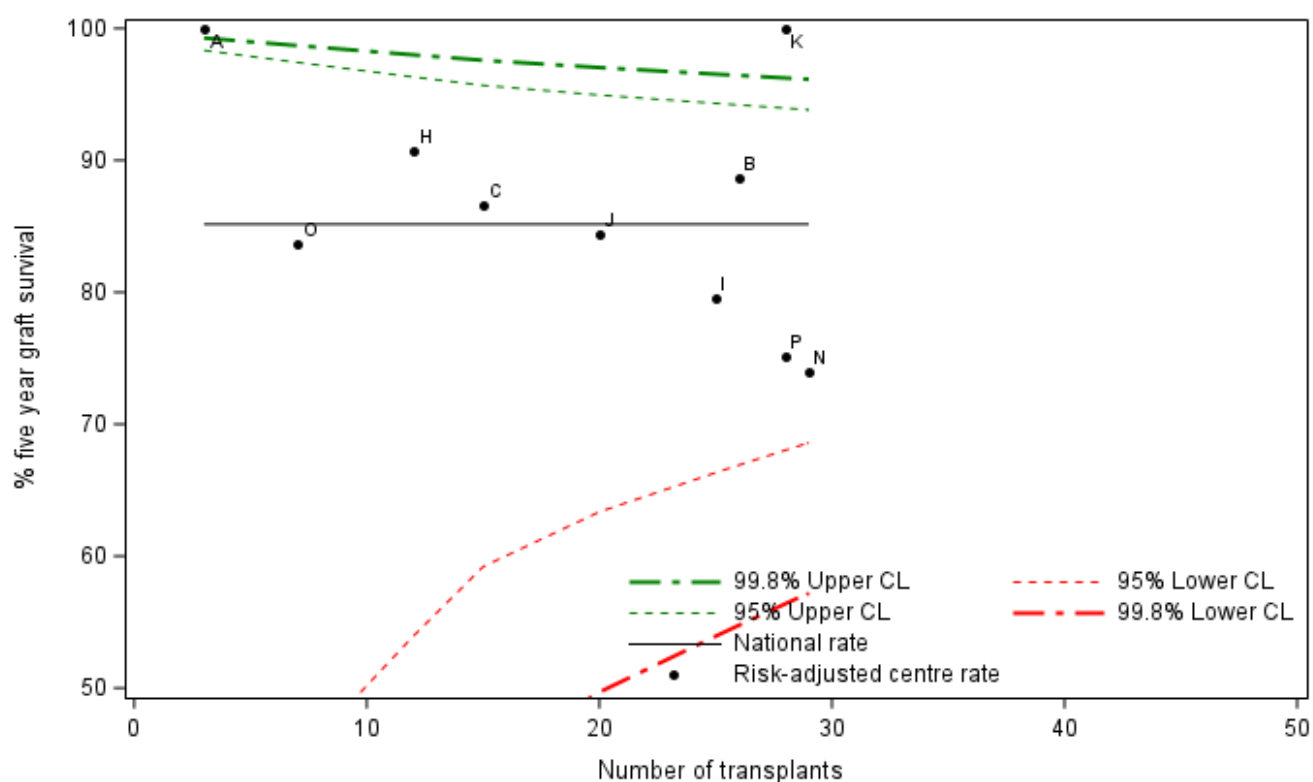


Figure 11.4 Risk-adjusted five year patient survival rates for first deceased donor kidney transplants in paediatric patients, between 1 April 2014 and 31 March 2018

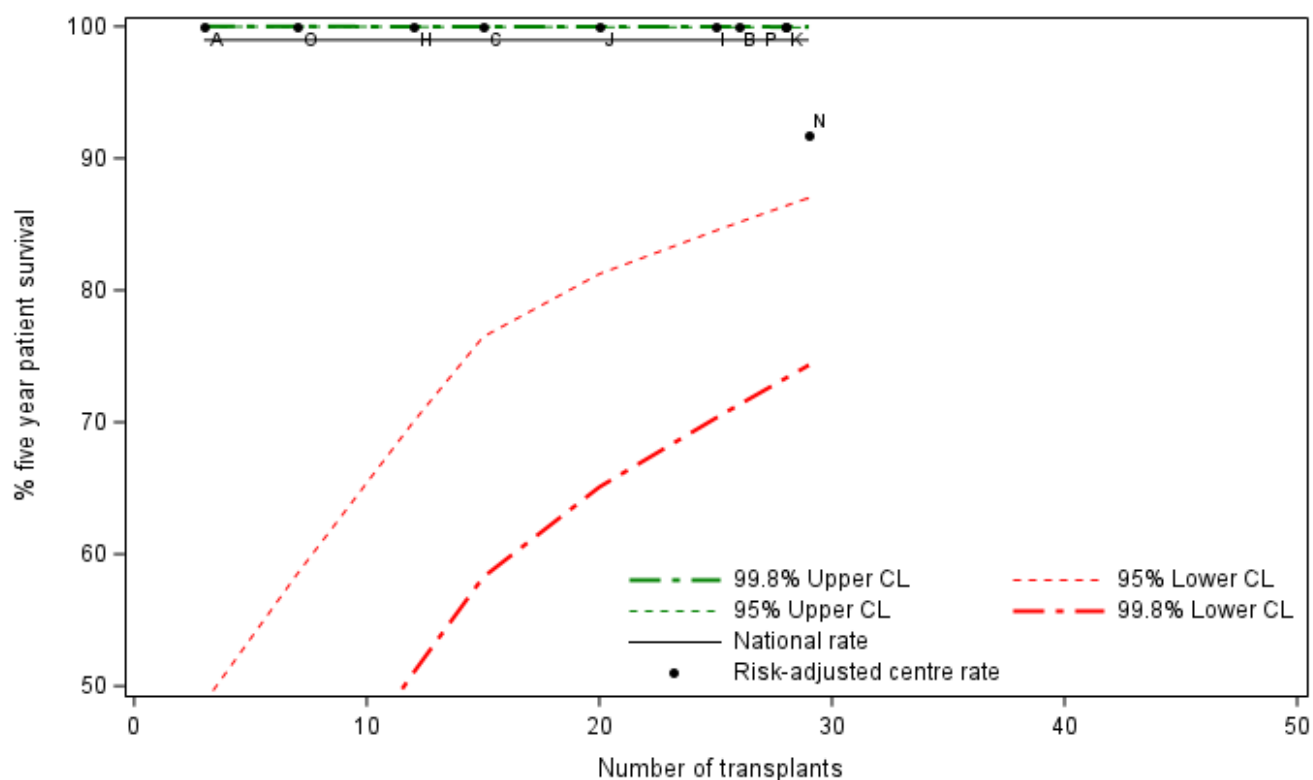


Table 11.1 One and five year first paediatric kidney-only graft and patient survival using kidneys from deceased donors

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	100	N/A
Birmingham	B	96	(80 - 100	89	(67 - 98)	100	N/A	100	N/A
Bristol	C	88	(32 - 100	87	(51 - 98)	100	N/A	100	N/A
GOSH	I	100	N/A	80	(50 - 95)	100	N/A	100	N/A
Glasgow	H	100	N/A	91	(49 - 100	100	N/A	100	N/A
Guy's	J	100	N/A	85	(47 - 98)	100	N/A	100	N/A
Leeds	K	100	N/A	100	N/A	100	N/A	100	N/A
Manchester	N	98	(90 - 100	72	(44 - 88)	100	N/A	92	(70 - 99)
Newcastle	O	94	(66 - 100	84	(12 - 100	100	N/A	100	N/A
Nottingham	P	97	(83 - 100	75	(49 - 90)	100	N/A	100	N/A
UK		97	(93 - 99)	85	(79 - 89)	100	N/A	99	(96 - 100

* Includes transplants performed between 1 April 2018 - 31 March 2022

** Includes transplants performed between 1 April 2014 - 31 March 2018

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 95% [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**.

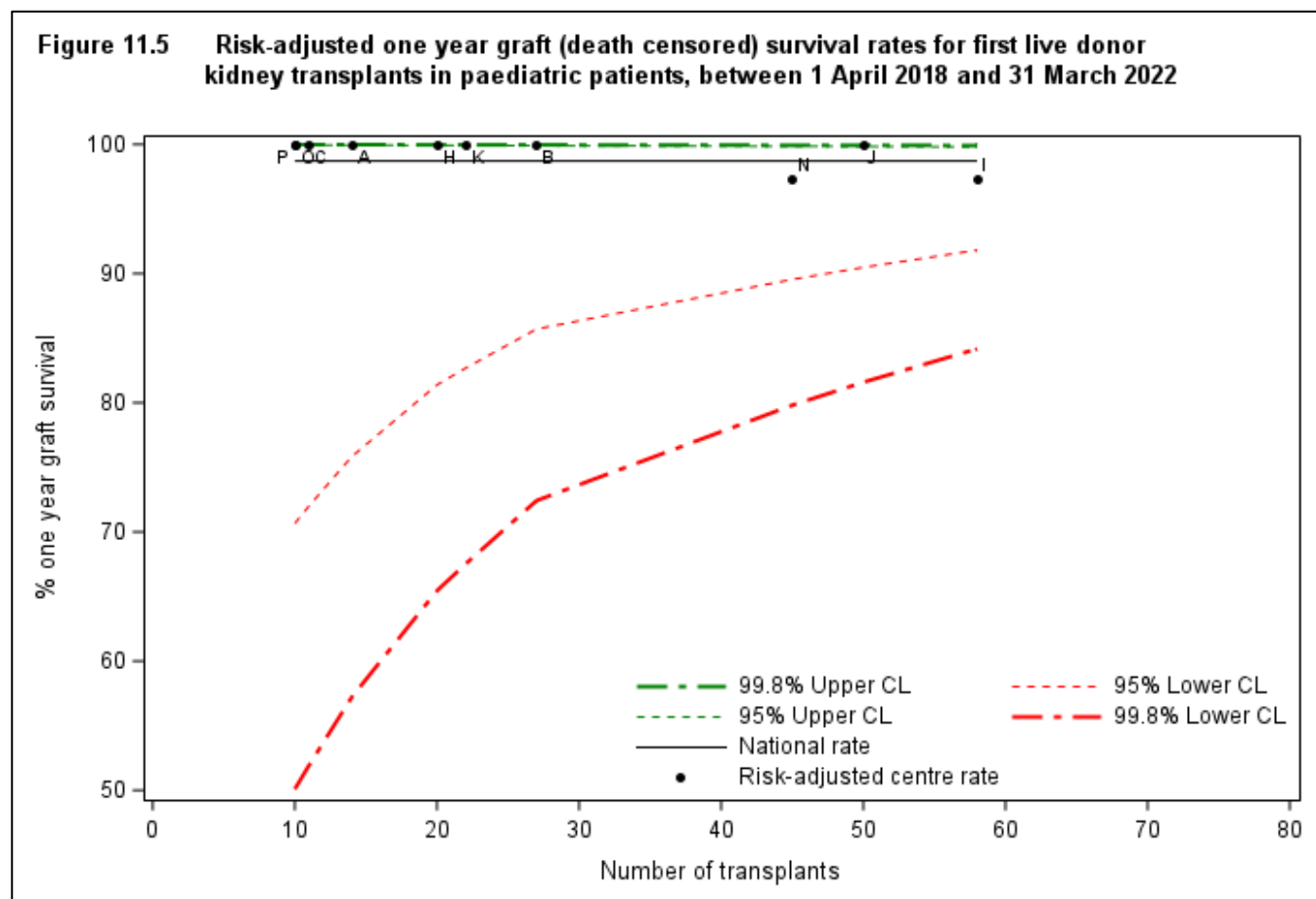


Figure 11.6 Risk-adjusted one year patient survival rates for first live donor kidney transplants in paediatric patients, between 1 April 2018 and 31 March 2022

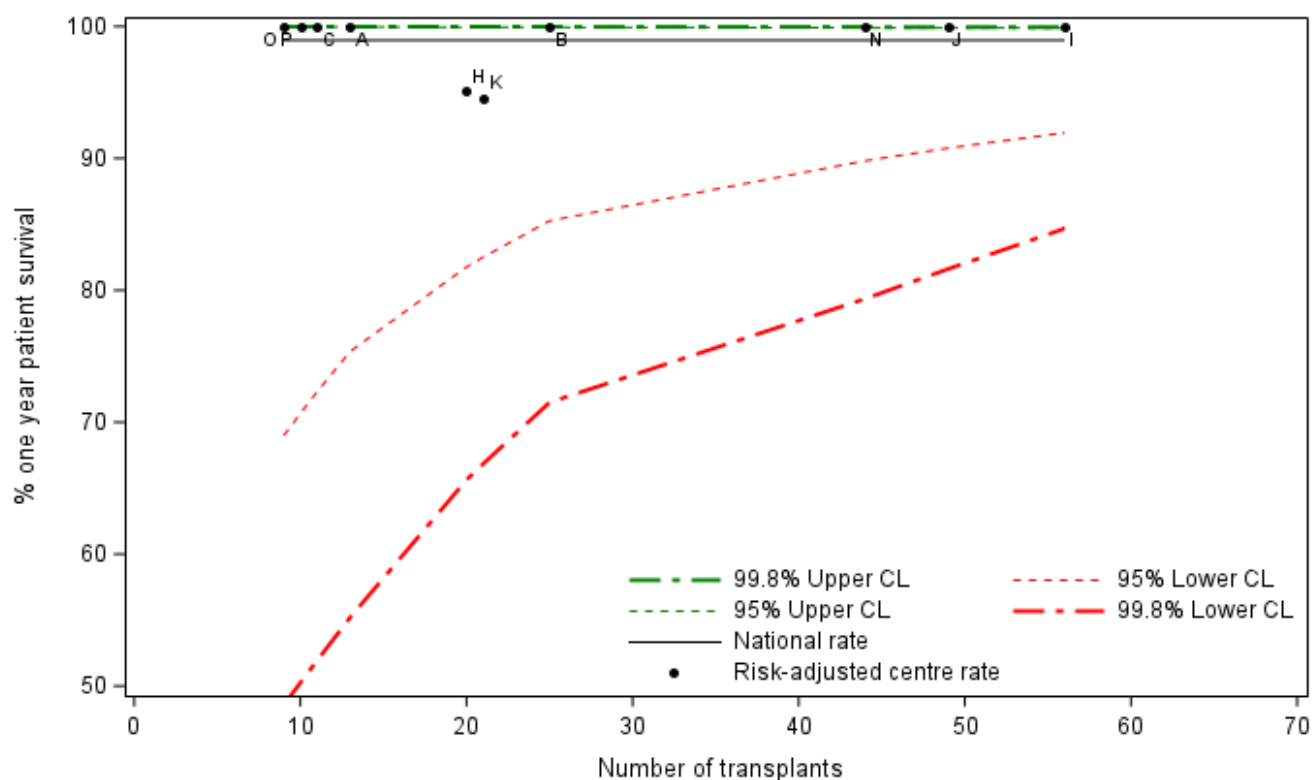


Figure 11.7 Risk-adjusted five year graft (death censored) survival rates for first live donor kidney transplants in paediatric patients, between 1 April 2014 and 31 March 2018

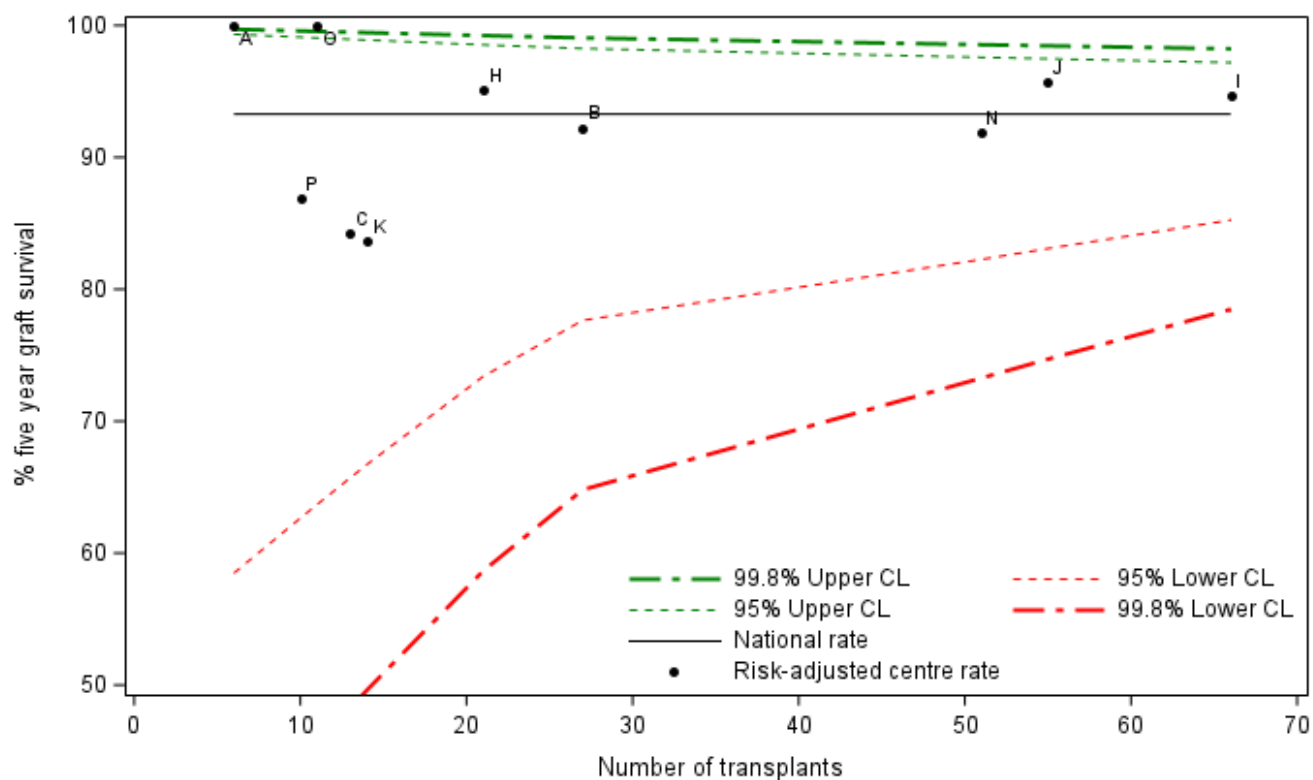


Figure 11.8 Risk-adjusted five year patient survival rates for first live donor kidney transplants in paediatric patients, between 1 April 2014 and 31 March 2018

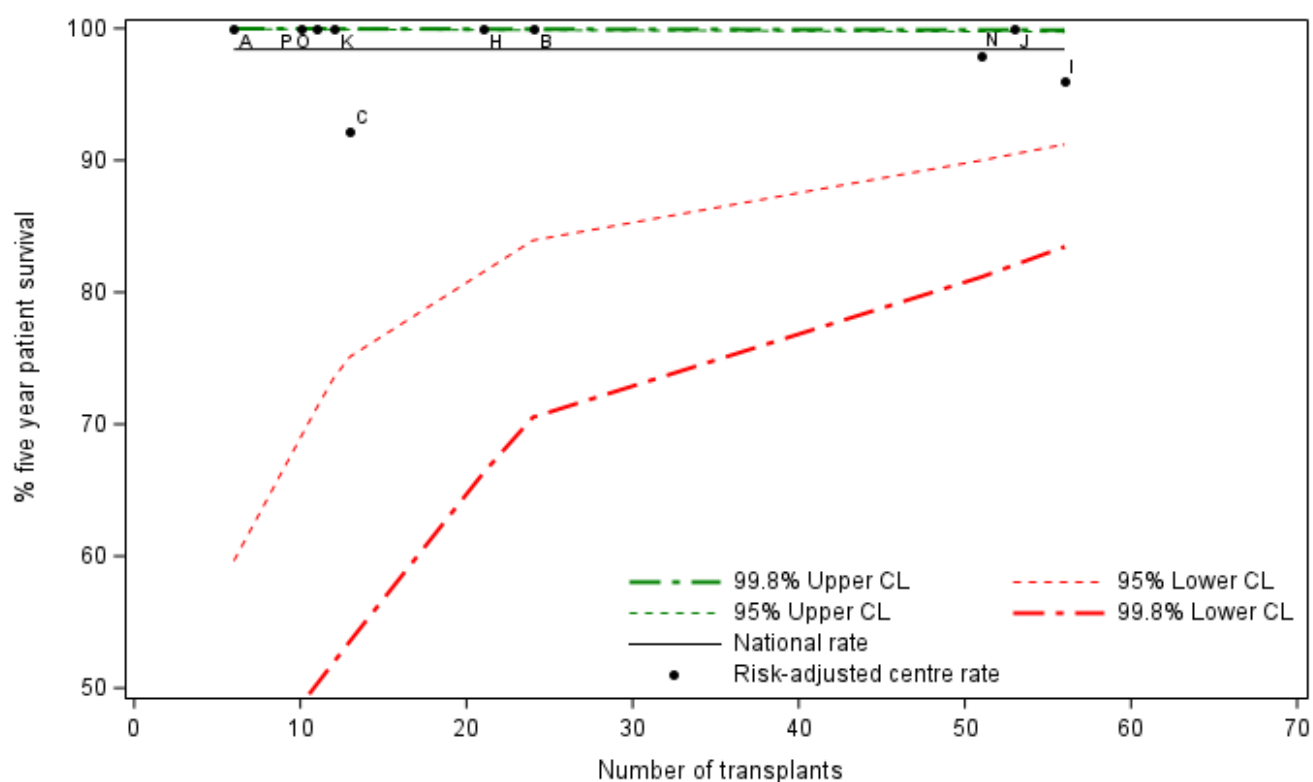


Table 11.2 One and five year first paediatric kidney-only graft and patient survival using kidneys from living donors

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	100	N/A	92	(72 - 99)	100	N/A	100	N/A
Bristol	C	100	N/A	84	(43 - 98)	100	N/A	92	(57 - 100)
GOSH	I	97	(85 - 100)	95	(84 - 99)	100	N/A	96	(85 - 100)
Glasgow	H	100	N/A	95	(73 - 100)	95	(73 - 100)	100	N/A
Guy's	J	100	N/A	96	(84 - 99)	100	N/A	100	N/A
Leeds	K	100	N/A	84	(41 - 98)	95	(70 - 100)	100	N/A
Manchester	N	97	(85 - 100)	92	(79 - 98)	100	N/A	98	(89 - 100)
Newcastle	O	100	N/A	100	N/A	100	N/A	100	N/A
Nottingham	P	100	N/A	87	(27 - 100)	100	N/A	100	N/A
UK		99	(96 - 100)	93	(90 - 96)	99	(96 - 100)	98	(96 - 99)

* Includes transplants performed between 1 April 2018 - 31 March 2022

** Includes transplants performed between 1 April 2014 - 31 March 2018

Form return rates

12.1 Deceased donor form return rates, 1 April 2022 – 31 March 2023

Form return rates are reported in **Table 12.1** for the kidney transplant record, three month and one year follow up form, along with lifetime follow up (more than two years). These include all paediatric deceased donor kidney only transplants between 1 April 2022 and 31 March 2023 for the transplant record, and all requests for follow up forms issued in this time period.

Table 12.1 Deceased donor form return rates, 1 April 2022 and 31 March 2023

Centre	TX RECORD		THREE MONTHS		ONE YEAR		LIFETIME	
	N	% returned	N	% returned	N	% returned	N	% returned
Birmingham, Birmingham Children's Hospital	1	100	1	100			26	96
Birmingham, Queen Elizabeth Hospital Birmingham	14	100	12	92	5	100	73	100
Bradford, St Lukes Hospital							20	100
Bristol, Southmead Hospital	5	100	6	83	6	50	46	67
Cardiff, University Of Wales Hospital							47	38
Glasgow, Queen Elizabeth University Hospital							44	68
Leeds, St James's University Hospital	3	100	1	100	2	100	108	84
Leicester, Leicester General Hospital							24	96
London, Great Ormond Street Hospital For Children	8	100	6	50	10	70	39	72
London, Guy's Hospital	6	100	7	71	7	14	74	59
London, Royal Free Hospital							37	68
London, The Royal London Hospital (Whitechapel)							27	96
Manchester, Manchester Royal Infirmary	6	100	5	100	9	100	51	96
Nottingham, Nottingham City Hospital	1	100	1	100			69	43
Portsmouth, Queen Alexandra Hospital							25	12
Salford, Salford Royal							20	90
Sheffield, Northern General Hospital							34	6

12.2 Living donor form return rates, 1 April 2022 – 31 March 2023

Form return rates are reported in **Table 12.2** for the kidney transplant record, three month and one year follow up form, along with lifetime follow up (more than two years). These include all paediatric living donor kidney only transplants between 1 April 2022 and 31 March 2023 for the transplant record, and all requests for follow up forms issued in this time period.

Table 12.2 Living donor form return rates, 1 April 2022 and 31 March 2023

Centre	TX RECORD		THREE MONTHS		ONE YEAR		LIFETIME	
	N	% returned	N	% returned	N	% returned	N	% returned
Belfast, Royal Belfast Hospital For Sick Children							31	10
Birmingham, Birmingham Children's Hospital							38	97
Birmingham, Queen Elizabeth Hospital Birmingham	7	100	7	100	6	100	30	100
Cardiff, University Of Wales Hospital			1	100	2	50	49	22
Glasgow, Queen Elizabeth University Hospital							43	86
Leeds, St James's University Hospital	7	100	8	88	5	100	45	91
Liverpool, Alder Hey Children's Hospital							21	100
Liverpool, Royal Liverpool University Hospital							25	100
London, Great Ormond Street Hospital For Children	19	95	20	80	26	58	76	78
London, Guy's Hospital	11	100	13	38	18	28	131	47
London, Royal Free Hospital							26	69
Manchester, Manchester Royal Infirmary	10	100	7	100	12	100	39	100
Manchester, Royal Manchester Children's Hospital							37	100
Newcastle, Royal Victoria Infirmary							27	93
Nottingham, Nottingham City Hospital	6	83	5	100	4	25	42	36
Oxford, Churchill Hospital					1	100	22	100
Portsmouth, Queen Alexandra Hospital							27	30
Southampton, Southampton University Hospitals							22	95

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 recipients 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 recipients 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 recipient was followed up for only nine months before they relocated. If we calculated a crude survival estimate using the number of recipients who survived for at least a year, this recipient would have to be excluded as it is not known whether or not the recipient was still alive at one year after transplant. The Kaplan-Meier method allows information about such recipients 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 recipient. 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 recipient receives more than one organ. For example, a recipient 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 recipients 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 recipients 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 recipients. A risk-adjusted survival rate for a centre is the expected survival rate for that centre given the case mix of their recipients. 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 recipient, transplant or donor that influence the length of time that a graft is likely to function or a recipient 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 recipients at the centre have the same chance of surviving a given length of time after transplant. In reality, recipients 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 recipients with incomplete follow-up information to be included in the computation. For example, in a cohort for estimating one-year patient survival rates, a recipient was followed up for only nine months before they relocated. If we calculated a crude survival estimate using the number of recipients who survived for at least a year, this recipient would have to be excluded, as it is not known whether or not the recipient was still alive one year after transplant. The Kaplan-Meier method allows information about such recipients 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 recipients as that seen nationally. The risk-adjusted rate therefore presents estimates in which differences in recipient 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 recipient 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 recipient based on their individual risk factor values. The sum of these probabilities for all recipients at a centre gives the number, E, of recipients or grafts expected to survive at least one year or five years after transplant at that centre. The number of recipients 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.

Systematic component of variation

For a given individual who is a resident in a given English Strategic Health Authority (SHA), registration to the transplant list is modelled as a Bernoulli trial. At the whole area level, this becomes a Binomial process which can be approximated by a Poisson distribution when rare events are modelled. Transplant counts follow similar assumptions.

To allow for the possibility that, even after allowing for area-specific Poisson rates, area differences remain, introduce an additional multiplicative rate factor which varies from area to area. Postulate a non-parametric distribution for the multiplicative factor, with variance σ^2 . If the factor is one for all areas, then area differences are fully explained by the area-specific Poisson rate. If the factor varies with a nonzero variance, σ^2 , then we conclude that there are unexplained area differences.

The systematic component of variation (SCV; McPherson *et al.*, *N Engl J Med* 1982, 307: 1310-4) is the moment estimator of σ^2 . Under the null hypothesis of homogeneity across areas, the SCV would be zero. The SCV, therefore, allows us to detect variability across areas beyond that expected by chance; the larger the SCV, the greater the evidence of systematic variation across areas.

Risk adjustment factors

Adult waiting time

Median waiting time Age at registration, sex, ethnicity, highly sensitised, blood group, dialysis status, matchability score, primary renal disease

Adult 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 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 recipient.

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

Adult 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

Prepared by:

Statistics and Clinical Research, NHS Blood and Transplant

Maria Jacobs
Shaminie Shanmugaranjan
Dr Matthew Robb