NHS
Blood and Transplant

ANNUAL REPORT ON KIDNEY TRANSPLANTATION

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

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PRODUCED IN COLLABORATION WITH NHS ENGLAND

Contents

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≥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.

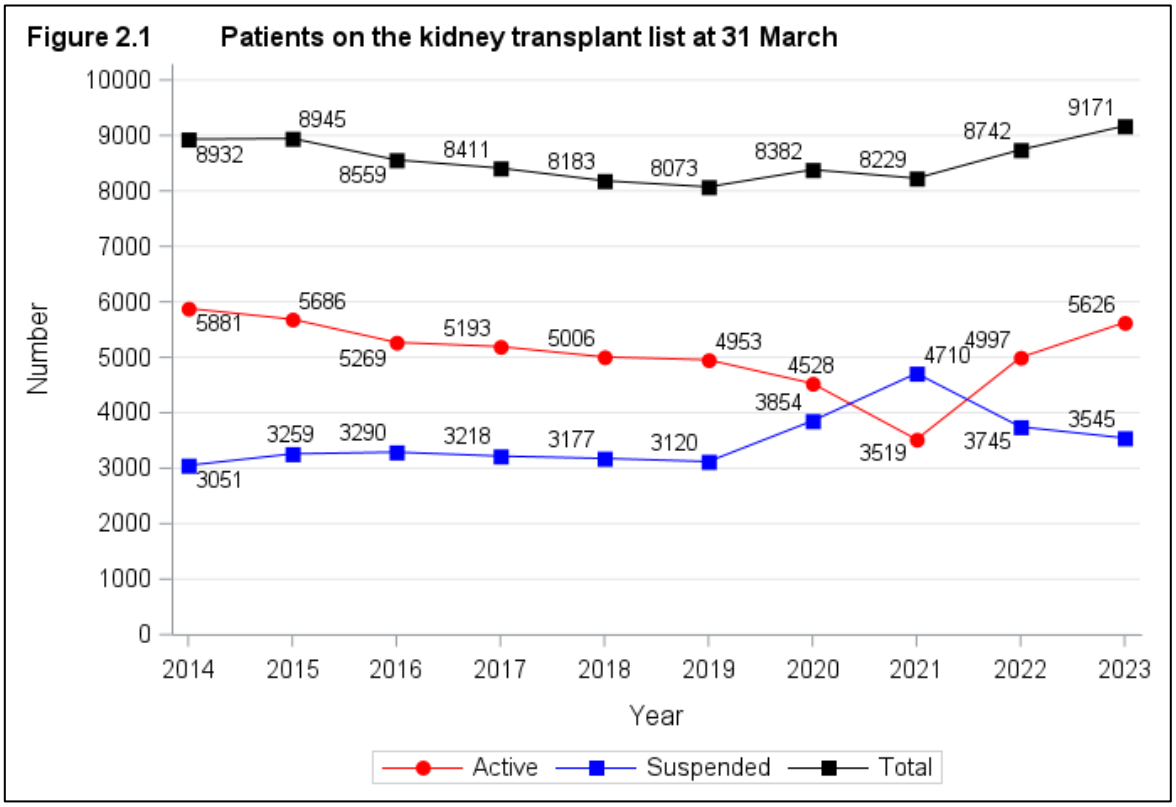


Figure 2.2 shows the number of patients on the kidney transplant list at 31 March 2023 for each transplant centre. Manchester has the largest active transplant list with 435 patients registered for a kidney transplant.

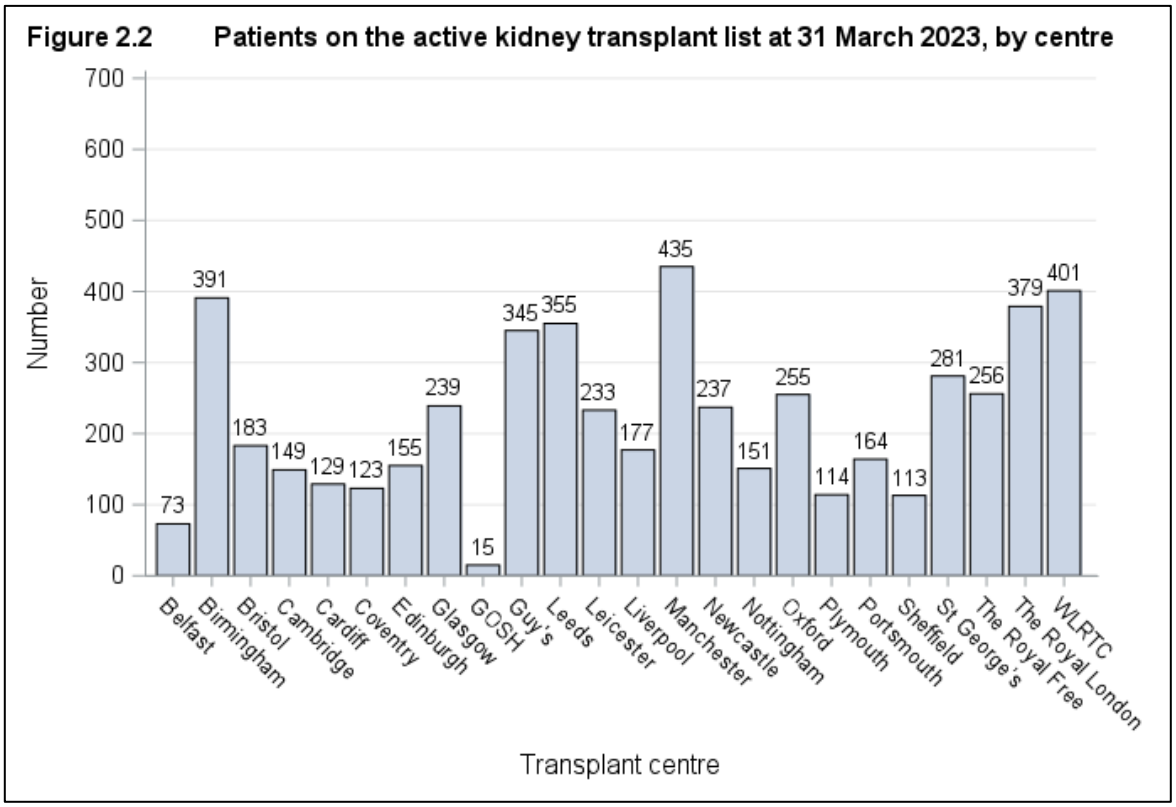


Figure 2.3 shows the total number of kidney transplants performed in the last ten years. The number of transplants has increased slightly overall from 3,259 in 2013/14 to 3,274 in 2022/23.

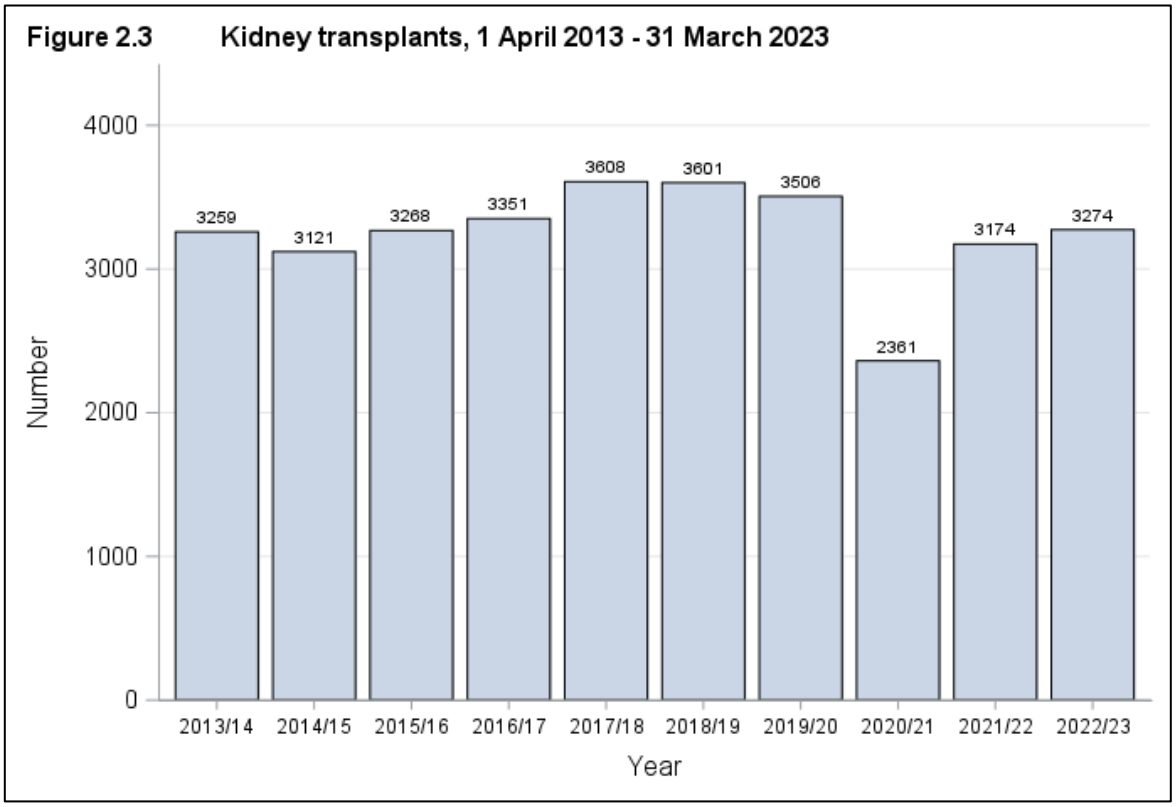


Figure 2.4 shows the total number of kidney transplants performed in 2022/23 at each transplant centre. Guy's had the highest activity last year with 278 transplants performed.

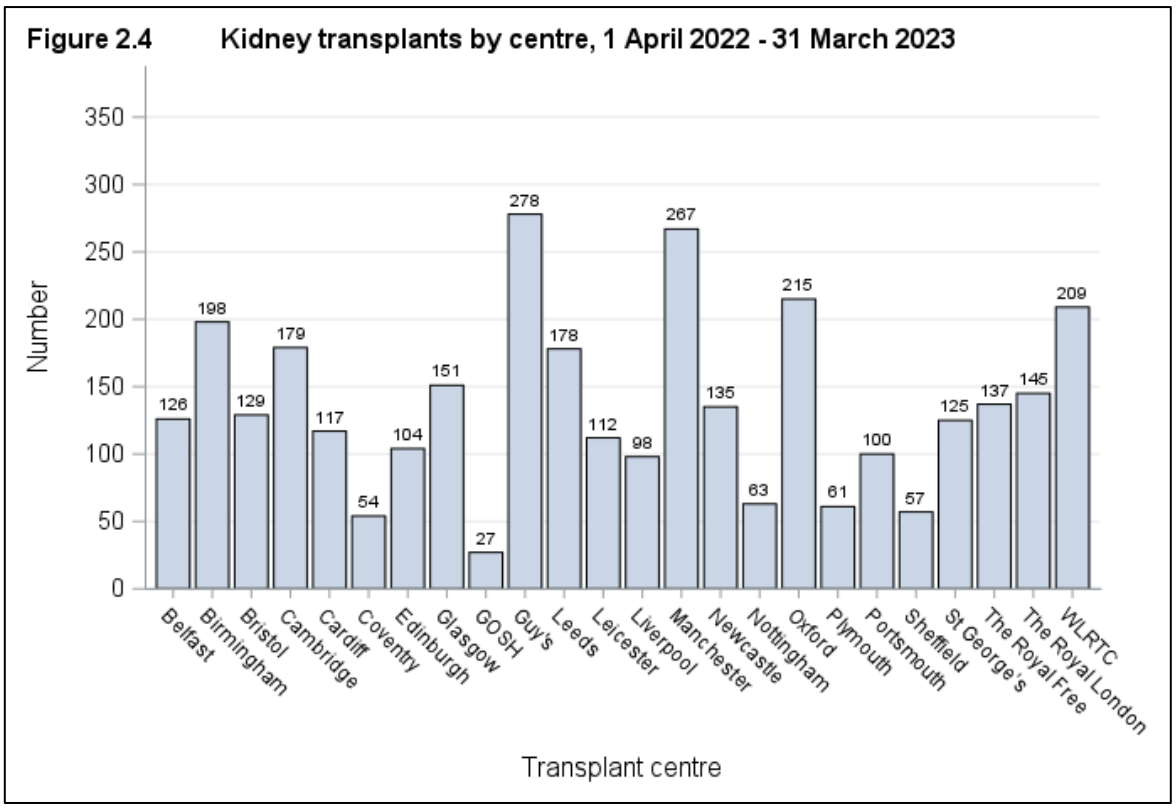


Figure 2.5 shows the total number of kidney transplants performed per million population in 2022/23 at each transplant centre. WLRTC had the highest number of adult deceased donor kidney transplants per million population.

Figure 2.5 Adult Deceased donor kidney transplants (pmp) in the UK, 1 April 2022 - 31 March 2023

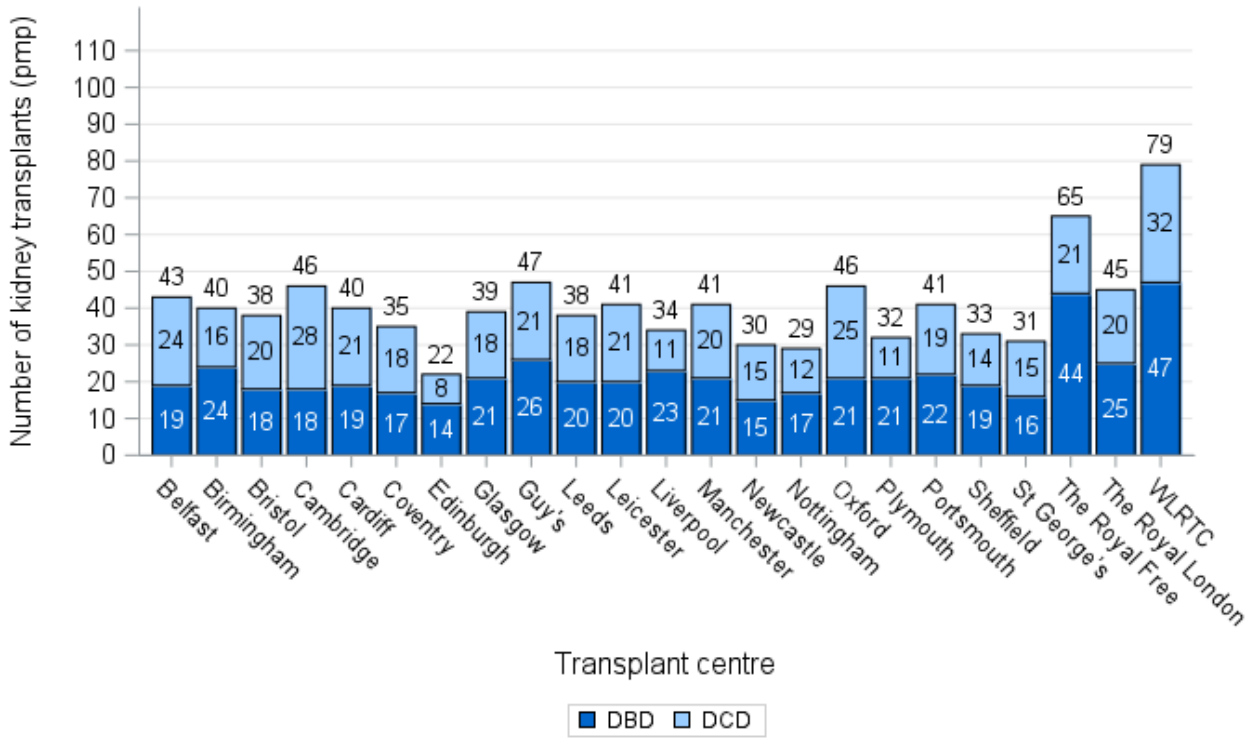
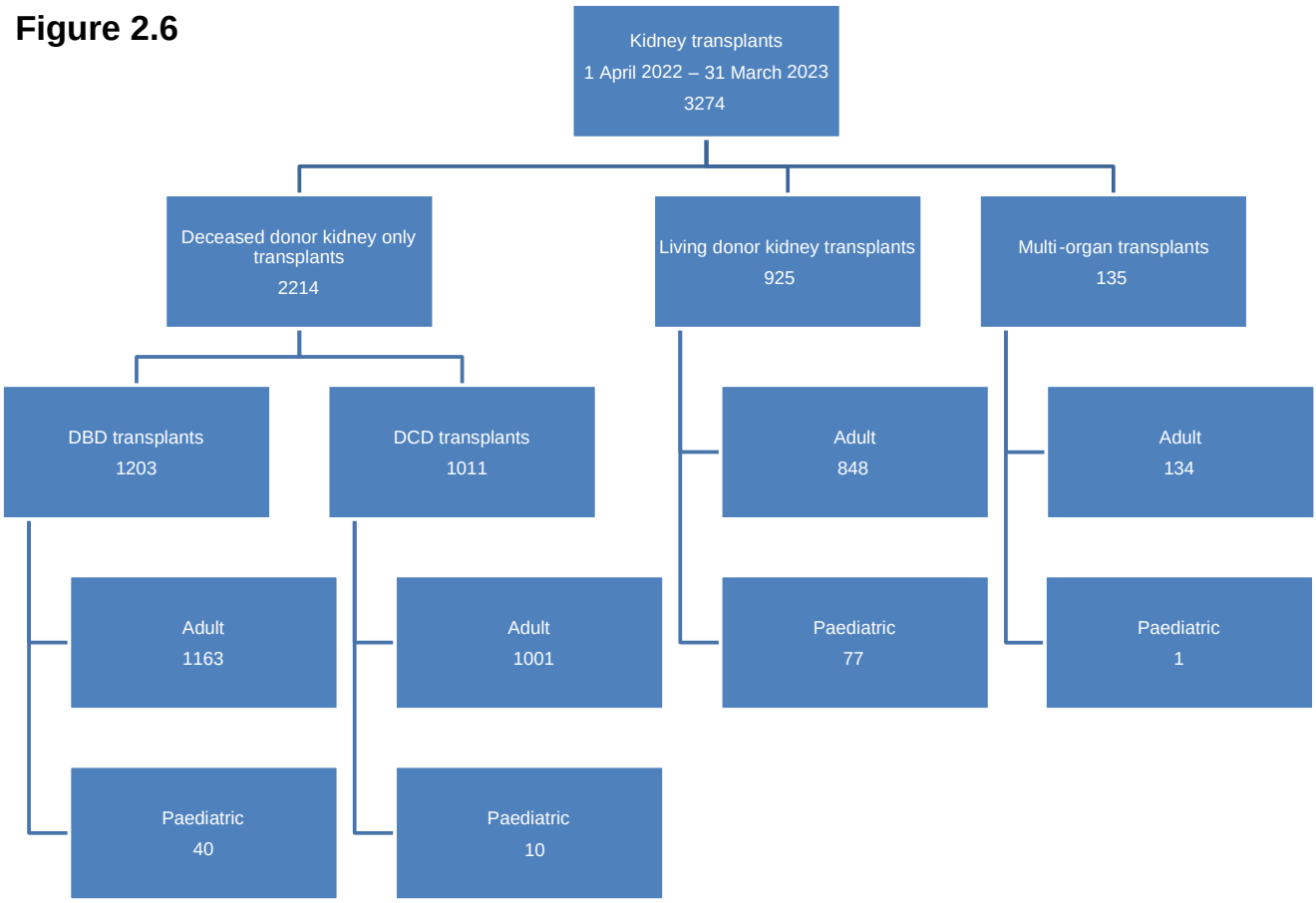


Figure 2.6 details the 3,274 kidney transplants performed in the UK between 1 April 2022 and 31 March 2023. Of these, 2,214 (68%) were deceased donor kidney only transplants and 925 (28%) were living donor kidney transplants. Of the 135 multi-organ transplants, 121 were simultaneous kidney and pancreas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

Figure 2.6



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 inevitable 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

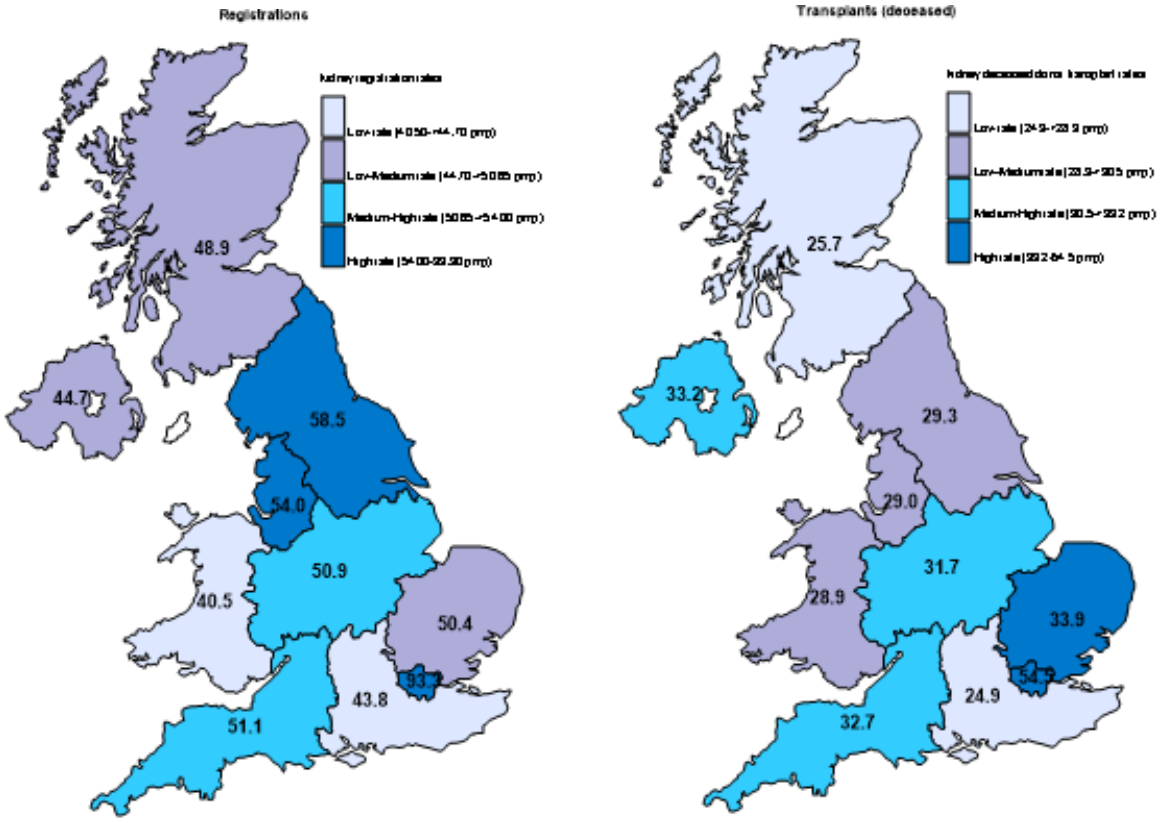


Figure 2.8 Living donor kidney transplant rates (pmp) by recipient country/NHS region of residence

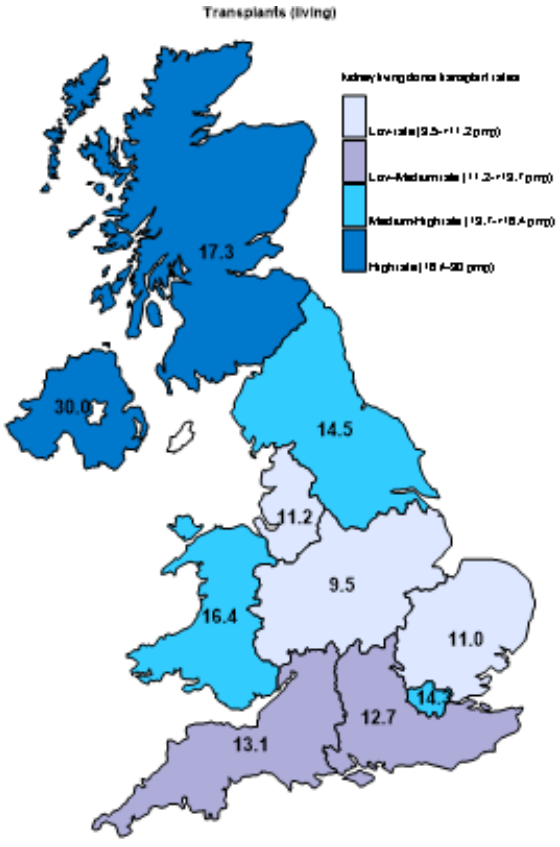


Table 2.2 Kidney registration and transplant rates per million population (pmp) in the UK, 1 April 2022 - 31 March 2023, by Country/NHS region

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 3.1 Adults on the kidney only transplant list at 31 March

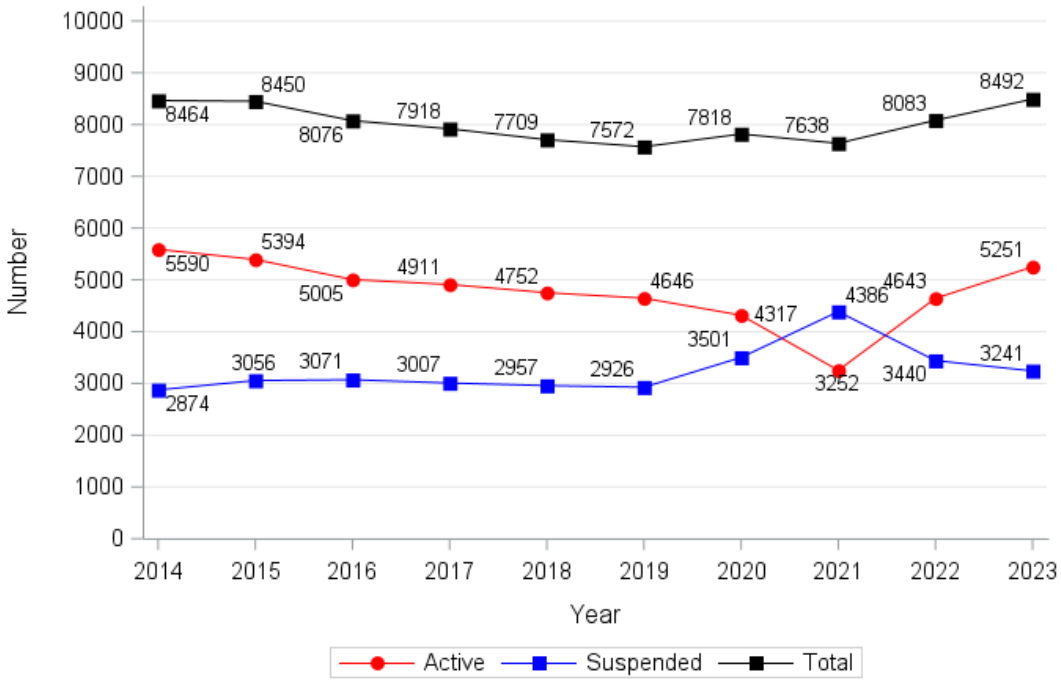


Figure 3.2 shows the number of adults on the active kidney only transplant list at 31 March 2023 by centre. In total, there were 5,251 adults active at this time. Manchester had the largest proportion of the transplant list (8%) and Belfast had the smallest (1%).

Figure 3.2 Adults on the active kidney only transplant list at 31 March 2023, by centre

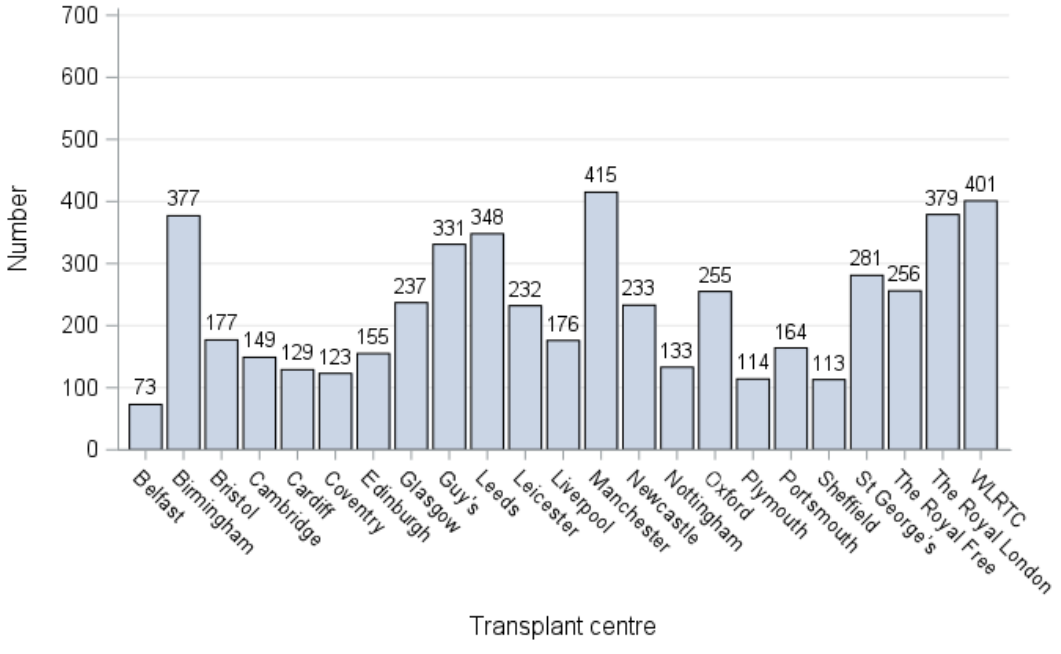


Figure 3.3 shows the number of adults on the suspended kidney only transplant list at 31 March 2023 by centre. In total, there were 3,241 adults suspended at this time. Manchester had the largest proportion of adults on the suspended transplant list (14%) and Plymouth had the smallest (1%).

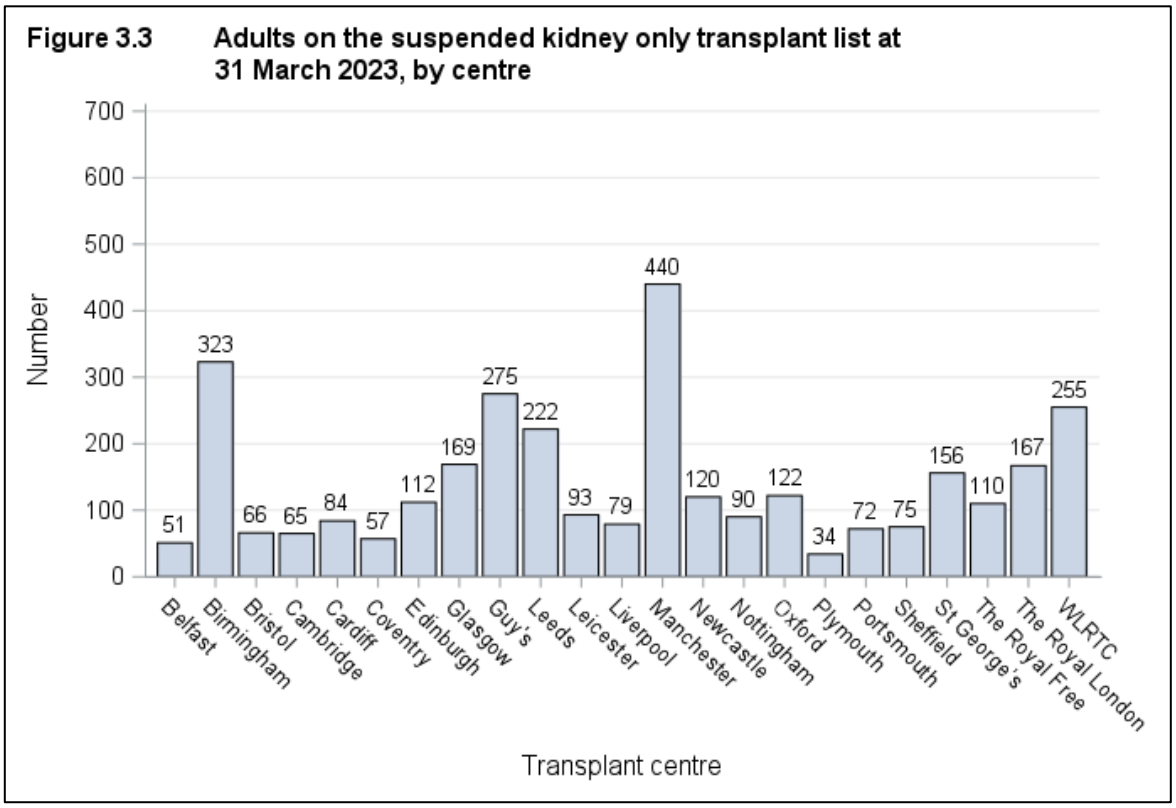
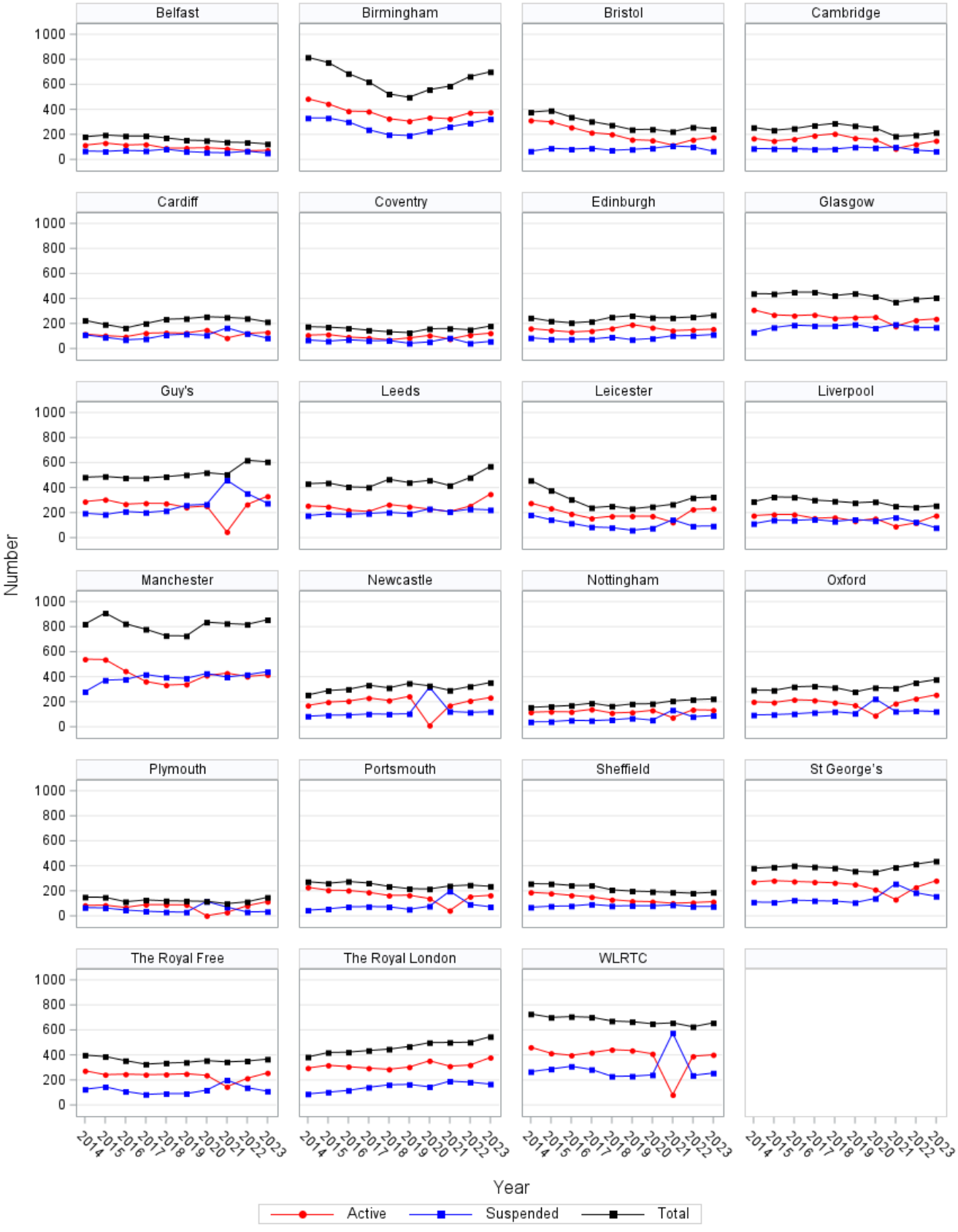


Figure 3.4 shows the number of adults on the transplant list at 31 March each year between 2014 and 2023 for each transplant centre.

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 3.5 Post-registration outcome for 3724 new adult kidney only registrations made in the UK, 1 April 2019 - 31 March 2020

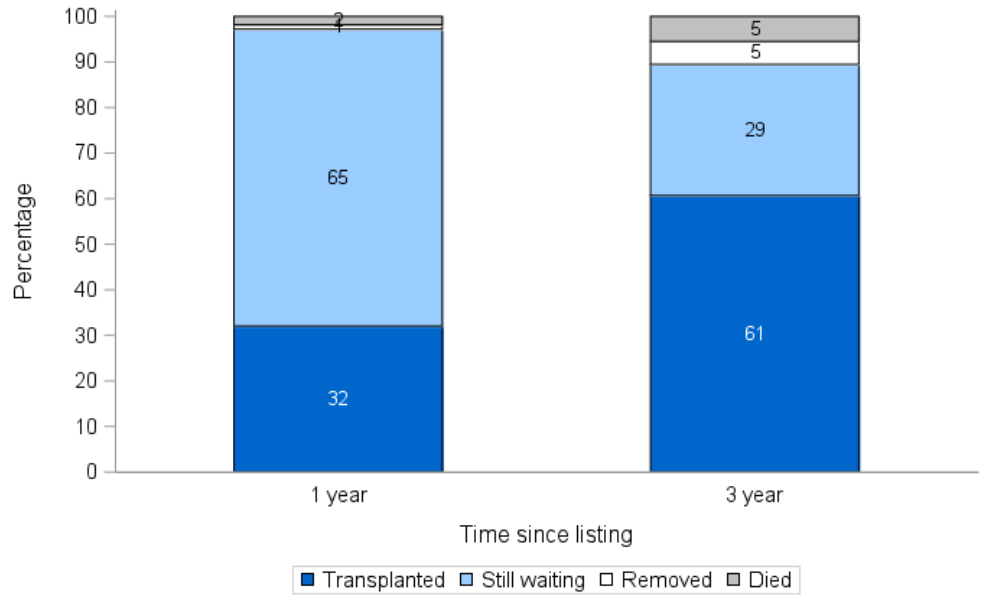
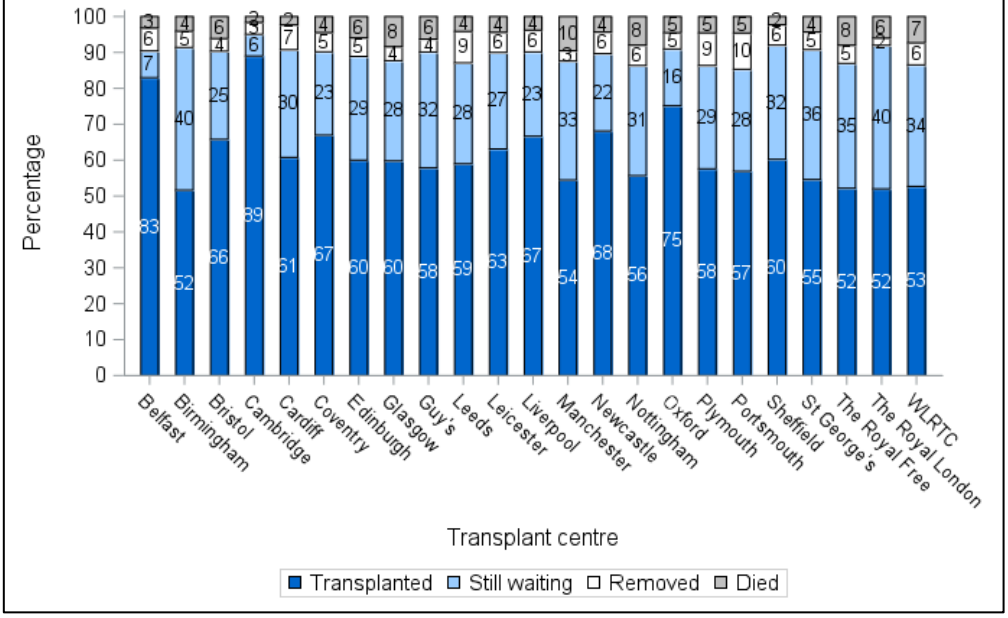


Figure 3.6 shows the proportion of patients transplanted or still waiting three years after joining the list by centre. The proportion of patients transplanted three years after listing at each centre ranges from 52% at Birmingham, Royal Free and Royal London to 89% at Cambridge.

Figure 3.6 Three-year post-registration outcome for 3724 new adult kidney only registrations made in the UK, 1 April 2019 - 31 March 2020, by centre



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

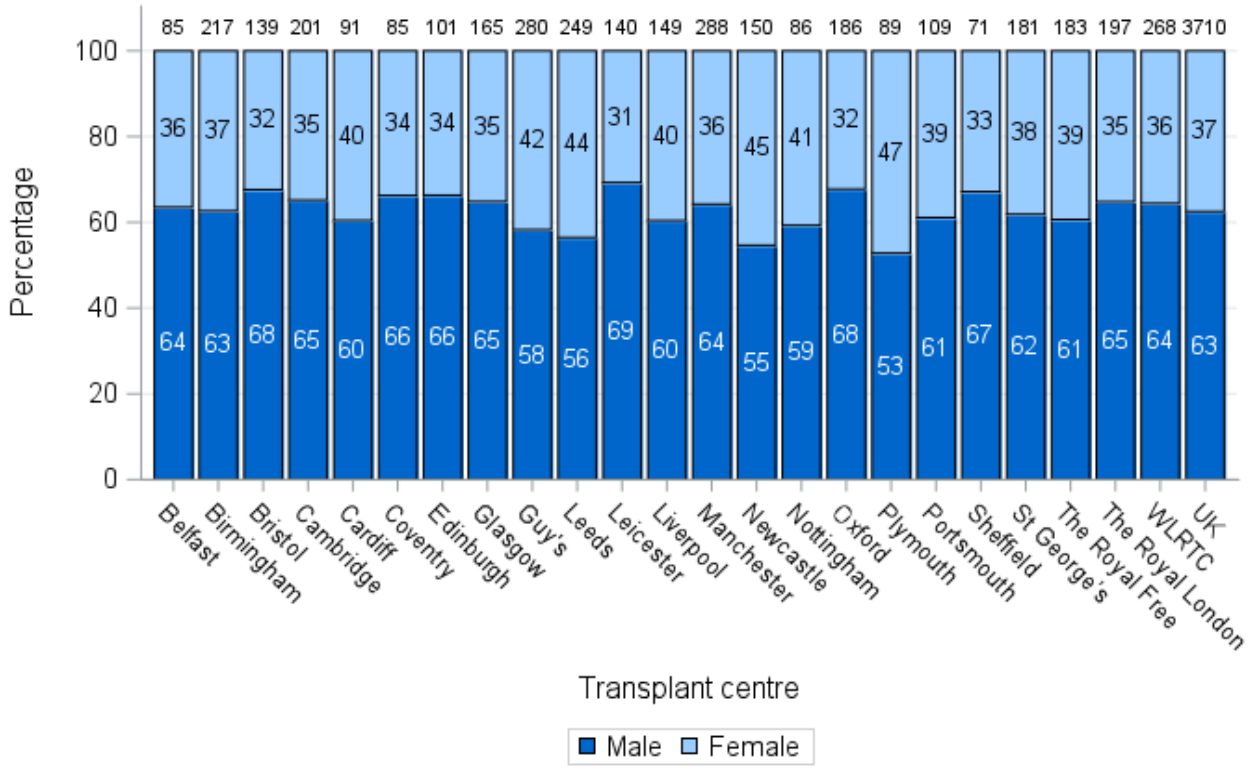


Figure 3.8 **Ethnicity of adult registrations on the active kidney only transplant list, 1 April 2022 and 31 March 2023, by centre**

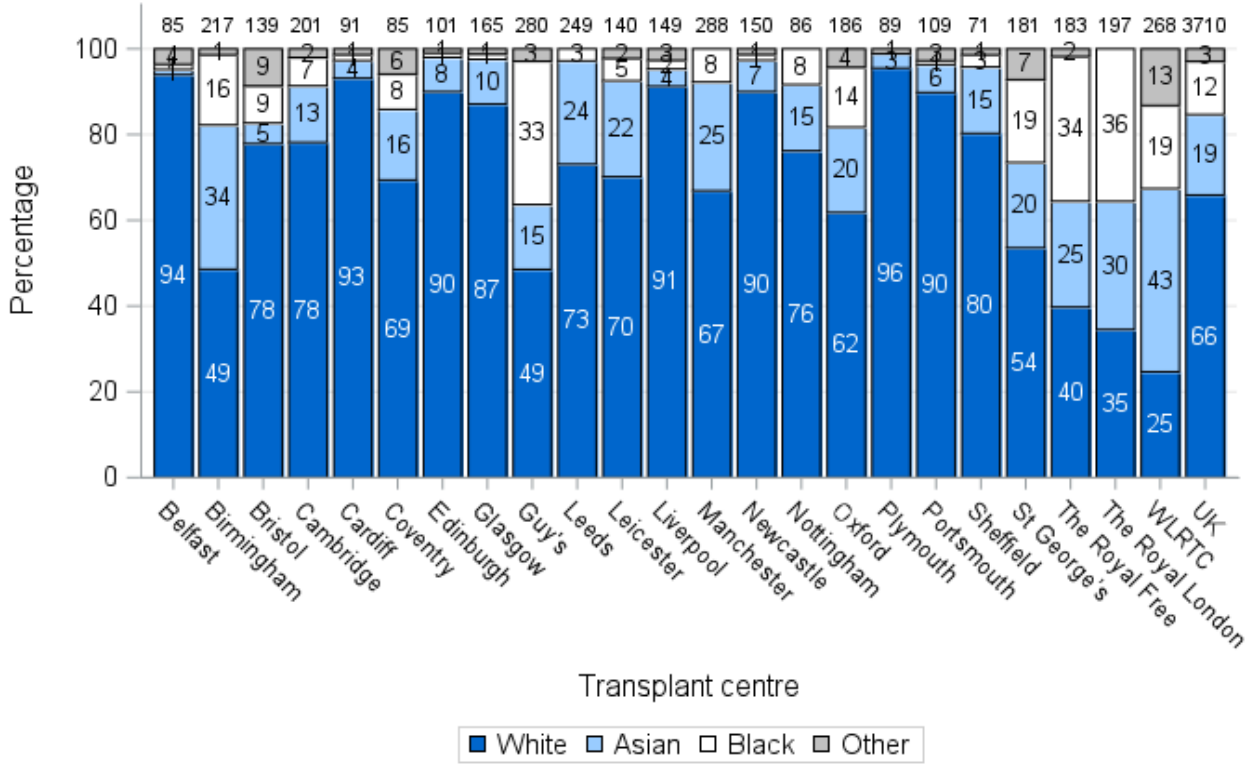


Figure 3.9 **Age of adult registrations on the active kidney only transplant list, 1 April 2022 and 31 March 2023, by centre**

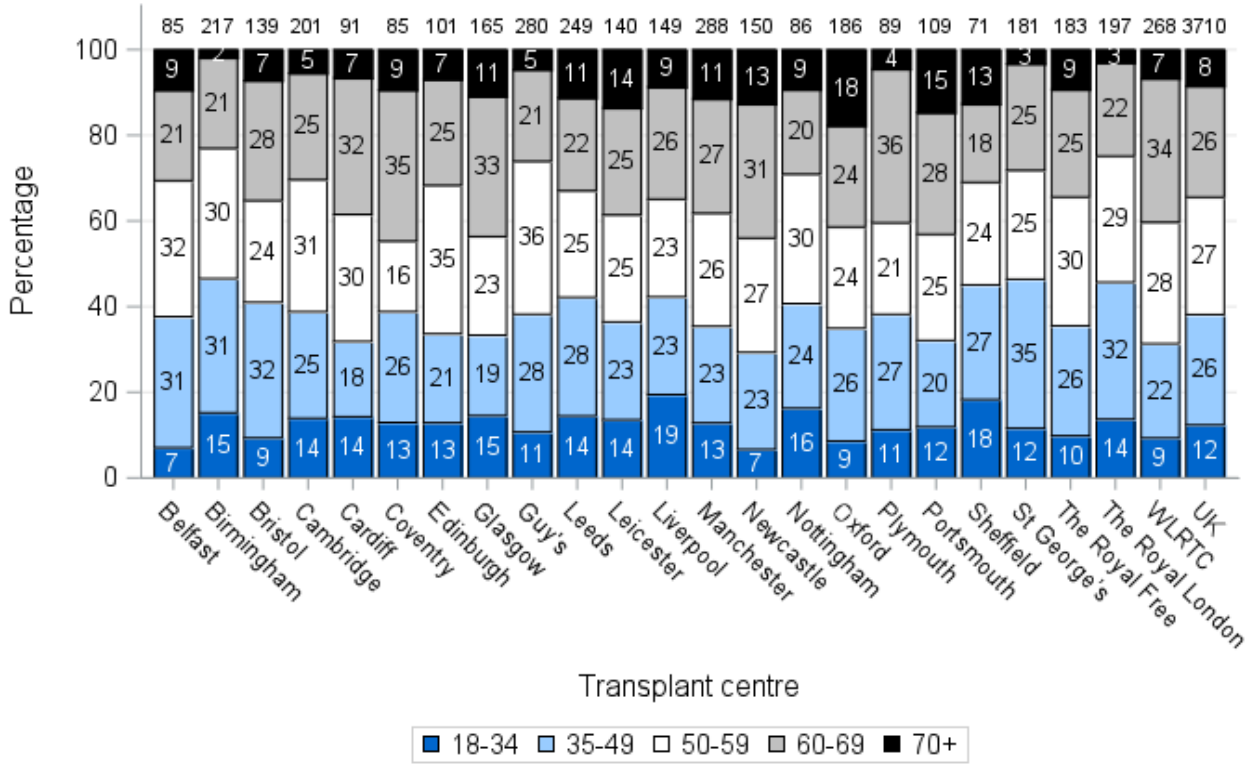


Figure 3.10 cRF of adult registrations on the active kidney only transplant list, 1 April 2022 and 31 March 2023, by centre

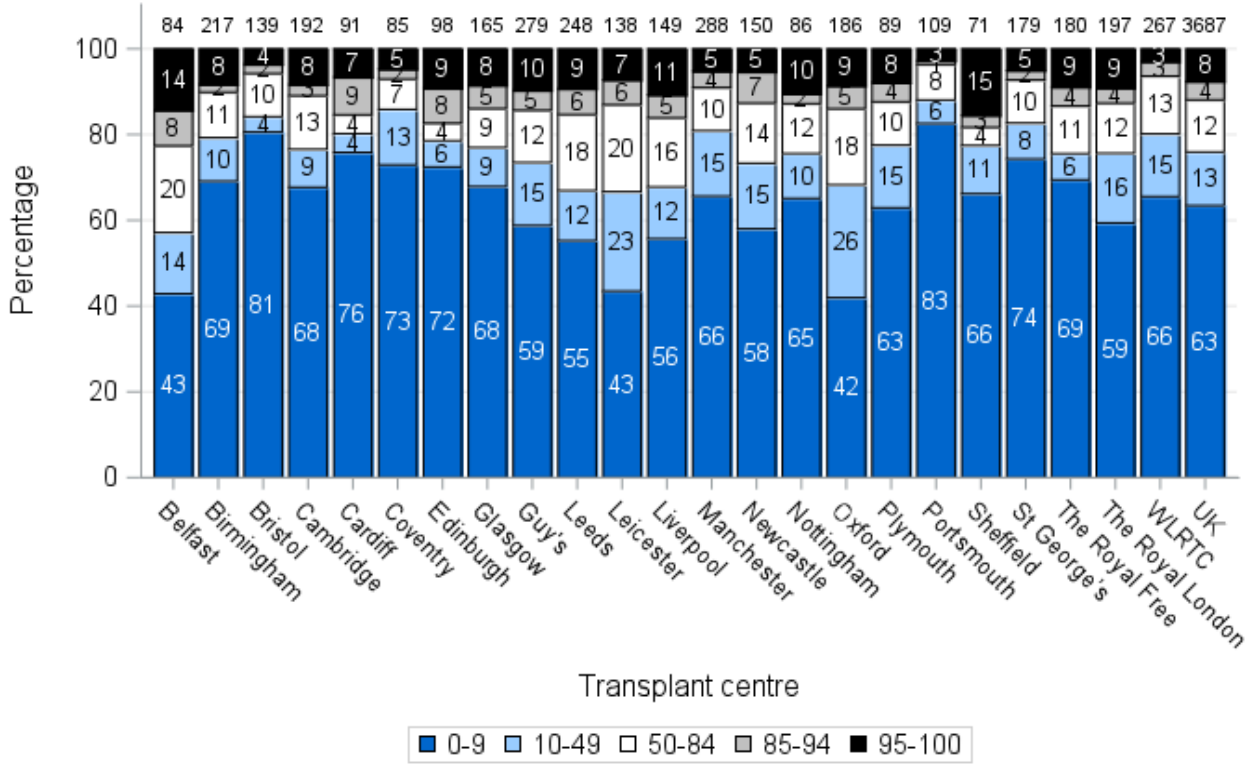
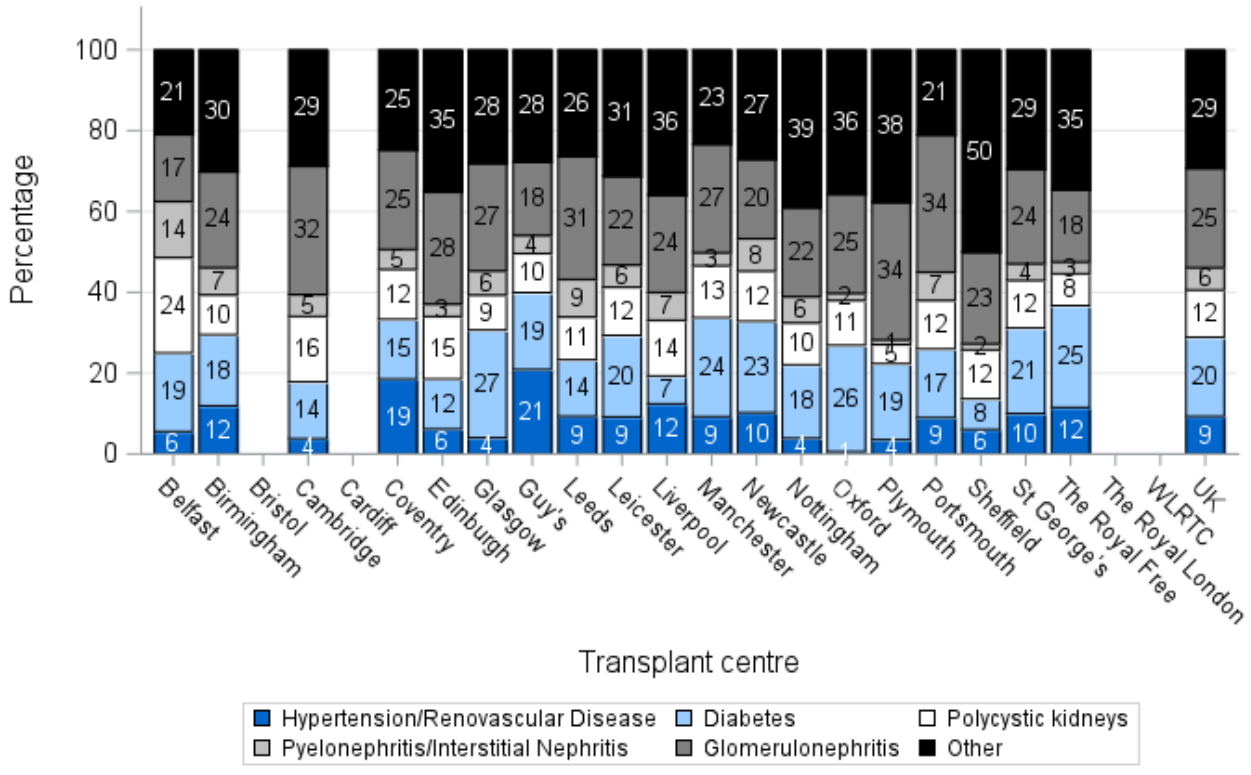


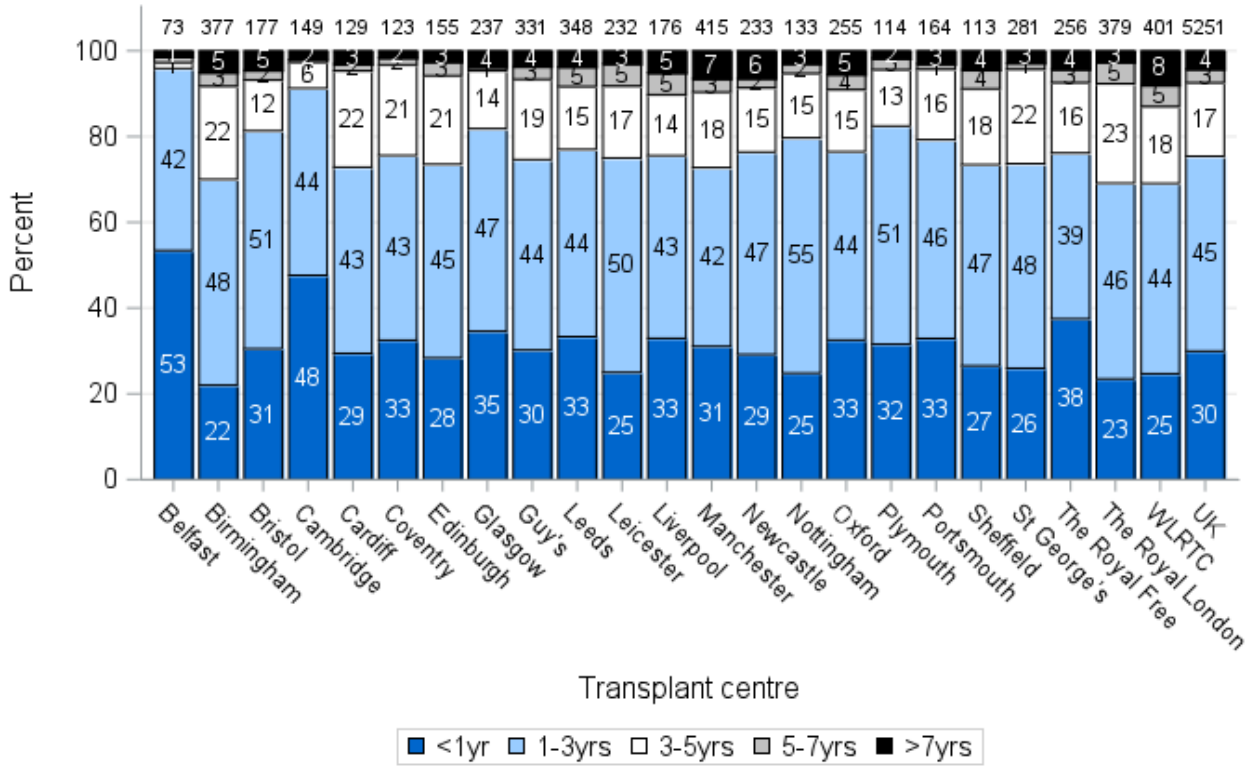
Figure 3.11 Primary renal disease of adult registrations on the active kidney only transplant list, 1 April 2022 and 31 March 2023, by centre



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.

Figure 3.12 Adults on the active kidney only transplant list as at 31 March 2023, by centre and waiting time



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 lime 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 3.13 Median waiting time to deceased donor transplant for adults registered on the kidney transplant list, 1 April 2017 - 31 March 2020

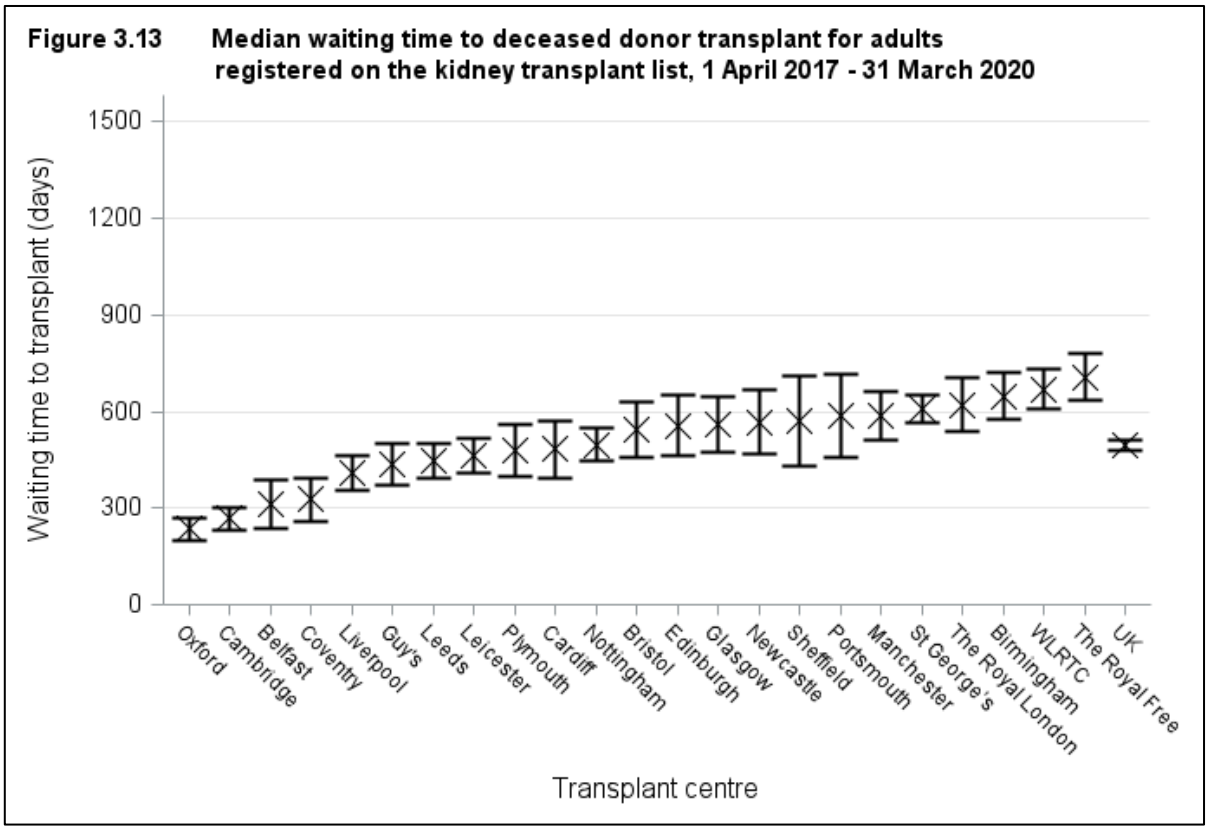


Figure 3.14 Adult risk-adjusted median waiting times for patients listed between 1 April 2017 and 31 March 2020

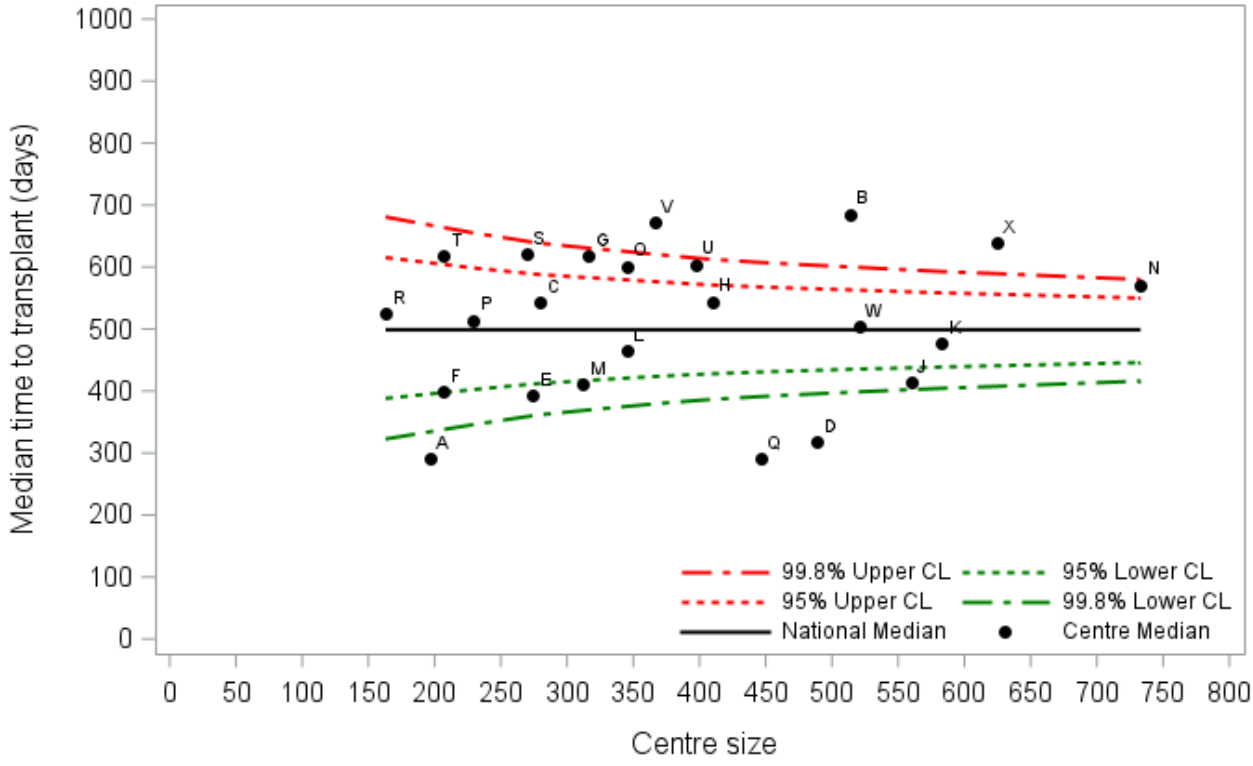


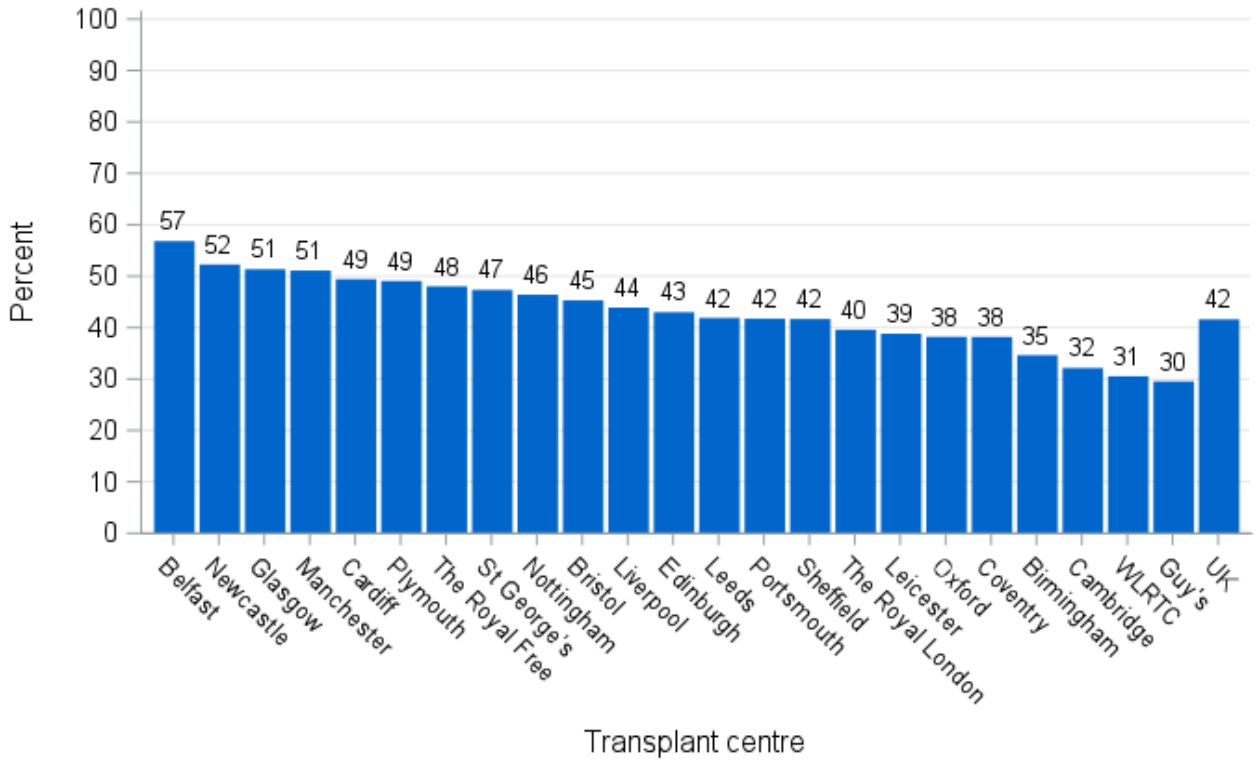
Table 3.1 Median waiting time to kidney only transplant in the UK, for adults registered 1 April 2017 - 31 March 2020

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.

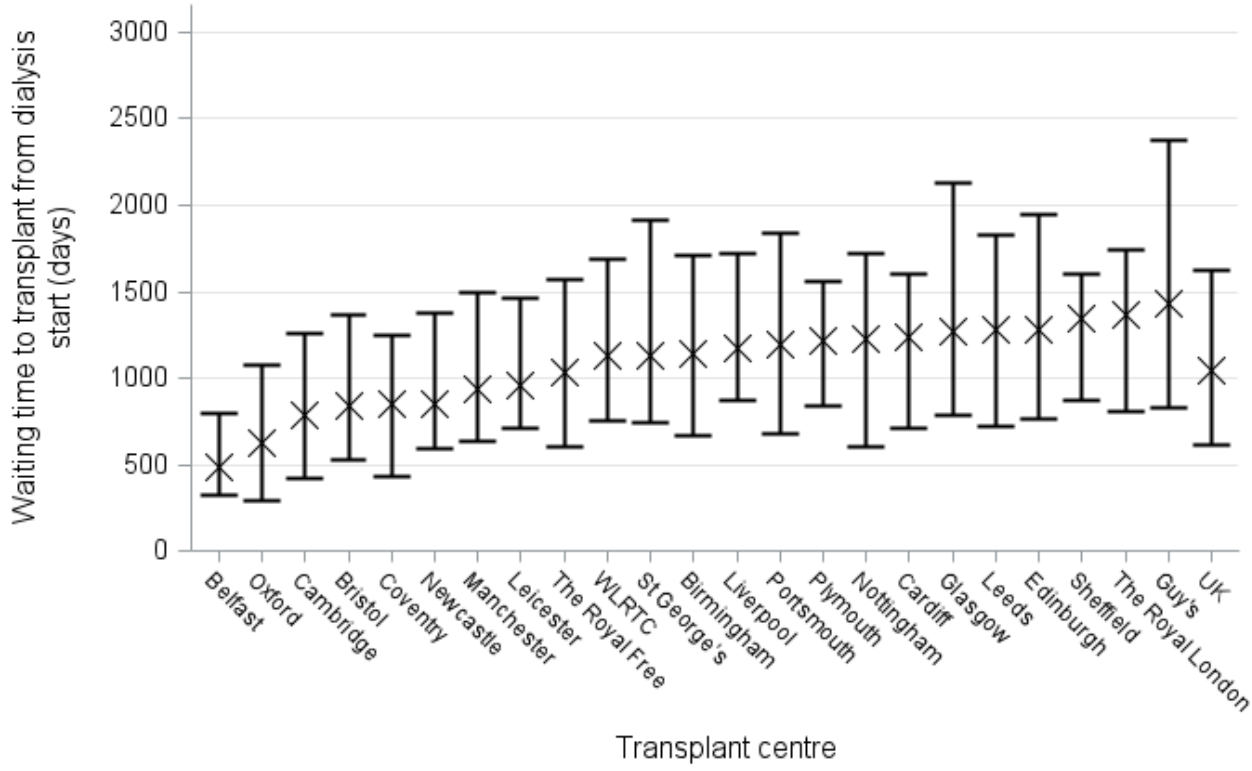
Figure 3.15 **Adult pre-emptive listing rates by centre, registrations between 1 April 2021 and 31 March 2022**



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.

Figure 3.16 Median days from dialysis start date to deceased donor transplant for adults transplanted, 1 April 2022 - 31 March 2023



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.

RRI = exp { 0 x (recipient age≤25)-75) +
0.016 x ((recipient age>25)-75) +
0.361 x (recipient on dialysis at registration) +
0.033 x ([waiting time from dialysis-950]/365.25) +
0.252 x (Diabetic recipient) }

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 µmol/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 on offer decline rate that is higher than the national rate, while centres positioned below the lower limits indicates on 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**.

Figure 4.1 **Adult standard criteria DBD donor kidney offer decline rates for kidneys that resulted in a transplant, 1 April 2020 and 31 March 2023**

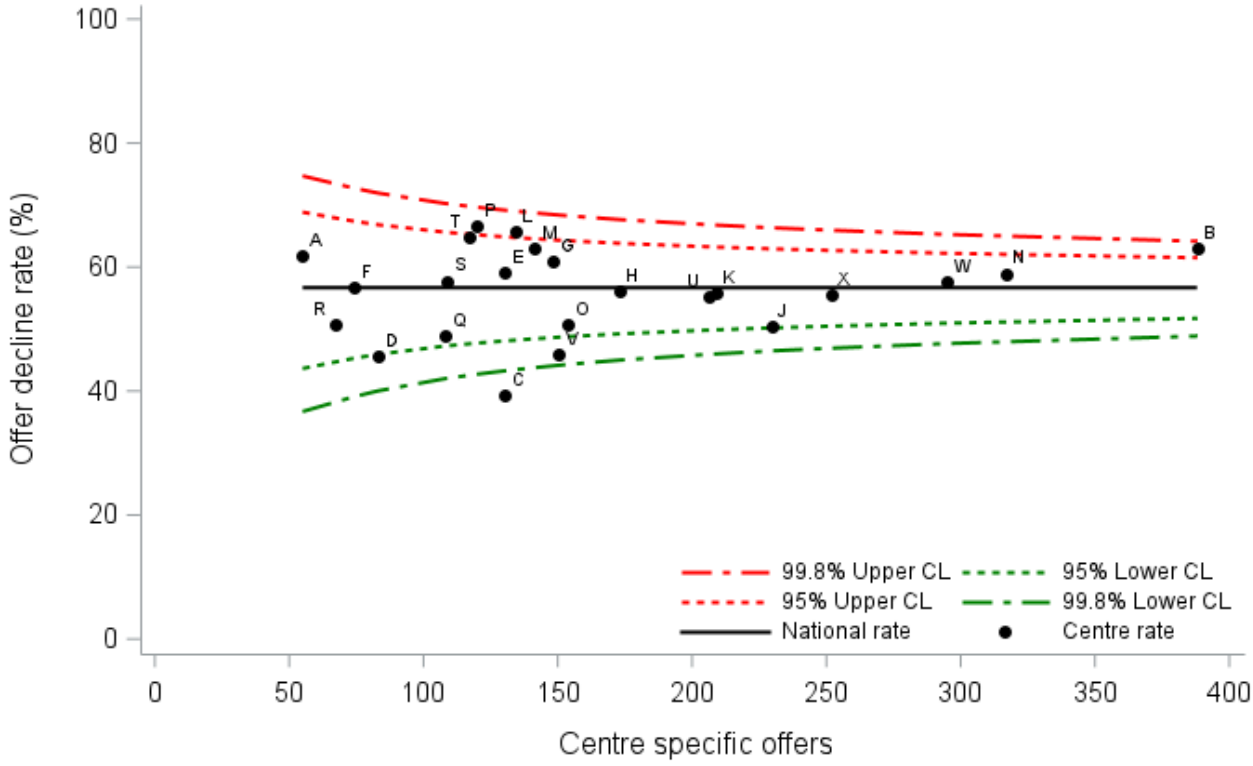


Table 4.1 compares individual centre offer decline rates for SCD over time by financial year.

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**.

Figure 4.2 **Adult extended criteria DBD donor kidney offer decline rates for kidneys that resulted in a transplant, 1 April 2020 and 31 March 2023**

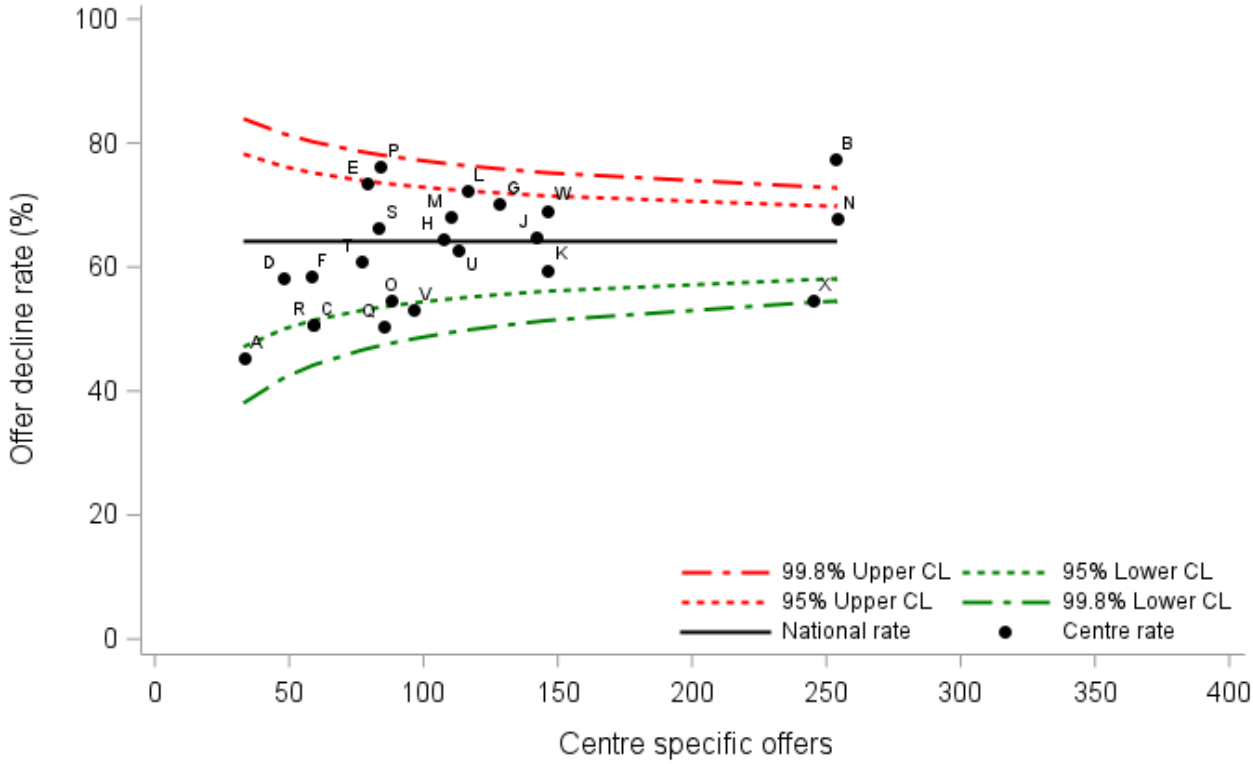


Table 4.2 compares individual centre offer decline rates for ECD over time by financial year.

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**.

Figure 4.3 **Adult standard criteria DCD donor kidney offer decline rates for kidneys that resulted in a transplant, 1 April 2020 and 31 March 2023**

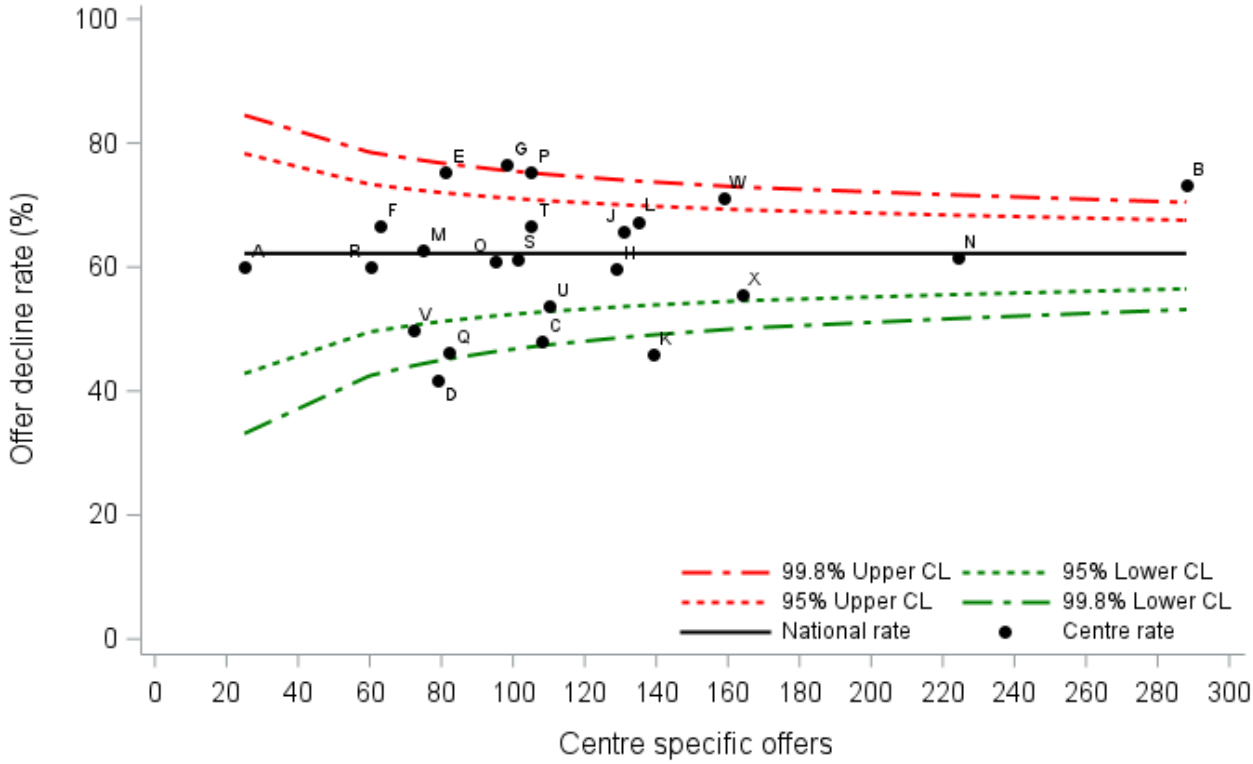


Table 4.3 compares individual centre offer decline rates for SCD over time by financial year.

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.

Figure 4.4 Local reallocation of DBD donor kidneys following an acceptance of an adult offer through the national allocation scheme

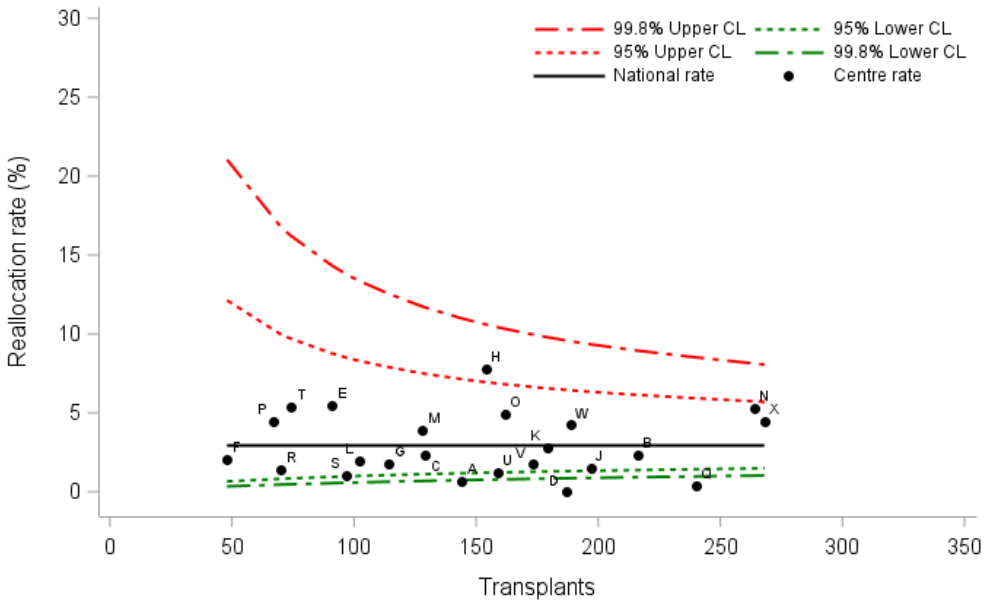


Table 4.4 compares individual reallocation rates over time by financial year.

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 5.1 Adult kidney only transplants, 1 April 2013 - 31 March 2023

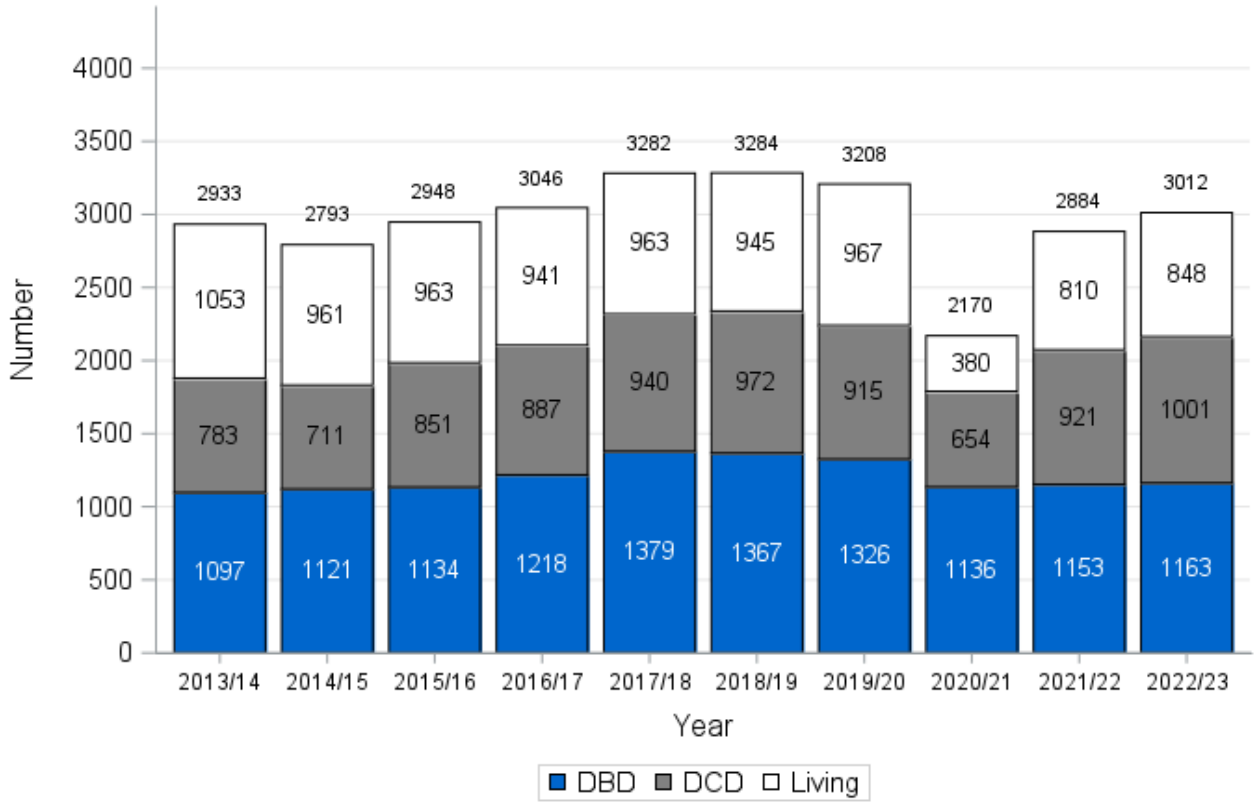
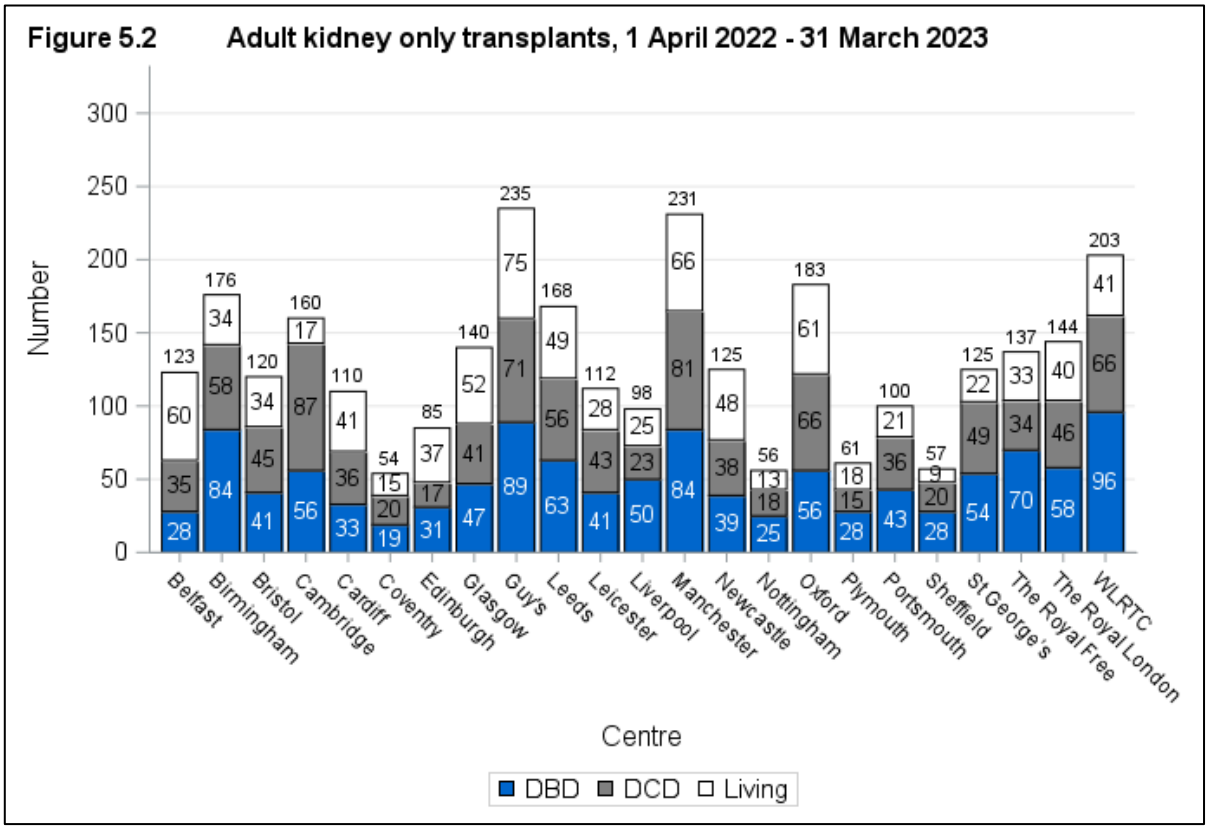


Figure 5.2 shows the total number of adult kidney only transplants performed in 2022/23, by centre and type of donor. The same information is presented in **Figure 5.3,** but this shows the proportion of DBD, DCD and living donor transplants performed at each centre.



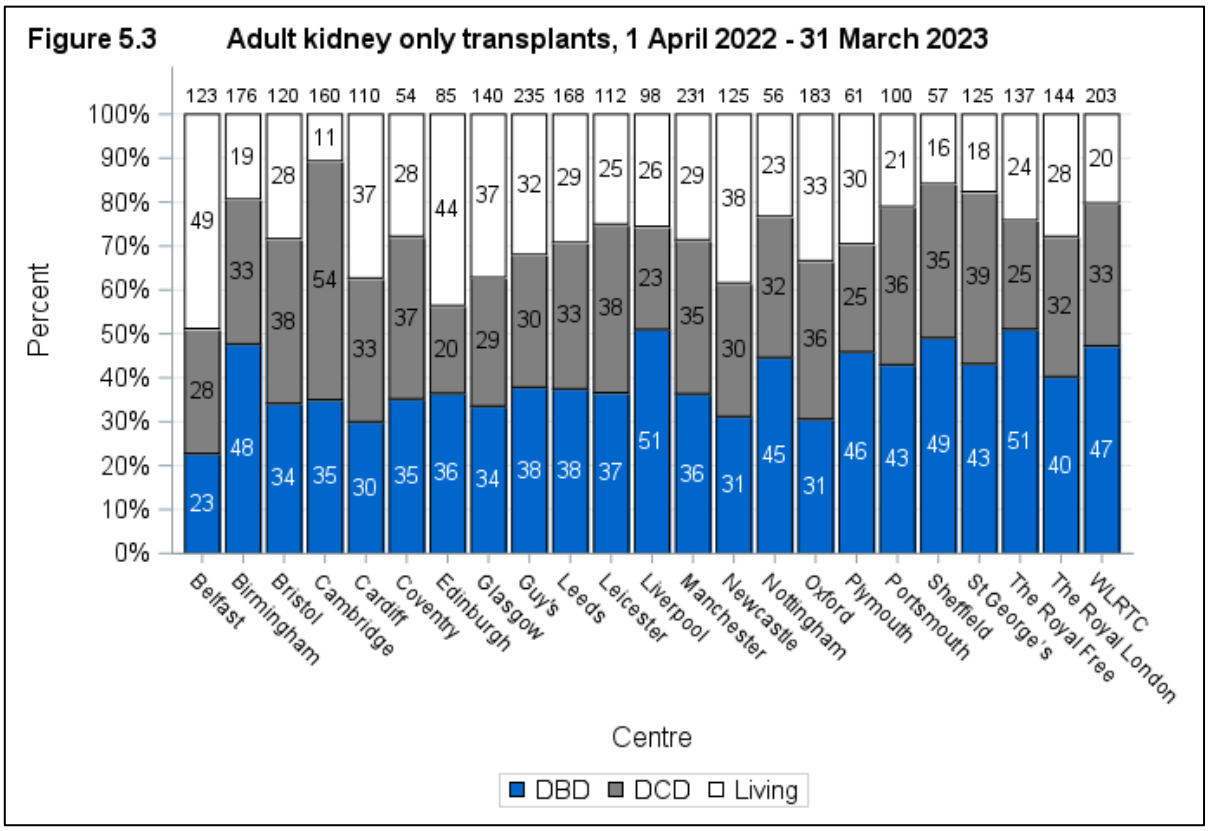
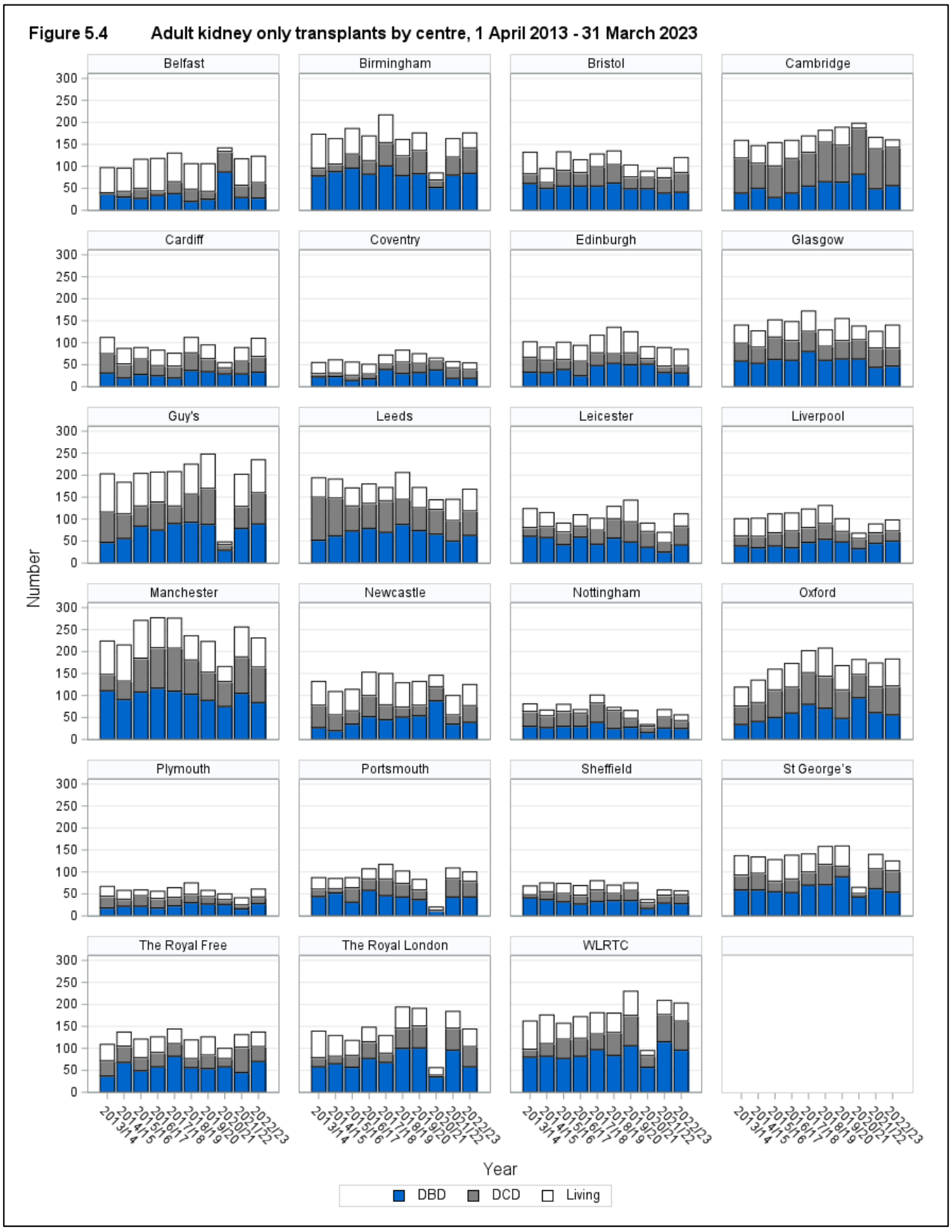


Figure 5.4 shows the total number of adult kidney only transplants performed in last ten years, by centre and type of donor.



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

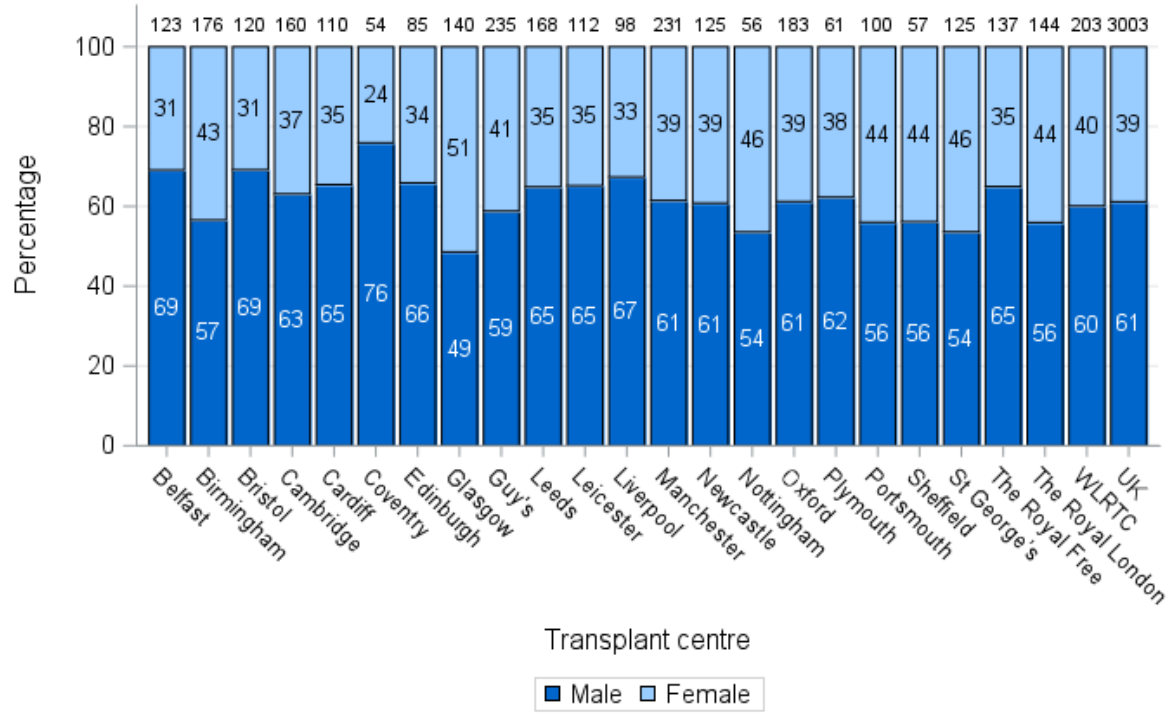


Figure 5.6 Ethnicity of adult kidney only transplant recipients, 1 April 2022 and 31 March 2023, by centre

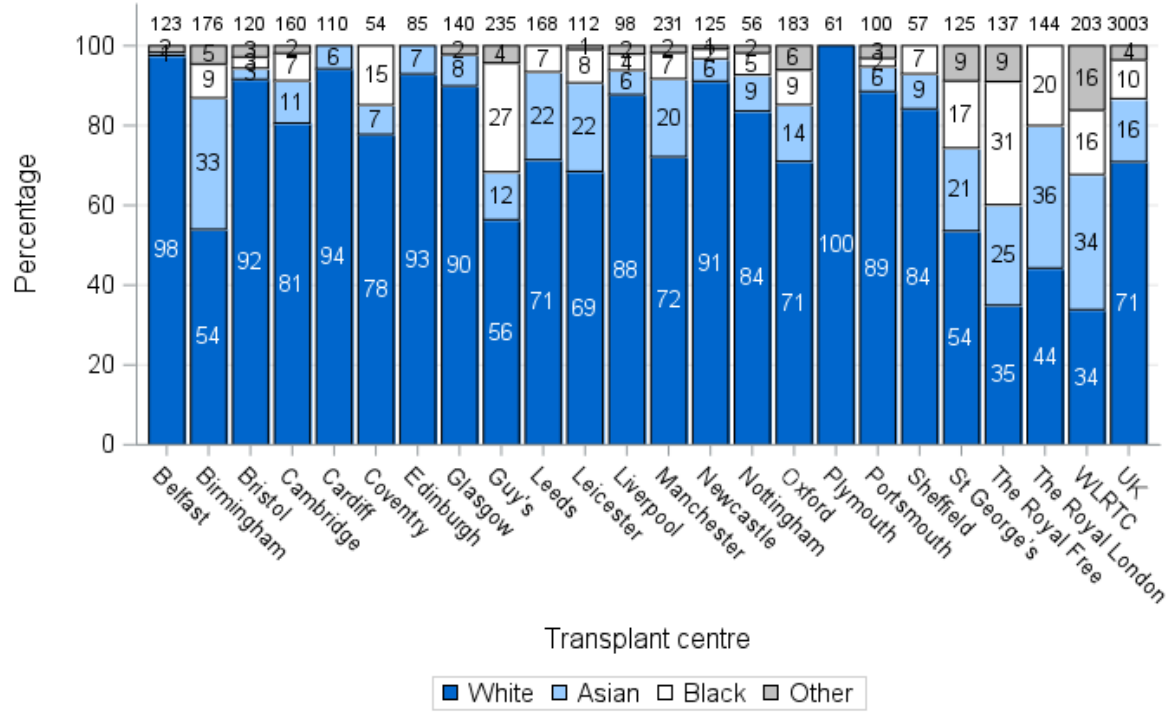
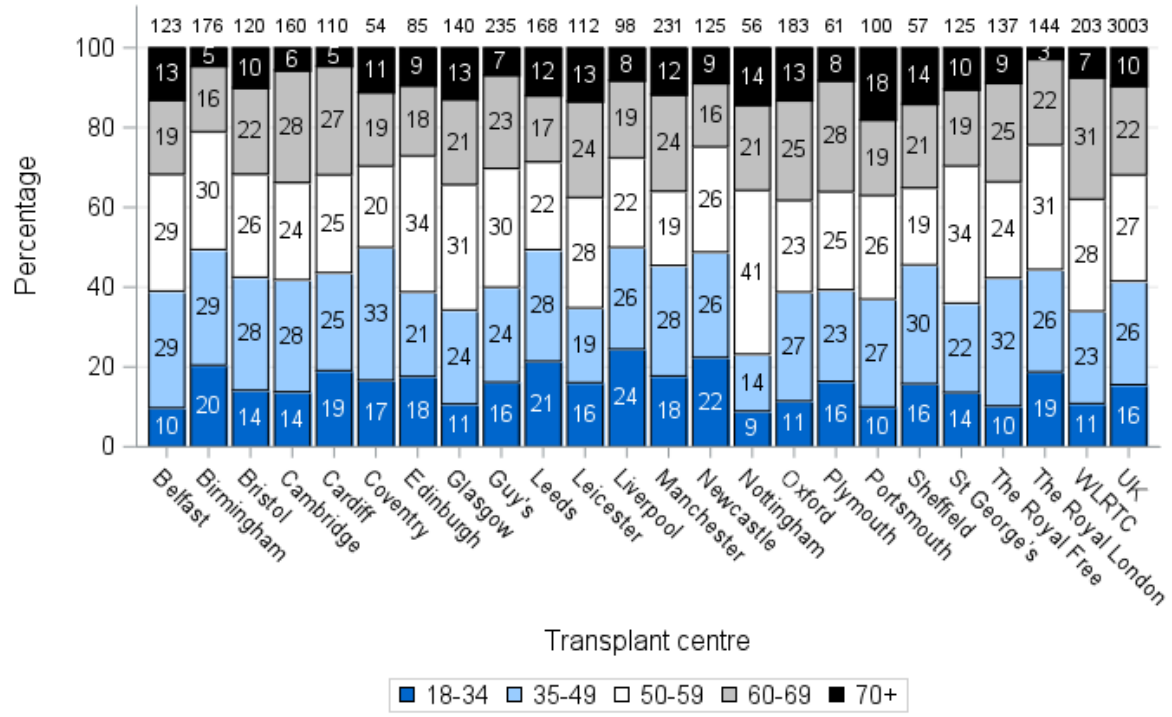


Figure 5.7 **Age of adult kidney only transplant recipients, 1 April 2022 and 31 March 2023, by centre**



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.

Figure 5.8 **Adult deceased donor pre-emptive transplant rates by centre, 1 April 2022 - 31 March 2023**

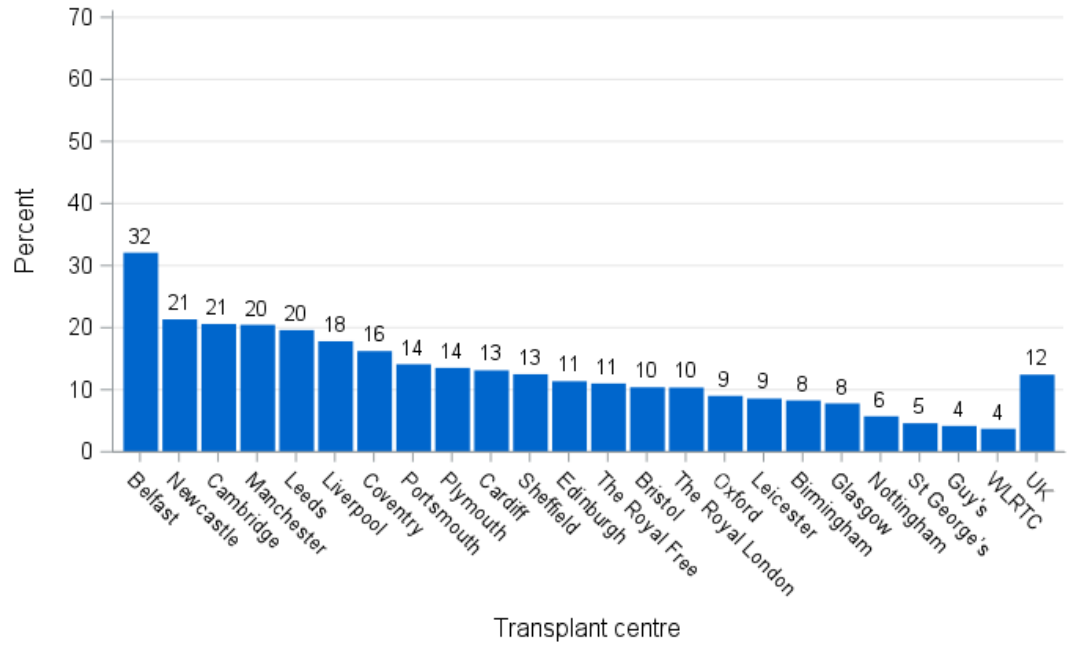
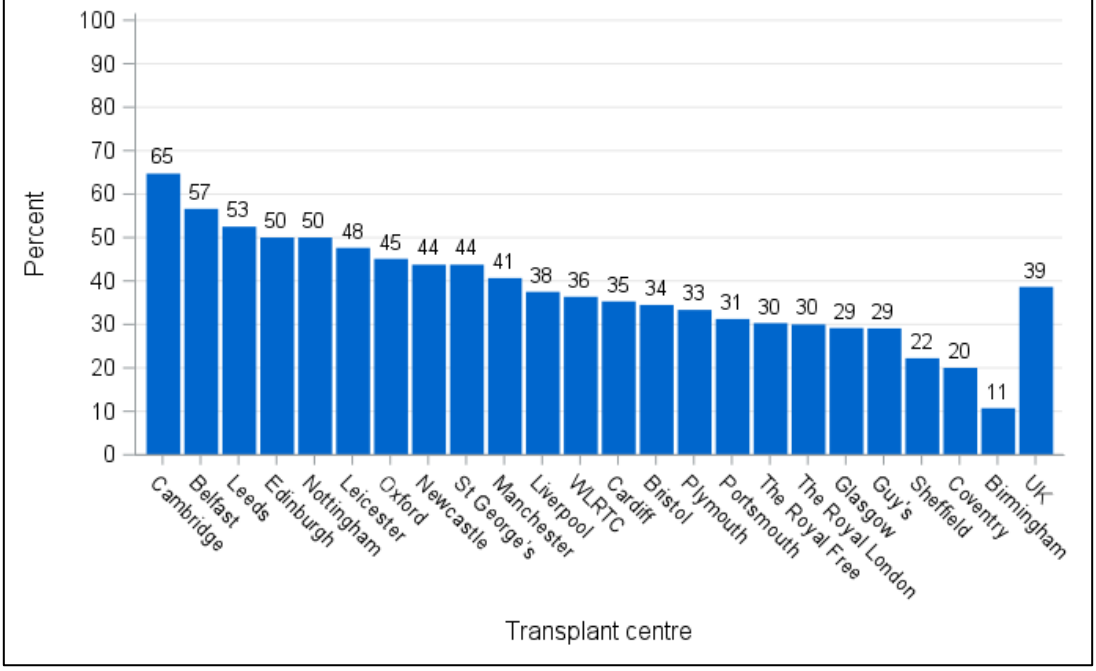


Figure 5.9 **Adult living donor pre-emptive transplant rates by centre, 1 April 2022 - 31 March 2023**



5.4 Kidney donor risk-index[1]

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:

UKKDRI = exp{-0.245 x (donor age <40) +
0.396 x (donor age ≥60) +
0.265 x (history of hypertension) +
0.0253 x [donor weight(kg)-75]/10) +
0.00461 x (days in hospital) +
0.0465 x (adrenaline)}

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.

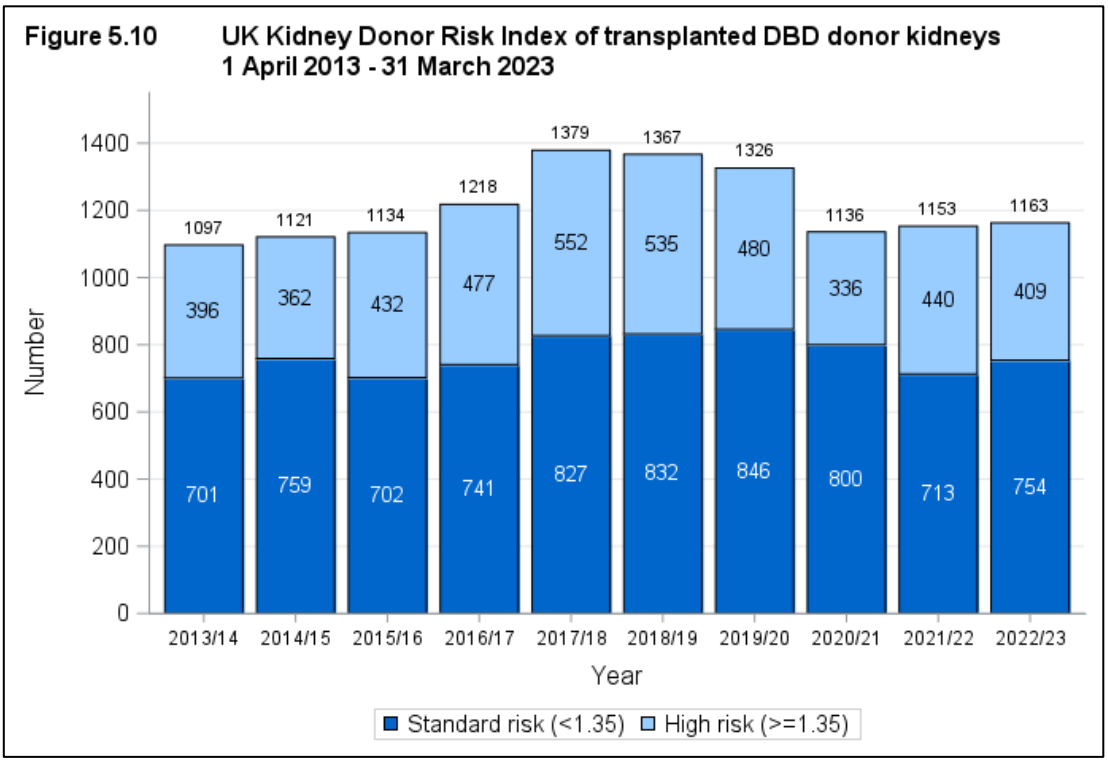


Figure 5.11 shows the number of transplanted DBD donor kidneys in 2022/23 by kidney donor risk index group for each transplant centre. The same information is presented in **Figure 5.12** but this shows the proportion of standard risk and high risk donor transplants performed at each centre.

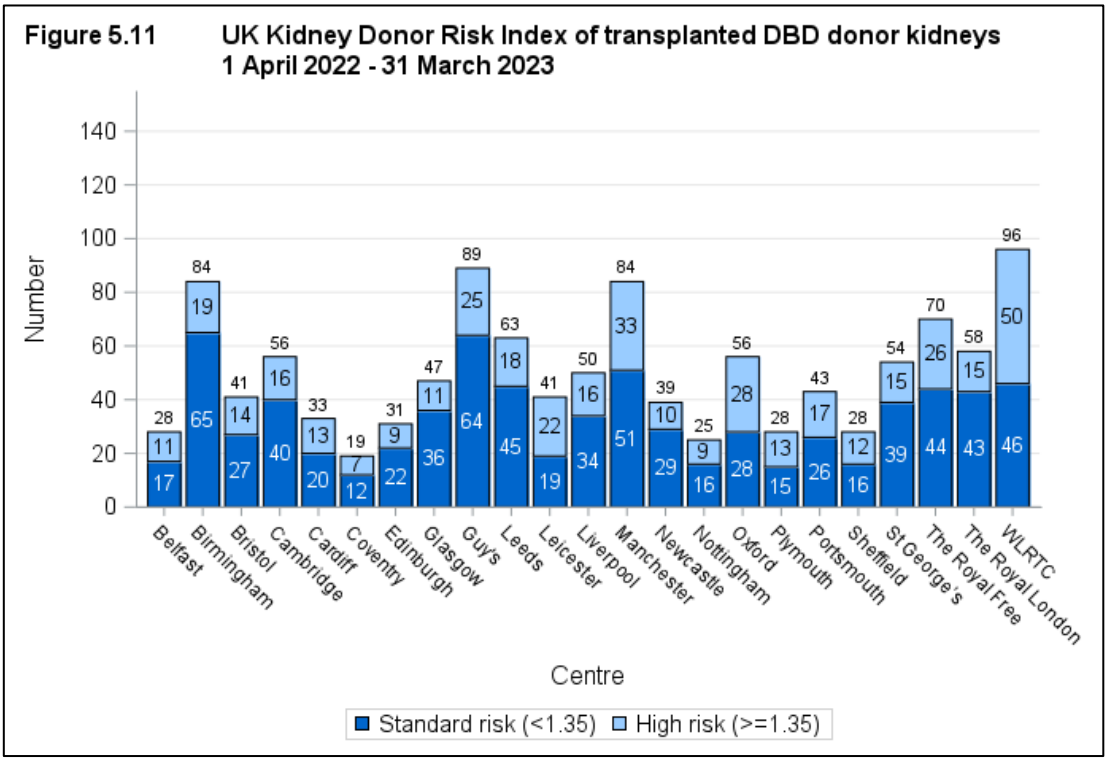


Figure 5.12 UK Kidney Donor Risk Index of transplanted DBD donor kidneys 1 April 2022 - 31 March 2023

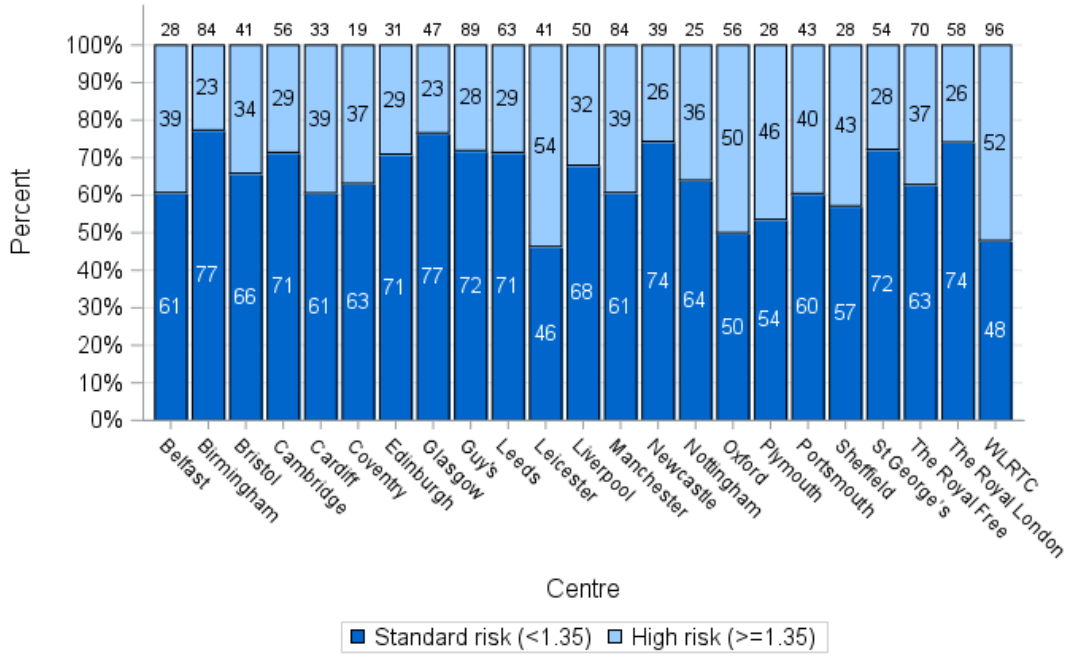


Figure 5.13 shows the number of transplanted DBD donor kidneys in the last ten years by kidney donor risk index group for each transplant centre.

Figure 5.13 **UK Kidney Donor Risk Index of transplanted DBD donor kidneys by centre, 1 April 2013 - 31 March 2023**

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.

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

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.

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

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.	Recipient Risk Group				Avg.
	D1	D2	D3	D4	DRI	R1	R2	R3	R4	RRI
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.

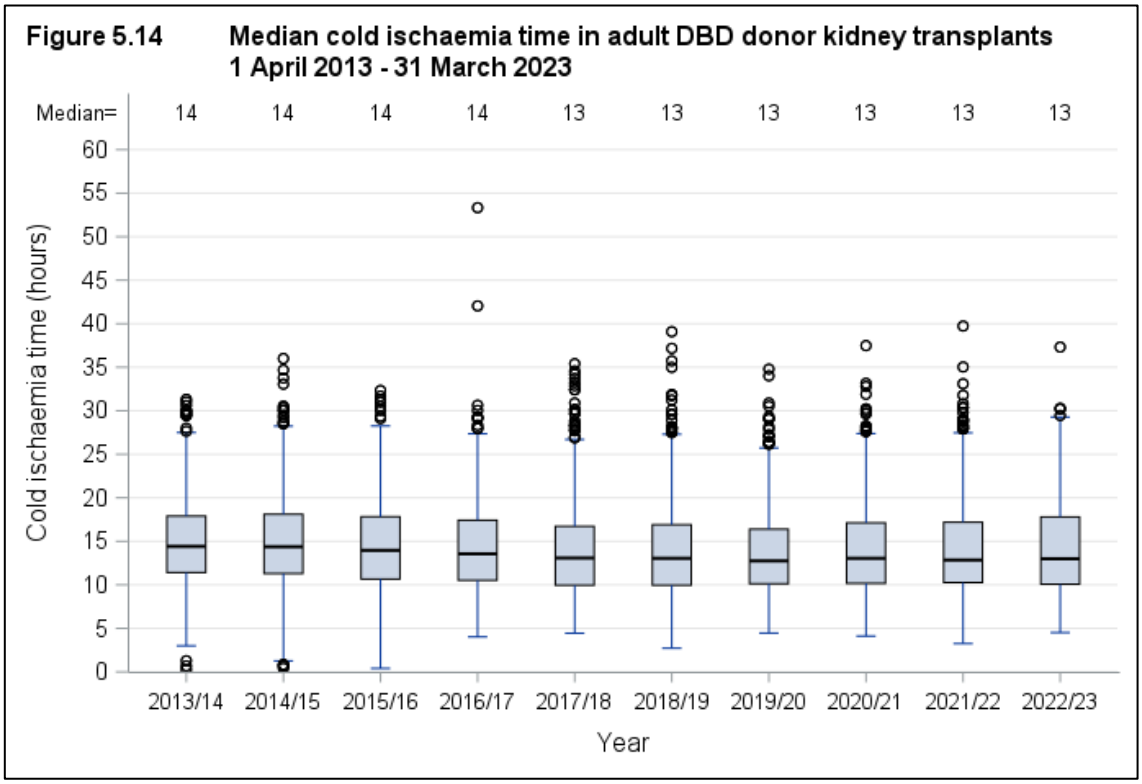


Figure 5.15 shows the median total cold ischaemia time in adult DBD donor kidney only transplants in 2022/23 for each transplant centre. Manchester had the longest median cold ischaemia time, 20 hours in 2022/23 compared with Nottingham who had the shortest, 9 hours.

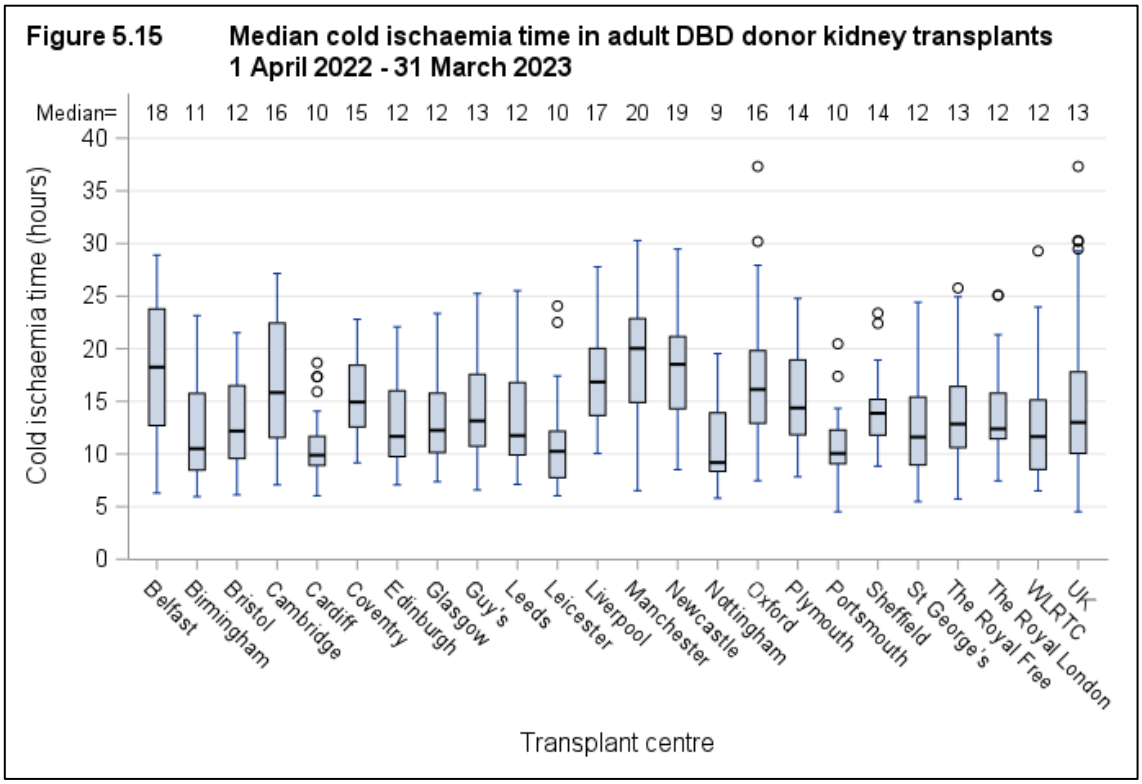


Figure 5.16 shows the median total cold ischaemia time in adult DBD donor kidney only transplants over the last ten years for each transplant centre.

Figure 5.16 **Median cold ischaemia time in adult DBD donor kidney transplants, 1 April 2013 - 31 March 2023**

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.

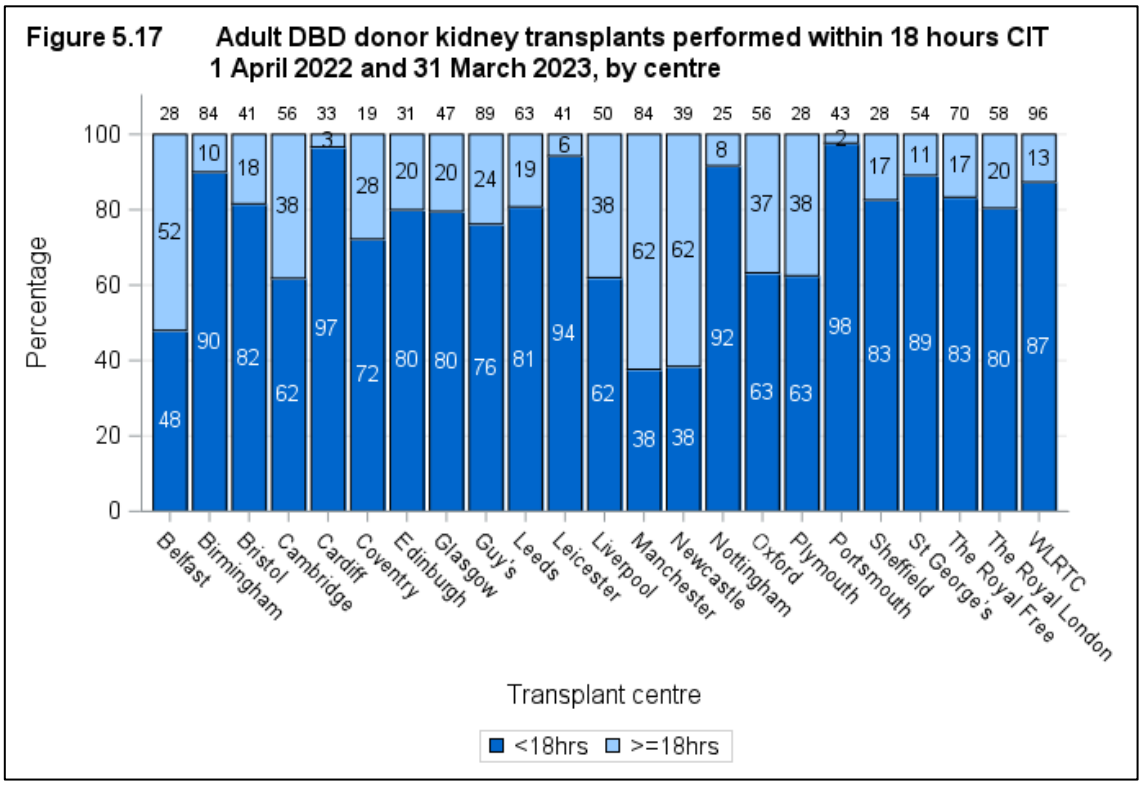


Figure 5.18 shows the median total cold ischaemia time in adult DCD donor kidney only transplants over the last 10 years. The median total ischaemia time has remained almost unchanged over the last 10 years.

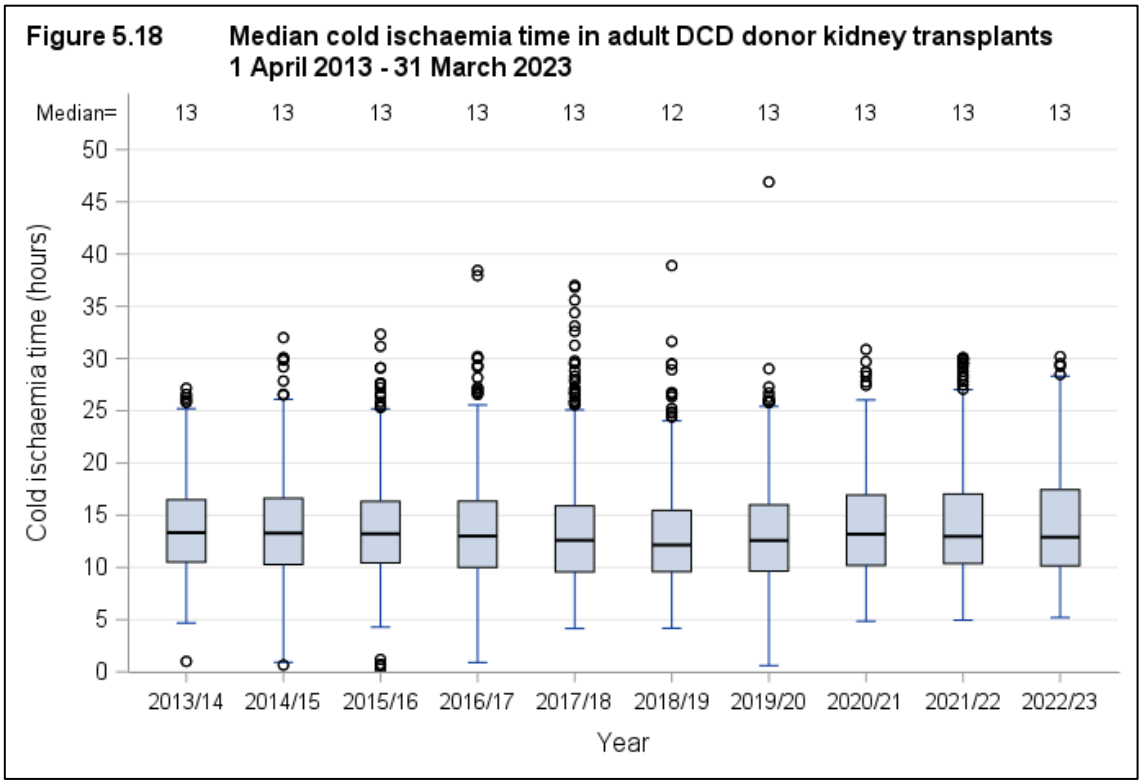


Figure 5.19 shows the median total cold ischaemia time in adult DCD donor kidney only transplants in 2022/23 for each transplant centre. Manchester had the longest median cold ischaemia time, 20 hours in 2022/23 compared with Leicester who had the shortest, 8 hours.

Figure 5.19 Median cold ischaemia time in adult DCD donor kidney transplants 1 April 2022 - 31 March 2023

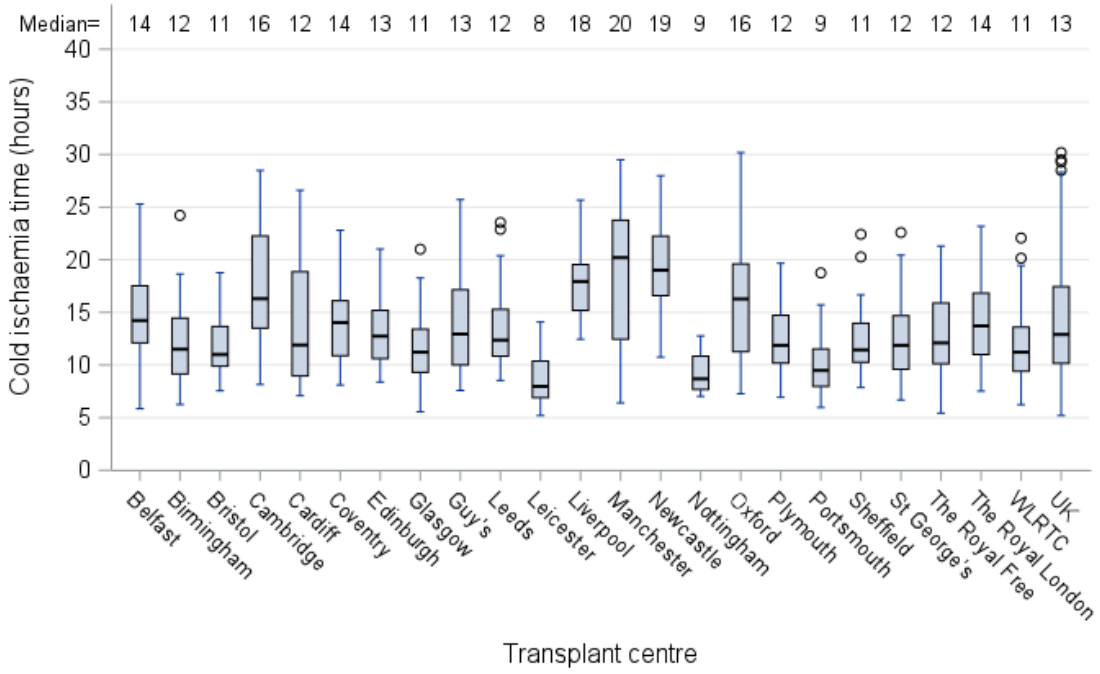


Figure 5.20 shows the median total cold ischaemia time in adult DCD donor kidney only transplants over the last ten years for each transplant centre.

Figure 5.20 Median cold ischaemia time in adult DCD donor kidney transplants, 1 April 2013 - 31 March 2023

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.

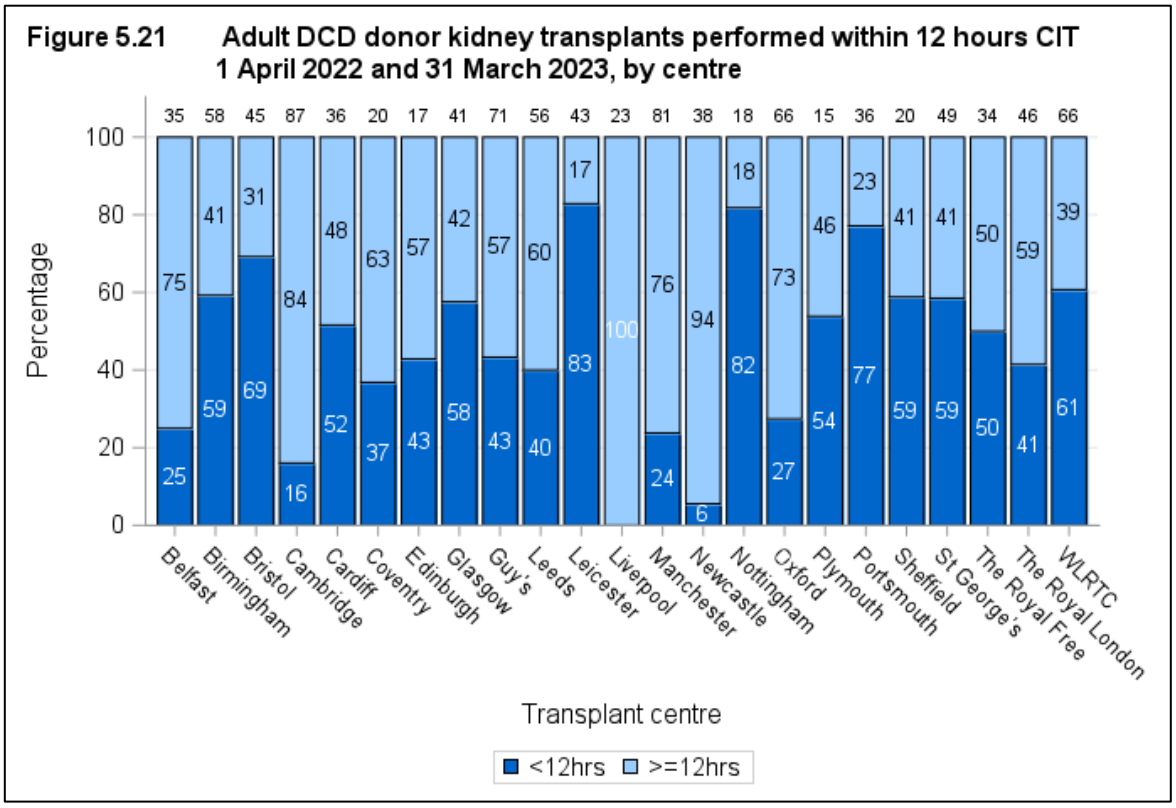


Figure 5.22 shows the median total cold ischaemia time in adult living donor kidney transplants over the last 10 years. The median total cold ischaemia time has increased marginally over the last ten years.

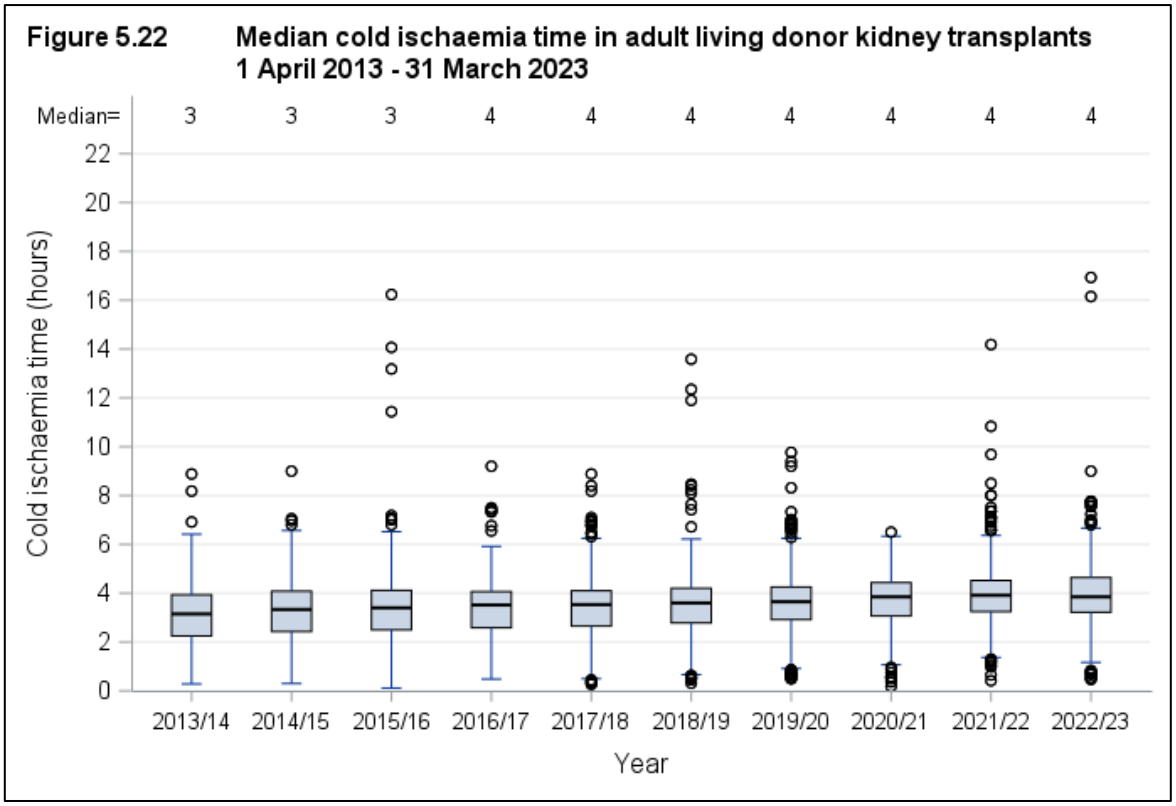


Figure 5.23 shows the median total cold ischaemia time in adult living donor kidney transplants in 2022/23 for each transplant centre.

Figure 5.23 Median cold ischaemia time in adult living donor kidney transplants 1 April 2022 - 31 March 2023

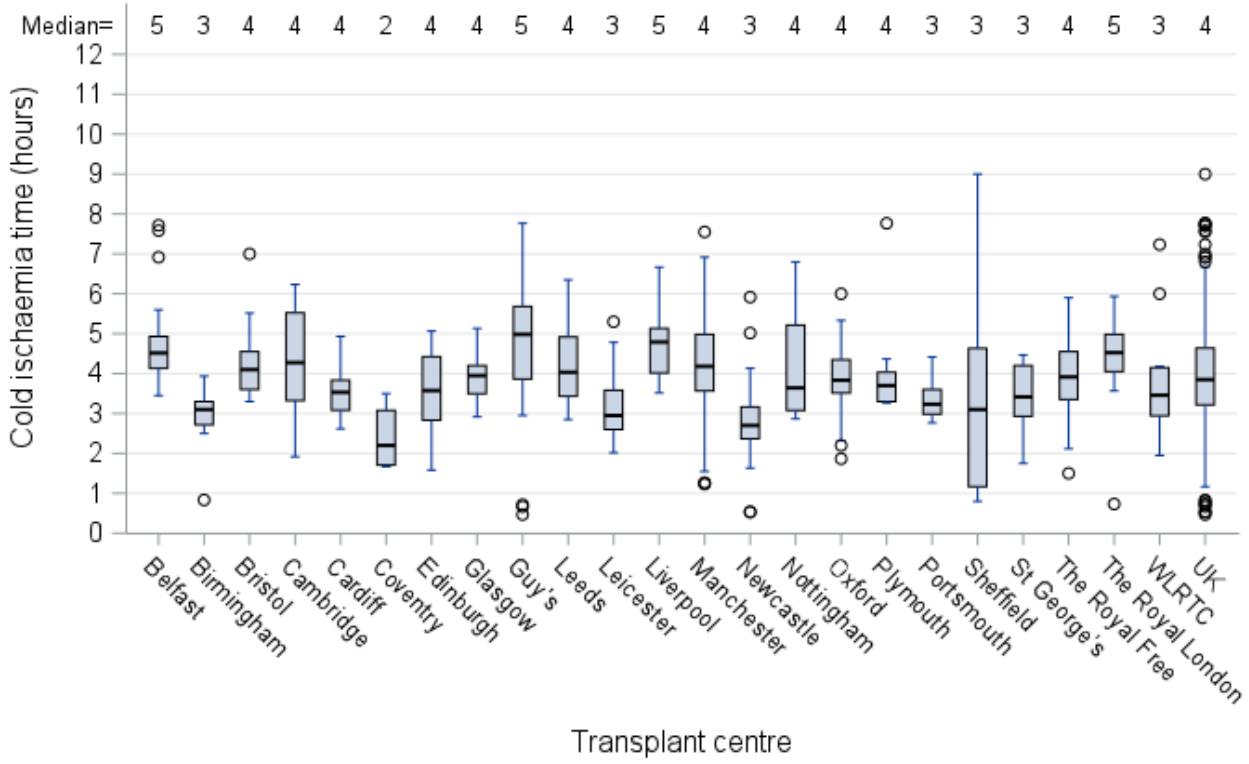
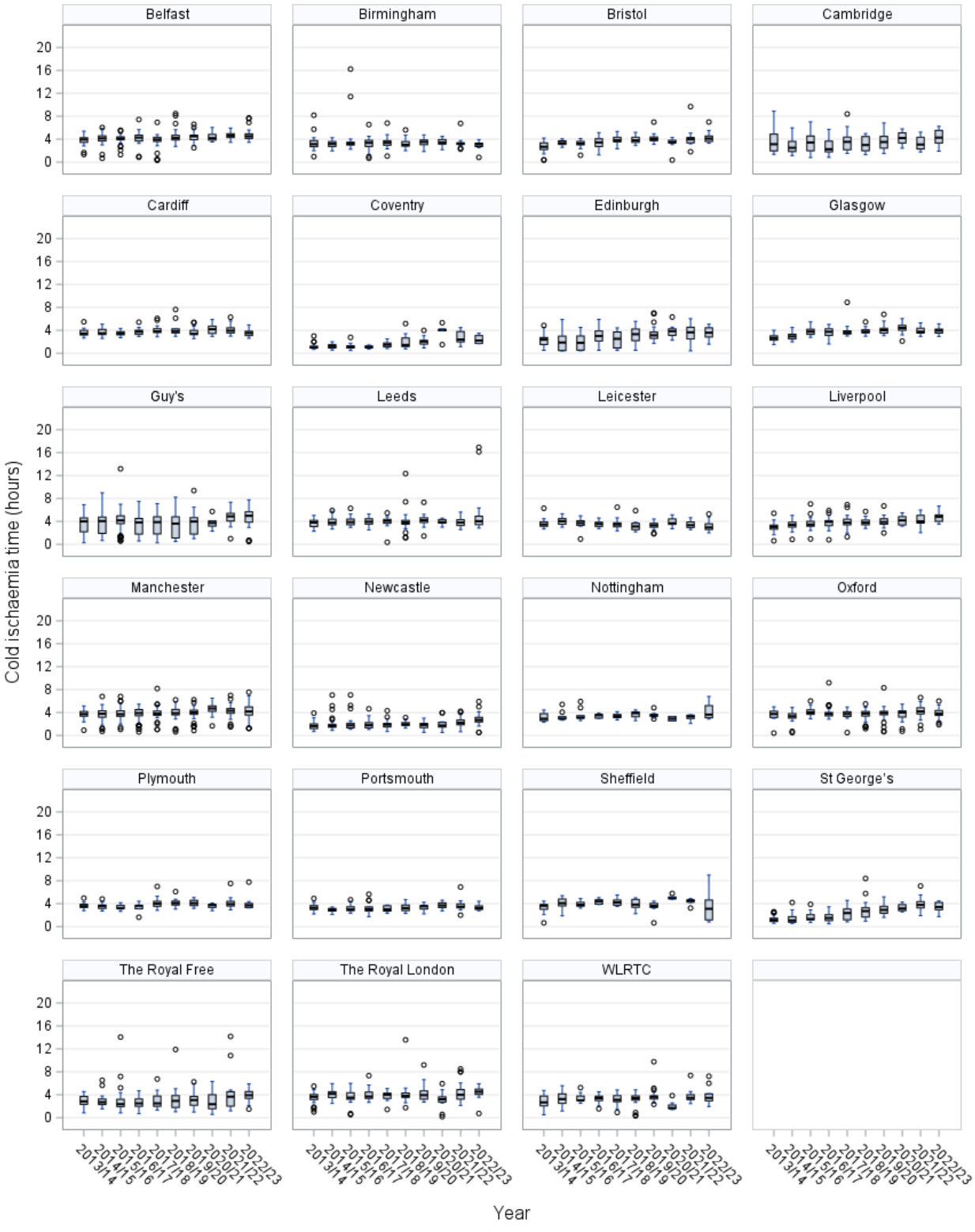


Figure 5.24 shows the median total cold ischaemia time in adult living donor kidney transplants over the last ten years for each transplant centre.

Figure 5.24 **Median cold ischaemia time in adult living donor kidney transplants, 1 April 2013 - 31 March 2023**



Adult kidney outcomes

6.1 Deceased donor graft and patient survival

The contents of this section will be provided at a later date.

6.2 Living donor graft and patient survival

The contents of this section will be provided at a later date.

6.3 Patient survival from listing

The contents of this section will be provided at a later date.

Form Return Rates

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

The contents of this section will be provided at a later date.

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

The contents of this section will be provided at a later date.

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 8.1 Paediatric patients on the kidney only transplant list at 31 March

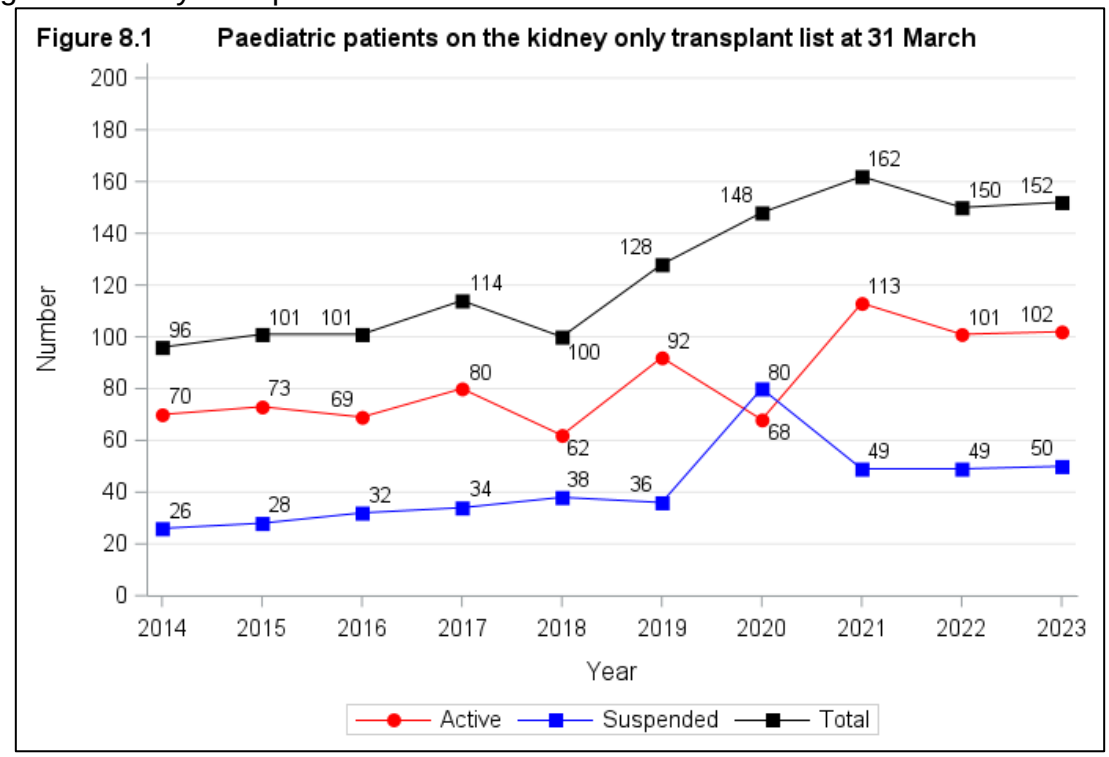


Figure 8.2 shows the number of paediatric patients on the active kidney only transplant list at 31 March 2023 by centre. Of the total 102 paediatric patients, Manchester had the largest proportion of the transplant list (20%) and Glasgow and adult centres had the smallest (2%); Belfast had 0 paediatric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

Figure 8.2 Paediatric patients on the active kidney only transplant list at 31 March 2023, by centre

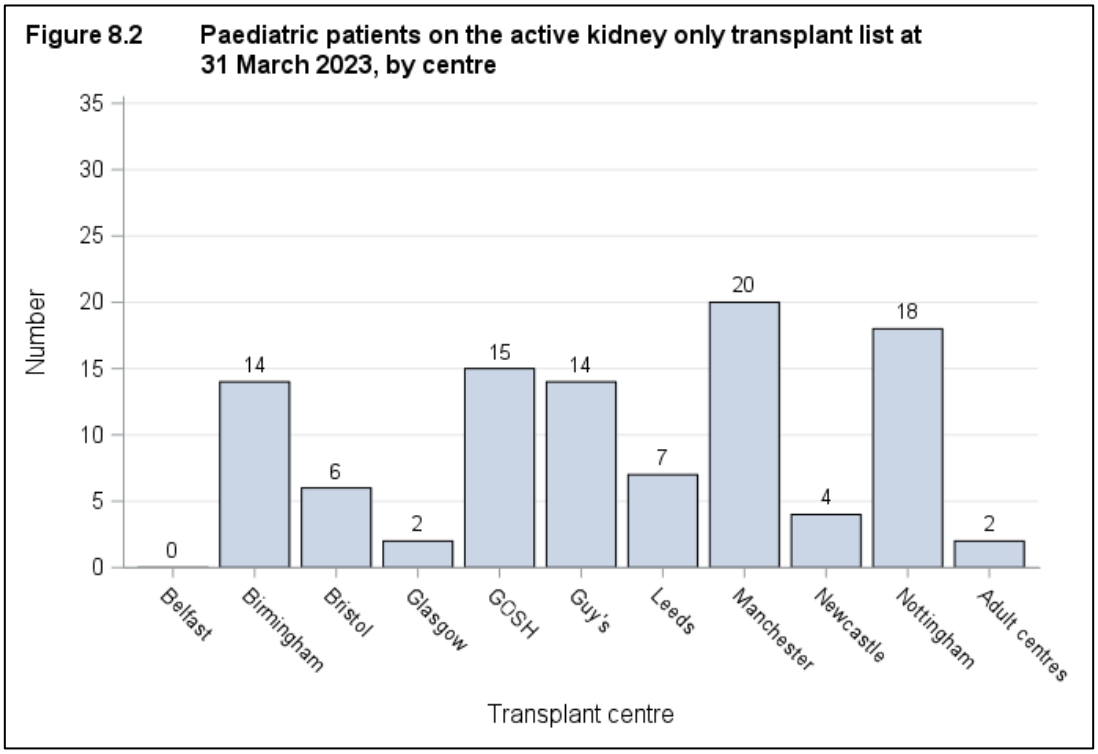


Figure 8.3 shows the number of paediatric patients on the suspended kidney only transplant list at 31 March 2023 by centre. Of the 50 suspended paediatric patients, GOSH had the largest proportion of the transplant list (20%) and adult centres had the smallest (6%); Belfast, Glasgow and Newcastle had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

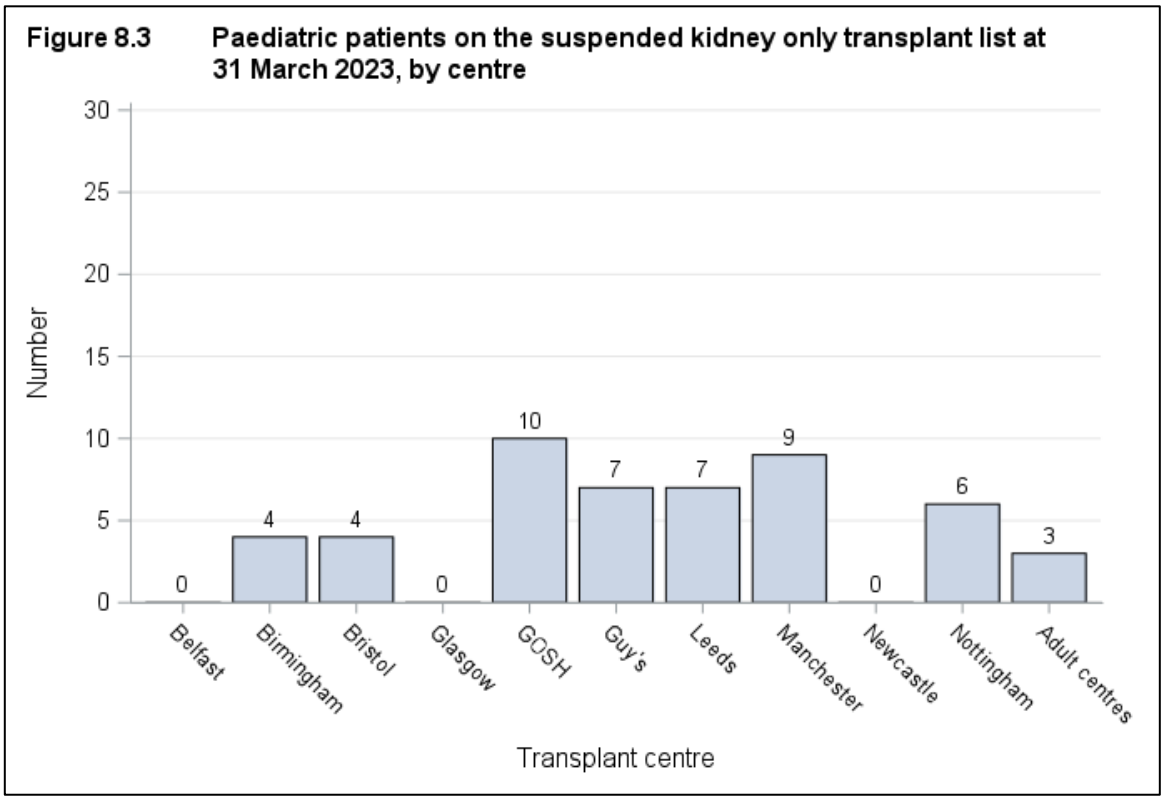
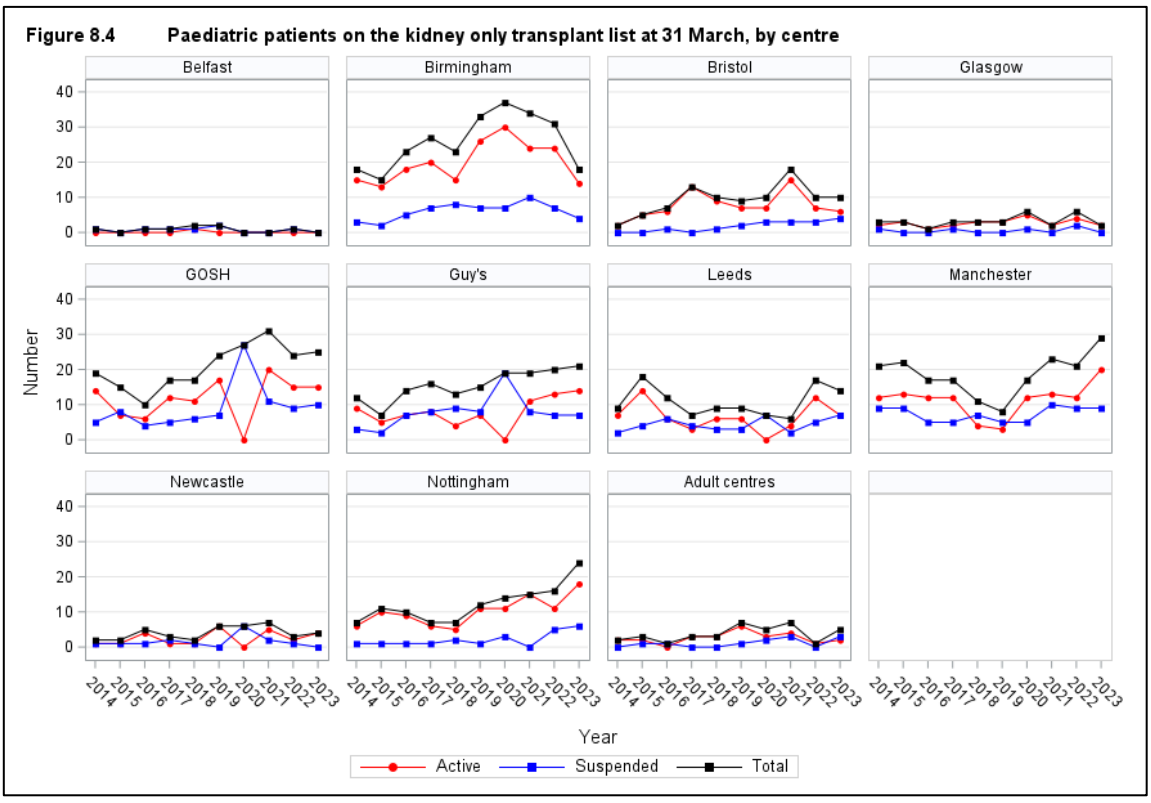


Figure 8.4 shows the number of paediatric patients on the transplant list at 31 March each year between 2014 and 2023 for each transplant centre.



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 8.5 **Sex of paediatric registrations on the active kidney only transplant list, 1 April 2022 and 31 March 2023, by centre**

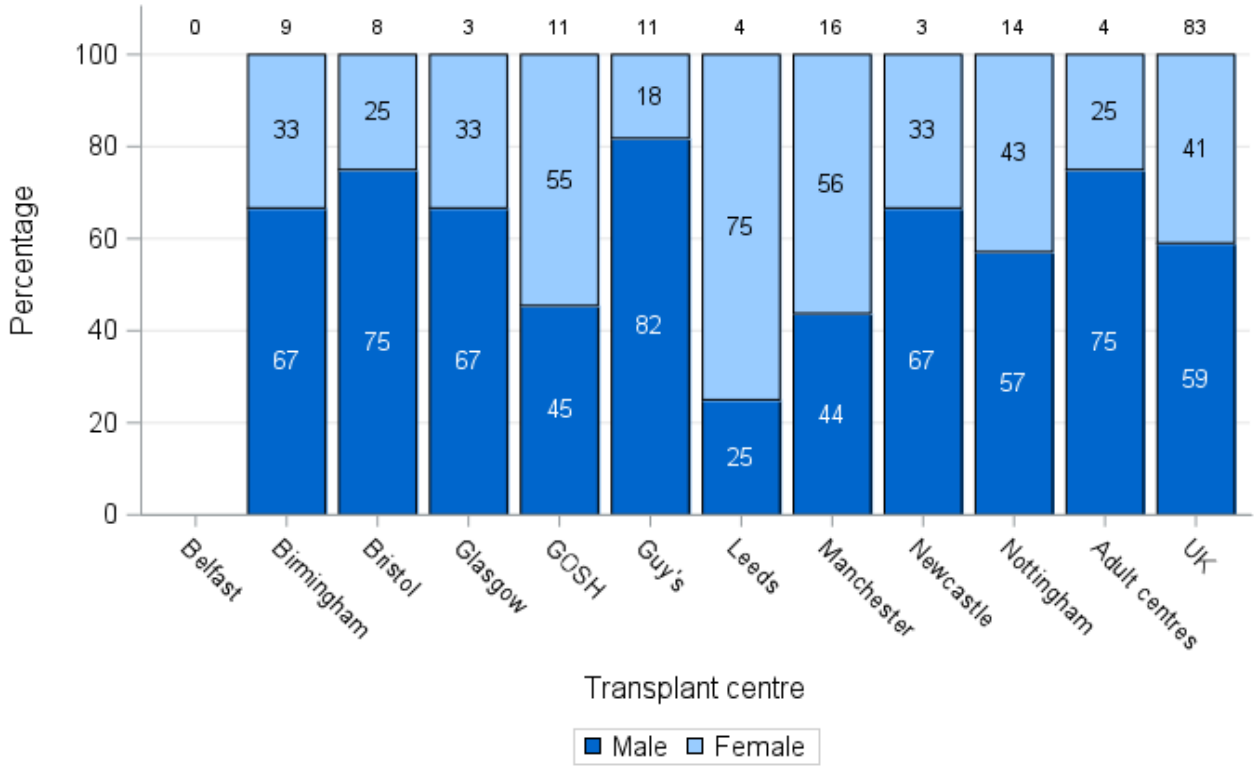


Figure 8.6 **Ethnicity of paediatric registrations on the active kidney only transplant list, 1 April 2022 and 31 March 2023, by centre**

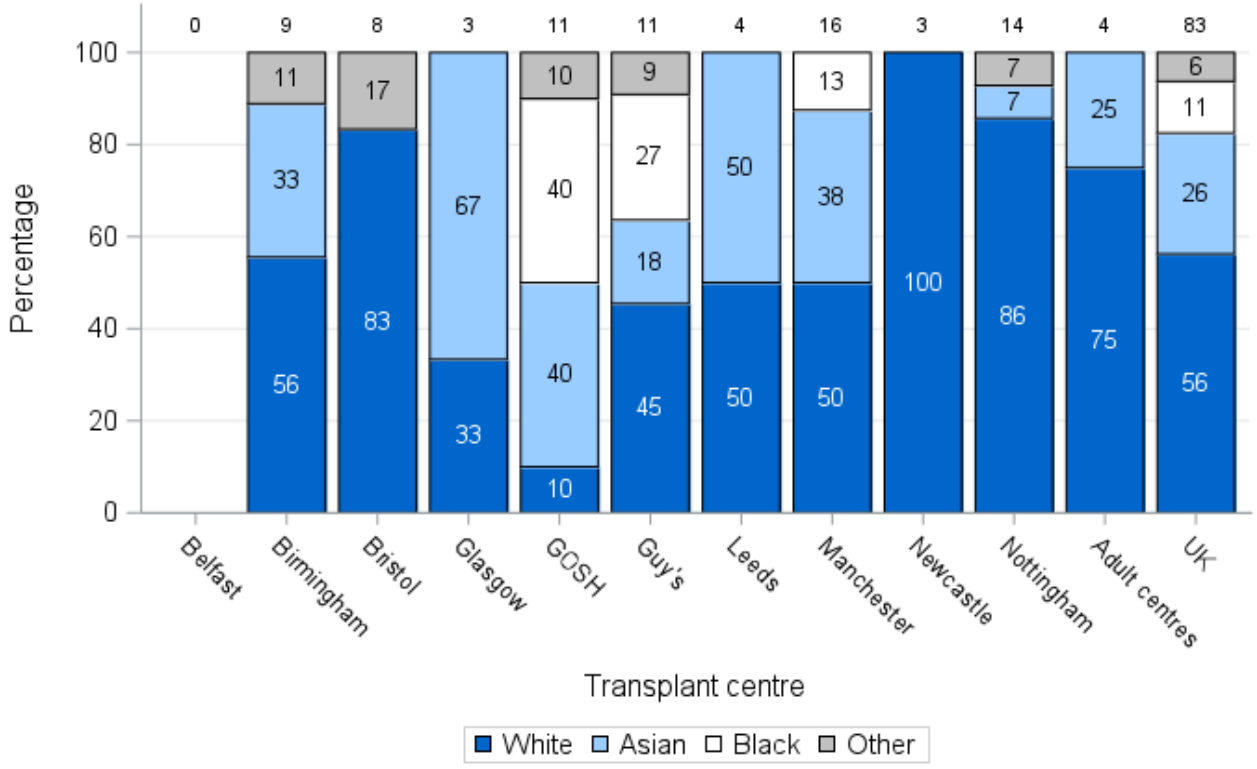


Figure 8.7 **Age of paediatric registrations on the active kidney only transplant list, 1 April 2022 and 31 March 2023, by centre**

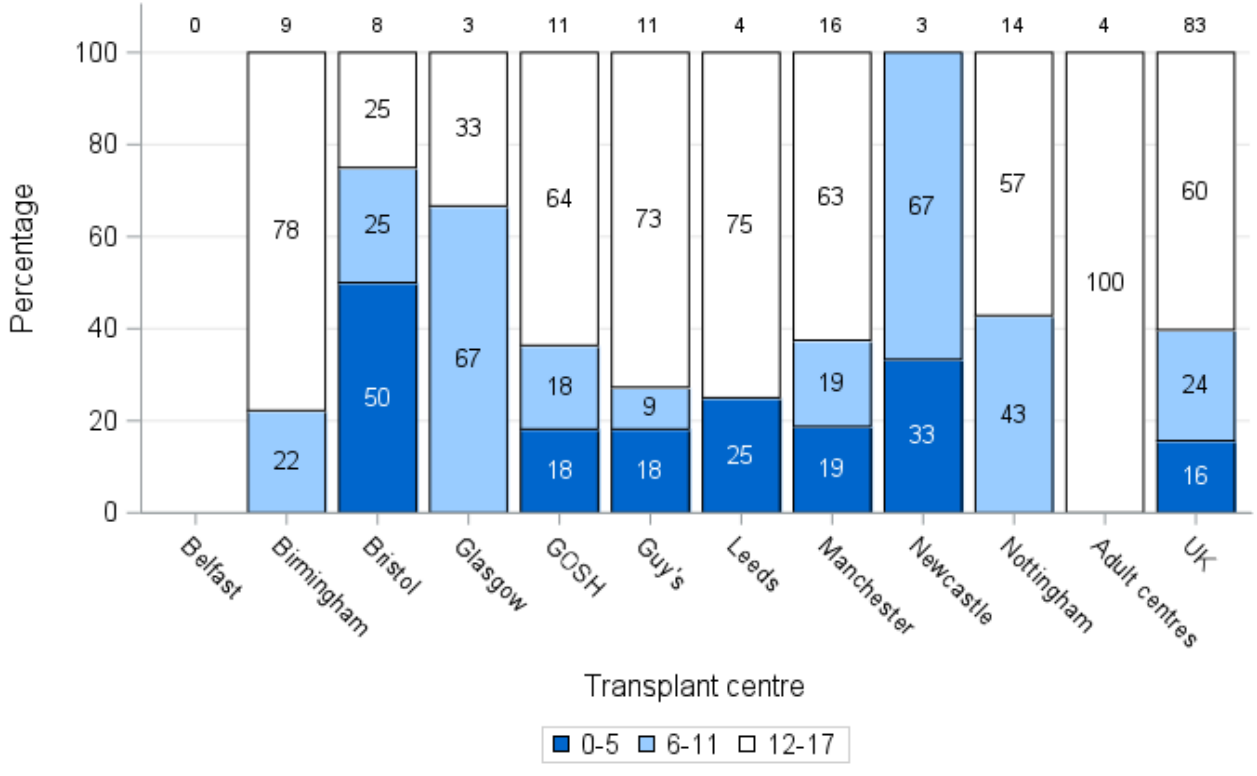
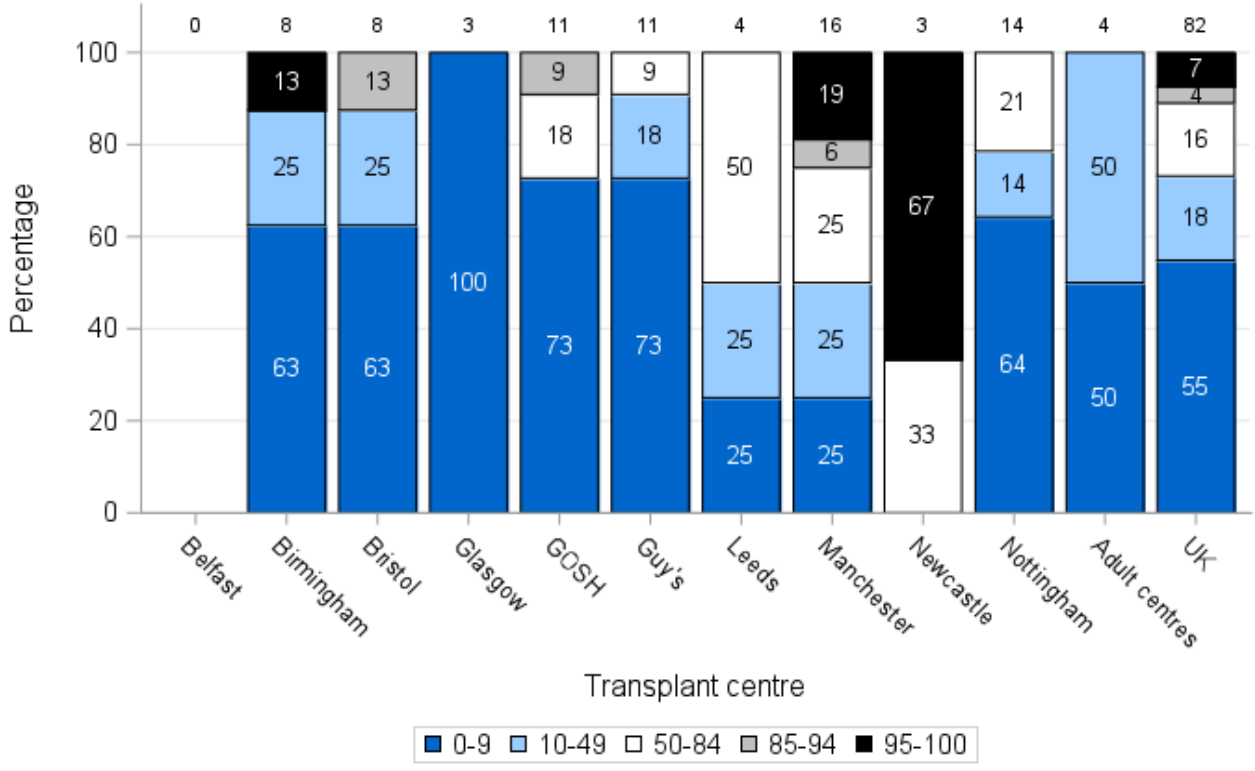


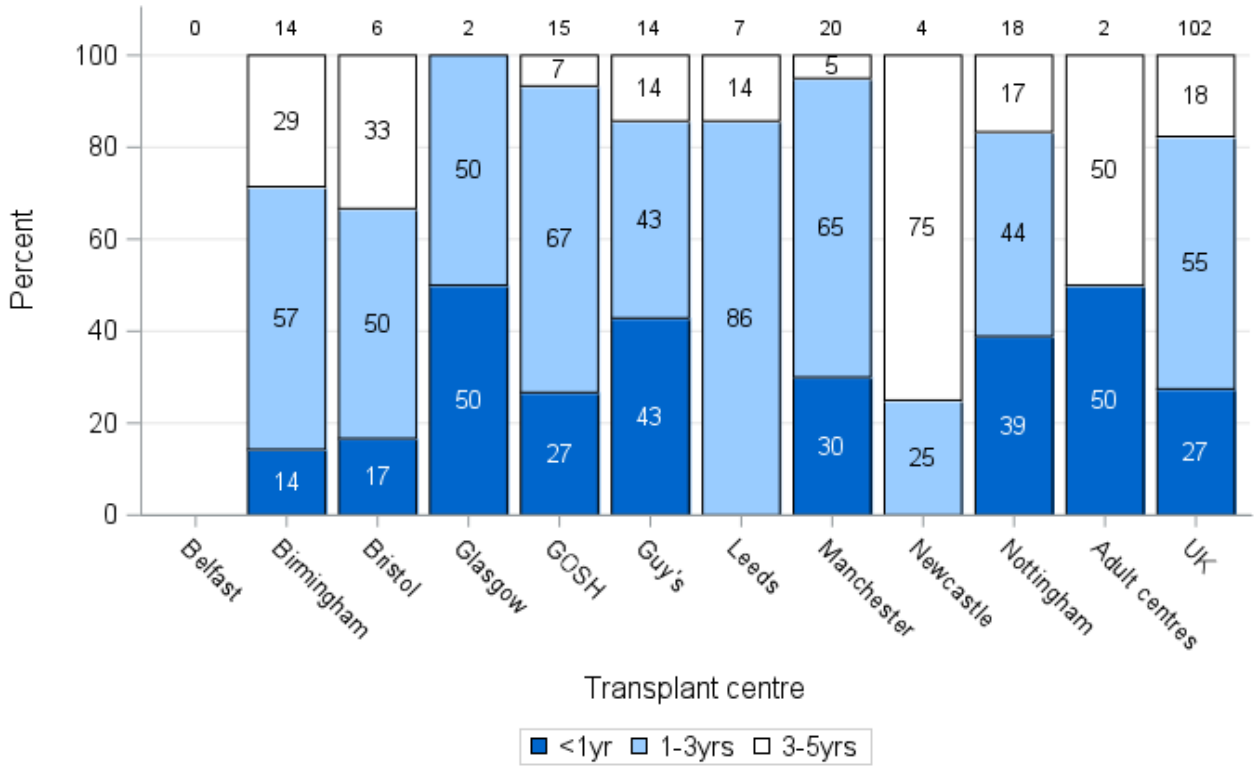
Figure 8.8 cRF of paediatric registrations on the active kidney only transplant list, 1 April 2022 and 31 March 2023, by centre



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.

Figure 8.9 Paediatric patients on the active kidney only transplant list as at 31 March 2023, by centre and waiting time



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 lime 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**

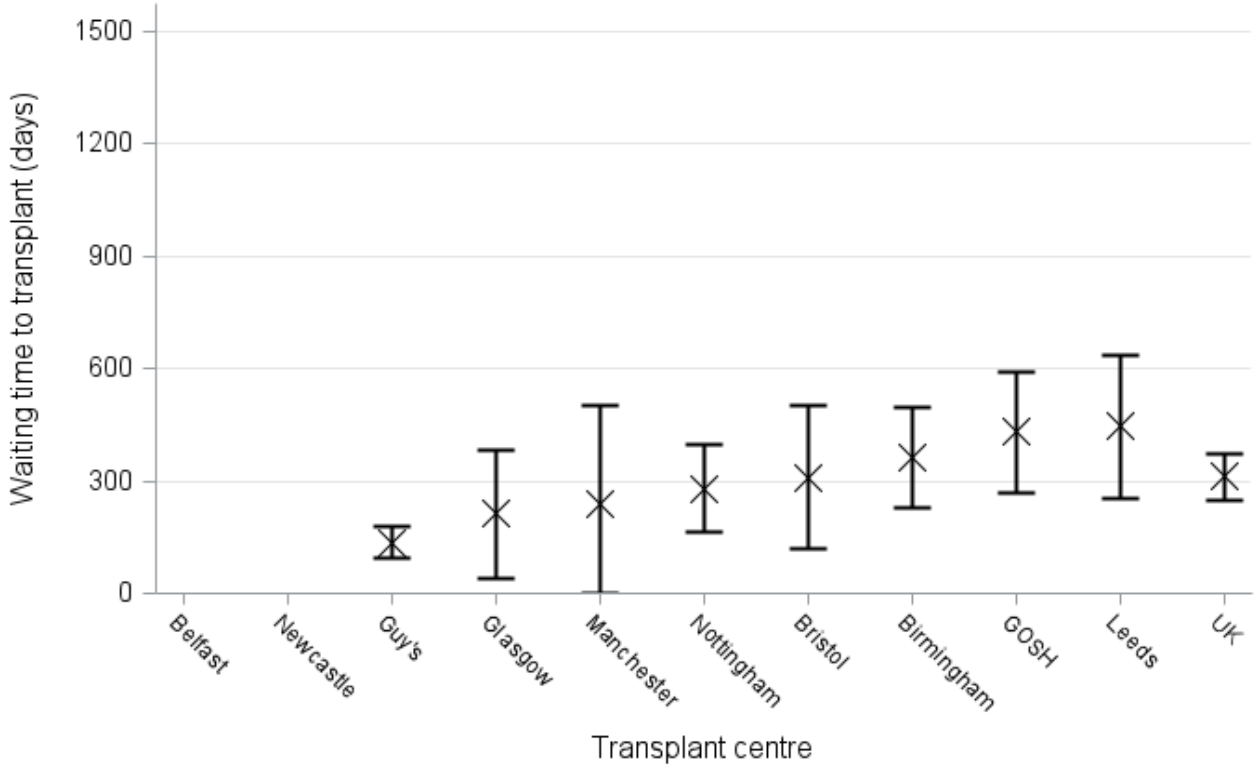


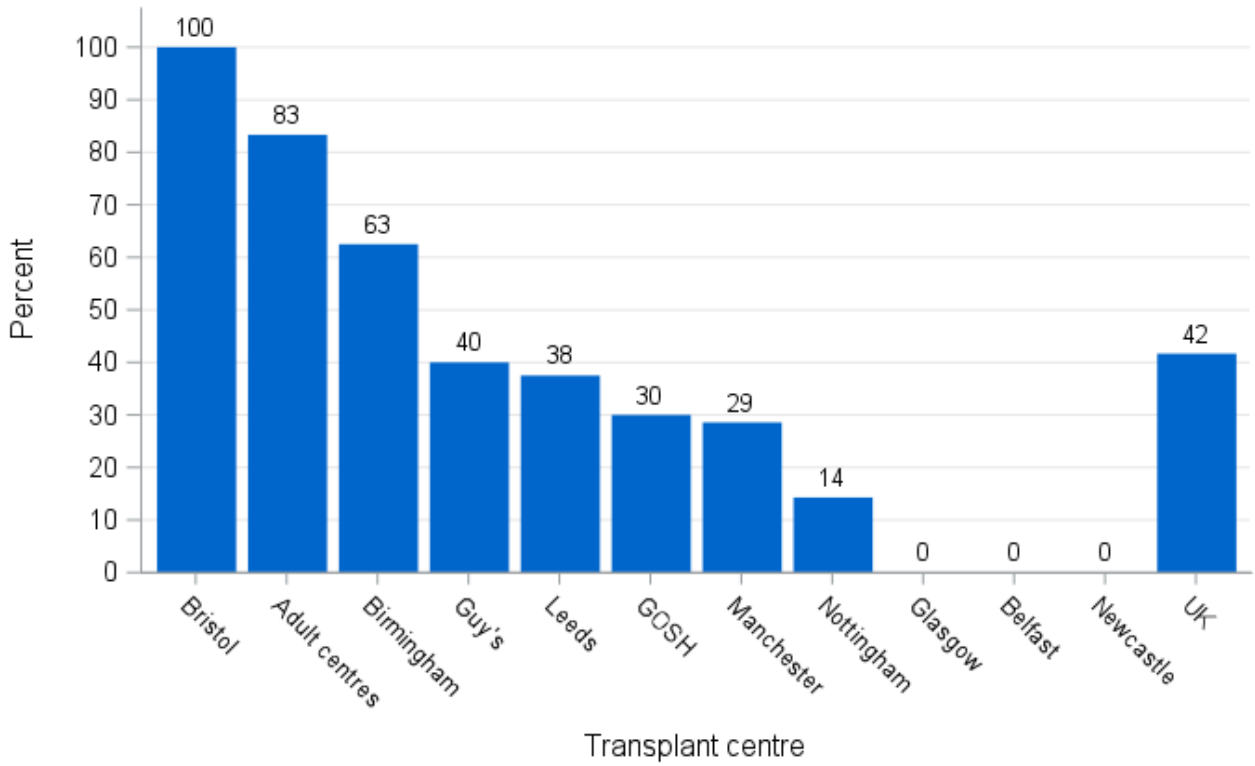
Table 8.1 **Median waiting time to kidney only transplant in the UK, for paediatric patients registered 1 April 2017 - 31 March 2020**

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.

Figure 8.11 Paediatric pre-emptive listing rates by centre, registrations between 1 April 2021 and 31 March 2022



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 on offer decline rate that is higher than the national rate, while centres positioned below the lower limits indicates on 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.

Figure 9.1 **Paediatric standard criteria DBD donor kidney offer decline rates for kidneys that resulted in a transplant, 1 April 2020 and 31 March 2023**

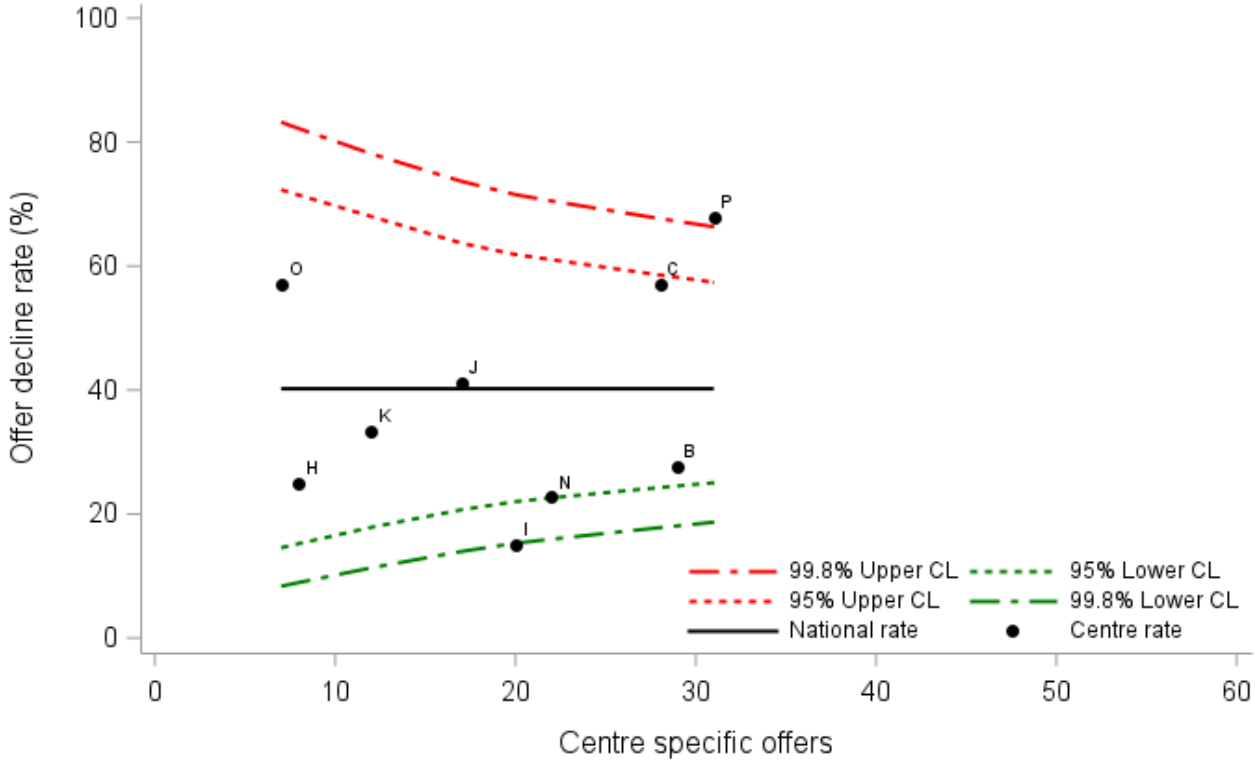


Table 9.1 compares individual centre offer decline rates for SCD over time by financial year.

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 10.1 Paediatric kidney only transplants, 1 April 2013 - 31 March 2023

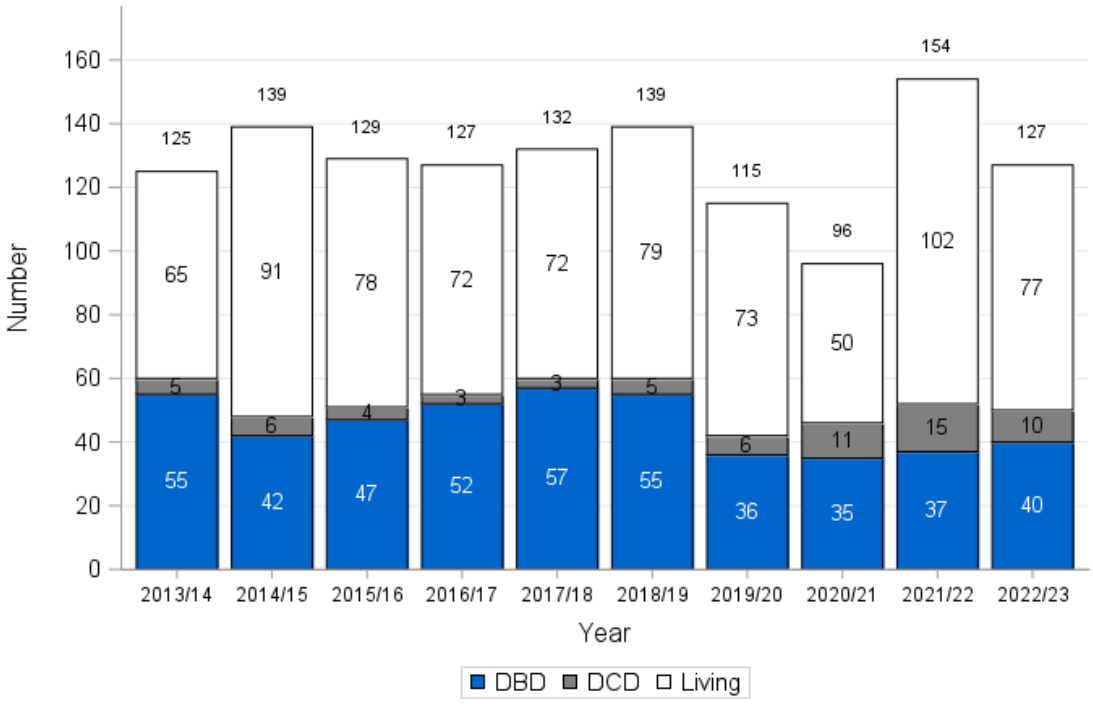
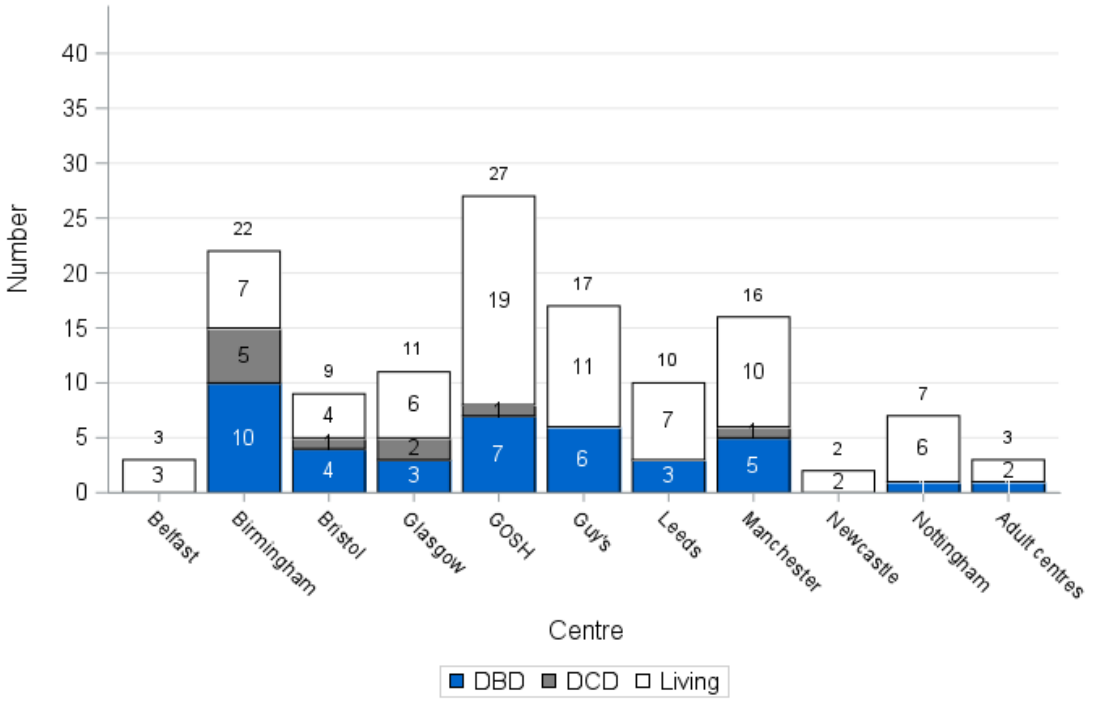


Figure 10.2 shows the total number of paediatric kidney only transplants performed in 2022/23, by centre and type of donor. The same information is presented in **Figure 10.3** but this shows the proportion of DBD, DCD and living donor transplants performed at each centre.

Figure 10.2 Paediatric kidney only transplants, 1 April 2022 - 31 March 2023



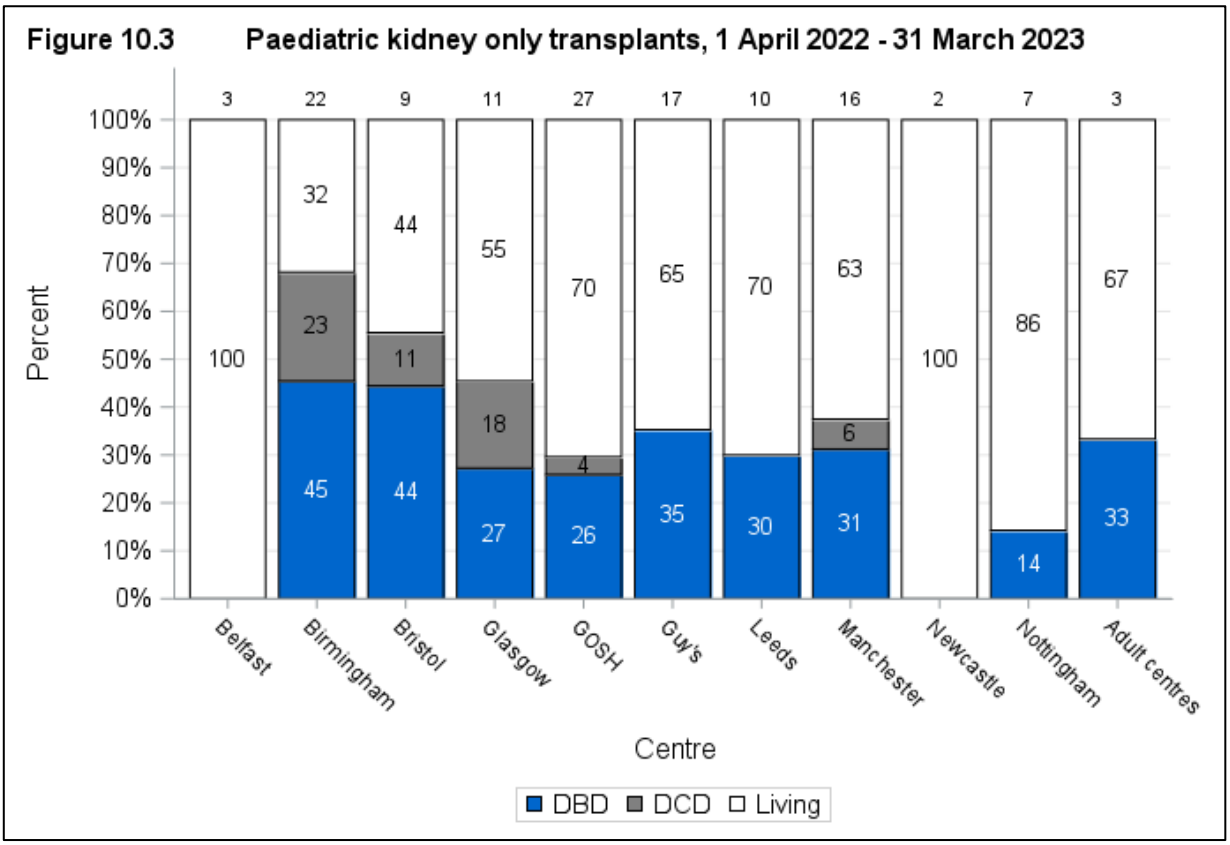
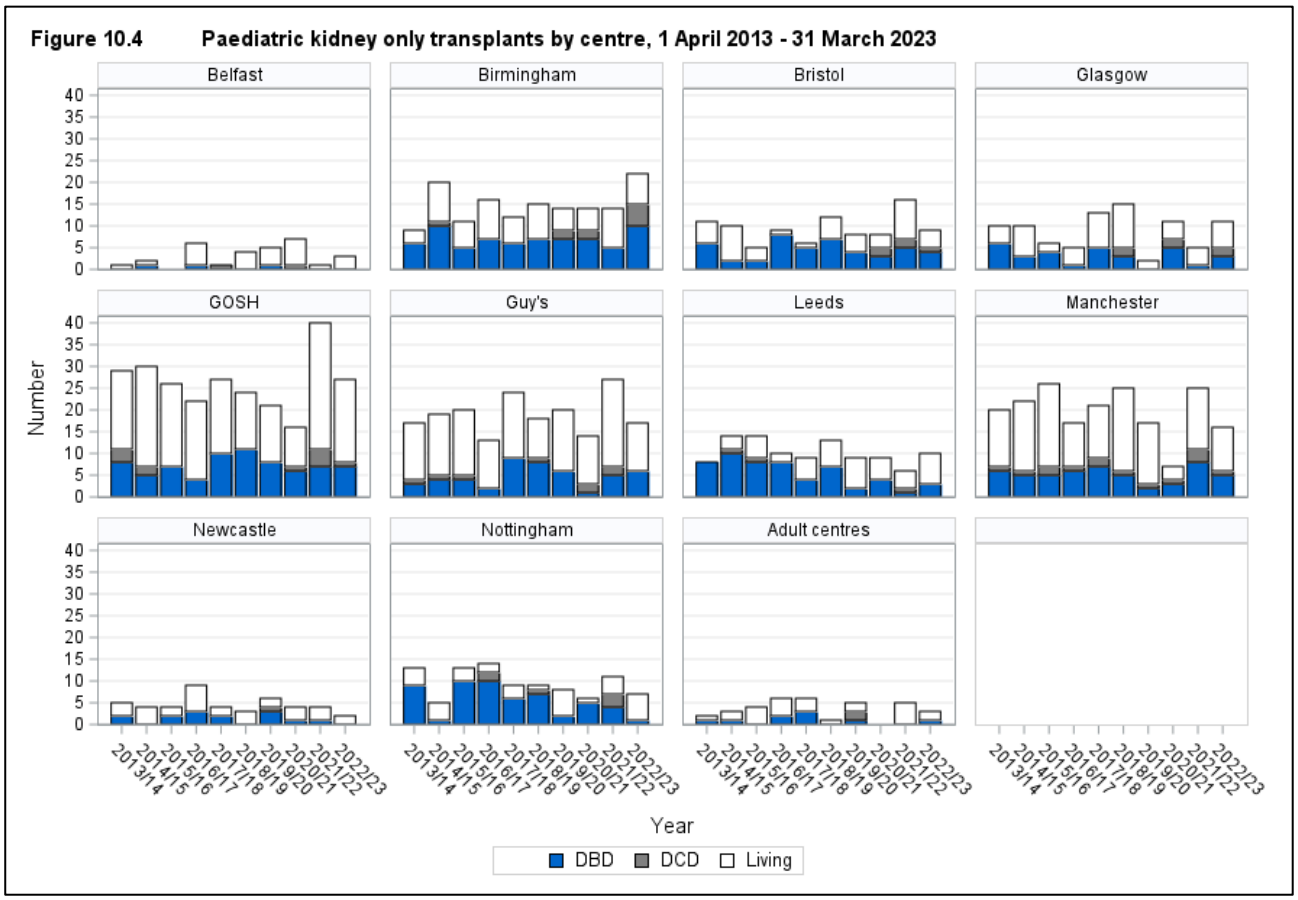


Figure 10.4 shows the total number of paediatric kidney only transplants performed in last ten years, by centre and type of donor.



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.

Figure 10.5 Paediatric deceased donor pre-emptive transplant rates by centre, 1 April 2022 - 31 March 2023

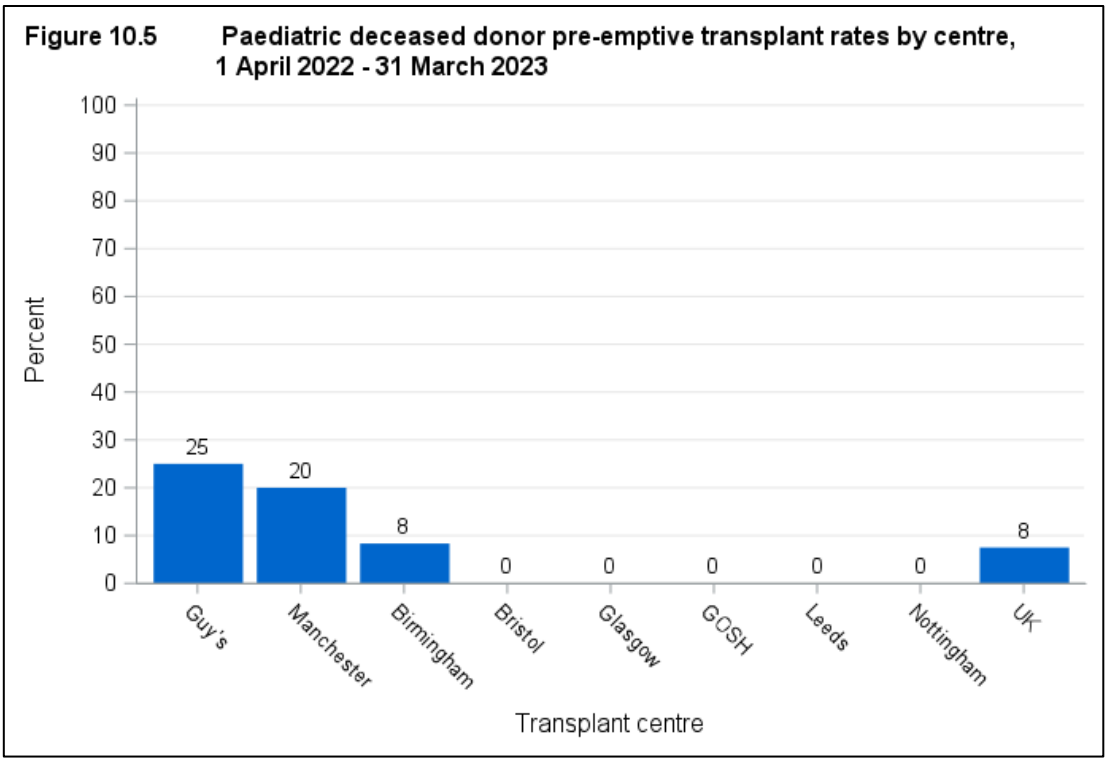
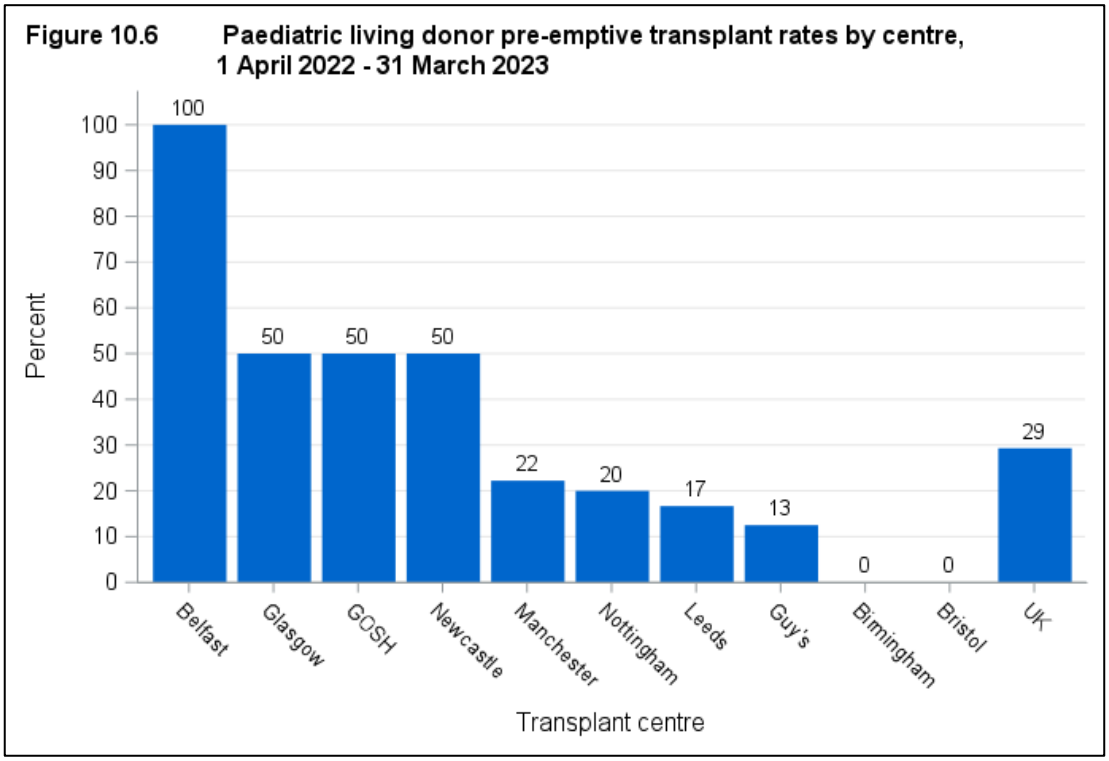


Figure 10.6 Paediatric living donor pre-emptive transplant rates by centre, 1 April 2022 - 31 March 2023



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 contents of this section will be provided at a later date.

11.2 Living donor graft and patient survival

The contents of this section will be provided at a later date.

Form return rates

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

The contents of this section will be provided at a later date.

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

The contents of this section will be provided at a later date.

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

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