



**Blood and Transplant**

# **ANNUAL REPORT ON KIDNEY TRANSPLANTATION**

**REPORT FOR 2021/2022  
(1 APRIL 2012 – 31 MARCH 2022)**

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**PRODUCED IN COLLABORATION WITH NHS ENGLAND**



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# **Executive Summary**

This report presents key figures about kidney transplantation in the UK. The period reported covers 10 years of transplant data, from 1 April 2012. 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 2022, there were 4,643 adults on the UK active kidney [transplant list](#) which represents a 43% increase in the number of patients a year earlier. The equivalent number of paediatric patients was 101, representing a 10% decrease from the previous year.
- There were 2,868 adult kidney only transplants performed in the UK in 2021/22 an increase of 32% compared to 2020/21. Of these, 1,154 were from [DBD](#) donors, 921 were from [DCD](#) donors and 793 were from living donors. The equivalent number of paediatric transplants was 149 representing a 55% increase from the previous year. Much of the reduction in activity in previous data is due to the impact of the COVID-19 pandemic.

Use of the contents of this report should be acknowledged as follows:

Annual Report on Kidney Transplantation 2021/22, NHS Blood and Transplant

# Introduction

This report presents information on transplant activity between 1 April 2012 and 31 March 2022, 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 2017 to 31 March 2021 and five-year post-transplant for the period 1 April 2013 to 31 March 2017. 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 2010 and 31 December 2021.

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

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

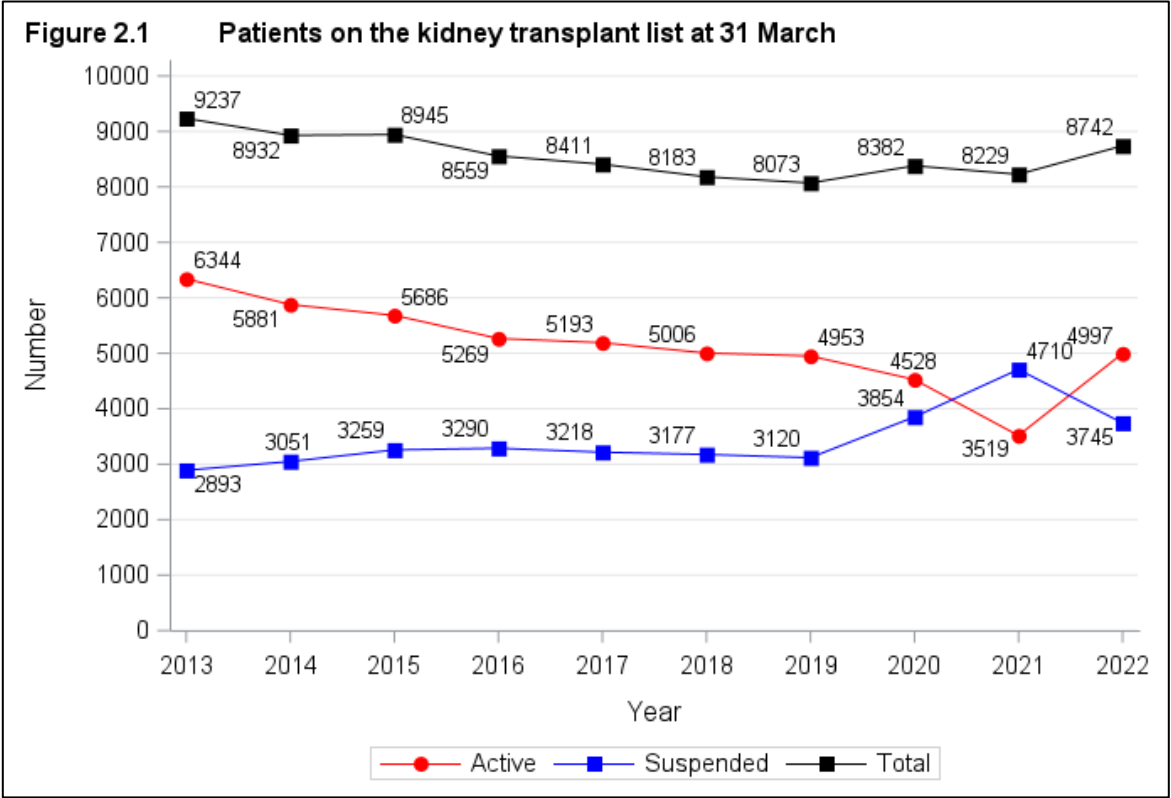
Throughout this report West London Renal and Transplant Centre is labeled as WLRTC.

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

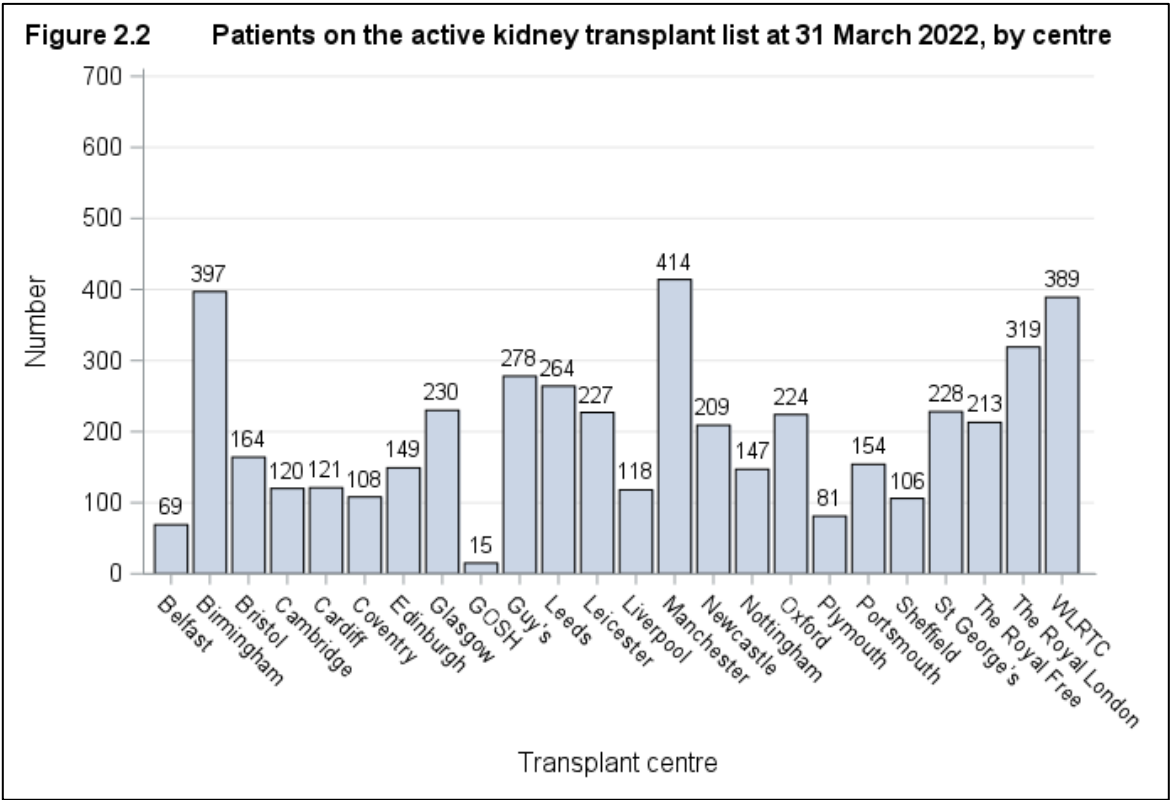
The COVID-19 pandemic has led to unprecedented challenges for UK transplantation. Concerns about the ability to care for transplant recipients, lack of access to resource because it is being used for patients in the pandemic, and the risk versus benefit for immunosuppressed transplant recipients, have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



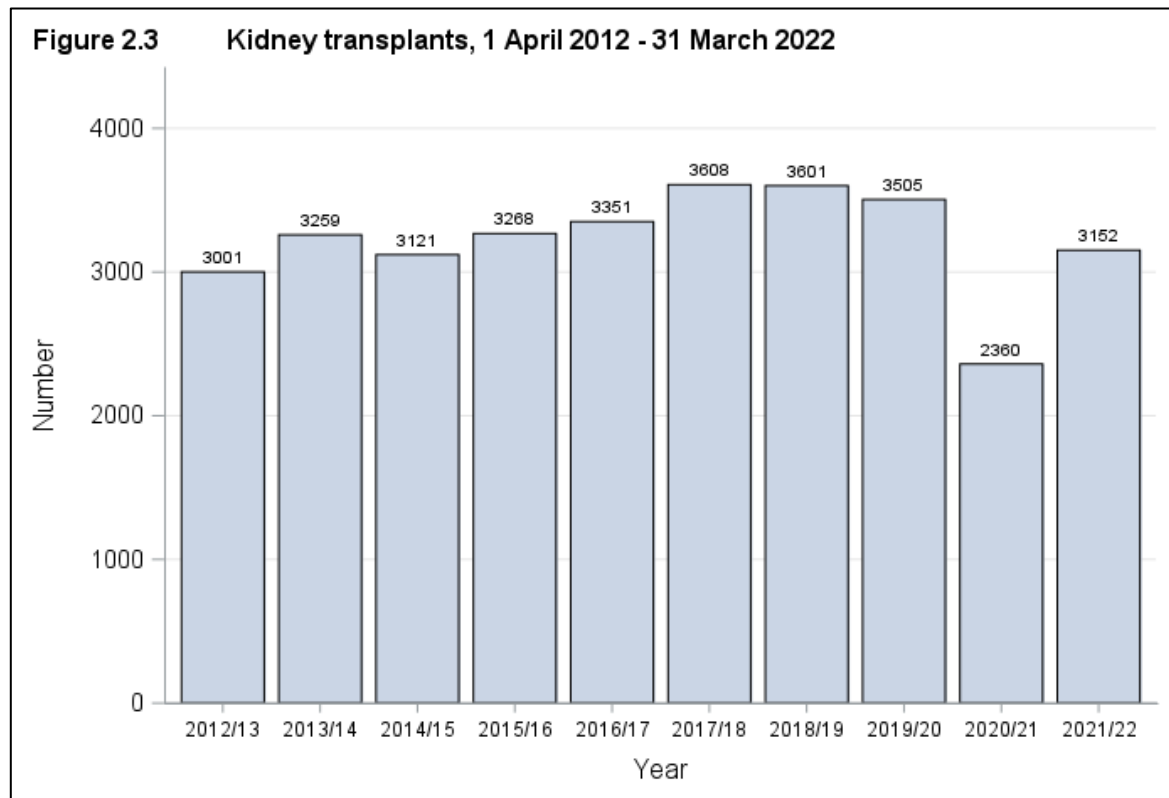
**Figure 2.1** shows the number of patients on the kidney [transplant list](#) on 31 March each year between 2013 and 2022. The number of patients actively waiting for a kidney transplant decreased from 6,344 in 2013 to 4,997 in 2022.



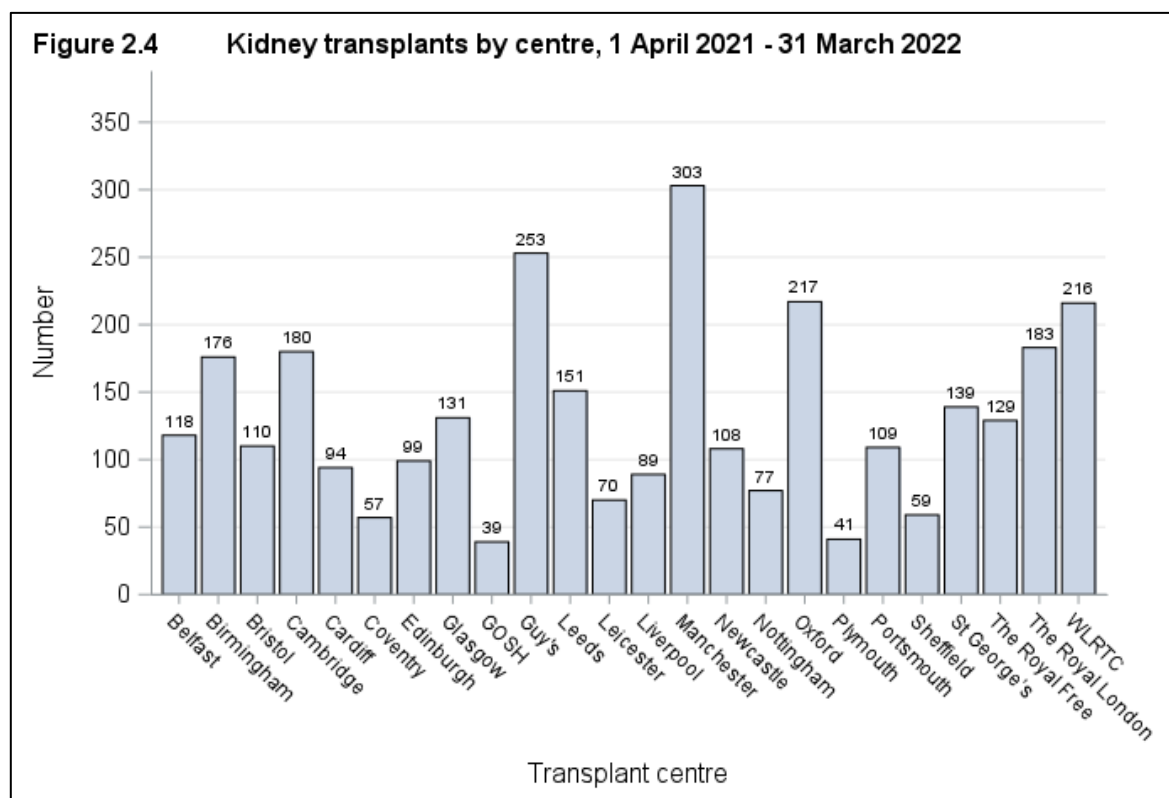
**Figure 2.2** shows the number of patients on the kidney [transplant list](#) at 31 March 2022 for each transplant centre. Manchester has the largest active [transplant list](#) with 414 patients registered for a kidney transplant.



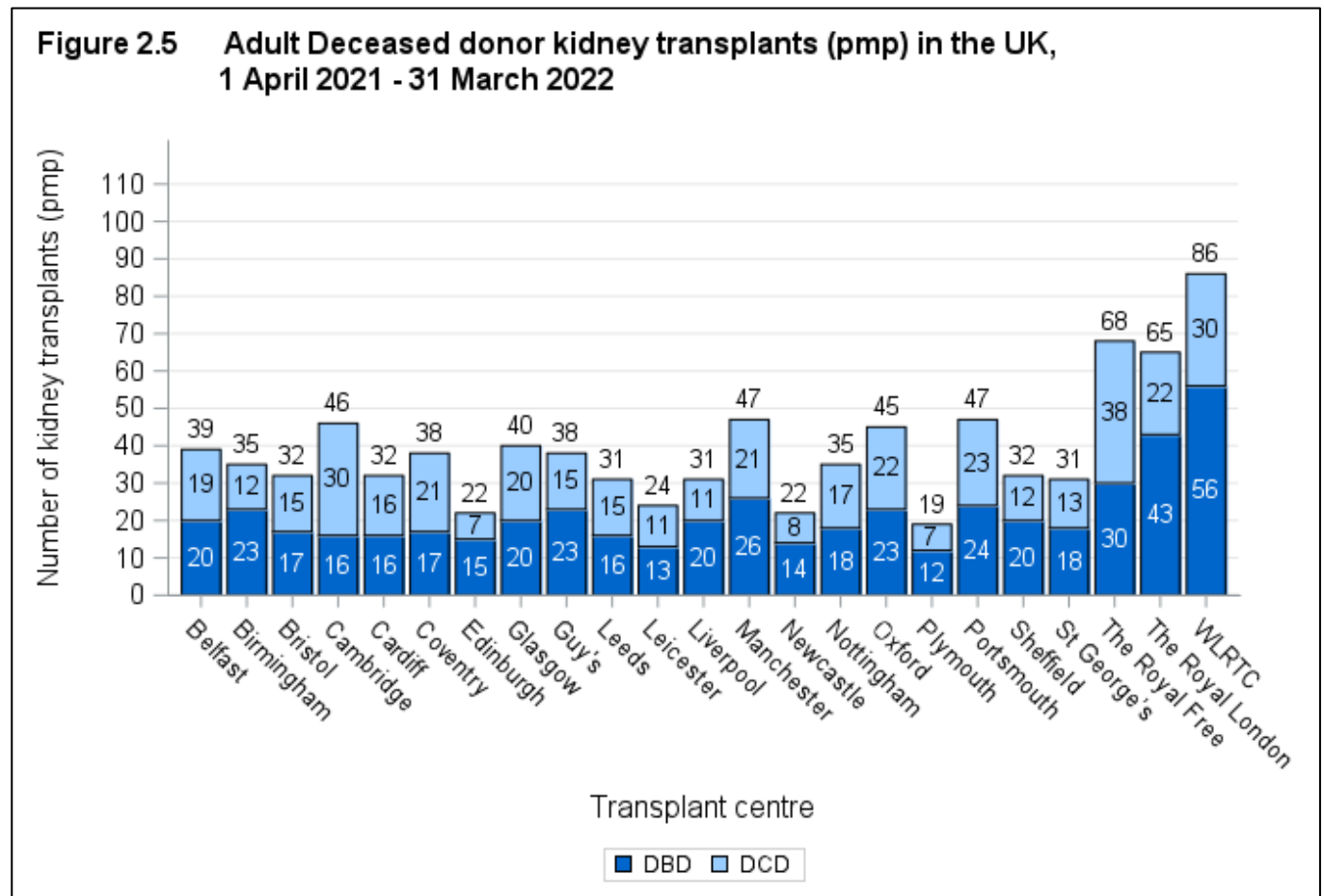
**Figure 2.3** shows the total number of kidney transplants performed in the last ten years. The number of transplants has increased overall from 3,001 in 2012/13 to 3,152 in 2021/22.



**Figure 2.4** shows the total number of kidney transplants performed in 2021/22 at each transplant centre. Manchester had the highest activity last year with 303 transplants performed.

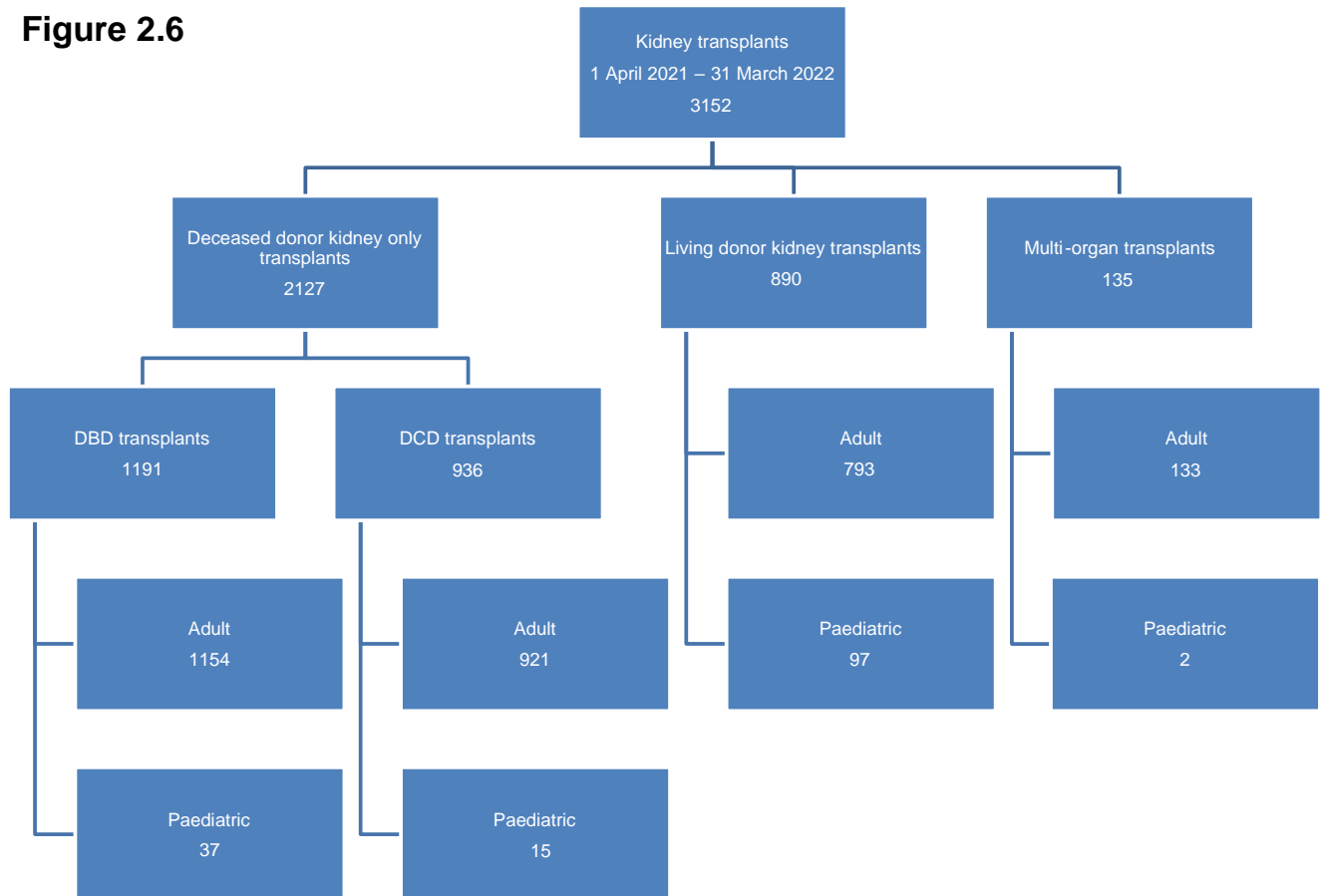


**Figure 2.5** shows the total number of kidney transplants performed per million population in 2021/22 at each transplant centre. WLRTC had the highest number of adult deceased donor kidney transplants per million population.



**Figure 2.6** details the 3,152 kidney transplants performed in the UK between 1 April 2021 and 31 March 2022. Of these, 2,127 (67%) were deceased donor kidney only transplants and 890 (28%) were living donor kidney transplants. Of the 135 [multi-organ transplants](#), 120 were simultaneous kidney and pancreas transplants, 7 were kidney and liver transplants, 6 were simultaneous kidney and islet transplants, and 2 were simultaneous kidney and heart transplants.

**Figure 2.6**

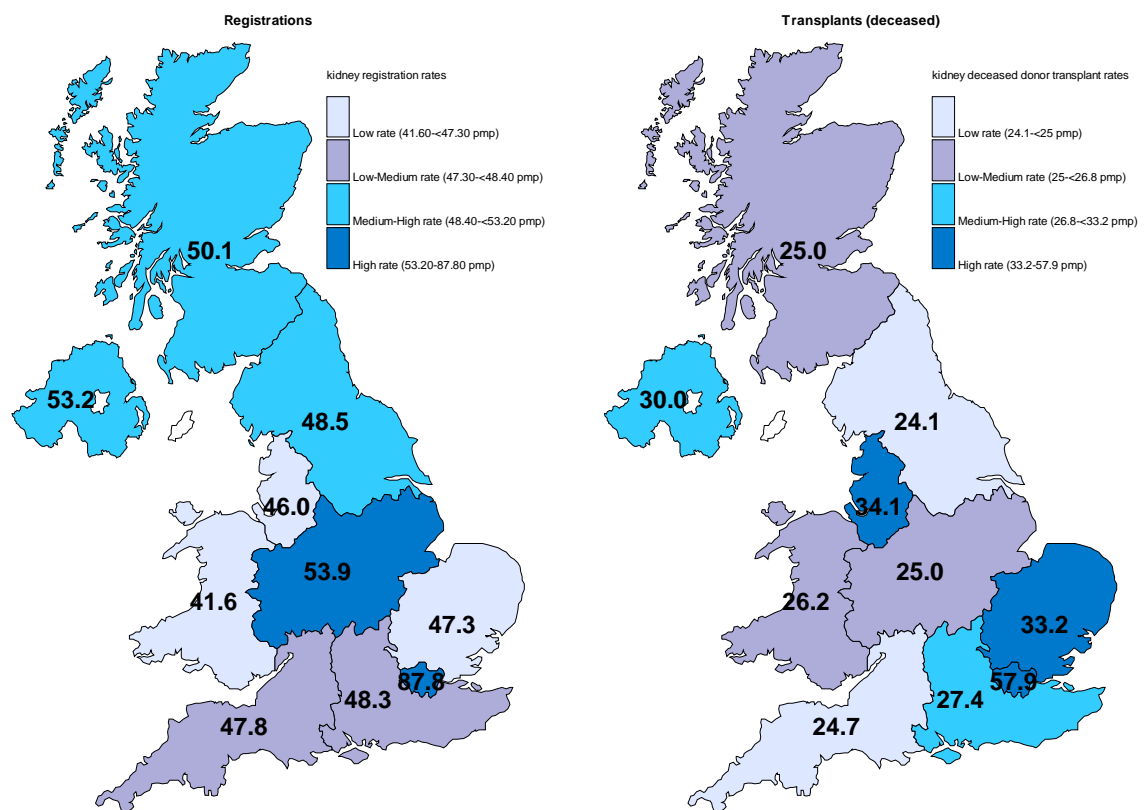


## Geographical variation in registration and transplant rates

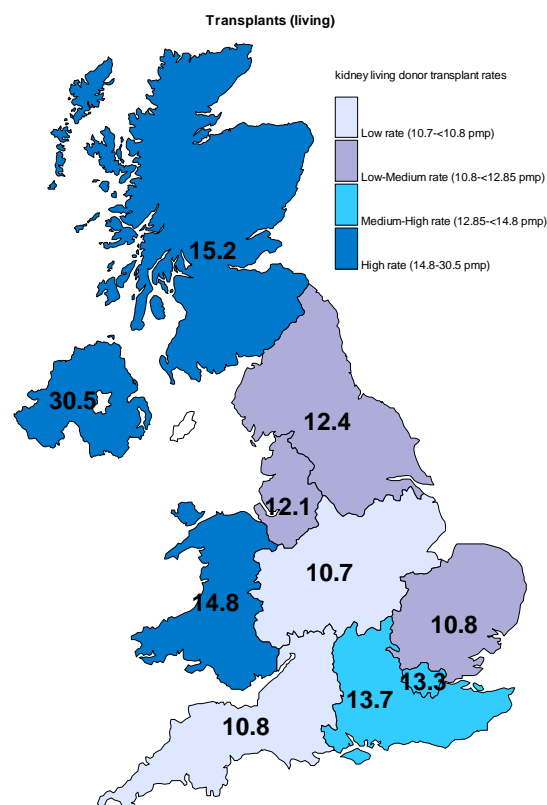
**Figure 2.7** shows rates of registration to the kidney only transplant list per million population (pmp) between 1 April 2021 and 31 March 2022 compared with deceased donor kidney only transplant rates pmp for the same time period, by recipient country/NHS region of residence. **Figure 2.8** shows the transplant rates pmp for living donor kidney only transplants in the same period. **Table 2.2** shows the breakdown of these numbers by recipient country/NHS region of residence. No adjustments have been made for potential demographic differences in populations. If a patient has had more than one registration/transplant in the period, each registration/transplant is considered. Note that this analysis only considered NHS Group 1 patients.

Since there will inevitably be some random variation in rates between areas, the systematic component of variation (SCV) was used to identify if the variation is more (or less) than a random effect for the different NHS regions in England only. Only first registrations and transplants in this period were considered. The larger the SCV the greater the evidence of a high level of systematic variation between areas. Registration, deceased donor transplant, and living donor transplant rates yielded an SCV of 0.0614 (p-value = <0.001), 0.1118 (p-value = <0.001), and 0 (p-value = >0.999) 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 2021 - 31 March 2022, by Country/NHS region**

<b>Country/ NHS region</b>	<b>Registrations (pmp)</b>		<b>Deceased Donor Transplants (pmp)</b>		<b>Living Donor Transplants (pmp)</b>	
North East and Yorkshire	419	(48.5)	208	(24.1)	107	(12.4)
North West	326	(46.0)	242	(34.1)	86	(12.1)
Midlands	575	(53.9)	267	(25.0)	114	(10.7)
East of England	310	(47.3)	218	(33.2)	71	(10.8)
London	790	(87.8)	521	(57.9)	120	(13.3)
South East	431	(48.3)	245	(27.4)	122	(13.7)
South West	271	(47.8)	140	(24.7)	61	(10.8)
<b>England</b>	<b>3122</b>	<b>(55.2)</b>	<b>1841</b>	<b>(32.6)</b>	<b>681</b>	<b>(12.0)</b>
<b>Isle of Man</b>	<b>2</b>	<b>(25.0)</b>	<b>2</b>	<b>(25.0)</b>	<b>1</b>	<b>(12.5)</b>
<b>Channel Islands</b>	<b>2</b>	<b>(11.8)</b>	<b>5</b>	<b>(29.4)</b>	<b>1</b>	<b>(5.9)</b>
<b>Wales</b>	<b>132</b>	<b>(41.6)</b>	<b>83</b>	<b>(26.2)</b>	<b>47</b>	<b>(14.8)</b>
<b>Scotland</b>	<b>274</b>	<b>(50.1)</b>	<b>137</b>	<b>(25.0)</b>	<b>83</b>	<b>(15.2)</b>
<b>Northern Ireland</b>	<b>101</b>	<b>(53.2)</b>	<b>57</b>	<b>(30.0)</b>	<b>58</b>	<b>(30.5)</b>
<b>TOTAL</b>	<b>3640<sup>1</sup></b>	<b>(54.3)</b>	<b>2126<sup>2</sup></b>	<b>(31.7)</b>	<b>872<sup>3</sup></b>	<b>(13.0)</b>

<sup>1</sup> Registrations include 7 recipients whose postcode was unknown and excludes 1 recipient who resides overseas

<sup>2</sup> Deceased donor transplants include 1 recipient whose postcode was unknown and excludes 1 recipient who resides overseas

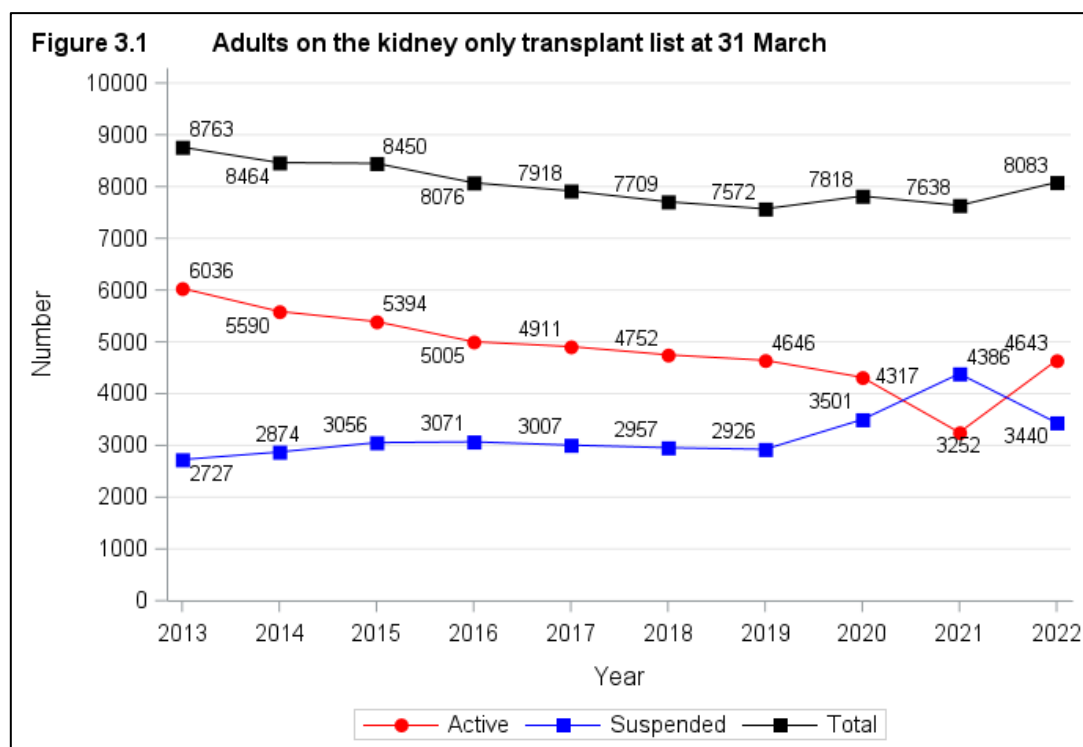
<sup>3</sup> Living donor transplants include 1 recipient whose postcode was unknown and excludes 3 recipients who reside in the Republic of Ireland and 1 recipient who resides overseas

## **Adult kidney transplant list**

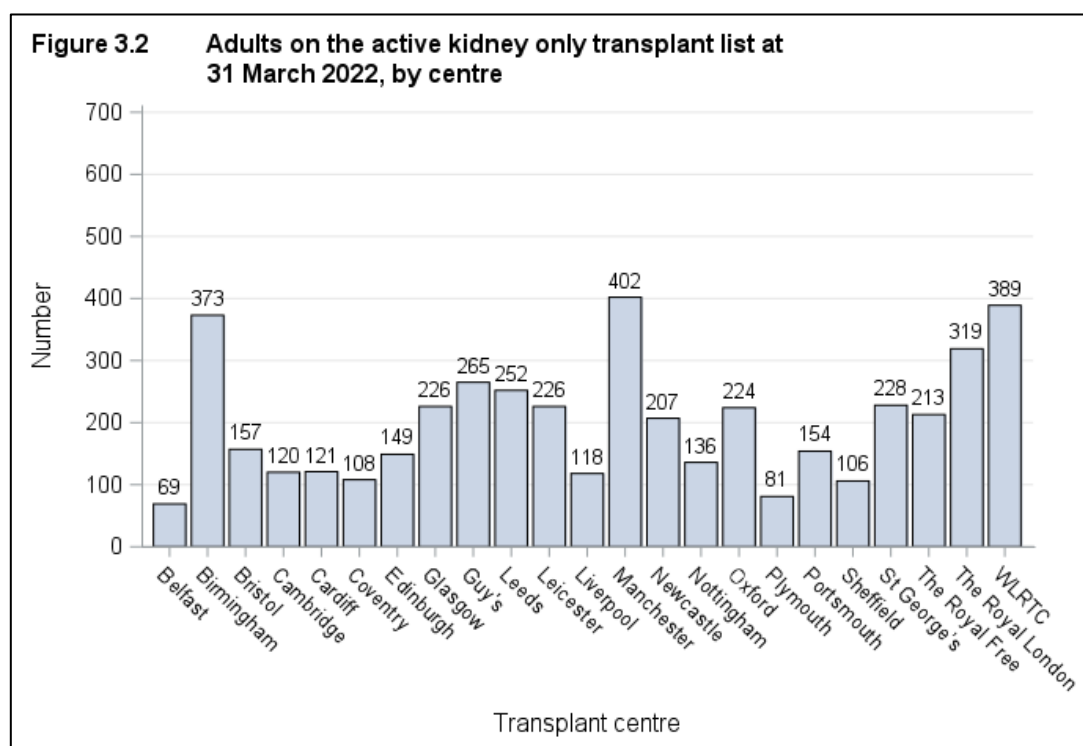


### 3.1 Adults on the kidney transplant list as at 31 March, 2013 – 2022

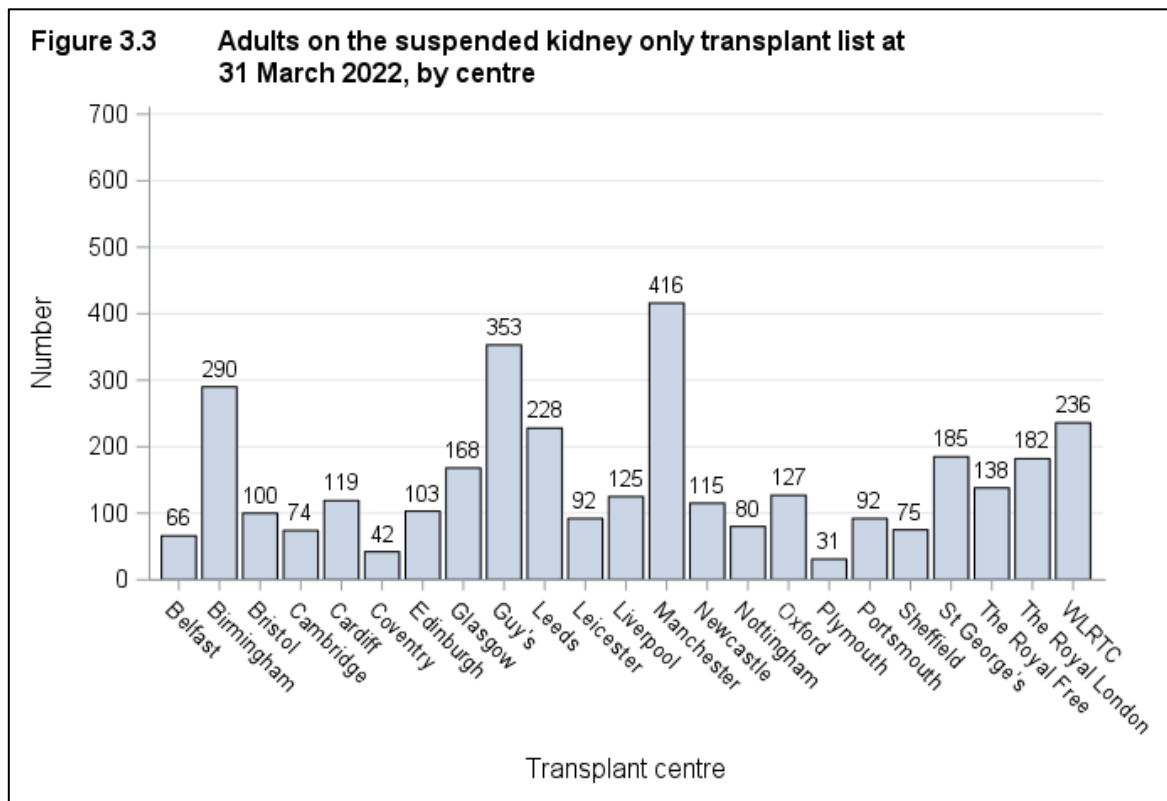
**Figure 3.1** shows the number of adults on the kidney only [transplant list](#) at 31 March each year between 2013 and 2022. The number of adults actively waiting for a kidney transplant has decreased from 6,036 in 2013 to 4,643 in 2022.



**Figure 3.2** shows the number of adults on the active kidney only [transplant list](#) at 31 March 2022 by centre. In total, there were 4,643 adults active at this time. Manchester had the largest proportion of the [transplant list](#) (9%) and Belfast had the smallest (1%).

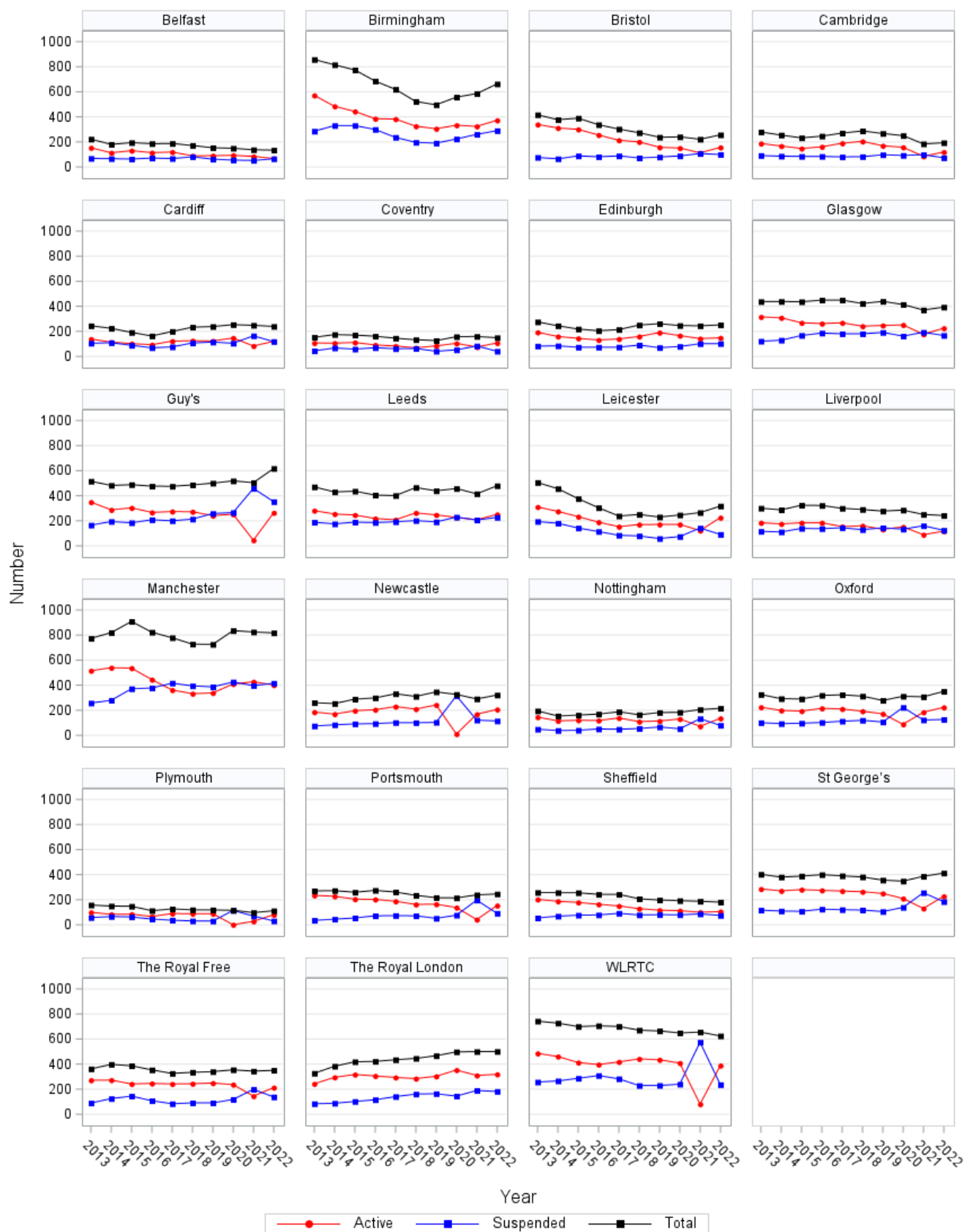


**Figure 3.3** shows the number of adults on the suspended kidney only [transplant list](#) at 31 March 2022 by centre. In total, there were 3,440 adults suspended at this time. Manchester had the largest proportion of adults on the suspended [transplant list](#) (12%) and Plymouth had the smallest (1%).



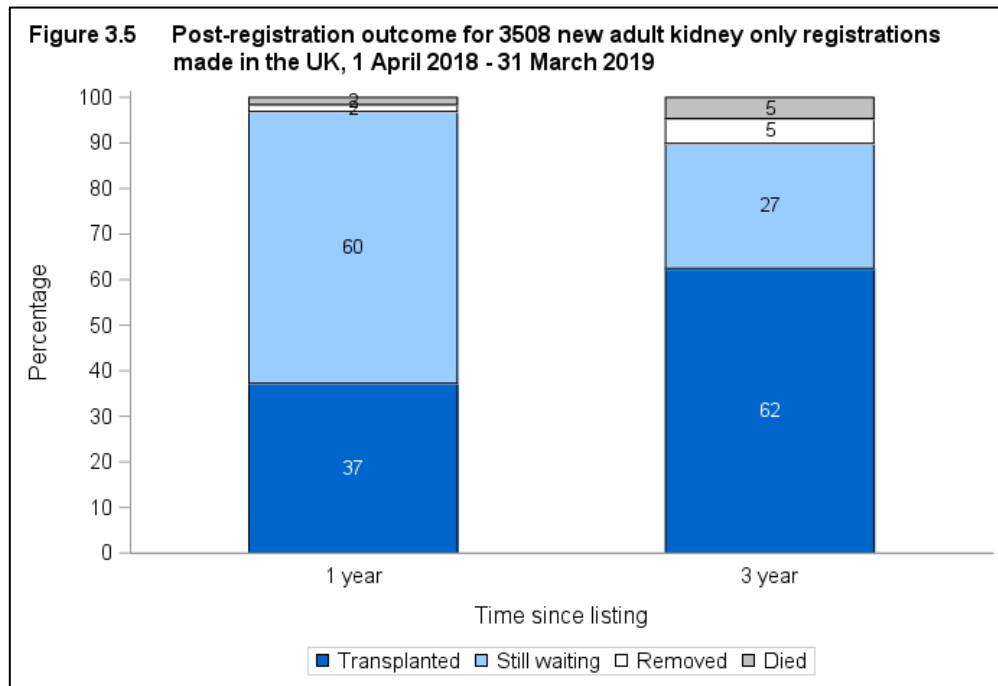
**Figure 3.4** shows the number of adults on the [transplant list](#) at 31 March each year between 2013 and 2022 for each transplant centre.

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

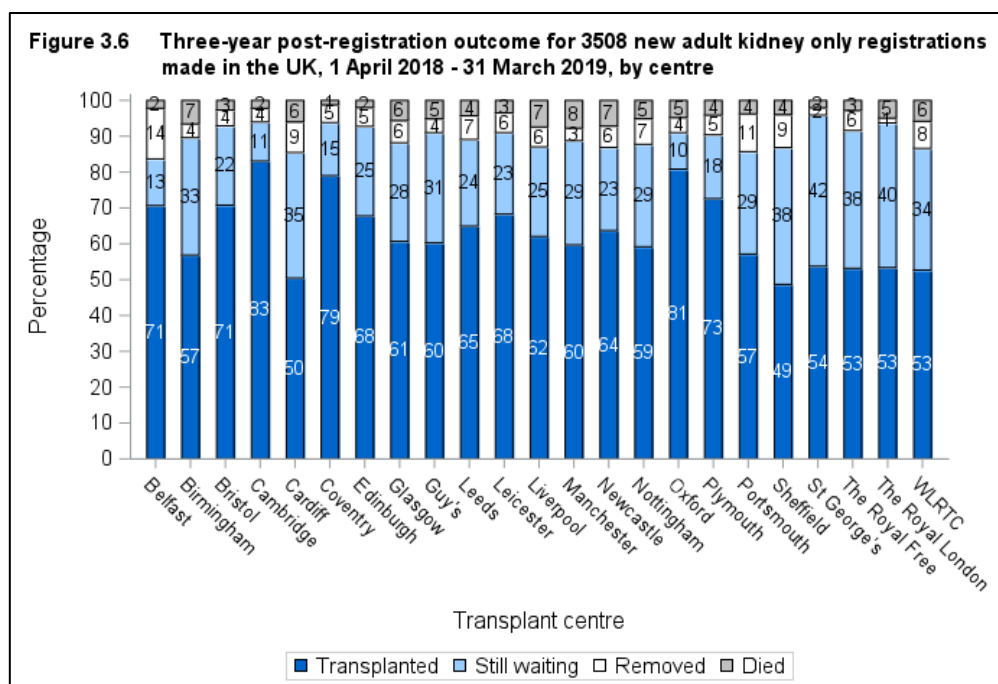


### 3.2 Post-registration outcomes, 1 April 2018 – 31 March 2019

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 37% of patients are transplanted within one year, while three years after listing 62% of patients have received a transplant.

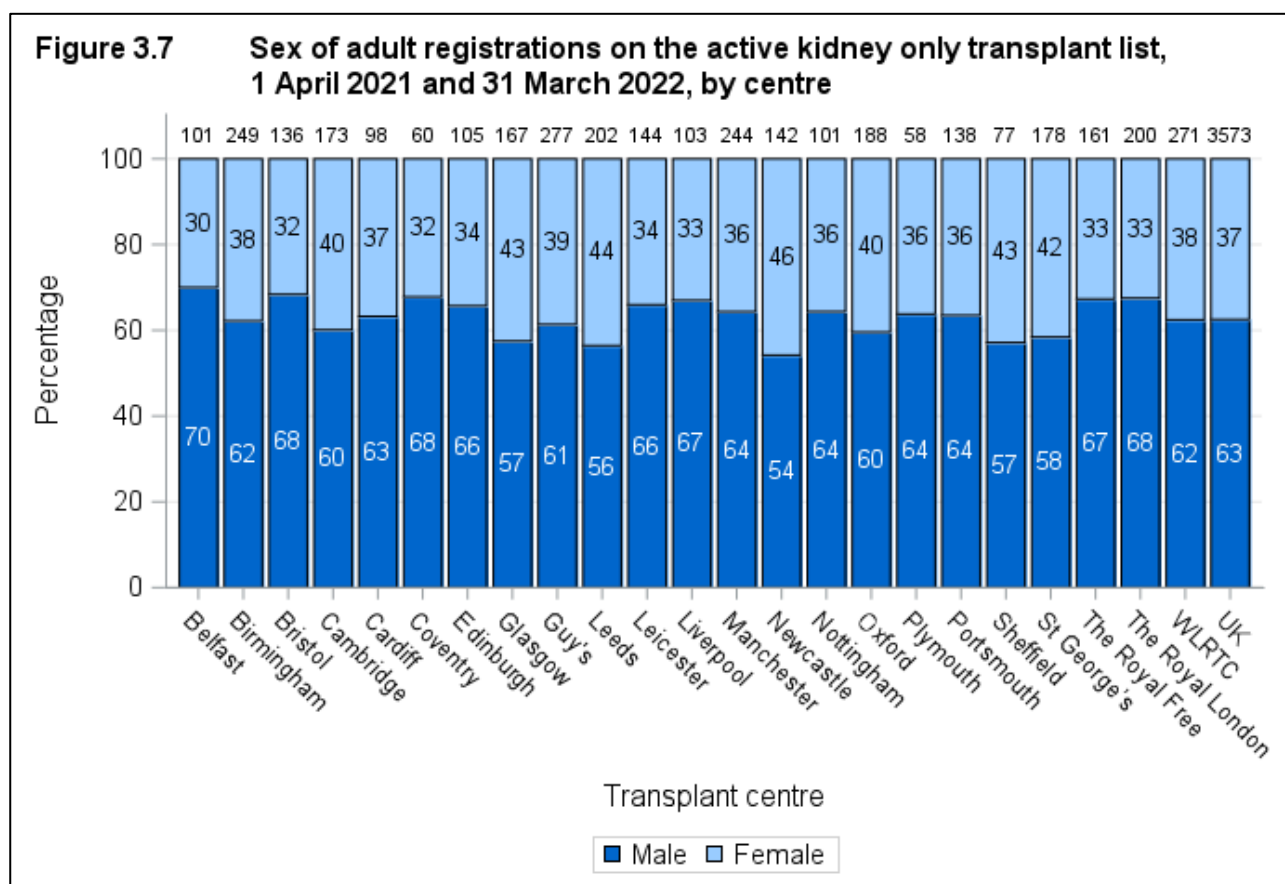


**Figure 3.6** shows the proportion of patients transplanted or still waiting three years after joining the list by centre. The proportion of patients transplanted three years after listing at each centre ranges from 49% at Sheffield to 83% at Cambridge.

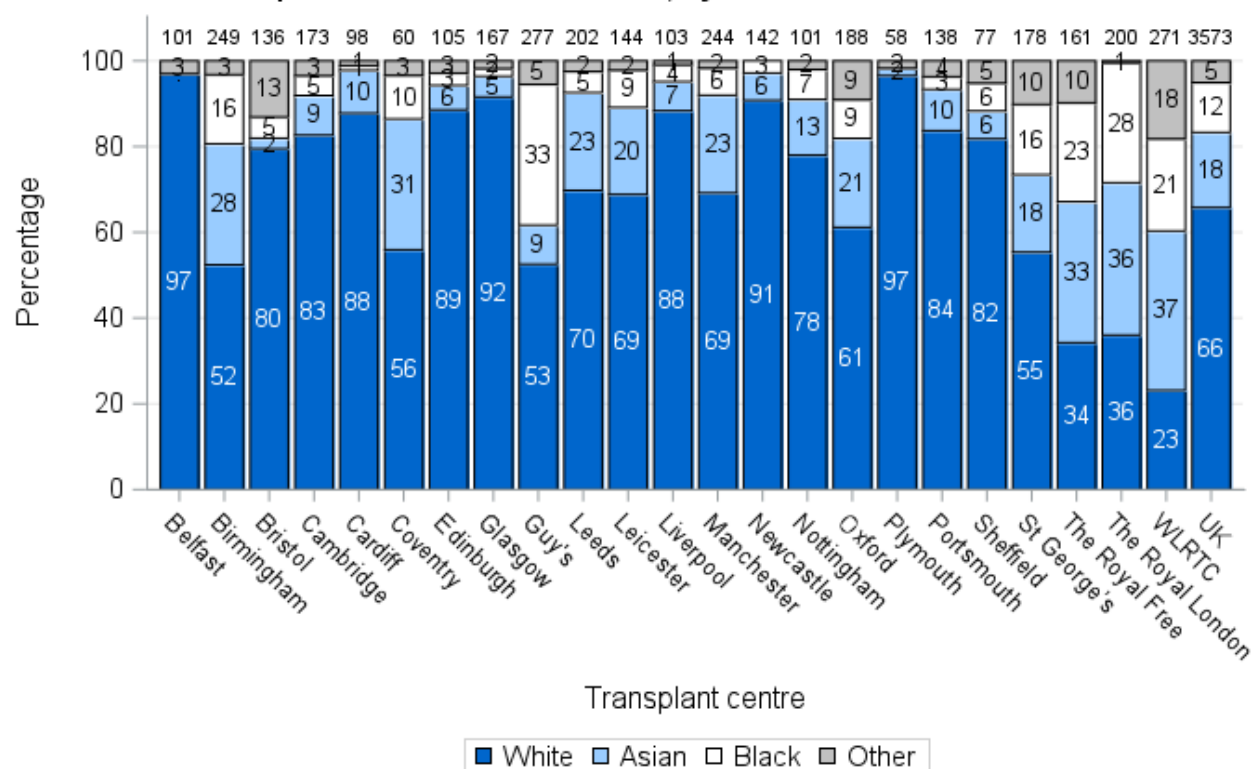


### 3.3 Demographic characteristics, 1 April 2021 – 31 March 2022

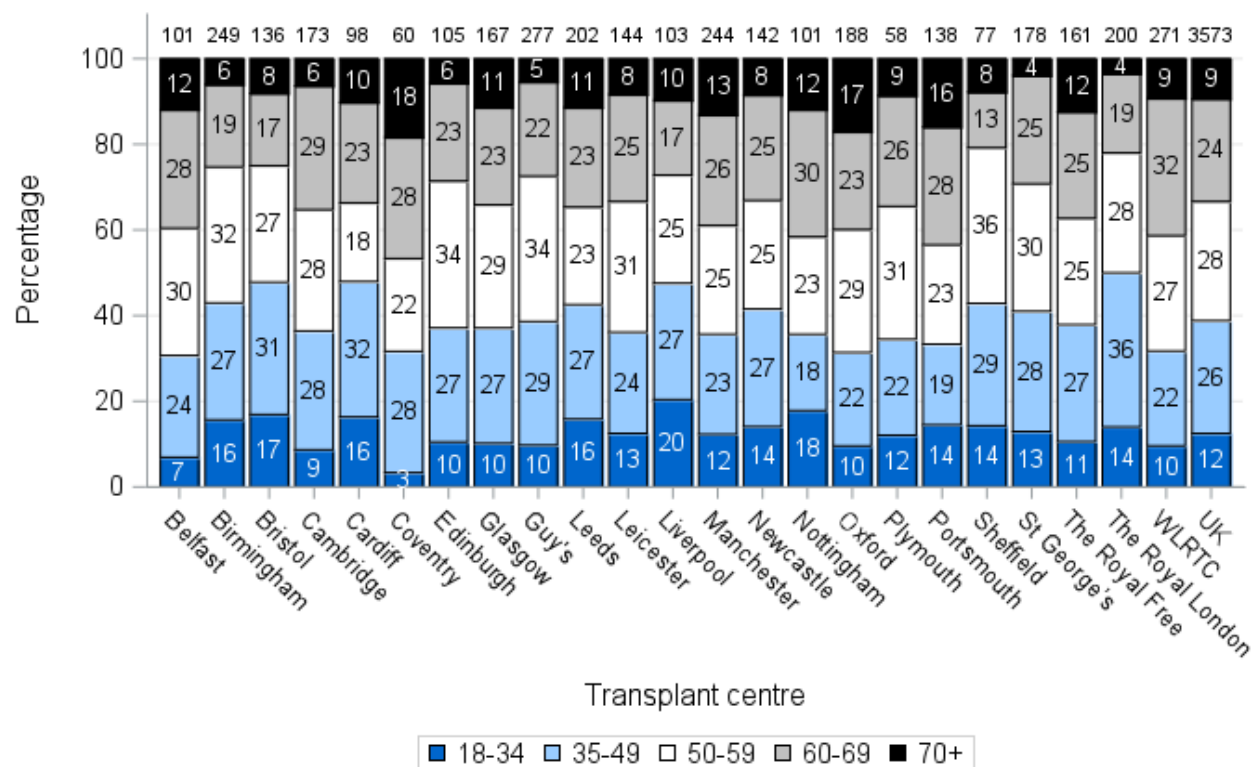
The sex, ethnicity, age group, calculated reaction frequency and primary renal disease of patients on the transplant list are shown by centre in **Figure 3.7, 3.8, 3.9, 3.10 and 3.11**, respectively. Note that all percentages quoted are based only on data where relevant information was available. Data are not presented where the proportion of missing data was over 50%. Changes made to the Kidney Allocation Scheme in 2006, and the 2019 National Kidney Offering Scheme mean that tissue matching criteria between donor and recipient are less strict than previously and waiting time to transplant is now more important than it was in deciding kidney allocation. These changes have an indirect benefit for patients from ethnic minority groups, who are less often a good tissue match with the predominantly white donor pool. As a result, access to transplantation is becoming more equitable.



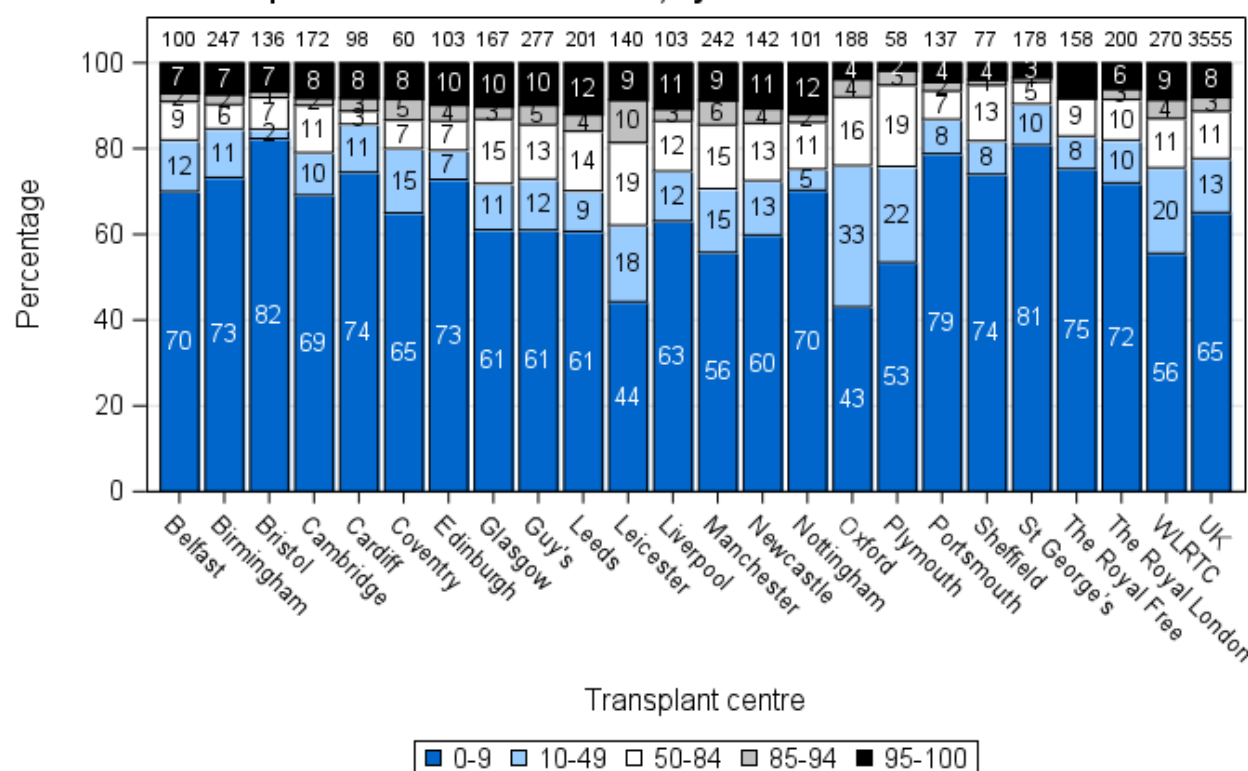
**Figure 3.8 Ethnicity of adult registrations on the active kidney only transplant list, 1 April 2021 and 31 March 2022, by centre**



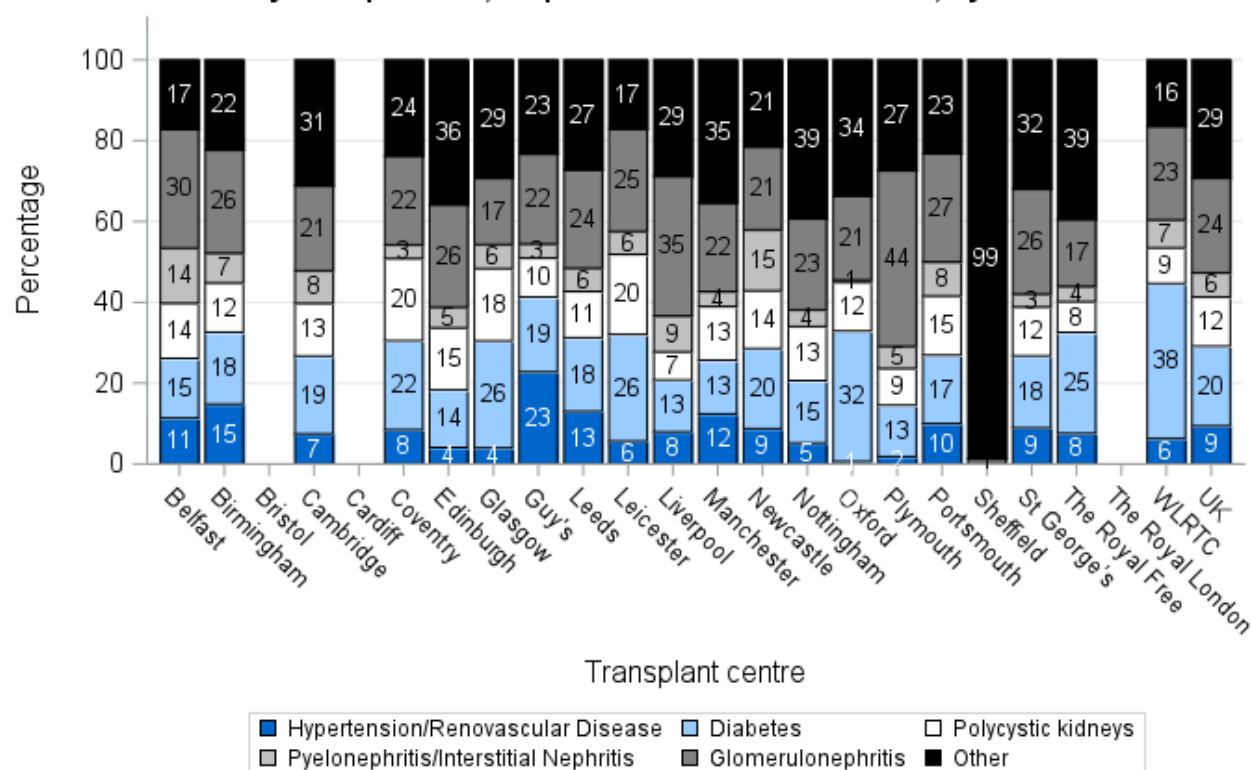
**Figure 3.9 Age of adult registrations on the active kidney only transplant list, 1 April 2021 and 31 March 2022, by centre**



**Figure 3.10 cRF of adult registrations on the active kidney only transplant list, 1 April 2021 and 31 March 2022, by centre**

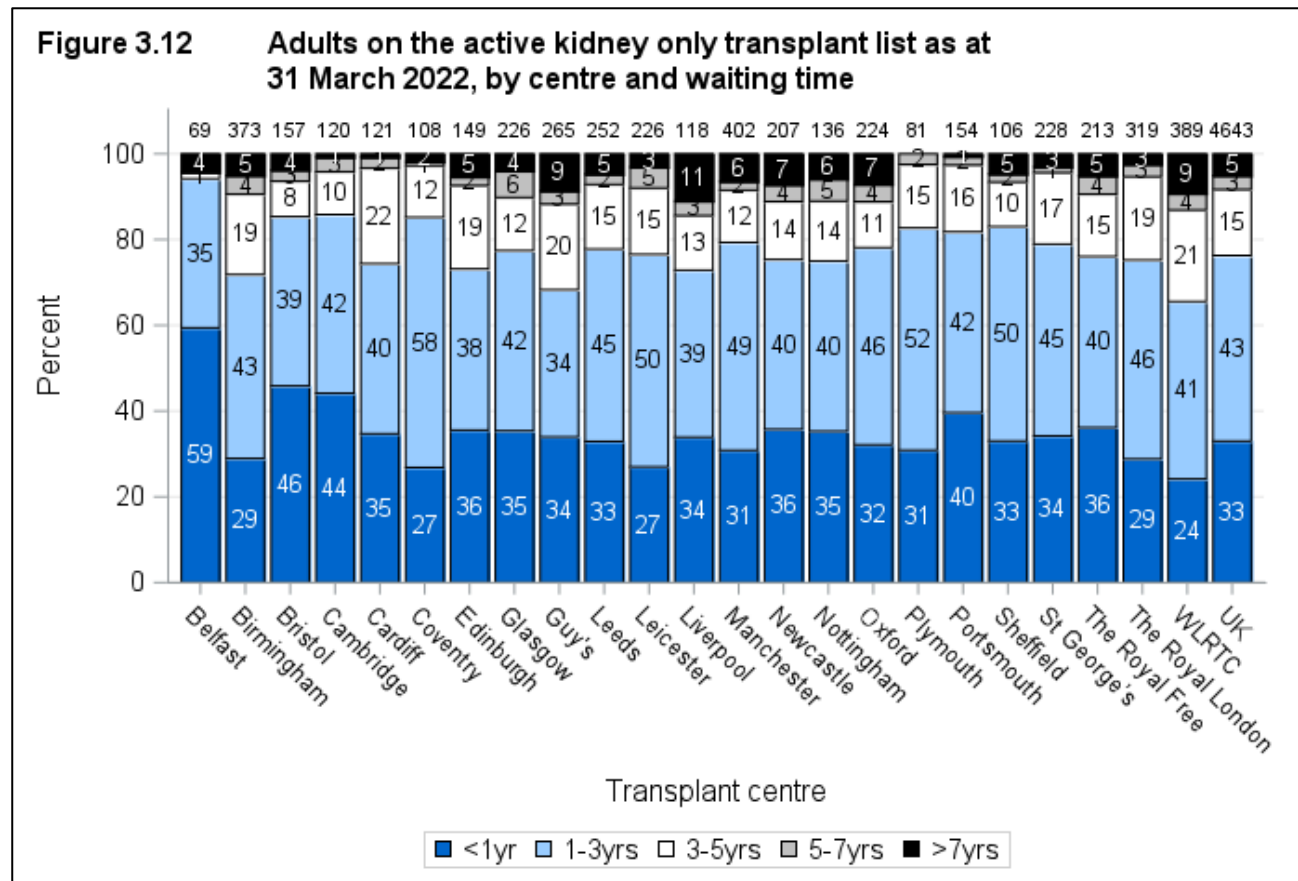


**Figure 3.11 Primary renal disease of adult registrations on the active kidney only transplant list, 1 April 2021 and 31 March 2022, by centre**



### 3.4 Adult waiting times for those currently on the list, 31 March 2022

**Figure 3.12** shows the length of time adults have been waiting on the kidney only [transplant list](#) at 31 March 2022 by centre. A small proportion of adults have been waiting for a transplant for more than seven years, 99% of these are highly sensitised with a calculated reaction frequency (cRF) of 85% or higher. Of those waiting for more than seven years, 93% have a cRF of 100% which makes these adults very difficult to match.





### 3.5 Median waiting time to transplant, 1 April 2016 – 31 March 2019

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

#### 2006 National Kidney Allocation Scheme

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

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

#### 2019 National Kidney Offering Scheme

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

We present a visual comparison of median waiting time to transplant among centres that is based on a graphical display known as a [funnel plot](#) (1, 2). This display is used to show how consistent the waiting times of the different transplant units are with the national rate accounting for different patient mix within centres. [Funnel plots](#) show the [risk-adjusted median waiting time to transplant](#) plotted against the number of patients registered at each centre, with the overall national [unadjusted waiting time to transplant](#) (solid line), and its 95% (thin dotted lines) and 99.8% (thick dotted lines) [confidence limits](#) superimposed. Each dot in the plot represents one of the centres.

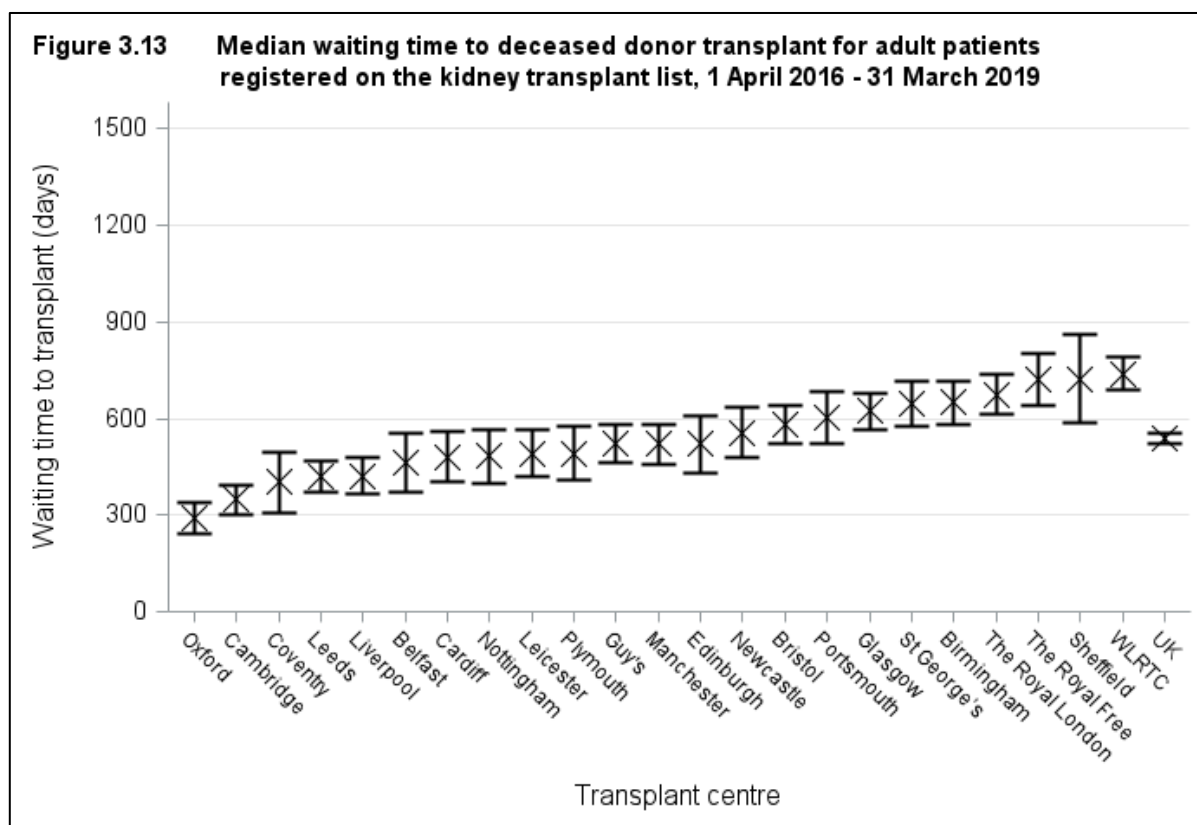
### Interpreting the [funnel plots](#)

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

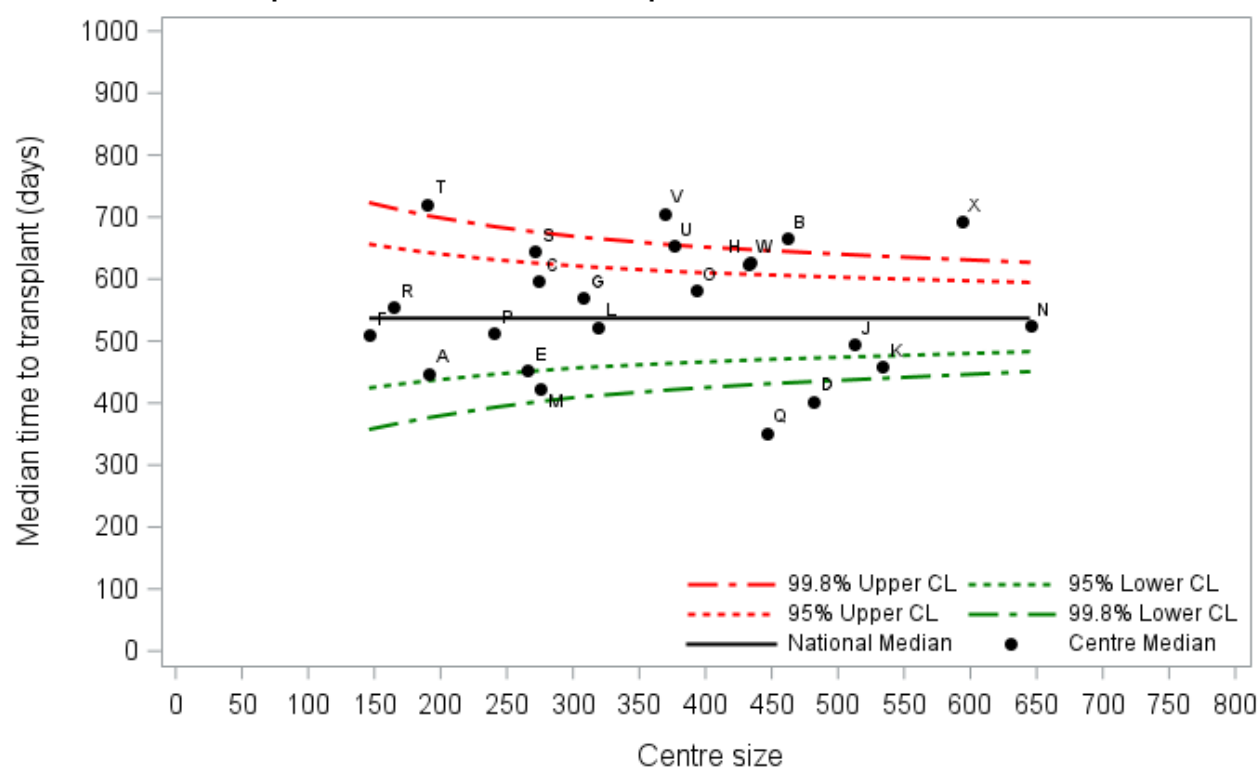
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1. Tekkis PP, McCulloch P, Steger AC, Benjamin IS, Poloniecki JD. Mortality control charts for comparing performance of surgical units: validation study using hospital mortality data. *British Medical Journal* 2003; 326: 786 – 788.
2. Stark J, Gallivan 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 2016 and 31 March 2019 is 536 days. This ranged from 291 days at Oxford to 739 days at WLRTC.



**Figure 3.14** Adult risk-adjusted median waiting times  
for patients listed between 1 April 2016 and 31 March 2019

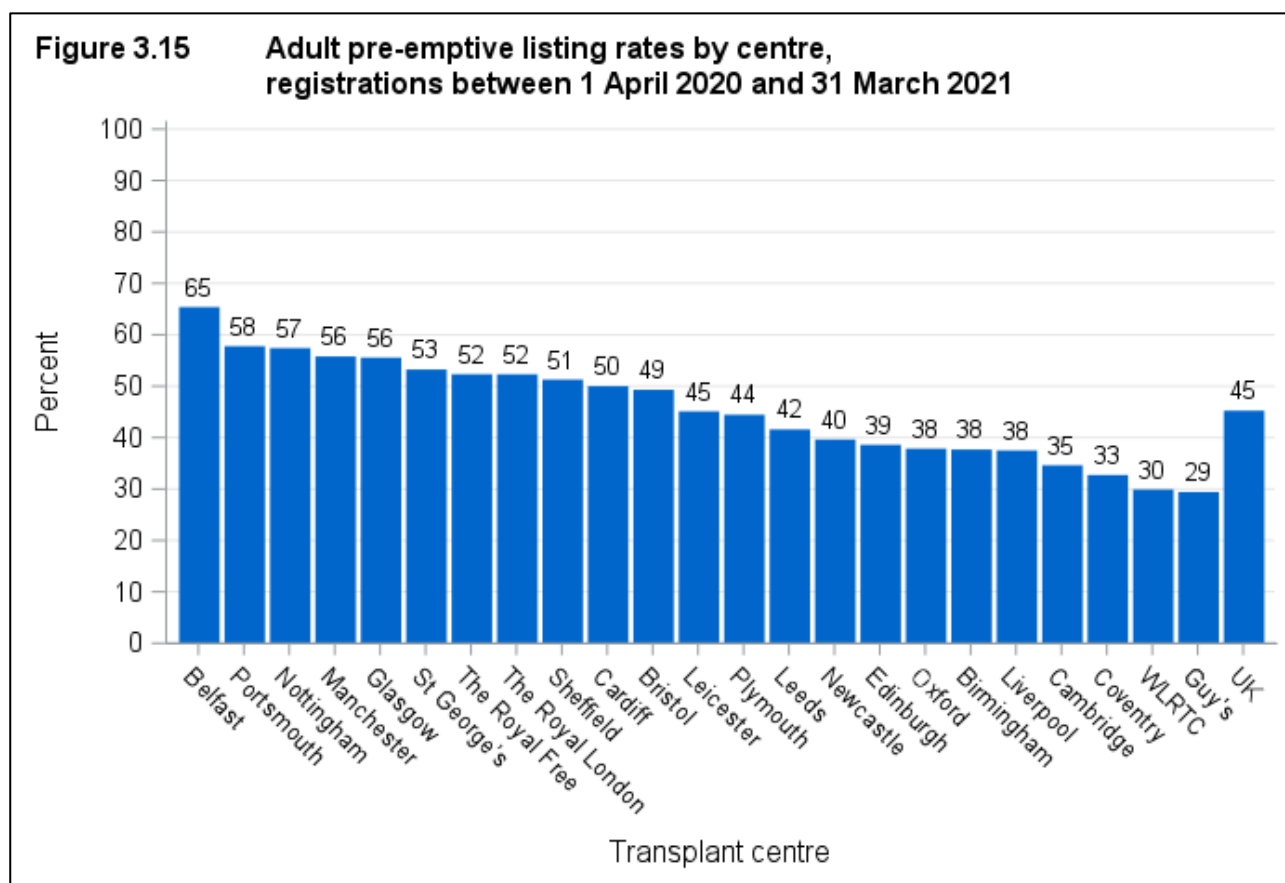


**Table 3.1 Median waiting time to kidney only transplant in the UK,  
for adults registered 1 April 2016 - 31 March 2019**

Transplant centre	Code	Number of adults registered	Waiting time (days)		
			Unadjusted Median	95% Confidence interval	Risk-adjusted median
Oxford	Q	452	291	242 - 340	352
Cambridge	D	488	348	300 - 396	402
Leeds	K	542	421	373 - 469	460
Coventry	F	149	402	306 - 498	510
Liverpool	M	278	422	366 - 478	425
Cardiff	E	289	480	402 - 558	454
Manchester	N	649	520	460 - 580	526
Nottingham	P	244	482	401 - 563	514
Plymouth	R	168	491	408 - 574	556
Edinburgh	G	311	520	432 - 608	571
Leicester	L	325	491	419 - 563	524
Belfast	A	191	463	372 - 554	449
Newcastle	O	394	556	477 - 635	582
Guy's	J	523	520	461 - 579	496
Bristol	C	276	581	521 - 641	598
Glasgow	H	436	622	566 - 678	626
Portsmouth	S	276	603	522 - 684	645
St George's	U	382	645	577 - 713	655
Birmingham	B	469	649	581 - 717	666
The Royal Free	V	373	720	641 - 799	707
The Royal London	W	458	675	614 - 736	627
Sheffield	T	196	723	588 - 858	722
WLRTC	X	602	739	688 - 790	694
<b>UK</b>		<b>8471</b>	<b>536</b>	<b>520 - 552</b>	

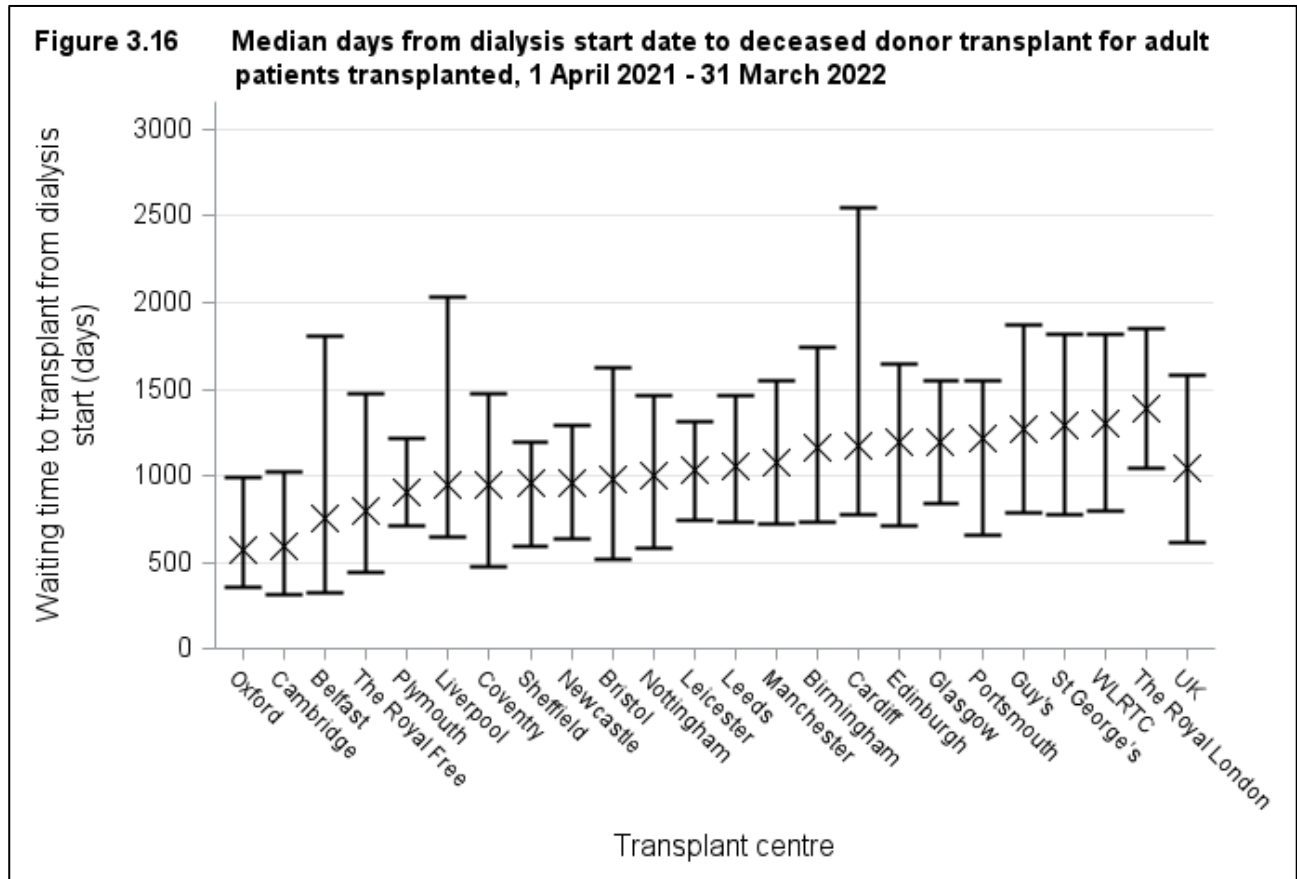
### 3.6 Pre-emptive listing rates, 1 April 2020 - 31 March 2021

Rates of [pre-emptive](#) kidney only listings are shown in **Figure 3.15** for adults joining the list between 1 April 2020 and 31 March 2021. 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 45% of all adult registrations across the UK ranging from 65% at Belfast to 29% at Guy's.



### 3.7 Median time from start of dialysis to transplant, 1 April 2021 - 31 March 2022

The median time from dialysis start date to deceased donor transplant for adults transplanted between 1 April 2021 and 31 March 2022 is shown in **Figure 3.16**. The UK [median](#) time is 1044 days. This ranged from 570 days at Oxford to 1383 days at Royal London.



### 3.8 2019 Kidney Offering Scheme Recipient Risk Index, 1 April 2021 – 31 March 2022

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

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

R1 → RRI ≤ 0.74 (lowest risk)

R2 → RRI 0.74 - 0.94

R3 → RRI 0.94 – 1.20

R4 → RRI ≥ 1.20 (highest risk)

**Table 3.2** presents the RRI groups and average scores for adults on the kidney only [transplant list](#) at 31 March 2022.

**Table 3.2 Recipient Risk Index of adults active on the kidney only transplant list at 31 March 2022**

Transplant centre	Recipient Risk Group				Avg. RRI
	R1	R2	R3	R4	
Belfast	30	16	14	9	0.85
Birmingham	126	102	85	60	0.9
Bristol	74	46	23	14	0.81
Cambridge	47	27	38	8	0.85
Cardiff	50	45	15	11	0.82
Coventry	32	36	26	14	0.91
Edinburgh	51	40	38	20	0.89
Glasgow	74	76	45	31	0.88
Guy's	89	62	62	52	0.93
Leeds	81	75	57	39	0.91
Leicester	70	61	52	43	0.93
Liverpool	46	30	25	17	0.88
Manchester	144	130	73	55	0.89
Newcastle	69	75	38	25	0.88
Nottingham	42	40	33	21	0.9
Oxford	69	51	54	50	0.96
Plymouth	32	18	22	9	0.87
Portsmouth	60	36	39	19	0.88
Sheffield	45	29	20	12	0.85
St George's	88	64	49	27	0.87
The Royal Free	62	72	45	34	0.91
The Royal London	118	102	71	28	0.85
WLRTC	112	79	91	107	1.01
<b>UK</b>	<b>1611</b>	<b>1312</b>	<b>1015</b>	<b>705</b>	<b>0.9</b>



## **Response to adult kidney offers**

## Offer decline rates

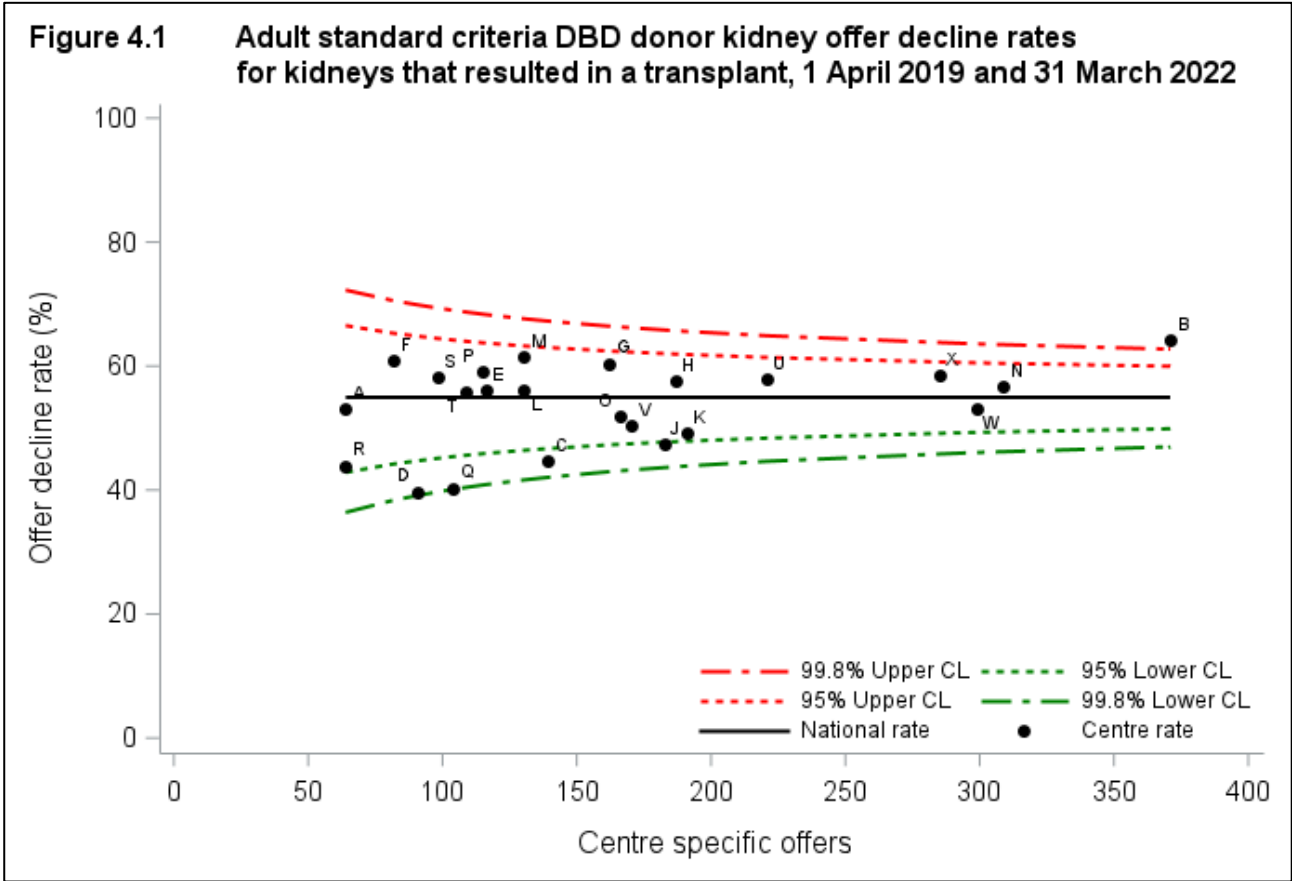
Kidney-only offers from [DBD](#) and [DCD](#) donors who had at least one kidney retrieved, offered directly and on behalf of a named individual patient and resulted in transplantation are included in the analysis. Any offers made through the reallocation of kidneys, declined kidney or fast track schemes 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  $\geq 60$  years at the time of death OR aged 50 to 59 years with at least two or three donor characteristics: hypertension, creatinine  $> 130 \mu\text{mol/l}$  or death due to intracranial haemorrhage. SCD are donors that did not meet the ECD criteria.

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

4.1 DBD Standard criteria offer decline rates, 1 April 2019 – 31 March 2022

**Figure 4.1** compares individual centre offer decline rates with the national rate for SCD over the time period, 1 April 2019 and 31 March 2022. Centres can be identified by the information shown in **Table 4.1**.

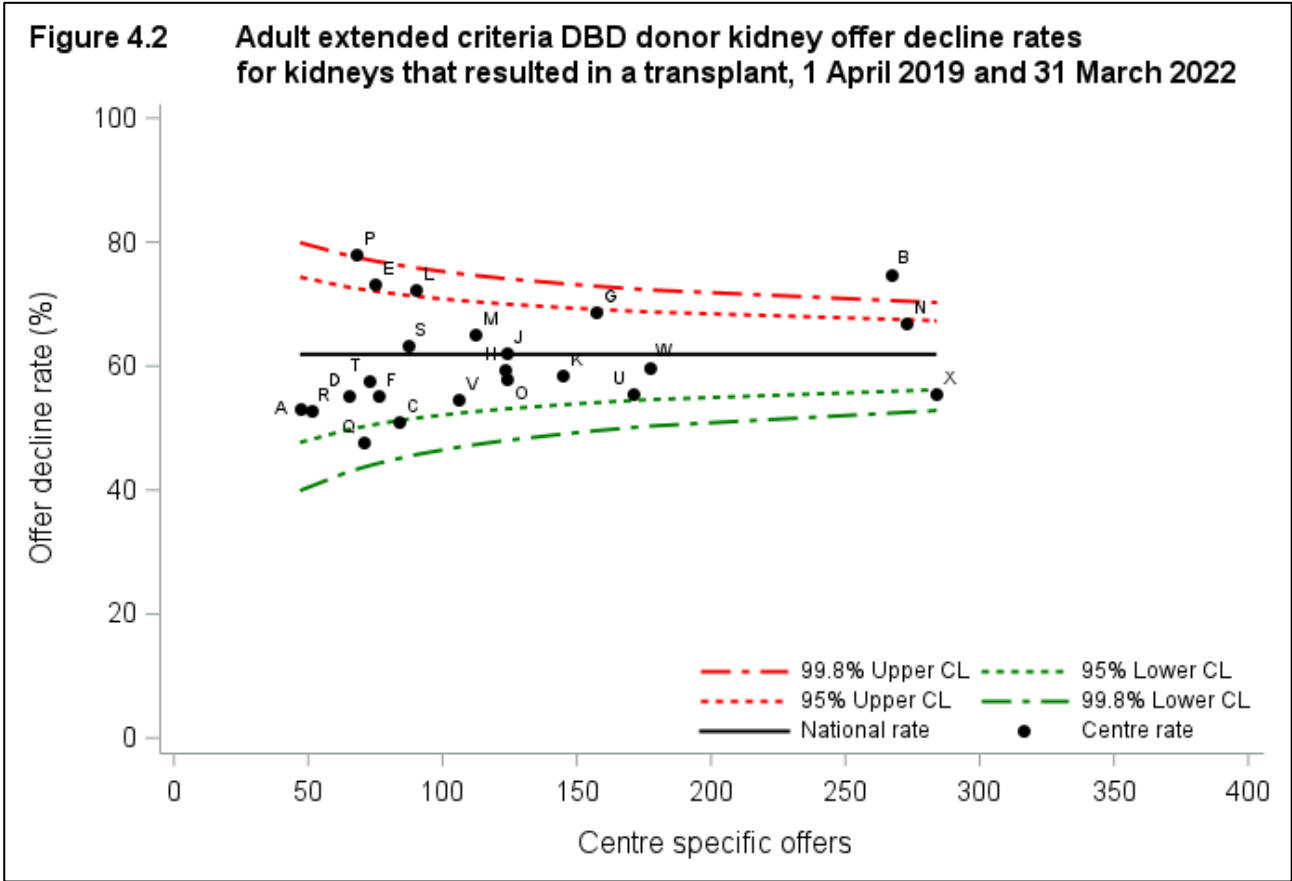


**Table 4.1** compares individual centre offer decline rates for SCD over time by financial year.

<b>Table 4.1 Adult standard criteria DBD donor kidney offer decline rates by transplant centre, 1 April 2019 and 31 March 2022</b>									
<b>Centre</b>	<b>Code</b>	<b>2019/20</b>		<b>2020/21</b>		<b>2021/22</b>		<b>Overall</b>	
		<b>N</b>	<b>(%)</b>	<b>N</b>	<b>(%)</b>	<b>N</b>	<b>(%)</b>	<b>N</b>	<b>(%)</b>
Belfast	A	17	(12)	38	(76)	9	(33)	64	(53)
Birmingham	B	112	(57)	121	(69)	138	(66)	371	(64)
Bristol	C	48	(50)	55	(42)	36	(42)	139	(45)
Cambridge	D	30	(20)	31	(42)	30	(57)	91	(40)
Cardiff	E	31	(48)	47	(53)	38	(66)	116	(56)
Coventry	F	26	(62)	36	(61)	20	(60)	82	(61)
Edinburgh	G	46	(50)	77	(68)	39	(59)	162	(60)
Glasgow	H	64	(55)	83	(67)	40	(43)	187	(58)
Guy's	J	70	(51)	32	(56)	81	(41)	183	(48)
Leeds	K	62	(37)	75	(59)	54	(50)	191	(49)
Leicester	L	50	(40)	31	(58)	49	(71)	130	(56)
Liverpool	M	47	(53)	54	(76)	29	(48)	130	(62)
Manchester	N	82	(46)	137	(69)	90	(48)	309	(57)
Newcastle	O	53	(53)	82	(51)	31	(52)	166	(52)
Nottingham	P	42	(50)	29	(66)	44	(64)	115	(59)
Oxford	Q	29	(45)	43	(40)	32	(38)	104	(40)
Plymouth	R	20	(25)	25	(32)	19	(79)	64	(44)
Portsmouth	S	39	(56)	11	(55)	48	(60)	98	(58)
Sheffield	T	28	(32)	46	(72)	35	(54)	109	(56)
St George's	U	93	(56)	48	(67)	80	(55)	221	(58)
The Royal Free	V	69	(52)	64	(48)	37	(51)	170	(51)
The Royal London	W	97	(48)	72	(63)	130	(52)	299	(53)
WLRTC	X	110	(63)	75	(64)	100	(50)	285	(59)
<b>UK</b>		<b>1265</b>	<b>(50)</b>	<b>1312</b>	<b>(61)</b>	<b>1209</b>	<b>(54)</b>	<b>3786</b>	<b>(55)</b>
		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 2019 – 31 March 2022

**Figure 4.2** compares individual centre offer decline rates with the national rate for ECD over the time period, 1 April 2019 and 31 March 2022. Centres can be identified by the information shown in **Table 4.2**.

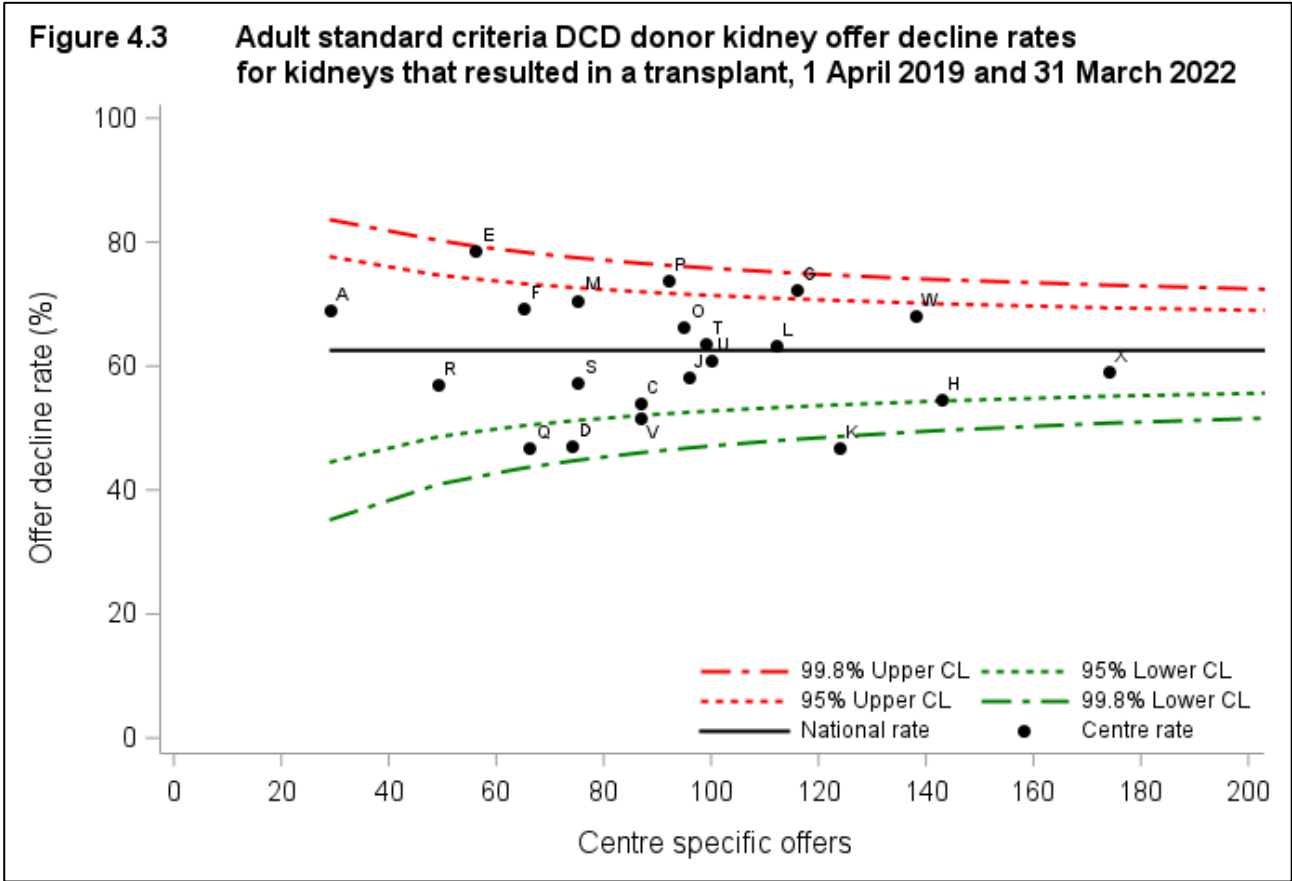


**Table 4.2** compares individual centre offer decline rates for ECD over time by financial year.

<b>Table 4.2 Adult extended criteria DBD donor kidney offer decline rates by transplant centre, 1 April 2019 and 31 March 2022</b>									
<b>Centre</b>	<b>Code</b>	<b>2019/20</b>		<b>2020/21</b>		<b>2021/22</b>		<b>Overall</b>	
		<b>N</b>	<b>(%)</b>	<b>N</b>	<b>(%)</b>	<b>N</b>	<b>(%)</b>	<b>N</b>	<b>(%)</b>
Belfast	A	17	(59)	19	(63)	11	(27)	47	(53)
Birmingham	B	87	(66)	69	(87)	111	(75)	267	(75)
Bristol	C	42	(50)	22	(59)	20	(45)	84	(51)
Cambridge	D	30	(50)	18	(50)	17	(71)	65	(55)
Cardiff	E	22	(64)	26	(85)	27	(70)	75	(73)
Coventry	F	36	(47)	25	(76)	15	(40)	76	(55)
Edinburgh	G	56	(61)	67	(73)	34	(74)	157	(69)
Glasgow	H	46	(46)	46	(70)	31	(65)	123	(59)
Guy's	J	47	(62)	22	(50)	55	(67)	124	(62)
Leeds	K	40	(53)	56	(63)	49	(59)	145	(59)
Leicester	L	20	(60)	28	(68)	42	(81)	90	(72)
Liverpool	M	40	(63)	38	(68)	34	(65)	112	(65)
Manchester	N	71	(56)	129	(82)	73	(51)	273	(67)
Newcastle	O	53	(64)	53	(58)	18	(39)	124	(58)
Nottingham	P	20	(80)	16	(81)	32	(75)	68	(78)
Oxford	Q	29	(52)	23	(52)	19	(37)	71	(48)
Plymouth	R	16	(50)	20	(60)	15	(47)	51	(53)
Portsmouth	S	38	(63)	10	(50)	39	(67)	87	(63)
Sheffield	T	31	(52)	15	(67)	27	(59)	73	(58)
St George's	U	88	(52)	35	(63)	48	(56)	171	(56)
The Royal Free	V	44	(59)	37	(51)	25	(52)	106	(55)
The Royal London	W	90	(57)	26	(69)	61	(61)	177	(60)
WLRTC	X	105	(55)	73	(68)	106	(47)	284	(56)
<b>UK</b>		<b>1068</b>	<b>(57)</b>	<b>873</b>	<b>(69)</b>	<b>909</b>	<b>(61)</b>	<b>2850</b>	<b>(62)</b>
		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 2019 – 31 March 2022

**Figure 4.3** compares individual centre offer decline rates with the national rate for SCD over the time period, 1 April 2019 and 31 March 2022. Centres can be identified by the information shown in **Table 4.3**.



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

<b>Table 4.3 Adult standard criteria DCD donor kidney offer decline rates by transplant centre, 1 April 2019 and 31 March 2022</b>									
<b>Centre</b>	<b>Code</b>	<b>2019/20</b>		<b>2020/21</b>		<b>2021/22</b>		<b>Overall</b>	
		<b>N</b>	<b>(%)</b>	<b>N</b>	<b>(%)</b>	<b>N</b>	<b>(%)</b>	<b>N</b>	<b>(%)</b>
Belfast	A	12	(58)	12	(83)	5	(60)	29	(69)
Birmingham	B	84	(70)	65	(82)	121	(74)	270	(75)
Bristol	C	17	(47)	39	(62)	31	(48)	87	(54)
Cambridge	D	17	(35)	29	(38)	28	(64)	74	(47)
Cardiff	E	12	(75)	26	(85)	18	(72)	56	(79)
Coventry	F	22	(68)	24	(79)	19	(58)	65	(69)
Edinburgh	G	36	(53)	55	(85)	25	(72)	116	(72)
Glasgow	H	44	(39)	54	(70)	45	(51)	143	(55)
Guy's	J	34	(53)	13	(62)	49	(61)	96	(58)
Leeds	K	30	(47)	49	(51)	45	(42)	124	(47)
Leicester	L	30	(43)	30	(60)	52	(77)	112	(63)
Liverpool	M	29	(79)	28	(68)	18	(61)	75	(71)
Manchester	N	60	(58)	82	(63)	77	(62)	219	(62)
Newcastle	O	28	(68)	47	(64)	20	(70)	95	(66)
Nottingham	P	24	(75)	32	(66)	36	(81)	92	(74)
Oxford	Q	26	(54)	19	(47)	21	(38)	66	(47)
Plymouth	R	12	(50)	21	(52)	16	(69)	49	(57)
Portsmouth	S	15	(47)	10	(90)	50	(54)	75	(57)
Sheffield	T	29	(59)	34	(71)	36	(61)	99	(64)
St George's	U	25	(68)	21	(81)	54	(50)	100	(61)
The Royal Free	V	33	(48)	20	(70)	34	(44)	87	(52)
The Royal London	W	52	(67)	25	(84)	61	(62)	138	(68)
WLRTC	X	54	(63)	46	(67)	74	(51)	174	(59)
<b>UK</b>		<b>725</b>	<b>(59)</b>	<b>781</b>	<b>(68)</b>	<b>935</b>	<b>(61)</b>	<b>2441</b>	<b>(63)</b>
		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 2019 – 31 March 2022

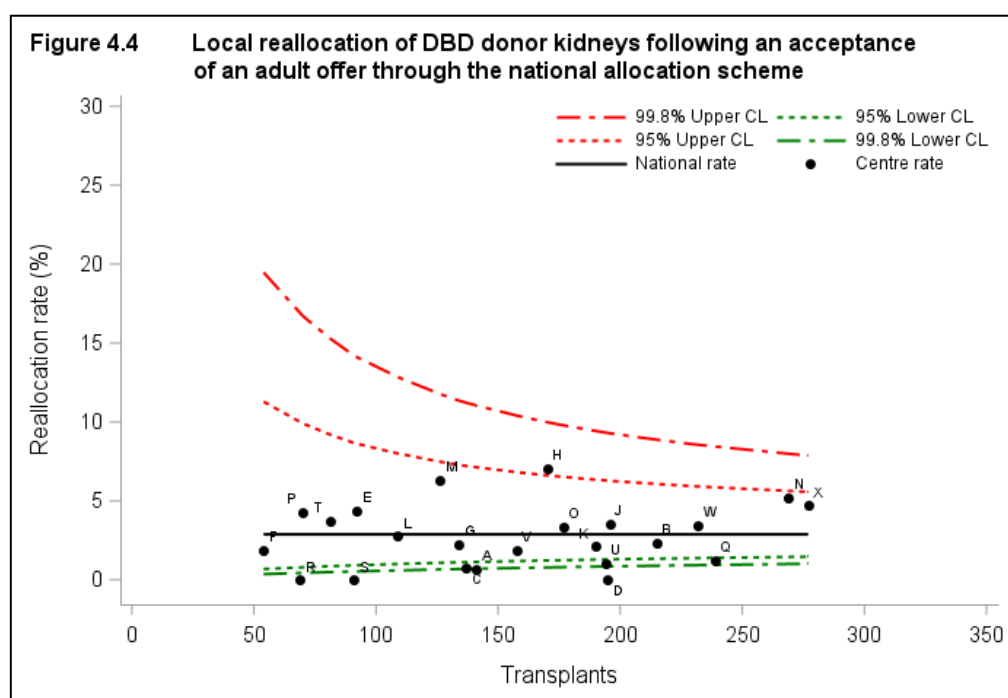
Between 3 April 2006 and 11 September 2019 all kidneys from donation after brain death (DBD) donors have been allocated through the 2006 National Kidney Allocation Scheme. There are however certain situations when a kidney can be reallocated to an alternative patient of the centre's choice. This occurs 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 2019 and 31 March 2022. Centres can be identified by the information shown in **Table 4.4**. Nationally 3% of all [DBD](#) kidney only transplants used kidneys that had been reallocated.



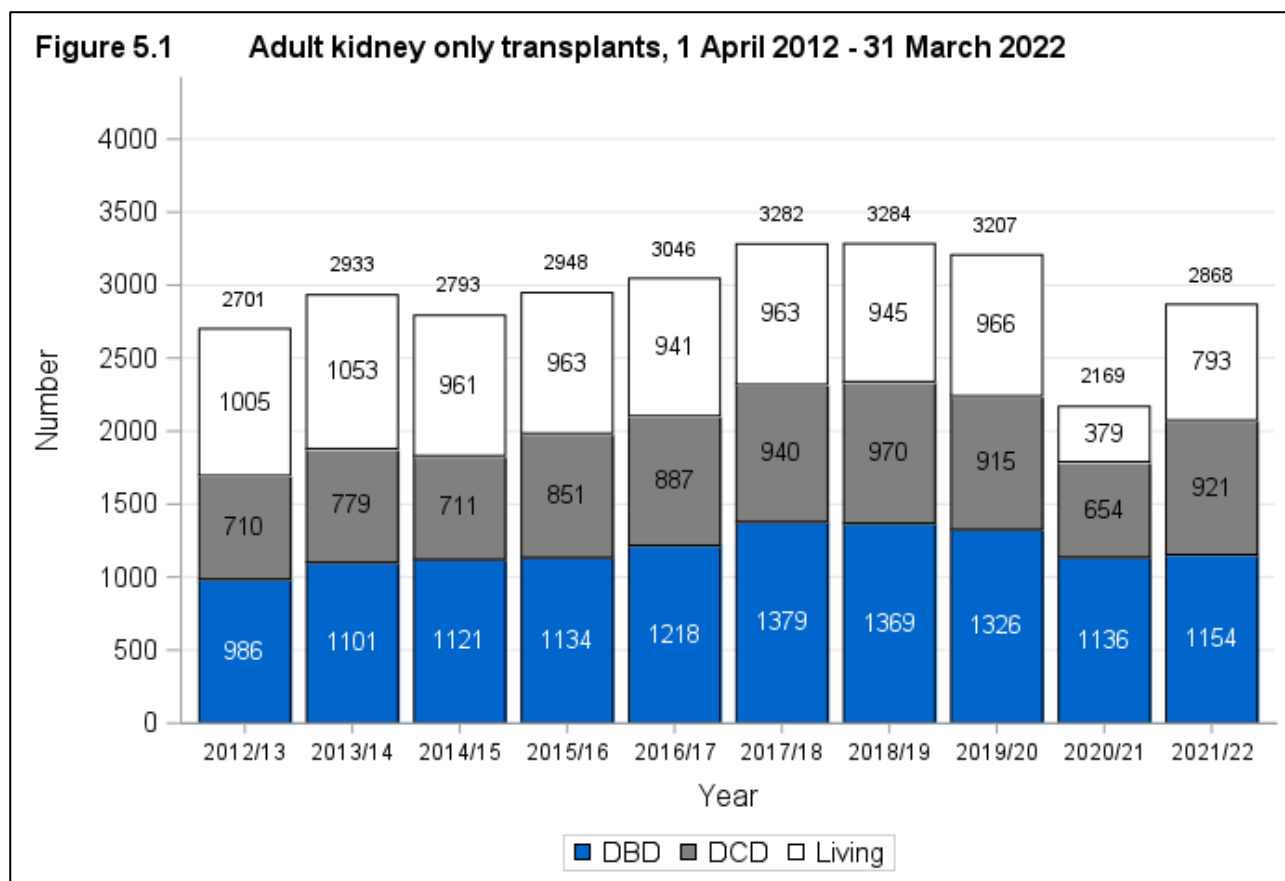
**Table 4.4** compares individual reallocation rates over time by financial year.

<b>Table 4.4 Local reallocation of DBD donor kidneys following an acceptance of an adult offer through the national allocation scheme</b>									
<b>Centre</b>	<b>Code</b>	<b>2019/20</b>		<b>2020/21</b>		<b>2021/22</b>		<b>Overall</b>	
		<b>N</b>	<b>(%)</b>	<b>N</b>	<b>(%)</b>	<b>N</b>	<b>(%)</b>	<b>N</b>	<b>(%)</b>
Belfast	A	25	(0)	87	(0)	29	(3)	141	(1)
Birmingham	B	83	(0)	52	(4)	80	(4)	215	(2)
Bristol	C	49	(2)	49	(0)	39	(0)	137	(1)
Cambridge	D	64	(0)	82	(0)	49	(0)	195	(0)
Cardiff	E	34	(3)	29	(3)	29	(7)	92	(4)
Coventry	F	24	(0)	9	(11)	21	(0)	54	(2)
Edinburgh	G	50	(2)	51	(4)	33	(0)	134	(2)
Glasgow	H	63	(3)	63	(11)	44	(7)	170	(7)
Guy's	J	88	(6)	29	(0)	79	(3)	196	(4)
Leeds	K	74	(1)	66	(3)	50	(2)	190	(2)
Leicester	L	48	(4)	36	(0)	25	(4)	109	(3)
Liverpool	M	48	(10)	33	(3)	45	(4)	126	(6)
Manchester	N	89	(6)	75	(4)	105	(6)	269	(5)
Newcastle	O	54	(4)	88	(3)	35	(3)	177	(3)
Nottingham	P	28	(0)	16	(13)	26	(4)	70	(4)
Oxford	Q	56	(4)	124	(0)	59	(2)	239	(1)
Plymouth	R	27	(0)	26	(0)	16	(0)	69	(0)
Portsmouth	S	37	(0)	11	(0)	43	(0)	91	(0)
Sheffield	T	35	(3)	17	(0)	29	(7)	81	(4)
St George's	U	89	(1)	43	(0)	62	(2)	194	(1)
The Royal Free	V	54	(2)	59	(0)	45	(4)	158	(2)
The Royal London	W	101	(4)	35	(0)	96	(4)	232	(3)
WLRTC	X	106	(6)	56	(7)	115	(3)	277	(5)
<b>UK</b>		<b>1326</b>	<b>(3)</b>	<b>1136</b>	<b>(2)</b>	<b>1154</b>	<b>(3)</b>	<b>3616</b>	<b>(3)</b>
		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							

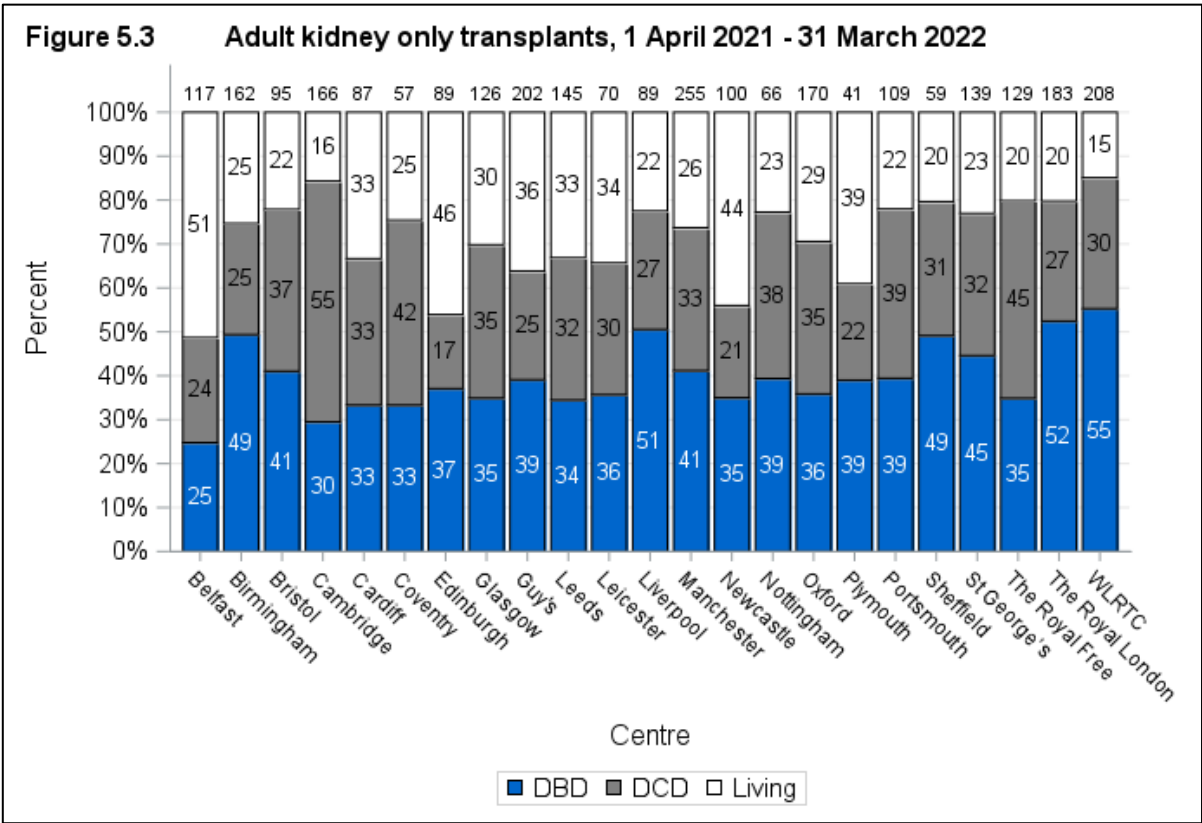
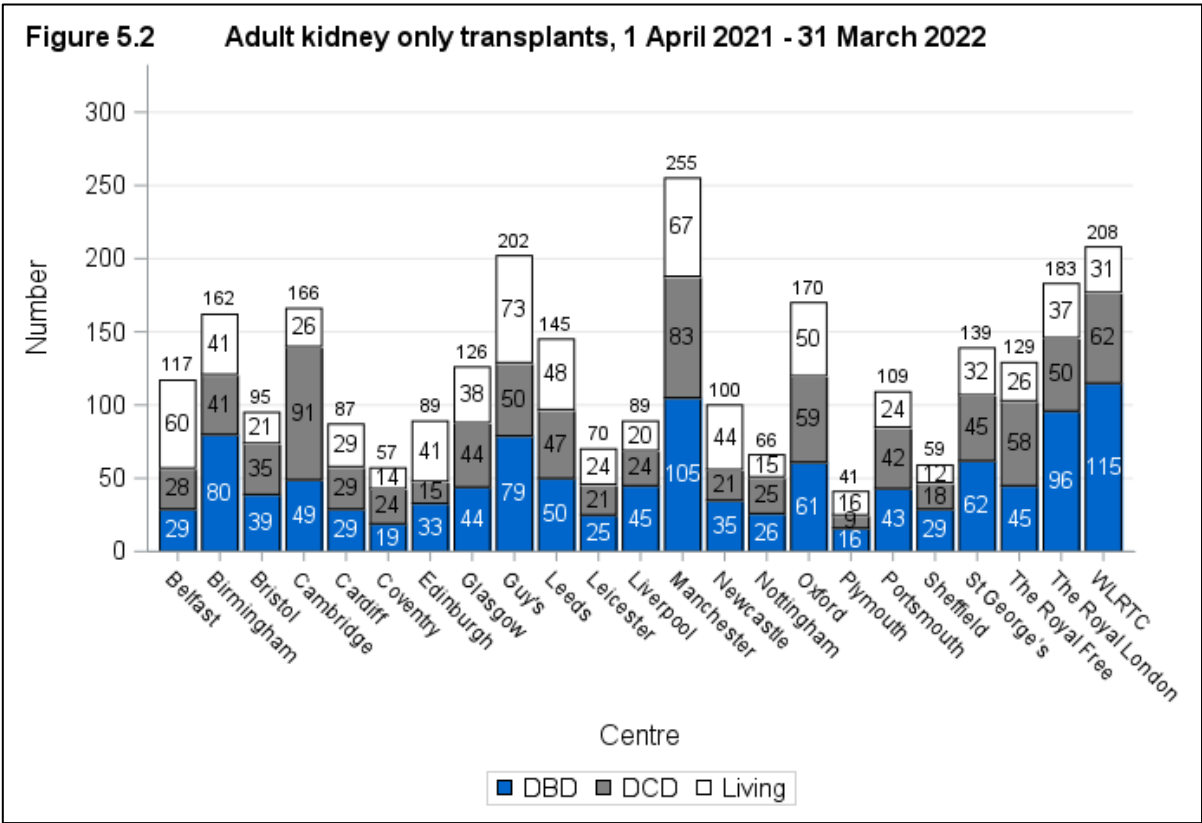
## **Adult kidney transplants**

## 5.1 Kidney only transplants, 1 April 2012 – 31 March 2022

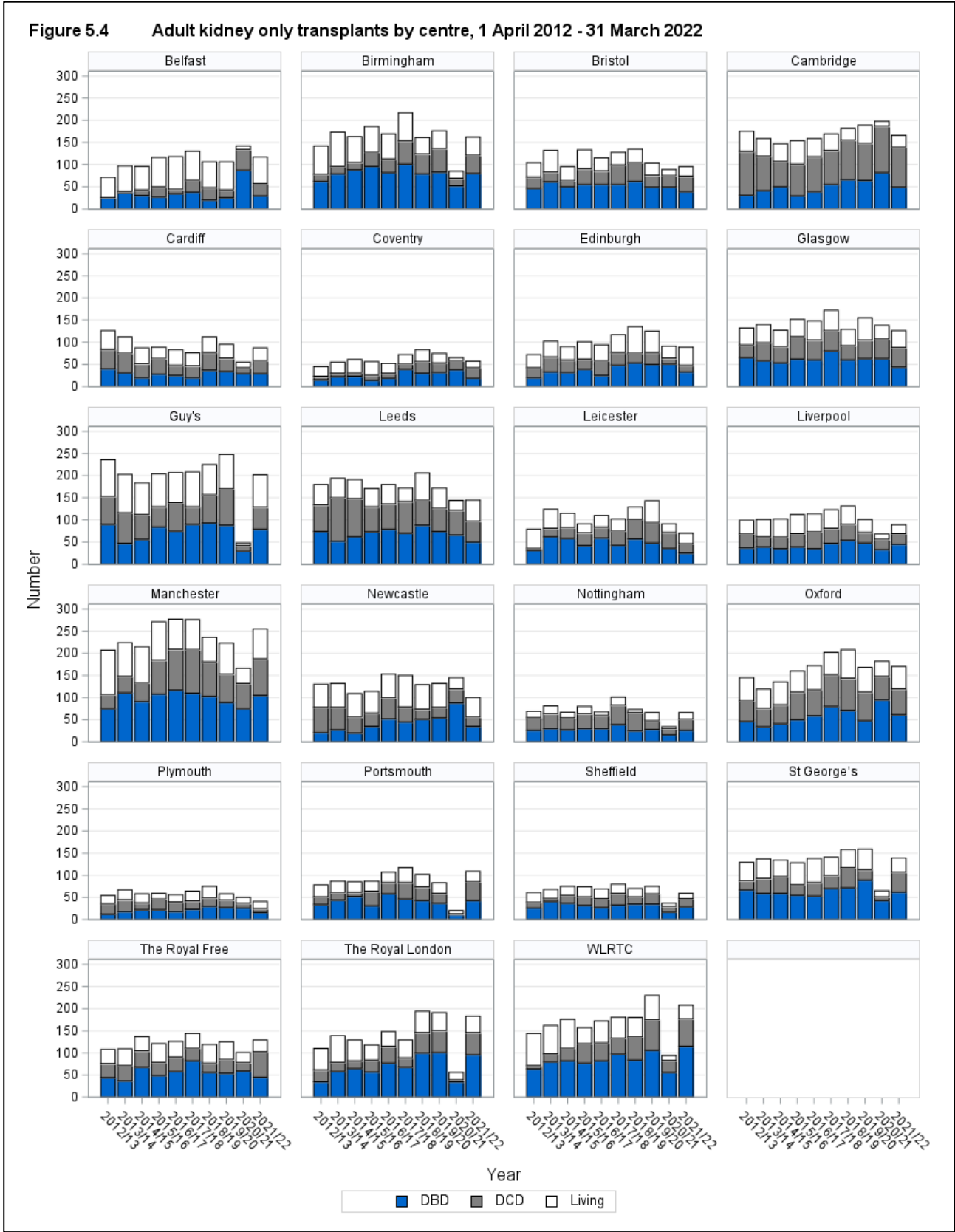
**Figure 5.1** shows the total number of adult kidney only transplants performed in the last ten years, by type of donor. The number of adult transplants from donors after circulatory death ([DCD](#)) steadily increased from 710 in 2012/13 to 970 in 2018/19 with a dip in activity since. The number of adult transplants from donors after brain death ([DBD](#)) increased from 986 in 2011/12 to 1379 in 2017/18 with a decrease to 1154 in 2021/22. The number of adult living kidney transplants performed has decreased from 1005 in 2012/13 to 793 in 2021/22.



**Figure 5.2** shows the total number of adult kidney only transplants performed in 2021/22, 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.



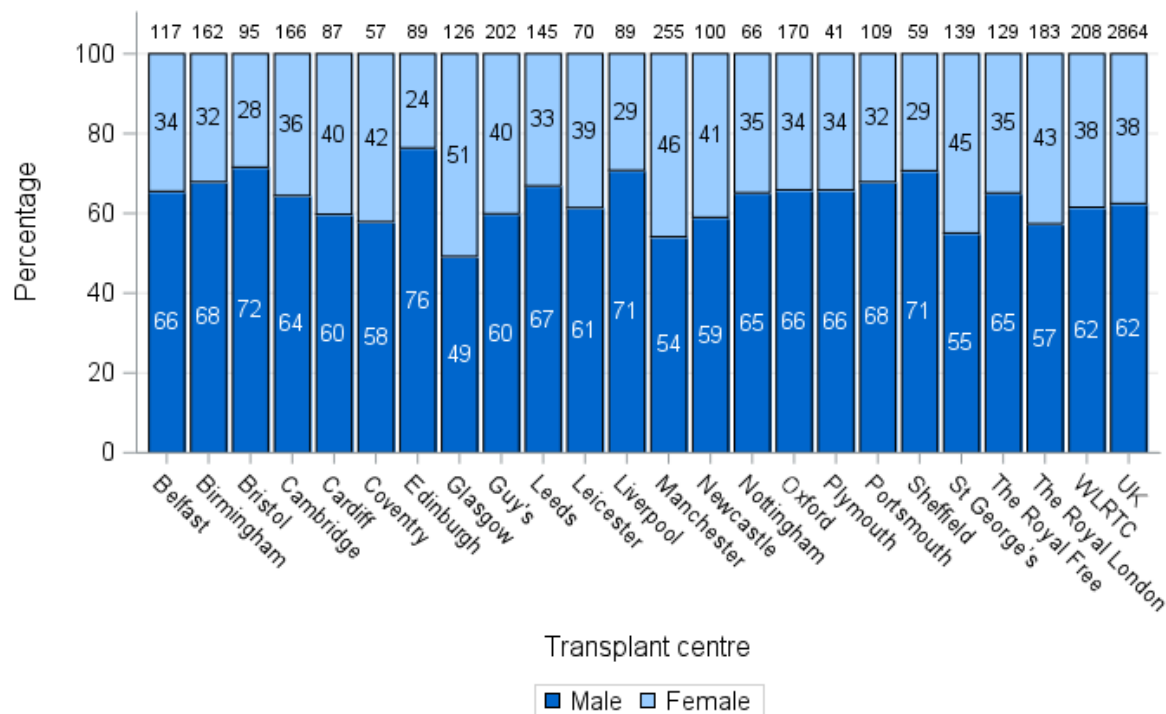
**Figure 5.4** shows the total number of adult kidney only transplants performed in last ten years, by centre and type of donor.



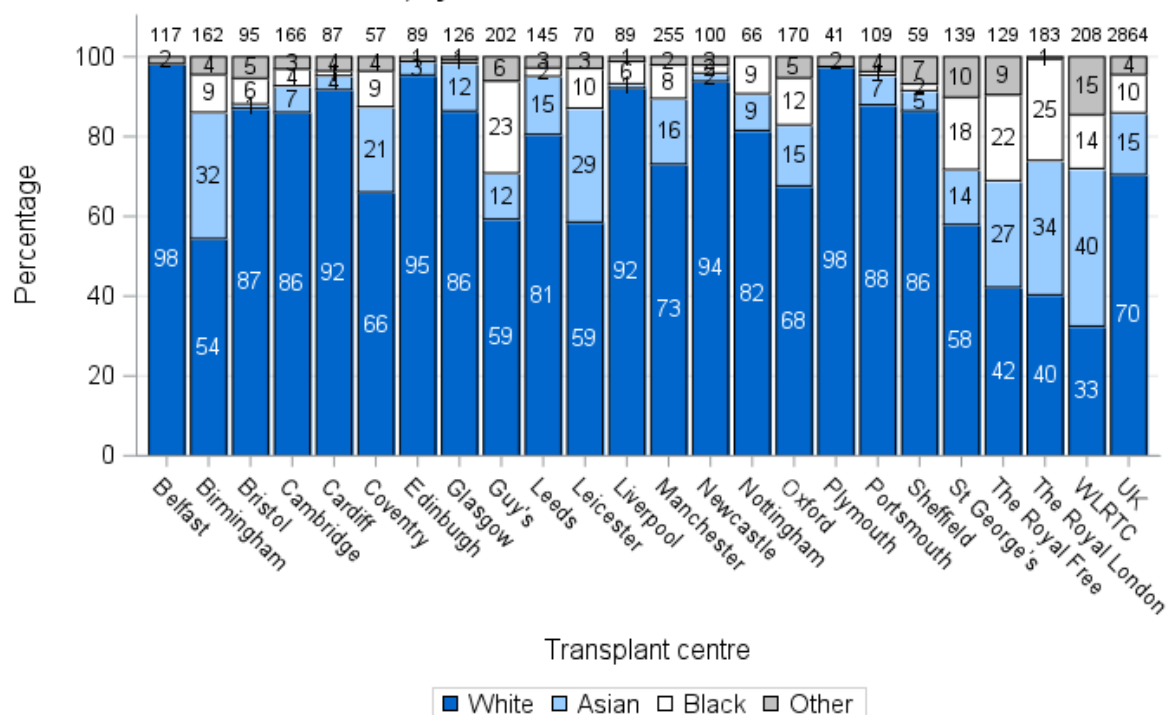
## 5.2 Demographic characteristics of recipients, 1 April 2021 - 31 March 2022

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.

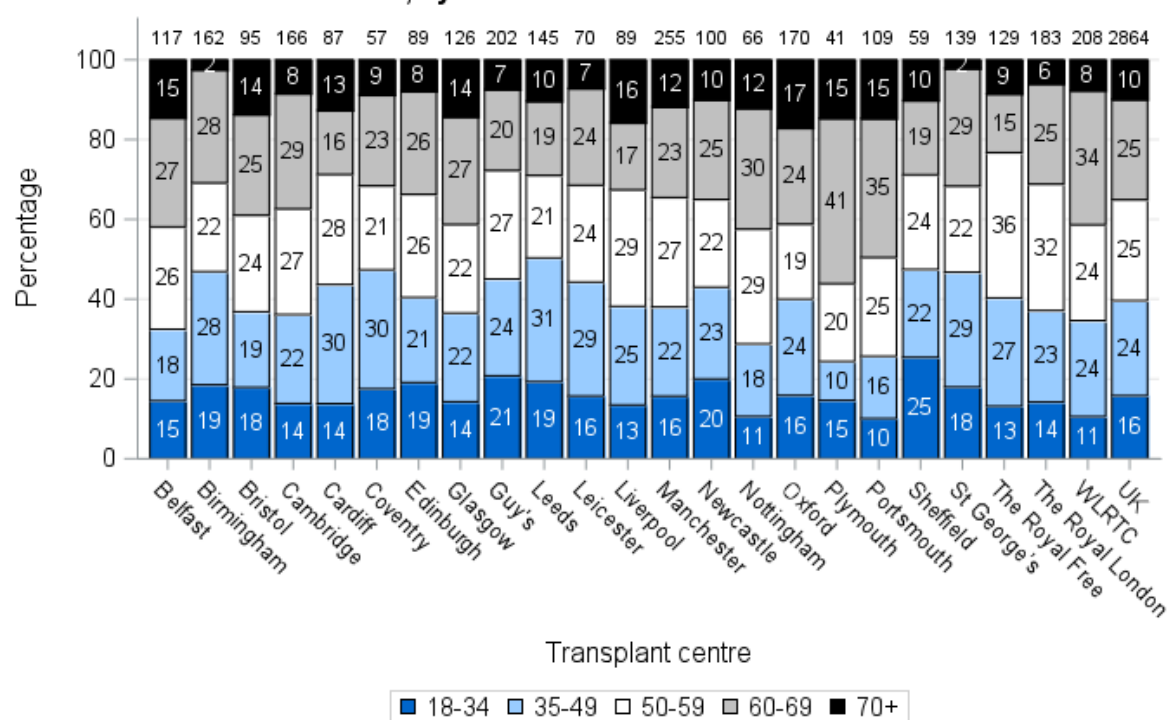
**Figure 5.5 Sex of adult kidney only transplant recipients, 1 April 2021 and 31 March 2022, by centre**



**Figure 5.6 Ethnicity of adult kidney only transplant recipients, 1 April 2021 and 31 March 2022, by centre**



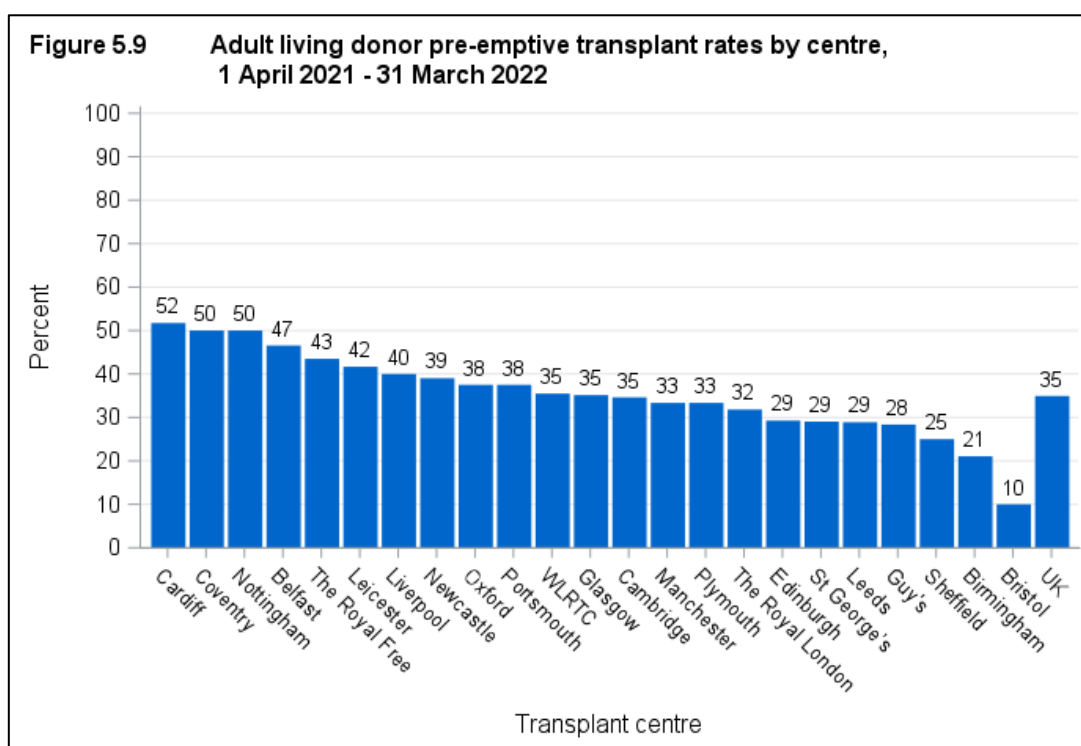
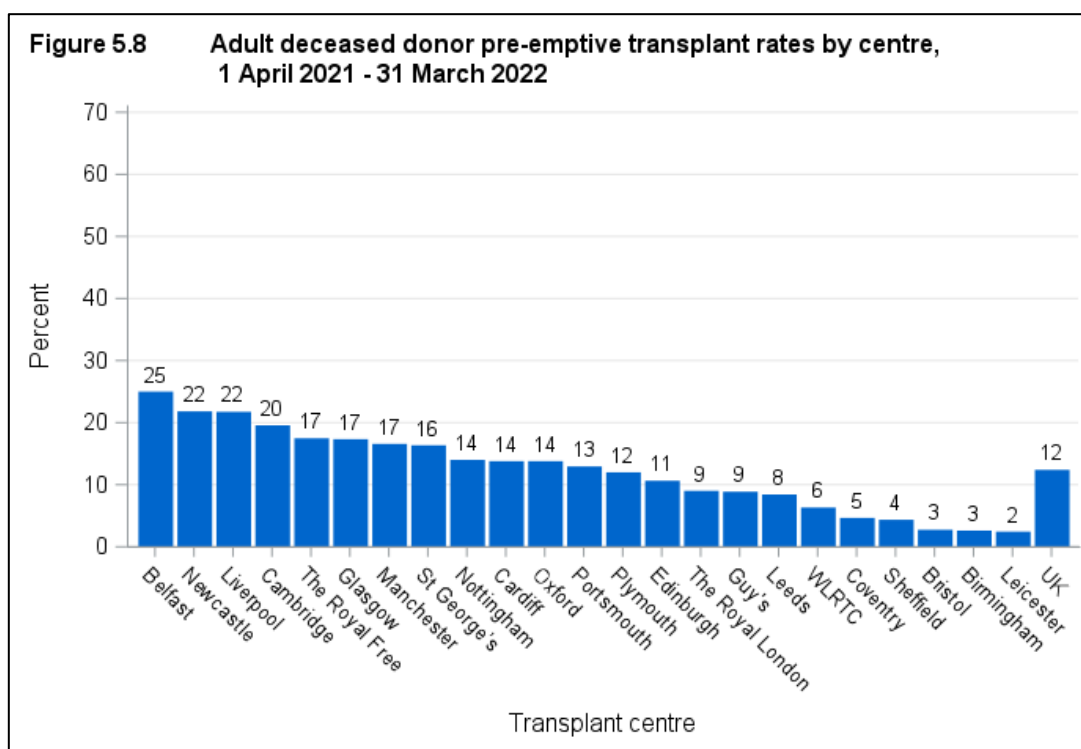
**Figure 5.7** Age of adult kidney only transplant recipients, 1 April 2021 and 31 March 2022, by centre





### 5.3 Pre-emptive transplant rates, 1 April 2021 - 31 March 2022

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: 35% 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 25% at Belfast to 2% at Leicester. Adult living donor [pre-emptive](#) transplant rates ranged from 52% at Cardiff to 10% at Bristol.



## 5.4 Kidney donor risk-index<sup>1</sup>

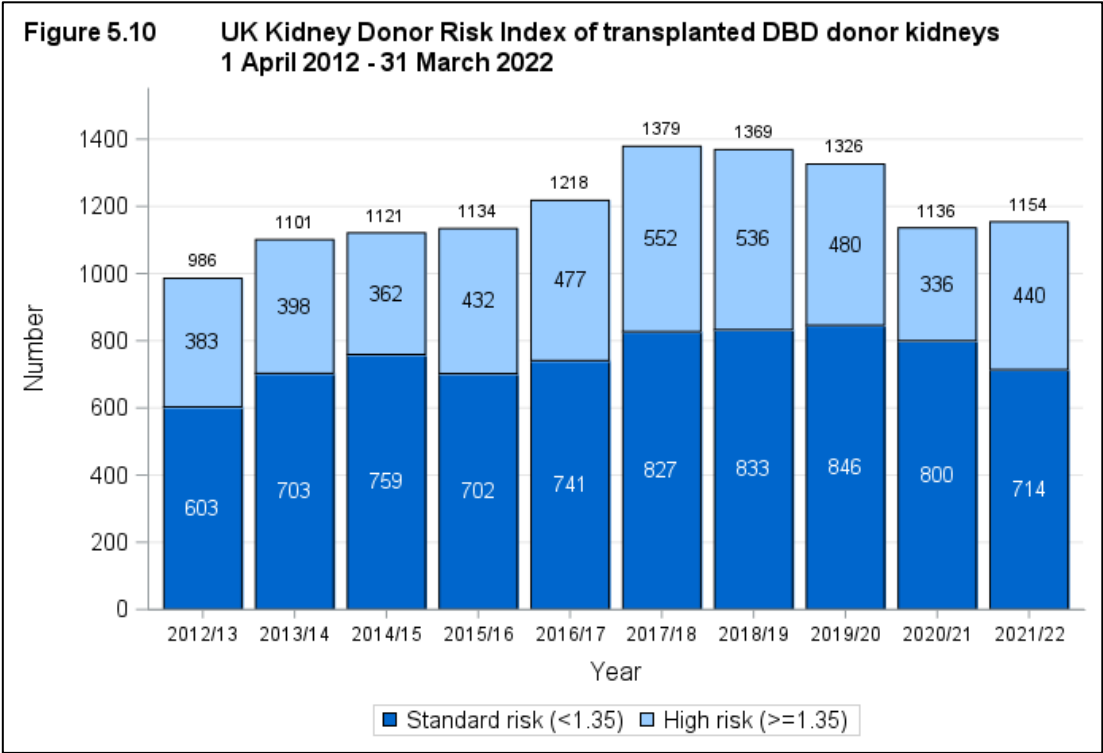
The severe shortage of deceased donor (DD) organs available for transplantation has led to increased use of kidneys from suboptimal donors with potentially less good transplant outcome. Categorising such kidneys according to anticipated outcome is important because it enables clinicians to be better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

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

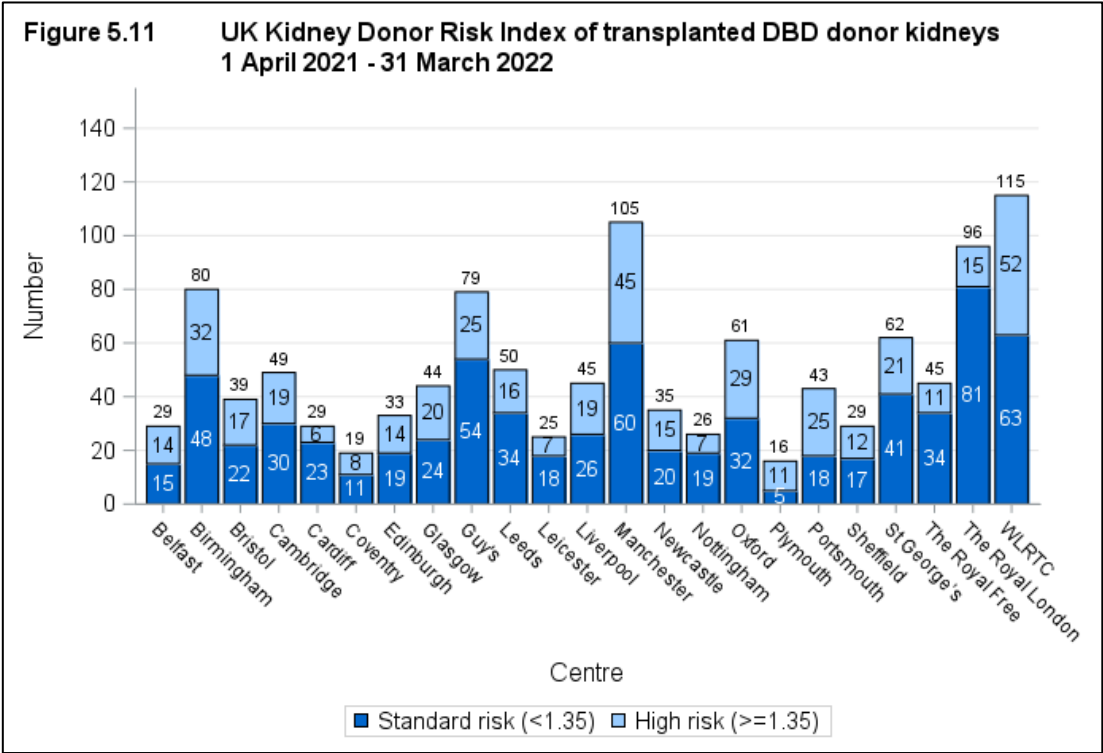
### Reference

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

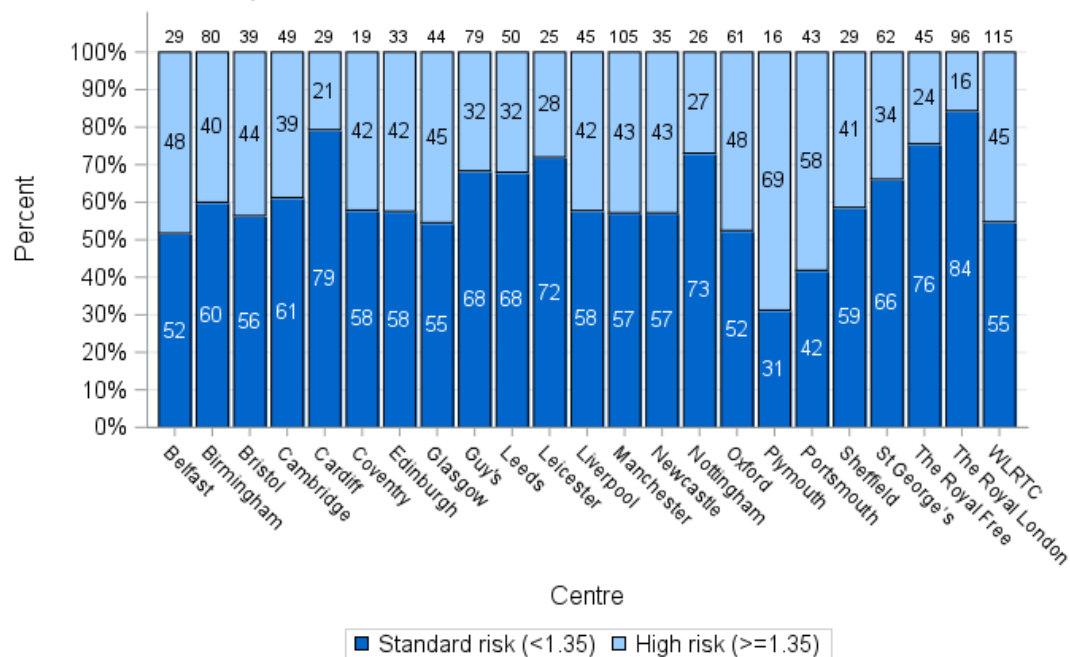
**Figure 5.10** shows the number of transplanted [DBD](#) donor kidneys over the last ten financial years by kidney donor risk index group. In 2012/13 39% of all transplants were performed using kidneys from donors categorised as high risk (UK Donor risk index  $\geq 1.35$ ) compared with 38% in 2021/22.



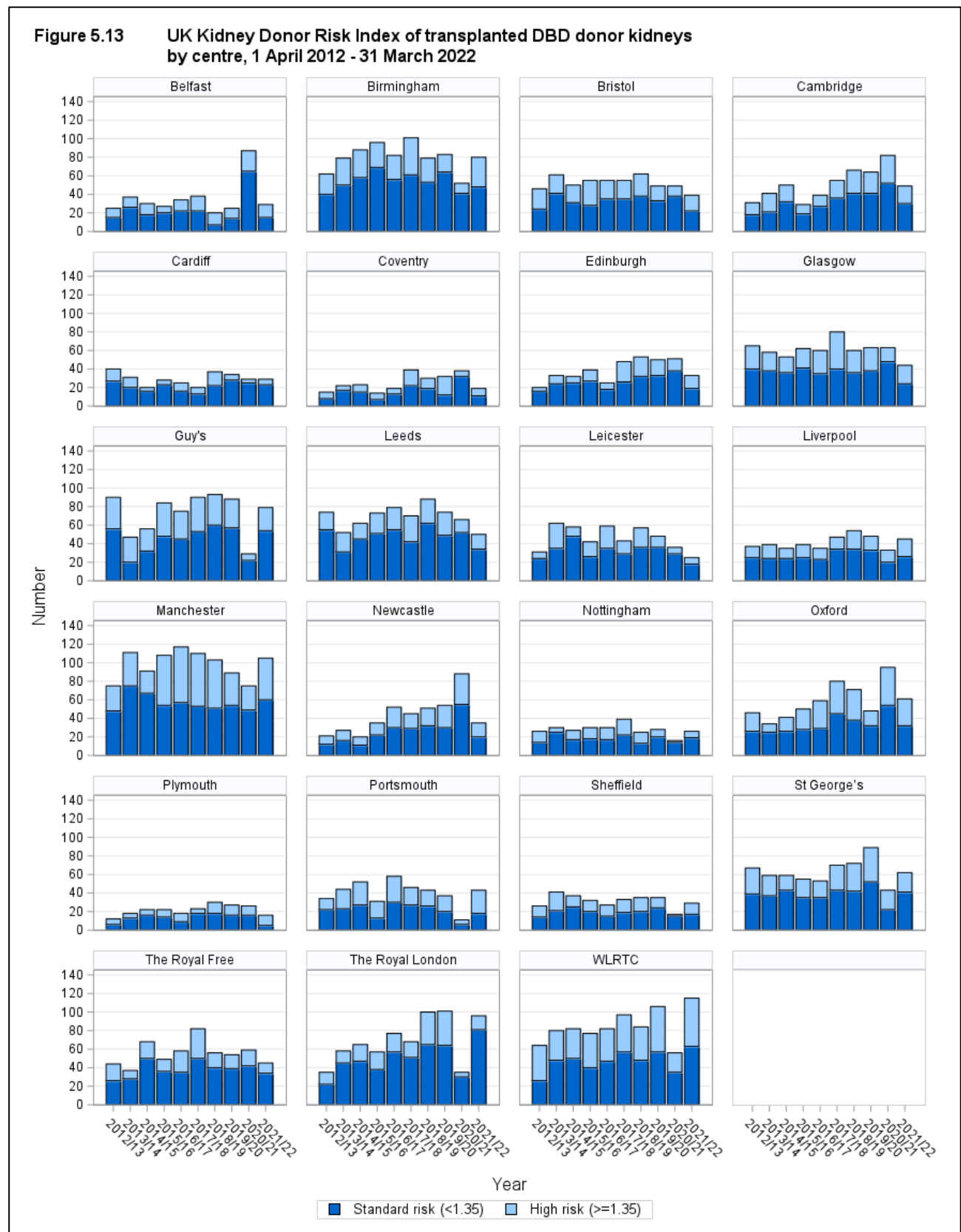
**Figure 5.11** shows the number of transplanted [DBD](#) donor kidneys in 2021/22 by kidney donor risk index group for each transplant centre. The same information is presented in **Figure 5.12** but this shows the proportion of standard risk and high risk donor transplants performed at each centre.



**Figure 5.12 UK Kidney Donor Risk Index of transplanted DBD donor kidneys  
1 April 2021 - 31 March 2022**



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



## 5.5 2019 Kidney Offering Scheme Donor Risk Index and Recipient Risk Index, 1 April 2021 – 31 March 2022

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

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

D1 → DRI ≤ 0.79 (lowest risk)

D2 → DRI 0.79 – 1.12

D3 → DRI 1.12 – 1.50

D4 → DRI ≥ 1.50 (highest risk)

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

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

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

R1 → RRI ≤ 0.74 (lowest risk)

R2 → RRI 0.74 - 0.94

R3 → RRI 0.94 – 1.20

R4 → RRI ≥ 1.20 (highest risk)

**Table 5.1** presents the DRI and RRI groups and average scores for kidneys transplanted between 1 April 2021 and 31 March 2022.

**Table 5.1 UK Kidney Donor Risk Index of transplanted deceased donor kidneys and Recipient Risk Index of those receiving them, 1 April 2021 - 31 March 2022**

Transplant centre	Donor Risk Group				Avg. DRI	Recipient Risk Group				Avg. RRI
	D1	D2	D3	D4		R1	R2	R3	R4	
Belfast	10	19	15	13	1.17	15	17	12	13	0.98
Birmingham	41	32	34	20	1.04	35	37	28	27	0.95
Bristol	20	16	23	22	1.2	19	15	23	24	1
Cambridge	34	41	36	42	1.21	39	47	32	34	0.96
Cardiff	24	17	16	6	0.96	17	24	13	9	0.89
Coventry	8	9	9	10	1.22	8	6	9	13	1.07
Edinburgh	21	15	12	10	1.03	17	18	10	13	0.94
Glasgow	19	22	24	24	1.2	26	20	22	21	0.97
GOSH	7	3	1	0	0.61	11	0	0	0	0.61
Guy's	59	41	35	26	1.01	40	41	40	36	0.97
Leeds	32	27	27	12	1.06	25	24	26	24	0.98
Leicester	14	12	13	7	1.07	8	16	12	10	0.98
Liverpool	13	21	15	19	1.21	17	23	10	19	0.98
Manchester	64	50	58	50	1.14	60	57	64	41	0.95
Newcastle	16	17	10	18	1.17	12	17	18	14	0.99
Nottingham	17	17	19	5	1.02	16	17	11	14	0.97
Oxford	55	38	27	53	1.57	30	62	43	38	1
Plymouth	2	5	11	7	1.33	2	5	7	11	1.07
Portsmouth	22	19	16	28	1.21	19	21	20	25	1.01
Sheffield	18	8	15	6	1	16	11	14	6	0.89
St George's	30	32	26	19	1.11	28	34	27	18	0.94
The Royal Free	38	22	25	18	1.04	33	24	23	23	0.97
The Royal London	38	56	33	19	1.05	32	52	37	25	0.92
WLRTC	42	38	62	41	1.19	31	44	38	70	1.07
<b>UK</b>	<b>644</b>	<b>577</b>	<b>562</b>	<b>475</b>	<b>1.15</b>	<b>556</b>	<b>632</b>	<b>539</b>	<b>528</b>	<b>0.97</b>

## 5.6 Cold ischaemia time, 1 April 2019 – 31 March 2022

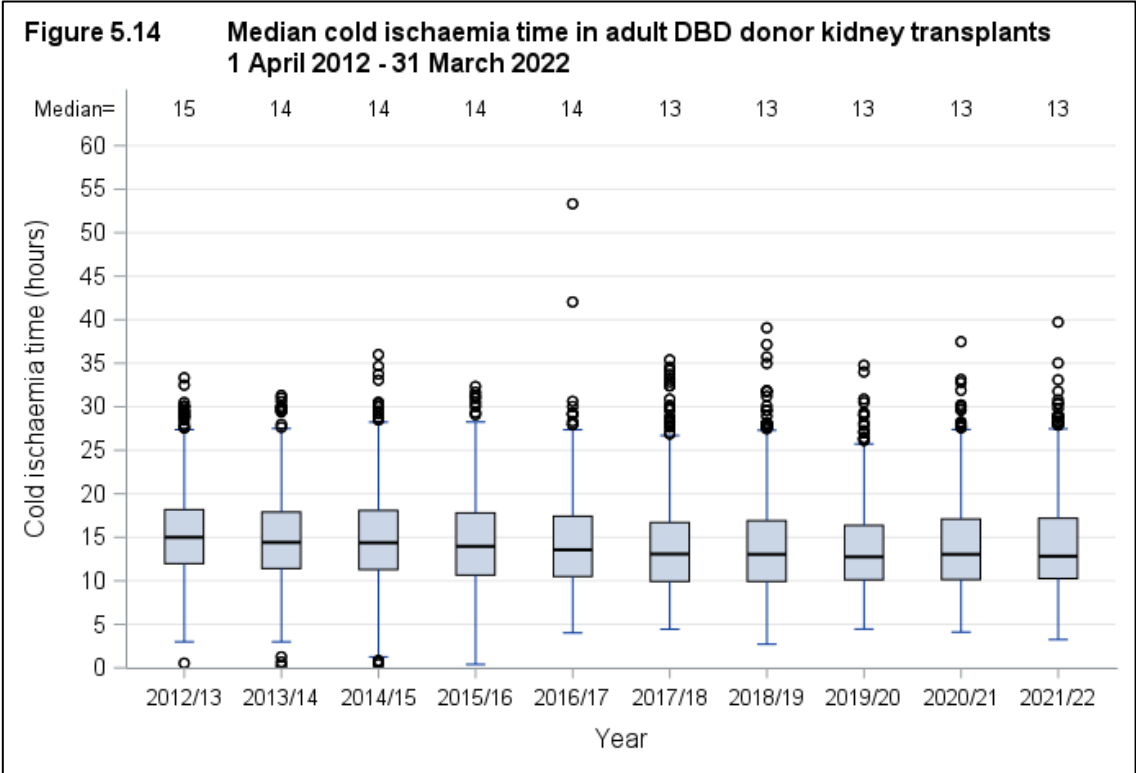
The length of time that elapses between a kidney being removed from the donor to its transplantation into the recipient is called the Cold Ischaemia Time (CIT). Generally, the shorter this time, the more likely the kidney is to work immediately and the better the long-term outcome. One of the reasons 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.

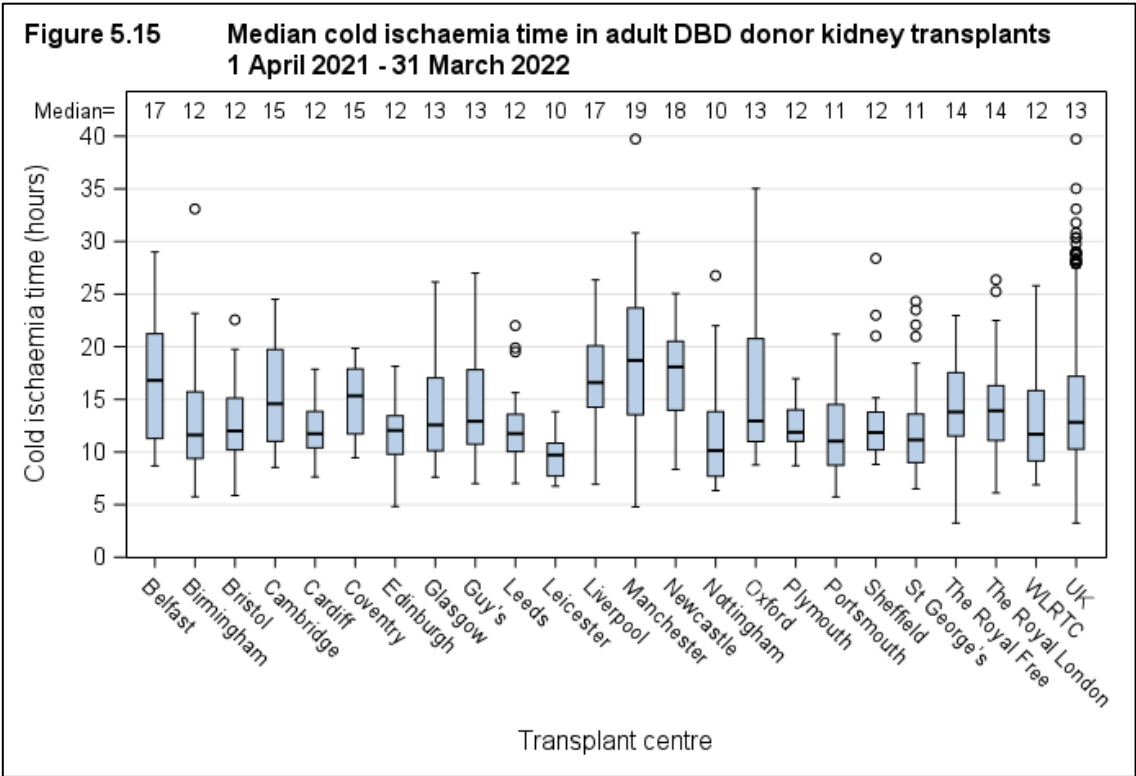
[Median](#) CITs are shown in addition to [inter-quartile ranges](#). Fifty percent of the transplants have a CIT within the [inter-quartile range](#). There is some variation in average ([median](#)) CIT between different transplant centres although all centres continually try to reduce this time.



**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 15 hours in 2012/13 to 13 hours in 2021/22.



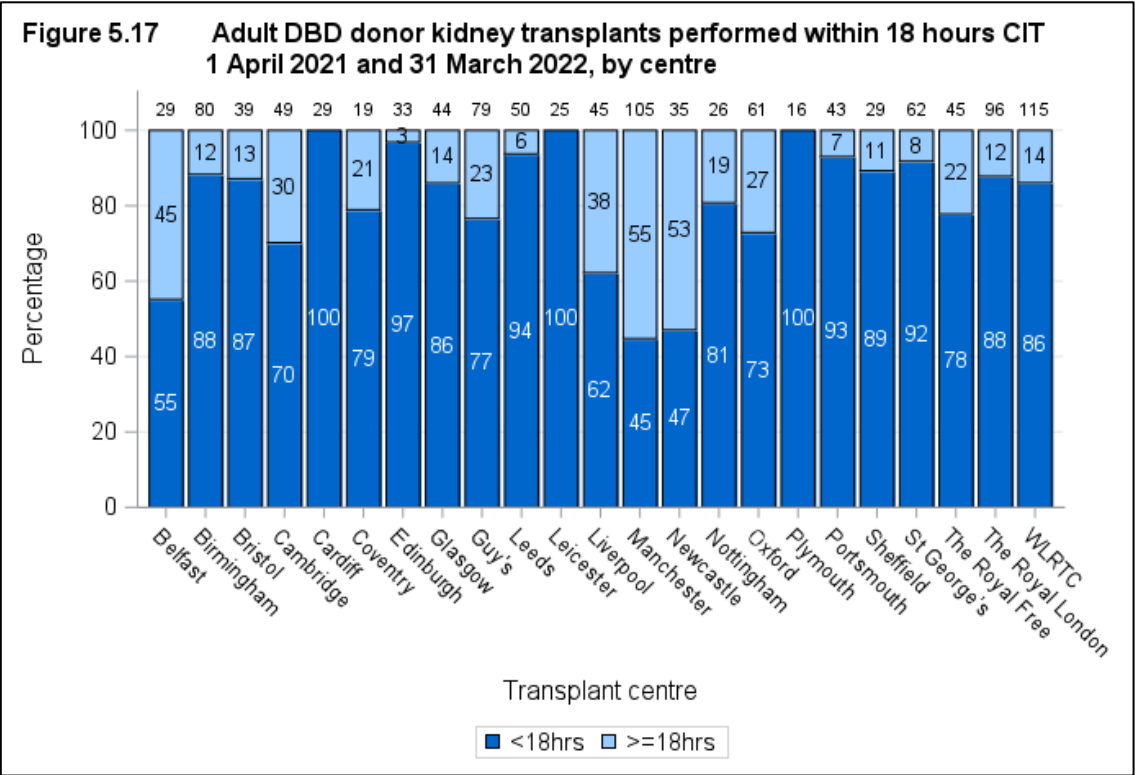
**Figure 5.15** shows the [median](#) total cold ischaemia time in adult [DBD](#) donor kidney only transplants in 2021/22 for each transplant centre. Manchester had the longest [median](#) cold ischaemia time, 19 hours in 2021/22 compared with Leicester and Nottingham who had the shortest, 10 hours.



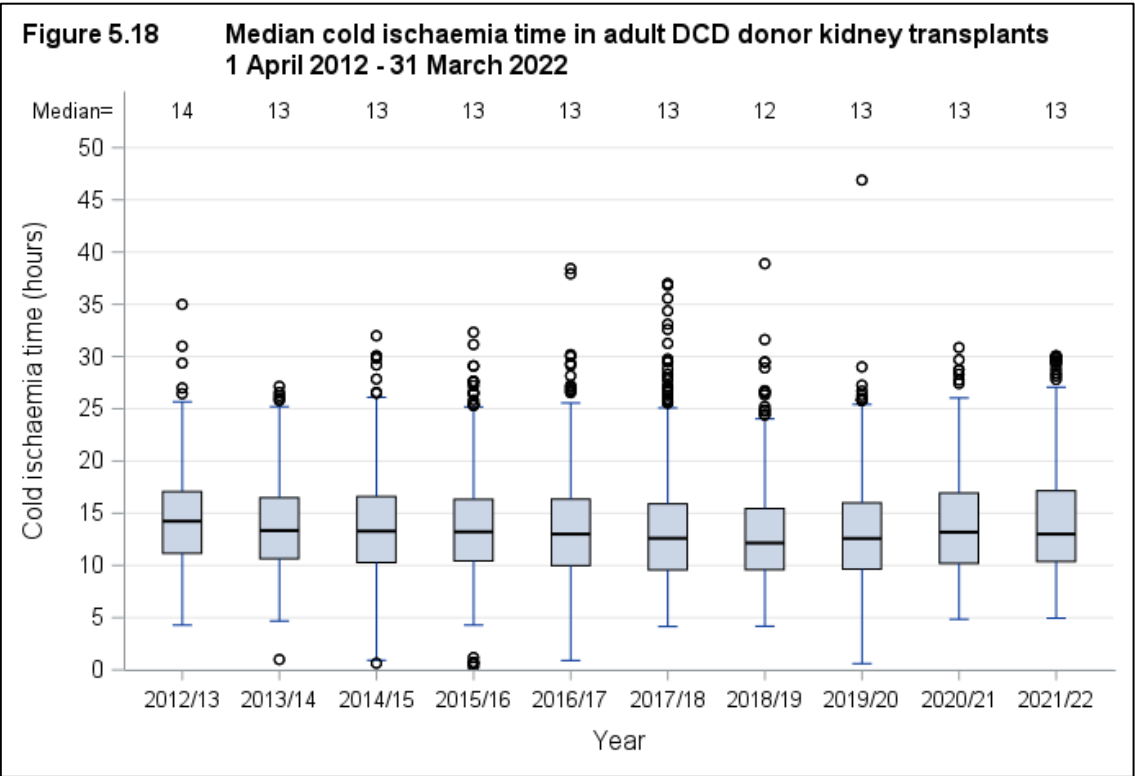
**Figure 5.16** shows the [median](#) total cold ischaemia time in adult [DBD](#) donor kidney only transplants over the last ten years for each transplant centre.



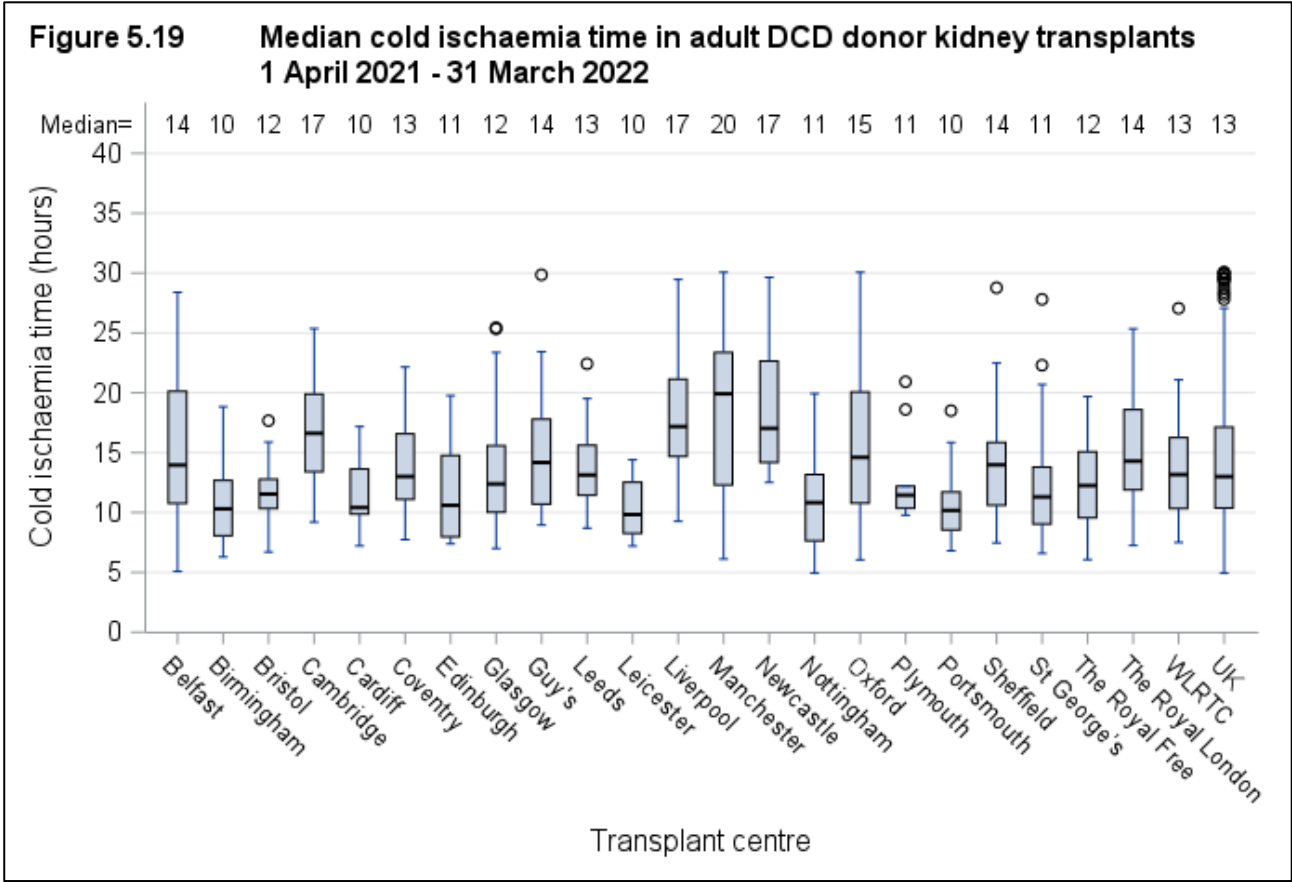
**Figure 5.17** shows the proportion of adult [DBD](#) donor kidney only transplants in 2021/22 that have been performed within 18 hours of CIT for each transplant centre. All centres except Manchester and Newcastle perform at least half of all [DBD](#) kidney only transplants within 18 hours CIT.



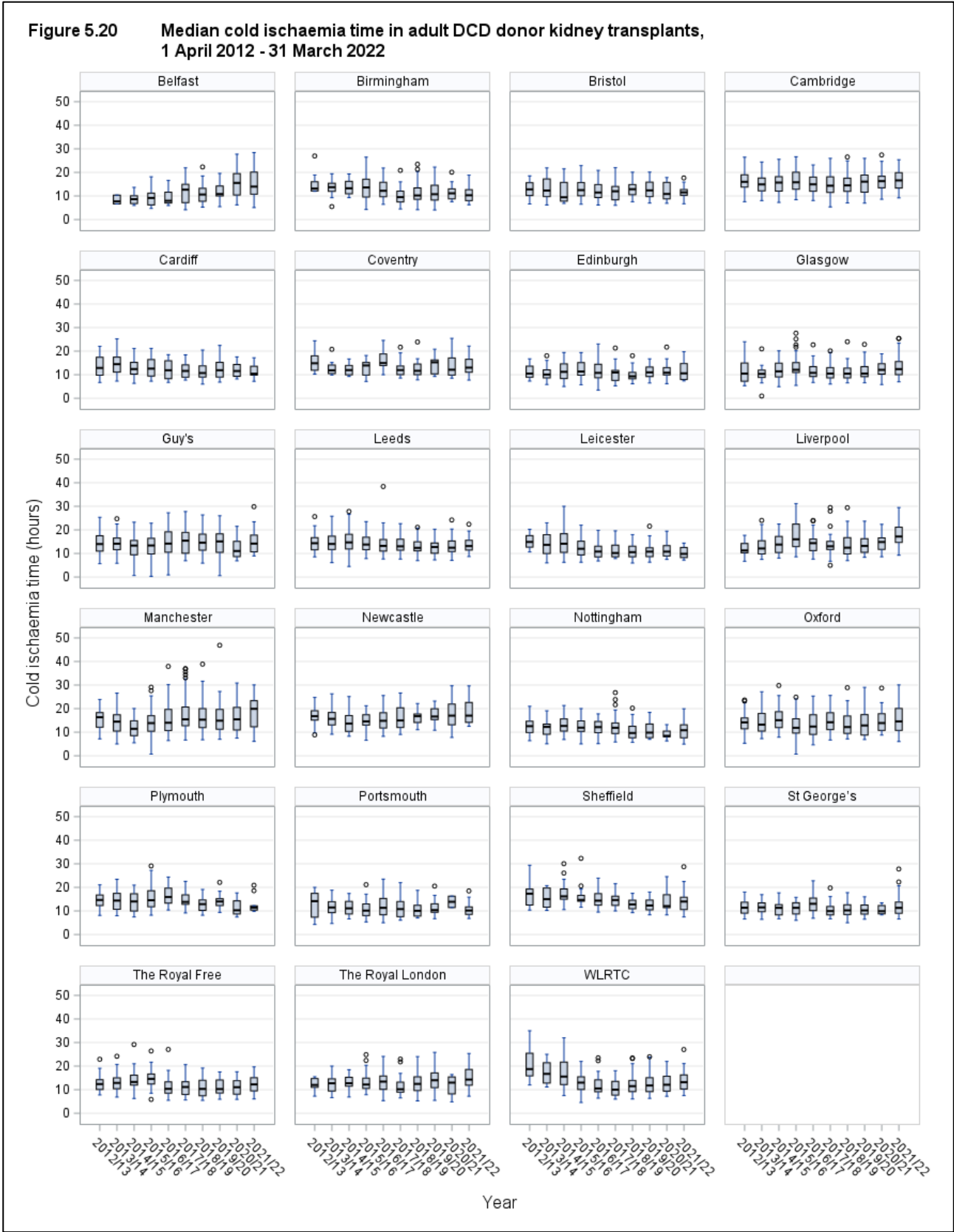
**Figure 5.18** shows the [median](#) total cold ischaemia time in adult [DCD](#) donor kidney only transplants over the last 10 years. The [median](#) total ischaemia time has remained almost unchanged over the last 10 years.



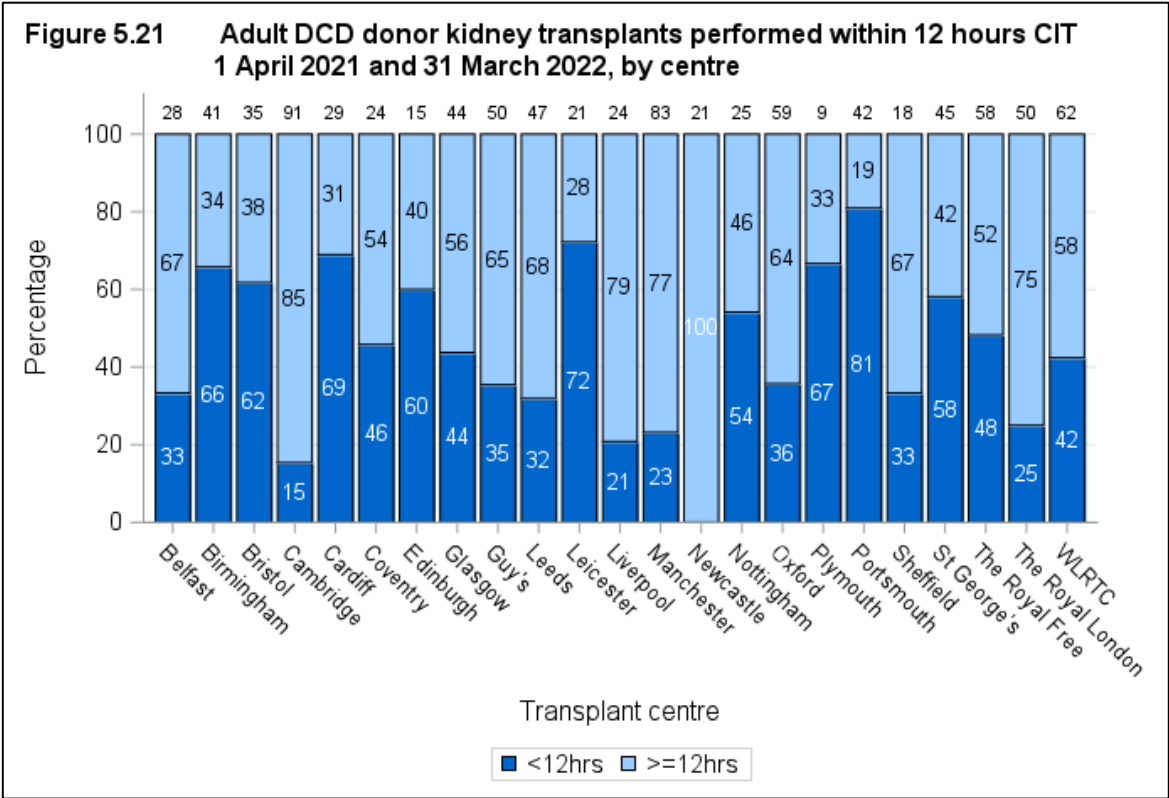
**Figure 5.19** shows the [median](#) total cold ischaemia time in adult [DCD](#) donor kidney only transplants in 2021/22 for each transplant centre. Manchester had the longest [median](#) cold ischaemia time, 20 hours in 2021/22 compared with Birmingham, Cardiff, Leicester and Portsmouth who had the shortest, 10 hours.



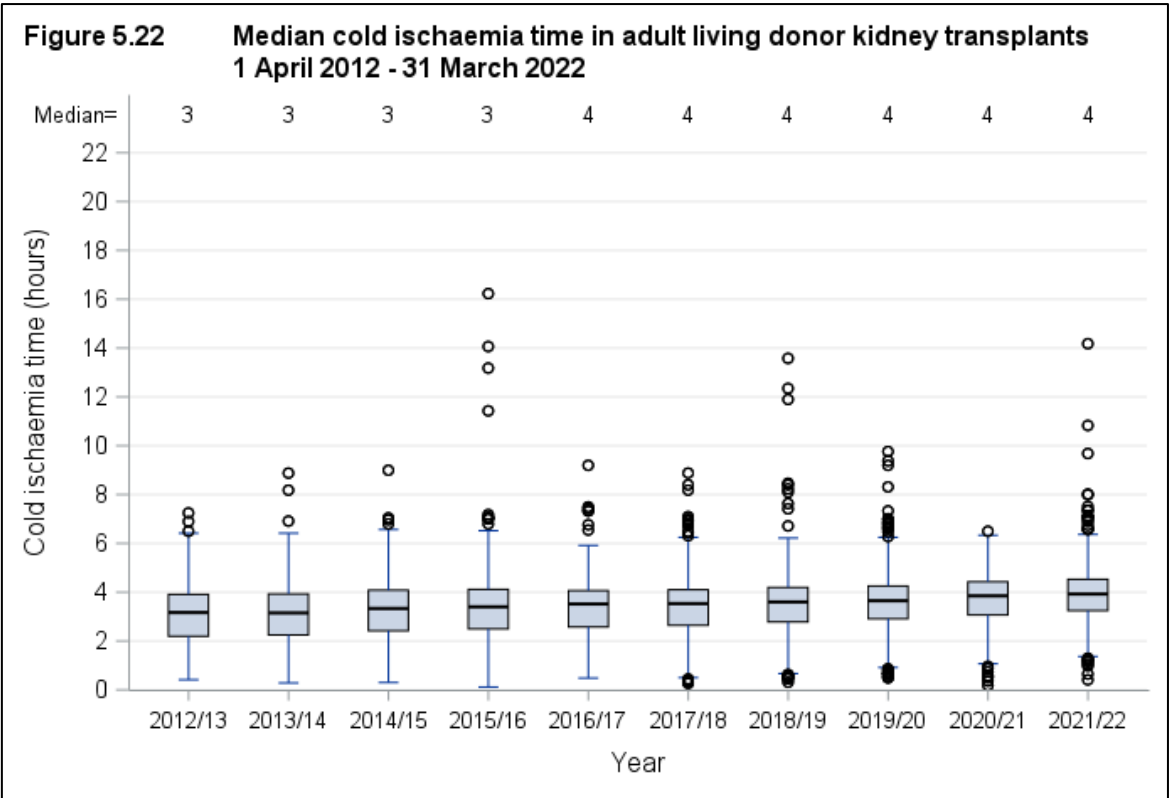
**Figure 5.20** shows the [median](#) total cold ischaemia time in adult [DCD](#) donor kidney only transplants over the last ten years for each transplant centre.



**Figure 5.21** shows the proportion of adult [DCD](#) donor kidney only transplants in 2021/22 that have been performed within 12 hours of CIT for each transplant centre.

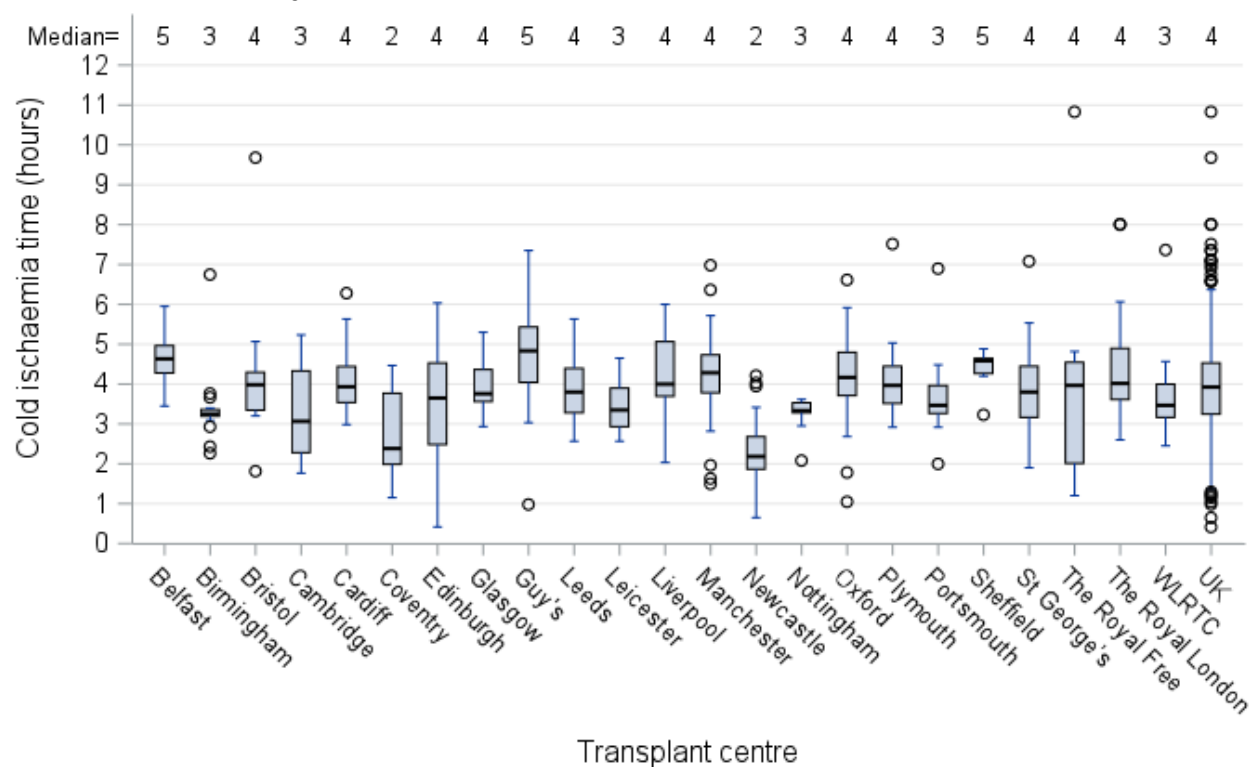


**Figure 5.22** shows the [median](#) total cold ischaemia time in adult living donor kidney transplants over the last 10 years. The [median](#) total cold ischaemia time has increased marginally over the last ten years.

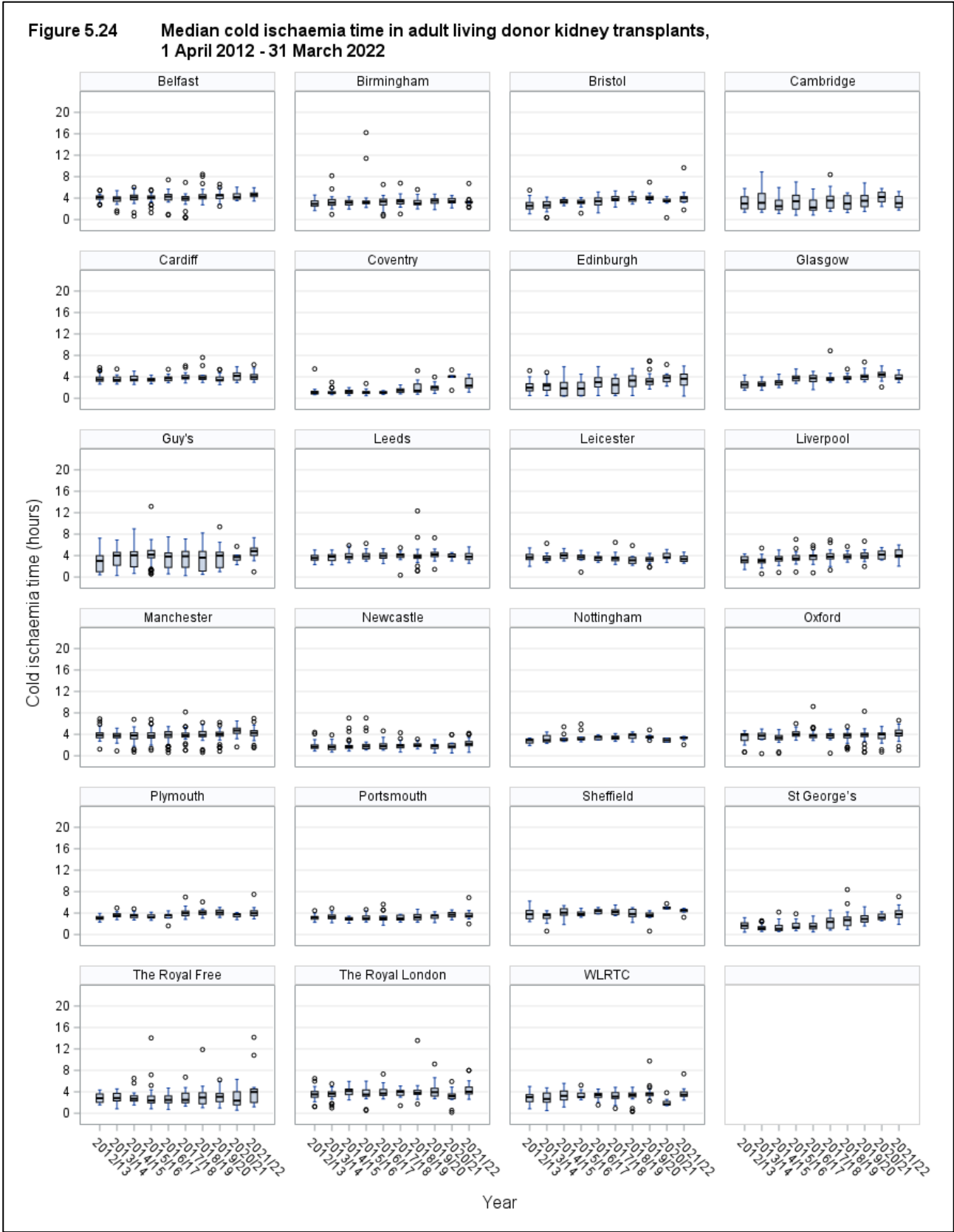


**Figure 5.23** shows the [median](#) total cold ischaemia time in adult living donor kidney transplants in 2021/22 for each transplant centre.

**Figure 5.23** Median cold ischaemia time in adult living donor kidney transplants  
1 April 2021 - 31 March 2022



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



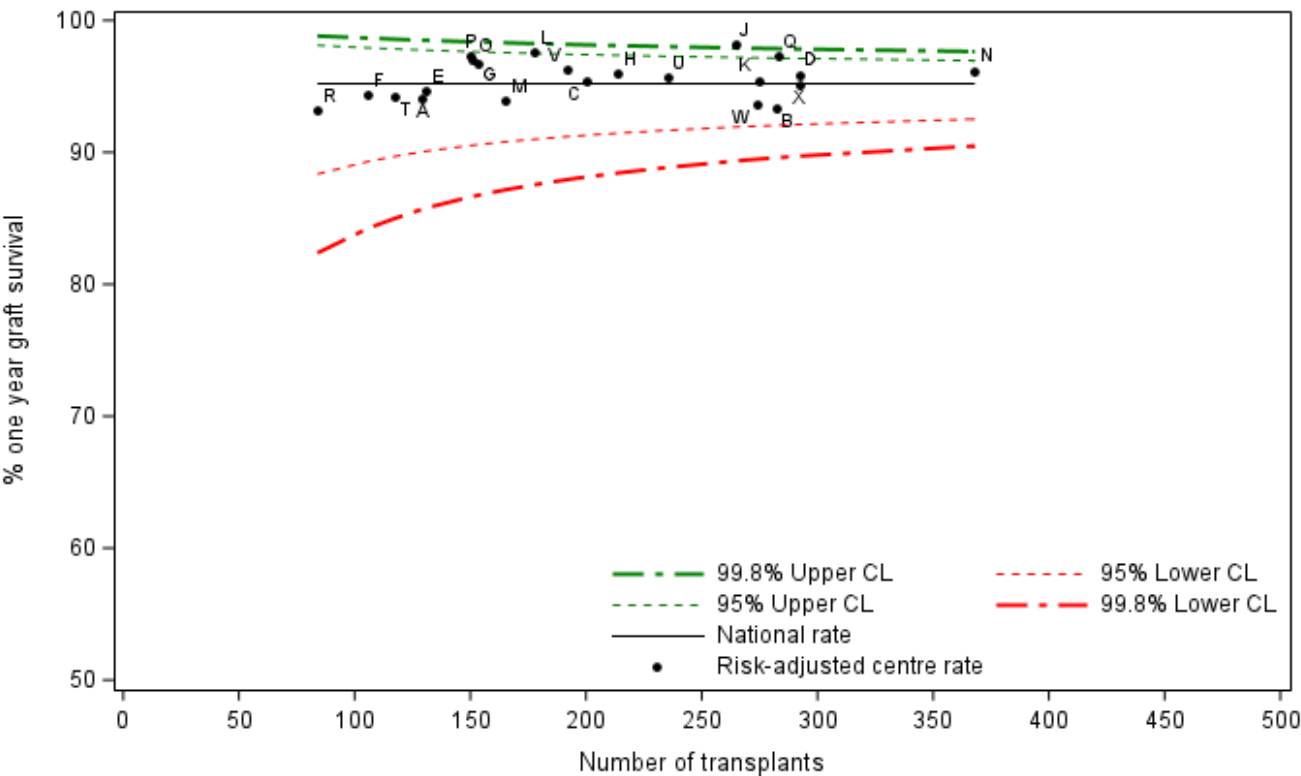


## **Adult kidney outcomes**

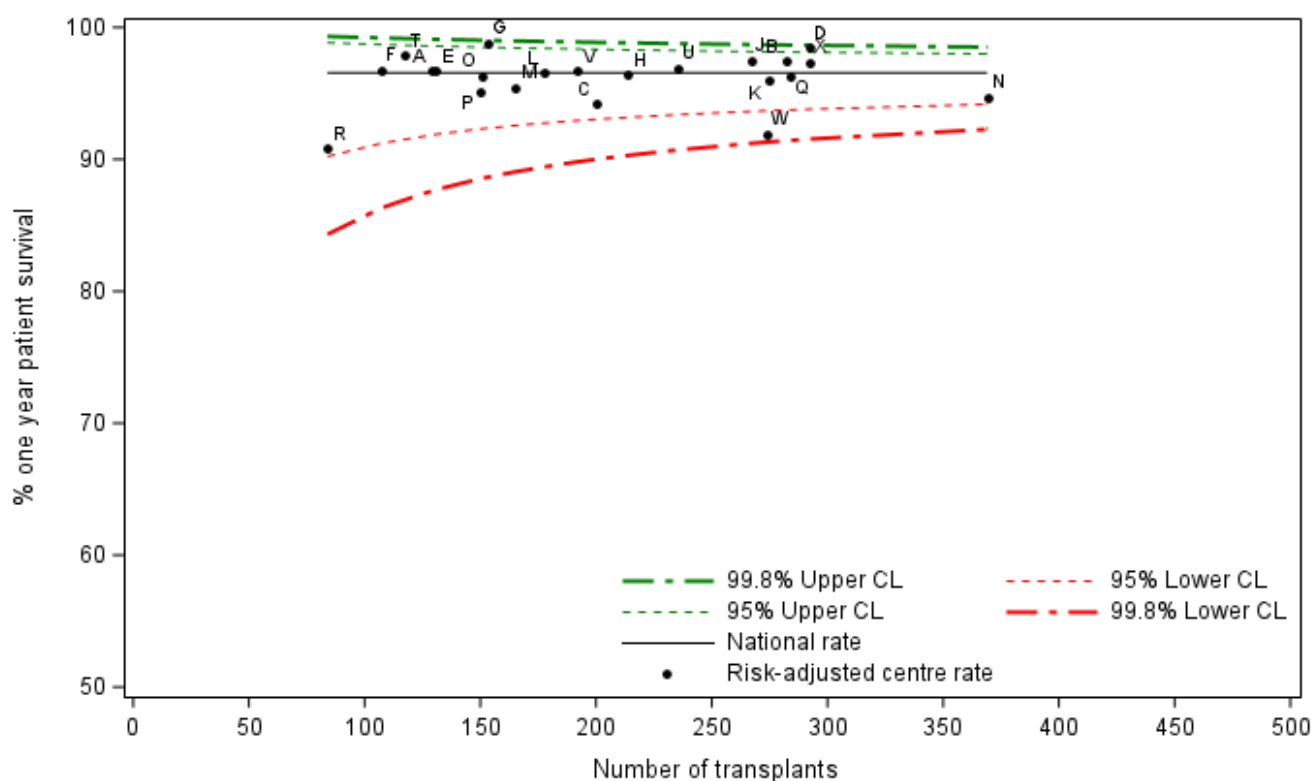
## 6.1 Deceased donor graft and patient survival

The [funnel plots](#) show that, for the most part, the centres lie within the [confidence limits](#). Some of the [funnel plots](#) show some centres lie outside the lower 95% [confidence limits](#), indicating that these centres have survival rates that are significantly lower than the national rate. Some of the [funnel plots](#) show some centres to be above the upper 99.8% [confidence limit](#). This suggests that these centres may have survival rates that are considerably higher than the national rate. Centres can be identified by the information shown in **Table 6.1**.

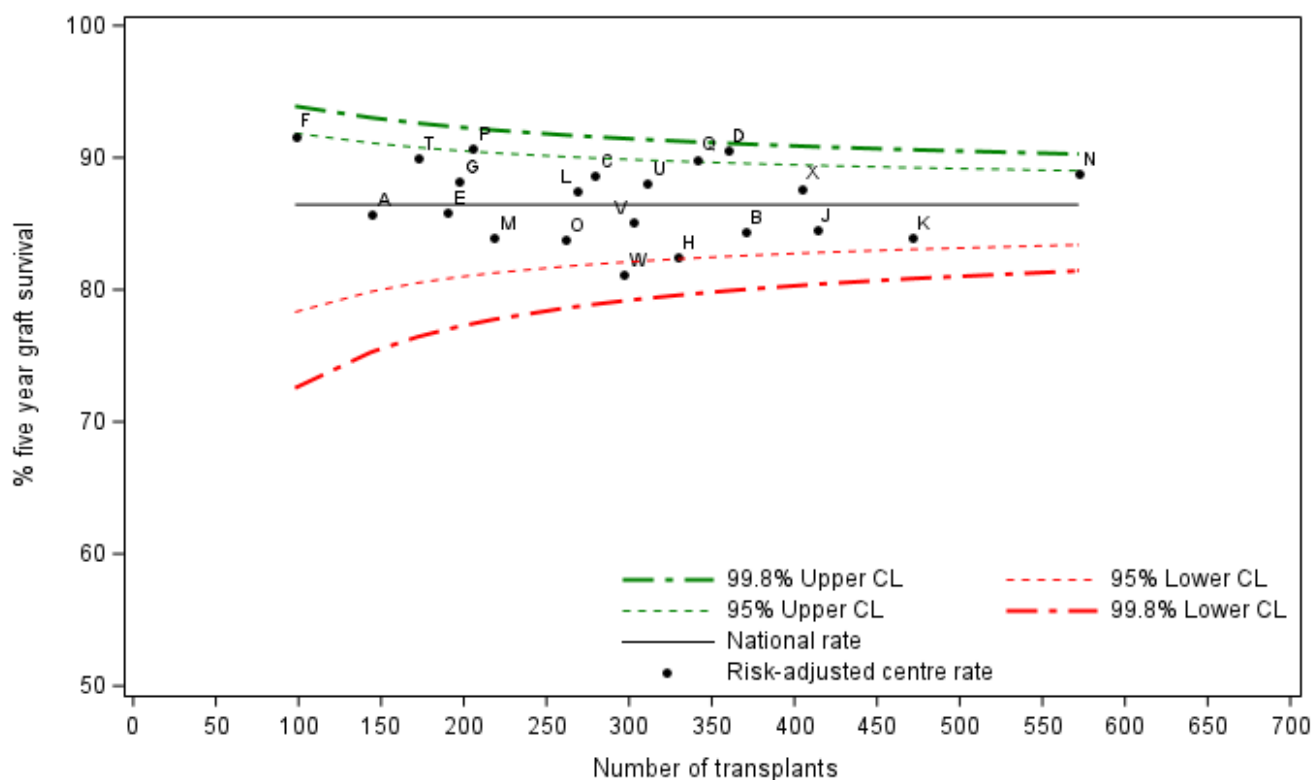
**Figure 6.1** Risk-adjusted one year graft (death censored) survival rates for first deceased donor kidney transplants in adult patients, between 1 April 2017 and 31 March 2021



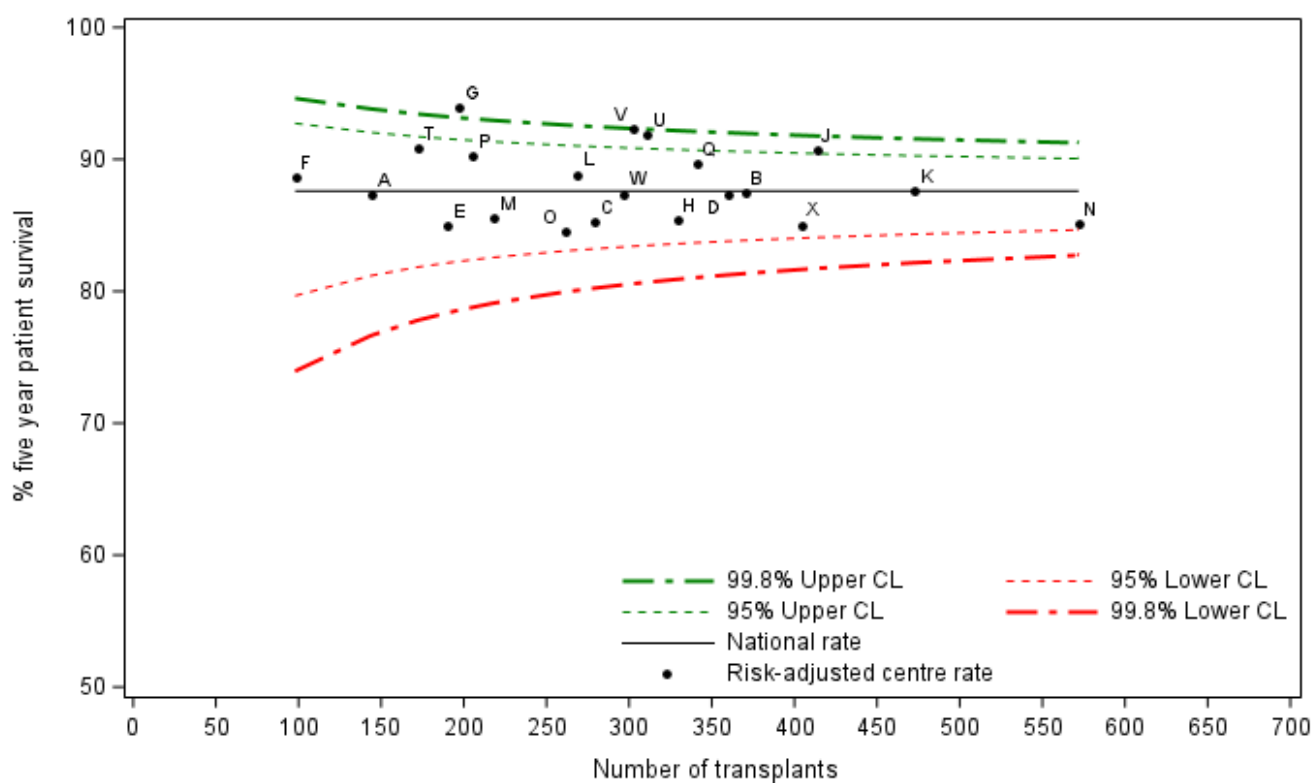
**Figure 6.2 Risk-adjusted one year patient survival rates for first deceased donor kidney transplants in adult patients, between 1 April 2017 and 31 March 2021**



**Figure 6.3 Risk-adjusted five year graft (death censored) survival rates for first deceased donor kidney transplants in adult patients, between 1 April 2013 and 31 March 2017**



**Figure 6.4 Risk-adjusted five year patient survival rates for first deceased donor kidney transplants in adult patients, between 1 April 2013 and 31 March 2017**



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

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

\* Includes transplants performed between 1 april 2017 - 31 March 2021

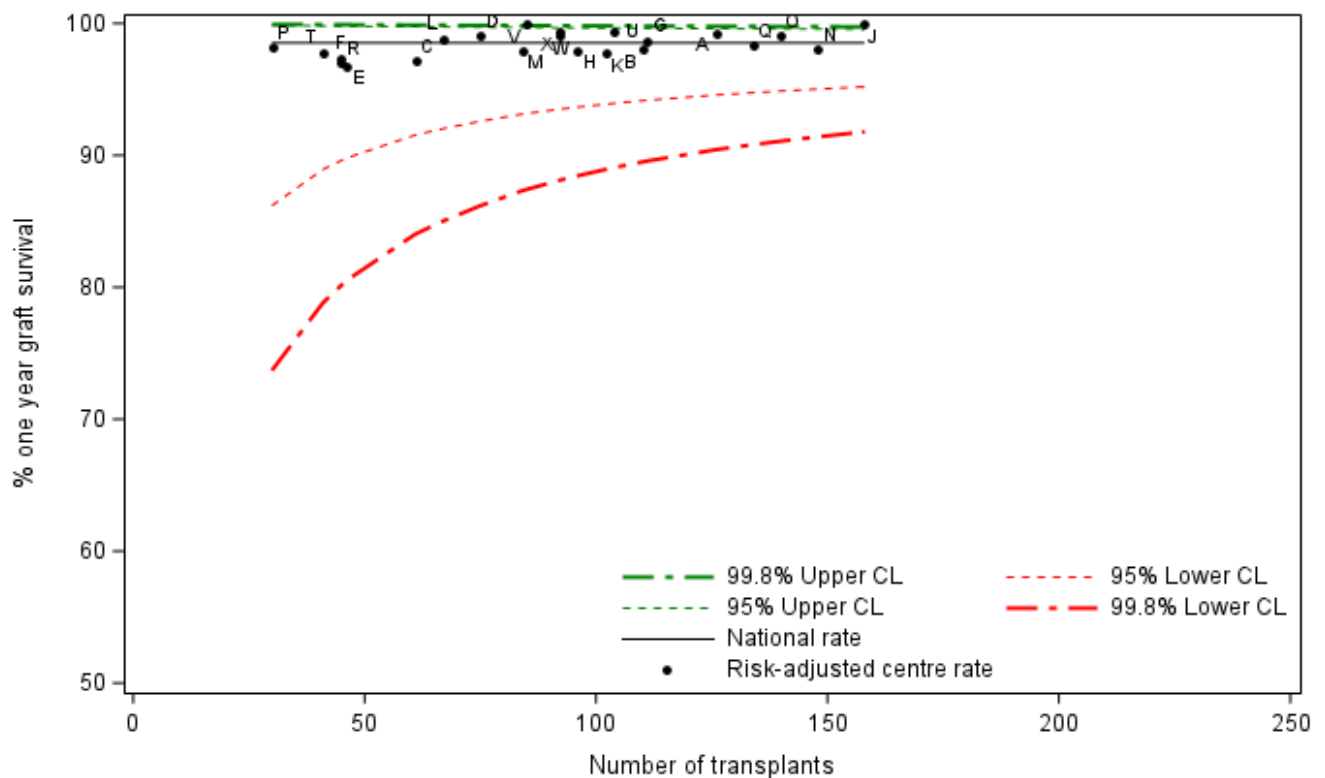
\*\* Includes transplants performed between 1 april 2013 - 31 March 2017

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

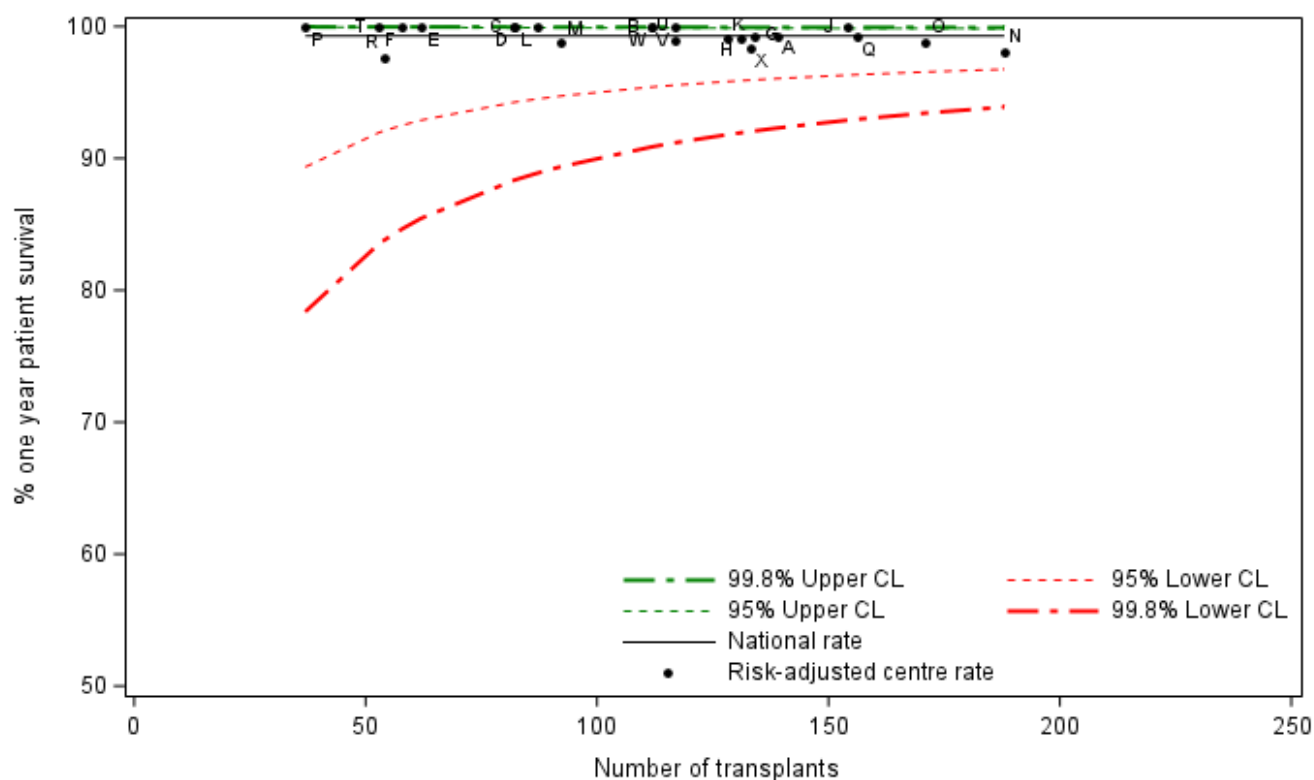
## 6.2 Living donor graft and patient survival

The [funnel plots](#) show that, for the most part, the centres lie within the [confidence limits](#). None of the [funnel plots](#) show any centres that lie outside the lower 95% [confidence limits](#). Some of the [funnel plots](#) show some centres to be above the upper 95% [confidence limit](#). This suggests that these centres may have survival rates that are considerably higher than the national rate. Centres can be identified by the information shown in **Table 6.2**. Living donor antibody incompatible kidney transplants are included in the analysis and these transplants are known to have inferior graft survival rates. **Table 6.3** shows the number of such transplants performed by each centre for each of the time periods analysed.

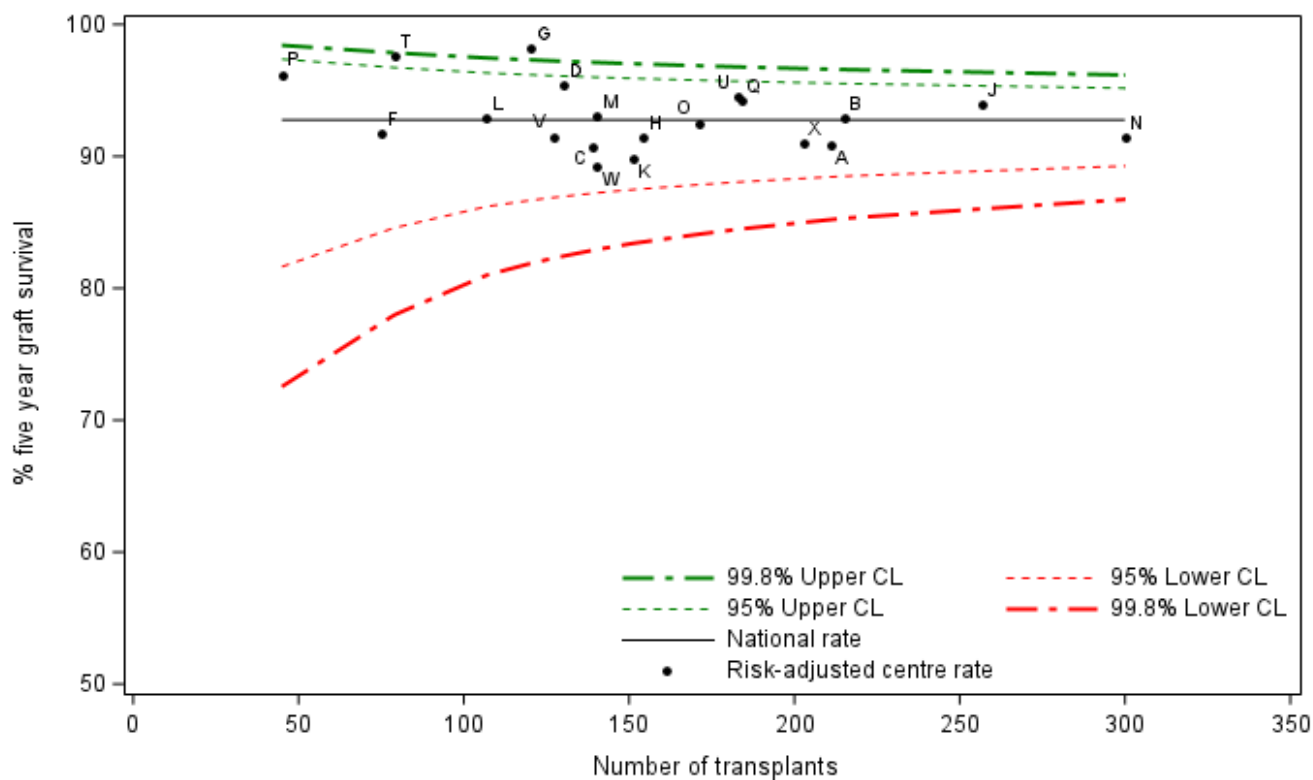
**Figure 6.5** Risk-adjusted one year graft (death censored) survival rates for first live donor kidney transplants in adult patients, between 1 April 2017 and 31 March 2021



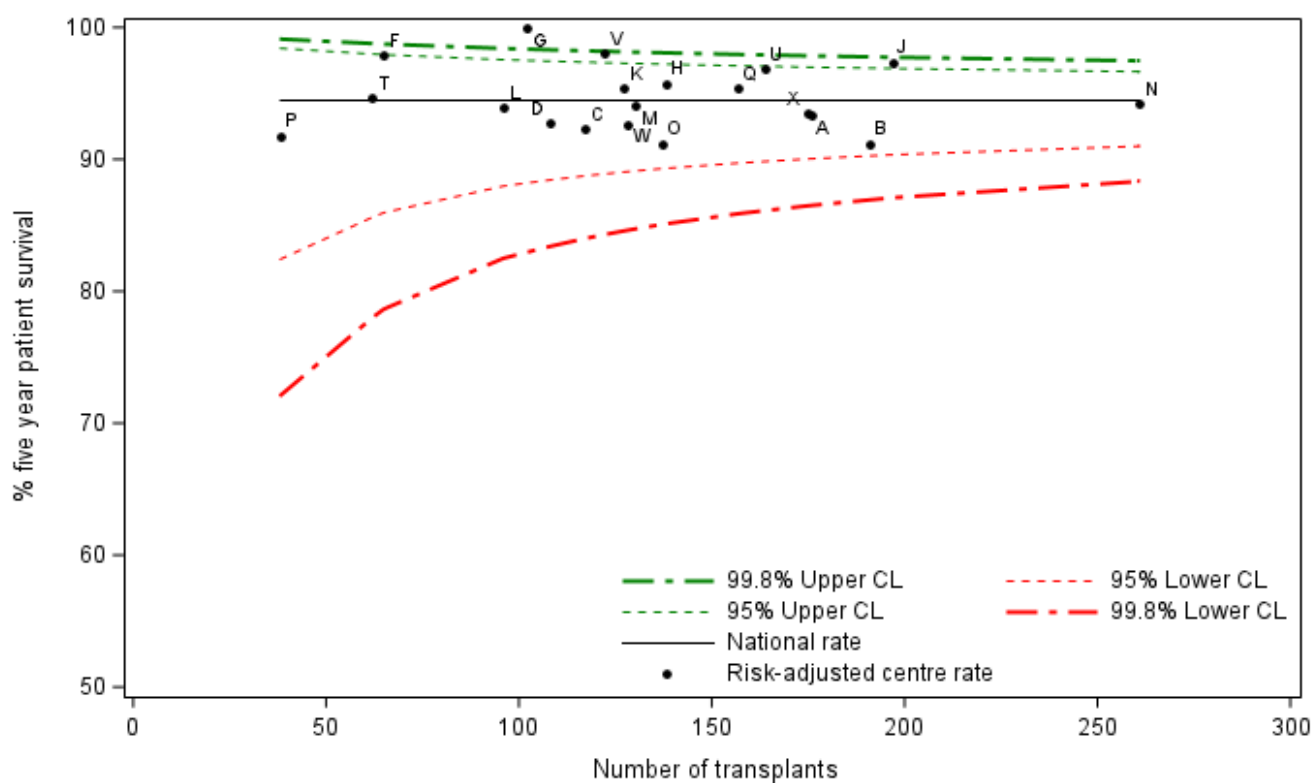
**Figure 6.6 Risk-adjusted one year patient survival rates for first live donor kidney transplants in adult patients, between 1 April 2017 and 31 March 2021**



**Figure 6.7 Risk-adjusted five year graft (death censored) survival rates for first live donor kidney transplants in adult patients, between 1 April 2013 and 31 March 2017**



**Figure 6.8 Risk-adjusted five year patient survival rates for first live donor kidney transplants in adult patients, between 1 April 2013 and 31 March 2017**





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

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

Centre has reached the upper 99.8% confidence limit

Centre has reached the upper 95% confidence limit

Centre has reached the lower 95% confidence limit

Centre has reached the lower 99.8% confidence limit

\* Includes transplants performed between 1 april 2017 - 31 March 2021

\*\* Includes transplants performed between 1 april 2013 - 31 March 2017

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

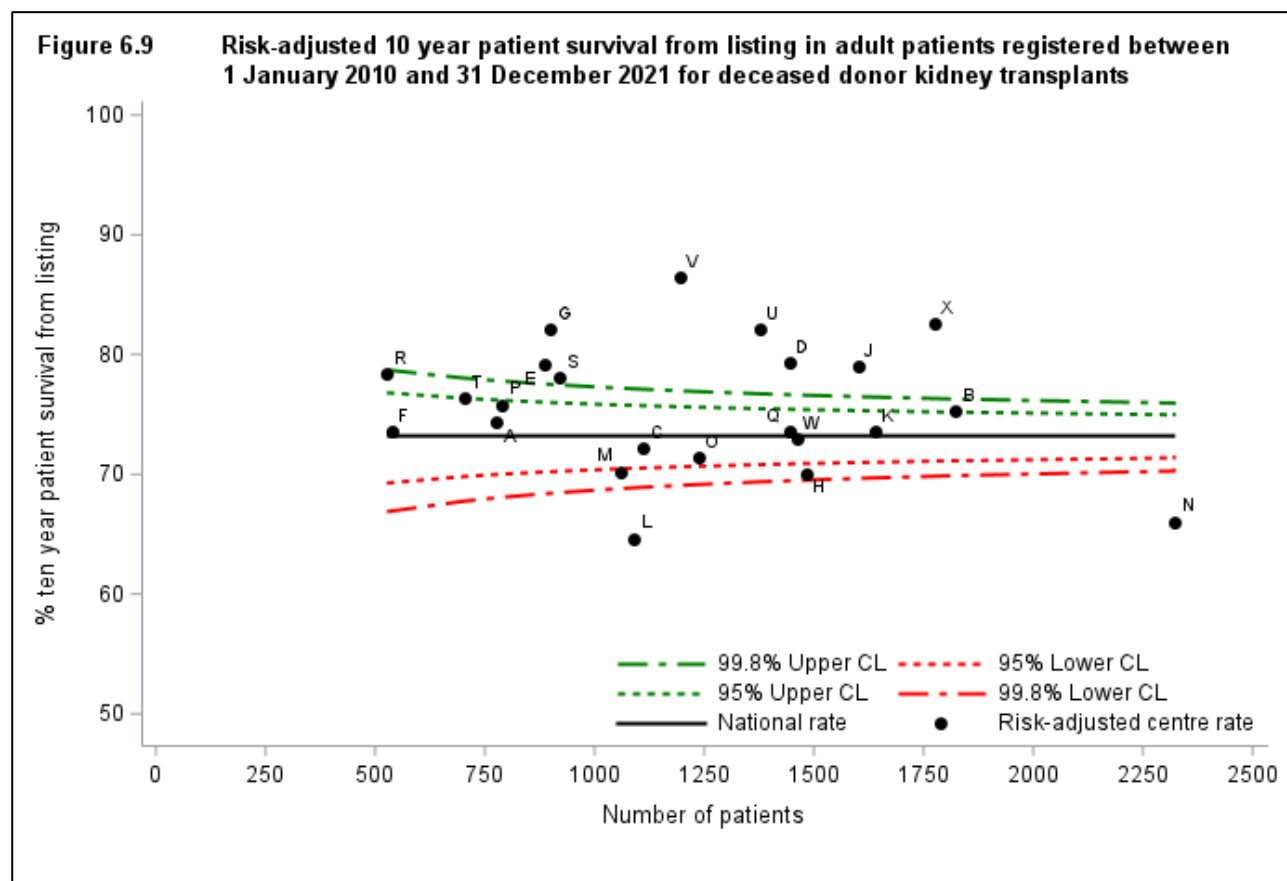
### 6.3 Graft and patient survival from listing

Survival from listing was analysed for all adult ( $\geq 18$  years) patients registered for the first time for a kidney only between 1 January 2010 and 31 December 2021. Survival time was defined as the time from joining the [transplant list](#) to death, regardless of the length of time on the [transplant list](#), whether or not the patient was transplanted and any factors associated with such a transplant e.g. donor type. Survival time was censored at either the date of removal from the list, or at the last known follow up date post transplant when no death date was recorded, or at the time of analysis if the patient was still active on the [transplant list](#).

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

Ten year [risk-adjusted survival rates](#) from the point of kidney transplant listing are shown by centre in **Figure 6.9**. Eight centres were above the upper 99.8% [confidence limit](#) indicating that these centres have 10-year survival rates from listing that are considerably higher than the national rate. Leicester and Manchester fell below the 99.8% lower [confidence limit](#) and Glasgow and Liverpool fell below the 95% lower confidence limit. This suggests that 10-year survival from listing at Leicester, Manchester, Glasgow, and Liverpool may be significantly lower than the national rate.

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



**Table 6.3 Risk-adjusted 1, 5 and 10 year patient survival from listing for adults registered between 1 January 2010 and 31 December 2021 for deceased donor kidney transplants**

Centre	Code	One year		Five year		Ten year	
		N	(%)	N	(%)	N	(%)
Belfast	A	777	(98)	777	(87)	777	(74)
Birmingham	B	1824	(99)	1824	(89)	1824	(75)
Bristol	C	1112	(99)	1112	(87)	1112	(72)
Cambridge	D	1444	(99)	1444	(91)	1444	(79)
Cardiff	E	885	(99)	885	(90)	885	(79)
Coventry	F	537	(98)	537	(87)	537	(74)
Edinburgh	G	899	(99)	899	(91)	899	(82)
Glasgow	H	1484	(98)	1484	(85)	1484	(70)
Guy's	J	1602	(99)	1602	(89)	1602	(79)
Leeds	K	1641	(98)	1641	(88)	1641	(74)
Leicester	L	1090	(98)	1090	(83)	1090	(65)
Liverpool	M	1060	(99)	1060	(86)	1060	(70)
Manchester	N	2324	(98)	2324	(83)	2324	(66)
Newcastle	O	1236	(98)	1236	(86)	1236	(71)
Nottingham	P	790	(98)	790	(88)	790	(76)
Oxford	Q	1444	(99)	1444	(88)	1444	(74)
Plymouth	R	527	(98)	527	(90)	527	(78)
Portsmouth	S	921	(99)	921	(89)	921	(78)
Sheffield	T	702	(99)	702	(88)	702	(76)
St George's	U	1378	(98)	1378	(90)	1378	(82)
The Royal Free	V	1197	(99)	1197	(94)	1197	(86)
The Royal London	W	1461	(98)	1461	(87)	1461	(73)
WLRTC	X	1776	(99)	1776	(92)	1776	(83)
<b>UK<sup>1</sup></b>		<b>28112</b>	<b>(98)</b>	<b>28112</b>	<b>(87)</b>	<b>28112</b>	<b>(73)</b>

	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

<sup>1</sup>Includes one transplant at London Bridge

## **Form Return Rates**

## 7.1 Deceased donor form return rates, 1 April 2021 – 31 March 2022

Form return rates are reported in **Table 7.1** for the kidney transplant record, three month and one year follow up form, along with lifetime follow up (more than two years). These include all adult deceased donor kidney only transplants between 1 April 2021 and 31 March 2022 for the transplant record, and all requests for follow up forms issued in this time period. Centres highlighted are transplant centres.

Centre	TX RECORD		THREE MONTHS		ONE YEAR		LIFETIME	
	N	% returned	N	% returned	N	% returned	N	% returned
Aberdeen, Aberdeen Royal Infirmary							178	90
Airdrie, Monklands District General Hospital							34	97
Bangor, Ysbyty Gwynedd District General Hospital							64	92
Basildon, Basildon Hospital							68	94
Belfast, Antrim Hospital							79	77
Belfast, Belfast City Hospital	57	100	52	98	114	67	288	74
Belfast, The Ulster Hospital							53	2
Birmingham, Birmingham Heartlands Hospital							113	1
Birmingham, Queen Elizabeth Hospital Birmingham	121	100	101	90	73	89	684	98
Bodelwyddan, Glan Clwyd District General Hospital							52	98
Bradford, St Lukes Hospital							273	99
Brighton, Royal Sussex County Hospital							269	97
Bristol, Southmead Hospital	74	99	74	72	82	78	645	83
Cambridge, Addenbrooke's Hospital	140	100	144	100	173	94	578	99
Canterbury, Kent And Canterbury Hospital							290	96
Cardiff, University Of Wales Hospital	58	100	65	26	42	12	741	17
Carlisle, Cumberland Infirmary							92	84
Carshalton, St Helier Hospital							431	88
Chelmsford, Broomfield Hospital							83	87
County Down, Daisy Hill Hospital							80	93
Coventry, University Hospital	36	100	38	95	18	100	313	99
Derby, Royal Derby Hospital							193	99
Doncaster, Doncaster Royal Infirmary							69	96
Dorchester, Dorset County Hospital							262	31
Dudley, Russells Hall Hospital							71	90
Dulwich, King's College Hospital							421	5
Dundee, Ninewells Hospital							126	20
Dunfermline, Queen Margaret Hospital							46	28
Edinburgh, Royal Infirmary Of Edinburgh	48	100	56	96	69	48	511	25
Exeter, Royal Devon And Exeter Hospital (Wonford)							256	80
Glasgow, Queen Elizabeth University Hospital							1085	88
Glasgow, Western Infirmary	88	95	96	99	107	95		
Gloucester, Gloucestershire Royal Hospital							187	19
Great Yarmouth, James Paget Hospital							26	100
Hereford, The County Hospital							37	65
Hull, Hull Royal Infirmary							275	90
Inverness, Raigmore Hospital							82	95
Ipswich, Ipswich Hospital							164	35
Leeds, St James's University Hospital	97	100	112	94	126	93	781	92
Leicester, Leicester General Hospital	46	100	33	100	70	99	711	97
Liverpool, Royal Liverpool University Hospital	69	100	79	99	61	97	423	99
London, Guy's Hospital	129	99	109	94	49	51	606	76
London, Hammersmith Hospital	178	99	144	100	93	98		
London, Royal Free Hospital	103	100	98	99	83	90	889	82
London, St George's Hospital	107	100	87	98	53	83	405	19
London, St Mary's Hospital							139	37
London, The Royal London Hospital (Whitechapel)	146	95	132	95	53	74	763	72
London, West London Renal And Transplant Centre							911	37
Londonderry, Altnagelvin Area Hospital							60	13
Manchester, Manchester Royal Infirmary	188	100	192	99	142	96	740	99
Middlesbrough, The James Cook University Hospital							321	75

**Table 7.1 Deceased donor form return rates, 1 April 2021 and 31 March 2022**

Centre	TX RECORD		THREE MONTHS		ONE YEAR		LIFETIME	
	N	% returned	N	% returned	N	% returned	N	% returned
Newcastle, Freeman Hospital	56	100	71	93	119	92	382	91
Northampton, Northampton General Hospital							58	48
Norwich, Norfolk And Norwich University Hospital							282	99
Nottingham, Nottingham City Hospital	51	98	47	100	33	67	475	58
Omagh, Tyrone County Hospital							56	4
Oxford, Churchill Hospital	127	99	126	99	176	94	769	96
Peterborough, Peterborough City Hospital							33	6
Plymouth, Derriford Hospital	25	100	26	73	37	65	203	92
Portsmouth, Queen Alexandra Hospital							829	1
Portsmouth, St Mary's Hospital	86	99	73	100				
Preston, Royal Preston Hospital							434	97
Reading, Royal Berkshire Hospital							308	92
Salford, Salford Royal							443	94
Sheffield, Northern General Hospital	47	98	50	92	35	69	532	5
Shrewsbury, Royal Shrewsbury Hospital							87	94
St Helier, Jersey General Hospital							30	100
Stevenage, Lister Hospital							216	80
Stoke-On-Trent, Royal Stoke University Hospital							219	97
Sunderland, Sunderland Royal Hospital							156	87
Swansea, Morriston Hospital							163	82
Truro, Royal Cornwall Hospital (Treliske)							227	22
Westcliff On Sea, Southend Hospital							77	64
Wirral, Arrowe Park Hospital							134	4
Wolverhampton, New Cross Hospital							135	98
Wrexham, Maelor General Hospital							101	99
York, York District Hospital							210	96

## 7.2 Living donor form return rates, 1 April 2021 – 31 March 2022

Form return rates are reported in **Table 7.2** for the kidney transplant record, three month and one year follow up form, along with lifetime follow up (more than two years). These include all adult living donor kidney only transplants between 1 April 2021 and 31 March 2022 for the transplant record, and all requests for follow up forms issued in this time period. Centres highlighted are transplant centres.

Centre	TX RECORD		THREE MONTHS		ONE YEAR		LIFETIME	
	N	% returned	N	% returned	N	% returned	N	% returned
Aberdeen, Aberdeen Royal Infirmary							89	90
Bangor, Ysbyty Gwynedd District General Hospital							23	83
Basildon, Basildon Hospital							32	100
Belfast, Antrim Hospital							66	70
Belfast, Belfast City Hospital	60	98	53	100	9	78	300	78
Belfast, The Ulster Hospital							51	4
Birmingham, Queen Elizabeth Hospital Birmingham	42	98	39	92	18	100	406	98
Bodelwyddan, Glan Clwyd District General Hospital							24	96
Bradford, St Lukes Hospital							62	98
Brighton, Royal Sussex County Hospital							189	98
Bristol, Southmead Hospital	22	95	23	70	17	59	344	80
Cambridge, Addenbrooke's Hospital	26	100	23	100	13	100	270	100
Canterbury, Kent And Canterbury Hospital							242	96
Cardiff, University Of Wales Hospital	31	100	29	14			394	14
Carlisle, Cumberland Infirmary							38	87
Carshalton, St Helier Hospital							289	92
Chelmsford, Broomfield Hospital							28	100
County Down, Daisy Hill Hospital							67	85
Coventry, University Hospital	15	93	15	100	9	78	239	100
Derby, Royal Derby Hospital							44	100
Doncaster, Doncaster Royal Infirmary							33	100
Dorchester, Dorset County Hospital							96	43
Dudley, Russells Hall Hospital							31	100
Dulwich, King's College Hospital							191	6
Dundee, Ninewells Hospital							74	26
Dunfermline, Queen Margaret Hospital							24	25
Edinburgh, Royal Infirmary Of Edinburgh	42	100	46	89	29	66	255	31
Exeter, Royal Devon And Exeter Hospital (Wonford)							118	75
Glasgow, Queen Elizabeth University Hospital							481	90
Glasgow, Western Infirmary	39	100	36	100	36	97		
Gloucester, Gloucestershire Royal Hospital							72	28
Hereford, The County Hospital							23	57
Hull, Hull Royal Infirmary							143	92
Inverness, Raigmore Hospital							51	94
Ipswich, Ipswich Hospital							60	32
Leeds, St James's University Hospital	48	100	41	93	24	88	274	92
Leicester, Leicester General Hospital	24	100	21	100	20	90	445	99
Liverpool, Royal Liverpool University Hospital	20	100	15	93	12	92	269	98
London, Guy's Hospital	73	97	60	95	7	57	480	78
London, Hammersmith Hospital	33	100	27	100	14	93		
London, Royal Free Hospital	28	93	22	100	25	80	458	76
London, St George's Hospital	33	100	29	100	14	79	175	15
London, St Mary's Hospital							115	39
London, The Royal London Hospital (Whitechapel)	38	74	28	93	18	94	366	71
London, West London Renal And Transplant Centre							536	39
Londonderry, Altnagelvin Area Hospital							44	16
Manchester, Manchester Royal Infirmary	68	97	64	98	36	92	381	95

**Table 7.2 Living donor form return rates, 1 April 2021 and 31 March 2022**

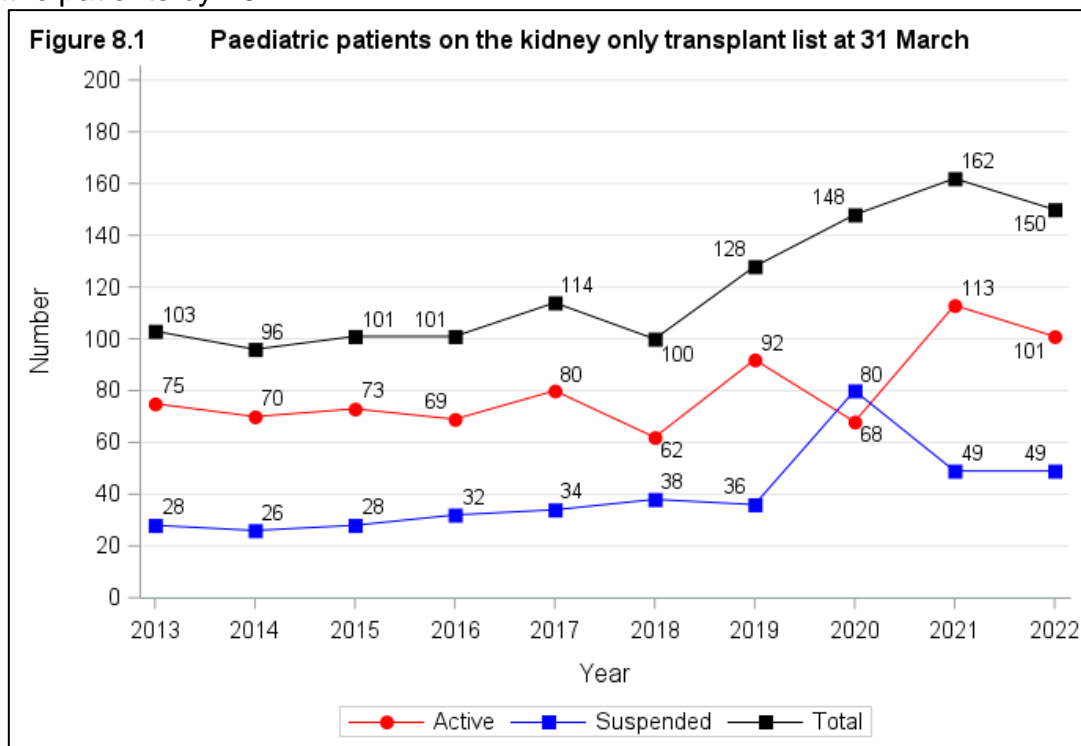
Centre	TX RECORD		THREE MONTHS		ONE YEAR		LIFETIME	
	N	% returned	N	% returned	N	% returned	N	% returned
Middlesbrough, The James Cook University Hospital							218	78
Newcastle, Freeman Hospital	44	100	47	98	29	97	259	90
Northampton, Northampton General Hospital							26	69
Norwich, Norfolk And Norwich University Hospital							75	96
Nottingham, Nottingham City Hospital	17	100	15	100	6	67	151	70
Omagh, Tyrone County Hospital							42	2
Oxford, Churchill Hospital	53	100	43	93	39	85	436	97
Plymouth, Derriford Hospital	16	100	14	71	15	80	88	93
Portsmouth, Queen Alexandra Hospital							350	1
Portsmouth, St Mary's Hospital	25	96	23	100				
Preston, Royal Preston Hospital							232	97
Reading, Royal Berkshire Hospital							112	95
Salford, Salford Royal							196	97
Sheffield, Northern General Hospital	12	100	12	100	8	88	245	4
Shrewsbury, Royal Shrewsbury Hospital							56	93
Stevenage, Lister Hospital							76	76
Stoke-On-Trent, Royal Stoke University Hospital							156	97
Sunderland, Sunderland Royal Hospital							88	85
Swansea, Morriston Hospital							53	85
Truro, Royal Cornwall Hospital (Treliske)							92	25
Westcliff On Sea, Southend Hospital							50	56
Wirral, Arrowe Park Hospital							61	3
Wolverhampton, New Cross Hospital							56	100
Wrexham, Maelor General Hospital							44	100
York, York District Hospital							67	99



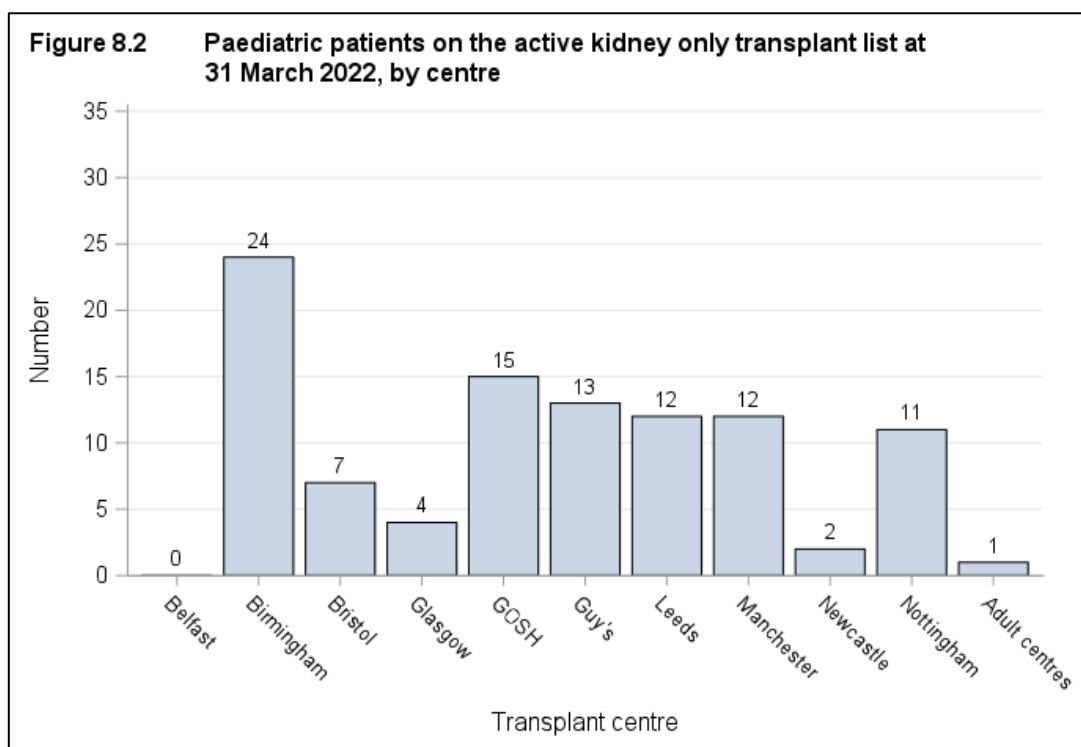
## **Paediatric kidney transplant list**

## 8.1 Paediatric patients on the kidney transplant list as at 31 March, 2013 – 2022

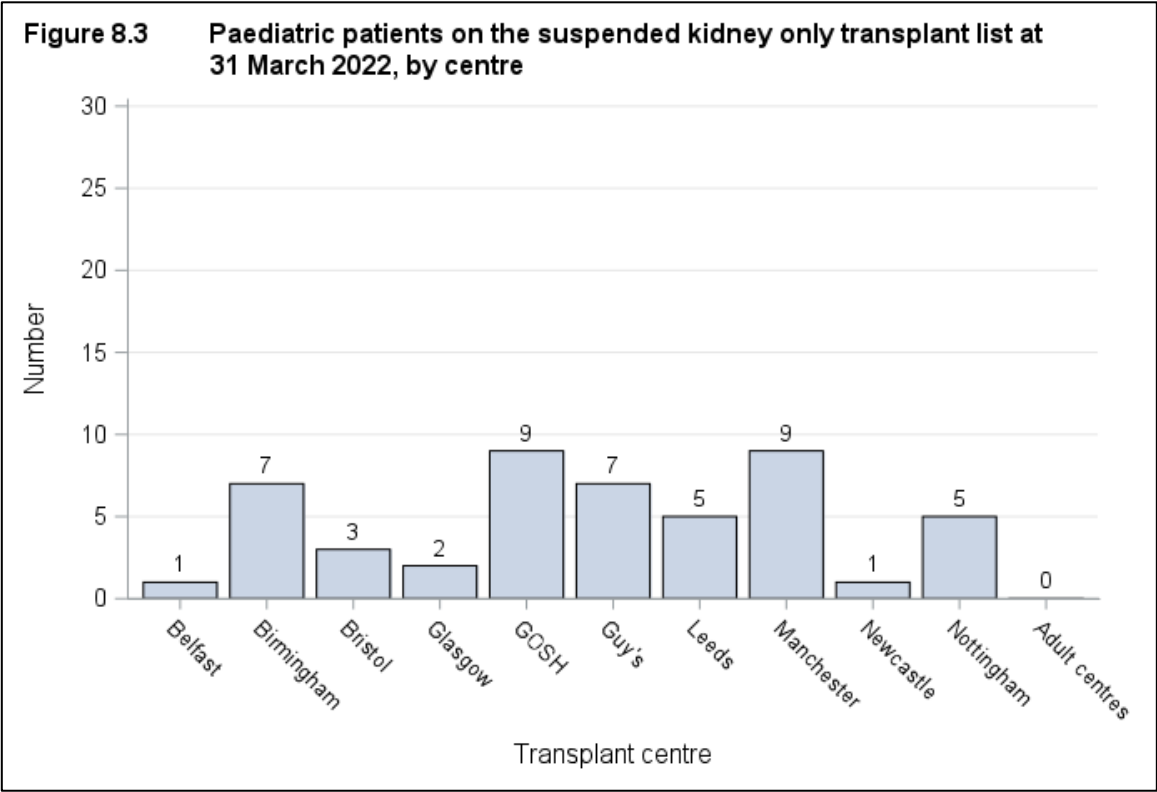
**Figure 8.1** shows the number of paediatric patients on the kidney only [transplant list](#) at 31 March each year between 2013 and 2022. The number of paediatric patients actively waiting for a kidney transplant fell from 75 in 2013 to 62 in 2018, with an increase to 101 paediatric patients by 2022.



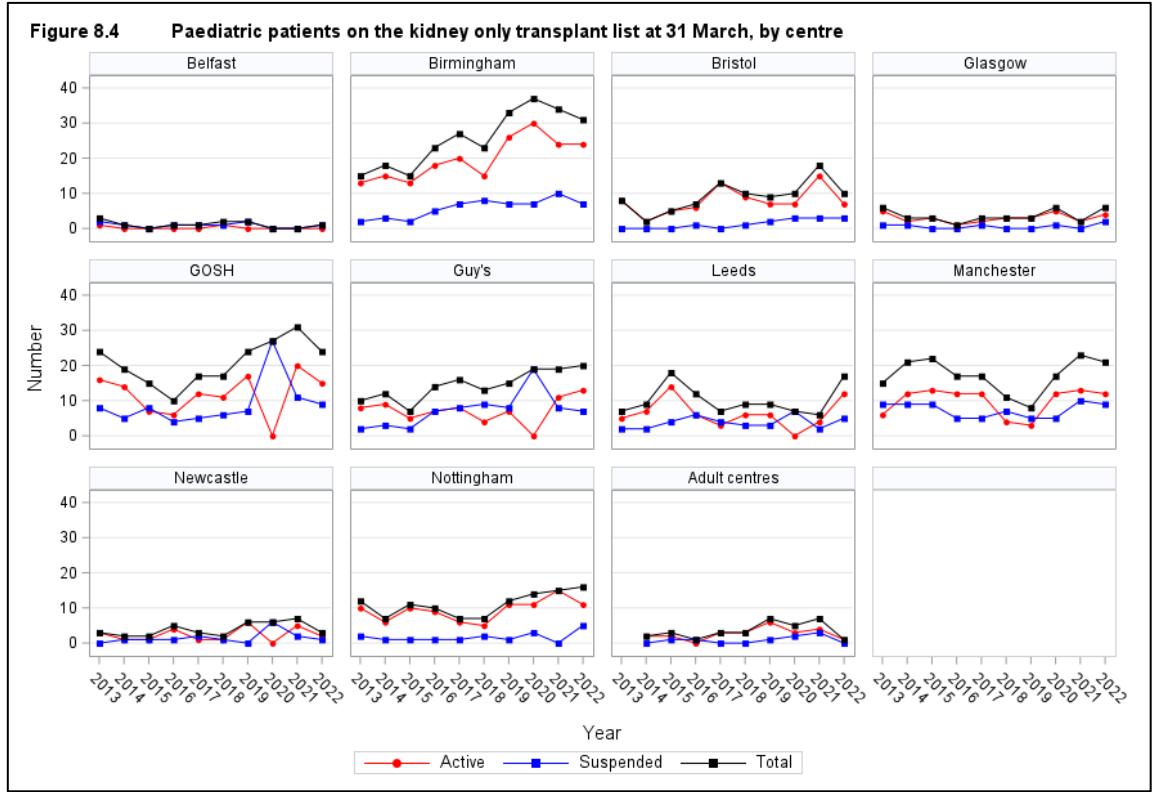
**Figure 8.2** shows the number of paediatric patients on the active kidney only [transplant list](#) at 31 March 2022 by centre. Of the total 101 paediatric patients, Birmingham had the largest proportion of the [transplant list](#) (24%) and adult centres had the smallest (1%), Belfast currently have 0 paediatric patients on the active list.



**Figure 8.3** shows the number of paediatric patients on the suspended kidney only [transplant list](#) at 31 March 2022 by centre. Of the 49 suspended paediatric patients, GOSH had the largest proportion of the [transplant list](#) (18%) and Belfast and Newcastle had the smallest (2%), adult centres currently have 0 paediatric patients on the suspended list.

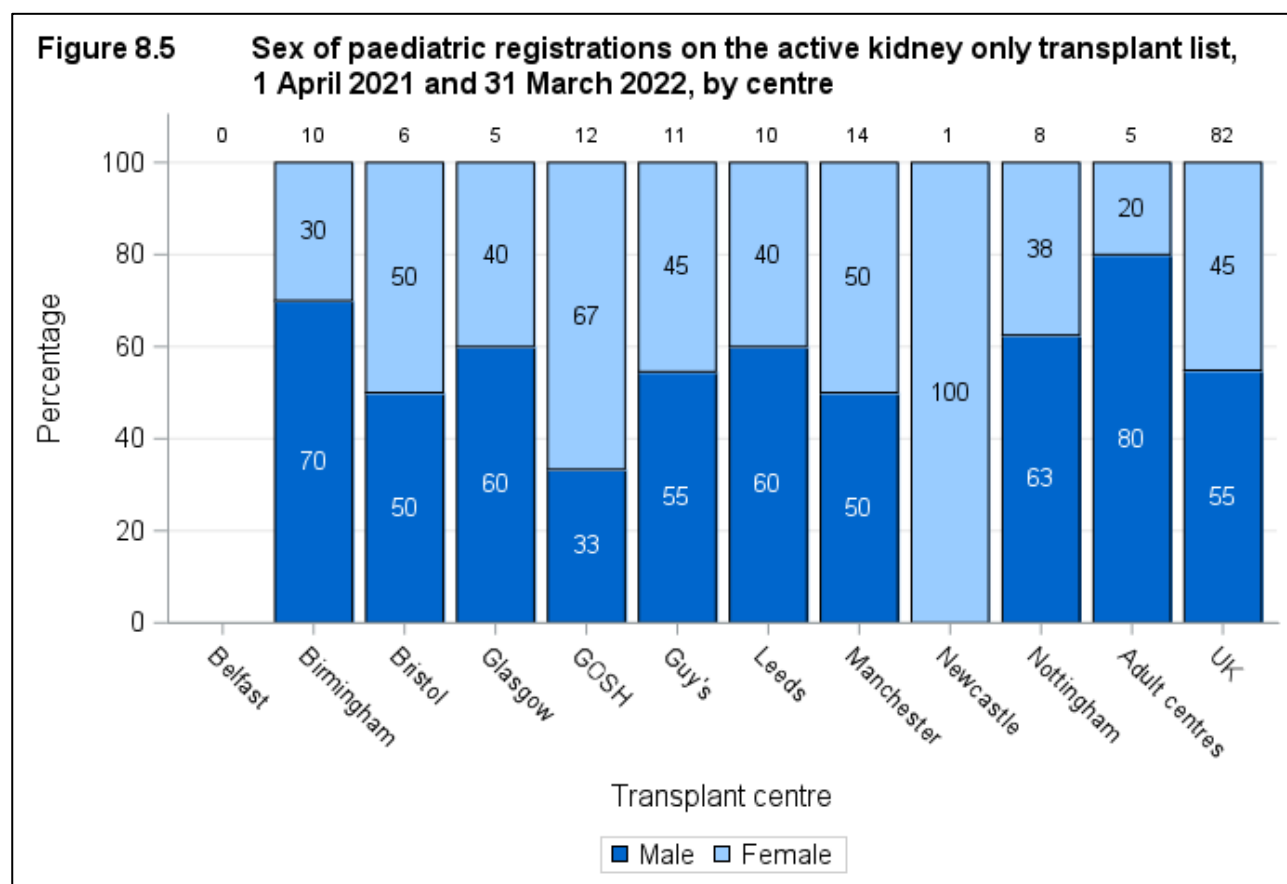


**Figure 8.4** shows the number of paediatric patients on the [transplant list](#) at 31 March each year between 2013 and 2022 for each transplant centre.

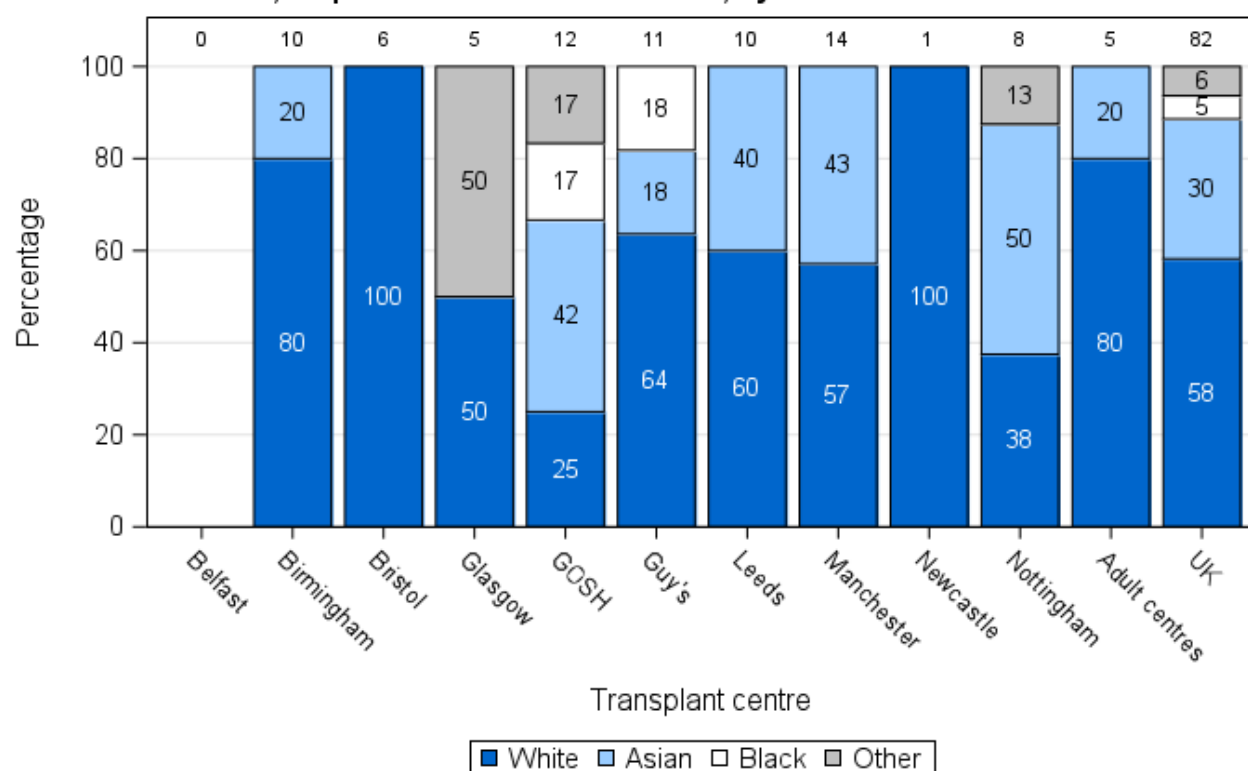


## 8.2 Demographic characteristics, 1 April 2021 – 31 March 2022

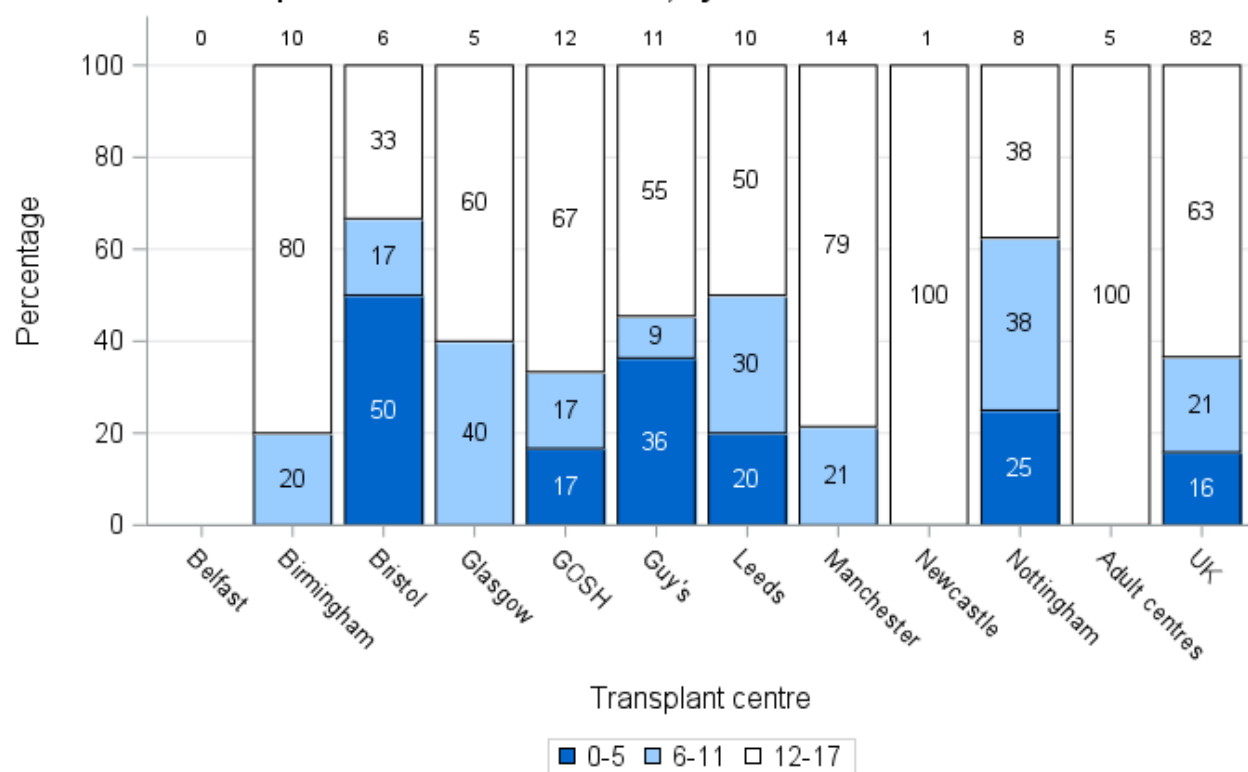
The sex, ethnicity, age group and calculated reaction frequency of patients on the transplant list are shown by centre in **Figure 8.5, 8.6, 8.7 and 8.8**, respectively. Note that all percentages quoted are based only on data where relevant information was available. Changes made to the Kidney Allocation Scheme in 2006 and the 2019 National Kidney Offering Scheme mean that tissue matching criteria between donor and recipient are less strict than previously and waiting time to transplant is now more important than it was in deciding kidney allocation. These changes have an indirect benefit for patients from ethnic minority groups, who are less often a good tissue match with the predominantly white donor pool. As a result, access to transplantation is becoming more equitable.



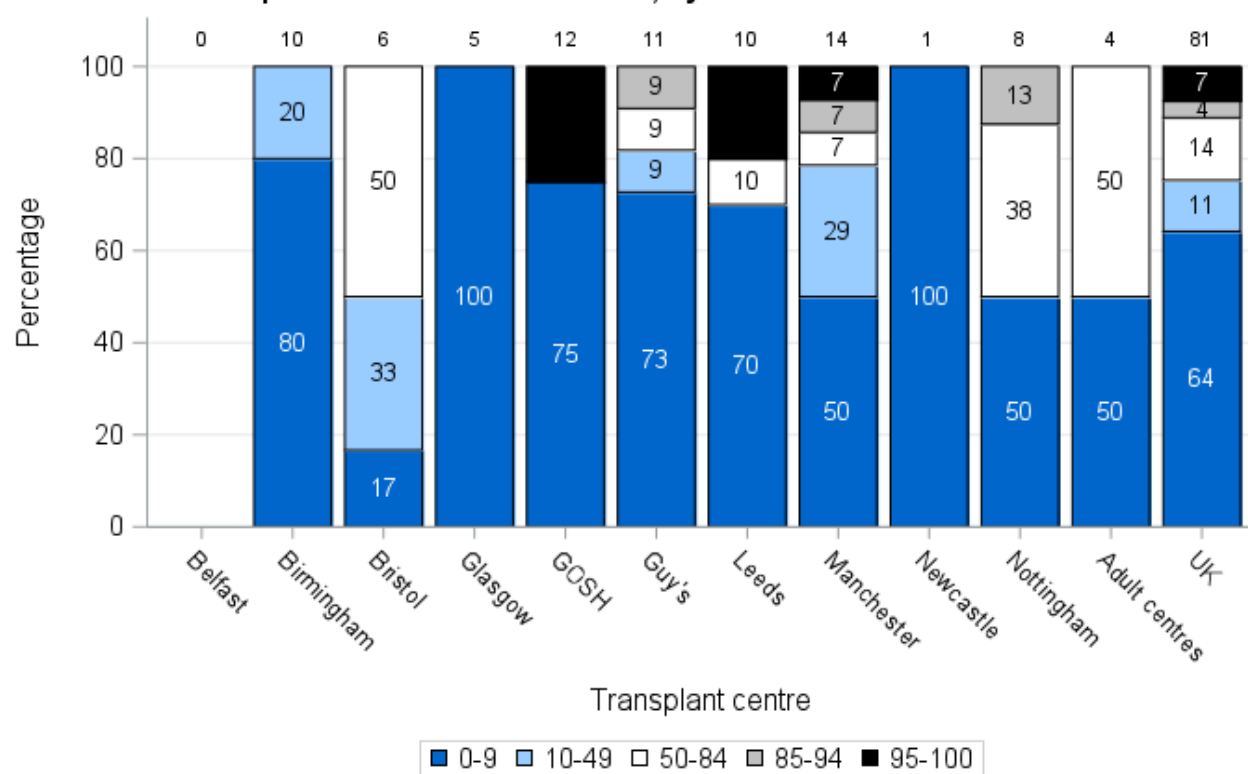
**Figure 8.6 Ethnicity of paediatric registrations on the active kidney only transplant list, 1 April 2021 and 31 March 2022, by centre**



**Figure 8.7 Age of paediatric registrations on the active kidney only transplant list, 1 April 2021 and 31 March 2022, by centre**

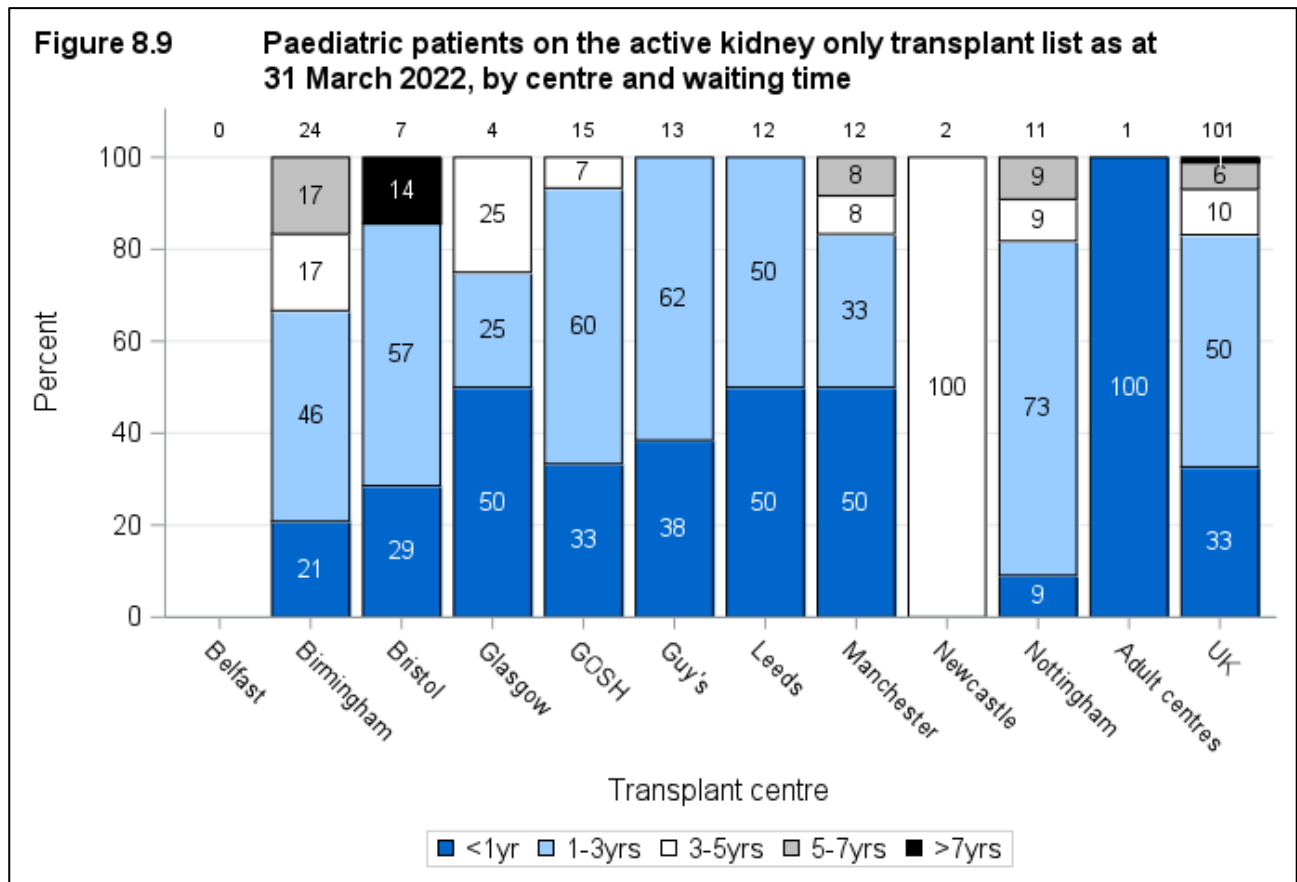


**Figure 8.8 cRF of paediatric registrations on the active kidney only transplant list, 1 April 2021 and 31 March 2022, by centre**



### 8.3 Paediatric waiting times for those currently on the list, 31 March 2022

**Figure 8.9** shows the length of time paediatric patients have been waiting on the kidney only [transplant list](#) at 31 March 2022 by centre.



#### 8.4 Median waiting time to transplant, 1 April 2016 - 31 March 2019

The length of time a patient waits for a kidney transplant varies across the UK. The [median](#) waiting time for paediatric deceased donor kidney only transplantation is shown in **Figure 8.10** and **Table 8.1** for patients registered at each individual unit. The data shown are for all paediatric patients, joining the list within the time period shown, including those still awaiting a transplant on the day of analysis. Patients who received a [live donor](#) or [multi-organ transplant](#) are not included. The national allocation scheme introduced in April 2006 helped to reduce the variability in deceased donor kidney waiting times across the country but currently some variability remains. Waiting times across centres continue to differ in a way that it is difficult for centres to control, given that the 2006 [National Kidney Allocation Scheme](#) determined allocation of all kidneys available for transplant from donors after brain death (DBD). This has continued following the introductions of the 2019 National Kidney Offering Scheme which determines allocation of all DBD kidneys and kidneys from donations after circulatory death (DCD).

##### 2006 National Kidney Allocation Scheme

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

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

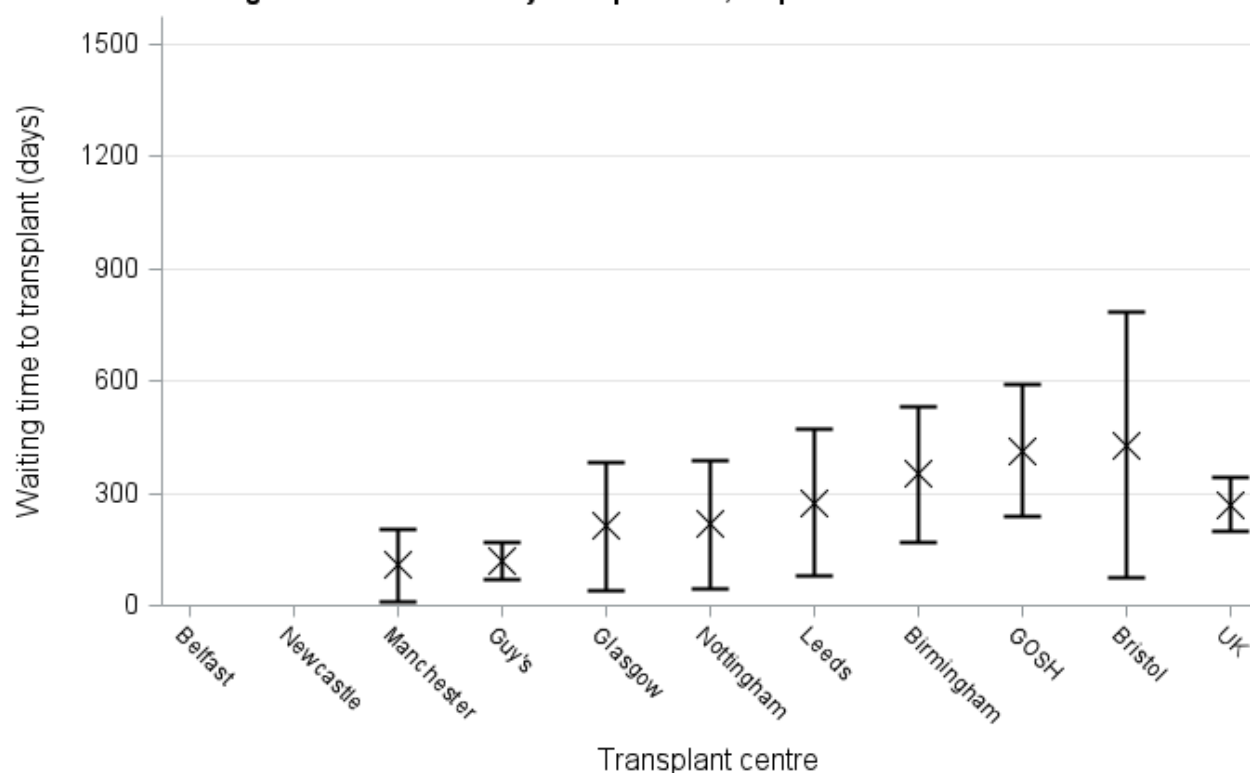
##### 2019 National Kidney Offering Scheme

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

The [median](#) waiting time to transplant for paediatric patients registered on the kidney only [transplant list](#) between 1 April 2016 and 31 March 2019 is 270 days. This ranged from 108 days at Manchester to 430 days at Bristol. 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 2016 - 31 March 2019



**Table 8.1** Median waiting time to kidney only transplant in the UK, for paediatric patients registered 1 April 2016 - 31 March 2019

Transplant centre	Number of paediatric patients registered	Waiting time (days)	
		Median	95% Confidence interval
Belfast	0	-	
Newcastle	0	-	
Manchester	17	108	10 - 206
Guy's	24	120	72 - 168
Glasgow	13	212	43 - 381
Nottingham	27	218	47 - 389
Leeds	20	276	79 - 473
Birmingham	38	351	169 - 533
GOSH	34	415	238 - 592
Bristol	24	430	75 - 785

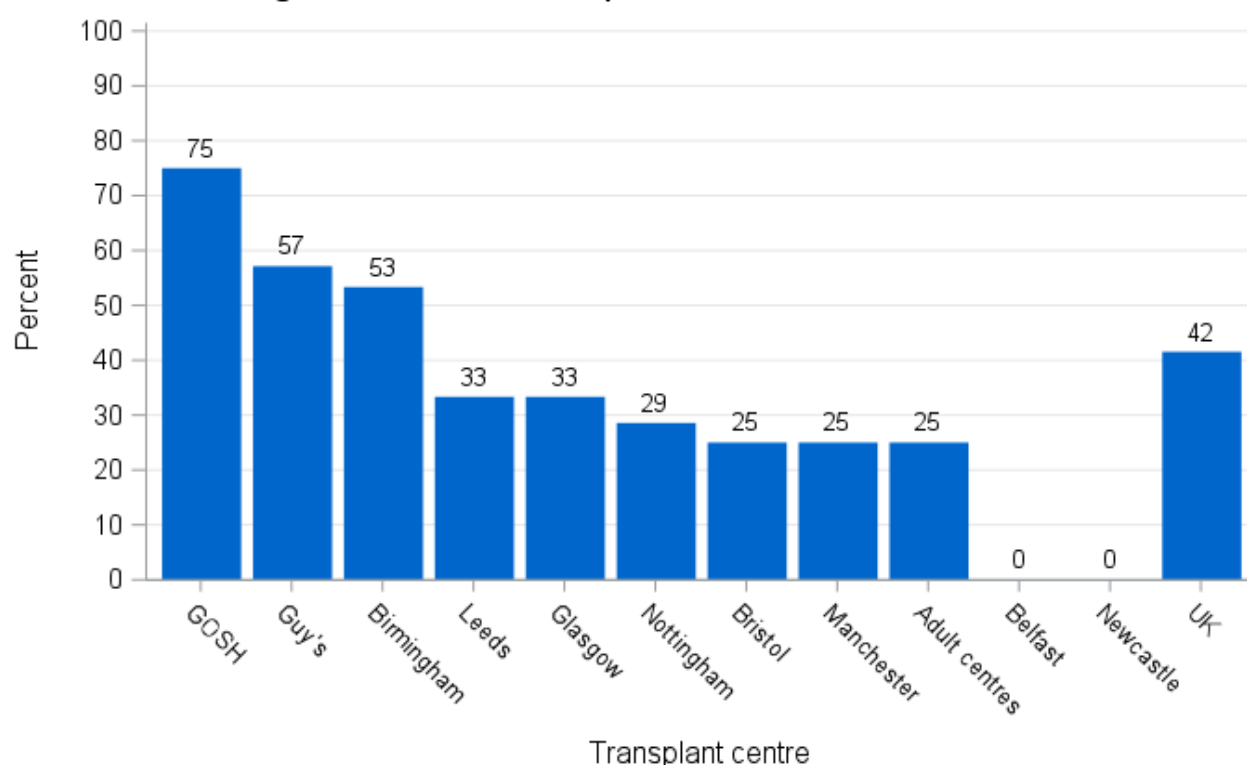
**Table 8.1 Median waiting time to kidney only transplant in the UK, for paediatric patients registered 1 April 2016 - 31 March 2019**

Transplant centre	Number of paediatric patients registered	Waiting time (days)	
		Median	95% Confidence interval
UK	229	270	198 - 342

## 8.5 Pre-emptive listing rates, 1 April 2020 - 31 March 2021

Rates of [pre-emptive](#) kidney only listings are shown in **Figure 8.11** for paediatric patients joining the list between 1 April 2020 and 31 March 2021. 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 75% at Great Ormond Street Hospital to 25% at Bristol, Manchester, and for adult centres combined. Belfast and Newcastle both had 0 registrations in the period.

**Figure 8.11 Paediatric pre-emptive listing rates by centre, registrations between 1 April 2020 and 31 March 2021**



## **Response to paediatric kidney offers**

## Offer decline rates

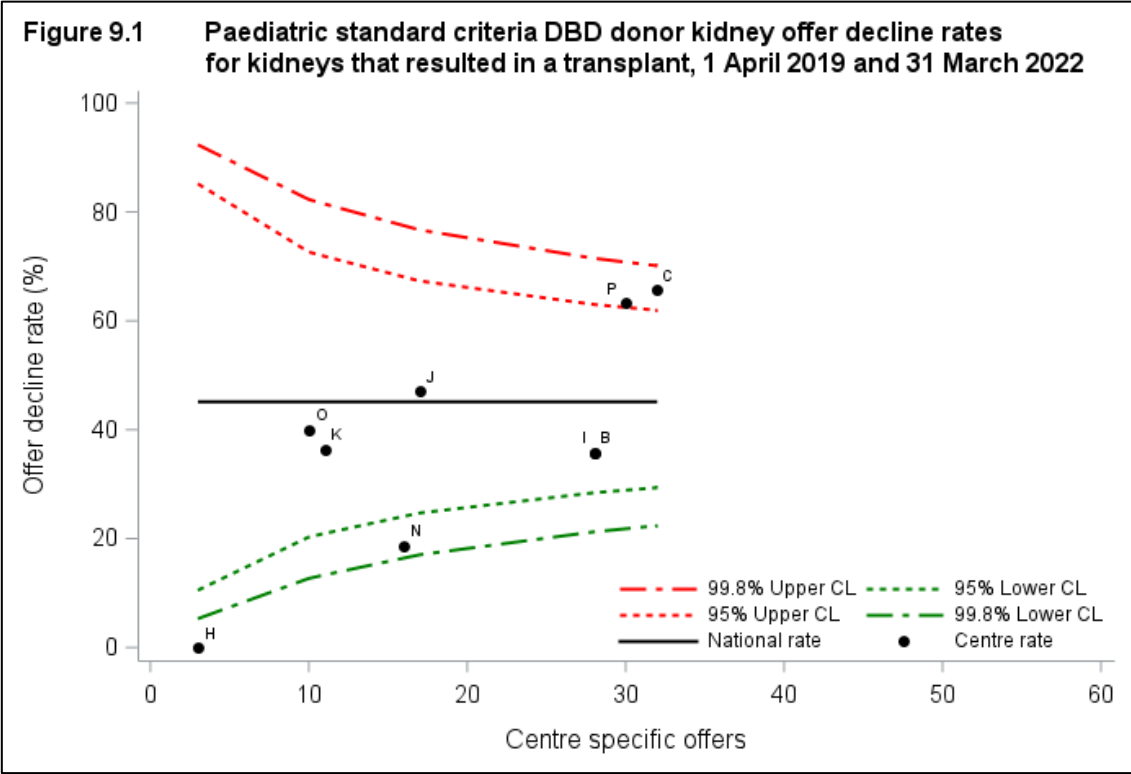
Kidney-only offers from [DBD](#) donors who had at least one kidney retrieved, offered directly and on behalf of a named individual patient and resulted in transplantation are included in the analysis. Any offers made through the reallocation of kidneys, declined kidney or fast track schemes were excluded,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

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

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

9.1 Standard criteria offer decline rates, 1 April 2019 – 31 March 2022

**Figure 9.1** compares individual centre offer decline rates with the national rate for SCD over the time period, 1 April 2019 and 31 March 2022. Centres can be identified by the information shown in **Table 9.1**. Two centres have an offer decline rate that falls above the 95% upper confidence limit, suggesting these centres have rates different from the national rate.



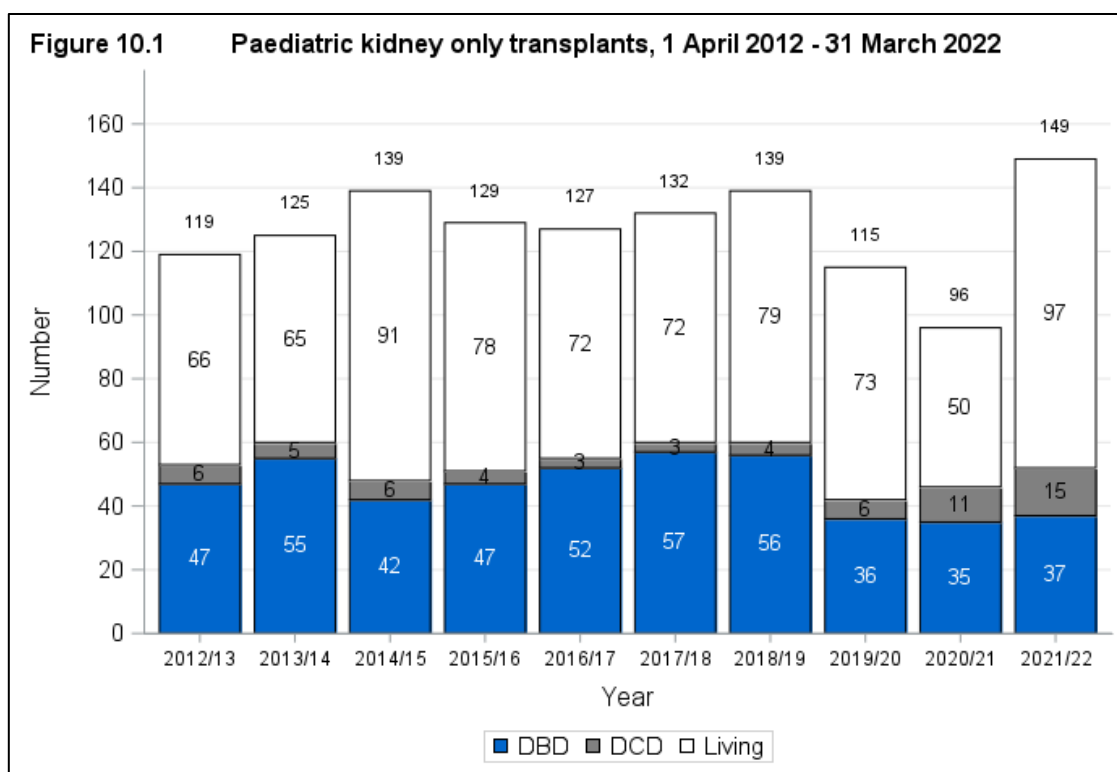
**Table 9.1** compares individual centre offer decline rates for SCD over time by financial year.

<b>Table 9.1 Paediatric standard criteria DBD donor kidney offer decline rates by transplant centre, 1 April 2019 and 31 March 2022</b>									
Centre	Code	2019/20		2020/21		2021/22		Overall	
		N	(%)	N	(%)	N	(%)	N	(%)
Birmingham	B	12	(42)	9	(22)	7	(43)	28	(38)
Bristol	C	10	(70)	12	(75)	10	(50)	32	(64)
GOSH	I	15	(47)	6	(33)	7	(14)	28	(39)
Glasgow	H			2	(0)	1	(0)	3	(44)
Guy's	J	8	(38)	3	(67)	6	(50)	17	(44)
Leeds	K	3	(33)	6	(33)	2	(50)	11	(38)
Manchester	N	3	(33)	5	(40)	8	(0)	16	(38)
Newcastle	O	5	(40)	2	(50)	3	(33)	10	(43)
Nottingham	P	5	(60)	16	(69)	9	(56)	30	(58)
<b>UK</b>		<b>61</b>	<b>(48)</b>	<b>61</b>	<b>(51)</b>	<b>53</b>	<b>(36)</b>	<b>175</b>	<b>(45)</b>

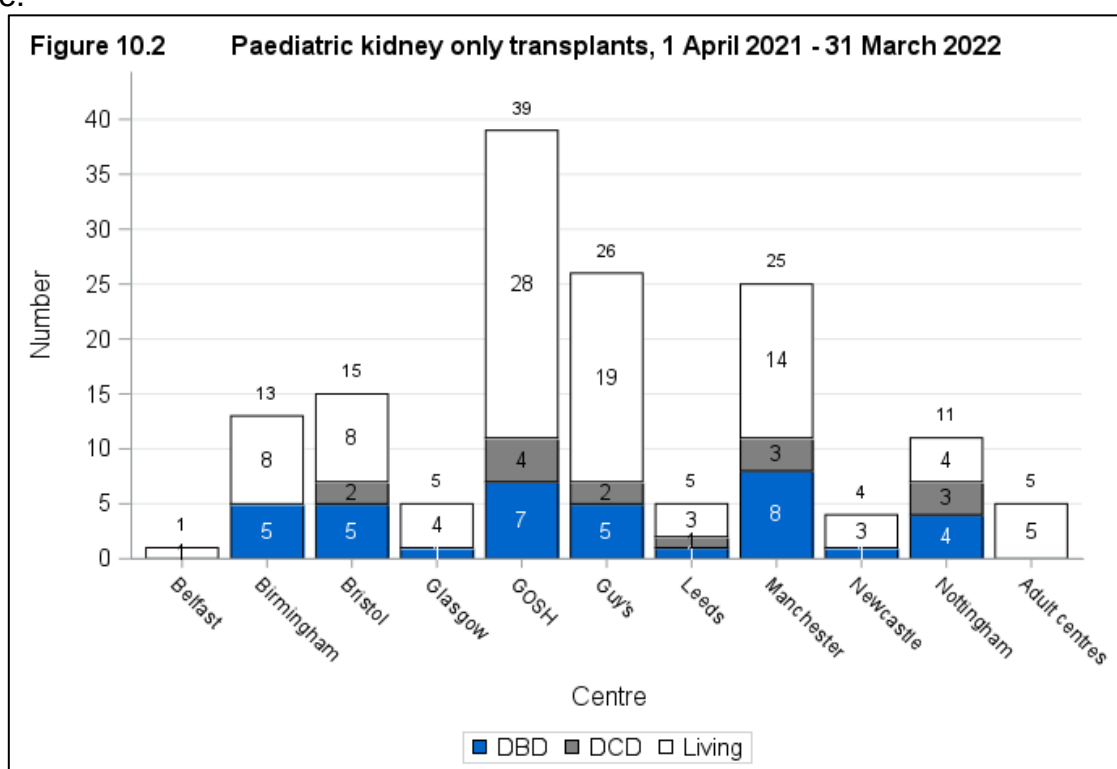
# **Paediatric kidney transplants**

## 10.1 Kidney only transplants, 1 April 2012 – 31 March 2022

**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](#)), 15 in 2021/22.

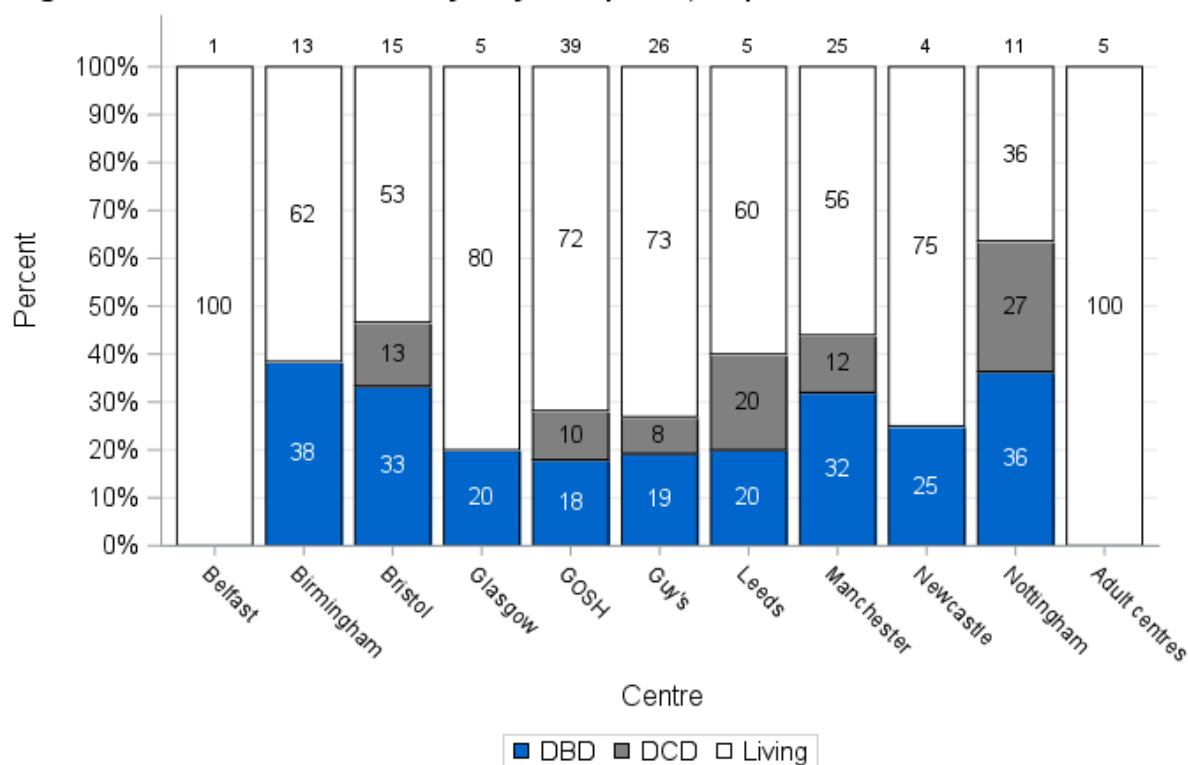


**Figure 10.2** shows the total number of paediatric kidney only transplants performed in 2021/22, by centre and type of donor. The same information is presented in **Figure 10.3** but this shows the proportion of [DBD](#), [DCD](#) and living donor transplants performed at each centre.



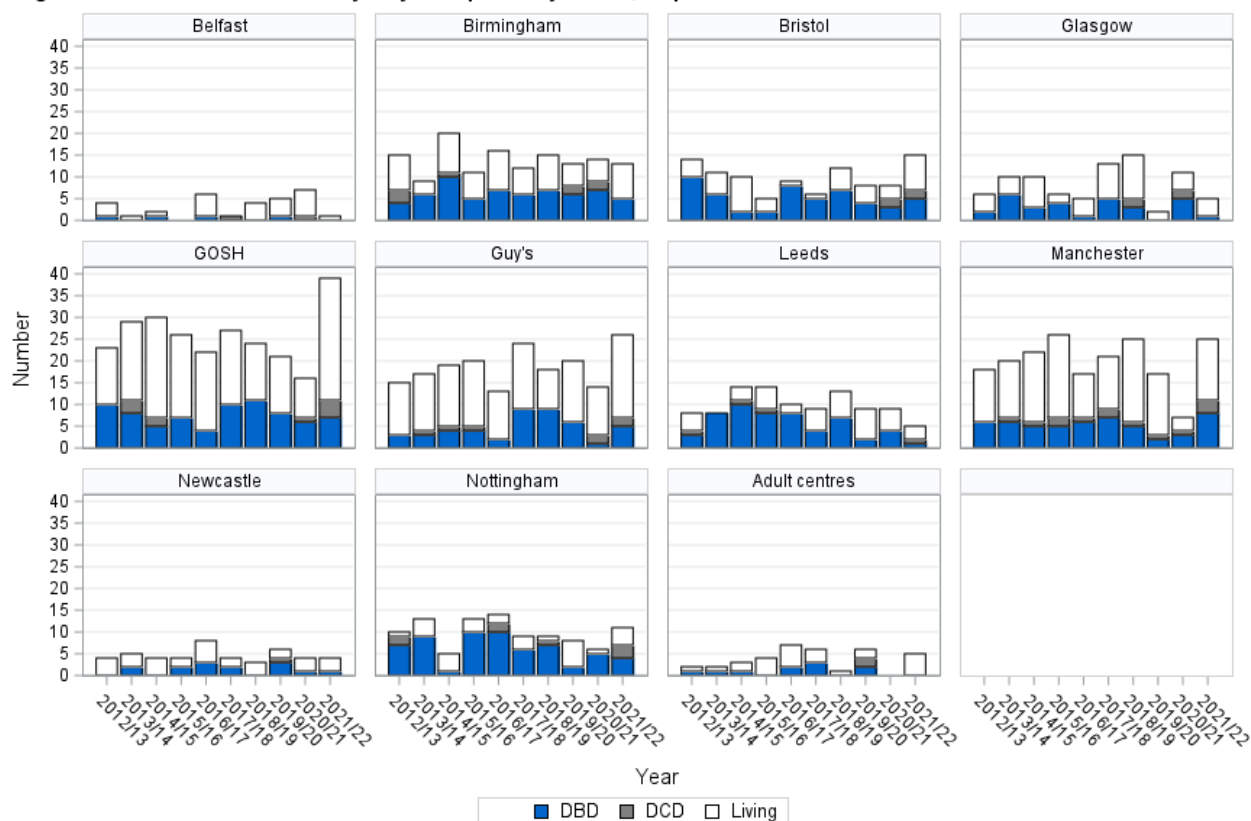


**Figure 10.3 Paediatric kidney only transplants, 1 April 2021 - 31 March 2022**



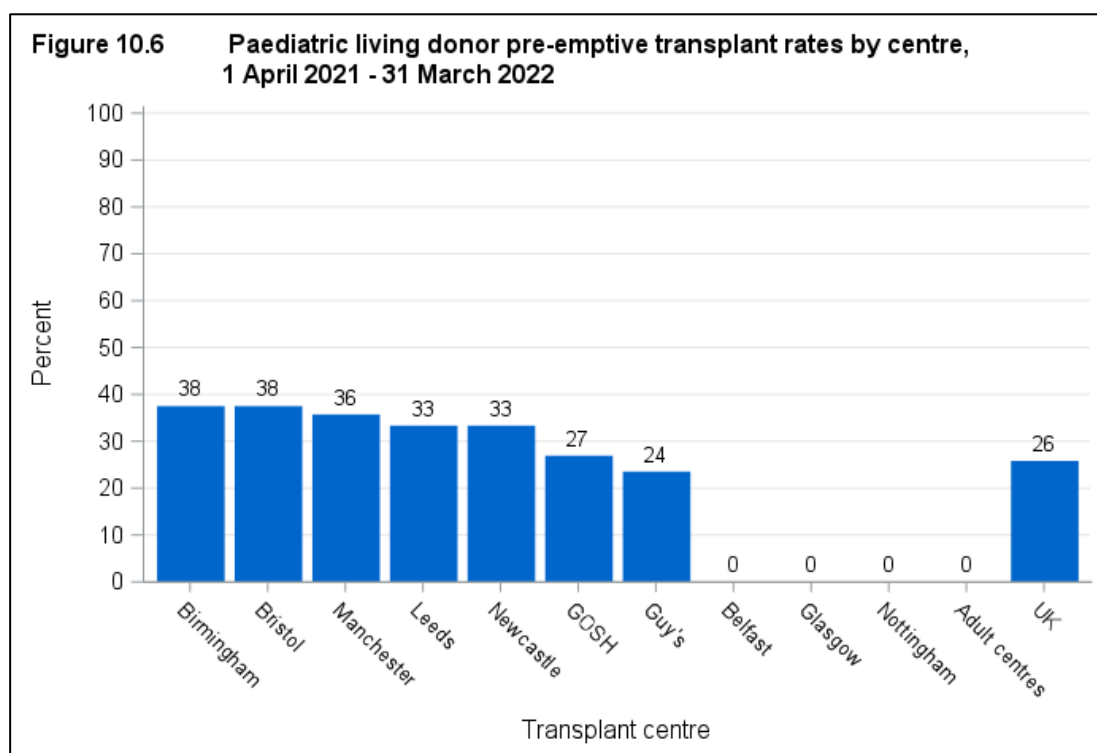
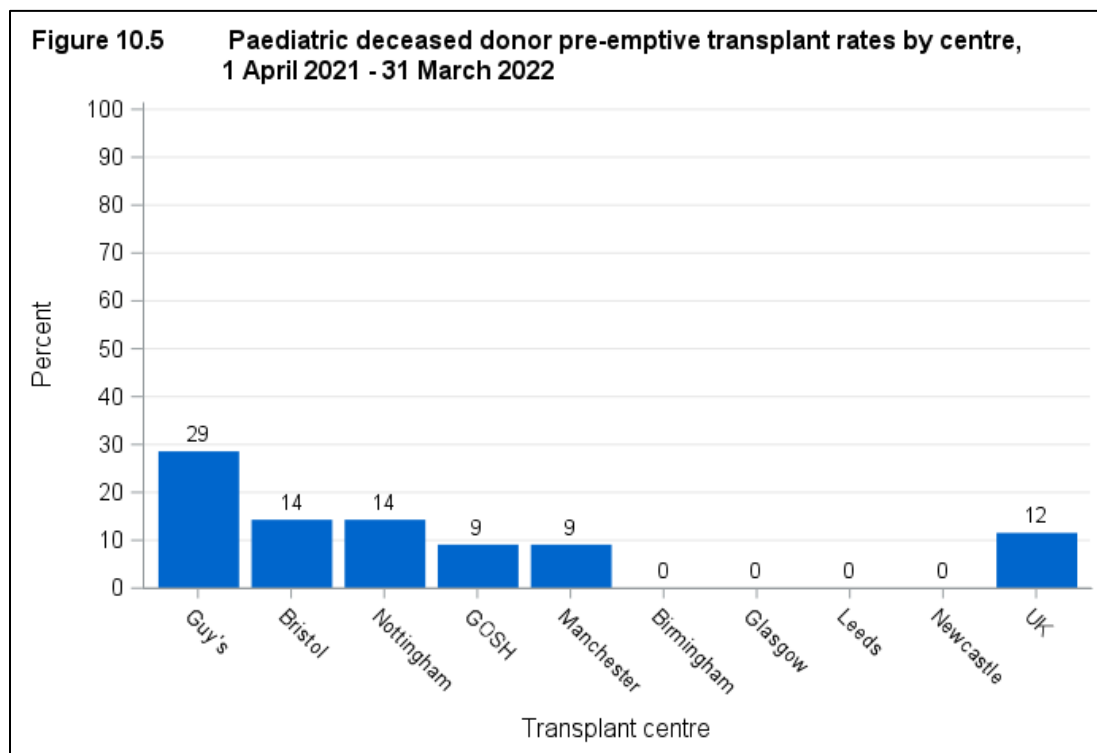
**Figure 10.4** shows the total number of paediatric kidney only transplants performed in last ten years, by centre and type of donor.

**Figure 10.4 Paediatric kidney only transplants by centre, 1 April 2012 - 31 March 2022**



## 10.2 Pre-emptive transplant rates, 1 April 2021 - 31 March 2022

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: 26% 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. Paediatric deceased donor [pre-emptive](#) transplant rates ranged from 29% at Guy's to 0% at a number of centres. Paediatric living donor [pre-emptive](#) transplant rates ranged from 38% at Birmingham and Bristol, to 0% at a number of centres.



## **Paediatric kidney outcomes**

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

#### Interpreting the [funnel plots](#)

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

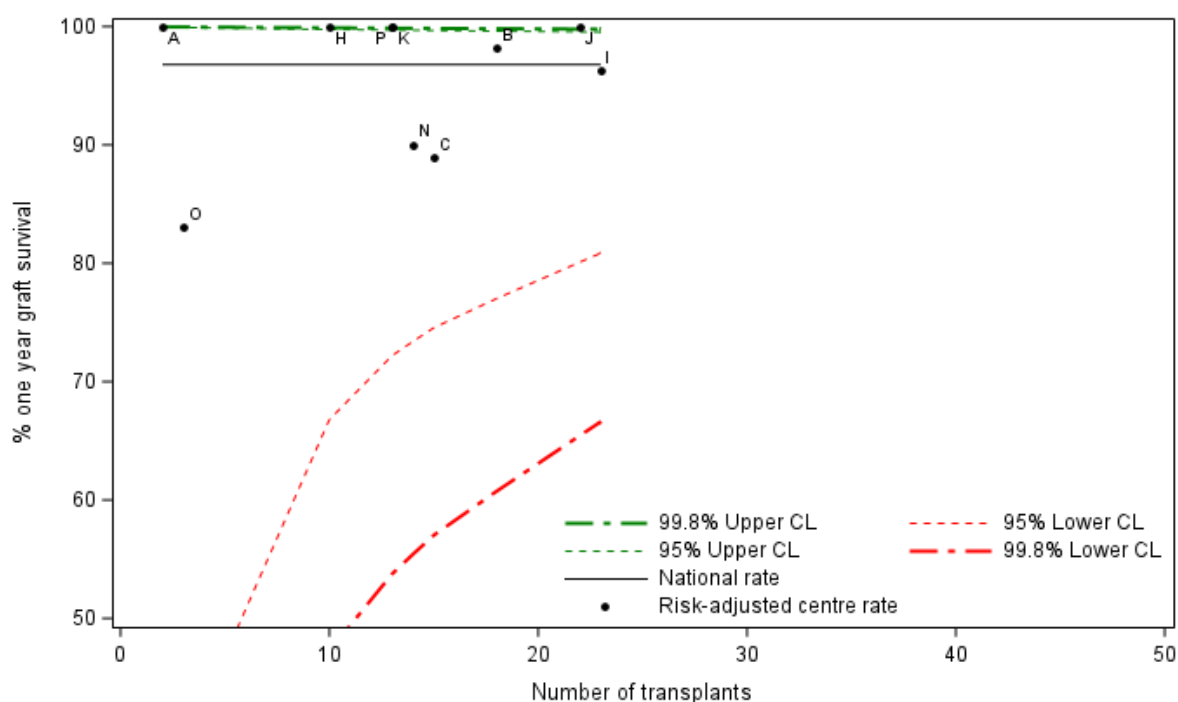
#### References

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

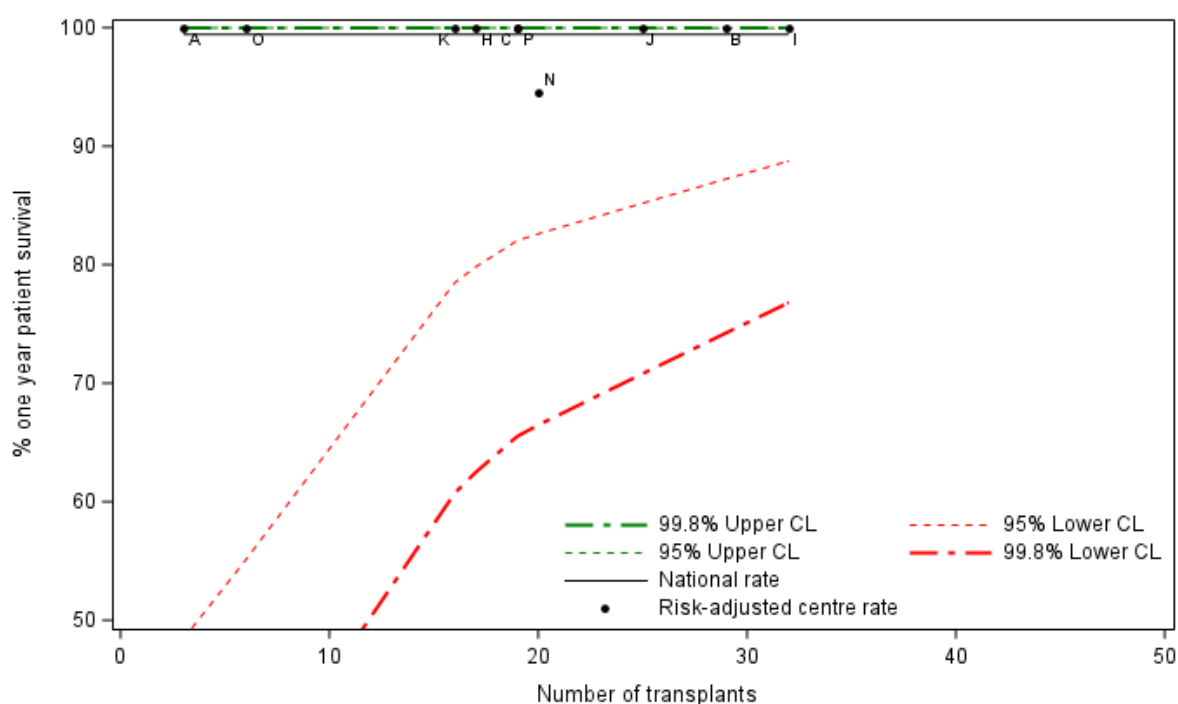
## 11.1 Deceased donor graft and patient survival

The [funnel plots](#) show that, for the most part, the centres lie within the [confidence limits](#). None of the [funnel plots](#) show any centres that lie outside the lower 95% [confidence limits](#). Some of the [funnel plots](#) show some centres to be above the upper 99.8% [confidence limit](#). This suggests that these centres may have survival rates that are considerably higher than the national rate. Centres can be identified by the information shown in **Table 11.1**.

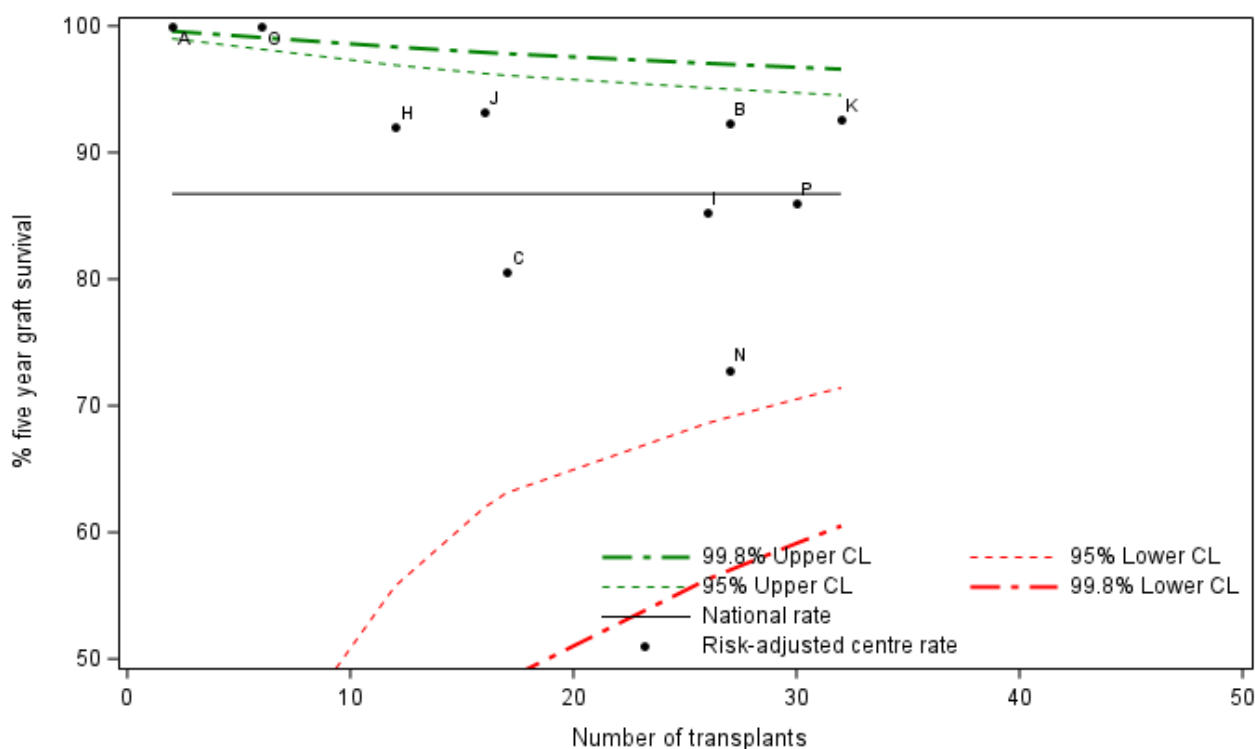
**Figure 11.1 Risk-adjusted one year graft (death censored) survival rates for first deceased donor kidney transplants in paediatric patients, between 1 April 2017 and 31 March 2021**



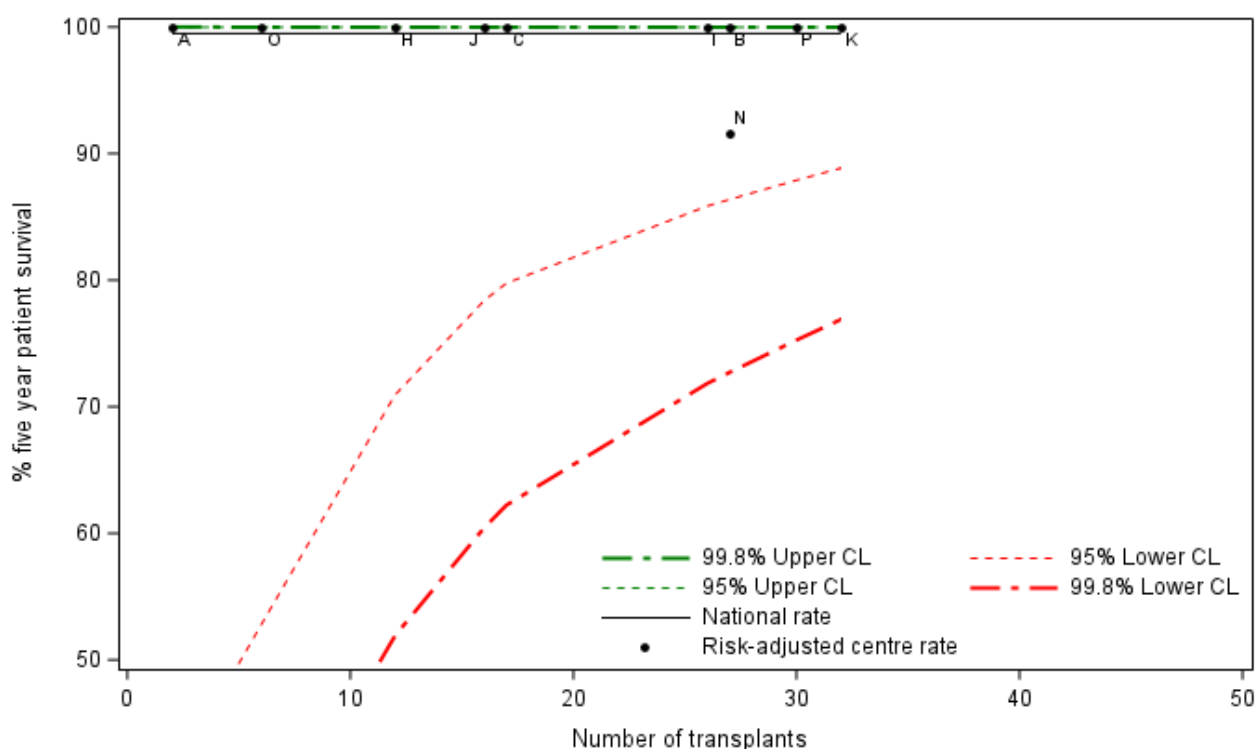
**Figure 11.2 Risk-adjusted one year patient survival rates for first deceased donor kidney transplants in paediatric patients, between 1 April 2017 and 31 March 2021**



**Figure 11.3 Risk-adjusted five year graft (death censored) survival rates for first deceased donor kidney transplants in paediatric patients, between 1 April 2013 and 31 March 2017**



**Figure 11.4 Risk-adjusted five year patient survival rates for first deceased donor kidney transplants in paediatric patients, between 1 April 2013 and 31 March 2017**



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

Centre	Code	Kidney graft survival				Patient survival			
		One-year*		Five-year**		One-year*		Five-year**	
		%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)
Belfast	A	100	N/A	100	N/A	100	N/A	100	N/A
Birmingham	B	98	(90 - 100	92	(72 - 99)	100	N/A	100	N/A
Bristol	C	89	(38 - 100	81	(43 - 96)	100	N/A	100	N/A
GOSH	I	96	(79 - 100	85	(62 - 96)	100	N/A	100	N/A
Glasgow	H	100	N/A	92	(55 - 100	100	N/A	100	N/A
Guy's	J	100	N/A	93	(62 - 100	100	N/A	100	N/A
Leeds	K	100	N/A	93	(73 - 99)	100	N/A	100	N/A
Manchester	N	90	(64 - 99)	73	(44 - 89)	95	(69 - 100	92	(53 - 100
Newcastle	O	83	(5 - 100)	100	N/A	100	N/A	100	N/A
Nottingham	P	100	N/A	86	(64 - 96)	100	N/A	100	N/A
<b>UK</b>		<b>97</b>	<b>(93 - 99)</b>	<b>87</b>	<b>(81 - 91)</b>	<b>99</b>	<b>(96 - 100</b>	<b>99</b>	<b>(96 - 100</b>

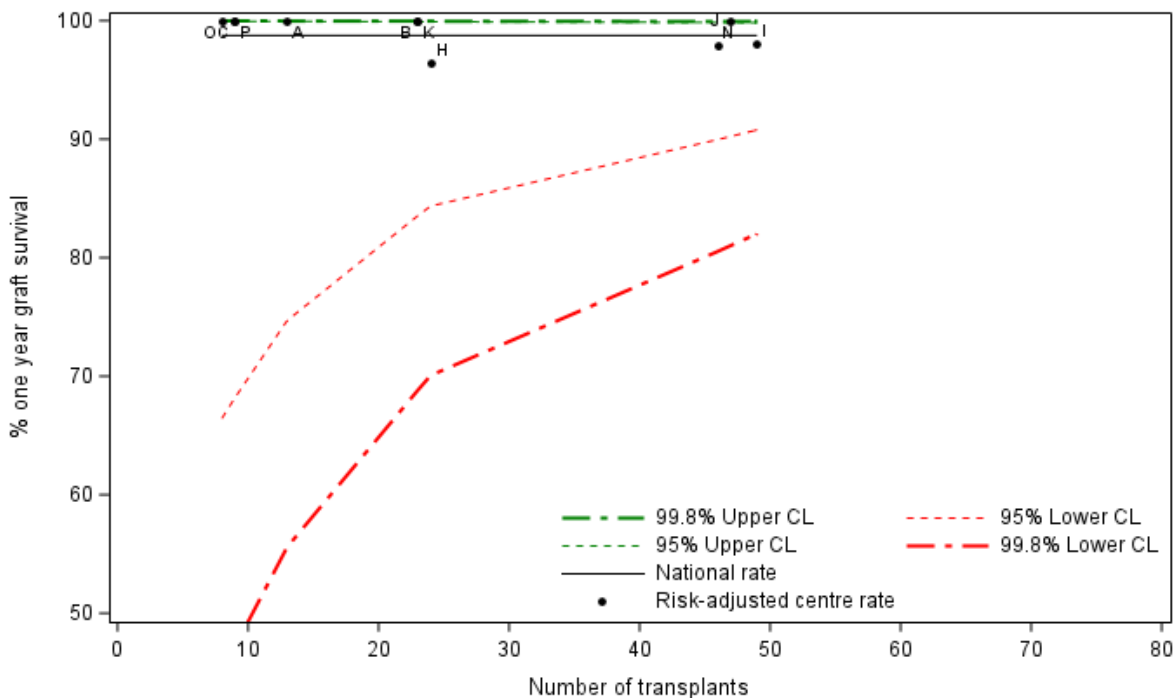
\* Includes transplants performed between 1 april 2017 - 31 March 2021

\*\* Includes transplants performed between 1 april 2013 - 31 March 2017

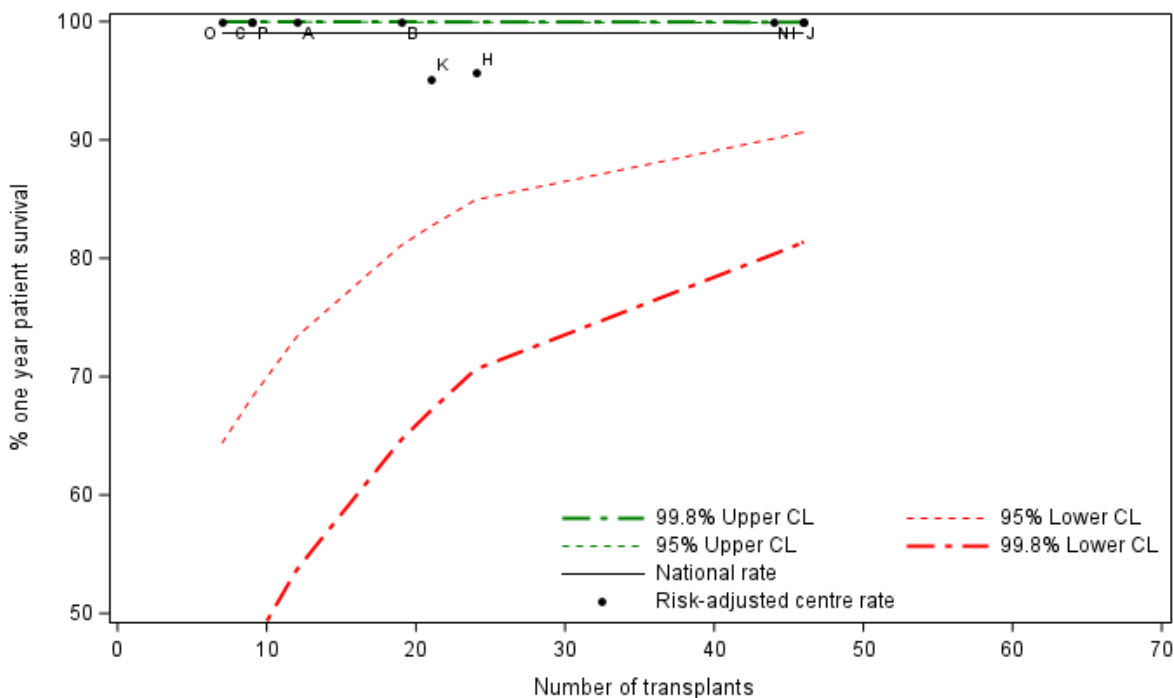
# 11.2 Living donor graft and patient survival

The [funnel plots](#) show that, for the most part, the centres lie within the [confidence limits](#). None of the [funnel plots](#) show any centres that lie outside the lower 95% [confidence limits](#). Some of the [funnel plots](#) show some centres to be above the upper 99.8% [confidence limit](#). This suggests that these centres may have survival rates that are considerably higher than the national rate. Centres can be identified by the information shown in **Table 11.2**.

**Figure 11.5 Risk-adjusted one year graft (death censored) survival rates for first live donor kidney transplants in paediatric patients, between 1 April 2017 and 31 March 2021**

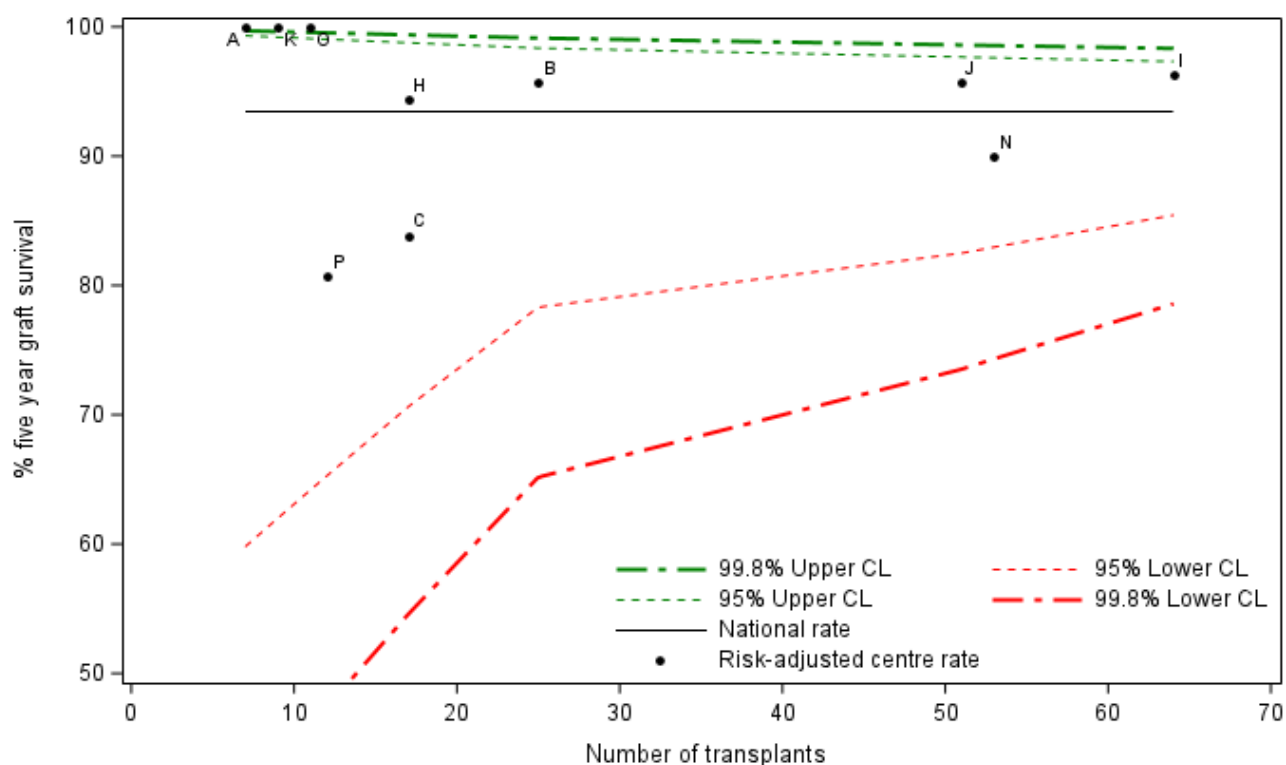


**Figure 11.6 Risk-adjusted one year patient survival rates for first live donor kidney transplants in paediatric patients, between 1 April 2017 and 31 March 2021**

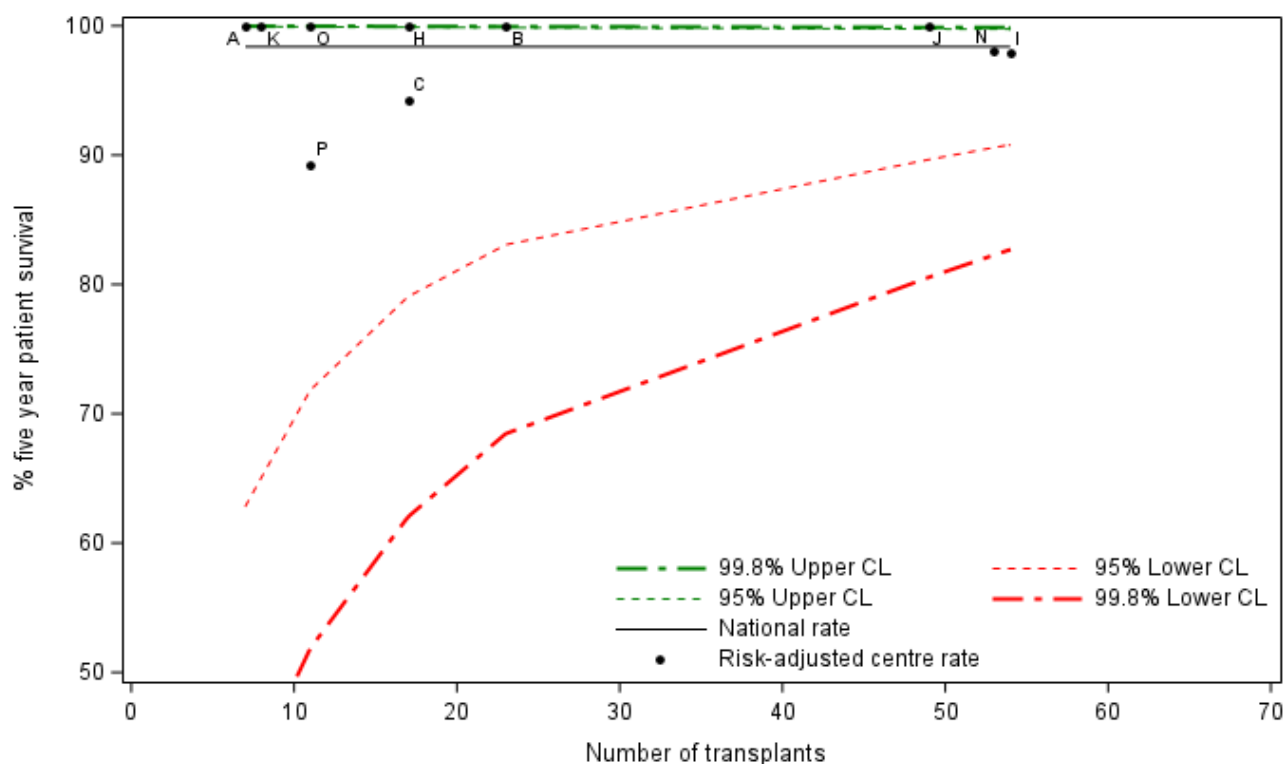




**Figure 11.7 Risk-adjusted five year graft (death censored) survival rates for first live donor kidney transplants in paediatric patients, between 1 April 2013 and 31 March 2017**



**Figure 11.8 Risk-adjusted five year patient survival rates for first live donor kidney transplants in paediatric patients, between 1 April 2013 and 31 March 2017**



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

Centre	Code	Kidney graft survival				Patient survival			
		One-year*		Five-year**		One-year*		Five-year**	
		%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)
Belfast	A	100	N/A	100	N/A	100	N/A	100	N/A
Birmingham	B	100	N/A	96	(76 - 100	100	N/A	100	N/A
Bristol	C	100	N/A	84	(53 - 97)	100	N/A	94	(68 - 100
GOSH	I	98	(89 - 100	96	(87 - 100	100	N/A	98	(88 - 100
Glasgow	H	96	(80 - 100	94	(69 - 100	96	(76 - 100	100	N/A
Guy's	J	100	N/A	96	(84 - 99)	100	N/A	100	N/A
Leeds	K	100	N/A	100	N/A	95	(73 - 100	100	N/A
Manchester	N	98	(88 - 100	90	(76 - 97)	100	N/A	98	(89 - 100
Newcastle	O	100	N/A	100	N/A	100	N/A	100	N/A
Nottingham	P	100	N/A	81	(31 - 98)	100	N/A	89	(40 - 100
<b>UK</b>		<b>98</b>	<b>(96 - 99)</b>	<b>93</b>	<b>(90 - 96)</b>	<b>99</b>	<b>(96 - 100</b>	<b>98</b>	<b>(96 - 99</b>

\* Includes transplants performed between 1 april 2017 - 31 March 2021

\*\* Includes transplants performed between 1 april 2013 - 31 March 2017

## Form return rates

## 12.1 Deceased donor form return rates, 1 April 2021 – 31 March 2022

Form return rates are reported in **Table 12.1** for the kidney transplant record, three month and one year follow up form, along with lifetime follow up (more than two years). These include all paediatric deceased donor kidney only transplants between 1 April 2021 and 31 March 2022 for the transplant record, and all requests for follow up forms issued in this time period.

**Table 12.1 Deceased donor form return rates, 1 April 2021 and 31 March 2022**

Centre	TX RECORD		THREE MONTHS		ONE YEAR		LIFETIME	
	N	% returned	N	% returned	N	% returned	N	% returned
Birmingham, Birmingham Children's Hospital							21	95
Birmingham, Queen Elizabeth Hospital Birmingham	5	100	7	86	10	80	72	94
Bradford, St Lukes Hospital							20	95
Bristol, Southmead Hospital	7	100	7	86	4	75	50	80
Cardiff, University Of Wales Hospital							45	13
Glasgow, Queen Elizabeth University Hospital							40	68
Leeds, St James's University Hospital	2	100	3	100	4	100	109	86
Leicester, Leicester General Hospital							26	85
London, Great Ormond Street Hospital For Children	11	100	13	100	8	100	35	100
London, Guy's Hospital	7	100	7	100			75	59
London, Royal Free Hospital							38	76
London, The Royal London Hospital (Whitechapel)							31	68
Manchester, Manchester Royal Infirmary	11	100	11	100	6	83	53	96
Nottingham, Nottingham City Hospital	7	100	7	100	5	80	64	63
Oxford, Churchill Hospital							22	91
Portsmouth, Queen Alexandra Hospital							28	14
Salford, Salford Royal							20	90

## 12.2 Living donor form return rates, 1 April 2021 – 31 March 2022

Form return rates are reported in **Table 12.2** for the kidney transplant record, three month and one year follow up form, along with lifetime follow up (more than two years). These include all paediatric living donor kidney only transplants between 1 April 2021 and 31 March 2022 for the transplant record, and all requests for follow up forms issued in this time period.

**Table 12.2 Living donor form return rates, 1 April 2021 and 31 March 2022**

Centre	TX RECORD		THREE MONTHS		ONE YEAR		LIFETIME	
	N	% returned	N	% returned	N	% returned	N	% returned
Belfast, Royal Belfast Hospital For Sick Children							27	15
Birmingham, Birmingham Children's Hospital							36	97
Birmingham, Queen Elizabeth Hospital Birmingham	9	100	7	71	8	100	29	97
Bristol, Southmead Hospital	9	100	8	25			23	87
Cardiff, University Of Wales Hospital	2	100					45	20
Glasgow, Queen Elizabeth University Hospital							41	83
Leeds, St James's University Hospital	4	100	4	75	5	100	43	88
Liverpool, Alder Hey Children's Hospital							24	100
Liverpool, Royal Liverpool University Hospital							24	100
London, Great Ormond Street Hospital For Children	29	97	24	100	10	100	69	100
London, Guy's Hospital	20	90	15	80	13	23	123	37
London, Royal Free Hospital							25	68
Manchester, Manchester Royal Infirmary	14	100	13	100	5	100	34	97
Manchester, Royal Manchester Children's Hospital							39	87
Newcastle, Royal Victoria Infirmary							28	79
Nottingham, Nottingham City Hospital	4	100	3	100	1	100	41	59
Oxford, Churchill Hospital	1	100	1	100			22	100
Portsmouth, Queen Alexandra Hospital							26	12
Southampton, Southampton University Hospitals							22	73

# 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  $\sigma^2$ . 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,  $\sigma^2$ , 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  $\sigma^2$ . 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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