



**Blood and Transplant**

**ANNUAL REPORT ON  
LIVER TRANSPLANTATION**

**REPORT FOR 2020/2021  
(1 APRIL 2011 – 31 MARCH 2021)**

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# **Executive Summary**



This report presents key figures about liver transplantation in the UK. The period reported covers ten years of transplant data, from 1 April 2011 to 31 March 2021. The report presents information of patients on the transplant list, number of transplants, demographic characteristics of donors and transplant recipients, and survival post registration and post first liver transplant. The data are reported both on a national and centre-specific basis, where relevant.

The National Liver Offering Scheme (NLOS) was introduced on 20<sup>th</sup> March 2018 for offering livers from donors after brain death (DBD).

## Key findings

- There were 602 patients on the UK liver transplant list on 31 March 2021 of which 123 patients were on the UK [active transplant list](#).
- Of the patients joining the [elective](#) liver only waiting list, approximately 80% had received a transplant within two years of listing.
- There were 9050 liver transplants performed in the UK in the ten year period. The number of liver transplants using deceased donors decreased in 2020/2021 compared with 2019/2020 for both [donors after brain death](#) (17%) and [donors after circulatory death](#) (29%). This was potentially due to donor age restrictions imposed in 2020/2021 during the first wave of COVID-19.
- The unadjusted national rates of patient survival one and five years after first liver only transplantation are given below

Unadjusted patient survival (%) post-transplant for first deceased donor liver only transplants		
	One year patient survival (%)	Five year patient survival (%)
<b>Adult</b>		
Elective	94	84
Super-urgent	90	82
<b>Paediatric</b>		
Elective	95	94
Super-urgent	88	76

- The national rates of patient survival after joining the transplant list for adult elective first liver only patients were 85% at one and 73% at five years post-registration.

# Introduction



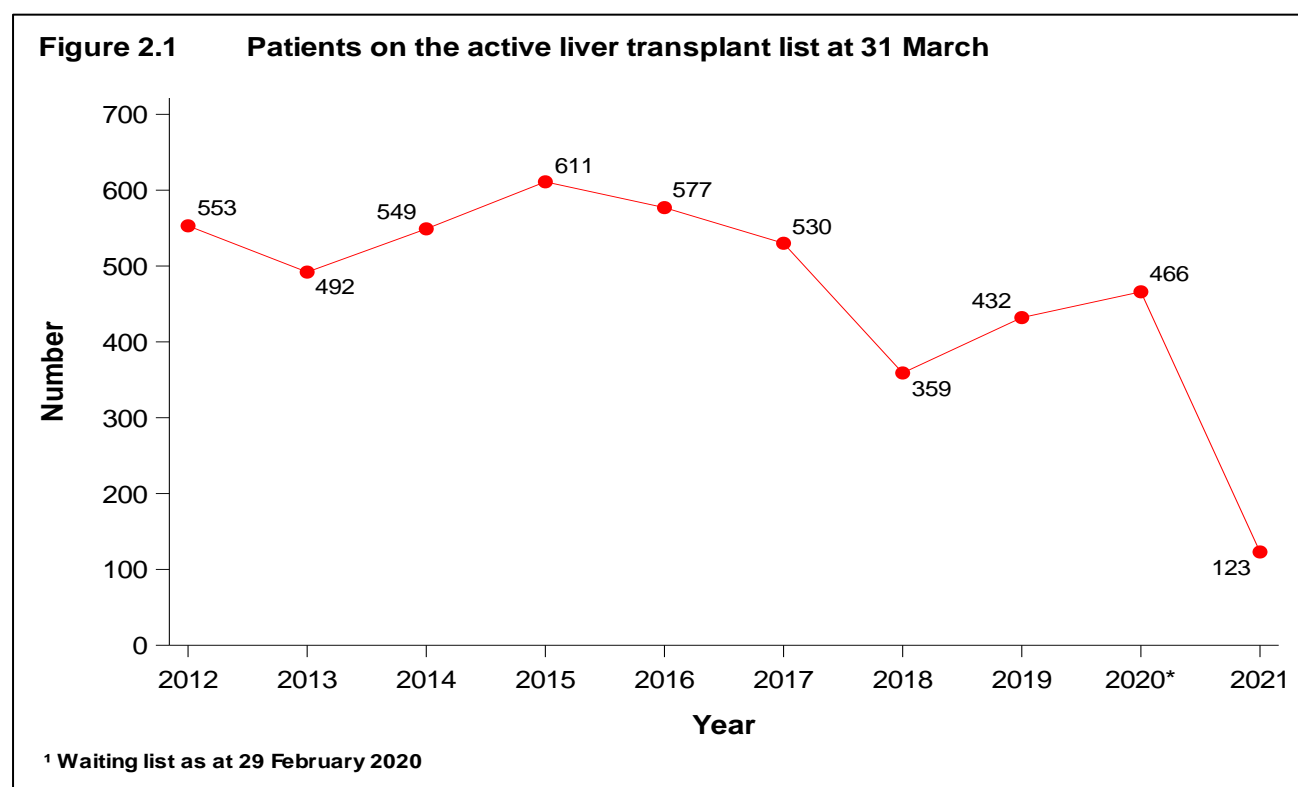
This report presents information on the UK transplant list, transplant activity and transplant outcomes between 1 April 2011 and 31 March 2021, for all seven centres performing liver transplantation in the UK. Data were obtained from the UK Transplant Registry, at NHS Blood & Transplant, that holds information relating to donors, recipients and outcomes for all liver transplants performed in the UK.

[Patient survival](#) post-transplant is reported for cohorts of patients transplanted between 1 April 2012 and 31 March 2016 for 5 year survival, and 1 April 2016 to 31 March 2020 for 1 year survival. Patient survival from registration is presented for the period 1 January 2009 to 31 December 2020. Results are described separately for adult (aged  $\geq 17$  years) and paediatric patients (aged  $< 17$  years) and according to the urgency of the transplantation ([elective and super-urgent](#)). Note, however, that the survival from listing analysis assumes adults are aged  $\geq 18$  years.

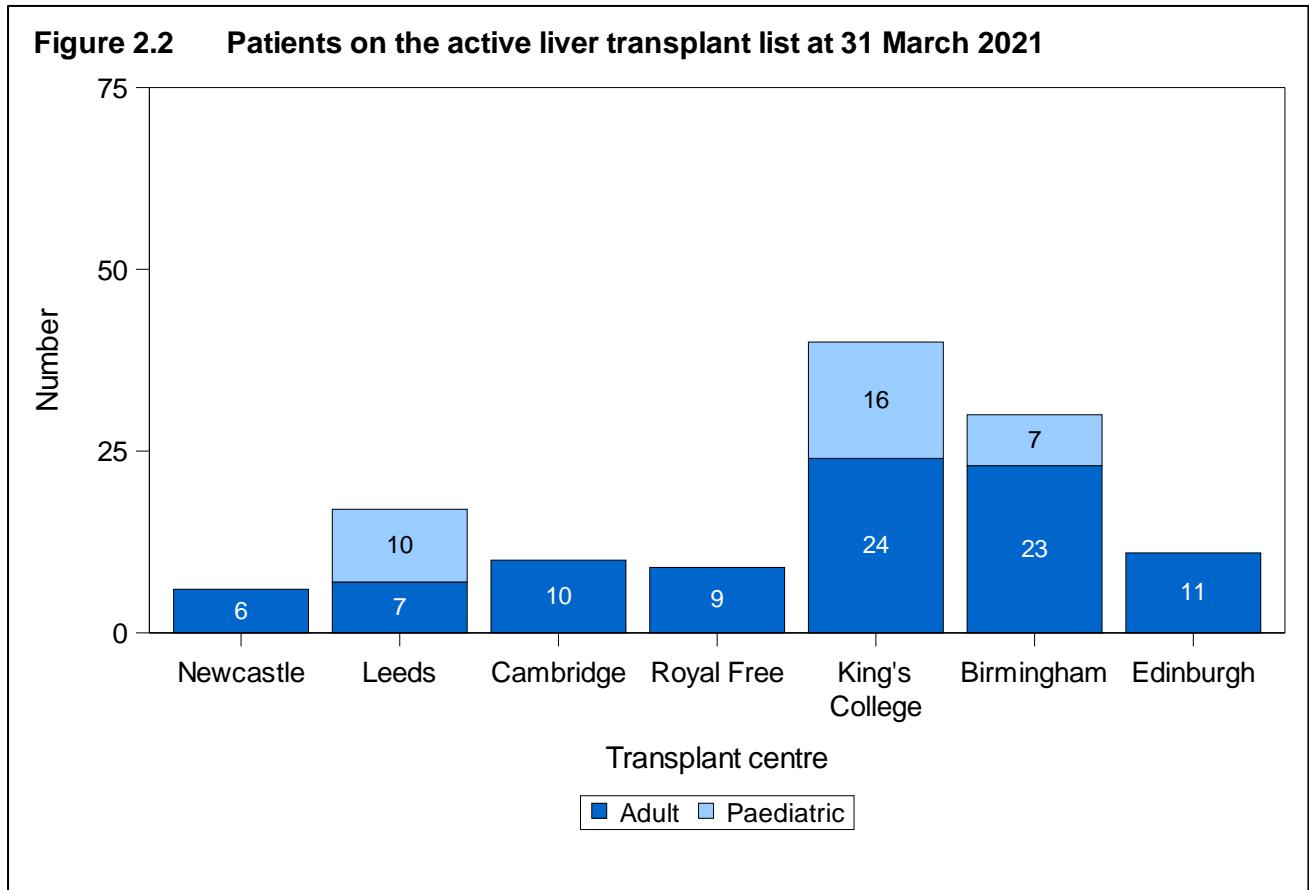
## 2.1 Transplant list

**Figure 2.1** shows the total number of liver patients on the [active transplant list](#) at 31 March each year between 2012 and 2021. The transplant list for 2020 was as at 29 February 2020 rather than 31 March 2020. It should be noted that the transplant list in 2021 is not reflective of the true active transplant list due to restrictions imposed during COVID-19.

The number of patients active on the liver transplant list increased from 553 in 2012 to 611 in 2015. There has been a decline in the number of active patients since 2015 to 359 patients in 2018 with a subsequent increase to 466 in 2020. The change in the number of patients actively listed in 2018 may be due to the introduction of the National Liver Offering Scheme (NLOS) on 20 March 2018. It may also be due to changes in medical treatment options for patients with certain aetiologies.

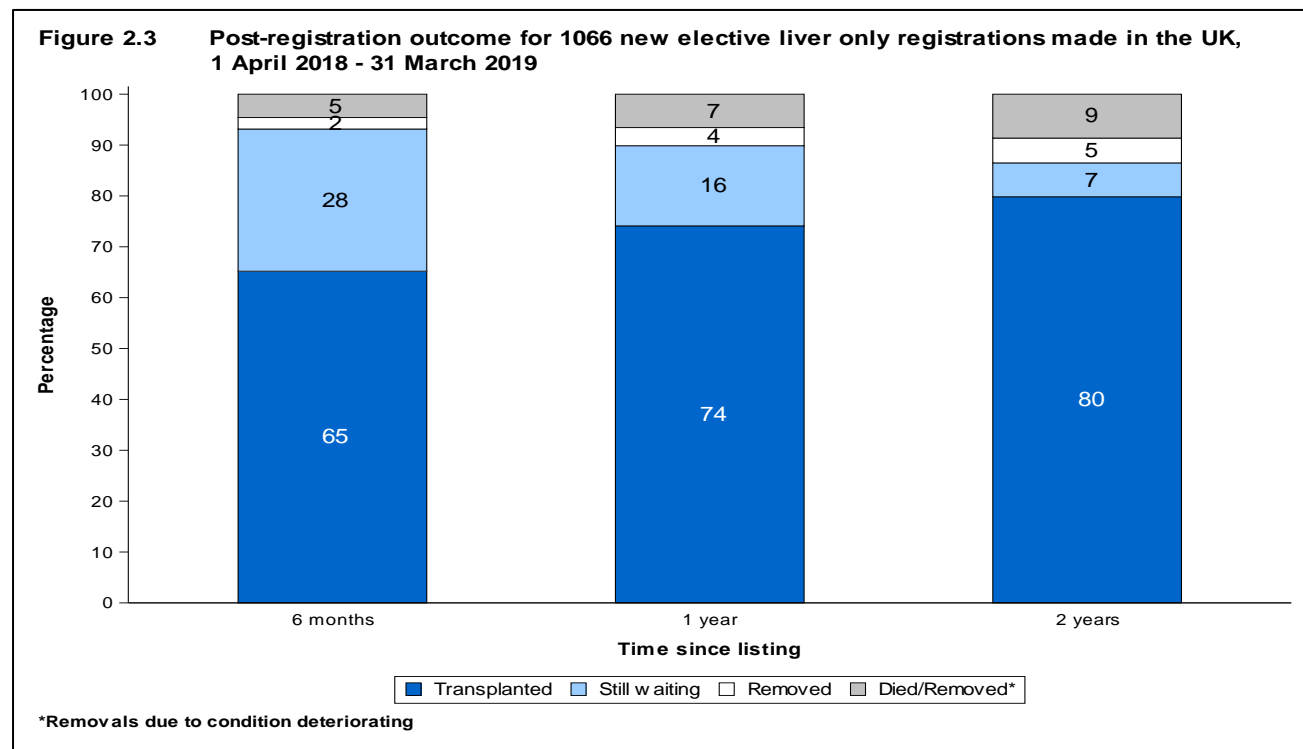


**Figure 2.2** shows the number of adult and paediatric patients on the active transplant list at 31 March 2021, by centre. In total, there were 90 adults and 33 paediatric patients on the active transplant list. Kings College had the largest share of the transplant list (33%) and Newcastle the smallest (5%). This figure includes [multi-organ](#), [elective](#) and [super-urgent](#) registrations.

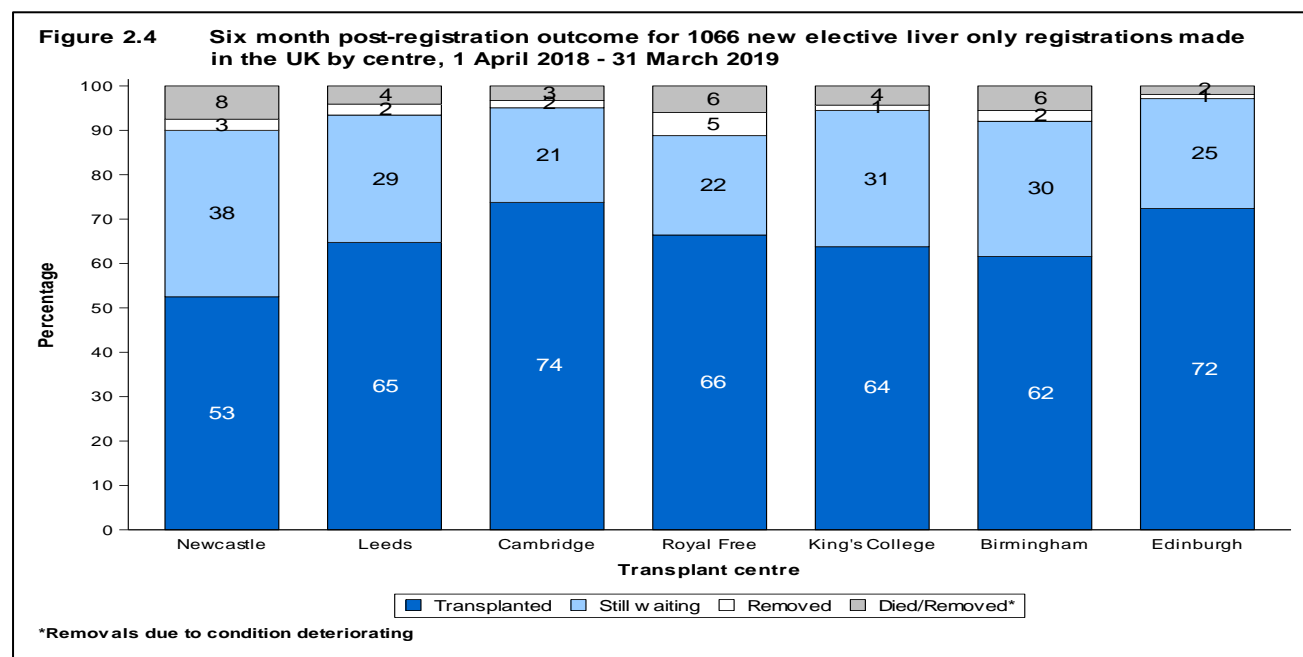




An indication of long-term outcomes for patients listed between April 2018 and March 2019 for a liver transplant is summarised in **Figure 2.3**. This shows the proportion of patients transplanted or still waiting six months, one year and two years after joining the transplant list. At six months post-registration, 65% of patients had received a transplant and 28% were still waiting.

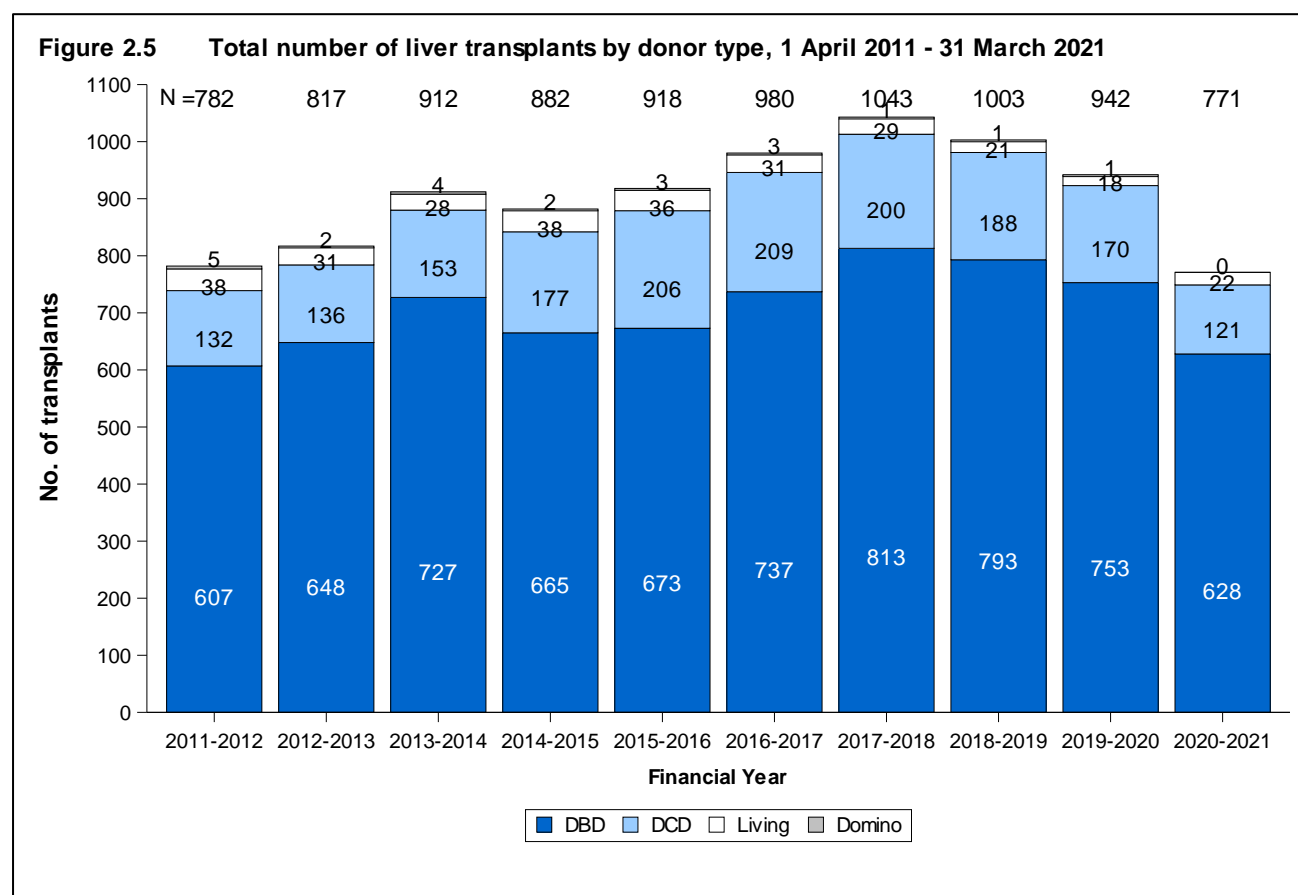


**Figure 2.4** shows the six month registration outcome by centre. The proportion of patients transplanted six months after listing at each centre ranges from 53% at Newcastle to 74% at Cambridge.

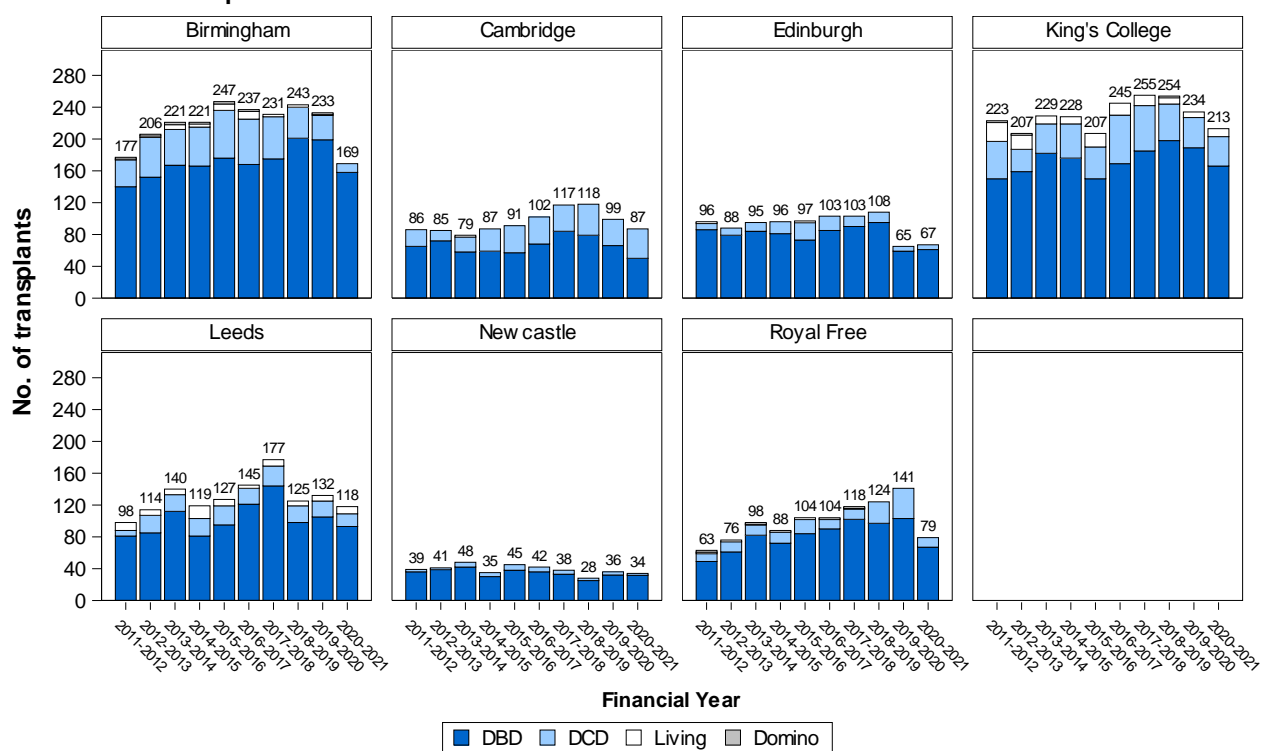


## 2.2 Transplant activity

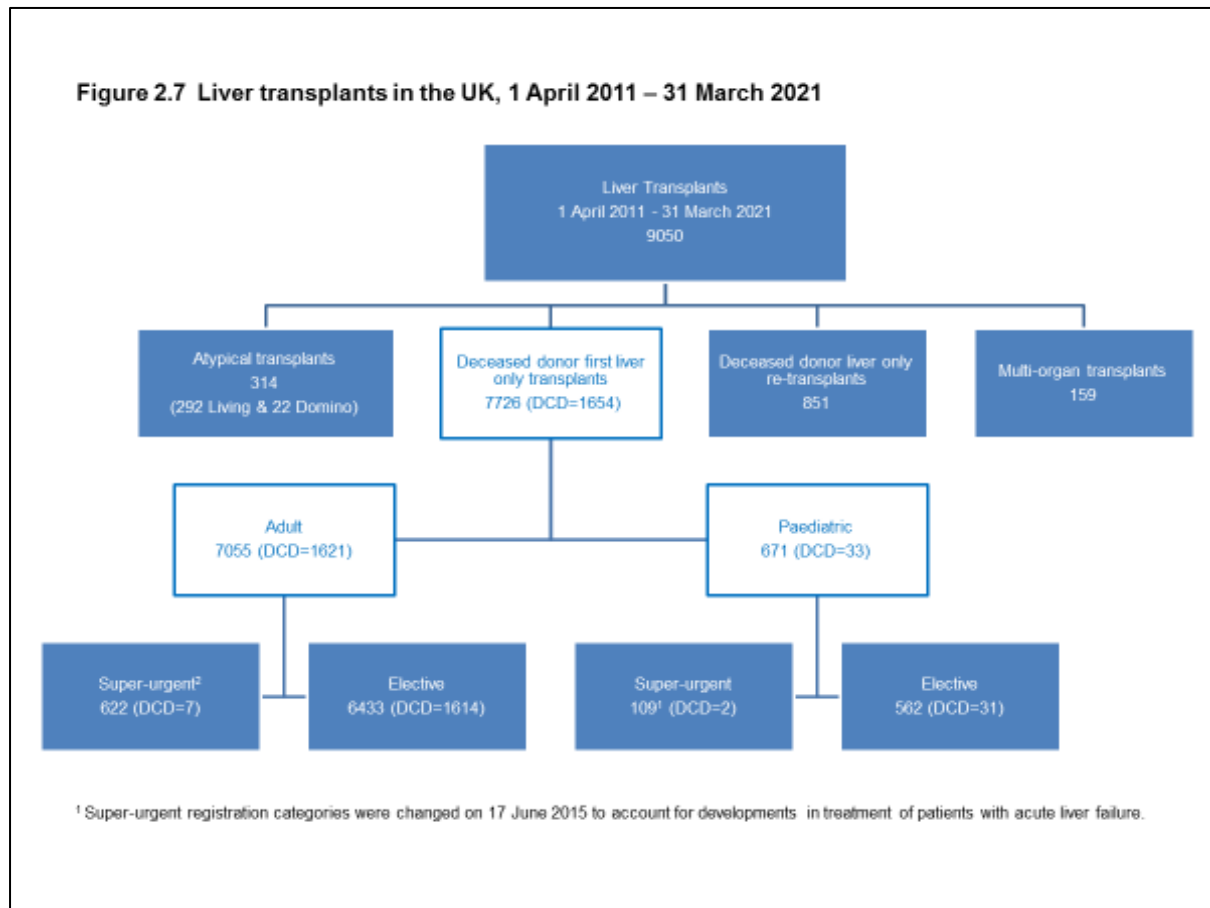
**Figure 2.5** shows the total number of liver transplants performed in the last ten years, by type of donor while **Figure 2.6** shows the equivalent information by transplant centre. The number of transplants from deceased donors steadily increased over the time period to 813 in 2017/2018 for DBD and 209 in 2016/17 for DCD. However, the number of deceased donor transplants has subsequently steadily reduced with 628 DBD and 121 DCD liver transplants performed in the UK in 2020/2021. There were 22 [living donor](#) liver transplants and 0 [domino](#) transplant performed in the last financial year.



**Figure 2.6 Total number of liver transplants by transplant centre and donor type, 1 April 2011 - 31 March 2021**



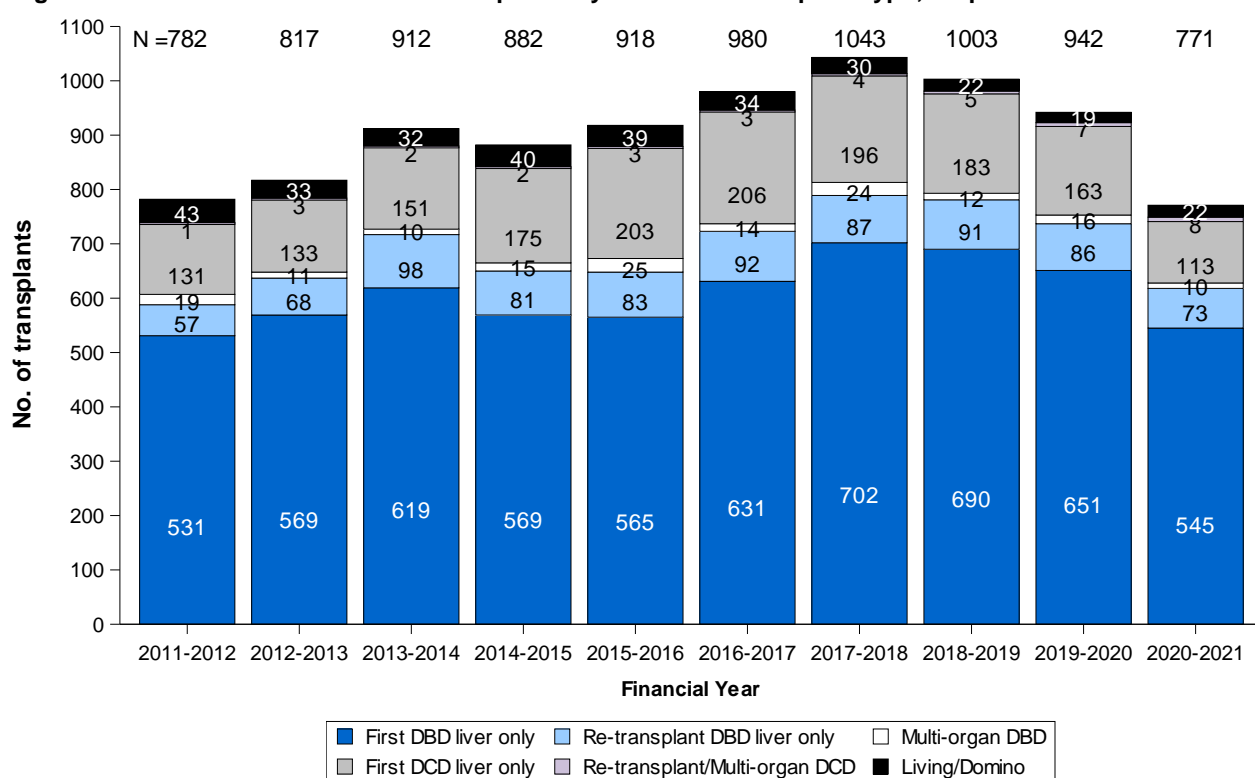
**Figure 2.7** details the 9050 liver transplants performed in the UK in the ten year period. Of these, 7726 (85%) were deceased donor first liver only transplants. Of the 7726 transplants that had consent and were analysed, 7055 (91%) were performed in adult and 671 (9%) in paediatric patients. Similarly including both adult and paediatric, 6995 (91%) were elective and 731 (9%) were super-urgent transplants.



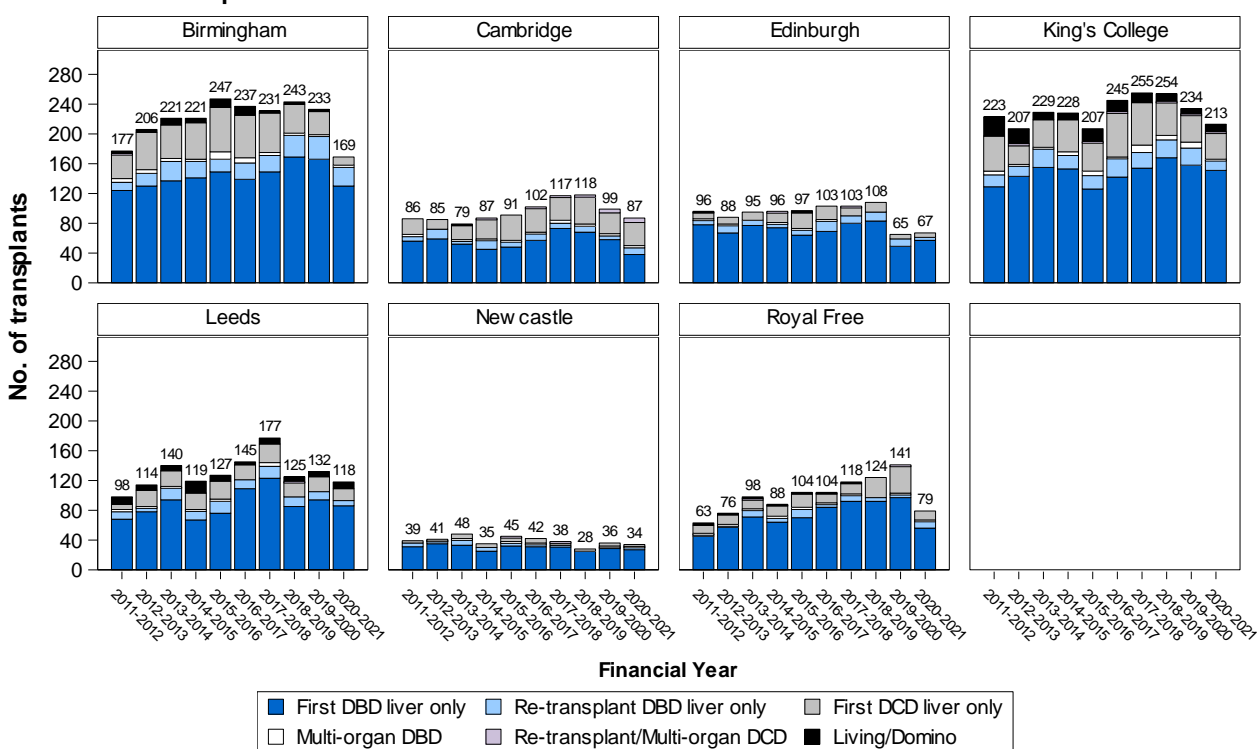
**Figure 2.8** shows the number of liver transplants performed in the last ten years, by type of transplant and donor whilst **Figure 2.9** shows the equivalent information by transplant centre. The number of liver only retransplants from donors after brain death (DBD) ranged between 57 in 2011/2012 and 98 in 2013/2014 with 73 performed in 2020/2021. During the last ten years, 156 DBD and 3 DCD multi-organ transplants involving the liver were performed of which 11 were retransplants. Of the 156 multi-organ DBD transplants, 147 were simultaneous liver and kidney transplants (11 of which were retransplants), five were simultaneous liver and heart transplants, three were simultaneous liver and lung transplants and one was a simultaneous liver and pancreas transplant

The majority of transplants (98%) performed over the last ten years involving donors after circulatory death (DCD) were first liver only transplants, with only 35 DCD retransplant liver only transplants and three simultaneous liver/kidney DCD transplants.

**Figure 2.8 Total number of liver transplants by donor and transplant type, 1 April 2011 - 31 March 2021**



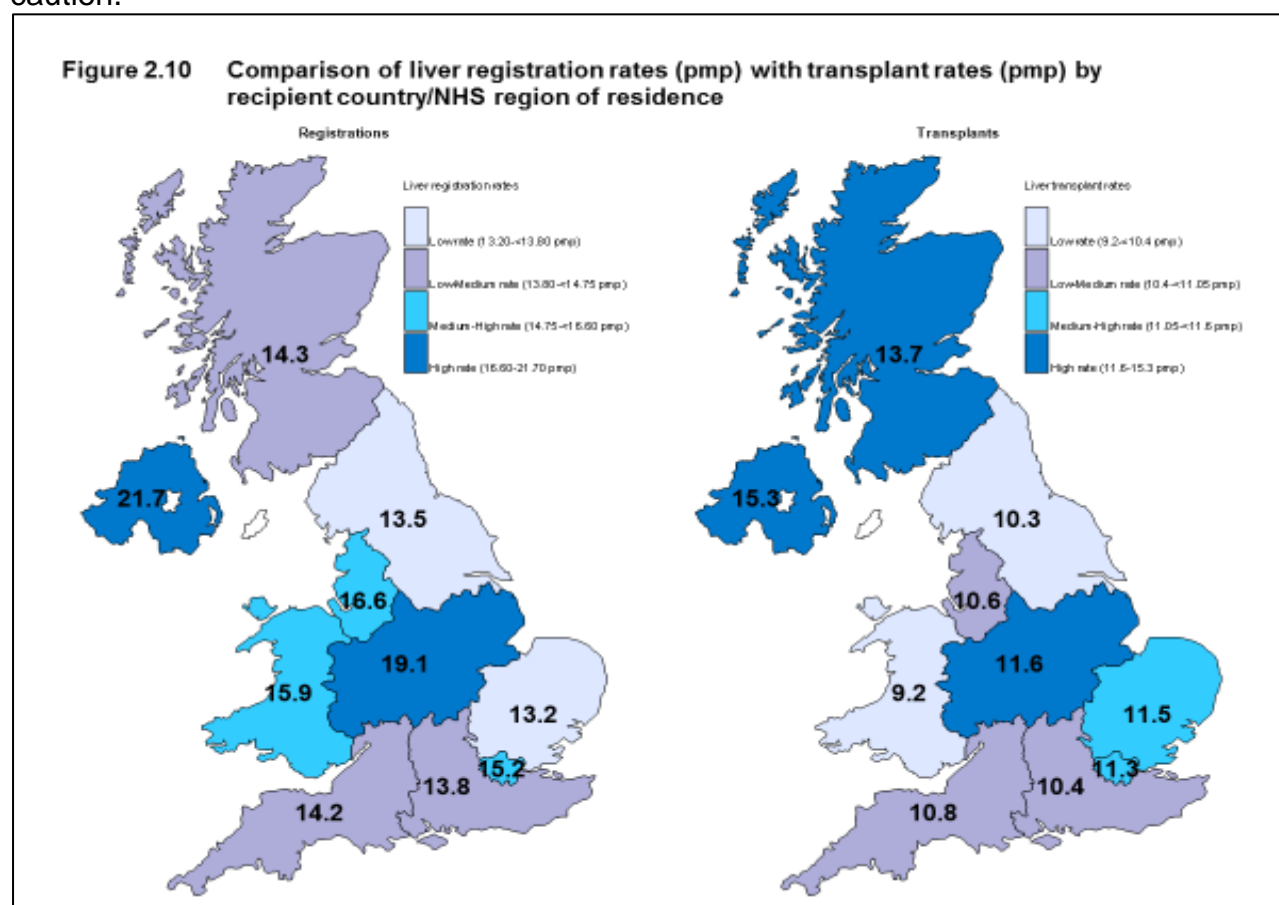
**Figure 2.9 Total number of liver transplants by transplant centre, donor type and transplant type, 1 April 2011 - 31 March 2021**



## Geographical variation in registration and transplant rates

**Figure 2.10** shows rates of registration to the liver transplant list per million population (pmp) between 1 April 2020 and 31 March 2021 compared with liver transplant rates pmp for the same time period, by recipient country/NHS region of residence. **Table 2.1** 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 coefficient 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 and transplant rates yielded an SCV of 0.008 (p-value = 0.039) 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 moderate evidence of geographical variation beyond what would be expected at random for registrations and no evidence for transplants. 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.



**Table 2.1 Liver registration and transplant rates per million population (pmp) in the UK, 1 April 2020 - 31 March 2021, by Country/NHS region**

<b>Country/ NHS region</b>	<b>Registrations (pmp)</b>		<b>Transplants (pmp)</b>	
North East and Yorkshire	116	(13.5)	89	(10.3)
North West	117	(16.6)	75	(10.6)
Midlands	202	(19.1)	123	(11.6)
East of England	86	(13.2)	75	(11.5)
London	136	(15.2)	101	(11.3)
South East	123	(13.8)	93	(10.4)
South West	80	(14.2)	61	(10.8)
<b>England</b>	<b>860</b>	<b>(15.3)</b>	<b>617</b>	<b>(11.0)</b>
<b>Isle of Man</b>	<b>1</b>	<b>(12.5)</b>	<b>2</b>	<b>(25.0)</b>
<b>Channel Islands</b>	<b>1</b>	<b>(5.9)</b>	<b>0</b>	<b>(0.0)</b>
<b>Wales</b>	<b>50</b>	<b>(15.9)</b>	<b>29</b>	<b>(9.2)</b>
<b>Scotland</b>	<b>78</b>	<b>(14.3)</b>	<b>75</b>	<b>(13.7)</b>
<b>Northern Ireland</b>	<b>41</b>	<b>(21.7)</b>	<b>29</b>	<b>(15.3)</b>
<b>TOTAL</b>	<b>1037<sup>1</sup></b>	<b>(15.5)</b>	<b>756<sup>2</sup></b>	<b>(11.3)</b>

<sup>1</sup> Registrations include 6 recipients whose postcode was unknown and excludes 5 recipients who reside in the Republic of Ireland and 3 recipients who reside overseas

<sup>2</sup> Transplants include 4 recipients whose postcode was unknown and excludes 4 recipients who reside in the Republic of Ireland and 2 recipients who reside overseas

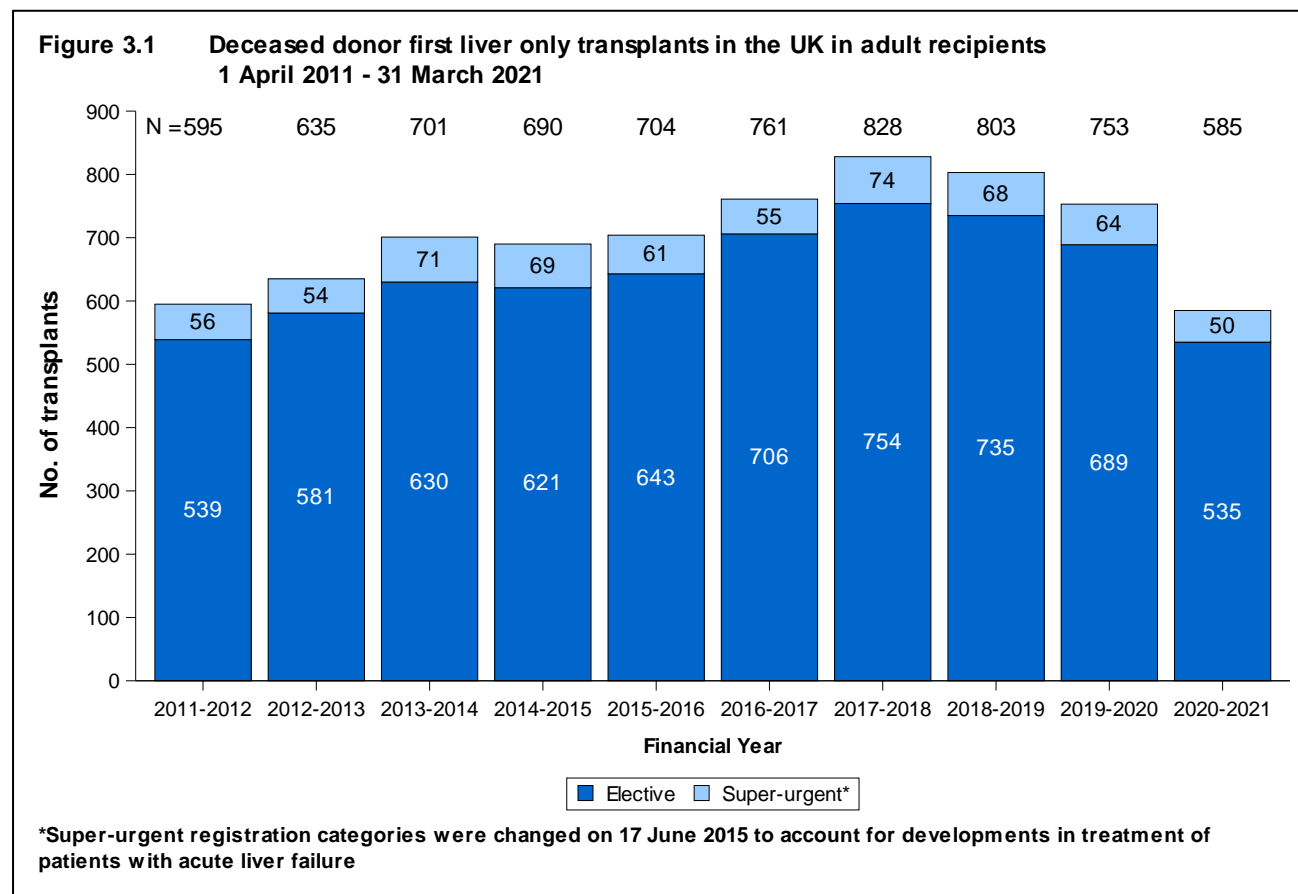
# **Adult Liver Transplantation**



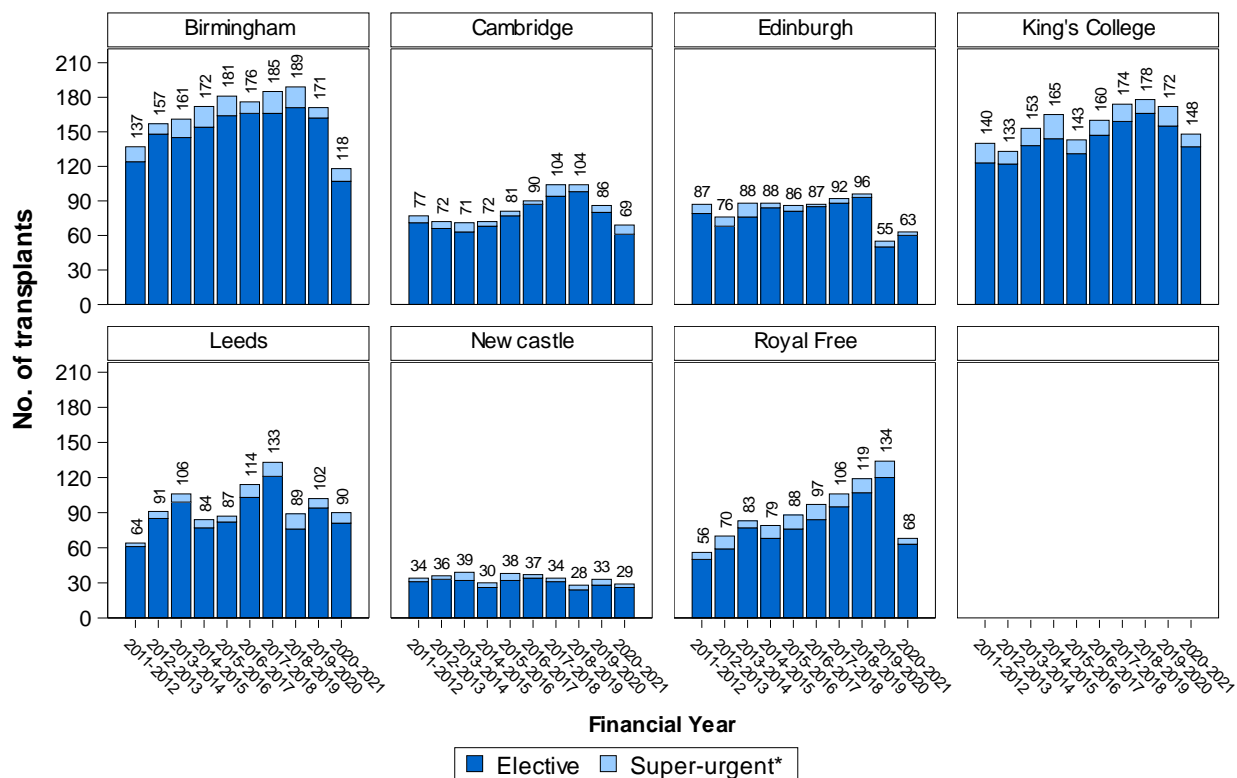


### 3.1 Overview

The number of adult deceased donor first liver only transplants in the last ten years is shown overall and by centre in **Figures 3.1 and 3.2**, respectively. Of the 585 transplants in the latest financial year, 535 (91%) were [elective](#) and 50 (9%) were [super-urgent](#) transplants. See **Appendix 1** for further details.

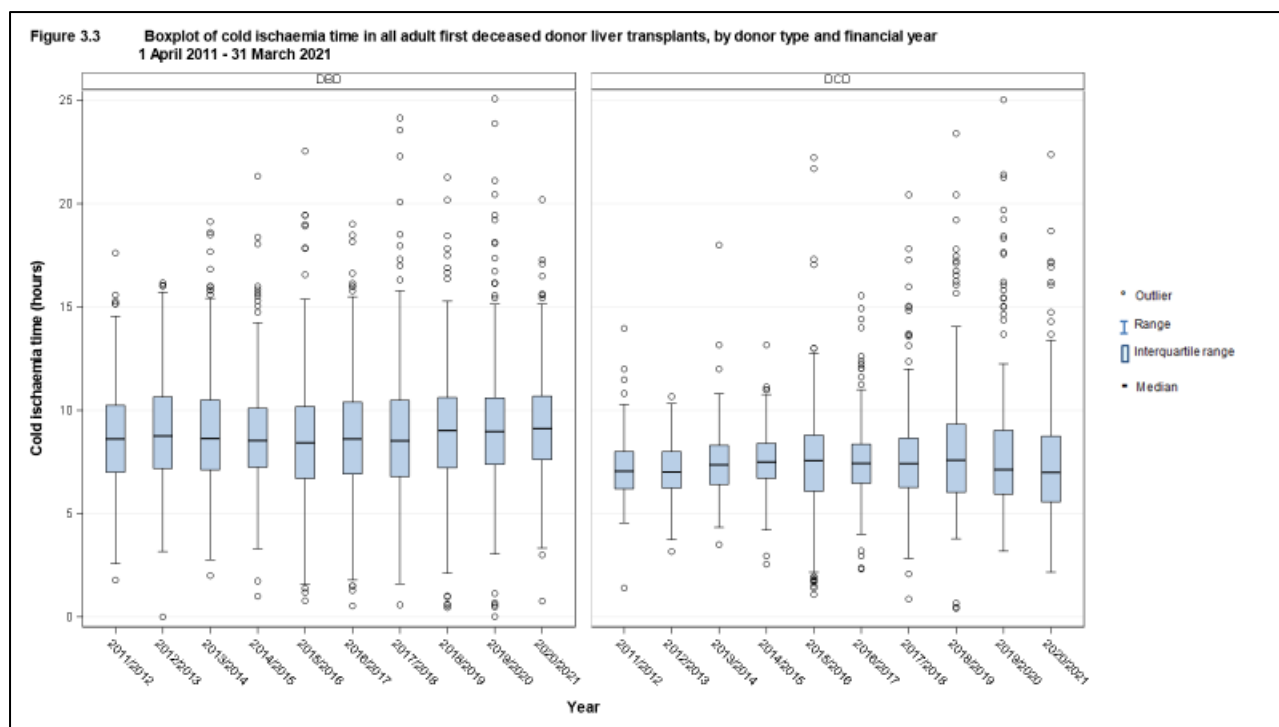


**Figure 3.2 Deceased donor first liver only transplants in the UK in adult recipients, 1 April 2011 - 31 March 2021**



\*Super-urgent registration categories were changed on 17 June 2015 to account for developments in treatment of patients with acute liver failure

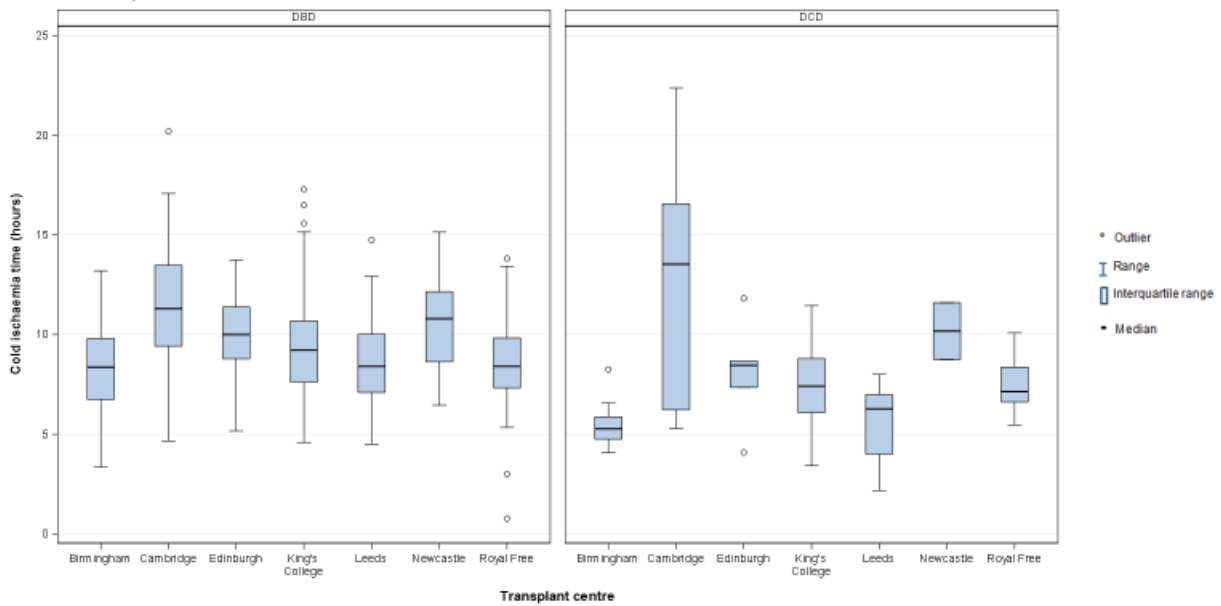
The overall [median cold ischaemia times](#) (CIT) for adult transplant recipients are shown by financial year in **Figure 3.3** for [DBD](#) and [DCD](#) donors, respectively. The national median CIT for transplants from DBD donors has remained relatively stable and was 8.6 hours in 2011/12 and 9.1 hours in 2020/21. Similarly, the national median for DCD donor transplants has remained relatively stable over the ten year period and was 7.1 hours in 2011/12 and 7.1 hours in 2020/21.



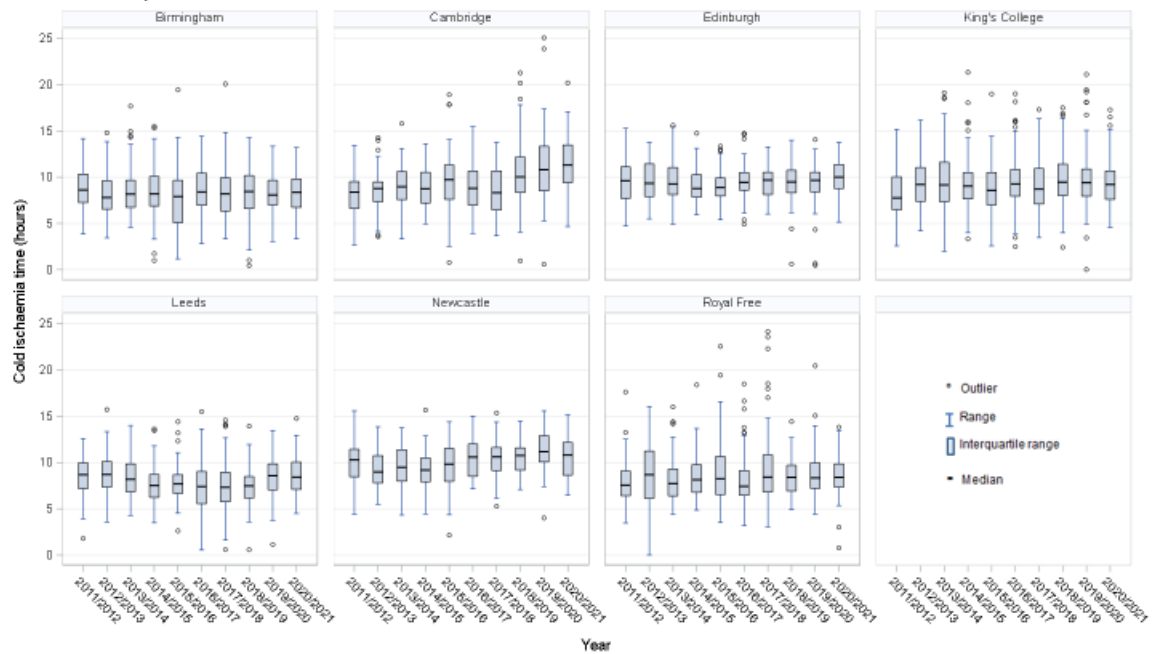
**Figure 3.4** shows boxplots of [cold ischaemia times](#) (CIT) for adult transplant recipients by centre and donor type in the latest financial year (2020/2021) while **Figure 3.5** and **Figure 3.6** show the equivalent information by centre over the last ten financial years for [DBD](#) and [DCD](#) donors, respectively. The median CIT for DBD in the last financial year ranged between 8.4 and 11.3 hours across transplant centres whilst the median CIT for DCD ranged between 5.3 and 13.5 hours.

The cold ischaemia time used is as reported on the liver transplant record form and may include periods of machine perfusion; no adjustment has been made for this. 118 (20%) of adult deceased donor first liver only transplants performed in the latest financial year were reported to have involved machine perfusion (either normothermically or hypothermically). This ranged from 2% to 62% for the centres who informed NHSBT.

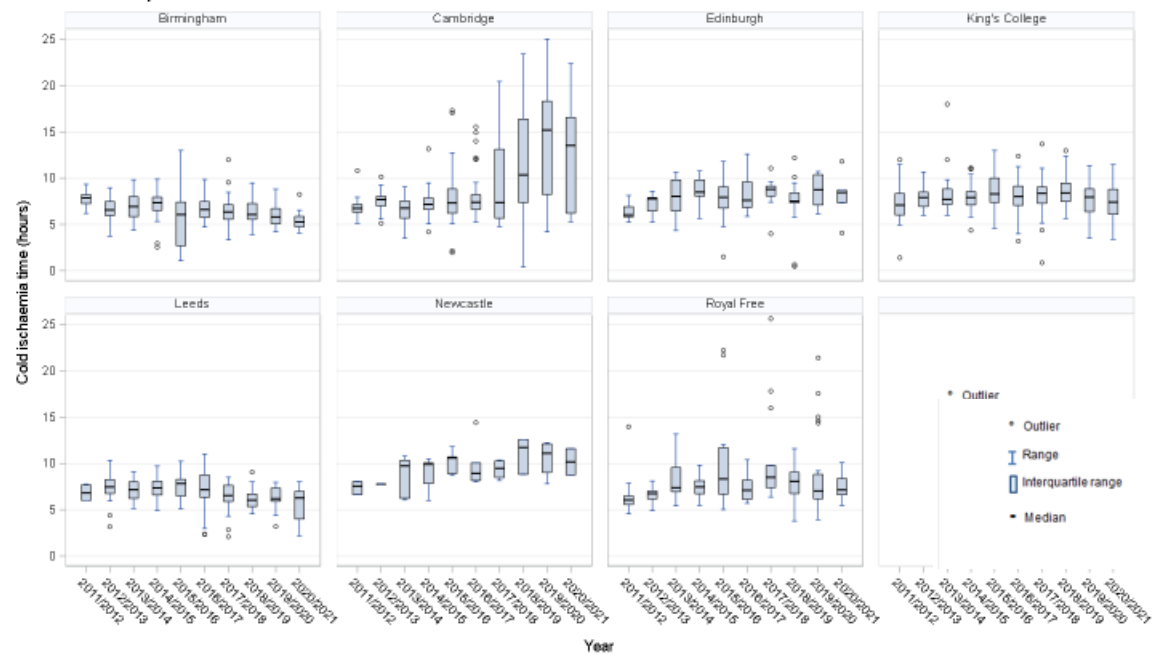
**Figure 3.4** Boxplot of cold ischaemia time in all adult first deceased donor liver transplants, by donor type and transplant centre  
1 April 2020 - 31 March 2021



**Figure 3.5** Boxplot of cold ischaemia time in all adult first DBD donor liver transplants, 1 April 2011 - 31 March 2021



**Figure 3.6** Boxplot of cold ischaemia time in all adult first DCD donor liver transplants, 1 April 2011 - 31 March 2021



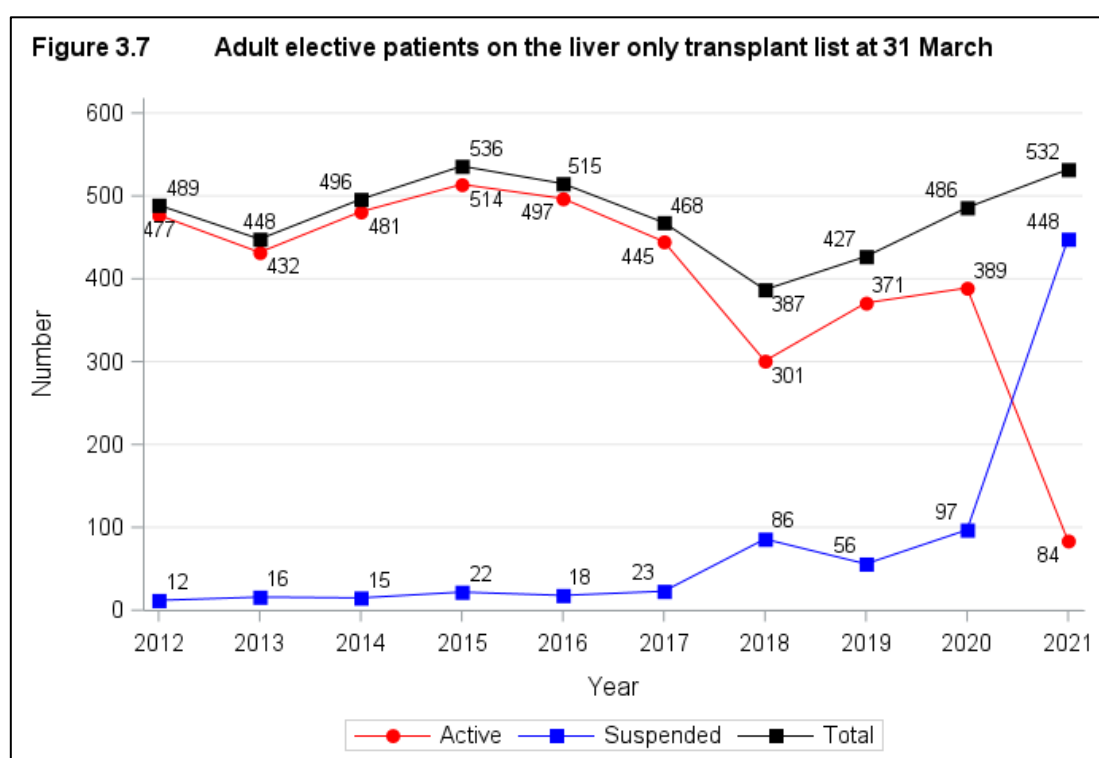
# **Adult Liver Transplantation Elective Patients**



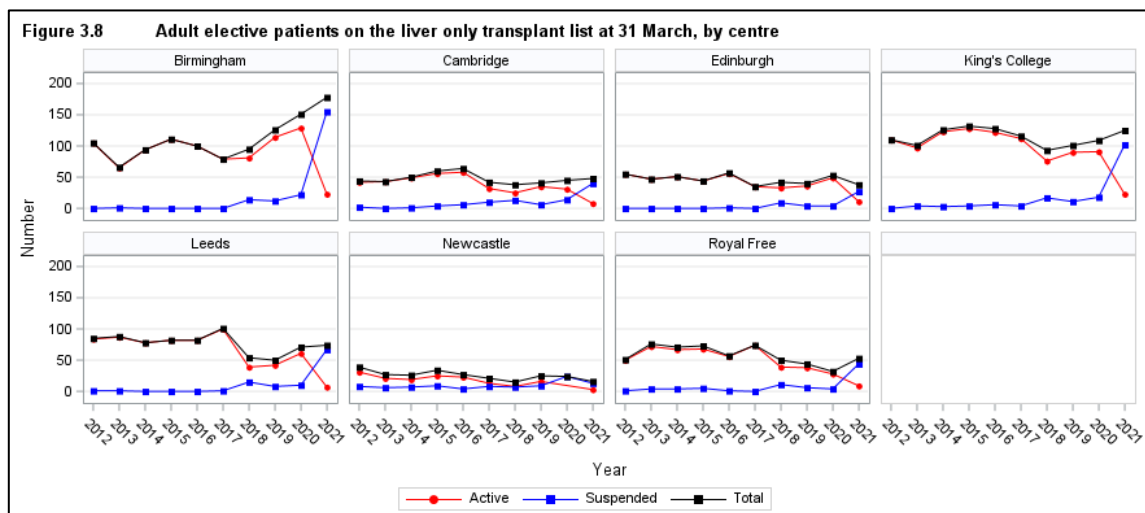
### 3.2.1 Transplant list

**Figure 3.7** shows the number of adult [elective](#) patients on the first liver only transplant list at 31 March each year between 2012 and 2021. The waiting list in 2020 is as at 29 February due to the COVID-19 pandemic affecting the numbers of active transplant registrations. The number of patients on the [active](#) liver only transplant list was stable from 477 in 2012 to 445 in 2016. This reduced to 301 in 2018 and subsequently increased to 389 active patients in 2020.

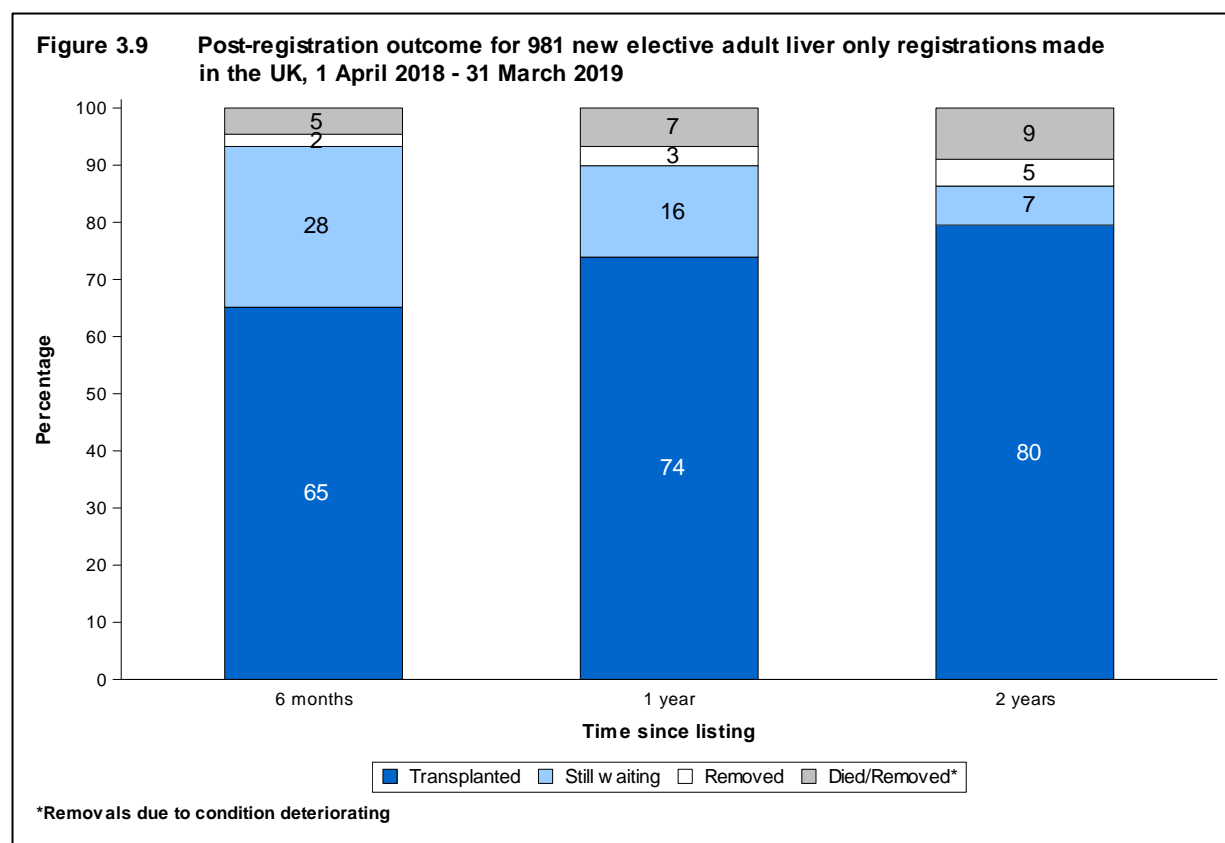
The total active and suspended transplant list on 31 March 2021 was 532 patients with 84 patients on the active list who were deemed clinically urgent by liver transplant centres. The majority of patients suspended on 31 March 2021 were reactivated by transplant centres in April 2021 following relaxation of restrictions imposed during COVID-19.



**Figure 3.8** shows the number of adult patients on the transplant list at 31 March each year between 2012 and 2021, by transplant centre. The waiting list in 2020 is as at 29 February.

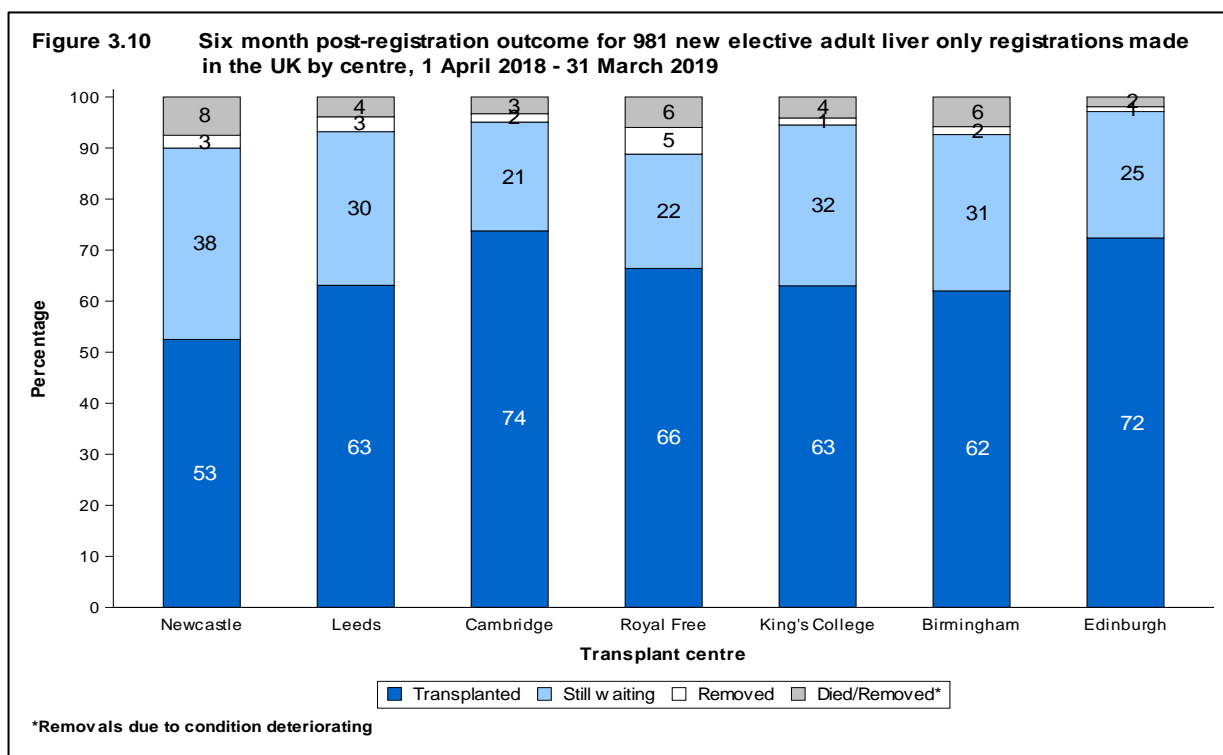


An indication of outcomes for adult [elective](#) patients listed for a liver transplant is summarised in **Figure 3.9**. This shows the proportion of patients transplanted or still waiting six months, one and two years after joining the list. It also shows the proportion removed from the transplant list and those dying while on the waiting list.



**Figure 3.10** shows the proportion of patients transplanted, removed, died while waiting, or still waiting on the list at 6 months after joining the list at each transplant centre. The proportion of patients transplanted six months after listing at each centre ranges from 53% at Newcastle to 74% at Cambridge.





**Table 3.1** shows the [median waiting time](#) to deceased donor liver only transplant for adult [elective](#) patients. The national median waiting time to transplant for adult elective patients is 72 days. The median waiting time to transplant was shorter at Royal Free (50 days) and longer at Newcastle (96 days), compared to the national median waiting time. Note that these waiting times are not adjusted to account for the patient [case-mix](#) at centres.

<b>Table 3.1 Median waiting time to liver only transplant in the UK, for adult elective patients registered 1 April 2018 - 31 March 2020</b>			
Transplant centre	Number of patients registered	Waiting time (days)	
		Median	95% Confidence interval
Royal Free	261	50	41 - 59
Cambridge	231	52	35 - 69
Edinburgh	188	64	34 - 94
Leeds	240	73	54 - 92
King's College	430	83	68 - 98
Birmingham	495	93	74 - 112
Newcastle	82	96	62 - 130
<b>UK</b>	<b>1927</b>	<b>72</b>	<b>64 - 80</b>

**Table 3.2** shows the demographics of 867 adult [elective](#) liver patients registered from 1 April 2020 to 31 March 2021, by transplant centre. The majority of patients that were registered were male (66%), white (86%) with a [median](#) age of 55 and a median BMI of 27. The most common indication for registration was alcoholic liver disease, followed by cancer. For some characteristics, due to rounding, percentages may not add up to 100.

**Table 3.2 Demographic characteristics of UK adult elective liver patients registered between 1 April 2020 and 31 March 2021**

		Birmingham	Cambridge	Edinburgh	King's college	Leeds	Newcastle	Royal Free	Total
		N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
<b>Number</b>		<b>216</b>	<b>102</b>	<b>66</b>	<b>203</b>	<b>122</b>	<b>47</b>	<b>111</b>	<b>867</b>
Recipient sex	Male	132 (61)	67 (66)	43 (65)	132 (65)	81 (66)	34 (72)	81 (73)	<b>570 (66)</b>
	Female	84 (39)	35 (34)	23 (35)	71 (35)	41 (34)	13 (28)	30 (27)	<b>297 (34)</b>
Recipient ethnicity	White	186 (86)	95 (93)	60 (91)	171 (84)	111 (91)	42 (89)	80 (72)	<b>745 (86)</b>
	Non-white	30 (14)	7 (7)	6 (9)	32 (16)	11 (9)	5 (11)	31 (28)	<b>122 (14)</b>
Indication	Cancer	40 (19)	15 (15)	13 (20)	27 (13)	31 (25)	10 (21)	22 (20)	<b>158 (18)</b>
	Hepatitis C	6 (3)	4 (4)	1 (2)	3 (1)	2 (2)	0 (0)	3 (3)	<b>19 (2)</b>
	Alcoholic liver disease	52 (24)	22 (22)	20 (30)	69 (34)	39 (32)	12 (26)	27 (24)	<b>241 (28)</b>
	Hepatitis B	4 (2)	0 (0)	1 (2)	2 (1)	2 (2)	1 (2)	2 (2)	<b>12 (1)</b>
	Primary sclerosing cholangitis	25 (12)	15 (15)	7 (11)	16 (8)	15 (12)	8 (17)	17 (15)	<b>103 (12)</b>
	Autoimmune and cryptogenic disease	19 (9)	4 (4)	4 (6)	14 (7)	5 (4)	5 (11)	7 (6)	<b>58 (7)</b>
	Primary biliary cholangitis	17 (8)	8 (8)	8 (12)	15 (7)	7 (6)	3 (6)	5 (5)	<b>63 (7)</b>
	Metabolic liver disease	19 (9)	16 (16)	7 (11)	17 (8)	7 (6)	4 (9)	14 (13)	<b>84 (10)</b>
	Other	19 (9)	13 (13)	5 (8)	28 (14)	7 (6)	4 (9)	12 (11)	<b>88 (10)</b>
	Acute hepatic failure	1 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	<b>1 (0)</b>
	Regraft	14 (6)	5 (5)	0 (0)	12 (6)	7 (6)	0 (0)	2 (2)	<b>40 (5)</b>
Recipient HCV	No	202 (94)	94 (92)	61 (92)	190 (94)	116 (95)	47 (100)	101 (91)	<b>811 (94)</b>
	Yes	14 (6)	8 (8)	5 (8)	13 (6)	6 (5)	0 (0)	10 (9)	<b>56 (6)</b>
Encephalopathy	Absence	152 (70)	65 (64)	50 (76)	117 (58)	94 (77)	33 (70)	76 (68)	<b>587 (68)</b>
	Presence	64 (30)	37 (35)	16 (24)	86 (42)	28 (23)	14 (30)	35 (32)	<b>280 (32)</b>
Renal support	No	214 (99)	100 (98)	65 (98)	190 (94)	120 (98)	46 (98)	110 (99)	<b>845 (97)</b>
	Yes	2 (1)	2 (2)	1 (2)	13 (6)	2 (2)	1 (2)	1 (1)	<b>22 (3)</b>
Previous abdominal surgery	No	162 (75)	76 (75)	54 (82)	146 (72)	97 (80)	41 (87)	79 (71)	<b>655 (76)</b>
	Yes	54 (25)	26 (25)	12 (18)	57 (28)	25 (20)	6 (13)	32 (29)	<b>211 (24)</b>
Recip age (years)	Median (IQR)	52 (39, 60)	56 (48, 62)	57 (49, 64)	55 (46, 61)	54 (43, 61)	56 (46, 61)	53 (46, 60)	<b>55 (44, 61)</b>

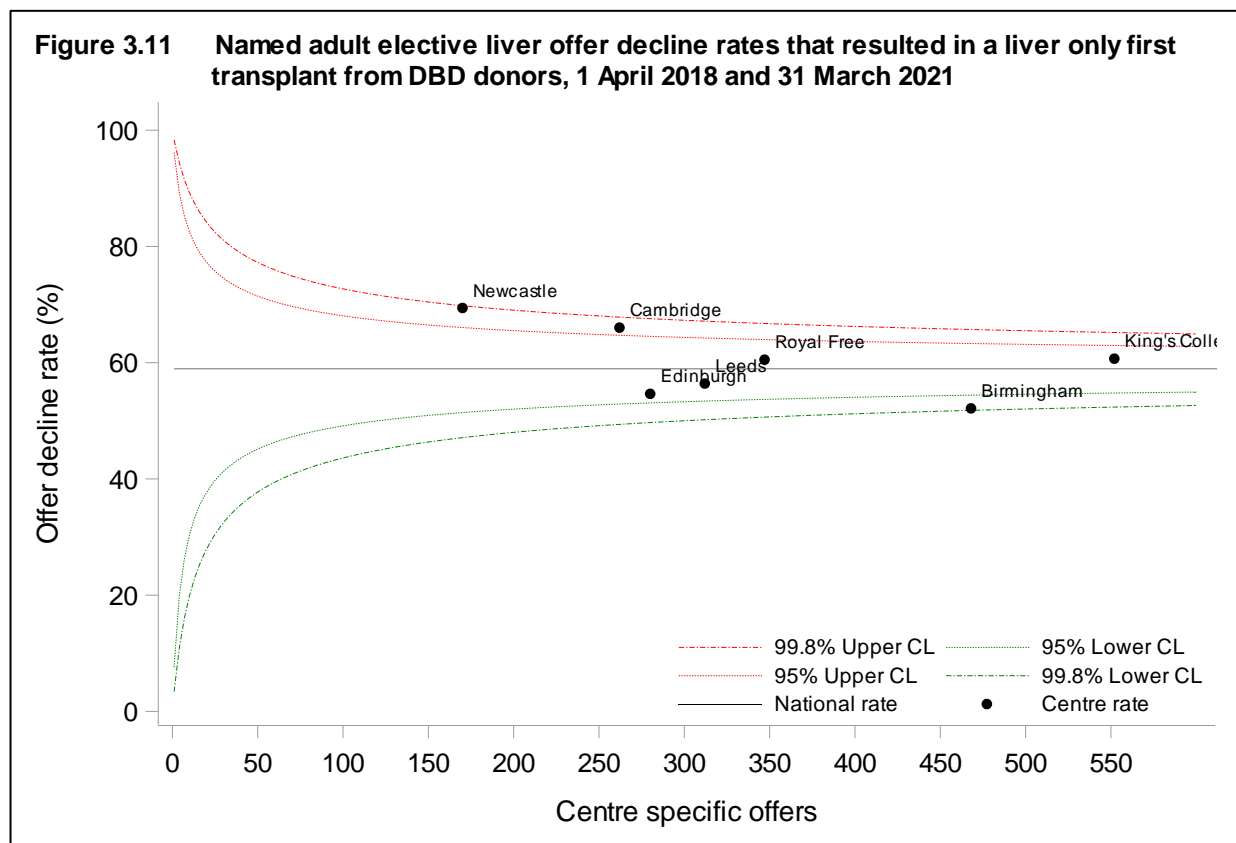
**Table 3.2 Demographic characteristics of UK adult elective liver patients registered between 1 April 2020 and 31 March 2021**

		Birmingham N (%)	Cambridge N (%)	Edinburgh N (%)	King's college N (%)	Leeds N (%)	Newcastle N (%)	Royal Free N (%)	Total N (%)
BMI kg/m2	Median (IQR)	27 (24, 31)	28 (24, 32)	28 (24, 32)	26 (23, 31)	28 (25, 31)	27 (25, 31)	27 (24, 31)	<b>27 (24, 31)</b>
Serum bilirubin umol/l	Median (IQR)	50 (27, 93)	39 (22, 85)	57 (28, 124)	45 (22, 97)	51 (24, 85)	57 (24, 120)	51 (25, 99)	<b>50 (25, 96)</b>
Serum creatinine umol/l	Median (IQR)	68 (55, 81)	70 (56, 94)	70 (60, 87)	71 (59, 92)	70 (59, 92)	72 (61, 94)	86 (72, 98)	<b>72 (59, 90)</b>
Serum sodium mmol/l	Median (IQR)	137 (134, 139)	136 (134, 138)	136 (132, 139)	137 (134, 140)	137 (134, 140)	136 (133, 139)	137 (134, 140)	<b>137 (134, 139)</b>
Serum potassium mmol/l	Median (IQR)	4 (4, 5)	4 (4, 5)	4 (4, 5)	4 (4, 4)	4 (4, 4)	4 (4, 4)	4 (4, 5)	<b>4 (4, 5)</b>
INR	Median (IQR)	1 (1, 2)	1 (1, 2)	1 (1, 2)	1 (1, 2)	1 (1, 2)	1 (1, 2)	1 (1, 2)	<b>1 (1, 2)</b>
Serum albumin g/l	Median (IQR)	30 (26, 35)	30 (26, 34)	25 (22, 32)	33 (29, 38)	31 (28, 35)	34 (25, 37)	34 (29, 38)	<b>31 (27, 36)</b>

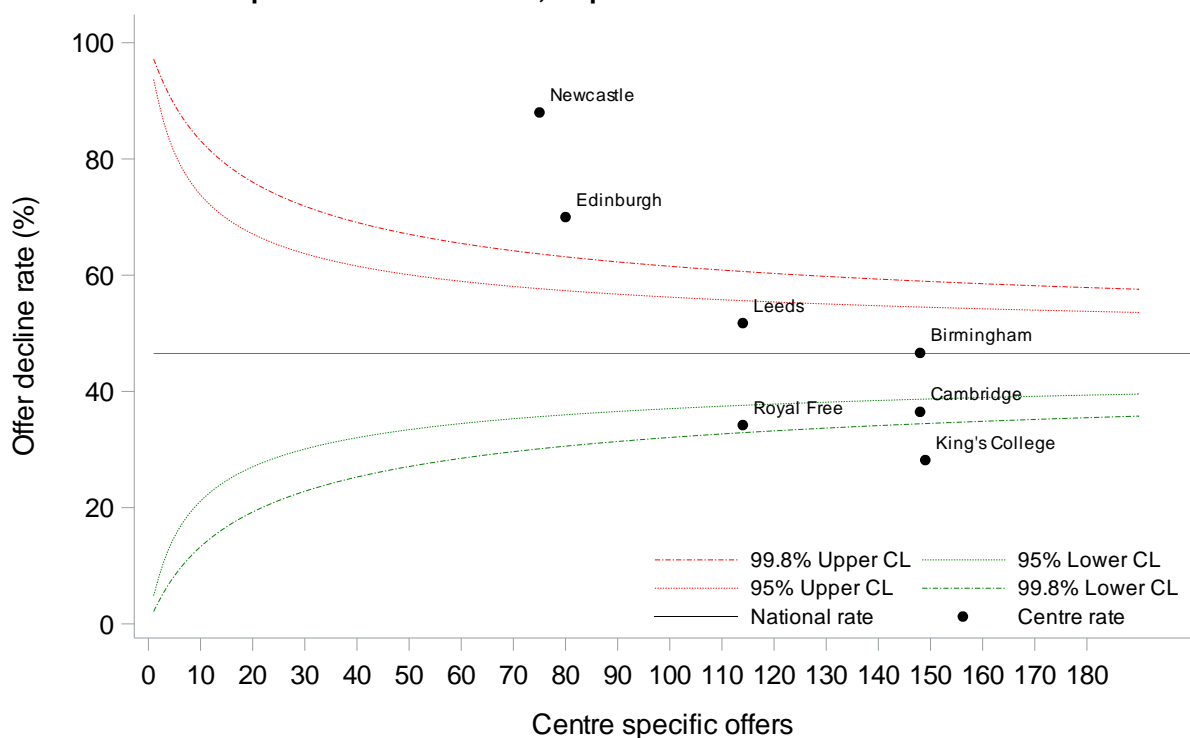
**Figure 3.11** shows the offer decline rate funnel plot for named adult and large paediatric elective DBD offers. All fast-track offers, regardless of whether the fast-track offer was accepted and the liver transplanted, were excluded along with offers to super-urgent, hepatoblastoma, paediatric, intestinal or liver and cardiothoracic patients. **Figure 3.12** shows the corresponding funnel plot of offer decline rates for DCD. Unlike **Figure 3.11**, fast-track offers were only included in **Figure 3.12** if the offer was accepted and transplanted.

A DBD liver transplant can involve a whole liver, reduced liver or split liver. The term reduced is used when only one lobe of the liver is transplanted and the term split applies when both lobes of the liver are transplanted into two different recipients. Offers of whole livers and right lobes which resulted in transplantation are included in **Figure 3.11** and offer decline rates by centre and organ offered are presented in **Table 3.3**.

DBD liver offers between 27 March and 9 July 2020 were excluded from **Figure 3.11** as transplant centres were able to accept for any clinically urgent patient thus offers during this time were centre based and not named patient offers.



**Figure 3.12** Adult elective liver offer decline rates that resulted in a liver only first transplant from DCD donors, 1 April 2018 and 31 March 2021



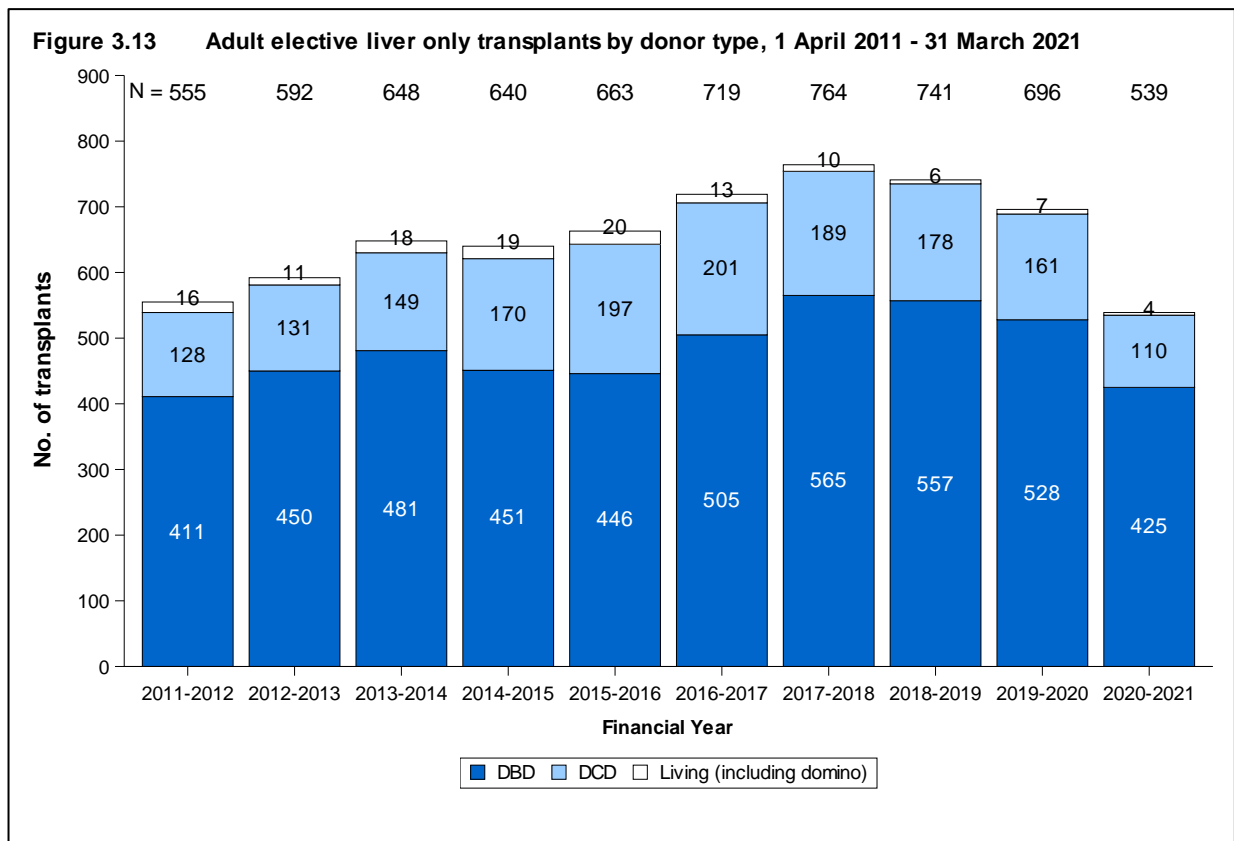
**Table 3.3** Offer decline rates for each centre by offered organ and donor type  
1 April 2018 and 31 March 2021

Centre	Whole Livers		DBD Donors Right Lobe		All Livers		DCD Donors Whole Livers	
	Offers	% Decline	Offers	% Decline	Offers	% Decline	Offers	% Decline
<b>A. All donors</b>								
Birmingham	419	49	49	76	468	52	148	47
Cambridge	219	63	43	84	262	66	148	36
Edinburgh	219	44	61	93	280	55	80	70
King's College	480	60	72	68	552	61	149	28
Leeds	261	51	51	86	312	56	114	52
Newcastle	140	63	30	100	170	69	75	88
Royal Free	294	57	53	81	347	61	114	34
<b>Total</b>	<b>2032</b>	<b>55</b>	<b>359</b>	<b>82</b>	<b>2391</b>	<b>59</b>	<b>828</b>	<b>46</b>
<b>B. DBD donors ≤65 years and DCD ≤60 years</b>								
Birmingham	293	46	49	76	342	50	111	54
Cambridge	151	53	43	84	194	60	119	38
Edinburgh	154	40	61	93	215	55	60	63
King's College	322	57	72	68	394	59	95	32
Leeds	186	46	51	86	237	55	94	43
Newcastle	89	61	30	100	119	71	56	84
Royal Free	198	48	53	81	251	55	84	32
<b>Total</b>	<b>1393</b>	<b>50</b>	<b>359</b>	<b>82</b>	<b>1752</b>	<b>57</b>	<b>619</b>	<b>46</b>

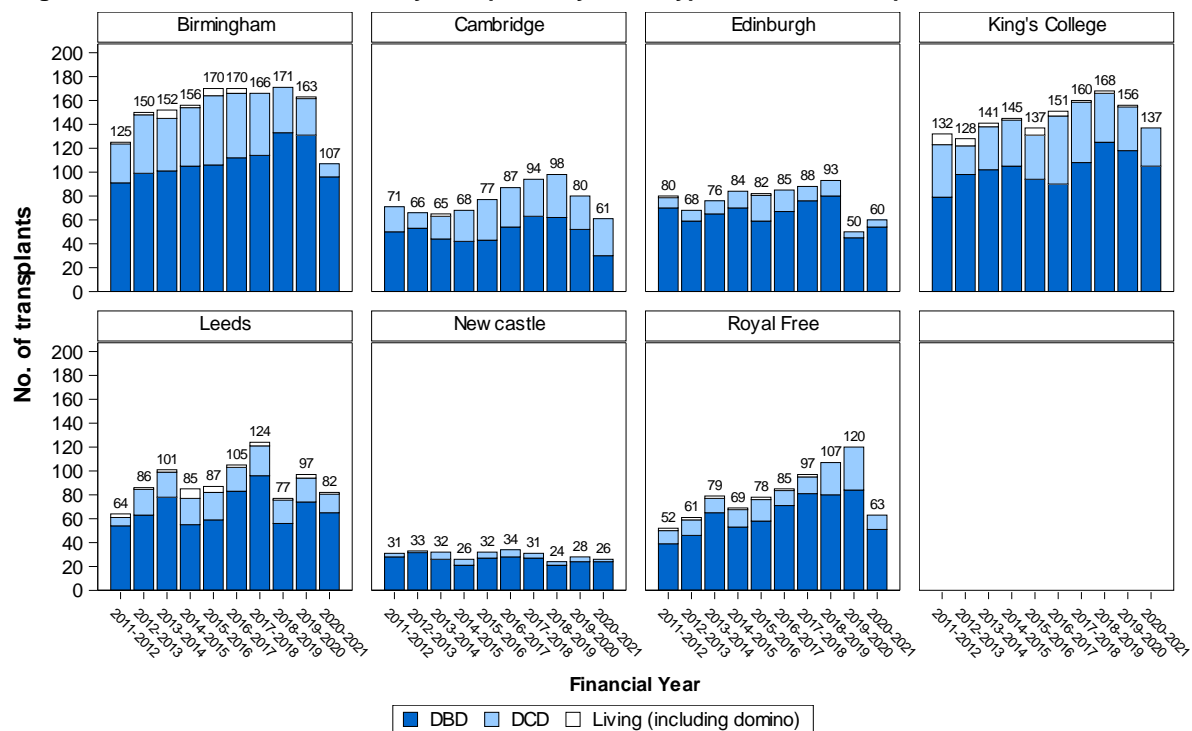
### 3.2.2 Transplant activity

**Figure 3.13** shows the number of first liver only transplants from deceased and living/domino donors performed in the last ten years, by type of donor. **Figure 3.14** shows the same information by centre. Please note that living liver transplants performed at London Bridge and Cromwell Hospitals are included in **Figure 3.13** but not in **Figure 3.14**.

Only Edinburgh observed an increase in the number of adult elective first liver only transplants performed in 2020/2021 compared with 2019/2020.



**Figure 3.14 Adult elective liver only transplants by donor type and centre, 1 April 2011 - 31 March 2021**



\*Excludes 19 and 4 living liver transplants at London Bridge Hospital and Cromwell Hospital, respectively

The demographic characteristics of 535 adult [elective](#) first deceased donor liver only transplant recipients in the latest year are shown by centre and overall in **Table 3.4**. The profile of patients are similar to those in **Table 3.2** which shows the demographics of patients registered. The profile donor was often a white (88%), male (53%), brainstem death (79%) with a [median](#) age of 51 and a median BMI of 26. For some characteristics, due to rounding, percentages may not add up to 100.

Table 3.4 Demographic characteristics of adult elective first deceased donor liver only transplant recipients, 1 April 2020 - 31 March 2021									
		Birmingham N (%)	Cambridge N (%)	Edinburgh N (%)	King's College N (%)	Leeds N (%)	Newcastle N (%)	Royal Free N (%)	TOTAL N (%)
Number		107	61	60	137	81	26	63	535 (100)
Recipient sex	Male	67 (63)	44 (72)	32 (53)	82 (60)	58 (72)	19 (73)	42 (67)	344 (64)
	Female	40 (37)	17 (28)	28 (47)	55 (40)	23 (28)	7 (27)	21 (33)	191 (36)
Recipient ethnicity	White	89 (83)	57 (93)	55 (92)	115 (84)	77 (95)	23 (88)	51 (81)	467 (87)
	Non-white	9 (8)	4 (7)	5 (8)	22 (16)	4 (5)	3 (12)	12 (19)	59 (11)
	Not reported	9 (8)	0	0	0	0	0	0	9 (2)
Indication	Cancer	11 (10)	14 (23)	6 (10)	21 (15)	17 (21)	3 (12)	13 (21)	85 (16)
	Hepatitis C	2 (2)	2 (3)	0	3 (2)	4 (5)	0	2 (3)	13 (2)
	Alcoholic liver disease	27 (25)	10 (16)	15 (25)	47 (34)	29 (36)	8 (31)	18 (29)	154 (29)
	Hepatitis B	2 (2)	0	1 (2)	0	0	1 (4)	0	4 (1)
	Primary sclerosing cholangitis	10 (9)	10 (16)	10 (17)	14 (10)	9 (11)	2 (8)	10 (16)	65 (12)
	Primary biliary cholangitis	13 (12)	4 (7)	12 (20)	14 (10)	4 (5)	1 (4)	5 (8)	53 (10)
	Autoimmune and cryptogenic disease	13 (12)	3 (5)	4 (7)	15 (11)	1 (1)	5 (19)	5 (8)	46 (9)
	Metabolic	11 (10)	15 (25)	8 (13)	15 (11)	13 (16)	5 (19)	7 (11)	74 (14)
	Other	17 (16)	3 (5)	4 (7)	7 (5)	4 (5)	1 (4)	3 (5)	39 (7)
	Acute Hepatic failure	1 (1)	0	0	1 (1)	0	0	0	2 (0)
Recipient HCV status	Negative	104 (97)	54 (89)	57 (95)	122 (89)	68 (84)	26 (100)	55 (87)	486 (91)
	Positive	2 (2)	7 (11)	3 (5)	9 (7)	8 (10)	0	5 (8)	34 (6)
	Not reported	1 (1)	0	0	6 (4)	5 (6)	0	3 (5)	15 (3)
Pre-transplant in-patient status	Out-patient	98 (92)	50 (82)	55 (92)	117 (85)	78 (96)	24 (92)	60 (95)	482 (90)
	In-patient	9 (8)	11 (18)	5 (8)	17 (12)	3 (4)	2 (8)	3 (5)	50 (9)
	Not reported	0	0	0	3 (2)	0	0	0	3 (1)



<b>Table 3.4 Demographic characteristics of adult elective first deceased donor liver only transplant recipients, 1 April 2020 - 31 March 2021</b>									
		Birmingham	Cambridge	Edinburgh	King's College	Leeds	Newcastle	Royal Free	TOTAL
		N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
Ascites	Absence	54 (50)	27 (44)	29 (48)	44 (32)	39 (48)	14 (54)	29 (46)	<b>236 (44)</b>
	Presence	53 (50)	34 (56)	31 (52)	90 (66)	42 (52)	12 (46)	34 (54)	<b>296 (55)</b>
	Not reported	0	0	0	3 (2)	0	0	0	<b>3 (1)</b>
Encephalopathy	Absence	87 (81)	35 (57)	53 (88)	72 (53)	54 (67)	16 (62)	45 (71)	<b>362 (68)</b>
	Presence	20 (19)	26 (43)	7 (12)	61 (45)	27 (33)	8 (31)	18 (29)	<b>167 (31)</b>
	Not reported	0	0	0	4 (3)	0	2 (8)	0	<b>6 (1)</b>
Pre-transplant renal support	No	107 (100)	60 (98)	60 (100)	126 (92)	80 (99)	24 (92)	61 (97)	<b>518 (97)</b>
	Yes	0	1 (2)	0	8 (6)	1 (1)	0	2 (3)	<b>12 (2)</b>
	Not reported	0	0	0	3 (2)	0	2 (8)	0	<b>5 (1)</b>
Previous abdominal surgery	No	94 (88)	47 (77)	48 (80)	107 (78)	74 (91)	24 (92)	52 (83)	<b>446 (83)</b>
	Yes	13 (12)	13 (21)	12 (20)	26 (19)	7 (9)	2 (8)	11 (17)	<b>84 (16)</b>
	Not reported	0	1 (2)	0	4 (3)	0	0	0	<b>5 (1)</b>
Varices & shunt	Absence	44 (41)	16 (26)	14 (23)	37 (27)	33 (41)	7 (27)	23 (37)	<b>174 (33)</b>
	Presence without treatment	61 (57)	40 (66)	44 (73)	88 (64)	41 (51)	19 (73)	37 (59)	<b>330 (62)</b>
	Presence with TIPS	2 (2)	5 (8)	2 (3)	7 (5)	0	0	3 (5)	<b>19 (4)</b>
	Not reported	0	0	0	5 (4)	7 (9)	0	0	<b>12 (2)</b>
Life style activity	Normal	13 (12)	12 (20)	9 (15)	0	17 (21)	3 (12)	13 (21)	<b>67 (13)</b>
	Restricted	25 (23)	14 (23)	7 (12)	54 (39)	25 (31)	10 (38)	44 (70)	<b>179 (34)</b>
	Self-care	60 (56)	26 (43)	32 (53)	64 (47)	36 (44)	12 (46)	5 (8)	<b>235 (44)</b>
	Confined	8 (7)	7 (11)	12 (20)	5 (4)	2 (2)	1 (4)	1 (2)	<b>36 (7)</b>
	Reliant	1 (1)	2 (3)	0	9 (7)	1 (1)	0	0	<b>13 (2)</b>
	Not reported	0	0	0	5 (4)	0	0	0	<b>5 (1)</b>
Graft appearance	Normal	91 (85)	43 (70)	57 (95)	128 (93)	72 (89)	20 (77)	56 (89)	<b>467 (87)</b>
	Abnormal	16 (15)	17 (28)	3 (5)	5 (4)	9 (11)	6 (23)	7 (11)	<b>63 (12)</b>
	Not reported	0	1 (2)	0	4 (3)	0	0	0	<b>5 (1)</b>
Recip age (years)	Median (IQR)	53 (41,61)	59 (49,64)	56 (49,62)	56 (46,62)	58 (52,64)	57 (54,63)	53 (47,61)	<b>56 (47,62)</b>
BMI kg/m2	Median (IQR)	27 (24,32)	30 (26,33)	27 (24,30)	27 (24,31)	29 (26,32)	27 (24,32)	27 (23,31)	<b>28 (24,32)</b>

**Table 3.4 Demographic characteristics of adult elective first deceased donor liver only transplant recipients, 1 April 2020 - 31 March 2021**

		Birmingham N (%)	Cambridge N (%)	Edinburgh N (%)	King's College N (%)	Leeds N (%)	Newcastle N (%)	Royal Free N (%)	TOTAL N (%)
Serum bilirubin umol/l	Median (IQR)	65 (37,155)	45 (25,135)	77 (38,206)	51 (25,119)	50 (23,85)	32 (25,64)	54 (28,101)	<b>55 (28,123)</b>
	Not reported	0	1	0	4	0	0	0	<b>5</b>
Serum creatinine umol/l	Median (IQR)	65 (54,87)	68 (55,80)	72 (62,87)	68 (56,86)	73 (58,93)	73 (62,87)	86 (71,104)	<b>70 (59,88)</b>
	Not reported	0	1	0	4	4	0	0	<b>9</b>
Serum sodium mmol/l	Median (IQR)	137 (133,139)	136 (133,138)	136 (132,138)	136 (133,138)	137 (134,140)	137 (134,139)	135 (133,138)	<b>136 (133,139)</b>
	Not reported	0	1	0	4	0	0	0	<b>5</b>
Serum potassium mmol/l	Median (IQR)	4.1 (3.8,4.5)	4.1 (3.8,4.4)	4.3 (4.0,4.5)	4.2 (3.8,4.5)	4.0 (3.8,4.6)	4.3 (3.9,4.6)	4.1 (3.8,4.4)	<b>4.2 (3.8,4.5)</b>
	Not reported	1	1	0	4	0	0	0	<b>6</b>
INR	Median (IQR)	1.4 (1.2,1.6)	1.4 (1.3,1.6)	1.5 (1.2,1.9)	1.4 (1.2,1.8)	1.4 (1.2,1.6)	1.6 (1.2,2.0)	1.3 (1.1,1.5)	<b>1.4 (1.2,1.7)</b>
	Not reported	0	51	0	4	0	0	0	<b>55</b>
Serum albumin g/l	Median (IQR)	29 (25,36)	30 (27,35)	26 (22,30)	34 (30,39)	30 (25,34)	34 (28,36)	34 (30,38)	<b>31 (27,36)</b>
	Not reported	0	1	0	4	0	0	0	<b>5</b>
Cold ischaemia time (hrs)	Median (IQR)	8 (6,10)	11 (8,15)	10 (9,11)	9 (7,10)	8 (7,10)	11 (10,12)	8 (7,9)	<b>9 (7,11)</b>
	Not reported	0	4	0	3	0	0	0	<b>7</b>
Time on list (days)	Median (IQR)	58 (6,217)	50 (14,116)	37 (10,267)	38 (8,135)	51 (17,133)	32 (6,112)	37 (11,107)	<b>43 (9,153)</b>
Donor sex	Male	55 (51)	35 (57)	25 (42)	71 (52)	50 (62)	9 (35)	38 (60)	<b>283 (53)</b>
	Female	52 (49)	26 (43)	35 (58)	66 (48)	31 (38)	17 (65)	25 (40)	<b>252 (47)</b>
Donor ethnicity	White	98 (92)	57 (93)	55 (92)	123 (90)	60 (74)	24 (92)	56 (89)	<b>473 (88)</b>
	Non-white	5 (5)	3 (5)	4 (7)	11 (8)	11 (14)	1 (4)	5 (8)	<b>40 (8)</b>
	Not reported	4 (4)	1 (2)	1 (2)	3 (2)	10 (12)	1 (4)	2 (3)	<b>22 (4)</b>
Donor cause of death	Intracranial	97 (91)	58 (95)	53 (88)	115 (84)	67 (83)	22 (85)	49 (78)	<b>461 (86)</b>
	Trauma	0	0	1 (2)	5 (4)	3 (4)	1 (4)	5 (8)	<b>15 (3)</b>
	Others	10 (9)	3 (5)	6 (10)	17 (12)	11 (14)	3 (12)	9 (14)	<b>59 (11)</b>
Donor history of diabetes	No	97 (91)	57 (93)	54 (90)	132 (96)	75 (93)	23 (88)	59 (94)	<b>497 (93)</b>
	Yes	9 (8)	3 (5)	5 (8)	2 (1)	4 (5)	3 (12)	4 (6)	<b>30 (6)</b>
	Not reported	1 (1)	1 (2)	1 (2)	3 (2)	2 (2)	0	0	<b>8 (2)</b>

Table 3.4		Demographic characteristics of adult elective first deceased donor liver only transplant recipients, 1 April 2020 - 31 March 2021							
		Birmingham N (%)	Cambridge N (%)	Edinburgh N (%)	King's College N (%)	Leeds N (%)	Newcastle N (%)	Royal Free N (%)	TOTAL N (%)
Donor type	Donor after brain death	96 (90)	30 (49)	54 (90)	105 (77)	65 (80)	24 (92)	51 (81)	<b>425 (79)</b>
	Donor after cardiac death	11 (10)	31 (51)	6 (10)	32 (23)	16 (20)	2 (8)	12 (19)	<b>110 (21)</b>
ABO match	Identical	98 (92)	61 (100)	58 (97)	136 (99)	78 (96)	24 (92)	62 (98)	<b>517 (97)</b>
	Compatible	9 (8)	0	2 (3)	1 (1)	3 (4)	2 (8)	1 (2)	<b>18 (3)</b>
Graft type	Whole	97 (91)	58 (95)	60 (100)	124 (91)	78 (96)	26 (100)	59 (94)	<b>502 (94)</b>
	Segmental	10 (9)	3 (5)	0	13 (9)	3 (4)	0	4 (6)	<b>33 (6)</b>
Donor age years	Median (IQR)	51 (34,61)	54 (37,60)	51 (38,59)	50 (39,60)	49 (33,58)	59 (47,65)	50 (36,60)	<b>51 (37,60)</b>
Donor BMI kg/m2	Median (IQR)	26 (24,30)	26 (22,30)	26 (23,29)	26 (23,29)	26 (23,30)	27 (24,35)	26 (23,28)	<b>26 (23,29)</b>

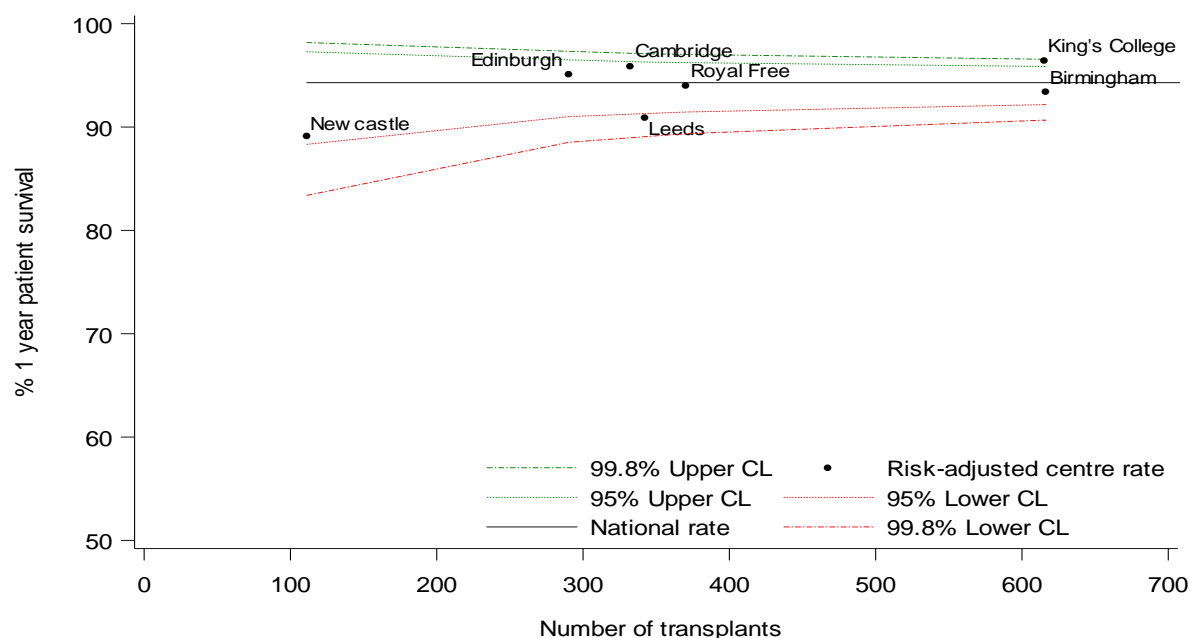
### 3.2.3 Post-transplant survival

#### LONG-TERM PATIENT SURVIVAL

**Table 3.5** shows one year [unadjusted](#) and [risk-adjusted patient survival](#) for 2680 of the 2884 transplants in the period, 1 April 2016 to 31 March 2020. Transplants were excluded if they were [auxiliary](#) or if survival information or [risk factors](#) were missing. The overall patient survival rate is 94.4% and, after risk adjustment, four centres had a lower survival rate than the national rate. All centres apart from Leeds and King's College lie within the 95% [confidence limit](#), as shown in **Figure 3.15**.

Centre	Number of transplants	1-year survival % (95% CI)			
		Unadjusted		Risk-adjusted	
Newcastle	111	91.9	84.9 - 95.7	89.3	79.4 - 94.4
Leeds	342	90.7	87.0 - 93.4	90.9	87.0 - 93.6
Cambridge	332	95.5	92.6 - 97.2	96.0	93.3 - 97.6
Royal Free	370	94.5	91.6 - 96.4	94.3	91.2 - 96.3
King's College	615	96.6	94.8 - 97.8	96.5	94.6 - 97.8
Birmingham	616	93.7	91.5 - 95.4	93.5	91.1 - 95.3
Edinburgh	290	94.7	91.4 - 96.8	95.0	91.7 - 97.0
<b>Total</b>	<b>2680</b>	<b>94.4</b>	<b>93.4 - 95.2</b>		

**Figure 3.15 Risk-adjusted 1 year patient survival rates for adult elective deceased donor first liver transplants, 1 April 2016 - 31 March 2020**

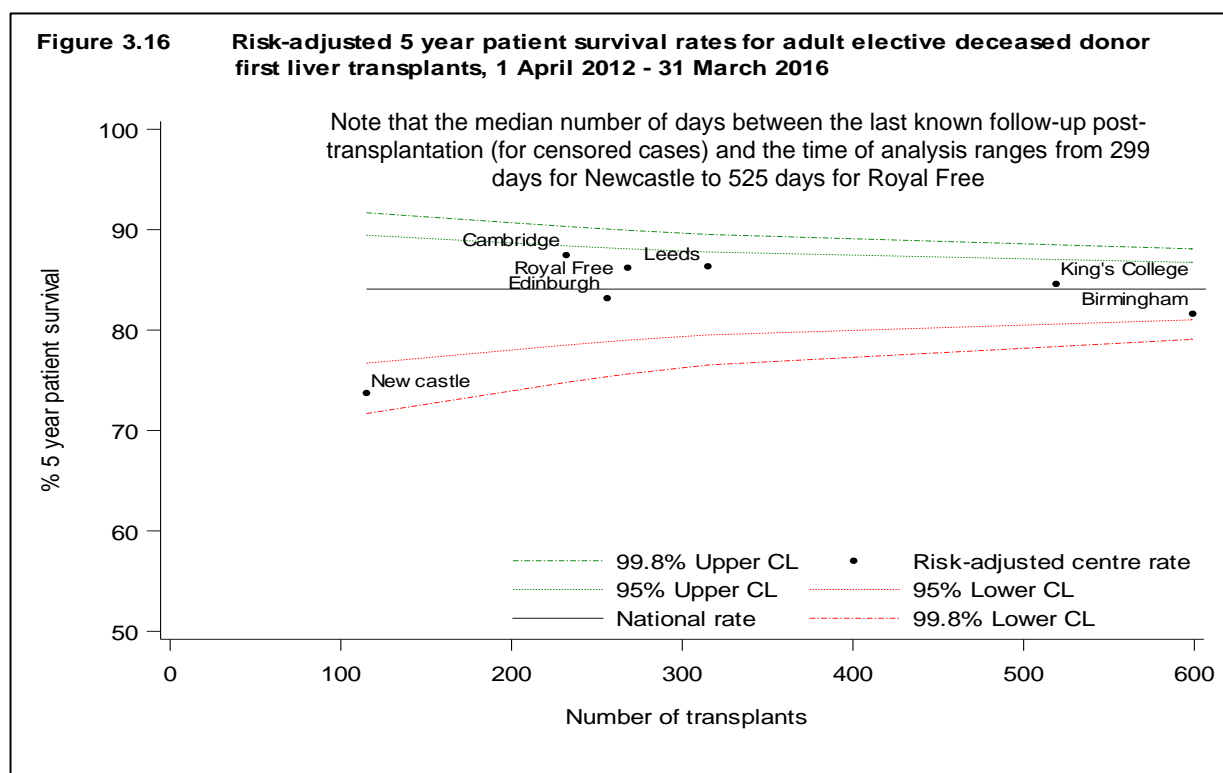


**Table 3.6** shows the five year [unadjusted](#) and [risk-adjusted patient survival](#) for 2304 of the 2475 transplants in the period, 1 April 2012 to 31 March 2016. The national rate is 84.1% and three centres have a lower survival rate after risk adjustment, as shown in **Figure 3.16**. The median number of days between the last known follow-up post-transplantation (for censored cases) and the time of analysis in **Table 3.6** and **Figure 3.16** ranges from 299 days for Newcastle to 525 days for Royal Free. The medians for all other centres fall in between these extremes. Results should therefore be interpreted in that light.

<b>Table 3.6 Five year patient survival for adult elective deceased donor first liver transplants, 1 April 2012 - 31 March 2016</b>					
Centre	Number of transplants	5-year survival % (95% CI)			
		Unadjusted		Risk-adjusted	
Newcastle	115	82.5	74.1 - 88.3	73.6	59.1 - 83.0
Leeds	315	85.2	80.7 - 88.7	86.4	81.8 - 89.8
Cambridge	232	84.6	79.2 - 88.7	87.5	82.6 - 91.0
Royal Free	268	84.8	79.9 - 88.6	86.2	81.2 - 89.9
King's College	519	87.5	84.3 - 90.1	84.6	80.3 - 88.0
Birmingham	599	80.2	76.7 - 83.2	81.6	78.0 - 84.7
Edinburgh	256	84.7	79.6 - 88.7	83.2	77.0 - 87.8
<b>Total</b>	<b>2304</b>	<b>84.1</b>	<b>82.5 - 85.6</b>		

	Centre has reached the lower 99.8% confidence limit
	Centre has reached the lower 95% confidence limit
	Centre has reached the upper 95% confidence limit
	Centre has reached the upper 99.8% confidence limit



**Table 3.7** shows one year [unadjusted](#) and [risk-adjusted patient survival](#), by primary disease group. The overall patient survival rate is 94.4% and, after risk adjustment, patients with cancer, primary sclerosing cholangitis, autoimmune and cryptogenic, metabolic disease or other liver disease had lower survival than the national rate.

<b>Table 3.7 One year patient survival for adult elective deceased donor first liver transplants, 1 April 2016 - 31 March 2020</b>					
Primary disease	Number of transplants	1-year survival % (95% CI)			
		Unadjusted		Risk adjusted	
Cancer	554	92.5	(89.9 - 94.4)	93.3	(90.9 - 95.1)
Hepatitis B and C	135	96.3	(91.3 - 98.4)	96.1	(90.6 - 98.4)
Alcoholic liver disease	738	96.5	(94.9 - 97.6)	96.5	(94.9 - 97.6)
Primary sclerosing cholangitis	324	95.6	(92.7 - 97.4)	94.3	(90.4 - 96.6)
Primary biliary cholangitis	225	94.6	(90.7 - 96.9)	94.8	(90.8 - 97.0)
Autoimmune and cryptogenic	193	94.6	(90.3 - 97.1)	94.0	(88.8 - 96.8)
Metabolic	340	92.3	(88.9 - 94.8)	92.5	(89.0 - 95.0)
Other	171	90.5	(85.0 - 94.1)	90.8	(85.0 - 94.4)
<b>Total</b>	<b>2680</b>	<b>94.4</b>	<b>(93.4 - 95.2)</b>		

**Table 3.8** shows five year [unadjusted](#) and [risk-adjusted patient survival](#), the overall patient survival rate is 84.1%. After risk adjustment, patients with cancer, primary sclerosing cholangitis, autoimmune and cryptogenic, or other liver disease had lower survival than the national rate.

<b>Table 3.8 Five year patient survival for adult elective deceased donor first liver transplants, 1 April 2012 - 31 March 2016</b>					
Primary disease	Number of transplants	5-year survival % (95% CI)			
		Unadjusted		Risk adjusted	
Cancer	561	78.1	(74.4 - 81.3)	81.1	(77.4 - 84.2)
Hepatitis B and C	253	88.0	(83.2 - 91.5)	89.0	(84.2 - 92.4)
Alcoholic liver disease	566	85.3	(82.1 - 88.0)	85.1	(81.5 - 88.0)
Primary sclerosing cholangitis	252	85.5	(80.4 - 89.3)	82.6	(75.8 - 87.4)
Primary biliary cholangitis	191	89.4	(84.1 - 93.1)	88.8	(82.6 - 92.7)
Autoimmune and cryptogenic	150	84.1	(77.1 - 89.2)	80.3	(70.4 - 86.9)
Metabolic	207	84.1	(78.1 - 88.6)	84.2	(77.5 - 88.9)
Other	124	86.7	(79.3 - 91.7)	84.0	(73.9 - 90.2)
<b>Total</b>	<b>2304</b>	<b>84.1</b>	<b>(82.5 - 85.6)</b>		

### 3.2.4 Survival from listing

Survival from listing was analysed for patients aged  $\geq 18$  years registered for the first time for a liver transplant between 1 January 2009 and 31 December 2020. One and five year [risk-adjusted survival rates](#) from the point of liver transplant listing are provided in **Table 3.9** and are shown by centre in **Figures 3.17** and **3.18** respectively.

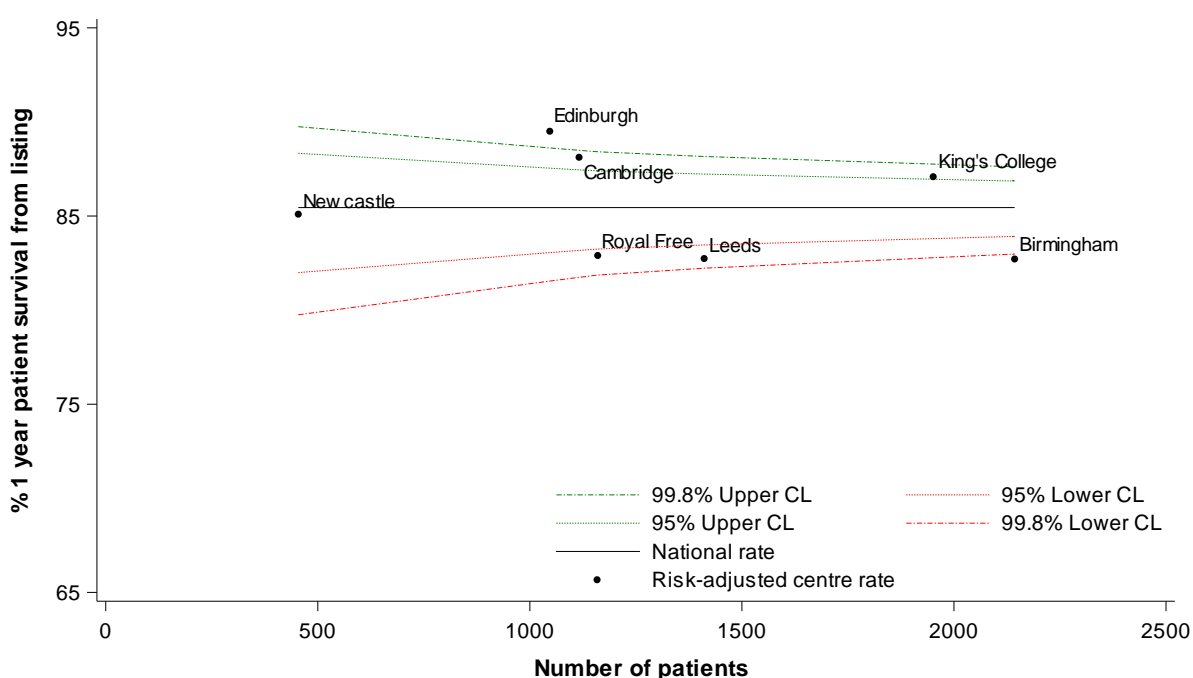
At one year, centre-specific risk adjusted survival rates range between 83% at Leeds and Birmingham and 90% at Edinburgh. At five years, Leeds and Birmingham have the lowest survival rate at 69% and Edinburgh has the highest at 79%; the remaining centres achieve survival rates that range in between these two extremes.

Note, however, that the median number of days between the last known follow-up post-transplantation (for censored, transplanted cases) and the time of analysis in **Figure 3.18** ranges from 270 days for Newcastle to 441 days for Leeds. The medians for all other centres fall in between these extremes. Results should therefore be interpreted in that light.

**Table 3.9 Risk adjusted 1 and 5 year patient survival rate from listing for adult elective first liver registrations, 1 January 2009 - 31 December 2020**

Centre	Number of registrations	Patient survival					
		One year			Five year		
		Number at Risk at 1 year	Survival Rate %	(95% CI)	Number at Risk at 5 years	Survival Rate %	(95% CI)
Newcastle	454	335	85.1	(81.7 - 87.8)	152	70.3	(65.2 - 74.7)
Leeds	1411	986	82.7	(80.4 - 84.8)	381	68.5	(65.0 - 71.6)
Cambridge	1116	840	88.1	(86.1 - 89.9)	367	76.7	(73.6 - 79.4)
Royal Free	1160	840	82.9	(80.3 - 85.2)	341	70.3	(66.7 - 73.6)
King's College	1951	1455	87.1	(85.4 - 88.6)	689	75.9	(73.4 - 78.1)
Birmingham	2143	1605	82.7	(80.8 - 84.5)	694	68.9	(66.1 - 71.4)
Edinburgh	1047	838	89.5	(87.6 - 91.1)	393	79.0	(76.1 - 81.5)
<b>UK</b>	<b>9282</b>	<b>6899</b>	<b>85.4</b>	<b>(84.7 - 86.2)</b>	<b>3017</b>	<b>72.9</b>	<b>(71.9 - 73.9)</b>

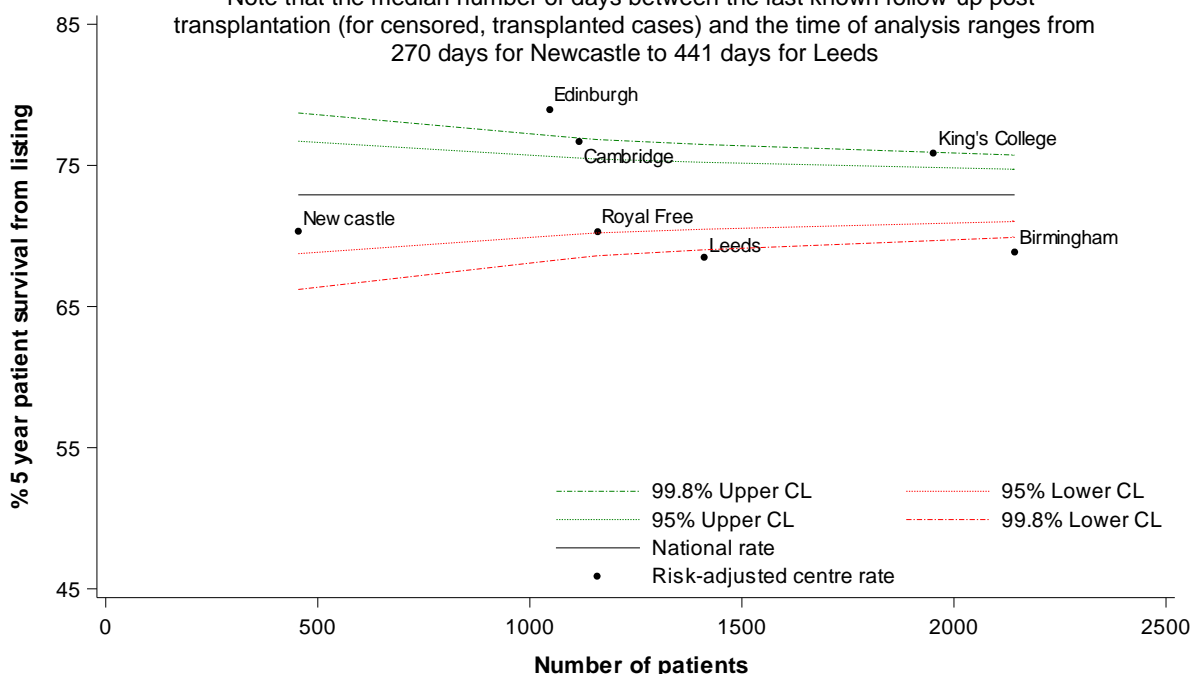
**Figure 3.17 Risk-adjusted 1 year patient survival rate from time of listing for adult\* elective first liver registrations, 1 January 2009 - 31 December 2020**



\* In this analysis, adult patients are defined as 18 years old and older.

**Figure 3.18 Risk-adjusted 5 year patient survival rate from time of listing for adult\* elective first liver registrations, 1 January 2009 - 31 December 2020**

Note that the median number of days between the last known follow-up post-transplantation (for censored, transplanted cases) and the time of analysis ranges from 270 days for Newcastle to 441 days for Leeds



\* In this analysis, adult patients are defined as 18 years old and older.



# **Adult Liver Transplantation Super-Urgent Patients**

### 3.3.1 Transplant list

**Table 3.10** shows the [median waiting time](#) to deceased donor liver only transplant for adult [super-urgent](#) patients. The national median waiting time to transplant is two days and at all but one of the seven liver transplant centres.

<b>Table 3.10    Median waiting time to liver only transplant in the UK, for adult super urgent patients registered 1 April 2018 - 31 March 2020</b>			
Transplant centre	Number of patients registered	Waiting time (days)	
		Median	95% Confidence interval
Newcastle	12	2	1 - 3
Leeds	41	2	2 - 2
Royal Free	38	2	1 - 3
King's College	40	2	2 - 2
Birmingham	44	2	1 - 3
Edinburgh	24	2	1 - 3
Cambridge	28	4	3 - 5
<b>UK</b>	<b>227</b>	<b>2</b>	<b>2 - 2</b>

The demographic characteristics of 85 adult [super-urgent](#) registrations in the last financial year are shown by centre and overall in **Table 3.11**. The majority of patients listed for a super-urgent liver were female (60%) and the median age was 44 with a median BMI of 26. For some characteristics, due to rounding, percentages may not add up to 100.

**Table 3.11 Demographic characteristics of UK adult super urgent liver patients registered between 1 April 2020 and 31 March 2021**

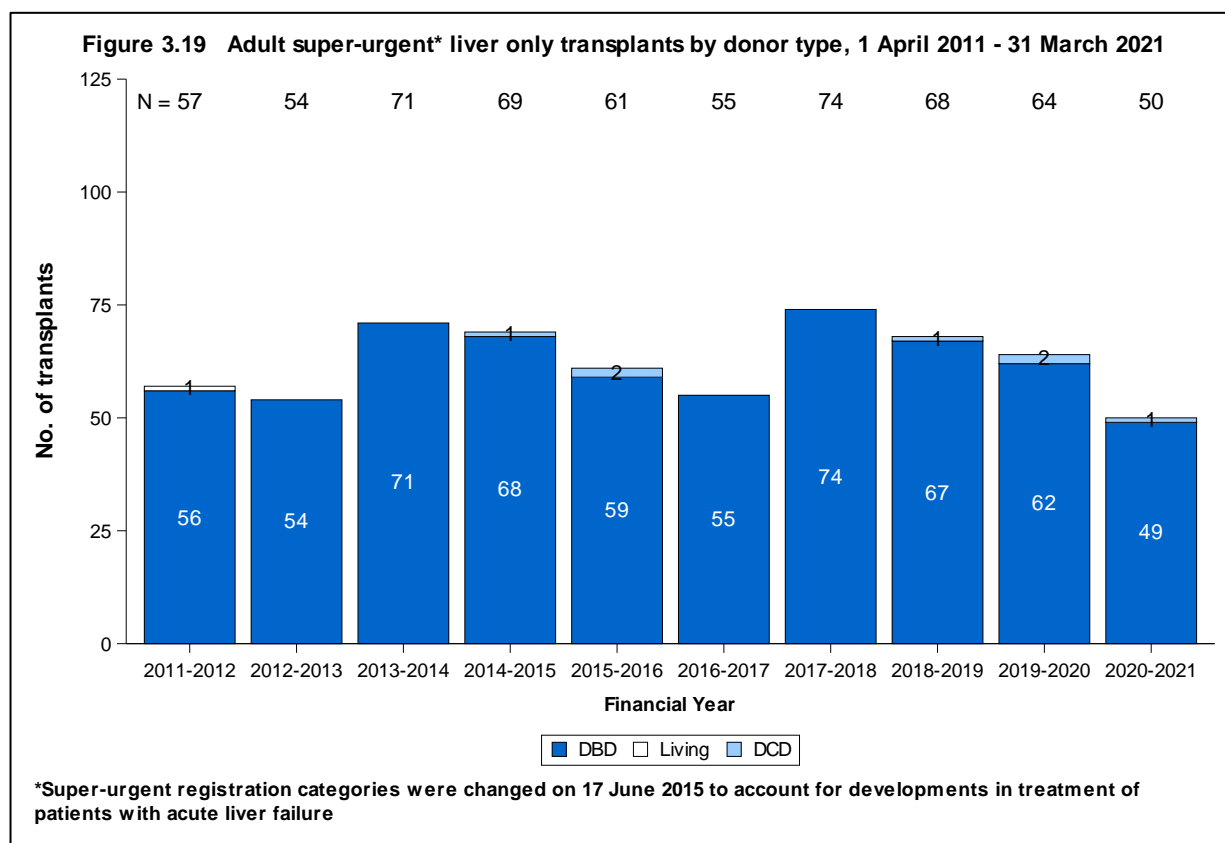
		Birmingham	Cambridge	Edinburgh	King's college	Leeds	Newcastle	Royal Free	Total
		N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
<b>Number</b>		<b>18</b>	<b>14</b>	<b>7</b>	<b>17</b>	<b>16</b>	<b>4</b>	<b>9</b>	<b>85</b>
Recipient sex	Male	4 (22)	8 (57)	3 (43)	8 (47)	8 (50)	1 (25)	2 (22)	<b>34 (40)</b>
	Female	14 (78)	6 (43)	4 (57)	9 (53)	8 (50)	3 (75)	7 (78)	<b>51 (60)</b>
Recipient ethnicity	White	13 (72)	11 (79)	5 (71)	11 (65)	12 (75)	4 (100)	8 (89)	<b>64 (75)</b>
	Non-white	3 (17)	2 (14)	2 (29)	6 (35)	4 (25)	0 (0)	1 (11)	<b>18 (21)</b>
	Not reported	2 (11)	1 (7)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	<b>3 (4)</b>
Recipient HCV	No	18 (100)	14 (100)	7 (100)	17 (100)	16 (100)	4 (100)	9 (100)	<b>85 (100)</b>
	Yes	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	<b>0 (0)</b>
Encephalopathy	Absence	5 (28)	1 (7)	0 (0)	2 (12)	1 (6)	0 (0)	3 (33)	<b>12 (14)</b>
	Presence	11 (61)	12 (86)	6 (86)	13 (76)	12 (75)	4 (100)	4 (44)	<b>62 (73)</b>
	Not reported	2 (11)	1 (7)	1 (14)	2 (12)	3 (19)	0 (0)	2 (22)	<b>11 (13)</b>
Renal support	No	9 (50)	6 (43)	2 (29)	4 (24)	7 (44)	1 (25)	5 (56)	<b>34 (40)</b>
	Yes	9 (50)	7 (50)	5 (71)	13 (76)	9 (56)	3 (75)	4 (44)	<b>50 (59)</b>
	Not reported	0 (0)	1 (7)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	<b>1 (1)</b>
Recip age (years)	Median (IQR)	48 (36, 54)	46 (37, 54)	29 (24, 38)	43 (31, 55)	43 (23, 51)	41 (30, 59)	50 (44, 53)	<b>44 (31, 54)</b>
BMI kg/m2	Median (IQR)	26 (24, 30)	27 (24, 29)	22 (21, 26)	25 (23, 28)	27 (24, 32)	27 (24, 29)	27 (24, 30)	<b>26 (23, 30)</b>
	Not reported	0	1	0	0	0	0	1	<b>2</b>
Serum bilirubin umol/l	Median (IQR)	259 (71, 458)	194 (140, 561)	71 (55, 119)	299 (164, 439)	181 (91, 337)	249 (58, 591)	290 (86, 354)	<b>203 (84, 427)</b>
	Not reported	0	0	0	1	0	0	0	<b>1</b>
Serum creatinine umol/l	Median (IQR)	76 (55, 92)	92 (66, 115)	89 (79, 129)	90 (60, 178)	130 (52, 150)	276 (119, 418)	108 (69, 152)	<b>91 (59, 144)</b>
	Not reported	1	2	1	1	1	0	1	<b>7</b>
Serum sodium mmol/l	Median (IQR)	140 (134, 142)	136 (133, 139)	139 (135, 144)	139 (133, 143)	138 (134, 142)	136 (135, 137)	137 (134, 138)	<b>138 (134, 141)</b>
	Not reported	0	1	0	2	0	0	0	<b>3</b>
Serum potassium mmol/l	Median (IQR)	4 (4, 4)	4 (4, 5)	5 (4, 5)	5 (4, 5)	4 (4, 5)	4 (4, 5)	5 (4, 5)	<b>4 (4, 5)</b>
	Not reported	0	1	0	2	0	0	0	<b>3</b>

**Table 3.11 Demographic characteristics of UK adult super urgent liver patients registered between 1 April 2020 and 31 March 2021**

		Birmingham	Cambridge	Edinburgh	King's college	Leeds	Newcastle	Royal Free	Total
		N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
INR	Median (IQR)	5 (3, 7)	2 (2, 4)	7 (2, 10)	5 (3, 15)	3 (2, 7)	2 (1, 3)	2 (2, 5)	<b>4 (2, 8)</b>
	Not reported	0	2	0	1	1	2	0	<b>6</b>
Serum albumin g/l	Median (IQR)	30 (23, 34)	22 (22, 25)	29 (20, 39)	28 (24, 31)	23 (20, 28)	32 (26, 34)	27 (25, 29)	<b>26 (22, 31)</b>
	Not reported	0	1	0	1	0	0	0	<b>2</b>

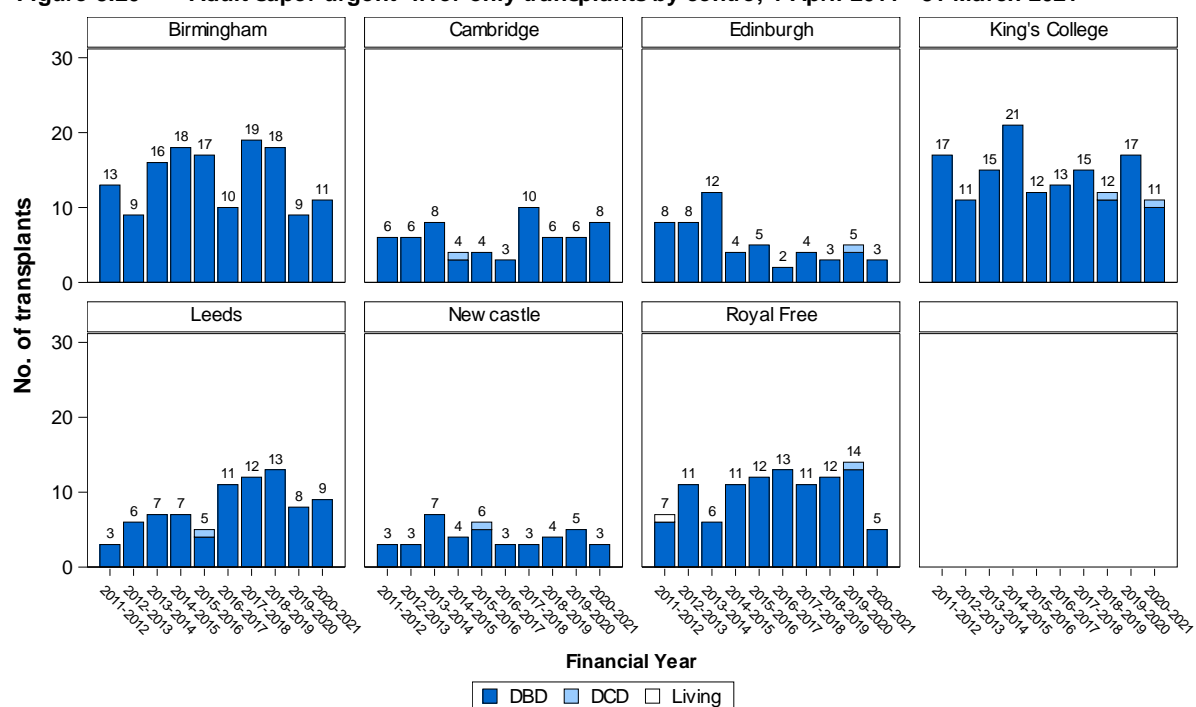
### 3.2.2 Transplant activity

**Figure 3.19** shows the number of adult [super-urgent](#) first liver only transplants from deceased and living donors performed in the last ten years, by type of donor. There have been 7 DCD super-urgent transplants during the ten year period and one living donor transplant performed in 2011/12. The number of super-urgent transplants in 2020/21 has slightly decreased compared to the previous financial year.



**Figure 3.20** shows the number of adult [super-urgent](#) first liver only transplants from deceased and living donors performed in the last ten years, by type of donor and transplant centre.

**Figure 3.20 Adult super-urgent\* liver only transplants by centre, 1 April 2011 - 31 March 2021**



\*Super-urgent registration categories were changed on 17 June 2015 to account for developments in treatment of patients with acute liver failure

The demographic characteristics of 50 adult [super-urgent](#) transplant recipients in the last financial year are shown by centre and overall in **Table 3.12**. Sixty four percent of these recipients were female and the [median](#) age was 44 years. All but one super-urgent transplant was performed in this time period using a [DBD](#) donor. The median recipient BMI was 26. For some characteristics, due to rounding, percentages may not add up to 100.

**Table 3.12 Demographic characteristics of adult super-urgent deceased donor liver transplant recipients, 1 April 2020 - 31 March 2021**

		Birmingham	Cambridge	Edinburgh	King's College	Leeds	Newcastle	Royal Free	TOTAL
		N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
<b>Number</b>		<b>11</b>	<b>8</b>	<b>3</b>	<b>11</b>	<b>9</b>	<b>3</b>	<b>5</b>	<b>50 (100)</b>
Recipient sex	Male	3 (27)	4 (50)	1 (33)	5 (45)	3 (33)	1 (33)	1 (20)	18 (36)
	Female	8 (73)	4 (50)	2 (67)	6 (55)	6 (67)	2 (67)	4 (80)	32 (64)
Recipient ethnicity	White	8 (73)	7 (88)	2 (67)	8 (73)	5 (56)	3 (100)	5 (100)	38 (76)
	Non-white	1 (9)	0	1 (33)	3 (27)	4 (44)	0	0	9 (18)
	Not reported	2 (18)	1 (13)	0	0	0	0	0	3 (6)
Recipient HCV status	Negative	10 (91)	7 (88)	2 (67)	11 (100)	7 (78)	3 (100)	5 (100)	45 (90)
	Not reported	1 (9)	1 (13)	1 (33)	0	2 (22)	0	0	5 (10)
Pre-transplant in-patient status	Out-patient	11 (100)	0	0	0	0	0	0	11 (22)
	In-patient	0	7 (88)	3 (100)	11 (100)	9 (100)	3 (100)	5 (100)	38 (76)
	Not reported	0	1 (13)	0	0	0	0	0	1 (2)
Ascites	Absence	11 (100)	3 (38)	2 (67)	6 (55)	6 (67)	3 (100)	4 (80)	35 (70)
	Presence	0	4 (50)	1 (33)	4 (36)	1 (11)	0	1 (20)	11 (22)
	Not reported	0	1 (13)	0	1 (9)	2 (22)	0	0	4 (8)
Encephalopathy	Absence	11 (100)	3 (38)	0	0	0	0	1 (20)	15 (30)
	Presence	0	4 (50)	2 (67)	11 (100)	7 (78)	3 (100)	4 (80)	31 (62)
	Not reported	0	1 (13)	1 (33)	0	2 (22)	0	0	4 (8)
Pre-transplant renal support	No	11 (100)	4 (50)	0	1 (9)	4 (44)	1 (33)	1 (20)	22 (44)
	Yes	0	3 (38)	3 (100)	10 (91)	5 (56)	2 (67)	4 (80)	27 (54)
	Not reported	0	1 (13)	0	0	0	0	0	1 (2)
Previous abdominal surgery	No	10 (91)	5 (63)	3 (100)	11 (100)	9 (100)	3 (100)	4 (80)	45 (90)
	Yes	0	2 (25)	0	0	0	0	1 (20)	3 (6)
	Not reported	1 (9)	1 (13)	0	0	0	0	0	2 (4)
Varices & shunt	Absence	11 (100)	1 (13)	2 (67)	8 (73)	4 (44)	1 (33)	5 (100)	32 (64)
	Presence without treatment	0	5 (63)	1 (33)	1 (9)	4 (44)	1 (33)	0	12 (24)
	Presence with TIPS	0	1 (13)	0	0	0	0	0	1 (2)
	Not reported	0	1 (13)	0	2 (18)	1 (11)	1 (33)	0	5 (10)

**Table 3.12 Demographic characteristics of adult super-urgent deceased donor liver transplant recipients, 1 April 2020 - 31 March 2021**

		Birmingham	Cambridge	Edinburgh	King's College	Leeds	Newcastle	Royal Free	TOTAL
		N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
Life style activity	Normal	10 (91)	0	0	0	1 (11)	1 (33)	0	12 (24)
	Restricted	1 (9)	0	0	0	0	0	0	1 (2)
	Self-care	0	1 (13)	0	0	0	0	0	1 (2)
	Confined	0	1 (13)	0	0	3 (33)	1 (33)	1 (20)	6 (12)
	Reliant	0	5 (63)	3 (100)	11 (100)	5 (56)	1 (33)	4 (80)	29 (58)
	Not reported	0	1 (13)	0	0	0	0	0	1 (2)
Graft appearance	Normal	10 (91)	5 (63)	3 (100)	11 (100)	9 (100)	2 (67)	5 (100)	45 (90)
	Abnormal	1 (9)	2 (25)	0	0	0	1 (33)	0	4 (8)
	Not reported	0	1 (13)	0	0	0	0	0	1 (2)
Recip age (years)	Median (IQR)	47 (36,50)	49 (44,57)	32 (29,38)	43 (30,54)	23 (22,39)	49 (27,69)	48 (44,50)	44 (31,50)
BMI kg/m2	Median (IQR)	26 (24,30)	29 (25,34)	22 (21,26)	25 (23,33)	24 (23,26)	26 (22,31)	29 (25,32)	26 (23,30)
	Not reported	0	0	0	0	0	0	1	1
Serum bilirubin umol/l	Median (IQR)	425 (266,465)	487 (189,595)	119 (93,120)	349 (249,473)	220 (136,324)	404 (94,706)	354 (176,385)	324 (202,465)
	Not reported	0	1	0	0	0	0	0	1
Serum creatinine umol/l	Median (IQR)	67 (48,82)	116 (65,142)	100 (90,308)	101 (54,159)	62 (45,162)	363 (62,372)	89 (75,136)	82 (62,136)
	Not reported	0	1	0	0	0	0	0	1
Serum sodium mmol/l	Median (IQR)	140 (133,145)	136 (134,137)	149 (135,150)	140 (135,150)	138 (136,141)	140 (136,141)	140 (137,142)	140 (135,145)
	Not reported	0	1	0	0	0	0	0	1
Serum potassium mmol/l	Median (IQR)	3.7 (3.6,4.0)	4.1 (4.0,4.2)	3.9 (3.2,5.0)	4.2 (4.0,4.7)	4.1 (3.8,4.5)	4.4 (4.0,4.5)	4.5 (4.5,4.5)	4.1 (3.9,4.5)
	Not reported	0	1	0	0	0	0	0	1
INR	Median (IQR)	2.6 (1.9,5.8)	2.5 (2.4,2.6)	7.5 (2.4,10.2)	3.4 (2.1,4.3)	2.3 (1.9,4.7)	2.4 (1.0,3.9)	1.8 (1.7,2.5)	2.6 (2.0,4.2)
	Not reported	0	6	0	0	0	0	0	6
Serum albumin g/l	Median (IQR)	22 (18,29)	25 (22,27)	26 (20,30)	30 (27,33)	22 (19,25)	33 (28,36)	30 (28,34)	27 (22,30)
	Not reported	0	1	0	0	1	0	0	2
Time on list (days)	Median (IQR)	2 (1,4)	2 (2,4)	1 (0,2)	2 (1,6)	2 (2,3)	2 (2,2)	4 (3,4)	2 (1,4)



**Table 3.12 Demographic characteristics of adult super-urgent deceased donor liver transplant recipients, 1 April 2020 - 31 March 2021**

		Birmingham	Cambridge	Edinburgh	King's College	Leeds	Newcastle	Royal Free	TOTAL
		N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
Donor sex	Male	6 (55)	6 (75)	1 (33)	6 (55)	1 (11)	2 (67)	4 (80)	26 (52)
	Female	5 (45)	2 (25)	2 (67)	5 (45)	8 (89)	1 (33)	1 (20)	24 (48)
Donor ethnicity	White	10 (91)	8 (100)	3 (100)	9 (82)	7 (78)	2 (67)	5 (100)	44 (88)
	Non-white	1 (9)	0	0	2 (18)	2 (22)	1 (33)	0	6 (12)
Donor cause of death	Intracranial	11 (100)	8 (100)	3 (100)	11 (100)	8 (89)	2 (67)	5 (100)	48 (96)
	Trauma	0	0	0	0	0	1 (33)	0	1 (2)
	Others	0	0	0	0	1 (11)	0	0	1 (2)
Donor history of diabetes	No	10 (91)	8 (100)	3 (100)	11 (100)	9 (100)	3 (100)	5 (100)	49 (98)
	Yes	1 (9)	0	0	0	0	0	0	1 (2)
Donor type	Donor after brain death	11 (100)	8 (100)	3 (100)	10 (91)	9 (100)	3 (100)	5 (100)	49 (98)
	Donor after cardiac death	0	0	0	1 (9)	0	0	0	1 (2)
ABO match	Identical	7 (64)	7 (88)	2 (67)	6 (55)	7 (78)	2 (67)	2 (40)	33 (66)
	Compatible	4 (36)	0	1 (33)	5 (45)	2 (22)	1 (33)	3 (60)	16 (32)
	Incompatible	0	1 (13)	0	0	0	0	0	1 (2)
Graft type	Whole	11 (100)	8 (100)	3 (100)	9 (82)	9 (100)	3 (100)	5 (100)	48 (96)
	Segmental	0	0	0	2 (18)	0	0	0	2 (4)
Donor age (years)	Median (IQR)	55 (50,68)	43 (30,50)	32 (18,57)	50 (41,57)	48 (46,57)	35 (24,72)	31 (24,47)	49 (35,57)
Donor BMI kg/m2	Median (IQR)	26 (24,27)	25 (24,28)	25 (24,31)	24 (22,27)	22 (21,30)	23 (23,30)	23 (22,27)	25 (22,27)

### 3.3.3 Post-transplant survival

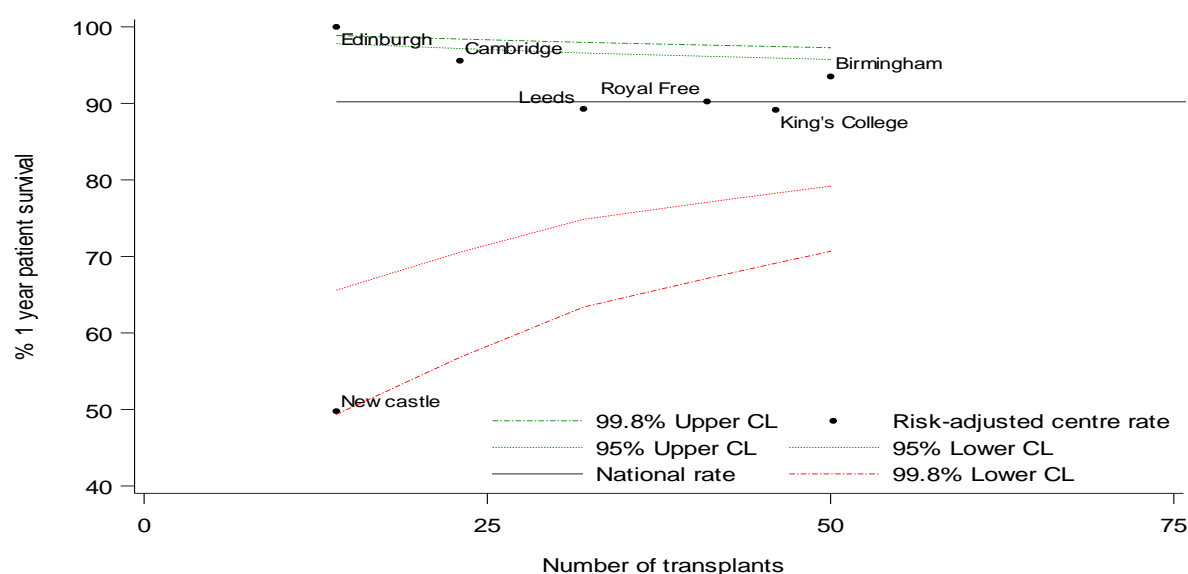
#### LONG-TERM PATIENT SURVIVAL

**Table 3.13** shows one year [unadjusted](#) and [risk-adjusted patient survival](#) for 222 of the 261 transplants in the period 1 April 2016 to 31 March 2020. Transplants were excluded if they were [auxiliary](#) or if survival information or [risk factors](#) were missing. The overall patient survival rate is 90.4% and, after risk adjustment, three of the seven centres had a lower survival rate than the national rate but within the [confidence limits](#), as shown in **Figure 3.21**.

<b>Table 3.13 One year patient survival for adult super-urgent deceased donor first liver transplants, 1 April 2016 - 31 March 2020</b>					
Centre	Number of transplants	1-year survival % (95% CI)			
		Unadjusted		Risk-adjusted	
Newcastle	14	78.6	47.2 - 92.5	49.9	0.0 - 83.8
Leeds	32	89.8	71.5 - 96.6	89.5	67.3 - 96.6
Cambridge	23	95.7	72.9 - 99.4	95.6	68.7 - 99.4
Royal Free	41	82.8	67.2 - 91.5	90.4	79.9 - 95.4
King's College	46	91.3	78.5 - 96.6	89.6	72.2 - 96.1
Birmingham	50	94.0	82.5 - 98.0	93.6	80.2 - 97.9
Edinburgh	14	100.0	-	100.0	-
<b>Total</b>	<b>222</b>	<b>90.4</b>	<b>85.6 - 93.6</b>		

Centre has reached the lower 99.8% confidence limit
  Centre has reached the lower 95% confidence limit
  Centre has reached the upper 95% confidence limit
  Centre has reached the upper 99.8% confidence limit

**Figure 3.21 Risk-adjusted 1 year patient survival rates for adult super-urgent deceased donor first liver transplants, 1 April 2016 - 31 March 2020**



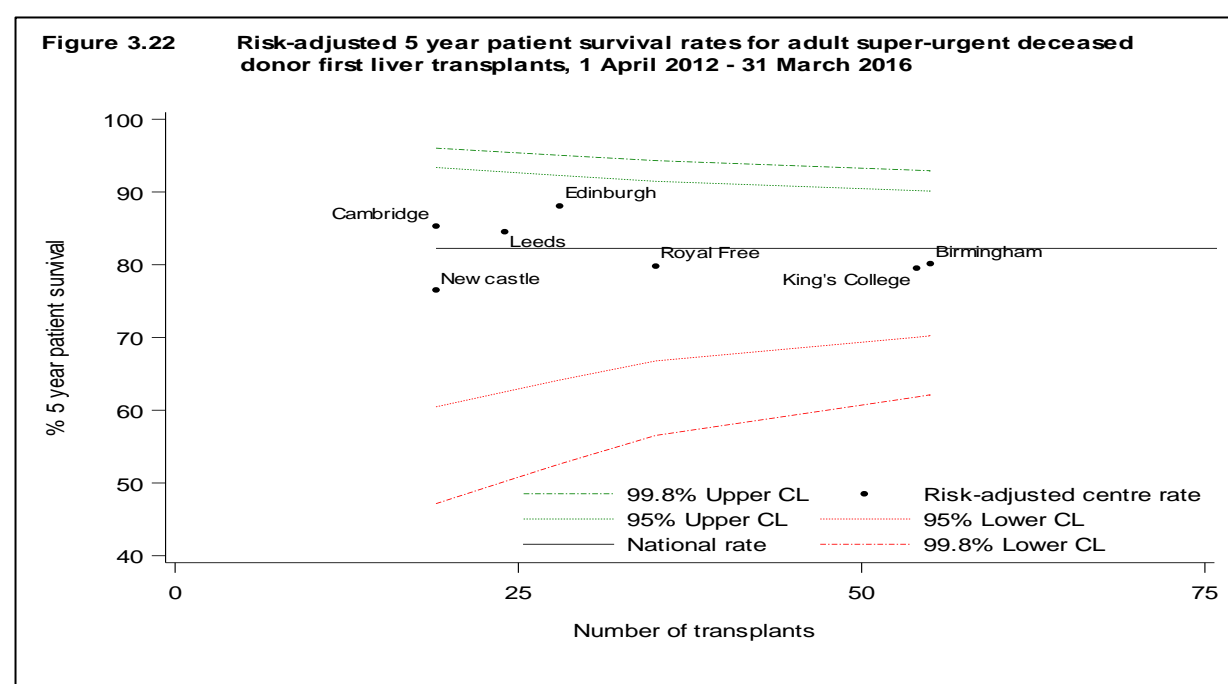
**Table 3.14** shows the five year [unadjusted](#) and [risk-adjusted patient survival](#) for 235 of the 255 transplants in the period, 1 April 2012 to 31 March 2016. The national rate is 82.5% and four centres have a lower survival rate after risk adjustment as shown in **Figure 3.22**. All fall within the 95% confidence limits.

The median number of days between the last known follow-up post-transplantation (for censored patients) and the time of analysis in **Table 3.14** and **Figure 3.22** ranges from 316 days for Birmingham to 877 days for Royal Free. The medians for all other centres fall in between these extremes.

<b>Table 3.14 Five year patient survival for adult super-urgent deceased donor first liver transplants, 1 April 2012 - 31 March 2016</b>					
Centre	Number of transplants	5-year survival % (95% CI)			
		Unadjusted		Risk-adjusted	
Newcastle	19	68.4	42.8 - 84.4	76.5	47.8 - 89.5
Leeds	24	83.1	61.0 - 93.3	84.6	59.0 - 94.2
Cambridge	19	83.1	55.9 - 94.3	85.7	55.8 - 95.4
Royal Free	35	82.7	65.3 - 91.9	80.8	57.2 - 91.4
King's College	54	86.8	74.3 - 93.5	79.8	57.6 - 90.4
Birmingham	55	81.3	67.9 - 89.5	80.3	63.5 - 89.4
Edinburgh	28	85.4	65.6 - 94.3	88.3	68.8 - 95.6
<b>Total</b>	<b>235</b>	<b>82.5</b>	<b>76.9 - 86.9</b>		

<div style="width: 20px; height: 10px; background-color: red; border: 1px solid black;"></div>	Centre has reached the lower 99.8% confidence limit
<div style="width: 20px; height: 10px; background-color: lightcoral; border: 1px solid black;"></div>	Centre has reached the lower 95% confidence limit
<div style="width: 20px; height: 10px; background-color: lightgreen; border: 1px solid black;"></div>	Centre has reached the upper 95% confidence limit
<div style="width: 20px; height: 10px; background-color: green; border: 1px solid black;"></div>	Centre has reached the upper 99.8% confidence limit



# **Adult Liver Transplantation**

## **Form return rates**

Form return rates are reported in **Table 3.15** for the liver transplant record, three month and one year follow up forms, along with lifetime follow up (after the first year). These include all adult [elective and super-urgent](#) deceased donor transplants between 1 January 2020 and 31 December 2020 for the transplant record, and all requests for follow-up forms issued in this time period. NHSBT are working closely with the Royal Free to ensure forms are completed and returned.

It should be noted that some of the forms issued later in 2020 may not have yet been “chased” by NHSBT when the report was produced in July 2021.

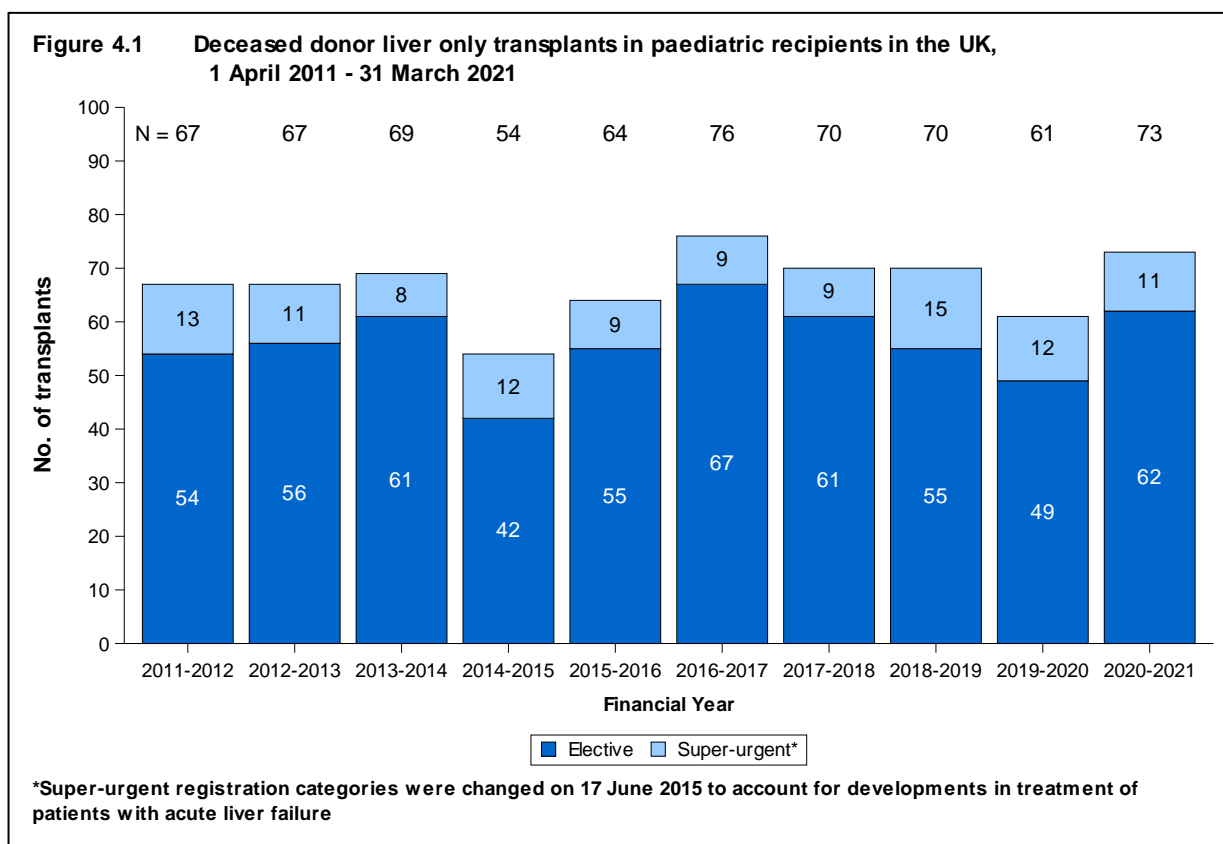
<b>Table 3.15 Form return rates for adult liver transplants, 1 January 2020 to 31 December 2020</b>								
Centre	Transplant record		3 month follow-up		1 year follow-up		Lifetime follow-up	
	N	% Returned	N	% Returned	N	% Returned	N	% Returned
Newcastle	25	100	27	100	29	100	210	100
Leeds	84	96	89	100	94	100	606	99
Cambridge	66	100	71	100	82	100	532	99
Royal Free	80	98	89	100	129	89	557	79
King's College	165	98	158	100	170	98	977	97
Birmingham	140	100	148	100	164	99	1019	96
Edinburgh	65	100	65	98	49	90	535	87
<b>Total</b>	<b>625</b>	<b>99</b>	<b>647</b>	<b>100</b>	<b>717</b>	<b>97</b>	<b>4436</b>	<b>94</b>

# **Paediatric Liver Transplantation**

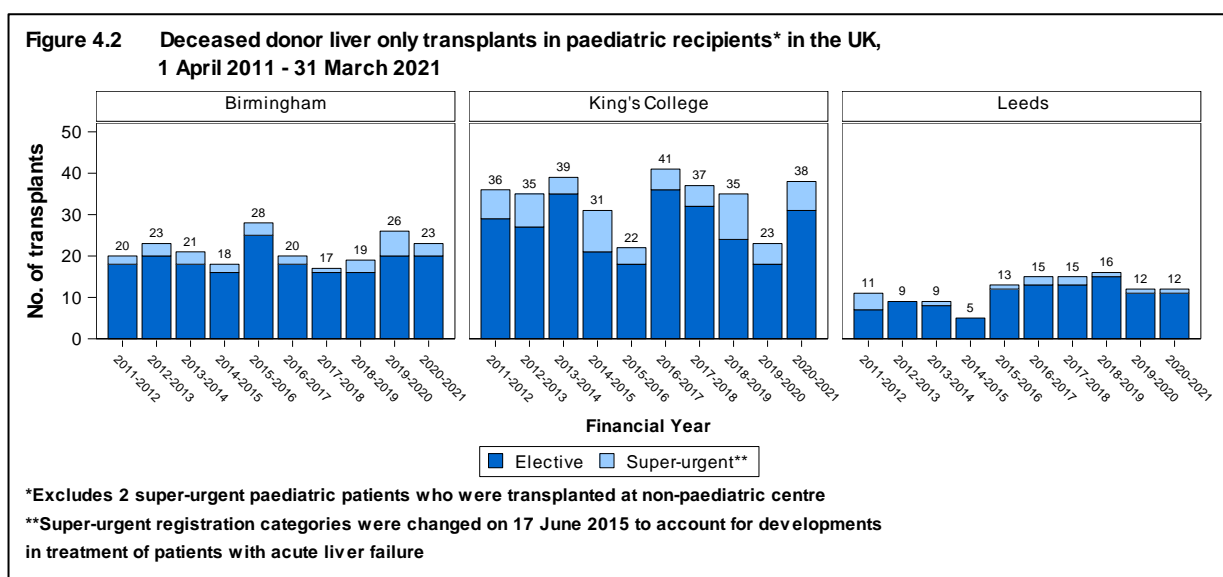


## 4.1 Overview

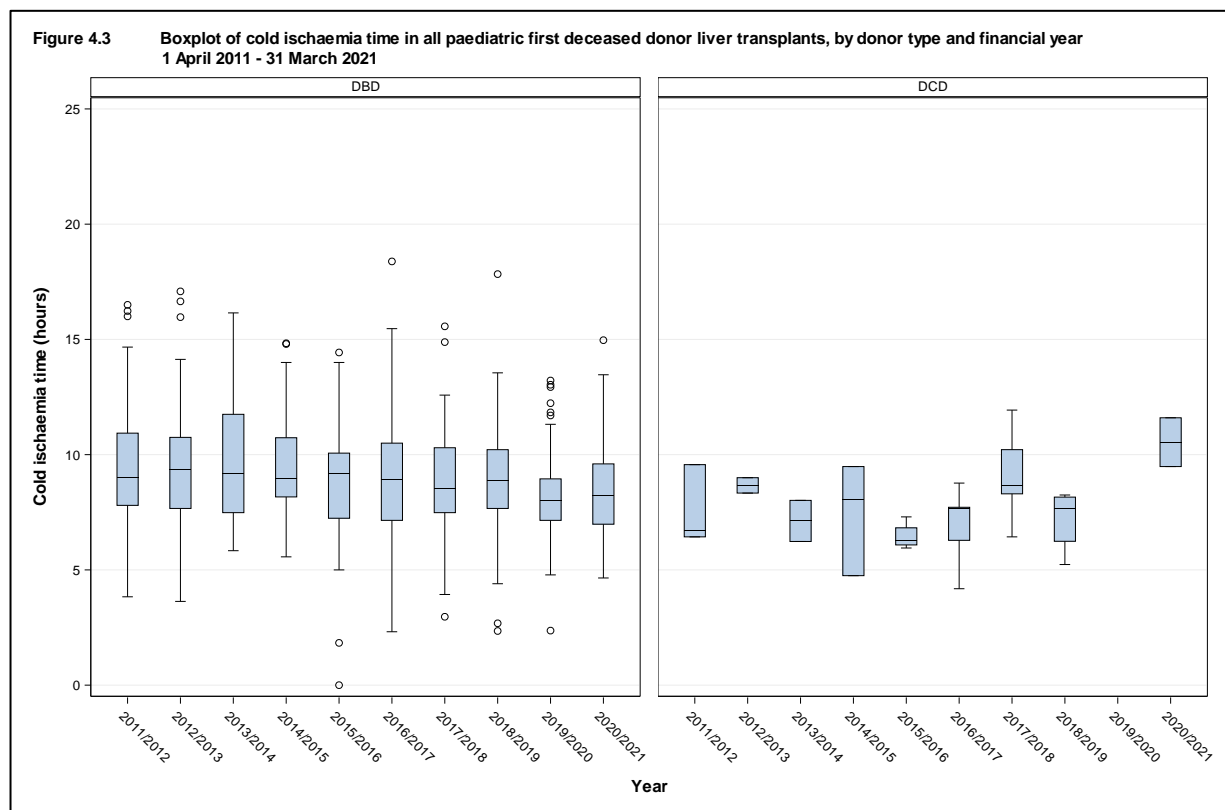
The number of deceased donor first liver only transplants for paediatric patients in the last ten years is shown overall and by centre in **Figures 4.1 and 4.2**, respectively. See **Appendix 1** for further details.



In the last year, 73 transplants in paediatric patients were performed. Sixty two (85%) of these transplants were for patients on the **elective** list and eleven (15%) for patients on the **super-urgent** list.



The overall [median cold ischaemia times](#) (CIT) for paediatric transplant recipients are shown by financial year in **Figure 4.3** for [DBD](#) and [DCD](#) donors, respectively. The national median CIT for transplants from DBD donors has decreased slightly from 9.0 hours in 2011/12 to 8.3 hours in 2020/21. The corresponding national median for DCD donor transplants has remained relatively stable over the ten year period, from 6.7 hours in 2011/12 to 10.5 hours in 2020/21. It should be noted the number of DCD paediatric transplants ranged between 0 and 7 per financial year with 2 in 2020/21.

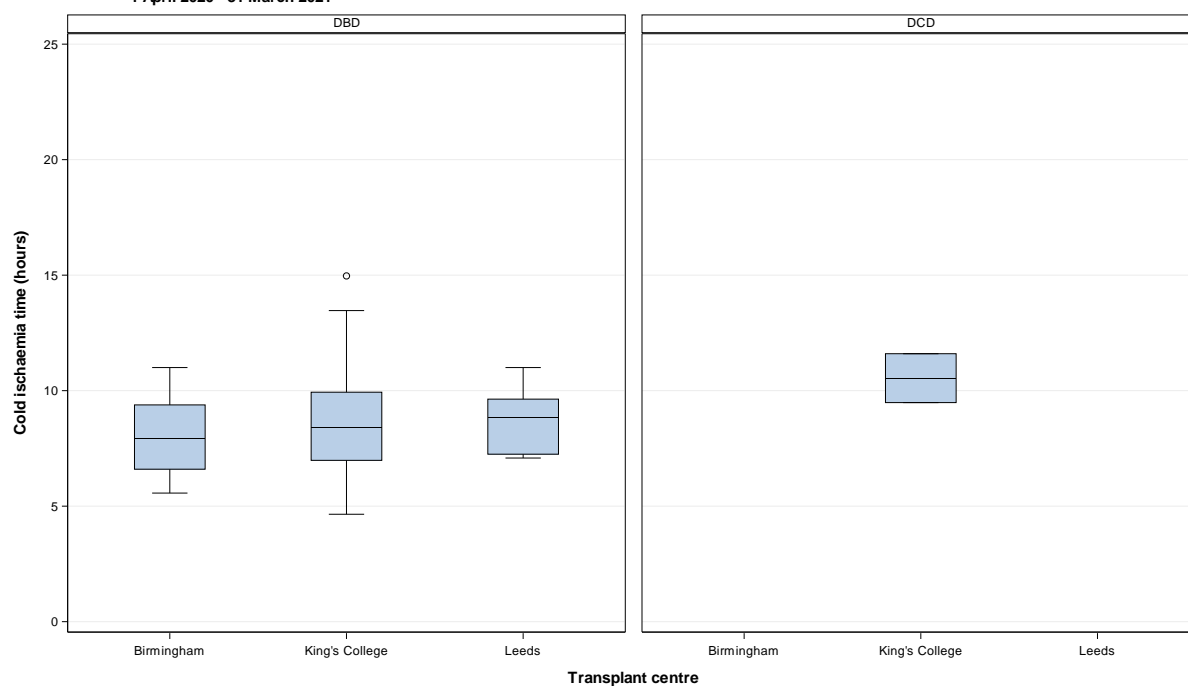


**Figure 4.4** shows boxplots of [cold ischaemia times](#) (CIT) for paediatric transplant recipients by centre in the latest financial year (2020/21) while **Figure 4.5** and **Figure 4.6** show the equivalent information by centre and donor type over the last ten financial years for [DBD](#) and [DCD](#) donors, respectively. The median (IQR) CIT for DBD in the last financial year were 8.0 (6.6, 9.4) hours at Birmingham, 8.4 (7.0, 9.9) hours at King's College and 8.9 (7.3, 9.6) hours at Leeds.

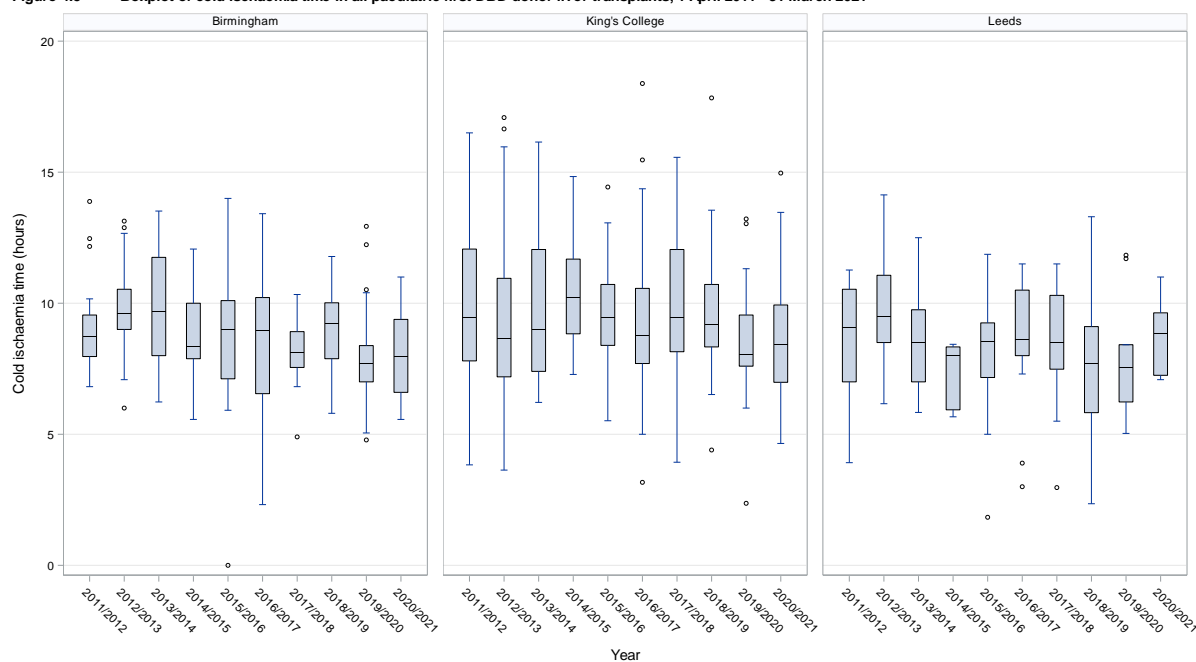
The cold ischaemia time used is as reported on the liver transplant record form and may include periods of machine perfusion; no adjustment has been made for this. One paediatric deceased donor first liver only transplant performed in the latest financial year was reported to have involved machine perfusion.

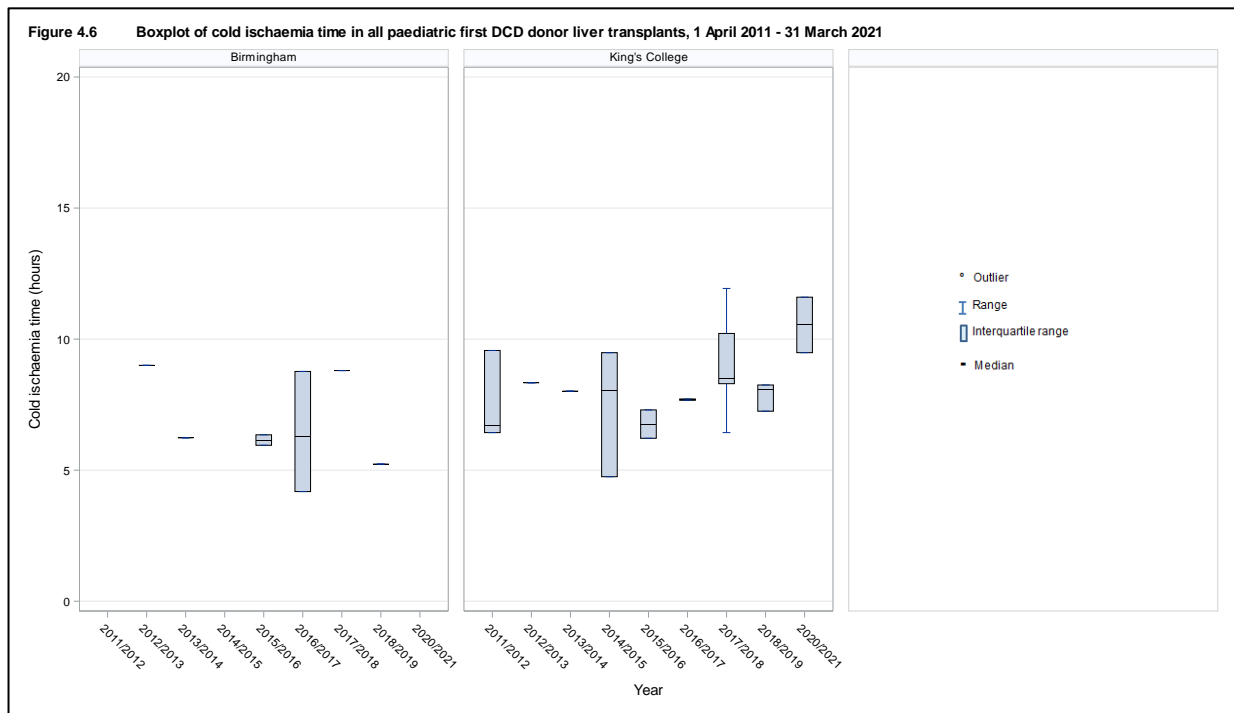


**Figure 4.4** Boxplot of cold ischaemia time in all paediatric first deceased donor liver transplants, by donor type and transplant centre  
1 April 2020 - 31 March 2021



**Figure 4.5** Boxplot of cold ischaemia time in all paediatric first DBD donor liver transplants, 1 April 2011 - 31 March 2021





The demographic characteristics of 93 paediatric registrations and 73 paediatric transplant recipients in the latest year are shown by centre and nationally in **Table 4.1**. Of the patients registered for a liver transplant, 56% were male, 28% were between 1 - 4 years old and 19% were registered as super-urgent. Of the transplant recipients, 55% were male, 33% were aged between one and four years old and 11 (15%) were of [super-urgent](#) status. For some characteristics, due to rounding, percentages may not add up to 100.

**Table 4.1 Demographic characteristics of UK paediatric registrations and deceased donor liver transplant recipients, 1 April 2020 - 31 March 2021**

		Birmingham N (%)		King's College N (%)		Leeds N (%)		TOTAL N (%)	
		Registration	Transplant	Registration	Transplant	Registration	Transplant	Registration	Transplant
Number		30	23	40	38	23	12	93	73
Recipient age years	<1	9 (30)	7 (30)	10 (25)	7 (18)	7 (30)	3 (25)	26 (28)	17 (23)
	1-4	10 (33)	8 (35)	10 (25)	12 (32)	6 (26)	4 (33)	26 (28)	24 (33)
	5-12	5 (17)	5 (22)	8 (20)	10 (26)	4 (17)	4 (33)	17 (18)	19 (26)
	13-16	6 (20)	3 (13)	12 (30)	9 (24)	6 (26)	1 (8)	24 (26)	13 (18)
Recipient sex	Male	13 (43)	8 (35)	28 (70)	24 (63)	11 (48)	8 (67)	52 (56)	40 (55)
	Female	17 (57)	15 (65)	12 (30)	14 (37)	12 (52)	4 (33)	41 (44)	33 (45)
Indication	Super Urgent	5 (17)	3 (13)	11 (28)	7 (18)	2 (8)	1 (8)	18 (19)	11 (15)
	Biliary Atresia	9 (30)	6 (26)	8 (20)	12 (32)	7 (29)	2 (17)	24 (26)	20 (27)
	Other Cholestatic	0 (0)	0 (0)	1 (3)	1 (3)	1 (4)	1 (8)	2 (2)	2 (3)
	Metabolic	2 (7)	2 (9)	4 (10)	5 (13)	3 (13)	1 (8)	9 (10)	8 (11)
	Other	14 (47)	12 (52)	16 (40)	13 (34)	11 (46)	7 (58)	41 (44)	32 (44)
Pre-transplant in-patient status	Out-patient		14 (61)		23 (61)		5 (42)		42 (58)
	In-patient		9 (39)		12 (32)		6 (50)		27 (37)
	Not reported		0 (0)		3 (8)		1 (8)		4 (6)
Pre-transplant renal support	No		22 (96)		32 (84)		10 (83)		64 (88)
	Yes		1 (4)		3 (8)		1 (8)		5 (7)
	Not reported		0 (0)		3 (8)		1 (8)		4 (6)
Ascites	Absence		15 (65)		26 (68)		5 (42)		46 (63)
	Presence		8 (35)		9 (24)		6 (50)		23 (32)
	Not reported		0 (0)		3 (8)		1 (8)		4 (6)
Previous abdominal surgery	No	14 (47)	14 (61)	14 (35)	16 (42)	11 (48)	7 (58)	39 (42)	37 (51)
	Yes	11 (37)	9 (39)	13 (33)	18 (47)	10 (43)	4 (33)	34 (37)	31 (43)
	Not reported	0 (0)	0 (0)	2 (5)	4 (11)	0 (0)	1 (8)	2 (2)	5 (7)
	Not collected	5 (17)	0 (0)	11 (28)	0 (0)	2 (8)	0 (0)	18 (19)	0 (0)

**Table 4.1 Demographic characteristics of UK paediatric registrations and deceased donor liver transplant recipients, 1 April 2020 - 31 March 2021**

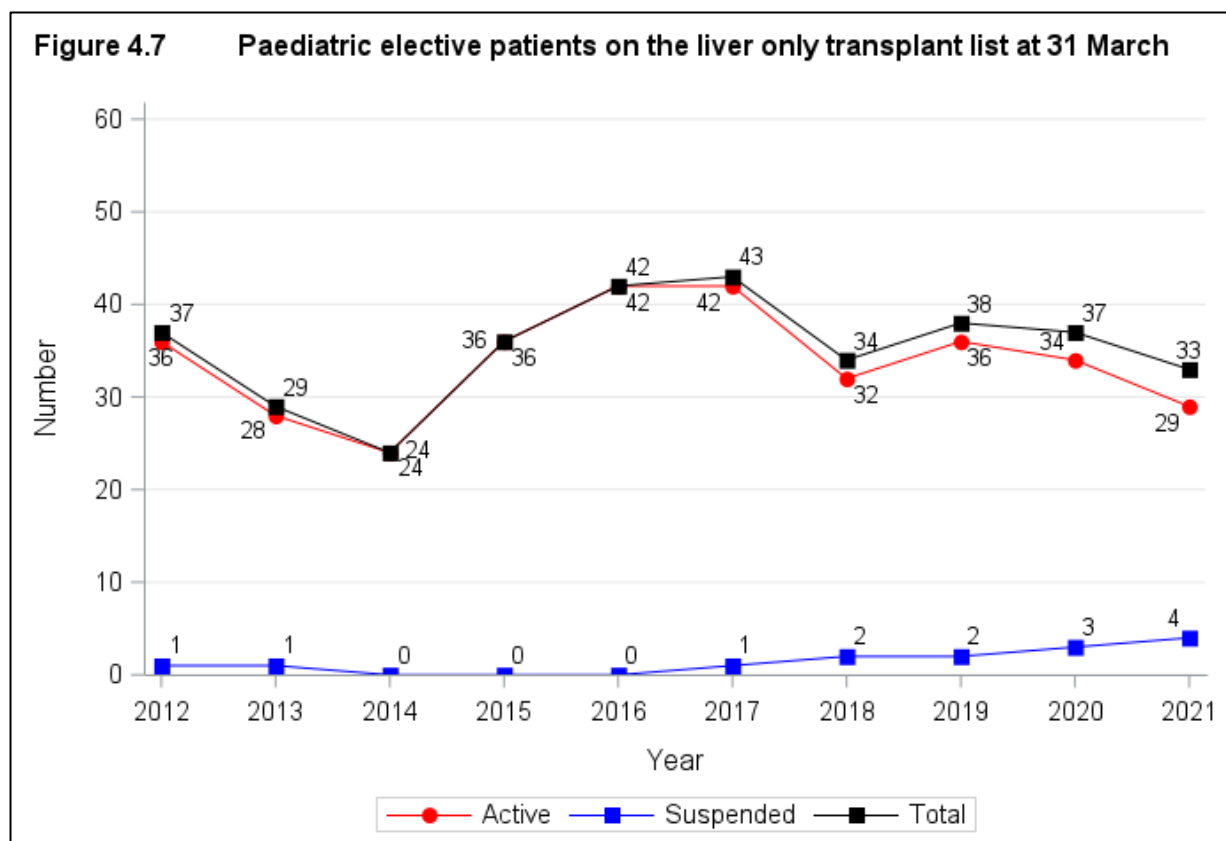
		Birmingham N (%)		King's College N (%)		Leeds N (%)		TOTAL N (%)	
		Registration	Transplant	Registration	Transplant	Registration	Transplant	Registration	Transplant
INR	<=1.0	13 (43)	11 (48)	14 (35)	7 (18)	3 (13)	4 (33)	<b>30 (32)</b>	<b>22 (30)</b>
	1.1-1.5	7 (23)	7 (30)	13 (33)	18 (47)	12 (52)	2 (17)	<b>32 (34)</b>	<b>27 (37)</b>
	1.6-3.0	7 (23)	4 (17)	1 (3)	6 (16)	6 (25)	4 (33)	<b>14 (15)</b>	<b>14 (19)</b>
	>3.0	3 (10)	1 (4)	9 (23)	4 (11)	2 (8)	1 (8)	<b>14 (15)</b>	<b>6 (8)</b>
	Not reported	0 (0)	0 (0)	3 (8)	3 (8)	0 (0)	1 (8)	<b>3 (3)</b>	<b>4 (6)</b>
Serum sodium mmol/l	<135	4 (13)	1 (4)	7 (18)	8 (21)	1 (4)	1 (8)	<b>12 (13)</b>	<b>10 (14)</b>
	>=135	26 (87)	22 (96)	30 (75)	27 (71)	22 (96)	9 (75)	<b>78 (84)</b>	<b>58 (80)</b>
	Not reported	0 (0)	0 (0)	3 (8)	3 (8)	0 (0)	2 (17)	<b>3 (3)</b>	<b>5 (7)</b>
Donor age years	<5		0 (0)		1 (3)		0 (0)		<b>1 (1)</b>
	5-16		4 (17)		4 (11)		1 (8)		<b>9 (12)</b>
	17-30		14 (61)		16 (42)		4 (33)		<b>34 (47)</b>
	>=31		5 (22)		17 (45)		7 (58)		<b>29 (40)</b>
Donor sex	Male		12 (52)		24 (63)		5 (42)		<b>41 (56)</b>
	Female		11 (48)		14 (37)		7 (58)		<b>32 (44)</b>
Donor type	DBD		23 (100)		36 (95)		12 (100)		<b>71 (97)</b>
	DCD		0 (0)		2 (5)		0 (0)		<b>2 (3)</b>
Graft appearance	Normal		23 (100)		35 (92)		10 (83)		<b>68 (93)</b>
	Abnormal		0 (0)		0 (0)		1 (8)		<b>1 (1)</b>
	Not reported		0 (0)		3 (8)		1 (8)		<b>4 (6)</b>
Graft type	Whole		2 (9)		9 (24)		1 (8)		<b>12 (16)</b>
	Reduced		4 (17)		16 (42)		4 (33)		<b>24 (33)</b>
	Segmental		17 (74)		13 (34)		7 (58)		<b>37 (51)</b>
Urgency Status	Elective	25 (83)	20 (87)	29 (73)	31 (82)	21 (91)	11 (92)	<b>75 (81)</b>	<b>62 (85)</b>
	Super Urgent	5 (17)	3 (13)	11 (28)	7 (18)	2 (9)	1 (8)	<b>18 (19)</b>	<b>11 (15)</b>

# **Paediatric Liver Transplantation Elective Patients**

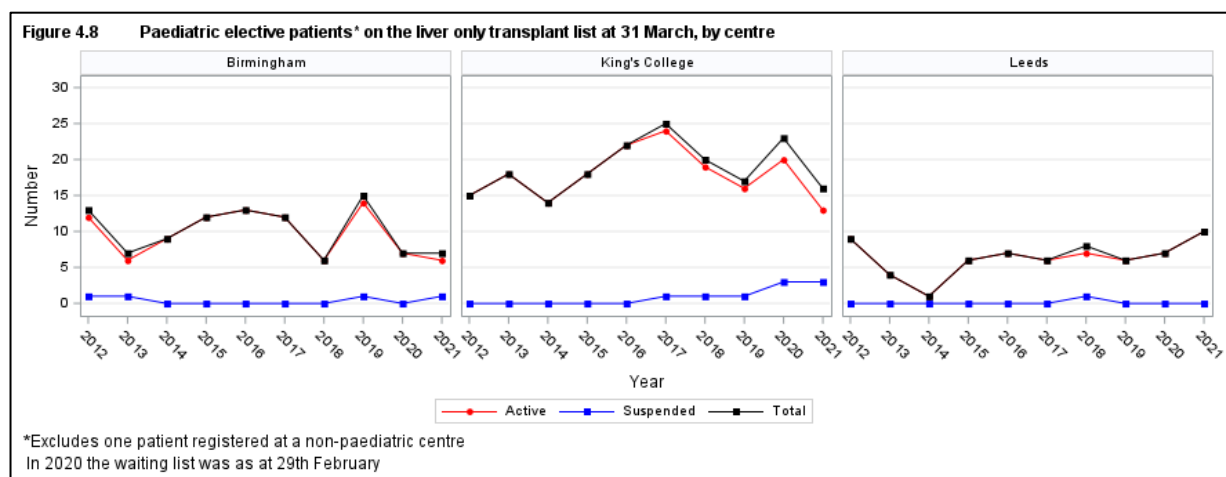


## 4.2.1 Transplant list

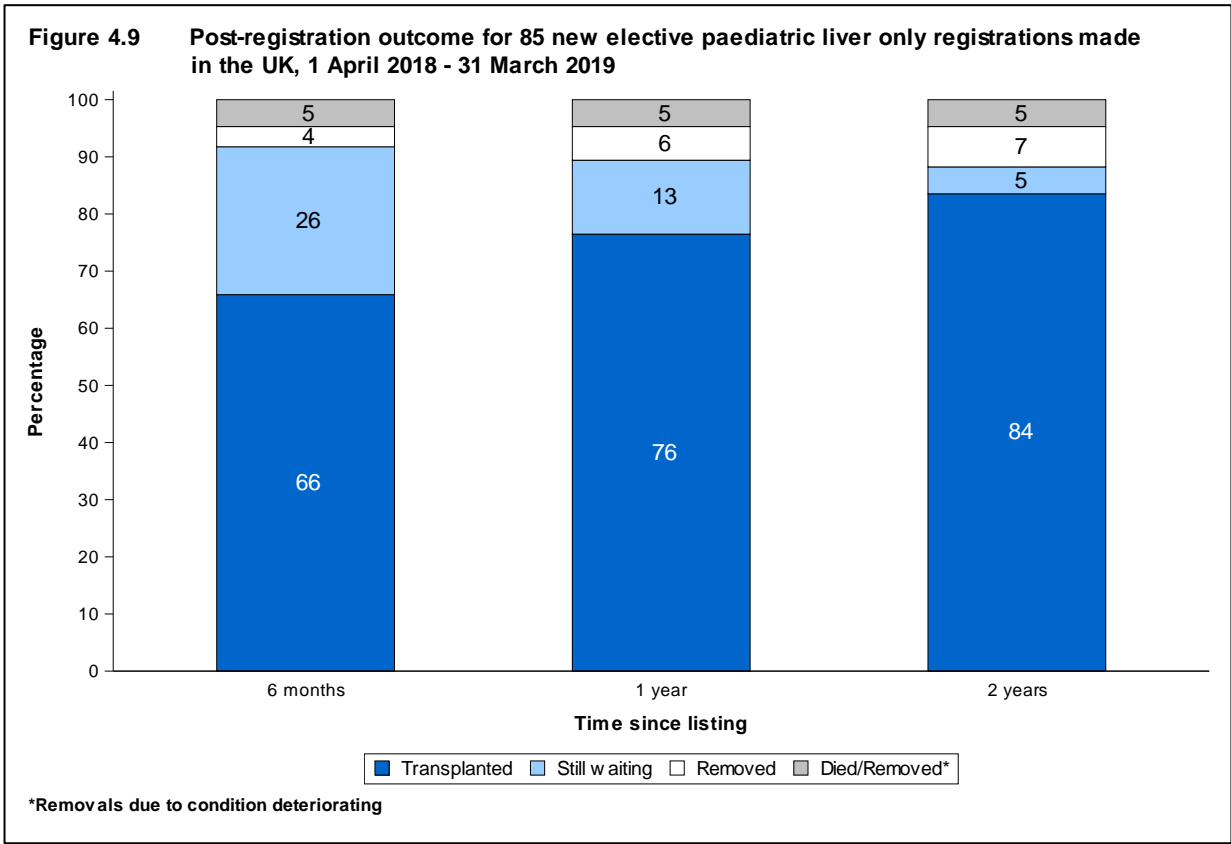
**Figure 4.7** shows the number of paediatric [elective](#) patients on the liver only transplant list at 31 March each year between 2012 and 2021. In 2020 the transplant list is as at 29 February. The number of patients on the [active](#) liver only transplant list has ranged between 24 and 42 each year with 29 paediatric patients active on the liver only transplants on 31 March 2021.



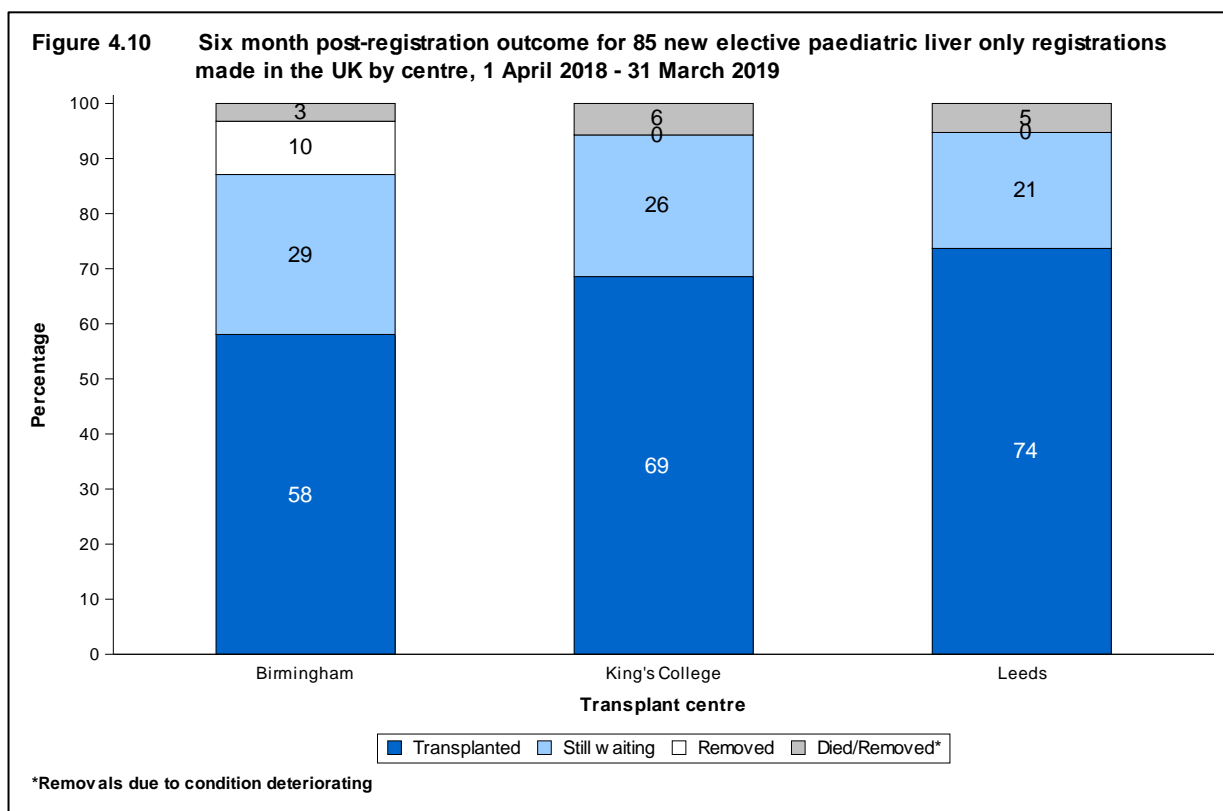
**Figure 4.8** shows the number of [elective](#) patients on the transplant list at 31 March each year between 2012 and 2021 for each transplant centre. In 2020 the transplant list is as at 29 February.



An indication of outcomes for paediatric patients listed for a liver transplant is summarised in **Figure 4.9**. This shows the proportion of patients transplanted or still waiting six months, one and two years after joining the list. After six months, 66% of patients have had a liver transplant, and 26% were still waiting.



**Figure 4.10** shows the proportion of patients transplanted, removed, died while waiting, or still waiting on the list at 6 months after joining the list at each transplant centre. The proportion of patients transplanted six months after listing at each centre ranges from 58% at Birmingham to 74% at Leeds.



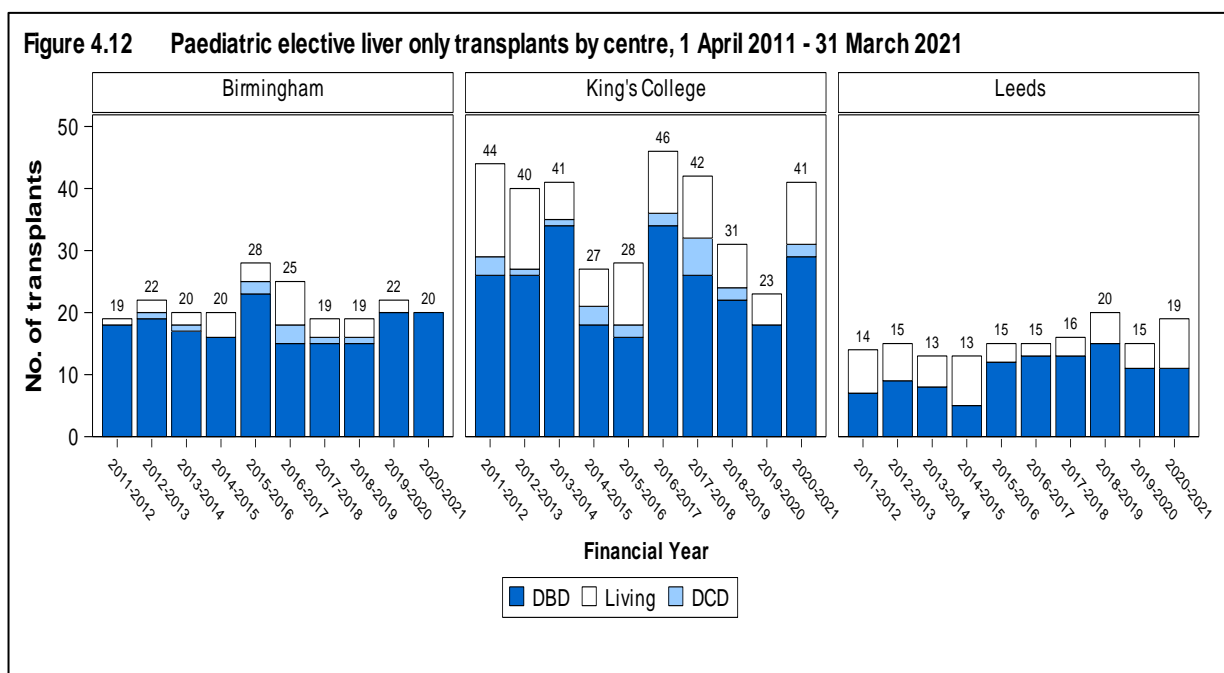
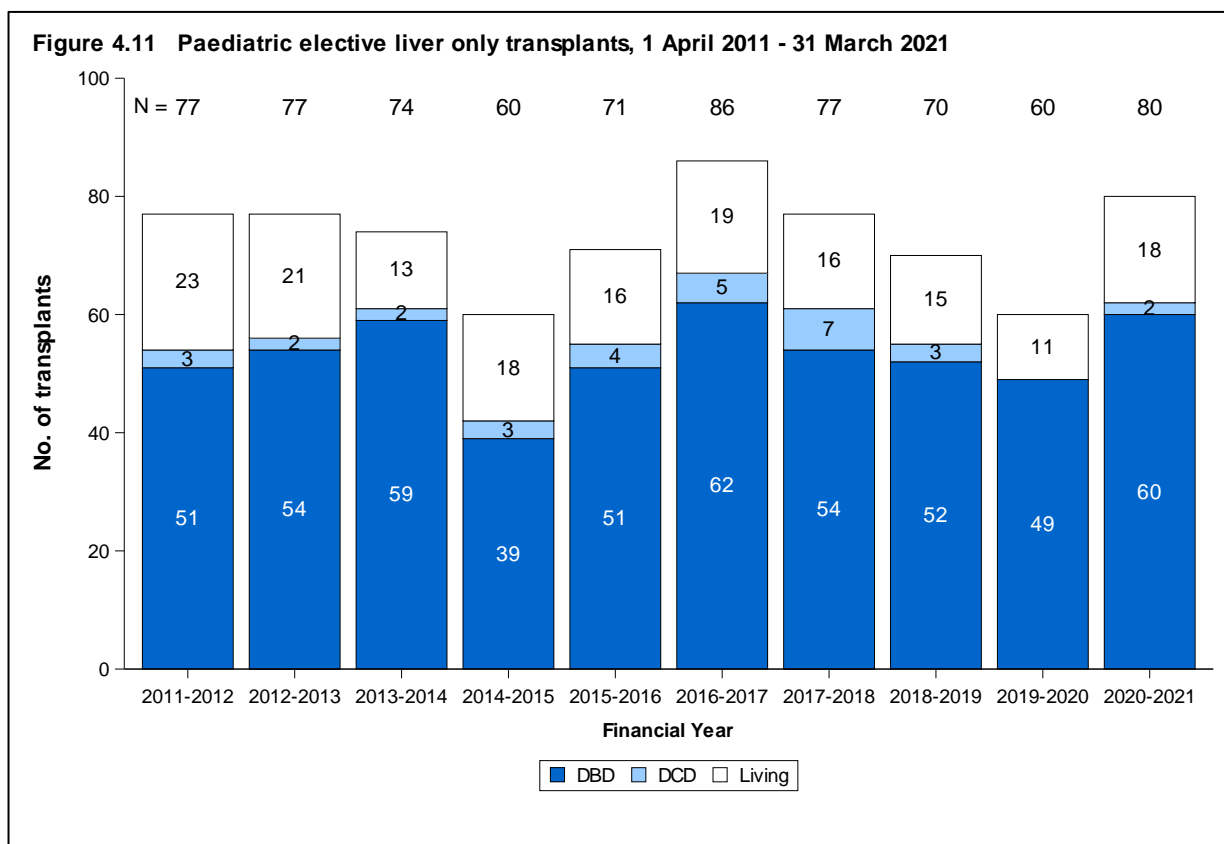
**Table 4.2** shows the [median waiting time](#) to deceased donor liver only transplant for paediatric [elective](#) patients. The median waiting time to transplant is longest at King's College at 81 days, and shortest at Leeds, at 66 days. The national median waiting time to transplant is 72 days.

Table 4.2 Median waiting time to liver only transplant in the UK, for paediatric elective patients registered 1 April 2018 - 31 March 2020			
Transplant centre	Number of patients registered	Waiting time (days)	
		Median	95% Confidence interval
Leeds	27	66	42 - 90
Birmingham	54	77	50 - 104
King's College	60	81	50 - 112
<b>UK</b>	<b>141</b>	<b>72</b>	<b>56 - 88</b>



## 4.2.2 Transplant activity

**Figure 4.11** shows the number of paediatric elective liver only transplants from deceased and living donors performed in the last ten years, by type of donor. **Figure 4.12** shows the same information by centre.



### 4.2.3 Post-transplant survival

**Table 4.3** shows the [unadjusted](#) one year paediatric [patient survival](#) for all 231 deceased donor transplants (excluding [auxiliary](#) transplants) from 1 April 2016 to 31 March 2020, nationally and by centre. Note that these survival rates should be interpreted with caution as one-year patient follow-up is incomplete for two of the three transplant centres (refer to **Table 4.8**).

<b>Table 4.3 One year unadjusted patient survival for paediatric elective deceased donor first liver transplants, 1 April 2016 - 31 March 2020</b>			
Centre	Number of transplants	1-year survival % (95% CI)	
Leeds	52	98.1	(87.1 - 99.7)
King's College	109	97.2	(91.6 - 99.1)
Birmingham	70	90.0	(80.1 - 95.1)
<b>Total</b>	<b>231</b>	<b>95.1</b>	<b>(91.4 - 97.3)</b>

**Table 4.4** shows the [unadjusted](#) five year paediatric [patient survival](#) for all 212 transplants (excluding [auxiliary](#) transplants) from 1 April 2012 to 31 March 2016, nationally and by centre. Note that these survival rates should be interpreted with caution as lifetime patient follow-up is incomplete for all centres (refer to **Table 4.8**).

<b>Table 4.4 Five year unadjusted patient survival for paediatric elective deceased donor first liver transplants, 1 April 2012 - 31 March 2016</b>			
Centre	Number of transplants	5-year survival % (95% CI)	
Leeds	34	100.0	-
King's College	99	92.5	(84.9 - 96.4)
Birmingham	79	93.6	(85.2 - 97.3)
<b>Total</b>	<b>212</b>	<b>94.1</b>	<b>(89.8 - 96.6)</b>

# **Paediatric Liver Transplantation Super-Urgent Patients**



### 4.3.1 Transplant list

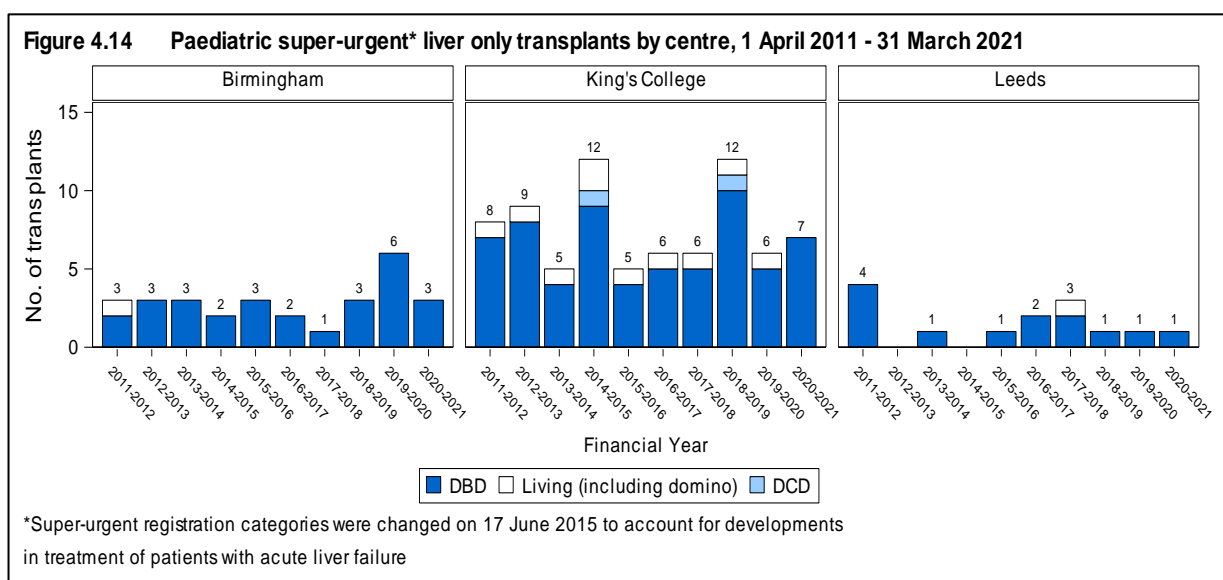
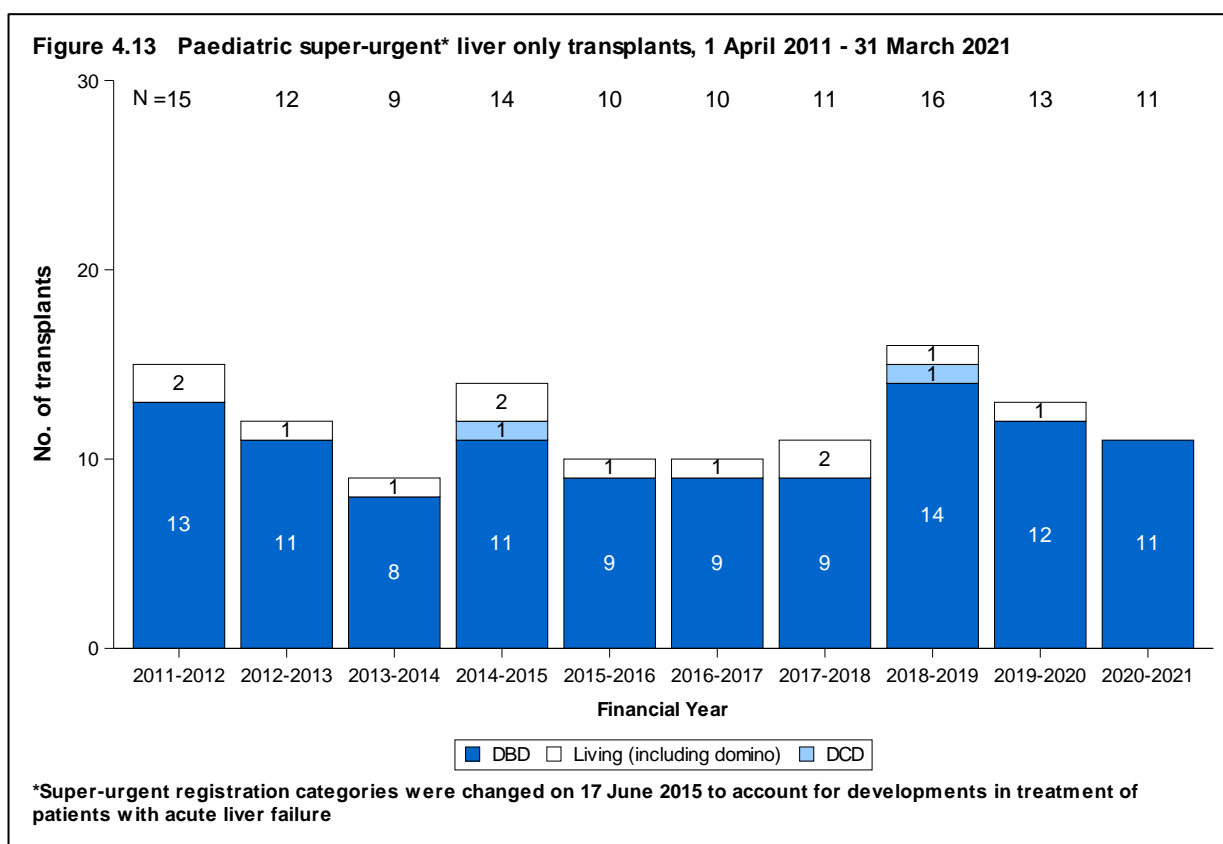
**Table 4.5** shows the [median waiting time](#) to deceased donor liver only transplant for paediatric [super-urgent](#) patients. The median waiting time to transplant is shortest at Leeds but there is no statistically significant difference across the three centres. The national median waiting time to transplant is four days.

<b>Table 4.5      Median waiting time to liver only transplant in the UK for, paediatric super urgent patients registered 1 April 2018 - 31 March 2020</b>			
Transplant centre	Number of patients registered	Waiting time (days)	
		Median	95% Confidence interval
Leeds	3	3	1 - 5
Birmingham	17	3	2 - 4
King's College	20	4	2 - 6
<b>National</b>	<b>40</b>	<b>4</b>	<b>3 - 5</b>

**Table 4.5** includes registrations for re-transplants. Of the 40 registrations for the UK in the time period, 34 led to transplants. 7 of the 34 transplants were re-transplants, hence, the difference between the 27 *first* deceased donor liver only transplants reported in **Figure 4.13** for the period 2018 – 2020 and **Table 4.5**.

### 4.3.2 Transplant activity

**Figure 4.13** shows the number of paediatric [super-urgent](#) first liver only transplants from deceased and living (including domino) donors performed in the last ten years, by type of donor. **Figure 4.14** shows the same information by transplant centre.



### 4.3.3 Post-transplant survival

One year [unadjusted patient survival](#) for 33 transplants (excluding [auxiliary](#) transplants) between 1 April 2016 and 31 March 2020 is shown in **Table 4.6**. Note that these survival rates should be interpreted with caution as one-year patient follow-up is incomplete for two of the three transplant centres (refer to **Table 4.8**).

<b>Table 4.6 One year unadjusted patient survival for paediatric deceased donor super urgent first transplants, 1 April 2016 - 31 March 2020</b>			
Centre	Number of transplants	1-year survival % (95% CI)	
Leeds	6 <sup>1</sup>	-	-
King's College	14	78.6	(47.2 - 92.5)
Birmingham	12	91.7	(53.9 - 98.8)
<b>Total*</b>	<b>33</b>	<b>87.7</b>	<b>(70.4 - 95.2)</b>
* Includes 1 patient transplanted at a non-paediatric centre			
<sup>1</sup> Survival rates for less than 10 transplants are not presented due to small numbers			

**Table 4.7** shows the [unadjusted](#) five year paediatric [patient survival](#) for 38 transplants (excluding [auxiliary](#) transplants) between 1 April 2012 and 31 March 2016, nationally and by centre. Note that these survival rates should be interpreted with caution as lifetime patient follow-up is incomplete for all centres (refer to **Table 4.8**).

<b>Table 4.7 Five year unadjusted patient survival for paediatric deceased donor super urgent first transplants, 1 April 2012 - 31 March 2016</b>			
Centre	Number of transplants	5-year survival % (95% CI)	
Leeds	2 <sup>1</sup>	-	-
King's College	24	74.5	(51.7 - 87.7)
Birmingham	11	72.7	(37.1 - 90.3)
<b>Total*</b>	<b>38</b>	<b>76.0</b>	<b>(58.9 - 86.8)</b>
* Includes 1 patient transplanted at a non-paediatric centre			
<sup>1</sup> Survival rates for less than 10 transplants are not presented due to small numbers			

The survival rates presented in the two tables have wide confidence intervals due to the small number of transplants performed and should, therefore, be interpreted with caution.

# **Paediatric Liver Transplantation Form return rates**



Form return rates are reported in **Table 4.8** for the liver transplant record, three month and one year follow up forms, along with lifetime follow-up (after the first year). These include all paediatric [elective and super-urgent](#) deceased donor transplants between 1 January 2020 and 31 December 2020 for the transplant record, and all requests for follow-up forms issued in this time period. Note that the Leeds Data Collector contract ended at the beginning of 2016 and that NHSBT are working closely with Leeds to ensure that all forms are completed and returned to NHSBT.

<b>Table 4.8 Form Return rates 1 January 2020 - 31 December 2020</b>								
Centre	Transplant Record		3 Month follow-up		1 year follow-up		Lifetime follow-up	
	N	% returned	N	% returned	N	% returned	N	% returned
Leeds	15	87	14	93	11	64	80	40
King's College	36	94	33	100	21	95	224	85
Birmingham	24	100	23	100	26	100	127	98
<b>Total</b>	<b>75</b>	<b>95</b>	<b>70</b>	<b>99</b>	<b>58</b>	<b>91</b>	<b>433</b>	<b>80</b>





# Appendix



## A1 Data

Data were obtained from the UK Transplant Registry for the ten year time period, 1 April 2011 to 31 March 2021 and include NHS Group 2 transplants, [auxiliary](#) transplants, liver only transplants for intestinal failure patients and exclude all other transplants involving the liver for intestinal failure patients.

### Geographical variation analysis Registration rates

All NHS group 1 patients who were registered onto the liver transplant list with an active status between 1 April 2020 and 31 March 2021 were extracted from the UK Transplant Registry on 14 July 2021 (numerator). Patients registered for an intestinal transplant requiring a liver were excluded. Patients were assigned to NHS regions in England using their postcode of residence, as reported at registration. The number of registrations per million population (pmp) by NHS region was obtained using mid-2019 population estimates based on the Office for National Statistics (ONS) 2011 Census figures (denominator). No NHS region age- or sex-specific standardisation of rates was performed.

The registration rates pmp were categorised into four groups – low, low-medium, medium-high and high – based on the quartiles of their distribution and visualised in a map using contrasting colours.

### Transplant rates

Transplant rates pmp were obtained as the number of liver transplants on NHS group 1 recipients between 1 April 2020 and 31 March 2021 (numerator), divided by the mid-2019 population estimates from the ONS (denominator). Patients who received an intestinal transplant containing a liver were excluded. Transplant rates pmp were categorised and visualised in a map as done for the registration rates.

### Systematic component of variation

Only registrations or transplants in England between 1 April 2020 and 31 March 2021 were included. If a patient was re-registered during the time period, only the first registration was considered. If a patient underwent more than one liver transplant in the time period, only the first transplant was considered.

### Adult and paediatric analysis

The adult and paediatric sections are limited to first liver only transplants, and survival is only estimated for deceased donor transplants, excluding [auxiliary](#) transplants.

**Table A1.1** shows the total number of adult transplants in the three time periods defined in the report, including atypical donor, [multi-organ](#) and re-transplants. **Table A1.2** shows the number of adult deceased donor first liver only transplants.

**Table A1.1 Number of adult liver transplants in each time period, by transplant centre and urgency status**

Transplant centre	Latest year		Last 3 years		Last 10 years	
	April 2020-March 2021		April 2018-March 2021		April 2011-March 2021	
	Elective	Super-urgent	Elective	Super-urgent	Elective	Super-urgent
Newcastle	30	4	85	13	337	48
Leeds	88	10	276	39	981	124
Cambridge	75	12	272	32	842	108
Royal Free	72	7	308	36	861	132
King's College	151	13	517	51	1639	180
Birmingham	130	13	509	51	1690	188
Edinburgh	63	4	217	23	825	93
<b>TOTAL</b>	<b>613<sup>1</sup></b>	<b>63</b>	<b>2193<sup>2</sup></b>	<b>245</b>	<b>7200<sup>3</sup></b>	<b>873</b>

<sup>1</sup> Includes 4 transplants performed at London Bridge Hospital

<sup>2</sup> Includes 9 transplants performed at London Bridge Hospital

<sup>3</sup> Includes 21 and 4 transplants at London Bridge Hospital and Cromwell Hospital, respectively

**Table A1.2 Number of deceased donor adult first liver only transplants in each time period, by transplant centre and urgency status**

Transplant centre	Latest year		Last 3 years		Last 10 years	
	April 2020-March 2021		April 2018-March 2021		April 2011-March 2021	
	Elective	Super-urgent	Elective	Super-urgent	Elective	Super-urgent
Newcastle	26	3	78	12	297	41
Leeds	81	9	251	30	879	81
Cambridge	61	8	239	20	765	61
Royal Free	63	5	290	31	799	101
King's College	137	11	458	40	1422	144
Birmingham	107	11	440	38	1507	140
Edinburgh	60	3	203	11	764	54
<b>TOTAL</b>	<b>535</b>	<b>50</b>	<b>1959</b>	<b>182</b>	<b>6433</b>	<b>622</b>

**Table A1.3** shows the total number of paediatric transplants in the three time periods defined in the report, including atypical donor, [multi-organ](#) and re-transplants. **Table A1.4** shows the number of paediatric deceased donor first liver only transplants. Transplants were excluded from the [patient survival](#) analysis if [risk factors](#) were missing. Therefore, missing factors were not imputed.

**Table A1.3 Number of paediatric liver transplants in each time period, by transplant centre and urgency status**

Transplant centre	Latest year		Last 3 years		Last 10 years	
	April 2020-March 2021		April 2018-March 2021		April 2011-March 2021	
	Elective	Super-urgent	Elective	Super-urgent	Elective	Super-urgent
Newcastle	0	0	0	0	0	1
Leeds	19	1	56	4	167	23
Cambridge	0	0	0	0	0	1
Royal Free	0	0	0	0	1	1
King's College	41	8	104	29	388	88
Birmingham	22	4	69	16	261	46
<b>TOTAL</b>	<b>82</b>	<b>13</b>	<b>229</b>	<b>49</b>	<b>817</b>	<b>160</b>

**Table A1.4 Number of deceased donor paediatric first liver only transplants in each time period, by transplant centre and urgency status**

Transplant centre	Latest year		Last 3 years		Last 10 years	
	April 2020-March 2021		April 2018-March 2021		April 2011-March 2021	
	Elective	Super-urgent	Elective	Super-urgent	Elective	Super-urgent
Newcastle	0	0	0	0	0	1
Leeds	11	1	37	3	104	13
Cambridge	0	0	0	0	0	1
King's College	31	7	73	23	271	66
Birmingham	20	3	56	12	187	28
<b>TOTAL</b>	<b>62</b>	<b>11</b>	<b>166</b>	<b>38</b>	<b>562</b>	<b>109</b>

## A2 Methods

### Waiting time to transplant

Waiting time is calculated from date of registration to date of transplant, for patients registered for a liver. Patients who are registered for another organ within the timeframe are excluded and only deceased donor transplants are included. Registrations for a re-transplant are included. [Kaplan-Meier](#) estimates are used to calculate waiting time, where patients who are removed or died on the waiting list are censored at the date of the event. Patients who are still actively waiting for a transplant are censored at that time. Any periods of suspension are not included in the waiting time.

### Geographical variation analysis

For a given individual who is a resident in a given NHS region 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.

A one-sided p-value for the hypothesis that the SCV is greater than zero versus the null hypothesis that the SCV is equal to zero was derived using a parametric bootstrap where data were simulated from the Poisson distribution that would be consistent with the null hypothesis (multiplicative rate factor is equal to one in all areas and  $\sigma^2$  equal to zero). The observed SCV was then compared against this simulated data to

calculate the probability that an SCV of at least this size would be observed due to chance if the null hypothesis were true.

10,000 bootstrap samples of size 7 (number of areas) were simulated, where the registration/transplant count in each area was drawn from a Poisson distribution with its expected value being the area-specific expected count (the rate of transplants/registrations in the total population multiplied by the population of the area). The SCV was then calculated in each of the 10,000 samples and a bootstrap p-value for the SCV in the observed data was estimated as:

$$P_{boot} = \frac{1 + \#\{SCV_{sim} \geq SCV_{obs}\}}{10000 + 1}$$

where  $\#\{SCV_{sim} \geq SCV_{obs}\}$  is the number of SCV values in the simulated datasets which are greater than or equal to the SCV in the observed data. This follows the simulation method given in Ibanez et al., BMC Health Services Research, 2009, 9:60. No adjustment was made for area-specific demographic characteristics that may impact the rates of registration to the transplant list and transplantation such as age and sex.

### Unadjusted survival rates

[Unadjusted patient survival](#) and [graft function](#) rates were estimated using [Kaplan-Meier](#) methods. Patient survival rates are based on the number of patients transplanted and the number and timing of those that die within the post-transplant period of interest. Patients can be included in this method of analysis irrespective of the length of follow-up recorded. If a patient is alive at the end of the follow-up, then information about the survival of the patient is censored at the time of analysis. Death, irrespective of whether the graft is still functioning or not, is classed as an event. Estimates of graft function follow similar principles but the event of interest is graft failure in living post-transplant patients instead of patient death.

### 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 the same mix of patients as the one seen nationally. The risk-adjusted rate therefore presents estimates for which differences in the patient mix across centres have been removed as much as possible. For that reason, it is valid to only compare centres using risk-adjusted rather than unadjusted rates, as differences among the latter can be attributed to differences in the patient mix.

Risk-adjusted survival estimates were obtained through indirect standardisation. A [Cox Proportional Hazards model](#) was used to determine the probability of survival for each patient based on their individual risk factor values. The sum of these probabilities for all patients at a centre gives the number,  $E$ , of patients or grafts expected to survive at least one year or five years after transplant at that centre. The number of patients who actually survive the time period of interest 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 **survival post transplantation** models are shown in **Tables A3.1 and A3.2** below.

The [funnel plot](#) is a graphical method to show how consistent the survival rates of the different transplant centres are compared to the national rate. The graph shows for each centre, 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.

A fundamentally similar method was used to conduct the **survival from listing** analysis. The [risk factors](#) used in this case were: recipient blood group, recipient age at registration, recipient ethnic group, recipient primary disease at registration, recipient sex, recipient BMI, serum creatinine, serum sodium, serum bilirubin, INR and year of registration, as shown in **Table A3.3**.

### A3 Risk models

Table A3.1 Risk factors and categories used in the adult elective risk adjusted survival models post transplantation	
Recipient sex	Male Female
Recipient ethnicity	White Non-white
Indication	Cancer HCV ALD HBV PSC PBC AID Metabolic Other Acute hepatic failure
Recipient HCV status	Negative Positive
Pre-transplant in-patient status	Out-patient In-patient
Ascites	Absence Presence
Encephalopathy	Absence Presence
Pre-transplant renal support	No Yes
Previous abdominal surgery	No Yes
Varices & shunt	Absence Presence without treatment Presence with surgical shunt Presence with TIPS
Life style activity	Normal Restricted Self-care Confined Reliant
Graft appearance	Normal Abnormal
Recipient age years	Per 1 year increase
BMI kg/m <sup>2</sup>	Per 1 kg/m <sup>2</sup> increase
Serum Bilirubin µmol/l	≤30 31-50 51-70

**Table A3.1 Risk factors and categories used in the adult elective risk adjusted survival models post transplantation**

	71-90
	≥91
Serum Creatinine µmol/l	≤70
	71-90
	91-110
	111-130
	≥131
Serum sodium mmol/l	Per 10 mmol/l increase
Serum potassium mmol/l	Per 1 mmol/l increase
INR	Per 1 unit increase
Serum Albumin g/l	Per 5g/l increase
Cold Ischaemia time	Per 1 hour increase
Time on transplant list	Per 1 month increase
Donor sex	Male
	Female
Donor ethnicity	White
	Non-white
Donor cause of death	Trauma
	CVA
	Others
Donor history of diabetes	No
	Yes
Donor type	Donor after brain death
	Donors after circulatory death
ABO match	Identical
	Compatible
	Incompatible
Graft type	Whole
	Segmental
Donor age years	Per 1 year increase
Donor BMI kg/m <sup>2</sup>	Per 1 kg/ m <sup>2</sup> increase

**Table A3.2 Risk factors and categories used in the adult super-urgent risk adjusted survival models post transplantation**

Recipient sex	Male
	Female
Recipient ethnicity	White
	Non-white
Recipient HCV status	Negative
	Positive
Pre-transplant in-patient status	Out-patient
	In-patient
Ascites	Absence
	Presence
Encephalopathy	Absence
	Presence
Pre-transplant renal support	No
	Yes
Previous abdominal surgery	No
	Yes
Varices & shunt	Absence
	Presence without treatment
	Presence with surgical shunt
	Presence with TIPS

<b>Table A3.2      Risk factors and categories used in the adult super-urgent risk adjusted survival models post transplantation</b>	
Life style activity	Normal Restricted Self-care Confined Reliant
Graft appearance	Normal Abnormal
Recip age years	Per 1 year increase
BMI kg/m <sup>2</sup>	Per 1 kg/m <sup>2</sup> increase
Serum Bilirubin µmol/l	≤100 101-200 201-300 301-400 ≥401
Serum Creatinine µmol/l	≤100 101-130 131-160 161-190 ≥191
Serum sodium mmol/l	Per 10 mmol/l increase
Serum potassium mmol/l	Per 1 mmol/l increase
INR	Per 1 unit increase
Serum Albumin g/l	Per 5g/l increase
Cold Ischaemia time	Per 1 hour increase
Time on transplant list	Per 1 day increase
Donor sex	Male Female
Donor ethnicity	White Non-white
Donor cause of death	Trauma CVA Others
Donor history of diabetes	No Yes
Donor type	Donor after brain death Donors after circulatory death
ABO match	Identical Compatible Incompatible
Graft type	Whole Segmental
Donor age years	Per 1 year increase
Donor BMI kg/m <sup>2</sup>	Per 1 kg/ m <sup>2</sup> increase



Table A3.3 Risk factors and categories used in the adult elective risk adjusted survival models post registration	
Recipient sex	Male Female
Recipient ethnicity	White Non-white
Recipient age at registration years	Per 1 year increase
Recipient BMI kg/m <sup>2</sup>	Per 1 kg/m <sup>2</sup> increase
Recipient blood group	O A B AB
Indication	Cancer HCV ALD HBV PSC PBC AID Metabolic Other
Serum sodium mmol/l	Per 10 mmol/l increase
Serum creatinine µmol/l	Per 10 µmol/l increase
Serum bilirubin µmol/l	Per 10 µmol/l increase
INR	Per 1 unit increase
Year of registration	Split into three time intervals equally divided

## **A4 Glossary of terms**

### **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 organ becomes available, the patient is included among those who are matched against the donor to determine whether or not the organ 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 organs that become available. Permanent suspension is known as a removal from the waiting list and is not included in suspended figures.

### **Auxiliary transplant**

An auxiliary liver transplant involves surgically attaching part of a donor liver to the whole liver of the recipient without removal. The donor liver supports the native liver until it recovers. The donor liver can then be removed or left attached.

### **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.

### **Cold ischaemia time (CIT)**

The length of time that elapses between an organ being removed from the donor to its transplantation into the recipient is called Cold Ischaemia Time (CIT). Generally, the shorter this time, the more likely the organ is to work immediately and the better the long-term outcome. The factors which determine CIT include a) transportation of the organ 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 organ 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. Note that NHSBT currently do not record whether machine perfusion was used either prior to retrieval or prior to the organ being transplanted. In cases where organ maintenance systems were used not all of this time duration is ischaemic, and no adjustment has been made for this in this report.

### **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.

### **Donor type**

Liver donors can be of different types.

*Donor after brain death (DBD)* means donation which takes place following the diagnosis of death using neurological criteria.

*Donor after circulatory death (DCD)* means donation which takes place following the diagnosis of death using circulatory criteria.

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

*Domino donor.* A donor with a certain type of rare degenerative liver disease who receives a liver transplant to treat their condition. This donor gives their liver to another recipient in a domino liver transplant, because the liver still functions well for other recipients.

### **Elective and super-urgent patients**

Separate selection criteria to join the liver transplant list have been devised for those patients requiring emergency transplantation (super-urgent) compared to those who require a routine procedure (elective transplantation). The two groups have a different range of aetiologies with markedly different short-term prognoses; different criteria are required to define that prognosis. Similarly, processes to allocate a donor liver are different for super-urgent and elective transplantation, reflecting those patient groups with a different risk of death without transplantation.

### **Funnel plot**

A graphical method that shows how consistent the rates, such as survival rates or decline rates, of the different transplant units are compared to the national rate. For survival rates, 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 function**

The percentage of patients who are alive with a functioning graft. This is usually specified for a given time period after transplant. For example, a 90 day graft function rate is the percentage of patients alive with a functioning graft 90 days after transplant.

**Inter-quartile range (IQR)**

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

**Kaplan-Meier method**

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

**Median**

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

**Multi-organ transplant**

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

**Patient survival rate**

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

***p* value**

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

**Risk-adjusted survival rate**

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

**Risk factors**

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

**Unadjusted survival rate**

Unadjusted survival rates do not take account of [risk factors](#) and are based only on the number of transplants at a given centre and the number and timing of those that fail within the post-transplant period of interest. In this case, unlike for [risk-adjusted rates](#), all transplants are assumed to be equally likely to fail at any given time.

However, some centres may have lower unadjusted survival rates than others simply because they tend to undertake transplants that have increased risks of failure.

Comparison of unadjusted survival rates across centres and to the national rate is therefore inappropriate.

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