NHS
Blood and Transplant

ANNUAL REPORT ON LIVER TRANSPLANTATION

REPORT FOR 2023/2024
(1 APRIL 2014 – 31 MARCH 2024)

PUBLISHED SEPTEMBER 2024

PRODUCED IN COLLABORATION WITH NHS ENGLAND

Contents

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 2014 to 31 March 2024. 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 20th March 2018 for offering livers from donors after brain death (DBD).

Key findings

- There were 806 patients on the UK liver transplant list on 31 March 2024 of which 678 patients were on the UK active transplant list.

- Of the patients joining the elective liver only waiting list, approximately 69% had received a transplant within two years of listing.

- There were 9183 liver transplants performed in the UK in the ten year period. The number of liver transplants using deceased donors decreased in 2023/2024 compared with 2022/2023 for donors after brain death (5.9%) and increased for donors after circulatory death (6.0%).

- 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 (%)
Adult		
Elective	95	83
Super-urgent	90	84
Paediatric		
Elective	95	92
Super-urgent	90	91

- The national rates of patient survival after joining the transplant list for adult elective first liver only patients were 89% at one and 76% at five years post-registration.

How to cite this report:
Annual Report on Liver Transplantation 2023/2024. NHS Blood and Transplant.

Introduction

This report presents information on the UK transplant list, transplant activity and transplant outcomes between 1 April 2014 and 31 March 2024, 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.

Patients registered and transplanted at Dublin in the Republic of Ireland (RoI) are included in the centre specific charts and tables but not in the overall charts throughout the report. It has been noted in both the text and relevant figures and tables where Dublin has been included.

Patient survival from both registration and transplant are reported for cohorts of patients registered or transplanted between 1 April 2014 and 31 March 2019 for 5 year survival, and 1 April 2019 to 31 March 2023 for 1 year survival. Results are described separately for adults (aged≥17 years) and paediatrics (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 ≥18 years.

2.1 Transplant list

Figure 2.1 shows the total number of liver patients on the UK active transplant list at 31 March each year between 2014 and 2024. It should be noted that the transplant list on 31 March 2021 is not reflective of the true active transplant list due to restrictions imposed during COVID-19. Patients active in Dublin are not included.

There has been a decrease in the number of patients registered on the UK active liver transplant list between 2014-2015 and 2019-2020. However, this number has increased to 678 patients active in March 2024, higher than pre-pandemic levels.

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 diseases.

Figure 2.1 **Patients on the active liver transplant list in the UK at 31 March**

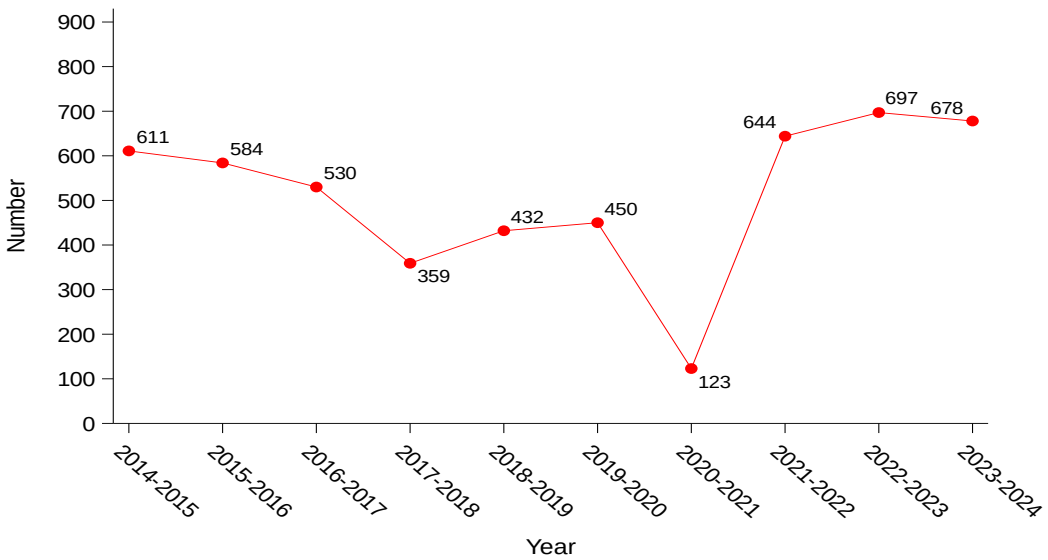
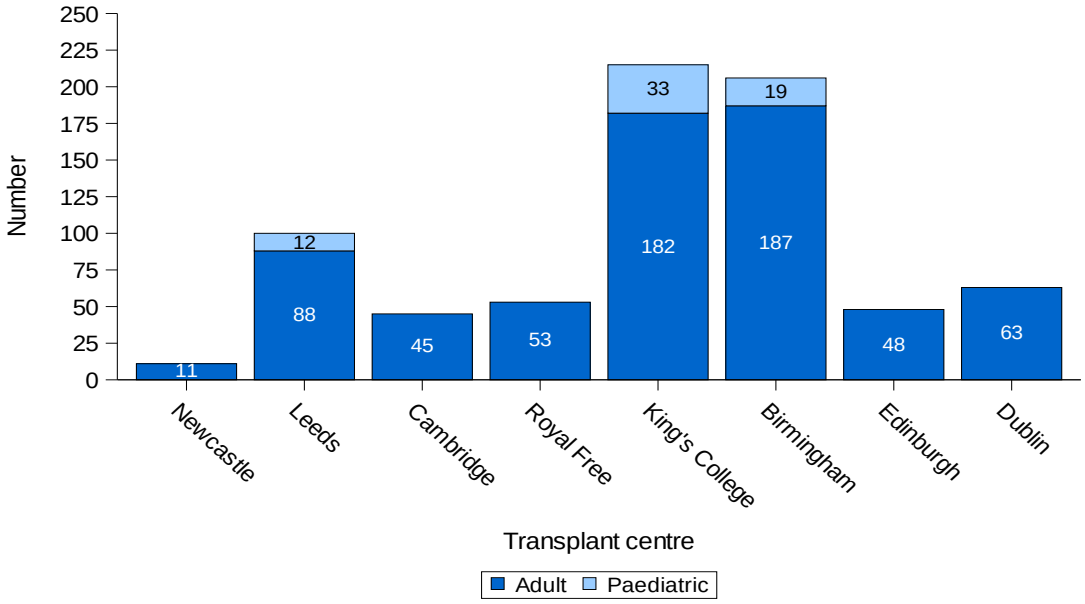


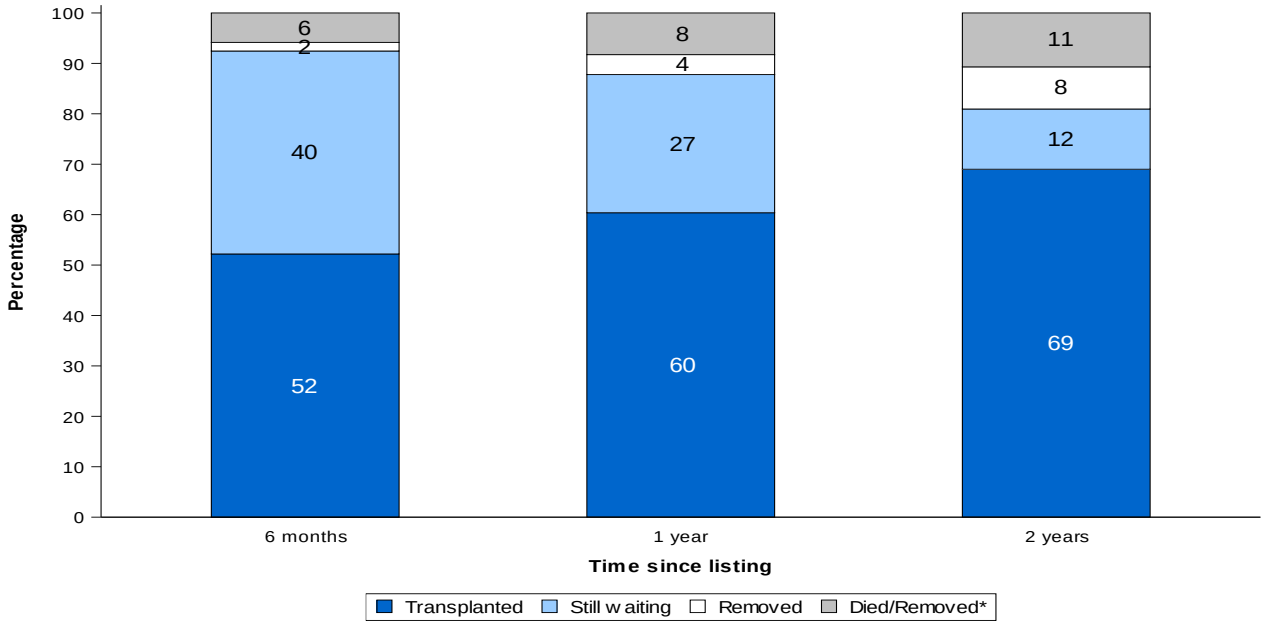
Figure 2.2 shows the number of adults and paediatrics on the active UK and RoI transplant list at 31 March 2024, by centre. In total, there were 614 adults and 64 paediatrics on the UK active transplant list and 63 adults on the Dublin active transplant list. King's College had the largest share of the UK transplant list (32%) and Newcastle the smallest (2%). This figure includes multi-organ, elective and super-urgent registrations.

Figure 2.2 Patients on the active liver transplant list at 31 March 2024



An indication of long-term outcomes for patients listed in the UK between April 2021 and March 2022 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, 52% of patients had received a transplant and 40% were still waiting.

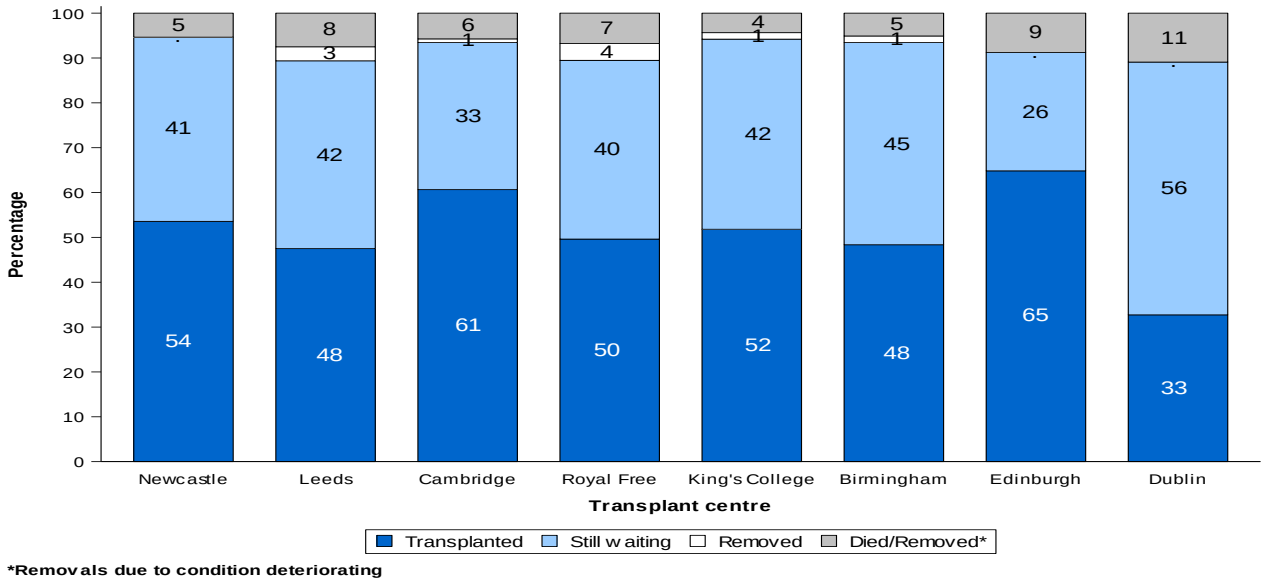
Figure 2.3 **Post-registration outcome for 1113 new elective liver only registrations made in the UK, 1 April 2021 - 31 March 2022**



*Removals due to condition deteriorating

Figure 2.4 shows the six month registration outcome by centre. The proportion of patients transplanted six months after listing at each UK transplant centre ranges from 48% at Leeds and Birmingham to 65% at Edinburgh.

Figure 2.4 **Six month post-registration outcome for 1168 new elective liver only registrations made in the UK and Dublin by centre, 1 April 2021 - 31 March 2022**



*Removals due to condition deteriorating

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. Dublin are included in **Figure 2.6** but not **Figure 2.5**.

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 DBD liver transplants has subsequently steadily reduced with 587 transplants performed in 2023/24. The number of DCD liver transplants performed in the UK in the last financial year increased to 267 which is a 38% increase when compared to 2021/22 (194). There were 31 living donor liver transplants and 0 domino transplant performed in the last financial year.

Figure 2.5 Total number of liver transplants by donor type in the UK, 1 April 2014 - 31 March 2024

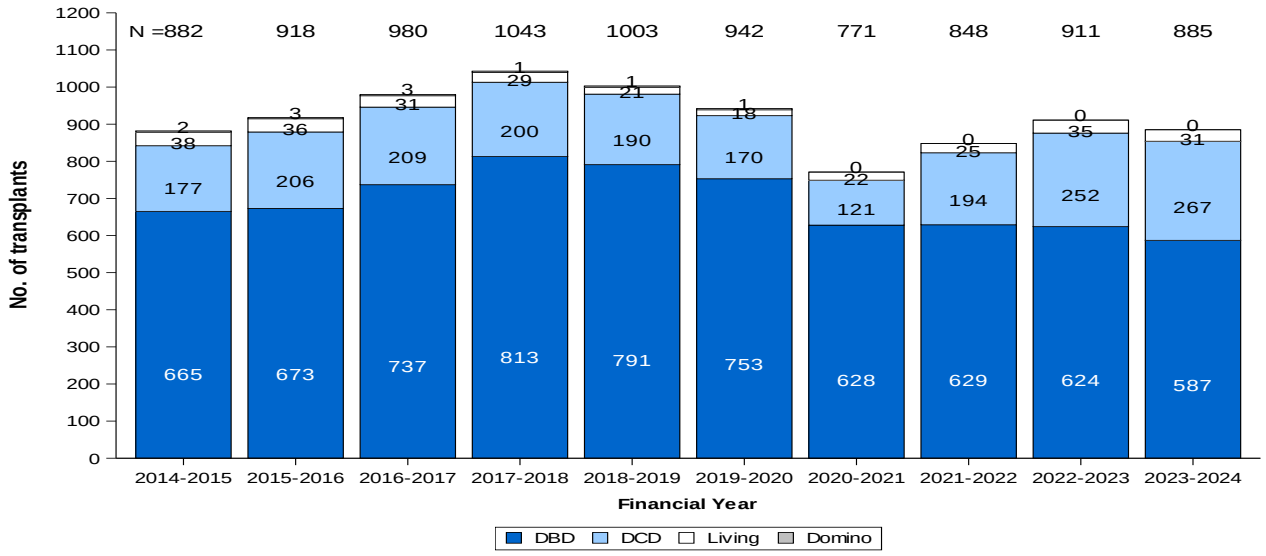


Figure 2.6 Total number of liver transplants by transplant centre and donor type, 1 April 2014 - 31 March 2024

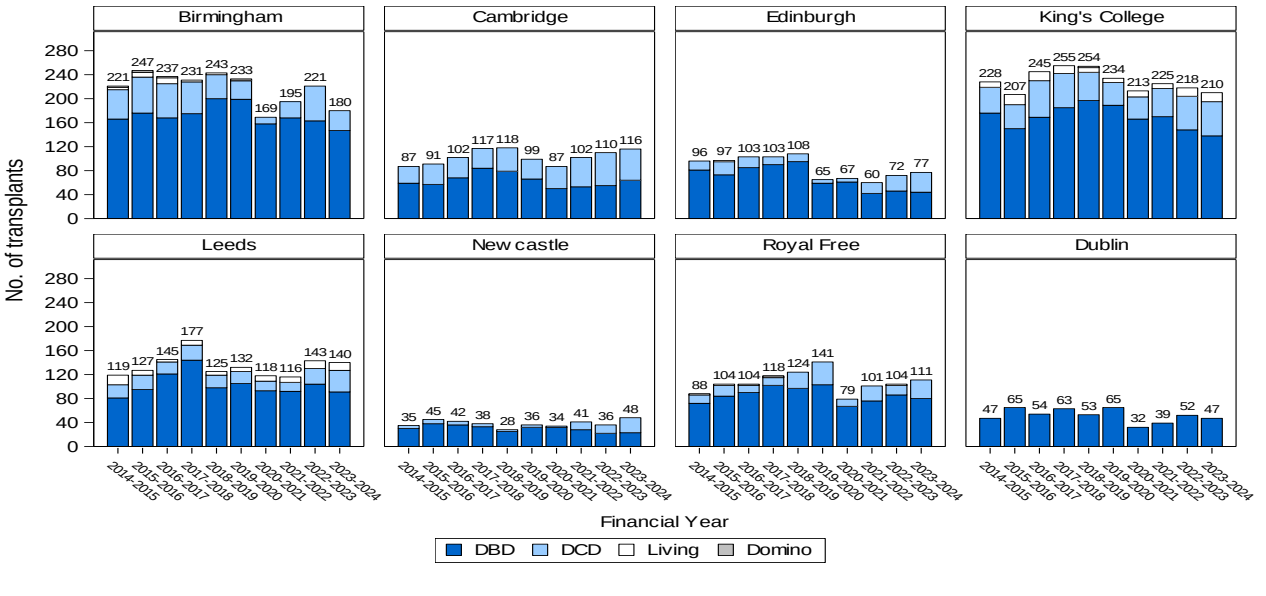
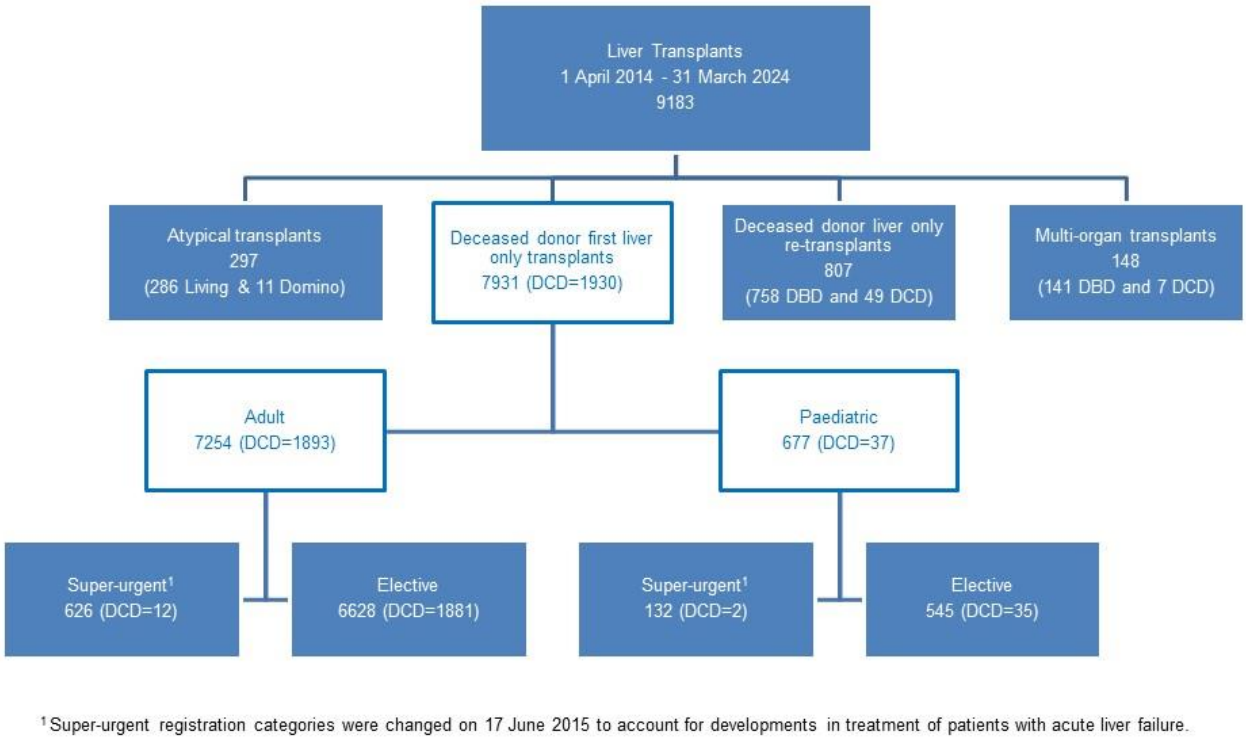


Figure 2.7 details the 9183 liver transplants performed in the UK in the ten year period (Dublin are excluded). Of these, 7931 (86%) were deceased donor first liver only transplants. 7254 (91%) of the deceased donor first liver only transplants were performed in adults and 677 (9%) in paediatrics. Similarly including both adult and paediatric, 7173 (90%) were elective and 758 (10%) were super-urgent transplants.

Figure 2.7 Liver transplants in the UK, 1 April 2014 – 31 March 2024



[1] Super-urgent registration categories were changed on 17 June 2015 to account for developments in treatment of patients with acute liver failure.

Figure 2.8 shows the number of liver transplants performed in the UK the last ten years, by type of transplant and donor whilst **Figure 2.9** shows the equivalent information by transplant centre. Dublin are included in **Figure 2.9** but not **Figure 2.8**.

The number of liver only retransplants in the UK from donors after brain death (DBD) ranged between 48 in 2021/2022 and 92 in 2016/2017. During the last ten years, 141 DBD and 7 DCD multi-organ transplants involving the liver were performed of which 10 were retransplants. Of the 141 multi-organ DBD transplants, 128 were simultaneous liver and kidney transplants (nine of which were retransplants), eight were simultaneous liver and heart transplants, four were simultaneous liver and lung transplants and one was a simultaneous liver and pancreas transplant.

The majority of transplants (97.2%) performed in the UK over the last ten years involving donors after circulatory death (DCD) were first liver only transplants, with only 49 DCD retransplant liver only transplants, six simultaneous liver/kidney DCD transplants and one simultaneous liver and heart transplant.

The majority of transplants (460 (89%)) performed in Dublin over the last ten years were first liver only DBD transplants, with 57 (11%) DBD retransplant liver only transplants and one simultaneous liver and lung transplant.

Figure 2.8 Total number of liver transplants by donor and transplant type in the UK, 1 April 2014 - 31 March 2024

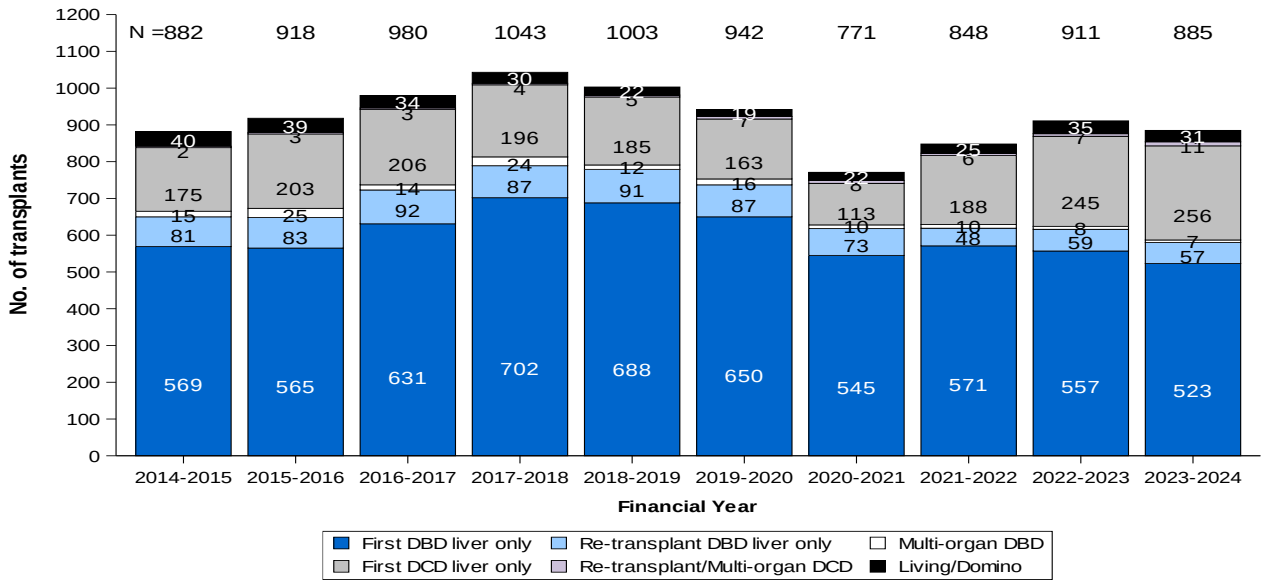
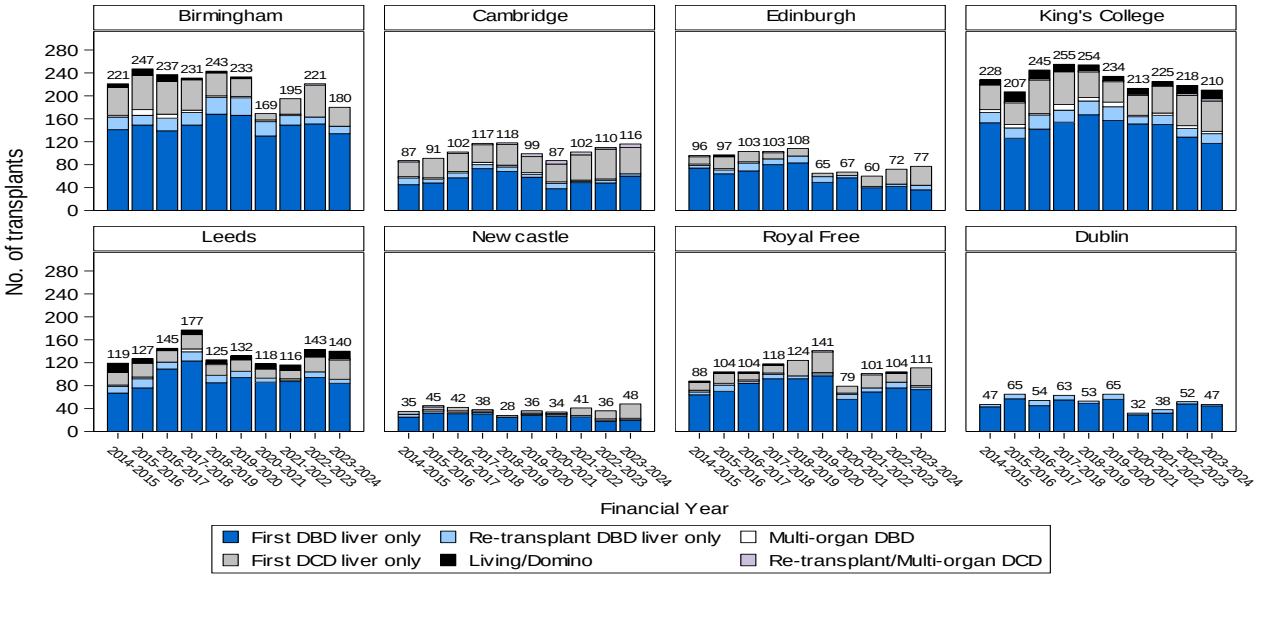


Figure 2.9 Total number of liver transplants by transplant centre, donor type and transplant type, 1 April 2014 - 31 March 2024



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 2023 and 31 March 2024 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 inevitable 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 0.013 (p-value = 0.005) and 0.0182 (p-value = 0.004), respectively. The p-value shows the probability that an SCV of this size (or higher) would be observed by chance if only random variation existed and therefore, strong evidence of geographical variation beyond what would be expected at random. No adjustment has been made for area-specific demographic characteristics that may impact the rates of registration to the transplant list and transplantation such as age and sex. Therefore, these results should be interpreted with caution.

Figure 2.10 Comparison of liver registration rates (pmp) with transplant rates (pmp) by recipient country/NHS region of residence

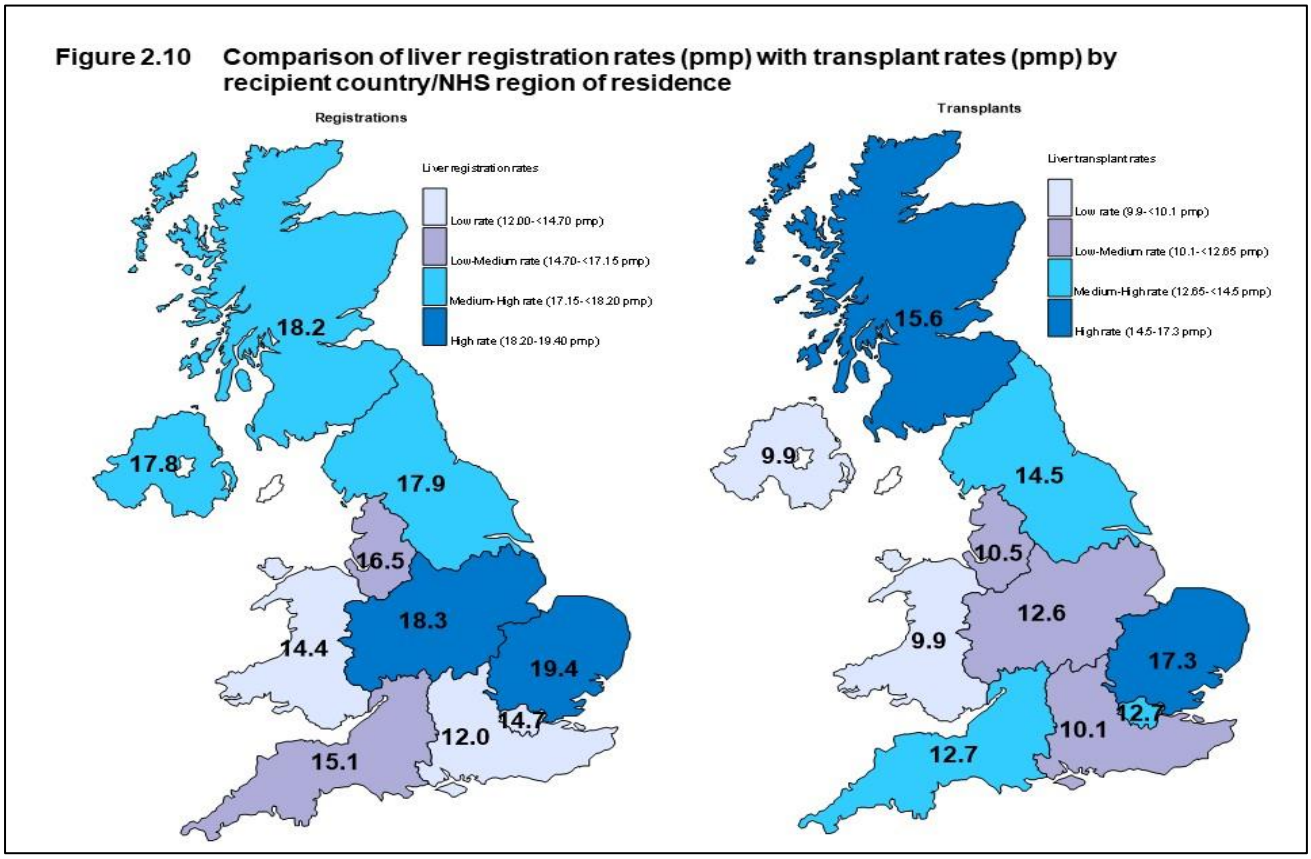


Table 2.1 Liver registration and transplant rates per million population (pmp) in the UK, 1 April 2023 - 31 March 2024, by Country/NHS region

Country/ NHS region	Registrations	(pmp)	Transplants	(pmp)
North East and Yorkshire	147	(17.9)	119	(14.5)
North West	124	(16.5)	79	(10.5)
Midlands	201	(18.3)	138	(12.6)
East of England	124	(19.4)	111	(17.3)
London	130	(14.7)	113	(12.7)
South East	113	(12)	95	(10.1)
South West	87	(15.1)	73	(12.7)
England	**926**	**(16.2)**	**728**	**(12.7)**
Isle of Man	**3**	**(37.5)**	**4**	**(50)**
Channel Islands	**0**	**(0.0)**	**0**	**(0.0)**
Wales	**45**	**(14.4)**	**31**	**(9.9)**
Scotland	**99**	**(18.2)**	**85**	**(15.6)**
Northern Ireland	**34**	**(17.8)**	**19**	**(9.9)**
TOTAL[1,2]	**1111**	**(16.4)**	**871**	**(12.9)**

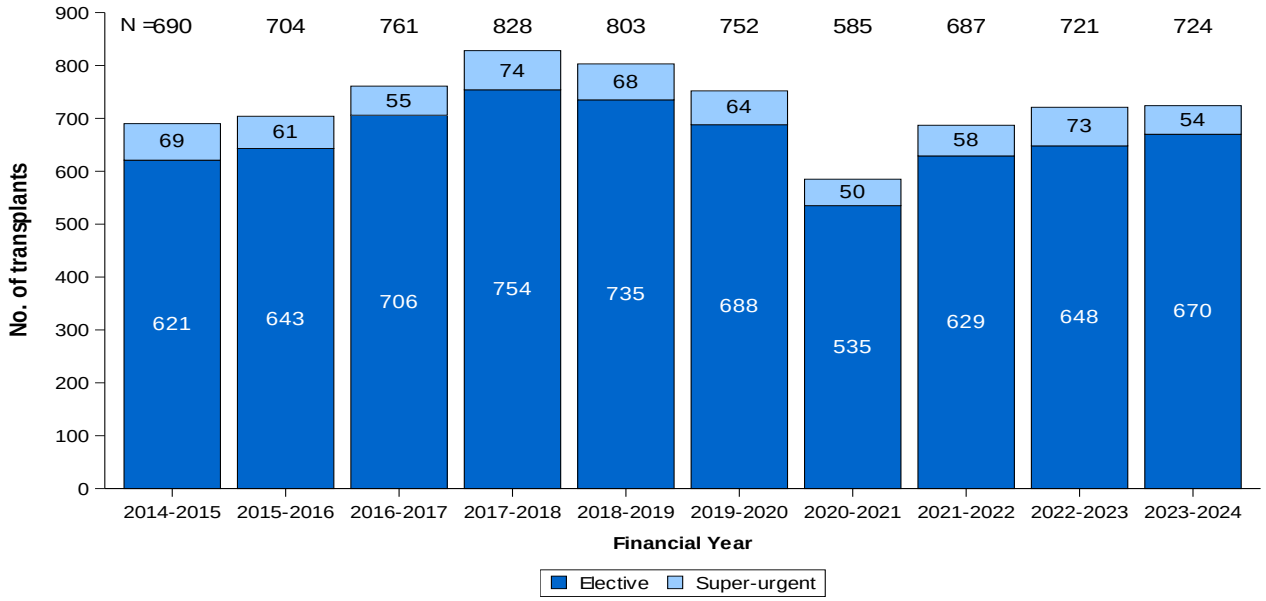
[1] Registrations include 4 recipients whose postcode was unknown and excludes 6 recipients who reside in the Republic of Ireland
[2] Transplants include 4 recipients whose postcode was unknown and excludes 4 recipients who reside in the Republic of Ireland

Adult Liver Transplantation

3.1 Overview

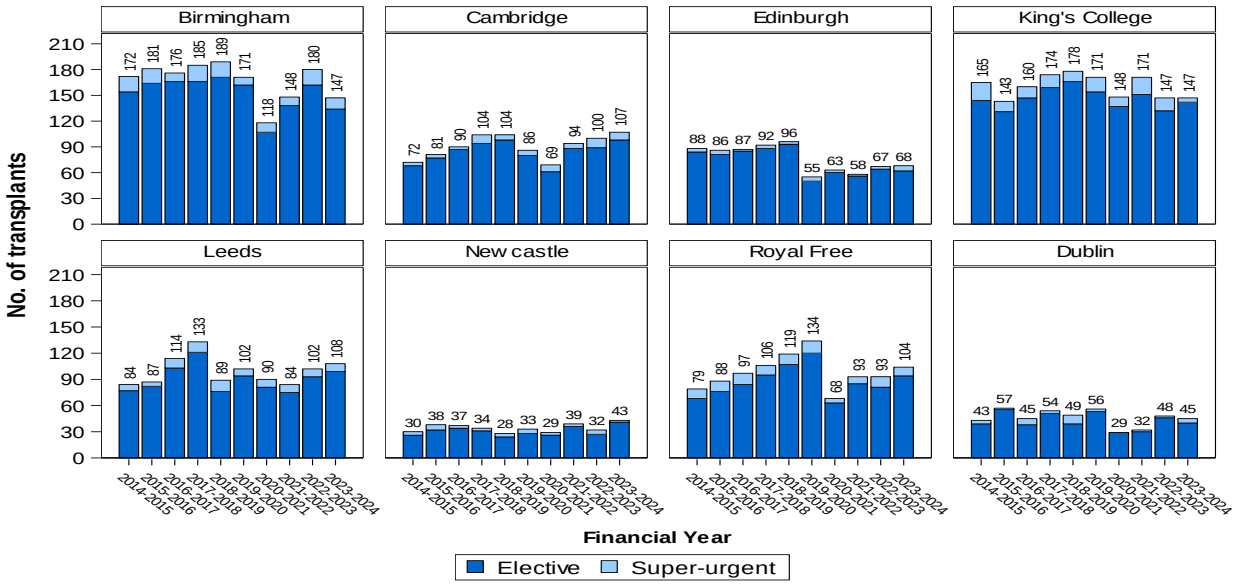
The number of adult deceased donor first liver only transplants in the last ten years is shown overall and by centre in **Figures 3.1 and 3.2**, respectively. Dublin are included in **Figure 3.2** but not **Figure 3.1**. Of the 724 transplants performed in the UK in the latest financial year, 670 (93%) were elective and 54 (7%) were super-urgent transplants. See **Appendix 1** for further details.

Figure 3.1 Deceased donor first liver only transplants in the UK in adult recipients 1 April 2014 - 31 March 2024



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

Figure 3.2 Deceased donor first liver only transplants in the UK and Dublin in adult recipients, 1 April 2014 - 31 March 2024



*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 total preservation times (TPT) for UK adult transplant recipients are shown by financial year in **Figure 3.3** for DBD and DCD donors, respectively. The UK national median total preservation time for transplants from DBD donors has remained relatively stable and was 8.5 hours in 2014/15 and 9.1 hours in 2023/24. Similarly, the UK national median for DCD donor transplants has remained relatively stable over the ten year period and was 7.5 hours in 2014/15 and 7.5 hours in 2023/25.

Figure 3.3 Boxplot of total preservation time in all adult first deceased donor liver transplants in the UK, by donor type and financial year 1 April 2014 - 31 March 2024

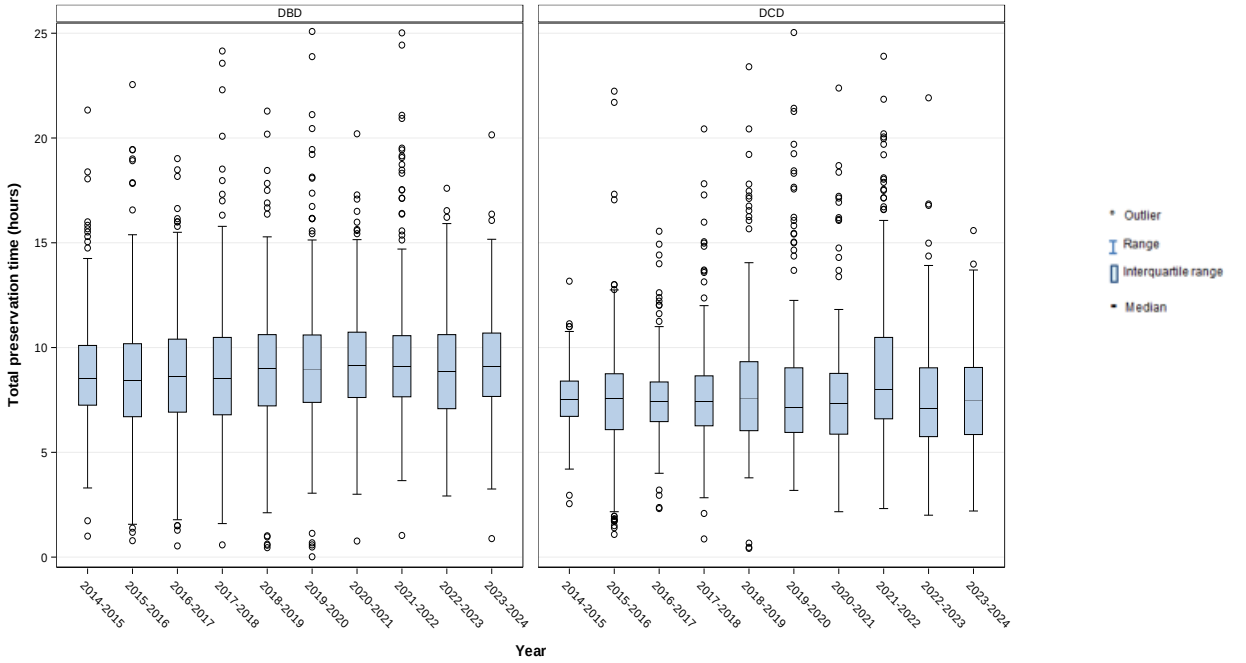


Figure 3.4 shows boxplots of total preservation times (TPT) for adult transplant recipients by centre and donor type in the latest financial year (2023/2024) while **Figure 3.5** and **Figure 3.6** show the equivalent information by centre over the last ten financial years for DBD and DCD donors, respectively. Dublin are included in all three boxplots. The median total presevation time for DBD in the last financial year ranged between 7.9 and 10.6 hours across UK transplant centres whilst the median for DCD ranged between 5.9 and 10.8 hours. The median total presevation time for patients transplanted at Dublin in the last financial year was 5.9 hours for DBD transplants.

The total presevation 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. 301 (39%) of adult deceased donor first liver only transplants performed in the latest financial year were reported to have involved in situ normothermic regional perfusion or ex situ machine perfusion (either normothermic or hypothermic). This ranged from 20% to 70% by transplant centre.

Figure 3.4 **Boxplot of total preservation time in all adult first deceased donor liver transplants, by donor type and transplant centre**
1 April 2023 - 31 March 2024

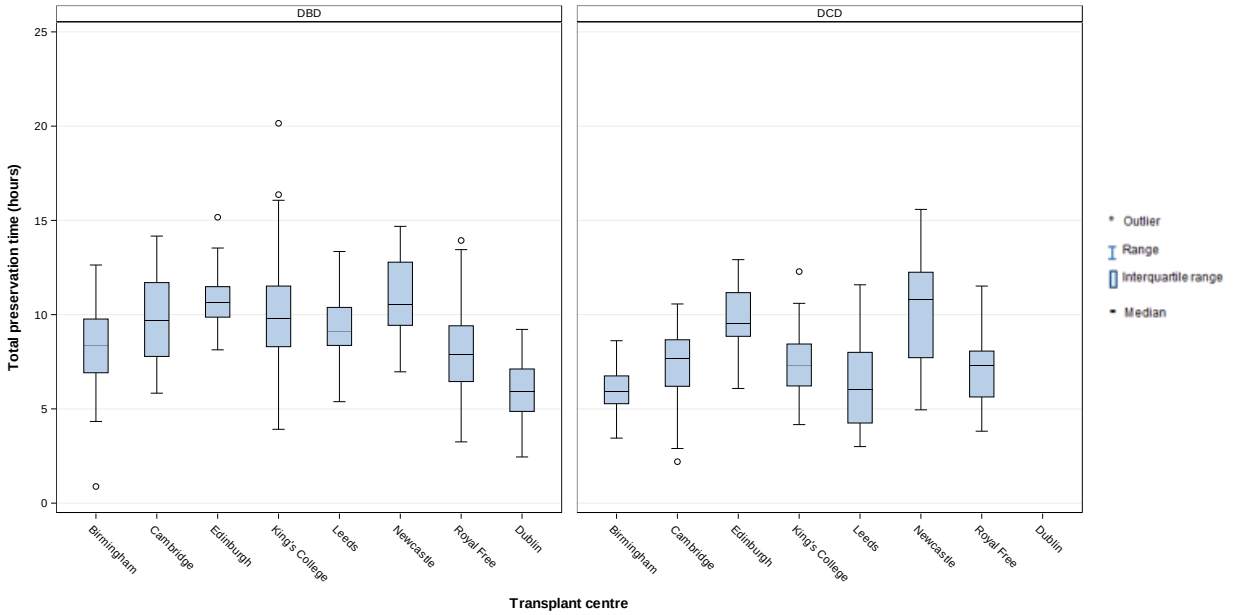


Figure 3.5 **Boxplot of total preservation time in all adult first DBD donor liver transplants, by donor type and transplant centre**
1 April 2014 - 31 March 2024

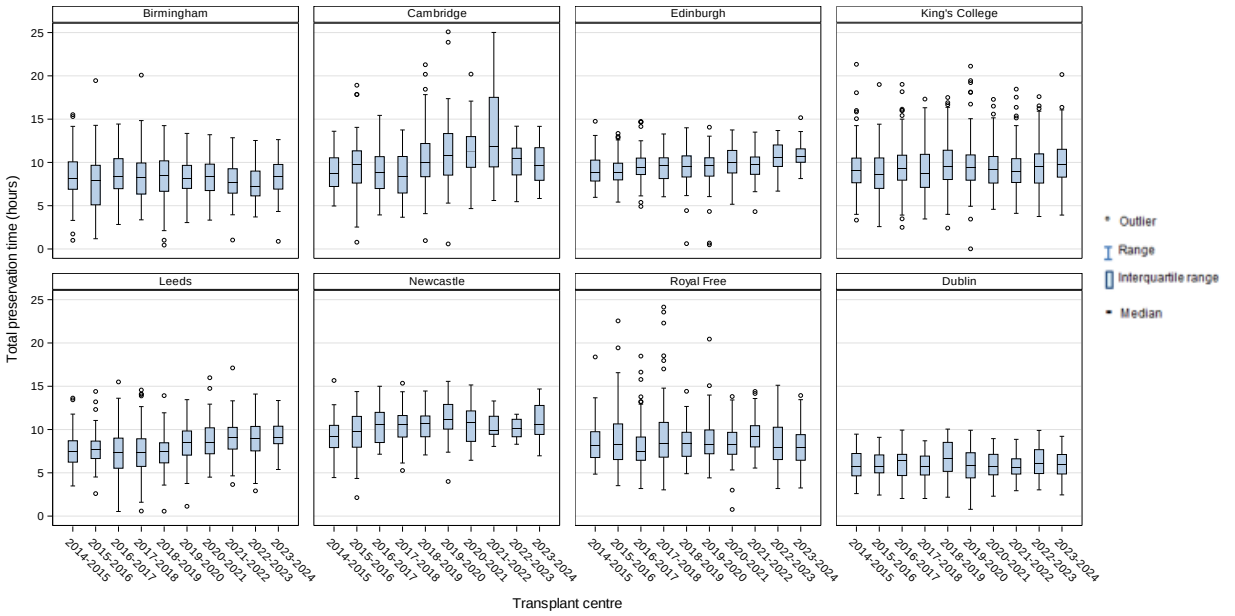
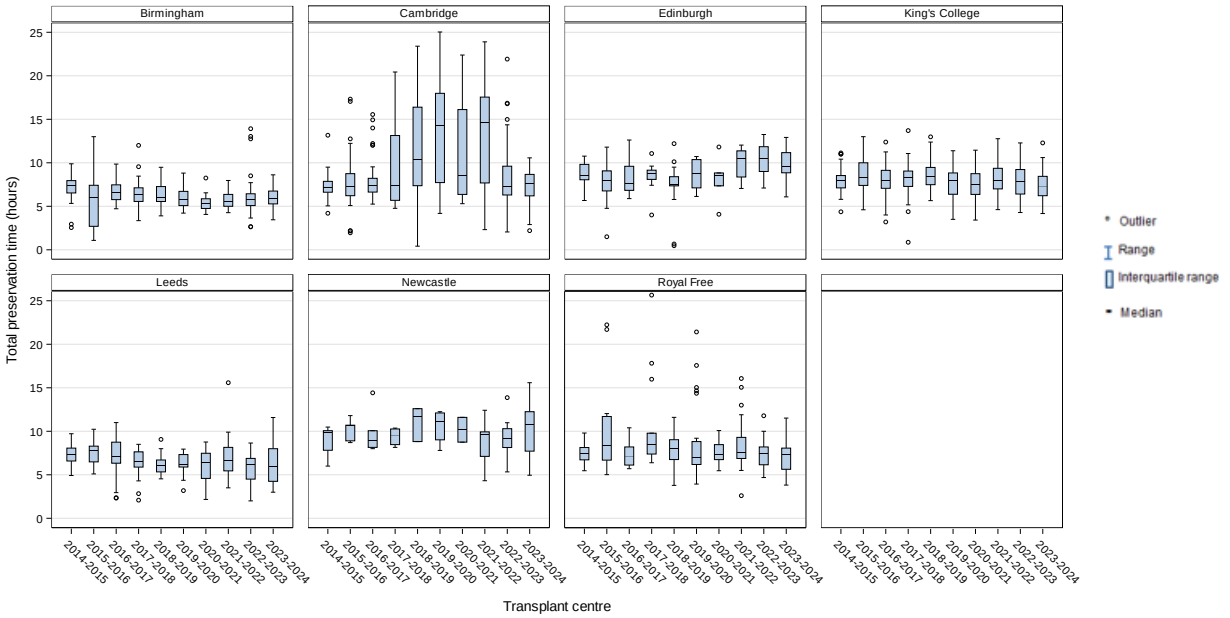


Figure 3.6 **Boxplot of total preservation time in all adult first DCD donor liver transplants, by transplant centre**
1 April 2014 - 31 March 2024



Adult Liver Transplantation
Elective Patients

3.2.1 Transplant list

Figure 3.7 shows the number of adult elective patients on the UK liver only transplant list at 31 March each year between 2015 and 2024. Patients registered at Dublin were excluded. Seven hundred and two adult elective patients were either active or suspended on the UK liver only transplant list on 31 March 2024, a 31% increase compared with 31 March 2015.

The number of adult patients on the UK active liver only transplant list has increased from 514 in 2015 to 580 in 2024. 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 3.7 Adult elective patients on the liver only transplant list in the UK at 31 March

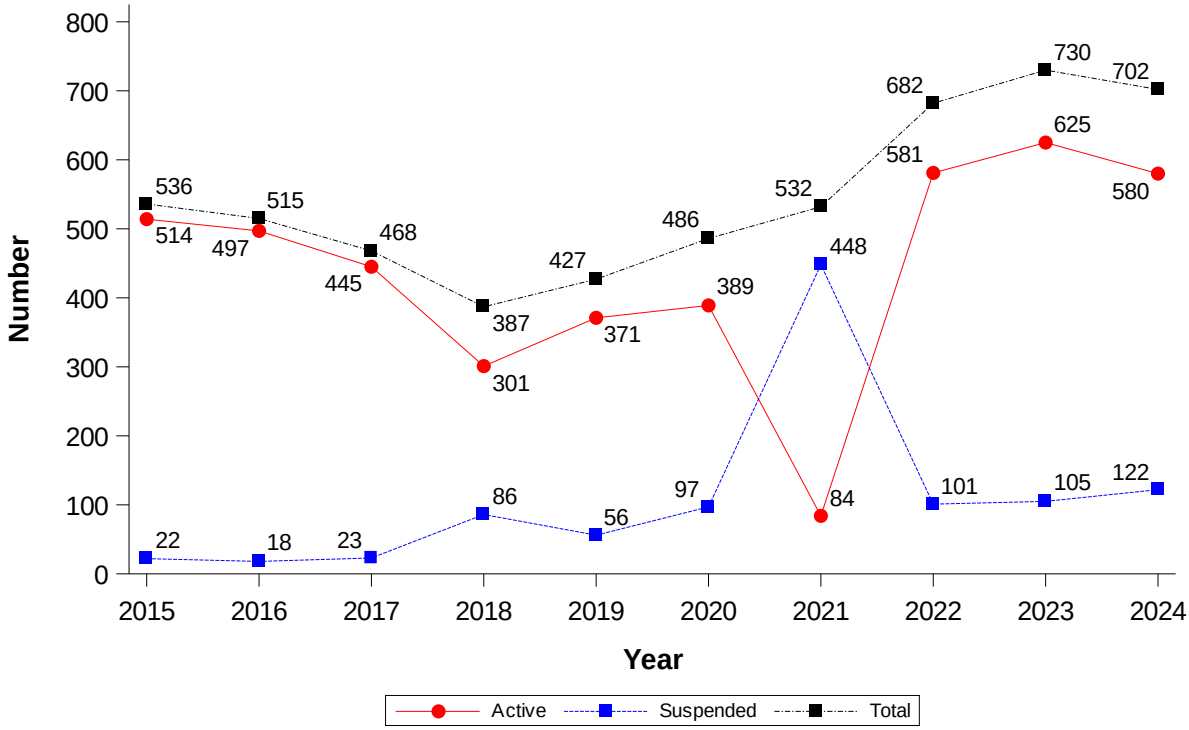
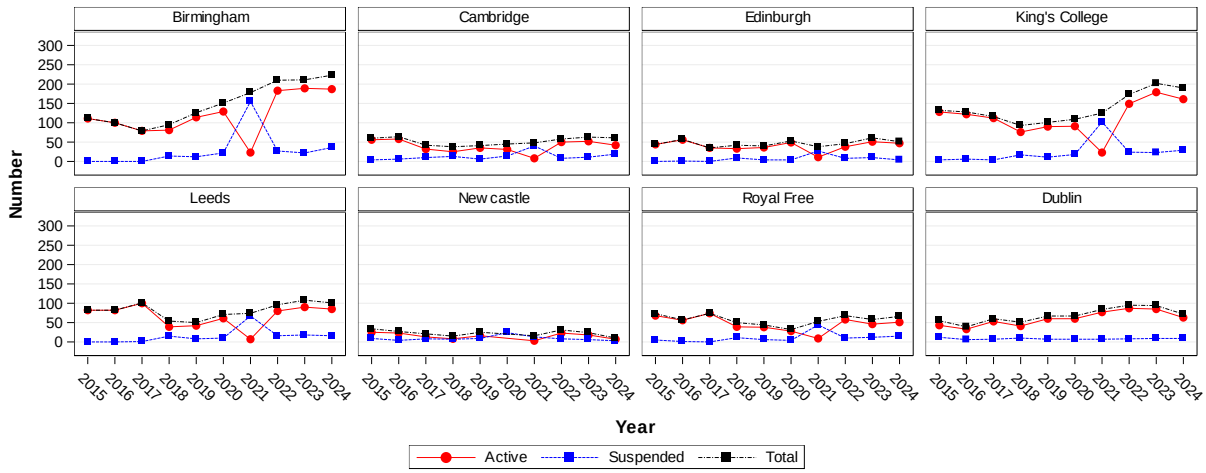


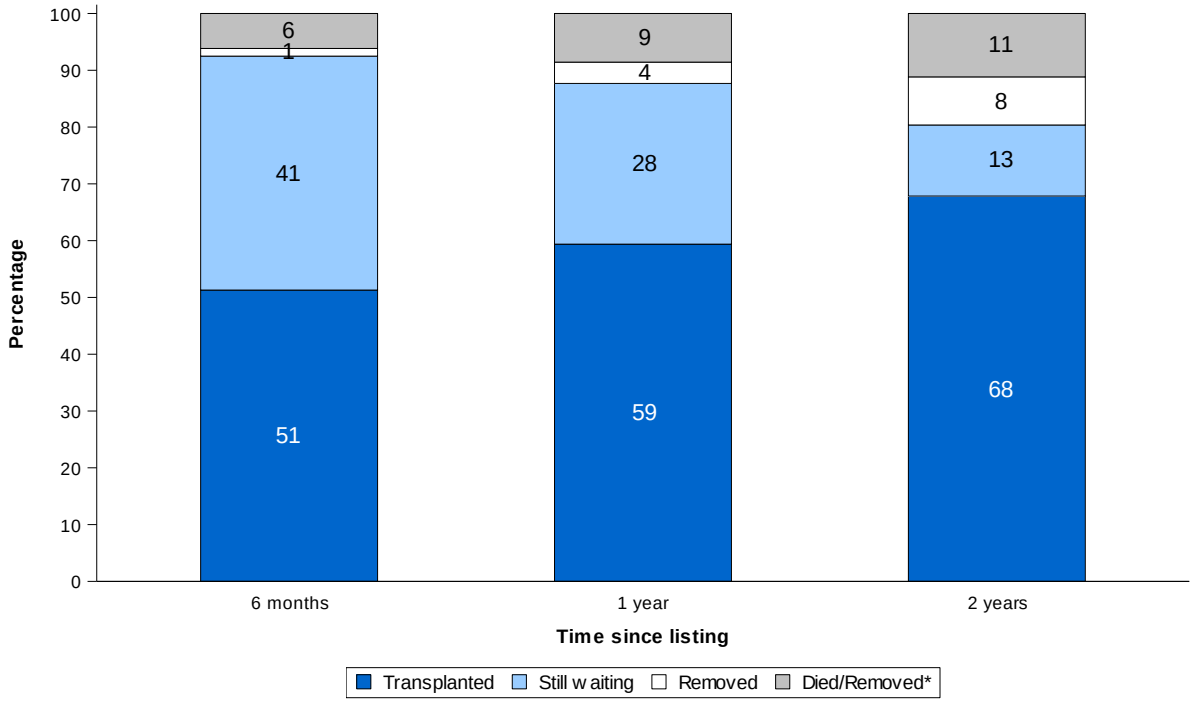
Figure 3.8 shows the number of adults on the transplant list in the UK and Dublin at 31 March each year between 2015 and 2024, by transplant centre. The number of adult patients active on the elective liver transplant list on 31 March 2024 ranged between 7 at Newcastle and 187 at Birmingham.

Figure 3.8 **Adult elective patients on the liver only transplant list in the UK at 31 March, by centre**



An indication of outcomes for adult elective patients listed for a liver transplant in the UK is summarised in **Figure 3.9**. Patients at Dublin are not included 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. It should be noted that restrictions imposed during COVID-19 may have impacted UK post-registration outcome.

Figure 3.9 **Post-registration outcome for 1039 new adult elective liver only registrations made in the UK, 1 April 2021 - 31 March 2022**



*Removals due to condition deteriorating

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. Patients registered in Dublin are included in **Figure 3.10**. The proportion of patients transplanted six months after listing at each UK transplant centre ranges from 45% at Leeds and Birmingham to 65% at Edinburgh.

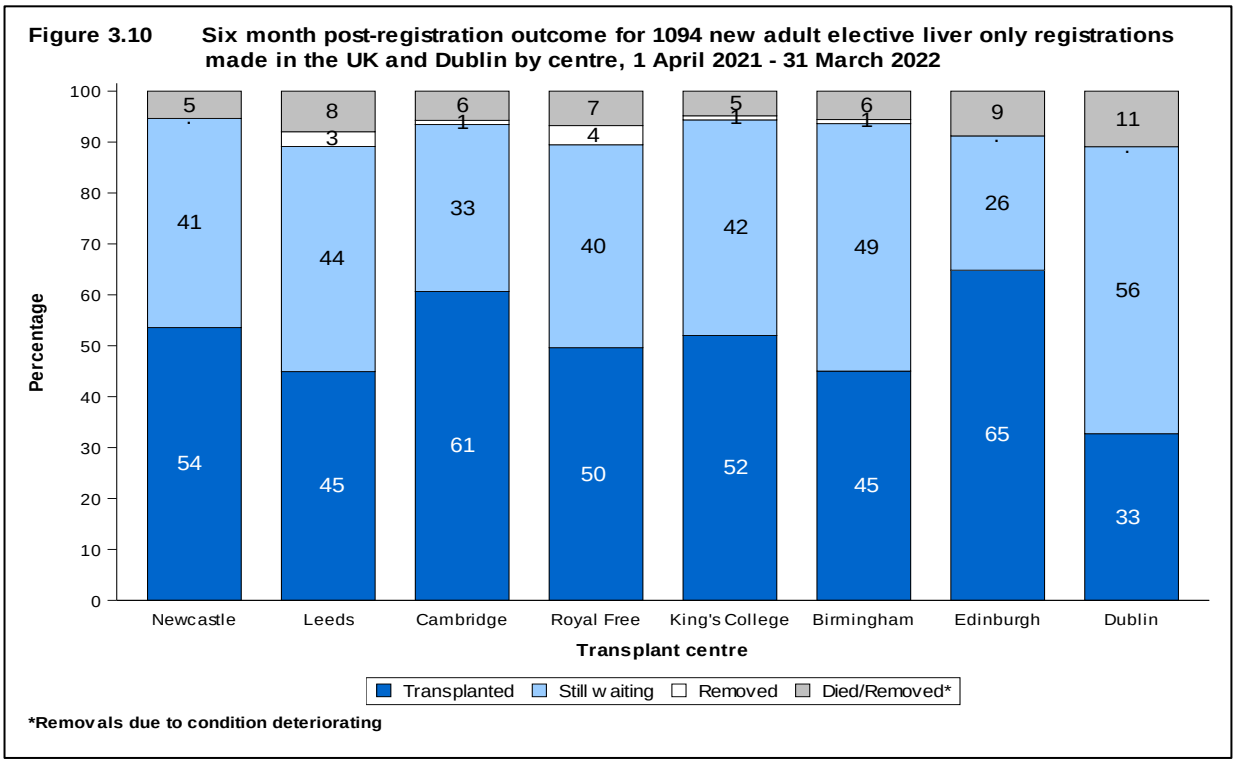


Table 3.1 shows the median waiting time to deceased donor liver only transplant for adult elective patients. The national UK median waiting time to transplant for adult elective patients is 146 days. The median waiting time to transplant was shorter at Cambridge (90 days) and longer at Birmingham (226 days), compared to the national median waiting time. The median waiting time for patients registered in Dublin is also presented in **Table 3.1**.

Note that these waiting times are not adjusted to account for the patient case-mix at centres and will be impacted by COVID-19

Table 3.1 Median waiting time to liver only transplant for adult elective patients registered in the UK and Republic of Ireland, 1 April 2021 - 31 March 2023

Transplant centre	Number of patients registered	Waiting time (days)	
		Median	95% Confidence interval
Cambridge	241	90	60 - 120
Edinburgh	187	91	43 - 139
Royal Free	250	110	74 - 146
Newcastle	91	130	87 - 173
Leeds	277	154	110 - 198
Kings College	464	190	152 - 228
Birmingham	511	226	156 - 296
UK	**2021**	**146**	**129 - 163**
Dublin	101	213	167 - 259

Table 3.2 shows the demographics of 922 adult elective liver patients in the UK and 51 in Dublin, registered from 1 April 2023 to 31 March 2024, by transplant centre. The majority of patients that were registered in the UK were male (62%), white (88%) with a median age of 55 and a median BMI of 28. The most common indication for registration was alcoholic liver disease followed by HCC. For some characteristics, due to rounding, percentages may not add up to 100.

Please note that, due to small numbers, patients registered as part of the new cancer service evaluations are reported in the other disease category but will be included in a separate category in future reports.

Table 3.2 Demographic characteristics of adult elective liver patients registered from 1 April 2023 - 31 March 2024

		Birmingham N (%)	Cambridge N (%)	Edinburgh N (%)	King's college N (%)	Leeds N (%)	Newcastle N (%)	Royal Free N (%)	**UK N (%)**	**Dublin N (%)**
Number		219	123	74	198	149	42	117	**922**	**51**
Recipient sex	Male	131 (60)	88 (72)	42 (57)	108 (55)	102 (68)	26 (62)	79 (68)	**576 (62)**	**32 (63)**
	Female	88 (40)	35 (28)	32 (43)	90 (45)	47 (32)	16 (38)	38 (32)	**346 (38)**	**19 (37)**
Recipient ethnicity	White	195 (89)	110 (89)	70 (95)	167 (84)	136 (91)	40 (95)	89 (76)	**807 (88)**	**50 (98)**
	Asian	13 (6)	4 (3)	4 (5)	14 (7)	10 (7)	2 (5)	19 (16)	**66 (7)**	**0 (0)**
	Black	2 (1)	1 (1)	0 (0)	15 (8)	0 (0)	0 (0)	6 (5)	**24 (3)**	**1 (2)**
	Other	1 (0)	1 (1)	0 (0)	2 (1)	1 (1)	0 (0)	3 (3)	**8 (1)**	**0 (0)**
	Not reported	8 (4)	7 (6)	0 (0)	0 (0)	2 (1)	0 (0)	0 (0)	**17 (2)**	**0 (0)**
Indication	Acute on Chronic Liver Failure (ACLF)	5 (2)	6 (5)	1 (1)	4 (2)	2 (1)	1 (2)	3 (3)	**22 (2)**	**0 (0)**
	Cancer	25 (11)	15 (12)	15 (20)	44 (22)	26 (17)	12 (29)	29 (25)	**166 (18)**	**12 (24)**
	Hepatitis C	4 (2)	3 (2)	1 (1)	3 (2)	5 (3)	0 (0)	2 (2)	**18 (2)**	**2 (4)**
	Alcoholic liver disease	59 (27)	40 (33)	11 (15)	40 (20)	48 (32)	10 (24)	30 (26)	**238 (26)**	**12 (24)**
	Hepatitis B	1 (0)	1 (1)	1 (1)	2 (1)	1 (1)	1 (2)	3 (3)	**10 (1)**	**0 (0)**
	Primary sclerosing cholangitis	40 (18)	15 (12)	10 (14)	20 (10)	14 (9)	5 (12)	17 (15)	**121 (13)**	**9 (18)**
	Primary biliary cholangitis	17 (8)	6 (5)	10 (14)	12 (6)	7 (5)	3 (7)	5 (4)	**60 (7)**	**3 (6)**
	Autoimmune and cryptogenic disease	12 (5)	5 (4)	6 (8)	10 (5)	4 (3)	4 (10)	4 (3)	**45 (5)**	**3 (6)**
	Metabolic liver disease	23 (11)	19 (15)	10 (14)	19 (10)	23 (15)	2 (5)	9 (8)	**105 (11)**	**6 (12)**
	Acute hepatic failure	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	**0 (0)**	**0 (0)**
	Other	29 (13)	12 (10)	9 (12)	28 (14)	13 (9)	4 (10)	15 (13)	**110 (12)**	**4 (8)**
	Regraft	4 (2)	1 (1)	0 (0)	16 (8)	6 (4)	0 (0)	0 (0)	**27 (3)**	**0 (0)**
Recipient HCV	No	208 (95)	118 (96)	68 (92)	189 (95)	137 (92)	42 (100)	110 (94)	**872 (95)**	**46 (90)**
	Yes	11 (5)	5 (4)	6 (8)	9 (5)	12 (8)	0 (0)	7 (6)	**50 (5)**	**5 (10)**
Encephalo-pathy	Absence	123 (56)	63 (51)	61 (82)	130 (66)	101 (68)	27 (64)	94 (80)	**599 (65)**	**38 (75)**
	Presence	96 (44)	60 (49)	13 (18)	68 (34)	48 (32)	15 (36)	23 (20)	**323 (35)**	**13 (25)**
Renal support	No	215 (98)	115 (93)	71 (96)	190 (96)	146 (98)	41 (98)	115 (98)	**893 (97)**	**51 (100)**
	Yes	4 (2)	8 (7)	3 (4)	8 (4)	3 (2)	1 (2)	2 (2)	**29 (3)**	**0 (0)**

Table 3.2 Demographic characteristics of adult elective liver patients registered from 1 April 2023 - 31 March 2024

		Birmingham N (%)	Cambridge N (%)	Edinburgh N (%)	King's college N (%)	Leeds N (%)	Newcastle N (%)	Royal Free N (%)	**UK N (%)**	**Dublin N (%)**
Previous abdominal surgery	No Yes	180 (82) 39 (18)	108 (88) 15 (12)	66 (89) 8 (11)	135 (68) 63 (32)	118 (79) 31 (21)	39 (93) 3 (7)	96 (82) 21 (18)	**742 (80)** **180 (20)**	**48 (94)** **3 (6)**
Recip age (years)	Median (IQR)	53 (39, 61)	56 (46, 62)	59 (50, 63)	55 (43, 61)	55 (45, 62)	60.5 (53, 66)	54 (47, 60)	**55 (45, 62)**	**56 (49, 62)**
BMI (kg/m^2)	Median (IQR)	28 (24, 32)	28 (24, 31)	28 (24, 31)	27 (23, 30)	29 (25, 32)	30 (25, 34)	27 (24, 30)	**28 (24, 32)**	**28 (25, 32)**
Serum bilirubin (umol/l)	Median (IQR)	42 (21, 89)	46 (25, 107)	49 (28, 91)	36 (21, 79)	48 (21, 87)	41.5 (14, 89)	41 (18, 101)	**42 (21, 89)**	**46 (22, 81)**
Serum creatinine (umol/l)	Median (IQR)	68 (55, 85)	73 (59, 91)	67.5 (54, 99)	71 (57, 94)	74 (59, 96)	73.5 (62, 107)	80 (67, 92)	**73 (59, 93)**	**67 (61, 93)**
Serum sodium (mmol/l)	Median (IQR)	137 (134, 139)	136 (134, 139)	137 (133, 139)	138 (135, 140)	136 (133, 139)	138 (135, 140)	138 (135, 141)	**137 (134, 139)**	**137 (134, 139)**
Serum potassium (mmol/l)	Median (IQR)	4.1 (3.9, 4.5)	4.1 (3.8, 4.5)	4.1 (3.9, 4.5)	4.2 (3.9, 4.4)	4.1 (3.9, 4.5)	4.2 (4, 4.6)	4.3 (4, 4.6)	**4.2 (3.9, 4.5)**	**4.2 (4, 4.6)**
INR	Median (IQR)	1.2 (1.1, 1.6)	1.4 (1.2, 1.7)	1.2 (1.1, 1.4)	1.2 (1.1, 1.4)	1.3 (1.2, 1.6)	1.2 (1, 1.4)	1.2 (1.1, 1.4)	**1.3 (1.1, 1.5)**	**1.3 (1.2, 1.5)**
Serum albumin (g/l)	Median (IQR)	30 (25, 35)	28 (25, 31)	27 (23, 31)	34 (30, 39)	29 (25, 33)	37.5 (30, 45)	35 (29, 39)	**31 (26, 36)**	**29 (24, 33)**

Figure 3.11 shows the offer decline rate funnel plot for named adult and large paediatric elective DBD offers to UK transplant centres. 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, ACLF, 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. Dublin are not included in **Figure 3.11** or **Figure 3.12**.

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**.

Figure 3.11 Named adult elective liver offer decline rates that resulted in a liver only first transplant from DBD donors, 1 April 2021 and 31 March 2024

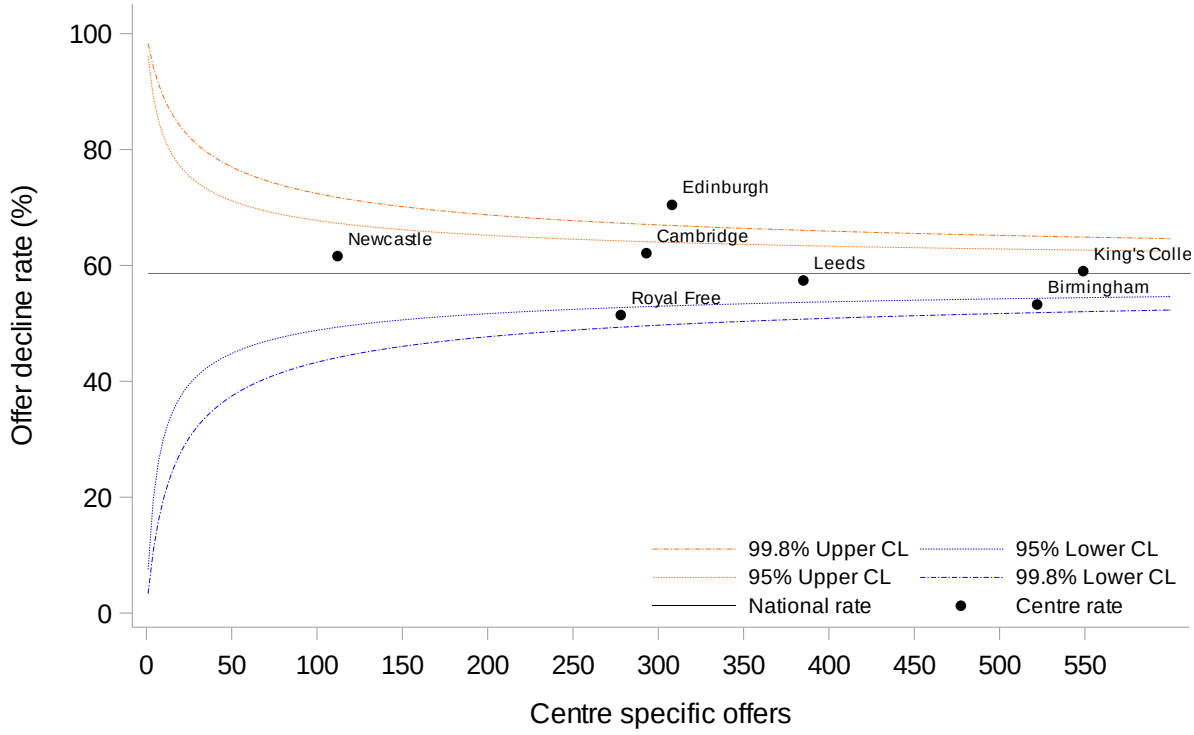


Figure 3.12 **Adult elective liver offer decline rates that resulted in a liver only first transplant from DCD donors, 1 April 2021 and 31 March 2024**

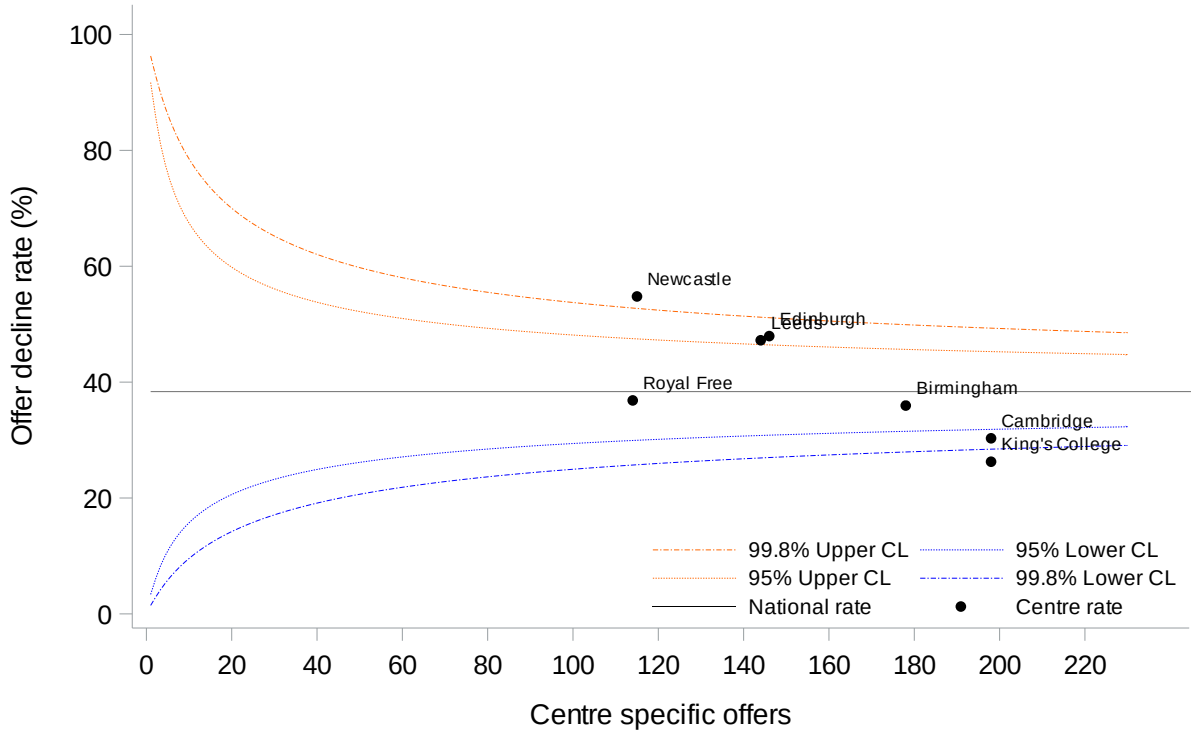


Table 3.3 **Offer decline rates for each centre by offered organ and donor type 1 April 2021 and 31 March 2024**

Centre	DBD Donors Whole Livers		DBD Donors Right Lobe		All Livers		DCD Donors Whole Livers	
	Offers	% Decline	Offers	% Decline	Offers	% Decline	Offers	% Decline
A. All donors								
Birmingham	467	50	55	78	522	53	178	36
Cambridge	250	59	43	79	293	62	198	30
Edinburgh	246	63	62	100	308	70	146	48
King's College	498	58	51	73	549	59	198	26
Leeds	322	54	63	73	385	57	144	47
Newcastle	81	47	31	100	112	62	115	55
Royal Free	231	48	47	68	278	51	114	37
Total	**2095**	**55**	**352**	**81**	**2447**	**59**	**1093**	**38**
B. DBD donors aged≤ 65 years and DCD donors aged ≤ 60 years								
Birmingham	326	48	55	78	381	52	113	35
Cambridge	186	53	43	79	229	58	128	23
Edinburgh	181	61	62	100	243	71	84	44
King's College	309	53	51	73	360	56	128	31
Leeds	223	47	63	73	286	52	102	38
Newcastle	59	51	31	100	90	68	74	42
Royal Free	169	43	47	68	216	49	79	37
Total	**1453**	**51**	**352**	**81**	**1805**	**57**	**708**	**35**

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. Dublin are included in **Figure 3.14** but not **Figure 3.13**. 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**.

All centres apart from Birmingham, Edinburgh and Dublin observed an increase in the number of adult elective first liver only transplants performed in 2023/2024 compared with 2022/2023.

Figure 3.13 Adult elective liver only transplants by donor type in the UK, 1 April 2014 - 31 March 2024

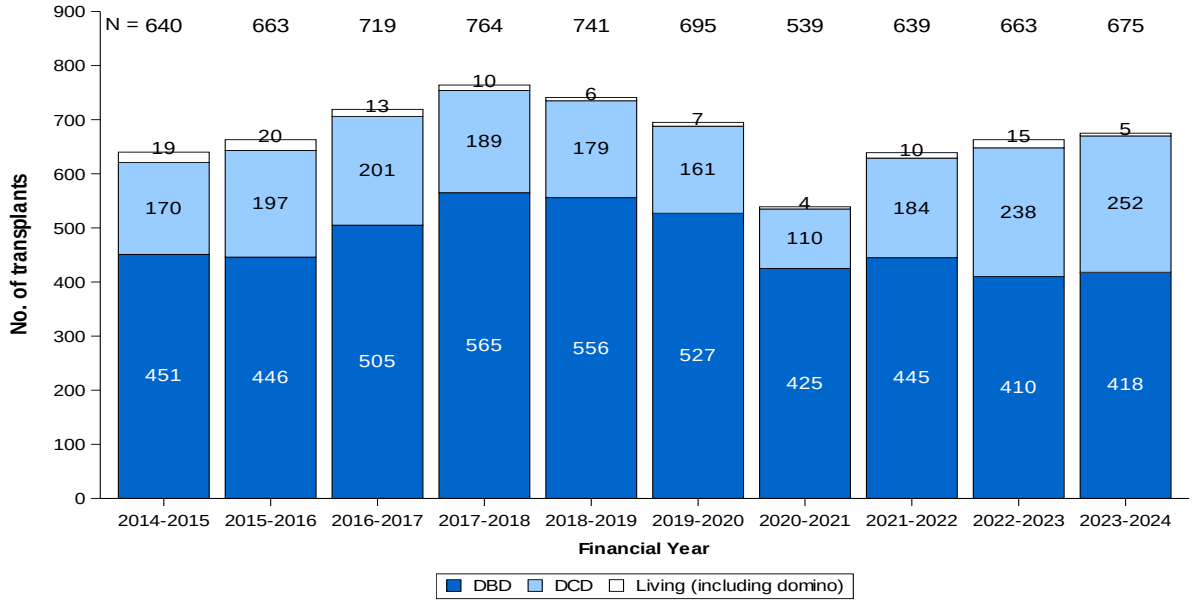
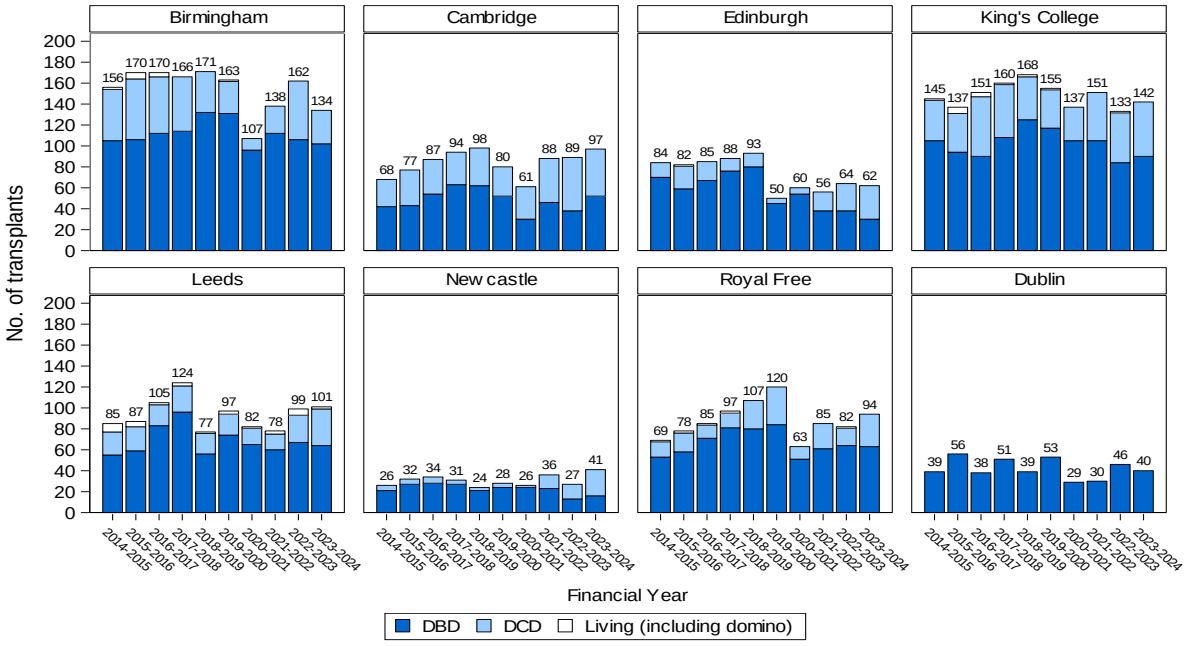


Figure 3.14 Adult elective liver only transplants by donor type and centre, 1 April 2014 - 31 March 2024



*Excludes 26 and 12 living liver transplants at London Bridge Hospital and Cromwell Hospital, respectively

The demographic characteristics of 670 adult elective first deceased donor liver only transplant recipients in the UK, and 40 in Dublin, respectively, in the latest year are shown by centre and overall in **Table 3.4**. The profile of recipients are similar to those in **Table 3.2** which shows the demographics of patients registered. The profile donor was often a white (89%), male (57%), brainstem death (62%) with a median age of 53 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 2023 - 31 March 2024

		Birmingham	Cambridge	Edinburgh	King's College	Leeds	Newcastle	Royal Free	**UK**	**Dublin**
		N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	**N (%)**	**N (%)**
Number		134	98	62	142	99	41	94	**670 (100)**	40
Recipient sex	Male	83 (62)	72 (73)	41 (66)	87 (61)	69 (70)	28 (68)	70 (74)	**450 (67)**	23 (58)
	Female	51 (38)	26 (27)	21 (34)	55 (39)	30 (30)	13 (32)	24 (26)	**220 (33)**	17 (43)
Recipient ethnicity	White	102 (76)	86 (88)	57 (92)	118 (83)	92 (93)	39 (95)	77 (82)	**571 (85)**	38 (95)
	Asian	9 (7)	5 (5)	5 (8)	12 (8)	5 (5)	2 (5)	11 (12)	**49 (7)**	1 (3)
	Black	4 (3)	3 (3)	0	9 (6)	0	0	4 (4)	**20 (3)**	1 (3)
	Other	0	1 (1)	0	3 (2)	1 (1)	0	2 (2)	**7 (1)**	0
	Not reported	19 (14)	3 (3)	0	0	1 (1)	0	0	**23 (3)**	0
Indication	Acute on Chronic Liver Failure	6 (4)	5 (5)	1 (2)	6 (4)	3 (3)	2 (5)	3 (3)	**26 (4)**	0
	Cancer	8 (6)	11 (11)	17 (27)	11 (8)	17 (17)	11 (27)	8 (9)	**83 (12)**	12 (30)
	Hepatitis C	3 (2)	4 (4)	0	4 (3)	2 (2)	0	4 (4)	**17 (3)**	1 (3)
	Alcoholic liver disease	40 (30)	22 (22)	12 (19)	35 (25)	42 (42)	10 (24)	31 (33)	**192 (29)**	6 (15)
	Hepatitis B	4 (3)	2 (2)	1 (2)	3 (2)	0	1 (2)	7 (7)	**18 (3)**	0
	Primary sclerosing cholangitis	19 (14)	18 (18)	8 (13)	22 (15)	9 (9)	5 (12)	15 (16)	**96 (14)**	9 (23)
	Primary biliary cholangitis	13 (10)	6 (6)	8 (13)	8 (6)	6 (6)	4 (10)	2 (2)	**47 (7)**	3 (8)
	Autoimmune and cryptogenic disease	10 (7)	5 (5)	2 (3)	18 (13)	2 (2)	3 (7)	7 (7)	**47 (7)**	2 (5)
	Metabolic	24 (18)	21 (21)	12 (19)	21 (15)	14 (14)	2 (5)	11 (12)	**105 (16)**	4 (10)
	Other	7 (5)	4 (4)	1 (2)	14 (10)	4 (4)	3 (7)	6 (6)	**39 (6)**	3 (8)
Recipient HCV status	Negative	125 (93)	91 (93)	57 (92)	133 (94)	86 (87)	38 (93)	86 (91)	**616 (92)**	27 (68)
	Positive	8 (6)	6 (6)	3 (5)	8 (6)	6 (6)	0	7 (7)	**38 (6)**	3 (8)
	Not reported	1 (1)	1 (1)	2 (3)	1 (1)	7 (7)	3 (7)	1 (1)	**16 (2)**	10 (25)

Table 3.4 Demographic characteristics of adult elective first deceased donor liver only transplant recipients, 1 April 2023 - 31 March 2024

		Birmingham	Cambridge	Edinburgh	King's College	Leeds	Newcastle	Royal Free	**UK**	**Dublin**
		N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	**N (%)**	**N (%)**
Pre-tx in-patient status	Out-patient	111 (83)	62 (63)	49 (79)	115 (81)	89 (90)	38 (93)	84 (89)	**548 (82)**	33 (83)
	In-patient	23 (17)	36 (37)	12 (19)	27 (19)	6 (6)	3 (7)	10 (11)	**117 (18)**	7 (18)
	Not reported	0	0	1 (2)	0	4 (4)	0	0	**5 (1)**	0
Ascites	Absence	56 (42)	35 (36)	31 (50)	58 (41)	33 (33)	19 (46)	66 (70)	**298 (45)**	25 (63)
	Presence	78 (58)	62 (63)	29 (47)	83 (58)	60 (61)	22 (54)	28 (30)	**362 (54)**	15 (38)
	Not reported	0	1 (1)	2 (3)	1 (1)	6 (6)	0	0	**10 (2)**	0
Encephal opathy	Absence	91 (68)	50 (51)	48 (77)	104 (73)	63 (64)	29 (71)	74 (79)	**459 (69)**	35 (88)
	Presence	43 (32)	28 (29)	13 (21)	38 (27)	24 (24)	12 (29)	19 (20)	**177 (26)**	5 (13)
	Not reported	0	20 (20)	1 (2)	0	12 (12)	0	1 (1)	**34 (5)**	0
Pre-tx renal support	No	119 (89)	87 (89)	59 (95)	136 (96)	92 (93)	37 (90)	88 (94)	**618 (92)**	40 (100)
	Yes	13 (10)	7 (7)	2 (3)	6 (4)	2 (2)	2 (5)	6 (6)	**38 (6)**	0
	Not reported	2 (1)	4 (4)	1 (2)	0	5 (5)	2 (5)	0	**14 (2)**	0
Previous abdominal surgery	No	133 (99)	63 (64)	52 (84)	132 (93)	88 (89)	39 (95)	86 (91)	**593 (89)**	37 (93)
	Yes	0	17 (17)	7 (11)	10 (7)	7 (7)	2 (5)	8 (9)	**51 (8)**	3 (8)
	Not reported	1 (1)	18 (18)	3 (5)	0	4 (4)	0	0	**26 (4)**	0
Varices & shunt	Absence	55 (41)	25 (26)	6 (10)	24 (17)	30 (30)	13 (32)	12 (13)	**165 (25)**	21 (53)
	Presence without treatment	53 (40)	65 (66)	51 (82)	114 (80)	41 (41)	26 (63)	79 (84)	**429 (64)**	19 (48)
	Presence with TIPS	0	5 (5)	4 (6)	3 (2)	1 (1)	0	3 (3)	**16 (2)**	0
	Not reported	26 (19)	3 (3)	1 (2)	1 (1)	27 (27)	2 (5)	0	**60 (9)**	0
Life style activity	Normal	34 (25)	16 (16)	8 (13)	8 (6)	11 (11)	4 (10)	17 (18)	**98 (15)**	5 (13)
	Restricted	55 (41)	32 (33)	23 (37)	17 (12)	41 (41)	16 (39)	51 (54)	**235 (35)**	15 (38)
	Self-care	39 (29)	36 (37)	19 (31)	92 (65)	39 (39)	18 (44)	20 (21)	**263 (39)**	10 (25)
	Confined	2 (1)	5 (5)	9 (15)	18 (13)	2 (2)	2 (5)	2 (2)	**40 (6)**	8 (20)
	Reliant	4 (3)	7 (7)	2 (3)	7 (5)	2 (2)	1 (2)	4 (4)	**27 (4)**	2 (5)
	Not reported	0	2 (2)	1 (2)	0	4 (4)	0	0	**7 (1)**	0
Graft appearance	Normal	115 (86)	68 (69)	57 (92)	125 (88)	73 (74)	41 (100)	63 (67)	**542 (81)**	37 (93)
	Abnormal	19 (14)	27 (28)	3 (5)	17 (12)	15 (15)	0	30 (32)	**111 (17)**	3 (8)
	Not reported	0	3 (3)	2 (3)	0	11 (11)	0	1 (1)	**17 (3)**	0

Table 3.4 Demographic characteristics of adult elective first deceased donor liver only transplant recipients, 1 April 2023 - 31 March 2024

		Birmingham	Cambridge	Edinburgh	King's College	Leeds	Newcastle	Royal Free	**UK**	**Dublin**
		N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	**N (%)**	**N (%)**
Recip age (years)	Median (IQR)	57 (48,64)	58 (49,63)	61 (53,65)	56 (45,62)	59 (49,65)	59 (48,64)	57 (49,61)	**58 (48,63)**	58 (52,63)
BMI (kg/m^2)	Median (IQR)	28 (25,33)	28 (25,32)	29 (25,31)	27 (23,32)	28 (25,32)	30 (24,35)	27 (24,31)	**28 (25,32)**	28 (25,32)
Serum bilirubin (umol/l)	Median (IQR)	55 (26,125)	57 (28,148)	43 (22,131)	43 (27,131)	46 (18,93)	41 (18,98)	53 (23,121)	**48 (24,119)**	32 (20,74)
	Not reported	0	0	1	0	4	0	1	**6**	0
Serum creatinine (umol/l)	Median (IQR)	71 (53,90)	73 (60,100)	68 (52,92)	67 (54,86)	74 (59,96)	67 (59,92)	82 (69,97)	**72 (58,93)**	65 (56,91)
	Not reported	0	0	1	0	4	0	0	**5**	0
Serum sodium (mmol/l)	Median (IQR)	136 (134,140)	138 (135,140)	135 (132,139)	137 (134,140)	136 (134,139)	137 (133,139)	138 (135,141)	**137 (134,140)**	138 (134,139)
	Not reported	2	0	3	0	5	0	0	**10**	0
Serum potassium (mmol/l)	Median (IQR)	4.2 (3.8,4.4)	4.2 (3.9,4.5)	4.2 (3.9,4.7)	4.2 (3.9,4.5)	4.2 (3.9,4.6)	4.1 (3.8,4.6)	4.3 (4.0,4.6)	**4.2 (3.9,4.5)**	4.1 (3.9,4.3)
	Not reported	6	0	3	0	4	0	2	**15**	0
INR	Median (IQR)	1.4 (1.2,1.8)	1.4 (1.2,1.8)	1.3 (1.1,1.5)	1.3 (1.1,1.5)	1.5 (1.3,1.9)	1.4 (1.1,1.6)	1.4 (1.2,1.6)	**1.4 (1.2,1.7)**	1.3 (1.1,1.5)
	Not reported	1	0	2	0	7	4	1	**15**	0
Serum albumin (g/l)	Median (IQR)	29 (24,33)	28 (24,32)	27 (21,30)	32 (27,36)	28 (24,31)	34 (31,41)	34 (29,38)	**30 (26,35)**	29 (26,31)
	Not reported	0	0	2	1	4	0	0	**7**	0
Cold ischaemia time (hrs)	Median (IQR)	8 (6,9)	9 (7,10)	10 (9,12)	9 (7,11)	8 (6,10)	11 (9,12)	8 (6,9)	**9 (7,10)**	6 (5,7)
	Not reported	0	5	3	0	4	0	1	**13**	0
Time on list (days)	Median (IQR)	96 (23,244)	44 (13,122)	138 (32,276)	117 (35,275)	84 (17,238)	35 (17,137)	54 (18,171)	**80 (22,235)**	103 (36,198)

Table 3.4 Demographic characteristics of adult elective first deceased donor liver only transplant recipients, 1 April 2023 - 31 March 2024

		Birmingham	Cambridge	Edinburgh	King's College	Leeds	Newcastle	Royal Free	**UK**	**Dublin**
		N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	**N (%)**	**N (%)**
Donor sex	Male	83 (62)	53 (54)	29 (47)	75 (53)	57 (58)	26 (63)	60 (64)	**383 (57)**	20 (50)
	Female	51 (38)	45 (46)	33 (53)	67 (47)	42 (42)	15 (37)	34 (36)	**287 (43)**	16 (40)
Donor ethnicity	White	121 (90)	90 (92)	54 (87)	127 (89)	88 (89)	37 (90)	82 (87)	**599 (89)**	0
	Asian	4 (3)	1 (1)	3 (5)	6 (4)	7 (7)	0	6 (6)	**27 (4)**	0
	Black	5 (4)	2 (2)	0	3 (2)	2 (2)	0	1 (1)	**13 (2)**	0
	Other	0	2 (2)	1 (2)	1 (1)	0	1 (2)	2 (2)	**7 (1)**	0
	Not reported	4 (3)	3 (3)	4 (6)	5 (4)	2 (2)	3 (7)	3 (3)	**24 (4)**	40 (100)
Donor cause of death	Intracranial	122 (91)	90 (92)	55 (89)	123 (87)	85 (86)	30 (73)	84 (89)	**589 (88)**	0
	Trauma	5 (4)	2 (2)	1 (2)	6 (4)	4 (4)	3 (7)	2 (2)	**23 (3)**	0
	Others	7 (5)	6 (6)	6 (10)	13 (9)	10 (10)	8 (20)	8 (9)	**58 (9)**	40 (100)
Donor history of diabetes	No	122 (91)	92 (94)	53 (85)	131 (92)	90 (91)	32 (78)	88 (94)	**608 (91)**	0
	Yes	12 (9)	5 (5)	6 (10)	9 (6)	9 (9)	6 (15)	4 (4)	**51 (8)**	0
	Not reported	0	1 (1)	3 (5)	2 (1)	0	3 (7)	2 (2)	**11 (2)**	40 (100)
Donor type	Donor after brain death	102 (76)	53 (54)	30 (48)	90 (63)	64 (65)	16 (39)	63 (67)	**418 (62)**	40 (100)
	Donor after cardiac death	32 (24)	45 (46)	32 (52)	52 (37)	35 (35)	25 (61)	31 (33)	**252 (38)**	0
ABO match	Identical	132 (99)	93 (96)	59 (95)	137 (96)	96 (97)	39 (95)	92 (98)	**648 (97)**	20 (100)
	Compatible	2 (1)	4 (4)	3 (5)	5 (4)	3 (3)	2 (5)	2 (2)	**21 (3)**	0
Graft type	Whole	128 (96)	94 (96)	62 (100)	137 (96)	92 (93)	41 (100)	89 (95)	**643 (96)**	40 (100)
	Right lobe	6 (4)	4 (4)	0	5 (4)	7 (7)	0	5 (5)	**27 (4)**	0
Donor age (years)	Median (IQR)	52 (42,65)	52 (38,62)	55 (38,65)	57 (43,67)	49 (35,61)	53 (40,63)	51 (38,64)	**53 (39,64)**	50 (42,60)
Donor BMI (kg/m2)	Median (IQR)	26 (23,31)	26 (24,31)	25 (22,29)	25 (23,29)	26 (24,30)	26 (22,30)	26 (23,29)	**26 (23,29)**	25 (23,29)
	Not reported	0	0	0	0	0	0	0	**0**	1

3.2.3 Post-transplant survival

LONG-TERM PATIENT SURVIVAL

Table 3.5 shows one year unadjusted and risk-adjusted patient survival for 2207 of the 2496 transplants in the period, 1 April 2019 to 31 March 2023. Transplants were excluded if they were auxiliary or if survival information or risk factors were missing. The overall patient survival rate is 95.2% and, after risk adjustment, four centres had a lower survival rate than the national rate. All centres lie within the lower 95% confidence limit, as shown in **Figure 3.15**.

Table 3.5 One year patient survival for adult elective deceased donor first liver transplants, 1 April 2019 - 31 March 2023

Centre	Number of transplants	1-year survival % (95% CI) Unadjusted		Risk-adjusted	
Newcastle	108	97.2	91.6 - 99.1	96.3	88.6 - 98.8
Leeds	266	93.6	89.8 - 95.9	93.9	90.2 - 96.2
Cambridge	304	95.7	92.7 - 97.5	96.4	93.8 - 97.9
Royal Free	313	94.2	90.9 - 96.3	94.5	91.2 - 96.5
King's College	549	97.3	95.5 - 98.4	96.9	94.8 - 98.2
Birmingham	446	94.8	92.2 - 96.5	94.0	91.0 - 96.0
Edinburgh	221	92.7	88.4 - 95.5	94.4	90.9 - 96.6
Total	**2207**	**95.2**	**94.2 – 96.0**		

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 3.15 Risk-adjusted 1 year patient survival rates for adult elective deceased donor first liver transplants, 1 April 2019 - 31 March 2023

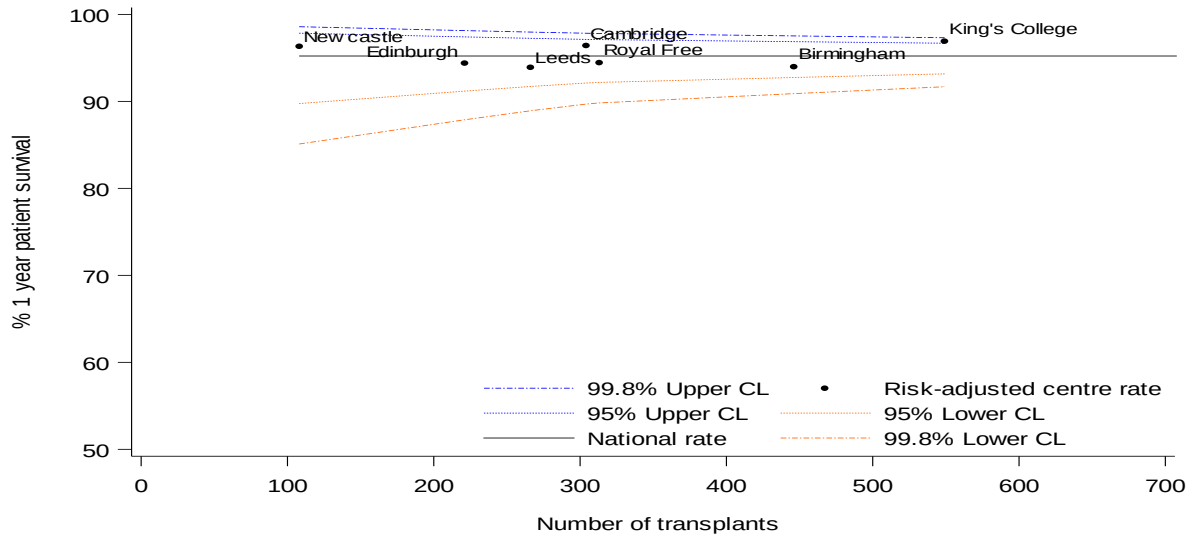


Table 3.6 shows the five year unadjusted and risk-adjusted patient survival for 2614 of the 2834 transplants in the period, 1 April 2015 to 31 March 2019. The national rate is 82.9% and four centres have a lower survival rate after risk adjustment, as shown in **Figure 3.16**. The median number of days 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 264 days for Newcastle to 617 days for Edinburgh. The medians for all other centres fall in between these extremes. Results should therefore be interpreted in that light.

Table 3.6 Five year patient survival for adult elective deceased donor first liver transplants, 1 April 2015 - 31 March 2019

Centre	Number of transplants	5-year survival % (95% CI) Unadjusted		Risk-adjusted	
Newcastle	114	78.7	70.0 - 85.2	77.8	66.9 - 85.1
Leeds	329	81.5	76.9 - 85.4	79.6	73.8 - 84.2
Cambridge	310	86.5	82.1 - 89.9	88.2	84.0 - 91.3
Royal Free	331	81.4	76.7 - 85.2	79.9	74.2 - 84.4
King's College	589	85.9	82.7 - 88.5	85.7	82.1 - 88.5
Birmingham	637	80.9	77.6 - 83.8	80.8	77.0 - 84.0
Edinburgh	304	82.2	76.9 - 86.3	84.2	79.0 - 88.1
Total	**2614**	**82.9**	**81.4 – 84.3**		

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 3.16 Risk-adjusted 5 year patient survival rates for adult elective deceased donor first liver transplants, 1 April 2015 - 31 March 2019

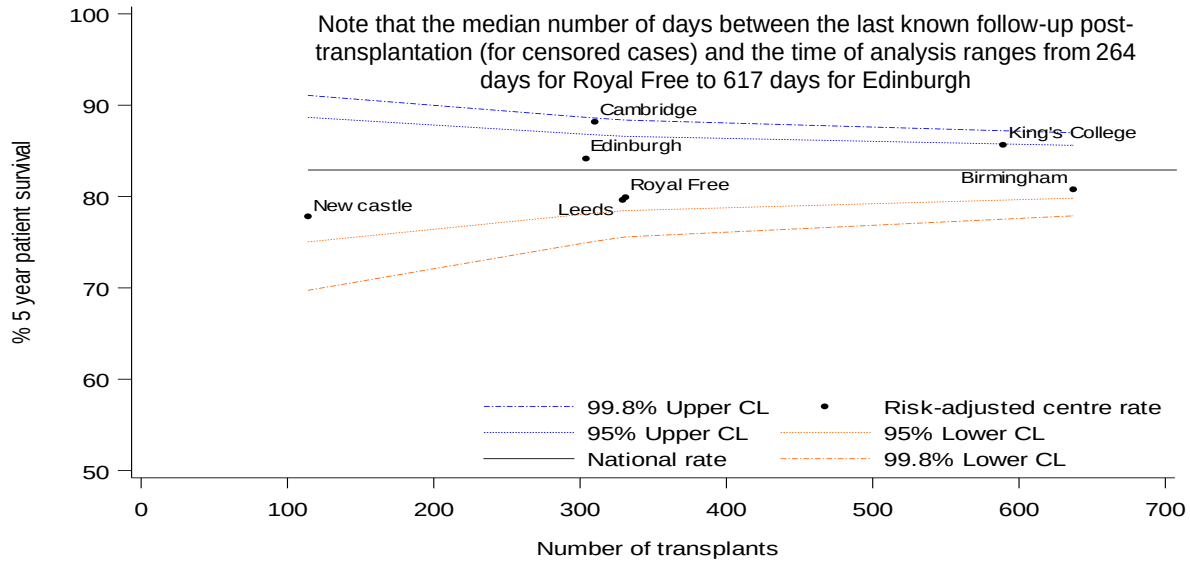


Table 3.7 shows one year unadjusted and risk-adjusted patient survival, by primary disease group. The overall patient survival rate is 95.2% and, after risk adjustment, patients with cancer, autoimmune and cryptogenic, PBC, metabolic disease or other liver disease had lower survival than the national rate.

Table 3.7 One year patient survival for adult elective deceased donor first liver transplants, 1 April 2019 - 31 March 2023

Primary disease	Number of transplants	1-year survival % (95% CI) Unadjusted		Risk adjusted	
Cancer	362	93.0	(89.9 - 95.2)	94.6	(92.0 - 96.3)
Hepatitis B and C	94	96.6	(89.9 - 98.9)	97.9	(93.6 - 99.3)
Alcoholic liver disease	642	97.2	(95.5 - 98.2)	96.9	(95.1 - 98.1)
Primary sclerosing cirrhosis	278	97.1	(94.2 - 98.5)	96.2	(92.3 - 98.1)
Primary biliary cirrhosis	191	94.7	(90.4 - 97.1)	93.5	(87.9 - 96.5)
Autoimmune and cryptogenic	168	95.7	(91.1 - 97.9)	95.3	(90.1 - 97.8)
Metabolic	326	93.5	(90.2 - 95.7)	94.1	(90.9 - 96.1)
Other	146	91.6	(85.7 - 95.1)	90.0	(82.5 - 94.3)
Total	**2207**	**95.2**	**(94.2 – 96.0)**		

Table 3.8 shows five year unadjusted and risk-adjusted patient survival, the overall patient survival rate is 82.9%. After risk adjustment, patients with cancer, PSC, metabolic or other liver disease had lower survival than the national rate.

Table 3.8 Five year patient survival for adult elective deceased donor first liver transplants, 1 April 2015 - 31 March 2019

Primary disease	Number of transplants	5-year survival % (95% CI) Unadjusted		Risk adjusted	
Cancer	563	77.1	(73.3 - 80.4)	81.7	(78.2 - 84.7)
Hepatitis B and C	151	89.8	(83.7 - 93.7)	90.7	(84.5 - 94.4)
Alcoholic liver disease	728	84.6	(81.7 - 87.1)	83.9	(80.5 - 86.7)
Primary sclerosing cirrhosis	311	83.2	(78.4 - 86.9)	78.3	(71.4 - 83.5)
Primary biliary cirrhosis	214	87.9	(82.6 - 91.7)	87.4	(81.4 - 91.5)
Autoimmune and cryptogenic	175	86.6	(80.5 - 90.9)	83.5	(75.2 - 89.0)
Metabolic	306	80.5	(75.4 - 84.7)	80.6	(74.8 - 85.1)
Other	166	81.9	(75.0 - 87.1)	80.6	(72.1 - 86.5)
Total	**2614**	**82.9**	**(81.4 - 84.3)**		

3.2.4 Survival from listing

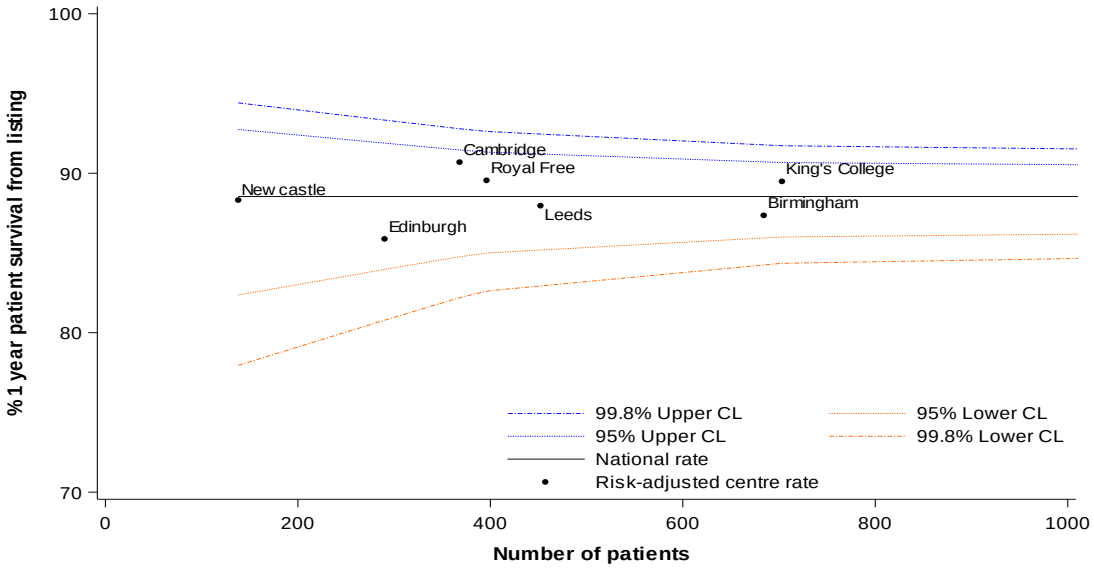
Table 3.9A shows one year unadjusted and risk-adjusted survival from listing for patients aged 18 years or over registered for the first time for a liver transplant in the UK between 1 April 2019 to 31 March 2023. The overall one year survival from listing rate is 88.5% and, after risk adjustment, four centres had a lower survival rate than the national rate. All centres lie within the 95% confidence limits, as shown in **Figure 3.17**. Dublin are not included in **Table 3.9A** and **Figure 3.17**.

Table 3.9A 1 year patient survival rate from listing for adult elective first liver registrations, 1 April 2019 - 31 March 2023

Centre	Number of registrations	Number at risk at 1 year	1 year patient survival % (95% CI) Unadjusted		Risk-adjusted	
Newcastle	138	114	88.3	(81.6 - 92.7)	88.3	(84.2 - 91.4)
Leeds	452	362	87.5	(84 - 90.2)	88.0	(85.0 - 90.4)
Cambridge	368	310	90.9	(87.5 - 93.5)	90.7	(87.4 - 93.1)
Royal Free	396	319	90.7	(87.3 - 93.2)	89.6	(86.5 - 91.9)
King's College	703	586	90.5	(88.1 - 92.5)	89.5	(87.0 - 91.5)
Birmingham	684	550	87.1	(84.3 - 89.4)	87.4	(84.6 - 89.6)
Edinburgh	290	219	83.0	(78.1 - 86.8)	85.9	(81.0 - 89.5)
UK	**3031**	**2460**	**88.5**	**(87.3 - 89.6)**		

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 3.17 Risk-adjusted 1 year patient survival rate from time of listing for adult* elective first liver registrations, 1 April 2019 - 31 March 2023



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

Table 3.9B shows five year unadjusted and risk-adjusted survival from listing for patients aged 18 years or over registered for the first time for a liver transplant in the UK between 1 April 2015 to 31 March 2019. The overall five year survival from listing rate is 75.5% and, after risk adjustment, four centres had a lower survival rate than the national rate. All centres lie within the 99.8% confidence limits, as shown in **Figure 3.18**. Dublin are not included in **Table 3.9B** and **Figure 3.18**.

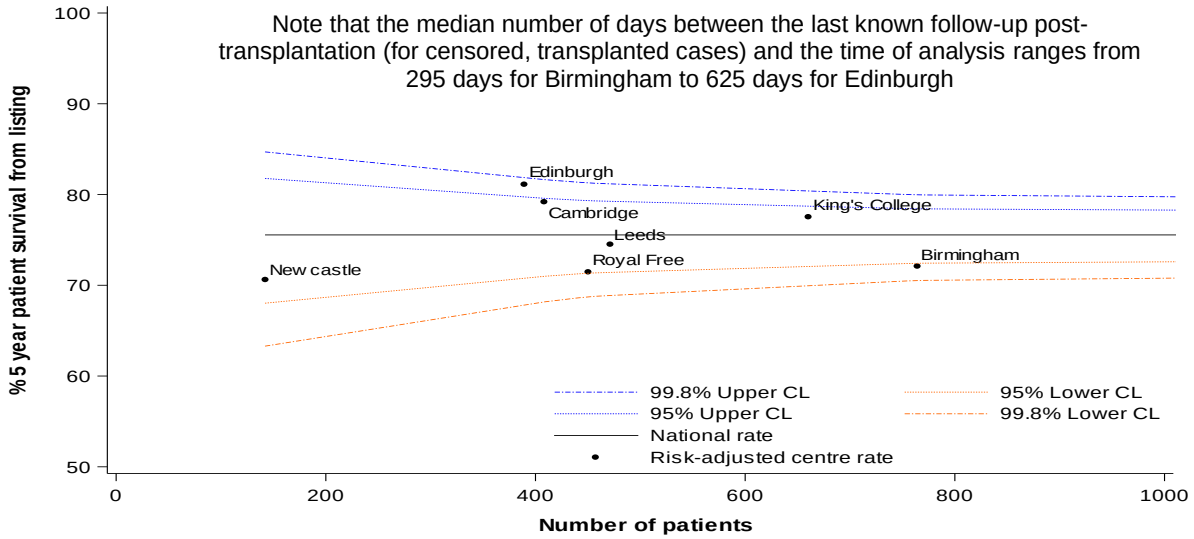
Note, however, that the median number of days between the last known follow-up post-transplantation (for censored, transplanted cases) and the time of analysis in **Figure 3.18** ranges from 295 days for Birmingham to 625 days for Edinburgh. The medians for all other centres fall in between these extremes. Results should therefore be interpreted in that light.

Table 3.9B 5 year patient survival rate from listing for adult elective first liver registrations, 1 April 2015 - 31 March 2019

Centre	Number of registrations	Number at risk at 5 year	5 year patient survival % (95% CI) Unadjusted		Risk-adjusted	
Newcastle	142	74	65.2	(56.4 - 72.6)	70.6	(61.7 - 77.5)
Leeds	471	274	75.2	(70.8 - 78.9)	74.5	(69.8 - 78.5)
Cambridge	408	208	78.7	(74.3 - 82.5)	79.2	(74.7 - 82.9)
Royal Free	450	256	72.3	(67.7 - 76.3)	71.5	(66.1 - 76.0)
King's College	660	393	78.5	(75.0 - 81.6)	77.6	(73.7 - 80.8)
Birmingham	764	435	73.4	(70.0 - 76.5)	72.1	(68.0 - 75.7)
Edinburgh	389	191	79.3	(74.6 - 83.3)	81.1	(76.6 - 84.8)
UK	**3284**	**1831**	**75.5**	**(74.0 – 77.0)**		

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 3.18 Risk-adjusted 5 year patient survival rate from time of listing for adult* elective first liver registrations, 1 April 2015 - 31 March 2019



* 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 four of the seven UK centres.

Table 3.10 Median waiting time to liver only transplant in the UK, for adult super urgent patients registered 1 April 2021 - 31 March 2023

Transplant centre	Number of patients registered	Waiting time (days)	
		Median	95% Confidence interval
Adult			
Newcastle	11	2	2 - 2
Cambridge	26	2	1 - 3
Royal Free	31	2	-
Edinburgh	10	2	1 - 3
Leeds	29	3	2 - 4
King's College	49	3	2 - 4
Birmingham	41	3	2 - 4
UK	**197**	**2**	**2 - 2**
Dublin	**8**	**1**	**-**

The demographic characteristics of 101 adult super-urgent registrations in the UK, and 7 in Dublin, 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 (55%) and the median age was 44 years with a median BMI of 28 kg/m^2. For some characteristics, due to rounding, percentages may not add up to 100.

Table 3.11 Demographic characteristics of adult super urgent liver patients registered from 1 April 2023 - 31 March 2024

		Birmingham N (%)	Cambridge N (%)	Edinburgh N (%)	King's college N (%)	Leeds N (%)	Newcastle N (%)	Royal Free N (%)	**UK N (%)**	**Dublin N (%)**
Number		**18**	**17**	**17**	**12**	**18**	**5**	**14**	**101**	**7**
Recipient sex	Male	9 (50)	9 (53)	7 (41)	8 (67)	6 (33)	1 (20)	5 (36)	**45 (45)**	**3 (43)**
	Female	9 (50)	8 (47)	10 (59)	4 (33)	12 (67)	4 (80)	9 (64)	**56 (55)**	**4 (57)**
Recipient ethnicity	White	13 (72)	15 (88)	16 (94)	10 (83)	13 (72)	5 (100)	9 (64)	**81 (80)**	**6 (86)**
	Asian	3 (17)	1 (6)	1 (6)	1 (8)	4 (22)	0 (0)	2 (14)	**12 (12)**	**0 (0)**
	Other	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	**0 (0)**	**1 (14)**
	Black	0 (0)	0 (0)	0 (0)	1 (8)	1 (6)	0 (0)	2 (14)	**4 (4)**	**0 (0)**
	Not reported	2 (11)	1 (6)	0 (0)	0 (0)	0 (0)	0 (0)	1 (7)	**4 (4)**	**0 (0)**
Recipient HCV	No	18 (100)	17 (100)	17 (100)	12 (100)	18 (100)	5 (100)	14 (100)	**101 (100)**	**7 (100)**
	Yes	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	**0 (0)**	**0 (0)**
Encephalopathy	Absence	5 (28)	6 (35)	3 (18)	2 (17)	2 (11)	0 (0)	3 (21)	**21 (21)**	**2 (29)**
	Presence	11 (61)	9 (53)	13 (76)	7 (58)	14 (78)	4 (80)	10 (71)	**68 (67)**	**4 (57)**
	Not reported	2 (11)	2 (12)	1 (6)	3 (25)	2 (11)	1 (20)	1 (7)	**12 (12)**	**1 (14)**
Renal support	No	8 (44)	9 (53)	3 (18)	3 (25)	9 (50)	4 (80)	6 (43)	**42 (42)**	**6 (86)**
	Yes	10 (56)	8 (47)	14 (82)	8 (67)	9 (50)	0 (0)	7 (50)	**56 (55)**	**1 (14)**
	Not reported	0 (0)	0 (0)	0 (0)	1 (8)	0 (0)	1 (20)	1 (7)	**3 (3)**	**0 (0)**
Recip age (years)	Median (IQR)	42 (23, 51)	44 (39, 57)	36 (28, 51)	54.5 (36.5, 59)	42 (27, 59)	40 (32, 49)	45 (42, 55)	**44 (32, 56)**	**38 (19, 52)**
BMI (kg/m2)	Median (IQR)	27 (24, 30)	28 (25, 31)	27 (25, 29)	30 (24, 32.5)	30 (21, 33)	26 (26, 26)	27.5 (24, 30)	**28 (24, 31)**	**26 (23, 30)**
Serum bilirubin (umol/l)	Median (IQR)	118.5 (70, 308)	185 (81, 427)	104 (65, 183)	269 (48, 437)	114.5 (60, 327)	273 (125, 340.5)	280 (86, 408)	**157 (70, 338)**	**353 (99, 495)**
	Not reported	0	1	0	1	0	1	0	**3**	**0**
Serum creatinine (umol/l)	Median (IQR)	96.5 (67, 160)	86 (61, 153.5)	127 (94, 271)	87 (50, 159)	125 (81, 192)	136 (84.5, 162.5)	89 (73, 111)	**98.5 (66.5, 170.5)**	**77 (64, 206)**
	Not reported	0	1	1	0	1	1	1	**5**	**0**

Table 3.11 Demographic characteristics of adult super urgent liver patients registered from 1 April 2023 - 31 March 2024

		Birmingham N (%)	Cambridge N (%)	Edinburgh N (%)	King's college N (%)	Leeds N (%)	Newcastle N (%)	Royal Free N (%)	**UK N (%)**	**Dublin N (%)**
Serum sodium (mmol/l)	Median (IQR)	134.5 (129, 136)	137 (136, 143)	143 (140, 146)	138 (136.5, 141.5)	136.5 (130, 138)	136 (131, 138)	139.5 (136, 142)	**137 (134.5, 142)**	**136 (136, 138)**
	Not reported	0	0	0	0	0	1	0	**1**	**0**
Serum potassium (mmol/l)	Median (IQR)	4.2 (4, 4.8)	4.3 (4, 4.7)	4.5 (3.6, 5)	4.6 (4.2, 5.2)	4.6 (3.9, 5.4)	4.3 (3.5, 4.9)	4.3 (3.7, 4.9)	**4.4 (3.9, 5)**	**3.8 (3.6, 4)**
	Not reported	0	0	0	1	0	1	0	**2**	**1**
INR	Median (IQR)	2.9 (1.7, 5.2)	4.2 (2.6, 5.5)	4.1 (3, 5.8)	3.5 (1.8, 5.2)	3 (1.9, 5.4)	2.2 (1.4, 5)	2.6 (2, 4.2)	**3.4 (2.2, 5.4)**	**3.2 (2.6, 4.5)**
	Not reported	0	2	1	0	0	2	0	**5**	**0**
Serum albumin (g/l)	Median (IQR)	23 (19, 28)	26 (21, 31)	27 (22, 28)	30 (25, 32)	24 (19, 25)	27.5 (23, 33.5)	28.5 (25, 31)	**25 (22, 30)**	**25 (18, 27)**
	Not reported	0	0	2	1	1	1	0	**5**	**0**

3.2.2 Transplant activity

Figure 3.19 shows the number of UK adult super-urgent first liver only transplants from deceased and living donors performed in the UK in the last ten years, by type of donor. There have been 12 DCD super-urgent transplants during the ten year period and no adult super-urgent liver only transplants from living donors. Dublin are not included.

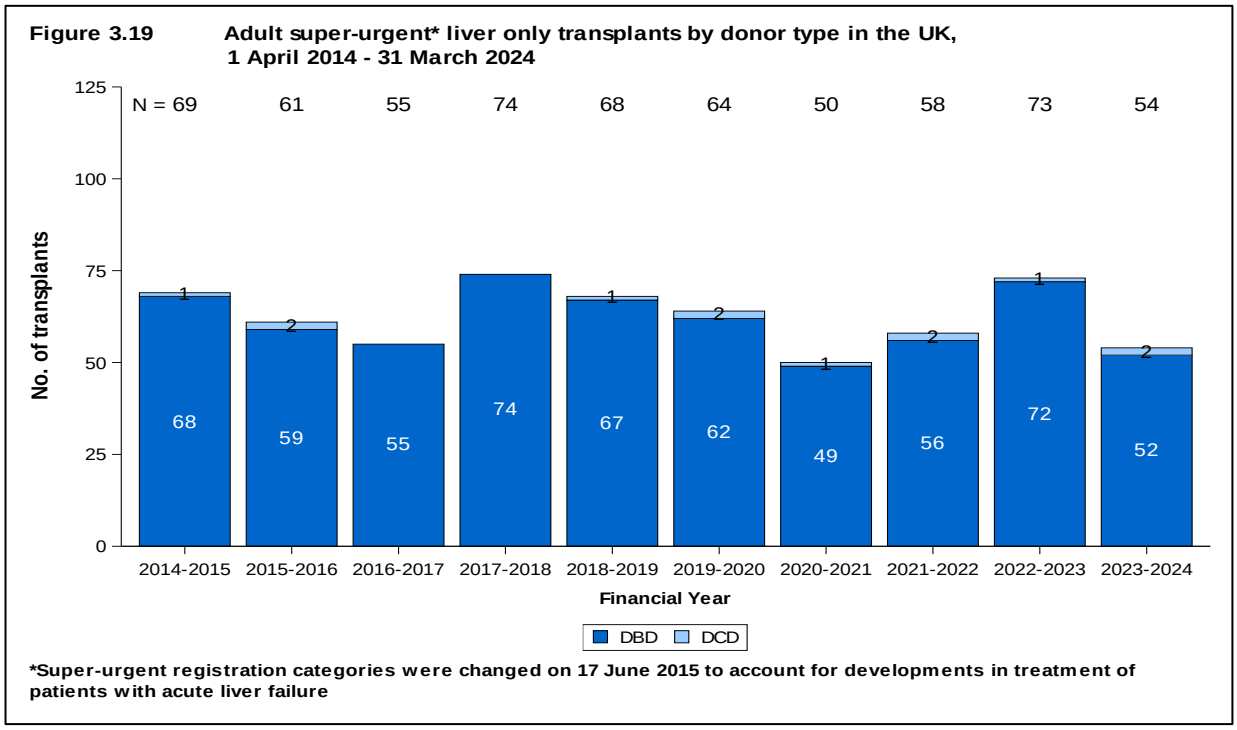
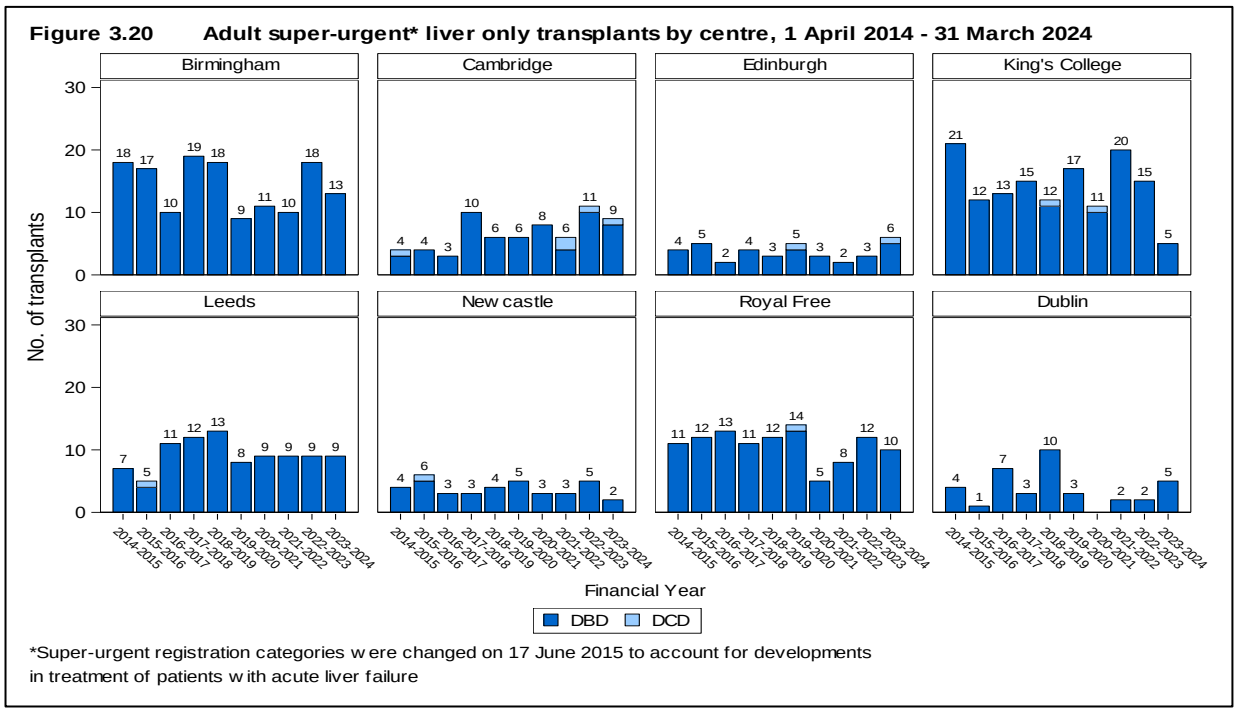


Figure 3.20 shows the number of adult super-urgent first liver only transplants from deceased and living donors performed in the last ten years, by type of donor and UK and RoI transplant centre.



The demographic characteristics of 54 adult super-urgent transplant recipients in the UK and 5 in Dublin in the last financial year are shown by centre and overall in **Table 3.12**. Sixty three percent of these recipients in the UK were female and the median age was 43 years with a median BMI of 27kg/m^2. All but two super-urgent transplants were performed in this time period using a DBD donor. 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 2023 - 31 March 2024

		Birmingham	Cambridge	Edinburgh	King's College	Leeds	Newcastle	Royal Free	**UK**	**Dublin**
		N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	**N (%)**	**N (%)**
Number		13	9	6	5	9	2	10	**54 (100)**	**5**
Recipient sex	Male	5 (38)	5 (56)	2 (33)	2 (40)	3 (33)	0	3 (30)	**20 (37)**	**1 (20)**
	Female	8 (62)	4 (44)	4 (67)	3 (60)	6 (67)	2 (100)	7 (70)	**34 (63)**	**4 (80)**
Recipient ethnicity	White	9 (69)	8 (89)	6 (100)	4 (80)	5 (56)	2 (100)	6 (60)	**40 (74)**	**4 (80)**
	Asian	2 (15)	0	0	1 (20)	3 (33)	0	1 (10)	**7 (13)**	**0**
	Black	0	0	0	0	1 (11)	0	2 (20)	**3 (6)**	**0**
	Other	0	0	0	0	0	0	0		**1 (20)**
	Not reported	2 (15)	1 (11)	0	0	0	0	1 (10)	**4 (7)**	**0**
Recipient HCV status	Negative	12 (92)	9 (100)	6 (100)	4 (80)	7 (78)	2 (100)	9 (90)	**49 (91)**	**5 (100)**
	Not reported	1 (8)	0	0	1 (20)	2 (22)	0	1 (10)	**5 (9)**	**0**
Pre-transplant in-patient status	Out-patient	1 (8)	1 (11)	0	0	1 (11)	0	0	**3 (6)**	**0**
	In-patient	12 (92)	8 (89)	6 (100)	5 (100)	8 (89)	2 (100)	10 (100)	**51 (94)**	**5 (100)**
Ascites	Absence	4 (31)	3 (33)	5 (83)	2 (40)	6 (67)	1 (50)	10 (100)	**31 (57)**	**2 (40)**
	Presence	6 (46)	6 (67)	1 (17)	3 (60)	2 (22)	1 (50)	0	**19 (35)**	**3 (60)**
	Not reported	3 (23)	0	0	0	1 (11)	0	0	**4 (7)**	**0**
Encephalopathy	Absence	10 (77)	2 (22)	0	0	2 (22)	0	1 (10)	**15 (28)**	**3 (60)**
	Presence	3 (23)	5 (56)	6 (100)	5 (100)	5 (56)	1 (50)	9 (90)	**34 (63)**	**2 (40)**
	Not reported	0	2 (22)	0	0	2 (22)	1 (50)	0	**5 (9)**	**0**
Pre-transplant renal support	No	4 (31)	3 (33)	0	1 (20)	4 (44)	1 (50)	4 (40)	**17 (32)**	**3 (60)**
	Yes	9 (69)	6 (67)	6 (100)	4 (80)	5 (56)	1 (50)	6 (60)	**37 (69)**	**2 (40)**
Previous abdominal surgery	No	12 (92)	1 (11)	5 (83)	5 (100)	7 (78)	2 (100)	10 (100)	**42 (78)**	**5 (100)**
	Yes	0	2 (22)	1 (17)	0	1 (11)	0	0	**4 (7)**	**0**
	Not reported	0	6 (67)	0	0	1 (11)	0	0	**7 (13)**	**0**

Table 3.12 Demographic characteristics of adult super-urgent deceased donor liver transplant recipients, 1 April 2023 - 31 March 2024

		Birmingham	Cambridge	Edinburgh	King's College	Leeds	Newcastle	Royal Free	**UK**	**Dublin**
		N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	**N (%)**	**N (%)**
Varices & shunt	Absence	3 (23)	2 (22)	3 (50)	1 (20)	4 (44)	1 (50)	4 (40)	**18 (33)**	**3 (60)**
	Presence without treatment	2 (15)	6 (67)	2 (33)	4 (80)	1 (11)	1 (50)	6 (60)	**22 (41)**	**2 (40)**
	Not reported	8 (62)	1 (11)	1 (17)	0	4 (44)	0	0	**14 (26)**	**0**
Life style activity	Normal	1 (8)	1 (11)	0	0	1 (11)	0	0	**3 (6)**	**0**
	Restricted	2 (15)	0	0	0	0	0	0	**2 (4)**	**1 (20)**
	Self-care	2 (15)	1 (11)	0	0	1 (11)	0	3 (30)	**7 (13)**	**0**
	Confined	2 (15)	0	0	0	0	0	0	**2 (4)**	**1 (20)**
	Reliant	6 (46)	7 (78)	6 (100)	5 (100)	7 (78)	2 (100)	7 (70)	**40 (74)**	**3 (60)**
Graft appearance	Normal	11 (85)	6 (67)	5 (83)	5 (100)	7 (78)	2 (100)	10 (100)	**46 (85)**	**5 (100)**
	Abnormal	2 (15)	3 (33)	1 (17)	0	0	0	0	**6 (11)**	**0**
	Not reported	0	0	0	0	2 (22)	0	0	**2 (4)**	**0**
Recip age (years)	Median (IQR)	41 (23,43)	44 (39,53)	34 (27,44)	41 (32,45)	38 (26,45)	36 (32,40)	45 (42,51)	**43 (32,49)**	**25 (19,38)**
BMI (kg/m2)	Median (IQR)	26 (24,30)	28 (25,30)	24 (21,28)	25 (23,32)	26 (21,33)	26 (26,27)	29 (27,31)	**27 (24,30)**	**26 (24,28)**
Serum bilirubin (umol/l)	Median (IQR)	241 (166,357)	363 (109,492)	100 (48,213)	374 (356,449)	314 (120,368)	339 (307,370)	258 (151,362)	**275 (120,374)**	**498 (409,547)**
Serum creatinine (umol/l)	Median (IQR)	79 (66,118)	76 (54,112)	142 (104,163)	49 (46,96)	160 (97,221)	97 (60,133)	77 (69,104)	**94 (64,138)**	**101 (85,139)**
Serum sodium (mmol/l)	Median (IQR)	136 (133,149)	142 (138,143)	149 (146,150)	137 (137,140)	137 (136,141)	142 (134,149)	144 (137,147)	**141 (136,146)**	**134 (132,135)**
	Not reported	1	0	0	0	0	0	0	**1**	**0**

Table 3.12 Demographic characteristics of adult super-urgent deceased donor liver transplant recipients, 1 April 2023 - 31 March 2024

		Birmingham	Cambridge	Edinburgh	King's College	Leeds	Newcastle	Royal Free	**UK**	**Dublin**
		N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	**N (%)**	**N (%)**
Serum potassium (mmol/l)	Median (IQR)	4.2 (3.8,4.4)	4.0 (3.9,4.2)	4.1 (3.9,4.3)	4.4 (4.2,4.8)	4.8 (4.8,5.4)	3.9 (3.8,4.0)	4.1 (3.9,4.7)	**4.2 (3.9,4.5)**	**3.8 (3.6,3.9)**
INR	Median (IQR)	2.6 (1.6,3.5)	3.5 (2.9,5.3)	1.3 (1.3,1.9)	4.5 (4.1,5.2)	3.2 (2.2,8.4)	5.0 (5.0,5.0)	2.4 (2.1,3.1)	**2.8 (2.0,4.1)**	**2.8 (2.8,3.9)**
	Not reported	1	0	1	0	0	1	0	**3**	**0**
Serum albumin (g/l)	Median (IQR)	23 (21,25)	28 (18,28)	26 (24,28)	30 (27,31)	23 (20,26)	23 (21,24)	30 (28,33)	**25 (21,29)**	**25 (22,28)**
	Not reported	0	0	0	0	1	0	0	**1**	**0**
Time on list (days)	Median (IQR)	3 (2,4)	2 (1,2)	2 (2,4)	2 (2,2)	2 (1,3)	3 (2,3)	2 (2,4)	**2 (2,3)**	**3 (2,4)**
Donor sex	Male	7 (54)	4 (44)	2 (33)	2 (40)	5 (56)	2 (100)	2 (20)	**24 (44)**	**1 (20)**
	Female	6 (46)	5 (56)	4 (67)	3 (60)	4 (44)	0	8 (80)	**30 (56)**	**4 (80)**
Donor ethnicity	White	13 (100)	9 (100)	4 (67)	2 (40)	9 (100)	2 (100)	10 (100)	**49 (91)**	**4 (80)**
	Asian	0	0	2 (33)	2 (40)	0	0	0	**4 (7)**	**0**
	Other	0	0	0	1 (20)	0	0	0	**1 (2)**	**0**
	Not reported	0	0	0	0	0	0	0	**0**	**1 (20)**
Donor cause of death	Intracranial	12 (92)	9 (100)	5 (83)	5 (100)	9 (100)	2 (100)	7 (70)	**49 (91)**	**3 (60)**
	Trauma	1 (8)	0	0	0	0	0	1 (10)	**2 (4)**	**0**
	Others	0	0	1 (17)	0	0	0	2 (20)	**3 (6)**	**2 (40)**
Donor history of diabetes	No	13 (100)	7 (78)	6 (100)	5 (100)	9 (100)	2 (100)	10 (100)	**52 (96)**	**4 (80)**
	Yes	0	1 (11)	0	0	0	0	0	**1 (2)**	**0**
	Not reported	0	1 (11)	0	0	0	0	0	**1 (2)**	**1 (20)**
Donor type	DBD	13 (100)	8 (89)	5 (83)	5 (100)	9 (100)	2 (100)	10 (100)	**52 (96)**	**5 (100)**
	DCD	0	1 (11)	1 (17)	0	0	0	0	**2 (4)**	**0**

Table 3.12 Demographic characteristics of adult super-urgent deceased donor liver transplant recipients, 1 April 2023 - 31 March 2024

		Birmingham	Cambridge	Edinburgh	King's College	Leeds	Newcastle	Royal Free	**UK**	**Dublin**
		N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	**N (%)**	**N (%)**
ABO match	Identical	8 (62)	8 (89)	6 (100)	4 (80)	6 (67)	1 (50)	7 (70)	**40 (74)**	**1 (20)**
	Compatible	5 (38)	1 (11)	0	1 (20)	3 (33)	1 (50)	3 (30)	**14 (26)**	**4 (80)**
Graft type	Whole	13 (100)	9 (100)	6 (100)	5 (100)	9 (100)	2 (100)	10 (100)	**54 (100)**	**5 (100)**
Donor age (years)	Median (IQR)	46 (27,56)	56 (43,63)	43 (24,64)	47 (43,52)	47 (28,65)	61 (56,66)	47 (24,56)	**50 (27,62)**	**29 (16,33)**
Donor BMI (kg/m2)	Median (IQR)	25 (24,27)	27 (23,29)	23 (22,25)	24 (23,24)	23 (20,27)	27 (25,28)	25 (23,29)	**25 (23,27)**	**22 (19,25)**

3.3.3 Post-transplant survival

LONG-TERM PATIENT SURVIVAL

Table 3.13 shows one year unadjusted and risk-adjusted patient survival for 201 of the 245 transplants in the period 1 April 2019 to 31 March 2023. 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.**

Table 3.13 One year patient survival for adult super-urgent deceased donor first liver transplants, 1 April 2019 - 31 March 2023

Centre	Number of transplants	1-year survival % (95% CI) Unadjusted		Risk-adjusted	
Newcastle	15	73.3	43.6 - 89.1	77.2	39.2 - 91.4
Leeds	26	88.1	67.6 - 96.0	81.4	42.2 - 94.0
Cambridge	30	96.7	78.6 - 99.5	96.8	77.5 - 99.6
Royal Free	35	91.4	75.7 - 97.2	93.0	78.2 - 97.7
King's College	52	92.0	80.1 - 96.9	90.9	75.6 - 96.6
Birmingham	30	90.0	72.1 - 96.7	88.4	63.9 - 96.2
Edinburgh	13	92.3	56.6 - 98.9	95.1	65.0 - 99.3
Total	**201**	**90.4**	**85.3 - 93.8**		

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 2019 - 31 March 2023

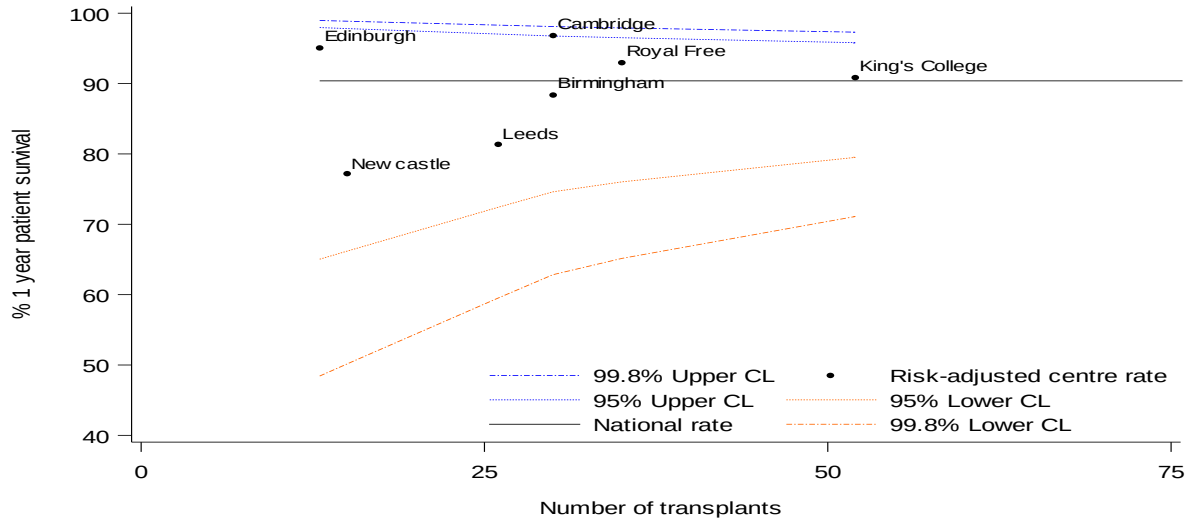


Table 3.14 shows the five year unadjusted and risk-adjusted patient survival for 221 of the 258 transplants in the period, 1 April 2015 to 31 March 2019. The national rate is 83.5% and four centres have a lower survival rate after risk adjustment as shown in **Figure 3.22**. Leeds has a risk-adjusted survival rate above the 95% confidence interval indicating that the survival rates are significantly higher than the national rate whilst Newcastle has a risk-adjusted survival rate below the 95% confidence interval indicating that the survival rates are significantly lower than the national rate. All other centres fall within the 95% confidence limits. Caution should be taken in interpreting the survival rates due to small number of transplants at Newcastle and Edinburgh.

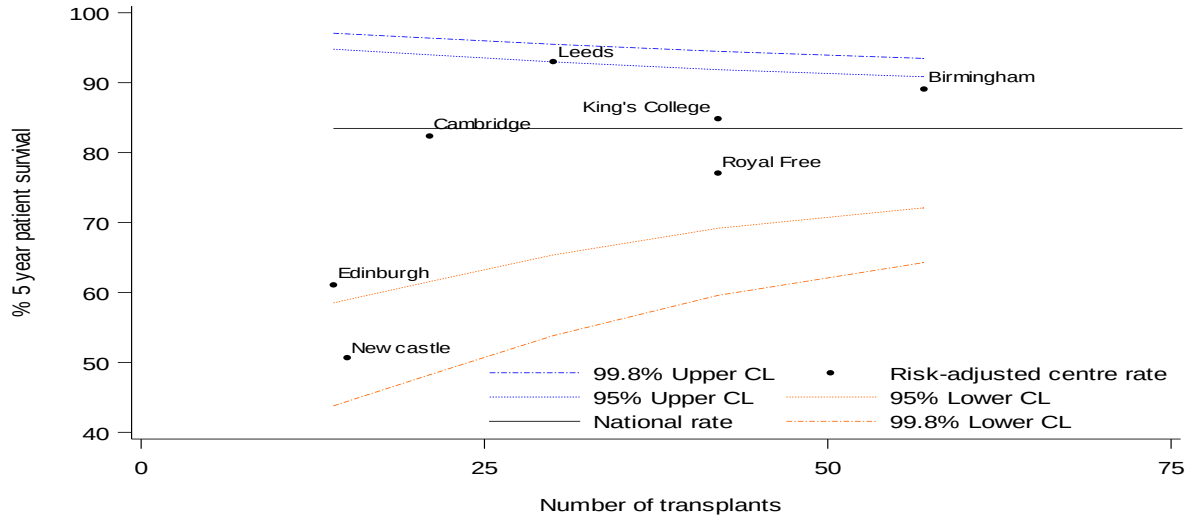
The median number of days between the last known follow-up post-transplantation (for censored recipients) and the time of analysis in **Table 3.14** and **Figure 3.22** ranges from 259 days for Birmingham to 1013.5 days for Edinburgh. The medians for all other centres fall in between these extremes.

Table 3.14 Five year patient survival for adult super-urgent deceased donor first liver transplants, 1 April 2015 - 31 March 2019

Centre	Number of transplants	5-year survival % (95% CI) Unadjusted		Risk-adjusted	
Newcastle	15	73.3	43.6 - 89.1	50.7	0.0 - 81.5
Leeds	30	93.3	75.9 - 98.3	93.0	72.1 - 98.3
Cambridge	21	76.2	51.9 - 89.3	82.4	57.7 - 92.7
Royal Free	42	76.1	60.1 - 86.4	77.1	57.4 - 87.7
King's College	42	85.7	70.9 - 93.3	84.9	66.3 - 93.2
Birmingham	57	87.2	74.9 - 93.7	89.1	77.1 - 94.8
Edinburgh	14	85.7	53.9 - 96.2	61.1	0.0 - 90.3
Total	**221**	**83.5**	**77.8 - 87.8**		

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 3.22 Risk-adjusted 5 year patient survival rates for adult super-urgent deceased donor first liver transplants, 1 April 2015 - 31 March 2019



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 2023 and 31 December 2023 for the transplant record, and all requests for follow-up forms issued in this time period.

It should be noted that some of the forms issued later in 2023 may not have yet been "chased" by NHSBT when the report was produced in August 2024.

Table 3.15 Form return rates for adult liver transplants, 1 January 2023 to 31 December 2023

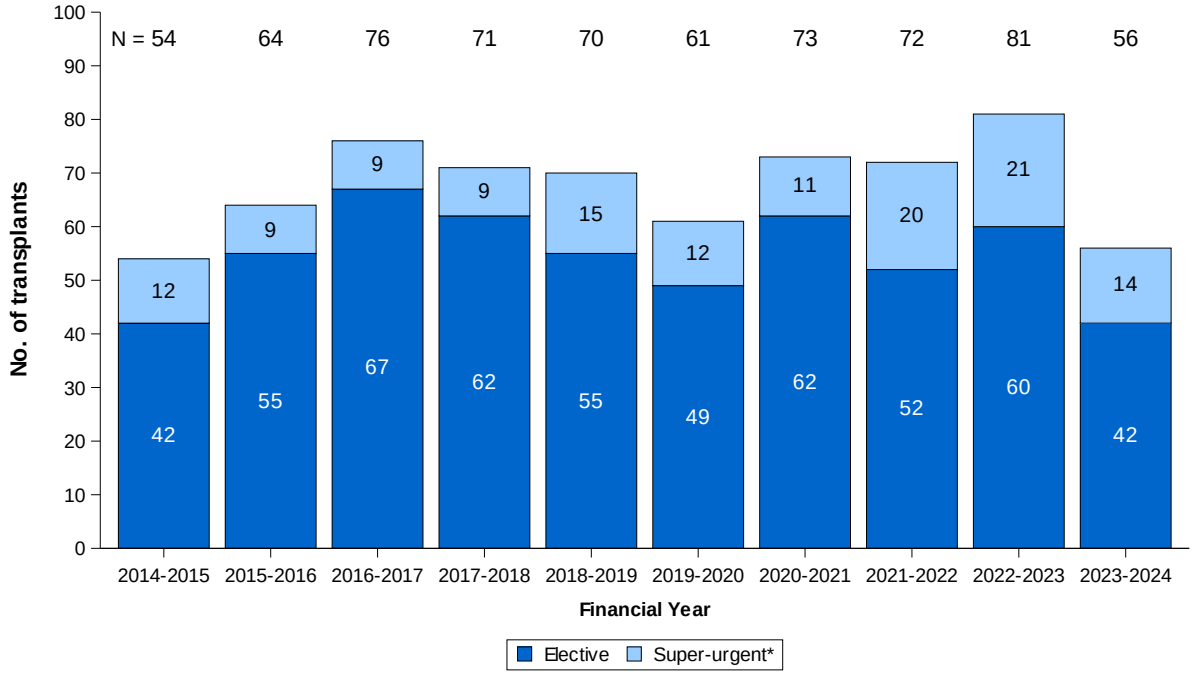
Centre	Transplant record		3 month follow-up		1 year follow-up		Lifetime follow-up	
	N	% Returned	N	% Returned	N	% Returned	N	% Returned
Newcastle	42	100	41	98	27	100	218	99
Leeds	117	97	114	100	93	98	592	71
Cambridge	98	100	94	100	94	99	553	95
Royal Free	95	100	97	100	88	100	613	100
King's College	136	100	137	99	145	92	1038	96
Birmingham	158	100	169	100	176	100	1033	95
Edinburgh	62	100	63	100	66	100	475	69
Total	**729**	**100**	**714**	**100**	**643**	**97**	**4531**	**90**
Dublin	708	99	715	100	689	98	4522	90

Paediatric Liver Transplantation

4.1 Overview

The number of deceased donor first liver only transplants performed in the UK for paediatric recipients in the last ten years is shown overall and by centre in **Figures 4.1 and 4.2**, respectively. One paediatric elective transplant was performed in Dublin in 2018. See **Appendix 1** for further details.

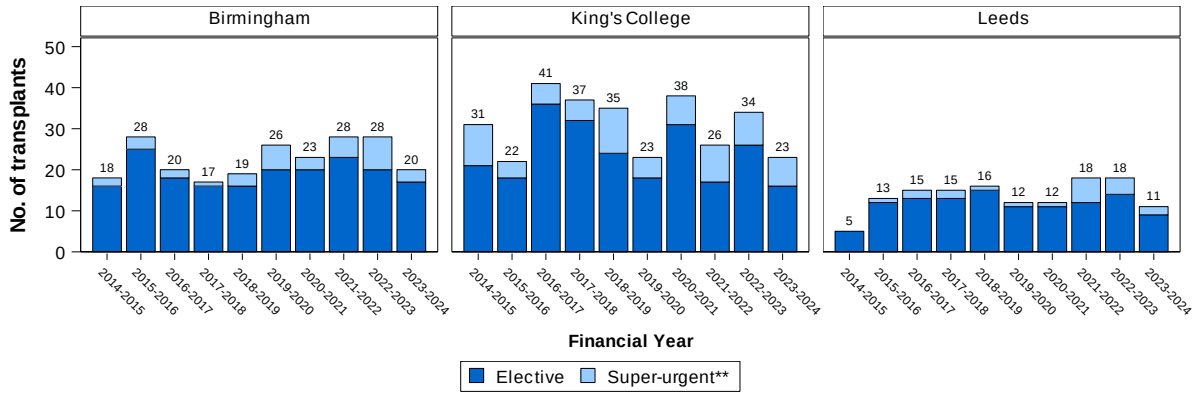
Figure 4.1 Deceased donor liver only transplants in paediatric recipients in the UK, 1 April 2014 - 31 March 2024



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

In the last year, 56 transplants in paediatric recipients were performed (all but two were performed at UK paediatric centres). Fourty two (75%) of these transplants were for patients on the elective list and fourteen (25%) for patients on the super-urgent list.

Figure 4.2 Deceased donor liver only transplants in paediatric recipients* in the UK, 1 April 2014 - 31 March 2024



***Excludes 5 super-urgent paediatrics who were transplanted at non-paediatric centre**

****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 total preservation time (TPT) for paediatric transplant recipients are shown by financial year in **Figure 4.3** for DBD and DCD donors, respectively. The national median total preservation time for transplants from DBD donors has decreased slightly from 9.0 hours in 2014/15 to 8.9 hours in 2023/24. The corresponding national median for DCD donor transplants has decreased over the ten year period, from 8.05 hours in 2014/15 to 7.7 hours in 2023/24. It should be noted the number of DCD paediatric transplants ranged between 0 and 8 per financial year with 2 in 2023/24.

Figure 4.3 **Boxplot of total preservation time in all paediatric first deceased donor liver transplants, by donor type and financial year 1 April 2014 - 31 March 2024**

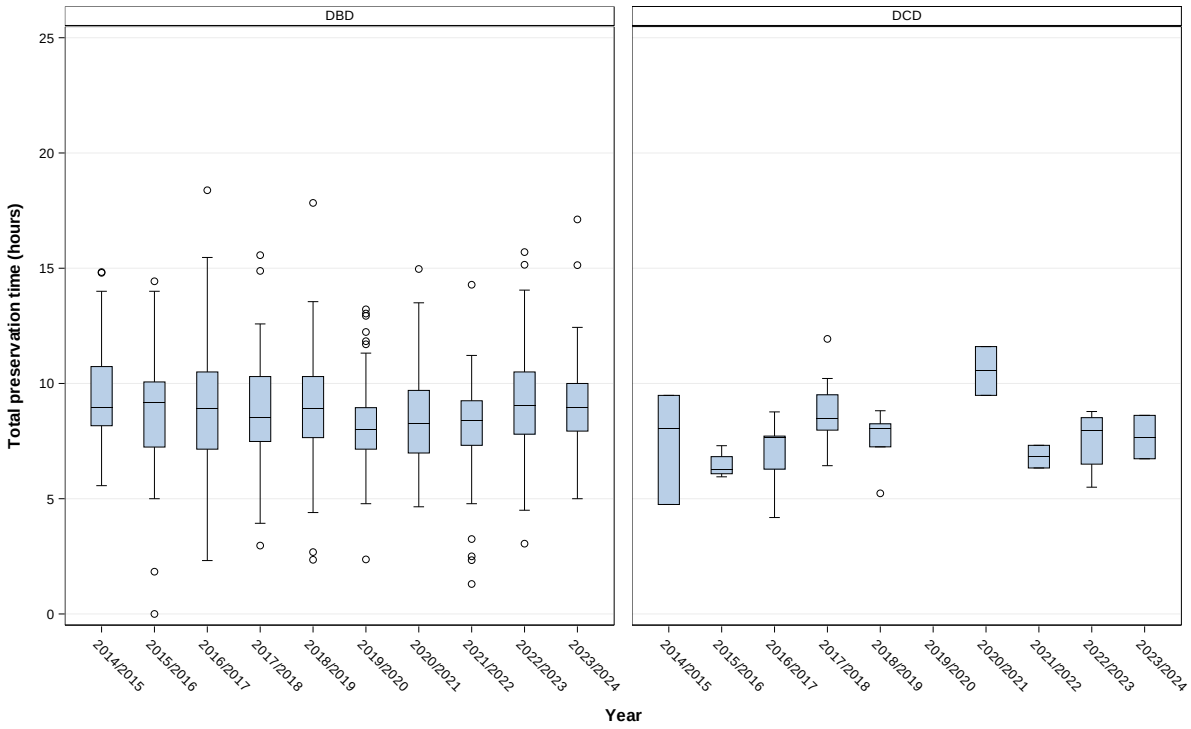


Figure 4.4 shows boxplots of total preservation time (TPT) for paediatric transplant recipients by centre in the latest financial year (2023/2024) while **Figure 4.5** and **Figure 4.6** show the equivalent information by centre and donor type over the last ten financial years for DBD and DCD donors, respectively. The median (IQR) total preservation time for DBD in the last financial year were 8.0 (7.2, 9.4) hours at Birmingham, 9.4 (8.7, 11.7) hours at King's College and 8.4 (7.9, 9.2) hours at Leeds.

The total preservation 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. None of the paediatric deceased donor first liver only transplants performed in the latest financial year were reported to have involved machine perfusion.

Figure 4.4 **Boxplot of total preservation time in all paediatric first deceased donor liver transplants, by donor type and transplant centre 1 April 2023 - 31 March 2024**

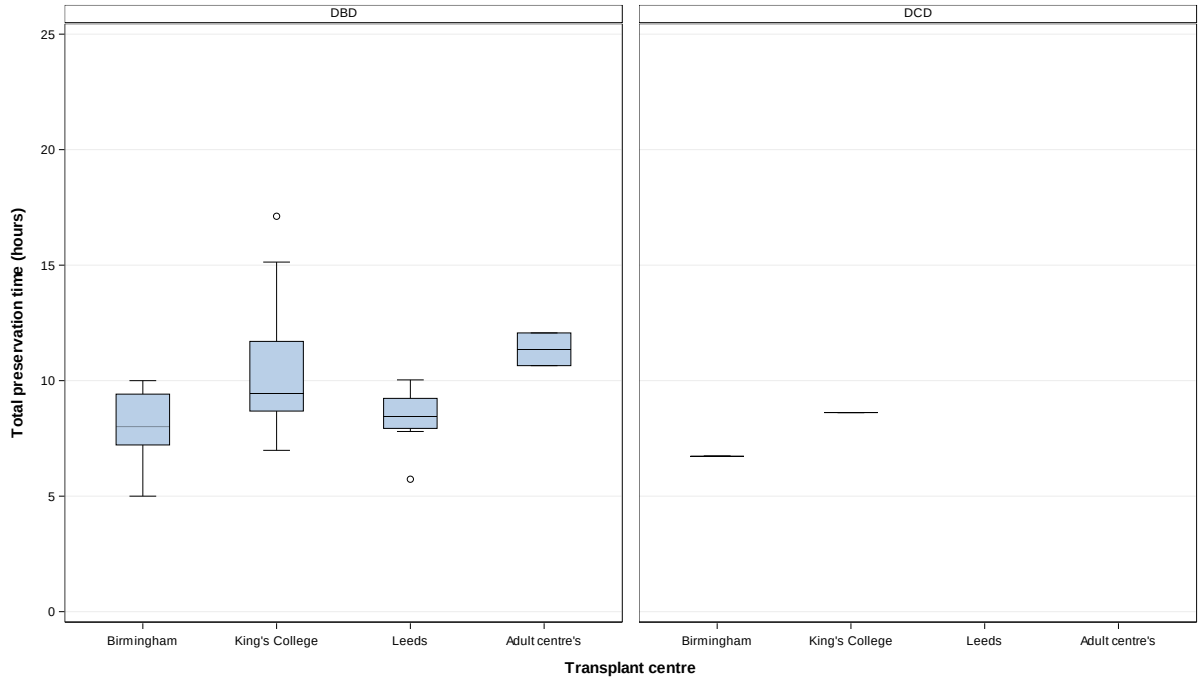


Figure 4.5 **Boxplot of total preservation time in all paediatric first DBD donor liver transplants, 1 April 2014 - 31 March 2024**

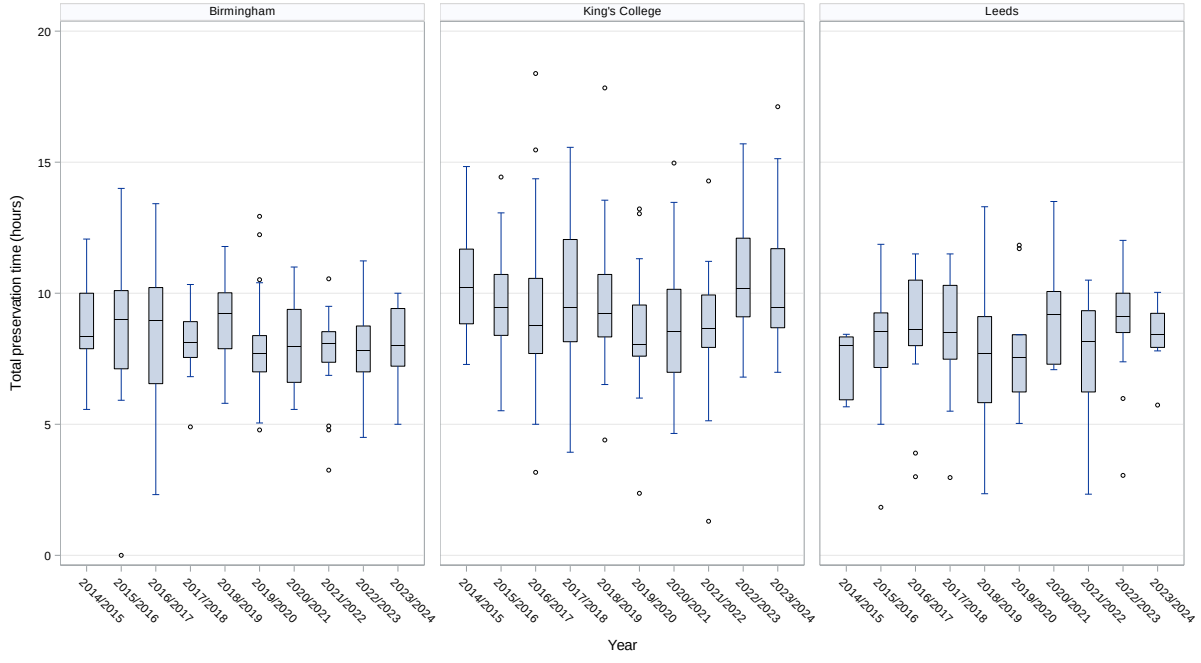
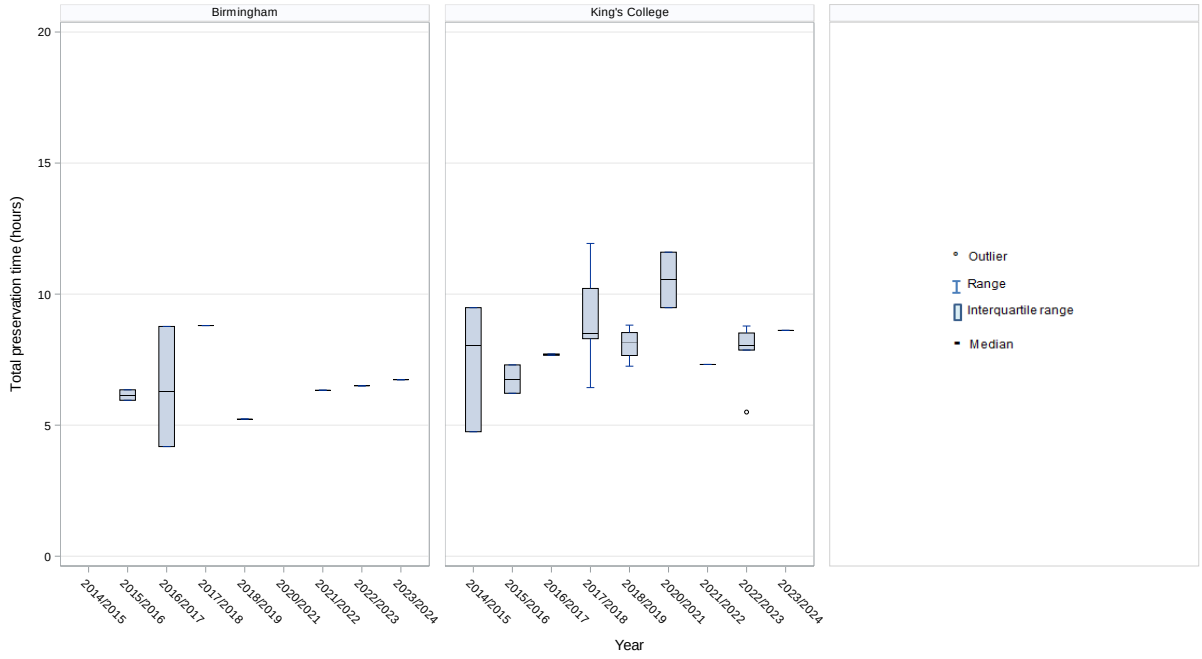


Figure 4.6 Boxplot of total preservation time in all paediatric first DCD donor liver transplants, 1 April 2014 - 31 March 2024



The demographic characteristics of 97 paediatric registrations and 56 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, 54% were male, 32% were between one and four years old and 19% were registered as super-urgent. Of the transplant recipients, 54% were male, 34% were aged between one and four years old and 25% were of super-urgent status. For some characteristics, due to rounding, percentages may not add up to 100.

Table 4.1 Demographic characteristics of paediatric registrations and deceased donor liver transplant recipients, 1 April 2023 - 31 March 2024

		Birmingham N (%)		King's College N (%)		Leeds N (%)		**TOTAL N (%)**	
		Registration	Transplant	Registration	Transplant	Registration	Transplant	Registration	Transplant
Number		37	20	40	23	18	11	**97 (100)**	**56 (100)**
Recip age years	<1	5 (14)	5 (25)	12 (30)	3 (13)	1 (6)	0	**18 (19)**	**8 (14)**
	1-4	15 (41)	8 (40)	12 (30)	10 (43)	4 (22)	1 (9)	**31 (32)**	**19 (34)**
	5-12	10 (27)	4 (20)	10 (25)	6 (26)	7 (39)	6 (55)	**27 (28)**	**16 (29)**
	13-16	7 (19)	3 (15)	6 (15)	4 (17)	6 (33)	4 (36)	**21 (22)**	**13 (23)**
Recipient sex	Male	24 (65)	12 (60)	20 (50)	13 (57)	7 (39)	4 (36)	**52 (54)**	**30 (54)**
	Female	13 (35)	8 (40)	20 (50)	10 (43)	11 (61)	7 (64)	**45 (46)**	**26 (46)**
Indication	Super Urgent	4 (11)	3 (15)	9 (23)	7 (30)	3 (17)	2 (18)	**18 (19)**	**14 (25)**
	Biliary Atresia	8 (22)	8 (40)	9 (23)	8 (35)	2 (11)	1 (9)	**19 (20)**	**17 (30)**
	Other Cholestatic	0 (0)	0	0 (0)	1 (4)	2 (11)	1 (9)	**2 (2)**	**2 (4)**
	Metabolic	7 (19)	3 (15)	4 (10)	0	2 (11)	1 (9)	**13 (13)**	**4 (7)**
	Other	18 (49)	6 (30)	18 (45)	7 (30)	9 (50)	6 (55)	**45 (46)**	**19 (34)**
Pre-transplant in-patient status	Out-patient	-	11 (55)	-	10 (43)	-	7 (64)	**-**	**28 (50)**
	In-patient	-	9 (45)	-	13 (57)	-	4 (36)	**-**	**28 (50)**
Pre-transplant renal support	No	-	19 (95)	-	17 (74)	-	9 (82)	**-**	**45 (80)**
	Yes	-	1 (5)	-	5 (22)	-	2 (18)	**-**	**10 (18)**
	Not reported	-	0	-	1 (4)	-	0	**-**	**1 (2)**
Ascites	Absence	-	11 (55)	-	14 (61)	-	11 (100)	**-**	**38 (68)**
	Presence	-	8 (40)	-	8 (35)	-	0	**-**	**16 (29)**
	Not reported	-	1 (5)	-	1 (4)	-	0	**-**	**2 (4)**
Previous abdominal surgery	No	20 (54)	13 (65)	17 (43)	14 (61)	10 (56)	10 (91)	**47 (48)**	**39 (70)**
	Yes	13 (35)	7 (35)	14 (35)	9 (39)	5 (28)	1 (9)	**32 (33)**	**17 (30)**
	Not collected for super-urgent	4 (11)	-	9 (23)	-	3 (17)	-	**18 (19)**	**-**

Table 4.1 Demographic characteristics of paediatric registrations and deceased donor liver transplant recipients, 1 April 2023 - 31 March 2024

		Birmingham N (%)		King's College N (%)		Leeds N (%)		**TOTAL N (%)**	
		Registration	Transplant	Registration	Transplant	Registration	Transplant	Registration	Transplant
INR	<=1.0	8 (22)	6 (30)	9 (23)	4 (17)	2 (11)	1 (9)	**19 (20)**	**11 (20)**
	1.1-1.5	21 (57)	7 (35)	19 (48)	12 (52)	8 (44)	6 (55)	**48 (49)**	**26 (46)**
	1.6-3.0	2 (5)	3 (15)	2 (5)	3 (13)	6 (33)	2 (18)	**10 (10)**	**8 (14)**
	>3.0	6 (16)	3 (15)	10 (25)	4 (17)	2 (11)	1 (9)	**19 (20)**	**9 (16)**
	Not reported	0 (0)	1 (5)	0 (0)	0	0 (0)	1 (9)	**1 (1)**	**2 (4)**
Serum sodium mmol/l	<135	6 (16)	5 (25)	3 (8)	4 (17)	3 (17)	1 (9)	**12 (12)**	**10 (18)**
	>=135	31 (84)	15 (75)	37 (93)	19 (83)	15 (83)	10 (91)	**85 (88)**	**46 (82)**
	Not reported	0 (0)		0 (0)		0 (0)		**0 (0)**	
Donor age years	5-16	-	3 (15)	-	4 (17)	-	1 (9)	**-**	**8 (14)**
	17-30	-	6 (30)	-	10 (43)	-	3 (27)	**-**	**19 (34)**
	>=31	-	11 (55)	-	9 (39)	-	7 (64)	**-**	**29 (52)**
Donor sex	Male	-	8 (40)	-	15 (65)	-	5 (45)	**-**	**28 (50)**
	Female	-	12 (60)	-	8 (35)	-	6 (55)	**-**	**28 (50)**
Donor type	Donor after brain death	-	19 (95)	-	22 (96)	-	11 (100)	**-**	**54 (96)**
	Donor after cardiac death	-	1 (5)	-	1 (4)	-	0	**-**	**2 (4)**
Graft appearance	Normal		18 (90)	-	22 (96)	-	11 (100)	**-**	**53 (95)**
	Abnormal	-	2 (10)	-	0	-	0	**-**	**2 (4)**
	Not reported	-	0	-	1 (4)	-	0	**-**	**1 (2)**
Graft type	Whole	-	5 (25)	-	1 (4)	-	4 (36)	**-**	**12 (21)**
	Segmental	-	7 (35)	-	7 (30)	-	3 (27)	**-**	**17 (30)**
Urgency Status	Elective	33 (89)	17 (85)	31 (78)	16 (70)	15 (83)	9 (82)	**79 (81)**	**42 (75)**
	Super Urgent	4 (11)	3 (15)	9 (23)	7 (30)	3 (17)	2 (18)	**18 (19)**	**14 (25)**

[1] Includes two regsitrations and transplants at non paediatric centres, one in Edinburgh and one in Newcastle.

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 2015 and 2024. The number of patients on the active liver only transplant list has ranged between 28 and 59 each year with 59 paediatric patients active on the liver only transplant list on 31 March 2023.

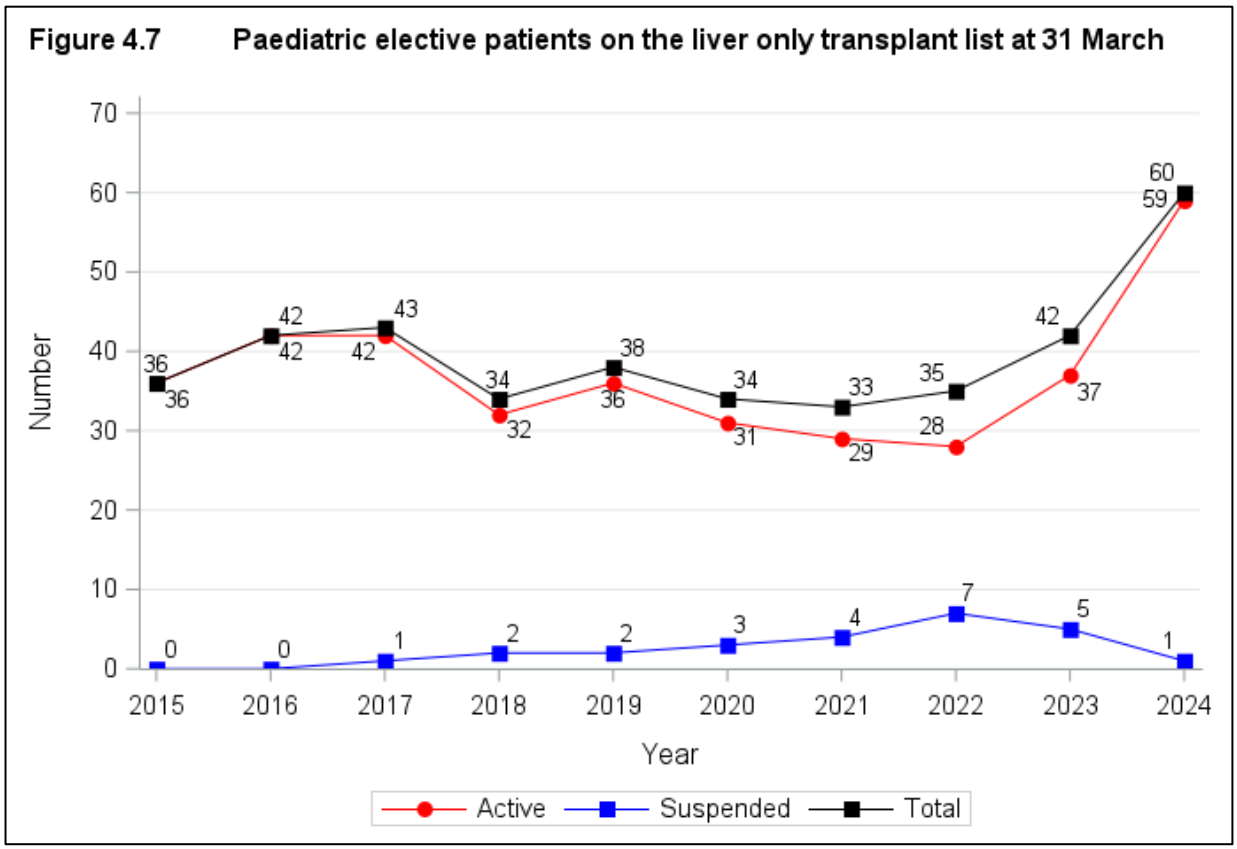
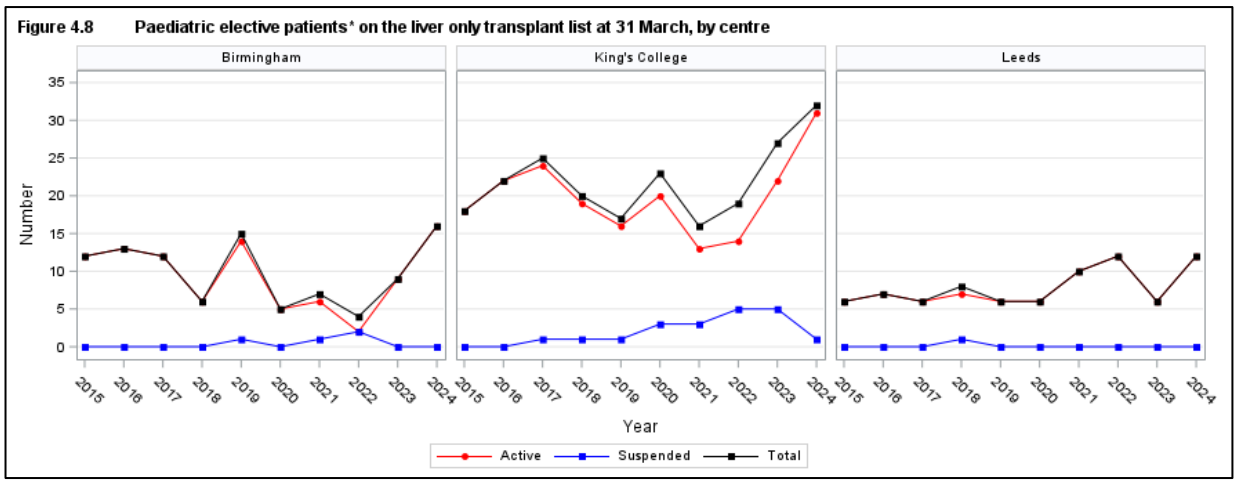
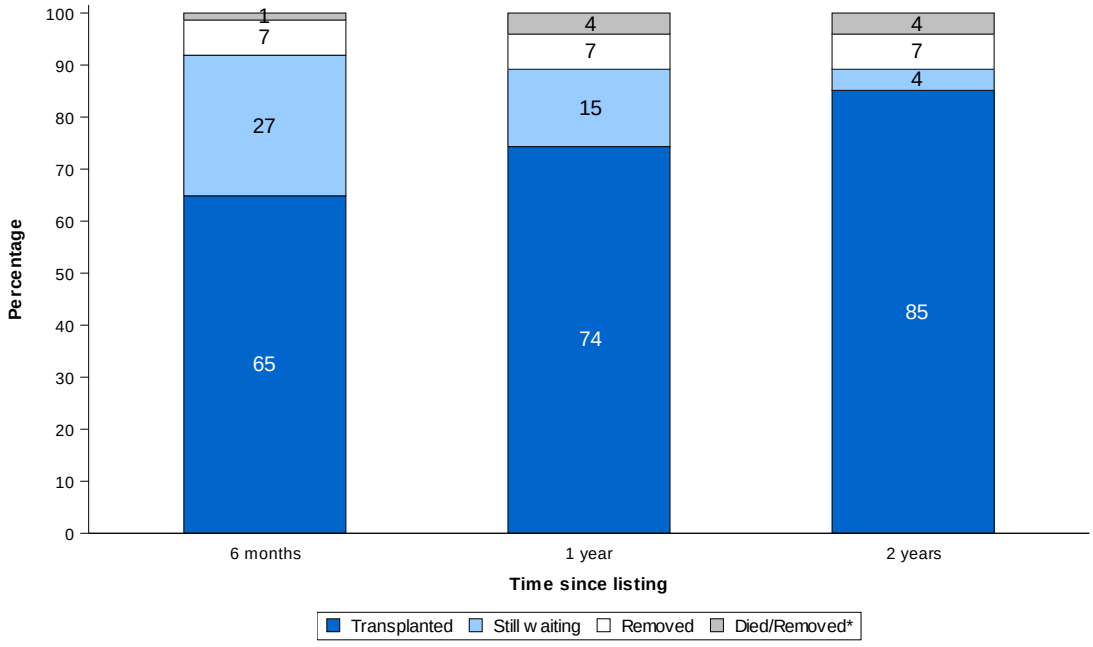


Figure 4.8 shows the number of elective patients on the transplant list at 31 March each year between 2015 and 2024 for each transplant centre.



An indication of outcomes for paediatrics listed for a liver transplant is summarised in **Figure 4.9**. This shows the proportion of paediatrics transplanted or still waiting six months, one and two years after joining the list. After six months, 65% of paediatrics have had a liver transplant, and 27% were still waiting.

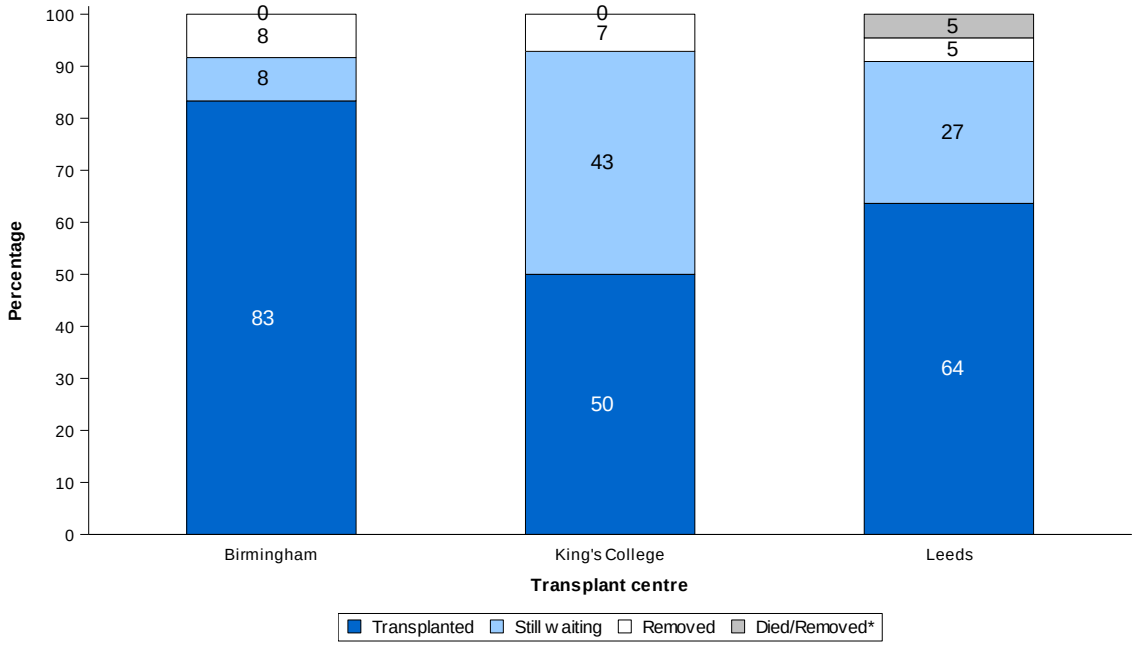
Figure 4.9 **Post-registration outcome for 74 new elective paediatric liver only registrations made in the UK, 1 April 2021 - 31 March 2022**



*Removals due to condition deteriorating

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 50% at Kings College to 83% at Birmingham.

Figure 4.10 **Six month post-registration outcome for 74 new elective paediatric liver only registrations made in the UK by centre, 1 April 2021 - 31 March 2022**



*Removals due to condition deteriorating

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 174 days, and shortest at Birmingham, at 42 days. The national median waiting time to transplant is 108 days.

Table 4.2 Median waiting time to liver only transplant in the UK, for paediatric elective patients registered 1 April 2021 - 31 March 2023

Transplant centre	Number of patients registered	Waiting time (days) Median	95% Confidence interval
Birmingham	49	42	14 - 70
Leeds	30	152	36 - 268
King's College	66	174	106 - 242
UK	**145**	**108**	**66 - 150**

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.

Figure 4.11 Paediatric elective liver only transplants, 1 April 2014 - 31 March 2024

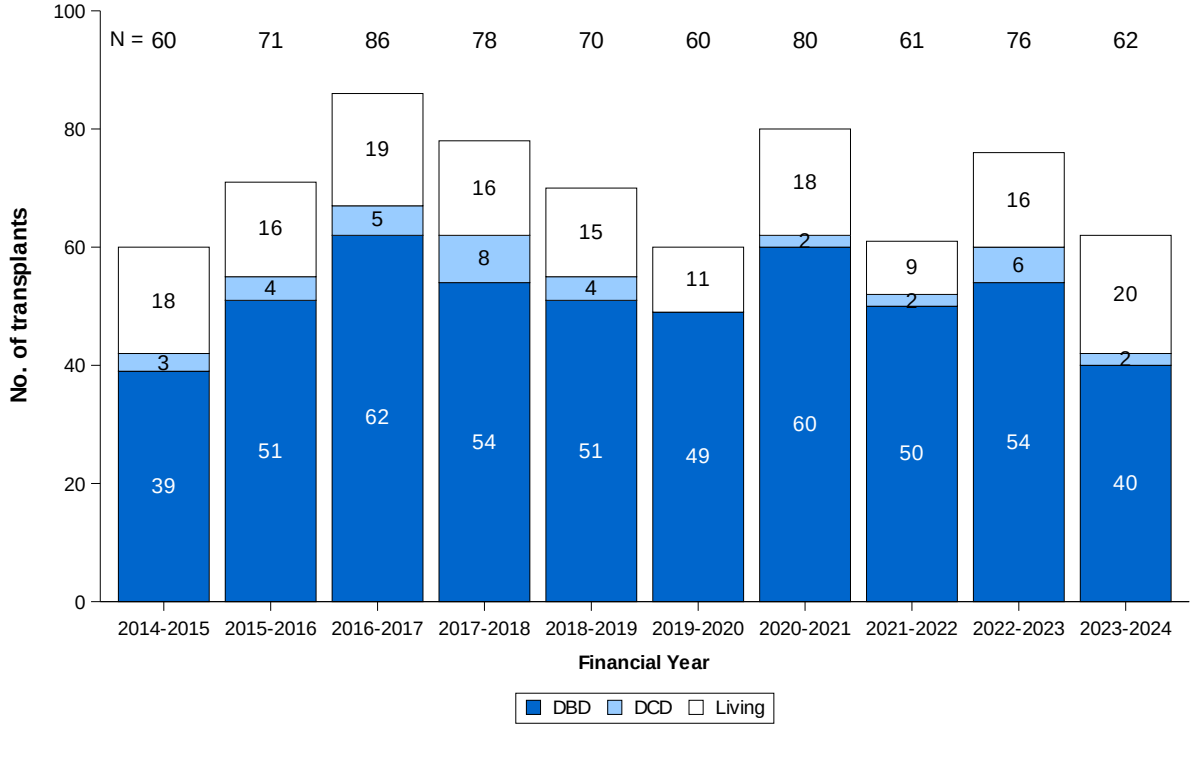
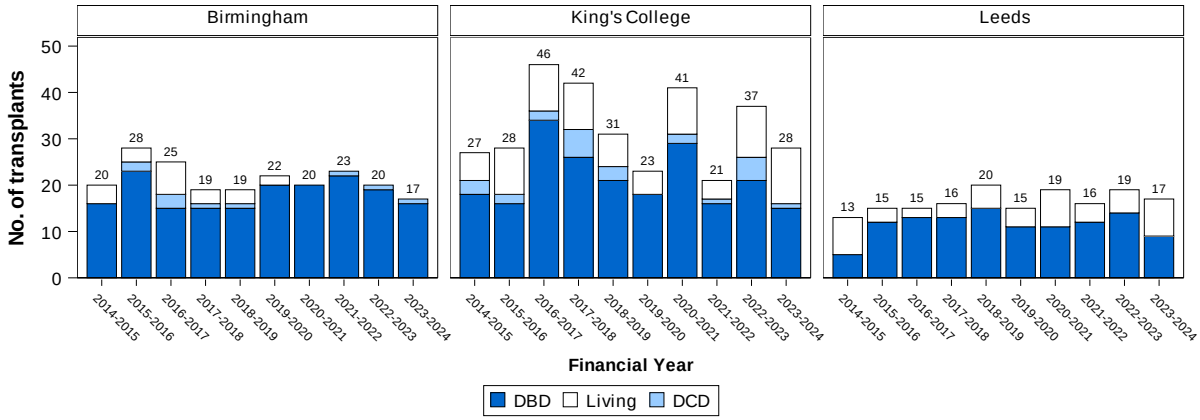


Figure 4.12 Paediatric elective liver only transplants by centre, 1 April 2014 - 31 March 2024



4.2.3 Post-transplant survival

Table 4.3 shows the unadjusted one year paediatric patient survival for 221 of the 223 deceased donor transplants (excluding auxiliary transplants) from 1 April 2019 to 31 March 2023, nationally and by centre. Note that these survival rates should be interpreted with caution as one-year patient follow-up is incomplete for one of the three transplant centres (refer to **Table 4.8**).

Table 4.3 One year unadjusted patient survival for paediatric elective deceased donor first liver transplants, 1 April 2019 - 31 March 2023

Centre	Number of transplants	1-year survival %	(95% CI)
Leeds	48	95.3	(82.5 - 98.8)
King's College	90	96.6	(89.9 - 98.9)
Birmingham	83	93.9	(85.9 - 97.4)
Total	**221**	**95.4**	**(91.5 - 97.5)**

Table 4.4 shows the unadjusted five year paediatric patient survival for 237 of the 239 deceased donor transplants (excluding auxiliary transplants) from 1 April 2015 to 31 March 2019, 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**).

Table 4.4 Five year unadjusted patient survival for paediatric elective deceased donor first liver transplants, 1 April 2015 - 31 March 2019

Centre	Number of transplants	5-year survival % (95% CI)	
Leeds	53	96.2	(85.5 - 99.0)
King's College	108	95.3	(89.1 - 98.0)
Birmingham	75	85.2	(74.9 - 91.5)
Total*	**237**	**92.3**	**(88.1 - 95.1)**

* Includes 1 patient transplanted at a non-paediatric centre

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 national median waiting time to transplant is three days.

Table 4.5 Median waiting time to liver only transplant in the UK for, paediatric super urgent patients registered 1 April 2021 - 31 March 2023

Transplant centre	Number of patients registered	Waiting time (days) Median	95% Confidence interval
Paediatric			
King's College	26	3	1 - 5
Birmingham	15	3	2 - 4
Leeds	14	4	3 - 5
UK*	**57**	**3**	**2 - 4**

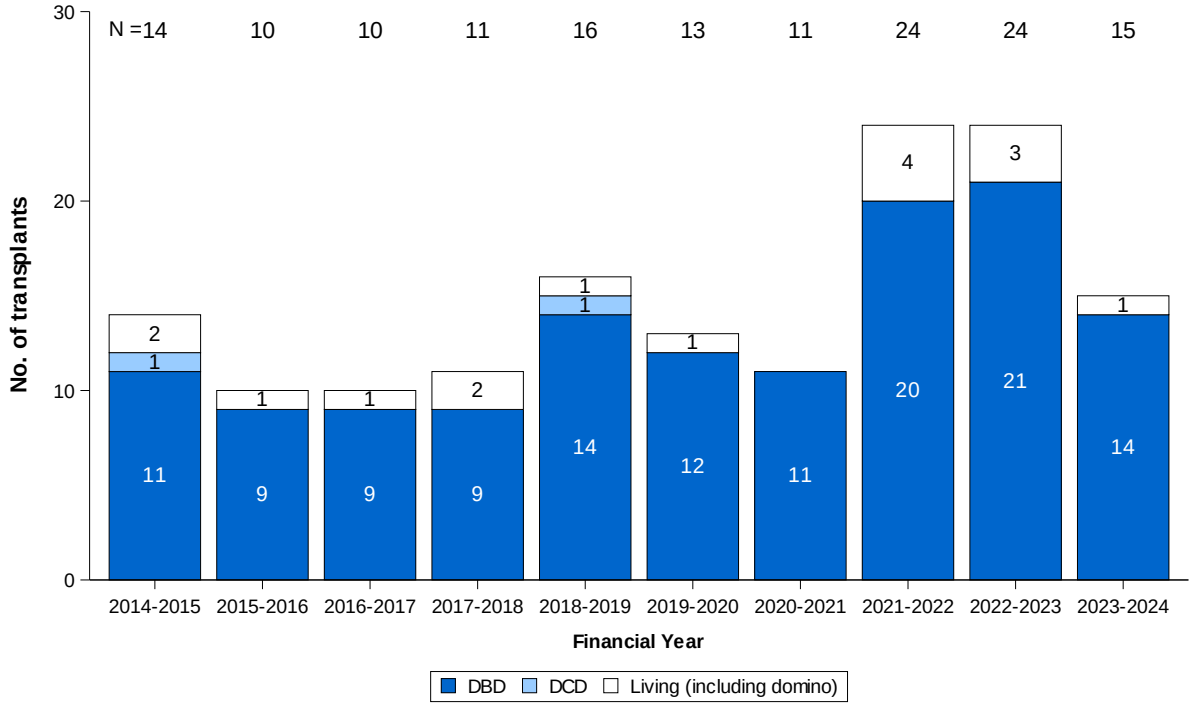
* Includes 2 patients registered at a non-paediatric centre

Table 4.5 includes registrations for re-transplants. Of the 57 registrations for the UK in the time period, 46 led to transplants (all during this time period). Five of the 46 transplants performed in the time period were re-transplants, hence, the difference between the *first* deceased donor liver only transplants reported in **Figure 4.13** for the period 1 April 2021 – 31 March 2023 and **Table 4.5.** Note that **Figure 4.13** also includes living donor transplants.

4.3.2 Transplant activity

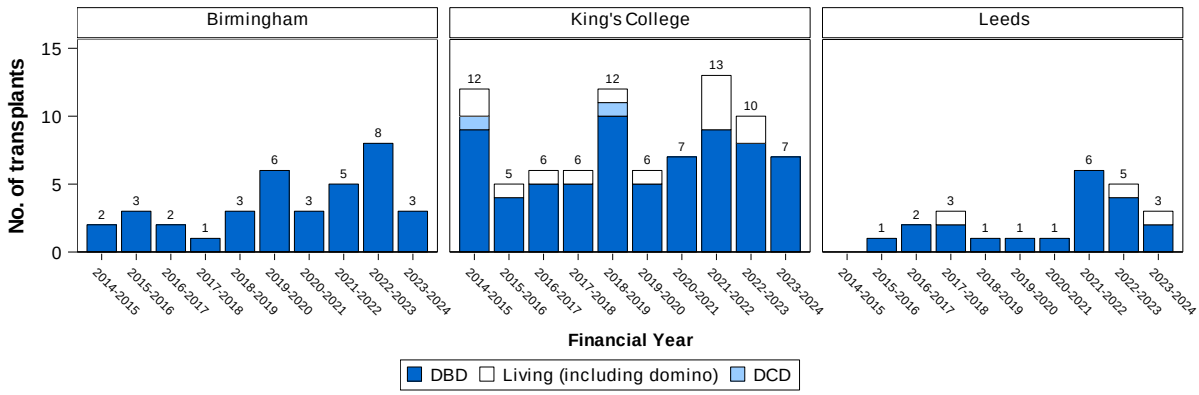
Figure 4.13 shows the number of paediatric super-urgent first liver only transplants from deceased and living (including domino) donors performed in the last ten years, by type of donor. **Figure 4.14** shows the same information by transplant centre. There were two super-urgent paediatric transplants that occurred in non-paediatric centres, one in Newcastle and one in Edinburgh in 2023/24. See **Appendix 1** for further details.

Figure 4.13 Paediatric super-urgent* liver only transplants, 1 April 2014 - 31 March 2024



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

Figure 4.14 Paediatric super-urgent* liver only transplants by centre, 1 April 2014 - 31 March 2024



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

4.3.3 Post-transplant survival

One year unadjusted patient survival for 48 transplants (excluding auxiliary transplants) between 1 April 2019 and 31 March 2023 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 one of the three transplant centres (refer to **Table 4.8**).

Table 4.6 One year unadjusted patient survival for paediatric deceased donor super urgent first transplants, 1 April 2019 - 31 March 2023

Centre	Number of transplants	1-year survival %	(95% CI)
Leeds	12	90.0	(47.3 - 98.5)
King's College	24	87.5	(66.1 - 95.8)
Birmingham	22	90.9	(68.3 - 97.6)
Total*	**59**	**89.7**	**(78.5 - 95.2)**

* Includes 1 patients transplanted at a non-paediatric centre

Table 4.7 shows the unadjusted five year paediatric patient survival for 32 transplants (excluding auxiliary transplants) between 1 April 2015 and 31 March 2019, 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**).

Table 4.7 Five year unadjusted patient survival for paediatric deceased donor super urgent first transplants, 1 April 2015 - 31 March 2019

Centre	Number of transplants	5-year survival %	(95% CI)
Leeds	6		(-)
King's College	15	86.7	(56.4 - 96.5)
Birmingham	9	88.9	(43.3 - 98.4)
Total*	**32**	**90.5**	**(73.4 - 96.8)**

* Includes 2 patients transplanted at a non-paediatric centre

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 2023 and 31 December 2023 for the transplant record, and all requests for follow-up forms issued in this time period.

Table 4.8 Form Return rates 1 January 2023 - 31 December 2023

Centre	Transplant Record		3 Month follow-up		1 year follow-up		Lifetime follow-up	
	N	% returned	N	% returned	N	% returned	N	% returned
Leeds	10	100	11	100	16	50	93	41
King's College	27	100	27	93	27	100	212	95
Birmingham	20	100	21	100	26	100	142	99
Total	**57**	**100**	**59**	**97**	**69**	**88**	**447**	**85**

Appendix

A1 Data

Data were obtained from the UK Transplant Registry for the ten year time period, 1 April 2014 to 31 March 2024 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 2023 and 31 March 2024 were extracted from the UK Transplant Registry on 10 July 2024 (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-2022 population estimates based on the Office for National Statistics (ONS) 2021 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 2023 and 31 March 2024 (numerator), divided by the mid-2022 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 2023 and 31 March 2024 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

	Latest year April 2023-March 2024		Last 3 years April 2021-March 2024		Last 10 years April 2014-March 2024	
Transplant centre	**Elective**	**Super-urgent**	**Elective**	**Super-urgent**	**Elective**	**Super-urgent**
Newcastle	42	5	109	15	335	46
Leeds	106	11	293	34	1007	128
Cambridge	104	13	293	36	921	108
Royal Free	99	12	275	41	933	141
King's College	159	9	469	54	1667	177
Birmingham	141	18	463	55	1697	187
Edinburgh	63	13	187	20	770	76
UK	**717[1]**	**81**	**2106[2]**	**255**	**7370[3]**	**863**
Dublin	**41**	**6**	**125**	**13**	**467**	**49**

[1] Includes 2 and 1 transplants performed at London Bridge Hospital and Cromwell Hospital, respectively
[2] Includes 9 and 8 transplants performed at London Bridge Hospital and Cromwell Hospital, respectively
[3] Includes 28 and 12 transplants performed 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

	Latest year April 2023-March 2024		Last 3 years April 2021-March 2024		Last 10 years April 2014-March 2024	
Transplant centre	**Elective**	**Super-urgent**	**Elective**	**Super-urgent**	**Elective**	**Super-urgent**
Newcastle	41	2	104	10	305	38
Leeds	99	9	267	27	901	92
Cambridge	98	9	275	26	840	67
Royal Free	94	10	260	30	873	108
King's College	142	5	425	40	1463	141
Birmingham	134	13	434	41	1524	143
Edinburgh	62	6	182	11	723	37
UK	**670**	**54**	**1947**	**185**	**6629**	**626**
Dublin	**40**	**5**	**116**	**9**	**421**	**37**

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

	Latest year April 2023-March 2024		Last 3 years April 2021-March 2024		Last 10 years April 2014-March 2024	
Transplant centre	**Elective**	**Super-urgent**	**Elective**	**Super-urgent**	**Elective**	**Super-urgent**
Newcastle	0	1	0	1	0	2
Leeds	20	3	58	14	177	30
Cambridge	0	0	0	0	0	1
Royal Free	0	0	0	0	0	0
King's College	34	8	94	36	347	98
Birmingham	18	3	61	17	248	45
Edinburgh	0	1	0	2	0	2
UK	**72**	**16**	**214**[1]	**70**	**773**[1]	**178**
Dublin	**0**	**0**	**0**	**0**	**1**	**0**

[1] Includes 1 transplant performed at Cromwell Hospital

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

	Latest year April 2023-March 2024		Last 3 years April 2021-March 2024		Last 10 years April 2014-March 2024	
Transplant centre	**Elective**	**Super-urgent**	**Elective**	**Super-urgent**	**Elective**	**Super-urgent**
Newcastle	0	1	0	1	0	2
Leeds	9	2	35	12	115	20
Cambridge	0	0	0	0	0	1
Royal Free	0	0	0	0	0	0
King's College	16	7	59	24	239	71
Birmingham	17	3	60	16	191	36
Edinburgh	0	1	0	2	0	2
UK	**42**	**14**	**154**	**55**	**545**	**132**
Dublin	**0**	**0**	**0**	**0**	**1**	**0**

A2 Methods

Waiting time to transplant

Waiting time is calculated from date of registration to date of either transplant, removal, death on the list or last known date 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 σ^2. If the factor is one for all areas, then area differences are fully explained by the area-specific Poisson rate. If the factor varies with a nonzero variance, σ^2, then we conclude that there are unexplained area differences.

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

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 σ^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 recipients instead of recipient 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 and INR, 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 Asian Black Other
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^2	Per 1 kg/m^2 increase
Serum Bilirubin µmol/l	≤30 31-50 51-70 71-90 ≥91
Serum Creatinine µmol/l	≤70 71-90 91-110 111-130 ≥131

Table A3.1	Risk factors and categories used in the adult elective risk adjusted survival models post transplantation
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 Asian Black Other
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^2	Per 1 kg/ m^2 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 Asian Black Other
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
Recip age years	Per 1 year increase
BMI kg/m^2	Per 1 kg/m^2 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 Asian Black Other
Donor cause of death	Trauma CVA Others

Table A3.2	Risk factors and categories used in the adult super-urgent risk adjusted survival models post transplantation
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^2	Per 1 kg/ m^2 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^2	Per 1 kg/m^2 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

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.

Total Presevation Time (TPT)
The length of time that elapses between an organ being removed from the donor to its transplantation into the recipient. 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 TPT 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. 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 recipient 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 recipient is likely to survive following a transplant. For example, when all else is equal, a transplant from a younger donor is expected to survive longer than that from an older donor and so donor age is a risk factor.

Unadjusted survival rate
Unadjusted survival rates do not take account of risk factors and are based only on the number of transplants at a given centre and the number and timing of those that fail within the post-transplant period of interest. In this case, unlike for risk-adjusted rates, all transplants are assumed to be equally likely to fail at any given time. However, some centres may have lower unadjusted survival rates than others simply because they tend to undertake transplants that have increased risks of failure. Comparison of unadjusted survival rates across centres and to the national rate is therefore inappropriate.

Prepared by:

Statistics and Clinical Research, NHS Blood and Transplant

Mrs Rhiannon Taylor
Miss Rhiannon Wallis