

ANNUAL REPORT ON LIVER TRANSPLANTATION

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Executive Summary



This report presents key figures about liver transplantation in the UK. The period reported covers ten years of transplant data, from 1 April 2013 to 31 March 2023. 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 818 patients on the UK liver transplant list on 31 March 2023 of which 697 patients were on the UK <u>active transplant list</u>.
- Of the patients joining the <u>elective</u> liver only waiting list, approximately 68% had received a transplant within two years of listing.
- There were 9210 liver transplants performed in the UK in the ten year period. The number of liver transplants using deceased donors decreased in 2022/2023 compared with 2021/2022 for <u>donors after brain death</u> (0.8%) and increased for <u>donors after circulatory death</u> (29.9%). This was potentially due to restrictions imposed in 2020/2021 during the first waves of COVID-19.
- The unadjusted national rates of patient survival one and five years after first liver only transplantation are given below

Unadjusted patient survival (%) post-transplant for first deceased donor liver only transplants										
	One year patient survival	Five year patient survival								
	(%)	(%)								
Adult										
Elective	95	84								
Super-urgent	90	83								
Paediatric										
Elective	95	94								
Super-urgent	83	91								

• The national rates of patient survival after joining the transplant list for adult elective first liver only patients were 87% at one and 75% at five years post-registration.

Introduction



This report presents information on the UK transplant list, transplant activity and transplant outcomes between 1 April 2013 and 31 March 2023, 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 post-transplant is reported for cohorts of patients transplanted between 1 April 2013 and 31 March 2018 for 5 year survival, and 1 April 2018 to 31 March 2022 for 1 year survival. Patient survival from registration is presented for the period 1 January 2011 to 31 December 2022. Results are described separately for adults (aged \geq 17 years) and paediatrics (aged <17 years) and according to the urgency of the transplantation (<u>elective</u> and super-urgent). Note, however, that the survival from listing analysis assumes adults are aged \geq 18 years.

2.1 Transplant list

Figure 2.1 shows the total number of liver patients on the UK <u>active transplant list</u> at 31 March each year between 2013 and 2023. 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.

The number of patients active on the UK liver transplant list increased from 549 in 2014 to 611 in 2015. There has been a decrease in the number of patients registered on the active liver transplant list between 2013-2014 and 2019-2020. However, this number has increased to 697 patients active in March 2023, 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 2.2 shows the number of adults and paediatrics on the active UK and Rol transplant list at 31 March 2023, by centre. In total, there were 657 adults and 40 paediatrics on the UK active transplant list and 85 adults on the Dublin active transplant list. King's College had the largest share of the UK transplant list (31%) and Newcastle the smallest (4%). This figure includes <u>multi-organ</u>, <u>elective</u> and <u>super-urgent</u> registrations.



An indication of long-term outcomes for patients listed in the UK between April 2020 and March 2021 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 38% were still waiting.



Figure 2.4 shows the six month registration outcome by centre. The proportion of patients transplanted six months after listing at each centre ranges from 35% at Dublin to 64% at Cambridge.



2.2 Transplant activity

Figure 2.5 shows the total number of liver transplants performed in the last ten years, by type of donor while **Figure 2.6** shows the equivalent information by transplant centre. 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 624 transplants performed in 2022/23. The number of DCD liver transplants performed in the UK in the last financial year increased to 252 which is a 30% increase when compared to 2021/22 (194). There were 35 living donor liver transplants and 0 domino transplant performed in the last financial year.





Figure 2.7 details the 9210 liver transplants performed in the UK in the ten year period (Dublin are excluded). Of these, 7922 (86%) were deceased donor first liver only transplants. 7232 (91%) of the deceased donor first liver only transplants were performed in adults and 690 (9%) in paediatrics. Similarly including both adult and paediatric, 7153 (90%) were <u>elective</u> and 769 (10%) were <u>super-urgent</u> transplants.



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 2022/2023 and 98 in 2013/2014. During the last ten years, 144 DBD and 6 DCD multi-organ transplants involving the liver were performed of which 10 were retransplants. Of the 144 multi-organ DBD transplants, 131 were simultaneous liver and kidney transplants (10 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 (97.5%) performed in the UK over the last ten years involving donors after circulatory death (<u>DCD</u>) were first liver only transplants, with only 41 DCD retransplant liver only transplants, five simultaneous liver/kidney DCD transplants and one simultaneous liver and heart transplant.

The majority of transplants (457 (87%)) performed in Dublin over the last ten years were first liver only DBD transplants, with 60 (11%) DBD retransplant liver only transplants, one simultaneous liver and lung transplant and seven liver only DCD transplants also performed.





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 2022 and 31 March 2023 compared with liver transplant rates pmp for the same time period, by recipient country/NHS region of residence. **Table 2.1** shows the breakdown of these numbers by recipient country/NHS region of residence. No adjustments have been made for potential demographic differences in populations. If a patient has had more than one registration/transplant in the period, each registration/transplant is considered. Note that this analysis only considered NHS Group 1 patients.

Since there will inevitably be some random variation in rates between areas, the systematic coefficient component of variation (SCV) was used to identify if the variation is more (or less) than a random effect for the different NHS regions in England only. Only first registrations and transplants in this period were considered. The larger the SCV the greater the evidence of a high level of systematic variation between areas. Registration and transplant rates yielded an SCV of 0.007 (p-value = 0.035) and 0.0019 (p-value = 0.213), 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 no 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.



Table 2.1	Liver registration and transplant rates per million population (pmp) in the UK, 1 April 2022 - 31 March 2023, by Country/NHS region										
Country/ NHS region		Registratio	ons (pmp)	Transplants (pmp)							
North East an North West Midlands East of Englar London South East South West	d Yorkshire nd	138 126 215 140 155 138 105	(17) (17) (19.8) (22) (17.6) (14.9) (18.4)	107 82 158 101 109 114 75	(13.2) (11.1) (14.6) (15.9) (12.4) (12.3) (13.1)						
England Isle of Man Channel Islar	nds	1017 2 0	(18) (25) (0.0)	746 0 0	(13.2) (0.0) (0.0)						
Wales		58	(18.6)	42	(13.5)						
Scotland		111	(20.3)	76	(13.9)						
Northern Irela	and	39	(20.5)	21	(11.1)						
TOTAL ^{1,2}		1235	(18.4)	890	(13.3)						
¹ Registrations who reside in th ² Transplants in	¹ Registrations include 3 recipients whose postcode was unknown and excludes 4 recipients who reside in the Republic of Ireland and 6 recipients who reside overseas										

 2 Transplants include 3 recipients whose postcode was unknown and excludes 8 recipients who reside in the Republic of Ireland and 4 recipients who reside overseas

Adult Liver Transplantation



3.1 Overview

The number of adult deceased donor first liver only transplants in the last ten years is shown overall and by centre in **Figures 3.1 and 3.2**, respectively. Dublin are included in **Figure 3.2** but not **Figure 3.1**. Of the 721 transplants performed in the UK in the latest financial year, 648 (90%) were <u>elective</u> and 73 (10%) were <u>super-urgent</u> transplants. See **Appendix 1** for further details.





The overall <u>median cold ischaemia times</u> (CIT) for UK adult transplant recipients are shown by financial year in **Figure 3.3** for <u>DBD</u> and <u>DCD</u> donors, respectively. The UK national median CIT for transplants from DBD donors has remained relatively stable and was 8.5 hours in 2013/14 and 8.6 hours in 2022/23. Similarly, the UK national median for DCD donor transplants has remained relatively stable over the ten year period and was 7.3 hours in 2013/14 and 7.0 hours in 2022/23.



Figure 3.4 shows boxplots of <u>cold ischaemia times</u> (CIT) for adult transplant recipients by centre and donor type in the latest financial year (2022/2023) while **Figure 3.5** and **Figure 3.6** show the equivalent information by centre over the last ten financial years for <u>DBD</u> and <u>DCD</u> donors, respectively. Dublin are included in all three boxplots. The median CIT for DBD in the last financial year ranged between 7.3 and 10.6 hours across UK transplant centres whilst the median CIT for DCD ranged between 5.8 and 10.5 hours. The median CIT for patients transplanted at Dublin in the last financial year was 6.2 for DBD transplants and 5.4 hours for DCD transplants.

The cold ischaemia time used is as reported on the liver transplant record form and may include periods of machine perfusion; no adjustment has been made for this. 233 (32%) 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 69% by transplant centre.







Adult Liver Transplantation Elective Patients



3.2.1 Transplant list

Figure 3.7 shows the number of adult <u>elective</u> patients on the UK liver only transplant list at 31 March each year between 2014 and 2023. Patients registered at Dublin were excluded. Seven hundred and thirty adult elective patients were either active or suspended on the UK liver only transplant list on 31 March 2023, a 47% increase compared with 31 March 2014.

The number of adult patients on the UK <u>active</u> liver only transplant list has increased from 481 in 2014 to 625 in 2023. The majority of patients suspended on 31 March 2021 were reactivated by transplant centres in April 2021 following relaxation of restrictions imposed during COVID-19.



Figure 3.8 shows the number of adults on the transplant list in the UK and Dublin at 31 March each year between 2013 and 2023, by transplant centre. The number of adult patients active on the elective liver transplant list on 31 March 2023 ranged between 18 at Newcastle and 189 at Birmingham.



An indication of outcomes for adult <u>elective</u> 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 3.10 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 centre ranges from 35% at Birmingham and Edinburgh to 64% at Cambridge.



Table 3.1 shows the <u>median waiting time</u> to deceased donor liver only transplant for adult <u>elective</u> patients. The national UK median waiting time to transplant for adult elective patients is 119 days. The median waiting time to transplant was shorter at Edinburgh (50 days) and longer at Birmingham (221 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 <u>case-mix</u> at centres and will be impacted by COVID-19

Table 3.1	Median waiting time to registered in the UK ar	liver only transplant nd Republic of Ireland	for adult elective patients I, 1 April 2020 - 31 March 2022
Transplant cen	tre Number of pati	ients	Waiting time (days)
	registered	Median	95% Confidence interval
Edinburgh	157	50	32 - 68
Cambridge	216	82	65 - 99
Royal Free	241	110	69 - 151
Newcastle	99	120	80 - 160
King's College	444	125	101 - 149
Leeds	254	136	88 - 184
Birmingham	462	221	157 - 285
UK	1873	119	106 - 132
Dublin	98	294	228 - 360

Table 3.2 shows the demographics of 1016 adult <u>elective</u> liver patients in the UK and 53 in Dublin, registered from 1 April 2022 to 31 March 2023, by transplant centre. The majority of patients that were registered in the UK were male (63%), white (79%) with a <u>median</u> age of 56 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 2022 - 31 March 2023										
Number		Birmingham N (%) 262	Cambridge N (%) 127	Edinburgh N (%) 97	King's college N (%) 226	Leeds N (%) 144	Newcastle N (%) 39	Royal Free N (%) 121	UK N (%) 1016	Dublin N (%) 53
Recipient	Male	168 (64)	87 (69)	57 (59)	128 (57)	96 (67)	24 (62)	79 (65)	639 (63)	37 (70)
sex	Female	94 (36)	40 (31)	40 (41)	98 (43)	48 (33)	15 (38)	42 (35)	377 (37)	16 (30)
Recipient ethnicity	White Asian Black Other Not reported	158 (60) 18 (7) 4 (2) 1 (0) 81 (31)	109 (86) 6 (5) 5 (4) 3 (2) 4 (3)	90 (93) 4 (4) 1 (1) 2 (2) 0 (0)	181 (80) 21 (9) 15 (7) 9 (4) 0 (0)	131 (91) 12 (8) 1 (1) 0 (0) 0 (0)	38 (97) 1 (3) 0 (0) 0 (0) 0 (0)	97 (80) 18 (15) 6 (5) 0 (0) 0 (0)	804 (79) 80 (8) 32 (3) 15 (1) 85 (8)	51 (96) 1 (2) 0 (0) 1 (2) 0 (0)
Indication	Acute on Chronic Liver Failure	4 (2)	3 (2)	1 (1)	5 (2)	0 (0)	0 (0)	5 (4)	18 (2)	0 (0)
	Cancer (HCC)	49 (19)	23 (18)	17 (18)	33 (15)	28 (19)	5 (13)	16 (13)	171 (17)	10 (19)
	Hepatitis C	3 (1)	5 (4)	0 (0)	2 (1)	4 (3)	0 (0)	2 (2)	16 (2)	0 (0)
	Alcoholic liver disease	76 (29)	29 (23)	27 (28)	51 (23)	61 (42)	12 (31)	32 (26)	288 (28)	8 (15)
	Hepatitis B	3 (1)	1 (1)	0 (0)	4 (2)	1 (1)	0 (0)	8 (7)	17 (2)	0 (0)
	Primary sclerosing cholangitis	27 (10)	14 (11)	14 (14)	32 (14)	8 (6)	5 (13)	19 (16)	119 (12)	18 (34)
	Autoimmune and cryptogenic	18 (7)	5 (4)	8 (8)	25 (11)	6 (4)	1 (3)	10 (8)	73 (7)	2 (4)
	disease Primary biliary cholangitis Metabolic liver disease Other Acute hepatic failure Regraft	14 (5) 33 (13) 29 (11) 0 (0) 6 (2)	7 (6) 29 (23) 9 (7) 0 (0) 2 (2)	10 (10) 14 (14) 6 (6) 0 (0) 0 (0)	11 (5) 20 (9) 28 (12) 0 (0) 14 (6)	10 (7) 12 (8) 5 (3) 0 (0) 9 (6)	6 (15) 2 (5) 8 (21) 0 (0) 0 (0)	6 (5) 6 (5) 15 (12) 0 (0) 1 (1)	64 (6) 116 (11) 100 (10) 0 (0) 32 (3)	3 (6) 6 (11) 6 (11) 0 (0) 0 (0)
Recipient	No	247 (94)	116 (91)	93 (96)	215 (95)	133 (92)	39 (100)	115 (95)	958 (94)	52 (98)
HCV	Yes	15 (6)	11 (9)	4 (4)	11 (5)	11 (8)	0 (0)	6 (5)	58 (6)	1 (2)
Encephalo-	Absence	157 (60)	70 (55)	81 (84)	142 (63)	86 (60)	24 (62)	91 (75)	651 (64)	46 (87)
pathy	Presence	105 (40)	57 (45)	16 (16)	84 (37)	58 (40)	15 (38)	30 (25)	365 (36)	7 (13)
Renal	No	256 (98)	120 (94)	95 (98)	219 (97)	142 (99)	39 (100)	117 (97)	988 (97)	52 (98)
support	Yes	6 (2)	7 (6)	2 (2)	7 (3)	2 (1)	0 (0)	4 (3)	28 (3)	1 (2)

Table 3.2	Demographic characteris	tics of adult elective	ve liver patien	ts registered	irom 1 April 20	022 - 31 March	2023			
Previous abdominal surgery	No Yes	Birmingham N (%) 198 (76) 64 (24)	Cambridge N (%) 98 (77) 29 (23)	Edinburgh N (%) 76 (78) 21 (22)	King's college N (%) 153 (68) 73 (32)	Leeds N (%) 120 (83) 24 (17)	Newcastle N (%) 33 (85) 6 (15)	Royal Free N (%) 92 (76) 29 (24)	UK N (%) 770 (76) 246 (24)	Dublin N (%) 43 (81) 10 (19)
Recip age (years)	Median (IQR)	55 (46, 63)	58 (49, 63)	59 (50, 63)	55 (43, 62)	56 (50, 62)	58 (45, 65)	53 (42, 60)	56 (46, 62)	54 (42, 61)
BMI (kg/m²)	Median (IQR)	28 (24, 32)	28 (25, 32)	29 (26, 34)	27 (23, 32)	28 (24, 32)	28 (24, 32)	27 (24, 30)	28 (24, 32)	27 (24, 31)
Serum bilirubin (umol/l)	Median (IQR)	37 (22, 70)	44 (24, 78)	41 (22, 85)	33 (18, 68)	43.5 (22.5, 105.5)	38 (24, 90)	54 (26, 124)	41 (22, 79)	42 (24, 90)
Serum creatinine (umol/l)	Median (IQR)	72 (55, 92)	76 (62, 98)	74 (57, 100)	71 (60, 95)	73.5 (59, 93)	68 (52, 101)	77 (70, 90)	73 (60, 94)	69 (57, 90)
Serum sodium (mmol/l)	Median (IQR)	137 (135, 139)	137 (134, 138)	135 (133, 139)	137 (134, 139)	138 (134, 140)	136 (134, 138)	138 (134, 140)	137 (134, 139)	137 (134, 139)
Serum potassium (mmol/l)	Median (IQR)	4.1 (3.7, 4.5)	4.2 (3.9, 4.6)	4.1 (3.8, 4.4)	4.2 (3.9, 4.5)	4.2 (3.9, 4.5)	4.2 (3.9, 4.6)	4.3 (3.9, 4.6)	4.2 (3.9, 4.5)	4.2 (3.8, 4.4)
INR	Median (IQR)	1.3 (1.2, 1.6)	1.4 (1.3, 1.7)	1.2 (1.1, 1.4)	1.2 (1.1, 1.4)	1.4 (1.2, 1.7)	1.2 (1, 1.5)	1.2 (1.1, 1.4)	1.3 (1.1, 1.5)	1.2 (1.1, 1.5)
Serum albumin (g/l)	Median (IQR)	31 (27, 36)	29 (25, 33)	26 (22, 28)	35 (29, 40)	28 (25, 32)	35 (31, 40)	34 (30, 38)	31 (26, 36)	28 (25, 32)

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**.

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





Table 3.3Offer decline rates for each centre by offered organ and donor type1 April 2020 and 31 March 2023										
			DBD	Donors			DCD	Donors		
Centre	Who	Whole Livers Right Lobe		All	Livers	Whole Livers				
A All donors	Offers	% Decline	Offers	% Decline	Offers	% Decline	Offers	% Decime		
Birmingham	380	50	50	82	430	54	167	44		
Cambridge	219	67	43	84	262	69	190	35		
Edinburah	237	58	64	100	301	67	110	55		
King's College	440	54	57	68	497	56	170	26		
Leeds	306	54	62	77	368	58	122	54		
Newcastle	94	49	33	100	127	62	93	69		
Royal Free	241	56	53	72	294	59	91	42		
Total	1917	55	362	83	2279	60	943	44		
B. DBD donors ag	∣ ed≤ 65 yea	irs and DCD d	onors age	ed ≤ 60						
years	1									
Birmingham	265	48	50	82	315	53	120	47		
Cambridge	159	61	43	84	202	66	137	30		
Edinburgh	173	54	64	100	237	67	70	51		
King's College	285	50	57	68	342	53	117	32		
Leeds	215	47	62	11	277	54	89	46		
Newcastle	66	53	33	100	99	69	65	58		
Royal Free	170	51	53	72	223	56	/1	42		
Total	1333	51	362	83	1695	58	669	42		

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 King's College, Newcastle and Royal Free observed an increase in the number of adult elective first liver only transplants performed in 2022/2023 compared with 2021/2022.





The demographic characteristics of 648 adult <u>elective</u> first deceased donor liver only transplant recipients in the UK, and 46 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 (90%), male (53%), brainstem death (63%) with a <u>median</u> age of 53 and a median BMI of 27. For some characteristics, due to rounding, percentages may not add up to 100.

Table 3.4	Cable 3.4 Demographic characteristics of adult elective first deceased donor liver only transplant recipients, 1 April 2022 - 31 March 2023											
		Birmingham	Cambridge	Edinburgh	King's College	Leeds	Newcastle	Royal Free	UK	Dublin		
		N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)		
Number		162	89	64	132	93	27	81	648 (100)	46		
Recipient sex	Male Female	112 (69) 50 (31)	60 (67) 29 (33)	42 (66) 22 (34)	79 (60) 53 (40)	63 (68) 30 (32)	17 (63) 10 (37)	57 (70) 24 (30)	430 (66) 218 (34)	27 (59) 19 (41)		
Recipient ethnicity	White Asian Black Other Not reported	108 (67) 14 (9) 0 0 40 (25)	82 (92) 4 (4) 2 (2) 1 (1) 0	61 (95) 1 (2) 0 2 (3) 0	114 (86) 9 (7) 3 (2) 6 (5) 0	84 (90) 9 (10) 0 0 0	27 (100) 0 0 0 0	61 (75) 12 (15) 6 (7) 2 (2) 0	537 (83) 49 (8) 11 (2) 11 (2) 40 (6)	43 (93) 2 (4) 0 1 (2) 0		
Indication	Acute on Chronic Liver Failure Cancer (HCC) Hepatitis C Alcoholic liver disease Hepatitis B Primary sclerosing cholangitis Primary biliary cholangitis Autoimmune and cryptogenic disease	2 (1) 21 (13) 3 (2) 50 (31) 2 (1) 22 (14) 14 (9) 9 (6)	2 (2) 21 (24) 2 (2) 23 (26) 0 7 (8) 6 (7) 2 (2)	0 9 (14) 0 20 (31) 0 13 (20) 4 (6) 4 (6)	3 (2) 7 (5) 4 (3) 43 (33) 3 (2) 15 (11) 8 (6) 14 (11)	0 18 (19) 2 (2) 41 (44) 1 (1) 5 (5) 8 (9) 6 (6)	0 6 (22) 0 10 (37) 0 3 (11) 4 (15) 0	4 (5) 6 (7) 3 (4) 26 (32) 7 (9) 17 (21) 2 (2) 5 (6)	11 (2) 88 (14) 14 (2) 213 (33) 13 (2) 82 (13) 46 (7) 40 (6)	0 11 (24) 1 (2) 7 (15) 0 13 (28) 1 (2) 4 (9)		
	Metabolic Other	36 (22) 3 (2)	22 (25) 4 (4)	12 (19) 2 (3)	22 (17) 13 (10)	10 (11) 2 (2)	4 (15) 0	5 (6) 6 (7)	111 (17) 30 (5)	6 (13) 3 (7)		
Recipient HCV status	Negative Positive Not reported	155 (96) 7 (4) 0	79 (89) 10 (11) 0	61 (95) 3 (5) 0 33	129 (98) 3 (2) 0	77 (83) 5 (5) 11 (12)	25 (93) 2 (7) 0	71 (88) 6 (7) 4 (5)	597 (92) 36 (6) 15 (2)	29 (63) 3 (7) 14 (30)		

Table 3.4	Demographic characteristic	s of adult elective	first decease	d donor liver o	only transplan	t recipients,	1 April 2022 - 3	1 March 2023		
		Birmingham	Cambridge	Edinburgh	King's College	Leeds	Newcastle	Royal Free	UK	Dublin
		N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
Pre-tx	Out-patient	136 (84)	70 (79)	53 (83)	112 (85)	86 (92)	27 (100)	65 (80)	549 (85)	37 (80)
in-patient	In-patient	26 (16)	19 (21)	11 (17)	19 (14)	7 (8)	0	15 (19)	97 (15)	9 (20)
status	Not reported	0	0	0	1 (1)	0	0	1 (1)	2 (0)	0
Ascites	Absence	70 (43)	24 (27)	22 (34)	42 (32)	26 (28)	9 (33)	53 (65)	246 (38)	24 (52)
	Presence	91 (56)	65 (73)	42 (66)	90 (68)	61 (66)	18 (67)	26 (32)	393 (61)	21 (46)
	Not reported	1 (1)	0	0	0	6 (6)	0	2 (2)	9 (1)	1 (2)
Encephal opathy	Absence Presence Not reported	114 (70) 44 (27) 4 (2)	41 (46) 48 (54) 0	58 (91) 6 (9) 0	71 (54) 59 (45) 2 (2)	63 (68) 26 (28) 4 (4)	17 (63) 10 (37) 0	65 (80) 11 (14) 5 (6)	429 (66) 204 (32) 15 (2)	40 (87) 6 (13) 0
Pre-tx	No	131 (81)	84 (94)	63 (98)	122 (92)	92 (99)	27 (100)	74 (91)	593 (92)	44 (96)
renal	Yes	29 (18)	5 (6)	1 (2)	10 (8)	0	0	6 (7)	51 (8)	2 (4)
support	Not reported	2 (1)	0	0	0	1 (1)	0	1 (1)	4 (1)	0
Previous	No	128 (79)	69 (78)	57 (89)	117 (89)	87 (94)	25 (93)	75 (93)	558 (86)	40 (87)
abdominal	Yes	3 (2)	20 (22)	7 (11)	15 (11)	5 (5)	2 (7)	6 (7)	58 (9)	5 (11)
surgery	Not reported	31 (19)	0	0	0	1 (1)	0	0	32 (5)	1 (2)
Varices & shunt	Absence	46 (28)	11 (12)	16 (25)	21 (16)	26 (28)	7 (26)	30 (37)	157 (24)	13 (28)
	Presence without treatment	101 (62)	73 (82)	46 (72)	107 (81)	46 (49)	18 (67)	48 (59)	439 (68)	27 (59)
	Presence with TIPS	1 (1)	5 (6)	2 (3)	3 (2)	1 (1)	2 (7)	2 (2)	16 (3)	1 (2)
	Not reported	14 (9)	0	0	1 (1)	20 (22)	0	1 (1)	36 (6)	5 (11)
Life style activity	Normal Restricted Self-care Confined Reliant Not reported	43 (27) 55 (34) 57 (35) 5 (3) 2 (1) 0	16 (18) 21 (24) 33 (37) 17 (19) 2 (2) 0	10 (16) 23 (36) 23 (36) 6 (9) 2 (3) 0	0 18 (14) 91 (69) 13 (10) 10 (8) 0	17 (18) 28 (30) 46 (49) 1 (1) 1 (1) 0	4 (15) 8 (30) 14 (52) 1 (4) 0 0	14 (17) 51 (63) 8 (10) 3 (4) 4 (5) 1 (1)	104 (16) 204 (32) 272 (42) 46 (7) 21 (3) 1 (0)	5 (11) 13 (28) 20 (43) 5 (11) 3 (7) 0

Table 3.4	Demographic characteristics	of adult elective	first deceased	l donor liver o	only transplan	t recipients,	1 April 2022 - 31	March 2023		
		Birmingham	Cambridge	Edinburgh	King's College	Leeds	Newcastle	Royal Free	UK	Dublin
Graft appearan ce	Normal Abnormal Not reported	N (%) 137 (85) 24 (15) 1 (1)	N (%) 63 (71) 26 (29) 0	N (%) 58 (91) 6 (9) 0	N (%) 129 (98) 3 (2) 0	N (%) 76 (82) 12 (13) 5 (5)	N (%) 25 (93) 2 (7) 0	N (%) 65 (80) 14 (17) 2 (2)	N (%) 553 (85) 87 (13) 8 (1)	N (%) 42 (91) 2 (4) 2 (4)
Recip age (years)	Median (IQR)	58 (50,64)	59 (53,63)	59 (50,63)	57 (42,63)	58 (51,63)	63 (49,68)	55 (43,61)	58 (49,63)	51 (43,60)
BMI (kg/m²)	Median (IQR)	28 (24,32)	29 (26,33)	29 (24,31)	27 (24,31)	28 (24,31)	29 (26,33)	26 (24,30)	28 (24,31)	28 (24,30)
Serum bilirubin (umol/l)	Median (IQR) Not reported	48 (23,99) 1	42 (22,72) 0	64 (30,196) 0	41 (21,97) 0	37 (19,92) 2	42 (21,63) 0	78 (35,172) 2	47 (23,104) 6	38 (21,61) 1
Serum creatinine (umol/l)	Median (IQR) Not reported	73 (58,94) 0	73 (61,93) 0	83 (63,95) 0	73 (59,96) 0	71 (59,88) 2	71 (55,100) 0	79 (65,91) 2	74 (60,93) 4	76 (59,90) 0
Serum sodium	Median (IQR)	137 (134,139)	135 (133 139)	134 (131-138)	136 (133,139)	137 (133,140)	137 (135,139)	137 (133,139)	136 (133,139)	137 (133,140)
(mmol/l)	Not reported	0	0	0	0	2	0	2	4	0
Serum potassium (mmol/l)	Median (IQR) Not reported	4.2 (3.9,4.5) 8	4.2 (3.9,4.5) 0	4.2 (3.9,4.7) 0	4.2 (3.9,4.5) 0	4.2 (4.0,4.5) 4	4.2 (3.8,4.7) 0	4.2 (3.8,4.5) 3	4.2 (3.9,4.5) 15	4.1 (3.8,4.5) 0
INR	Median (IQR) Not reported	1.5 (1.2,1.8) 2	1.4 (1.2,1.8) 0	1.3 (1.2,1.6) 0	1.3 (1.1,1.5) 0	1.5 (1.3,1.9) 6	1.4 (1.1,2.2) 0	1.4 (1.1,1.7) 6	1.4 (1.2,1.7) 14	1.3 (1.1,1.5) 0
Serum albumin (g/l)	Median (IQR) Not reported	30 (26,35) 1	29 (26,33) 0	23 (20,29) 0	34 (30,39) 0	28 (24,33) 2	34 (29,40) 0	34 (29,38) 2	31 (26,36) 5	27 (25,35) 0

Table 3.4	Demographic characteristic	cs of adult elective	first deceased	I donor liver	only transplan	t recipients, 1	l April 2022 - 3	1 March 2023		
		Birmingham	Cambridge	Edinburgh	King's College	Leeds	Newcastle	Royal Free	UK	Dublin
		N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
Cold ischaemia time (hrs)	Median (IQR) Not reported	7 (6,8) 0	8 (7,11) 0	10 (9,12) 0	9 (7,11) 0	8 (7,10) 0	10 (8,11) 0	8 (7,10) 1	8 (7,10) 1	6 (5,7) 0
Time on list (days)	Median (IQR)	86 (20,264)	45 (11,137)	37 (9,155)	118 (31,295)	49 (13,200)	47 (9,196)	51 (10,135)	70 (14,209)	145 (40,298)
Donor sex	Male Female	83 (51) 79 (49)	56 (63) 33 (37)	32 (50) 32 (50)	71 (54) 61 (46)	45 (48) 48 (52)	14 (52) 13 (48)	39 (48) 42 (52)	340 (53) 308 (48)	21 (46) 20 (43)
Donor ethnicity	White Asian Black Other Not reported	143 (88) 6 (4) 4 (2) 4 (2) 5 (3)	85 (96) 0 1 (1) 3 (3)	54 (84) 1 (2) 2 (3) 1 (2) 6 (9)	121 (92) 5 (4) 2 (2) 1 (1) 3 (2)	86 (92) 1 (1) 3 (3) 2 (2) 1 (1)	25 (93) 0 1 (4) 1 (4)	71 (88) 5 (6) 2 (2) 2 (2) 1 (1)	585 (90) 18 (3) 13 (2) 12 (2) 20 (3)	2 (4) 0 0 0 44 (96)
Donor cause of death	Intracranial Trauma Others	146 (90) 6 (4) 10 (6)	84 (94) 2 (2) 3 (3)	57 (89) 0 7 (11)	117 (89) 2 (2) 13 (10)	86 (92) 0 7 (8)	23 (85) 0 4 (15)	73 (90) 1 (1) 7 (9)	586 (90) 11 (2) 51 (8)	0 0 46 (100)
Donor history of diabetes	No Yes Not reported	140 (86) 21 (13) 1 (1)	82 (92) 7 (8) 0	58 (91) 3 (5) 3 (5)	124 (94) 7 (5) 1 (1)	86 (92) 6 (6) 1 (1)	22 (81) 4 (15) 1 (4)	76 (94) 4 (5) 1 (1)	588 (91) 52 (8) 8 (1)	0 0 46 (100)
Donor type	Donor after brain death Donor after cardiac death	106 (65) 56 (35)	38 (43) 51 (57)	38 (59) 26 (41)	84 (64) 48 (36)	67 (72) 26 (28)	13 (48) 14 (52)	64 (79) 17 (21)	410 (63) 238 (37)	44 (96) 2 (4)
ABO match	Identical Compatible	154 (95) 8 (5)	83 (93) 6 (7)	59 (92) 5 (8)	130 (98) 2 (2)	90 (97) 3 (3)	26 (96) 1 (4)	76 (94) 5 (6)	618 (95) 30 (5)	23 (100) 0
Table 3.4	Demographic characteristics o	f adult elective	first deceased	l donor liver o	nly transplan	t recipients, 1	April 2022 - 31	March 2023		
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		Birmingham	Cambridge	Edinburgh	King's College	Leeds	Newcastle	Royal Free	UK	Dublin
		N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
Graft type	Whole	157 (97)	86 (97)	64 (100)	124 (94)	89 (96)	27 (100)	71 (88)	618 (95)	46 (100)
	Reduced	0	0	0	0	1 (1)	0	0	1 (0)	0
	Segmental	5 (3)	3 (3)	0	8 (6)	3 (3)	0	10 (12)	29 (5)	0
Donor age years	Median (IQR)	53 (40,64)	50 (40,60)	53 (38,66)	57 (42,67)	52 (39,60)	55 (40,64)	54 (36,63)	53 (40,63)	46 (25,60)
Donor BMI kg/m2	Median (IQR)	27 (23,31)	27 (23,30)	27 (23,30)	26 (23,29)	27 (24,30)	26 (22,28)	25 (22,29)	27 (23,30)	25 (23,26)

3.2.3 Post-transplant survival

LONG-TERM PATIENT SURVIVAL

Table 3.5 shows one year <u>unadjusted</u> and <u>risk-adjusted</u> patient survival for 2410 of the 2583 transplants in the period, 1 April 2018 to 31 March 2022. Transplants were excluded if they were <u>auxiliary</u> or if survival information or <u>risk factors</u> were missing. The overall patient survival rate is 95.1% 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 s donor first liver tra	survival fo ansplants	or adult electiv , 1 April 2018	ve decea - 31 Mar	sed ch 2022	
			1-year surviva	al % (95%	o CI)	
Centre	Number of transplants	Una	idjusted	Risk-adjusted		
Newcastle	105	98.1	92.5 - 99.5	97.2	88.6 - 99.3	
Leeds	277	92.4	88.5 - 95.0	94.1	91.0 - 96.2	
Cambridge	313	95.8	92.9 - 97.5	95.4	92.1 - 97.4	
Royal Free	353	93.7	90.6 - 95.8	94.4	91.5 - 96.3	
King's College	588	96.9	95.0 - 98.1	96.6	94.5 - 97.9	
Birmingham	524	94.9	92.7 - 96.5	94.9	92.5 - 96.5	
Edinburgh	250	93.9	90.2 - 96.3	93.8	89.7 - 96.3	
Total	2410	95.1	94.1 - 95.9			



Table 3.6 shows the five year <u>unadjusted</u> and <u>risk-adjusted</u> patient <u>survival</u> for 2468 of the 2719 transplants in the period, 1 April 2014 to 31 March 2018. The national rate is 84.1% and three centres have a lower survival rate after risk adjustment, as shown in **Figure 3.16**. The median number of days between the last known follow-up post-transplantation (for censored cases) and the time of analysis in **Table 3.6** and **Figure 3.16** ranges from 272 days for Royal Free to 524 days for Edinburgh. The medians for all other centres fall in between these extremes. Results should therefore be interpreted in that light.

ïve year patient s lonor first liver tra	urvival fo insplants	or adult electiv s, 1 April 2014	ve decea - 31 Mar	sed ch 2018					
		5-year surviva	al % (95%	o CI)					
Number of transplants	transplants Unadjusted Risk-adjusted								
115	82.5	74.1 - 88.3	77.6	65.2 - 85.5					
323	83.4	78.9 - 87.1	82.9	77.6 - 86.9					
273	86.5	81.8 - 90.1	88.0	83.4 - 91.4					
295	85.3	80.6 - 88.8	86.3	81.5 - 89.8					
565	86.2	82.9 - 88.8	85.6	81.9 - 88.6					
619	81.3	77.9 - 84.2	80.6	76.7 - 83.9					
278	83.6	78.3 - 87.7	85.2	79.9 - 89.1					
2468	84.1	82.6 - 85.5							
Centre has reac	hed the lo	ower 99.8% co	nfidence	limit					
Centre has reac	hed the lo	ower 95% conf	idence lin	nit					
Centre has reached the upper 95% confidence limit									
Centre has reached the upper 99.8% confidence limit									
	ive year patient s onor first liver transplants 115 323 273 295 565 619 278 2468 Centre has reac Centre has reac Centre has reac Centre has reac	Number of transplantsUna11582.532383.427386.529585.356586.261981.327883.6246884.1Centre has reached the lo Centre has reached the u Centre has reached the u	Tive year patient survival for adult elective on or first liver transplants, 1 April 2014 5-year survival Number of transplants 115 82.5 323 83.4 273 86.5 85.5 81.8 295 85.3 86.2 82.9 278 83.6 84.1 82.6 - 85.5 Centre has reached the lower 99.8% conf Centre has reached the upper 95% conf	Tive year patient survival for adult elective decear onor first liver transplants, 1 April 2014 - 31 Mar 5-year survival % (95% Number of transplants Unadjusted 115 82.5 74.1 - 88.3 123 83.4 78.9 - 87.1 273 86.5 81.8 - 90.1 295 85.3 80.6 - 88.8 295 85.3 80.6 - 88.8 278 83.6 78.3 - 87.7 278 83.6 78.3 - 87.7 2468 84.1 82.6 - 85.5 Centre has reached the lower 99.8% confidence lin Centre has reached the upper 95% confidence lin Centre has reached the upper 95% confidence lin Centre has reached the upper 95% confidence lin					



Table 3.7 shows one year <u>unadjusted</u> and <u>risk-adjusted</u> <u>patient survival</u>, by primary disease group. The overall patient survival rate is 95.1% and, after risk adjustment, patients with cancer, autoimmune and cryptogenic, metabolic disease or other liver disease had lower survival than the national rate.

Table 3.7 One year donor firs	patient survival for ad t liver transplants, 1	dult elect April 2018	ive deceased 3 - 31 March 20	22	
			1-year surviva	l % (95%	CI)
Primary disease	Number of transplants	Un	adjusted	Risk	adjusted
Cancer	451	93.0	(90.2 - 95.0)	94.7	(92.4 - 96.2)
Hepatitis B and C	100	95.8	(89.3 - 98.4)	96.5	(90.7 - 98.7)
Alcoholic liver disease	693	97.8	(96.3 - 98.7)	97.5	(95.9 - 98.5)
Primary sclerosing cholar	ngitis 281	96.3	(93.3 - 98.0)	95.4	(91.4 - 97.5)
Primary biliary cholangitis	208	95.1	(91.1 - 97.3)	95.3	(91.2 - 97.4)
Autoimmune and cryptog	enic 187	94.4	(89.9 - 97.0)	93.6	(88.1 - 96.6)
Metabolic	332	92.7	(89.3 - 95.1)	93.0	(89.5 - 95.3)
Other	158	92.1	(86.5 - 95.4)	91.1	(84.3 - 94.9)
Total	2410	95.1	(94.1 - 95.9)		

Table 3.8 shows five year <u>unadjusted</u> and <u>risk-adjusted</u> <u>patient survival</u>, the overall patient survival rate is 84.1%. After risk adjustment, patients with cancer, primary sclerosing cholangitis, autoimmune and cryptogenic, metabolic or other liver disease had lower survival than the national rate.

Table 3.8	Five year patient donor first liver	t survival for ad transplants, 1 A	ult elect pril 2014	ive deceased 4 - 31 March 20′	18		
				5-year survival	% (95%	CI)	
Primary disea	se	Number of transplants	Una	adjusted	Risk adjusted		
Cancer		559	78.6	(74.9 - 81.8)	82.4	(78.8 - 85.3)	
Hepatitis B an	d C	182	88.6	(82.9 - 92.5)	89.6	(84.0 - 93.3)	
Alcoholic liver	disease	645	85.0	(81.9 - 87.6)	84.5	(81.0 - 87.4)	
Primary sclero	sing cholangitis	293	84.9	(80.2 - 88.6)	81.8	(75.5 - 86.5)	
Primary biliary	cholangitis	201	89.8	(84.6 - 93.3)	89.1	(83.0 - 92.9)	
Autoimmune a	and cryptogenic	160	85.8	(79.2 - 90.4)	82.4	(73.3 - 88.4)	
Metabolic		275	84.1	(78.9 - 88.1)	83.9	(78.1 - 88.2)	
Other		153	83.9	(76.9 - 88.9)	81.8	(72.8 - 87.8)	
Total		2468	84.1	(82.6 - 85.5)			

3.2.4 Survival from listing

Survival from listing was analysed for patients aged \geq 18 years registered for the first time for a liver transplant in the UK between 1 January 2011 and 31 December 2022. One and five year <u>risk-adjusted survival rates</u> from the point of liver transplant listing are provided in **Table 3.9** and are shown by centre in **Figures 3.17** and **3.18** respectively. Dublin are not included in **Table 3.9**, **Figures 3.17** and **3.18**.

At one year, centre-specific risk adjusted survival rates range between 84.5% at Birmingham and 89.4% at Edinburgh. At five years, Birmingham had the lowest survival rate at 70.3% and Edinburgh has the highest at 78.7%; the remaining centres achieve survival rates that range in between these two extremes.

Note, however, that the median number of days between the last known follow-up post-transplantation (for censored, transplanted cases) and the time of analysis in **Figure 3.18** ranges from 277 days for Royal Free to 425 days for Cambridge. The medians for all other centres fall in between these extremes. Results should therefore be interpreted in that light.

Table 3.9	Risk adjusted 1 a adult elective firs	nd 5 year pa t liver registi	tient surviva ations, 1 Ja	al rate from listi nuary 2011 - 31	ing for I December 2	2022			
				Patient	survival				
Centre	Number of registrations	Numbor	One year	One year Five year					
		at Risk at	Survival Rate %	(95% CI)	at Risk at	Survival Rate %	(95% CI)		
	150					70.0			
Newcastle	450	329	86.8	(83.7 - 89.3)	143	72.2	(67.1 - 76.4)		
Leeds	1442	1075	85.1	(83.0 - 87.0)	499	72.1	(69.0 - 74.9)		
Cambridge	1145	880	89.2	(87.3 - 90.9)	371	78.1	(75.2 - 80.7)		
Royal Free	1234	933	85.6	(83.4 - 87.6)	429	73.1	(69.8 - 76.0)		
King's College	2037	1555	88.8	(87.3 - 90.2)	719	77.6	(75.3 - 79.7)		
Birmingham	2257	1709	84.5	(82.7 - 86.1)	777	70.3	(67.6 - 72.7)		
Edinburgh	1068	841	89.4	(87.5 - 91.0)	392	78.7	(75.8 - 81.2)		
UK	9633	7322	87.0	(86.3 - 87.7)	3330	74.6	(73.6 - 75.6)		





Adult Liver Transplantation Super-Urgent Patients

3.3.1 Transplant list

Table 3.10 shows the <u>median waiting time</u> to deceased donor liver only transplant for adult <u>super-urgent</u> patients. The national median waiting time to transplant is two days and at five of the seven UK centres.

Table 3.10	Median waiting time adult super urgent pa	to liver only transplant atients registered 1 Ap	in the UK, for ril 2020 - 31 March 2	022			
Transplant cer	ntre Number of pa	atients	Waiting time (days)				
	registere	d Median	Median 95% Confiden				
Adult							
Newcastle		7 2	-				
Leeds	29	9 2	1 - 3	3			
Cambridge	24	4 2	1 - 3	3			
Birmingham	34	4 2	1 - 3	3			
Edinburgh	10) 2	-				
Royal Free	22	2 3	1 - 5	5			
King's College	9 40	6 3	2 - 4	1			
UK	17:	2 2	2 - 2	2			
Dublin	:	8 1	-				

The demographic characteristics of 110 adult <u>super-urgent</u> registrations in the UK, and 3 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 (51%) and the median age was 41.5 with a median BMI of 26. For some characteristics, due to rounding, percentages may not add up to 100.

Table 3.11 Do	emographic ch	aracteristics of	f adult super urg	ent liver patie	nts registere	d from 1 April	2022 - 31 Mar	ch 2023		
Number		Birmingham N (%) 25	Cambridge N (%) 16	Edinburgh N (%) 7	King's college N (%) 20	Leeds N (%) 16	Newcastle N (%) 8	Royal Free N (%) 18	UK N (%) 110	Dublin N (%) 3
Recipient sex	Male Female	13 (52) 12 (48)	5 (31) 11 (69)	5 (71) 2 (29)	9 (45) 11 (55)	8 (50) 8 (50)	3 (38) 5 (63)	11 (61) 7 (39)	54 (49) 56 (51)	0 (0) 3 (100)
Recipient ethnicity	White Asian Black Other Not reported	21 (84) 1 (4) 2 (8) 0 (0) 1 (4)	12 (75) 3 (19) 0 (0) 0 (0) 1 (6)	6 (86) 0 (0) 0 (0) 1 (14) 0 (0)	17 (85) 0 (0) 3 (15) 0 (0) 0 (0)	12 (75) 3 (19) 1 (6) 0 (0) 0 (0)	7 (88) 1 (13) 0 (0) 0 (0) 0 (0)	9 (50) 6 (33) 2 (11) 0 (0) 1 (6)	84 (76) 14 (13) 8 (7) 1 (1) 3 (3)	3 (100) 0 (0) 0 (0) 0 (0) 0 (0)
Recipient HCV	No Yes	25 (100) 0 (0)	16 (100) 0 (0)	7 (100) 0 (0)	20 (100) 0 (0)	16 (100) 0 (0)	8 (100) 0 (0)	18 (100) 0 (0)	110 (100) 0 (0)	3 (100) 0 (0)
Encephalopathy	Absence Presence Not reported	2 (8) 17 (68) 6 (24)	5 (31) 11 (69) 0 (0)	2 (29) 5 (71) 0 (0)	0 (0) 19 (95) 1 (5)	4 (25) 10 (63) 2 (13)	0 (0) 8 (100) 0 (0)	3 (17) 12 (67) 3 (17)	16 (15) 82 (75) 12 (11)	1 (33) 2 (67) 0 (0)
Renal support	No Yes Not reported	6 (24) 19 (76) 0 (0)	10 (63) 5 (31) 1 (6)	2 (29) 5 (71) 0 (0)	4 (20) 16 (80) 0 (0)	8 (50) 8 (50) 0 (0)	5 (63) 3 (38) 0 (0)	9 (50) 9 (50) 0 (0)	44 (40) 65 (59) 1 (1)	2 (67) 1 (33) 0 (0)
Recip age (years)	Median (IQR)	39 (35, 45)	53 (43.5, 57.5)	55 (32, 57)	36 (21, 57)	38.5 (31.5, 53.5)	55 (50.5, 65)	41 (32, 49)	41.5 (32, 56)	51 (20, 61)
BMI (kg/m²)	Median (IQR)	25 (24, 29)	27.5 (24, 33.5)	29 (25, 30)	23 (22.5, 29)	28 (24, 30)	28.5 (26, 32.5)	23.5 (21, 27)	26 (23, 30)	28 (26, 35)
Serum bilirubin (umol/l)	Median (IQR)	215 (92, 430)	230 (30, 421)	150 (76, 434)	192 (128, 393.5)	90 (36.5, 370)	293 (100.5, 408)	229.5 (93, 386)	198 (82, 403)	466 (60, 550)
	Not reported	0	1	0	0	0	0	0	1	0

Table 3.11 D	emographic ch	aracteristics of	adult super ur	gent liver patie	nts registere	d from 1 April	2022 - 31 Mar	ch 2023		
Serum creatinine (umol/l)	Median (IQR) Not reported	Birmingham N (%) 86 (68, 168) 3	Cambridge N (%) 87 (58, 134) 1	Edinburgh N (%) 140 (67, 213) 0	King's college N (%) 89 (51, 145) 3	Leeds N (%) 108 (74, 163) 1	Newcastle N (%) 83 (61, 86) 0	Royal Free N (%) 100 (60, 130) 1	UK N (%) 87 (60, 145) 9	Dublin N (%) 164 (164, 164) 2
Serum sodium (mmol/l)	Median (IQR)	137 (135, 142)	132.5 (126.5, 137.5)	141 (138, 143)	142 (132, 149)	137.5 (131.5, 141.5)	139 (138, 141.5)	142.5 (136, 147)	138 (134, 143)	133 (132, 138)
Serum potassium (mmol/l)	Median (IQR) Not reported	4.3 (4, 4.6)	4.4 (4, 4.7)	4.9 (4.2, 5.7) 0	4.5 (4.2, 5)	4.7 (4, 5.1) 0	3.8 (3.5, 4) 0	4.3 (4.1, 4.9) 1	4.3 (4, 4.8) 1	4.2 (3.3, 5.2) 0
INR	Median (IQR)	4.8 (3.3, 9)	3.7 (2.4, 7.4)	2.5 (1.9, 10)	3.8 (2.3, 6.5)	3.7 (2.2, 8.3)	2.2 (1.4, 6.3)	2.4 (1.9, 3.5)	3.5 (2.1, 7.2)	0 2.1 (1.7, 10.5)
	Not reported	0	2	0	0	1	0	1	4	0
Serum albumin (g/l)	Median (IQR)	28 (24, 29)	23 (21, 28)	24 (20, 28)	30 (27, 32)	24 (21.5, 26.5)	31 (25.5, 39)	29 (26, 34)	27 (23, 31)	19 (15, 24)
	Not reported	0	0	0	1	0	0	0	1	0

3.2.2 Transplant activity

Figure 3.19 shows the number of adult <u>super-urgent</u> 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 11 DCD super-urgent transplants during the ten year period. The number of super-urgent transplants in 2022/23 has increased compared to the previous financial year. There have been no adult super-urgent liver only transplants from living donors during the decade. Dublin are not included.



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



The demographic characteristics of 73 adult <u>super-urgent</u> transplant recipients in the UK, and 2 in Dublin, in the last financial year are shown by centre and overall in **Table 3.12**. Fifty five percent of these recipients in the UK were female and the <u>median</u> age was 38 years. All but one super-urgent transplants were performed in this time period using a <u>DBD</u> donor. The median recipient BMI was 25. For some characteristics, due to rounding, percentages may not add up to 100.

Table 3.12	Demographic cha	aracteristics of ad	lult super-urge	nt deceased do	nor liver tran	splant recip	oients, 1 April 2	2022 - 31 March	2023	
		Birmingham	Cambridge	Edinburgh	King's College	Leeds	Newcastle	Royal Free	UK	Dublin
		N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
Number		18	11	3	15	9	5	12	73 (100)	2
Recipient sex	Male	8 (44)	3 (27)	2 (67)	7 (47)	4 (44)	1 (20)	8 (67)	33 (45)	0
	Female	10 (56)	8 (73)	1 (33)	8 (53)	5 (56)	4 (80)	4 (33)	40 (55)	2 (100)
Recipient ethnicity	White Asian Black Not reported	14 (78) 1 (6) 2 (11) 1 (6)	9 (82) 2 (18) 0 0	3 (100) 0 0 0	12 (80) 0 3 (20) 0	7 (78) 1 (11) 1 (11) 0	4 (80) 1 (20) 0 0	6 (50) 3 (25) 2 (17) 1 (8)	55 (75) 8 (11) 8 (11) 2 (3)	2 (100) 0 0 0
Recipient HCV	Negative	18 (100)	11 (100)	3 (100)	15 (100)	7 (78)	5 (100)	12 (100)	71 (97)	1 (50)
status	Not reported	0	0	0	0	2 (22)	0	0	2 (3)	1 (50)
Pre-transplant	Out-patient	5 (28)	0	0	0	1 (11)	0	0	6 (8)	0
in-patient status	In-patient	13 (72)	11 (100)	3 (100)	15 (100)	8 (89)	5 (100)	12 (100)	67 (92)	2 (100)
Ascites	Absence	5 (28)	4 (36)	3 (100)	3 (20)	3 (33)	4 (80)	9 (75)	31 (43)	0
	Presence	7 (39)	7 (64)	0	12 (80)	3 (33)	1 (20)	2 (17)	32 (44)	2 (100)
	Not reported	6 (33)	0	0	0	3 (33)	0	1 (8)	10 (14)	0
Encephalopathy	Absence	8 (44)	5 (45)	0	0	1 (11)	0	1 (8)	15 (21)	0
	Presence	3 (17)	6 (55)	3 (100)	15 (100)	8 (89)	5 (100)	11 (92)	51 (70)	2 (100)
	Not reported	7 (39)	0	0	0	0	0	0	7 (10)	0
Pre-transplant renal support	No Yes Not reported	5 (28) 13 (72) 0	3 (27) 8 (73) 0	2 (67) 1 (33) 0	4 (27) 11 (73) 0	3 (33) 5 (56) 1 (11)	3 (60) 2 (40) 0	7 (58) 5 (42) 0	27 (37) 45 (62) 1 (1)	1 (50) 1 (50) 0
Previous	No	5 (28)	9 (82)	3 (100)	14 (93)	9 (100)	5 (100)	11 (92)	56 (77)	2 (100)
abdominal	Yes	0	2 (18)	0	1 (7)	0	0	0	3 (4)	0
surgery	Not reported	1 (6)	0	0	0	0	0	1 (8)	2 (3)	0

Table 3.12	Demographic chara	cteristics of ad	ult super-urger	nt deceased do	nor liver tran	splant recip	ients, 1 April 2	022 - 31 March	2023	
		Birmingham	Cambridge	Edinburgh	King's College	Leeds	Newcastle	Royal Free	UK	Dublin
Varices & shunt	Absence Presence without	N (%) 6 (33) 1 (6)	N (%) 2 (18) 9 (82)	N (%) 2 (67) 1 (33)	N (%) 10 (67) 5 (33)	N (%) 3 (33) 1 (11)	N (%) 1 (20) 4 (80)	N (%) 4 (33) 8 (67)	N (%) 28 (38) 29 (40)	N (%) 2 (100) 0
	treatment Not reported	11 (61)	0	0	0	5 (56)	0	0	16 (22)	0
Life style activity	Normal Restricted Self-care Confined Reliant	4 (22) 3 (17) 0 11 (61)	0 1 (9) 0 1 (9) 9 (82)	0 1 (33) 0 1 (33) 1 (33)	0 0 1 (7) 1 (7) 12 (80)	2 (22) 1 (11) 0 1 (11) 5 (56)	0 0 2 (40) 3 (60)	0 0 1 (8) 4 (33) 7 (58)	6 (8) 6 (8) 2 (3) 10 (14) 48 (66)	0 0 0 2 (100)
Graft appearance	Normal Abnormal	16 (89) 2 (11)	7 (64) 4 (36)	3 (100) 0	14 (93) 1 (7)	8 (89) 1 (11)	4 (80) 1 (20)	11 (92) 1 (8)	63 (86) 10 (14)	2 (100) 0
Recip age (years)	Median (IQR)	39 (33,45)	51 (36,57)	35 (32,55)	36 (22,55)	35 (26,45)	54 (52,56)	35 (30,47)	38 (31,54)	56 (51,61)
BMI (kg/m²)	Median (IQR)	25 (24,28)	27 (24,32)	29 (25,29)	23 (22,29)	30 (20,30)	28 (24,29)	23 (21,26)	25 (23,29)	31 (26,35)
Serum bilirubin (umol/l)	Median (IQR)	216 (143,362)	315 (196,459)	417 (179,470)	210 (80,407)	371 (275,516)	385 (316,425)	343 (227,391)	309 (165,423)	523 (450,595)
Serum creatinine (umol/l)	Median (IQR)	83 (44,96)	133 (72,189)	66 (45,152)	63 (41,125)	99 (70,153)	87 (60,102)	71 (62,127)	82 (56,125)	213 (151,274)
Serum sodium (mmol/l)	Median (IQR)	144 (139,149)	133 (126,136)	138 (137,145)	141 (133,149)	139 (133,141)	141 (138,144)	146 (139,148)	140 (135,147)	136 (131,141)
Serum potassium (mmol/I)	Median (IQR)	4.1 (3.9,4.6)	4.1 (3.8,4.5)	3.9 (3.8,4.6)	4.8 (4.0,5.2)	4.7 (4.1,5.1)	4.3 (4.0,4.4)	4.5 (4.3,4.7)	4.3 (4.0,4.7)	3.7 (2.7,4.7)

Table 3.12	Demographic chara	acteristics of ad	ult super-urger	nt deceased do	onor liver trar	nsplant recip	ients, 1 April 2	022 - 31 March	2023	
		Birmingham	Cambridge	Edinburgh	King's College	Leeds	Newcastle	Royal Free	UK	Dublin
INR	Median (IQR) Not reported	N (%) 2.7 (2.1,3.8) 1	N (%) 3.2 (1.5,4.7) 0	N (%) 2.2 (1.7,4.0) 0	N (%) 4.5 (2.2,6.3) 0	N (%) 3.9 (3.0,5.8) 0	N (%) 3.4 (2.3,5.0) 0	N (%) 2.3 (1.9,2.9) 0	N (%) 2.8 (1.9,5.0) 1	N (%) 2.5 (1.7,3.2) 0
Serum albumin (g/l)	Median (IQR)	29 (25,33)	25 (21,35)	24 (21,26)	28 (26,31)	23 (20,27)	26 (23,28)	31 (25,33)	27 (23,32)	21 (19,23)
Time on list (days)	Median (IQR)	3 (2,4)	2 (2,4)	2 (2,3)	3 (2,4)	2 (1,4)	2 (1,2)	2 (2,5)	2 (2,4)	4 (2,5)
Donor sex	Male Female	5 (28) 13 (72)	4 (36) 7 (64)	1 (33) 2 (67)	11 (73) 4 (27)	4 (44) 5 (56)	2 (40) 3 (60)	7 (58) 5 (42)	34 (47) 39 (53)	1 (50) 1 (50)
Donor ethnicity	White Asian Other Not reported	14 (78) 1 (6) 0 3 (17)	11 (100) 0 0 0	3 (100) 0 0 0	15 (100) 0 0 0	8 (89) 1 (11) 0 0	4 (80) 1 (20) 0 0	11 (92) 0 1 (8) 0	66 (90) 3 (4) 1 (1) 3 (4)	1 (50) 0 0 1 (50)
Donor cause of death	Intracranial Trauma Others	17 (94) 0 1 (6)	10 (91) 0 1 (9)	3 (100) 0 0	14 (93) 1 (7) 0	9 (100) 0 0	5 (100) 0 0	10 (83) 0 2 (17)	68 (93) 1 (1) 4 (6)	1 (50) 0 1 (50)
Donor history of diabetes	No Yes Not reported	17 (94) 1 (6) 0	11 (100) 0 0	3 (100) 0 0	15 (100) 0 0	8 (89) 0 1 (11)	5 (100) 0 0	12 (100) 0 0	71 (97) 1 (1) 1 (1)	1 (50) 0 1 (50)
Donor type	Donor after brain death Donor after	18 (100) 0	10 (91) 1 (9)	3 (100) 0	15 (100) 0	9 (100) 0	5 (100) 0	12 (100) 0	72 (99) 1 (1)	2 (100) 0
ABO match	cardiac death Identical Compatible	11 (61) 7 (39)	9 (82) 2 (18)	3 (100) 0	11 (73) 4 (27)	7 (78) 2 (22)	3 (60) 2 (40)	8 (67) 4 (33)	52 (71) 21 (29)	1 (50) 1 (50)

Table 3.12	Demographic cha	racteristics of ad	lult super-urger	nt deceased do	onor liver trar	splant recip	ients, 1 April 2	022 - 31 March	2023	
		Birmingham	Cambridge	Edinburgh	King's College	Leeds	Newcastle	Royal Free	UK	Dublin
		N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
Graft type	Whole	18 (1Ó0)	11 (1ÓO)	3 (100)	12 (80)	9 (100)	5 (100)	12 (1Ó0)	70 (96)	2 (100)
	Reduced	Û Í	Û	Û	3 (20)	О́	0	0	3 (4)	Û
Donor age (years)	Median (IQR)	53 (40,74)	55 (40,64)	56 (29,70)	47 (38,59)	45 (33,54)	41 (35,57)	38 (29,54)	47 (36,59)	42 (29,54)
Donor BMI (kg/m²)	Median (IQR)	24 (22,28)	26 (24,30)	23 (23,27)	27 (24,29)	23 (22,24)	23 (21,24)	22 (20,25)	24 (22,28)	27 (23,30)

3.3.3 Post-transplant survival

LONG-TERM PATIENT SURVIVAL

Table 3.13 shows one year <u>unadjusted</u> and <u>risk-adjusted patient survival</u> for 214 of the 240 transplants in the period 1 April 2018 to 31 March 2022. Transplants were excluded if they were <u>auxiliary</u> or if survival information or <u>risk factors</u> were missing. The overall patient survival rate is 90% and, after risk adjustment, five of the seven centres had a lower survival rate than the national rate but within the <u>confidence limits</u>, as shown in **Figure 3.21**.

Table 3.13One year patient survival for adult super-urgent deceased donor first liver transplants, 1 April 2018 - 31 March 2022								
			1-year surviva	al % (95%	o CI)			
Centre	Number of							
	transplants	Una	adjusted	Risk	-adjusted			
Newcastle	13	84.6	51.2 - 95.9	76.2	5.0 - 94.1			
Leeds	34	85.0	67.6 - 93.5	83.3	59.9 - 93.1			
Cambridge	25	100.0	-	100.0	-			
Royal Free	38	84.2	68.2 - 92.6	89.5	76.7 - 95.3			
King's College	49	93.6	81.5 - 97.9	94.0	81.5 - 98.1			
Birmingham	42	90.5	76.6 - 96.3	89.0	70.8 - 95.9			
Edinburgh	13	92.3	56.6 - 98.9	89.5	25.2 - 98.5			
Total	214	90.0	85.1 - 93.4					
	Centre has read	ched the lo	ower 99.8% co	nfidence	limit			
	Centre has read	ched the lo	ower 95% conf	idence lin	nit			
	Centre has read	ched the u	pper 95% cont	fidence lir	nit			
	Centre has read	ched the u	pper 99.8% cc	onfidence	limit			



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Table 3.14 shows the five year <u>unadjusted</u> and <u>risk-adjusted</u> patient survival for 223 of the 259 transplants in the period, 1 April 2014 to 31 March 2018. The national rate is 82.6% and four centres have a lower survival rate after risk adjustment as shown in **Figure 3.22**. Birmingham has a survival rate above the 95% confidence interval indicating that the survival rates are significantly higher than the national rate. All other centres fall within the 95% confidence limits.

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 264 days for Birmingham to 682 days for Edinburgh. The medians for all other centres fall in between these extremes.

Table 3.14Five year patient survival for adult super-urgent deceased donor first liver transplants, 1 April 2014 - 31 March 2018								
			5-year surviva	al % (95%	ώCI)			
Centre	Number of				-			
	transplants	Una	adjusted	Risł	k-adjusted			
Newcastle	16	68.8	40.5 - 85.6	76.0	42.3 - 90.0			
Leeds	26	88.5	68.4 - 96.1	83.9	50.1 - 94.8			
Cambridge	18	75.0	45.2 - 90.1	81.4	50.5 - 93.0			
Royal Free	39	79.5	63.1 - 89.2	77.8	55.6 - 88.9			
King's College	52	78.8	64.9 - 87.6	80.5	64.7 - 89.2			
Birmingham	57	90.7	79.0 - 96.0	90.7	77.7 - 96.1			
Edinburgh	15	86.7	56.4 - 96.5	82.9	31.7 - 95.7			
Total	223	82.6	76.9 - 87.1					
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								



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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 <u>elective and super-urgent</u> deceased donor transplants between 1 January 2022 and 31 December 2022 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 2022 may not have yet been "chased" by NHSBT when the report was produced in August 2023.

Table 3.15	Form return	n rates	s for adult liv	er trans	plants, 1 Jan	uary 202	22 to 31 Dec	ember 20)22
Cent	re -	Transp	lant record	3 mont	h follow-up	1 year	follow-up	Lifetim	e follow-up
		NI	% Deturned	NI	% Deturned	N	% Deturned	NI	% Deturned
		IN	Returned	IN	Returned	IN	Returned	IN	Returned
Newcastle		29	100	28	100	41	100	206	98
Leeds		101	99	98	100	79	100	624	98
Cambridge		102	100	100	100	92	100	526	100
Royal Free		90	100	89	100	80	100	618	100
King's College	Э	153	100	149	99	163	88	1010	88
Birmingham		181	100	180	100	136	100	1053	92
Edinburgh		73	100	70	100	52	96	494	52
Total		729	100	714	100	643	97	4531	90
Dublin		45	100	48	100	27	0	298	3

Paediatric Liver Transplantation



4.1 Overview

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



In the last year, 81 transplants in paediatric recipients were performed (all but one were performed at UK paediatric centres). Sixty (74%) of these transplants were for patients on the <u>elective</u> list and twenty one (26%) for patients on the <u>super-urgent_list</u>.



The overall <u>median cold ischaemia times</u> (CIT) for paediatric transplant recipients are shown by financial year in **Figure 4.3** for <u>DBD</u> and <u>DCD</u> donors, respectively. The national median CIT for transplants from DBD donors has decreased slightly from 9.18 hours in 2013/14 to 9.03 hours in 2022/23. The corresponding national median for DCD donor transplants has increased over the ten year period, from 7.13 hours in 2013/14 to 7.96 hours in 2022/23. It should be noted the number of DCD paediatric transplants ranged between 0 and 7 per financial year with 6 in 2022/23.



Figure 4.4 shows boxplots of <u>cold ischaemia times</u> (CIT) for paediatric transplant recipients by centre in the latest financial year (2022/2023) while **Figure 4.5** and **Figure 4.6** show the equivalent information by centre and donor type over the last ten financial years for <u>DBD</u> and <u>DCD</u> donors, respectively. The median (IQR) CIT for DBD in the last financial year were 7.8 (7.0, 8.8) hours at Birmingham, 10.2 (9.1, 12.1) hours at King's College and 9.1 (8.5, 10.0) hours at Leeds.

The cold ischaemia time used is as reported on the liver transplant record form and may include periods of machine perfusion; no adjustment has been made for this. None of paediatric deceased donor first liver only transplants performed in the latest financial year were reported to have involved machine perfusion.







The demographic characteristics of 119 paediatric registrations and 81 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, 55% were male, 28% were between 1 - 4 years old and 28% were registered as super-urgent. Of the transplant recipients, 58% were male, 28% were aged between one and four years old and 26% were of <u>super-urgent</u> status. For some characteristics, due to rounding, percentages may not add up to 100.

Table 4.1 Demo	ographic characterist	ics of paediatric	registrations a	and deceased do	nor liver transp	lant recipients, ²	1 April 2022 - 3	31 March 2023	
		Birmingha	am N (%)	Kina's Coll	ege N (%)	Leeds	N (%)	ΤΟΤΑΙ	- N (%)
		Registration	Transplant	Registration	Transplant	Registration	Transplant	Registration ¹	Transplant ¹
Number		37	28	59	34	22	18	119 (100)	81 (100)
Recip age years	<1 1-4 5-12 13-16	10 (27) 11 (30) 8 (22) 8 (22)	6 (21) 9 (32) 5 (18) 8 (29)	15 (25) 17 (29) 14 (24) 13 (22)	7 (21) 8 (24) 12 (35) 7 (21)	6 (27) 5 (23) 7 (32) 4 (18)	3 (17) 6 (33) 6 (33) 3 (17)	31 (26) 33 (28) 29 (24) 26 (22)	16 (20) 23 (28) 23 (28) 19 (24)
Recipient sex	Male Female	18 (49) 19 (51)	14 (50) 14 (50)	37 (63) 22 (37)	25 (74) 9 (26)	11 (50) 11 (50)	8 (44) 10 (56)	66 (55) 53 (45)	47 (58) 34 (42)
Indication	Super Urgent Biliary Atresia Other Cholestatic	10 (27) 12 (32) 0 (0)	8 (29) 9 (32) -	14 (24) 12 (20) 2 (3)	8 (24) 6 (18) -	8 (36) 2 (9) 0 (0)	4 (22) 3 (17)	33 (28) 26 (22) 2 (2)	21 (26) 18 (22)
	Metabolic Other	3 (8) 12 (32)	1 (4) 10 (36)	3 (5) 28 (47)	3 (9) 17 (50)	1 (5) 11 (50)	2 (11) 9 (50)	7 (6) 51 (43)	6 (7) 36 (44)
Pre-transplant in- patient status	Out-patient In-patient	-	14 (50) 14 (50)	-	16 (47) 18 (53)	-	9 (50) 9 (50)	:	39 (48) 42 (52)
Pre-transplant renal support	No Yes Not reported	- - -	25 (89) 1 (4) 2 (7)	-	29 (85) 4 (12) 1 (3)	- - -	15 (83) 2 (11) 1 (6)	-	69 (85) 8 (10) 4 (5)
Ascites	Absence Presence Not reported	-	13 (46) 15 (54) 0	-	21 (62) 13 (38) 0	-	11 (61) 4 (22) 3 (17)	-	46 (57) 32 (40) 3 (4)
Previous abdominal surgery	No Yes Not collected for super-urgent	14 (38) 13 (35) 10 (27)	17 (61) 11 (39) -	23 (39) 22 (37) 14 (24)	27 (79) 7 (21) -	10 (45) 4 (18) 8 (36)	17 (94) 1 (6) -	47 (40) 39 (33) 33 (28)	62 (77) 19 (24) -

Table 4.1 Demographic characteristics of paediatric registrations and deceased donor liver transplant recipients, 1 April 2022 - 31 March 2023									
INR	<=1.0 1.1-1.5 1.6-3.0 >3.0 Not reported	Birmingha Registration 13 (35) 12 (32) 5 (14) 7 (19) 0 (0)	am N (%) Transplant 10 (36) 6 (21) 8 (29) 3 (11) 1 (4)	King's Coll Registration 15 (25) 28 (47) 4 (7) 12 (20) 0 (0)	ege N (%) Transplant 4 (12) 16 (47) 7 (21) 7 (21) 0	Leeds Registration 3 (14) 8 (36) 5 (23) 6 (27) 0	N (%) Transplant 2 (11) 6 (33) 6 (33) 3 (17) 1 (6)	TOTAL Registration ¹ 31 (26) 48 (40) 14 (12) 26 (22) 0	- N (%) Transplant ¹ 16 (20) 28 (35) 21 (26) 14 (17) 2 (3)
Serum sodium mmol/l	<135 >=135 Not reported	9 (24) 28 (76) 0 (0)	5 (18) 23 (82)	7 (12) 52 (88) 0 (0)	3 (9) 31 (91)	2 (9) 20 (91) 0 (0)	1 (6) 17 (94)	18 (15) 101 (85) 0 (0)	9 (11) 72 (89)
Donor age years	<5 5-16 17-30 >=31		1 (4) 2 (7) 12 (43) 13 (46)	- - -	2 (6) 13 (38) 10 (29) 9 (26)	- - -	1 (6) 4 (22) 7 (39) 6 (33)	- - -	4 (5) 19 (24) 29 (36) 29 (36)
Donor sex	Male Female	-	13 (46) 15 (54)	-	22 (65) 12 (35)	-	10 (56) 8 (44)	-	46 (57) 35 (43)
Donor type	Donor after brain	-	27 (96)	-	29 (85)	-	18 (100)	-	75 (93)
	Donor after cardiac death	-	1 (4)	-	5 (15)	-	0	-	6 (7)
Graft appearance	Normal Abnormal	-	25 (89) 3 (11)	:	34 (100) 0	-	18 (100) 0	-	77 (95) 4 (5)
Graft type	Whole Reduced Split	- - -	11 (39) 9 (32) 8 (29)	-	9 (26) 9 (26) 16 (47)	- - -	5 (28) 5 (28) 8 (44)	- - -	26 (32) 23 (28) 32 (40)
Urgency Status	Elective Super Urgent	27 (73) 10 (27)	20 (71) 8 (29)	45 (76) 14 (24)	26 (76) 8 (24)	14 (64) 8 (36)	14 (78) 4 (22)	86 (72) 33 (28)	60 (74) 21 (26)
¹ Includes one regsitration ar	nd transplant at Edinburgh								

Paediatric Liver Transplantation Elective Patients



4.2.1 Transplant list

Figure 4.7 shows the number of paediatric <u>elective</u> patients on the liver only transplant list at 31 March each year between 2014 and 2023. The number of patients on the <u>active</u> liver only transplant list has ranged between 24 and 42 each year with 37 paediatric patients active on the liver only transplant list on 31 March 2023.



Figure 4.8 shows the number of <u>elective</u> patients on the transplant list at 31 March each year between 2013 and 2023 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, 72% of paediatrics have had a liver transplant, and 22% were still waiting.



Figure 4.10 shows the proportion of patients transplanted, removed, died while waiting, or still waiting on the list at 6 months after joining the list at each transplant centre. The proportion of patients transplanted six months after listing at each centre ranges from 56% at Leeds to 84% at Birmingham.



Table 4.2 shows the <u>median waiting time</u> to deceased donor liver only transplant for paediatric <u>elective</u> patients. The median waiting time to transplant is longest at Leeds at 168 days, and shortest at Birmingham, at 16 days. The national median waiting time to transplant is 64 days.

Table 4.2Median waiting time to liver only transplant in the UK, for paediatric elective patients registered 1 April 2020 - 31 March 2022									
Transplant centre	Number of patients	Waitir	ng time (davs)						
	registered	Median	95% Confidence interval						
Birmingham	48	16	0-32						
King's College	48	122	66 – 178						
Leeds	35	168	10 – 326						
UK	131	64	32 - 96						

4.2.2 Transplant activity

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





4.2.3 Post-transplant survival

Table 4.3 shows the <u>unadjusted</u> one year paediatric <u>patient survival</u> for 217 of the 226 deceased donor transplants (excluding <u>auxiliary</u> transplants) from 1 April 2018 to 31 March 2022, nationally and by centre. Note that these survival rates should be interpreted with caution as one-year patient follow-up is incomplete for two of the three transplant centres (refer to **Table 4.8**).

Table 4.3	One year unadjusted patient surviv	val for paediatri	c elective
	deceased donor first liver transpla	nts, 1 April 201	8 - 31 March 2022
Centre	Number of transplants	1-year	survival % (95% CI)
Leeds	49	100	(88.0 - 98.2)
King's College	89	95.3	
Total*	79	92.2	(83.4 - 96.4)
	217	95.2	(91.3 - 97.4)

Table 4.4 shows the <u>unadjusted</u> five year paediatric <u>patient survival</u> for all 223 transplants (excluding <u>auxiliary</u> transplants) from 1 April 2014 to 31 March 2018, 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**).

Г

Table 4.4	Five year unadjusted patient survival deceased donor first liver transplants	l for paediatric elective s, 1 April 2014 - 31 March 20 [.]	18
Centre	Number of transplants	f 5-year survival % (959 s	% CI)
Leeds	43	95.2 (82.2 - 9	98.8)
King's College	105	99.0 (93.4 - 9) 9.9)
Birmingham	75	86.6 (76.6 - 9	92.6)
Total	223	94.1 (90.0 - 9	96.5)

Paediatric Liver Transplantation Super-Urgent Patients



4.3.1 Transplant list

Table 4.5 shows the <u>median waiting time</u> to deceased donor liver only transplant for paediatric <u>super-urgent</u> patients. The national median waiting time to transplant is three days.

Table 4.5Median waiting time to liver only transplant in the UK for, paediatric super urgent patients registered 1 April 2020 - 31 March 2022									
Transplant cer	ntre Number	of patients	Wa	iting time (days)					
	reg	istered	Median	95% Confidence interval					
Paediatric									
Leeds		8	3	2 - 4					
Birmingham		10	2	1 – 3					
King's College	9	23	4	2 - 6					
UK*		41	3	2 - 4					

Table 4.5 includes registrations for re-transplants. Of the 41 registrations for the UK in the time period, 37 led to transplants (36 during the time period and 1 in 2022/2023). 5 of the 36 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 2020 – 2022 and **Table 4.5.** Note that Figure 4.13 also includes living donor transplants (4 during 2020-2022).

4.3.2 Transplant activity

Figure 4.13 shows the number of paediatric <u>super-urgent</u> 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 was one super-urgent paediatric transplant that occurred in Edinburgh. See **Appendix 1** for further details.




4.3.3 Post-transplant survival

One year <u>unadjusted patient survival</u> for 48 transplants (excluding <u>auxiliary</u> transplants) between 1 April 2018 and 31 March 2022 is shown in **Table 4.6.** Note that these survival rates should be interpreted with caution as one-year patient follow-up is incomplete for two of the three transplant centres (refer to **Table 4.8**).

Table 4.6One year unadjusted patient survival for paediatric deceased donor super urgent first transplants, 1 April 2018 - 31 March 2022				
Centre	Number of transplants	1-year surv	ival % (95% CI)	
Leeds King's College Birmingham	9 22 17	85.7 81.8 82.4	(33.4 - 97.9) (58.5 - 92.8) (54.7 - 93.9)	
Total* 48 83.0 (68.9 - 91.1)				
* Includes &other6. patients transplanted at a non-paediatric centre				

Table 4.7 shows the <u>unadjusted</u> five year paediatric <u>patient survival</u> for 33 transplants (excluding <u>auxiliary</u> transplants) between 1 April 2014 and 31 March 2018, 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 4.7Five year unadjusted patient survival for paediatric deceased donor super urgent first transplants, 1 April 2014 - 31 March 2018				
Centre		Number of transplants	5-year surv	rival % (95% CI)
Leeds		5		(-)
King's College	е	18	88.9	(62.4 - 97.1)
Birmingham		8	87.5	(38.7 - 98.1)
Total*		33	90.6	(73.7 - 96.9)
* 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 <u>elective and super-urgent</u> deceased donor transplants between 1 January 2022 and 31 December 2022 for the transplant record, and all requests for follow-up forms issued in this time period.

Table 4.8Form Return rates 1 January 2022 - 31 December 2022								
Centre	Tra	ansplant Reco	rd 3 Mo	onth follow-u	up 1 ye	ar follow-up	Lifetim	ne follow-up %
	I	N retu	rned N	returne	ed N	returned	Ν	returned
Leeds	2	20 10	0 19	74	15	73	88	73
King's College	e 3	32 10	0 33	100	25	100	216	88
Birmingham	3	30 10	0 29	100	25	100	135	99
Total	8	32 10	0 81	94	65	94	439	89



Appendix



A1 Data

Data were obtained from the UK Transplant Registry for the ten year time period, 1 April 2013 to 31 March 2023 and include NHS Group 2 transplants, <u>auxiliary</u> 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 2022 and 31 March 2023 were extracted from the UK Transplant Registry on 12 July 2023 (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-2020 population estimates based on the Office for National Statistics (ONS) 2011 Census figures (denominator). No NHS region age- or sex-specific standardisation of rates was performed.

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

Transplant rates

Transplant rates pmp were obtained as the number of liver transplants on NHS group 1 recipients between 1 April 2022 and 31 March 2023 (numerator), divided by the mid-2020 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 2022 and 31 March 2023 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 <u>auxiliary</u> transplants.

Table A1.1 shows the total number of adult transplants in the three time periodsdefined in the report, including atypical donor, <u>multi-organ</u> 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

	Late	est year	Last	3 years	Last	10 years
	April 202	2-March 2023	April 202	0-March 2023	April 201	3-March 2023
Transplant centre	Elective	Super-urgent	Elective	Super-urgent	Elective	Super-urgent
Newcastle	29	7	97	14	331	51
Leeds	107	11	275	33	1011	130
Cambridge	94	16	264	35	885	106
Royal Free	86	18	248	36	919	140
King's College	150	17	461	58	1662	191
Birmingham	170	23	452	50	1722	192
Edinburgh	66	5	187	11	788	77
UK	709 ¹	97	2002 ²	237	7357 ³	887
Dublin	50	2	114	9	472	52

¹ Includes 3 and 4 transplants performed at London Bridge Hospital and Cromwell Hospital, respectively

² Includes 11 and 7 transplants performed at London Bridge Hospital and Cromwell Hospital, respectively

³ Includes 28 and 11 transplants performed at London Bridge Hospital and Cromwell Hospital, respectively

Table A1.2Number of deceased donor adult first liver only transplants in each time period, by transplant centre and urgency status						
	Lates	st year	Last	3 years	Last	10 years
Transplant contro	April 202	2-March 2023	April 202	0-March 2023	April 201	3-March 2023
Transplant centre	Elective	Super-urgent	Elective	Super-urgent	Elective	Super-urgent
Newcastle	27	5	89	11	27	5
Leeds	93	9	249	27	93	9
Cambridge	89	11	238	25	89	11
Royal Free	81	12	229	25	81	12
King's College	132	15	420	46	132	15
Birmingham	162	18	407	39	162	18
Edinburgh	64	3	180	8	64	3
UK	648	73	1812	181	648	73
Dublin	46	2	105	4	422	40

Table A1.3 shows the total number of paediatric transplants in the three time periods defined in the report, including atypical donor, <u>multi-organ</u> and re-transplants. **Table A1.4** shows the number of paediatric deceased donor first liver only transplants. Transplants were excluded from the <u>patient survival</u> analysis if <u>risk factors</u> 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						
	Late April 2022	est year 2-March 2023	Last April 2020	3 years)-March 2023	Last April 2013	10 years 3-March 2023
Transplant centre	Elective	Super-urgent	Elective	Super-urgent	Elective	Super-urgent
Newcastle	0	0	0	0	0	1
Leeds	20	5	57	12	173	28
Cambridge	0	0	0	0	0	1
Royal Free	0	0	0	0	1	1
King's College	38	13	101	36	358	97
Birmingham	20	8	65	18	254	50
Edinburgh	0	1	0	1	0	1
UK	78	27	224	67	787	179
Dublin	0	0	0	0	1	0
¹ Includes 1 transplant performed at Cromwell Hospital						

Table A1.4Number of deceased donor paediatric first liver only transplants in each time period, by transplant centre and urgency status						
	Amril	Latest year	 	Last 3 years	La Amila	ast 10 years
Transplant cent	re Electi	ve Super-ui	aent Electiv	e Super-ur	aent Elective	e Super-urgent
Newcastle	0	0	0	0	0	1
Leeds	14	4	37	11	114	19
Cambridge	0	0	0	0	0	1
Royal Free	0	0	0	0	0	0
King's College	26	8	74	24	258	68
Birmingham	20	8	63	16	192	36
Edinburgh	0	1	0	1	0	1
UK	60	21	174	52	564	126
Dublin	0	0	0	0	1	0

A2 Methods

Waiting time to transplant

Waiting time is calculated from date of registration to date of transplant, for patients registered for a liver. Patients who are registered for another organ within the timeframe are excluded and only deceased donor transplants are included. Registrations for a re-transplant are included. <u>Kaplan-Meier</u> 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:

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

where $\#{SCV_{sim} \ge SCV_{obs}}$ 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

<u>Unadjusted patient survival</u> and <u>graft function</u> rates were estimated using <u>Kaplan-Meier</u> 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 <u>risk-adjusted survival rate</u> 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 <u>Cox Proportional Hazards model</u> 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 <u>funnel plot</u> 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 <u>confidence limits</u> 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 <u>risk factors</u> used in this case were: recipient blood group, recipient age at registration, recipient ethnic group, recipient primary disease at registration, recipient sex, recipient BMI, serum creatinine, serum sodium, serum bilirubin, INR and year of registration, as shown in **Table A3.3**.

A3 Risk models

Table A3.1	Risk factors and categories used in the adult elective risk adjusted survival models post transplantation			
Recipient sex		Male		
Recipient ethni	city	White Asian Black Other		
Indication		Cancer HCV ALD HBV PSC PBC AID Metabolic Other Acute hepatic failure		
Recipient HCV	status	Negative		
Pre-transplant	in-patient status	Out-patient In-patient		
Ascites		Absence		
Encephalopath	у	Absence Presence		
Pre-transplant	renal support	No		
Previous abdo	minal surgery	No Yes		
Varices & shur	it	Absence Presence without treatment Presence with surgical shunt Presence with TIPS		
Life style activi	ty	Normal Restricted Self-care Confined Reliant		
Graft appearar	ice	Normal Abnormal		
Recipient age	years	Per 1 year increase		
Serum Bilirubir	η μmol/l	≤30 31-50 51-70 71-90 ≥91		
Serum Creatin	ine µmol/l	≤70 71-90 91-110 111-130 ≥131		

Risk factors and categories used in the adult elective riskTable A3.1adjusted 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
Variana 8 abunt	fes Abaanaa
vances & shunt	Absence Brosonce without treatment
	Presence with surgical abunt
	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
Sorum Croatining umol/	2401
Serum Creatinine µmol/i	≤100 101 120
	131-160
	161-100
	>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
	BIACK
Depart equips of death	
Donor cause of death	
	Others
	Othors

Risk factors and categories used in the adult super-urgentTable A3.2risk 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

Risk factors and categories used in the adult elective riskTable A3.3adjusted 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
Year of registration	Split into three time intervals equally divided

A4 Glossary of terms

Active transplant list

When a patient is registered for a transplant, they are registered on what is called the 'active' transplant list. This means that when a donor organ becomes available, the patient is included among those who are matched against the donor to determine whether or not the organ is suitable for them. It may sometimes be necessary to take a patient off the transplant list, either temporarily or permanently. This may be done, for example, if someone becomes too ill to receive a transplant. The patient is told about the decision to suspend them from the list and is informed whether the suspension is temporary or permanent. If a patient is suspended from the list, they are not included in the matching of any donor organs that become available. Permanent suspension is known as a removal from the waiting list and is not included in suspended figures.

Auxiliary transplant

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

Case mix

The types of patients treated at a unit for a common condition. This can vary across units depending on the facilities available at the unit as well as the types of people in the catchment area of the unit. The definition of what type of patient a person is depends on the patient characteristics that influence the outcome of the treatment.

Cold ischaemia time (CIT)

The length of time that elapses between an organ being removed from the donor to its transplantation into the recipient is called Cold Ischaemia Time (CIT). Generally, the shorter this time, the more likely the organ is to work immediately and the better the long-term outcome. The factors which determine CIT include a) transportation of the organ from the retrieval hospital to the hospital where the transplant is performed, b) the need to tissue type the donor and cross-match the donor and potential recipients, c) the occasional necessity of moving the organ to another hospital if a transplant cannot go ahead, d) contacting and preparing the recipient for the transplant and e) access to the operating theatre. 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 <u>confidence interval</u>.

Cox Proportional Hazards model

A statistical model that relates the instantaneous risk (hazard) of an event occurring at a given time point to the <u>risk factors</u> 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 <u>confidence limits</u> 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 <u>patient</u> <u>survival</u> 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 <u>risk factors</u>, among patients. A risk-adjusted survival rate for a centre is the expected survival rate for that centre given the <u>case mix</u> 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 <u>risk factors</u> 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 <u>risk-adjusted</u> <u>rates</u>, 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:

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