

**NHS BLOOD AND TRANSPLANT**

**LIVER ADVISORY GROUP**

**NHSBT LIVER TRANSPLANT REPORT 2014/15**

- 1 The 2014/15 NHSBT Liver Transplant Report was published on 11 September 2015 and is provided as an **Appendix**.
- 2 The report is prepared once a year with a shorter, interim report produced six months after each full report. The report monitors activity and outcomes for the liver transplant programme in the UK and is produced in collaboration with NHS England.
- 3 The report
  - a. Covers all transplant centres
  - b. Includes named centre data
  - c. Was validated by centres before publication
  - d. Is available publically at [www.odt.nhs.uk](http://www.odt.nhs.uk)
- 4 In the next annual report it is planned that DBD and DCD liver transplant outcomes will be analysed separately. **Any feedback including suggestions for additions or amendments should be sent to [rachel.johnson@nhsbt.nhs.uk](mailto:rachel.johnson@nhsbt.nhs.uk).**

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**Statistics & Clinical Studies**

**October 2015**





*Blood and Transplant*

**ANNUAL REPORT ON  
LIVER TRANSPLANTATION**

**REPORT FOR 2014/2015  
(1 APRIL 2005 – 31 MARCH 2015)**

**PUBLISHED SEPTEMBER 2015**

**PRODUCED IN COLLABORATION WITH NHS ENGLAND**



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# EXECUTIVE SUMMARY



## 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 2005 to 31 March 2015. 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, both on a national and centre-specific basis.

### Key findings

- On 31 March 2015, there were 611 patients on the UK [active transplant list](#), which represents an 11% increase in the number of patients a year earlier. The number of patients on the transplant list has doubled since March 2008. Of those patients joining the [elective](#) liver only waiting list, approximately 76% had received a transplant within two years of listing.
- There were 7399 liver transplants performed in the UK in the ten year period. The number of liver transplants using [donors after circulatory death](#) has steadily increased in the last five years while the number of transplants from [donors after brain death](#) has decreased in the last year following an increase over three years.
- 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 liver transplants		
	One year patient survival (%)	Five year patient survival (%)
<b>Adult</b>		
Elective	92	80
Super-urgent	90	80
<b>Paediatric</b>		
Elective	96	90
Super-urgent	79	75

- The [risk-adjusted](#) national rates of patient survival after joining the transplant list for adult elective first liver only patients is 81% at one, 68% at five and 57% at ten years post-registration.

# INTRODUCTION



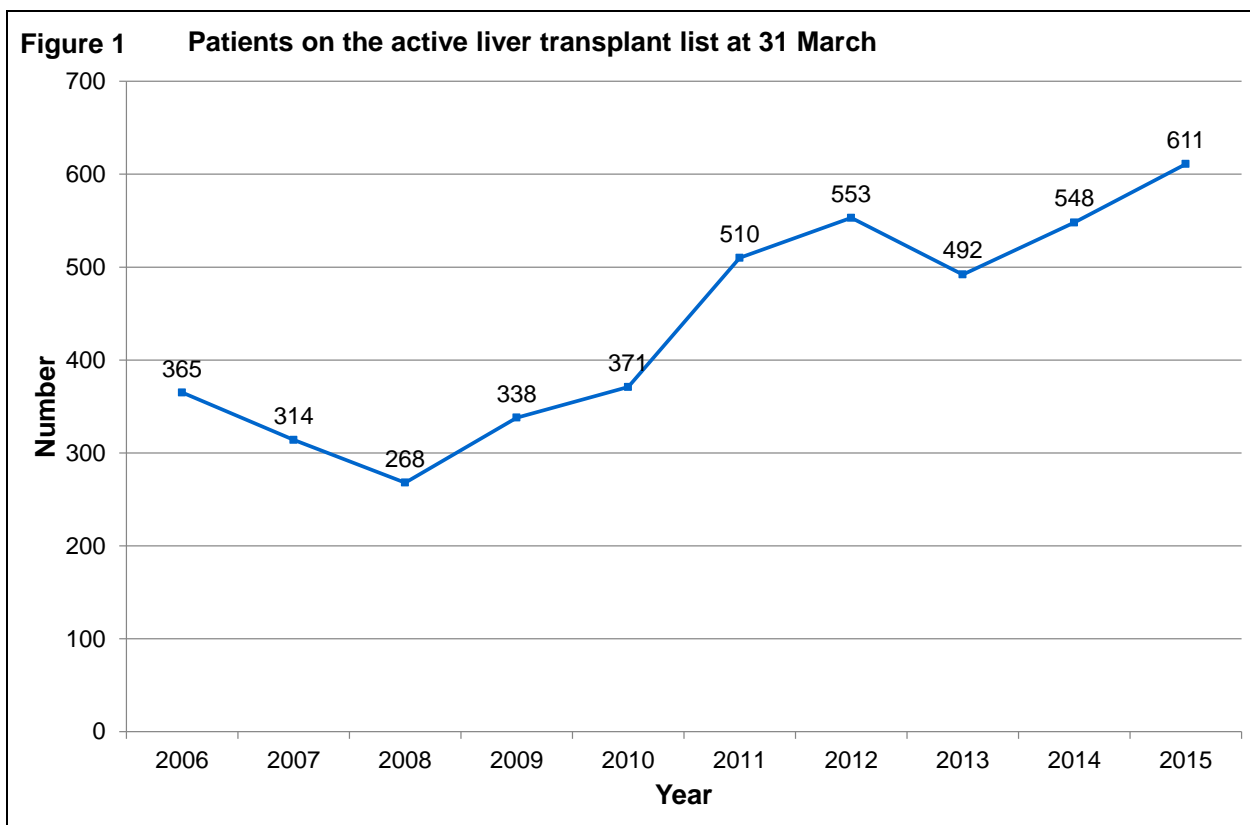
## INTRODUCTION

This report presents information on the UK transplant list, transplant activity and transplant outcomes between 1 April 2005 and 31 March 2015, for all seven centres performing liver transplantation in the UK. Data were obtained from the UK Transplant Registry, at NHS Blood & Transplant, that holds information relating to donors, recipients and outcomes for all liver transplants performed in the UK.

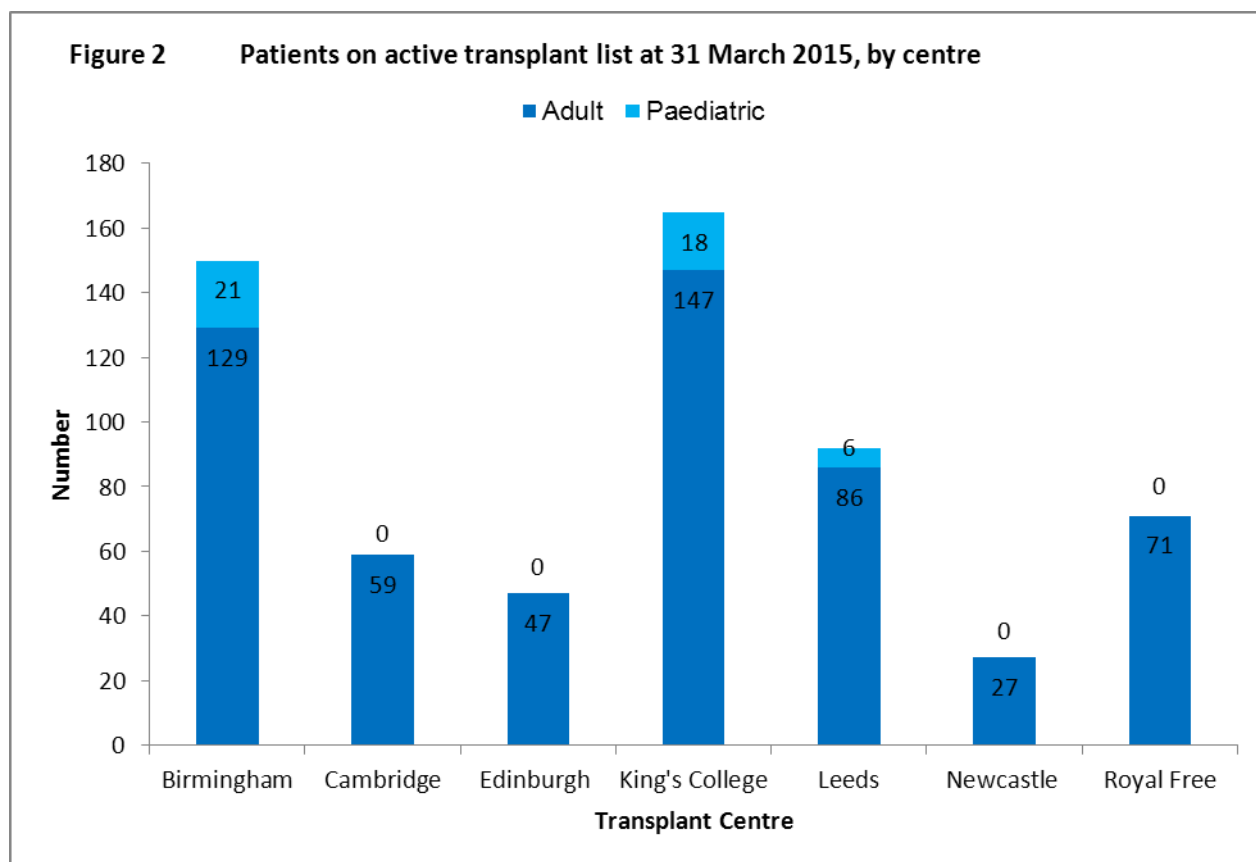
[Patient survival](#) post-transplant is reported for cohorts of patients transplanted between 1 April 2006 and 31 March 2010 for 5 year survival, and 1 April 2010 to 31 March 2014 for 1 year survival. Patient survival from registration is presented for the period 1 January 2003 to 31 December 2014. Results are described separately for adult (aged  $\geq 17$  years) and paediatric patients (aged  $< 17$  years) and according to the urgency of the transplantation ([elective and super-urgent](#)). Note, however, that the survival from listing analysis assumes adults are aged  $\geq 18$  years.

## TRANSPLANT LIST

**Figure 1** shows the total number of liver patients on the [active transplant list](#) at 31 March each year between 2006 and 2015. The number of patients waiting for a transplant increased each year from 268 in 2008 to 553 in 2012 and fell slightly to 492 in 2013, then increased again to 611 in 2015.



**Figure 2** shows the number of adult and paediatric patients on the transplant list at 31 March 2015 by centre. In total, there were 566 adults and 45 paediatric patients. King's College Hospital had the largest share of the transplant list (27%) and Newcastle the smallest (4%). This figure includes [elective](#) and [super-urgent](#) registrations

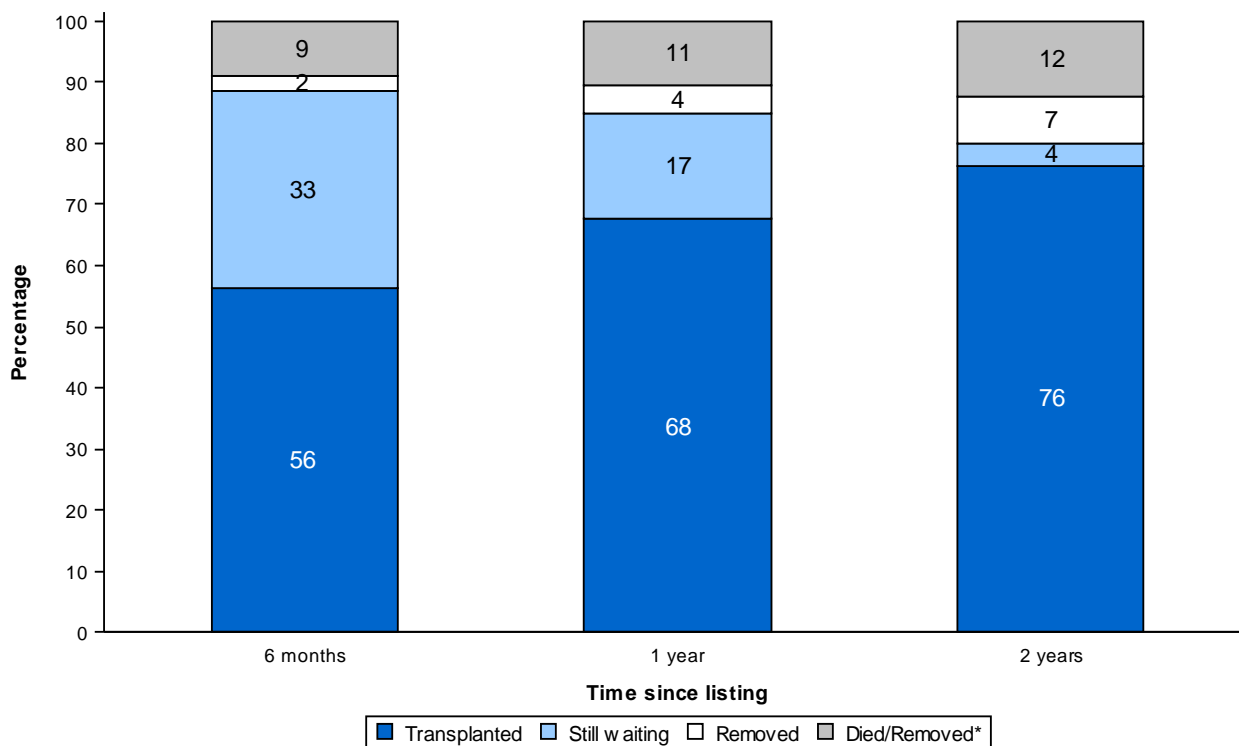


An indication of long-term outcomes for patients listed between April 2012 and March 2013, for a liver transplant is summarised in **Figure 3**. This shows the proportion of patients transplanted or still waiting six months, one year and two years after joining the transplant list. At one year post-registration 68% of patients had received a transplant and 17% were still waiting.

## TRANSPLANT ACTIVITY

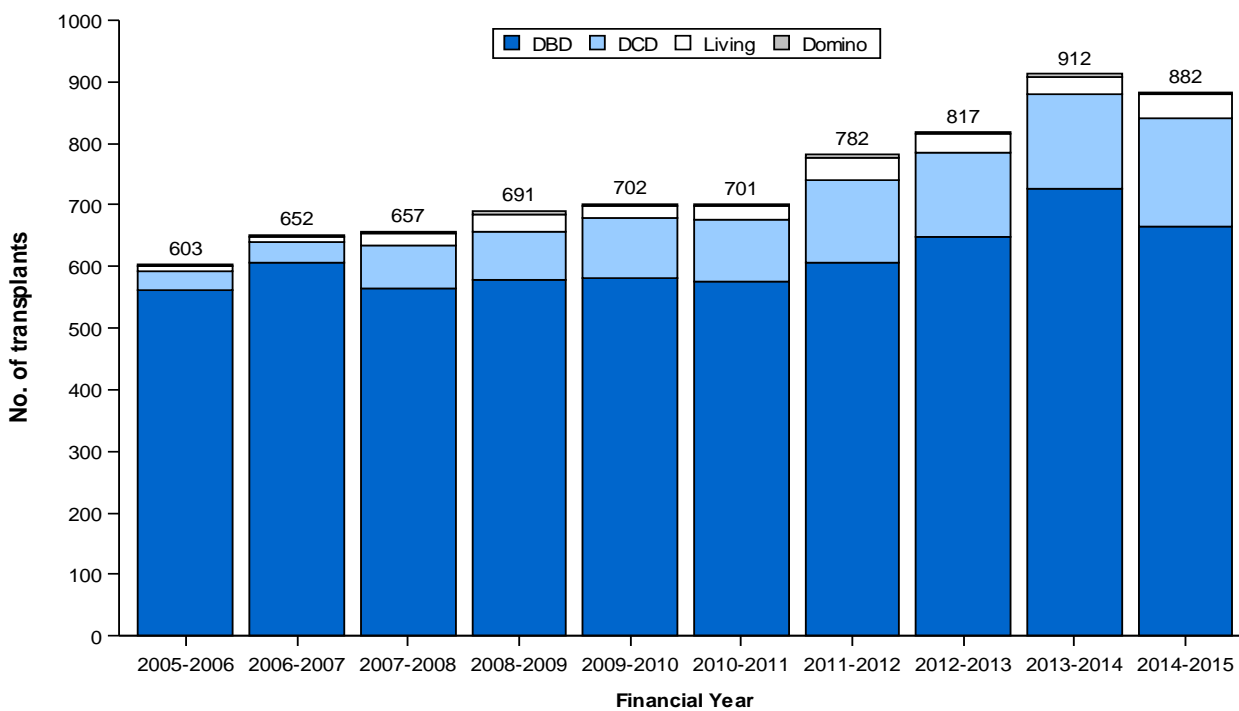
**Figure 4** shows the total number of liver transplants performed in the last ten years, by type of donor. The number of transplants from donors after circulatory death ([DCD](#)) has been steadily increasing over the time period to 177 in the last financial year. The number of transplants from donors after brain death ([DBD](#)) has decreased in the most recent year to 665 in 2014/2015. The number of [living donor](#) liver transplants performed has slightly increased to 38 in the latest financial year, from 28 in the previous financial year. There were 2 [domino](#) transplants in the last financial year.

**Figure 3** Post-registration outcome for 860 new elective liver only registrations made in the UK, 1 April 2012 - 31 March 2013



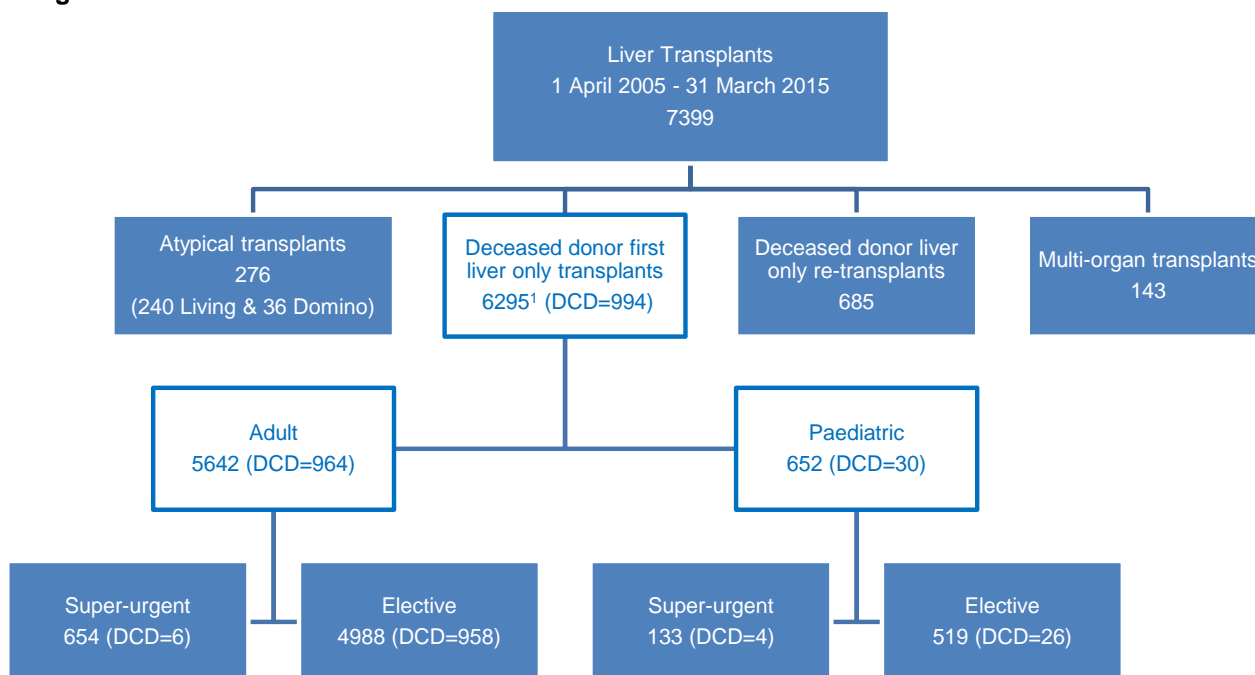
\*Removals due to condition deteriorating

**Figure 4** Total number of liver transplants by donor type, 1 April 2005 - 31 March 2015



**Figure 5** details the 7399 liver transplants performed in the UK in the ten year period. Of these, 6295 (85%) were deceased donor first liver only transplants. One transplant recipient refused consent for their data to be used in analysis and therefore could not be categorised as an adult or paediatric patient, so 6294 transplants were analysed: 5642 (90%) in adult and 652 (10%) in paediatric patients. Of the 6294 transplants, 5507 (87%) were [elective](#) and 787 (13%) were [super-urgent](#) transplants.

**Figure 5**



<sup>1</sup> One patient refused consent for their data to be used in analysis and has been excluded from subsequent categorisation

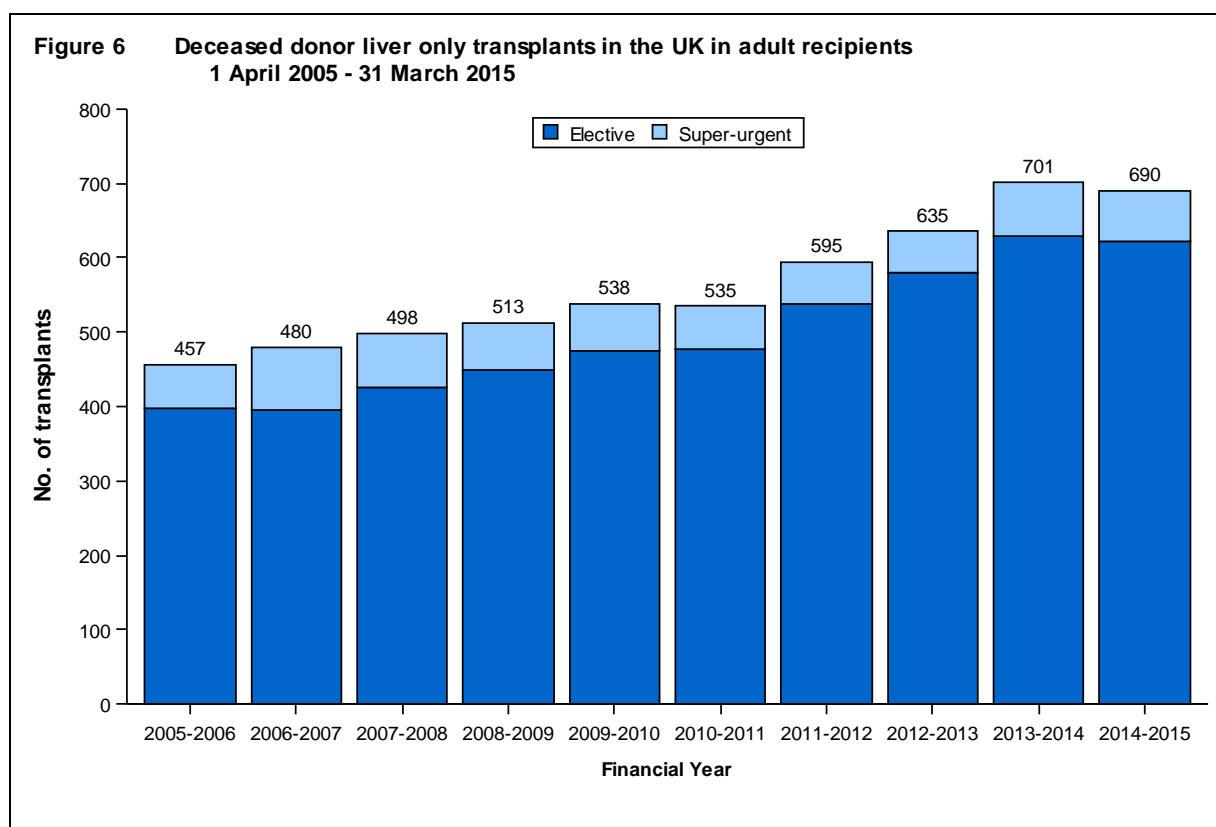
# **ADULT LIVER TRANSPLANTATION**



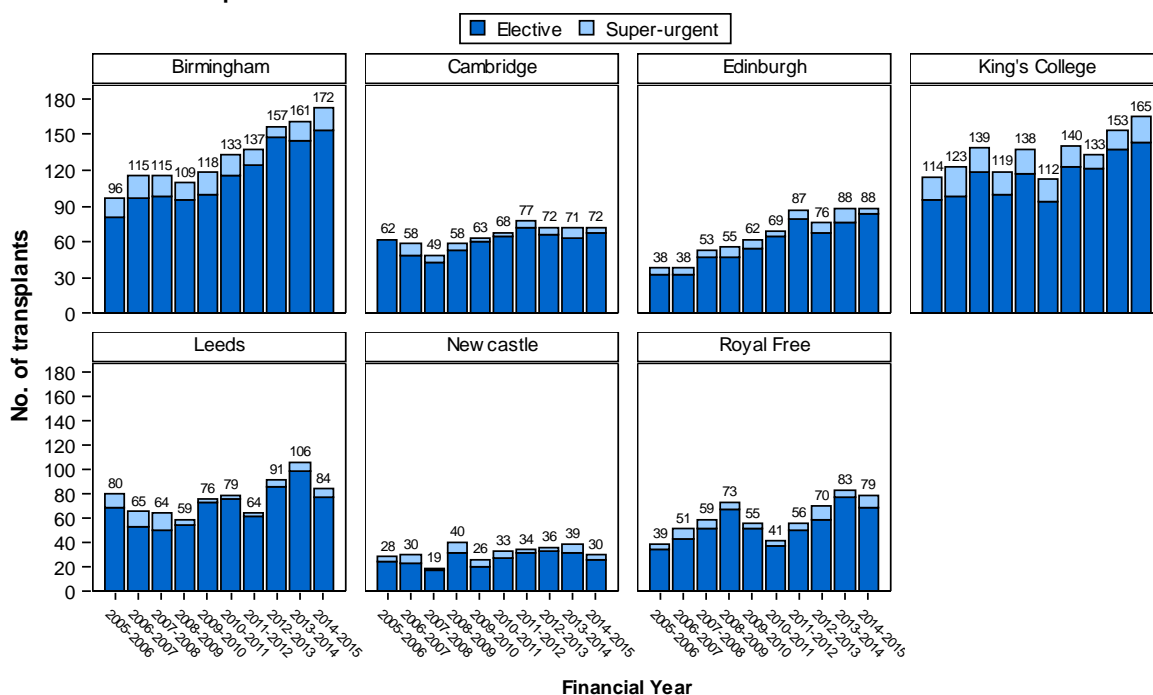
## ADULT LIVER TRANSPLANTATION

### OVERVIEW

The number of adult deceased donor first liver only transplants in the last ten years is shown overall and by centre in **Figures 6 and 7**, respectively. Of the 690 transplants in the latest financial year, 621 were [elective](#) and 69 were [super-urgent](#) transplants. See **Appendix 1** for further details.

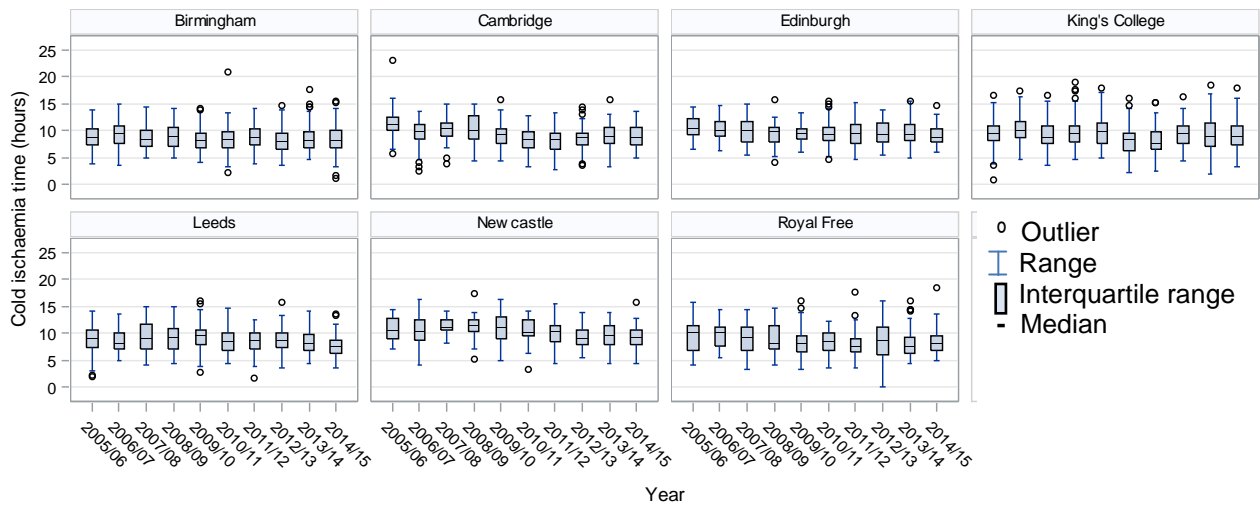


**Figure 7 Deceased donor liver only transplants in the UK in adult recipients,  
1 April 2005 - 31 March 2015**

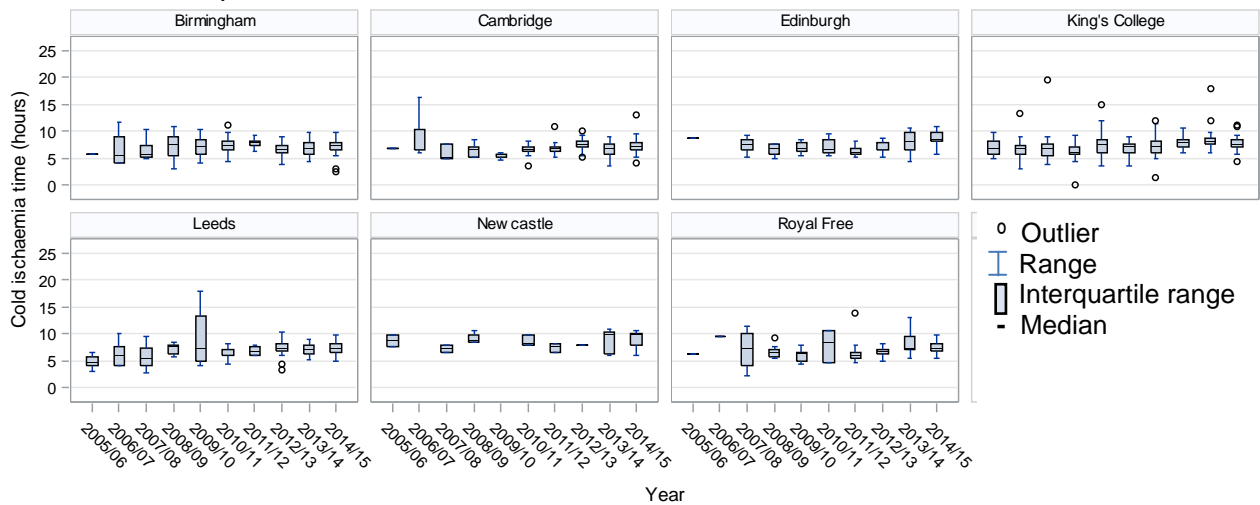


The [median cold ischaemia times](#) for adult transplant recipients are shown in **Figures 8 and 9** for [DBD](#) and [DCD](#) donors, respectively. Median cold ischaemia times were calculated each year during the last ten years, by transplant centre. The national median cold ischaemia time for transplants from DBD donors has decreased from 10 hours in 2005/06 to 8 hours in 2014/15. The median cold ischaemia time in the last financial year ranged between 7 and 10 hours across transplant centres. The national median for DCD donor transplants has remained relatively stable over the ten year period, at 7 hours. In the last financial year, the median cold ischaemia time for DCD donor transplants at different centres ranged from 7 to 10 hours.

**Figure 8** Median cold ischaemia time in all adult DBD donor liver transplants,  
1 April 2005 - 31 March 2015



**Figure 9** Median cold ischaemia time in all adult DCD donor liver transplants,  
1 April 2005 - 31 March 2015



# **ADULT LIVER TRANSPLANTATION**

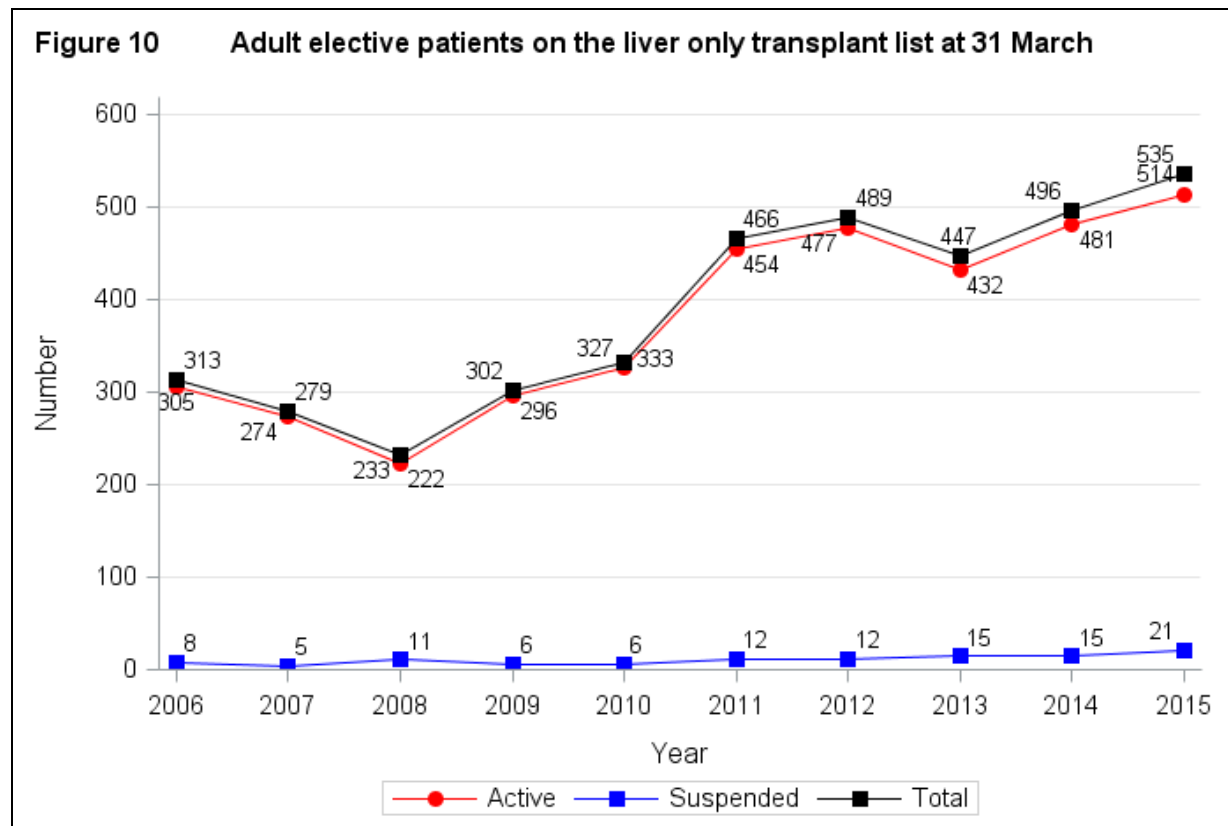
## **ELECTIVE PATIENTS**



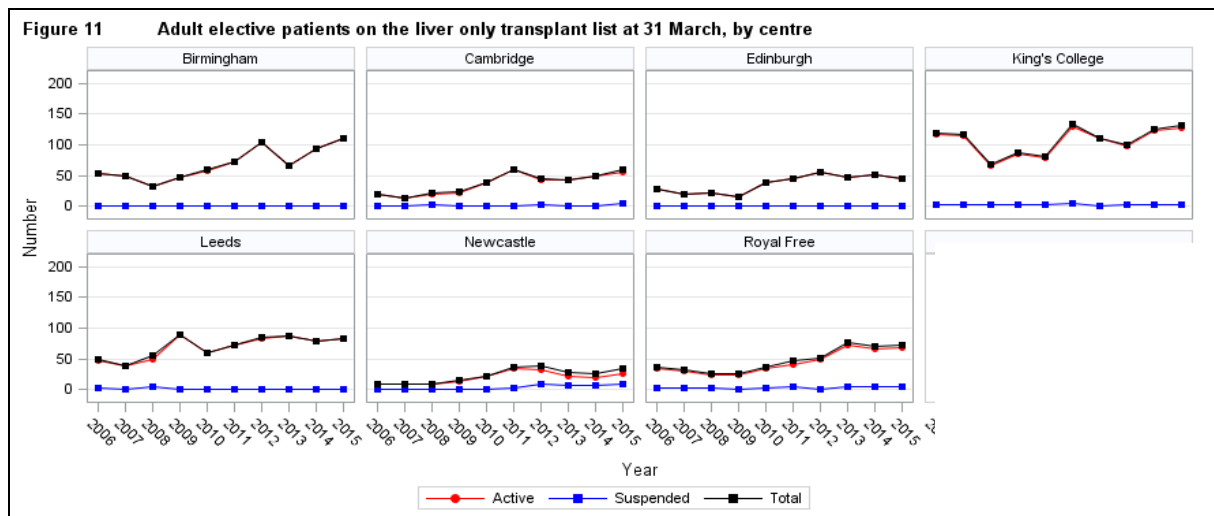
## ELECTIVE PATIENTS

### TRANSPLANT LIST

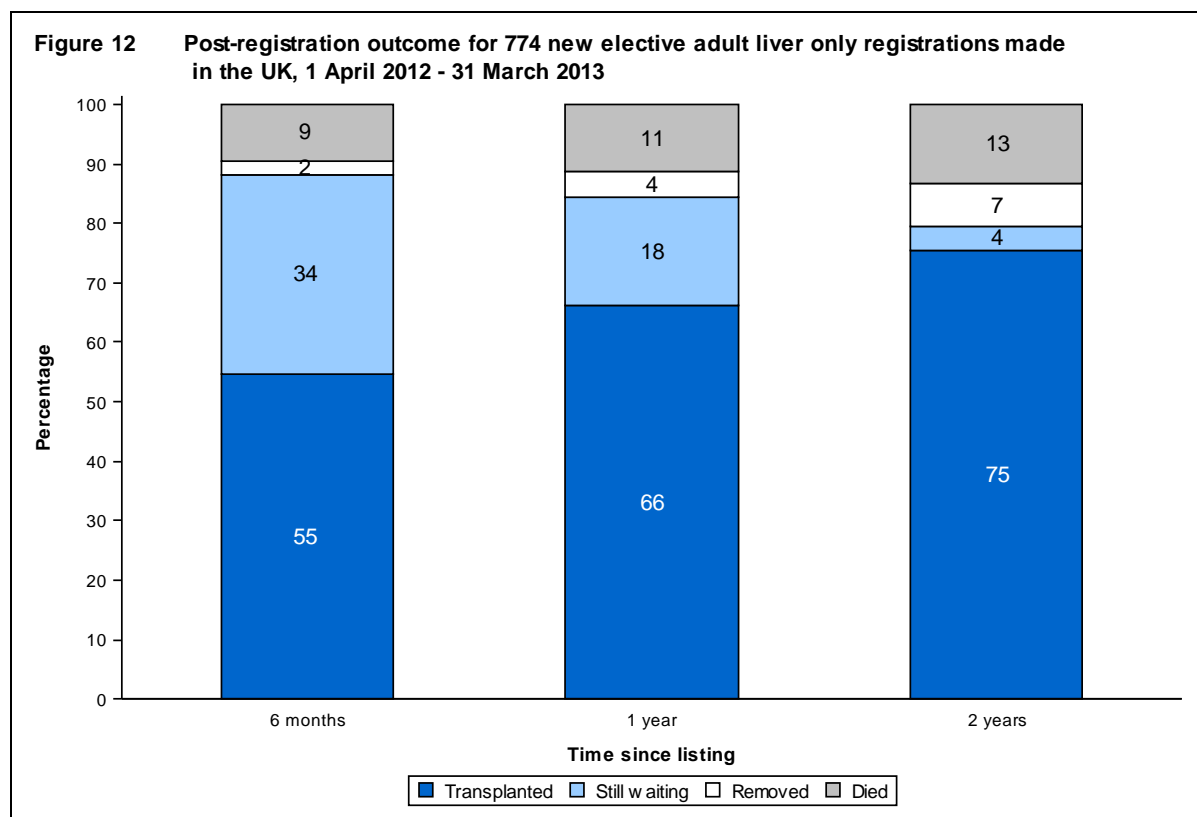
**Figure 10** shows the number of adult [elective](#) patients on the first liver only transplant list at 31 March each year between 2006 and 2015. The number of patients on the [active](#) liver only transplant list increased each year from 305 in 2006 to 514 in 2015. In addition a small number of patients are temporarily suspended from the list at any one time.



**Figure 11** shows the number of adult patients on the transplant list at 31 March each year between 2006 and 2015 for each transplant centre.



An indication of outcomes for adult [elective](#) patients listed for a liver transplant is summarised in **Figure 12**. 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 (including patients removed because their condition deteriorated).

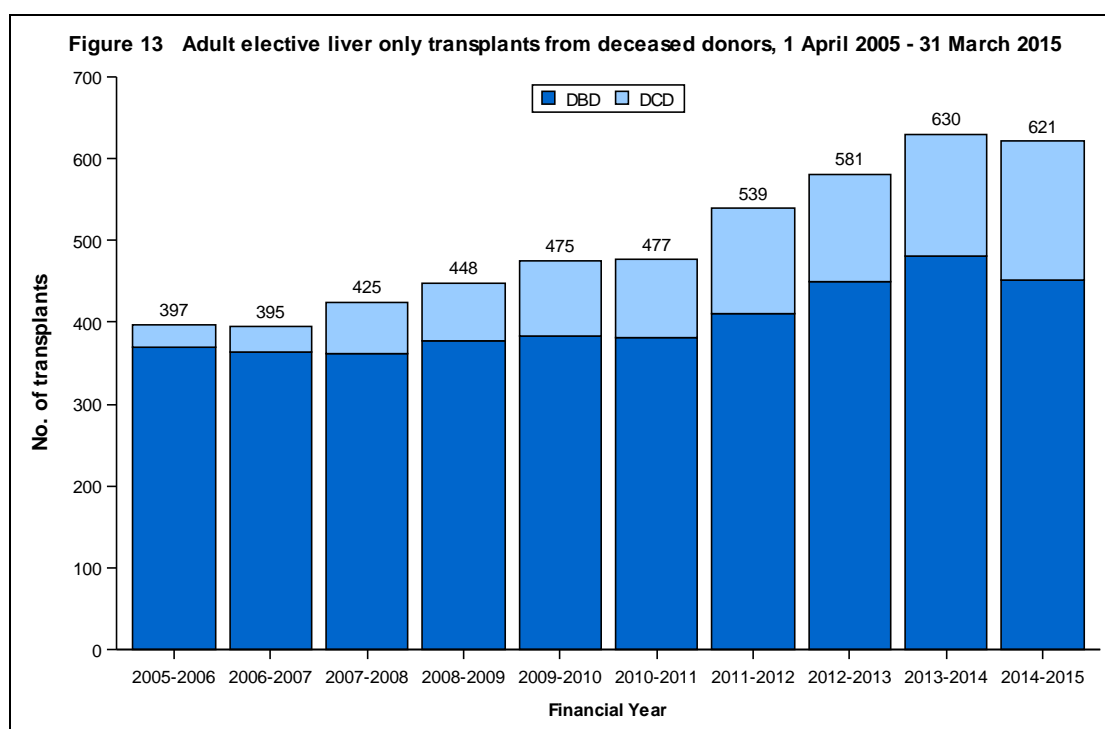


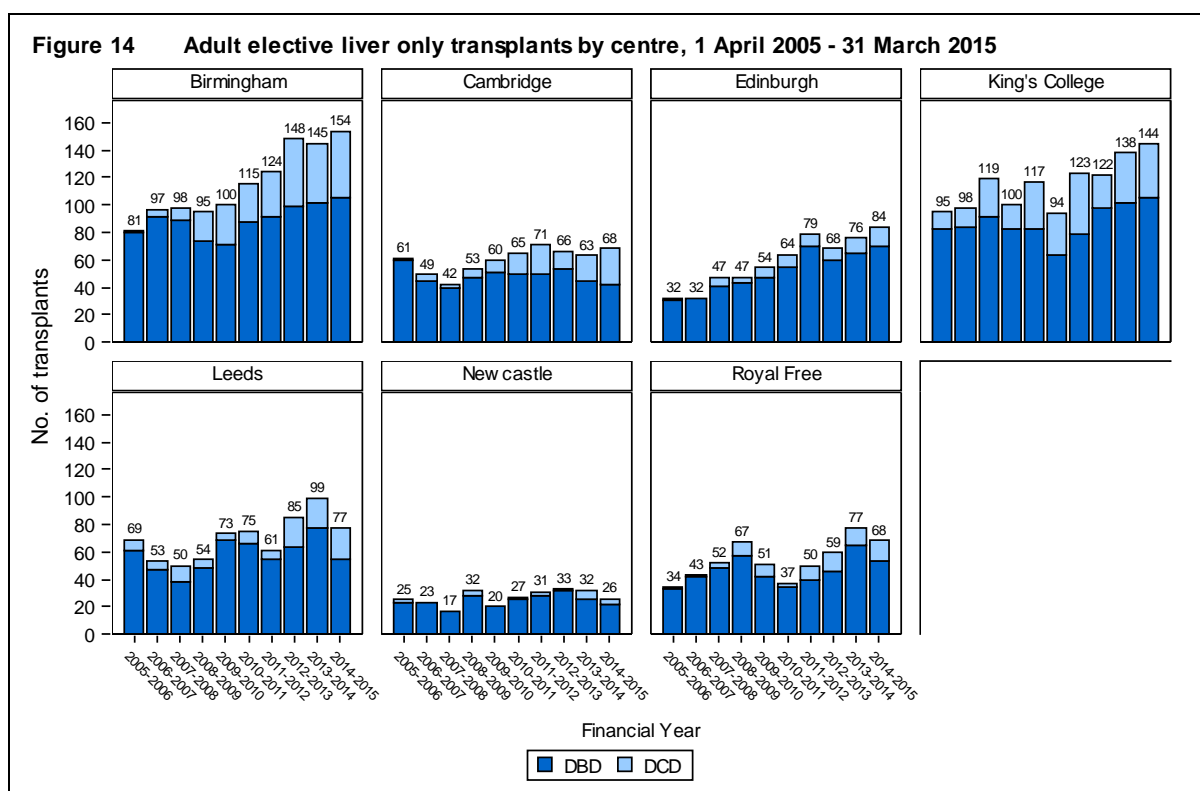
**Table 1** shows the [median waiting time](#) to liver only transplant for adult [elective](#) patients. The national median waiting time to transplant for adult elective patients is 152 days. The median waiting time to transplant is shorter at Edinburgh (90 days) and longer at Leeds (224 days), compared to the national median waiting time. Note that these waiting times are not adjusted to account for the patient [case-mix](#) at centres.

<b>Table 1      Median waiting time to liver only transplant in the UK, for adult elective patients registered 1 April 2009 - 31 March 2012</b>			
Transplant centre	Number of patients registered	Waiting time (days)	
		Median	95% Confidence interval
<b>Adult</b>			
Edinburgh	289	90	67 - 113
Birmingham	533	127	109 - 145
Cambridge	284	139	107 - 171
Royal Free	234	186	150 - 222
King's College	519	188	157 - 219
Newcastle	145	218	145 - 291
Leeds	353	224	174 - 274
<b>UK</b>	<b>2357</b>	<b>152</b>	<b>141 - 163</b>

## TRANSPLANT ACTIVITY

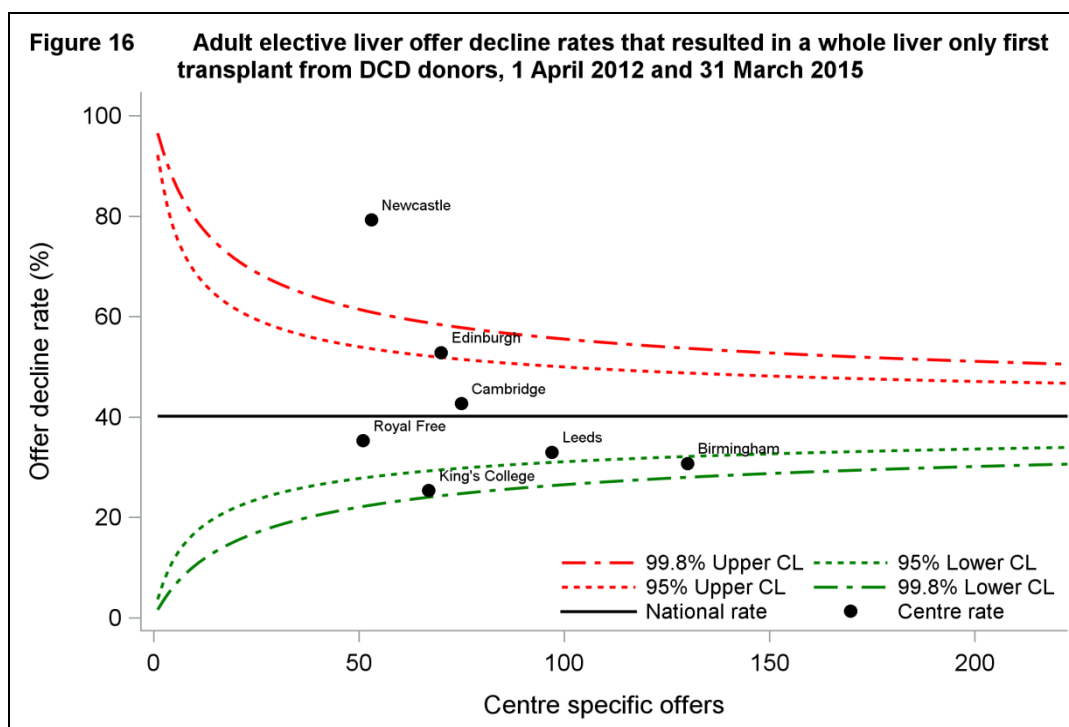
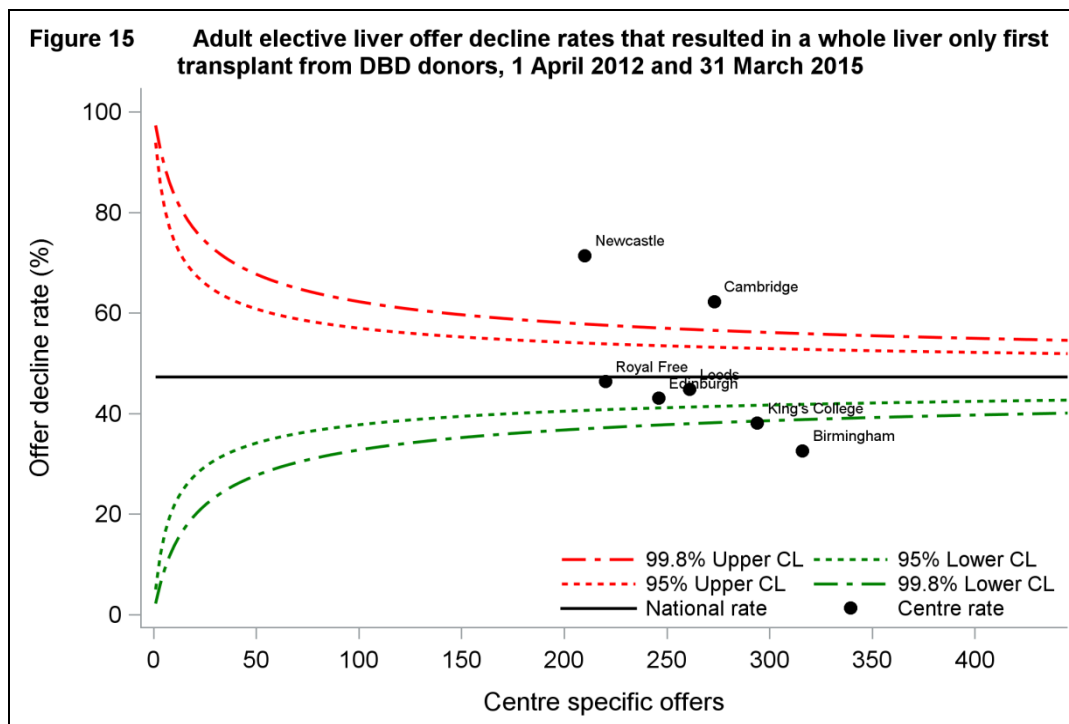
**Figure 13** shows the number of first liver only transplants from deceased donors performed in the last ten years, by type of donor. **Figure 14** shows the same information by centre.





The reasons for decline of all whole liver offers which were subsequently transplanted are provided in **Table 2** and **Table 3**, for [DBD](#) and [DCD](#) respectively. For some offers, due to rounding, percentages may not add up to 100. **Figure 15** and **Figure 16** are funnel plots of the offer decline rates, for DBD and DCD respectively. A 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. Only whole liver offers which resulted in whole liver transplants are reported on. This may affect the decline rates for centres that perform a large number of split or reduced liver transplants. Only offers from donors aged 65 and under for DBD, and under 60 for DCD were included to ensure a meaningful analysis across centres, since some centres specify an upper donor age limit for receipt of offers.

It can be seen that those centres with the smallest number of patients on the transplant list have the highest decline rates (Newcastle, Edinburgh, Cambridge). Because of the matching of donor to recipient there may not always be a suitable patient on the list in those centres.



The demographic characteristics of 621 adult [elective](#) transplant recipients in the latest year are shown by centre and overall in **Table 4**. Over two thirds of these recipients were male and the [median](#) age was 56 years. The most common indication for transplantation was Cancer followed by ALD. The median recipient BMI was 27. For some characteristics, due to rounding, percentages may not add up to 100.

**Table 2**      **Number of whole liver offers declined from donors after brain death aged ≤65 years old in the UK, where whole livers were subsequently transplanted, by reason for decline and transplant centre, 1 April 2012 to 31 March 2015**

	Liver transplant centre															
	Birmingham		Cambridge		Edinburgh		King's College		Leeds		Newcastle		Royal Free		TOTAL	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
DECLINED	103	33	170	62	106	41	112	38	117	44	150	70	102	46	860	47
Donor reasons	75	24	117	43	54	21	90	31	68	25	95	44	81	37	580	32
ABO type	1	0	4	1	7	3	1	0	0	0	4	2	5	2	22	1
Ischaemia time too long-cold	1	0	1	0	0	0	3	1	1	0	1	0	0	0	7	0
Ischaemia time too long-warm	0	0	1	0	0	0	0	0	0	0	1	0	1	0	3	0
Donor unsuitable - age	7	2	7	3	0	0	9	3	4	1	1	0	2	1	30	2
Donor unsuitable - cause of death	0	0	3	1	1	0	2	1	2	1	3	1	2	1	13	1
Donor unsuitable - past history	16	5	48	18	22	8	28	10	29	11	42	20	23	10	208	11
Donor unsuitable - size	38	12	17	6	3	1	29	10	10	4	8	4	23	10	128	7
Donor unsuitable – virology/other	3	1	8	3	3	1	5	2	3	1	7	3	1	0	30	2
Fatty organ	2	1	4	1	3	1	5	2	3	1	2	1	4	2	23	1
Poor function	7	2	24	9	15	6	8	3	16	6	26	12	20	9	116	6
Recipient reasons	10	3	5	2	8	3	6	2	9	3	0	0	4	2	42	2
Recipient refused/did not need transplant	4	1	1	0	1	0	4	1	7	3	0	0	1	0	18	1
Recipient unfit/died	6	2	4	1	7	3	2	1	2	1	0	0	3	1	24	1
No suitable recipients	3	1	18	7	21	8	7	2	16	6	30	14	10	5	105	6
Logistical reasons	15	5	30	11	23	9	9	3	24	9	25	12	7	3	133	7
Centre already retrieving/transplanting	7	2	11	4	14	5	1	0	2	1	14	7	1	0	50	3
No beds/staff/theatre	1	0	2	1	0	0	0	0	7	3	0	0	0	0	10	1
Other	7	2	17	6	9	3	8	3	15	6	11	5	6	3	73	4
ACCEPTED (NUMBER OF LIVERS)	213	67	103	38	140	54	182	62	144	54	60	28	118	54	960	53
TOTAL NUMBER OF OFFERS	316	100	273	100	246	100	294	100	261	100	210	100	220	100	1820	100

**Table 3** Number of liver offers declined from donors after circulatory death aged ≤60 years old in the UK, where livers were subsequently transplanted, by reason for decline and transplant centre, 1 April 2012 to 31 March 2015

	Liver transplant centre														TOTAL	
	Birmingham		Cambridge		Edinburgh		King's College		Leeds		Newcastle		Royal Free			
	N	%	N	%	N	%	N	%	N	%	N	%	N	%		
DECLINED	40	31	32	43	37	53	17	25	32	33	42	79	18	35	218	40
Donor reasons	16	12	9	12	16	23	3	4	12	12	20	38	9	18	85	16
Centre criteria not achieved	0	0	1	1	1	1	0	0	0	0	1	2	0	0	3	1
Cold ischaemia time too long	0	0	0	0	0	0	0	0	0	0	0	0	1	2	1	0
Donor unsuitable - age	1	1	0	0	2	3	0	0	2	2	0	0	0	0	5	1
Donor unsuitable - past history	6	5	2	3	10	14	1	1	4	4	13	25	4	8	40	7
Donor unsuitable - size	1	1	3	4	0	0	0	0	0	0	2	4	0	0	6	1
Donor unsuitable - virology	0	0	0	0	0	0	0	0	0	0	1	2	1	2	2	0
Infection	1	1	1	1	1	1	0	0	1	1	0	0	0	0	4	1
Poor function	7	5	2	3	2	3	1	1	5	5	3	6	3	6	23	4
Warm ischaemia time too long	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0
Recipient reasons	1	1	0	0	0	0	1	1	0	0	0	0	1	2	3	1
Recipient refused	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0
Recipient unfit	1	1	0	0	0	0	0	0	0	0	0	0	1	2	2	0
No suitable recipients	9	7	6	8	11	16	7	10	11	11	13	25	6	12	63	12
Logistical reasons	14	11	17	23	10	14	6	9	9	9	9	17	2	4	67	12
Centre already retrieving/ transplanting	10	8	9	12	3	4	4	6	1	1	4	8	1	2	32	6
No beds/staff/theatre	0	0	3	4	0	0	0	0	1	1	2	4	0	0	6	1
No time	0	0	1	1	2	3	0	0	0	0	0	0	0	0	3	1
Other	4	3	4	5	5	7	2	3	7	7	3	6	1	2	26	5
ACCEPTED (NUMBER OF LIVERS)	90	69	43	57	33	47	50	75	65	67	11	21	33	65	325	60
TOTAL NUMBER OF OFFERS	130	100	75	100	70	100	67	100	97	100	53	100	51	100	543	100

<b>Table 4 (cont'd)</b>		<b>Demographic characteristics of adult elective liver transplant recipients, 1 April 2014 - 31 March 2015</b>							
		Birmingham N (%)	Cambridge N (%)	Edinburgh N (%)	King's College N (%)	Leeds N (%)	Newcastle N (%)	Royal Free N (%)	TOTAL N (%)
Number		154	68	84	144	77	26	68	621 (100)
<b>Recipient details</b>									
Recipient sex	Male	110 (71)	51 (75)	58 (69)	89 (62)	57 (74)	13 (50)	54 (79)	432 (70)
	Female	44 (29)	17 (25)	26 (31)	55 (38)	20 (26)	13 (50)	14 (21)	189 (30)
Recipient ethnicity	White	133 (86)	64 (94)	77 (92)	124 (86)	67 (87)	24 (92)	53 (78)	542 (87)
	Non-white	21 (14)	4 (6)	7 (8)	20 (14)	10 (13)	2 (8)	15 (22)	79 (13)
Indication	Cancer	39 (25)	23 (34)	26 (31)	37 (26)	15 (19)	6 (23)	18 (26)	164 (27)
	Hepatitis C	9 (6)	4 (6)	9 (11)	13 (9)	14 (18)	0	8 (12)	57 (9)
	Alcoholic liver disease	40 (26)	17 (25)	20 (24)	26 (18)	20 (26)	6 (23)	17 (25)	146 (24)
	Hepatitis B	4 (3)	0	0	3 (2)	1 (1)	0	3 (4)	11 (2)
	Primary sclerosing cholangitis	24 (16)	5 (7)	4 (5)	12 (8)	5 (6)	2 (8)	11 (16)	63 (10)
	Primary biliary cirrhosis	13 (8)	4 (6)	2 (2)	12 (8)	6 (8)	5 (19)	3 (4)	45 (7)
	Autoimmune and cryptogenic disease	9 (6)	3 (4)	5 (6)	16 (11)	5 (6)	2 (8)	2 (3)	42 (7)
	Metabolic	11 (7)	8 (12)	14 (17)	15 (10)	10 (13)	3 (12)	3 (4)	64 (10)
	Other	5 (3)	4 (6)	4 (5)	9 (6)	1 (1)	2 (8)	3 (4)	28 (5)
Recipient HCV status	Negative	125 (81)	48 (71)	63 (75)	116 (81)	63 (82)	24 (92)	44 (65)	483 (78)
	Positive	28 (18)	13 (19)	19 (23)	26 (18)	12 (16)	1 (4)	20 (29)	119 (19)
	Not reported	1 (1)	7 (10)	2 (2)	2 (1)	2 (3)	1 (4)	4 (6)	19 (3)
Pre-transplant in-patient status	Out-patient	150 (97)	60 (88)	69 (82)	114 (79)	69 (90)	24 (92)	62 (91)	548 (88)
	In-patient	4 (3)	7 (10)	15 (18)	29 (20)	8 (10)	2 (8)	2 (3)	67 (11)
	Not reported	0	1 (1)	0	1 (1)	0	0	4 (6)	6 (1)

**Table 4(cont'd) Demographic characteristics of adult elective liver transplant recipients, 1 April 2014 - 31 March 2015**

		Birmingham	Cambridge	Edinburgh	King's College	Leeds	Newcastle	Royal Free	TOTAL
		N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
Ascites	Absence	77 (50)	26 (38)	37 (44)	77 (53)	27 (35)	16 (62)	25 (37)	285 (46)
	Presence	77 (50)	41 (60)	47 (56)	65 (45)	49 (64)	10 (38)	39 (57)	328 (53)
	Not reported	0	1 (1)	0	2 (1)	1 (1)	0	4 (6)	8 (1)
Encephalopathy	Absence	87 (56)	44 (65)	37 (44)	103 (72)	40 (52)	19 (73)	63 (93)	393 (63)
	Presence	67 (44)	23 (34)	26 (31)	40 (28)	32 (42)	7 (27)	1 (1)	196 (32)
	Not reported	0	1 (1)	21 (25)	1 (1)	5 (6)	0	4 (6)	32 (5)
Pre-transplant renal support	No	152 (99)	62 (91)	72 (86)	133 (92)	72 (94)	26 (100)	62 (91)	579 (93)
	Yes	2 (1)	5 (7)	12 (14)	10 (7)	5 (6)	0	2 (3)	36 (6)
Previous abdominal surgery	No	142 (92)	57 (84)	71 (85)	128 (89)	70 (91)	22 (85)	52 (76)	542 (87)
	Yes	11 (7)	10 (15)	13 (15)	14 (10)	7 (9)	4 (15)	11 (16)	70 (11)
	Not reported	1 (1)	1 (1)	0	2 (1)	0	0	5 (7)	9 (1)
Varices & shunt	Absence	51 (33)	11 (16)	15 (18)	71 (49)	30 (39)	10 (38)	18 (26)	206 (33)
	Presence without treatment	89 (58)	47 (69)	63 (75)	64 (44)	45 (58)	16 (62)	43 (63)	367 (59)
	Presence with surgical shunt	0	1 (1)	0	0	1 (1)	0	0	2 (0)
	Presence with TIPS	14 (9)	1 (1)	5 (6)	8 (6)	0	0	3 (4)	31 (5)
	Not reported	0	8 (12)	1 (1)	1 (1)	1 (1)	0	4 (6)	15 (2)
Life style activity	Normal	2 (1)	4 (6)	25 (30)	1 (1)	7 (9)	5 (19)	1 (1)	45 (7)
	Restricted	75 (49)	13 (19)	22 (26)	66 (46)	18 (23)	10 (38)	1 (1)	205 (33)
	Self-care	72 (47)	31 (46)	20 (24)	52 (36)	30 (39)	9 (35)	59 (87)	273 (44)
	Confined	5 (3)	14 (21)	12 (14)	18 (13)	18 (23)	2 (8)	3 (4)	72 (12)
	Reliant	0	1 (1)	4 (5)	5 (3)	1 (1)	0	0	11 (2)
	Not reported	0	5 (7)	1 (1)	2 (1)	3 (4)	0	4 (6)	15 (2)

**Table 4(cont'd) Demographic characteristics of adult elective liver transplant recipients, 1 April 2014 - 31 March 2015**

		Birmingham N (%)	Cambridge N (%)	Edinburgh N (%)	King's College N (%)	Leeds N (%)	Newcastle N (%)	Royal Free N (%)	TOTAL N (%)
Graft appearance	Normal	135 (88)	37 (54)	74 (88)	41 (28)	61 (79)	22 (85)	42 (62)	<b>412 (66)</b>
	Abnormal	18 (12)	29 (43)	10 (12)	5 (3)	16 (21)	4 (15)	22 (32)	<b>104 (17)</b>
	Not reported	1 (1)	2 (3)	0	98 (68)	0	0	4 (6)	<b>105 (17)</b>
Recip age (years)	Median (IQR)	54 (45,62)	56 (52,62)	58 (51,63)	56 (46,64)	54 (46,61)	60 (52,65)	55 (49,62)	<b>56 (48,62)</b>
	Not reported	0	0	0	0	0	0	0	<b>0</b>
BMI kg/m2	Median (IQR)	27 (24,31)	28 (26,32)	29 (25,33)	27 (24,30)	27 (24,31)	27 (23,30)	26 (24,29)	<b>27 (24,31)</b>
	Not reported	0	0	0	0	0	0	0	<b>0</b>
Serum Bilirubin umol/l	Median (IQR)	35 (16,80)	47 (34,86)	47 (24,104)	46 (27,96)	47 (27,108)	48 (25,154)	44 (23,82)	<b>45 (24,87)</b>
	Not reported	0	1	0	1	0	1	4	<b>7</b>
Serum Creatinine umol/l	Median (IQR)	72 (58,88)	65 (52,87)	79 (65,103)	73 (57,90)	69 (59,88)	64 (55,79)	77 (66,97)	<b>72 (59,90)</b>
	Not reported	0	0	0	0	0	0	0	<b>0</b>
Serum sodium mmol/l	Median (IQR)	138 (135,140)	135 (133,139)	136 (133,140)	139 (136,142)	136 (133,139)	138 (131,139)	138 (134,141)	<b>138 (134,140)</b>
	Not reported	0	1	0	1	0	1	4	<b>7</b>
Serum potassium mmol/l	Median (IQR)	4.2 (3.9,4.6)	4.1 (3.8,4.6)	4.2 (3.9,4.5)	4.2 (3.9,4.6)	4.2 (3.9,4.6)	4.2 (4.1,4.6)	4.3 (4.1,4.6)	<b>4.2 (3.9,4.6)</b>
	Not reported	0	1	0	1	0	1	4	<b>7</b>
INR	Median (IQR)	1.4 (1.2,1.6)	1.5 (1.3,1.7)	1.4 (1.2,1.7)	1.6 (1.3,1.9)	1.5 (1.3,1.8)	1.4 (1.1,1.7)	1.5 (1.2,1.8)	<b>1.5 (1.2,1.8)</b>
	Not reported	1	2	0	1	0	1	4	<b>9</b>
Serum Albumin g/l	Median (IQR)	34 (30,39)	30 (27,34)	27 (22,32)	30 (25,35)	31 (27,35)	33 (29,36)	33 (29,38)	<b>31 (27,36)</b>
	Not reported	1	1	0	1	1	1	4	<b>9</b>
Cold Ischaemia Time (hrs)	Median (IQR)	8 (7,9)	8 (7,10)	9 (8,10)	9 (7,11)	7 (6,9)	10 (8,10)	8 (7,10)	<b>8 (7,10)</b>
	Not reported	1	6	0	65	1	0	6	<b>79</b>

**Table 4(cont'd) Demographic characteristics of adult elective liver transplant recipients, 1 April 2014 - 31 March 2015**

		Birmingham N (%)	Cambridge N (%)	Edinburgh N (%)	King's College N (%)	Leeds N (%)	Newcastle N (%)	Royal Free N (%)	TOTAL N (%)
Time on list (days)	Median (IQR)	73 (29,162)	74 (30,157)	57 (20,193)	181 (90,328)	59 (22,156)	174 (75,264)	91 (47,217)	93 (34,222)
	Not reported	0	0	0	0	1	1	1	3
<b>Donor details</b>									
Donor sex	Male	86 (56)	41 (60)	42 (50)	81 (56)	41 (53)	12 (46)	40 (59)	343 (55)
	Female	68 (44)	27 (40)	42 (50)	63 (44)	36 (47)	14 (54)	28 (41)	278 (45)
Donor ethnicity	White	129 (84)	58 (85)	76 (90)	124 (86)	66 (86)	22 (85)	52 (76)	527 (85)
	Non-white	6 (4)	5 (7)	3 (4)	7 (5)	5 (6)	2 (8)	10 (15)	38 (6)
	Not reported	19 (12)	5 (7)	5 (6)	13 (9)	6 (8)	2 (8)	6 (9)	56 (9)
Donor cause of death	Trauma	136 (88)	60 (88)	75 (89)	127 (88)	59 (77)	20 (77)	57 (84)	534 (86)
	CVA	12 (8)	5 (7)	6 (7)	14 (10)	12 (16)	2 (8)	8 (12)	59 (10)
	Others	6 (4)	3 (4)	3 (4)	3 (2)	6 (8)	4 (15)	3 (4)	28 (5)
Donor history of diabetes	No	132 (86)	64 (94)	79 (94)	133 (92)	72 (94)	24 (92)	63 (93)	567 (91)
	Yes	19 (12)	2 (3)	5 (6)	8 (6)	4 (5)	1 (4)	4 (6)	43 (7)
	Not reported	3 (2)	2 (3)	0	3 (2)	1 (1)	1 (4)	1 (1)	11 (2)
Donor type	Donor after brain death	105 (68)	42 (62)	70 (83)	105 (73)	55 (71)	21 (81)	53 (78)	451 (73)
	Donor after cardiac death	49 (32)	26 (38)	14 (17)	39 (27)	22 (29)	5 (19)	15 (22)	170 (27)
ABO match	Identical	150 (97)	66 (97)	84 (100)	143 (99)	74 (96)	26 (100)	68 (100)	611 (98)
	Compatible	4 (3)	2 (3)	0	0	3 (4)	0	0	9 (1)
	Incompatible	0	0	0	1 (1)	0	0	0	1 (0)
Graft type	Whole	144 (94)	63 (93)	80 (95)	134 (93)	76 (99)	24 (92)	64 (94)	585 (94)
	Segmental	10 (6)	5 (7)	4 (5)	10 (7)	1 (1)	2 (8)	4 (6)	36 (6)

Table 4(cont'd)

## Demographic characteristics of adult elective liver transplant recipients, 1 April 2014 - 31 March 2015

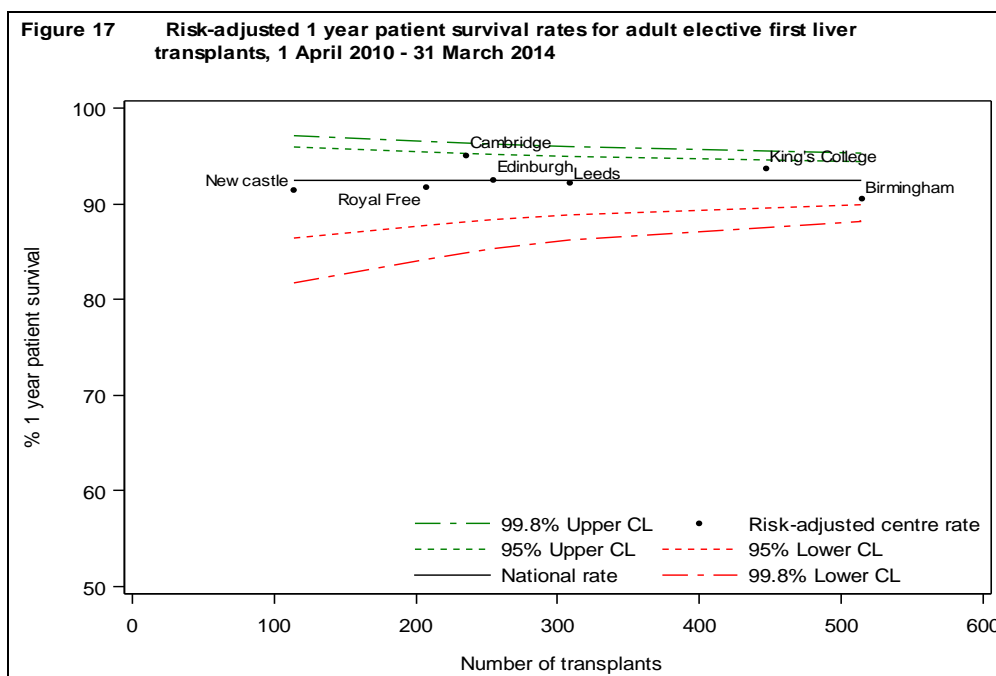
		Birmingham N (%)	Cambridge N (%)	Edinburgh N (%)	King's College N (%)	Leeds N (%)	Newcastle N (%)	Royal Free N (%)	TOTAL N (%)
Donor age years	Median (IQR)	50 (33,62)	52 (37,65)	51 (39,59)	57 (46,68)	48 (41,57)	49 (29,63)	51 (37,60)	51 (39,63)
	Not reported	0	0	0	0	0	0	0	0
Donor BMI kg/m2	Median (IQR)	25 (22,29)	26 (24,28)	26 (24,30)	26 (23,29)	26 (23,29)	25 (23,28)	26 (22,28)	26 (23,29)
	Not reported	0	0	0	0	0	0	0	0

## POST-TRANSPLANT SURVIVAL

### LONG-TERM PATIENT SURVIVAL

**Table 5** shows one year [unadjusted](#) and [risk-adjusted patient survival](#) for 2081 of the 2227 transplants in the period, 1 April 2010 to 31 March 2014. Transplants were excluded if survival information or [risk factors](#) were missing. The overall patient survival rate is 92.4% and after risk adjustment, four centres had a lower survival rate than the national rate. None of these centres lie outside of the 95% [confidence limit](#), as shown in **Figure 17**.

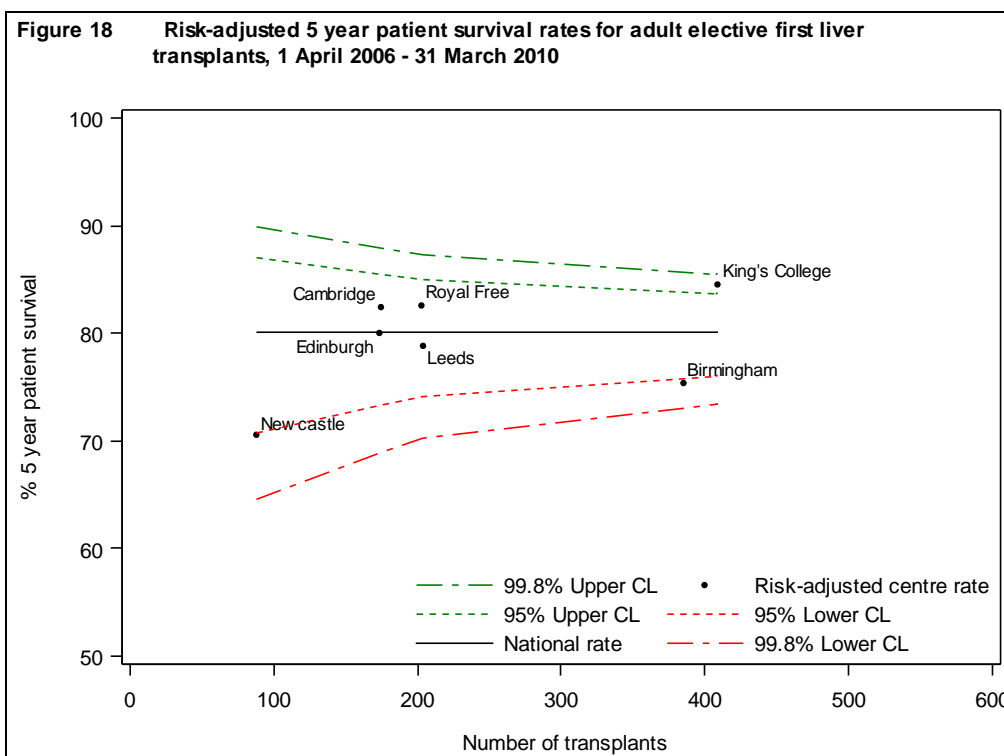
Centre	Number of transplants	1-year survival % (95% CI)			
		Unadjusted		Risk adjusted	
Newcastle	114	92.8	(86.2 - 96.4)	91.4	(82.7 - 95.7)
Leeds	308	91.7	(88.0 - 94.3)	92.1	(88.4 - 94.7)
Cambridge	235	93.9	(89.9 - 96.3)	95.1	(91.7 - 97.1)
Royal Free	207	91.5	(86.6 - 94.6)	91.7	(86.6 - 94.8)
King's College	447	94.0	(91.4 - 95.9)	93.7	(90.7 - 95.7)
Birmingham	515	90.9	(88.0 - 93.1)	90.5	(87.3 - 92.9)
Edinburgh	255	92.8	(88.9 - 95.4)	92.5	(88.2 - 95.3)
<b>Total</b>	<b>2081</b>	<b>92.4</b>	<b>(91.2 - 93.5)</b>		



**Table 6** shows the five [unadjusted](#) and [risk-adjusted patient survival](#) for 1639 of the 1743 transplants in the period, 1 April 2006 to 31 March 2010. The national rate is 80.1% and

three centres have a lower survival rate after risk adjustment. None of these centres lie outside of the 99.8% [confidence limit](#), as shown in **Figure 18**.

<b>Table 6 Five year patient survival for adult elective first transplants 1 April 2006 - 31 March 2010</b>				
Centre	Number of transplants	5-year survival % (95% CI)		
		Unadjusted		Risk adjusted
Newcastle	88	73.4	(62.3 - 81.7)	70.6 (55.4 - 80.7)
Leeds	204	79.7	(73.2 - 84.7)	78.8 (71.0 - 84.5)
Cambridge	176	79.6	(72.8 - 84.9)	82.4 (75.5 - 87.4)
Royal Free	203	84.1	(78.3 - 88.5)	82.5 (75.3 - 87.6)
King's College	409	83.8	(79.6 - 87.2)	84.5 (80.0 - 87.9)
Birmingham	385	76.9	(72.3 - 80.8)	75.4 (69.7 - 80.1)
Edinburgh	174	78.5	(71.5 - 83.9)	80.1 (72.5 - 85.6)
<b>Total</b>	<b>1639</b>	<b>80.1</b>	<b>(78.0 - 82.0)</b>	



**Table 7** shows one year [unadjusted](#) and [risk-adjusted patient survival](#), by primary disease group. The overall patient survival rate is 92.4% and after risk adjustment patients with cancer, AID, metabolic or other disease had a lower survival rate than the national rate.

<b>Table 7      One year patient survival for adult elective first transplants 1 April 2010 - 31 March 2014</b>					
Primary disease	Number of transplants	1-year survival % (95% CI)			
		Unadjusted		Risk adjusted	
Cancer	502	89.3	(86.2 - 91.8)	90.0	(86.9 - 92.4)
Hepatitis B and C	259	94.9	(91.4 - 97.0)	95.4	(92.1 - 97.3)
Alcoholic liver disease	473	92.3	(89.4 - 94.4)	92.8	(90.0 - 94.8)
Primary sclerosing cholangitis	233	96.1	(92.7 - 98.0)	95.2	(90.8 - 97.5)
Primary biliary cirrhosis	192	95.3	(91.1 - 97.5)	93.8	(88.1 - 96.8)
Autoimmune and cryptogenic	140	92.0	(86.1 - 95.5)	91.5	(84.6 - 95.3)
Metabolic	164	90.6	(84.9 - 94.2)	90.9	(84.9 - 94.5)
Other	117	92.0	(85.2 - 95.8)	91.4	(83.5 - 95.5)
<b>Total</b>	<b>2081</b>	<b>92.4</b>	<b>(91.2 - 93.5)</b>		

**Table 8** shows five year [unadjusted](#) and [risk-adjusted patient survival](#), the overall patient survival rate is 80.1%. After risk adjustment patients with cancer, primary biliary cirrhosis, metabolic, and other disease had a lower survival rate than the national rate.

<b>Table 8      Five year patient survival for adult elective first transplants 1 April 2006 - 31 March 2010</b>					
Primary disease	Number of transplants	5-year survival % (95% CI)			
		Unadjusted		Risk adjusted	
Cancer	388	72.6	(67.7 - 76.9)	75.6	(70.4 - 79.9)
Hepatitis B and C	219	76.8	(70.3 - 82.1)	80.3	(73.8 - 85.2)
Alcoholic liver disease	380	85.9	(81.8 - 89.1)	85.2	(80.6 - 88.8)
Primary sclerosing cholangitis	163	84.2	(77.4 - 89.0)	82.7	(74.4 - 88.3)
Primary biliary cirrhosis	174	81.0	(74.1 - 86.2)	79.1	(70.4 - 85.2)
Autoimmune and cryptogenic	131	86.0	(78.7 - 90.9)	83.2	(73.3 - 89.4)
Metabolic	59	74.5	(60.5 - 84.1)	74.8	(57.4 - 85.1)
Other	125	80.7	(72.3 - 86.8)	78.3	(67.3 - 85.6)
<b>Total</b>	<b>1639</b>	<b>80.1</b>	<b>(78.0 - 82.0)</b>		

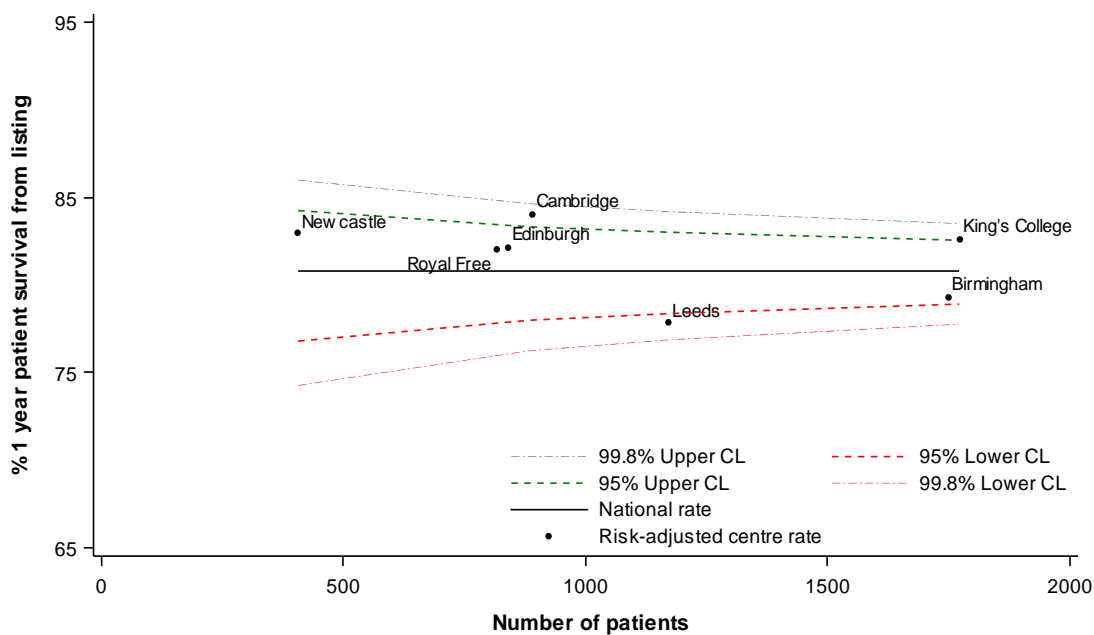
## SURVIVAL FROM LISTING

Survival from listing was analysed for patients aged  $\geq 18$  years registered for the first time for a liver transplant between 1 January 2003 and 31 December 2014. One, five and ten year [risk-adjusted survival rates](#) from the point of liver transplant listing are provided in **Table 9** and shown by centre in **Figures 19, 20 and 21**, respectively.

At one year, centre-specific risk adjusted survival rates range between 78% (95% [CI](#) 75-81%) at Leeds and 84% (95% CI 81-86%) at Cambridge. At five years, these two centres achieve, once again, the lowest and highest survival rates with 63% (95% CI 58-67%) for Leeds and 72% (95% CI 68-75%) for Cambridge; the remaining centres achieve survival rates that range in between these two extremes. Similarly, at ten years, Leeds achieves the lowest survival rate at 51% (95% CI 45-56%) while Cambridge has the highest at 61% (95% CI 57-66%).

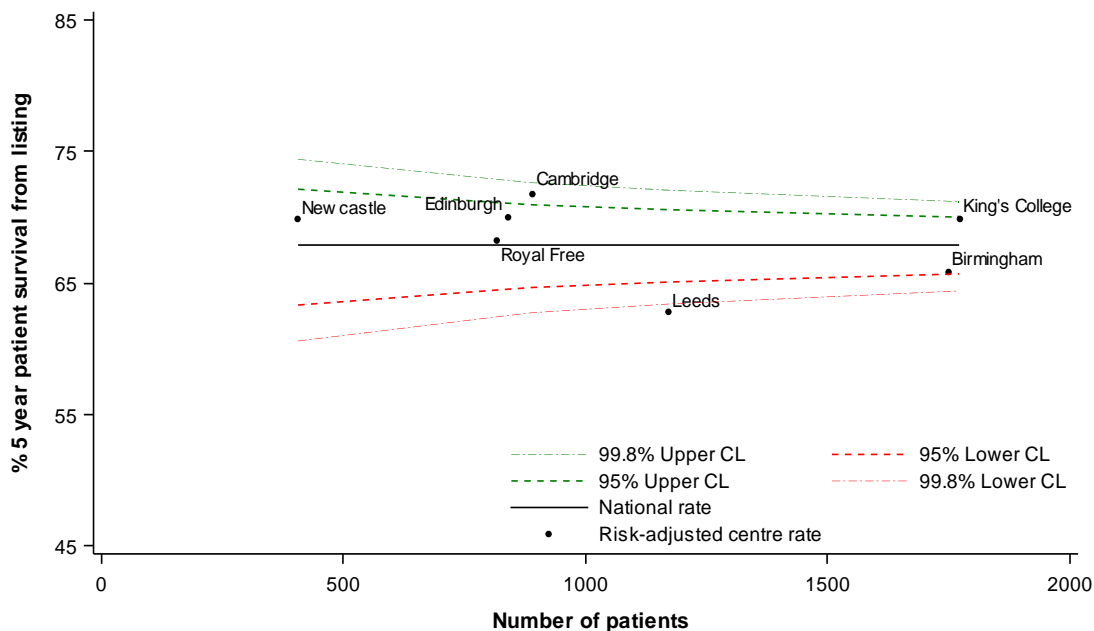
<b>Table 9      Risk-adjusted 1, 5 and 10 year patient survival rate from listing for adult elective first liver registrations, 1 January 2003 - 31 December 2014</b>				
<b>Centre</b>	<b>Number of registrations</b>	<b>One year (%)</b>	<b>Patient survival Five year (%)</b>	<b>Ten year (%)</b>
Newcastle	406	83	70	58
Leeds	1170	78	63	51
Cambridge	890	84	72	61
Royal Free	815	82	68	58
King's College	1771	83	70	60
Birmingham	1749	79	66	55
Edinburgh	841	82	70	60
<b>TOTAL</b>	<b>7642</b>	<b>81</b>	<b>68</b>	<b>57</b>

**Figure 19** Risk-adjusted 1 year patient survival rate from time of listing for adult\* elective first liver registrations, 1 January 2003 - 31 December 2014



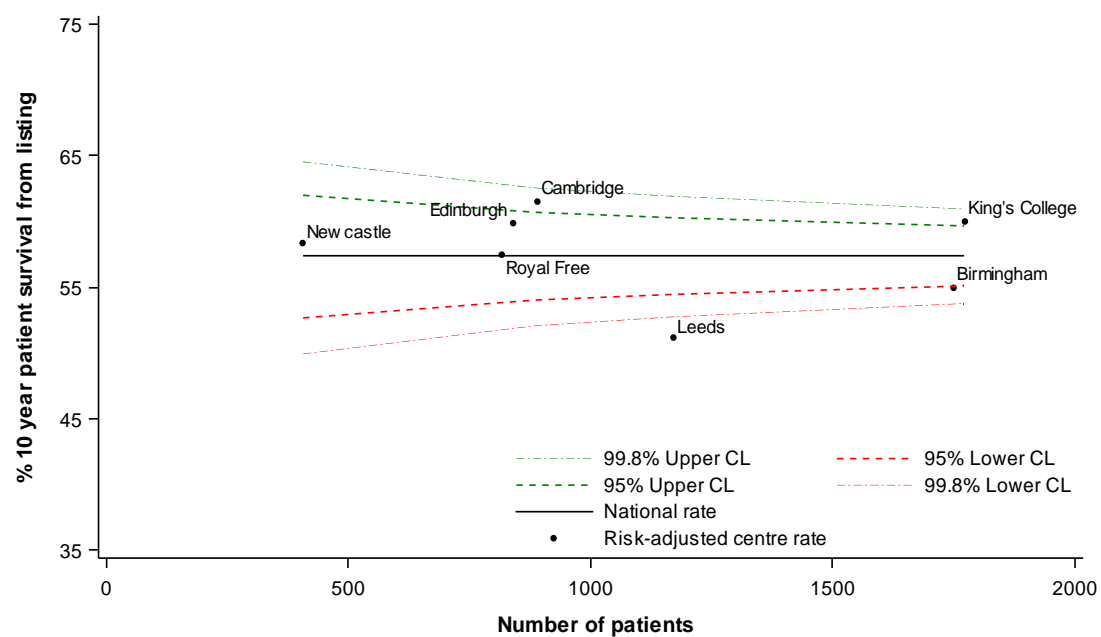
\* In this analysis, adult patients are defined as 18 years old and older.

**Figure 20** Risk-adjusted 5 year patient survival rate from time of listing for adult\* elective first liver registrations, 1 January 2003 - 31 December 2014



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

**Figure 21** Risk-adjusted 10 year patient survival rate from time of listing for adult\* elective first liver registrations, 1 January 2003 - 31 December 2014



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

# **ADULT LIVER TRANSPLANTATION**

## **SUPER-URGENT PATIENTS**



## SUPER-URGENT PATIENTS

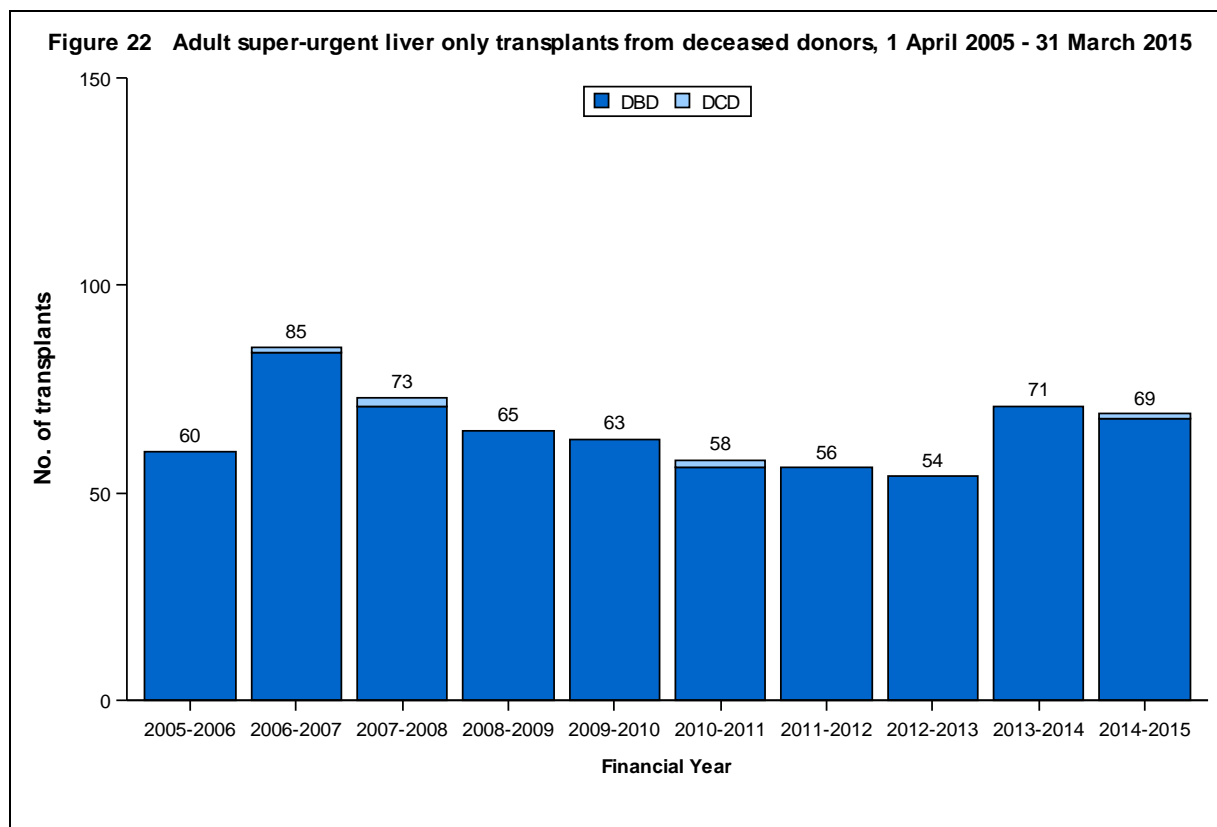
### TRANSPLANT LIST

**Table 10** shows the [median waiting time](#) to liver only transplant for adult [super-urgent](#) patients. The median waiting time to transplant is two days at all centres except Newcastle and Royal Free where it is three days. The national median waiting time to transplant is two days.

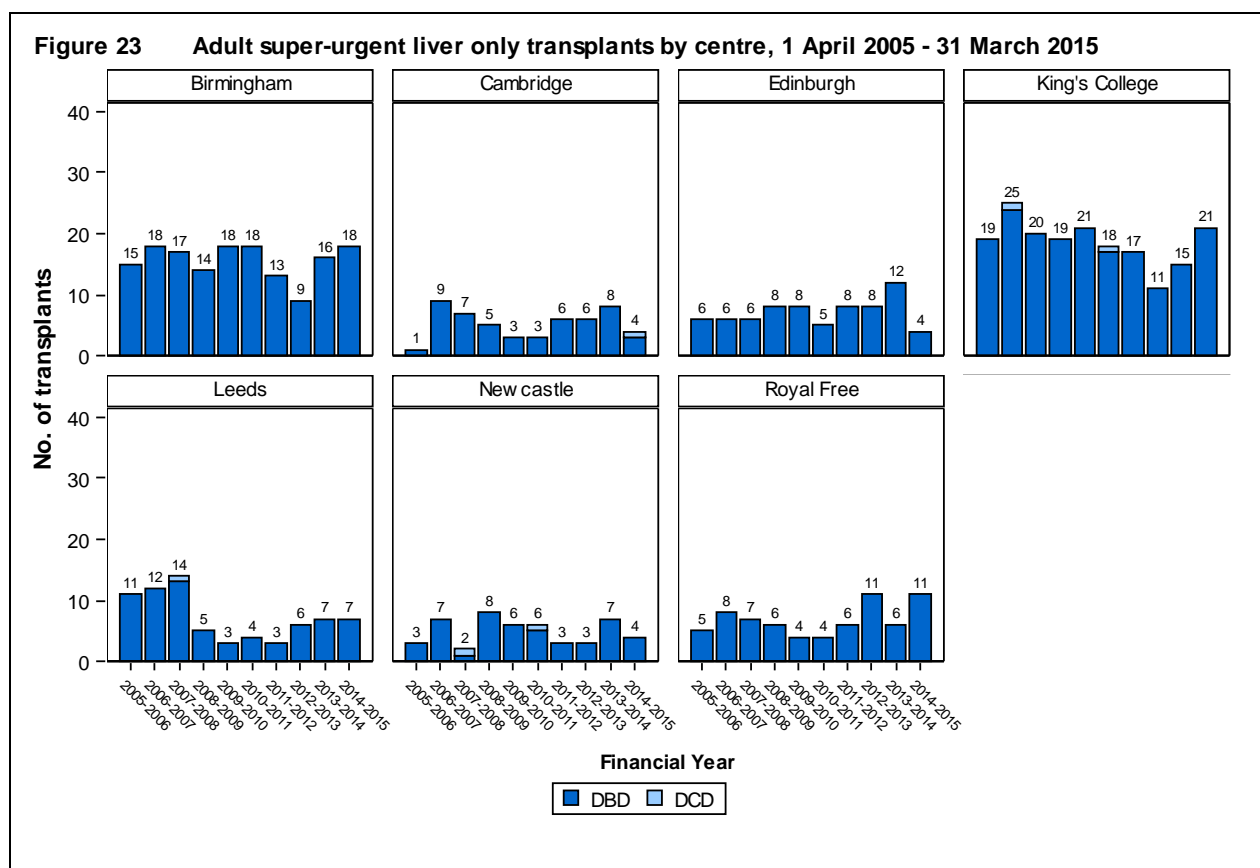
<b>Table 10      Median waiting time to liver only transplant in the UK, for adult super-urgent patients registered 1 April 2009 - 31 March 2012</b>			
Transplant centre	Number of patients registered	Waiting time (days) Median	95% Confidence interval
<b>Adult</b>			
Leeds	29	2	1 - 3
Cambridge	24	2	1 - 3
King's College	78	2	2 - 2
Birmingham	78	2	2 - 2
Edinburgh	41	2	1 - 3
Newcastle	29	3	2 - 4
Royal Free	30	3	2 - 4
<b>UK</b>	<b>309</b>	<b>2</b>	<b>2 - 2</b>

## TRANSPLANT ACTIVITY

**Figure 22** shows the number of adult [super-urgent](#) liver only transplants from deceased donors performed in the last ten years, by type of donor.



**Figure 23** shows the number of adult [super-urgent](#) liver only transplants from deceased donors performed in the last ten years, by type of donor and transplant centre.



The demographic characteristics of 308 adult [super-urgent](#) transplant recipients in the last five years are shown by centre and overall in **Table 11**. Two thirds of these recipients were female and the [median](#) age was 39 years. Only three super-urgent transplants have been performed in this time period using a [DCD](#) donor. The median recipient BMI was 25. For some characteristics, due to rounding, percentages may not add up to 100.

Table 11 (cont'd)

## Demographic characteristics of adult super urgent liver transplant recipients, 1 April 2010 - 31 March 2015

		Birmingham N (%)	Cambridge N (%)	Edinburgh N (%)	King's College N (%)	Leeds N (%)	Newcastle N (%)	Royal Free N (%)	TOTAL N (%)
Number		74	27	37	82	27	23	38	308 (100)
<b>Recipient details</b>									
Recipient sex	Male	27 (36)	6 (22)	12 (32)	30 (37)	12 (44)	4 (17)	18 (47)	109 (35)
	Female	47 (64)	21 (78)	25 (68)	52 (63)	15 (56)	19 (83)	20 (53)	199 (65)
Recipient ethnicity	White	64 (86)	23 (85)	35 (95)	64 (78)	24 (89)	23 (100)	18 (47)	251 (82)
	Non-white	9 (12)	4 (15)	2 (5)	18 (22)	3 (11)	0	20 (53)	56 (18)
	Not reported	1 (1)	0	0	0	0	0	0	1 (0)
Recipient HCV status	Negative	68 (92)	24 (89)	36 (97)	82 (100)	20 (74)	22 (96)	38 (100)	290 (94)
	Positive	1 (1)	1 (4)	1 (3)	0	0	0	0	3 (1)
	Not reported	5 (7)	2 (7)	0	0	7 (26)	1 (4)	0	15 (5)
Pre-transplant in-patient status	Out-patient	4 (5)	3 (11)	0	0	2 (7)	0	2 (5)	11 (4)
	In-patient	69 (93)	24 (89)	37 (100)	82 (100)	25 (93)	23 (100)	36 (95)	296 (96)
	Not reported	1 (1)	0	0	0	0	0	0	1 (0)
Ascites	Absence	48 (65)	12 (44)	33 (89)	72 (88)	20 (74)	20 (87)	15 (39)	220 (71)
	Presence	26 (35)	14 (52)	4 (11)	8 (10)	7 (26)	3 (13)	23 (61)	85 (28)
	Not reported	0	1 (4)	0	2 (2)	0	0	0	3 (1)
Encephalopathy	Absence	0	3 (11)	1 (3)	3 (4)	1 (4)	1 (4)	3 (8)	12 (4)
	Presence	74 (100)	23 (85)	35 (95)	77 (94)	26 (96)	22 (96)	35 (92)	292 (95)
	Not reported	0	1 (4)	1 (3)	2 (2)	0	0	0	4 (1)
Pre-transplant renal support	No	38 (51)	9 (33)	16 (43)	24 (29)	19 (70)	6 (26)	25 (66)	137 (45)
	Yes	36 (49)	18 (67)	21 (57)	58 (71)	8 (30)	16 (70)	13 (34)	170 (55)

Table 11 (cont'd)

## Demographic characteristics of adult super urgent liver transplant recipients, 1 April 2010 - 31 March 2015

		Birmingham N (%)	Cambridge N (%)	Edinburgh N (%)	King's College N (%)	Leeds N (%)	Newcastle N (%)	Royal Free N (%)	TOTAL N (%)
Previous abdominal surgery	No	71 (96)	25 (93)	36 (97)	75 (91)	25 (93)	20 (87)	35 (92)	287 (93)
	Yes	2 (3)	2 (7)	1 (3)	5 (6)	2 (7)	3 (13)	2 (5)	17 (6)
	Not reported	1 (1)	0	0	2 (2)	0	0	1 (3)	4 (1)
Varices & shunt	Absence	68 (92)	11 (41)	20 (54)	80 (98)	19 (70)	7 (30)	33 (87)	238 (77)
	Presence without treatment	6 (8)	16 (59)	17 (46)	2 (2)	8 (30)	16 (70)	2 (5)	67 (22)
	Presence with TIPS	0	0	0	0	0	0	1 (3)	1 (0)
Life style activity	Normal	0	0	0	0	1 (4)	1 (4)	0	2 (1)
	Restricted	2 (3)	0	0	0	1 (4)	1 (4)	0	4 (1)
	Self-care	0	1 (4)	0	2 (2)	3 (11)	0	0	6 (2)
	Confined	18 (24)	0	3 (8)	9 (11)	6 (22)	5 (22)	5 (13)	46 (15)
	Reliant	54 (73)	24 (89)	34 (92)	70 (85)	15 (56)	16 (70)	33 (87)	246 (80)
	Not reported	0	2 (7)	0	0	1 (4)	0	0	3 (1)
Graft appearance	Normal	70 (95)	22 (81)	36 (97)	16 (20)	21 (78)	19 (83)	31 (82)	215 (70)
	Abnormal	4 (5)	4 (15)	1 (3)	3 (4)	5 (19)	4 (17)	7 (18)	28 (9)
	Not reported	0	1 (4)	0	63 (77)	1 (4)	0	0	65 (21)
Recip age (years)	Median (IQR)	39 (27,48)	43 (24,56)	41 (29,53)	38 (26,47)	34 (25,52)	43 (25,55)	42 (31,50)	39 (27,51)
	Not reported	0	0	0	0	0	0	0	0
BMI kg/m2	Median (IQR)	25 (22,29)	25 (22,29)	25 (22,31)	24 (22,27)	25 (22,30)	25 (22,27)	27 (23,30)	25 (22,29)
	Not reported	0	0	0	2	0	5	6	13
Serum Bilirubin umol/l	Median (IQR)	245 (126,371)	267 (143,397)	165 (98,479)	206 (101,334)	185 (102,383)	245 (83,428)	360 (193,502)	248 (121,399)
	Not reported	0	0	0	0	0	0	0	0

**Table 11 (cont'd) Demographic characteristics of adult super urgent liver transplant recipients, 1 April 2010 - 31 March 2015**

		Birmingham N (%)	Cambridge N (%)	Edinburgh N (%)	King's College N (%)	Leeds N (%)	Newcastle N (%)	Royal Free N (%)	<b>TOTAL N (%)</b>
Serum Creatinine umol/l	Median (IQR) Not reported	94 (57,136) 0	130 (80,225) 0	145 (66,238) 0	118 (65,158) 0	90 (66,130) 0	94 (66,128) 0	88 (62,138) 0	<b>103 (65,158) 0</b>
Serum sodium mmol/l	Median (IQR) Not reported	144 (138,150) 0	140 (136,141) 0	136 (134,139) 0	143 (140,147) 0	138 (135,140) 0	137 (134,142) 0	140 (136,146) 0	<b>140 (136,146) 0</b>
Serum potassium mmol/l	Median (IQR) Not reported	4.1 (3.7,4.5) 0	4.1 (3.9,4.5) 0	3.8 (3.5,4.3) 0	4.3 (4.0,4.7) 0	4.5 (4.0,4.8) 0	3.9 (3.6,4.3) 0	4.1 (3.6,4.5) 0	<b>4.1 (3.7,4.5) 0</b>
INR	Median (IQR) Not reported	2.8 (2.0,6.4) 0	3.9 (2.8,5.4) 1	3.4 (2.3,4.6) 0	2.4 (1.8,3.9) 0	2.6 (1.9,6.8) 0	2.5 (2.1,3.3) 0	3.4 (2.3,5.1) 0	<b>2.8 (2.0,4.6) 1</b>
Serum Albumin g/l	Median (IQR) Not reported	28 (25,33) 0	26 (21,30) 0	25 (21,29) 0	24 (21,27) 0	27 (24,32) 0	32 (25,35) 0	27 (21,30) 2	<b>26 (22,30) 2</b>
Time on list (days)	Median (IQR) Not reported	2 (1,3) 0	2 (2,4) 0	2 (1,2) 0	2 (1,3) 0	2 (1,3) 0	2 (1,4) 0	3 (2,4) 0	<b>2 (1,3) 0</b>
<b>Donor details</b>									
Donor sex	Male	38 (51)	13 (48)	15 (41)	50 (61)	7 (26)	11 (48)	12 (32)	<b>146 (47)</b>
	Female	36 (49)	14 (52)	22 (59)	32 (39)	20 (74)	12 (52)	26 (68)	<b>162 (53)</b>
Donor ethnicity	White	68 (92)	23 (85)	35 (95)	73 (89)	25 (93)	22 (96)	35 (92)	<b>281 (91)</b>
	Non-white	4 (5)	3 (11)	1 (3)	6 (7)	1 (4)	1 (4)	3 (8)	<b>19 (6)</b>
	Not reported	2 (3)	1 (4)	1 (3)	3 (4)	1 (4)	0	0	<b>8 (3)</b>
Donor cause of death	Trauma	58 (78)	23 (85)	34 (92)	65 (79)	20 (74)	21 (91)	36 (95)	<b>257 (83)</b>
	CVA	10 (14)	3 (11)	0	11 (13)	4 (15)	2 (9)	0	<b>30 (10)</b>
	Others	6 (8)	1 (4)	3 (8)	6 (7)	3 (11)	0	2 (5)	<b>21 (7)</b>

Table 11 (cont'd)

## Demographic characteristics of adult super urgent liver transplant recipients, 1 April 2010 - 31 March 2015

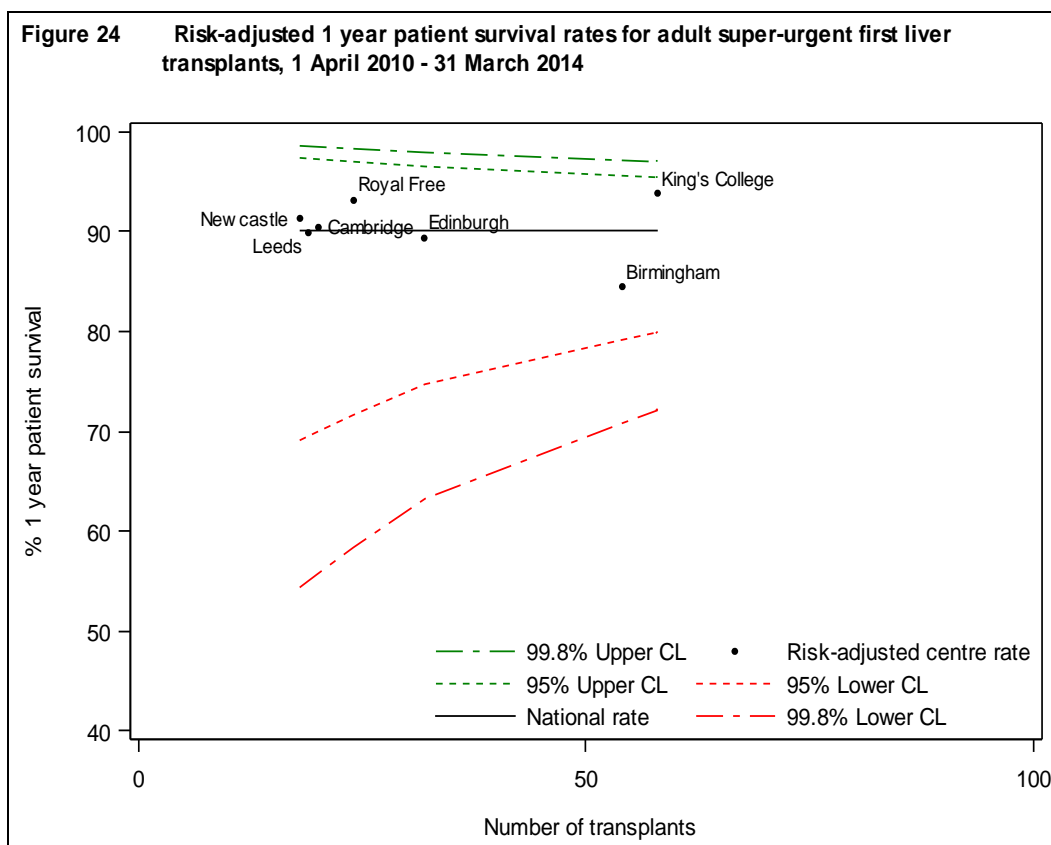
		Birmingham N (%)	Cambridge N (%)	Edinburgh N (%)	King's College N (%)	Leeds N (%)	Newcastle N (%)	Royal Free N (%)	<b>TOTAL N (%)</b>
Donor history of diabetes	No	72 (97)	25 (93)	36 (97)	76 (93)	25 (93)	21 (91)	37 (97)	<b>292 (95)</b>
	Yes	1 (1)	2 (7)	1 (3)	6 (7)	1 (4)	2 (9)	1 (3)	<b>14 (5)</b>
	Not reported	1 (1)	0	0	0	1 (4)	0	0	<b>2 (1)</b>
Donor type	Donor after brain death	74 (100)	26 (96)	37 (100)	81 (99)	27 (100)	22 (96)	38 (100)	<b>305 (99)</b>
	Donor after cardiac death	0	1 (4)	0	1 (1)	0	1 (4)	0	<b>3 (1)</b>
ABO match	Identical	49 (66)	18 (67)	29 (78)	50 (61)	14 (52)	18 (78)	27 (71)	<b>205 (67)</b>
	Compatible	25 (34)	7 (26)	8 (22)	32 (39)	13 (48)	5 (22)	11 (29)	<b>101 (33)</b>
	Incompatible	0	2 (7)	0	0	0	0	0	<b>2 (1)</b>
Graft type	Whole	72 (97)	26 (96)	37 (100)	71 (87)	25 (93)	23 (100)	38 (100)	<b>292 (95)</b>
	Segmental	2 (3)	1 (4)	0	11 (13)	2 (7)	0	0	<b>16 (5)</b>
Donor age (years)	Median (IQR)	45 (32,54)	45 (26,57)	47 (34,57)	51 (39,57)	46 (32,64)	47 (39,54)	48 (35,60)	<b>48 (34,57)</b>
	Not reported	0	0	0	0	0	0	0	<b>0</b>
Donor BMI kg/m2	Median (IQR)	25 (22,28)	24 (22,27)	26 (22,28)	26 (24,28)	26 (23,28)	23 (22,28)	23 (21,25)	<b>25 (22,28)</b>
	Not reported	0	0	0	0	0	0	0	<b>0</b>

## POST-TRANSPLANT SURVIVAL

### LONG-TERM PATIENT SURVIVAL

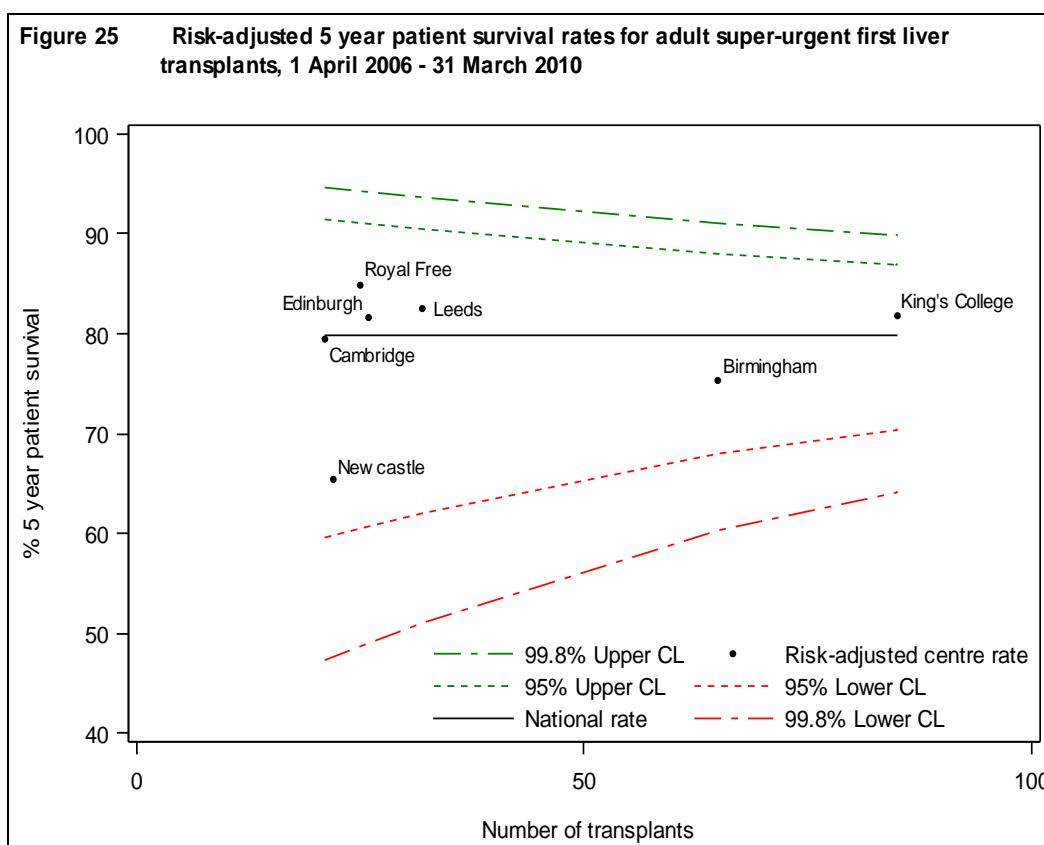
**Table 12** shows one year [unadjusted](#) and [risk-adjusted patient survival](#) for 225 of the 239 transplants in the period, 1 April 2010 to 31 March 2014. Transplants were excluded if survival information or [risk factors](#) were missing and were not imputed. The overall patient survival rate is 90.1% and after risk adjustment three centres had a lower survival rate than the national rate but within the [confidence limits](#), as shown in **Figure 24**.

<b>Table 12      One year patient survival for adult super-urgent first transplants, 1 April 2010 - 31 March 2014</b>					
Centre	Number of transplants	1-year survival % (95% CI)			
		Unadjusted		Risk adjusted	
Newcastle	18	88.9	(62.4 - 97.1)	91.4	(65.4 - 97.8)
Leeds	19	89.5	(64.1 - 97.3)	89.8	(59.4 - 97.5)
Cambridge	20	90.0	(65.6 - 97.4)	90.5	(62.0 - 97.6)
Royal Free	24	91.5	(70.0 - 97.8)	93.2	(72.8 - 98.3)
King's College	58	94.7	(84.5 - 98.3)	93.9	(81.0 - 98.0)
Birmingham	54	85.1	(72.3 - 92.2)	84.5	(69.1 - 92.3)
Edinburgh	32	90.4	(73.1 - 96.8)	89.4	(67.3 - 96.6)
<b>Total</b>	<b>225</b>	<b>90.1</b>	<b>(85.4 - 93.4)</b>		



**Table 13** shows the five year [unadjusted](#) and [risk-adjusted patient survival](#) for 276 of the 286 transplants in the period, 1 April 2006 to 31 March 2010. The national rate is 79.8% and three centres have a lower survival rate after risk adjustment but none are below the [confidence limits](#), as shown in **Figure 25**.

<b>Table 13 Five year patient survival for adult super-urgent first transplants, 1 April 2006 - 31 March 2010</b>					
Centre	Number of transplants	5-year survival % (95% CI)			
		Unadjusted		Risk adjusted	
Newcastle	22	77.3	(53.7 - 89.8)	65.4	(16.8 - 85.6)
Leeds	32	74.8	(55.8 - 86.5)	82.5	(65.0 - 91.2)
Cambridge	21	85.4	(61.3 - 95.1)	79.4	(36.2 - 93.4)
Royal Free	25	80.0	(58.4 - 91.1)	84.9	(63.8 - 93.7)
King's College	85	82.0	(71.9 - 88.7)	81.8	(69.7 - 89.0)
Birmingham	65	76.6	(64.2 - 85.2)	75.3	(59.1 - 85.1)
Edinburgh	26	84.6	(64.0 - 93.9)	81.6	(51.0 - 93.1)
<b>Total</b>	<b>276</b>	<b>79.8</b>	<b>(74.6 - 84.1)</b>		



## DATA COLLECTION

Form return rates are reported in **Table 14** for the liver transplant record, three month and one year follow up form, along with lifetime follow up (after the first year). These include all adult [elective and super-urgent](#) transplants between 1 January 2014 and 31 December 2014 for the transplant record, and all requests for follow up forms issued in this time period.

<b>Table 14</b> Form return rates, 1 January 2014 and 31 December 2014								
Centre	Transplant record		3 month follow-up		1 year follow-up		Lifetime follow-up	
	N	% returned	N	% returned	N	% returned	N	% returned
Newcastle	35	100	37	100	32	88	177	55
Leeds	94	100	100	100	99	93	432	98
Cambridge	72	99	74	100	65	100	379	96
Royal Free	87	99	88	100	76	100	345	99
King's College	175	100	173	100	129	95	784	95
Birmingham	181	100	176	100	144	100	701	98
Edinburgh	93	100	87	100	81	98	360	98

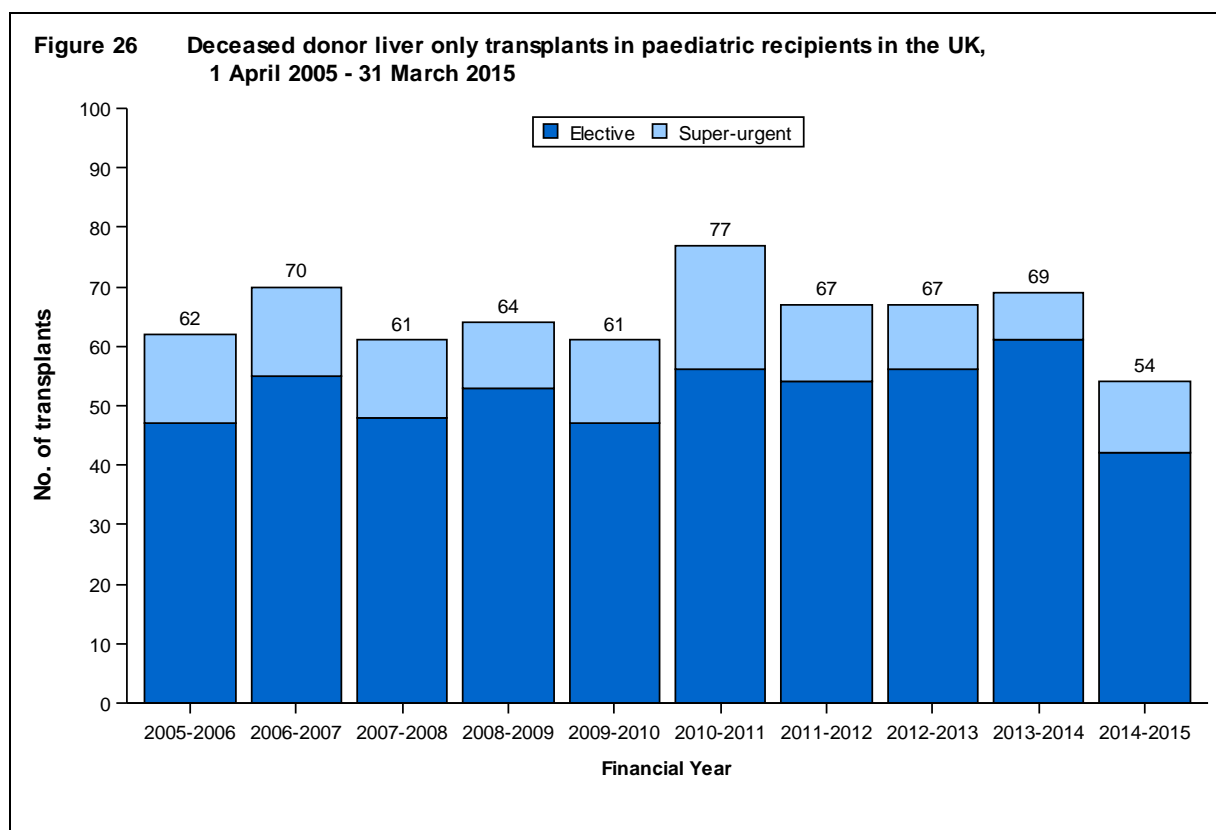
# **PAEDIATRIC LIVER TRANSPLANTATION**



## PAEDIATRIC LIVER TRANSPLANTATION

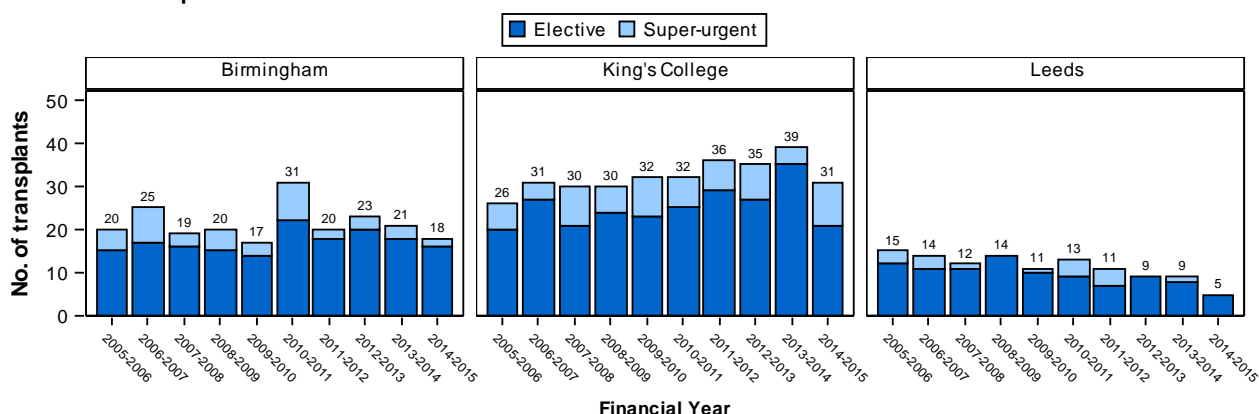
### OVERVIEW

The number of deceased donor liver only transplants for paediatric patients in the last ten years is shown overall and by centre in **Figures 26 and 27**, respectively. See **Appendix 1** for further details.



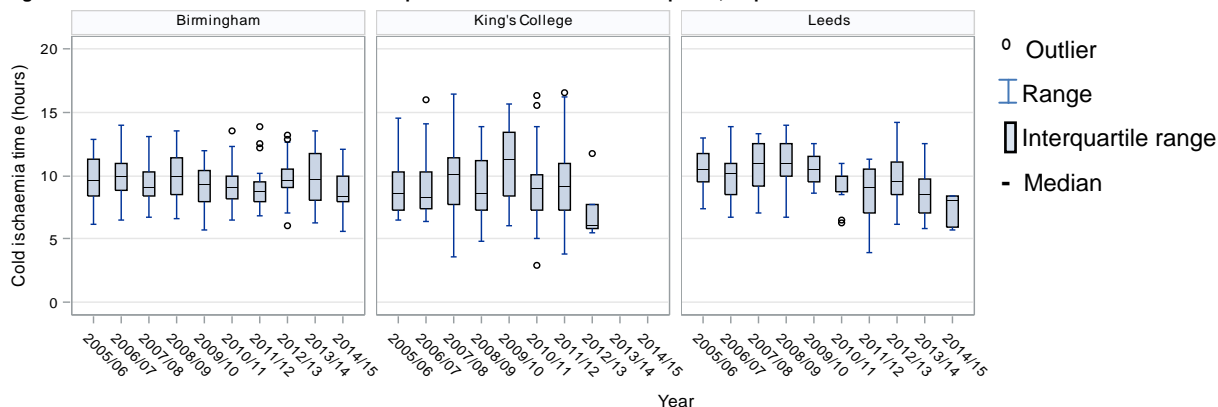
In the last year, 54 transplants in paediatric patients were performed, at the three paediatric centres in the UK. Forty-two of these transplants were for patients on the [elective](#) list and twelve for patients on the [super-urgent](#) list.

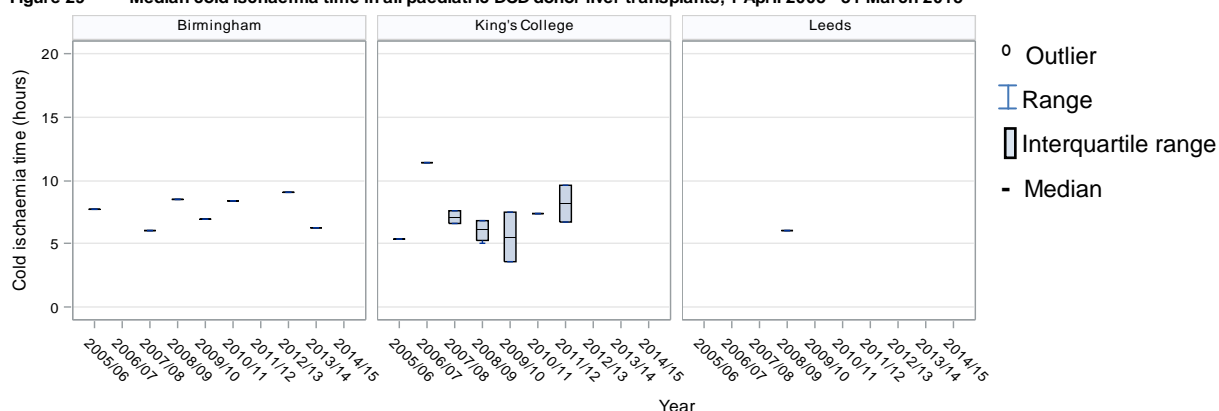
**Figure 27 Deceased donor liver only transplants in paediatric recipients in the UK, 1 April 2005 - 31 March 2015**



The [median cold ischaemia times](#) for paediatric transplant recipients are shown in **Figures 28 and 29** for [DBD](#) and [DCD](#) donors, respectively. Median cold ischaemia times were calculated each year during the last ten years, by transplant centre. The national median cold ischaemia time for transplants from DBD donors has decreased from 10 hours in 2005/06 to 8 hours in 2014/15. The median cold ischaemia time in the last financial year ranged between 8 and 9 hours for all transplant centres. The corresponding median for DCD donor transplants has decreased from 7 hours in 2005/06 to 6 hours in 2013/14 but note that this is based on very few paediatric recipients transplanted from a DCD donor. There was no data for cold ischemia time in paediatric DCD transplants in 2014/15.

**Figure 28 Median cold ischaemia time in all paediatric DBD donor liver transplants, 1 April 2005 - 31 March 2015**



**Figure 29** Median cold ischaemia time in all paediatric DCD donor liver transplants, 1 April 2005 - 31 March 2015

The demographic characteristics of 54 paediatric transplant recipients in the latest year are shown by centre and nationally in **Table 15**. Of these recipients, 46% were male and 33% were aged between one and four years old. Of the 54 transplants, 12 (22%) were of [super-urgent](#) status. For some characteristics, due to rounding, percentages may not add up to 100.

<b>Table 15 (cont'd)</b>		<b>Demographic characteristics of paediatric liver transplant recipients 1 April 2014 - 31 March 2015</b>			
		Birmingham N (%)	King's College N (%)	Leeds N (%)	TOTAL N (%)
Number		18	31	5	54 (100)
<b>Recipient details</b>					
Recip age years	<1	4 (22)	9 (29)	2 (40)	15 (28)
	1-4	8 (44)	9 (29)	1 (20)	18 (33)
	5-12	3 (17)	9 (29)	2 (40)	14 (26)
	13-16	3 (17)	4 (13)	0	7 (13)
Recipient sex	Male	8 (44)	13 (42)	4 (80)	25 (46)
	Female	10 (56)	18 (58)	1 (20)	29 (54)
Indication	Super Urgent	2 (11)	10 (32)	0	12 (22)
	Metabolic	3 (17)	5 (16)	0	8 (15)
	Other	13 (72)	16 (52)	5 (100)	34 (63)
Pre-transplant in-patient status	Out-patient	12 (67)	14 (45)	4 (80)	30 (56)
	In-patient	6 (33)	16 (52)	1 (20)	23 (43)
	Not reported	0	1 (3)	0	1 (2)
Pre-transplant renal support	No	17 (94)	23 (74)	5 (100)	45 (83)
	Yes	1 (6)	7 (23)	0	8 (15)
Ascites	Absence	12 (67)	20 (65)	5 (100)	37 (69)
	Presence	6 (33)	10 (32)	0	16 (30)
	Not reported	0	1 (3)	0	1 (2)

<b>Table 15 (cont'd)</b>		<b>Demographic characteristics of paediatric liver transplant recipients</b>			
		<b>1 April 2014 - 31 March 2015</b>			
		Birmingham N (%)	King's College N (%)	Leeds N (%)	TOTAL N (%)
Previous abdominal surgery	No	14 (78)	18 (58)	4 (80)	36 (67)
	Yes	4 (22)	12 (39)	1 (20)	17 (32)
	Not reported	0	1 (3)	0	1 (2)
INR	<=1.0	13 (72)	2 (6)	1 (20)	16 (30)
	1.1-1.5	4 (22)	8 (26)	4 (80)	16 (30)
	1.6-3.0	0	14 (45)	0	14 (26)
	>3.0	1 (6)	6 (19)	0	7 (13)
	Not reported	0	1 (3)	0	1 (2)
Serum sodium mmol/l	<135	3 (17)	4 (13)	0	7 (13)
	>=135	15 (83)	26 (84)	5 (100)	46 (85)
	Not reported	0	1 (3)	0	1 (2)
<b>Donor details</b>					
Donor age years	<5	0	2 (6)	0	2 (4)
	5-16	3 (17)	7 (23)	2 (40)	12 (22)
	17-30	8 (44)	6 (19)	2 (40)	16 (30)
	>=31	7 (39)	16 (52)	1 (20)	24 (44)
Donor sex	Male	6 (33)	11 (35)	3 (60)	20 (37)
	Female	12 (67)	20 (65)	2 (40)	34 (63)
Donor type	Donor after brain death	18 (100)	27 (87)	5 (100)	50 (93)
	Donor after cardiac death	0	4 (13)	0	4 (7)
Graft appearance	Normal	18 (100)	4 (13)	5 (100)	27 (50)
	Not reported	0	27 (87)	0	27 (50)
Graft type	Whole	5 (28)	6 (19)	2 (40)	13 (24)
	Segmental	13 (72)	25 (81)	3 (60)	41 (76)
Urgency Status	Elective	16 (89)	21 (68)	5 (100)	42 (78)
	Super Urgent	2 (11)	10 (32)	0	12 (22)

# **PAEDIATRIC LIVER TRANSPLANTATION**

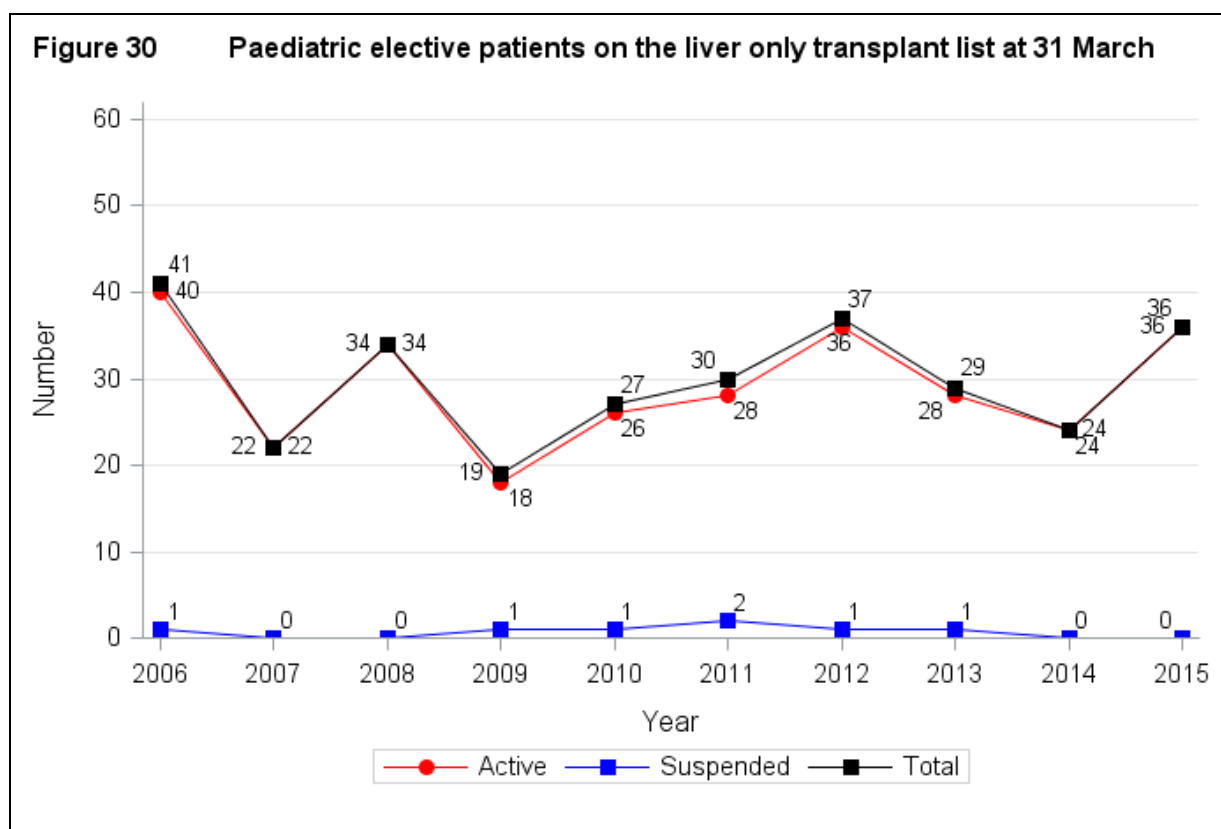
## **ELECTIVE PATIENTS**



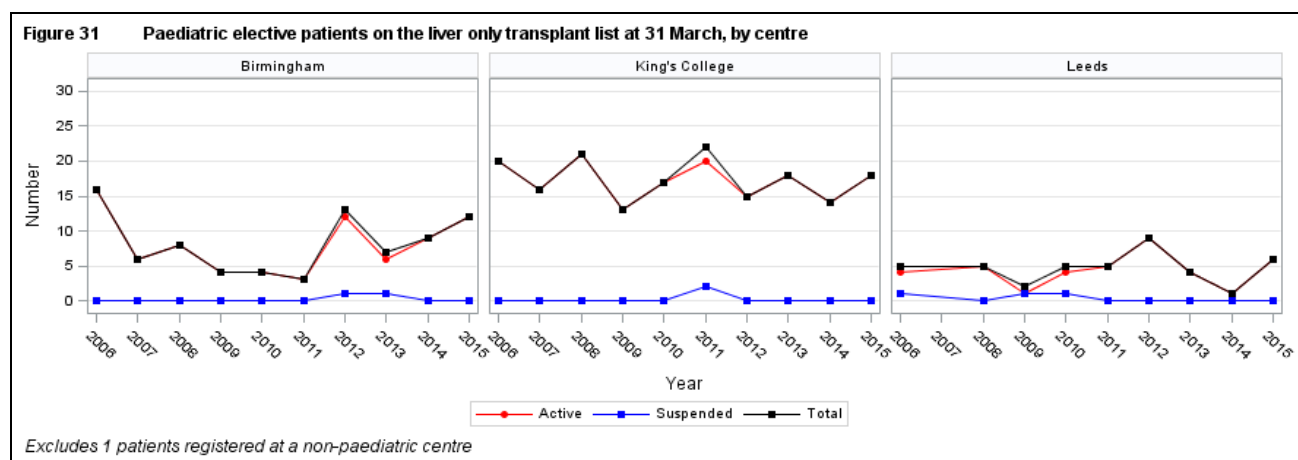
## ELECTIVE PATIENTS

## TRANPLANT LIST

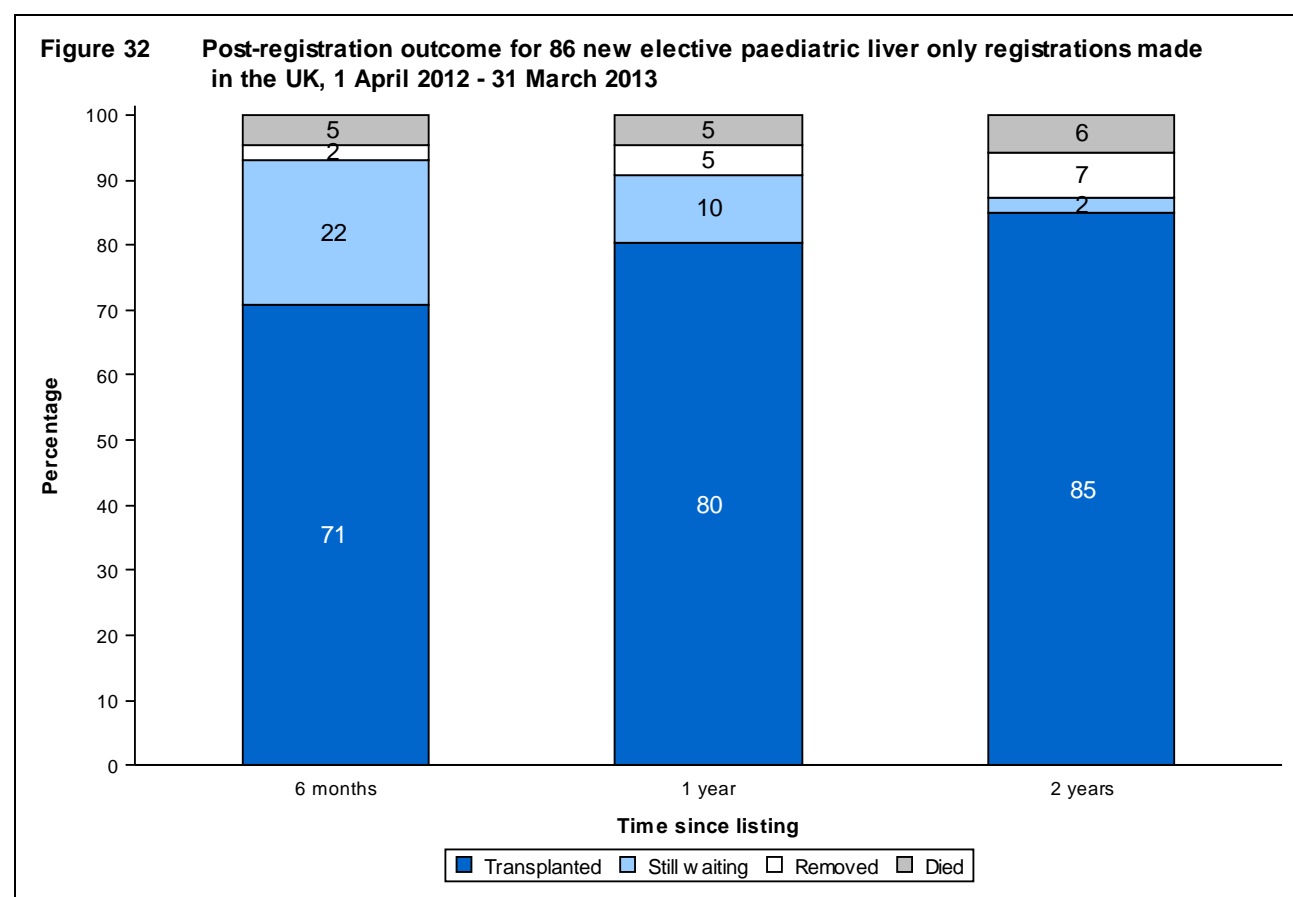
**Figure 30** shows the number of paediatric [elective](#) patients on the liver only transplant list at 31 March each year between 2006 and 2015. The number of patients on the [active](#) liver only transplant list has ranged between 18 and 40 each year. In the last year the number has increased from 24 to 36.



**Figure 31** shows the number of [elective](#) patients on the transplant list at 31 March each year between 2006 and 2015 for each transplant centre.



An indication of outcomes for paediatric patients listed for a liver transplant is summarised in **Figure 32**. This shows the proportion of patients transplanted or still waiting six months, one and two years after joining the list. After one year 80% of patients have had a liver transplant, and 10% are still waiting.

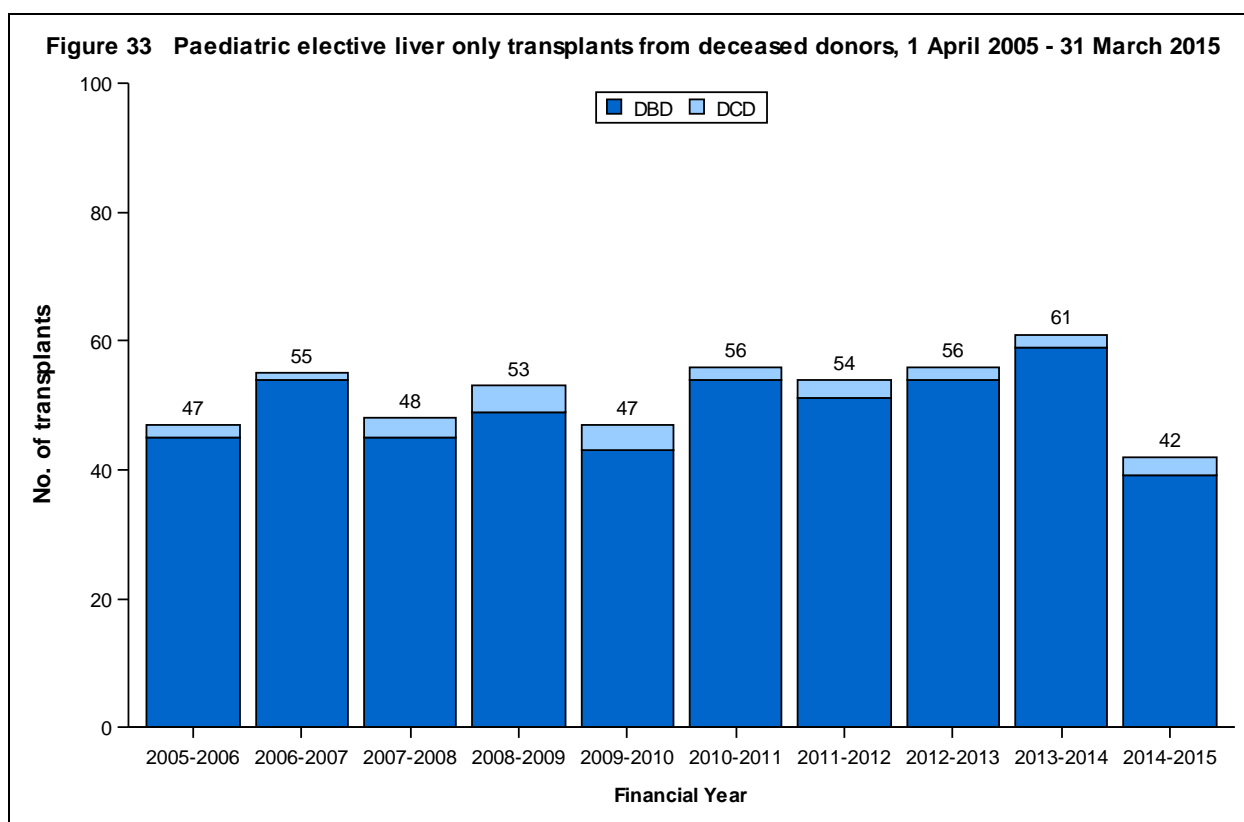


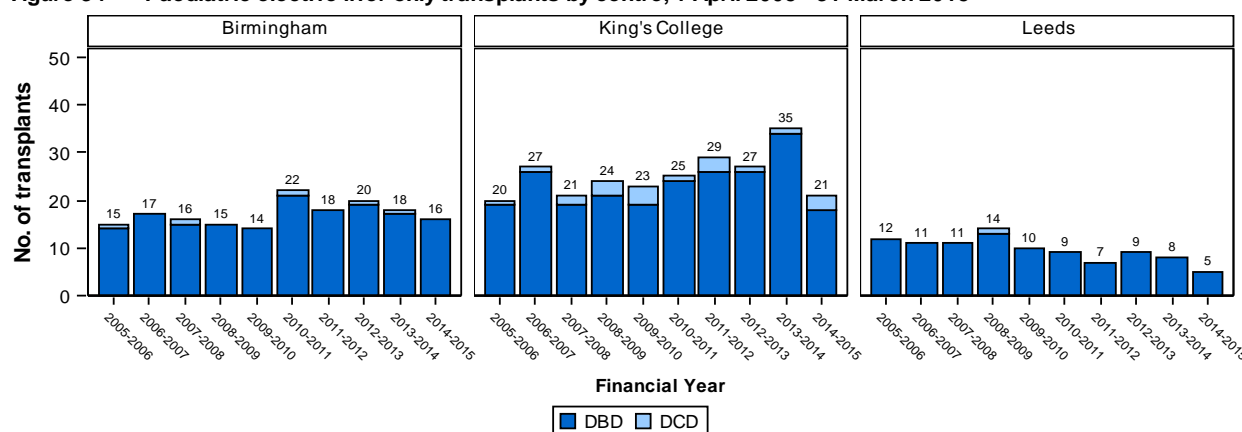
**Table 16** shows the [median waiting time](#) to liver only transplant for paediatric [elective](#) patients. The median waiting time to transplant is shortest at Birmingham, at 53 days, and longest at King's College Hospital, at 114 days. The national median waiting time to transplant is 71 days.

<b>Table 16      Median waiting time to liver only transplant in the UK, for paediatric elective patients registered 1 April 2009 - 31 March 2012</b>			
Transplant centre	Number of patients registered	Waiting time (days)	
		Median	95% Confidence interval
<b>Paediatric</b>			
Birmingham	69	53	34 - 72
Leeds	35	61	35 - 87
King's College	102	114	65 - 163
<b>UK*</b>	<b>207</b>	<b>71</b>	<b>53 - 89</b>
* Includes 1 patients registered at a non-paediatric centre			

## TRANSPLANT ACTIVITY

**Figure 33** shows the number of paediatric [elective](#) liver only transplants from deceased donors performed in the last ten years, by type of donor. **Figure 34** shows the same information by centre.



**Figure 34 Paediatric elective liver only transplants by centre, 1 April 2005 - 31 March 2015**

## POST-TRANSPLANT SURVIVAL

**Table 17** shows the [unadjusted](#) one year paediatric [patient survival](#) for all 227 transplants from 1 April 2010 to 31 March 2014, nationally and by centre.

<b>Table 17 One year unadjusted patient survival for paediatric elective first transplants, 1 April 2010 - 31 March 2014</b>			
Centre	Number of transplants	1-year survival % (95% CI)	
Leeds	33	93.8	(77.5 - 98.4)
King's College	116	96.5	(90.9 - 98.7)
Birmingham	78	96.2	(88.5 - 98.7)
<b>Total</b>	<b>227</b>	<b>96.0</b>	<b>(92.4 - 97.9)</b>

**Table 18** shows the [unadjusted](#) five year paediatric [patient survival](#) for all 203 transplants from 1 April 2006 to 31 March 2010, nationally and by centre.

<b>Table 18 Five year unadjusted patient survival for paediatric elective first transplants, 1 April 2006 - 31 March 2010</b>			
Centre	Number of transplants	5-year survival % (95% CI)	
Leeds	46	82.3	(67.6 - 90.7)
King's College	95	92.5	(85.0 - 96.4)
Birmingham	62	93.5	(83.7 - 97.5)
<b>Total*</b>	<b>203</b>	<b>90.4</b>	<b>(85.3 - 93.8)</b>

# **PAEDIATRIC LIVER TRANSPLANTATION**

## **SUPER URGENT PATIENTS**



## SUPER-URGENT PATIENTS

### TRANSPLANT LIST

**Table 19** shows the [median waiting time](#) to liver only transplant for paediatric [super-urgent](#) patients. The median waiting time to transplant is shortest at Leeds and longest at King's College and Birmingham but there is no statistically significant difference across the three centres. The national median waiting time to transplant is three days.

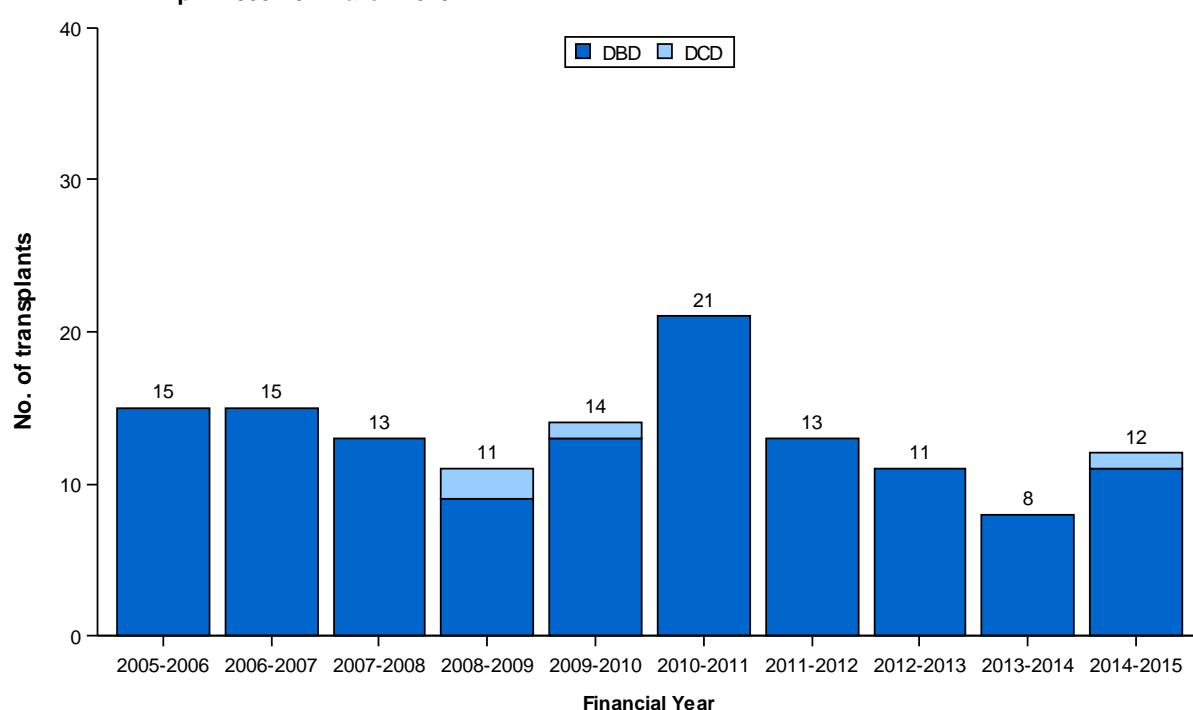
<b>Table 19      Median waiting time to liver only transplant in the UK, for paediatric super-urgent patients registered 1 April 2009 - 31 March 2012</b>			
Transplant centre	Number of patients registered	Waiting time (days) Median	95% Confidence interval
<b>Paediatric</b>			
Leeds	15	2	1 - 3
King's College	38	4	2 - 6
Birmingham	25	4	2 - 6
<b>UK*</b>	<b>81</b>	<b>3</b>	<b>2 - 4</b>
* Includes 3 patients registered at a non-paediatric centre			

**Table 19** includes registrations for a re-transplant. Of the 81 registrations for the UK in the three-year time period, only 57 led to transplants (the remaining 24 led to removal, suspension or death). Nine of the 57 transplants were re-transplants, hence, the difference between the 48 *first* liver only transplants reported in **Figure 35** for the period 2009 – 2012 and **Table 19**.

### TRANSPLANT ACTIVITY

**Figure 35** shows the number of paediatric [super-urgent](#) liver only transplants from deceased donors performed in the last ten years, by type of donor. **Figure 36** shows the same information by transplant centre.

**Figure 35 Paediatric super-urgent liver only transplants from deceased donors, 1 April 2005 - 31 March 2015**



## POST-TRANSPLANT SURVIVAL

One year [unadjusted patient survival](#) for 53 transplants in 1 April 2010 to 31 March 2014 is shown in **Table 20**.

Table 20 One year unadjusted patient survival for paediatric super urgent first transplants, 1 April 2010 - 31 March 2014			
Centre	Number of transplants	1-year survival % (95% CI)	
Leeds	9	88.9	(43.3 - 98.4)
King's College	26	79.6	(57.5 - 91.1)
Birmingham	17	70.6	(43.1 - 86.6)
<b>Total*</b>	<b>53</b>	<b>79.0</b>	<b>(65.3 - 87.8)</b>
* Includes 1 patients transplanted at a non-paediatric centre			

**Table 21** shows the [unadjusted](#) five year paediatric [patient survival](#) for 53 transplants in 1 April 2006 to 31 March 2010, nationally and by centre.

<b>Table 21      Five year unadjusted patient survival for paediatric super urgent first transplants, 1 April 2006 - 31 March 2010</b>			
Centre	Number of transplants	5-year survival % (95% CI)	
Leeds	5	80.0	(20.4 - 96.9)
King's College	28	74.7	(54.1 - 87.1)
Birmingham	19	78.9	(53.2 - 91.5)
<b>Total*</b>	<b>53</b>	<b>75.4</b>	<b>(61.4 - 84.9)</b>
* Includes 1 patients transplanted at a non-paediatric centre			

## DATA COLLECTION

Form return rates are reported in **Table 22** for the liver transplant record, three month and one year follow up form, along with lifetime follow up (after the first year). These include all paediatric [elective and super-urgent](#) transplants between 1 January 2014 and 31 December 2014 for the transplant record, and all requests for follow up forms issued in this time period.

<b>Table 22      Form return rates, 1 January 2014 and 31 December 2014</b>								
Centre	Transplant record		3 month follow-up		1 year follow-up		Lifetime follow-up	
	N	% returned	N	% returned	N	% returned	N	% returned
Leeds	7	100	8	100	8	100	75	89
King's College	32	100	33	100	37	97	198	83
Birmingham	18	100	22	95	18	100	136	98

# APPENDIX



## APPENDIX

### APPENDIX 1 - DATA

Data were obtained from the UK Transplant Registry for the ten year time period, 1 April 2005 to 31 March 2015 and include NHS Group 2 transplants, auxiliary transplants, liver only transplants for intestinal failure patients and exclude all other transplants involving the liver for intestinal failure patients.

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

<b>Table 1      Number of adult liver transplants in each time period, by transplant centre and urgency status</b>						
Centre	Latest year		Last 3 years		Last 10 years	
	April 2014-March 2015		April 2012-March 2015		April 2005-March 2015	
	Elective	Super-urgent	Elective	Super-urgent	Elective	Super-urgent
Newcastle	30	5	106	18	305	62
Leeds	95	10	293	31	768	102
Cambridge	77	10	217	34	667	85
Royal Free	75	13	223	37	589	92
King's College	170	25	466	63	1352	225
Birmingham	171	23	498	60	1264	207
Edinburgh	88	8	245	34	645	98
<b>TOTAL</b>	<b>706</b>	<b>94</b>	<b>2048</b>	<b>277</b>	<b>5590</b>	<b>871</b>

<b>Table 2      Number of deceased donor adult first liver only transplants in each time period, by transplant centre and urgency status</b>						
Centre	Latest year		Last 3 years		Last 10 years	
	April 2014-March 2015		April 2012-March 2015		April 2005-March 2015	
	Elective	Super-urgent	Elective	Super-urgent	Elective	Super-urgent
Newcastle	26	4	91	14	266	49
Leeds	77	7	261	20	696	72
Cambridge	68	4	197	18	598	52
Royal Free	68	11	204	28	538	68
King's College	144	21	404	47	1150	186
Birmingham	154	18	447	43	1157	156
Edinburgh	84	4	228	24	583	71
<b>TOTAL</b>	<b>621</b>	<b>69</b>	<b>1832</b>	<b>194</b>	<b>4988</b>	<b>654</b>

**Table 3** shows the total number of paediatric transplants in the three time periods defined in the report, including atypical donor, [multi-organ](#) and re-transplants. **Table 4** shows the number of paediatric deceased donor first liver only transplants

<b>Table 3      Number of paediatric liver transplants in each time period, by transplant centre and urgency status</b>						
Centre	Latest year		Last 3 years		Last 10 years	
	April 2014-March 2015		April 2012-March 2015		April 2005-March 2015	
	Elective	Super-urgent	Elective	Super-urgent	Elective	Super-urgent
Newcastle	0	0	0	0	0	1
Leeds	14	0	47	2	138	25
Cambridge	0	0	0	0	0	0
Royal Free	0	0	1	1	1	2
King's College	27	14	114	31	386	91
Birmingham	25	2	74	16	229	63
Edinburgh	0	0	0	0	0	1
<b>TOTAL</b>	<b>66</b>	<b>16</b>	<b>236</b>	<b>50</b>	<b>754</b>	<b>183</b>

<b>Table 4      Number of deceased donor paediatric first liver only transplants in each time period, by transplant centre and urgency status</b>						
Centre	Latest year		Last 3 years		Last 10 years	
	April 2014-March 2015		April 2012-March 2015		April 2005-March 2015	
	Elective	Super-urgent	Elective	Super-urgent	Elective	Super-urgent
Newcastle	0	0	0	0	0	1
Leeds	5	0	22	1	96	17
Cambridge	0	0	0	0	0	0
Royal Free	0	0	0	0	0	1
King's College	21	10	83	22	252	70
Birmingham	16	2	54	8	171	43
Edinburgh	0	0	0	0	0	1
<b>TOTAL</b>	<b>42</b>	<b>12</b>	<b>159</b>	<b>31</b>	<b>519</b>	<b>133</b>

Transplants were excluded from the [patient survival](#) analysis if [risk factors](#) were missing and were not imputed.

## APPENDIX 2 - METHODS

### Waiting time to transplant

Waiting time is calculated from date of registration to date of transplant, for patients registered between 1 April 2008 and 31 March 2011 for a liver. Patients who are registered for another organ are excluded and only deceased donor transplants are included.

Registrations for a re-transplant are included. [Kaplan-Meier](#) estimates are used to calculate waiting time, where patients who are removed or died on the waiting list are censored at the date of 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.

### Unadjusted survival rates

[Unadjusted patient survival](#) and [graft function](#) rates were estimated using [Kaplan-Meier](#) methods. Patient survival rates are based on the number of patients transplanted and the number and timing of those that die within the post-transplant period of interest. Patients can be included in this method of analysis irrespective of the length of follow-up recorded. If a patient is alive at the end of the follow-up then information about the survival of the patient is censored at time of analysis, 1 June 2015. Death, irrespective of whether the graft is still functioning or not, is classed as an event. Estimates of graft function follow similar principles but the event of interest is graft failure in living post-transplant patients instead of patient death.

### Risk-adjusted survival rates

A [risk-adjusted survival rate](#) is an estimate of what the survival rate at a centre would have been if they had had the same mix of patients as that seen nationally. The risk-adjusted rate therefore presents estimates in which differences in 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 patient mix.

Risk factors with missing values were imputed using multiple imputation, a method which samples the full data to estimate a missing value based on other factors.

Risk-adjusted survival estimates were obtained through indirect standardisation. A [Cox Proportional Hazards model](#) was used to determine the probability of survival for each patient based on their individual risk factor values. The sum of these probabilities for all patients at a centre gives the number,  $E$ , of patients or grafts expected to survive at least one year or five years after transplant at that centre. The number of patients who actually survive the given time period is given by  $O$ . The risk-adjusted estimate is then calculated by multiplying the ratio  $O/E$  by the overall unadjusted survival rate across all centres. The risk-adjustment models used were based on results from previous studies that looked at factors affecting the survival rates of interest. The factors included in the **survival post transplantation** models are shown in **Tables 5 and 6** below.

The [funnel plot](#) is a graphical method to show how consistent the survival rates of the different transplant centres are compared to the national rate. The graph shows for each centre, a survival rate plotted against the number of transplants undertaken, with the national rate and [confidence limits](#) around this national rate superimposed. In this report, 95% and 99.8% confidence limits were used. Units that lie within the confidence limits have survival rates that are statistically consistent with the national rate. When a unit is close to or outside the limits, this is an indication that the centre may have a rate that is considerably different from the national rate.

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

## APPENDIX 3 - RISK MODELS

Table 5 Risk factors and categories used in the adult elective risk adjusted survival models post transplantation	
Recipient sex	Male Female
Recipient ethnicity	White Non-white
Indication	Cancer HCV ALD HBV PSC PBC AID Metabolic Other Acute hepatic failure
Recipient HCV status	Negative Positive
Pre-transplant in-patient status	Out-patient In-patient
Ascites	Absence Presence
Encephalopathy	Absence Presence
Pre-transplant renal support	No Yes
Previous abdominal surgery	No Yes
Varices & shunt	Absence Presence without treatment Presence with surgical shunt Presence with TIPS
Life style activity	Normal Restricted Self-care Confined Reliant
Graft appearance	Normal Abnormal
Recipient age years	Per 1 year increase
BMI kg/m <sup>2</sup>	Per 1 kg/m <sup>2</sup> increase
Serum Bilirubin µmol/l	≤30 31-50 51-70 71-90 ≥91
Serum Creatinine µmol/l	≤70 71-90 91-110 111-130

<b>Table 5 Risk factors and categories used in the adult elective risk adjusted survival models post transplantation</b>	
	≥131
Serum sodium mmol/l	Per 10 mmol/l increase
Serum potassium mmol/l	Per 1 mmol/l increase
INR	Per 1 unit increase
Serum Albumin g/l	Per 5g/l increase
Cold Ischaemia time	Per 1 hour increase
Time on transplant list	Per 1 month increase
Donor sex	Male
	Female
Donor ethnicity	White
	Non-white
Donor cause of death	Trauma
	CVA
	Others
Donor history of diabetes	No
	Yes
Donor type	Donor after brain death
	Donor after cardiac death
ABO match	Identical
	Compatible
	Incompatible
Graft type	Whole
	Segmental
Donor age years	Per 1 year increase
Donor BMI kg/m <sup>2</sup>	Per 1 kg/ m <sup>2</sup> increase

<b>Table 6 Risk factors and categories used in the adult super-urgent risk adjusted survival models post transplantation</b>	
Recipient sex	Male
	Female
Recipient ethnicity	White
	Non-white
Recipient HCV status	Negative
	Positive
Pre-transplant in-patient status	Out-patient
	In-patient
Ascites	Absence
	Presence
Encephalopathy	Absence
	Presence
Pre-transplant renal support	No
	Yes
Previous abdominal surgery	No
	Yes
Varices & shunt	Absence
	Presence without treatment
	Presence with surgical shunt
	Presence with TIPS

<b>Table 6</b> <b>Risk factors and categories used in the adult super-urgent risk adjusted survival models post transplantation</b>	
Life style activity	Normal Restricted Self-care Confined Reliant
Graft appearance	Normal Abnormal
Recip age years	Per 1 year increase
BMI kg/m <sup>2</sup>	Per 1 kg/m <sup>2</sup> increase
Serum Bilirubin µmol/l	≤100 101-200 201-300 301-400 ≥401
Serum Creatinine µmol/l	≤100 101-130 131-160 161-190 ≥191
Serum sodium mmol/l	Per 10 mmol/l increase
Serum potassium mmol/l	Per 1 mmol/l increase
INR	Per 1 unit increase
Serum Albumin g/l	Per 5g/l increase
Cold Ischaemia time	Per 1 hour increase
Time on transplant list	Per 1 day increase
Donor sex	Male Female
Donor ethnicity	White Non-white
Donor cause of death	Trauma CVA Others
Donor history of diabetes	No Yes
Donor type	Donor after brain death Donor after cardiac death
ABO match	Identical Compatible Incompatible
Graft type	Whole Segmental
Donor age years	Per 1 year increase
Donor BMI kg/m <sup>2</sup>	Per 1 kg/ m <sup>2</sup> increase

## APPENDIX 4 - 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.

### 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.

### Confidence interval (CI)

When an estimate of a quantity such as a survival rate is obtained from data, the value of the estimate depends on the set of patients whose data were used. If, by chance, data from a different set of patients had been used, the value of the estimate may have been different. There is therefore some uncertainty linked with any estimate. A confidence interval is a range of values whose width gives an indication of the uncertainty or precision of an estimate. The number of transplants or patients analysed influences the width of a confidence interval. Smaller data sets tend to lead to wider confidence intervals compared to larger data sets. Estimates from larger data sets are therefore more precise than those from smaller data sets. Confidence intervals are calculated with a stated probability, usually 95%. We then say that there is a 95% chance that the confidence interval includes the true value of the quantity we wish to estimate.

### Confidence limit

The upper and lower bounds of a [confidence interval](#).

### **Cox Proportional Hazards model**

A statistical model that relates the instantaneous risk (hazard) of an event occurring at a given time point to the [risk factors](#) that influence the length of time it takes for the event to occur. This model can be used to compare the hazard of an event of interest, such as graft failure or patient death, across different groups of patients.

### **Donor type**

Liver donors can be of different types.

*Donor after brain death (DBD).* A donor whose heart is still beating when their entire brain has stopped working so that they cannot survive without the use of a ventilator. Organs for transplant are removed from the donor while their heart is still beating, but only after extensive tests determine that the brain cannot recover and they have been certified dead.

*Donor after circulatory death (DCD).* A donor whose heart stops beating before their brain stops working and who is then certified dead. The organs are then removed.

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

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

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

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

### **Funnel plot**

A graphical method that shows how consistent the rates, such as survival rates or decline rates, of the different transplant units are compared to the national rate. For survival rates, the graph shows for each unit, a survival rate plotted against the number of transplants undertaken, with the national rate and [confidence limits](#) around this national rate superimposed. In this report, 95% and 99.8% confidence limits were used. Units that lie within the confidence limits have survival rates that are statistically consistent with the national rate. When a unit is close to or outside the limits, this is an indication that the centre may have a rate that is considerably different from the national rate.

### **Graft function**

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

### **Inter-quartile range (IQR)**

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

### Kaplan-Meier method

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

### Median

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

### Multi-organ transplant

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

### Patient survival rate

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

### *p* value

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

### Risk-adjusted survival rate

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

### Risk factors

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

**Unadjusted survival rate**

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

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