



Blood and Transplant

**ANNUAL REPORT ON
LIVER TRANSPLANTATION**

**REPORT FOR 2013/2014
(1 APRIL 2004 – 31 MARCH 2014)**

PUBLISHED SEPTEMBER 2014

PRODUCED IN COLLABORATION WITH NHS ENGLAND



CONTENTS



CONTENTS

EXECUTIVE SUMMARY	5
INTRODUCTION	7
TRANSPLANT LIST	7
TRANSPLANT ACTIVITY	8
ADULT LIVER TRANSPLANTATION	12
OVERVIEW	12
ELECTIVE PATIENTS	16
TRANSPLANT LIST	16
TRANSPLANT ACTIVITY	18
POST-TRANSPLANT SURVIVAL	25
SURVIVAL FROM LISTING	30
SUPER URGENT PATIENTS	33
TRANSPLANT LIST	33
TRANSPLANT ACTIVITY	34
POST-TRANSPLANT SURVIVAL	40
PAEDIATRIC LIVER TRANSPLANTATION	46
OVERVIEW	46
90-DAY POST-TRANSPLANT SURVIVAL AND GRAFT FUNCTION	49
ELECTIVE PATIENTS	52
TRANPLANT LIST	52
TRANSPLANT ACTIVITY	54
POST-TRANSPLANT SURVIVAL	55
SUPER URGENT PATIENTS	58
TRANSPLANT LIST	58
TRANSPLANT ACTIVITY	58
POST-TRANSPLANT SURVIVAL	60
CONTINUOUS MONITORING OF CENTRE OUTCOMES	62
ADULT TRANSPLANTS	62
PAEDIATRIC TRANSPLANTS	64
APPENDIX	66
DATA	66
METHODS	67
RISK MODELS	69
GLOSSARY OF TERMS	73

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 2004 to 31 March 2014. 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 2014, there were 549 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 steadily increased from 2007/08 to 2011/12. Of those patients on the elective liver only waiting list, approximately 72% had received a transplant two years post registration.
- There were 7156 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 increased only in the last three years.
- The national rates of survival and [graft function](#) 90 days after first liver **transplantation of elective adults** from deceased donors are 96% and 92.4%, respectively. These rates vary between centres, ranging from 93.9% to 97.4% for survival and from 90.3% to 94.4% for [graft function](#).
- The national rates of survival and [graft function](#) 90 days after first liver **transplantation of super urgent adults** from deceased donors are 91.5% and 88.7%, respectively. Centre-specific estimates of these rates must be interpreted with caution due to the small number of transplants upon which they are based.
- The national 90-day survival and [graft function](#) rates for **paediatric first liver transplants** from deceased donors were estimated at 98.5% and 89.7%, respectively.
- The [unadjusted](#) national survival rate for **paediatric elective** first liver only transplants is 95% at one, 92.4% at three and 90.8% at five years post-transplant.
- The [unadjusted](#) national survival rate for **paediatric super urgent** first liver only transplants is 76.7% at one, 71% at three and 69.7% at five years post-transplant.

INTRODUCTION



INTRODUCTION

This report presents information on the UK transplant list, transplant activity and transplant outcomes between 1 April 2004 and 31 March 2014, 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 comprising the whole 10-year period, the most recent year (1 April 2013 to 31 March 2014) and the last 3 years (1 April 2011 to 31 March 2014). [Patient survival](#) from registration is presented for the period 1 January 2002 to 31 December 2013. Results are described separately for adult (aged ≥ 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 ≥ 18 years.

TRANSPLANT LIST

Figure 1 shows the total number of liver patients on the [active transplant list](#) at 31 March each year between 2005 and 2014. The number of patients waiting for a transplant increased each year from 268 in 2008 to 553 in 2012 and fell slightly to 494 in 2013, then increased again to 549 in 2014.

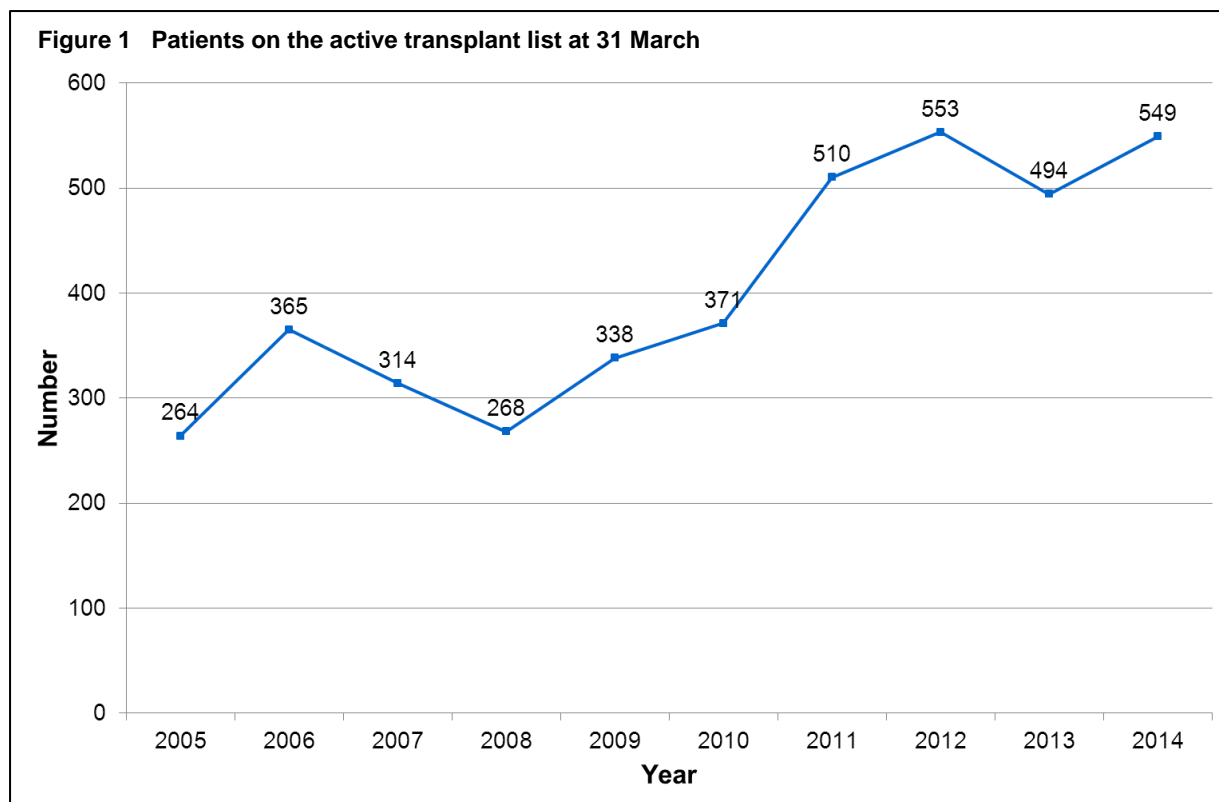
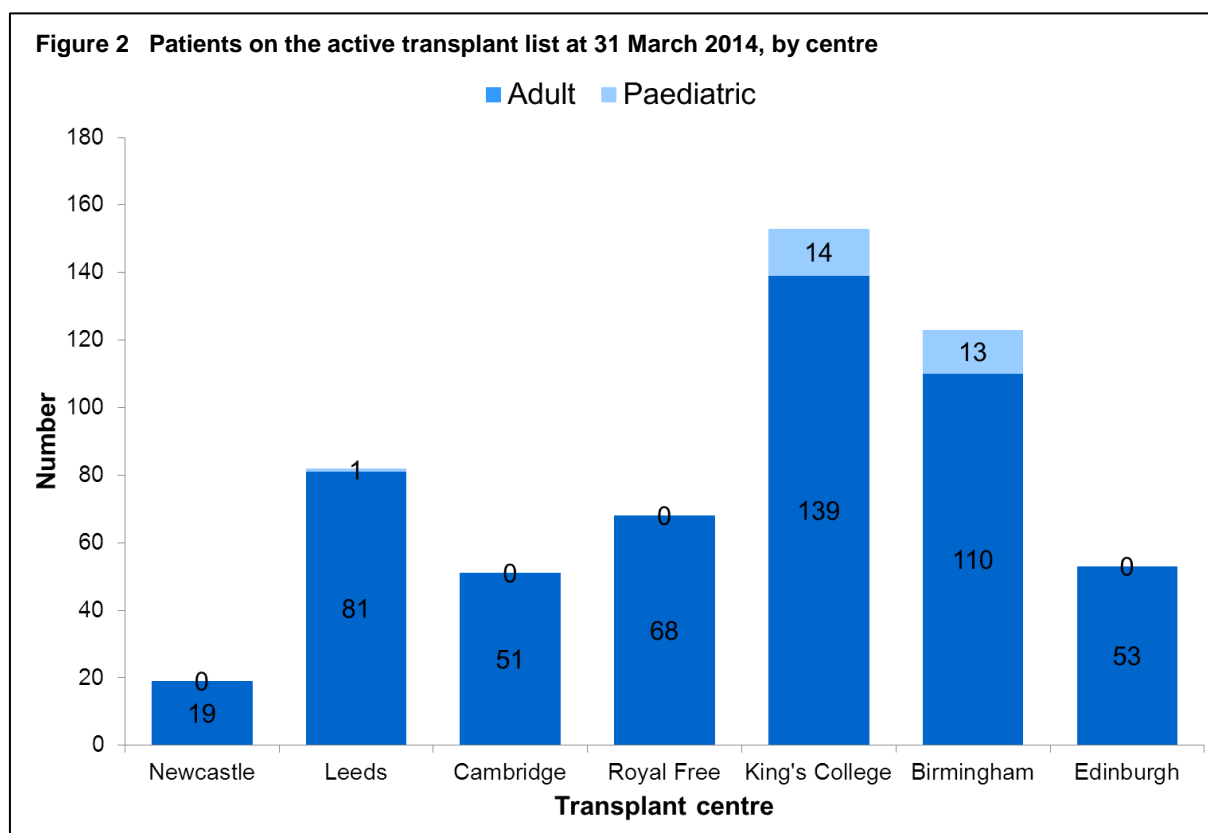


Figure 2 shows the number of adult and paediatric patients on the transplant list at 31 March 2014 by centre. In total, there were 521 adults and 28 paediatric patients. King's College Hospital had the largest proportion of the transplant list (28%) and Newcastle the smallest (3%).



An indication of long-term outcomes for patients listed between April 2011 and March 2012, 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 65% 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 [DCD](#) donors has been steadily increasing over the time period to 153 in the last financial year. The number of transplants from [DBD](#) donors has increased in the last couple of years to 726 in 2013/2014. The number of [living](#) liver transplants performed has slightly decreased in the last financial year, from 31 in the previous financial year to 28. There were 4 domino transplants in the last financial year.

Figure 3 Post-registration outcome for 940 new elective liver only registrations made in the UK, 1 April 2011 – 31 March 2012

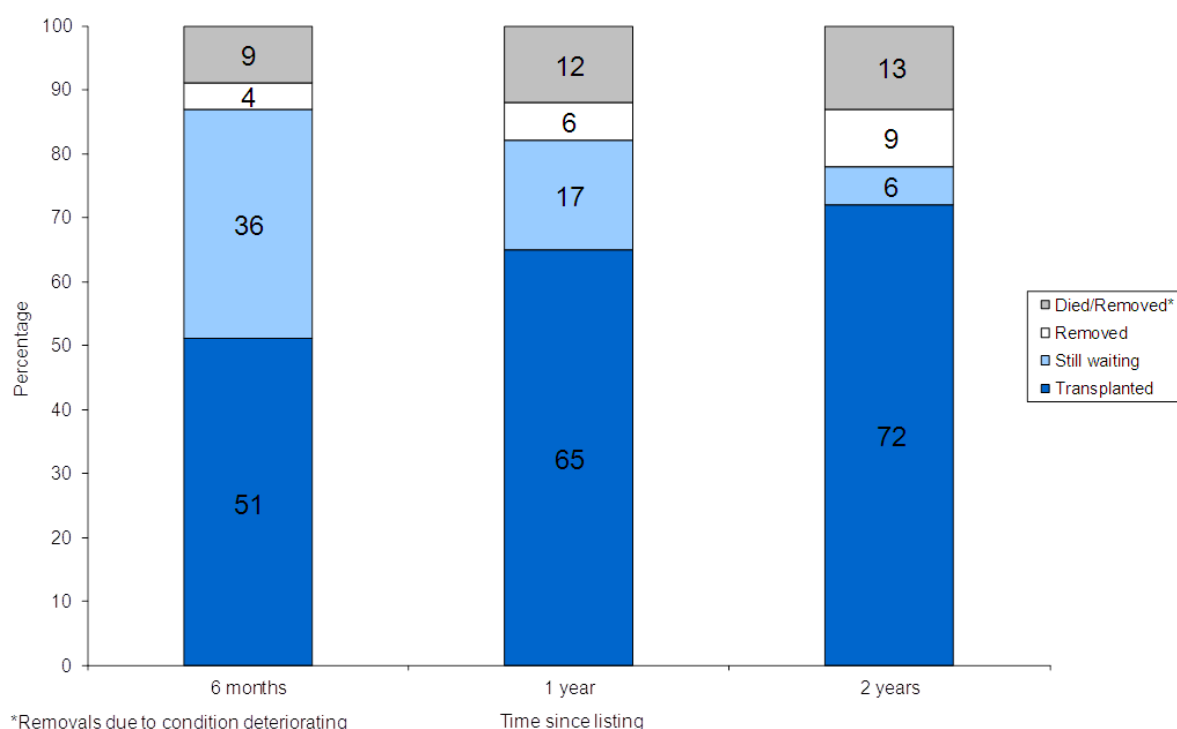


Figure 4 Total number of liver transplants by donor type, 1 April 2004 – 31 March 2014

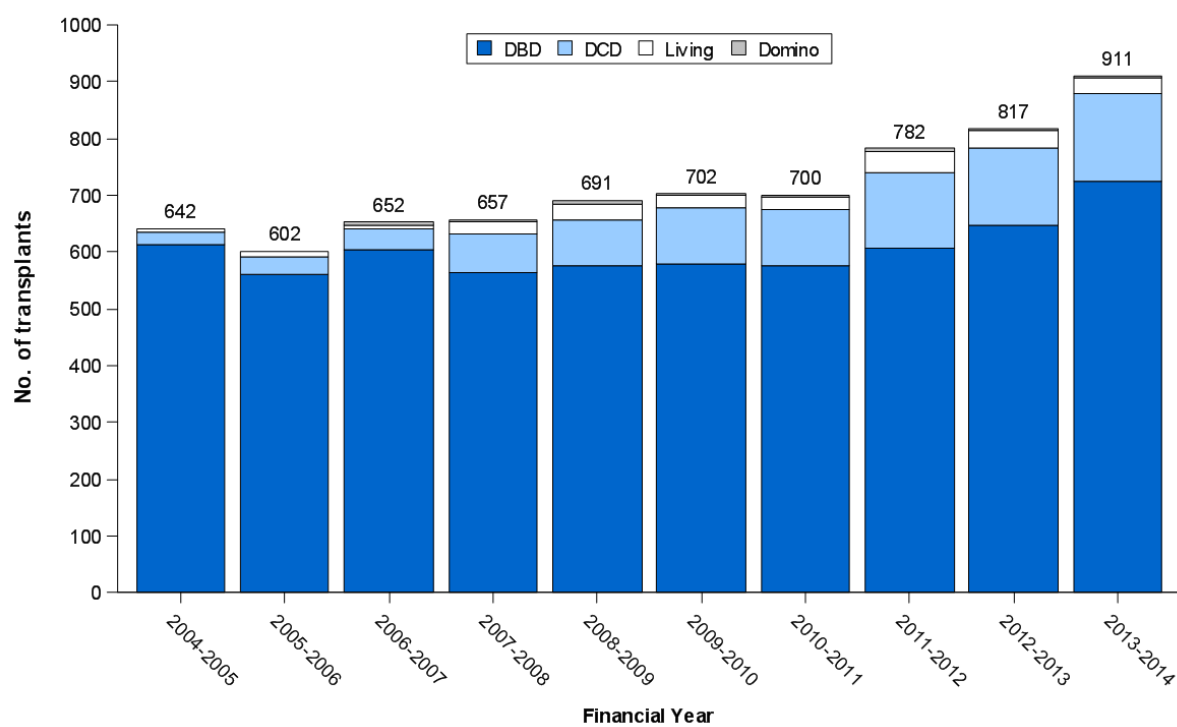
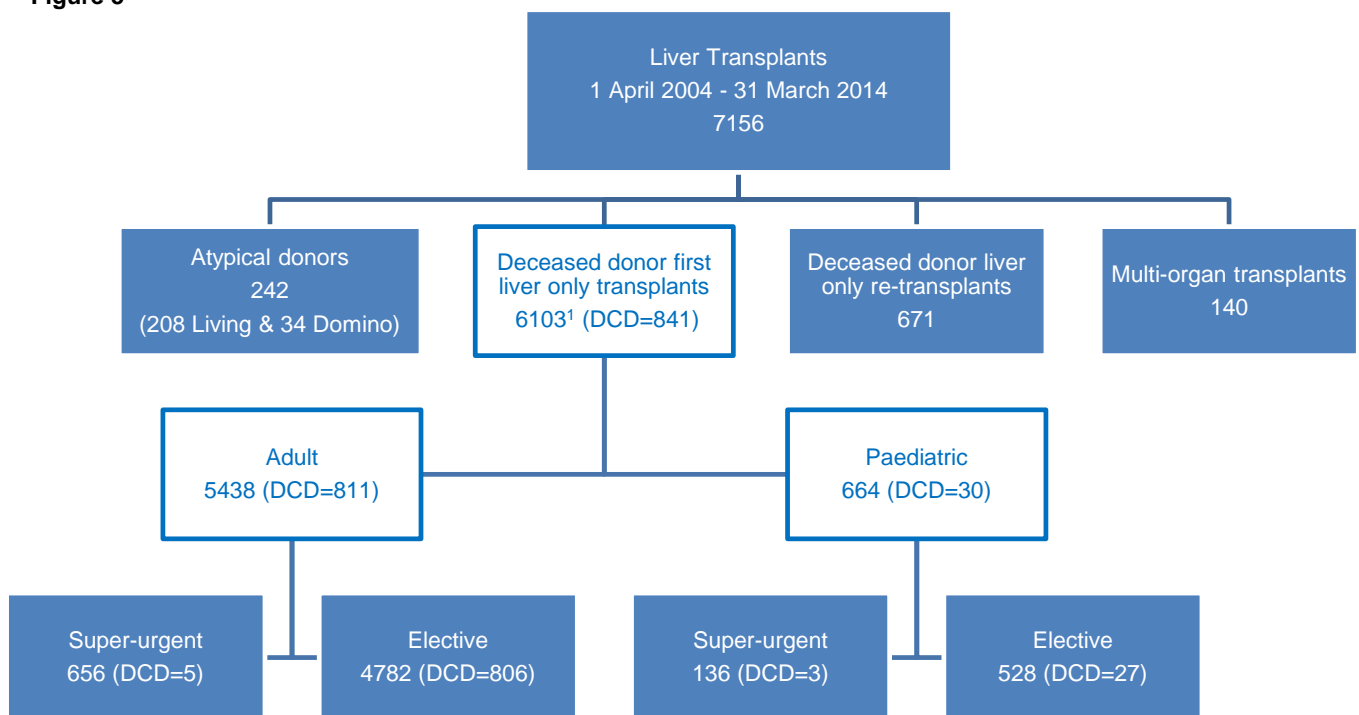


Figure 5 details the 7156 liver transplants performed in the UK in the ten year period. Of these, 6103 (85%) were deceased donor first liver only transplants. One transplant recipient refused consent for their data to be used in analysis and therefore could not be categorised as an adult or paediatric patient, so 6102 transplants were analysed: 5438 (89%) in adult and 664 (11%) in paediatric patients. Of the 6102 transplants, 5310 (87%) were elective and 792 (13%) were super-urgent transplants.

Figure 5



¹ 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 701 transplants in the latest financial year, 630 were elective and 71 were super urgent transplants.

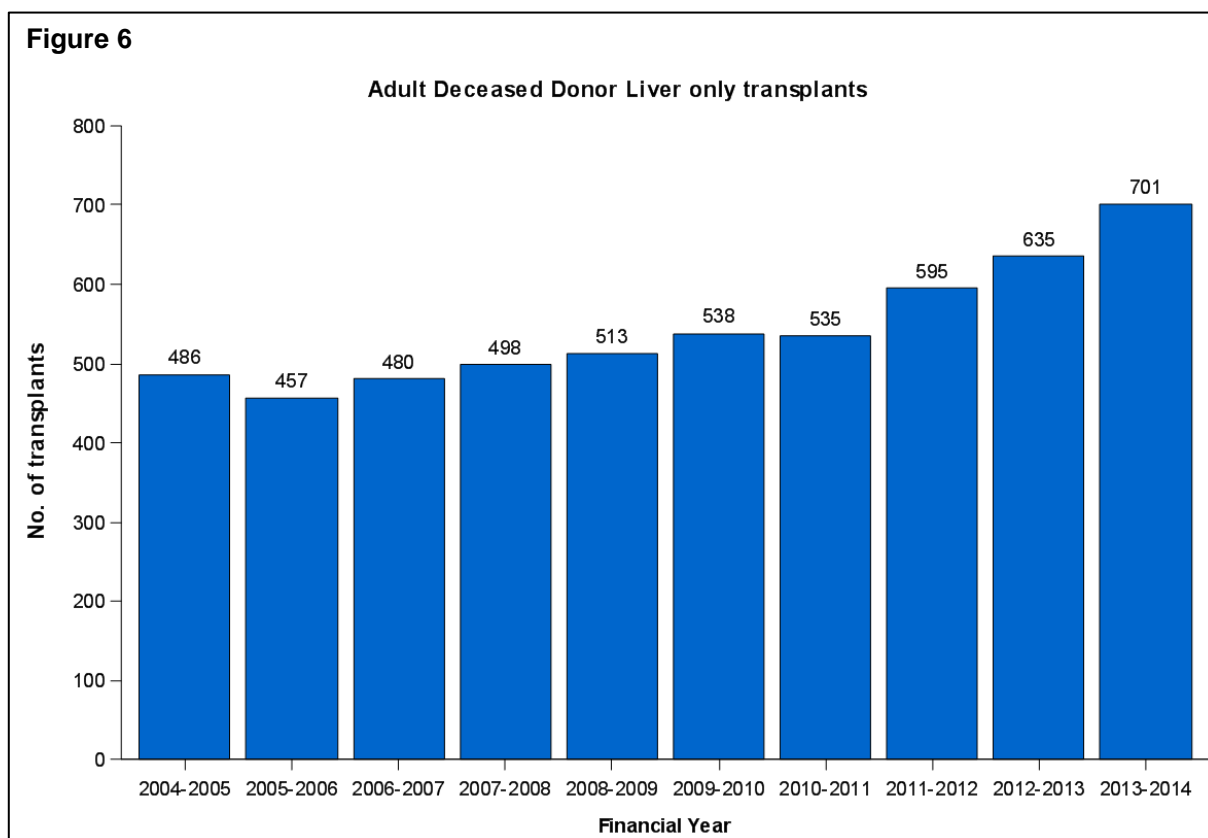
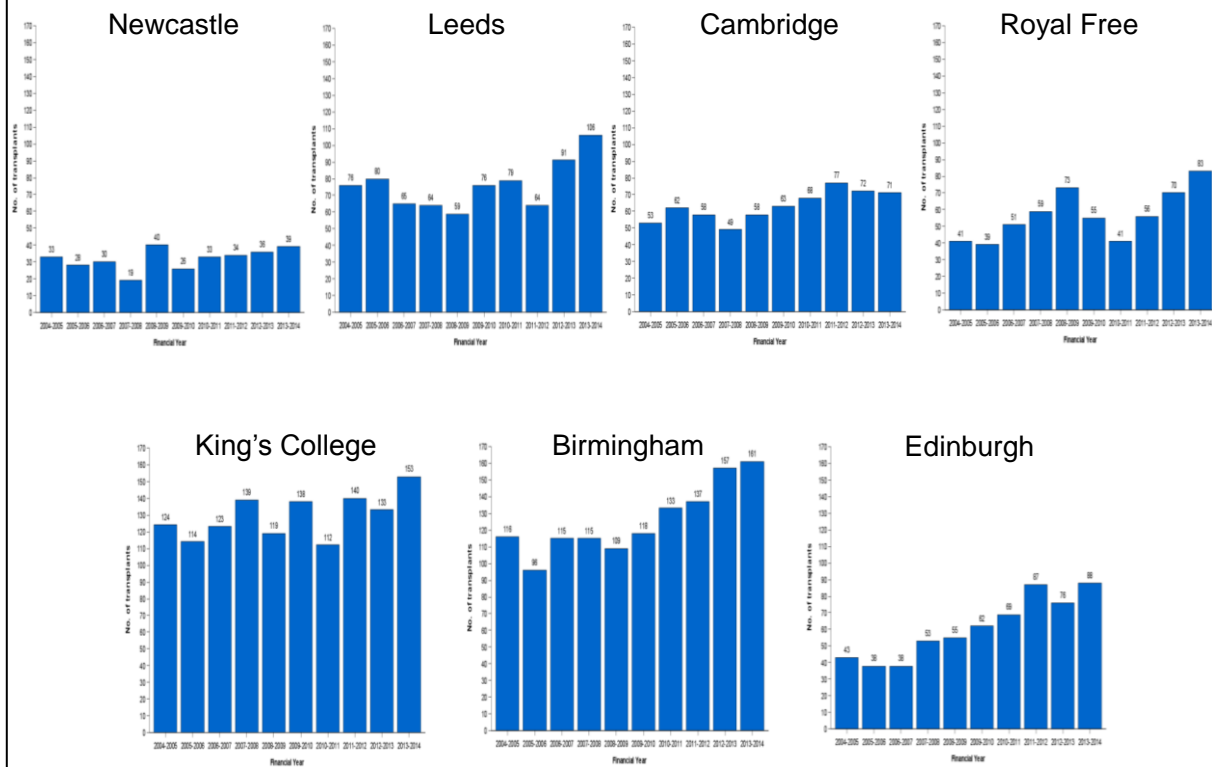


Figure 7 Adult deceased donor liver only transplants by centre



The [median](#) cold ischaemic times for adult transplant recipients are shown in **Figures 8 and 9** for [DBD](#) and [DCD](#) donors, respectively. [Median](#) cold ischaemic times were calculated each year during the last ten years, by transplant centre. The national [median](#) cold ischaemic time for transplants from [DBD](#) donors has decreased from 10 hours in 2004/05 to 9 hours in 2013/14. The [median](#) cold ischaemic time in the last financial year ranged between 8 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 ischaemic 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 2004 - 31 March 2014

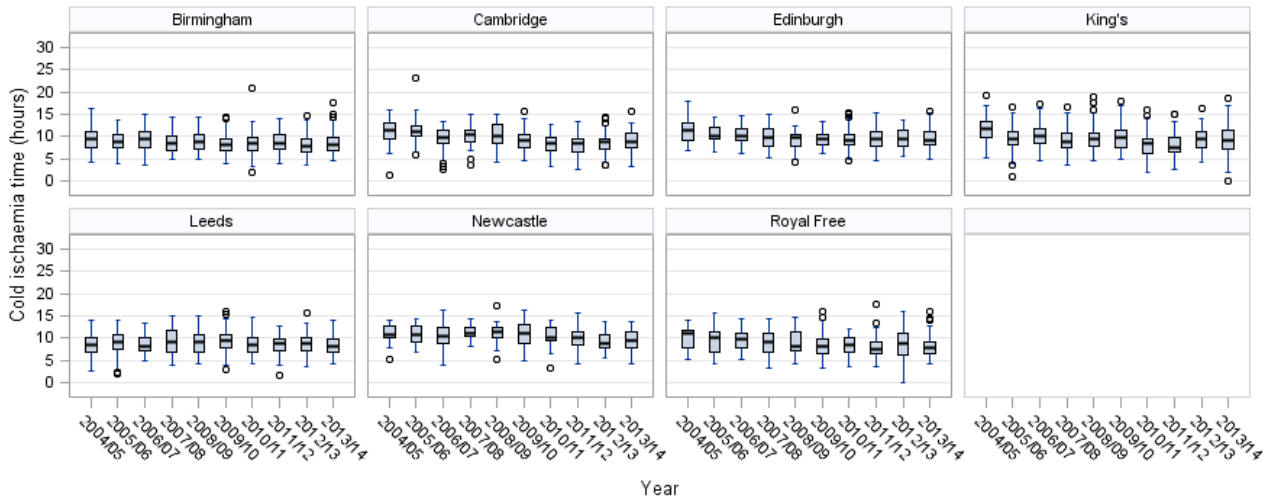
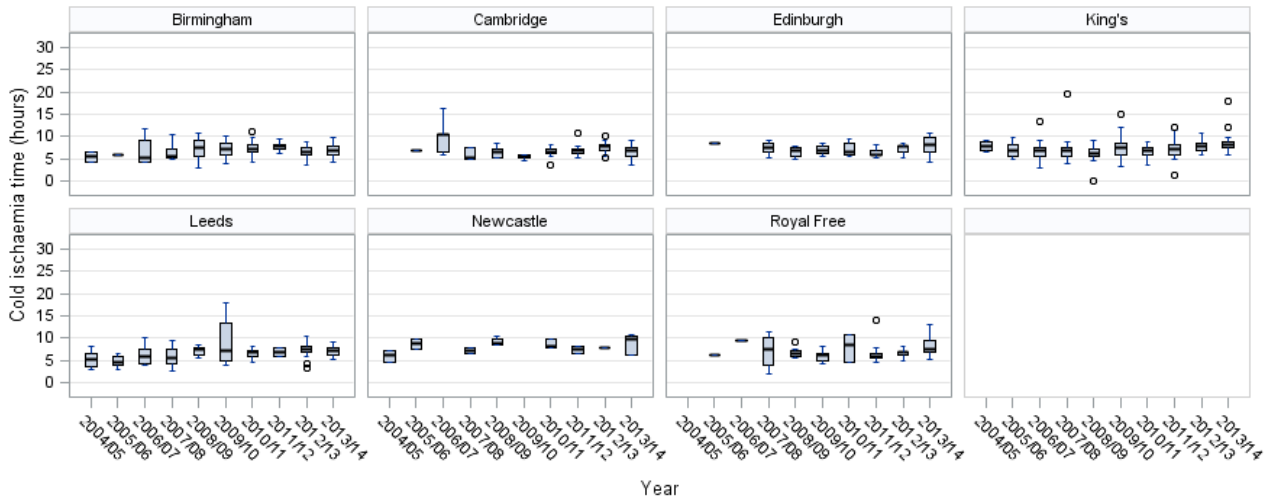


Figure 9 Median cold ischaemia time in all adult DCD donor liver transplants, 1 April 2004 - 31 March 2014



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 2005 and 2014. The number of patients actively waiting for a liver only transplant increased each year from 238 in 2005 to 481 in 2014.

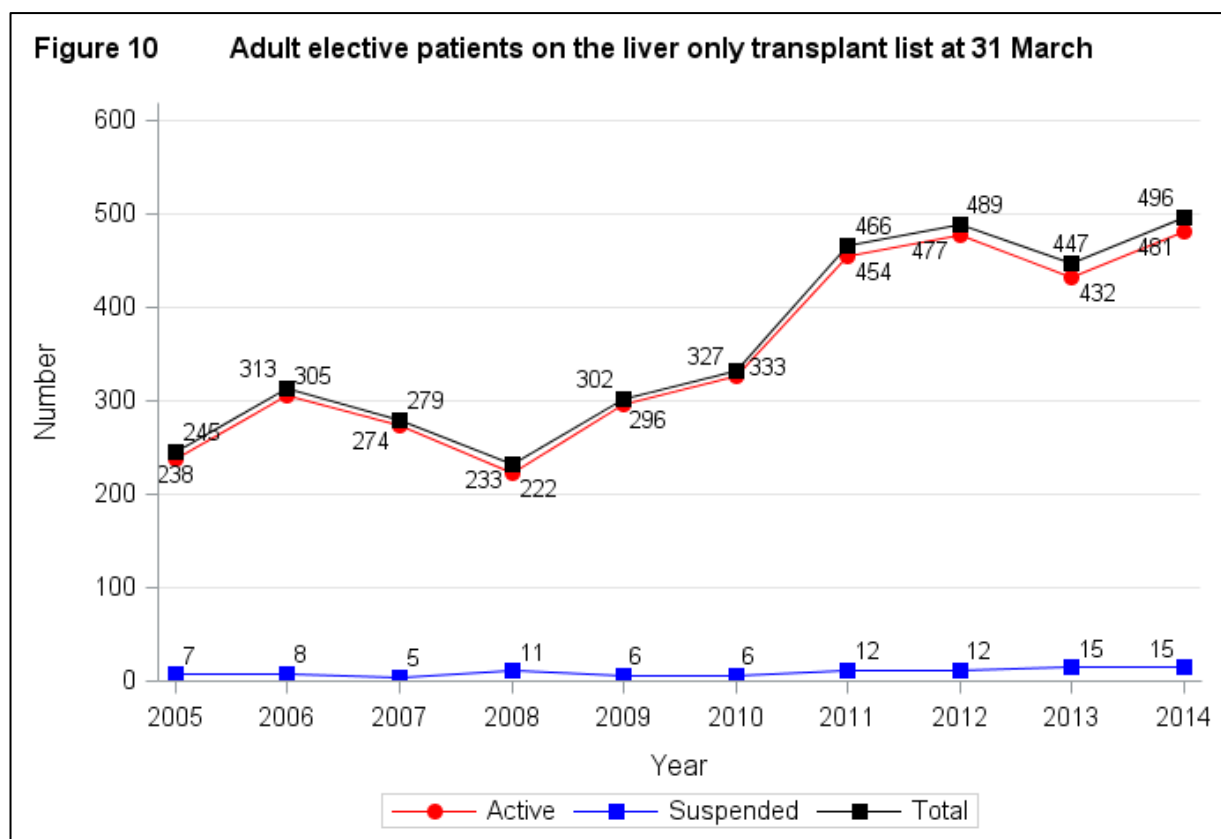
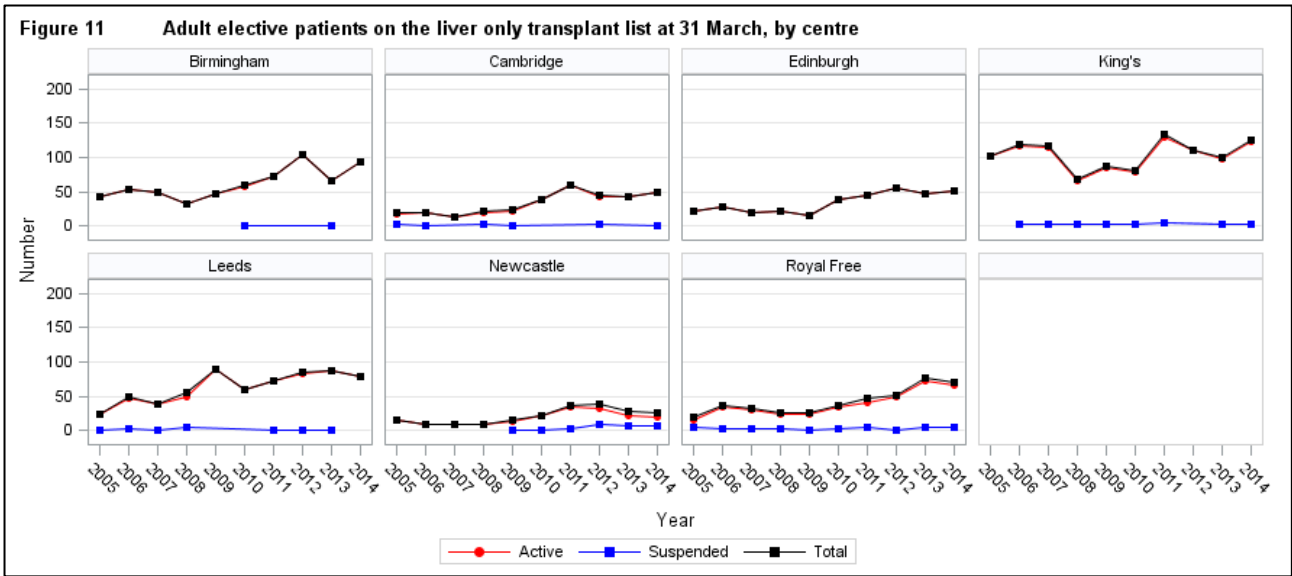


Figure 11 shows the number of adult patients on the transplant list at 31 March each year between 2005 and 2014 for each transplant centre.



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 (typically because they become too unwell for transplant) and those dying while on the waiting list.

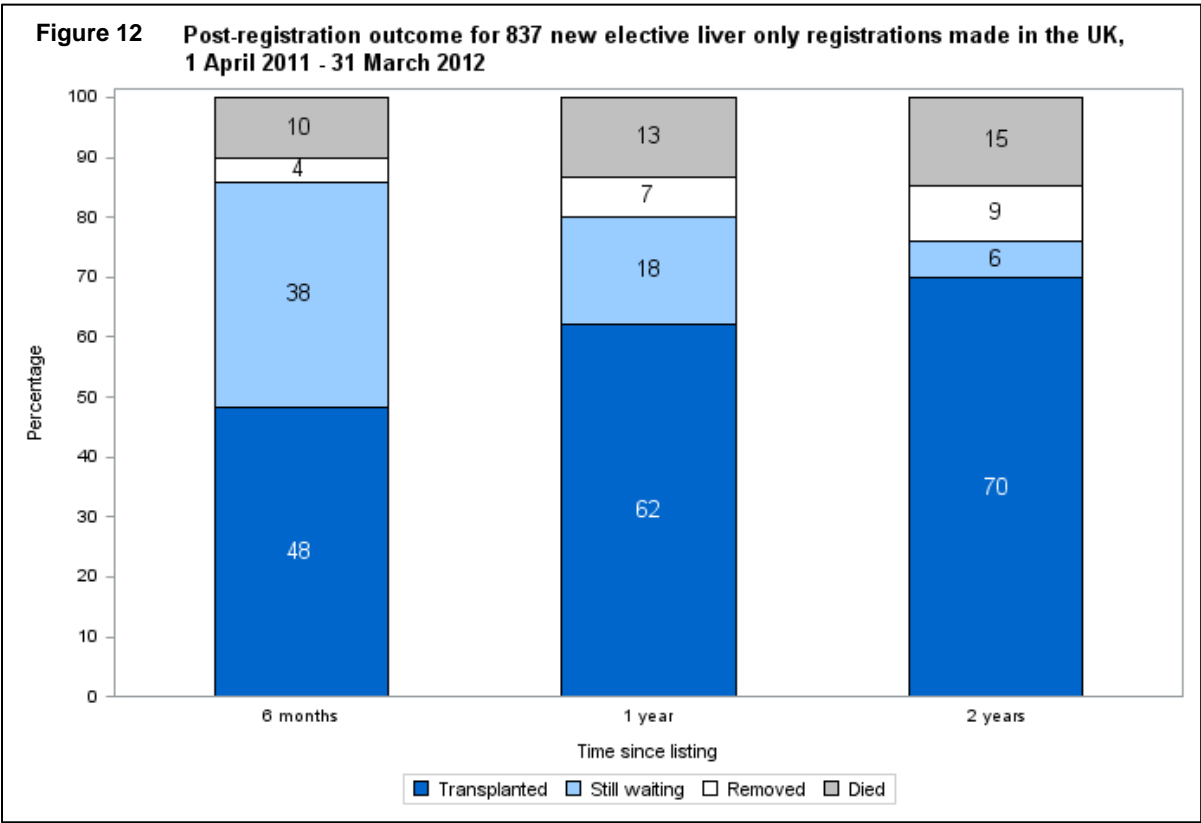


Table 1 shows the [median](#) waiting time to liver only transplant for adult elective patients. The national [median](#) waiting time to transplant for adult elective patients is 144 days. The [median](#) waiting time to transplant is shorter at Edinburgh (87 days) and longer at Leeds (238 days), compared to the national [median](#) waiting time. Note that these waiting times are not adjusted to account for the patient case-mix at centres.

Table 1 Median waiting time to liver only transplant in the UK, for adult elective patients registered 1 April 2008 - 31 March 2011			
Transplant centre	Number of patients registered	Waiting time (days)	
		Median	95% Confidence interval
Adult			
Edinburgh	243	87	60 - 114
Birmingham	488	115	95 - 135
Cambridge	285	135	100 - 170
Royal Free	230	143	115 - 171
King's College	542	170	138 - 202
Newcastle	137	171	113 - 229
Leeds	350	238	187 - 289
UK	2275	144	133 - 155

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.

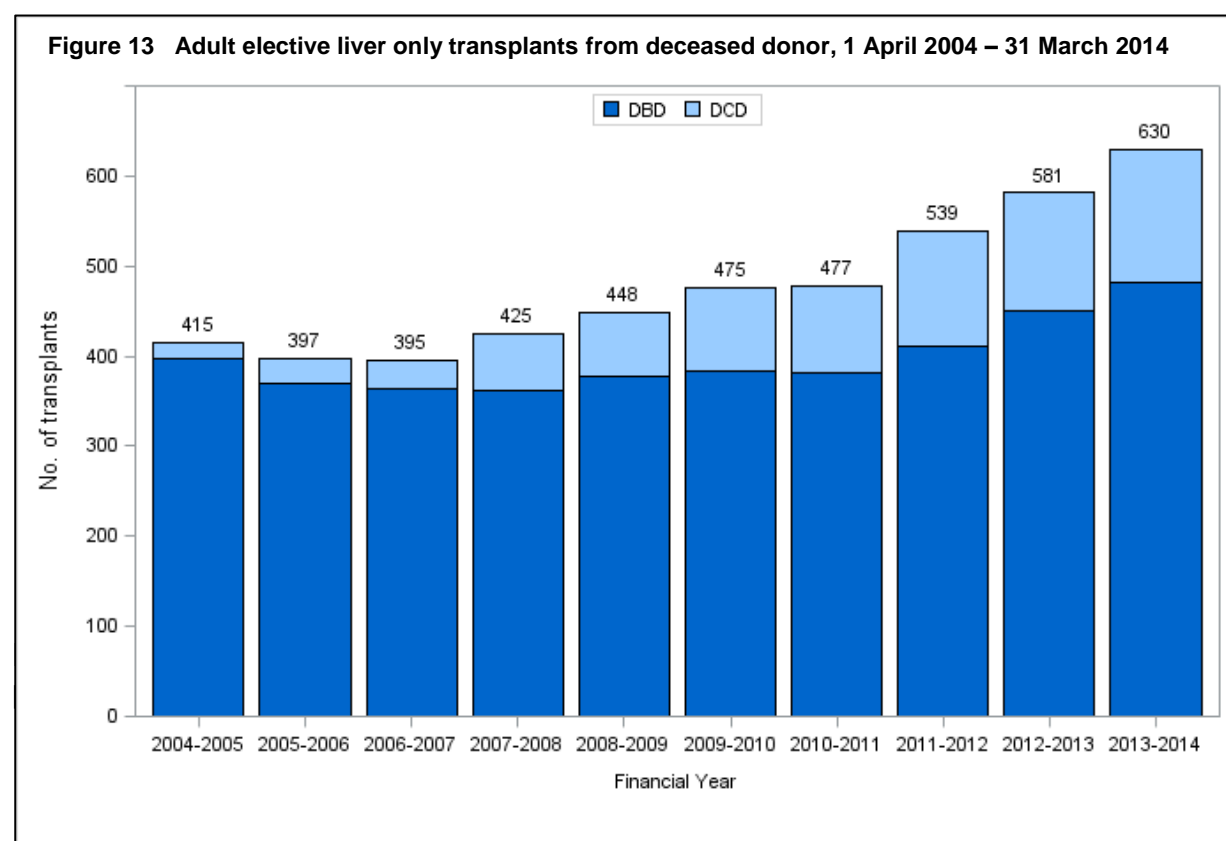
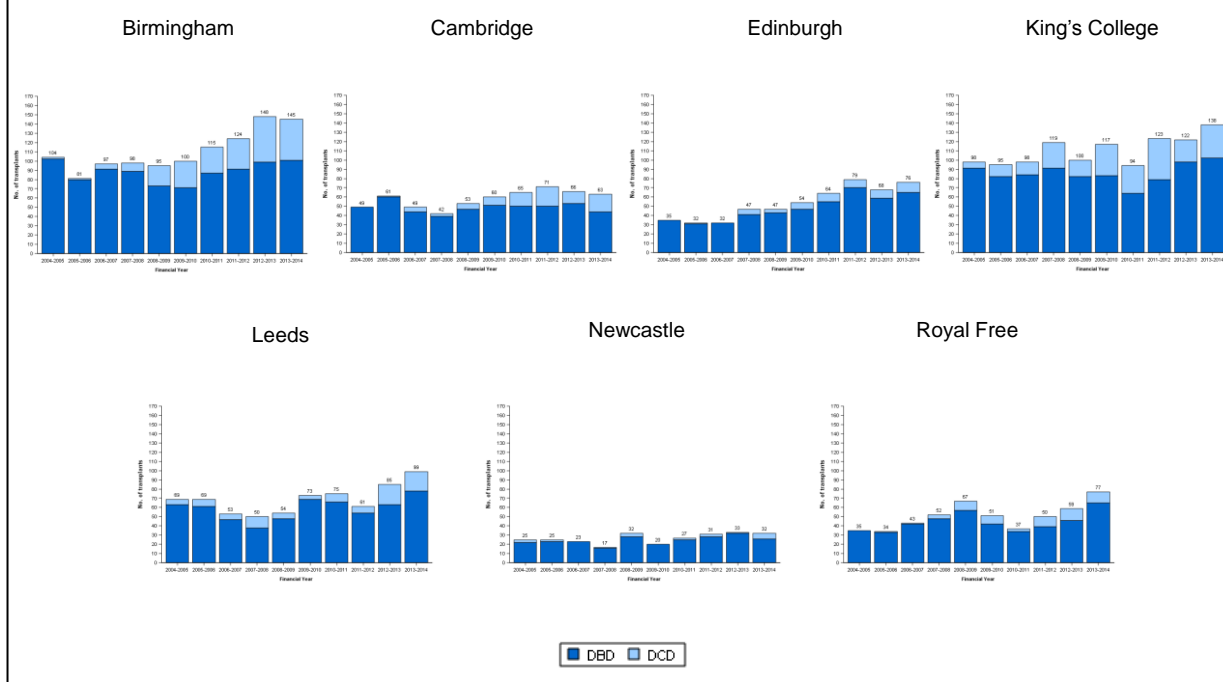


Figure 14 Adult elective liver only transplants by centre, 1 April 2004 – 31 March 2014



The demographic characteristics of 630 adult elective transplant recipients in the latest year are shown by centre and overall in **Table 2**. Two thirds of these recipients were male and the [median](#) age was 55 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 Demographic characteristics of adult elective liver transplant recipients, 1 April 2013 - 31 March 2014									
		Newcastle N (%)	Leeds N (%)	Cambridge N (%)	Royal Free N (%)	King's College N (%)	Birmingham N (%)	Edinburgh N (%)	TOTAL N (%)
Number		32	99	63	77	138	145	76	630 (100)
Recipient sex	Male	23 (72)	68 (69)	44 (70)	57 (74)	84 (61)	96 (66)	49 (64)	421 (67)
	Female	9 (28)	31 (31)	19 (30)	20 (26)	54 (39)	48 (33)	27 (36)	208 (33)
Recipient ethnicity	White	31 (97)	88 (89)	61 (97)	56 (73)	117 (85)	130 (90)	71 (93)	554 (88)
	Non-white	1 (3)	11 (11)	2 (3)	21 (27)	21 (15)	15 (10)	5 (7)	76 (12)
Indication	Cancer	4 (13)	20 (20)	14 (22)	22 (29)	36 (26)	31 (22)	29 (38)	156 (25)
	HCV	2 (6)	21 (21)	8 (13)	12 (16)	12 (9)	13 (9)	8 (11)	76 (12)
	ALD	12 (38)	23 (23)	17 (27)	15 (19)	29 (21)	29 (20)	17 (22)	142 (23)
	HBV	0	1 (1)	0	2 (3)	0	2 (1)	0	5 (1)
	PSC	4 (13)	15 (15)	6 (10)	9 (12)	17 (12)	20 (14)	5 (7)	76 (12)
	PBC	2 (6)	6 (6)	3 (5)	4 (5)	12 (9)	14 (10)	4 (5)	45 (7)
	AID	4 (13)	6 (6)	3 (5)	5 (6)	7 (5)	13 (9)	5 (7)	43 (7)
	Metabolic	4 (13)	5 (5)	8 (13)	6 (8)	9 (7)	13 (9)	7 (9)	52 (8)
	Other	0	2 (2)	4 (6)	2 (3)	14 (10)	9 (6)	1 (1)	32 (5)
	Acute Hepatic failure	0	0	0	0	2 (1)	0	0	2 (0)
Recipient HCV status	Negative	29 (91)	77 (78)	47 (75)	49 (64)	113 (82)	113 (78)	55 (72)	483 (77)
	Positive	3 (9)	16 (16)	13 (21)	28 (36)	23 (17)	32 (22)	18 (24)	133 (21)
	Missing	0	5 (5)	3 (5)	0	2 (1)	0	3 (4)	13 (2)
Pre-transplant in-patient status	Out-patient	26 (81)	83 (84)	41 (65)	74 (96)	109 (79)	141 (97)	65 (86)	539 (86)
	In-patient	6 (19)	16 (16)	21 (33)	3 (4)	27 (20)	4 (3)	11 (14)	88 (14)
	Missing	0	0	1 (2)	0	2 (1)	0	0	3 (1)

Table 2 Demographic characteristics of adult elective liver transplant recipients, 1 April 2013 - 31 March 2014									
		Newcastle N (%)	Leeds N (%)	Cambridge N (%)	Royal Free N (%)	King's College N (%)	Birmingham N (%)	Edinburgh N (%)	TOTAL N (%)
Ascites	Absence	16 (50)	47 (47)	30 (48)	30 (39)	68 (49)	62 (43)	34 (45)	287 (46)
	Presence	16 (50)	52 (53)	32 (51)	47 (61)	70 (51)	83 (57)	42 (55)	342 (54)
	Missing	0	0	1 (2)	0	0	0	0	1 (0)
Encephalopathy	Absence	19 (59)	69 (70)	42 (67)	72 (94)	96 (70)	86 (59)	47 (62)	431 (68)
	Presence	13 (41)	30 (30)	19 (30)	5 (6)	41 (30)	59 (41)	22 (29)	189 (30)
	Missing	0	0	2 (3)	0	1 (1)	0	7 (9)	10 (2)
Pre-transplant renal support	No	31 (97)	89 (90)	57 (90)	74 (96)	130 (94)	143 (99)	71 (93)	595 (94)
	Yes	1 (3)	10 (10)	5 (8)	3 (4)	7 (5)	2 (1)	5 (7)	33 (5)
Previous abdominal surgery	No	29 (91)	83 (84)	58 (92)	70 (91)	121 (88)	135 (93)	65 (86)	561 (89)
	Yes	3 (9)	16 (16)	4 (6)	7 (9)	17 (12)	10 (7)	10 (13)	67 (11)
	Missing	0	0	1 (2)	0	0	0	1 (1)	2 (0)
Varices & shunt	Absence	12 (38)	38 (38)	7 (11)	22 (29)	66 (48)	42 (29)	11 (14)	198 (31)
	Presence without treatment	18 (56)	59 (60)	53 (84)	51 (66)	64 (46)	95 (66)	62 (82)	402 (64)
	Presence with TIPS	2 (6)	1 (1)	2 (3)	4 (5)	7 (5)	8 (6)	1 (1)	25 (4)
	Missing	0	1 (1)	1 (2)	0	1 (1)	0	2 (3)	5 (1)
Life style activity	Normal	1 (3)	6 (6)	9 (14)	0	2 (1)	0	16 (21)	34 (5)
	Restricted	10 (31)	24 (24)	6 (10)	2 (3)	64 (46)	81 (56)	36 (47)	223 (35)
	Self-care	13 (41)	33 (33)	24 (38)	72 (94)	50 (36)	61 (42)	16 (21)	269 (43)
	Confined	8 (25)	32 (32)	9 (14)	3 (4)	17 (12)	3 (2)	5 (7)	77 (12)
	Reliant	0	3 (3)	9 (14)	0	3 (2)	0	3 (4)	18 (3)
	Missing	0	1 (1)	6 (10)	0	2 (1)	0	0	9 (1)

Table 2 Demographic characteristics of adult elective liver transplant recipients, 1 April 2013 - 31 March 2014									
		Newcastle N (%)	Leeds N (%)	Cambridge N (%)	Royal Free N (%)	King's College N (%)	Birmingham N (%)	Edinburgh N (%)	TOTAL N (%)
Graft appearance	Normal	21 (66)	79 (80)	44 (70)	47 (61)	42 (30)	94 (65)	70 (92)	397 (63)
	Abnormal	11 (34)	20 (20)	18 (29)	30 (39)	13 (9)	51 (35)	6 (8)	149 (24)
	Missing	0	0	1 (2)	0	83 (60)	0	0	84 (13)
Recip age years	Median (IQR)	58 (50,65)	55 (47,62)	55 (49,62)	54 (46,59)	52 (44,62)	54 (44,61)	57 (50,63)	55 (46,61)
	Missing	0	0	0	0	0	0	0	0
BMI kg/m2	Median (IQR)	30 (26,35)	27 (24,30)	28 (25,32)	26 (24,29)	26 (23,29)	27 (23,30)	28 (24,30)	27 (24,30)
	Missing	0	0	0	0	0	0	0	0
Serum Bilirubin µmol/l	Median (IQR)	44 (24,106)	59 (21,124)	55 (32,121)	40 (27,59)	60 (33,88)	43 (24,80)	43 (28,99)	48 (27,94)
	Missing	0	0	1	0	0	0	0	1
Serum Creatinine µmol/l	Median (IQR)	76 (61,113)	70 (58,89)	83 (67,110)	80 (68,97)	76 (59,104)	67 (57,84)	73 (63,93)	74 (60,96)
	Missing	0	0	0	0	0	0	0	0
Serum sodium mmol/l	Median (IQR)	139 (135,141)	136 (132,140)	137 (134,139)	138 (134,139)	141 (138,144)	137 (134,139)	135 (131,139)	138 (134,140)
	Missing	0	0	1	0	0	0	0	1
Serum potassium mmol/l	Median (IQR)	4 (4,4)	4 (4,5)	4 (4,4)	4 (4,5)	4 (4,5)	4 (4,4)	4 (4,5)	4 (4,5)
	Missing	1	0	1	1	0	0	0	3
INR	Median (IQR)	1 (1,2)	2 (1,2)	2 (1,2)	1 (1,2)	2 (1,2)	1 (1,2)	1 (1,2)	1 (1,2)
	Missing	0	0	1	0	0	0	1	2
Serum Albumin g/l	Median (IQR)	33 (31,39)	31 (27,36)	28 (25,32)	31 (28,38)	27 (24,31)	34 (30,39)	27 (21,31)	30 (26,36)
	Missing	0	0	1	0	0	0	0	1
Cold Ischaemic Time mins	Median (IQR)	581 (487,644)	464 (405,549)	465 (399,606)	464 (385,564)	510 (430,650)	466 (393,554)	557 (491,658)	493 (414,594)
	Missing	0	0	1	1	49	0	0	51

Table 2 Demographic characteristics of adult elective liver transplant recipients, 1 April 2013 - 31 March 2014									
		Newcastle N (%)	Leeds N (%)	Cambridge N (%)	Royal Free N (%)	King's College N (%)	Birmingham N (%)	Edinburgh N (%)	TOTAL N (%)
Time on list days	Median (IQR) Missing	99 (43,151) 0	74 (28,189) 1	71 (23,218) 0	123 (69,282) 0	139 (64,253) 0	42 (17,113) 0	25 (12,83) 0	78 (26,185) 1
Donor sex	Male	19 (59)	60 (61)	37 (59)	42 (55)	78 (57)	67 (46)	37 (49)	340 (54)
	Female	13 (41)	39 (39)	26 (41)	35 (45)	60 (43)	78 (54)	39 (51)	290 (46)
Donor ethnicity	White	29 (91)	92 (93)	52 (83)	64 (83)	122 (88)	132 (91)	70 (92)	561 (89)
	Non-white	1 (3)	3 (3)	6 (10)	8 (10)	8 (6)	6 (4)	0	32 (5)
	Missing	2 (6)	4 (4)	5 (8)	5 (6)	8 (6)	7 (5)	6 (8)	37 (6)
Donor cause of death	Trauma	26 (81)	85 (86)	49 (78)	66 (86)	120 (87)	123 (85)	63 (83)	532 (84)
	CVA	4 (13)	10 (10)	9 (14)	5 (6)	8 (6)	9 (6)	11 (14)	56 (9)
	Others	2 (6)	4 (4)	5 (8)	6 (8)	10 (7)	13 (9)	2 (3)	42 (7)
Donor history of diabetes	No	29 (91)	89 (90)	59 (94)	68 (88)	120 (87)	137 (94)	68 (89)	570 (91)
	Yes	2 (6)	8 (8)	3 (5)	7 (9)	14 (10)	7 (5)	5 (7)	46 (7)
	Missing	1 (3)	2 (2)	1 (2)	2 (3)	4 (3)	1 (1)	3 (4)	14 (2)
Donor type	Donor after brain death	26 (81)	78 (79)	44 (70)	65 (84)	102 (74)	101 (70)	65 (86)	481 (76)
	Donor after cardiac death	6 (19)	21 (21)	19 (30)	12 (16)	36 (26)	44 (30)	11 (14)	149 (24)
ABO match	Identical	31 (97)	94 (96)	62 (98)	77 (100)	138 (100)	141 (97)	76 (100)	619 (98)
	Compatible	1 (3)	4 (4)	0	0	0	4 (3)	0	9 (1)
	Incompatible	0	0	1 (2)	0	0	0	0	1 (0)
Graft type	Whole	31 (97)	88 (89)	60 (95)	72 (94)	123 (89)	135 (93)	65 (86)	574 (91)
	Segmental	1 (3)	11 (11)	3 (5)	5 (6)	15 (11)	10 (7)	11 (14)	56 (9)

Table 2		Demographic characteristics of adult elective liver transplant recipients, 1 April 2013 - 31 March 2014							
		Newcastle N (%)	Leeds N (%)	Cambridge N (%)	Royal Free N (%)	King's College N (%)	Birmingham N (%)	Edinburgh N (%)	TOTAL N (%)
Donor age years	Median (IQR) Missing	56 (45,63) 0	49 (34,58) 0	52 (28,61) 0	50 (39,60) 0	56 (40,68) 0	53 (37,65) 0	48 (31,57) 0	51 (37,64) 0
Donor BMI kg/m2	Median (IQR) Missing	25 (23,30) 0	27 (24,30) 0	26 (24,28) 0	25 (23,28) 0	26 (24,29) 0	26 (24,29) 0	26 (23,29) 0	26 (23,29) 0

POST-TRANSPLANT SURVIVAL

90-DAY SURVIVAL AND GRAFT FUNCTION

Table 3 shows the 90-day [survival](#) and [graft function](#) for adult elective first liver transplants in the latest year, overall and by centre. Of the 630 transplants in this time period, survival information was known for 624 transplants. Of these 96% were alive 90 days post-transplant and 92.4% of surviving patients had a functioning graft.

Table 3 90-day patient survival (%) and graft function (%) for adult elective first liver transplants between, 1 April 2013 and 31 March 2014, by transplant centre					
Centre	Number of transplants	90-day survival (95% CI)		90-day graft function (95% CI)	
Newcastle	31	96.8	(79.8-98.7)	90.3	(73.5-96.6)
Leeds	99	93.9	(86.1-96.6)	90.9	(84.0-94.5)
Cambridge	63	95.1	(86.1-98.7)	93.5	(84.0-96.6)
Royal Free	77	97.4	(90.3-98.7)	93.5	(86.1-96.6)
King's College	138	96.4	(92.4-98.7)	90.6	(84.0-94.5)
Birmingham	145	96.6	(92.4-98.7)	93.8	(88.2-96.6)
Edinburgh	71	95.8	(88.2-98.7)	94.4	(86.1-98.7)
TOTAL	624	96.0	(94.5-96.6)	92.4	(90.3-94.5)

LONG-TERM PATIENT SURVIVAL

One year [unadjusted](#) and risk-adjusted [patient survival](#) for 1618 of the 1750 transplants in the last three years is shown in **Table 4**. After risk adjustment two centres had a lower survival rate than the national rate. However, none of these were statistically significantly different to the national rate, as shown in the [funnel plot](#) in **Figure 15**.

Table 4 One year patient survival for adult elective first transplants 1 April 2011 - 31 March 2014					
Centre	Number of transplants	1-year survival % (95% CI)			
		Unadjusted		Risk adjusted	
Newcastle	88	96.3	(88.8 - 98.8)	96.5	(89.2 - 98.9)
Leeds	233	90.3	(85.1 - 93.8)	89.9	(84.2 - 93.6)
Cambridge	174	93.2	(87.7 - 96.3)	94.8	(90.3 - 97.2)
Royal Free	172	94.0	(88.8 - 96.9)	94.2	(88.8 - 97.0)
King's College	359	94.8	(91.5 - 96.8)	94.4	(90.8 - 96.6)
Birmingham	402	90.3	(86.7 - 93.0)	89.3	(85.1 - 92.3)
Edinburgh	190	92.8	(87.6 - 95.9)	93.3	(88.2 - 96.2)
Total	1618	92.6	(91.1 - 93.9)		

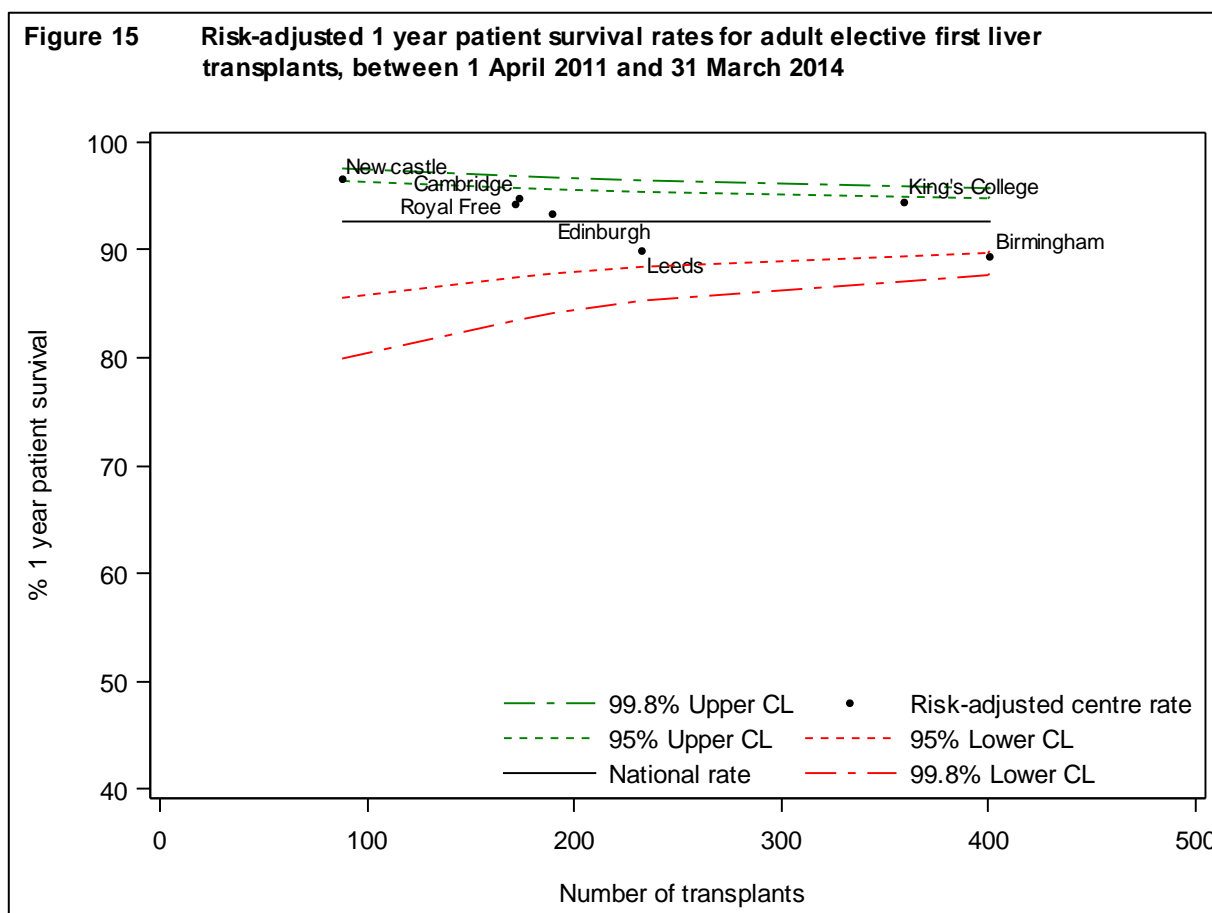
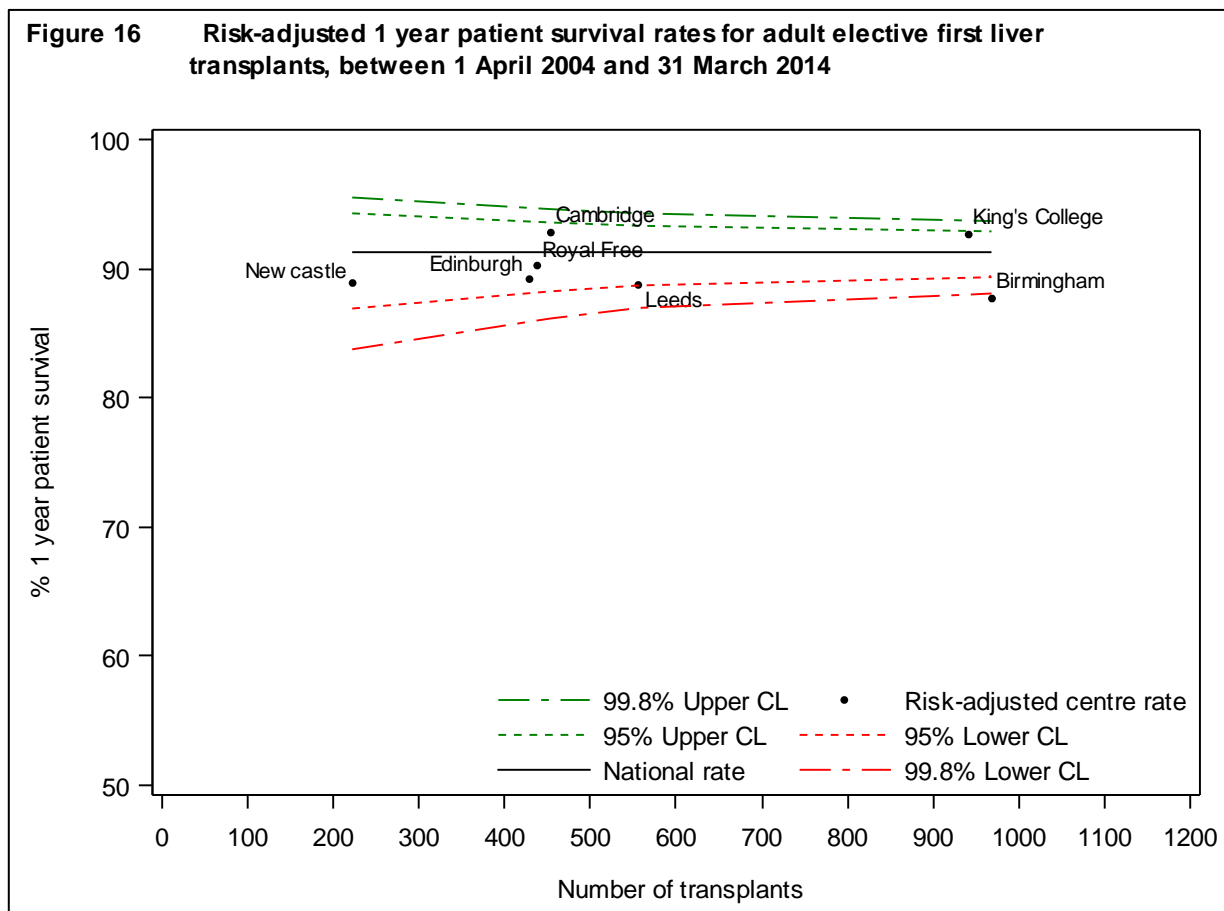


Table 5 shows one year [unadjusted](#) and risk-adjusted [patient survival](#) for 4468 of the 4782 transplants in the ten year period, 1 April 2004 to 31 March 2014. The overall [patient survival](#) rate is 91.3% and after risk adjustment five centres had a lower survival rate than the national rate. For one of these centres their rate was just outside of the 99.8% [confidence limit](#), as shown in **Figure 16**.

Table 5 One year patient survival for adult elective first transplants 1 April 2004 - 31 March 2014					
Centre	Number of transplants	1-year survival % (95% CI)			
		Unadjusted		Risk adjusted	
Newcastle	247	91.2	(86.8 - 94.2)	88.9	(83.0 - 92.8)
Leeds	632	90.4	(87.8 - 92.5)	88.7	(85.4 - 91.3)
Cambridge	514	92.7	(90.0 - 94.7)	92.8	(90.0 - 94.8)
Royal Free	474	92.0	(89.1 - 94.2)	90.2	(86.5 - 93.0)
King's College	1029	93.1	(91.3 - 94.6)	92.7	(90.7 - 94.3)
Birmingham	1083	89.3	(87.2 - 91.0)	87.7	(85.2 - 89.8)
Edinburgh	489	90.5	(87.5 - 92.9)	89.2	(85.4 - 91.9)
Total	4468	91.3	(90.4 - 92.1)		



Three year unadjusted and risk-adjusted [patient survival](#) for transplants in the last 10 years is shown in **Table 6**. The national survival rate is 85.5% and after risk adjustment four centres had a lower survival rate than the national rate. The survival rate for Birmingham is outside the lower 99.8% [confidence limit](#), as shown in **Figure 17**.

Table 6 Three year patient survival for adult elective first transplants 1 April 2004 - 31 March 2014					
Centre	Number of transplants	3-year survival % (95% CI)			
		Unadjusted		Risk adjusted	
Newcastle	247	85.3	(79.5 - 89.5)	81.3	(73.5 - 86.9)
Leeds	632	85.6	(82.2 - 88.4)	81.7	(77.1 - 85.4)
Cambridge	514	86.0	(82.3 - 89.0)	85.9	(81.8 - 89.0)
Royal Free	474	88.2	(84.6 - 91.0)	85.6	(80.9 - 89.1)
King's College	1029	87.3	(84.7 - 89.4)	87.6	(85.0 - 89.8)
Birmingham	1083	82.7	(80.1 - 85.0)	79.8	(76.5 - 82.7)
Edinburgh	489	85.2	(81.3 - 88.4)	82.9	(78.0 - 86.7)
Total	4468	85.5	(84.4 - 86.6)		

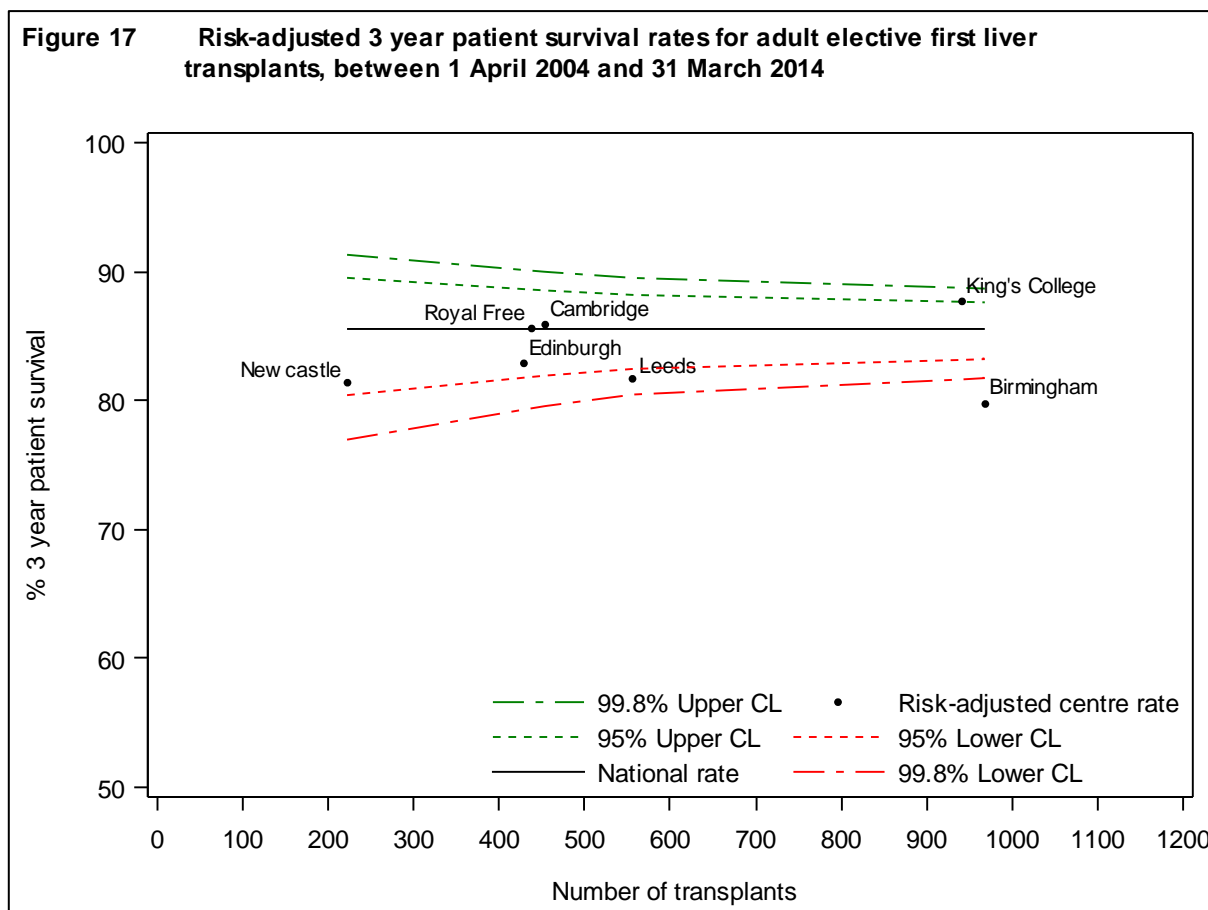
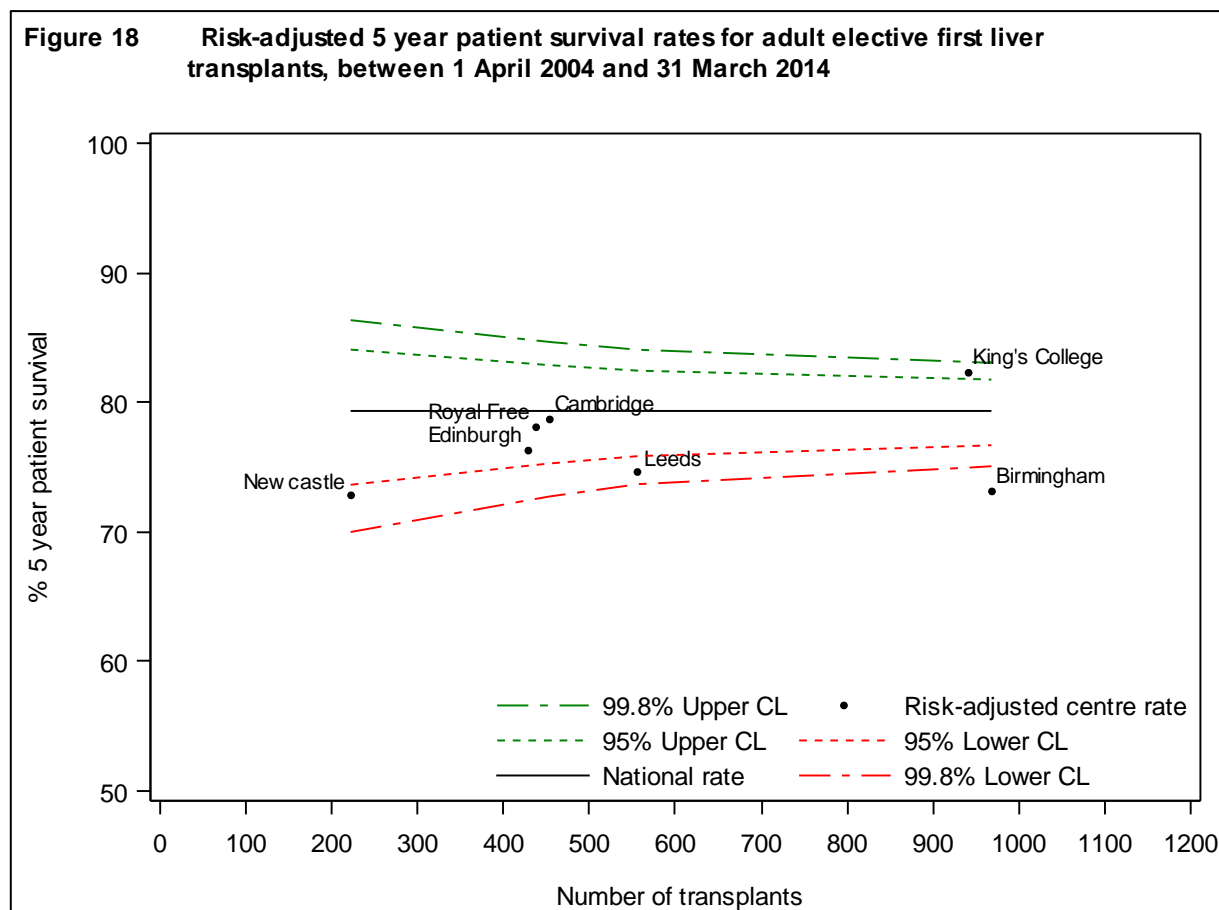


Table 7 shows the five year unadjusted and risk-adjusted [patient survival](#) for transplants in the last ten years and the [risk-adjusted rates](#) are also shown in **Figure 18**. The national rate is 79.3% and six centres have a lower survival rate after risk adjustment but that of Birmingham is outside the lower 99.8% [confidence limit](#).

Table 7 Five year patient survival for adult elective first transplants 1 April 2004 - 31 March 2014					
Centre	Number of transplants	5-year survival % (95% CI)			
		Unadjusted		Risk adjusted	
Newcastle	247	77.2	(69.7 - 83.2)	72.8	(62.9 - 80.1)
Leeds	632	79.5	(74.8 - 83.3)	74.7	(68.9 - 79.4)
Cambridge	514	77.8	(72.9 - 81.9)	78.6	(73.5 - 82.8)
Royal Free	474	81.0	(76.2 - 84.9)	78.1	(72.1 - 82.7)
King's College	1029	81.9	(78.7 - 84.8)	82.3	(78.9 - 85.1)
Birmingham	1083	77.6	(74.5 - 80.5)	73.2	(69.1 - 76.7)
Edinburgh	489	78.8	(73.7 - 83.0)	76.3	(70.2 - 81.1)
Total	4468	79.3	(77.8 - 80.8)		



SURVIVAL FROM LISTING

Survival from listing was analysed for patients aged ≥ 18 years registered for the first time for a liver transplant between 1 January 2002 and 31 December 2013. One, five and ten year [risk-adjusted survival rates](#) from the point of liver transplant listing are shown by centre in **Figures 19, 20 and 21**, respectively.

At one year, centre-specific risk adjusted survival rates range between 77% (95% [CI](#) 73-80%) 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 62% (95% CI 57-66%) for Leeds and 71% (95% CI 67-75%) 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 49% (95% CI 42-54%) while Cambridge has the highest at 61% (95% CI 56-66%).

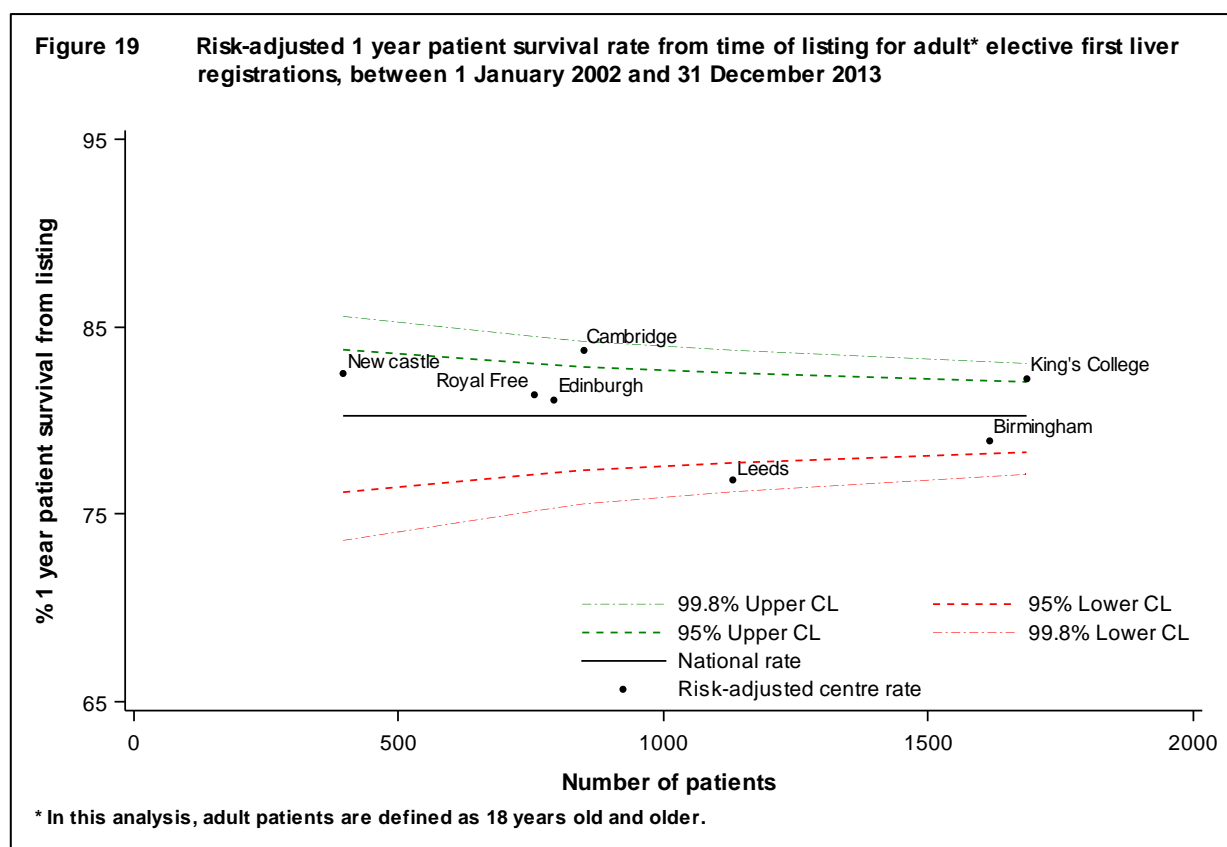


Figure 20 Risk-adjusted 5 year patient survival rate from time of listing for adult* elective first liver registrations, between 1 January 2002 and 31 December 2013

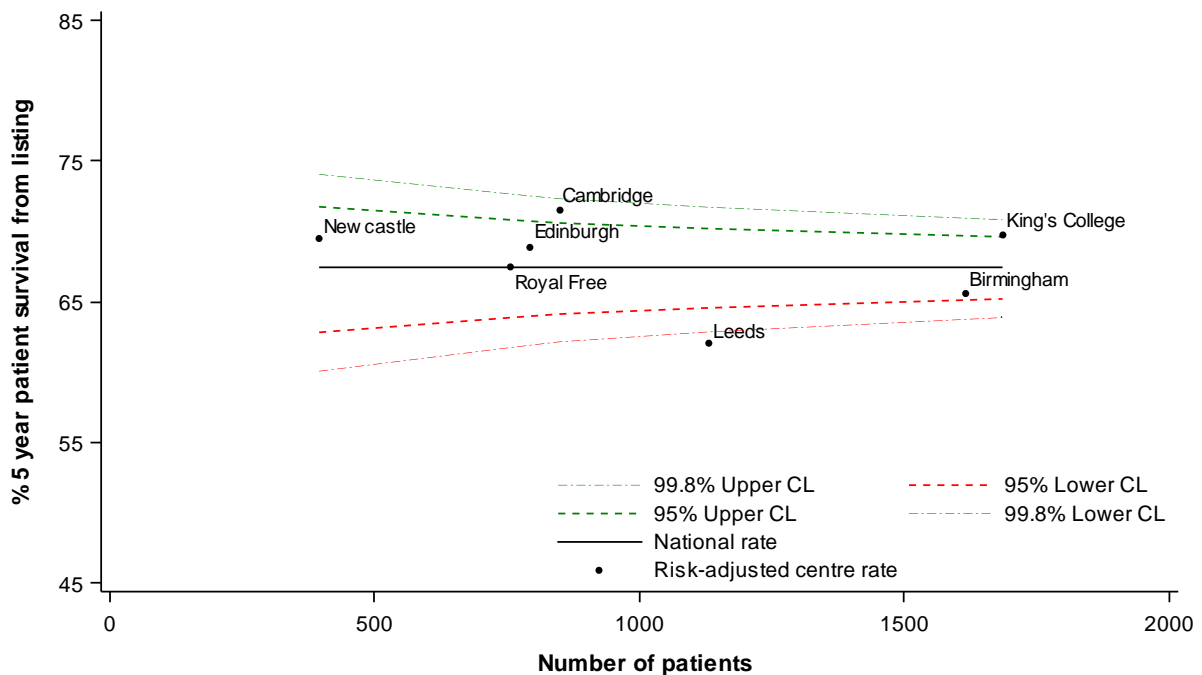
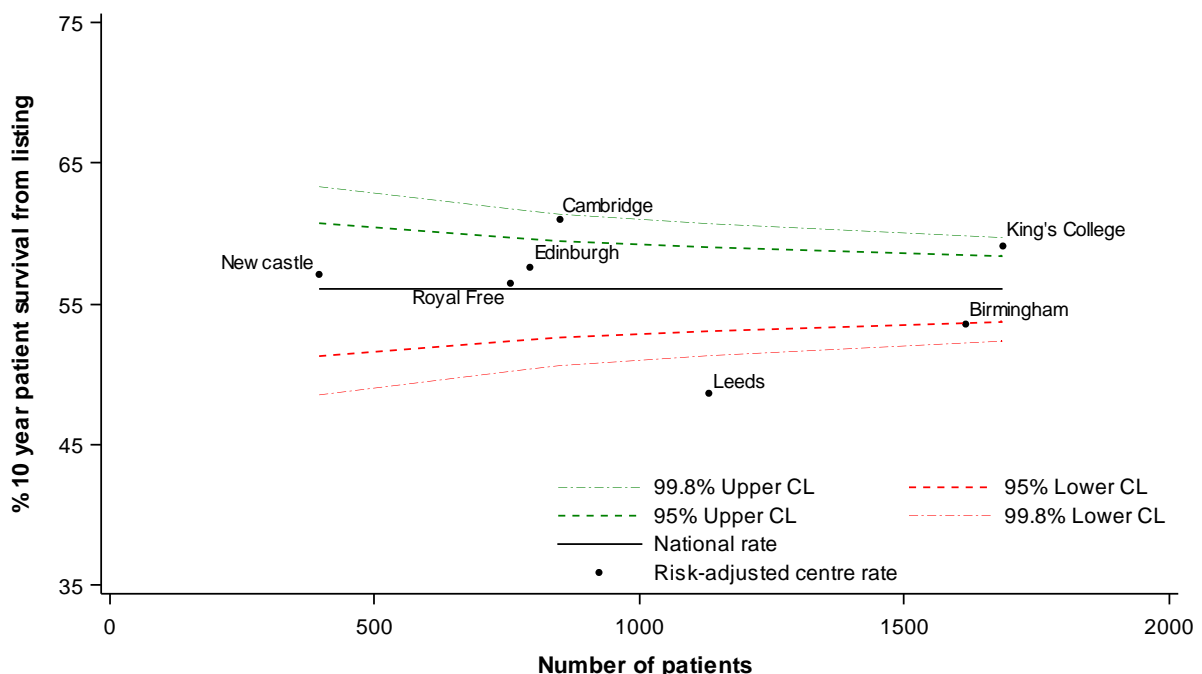


Figure 21 Risk-adjusted 10 year patient survival rate from time of listing for adult* elective first liver registrations, between 1 January 2002 and 31 December 2013



ADULT LIVER TRANSPLANTATION

SUPER URGENT PATIENTS



SUPER URGENT PATIENTS

TRANSPLANT LIST

Table 8 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 Cambridge and Royal Free where it is three days. The national [median](#) waiting time to transplant is two days.

Table 8 Median waiting time to liver only transplant in the UK, for adult super urgent patients registered 1 April 2008 - 31 March 2011			
Transplant centre	Number of patients registered	Waiting time (days) Median	95% Confidence interval
Adult			
Newcastle	34	2	1 - 3
Leeds	28	2	1 - 3
King's College	85	2	2 - 2
Birmingham	76	2	2 - 2
Edinburgh	35	2	1 - 3
Cambridge	22	3	2 - 4
Royal Free	38	3	1 - 5
UK	318	2	2 - 2

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.

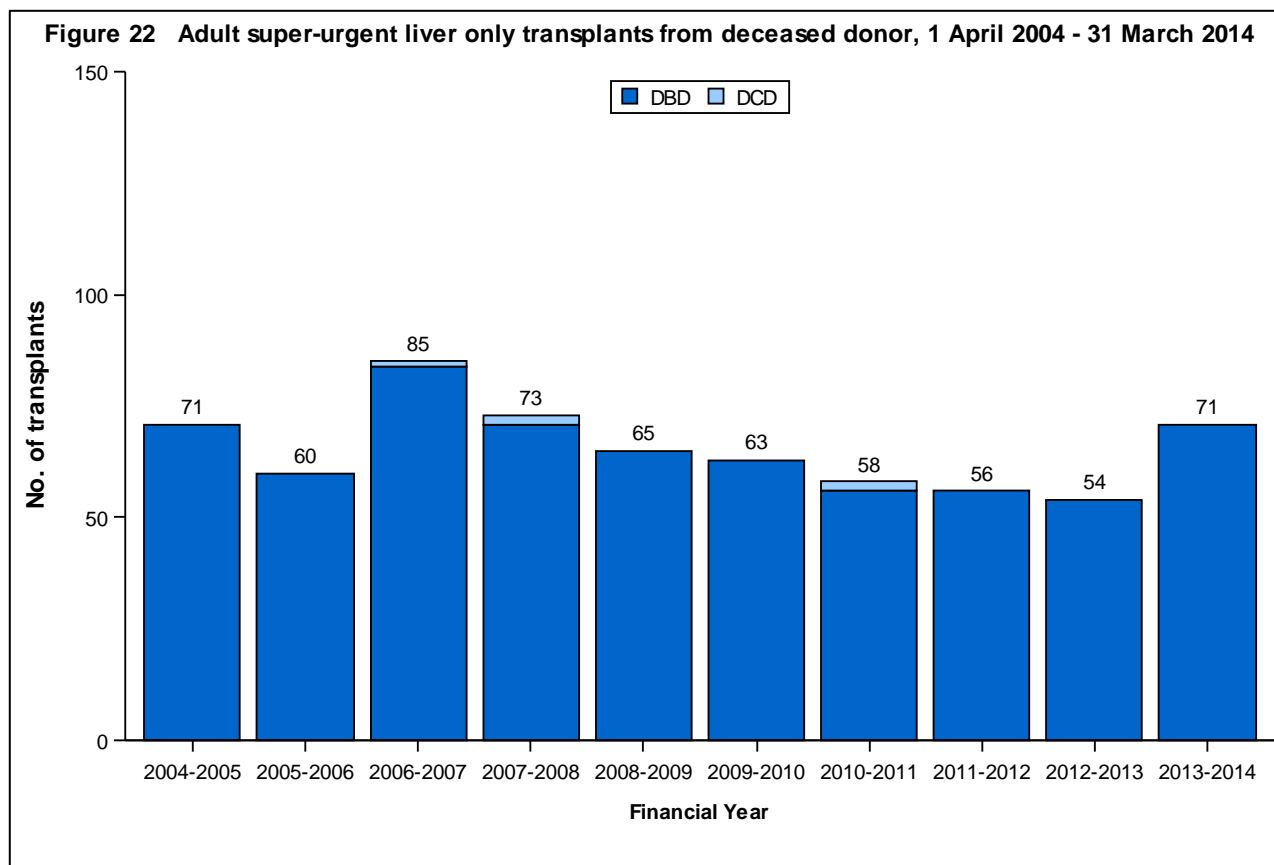
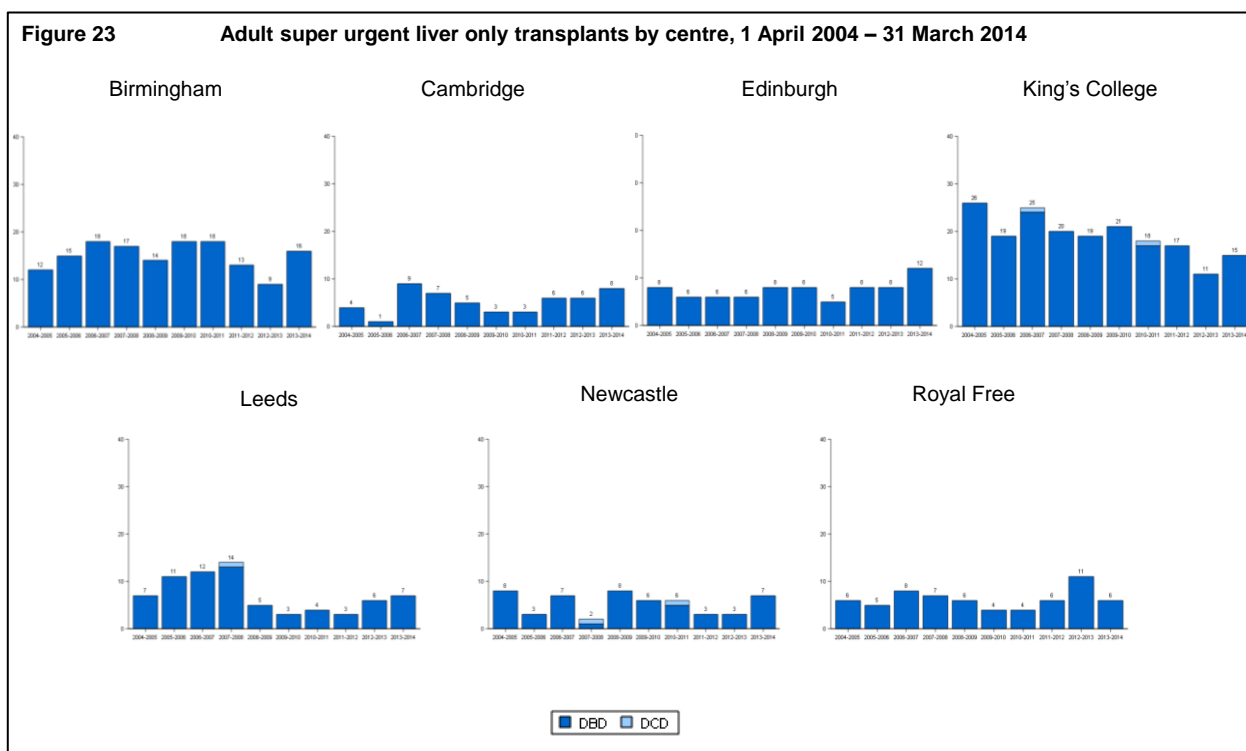


Figure 23 shows the number of adult super urgent liver only transplants from deceased donors performed in the last ten years, by type of donor and transplant centre.



The demographic characteristics of 181 adult super urgent transplant recipients in the last three years are shown by centre and overall in **Table 9**. Two thirds of these recipients were female and the [median](#) age was 39 years. No super urgent transplants have been performed in this time period using [DCD](#) donors. The media recipient BMI was 25. For some characteristics, due to rounding, percentages may not add up to 100.

Table 9 **Demographic characteristics of adult super urgent liver transplant recipients**
1 April 2011 - 31 March 2014

		Newcastle N (%)	Leeds N (%)	Cambridge N (%)	Royal Free N (%)	King's College N (%)	Birmingham N (%)	Edinburgh N (%)	TOTAL N (%)
Number		13	16	20	23	43	38	28	181 (100)
Recipient sex	Male	1 (8)	7 (44)	3 (15)	10 (43)	17 (40)	12 (32)	9 (32)	59 (33)
	Female	12 (92)	9 (56)	17 (85)	13 (57)	26 (60)	26 (68)	19 (68)	122 (67)
Recipient ethnicity	White	13 (100)	14 (88)	18 (90)	10 (43)	34 (79)	34 (89)	27 (96)	150 (83)
	Non-white	0	2 (13)	2 (10)	13 (57)	9 (21)	3 (8)	1 (4)	30 (17)
	Missing	0	0	0	0	0	1 (3)	0	1 (1)
Recipient HCV status	Negative	12 (92)	11 (69)	19 (95)	23 (100)	43 (100)	34 (89)	27 (96)	169 (93)
	Positive	0	0	0	0	0	1 (3)	1 (4)	2 (1)
	Missing	1 (8)	5 (31)	1 (5)	0	0	3 (8)	0	10 (6)
Pre-transplant in-patient status	Out-patient	0	0	2 (10)	2 (9)	0	0	0	4 (2)
	In-patient	13 (100)	16 (100)	18 (90)	21 (91)	43 (100)	38 (100)	28 (100)	177 (98)
Ascites	Absence	12 (92)	11 (69)	7 (35)	9 (39)	34 (79)	23 (61)	26 (93)	122 (67)
	Presence	1 (8)	5 (31)	13 (65)	14 (61)	7 (16)	15 (39)	2 (7)	57 (32)
	Missing	0	0	0	0	2 (5)	0	0	2 (1)
Encephalopathy	Absence	0	1 (6)	2 (10)	2 (9)	0	0	1 (4)	6 (3)
	Presence	13 (100)	15 (94)	17 (85)	21 (91)	41 (95)	38 (100)	26 (93)	171 (95)
	Missing	0	0	1 (5)	0	2 (5)	0	1 (4)	4 (2)
Pre-transplant renal support	No	3 (23)	12 (75)	8 (40)	16 (70)	11 (26)	18 (47)	12 (43)	80 (44)
	Yes	9 (69)	4 (25)	12 (60)	7 (30)	32 (74)	20 (53)	16 (57)	100 (55)

Table 9 **Demographic characteristics of adult super urgent liver transplant recipients**
1 April 2011 - 31 March 2014

		Newcastle N (%)	Leeds N (%)	Cambridge N (%)	Royal Free N (%)	King's College N (%)	Birmingham N (%)	Edinburgh N (%)	TOTAL N (%)
Previous abdominal surgery	No	12 (92)	15 (94)	19 (95)	21 (91)	36 (84)	37 (97)	27 (96)	167 (92)
	Yes	1 (8)	1 (6)	1 (5)	1 (4)	5 (12)	1 (3)	1 (4)	11 (6)
	Missing	0	0	0	1 (4)	2 (5)	0	0	3 (2)
Varices & shunt	Absence	5 (38)	10 (63)	7 (35)	21 (91)	41 (95)	34 (89)	18 (64)	136 (75)
	Presence without treatment	8 (62)	6 (38)	13 (65)	1 (4)	2 (5)	4 (11)	10 (36)	44 (24)
Life style activity	Restricted	0	0	0	0	0	1 (3)	0	1 (1)
	Self-care	0	2 (13)	1 (5)	0	1 (2)	0	0	4 (2)
	Confined	2 (15)	5 (31)	0	4 (17)	3 (7)	11 (29)	2 (7)	27 (15)
	Reliant	11 (85)	8 (50)	18 (90)	19 (83)	39 (91)	26 (68)	26 (93)	147 (81)
	Missing	0	1 (6)	1 (5)	0	0	0	0	2 (1)
Graft appearance	Normal	9 (69)	14 (88)	15 (75)	18 (78)	9 (21)	36 (95)	27 (96)	128 (71)
	Abnormal	4 (31)	1 (6)	4 (20)	5 (22)	2 (5)	2 (5)	1 (4)	19 (11)
	Missing	0	1 (6)	1 (5)	0	32 (74)	0	0	34 (19)
Recip age years	Median (IQR)	44 (19,54)	33 (28,52)	47 (31,56)	37 (30,49)	39 (26,49)	42 (29,48)	41 (33,53)	39 (29,51)
	Missing	0	0	0	0	0	0	0	0
BMI kg/m2	Median (IQR)	25 (21,27)	24 (21,27)	25 (22,29)	27 (22,30)	23 (21,25)	25 (23,29)	25 (22,30)	25 (22,28)
	Missing	3	0	0	4	1	0	0	8
Serum Bilirubin µmol/l	Median (IQR)	106 (61,375)	314 (114,395)	274 (132,487)	305 (177,448)	138 (88,276)	280 (159,432)	146 (92,432)	221 (106,395)
	Missing	0	0	0	0	0	0	0	0
Serum Creatinine µmol/l	Median (IQR)	94 (66,110)	87 (62,119)	129 (83,226)	77 (58,133)	130 (91,186)	113 (65,139)	147 (66,267)	115 (68,161)
	Missing	0	0	0	0	0	0	0	0

Table 9		Demographic characteristics of adult super urgent liver transplant recipients 1 April 2011 - 31 March 2014							
		Newcastle N (%)	Leeds N (%)	Cambridge N (%)	Royal Free N (%)	King's College N (%)	Birmingham N (%)	Edinburgh N (%)	TOTAL N (%)
Serum sodium mmol/l	Median (IQR) Missing	137 (136,140) 0	138 (136,140) 0	137 (136,141) 0	141 (136,147) 0	145 (141,150) 0	144 (137,150) 0	136 (134,138) 0	140 (136,146) 0
Serum potassium mmol/l	Median (IQR) Missing	4 (4,4) 0	4 (4,5) 0	4 (4,4) 0	4 (4,4) 0	4 (4,5) 0	4 (4,5) 0	4 (4,4) 0	4 (4,4) 0
INR	Median (IQR) Missing	3 (2,3) 0	3 (2,4) 0	4 (3,5) 1	4 (2,6) 0	2 (2,2) 0	2 (2,4) 0	3 (2,5) 0	3 (2,4) 1
Serum Albumin g/l	Median (IQR) Missing	32 (25,33) 0	26 (24,30) 0	28 (24,32) 0	25 (20,29) 0	23 (21,27) 0	31 (26,34) 0	25 (18,30) 0	26 (22,31) 0
Cold Ischaemic Time mins	Median (IQR) Missing	464 (406,572) 0	537 (412,575) 0	479 (390,528) 1	472 (389,588) 0	473 (419,565) 17	491 (435,599) 0	498 (432,605) 0	487 (417,572) 18
Time on list days	Median (IQR) Missing	2 (1,3) 0	3 (2,4) 0	2 (2,5) 0	2 (2,3) 0	2 (1,3) 0	2 (1,4) 0	2 (1,2) 0	2 (1,3) 0
Donor sex	Male	6 (46)	5 (31)	11 (55)	7 (30)	25 (58)	20 (53)	13 (46)	87 (48)
	Female	7 (54)	11 (69)	9 (45)	16 (70)	18 (42)	18 (47)	15 (54)	94 (52)
Donor ethnicity	White	12 (92)	15 (94)	18 (90)	20 (87)	37 (86)	36 (95)	27 (96)	165 (91)
	Non-white	1 (8)	1 (6)	2 (10)	3 (13)	5 (12)	1 (3)	1 (4)	14 (8)
	Missing	0	0	0	0	1 (2)	1 (3)	0	2 (1)
Donor cause of death	Trauma	12 (92)	11 (69)	17 (85)	21 (91)	33 (77)	29 (76)	26 (93)	149 (82)
	CVA	1 (8)	4 (25)	2 (10)	0	6 (14)	6 (16)	0	19 (11)
	Others	0	1 (6)	1 (5)	2 (9)	4 (9)	3 (8)	2 (7)	13 (7)

Table 9 **Demographic characteristics of adult super urgent liver transplant recipients**
1 April 2011 - 31 March 2014

		Newcastle N (%)	Leeds N (%)	Cambridge N (%)	Royal Free N (%)	King's College N (%)	Birmingham N (%)	Edinburgh N (%)	TOTAL N (%)
Donor history of diabetes	No	12 (92)	15 (94)	18 (90)	23 (100)	40 (93)	37 (97)	27 (96)	172 (95)
	Yes	1 (8)	1 (6)	2 (10)	0	3 (7)	0	1 (4)	8 (4)
	Missing	0	0	0	0	0	1 (3)	0	1 (1)
Donor type	Donor after brain death	13 (100)	16 (100)	20 (100)	23 (100)	43 (100)	38 (100)	28 (100)	181 (100)
ABO match	Identical	11 (85)	9 (56)	14 (70)	15 (65)	24 (56)	25 (66)	24 (86)	122 (67)
	Compatible	2 (15)	7 (44)	5 (25)	8 (35)	19 (44)	13 (34)	4 (14)	58 (32)
	Incompatible	0	0	1 (5)	0	0	0	0	1 (1)
Graft type	Whole	13 (100)	14 (88)	20 (100)	23 (100)	37 (86)	38 (100)	28 (100)	173 (96)
	Segmental	0	2 (13)	0	0	6 (14)	0	0	8 (4)
Donor age years	Median (IQR)	46 (41,54)	47 (34,66)	45 (26,61)	48 (34,65)	51 (39,56)	45 (33,59)	48 (37,61)	47 (34,57)
	Missing	0	0	0	0	0	0	0	0
Donor BMI kg/m2	Median (IQR)	23 (22,28)	25 (23,26)	24 (22,26)	23 (21,25)	25 (24,28)	26 (23,28)	26 (22,28)	25 (22,27)
	Missing	0	0	0	0	0	0	0	0

POST-TRANSPLANT SURVIVAL

90-DAY SURVIVAL AND GRAFT FUNCTION

Table 10 shows the 90-day survival and [graft function](#) for adult super urgent first liver transplants in the latest year, overall and by centre. Of the 71 transplants, 91.5% were alive 90 days post-transplant and 88.7% of surviving patients had a functioning graft. These rates have wide [confidence intervals](#) due to the small number of transplants performed.

Table 10 90-day patient survival (%) and graft function (%) for adult super urgent first liver transplants between, 1 April 2013 and 31 March 2014, by transplant centre					
Centre	Number of transplants	90-day survival (95% CI)		90-day graft function (95% CI)	
Newcastle	7	100	-	85.7	(33.6-98.7)
Leeds	7	100	-	100	-
Cambridge	8	87.5	(37.8-98.7)	87.5	(37.8-98.7)
Royal Free	6	83.3	(27.3-96.6)	83.3	(27.3-96.6)
King's College	15	93.3	(60.9-98.7)	93.3	(60.9-98.7)
Birmingham	16	93.8	(63.0-98.7)	87.5	(58.8-96.6)
Edinburgh	12	83.3	(48.3-96.6)	83.3	(48.3-96.6)
TOTAL	71	91.5	(81.9-96.6)	88.7	(77.7-94.5)

LONG-TERM PATIENT SURVIVAL

One year unadjusted and risk-adjusted [patient survival](#) for 169 of the 181 transplants in the last three years is shown in **Table 11**. After risk adjustment three centres had a lower survival rate than the national rate. However, none of these were significantly different to the national rate, as shown in the [funnel plot](#) in **Figure 24**.

Table 11 One year patient survival for adult super urgent first transplants, 1 April 2011 - 31 March 2014					
Centre	Number of transplants	1-year survival % (95% CI)			
		Unadjusted		Risk adjusted	
Newcastle	12	83.3	(48.2 - 95.6)	89.8	(59.3 - 97.5)
Leeds	15	93.3	(61.3 - 99.0)	89.9	(28.0 - 98.6)
Cambridge	18	88.9	(62.4 - 97.1)	92.7	(70.9 - 98.2)
Royal Free	21	89.9	(65.3 - 97.4)	88.2	(52.8 - 97.1)
King's College	40	91.6	(75.8 - 97.3)	92.8	(77.6 - 97.7)
Birmingham	36	88.9	(73.1 - 95.7)	82.0	(52.0 - 93.2)
Edinburgh	27	90.9	(67.7 - 97.7)	90.3	(61.3 - 97.6)
Total	169	89.9	(83.9 - 93.7)		

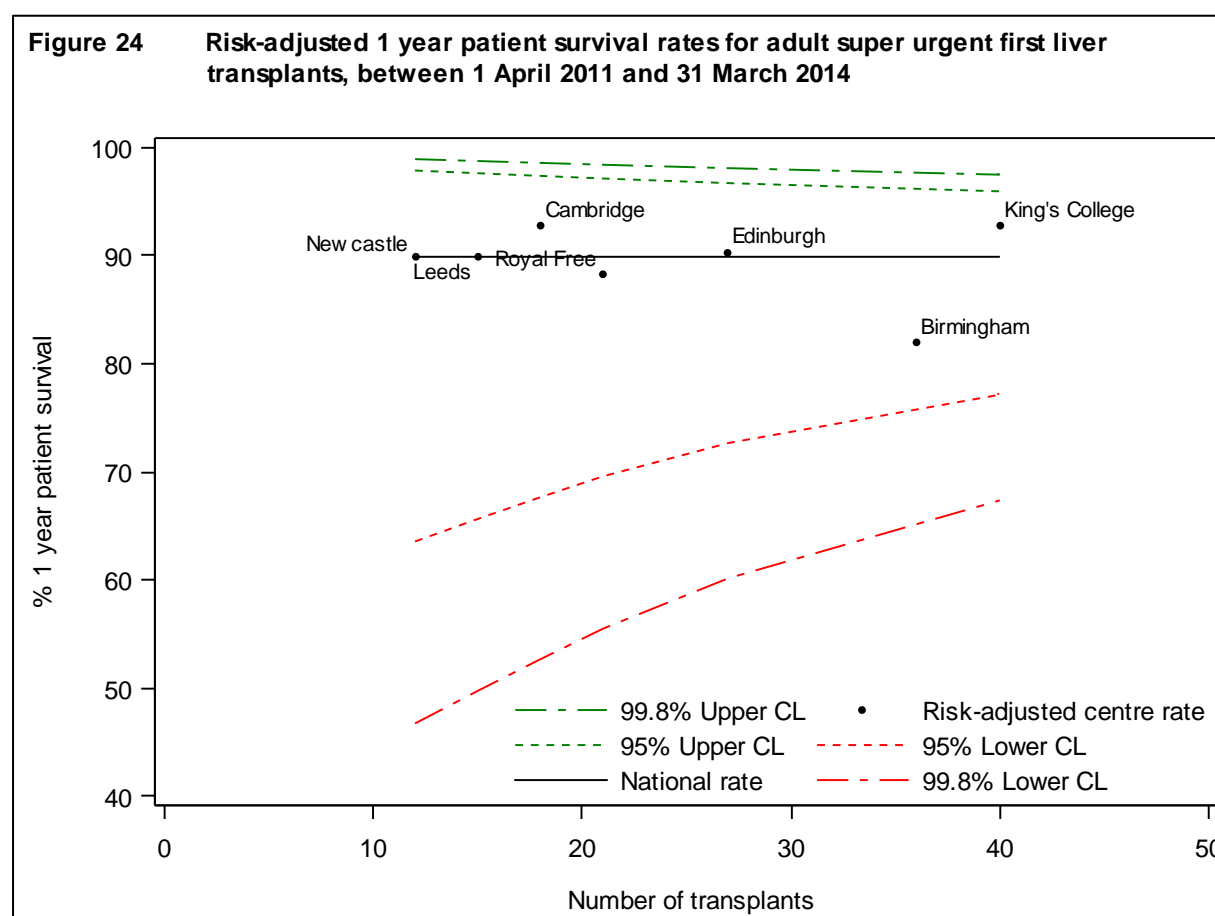
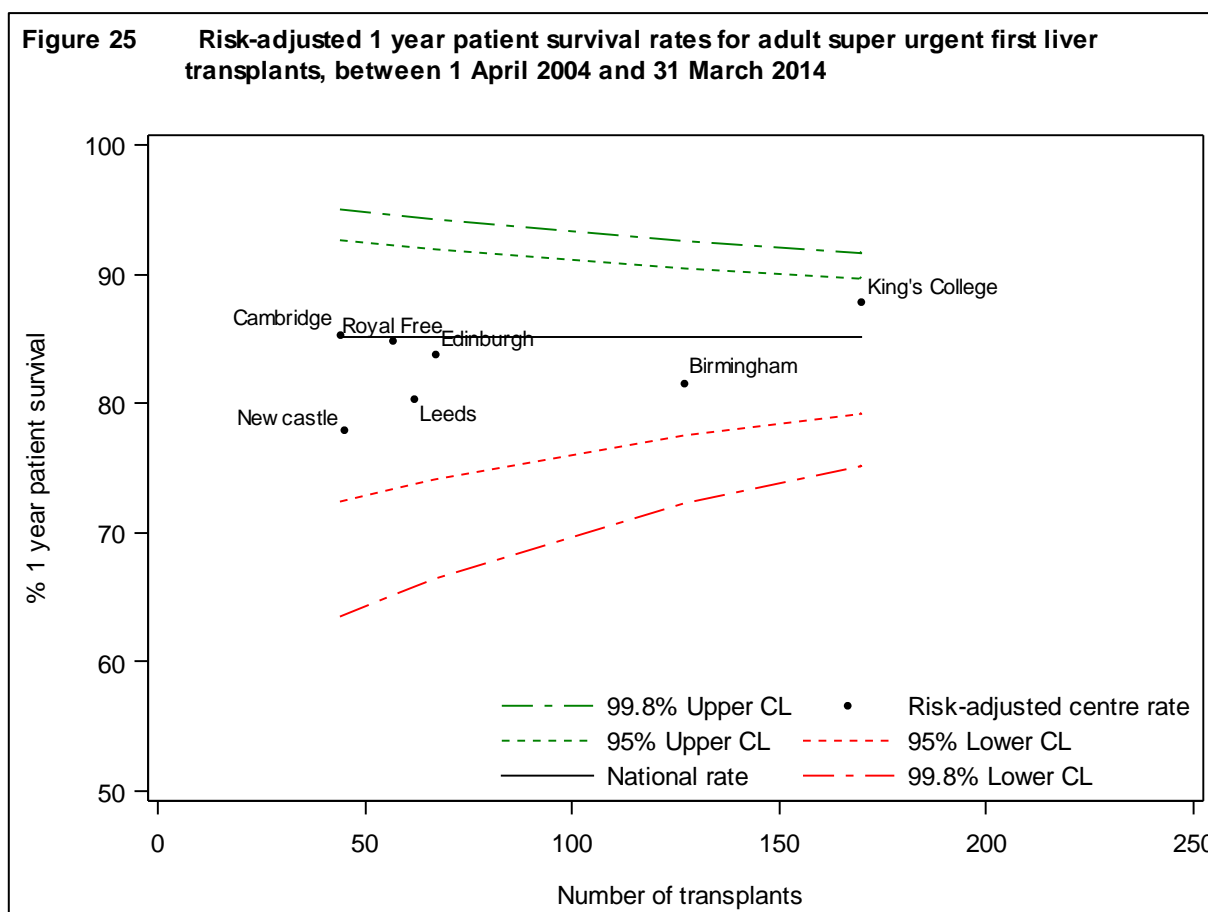


Table 12 shows one year unadjusted and risk-adjusted [patient survival](#) for 628 of the 656 transplants in the ten year period, 1 April 2004 to 31 March 2014. The overall [patient survival](#) rate is 85.1% and after risk adjustment five centres had a lower survival rate than the national rate but within the [confidence limits](#), as shown in **Figure 25**.

Table 12 One year patient survival for adult super urgent first transplants 1 April 2004 - 31 March 2014					
Centre	Number of transplants	1-year survival % (95% CI)			
		Unadjusted		Risk adjusted	
Newcastle	51	82.1	(68.4 - 90.3)	77.9	(57.6 - 88.5)
Leeds	66	78.6	(66.6 - 86.7)	80.3	(66.8 - 88.3)
Cambridge	46	88.7	(74.9 - 95.2)	85.3	(64.8 - 93.9)
Royal Free	60	86.5	(74.9 - 93.0)	84.9	(69.7 - 92.4)
King's College	188	85.4	(79.4 - 89.7)	87.8	(82.2 - 91.6)
Birmingham	145	86.8	(80.1 - 91.4)	81.6	(71.1 - 88.3)
Edinburgh	72	85.7	(75.0 - 92.0)	83.7	(69.7 - 91.2)
Total	628	85.1	(82.1 - 87.7)		



Three year unadjusted and risk-adjusted [patient survival](#) for transplants in the last 10 years is shown in **Table 13**. The national survival rate is 81.6% and after risk adjustment four centres had a lower survival rate than the national rate, but all were within the [confidence limits](#), as shown in **Figure 26**.

Table 13 Three year patient survival for adult super urgent first transplants 1 April 2004 - 31 March 2014					
Centre	Number of transplants	3-year survival % (95% CI)			
		Unadjusted		Risk adjusted	
Newcastle	51	79.8	(65.7 - 88.6)	73.8	(51.3 - 85.9)
Leeds	66	78.6	(66.6 - 86.7)	75.8	(59.1 - 85.7)
Cambridge	46	88.7	(74.9 - 95.2)	82.9	(59.0 - 92.9)
Royal Free	60	84.5	(72.3 - 91.7)	81.7	(64.8 - 90.5)
King's College	188	80.6	(73.8 - 85.8)	84.2	(77.8 - 88.7)
Birmingham	145	80.4	(72.4 - 86.3)	76.1	(64.9 - 83.7)
Edinburgh	72	83.9	(72.7 - 90.8)	80.2	(64.2 - 89.0)
Total	628	81.6	(78.1 - 84.5)		

Figure 26 Risk-adjusted 3 year patient survival rates for adult super urgent first liver transplants, between 1 April 2004 and 31 March 2014

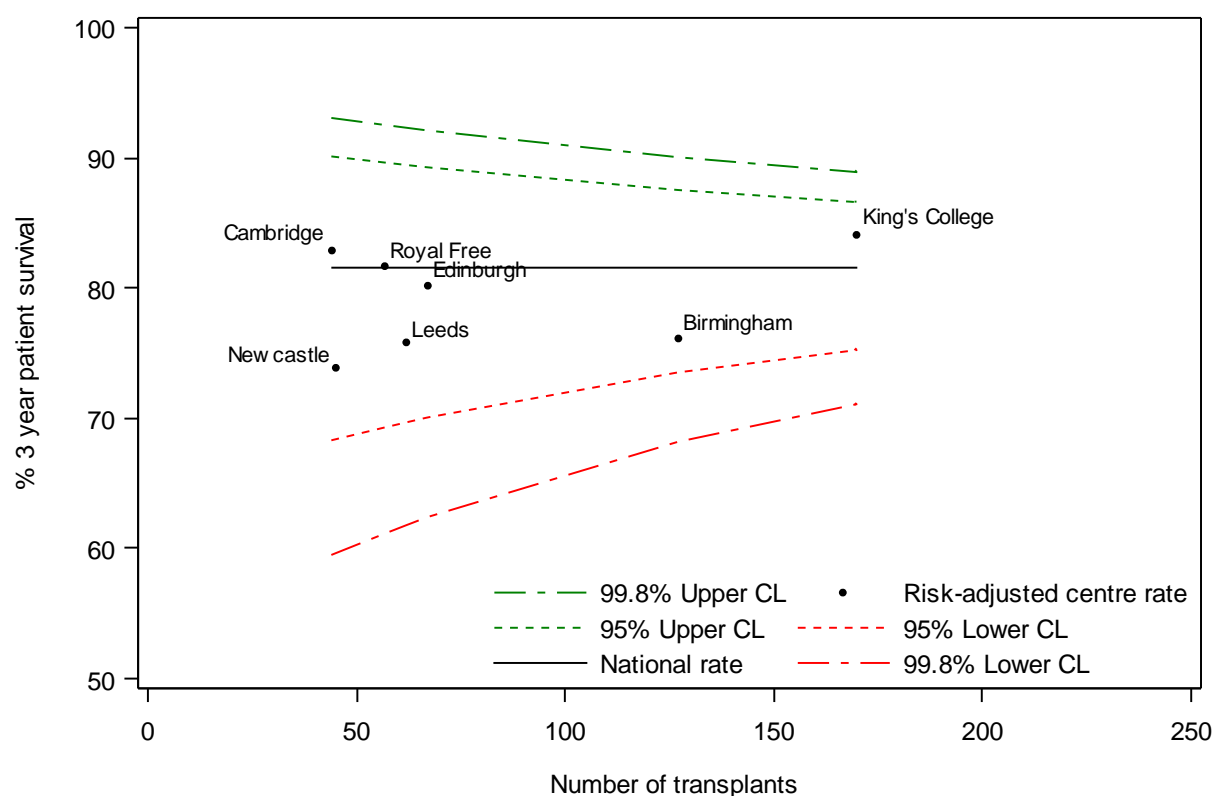
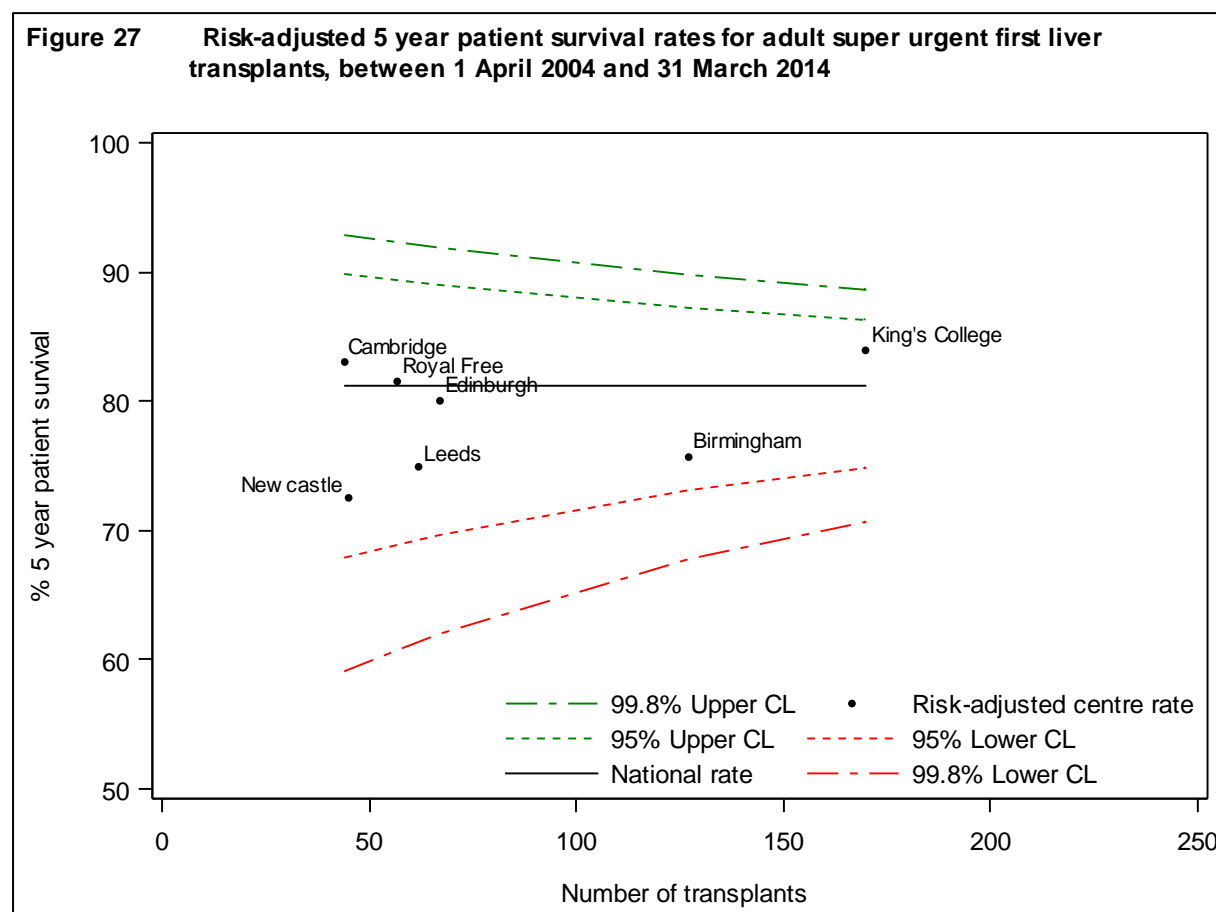


Table 14 shows the five year unadjusted and risk-adjusted [patient survival](#) for transplants in the last ten years and the [risk-adjusted rates](#) are also shown in **Figure 27**. The national rate is 81.2% and four centres have a lower survival rate after risk adjustment but none are below the [confidence limits](#).

Table 14 Five year patient survival for adult super urgent first transplants 1 April 2004 - 31 March 2014					
Centre	Number of transplants	5-year survival % (95% CI)			
		Unadjusted		Risk adjusted	
Newcastle	51	75.1	(58.0 - 86.0)	72.6	(50.5 - 84.8)
Leeds	66	78.6	(66.6 - 86.7)	74.9	(57.6 - 85.1)
Cambridge	46	88.7	(74.9 - 95.2)	83.0	(59.3 - 92.9)
Royal Free	60	84.5	(72.3 - 91.7)	81.5	(64.5 - 90.4)
King's College	188	80.6	(73.8 - 85.8)	83.9	(77.5 - 88.5)
Birmingham	145	80.4	(72.4 - 86.3)	75.7	(64.3 - 83.5)
Edinburgh	72	83.9	(72.7 - 90.8)	80.0	(63.9 - 88.9)
Total	628	81.2	(77.7 - 84.2)		



PAEDIATRIC LIVER TRANSPLANTATION



PAEDIATRIC LIVER TRANSPLANTATION

OVERVIEW

The number of paediatric deceased donor liver only transplants in the last ten years is shown overall and by centre in **Figures 28 and 29**, respectively. In the last year, 68 transplants in paediatric patients were performed, with the majority performed at King's College Hospital and Birmingham. Sixty of these transplants were from elective registrations and 8 from super-urgent.

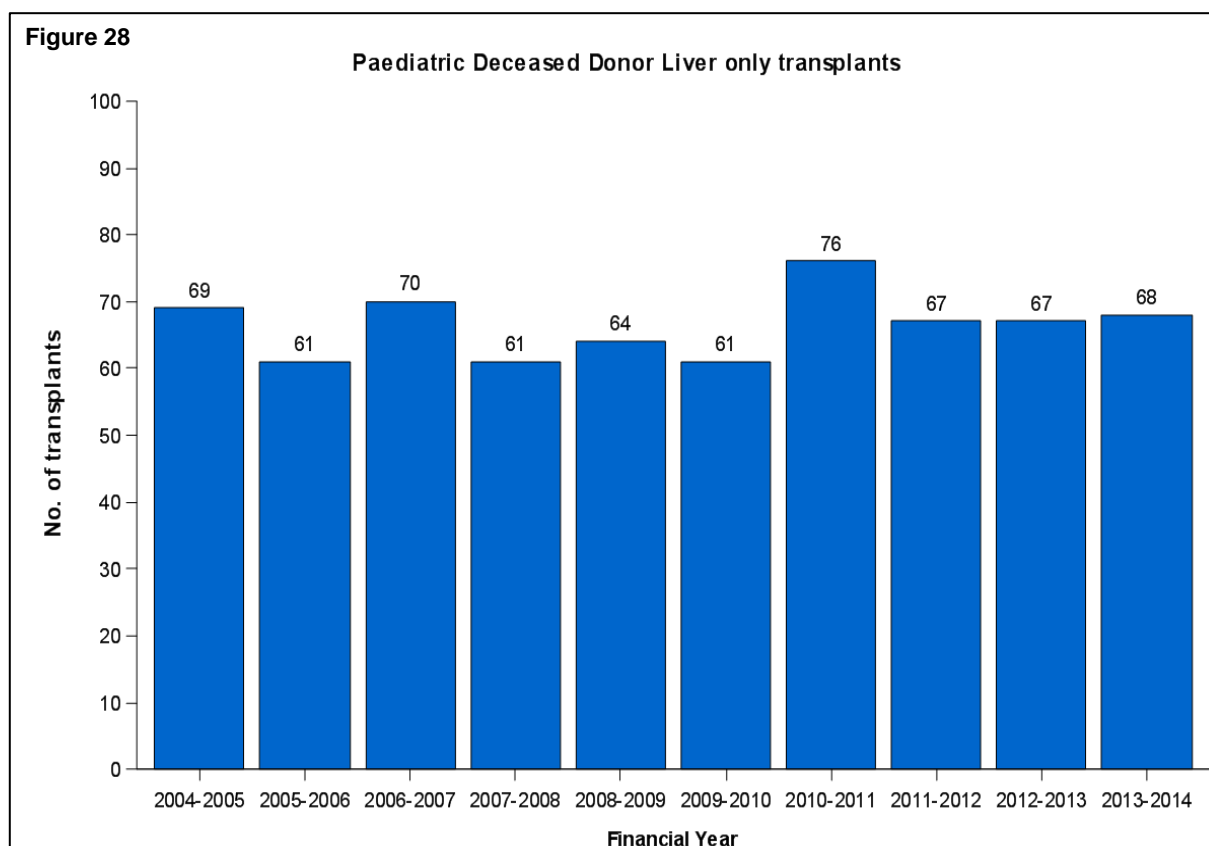
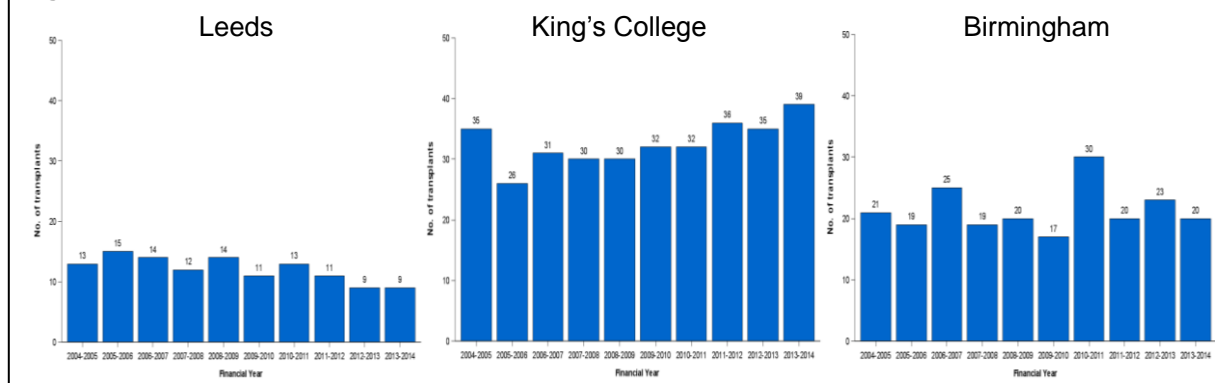
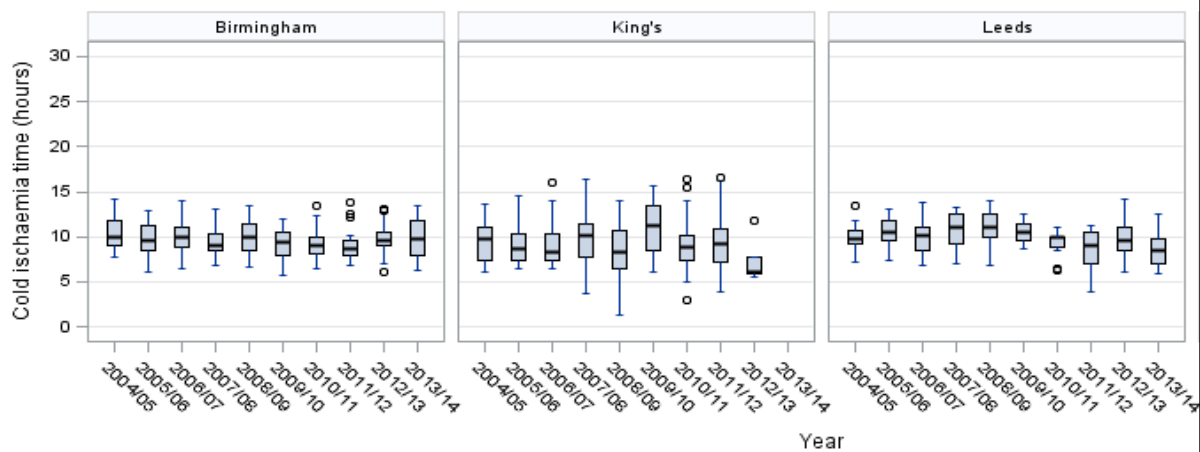
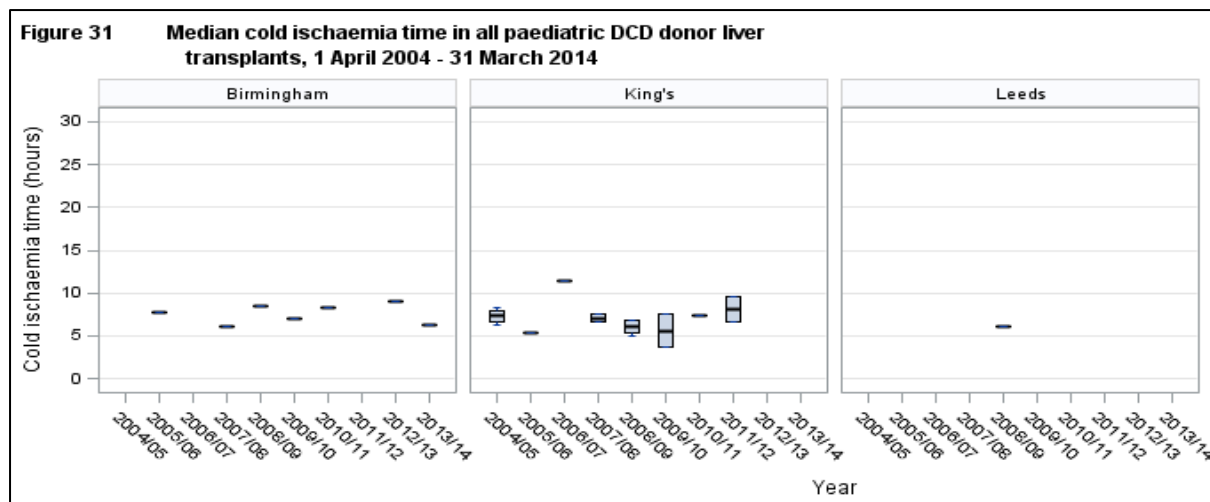


Figure 29

The [median](#) cold ischaemic times for paediatric transplant recipients are shown in **Figures 30 and 31** for [DBD](#) and [DCD](#) donors, respectively. [Median](#) cold ischaemic times were calculated each year during the last ten years, by transplant centre. The national [median](#) cold ischaemic time for transplants from [DBD](#) donors has decreased from 10 hours in 2004/05 to 9 hours in 2013/14. The [median](#) cold ischaemic time in the last financial year ranged between 9 and 10 hours for all transplant centres. The corresponding [median](#) for [DCD](#) donor transplants has decreased from 7 hours in 2004/05 to 6 hours in 2013/14 but note that this is based on very few paediatric recipients transplanted from a [DCD](#) donor.

Figure 30 Median cold ischaemia time in all paediatric DBD donor liver transplants, 1 April 2004 - 31 March 2014



The demographic characteristics of 68 paediatric transplant recipients in the latest year are shown by centre and overall in **Table 15**. Of these recipients, 46% were male and 49% were aged between one and four years old. Of the 68 transplants, 8 (12%) were of super urgent status. For some characteristics, due to rounding, percentages may not add up to 100.

Table 15 Demographic characteristics of paediatric liver transplant recipients 1 April 2013 - 31 March 2014					
		Leeds N (%)	King's College N (%)	Birmingham N (%)	TOTAL N (%)
Number		9	39	20	68 (100)
Recip age years	<1	2 (22)	10 (26)	7 (35)	19 (28)
	1-4	3 (33)	21 (54)	9 (45)	33 (49)
	5-12	4 (44)	6 (15)	4 (20)	14 (21)
	13-16	0	2 (5)	0	2 (3)
Recipient sex	Male	4 (44)	21 (54)	6 (30)	31 (46)
	Female	5 (56)	18 (46)	14 (70)	37 (54)
Indication	Super Urgent	1 (11)	4 (10)	3 (15)	8 (12)
	Metabolic	1 (11)	5 (13)	1 (5)	7 (10)
	Other	7 (78)	30 (77)	16 (80)	53 (78)
Pre-transplant in-patient status	Out-patient	6 (67)	28 (72)	16 (80)	50 (74)
	In-patient	3 (33)	10 (26)	4 (20)	17 (25)
	Missing	0	1 (3)	0	1 (2)
Pre-transplant renal support	No	9 (100)	34 (87)	18 (90)	61 (90)
	Yes	0	3 (8)	2 (10)	5 (7)
Ascites	Absence	6 (67)	32 (82)	11 (55)	49 (72)
	Presence	3 (33)	7 (18)	9 (45)	19 (28)

Table 15		Demographic characteristics of paediatric liver transplant recipients 1 April 2013 - 31 March 2014			
		Leeds N (%)	King's College N (%)	Birmingham N (%)	TOTAL N (%)
Previous abdominal surgery	No	5 (56)	23 (59)	14 (70)	42 (62)
	Yes	4 (44)	16 (41)	6 (30)	26 (38)
INR	<=1.0	2 (22)	2 (5)	11 (55)	15 (22)
	1.1-1.5	4 (44)	17 (44)	6 (30)	27 (40)
	1.6-3.0	2 (22)	18 (46)	2 (10)	22 (32)
	>3.0	1 (11)	1 (3)	1 (5)	3 (4)
	Missing	0	1 (3)	0	1 (2)
Serum sodium mmol/l	<135	2 (22)	7 (18)	2 (10)	11 (16)
	>=135	7 (78)	31 (79)	18 (90)	56 (82)
	Missing	0	1 (3)	0	1 (2)
Donor age years	<5	0	3 (8)	1 (5)	4 (6)
	5-16	0	7 (18)	1 (5)	8 (12)
	17-30	4 (44)	14 (36)	5 (25)	23 (34)
	>=31	5 (56)	15 (38)	13 (65)	33 (49)
Donor sex	Male	5 (56)	22 (56)	9 (45)	36 (53)
	Female	4 (44)	17 (44)	11 (55)	32 (47)
Donor type	Donor after brain death	9 (100)	38 (97)	19 (95)	66 (97)
	Donor after cardiac death	0	1 (3)	1 (5)	2 (3)
Graft appearance	Normal	7 (78)	4 (10)	20 (100)	31 (46)
	Abnormal	1 (11)	0	0	1 (2)
	Missing	1 (11)	35 (90)	0	36 (53)
Graft type	Whole	0	6 (15)	1 (5)	7 (10)
	Segmental	9 (100)	33 (85)	19 (95)	61 (90)
Urgency Status	Elective	8 (89)	35 (90)	17 (85)	60 (88)
	Super Urgent	1 (11)	4 (10)	3 (15)	8 (12)

90-DAY POST-TRANSPLANT SURVIVAL AND GRAFT FUNCTION

Table 16 shows the 90-day [survival](#) and [graft function](#) for paediatric first liver transplants in the latest year by urgency status, nationally and by centre. Of the 68 transplants, 98.5% were alive 90 days post-transplant and 89.7% of surviving patients had a functioning graft. For super urgent transplants 90-day survival was 100% and [graft function](#) was 87.5%.

Table 16 90-day patient survival (%) and graft function (%) for paediatric first liver transplants between, 1 April 2013 and 31 March 2014, by transplant centre

Centre	Indication	Number of transplants	90-day survival (95% CI)		90-day graft function (95% CI)	
Leeds	All	9	100.0	-	100.0	-
	Elective	8	100.0	-	100.0	-
	Super Urgent	1	100.0	-	100.0	-
King's College	All	39	97.4	(84.0-98.7)	89.7	(75.6-96.6)
	Elective	35	97.1	(81.9-98.7)	88.6	(71.4-94.5)
	Super Urgent	4	100.0	-	100.0	-
Birmingham	All	20	100.0	-	85.0	(60.9-94.5)
	Elective	17	100.0	-	88.2	(60.9-96.6)
	Super Urgent	3	100.0	-	66.7	(6.3-94.5)
TOTAL	All	68	98.5	(90.3-100.0)	89.7	(79.8-94.5)
	Elective	60	98.3	(88.2-100.0)	90.0	(79.8-94.5)
	Super Urgent	8	100.0	-	87.5	(37.8-98.7)

PAEDIATRIC LIVER TRANSPLANTATION

ELECTIVE PATIENTS



ELECTIVE PATIENTS

TRANPLANT LIST

Figure 32 shows the number of paediatric elective patients on the liver only transplant list at 31 March each year between 2005 and 2014. The number of patients actively waiting for a liver only transplant has ranged between 18 and 40 each year. In the last three years the number has decreased from 36 to 24.

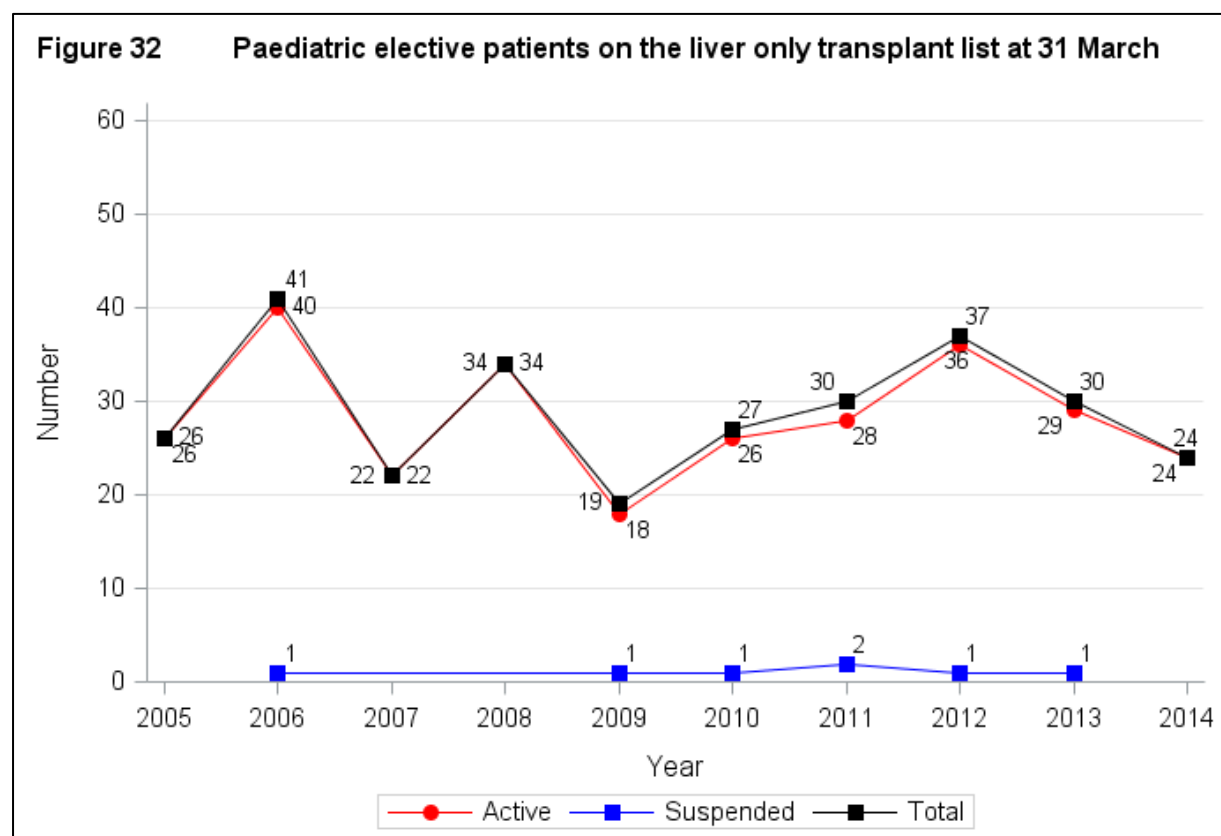
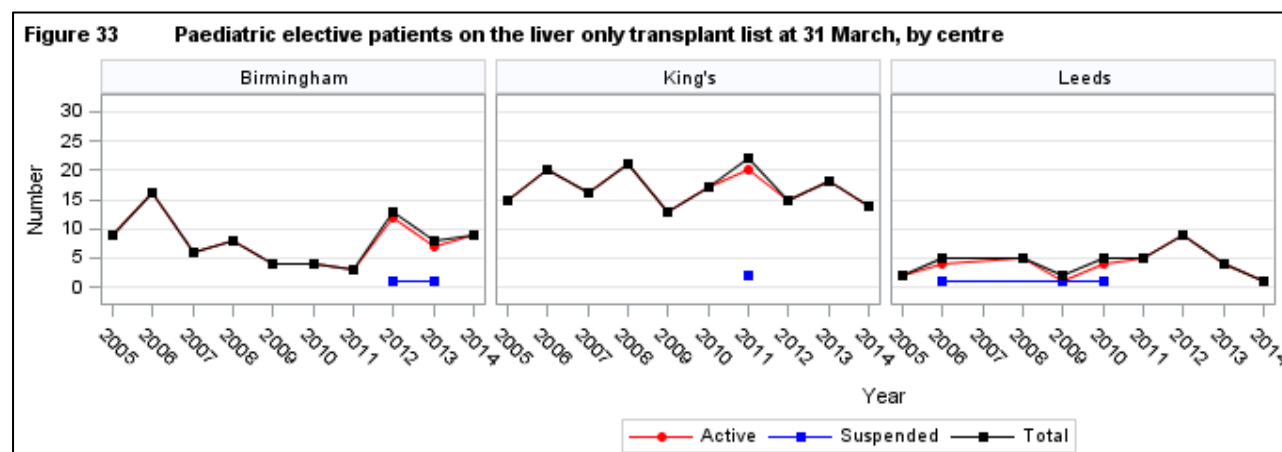


Figure 33 shows the number of elective patients on the transplant list at 31 March each year between 2005 and 2014 for each transplant centre.



An indication of outcomes for paediatric patients listed for a liver transplant is summarised in **Figure 34**. This shows the proportion of patients transplanted or still waiting six months, one and two years after joining the list. After one year 85% of patients have had a liver transplant, and 9% are still waiting.

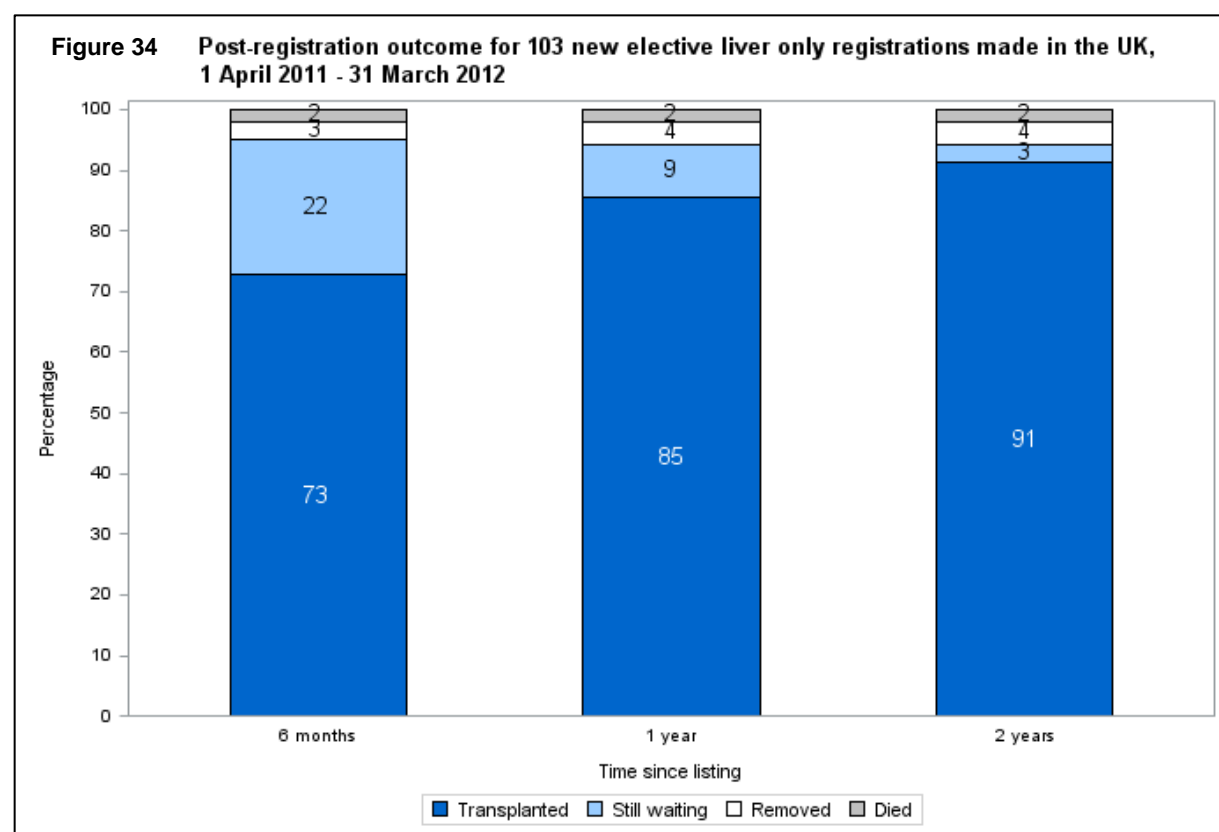


Table 17 shows the [median](#) waiting time to liver only transplant for paediatric elective patients. The [median](#) waiting time to transplant is shortest at Birmingham, at 38 days, and longest at King's College Hospital, at 120 days. The national [median](#) waiting time to transplant is 76 days.

Table 17 Median waiting time to liver only transplant in the UK, for paediatric elective patients registered 1 April 2008 - 31 March 2011			
Transplant centre	Number of patients registered	Waiting time (days)	
		Median	95% Confidence interval
Paediatric			
Birmingham	52	38	24 - 52
Leeds	35	45	9 - 81
King's College	102	120	75 - 165
UK	190	76	60 - 92

TRANSPLANT ACTIVITY

Figure 35 shows the number of paediatric elective liver only transplants from deceased donors performed in the last ten years, by type of donor.

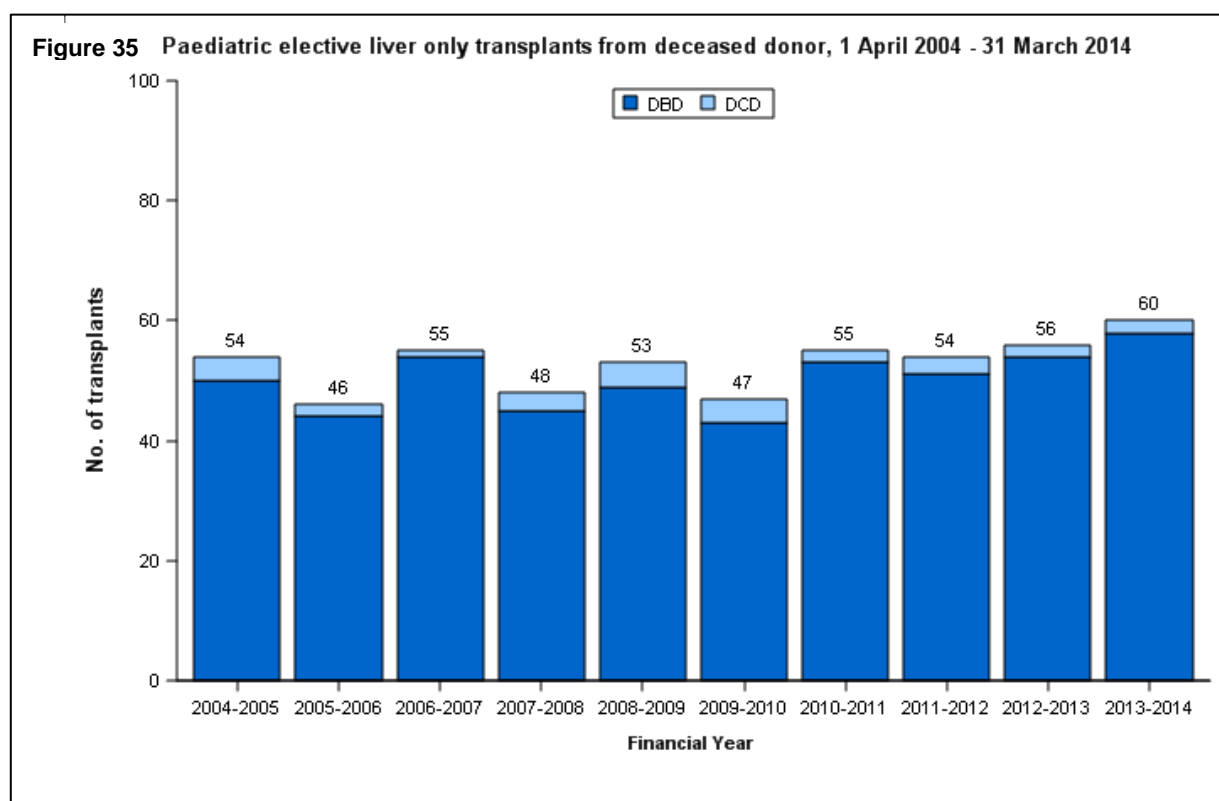
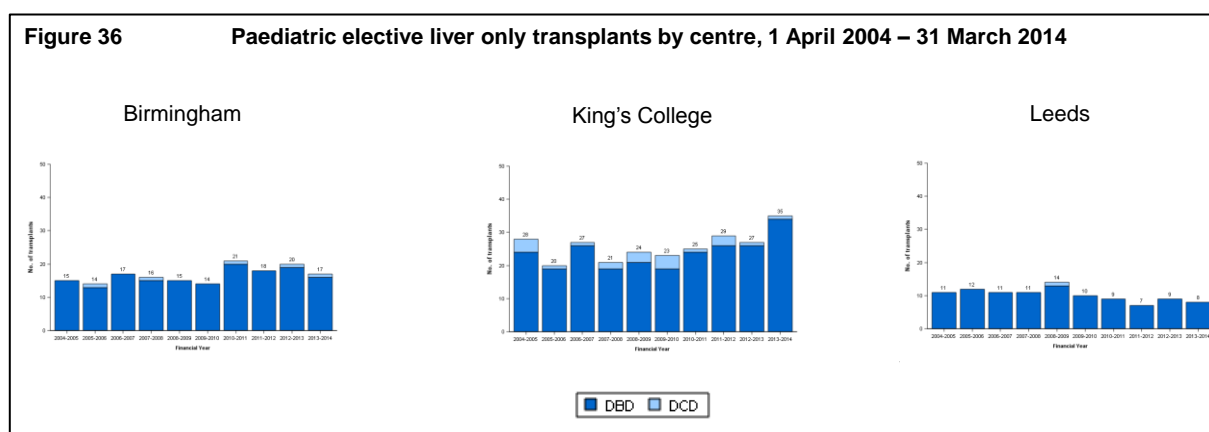


Figure 36 shows the number of paediatric elective liver only transplants from deceased donors performed in the last ten years, by type of donor and transplant centre.



POST-TRANSPLANT SURVIVAL

One year unadjusted [patient survival](#) for the 170 transplants in the last three years is shown in **Table 18**. The national rate was 94.9% and the centres ranged from 93.8% to 95.3%.

Table 18 One year unadjusted patient survival for paediatric elective first transplants, 1 April 2011 - 31 March 2014			
Centre	Number of transplants	1-year survival % (95% CI)	
Leeds	24	93.8	(63.2 - 99.1)
King's College	91	95.3	(87.8 - 98.2)
Birmingham	55	94.5	(84.0 - 98.2)
Total	170	94.9	(89.9 - 97.4)

Table 19 shows the unadjusted one, three and five year paediatric [patient survival](#) for 528 transplants in the last ten years nationally and by centre. The national 5-year survival rate was 90.8% and the centre rates ranged from 85.6% to 92.6%.

Table 19		Unadjusted patient survival for paediatric elective first transplants 1 April 2004 - 31 March 2014					
Centre	Number of transplants	1-year survival % (95% CI)		3-year survival % (95% CI)		5-year survival % (95% CI)	
Leeds	102	93.9	(87.0 - 97.2)	92.6	(85.0 - 96.4)	85.6	(74.9 - 92.0)
King's College	259	95.2	(91.7 - 97.3)	92.6	(88.2 - 95.3)	92.6	(88.2 - 95.3)
Birmingham	167	95.1	(90.5 - 97.5)	92.0	(86.3 - 95.4)	92.0	(86.3 - 95.4)
Total	528	95.0	(92.7 - 96.5)	92.4	(89.6 - 94.5)	90.8	(87.5 - 93.3)

PAEDIATRIC LIVER TRANSPLANTATION

SUPER URGENT PATIENTS



SUPER URGENT PATIENTS

TRANSPLANT LIST

Table 20 shows the [median](#) waiting time to liver only transplant for paediatric super urgent patients. The [median](#) waiting time to transplant is shortest at Birmingham and longest at Leeds but not statistically significantly different to each other. The national [median](#) waiting time to transplant is three days.

Table 20 Median waiting time to liver only transplant in the UK, for paediatric super urgent patients registered 1 April 2008 - 31 March 2011			
Transplant centre	Number of patients registered	Waiting time (days)	
		Median	95% Confidence interval
Paediatric			
Birmingham	27	2	1 - 3
King's College	39	4	2 - 6
Leeds	10	5	2 - 8
UK	79	3	2 - 4

Table 20 includes registrations for a re-transplant. Of the 79 registrations for the UK in the three-year time period, only 56 led to transplants (the remaining 23 led to removal, suspension or death). Ten of the 56 transplants were re-transplants, hence, the difference between the 46 *first* liver only transplants reported in **Figure 37** for the period 2008 – 2011 and **Table 20**.

TRANSPLANT ACTIVITY

Figure 37 shows the number of paediatric super urgent liver only transplants from deceased donors performed in the last ten years, by type of donor.

Figure 37 Paediatric super-urgent liver only transplants from deceased donor, 1 April 2004 - 31 March 2014

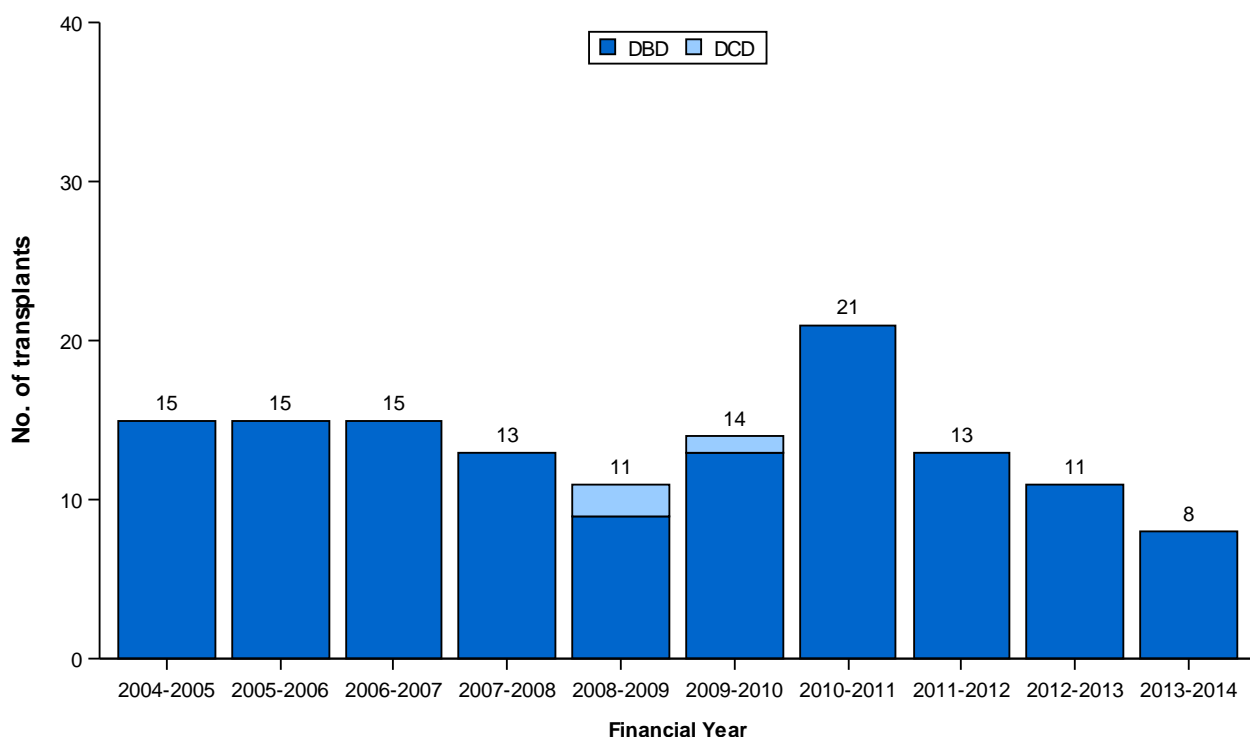
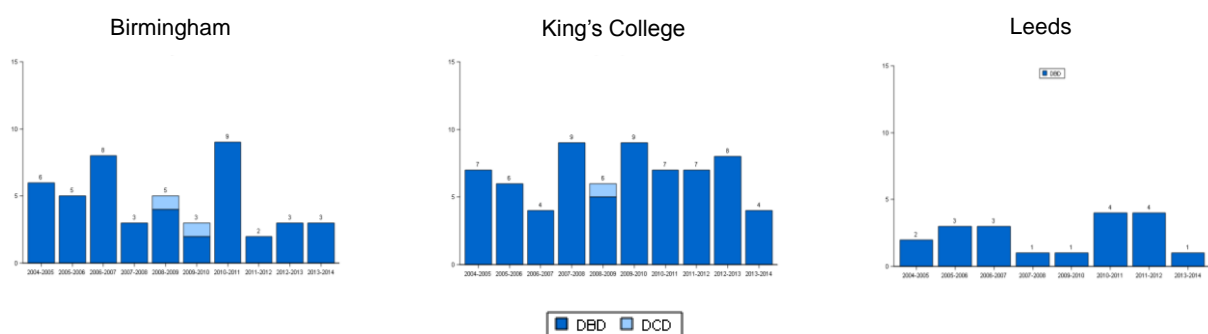


Figure 38 shows the number of paediatric super urgent liver only transplants from deceased donors performed in the last ten years, by type of donor and transplant centre.

Figure 38 Paediatric super urgent liver only transplants by centre, 1 April 2004 – 31 March 2014



POST-TRANSPLANT SURVIVAL

One year unadjusted [patient survival](#) for 32 transplants in the last three years is shown in **Table 21**. The national rate was 80.2% and the centres ranged from 70% to 100%.

Table 21 One year unadjusted patient survival for paediatric super urgent first transplants, 1 April 2011 - 31 March 2014			
Centre	Number of transplants	1-year survival % (95% CI)	
Leeds	5	100.0	-
King's College	19	78.9	(45.6 - 93.1)
Birmingham	8	70.0	(22.5 - 91.8)
TOTAL	32	80.2	(57.6 - 91.6)
Note: There were no deaths for Leeds patients therefore no survival estimated.			

Table 22 shows the unadjusted one, three and five year paediatric [patient survival](#) for 136 transplants in the last ten years nationally and by centre. The national 5-year survival rate was 69.7% and the centre rates ranged from 64.2% to 72.6%.

Table 22 Unadjusted patient survival for paediatric super urgent first transplants 1 April 2004 - 31 March 2014							
Centre	Number of transplants	1-year survival % (95% CI)		3-year survival % (95% CI)		5-year survival % (95% CI)	
Leeds	19	72.2	(45.3 - 87.4)	64.2	(36.0 - 82.5)	64.2	(36.0 - 82.5)
King's College	67	81.5	(69.7 - 89.1)	75.3	(62.0 - 84.4)	72.6	(58.6 - 82.5)
Birmingham	47	72.1	(56.8 - 82.7)	69.7	(54.2 - 80.8)	69.7	(54.2 - 80.8)
Total*	136	76.7	(68.6 - 83.0)	71.0	(62.1 - 78.1)	69.7	(60.6 - 77.1)
* Includes 3 patients transplanted at a non-paediatric centre							

CONTINUOUS MONITORING OF CENTRE OUTCOMES



CONTINUOUS MONITORING OF CENTRE OUTCOMES

For each liver transplant centre, 90-day patient mortality has been monitored for all first liver transplants since 1 January 2006. In this analysis, heterotopic liver and [multi-organ](#) transplants are excluded, as well as transplants from [living](#) donors. Patient mortality is defined as patient death within 90 days of first liver transplant. Outcomes following adult and paediatric, elective and super-urgent liver transplants are presented separately.

The continuous monitoring performed combines the use of two types of cumulative sum (CUSUM) chart; the 'Observed – Expected' (O-E) chart and the tabular CUSUM of centre outcomes.

The O-E chart is a useful tool for observing centre performance over time. A downward trend indicates a lower than expected rate of mortality compared with the baseline period (i.e. improved performance), whereas an upward trend points to an observed mortality rate that is higher than expected (i.e. inferior performance). From the O-E chart, it is not possible to determine when a significant change in the mortality rate has occurred. To identify statistically significant changes the tabular CUSUM chart is used to complement the O-E chart. A significant shift in the underlying mortality rate is evident when the chart crosses the limit and generates a signal.

The following O-E charts show the 90 day mortality of liver transplant patients between 1 January 2012 and 28 February 2014 for adult and paediatric, elective and super-urgent transplants separately. Signals from the tabular CUSUM charts are also noted on these charts.

ADULT TRANSPLANTS

Figure 39 shows the O-E charts for 90 day mortality of adult elective transplants at each centre. There have been no signals, indicating a significant change in the mortality rate, at any centre in the reported period.

The charts for 90 day mortality of adult super-urgent transplants at each centre are shown in **Figure 40**. There have been no signals since January 2012.

Figure 39 90 day mortality of adult elective liver transplant patients, from 1 January 2012 to 28 February 2014

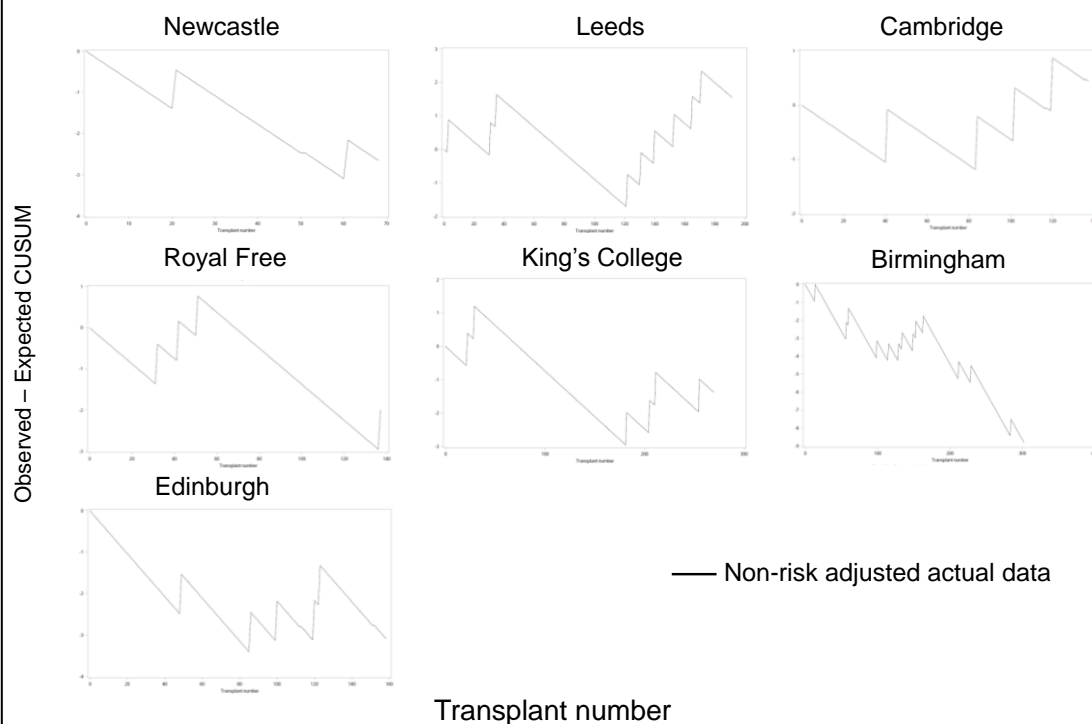
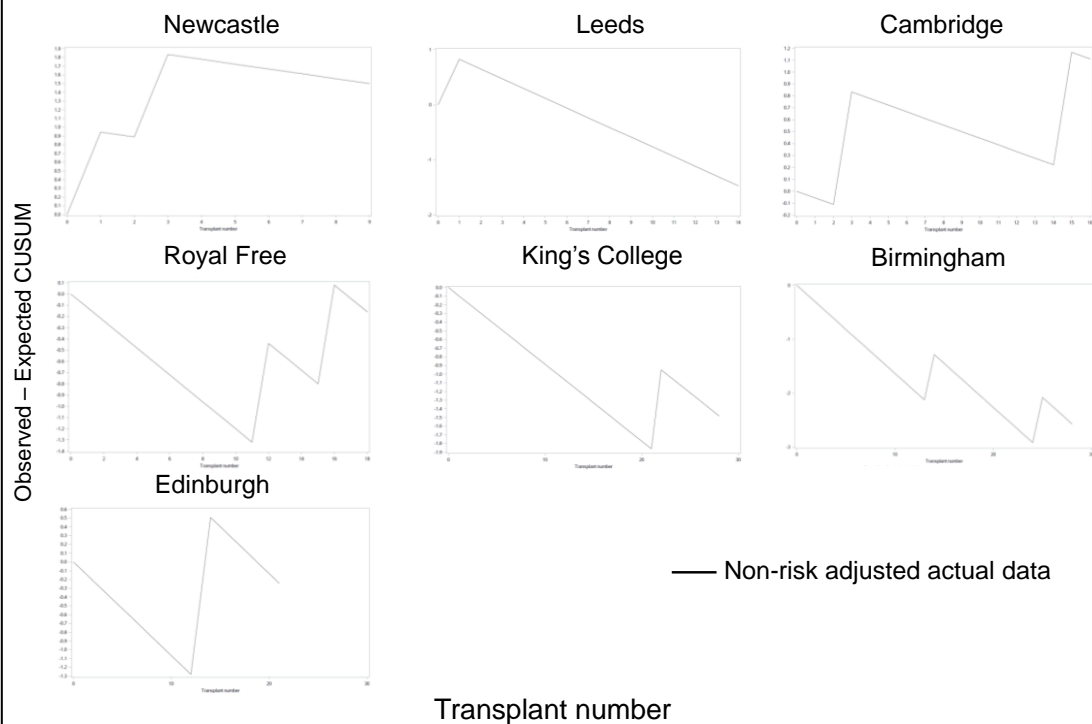
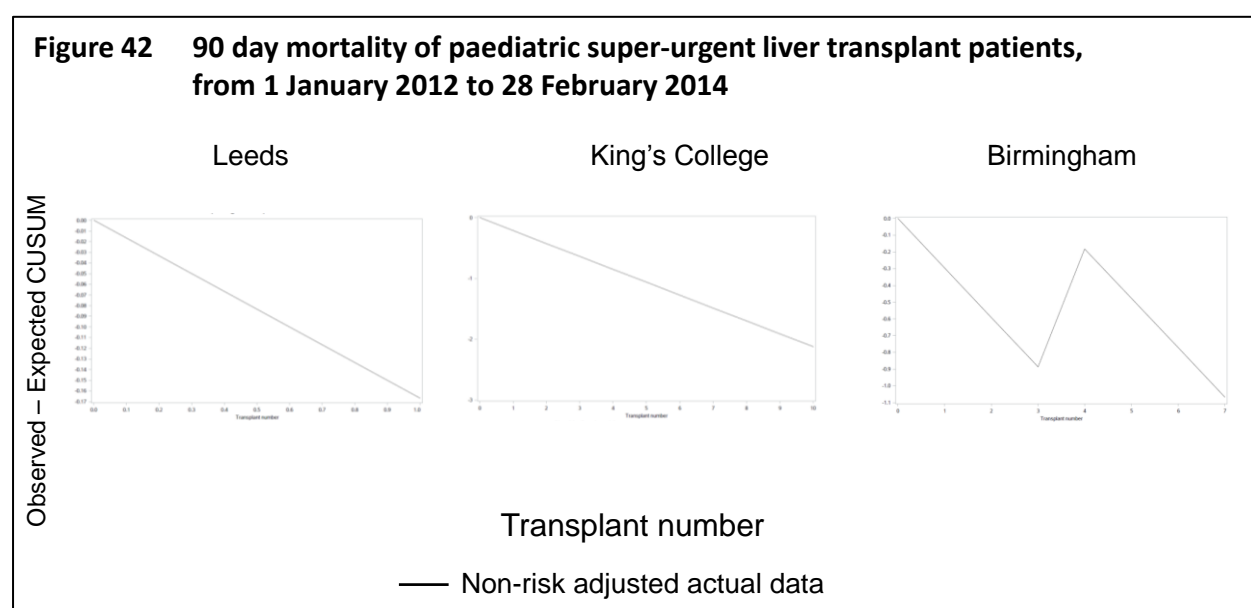
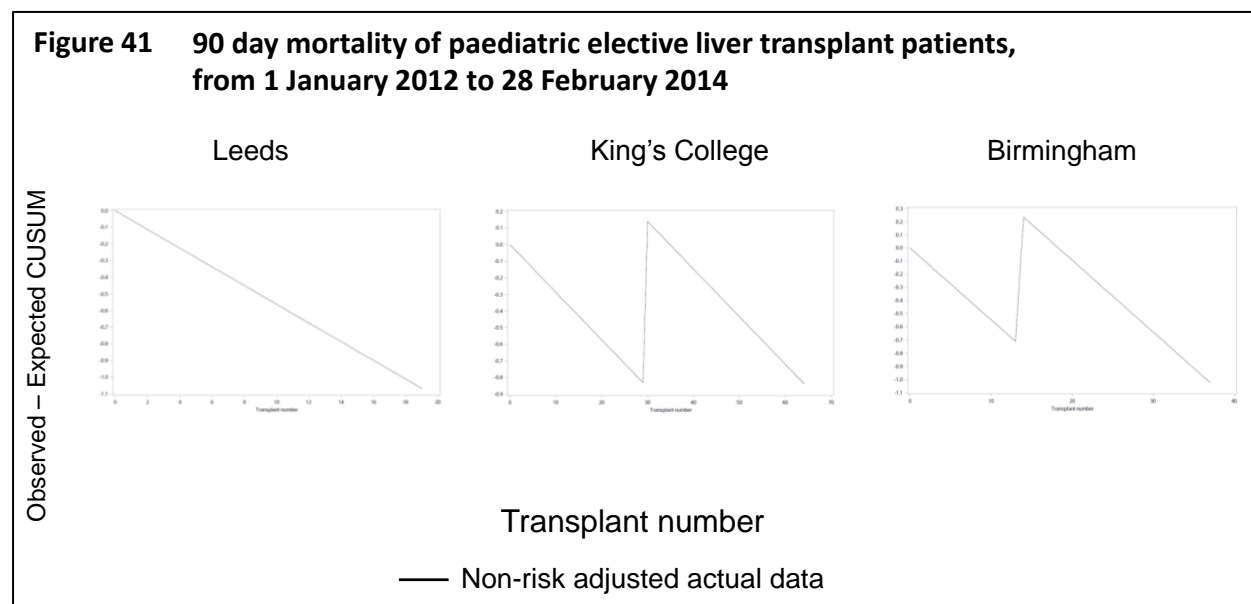


Figure 40 90 day mortality of adult super-urgent liver transplant patients, from 1 January 2012 to 28 February 2014



PAEDIATRIC TRANSPLANTS

Figures 41 and 42 show the O-E charts for 90 day mortality of paediatric elective and super-urgent transplants, respectively. There have been no signals for elective or super-urgent transplants in this period.



APPENDIX



APPENDIX

DATA

Data were obtained from the UK Transplant Registry for the ten year time period, 1 April 2004 to 31 March 2014 and include NHS Group 2 transplants, heterotopic and auxiliary transplants and exclude liver transplants for intestinal patients (including liver only transplants for intestinal 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.

Number of adult transplants in each time period, by transplant centre and urgency status						
Table 1 Centre	Latest year		Last 3 years		Last 10 years	
	April 2013-March 2014		April 2011-March 2014		April 2004-March 2014	
	Elective	Super-urgent	Elective	Super-urgent	Elective	Super-urgent
Newcastle	38	10	111	17	304	67
Leeds	110	13	267	30	746	102
Cambridge	68	11	214	36	646	83
Royal Free	85	11	203	32	551	89
King's College	156	23	443	57	1295	232
Birmingham	166	23	456	56	1207	197
Edinburgh	81	14	242	37	600	99
TOTAL	704	105	1936	265	5349	869

Number of deceased donor adult first liver only transplants in each time period, by transplant centre and urgency status						
Table 2 Centre	Latest year		Last 3 years		Last 10 years	
	April 2013-March 2014		April 2011-March 2014		April 2004-March 2014	
	Elective	Super-urgent	Elective	Super-urgent	Elective	Super-urgent
Newcastle	32	7	96	13	265	53
Leeds	99	7	245	16	688	72
Cambridge	63	8	200	20	579	52
Royal Free	77	6	186	23	505	63
King's College	138	15	383	43	1104	191
Birmingham	145	16	417	38	1107	150
Edinburgh	76	12	223	28	534	75
TOTAL	630	71	1750	181	4782	656

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

Table 3 Number of paediatric transplants in each time period, by transplant centre and urgency status						
Centre	Latest year		Last 3 years		Last 10 years	
	April 2013-March 2014		April 2011-March 2014		April 2004-March 2014	
	Elective	Super-urgent	Elective	Super-urgent	Elective	Super-urgent
Newcastle	0	0	0	0	0	1
Leeds	16	1	48	7	136	27
Cambridge	0	0	0	0	0	0
Royal Free	1	1	1	1	1	2
King's College	45	7	135	26	396	85
Birmingham	23	8	73	18	220	68
Edinburgh	0	0	0	0	0	1
TOTAL	85	17	257	52	753	184

Table 4 Number of deceased donor paediatric first liver only transplants in each time period, by transplant centre and urgency status						
Centre	Latest year		Last 3 years		Last 10 years	
	April 2013-March 2014		April 2011-March 2014		April 2004-March 2014	
	Elective	Super-urgent	Elective	Super-urgent	Elective	Super-urgent
Newcastle	0	0	0	0	0	1
Leeds	8	1	24	5	102	19
Cambridge	0	0	0	0	0	0
Royal Free	0	0	0	0	0	1
King's College	35	4	91	19	259	67
Birmingham	17	3	55	8	167	47
Edinburgh	0	0	0	0	0	1
TOTAL	60	8	170	32	528	136

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

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

[Kaplan-Meier](#) methods were used to estimate the [unadjusted](#) 90-day patient mortality and graft function and [patient survival](#) rates at one, three and five years. 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.

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-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.

Continuous monitoring of centre outcomes

The O-E chart plots the cumulative difference between the observed and expected patient mortality. Expected mortality has been determined from an unadjusted centre-specific average mortality rate based on transplants in the baseline period (between 2008 and 2011), with more recent transplants given greater weight. The chart is not reset but

continues to monitor each successive transplant in the monitoring period. For transplants with a positive 90-day outcome the chart goes down a small step (p ; $0 \leq p \leq 1$), while for each patient death the chart goes up by a larger step ($1-p$). The step sizes reflect that there is a small probability of death (p). For example, if the expected death rate in the centre is 10%, each transplant that is functioning at 90 days will cause the chart to go down by 0.1 and each patient death within 90 days will cause the chart to go up by 0.9.

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

Table 5 Risk factors and categories used in the adult elective risk adjusted survival models post transplantation	
Life style activity	Normal Restricted Self-care Confined Reliant
Graft appearance	Normal Abnormal
Recipient age years	Per 1 year increase
BMI kg/m ²	Per 1 kg/m ² increase
Serum Bilirubin µmol/l	≤30 31-50 51-70 71-90 ≥91
Serum Creatinine µmol/l	≤70 71-90 91-110 111-130 ≥131
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 Ischaemic 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 ²	Per 1 kg/ m ² increase
Time period (for ten year cohort)	1 April 2010 – 31 March 2013 1 April 2007 – 31 March 2010 1 April 2003 – 31 March 2007

Table 6 Risk factors and categories used in the adult super-urgent risk adjusted survival models post transplantation	
Recipient sex	Male Female
Recipient ethnicity	White Non-white
Recipient HCV status	Negative Positive
Pre-transplant in-patient status	Out-patient In-patient
Ascites	Absence Presence
Encephalopathy	Absence Presence
Pre-transplant renal support	No Yes
Previous abdominal surgery	No Yes
Varices & shunt	Absence Presence without treatment Presence with surgical shunt Presence with TIPS
Life style activity	Normal Restricted Self-care Confined Reliant
Graft appearance	Normal Abnormal
Recip age years	Per 1 year increase
BMI kg/m ²	Per 1 kg/m ² increase
Serum Bilirubin µmol/l	≤100 101-200 201-300 301-400 ≥401
Serum Creatinine µmol/l	≤100 101-130 131-160 161-190 ≥191
Serum sodium mmol/l	Per 10 mmol/l increase
Serum potassium mmol/l	Per 1 mmol/l increase
INR	Per 1 unit increase
Serum Albumin g/l	Per 5g/l increase
Cold Ischaemic 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

Table 6 Risk factors and categories used in the adult super-urgent risk adjusted survival models post transplantation	
Donor history of diabetes	No Yes
Donor type	Donor after brain death Donor after cardiac 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
Time period (for ten year cohort)	1 April 2010 – 31 March 2013 1 April 2007 – 31 March 2010 1 April 2003 – 31 March 2007

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.

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.

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 after brain death

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

A donor whose heart stops beating before their brain stops working and who is then certified dead. The organs are then removed.

Funnel plot

A graphical method that shows how consistent the 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 transplant survival rate is the percentage of transplants still functioning in living patients 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.

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.

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 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.

Prepared by:

Statistics and Clinical Studies, NHS Blood and Transplant

Miss Kate Martin
Dr Elisa Allen