

**NHS BLOOD AND TRANSPLANT  
ORGAN DONATION AND TRANSPLANTATION DIRECTORATE**

**KIDNEY ADVISORY GROUP**

**NATIONAL DCD KIDNEY ALLOCATION SCHEME**

**2 YEAR REVIEW**

**3 SEPTEMBER 2014 TO 31 AUGUST 2016**

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Statistics and Clinical Studies**

**November 2016**

**Key points:**

- 1 On 1<sup>st</sup> September 2016 the age range for offering the second kidney regionally increased from 5 to 54 years to 5 to 59 years.
- 2 The number of kidney only transplants performed under the new scheme is 1571. 747 have been from donors through the scheme (donors aged 5-49 in year 1, 5-54 in year 2 and 5-64 in London) and 824 have been from donors outside of the scheme.
- 3 98 SPK transplants have been performed under the new scheme. SPK transplants are now offered after high priority kidney only patients (long waiting patients, 000 mismatched paediatrics and 000 mismatched HSP or DR homozygous adults).
- 4 45% of all DCD kidney only transplants have been performed in the local kidney centre, 44% have been performed in a regional transplant centre and 11% have been fast tracked across the UK.
- 5 There has been an increase in the proportion of highly sensitised patients receiving a DCD transplant from 4% in the previous year to 7% during one year of the scheme and 7% during year two. Better matching has also been achieved with 19% of transplants were a level 4 mismatch in the previous year compared to 11% in year 1 and 9% in year 2.
- 6 93% of all kidneys have HLA available at time of offering. Four donor transplant coordinator teams have slightly lower rates of kidneys with HLA available at time of offering; South West (87%), Eastern (90%), Northern (91%), Northern Ireland (92%).
- 7 There has been a significant decrease in cold ischaemia time for the second kidney comparing all donors before the scheme (15.8 hours) to donors aged 5-49 in year 1 (15.3 hours,  $p=0.07$ ) and donors aged 5-54 in year 2 (14.9 hours,  $p=0.04$ ). There is also a borderline difference in cold ischaemia time for the second kidney comparing donors through the scheme and donors outside the scheme. Year 1, 5-49 vs <5 or 50+  $p=0.09$ . Year 2, 5-54 vs <5 or 55+  $p=0.08$ .
- 8 Screening centres received on average 17 calls per month over the six month period 1 December 2015 – 31 May 2016. Leeds received the most calls with an average of 25 calls per month (Cardiff (16), Cambridge (14), Guy's (12)). An additional 20 transplants were possible thanks to the screening centres.

**ACTION**

- 9 Members are asked to review the information presented and make any recommendations that are appropriate.

## DCD KIDNEY ALLOCATION SCHEME (2014)

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# TRANSPLANTATION

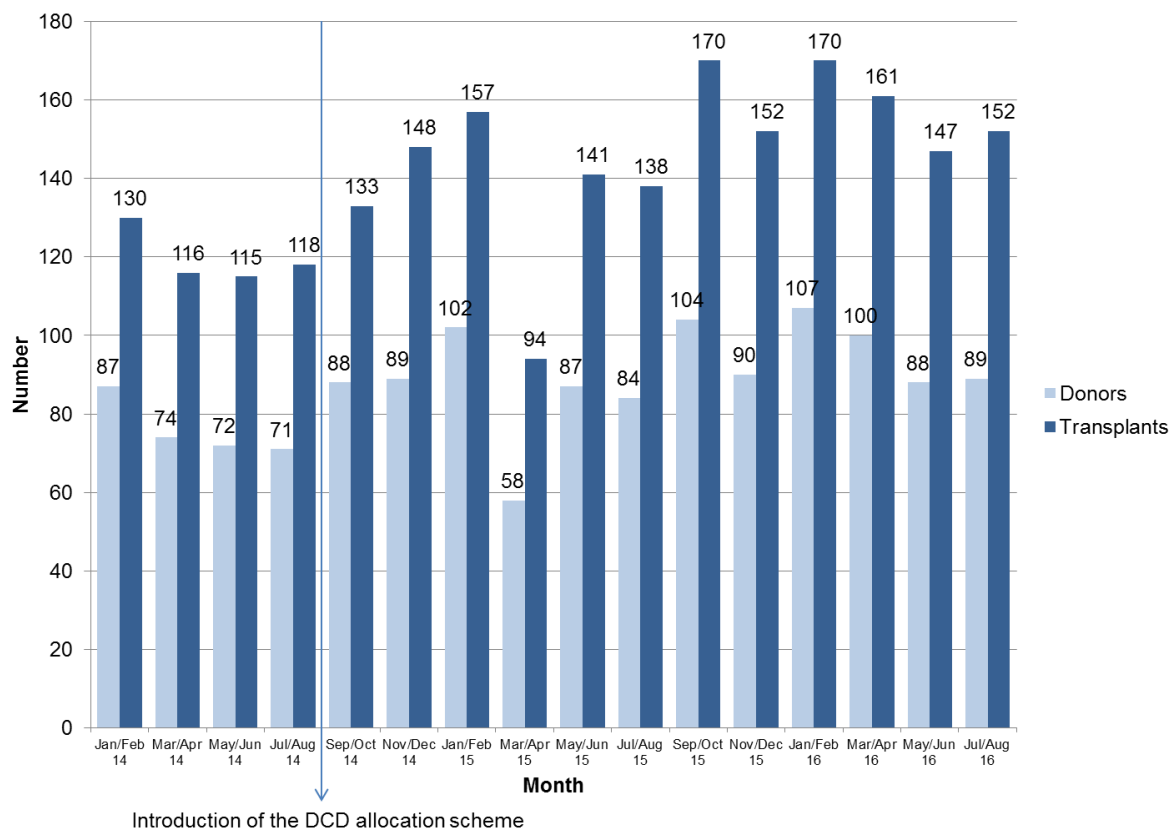
**Table 1.1 Overview of transplant activity**

Donors age:	1 Sep 2013 - 31 Aug 2014				3 Sep 2014 – 31 Aug 2015				1 Sep 2015 – 31 Aug 2016			
	5-49		<5 or 50+		5-49		<5 or 50+		5-54		<5 or 55+	
	N	%	N	%	N	%	N	%	N	%	N	%
Single kidney	211	85	454	88	313	84	395	91	434	91	429	91
Dual kidney	1	<1	58	11	1	<1	32	7	3	1	37	8
En-bloc kidney	-	-	4	1	-	-	7	2	-	-	8	2
SPK	37	15	2	<1	57	15	1	<1	40	8	-	-
<b>TOTAL</b>	<b>249</b>	<b>100</b>	<b>518</b>	<b>100</b>	<b>371</b>	<b>100</b>	<b>435</b>	<b>100</b>	<b>477</b>	<b>100</b>	<b>474</b>	<b>100</b>

**Table 1.2 Overview of kidney only transplant activity**

Donors age:	1 Sep 2013 - 31 Aug 2014				3 Sep 2014– 31 Aug 2015				1 Sep 2015 – 31 Aug 2016			
	5-49		<5 or 50+		5-49		<5 or 50+		5-54		<5 or 55+	
	N	%	N	%	N	%	N	%	N	%	N	%
Local	129	61	248	48	138	44	206	47	186	43	219	46
Regional	67	32	194	38	151	48	167	38	207	47	200	42
Rest of UK	16	8	74	14	25	8	61	14	44	10	55	12
<b>TOTAL</b>	<b>212</b>	<b>100</b>	<b>516</b>	<b>100</b>	<b>314</b>	<b>100</b>	<b>434</b>	<b>100</b>	<b>437</b>	<b>100</b>	<b>474</b>	<b>100</b>

Figure 1 DCD donor kidney programme in the UK, 1 January 2014 – 31 August 2016



**Table 1.3 Centre specific kidney only activity**

	1 Sep 2013 – 31 Aug 2014		3 Sep 2014 – 31 Aug 2015		3 Sep 2015 – 31 Aug 2016	
	Donors	Transplants	Donors	Transplants	Donors	Transplants
Belfast	10	5	21	23	11	13
Edinburgh	26	33	20	21	37	38
Glasgow	16	39	11	39	16	48
Leeds	36	87	29	69	27	58
Liverpool	21	27	20	23	34	37
Manchester	24	38	31	54	46	93
Newcastle	41	50	26	31	41	43
<b>North Region</b>	<b>174</b>	<b>279</b>	<b>158</b>	<b>260</b>	<b>212</b>	<b>330</b>
Birmingham	28	15	21	18	36	37
Cambridge	36	71	60	61	49	70
Coventry	9	7	9	7	8	14
Leicester	14	23	7	28	9	28
Nottingham	15	23	26	26	25	32
Sheffield	10	14	10	16	10	18
<b>Midlands Region</b>	<b>112</b>	<b>153</b>	<b>133</b>	<b>156</b>	<b>137</b>	<b>199</b>
Bristol	20	13	22	25	23	33
Cardiff	18	47	17	24	19	32
Oxford	18	37	18	49	23	66
Plymouth	28	25	21	21	22	24
Portsmouth	17	17	23	23	16	27
<b>South West Region</b>	<b>101</b>	<b>139</b>	<b>101</b>	<b>142</b>	<b>103</b>	<b>182</b>
GOSH	-	3	-	1	-	-
Guy's	-	62	-	49	-	65
The Royal Free	-	25	-	42	-	29
The Royal London	-	15	-	23	-	40
St George's	-	36	-	34	-	26
WLRTC	-	16	-	41	-	40
<b>London Region</b>	<b>89</b>	<b>157</b>	<b>113</b>	<b>190</b>	<b>126</b>	<b>200</b>
<b>TOTAL</b>	<b>476</b>	<b>728</b>	<b>505</b>	<b>748</b>		<b>911</b>

<b>Table 1.4 Patients through the scheme – DCD transplant demographics</b>					
<b>Factor</b>	<b>Level</b>	<b>1 Sep 13 – 31 Aug 14 BEFORE</b>	<b>3 Sep 14 – 31 Aug 15 YEAR 1</b>	<b>1 Sep 15 – 31 Aug 16 YEAR 2</b>	<b>3 Sep 14 – 31 Aug 16 LONDON</b>
		5-64	5-49	5-54	5-64
Number of transplants		496	237	339	285
		%	%	%	%
HLA mismatch	1	2	4	5	5
	2	25	35	32	38
	3	59	53	59	53
	4	14	8	4	5
Highly sensitised	Yes	5	10	9	5
Waiting time	<1 year	30	28	35	23
	1-3 years	44	46	40	46
	3-5 years	21	19	17	25
	5-7 years	4	5	6	5
	>=7 years	1	3	2	1
Matchability <sup>2</sup>	Easy (1-3)	47	41	49	34
	Moderate (4-7)	41	46	37	48
	Difficult (8-10)	13	13	14	18
Age (years)	<18	1	1	2	1
	18-29	7	12	7	7
	30-39	9	20	15	15
	40-49	24	26	28	26
	50-59	32	25	30	29
	60-69	23	13	16	19
	>=70	5	3	4	2
Blood group	O	45	41	43	46
	A	38	40	36	36
	B	13	14	15	13
	AB	5	4	6	5
Homozygosity	HLA-A	17	19	19	17
	HLA-B	11	8	10	10
	HLA-DR	17	15	17	18
	HLA-A,B,DR	1	2	2	2
Graft number	1	93	82	87	91
	2	7	16	10	9
	3	<1	3	3	<1
	4	<1	0	0	0
Diabetic	Yes	10	8	8	12
Donor-recipient age difference	<15 years	78	55	68	71
	15-25 years	15	25	23	20
	>25 years	7	20	10	8
Gender	Male	66	66	65	67
Ethnicity	White	78	80	81	40
	Asian	14	15	13	27
	Black	6	3	4	25
	Other	2	1	2	6
	Not Reported	<1	<1	1	2



<b>Table 1.4 cont'd Patients through the scheme – DCD transplant demographics</b>					
<b>Factor</b>	<b>Level</b>	<b>1 Sep 13 – 31 Aug 14 BEFORE</b>	<b>3 Sep 14 – 31 Aug 15 YEAR 1</b>	<b>1 Sep 15 – 31 Aug 16 YEAR 2</b>	<b>3 Sep 14 – 31 Aug 16 LONDON</b>
		5-64	5-49	5-54	5-64
Number of transplants		496	237	339	285
		%	%	%	%
Tier	A	0	0	0	0
	B	0	0	0	0
	C	1	2	2	1
	D	1	3	4	5
	E	84	87	90	89
	Other (HLA level 4)	14	8	4	5

Table 1.5		All patients – DCD transplant demographics					
Factor	Level	1 Sep 2013 – 31 Aug 2014		3 Sep 2014 – 31 Aug 2015		1 Sep 2015 – 31 Aug 2016	
Number of transplants		728		748		911	
		N	%	N	%	N	%
HLA mismatch	1	14	2	22	3	40	4
	2	159	22	220	29	238	26
	3	416	57	422	56	550	60
	4	139	19	84	11	83	9
Highly sensitised	Yes	29	4	53	7	59	7
Waiting time	<1 year	235	32	228	30	289	32
	1-3 years	314	43	329	44	400	44
	3-5 years	151	21	147	20	171	19
	5-7 years	24	3	34	5	43	5
	>=7 years	4	1	10	1	8	1
Matchability <sup>2</sup>	Easy (1-3)	347	48	340	46	418	46
	Moderate (4-7)	299	41	311	42	374	41
	Difficult (8-10)	80	11	97	13	119	13
Age (years)	<18	4	1	5	1	6	1
	18-29	33	5	44	6	35	4
	30-39	49	7	77	10	82	9
	40-49	128	18	151	20	168	18
	50-59	216	30	204	27	260	29
	60-69	225	31	209	28	273	30
	>=70	73	10	58	8	87	10
Blood group <sup>3</sup>	O	319	44	324	43	410	45
	A	286	39	298	40	350	38
	B	89	12	94	13	109	12
	AB	34	5	32	4	42	5
Homozygosity	HLA-A	132	18	127	17	164	18
	HLA-B	83	11	61	8	103	11
	HLA-DR	115	16	117	16	157	17
	HLA-A,B,DR	13	2	11	1	19	2
Graft number	1	681	94	659	88	825	91
	2	44	6	81	11	75	8
	3	2	0	8	1	11	1
	4	1	0	0	0	0	0
Diabetic	Yes	85	12	78	10	102	11
Donor-recipient age difference	<15 years	571	79.0	539	72	699	77
	15-25 years	114	15.8	142	19	147	16
	>25 years	38	5	64	9	59	7
Gender	Male	481	66	499	67	586	64
Ethnicity	White	570	78	531	71	664	73
	Asian	93	13	120	16	146	16
	Black	45	6	63	8	65	7
	Other	17	2	25	3	24	3
	Not Reported	3	<1	9	1	12	1

Table 1.5 cont'd		All patients – DCD transplant demographics					
Factor	Level	1 Sep 2013 – 31 Aug 2014		3 Sep 2014 – 31 Aug 2015		1 Sep 2015 – 31 Aug 2016	
Number of transplants		728		748		911	
		N	%	N	%	N	%
Tier	A	0	0	0	0	0	0
	B	0	0	0	0	0	0
	C	7	1	10	1	12	1
	D	7	1	17	2	32	4
	E	575	79	637	85	784	86
	Other (HLA level 4)	139	19	84	11	83	9

Table 1.6a		Cold ischaemia time								
	N	All Kidneys		N	First Kidney		N	Second Kidney		
		Median	IQ Range		Median	IQ Range		Median	IQ Range	
All DCD Donors										
Before	721	13.5	10.5-16.5	434	11.7	9.3-14.3	287	15.8	13.6-18.5	
Year 1	741	13.1	10.3-16.3	442	11.4	9.0-14.2	299	16.0	13.3-18.9	
Year 2	890	13.3	10.3-16.5	515	11.1	8.9-14.2	375	15.7	13.4-19.4	
Donors Through Scheme										
Year 1	368	12.7	10.0-16.0	224	11.4	8.9-13.8	144	15.7	13.0-18.1	
Year 2	480	13.0	10.2-16.5	274	11.0	9.0-14.1	206	15.8	13.3-19.5	
Donors Outside Scheme										
Year 1	373	13.7	10.5-16.7	220	11.6	9.1-14.5	153	16.0	13.7-19.1	
Year 2	410	13.7	10.4-16.4	242	11.2	8.7-14.3	168	15.5	13.7-19.4	

Comparison of second kidney:

Before vs Yr1 (age 5-49): p=0.2,

Yr1 (age 5-49) vs Yr1 (age <5,50+): p=0.13,

Before vs Yr2 (age 5-54): p=0.8

Yr2 (age 5-54) vs Yr2 (age <5, 55+): p=0.7

Table 1.6b Cold ischaemia time in London, 3 September 2014 – 31 August 2016										
	All Kidneys				First Kidney				Second Kidney	
	N	Median	IQ Range	N	Median	IQ Range	N	Median	IQ Range	
All DCD Donors	380	12.9	10.3-15.7	245	11.8	9.3-14.4	135	15.0	12.5-17.6	
Donors Through Scheme	280	12.6	10.2-15.3	175	11.5	9.1-14.2	105	14.7	12.2-16.7	
Donors Outside Scheme	100	13.8	11.1-16.3	70	12.6	10.0-14.9	30	16.0	14.3-19.0	

**Table 1.7 Blood group matching, 3 Sep 2014 – 31 Aug 2016**

Donor blood group	Recipient blood group								TOTAL	
	N	O (%)	N	A (%)	N	B (%)	N	AB (%)	N	(%)
O	734	(94)	3	(<1)	47	(6)	1	(<1)	785	<b>(47)</b>
A			645	(96)			26	(4)	671	<b>(40)</b>
B					156	(99)	1	(1)	157	<b>(9)</b>
AB							46	(100)	46	<b>(3)</b>
<b>TOTAL</b>	<b>734</b>	<b>(44)</b>	<b>648</b>	<b>(39)</b>	<b>203</b>	<b>(12)</b>	<b>74</b>	<b>(4)</b>	<b>1659</b>	<b>(100)</b>

**Table 1.8 Number of potential kidney donors with known HLA Type at offering, 3 September 2014 – 31 August 2016**

Donor transplant coordinator team	Number of potential donors where kidney(s) offered for transplant	Offered with HLA		Offered without HLA	
		N (%)	Transplanted	N	Transplanted
Eastern	279	252 (90)	117	27	11
London	141	132 (94)	76	9	5
Midlands	224	208 (93)	110	16	11
North West	221	208 (94)	116	13	5
Northern	129	117 (91)	51	12	6
Northern Ireland	60	55 (92)	28	5	3
Scotland	147	140 (95)	74	7	3
South Central	161	149 (93)	66	12	3
South East	200	190 (95)	91	10	3
South Wales	72	67 (93)	30	5	1
South West	146	127 (87)	69	19	10
Yorkshire	161	155 (96)	71	6	4
<b>Total</b>	<b>1941</b>	<b>1800 (93%)</b>	<b>899 (93%)</b>	<b>141 (7%)</b>	<b>65 (7%)</b>

# **OFFERING, RETRIEVAL AND ORGAN USE**

**Table 2.1 Use of kidneys from solid organ donors**

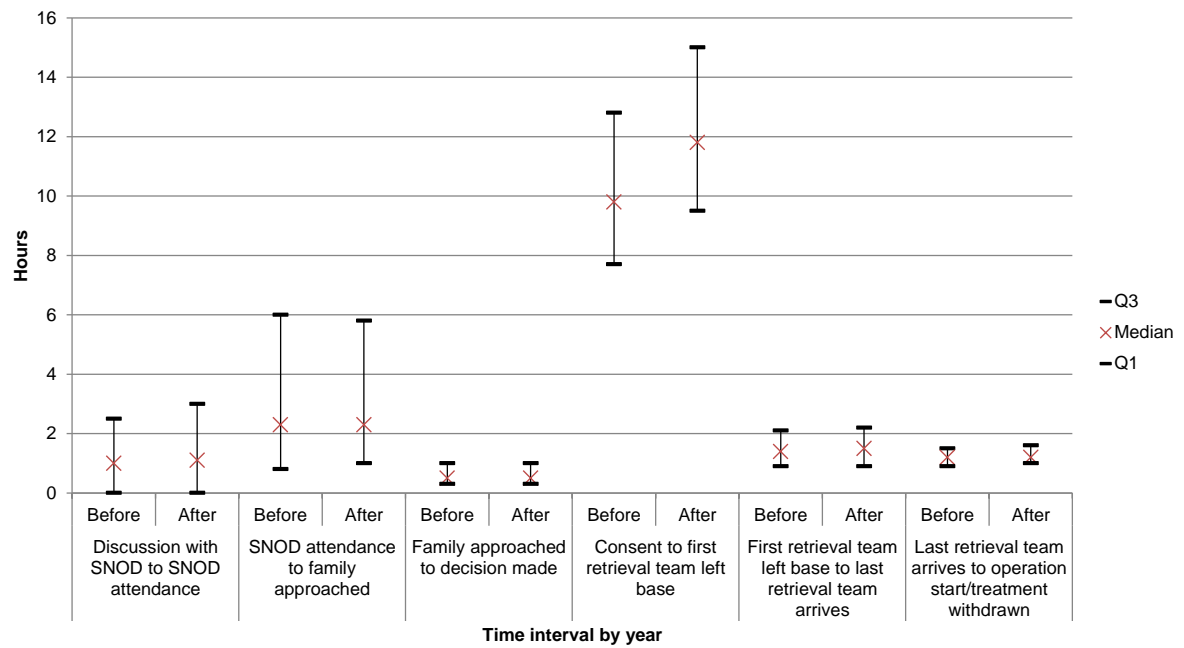
	Solid organ donors	Offered		Kidneys Retrieved		Transplanted		Conversion
	N	N	(%)	N	(%)	N	(%)	%
<b>DCD Donors through scheme</b>								
Before	148	283	(96)	275	(97)	250	(91)	84
Year 1	210	410	(98)	398	(97)	372	(93)	89
Year 2	270	530	(98)	519	(98)	481	(93)	89
<b>DCD Donors outside of scheme</b>								
Before	354	696	(98)	671	(96)	580	(86)	82
Year 1	322	637	(99)	603	(95)	477	(79)	74
Year 2	326	647	(99)	632	(98)	517	(82)	79
<b>All DCD donors</b>								
Before	502	979	(98)	946	(97)	830	(88)	83
Year 1	532	1047	(98)	1001	(96)	849	(85)	80
Year 2	596	1177	(99)	1151	(98)	998	(87)	84

**Table 2.2 Summary of kidney offers for named patients made through the DCD scheme (donors aged 5 to 49 for year 1, 5-54 for year 2, 5-64 for London)**

	Total offers		Offer accepted, used		Offer accepted, used in alternative patient		Offer declined	
	N	(%)	N	(%)	N	(%)	N	(%)
Belfast	27	(4)	1	(4)	0	(0)	25	(93)
Edinburgh	23	(3)	7	(30)	0	(0)	14	(61)
Glasgow	41	(6)	13	(32)	3	(7)	21	(51)
Leeds	32	(5)	12	(38)	4	(13)	15	(47)
Liverpool	32	(5)	5	(16)	2	(6)	21	(66)
Manchester	49	(7)	19	(39)	2	(4)	27	(55)
Newcastle	22	(3)	5	(23)	0	(0)	14	(64)
<b>North Region</b>	<b>226</b>	<b>(32)</b>	<b>62</b>	<b>(27)</b>	<b>11</b>	<b>(5)</b>	<b>137</b>	<b>(61)</b>
Birmingham	70	(10)	10	(14)	0	(0)	58	(83)
Cambridge	11	(2)	3	(27)	3	(27)	3	(27)
Coventry	12	(2)	1	(8)	1	(8)	8	(67)
Leicester	42	(6)	11	(26)	2	(5)	26	(62)
Nottingham	18	(3)	3	(17)	1	(6)	13	(72)
Sheffield	36	(5)	10	(28)	2	(6)	22	(61)
<b>Midlands Region</b>	<b>189</b>	<b>(27)</b>	<b>38</b>	<b>(20)</b>	<b>9</b>	<b>(5)</b>	<b>130</b>	<b>(69)</b>
Bristol	56	(8)	17	(30)	4	(7)	34	(61)
Cardiff	20	(3)	2	(10)	0	(0)	18	(90)
Oxford	30	(4)	8	(27)	5	(17)	12	(40)
Plymouth	9	(1)	3	(33)	1	(11)	5	(56)
Portsmouth	37	(5)	7	(19)	1	(3)	28	(76)
<b>South West Region</b>	<b>152</b>	<b>(22)</b>	<b>37</b>	<b>(24)</b>	<b>11</b>	<b>(7)</b>	<b>97</b>	<b>(64)</b>
GOSH								
Guy's	21	(3)	5	(24)	2	(10)	13	(62)
St George's	25	(4)	7	(28)	2	(8)	16	(64)
The Royal Free	19	(3)	7	(37)	2	(11)	8	(42)
The Royal London	30	(4)	7	(23)	3	(10)	19	(63)
WLRTC	36	(5)	7	(19)	1	(3)	22	(61)
<b>London Region</b>	<b>131</b>	<b>(19)</b>	<b>33</b>	<b>(25)</b>	<b>10</b>	<b>(8)</b>	<b>78</b>	<b>(60)</b>
<b>TOTAL</b>	<b>698</b>	<b>(100)</b>	<b>170</b>	<b>(24)</b>	<b>41</b>	<b>(6)</b>	<b>442</b>	<b>(63)</b>

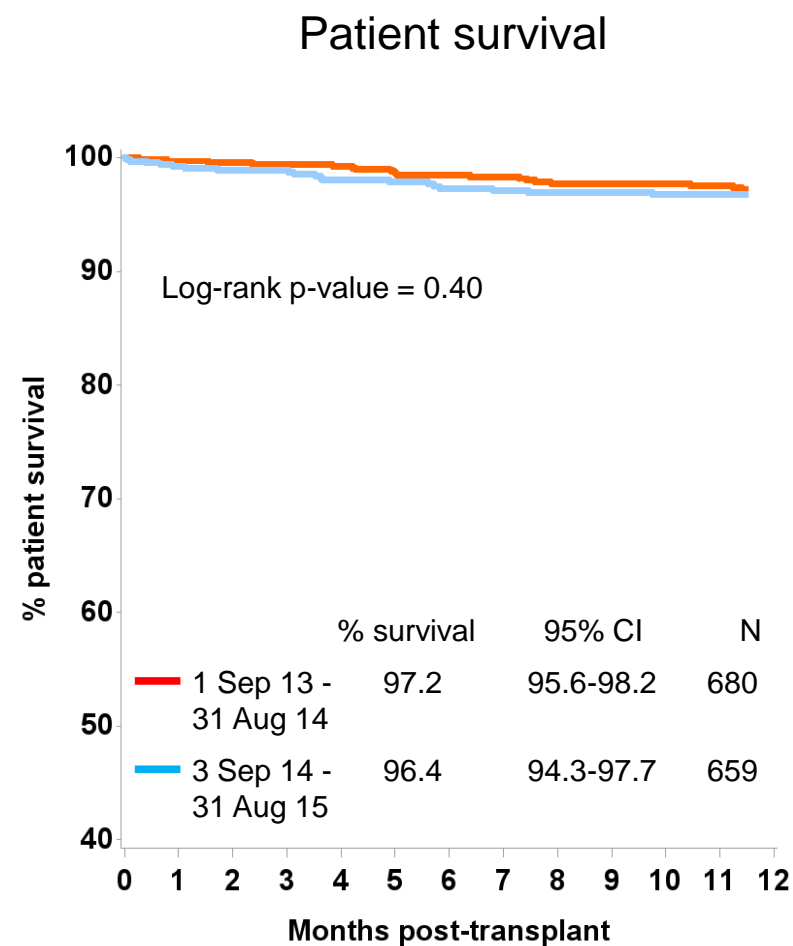
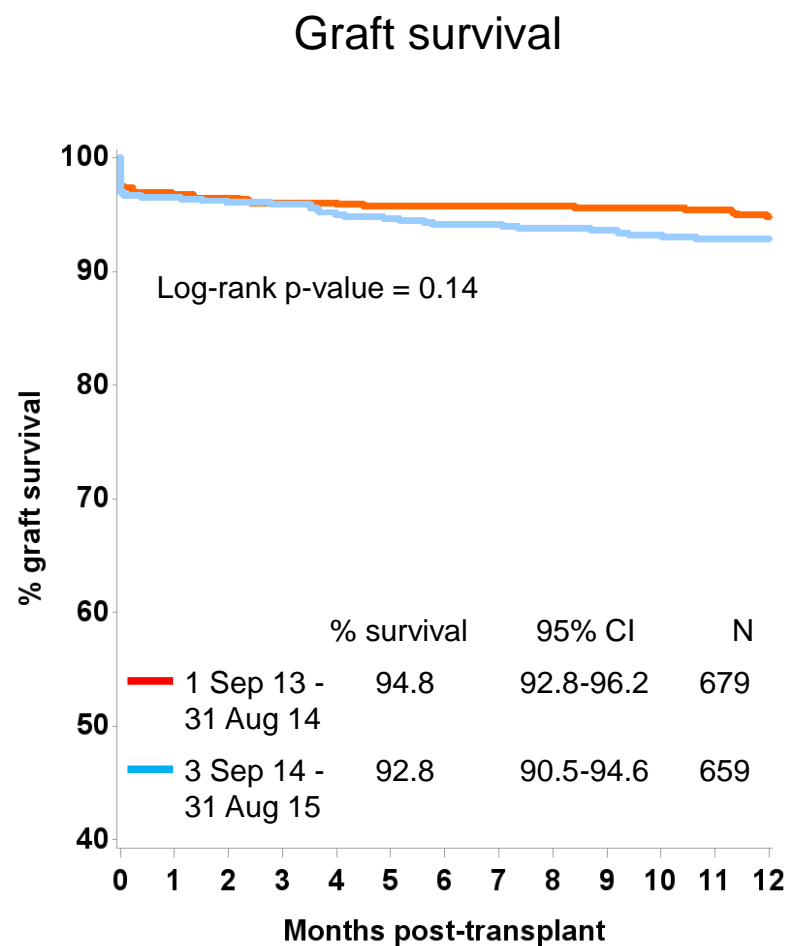
<b>Table 2.3</b>		<b>Donation process time intervals for potential DCD donors where data are complete</b>						
<b>Time interval</b>	<b>1 Sep 2013 – 3 Sep 2014</b>				<b>3 Sep 2014 – 31 Aug 2016</b>			
	<b>N</b>	<b>Median (hrs)</b>	<b>Inter-quartile range (50% fall within this range)</b>		<b>N</b>	<b>Median (hrs)</b>	<b>Inter-quartile range (50% fall within this range)</b>	
			<b>Q1</b>	<b>Q3</b>			<b>Q1</b>	<b>Q3</b>
Discussion with SNOD to SNOD attendance	596	<b>1.0</b>	0.0	2.5	365	<b>1.1</b>	0.0	3.0
SNOD attendance to family approached	596	<b>2.3</b>	0.8	6.0	365	<b>2.3</b>	1.0	5.8
Family approached to decision made	596	<b>0.5</b>	0.3	1.0	365	<b>0.5</b>	0.3	1.0
Consent to first retrieval team left base	596	<b>9.8</b>	7.7	12.8	365	<b>11.8</b>	9.5	15.0
First retrieval team left base to last retrieval team arrives	596	<b>1.4</b>	0.9	2.1	365	<b>1.5</b>	0.9	2.2
Last retrieval team arrives to treatment withdrawn	596	<b>1.2</b>	0.9	1.6	365	<b>1.2</b>	1.0	1.6
<b>Total time from discussion with SNOD to treatment withdrawn</b>	596	<b>20.0</b>	15.3	31.6	365	<b>22.6</b>	17.9	32.6
<b>Total time from consent to treatment withdrawn</b>	596	<b>12.7</b>	10.4	16.0	365	<b>14.8</b>	12.1	18.4



**Figure 2** Donation process time intervals for potential DCD donors where data are complete

## DCD OUTCOME

**Figure 3      Adult patients – Graft and patient survival after first kidney only transplant from a DCD donor in the UK**



# DCD SCREENING

- 1 The four transplant centres providing a DCD kidney donor screening service are Cambridge, Cardiff, Guy's and Leeds. They agreed to do this on a pilot basis with data collection to support evaluation of two main aims:
  - a. To improve the usage of extended criteria kidney donors referred
  - b. To identify further contraindications to kidney donation
- 2 When SNODs need transplant centre advice about whether a potential donor is acceptable, they contact firstly the local transplant centre, then one of the four screening centres (preferably within region), before a potential donor is deemed unacceptable for kidney transplantation. A two page audit form was introduced for SNODs to use on their iPads. SNODs record donor characteristics including past medical history and other relevant medical factors. Reasons why transplant teams deemed kidneys unacceptable are also recorded.

### KIDNEY USAGE RATES

- 3 Between 1 December 2015 and 31 May 2016 screening forms were completed for a total of 782 potential donors. 247 (32%) of these donors were deemed acceptable by the local transplant team or one of the screening centres. A summary of the outcomes is shown in **Table 2** and **Figure 2**.

**Table 1 Outcome of DCD kidney donor screening calls**

	Local transplant team	Screening Centre
No. potential donors screened	747	407
No. potential donors deemed acceptable	184	63
% of screened referrals acceptable	25	15
No. that were approached	141	42
No consented	100	25
No. offered	86	20
No. accepted	75	18
N. with prolonged time to death	29	6
No. kidney donors	42	11
% of those deemed acceptable	23	17
No. kidneys transplanted	69	20

**Table 2 Outcome of DCD kidney donor screening calls by centre**

	Acceptable - used	Acceptable – not used	Not acceptable
Leeds	2	20	133
Cambridge	4	13	64
Guy's	0	4	69
Cardiff	4	16	78

# BELFAST

## NHS BLOOD AND TRANSPLANT

### DCD KIDNEY ALLOCATION SCHEME

#### Investigation of potential centre disadvantage in allocation of DCD kidneys by limitations of cold ischaemia time in long distance offers

#### BACKGROUND

1. Organs donated by deceased donors in the UK are considered a national resource and are allocated according to agreed and transparent guidelines. Kidneys from deceased donors are offered to named patients on the basis of several factors including waiting time and the degree of matching (see appropriate policy for details).
2. The DCD Kidney Allocation Scheme was designed to complement the DBD kidney allocation scheme and to improve equity of access to kidney transplantation across the UK. It was devised by the Kidney Advisory Group and, after discussion with patients and patient groups, was implemented in September 2014, with one kidney from each donor aged 50 years and under being allocated through the national scheme. Following a successful first two years of the scheme, the age threshold has increased to 59 years, thus improving the access to kidney transplantation for patients across the UK.
3. There is clear evidence that DCD donor kidneys are less able than DBD donor kidneys to tolerate long cold ischaemia times (CIT)<sup>1</sup> so the DCD kidney allocation scheme had to take into account the expected cold ischemia times for shipping of kidneys from donor hospitals to transplant centres so as to avoid graft loss. To ensure a fair balance between need, benefit and utility across the UK, the UK was divided into four regions in order to facilitate timely transplantation, ideally with no more than 12 hours of CIT.

#### CONCERNS

4. Concerns have been raised that in some parts of the UK, some transplant candidates have been disadvantaged because offers are declined as the transport of kidneys offered would take too long to ensure an acceptable CIT.
5. The cold ischemia time measures the interval from cold perfusion at the donor hospital to warming the organ at the implanting hospital. This interval includes several stages including the time needed to get the organ to the transport, the time of transport and any delay in theatre access at the implanting transplant centre. In developing the scheme, geographic distance was taken as a surrogate for transport time (through allocation within the four regions), but it has been suggested that in some cases, such as where an organ has to be transported by air, or where road travel needs to be circuitous, this measure may result in inequity.

#### AIM

6. To investigate whether transplant candidates in any designated transplant centre in the UK are being disadvantaged by the current DCD national kidney allocation scheme due to the need for transplantation avoiding prolonged cold ischaemia times.

## DATA AND METHODS

7. Data were obtained from the UK Transplant Registry on 4,646 adult deceased kidney only transplants performed in the UK between 1 April 2014 and 30 September 2016. Included are 2,760 DBD donor transplants and 1,886 DCD donor transplants.
8. Cold ischaemia times are presented separately for imported and local DBD and DCD kidneys. Unadjusted survival at 3 months following DBD and DCD kidney only transplant (imported and local) are shown in funnel plots. Risk adjusted analysis was performed to identify if cold ischaemia time had an impact on graft survival.
9. Median cold ischaemia time for imported DBD kidneys is shown by centre for each of the four DCD regions and the three DBD regions to help explore the appropriateness of the groupings of transplant centres for prioritising allocation. Imported DBD kidneys are used as DCD organs are not shipped across the whole of the UK by design.
10. It was not possible to analyse data from NHSBT transport providers Amvale for all transplant centres due to the manual effort of matching the travel times to the individual transplants. Further data from Amvale will be available in the foreseeable future which will be easier to analyse.

## RESULTS

11. **Figure 1** shows median cold ischaemia times (CIT) by centre for imported and local DBD kidneys transplanted between 1 April 2014 and 30 September 2016. Overall median CIT for imported kidneys was 14.4 hours compared to 11.8 hours for kidneys transplanted in the local centre ( $p < 0.0001$ ). For imported kidneys, median CIT ranged from 11.4 hours in St George's to 18.0 hours in Newcastle. No centre had a 3 month survival rate that was different to the national rate. Risk-adjusted analysis showed that CIT had no significant association with graft survival. For kidneys transplanted in the local centre the median CIT ranged from 8.0 hours in St George's to 17.9 hours in Leicester. There was no difference in 3 month survival by centre and CIT had no effect on graft outcomes in a risk-adjusted model in this cohort.
12. **Figure 2** shows median CIT by centre for imported and local DCD kidneys transplanted between 1 April 2014 and 30 September 2016. Overall median CIT for imported kidneys was 14.0 hours compared to 12.5 hours for kidneys transplanted in the local centre ( $p < 0.0001$ ). For imported kidneys, median CIT ranged from 11.6 hours in St George's to 20.7 hours in Liverpool. No centre had a 3 month survival rate that was different to the national rate. CIT was



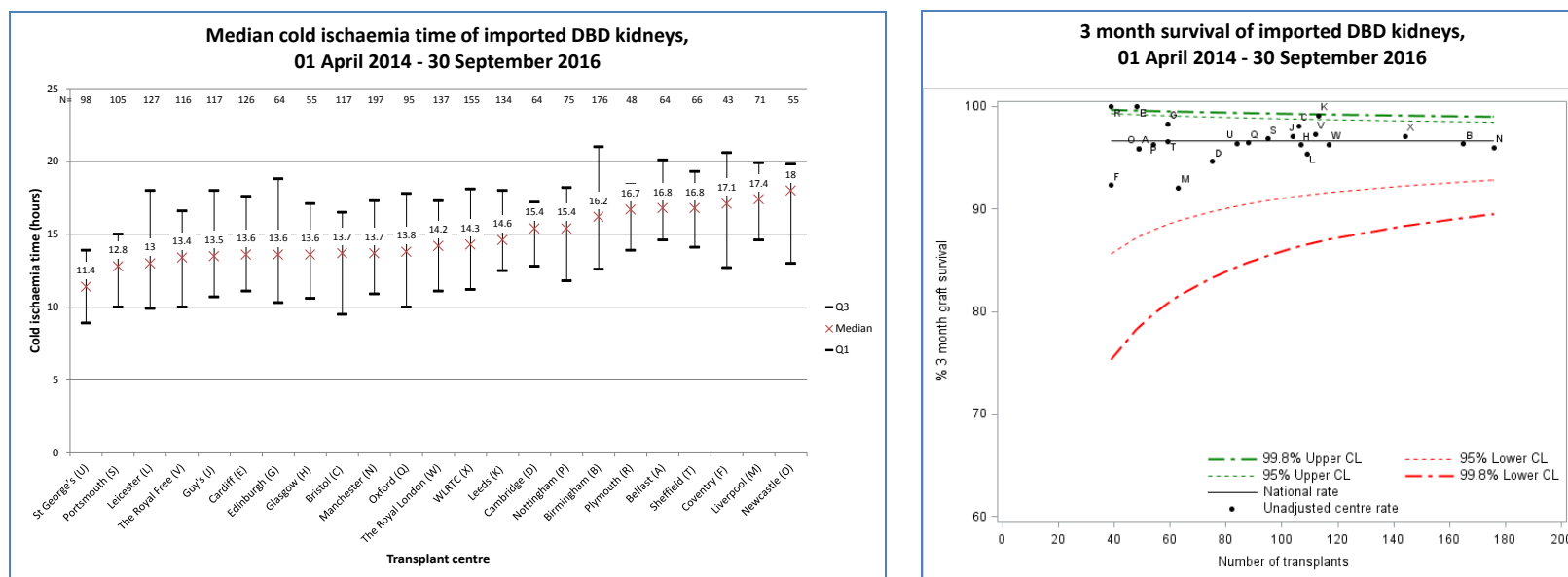
found to have a borderline effect on graft outcome ( $p=0.06$ ): for every hour increase in CIT the risk of graft failure increases by 1.06). For kidneys transplanted in the local centre the median CIT ranged from 8.5 hours in Belfast to 16.2 hours in Sheffield. There was no difference in 3 month survival by centre and CIT had no effect on graft outcomes in a risk-adjusted model.

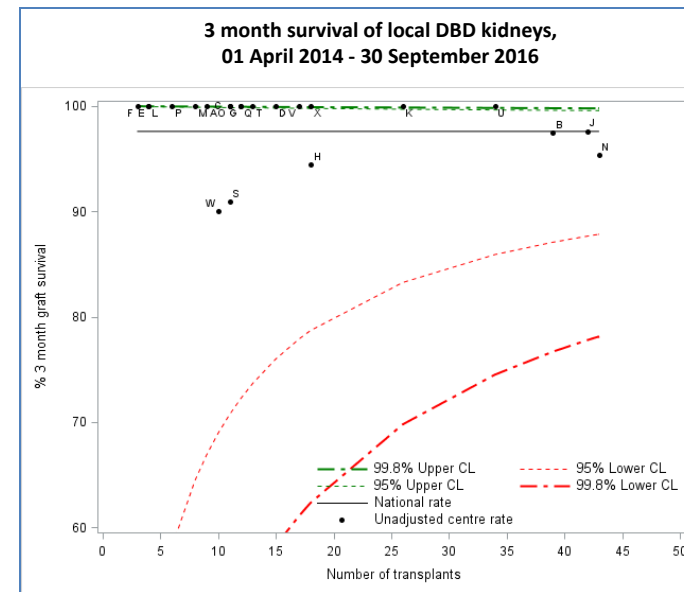
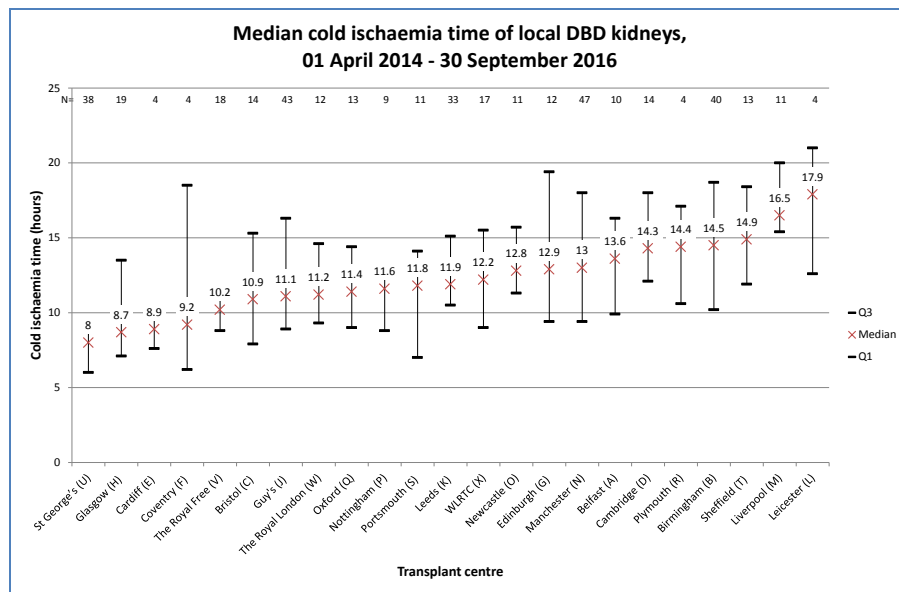
13. **Table 1 and 2** show the median CIT of imported DBD kidneys for each centre by DCD region and DBD region, respectively. Cells are highlighted green in both tables if the region has the largest contribution of kidneys and the shortest CIT.
14. **Table 1** shows that Belfast and Liverpool both have CIT that are 2.5 hours shorter from imported kidneys outside of their allocated DCD region. For Belfast, CIT are shorter for kidneys imported from the South West region (13.8 hours) and the Midlands region (16.6 hours) compared to the Northern region (18.3 hours). Liverpool has shorter CIT for kidneys imported from the Midlands region (15 hours) and the London region (16 hours) compared to the Northern region (17.7 hours). If we compare the CIT in **Table 2** for the DBD regions for these two centres it shows that both Belfast and Liverpool has the shortest CIT for the Midlands region (16.7 and 14.7 hours, respectively). This indicates that in terms of CIT only, Belfast and Liverpool could benefit from a change in DCD region from Northern to Midlands.
15. **Table 3** shows the impact on the Northern region by moving Belfast into the Midlands region. Currently the proportion of DCD donors retrieved within the Northern region is higher than the proportion of patients (33.1% cf. 30.8%). If Belfast were moved, the proportion of DCD donors falls to 30.1% but this is still higher than the proportion on the waiting list without Belfast patients (28.6%).

## SUMMARY

16. DBD and DCD cold ischaemia times (CIT) have wide variation across centre for both imported and locally transplanted kidneys. Centre location does not seem to be a factor in overall length of CIT.
17. In a recent cohort of transplants CIT is not shown to have an effect on graft outcome for imported or locally transplanted DBD kidneys. This may be due to the large efforts of transplant centres to reduce their overall CIT. There is an effect on graft outcome for imported DCD kidneys, and every hour of CIT increases the risk of graft loss by 6%. Despite longer CITs in certain transplant centres, all centres are in line with the national rate for 3 month graft survival.
18. Looking at median CIT by DCD and DBD region for all imported DBD kidneys shows that Belfast may benefit from being moved from the Northern region to the Midlands region to help shorten CIT.

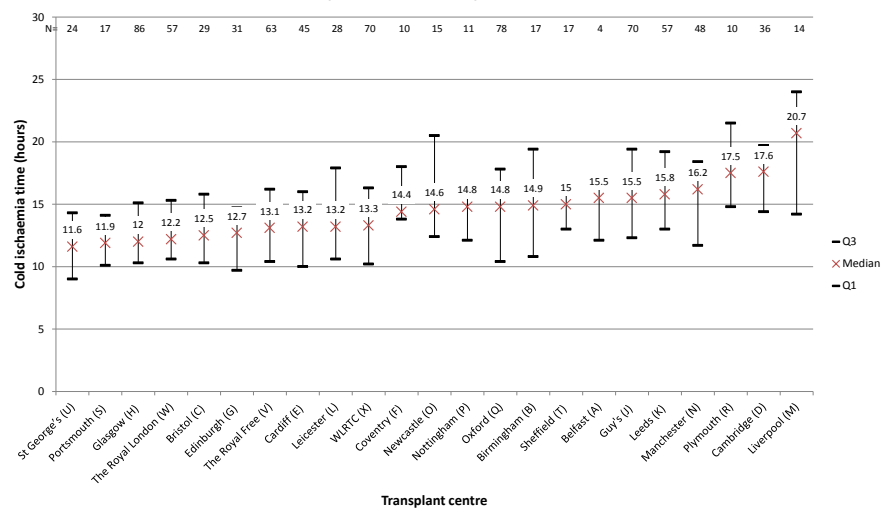
**Figure 1** Median cold ischaemia time and 3 month survival of imported and local DBD kidneys, 1 Apr 14 – 30 Sep 16



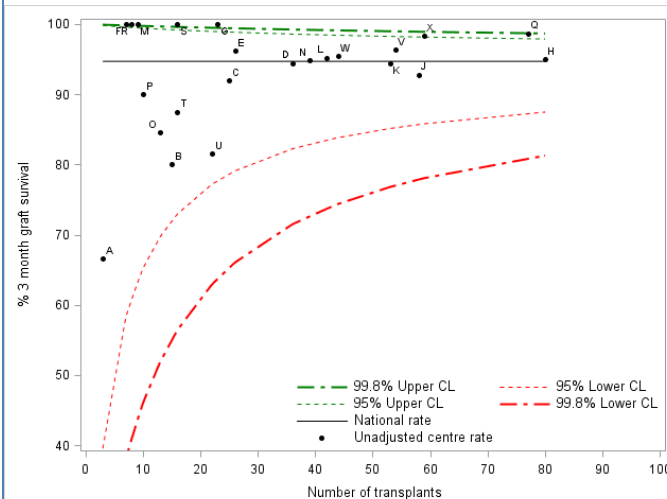


**Figure 2 Median cold ischaemia time and 3 month survival of imported and local DCD kidneys, 1 Apr 14 – 30 Sep 16**

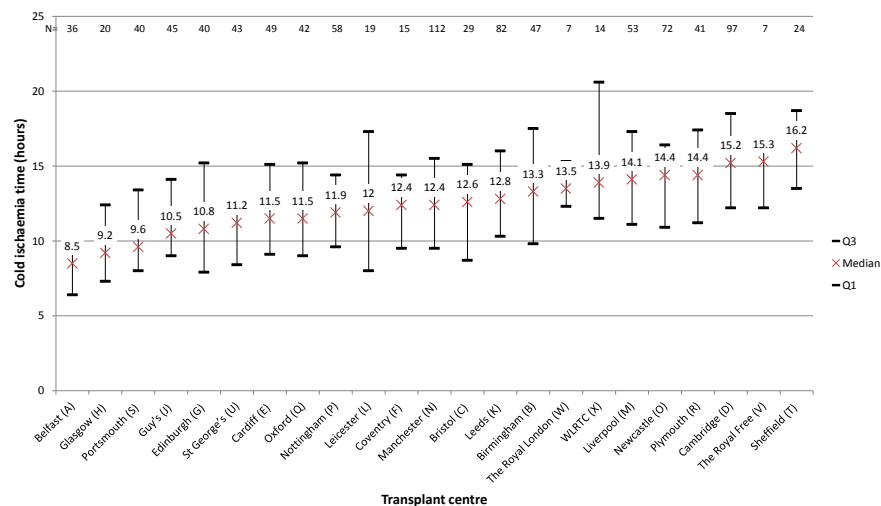
**Median cold ischaemia time of imported DCD kidneys,  
01 April 2014 - 30 September 2016**



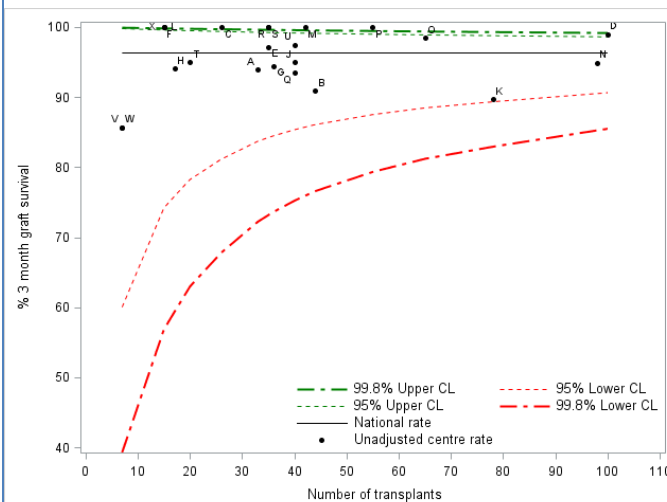
**3 month survival of imported DCD kidneys,  
01 April 2014 - 30 September 2016**



**Median cold ischaemia time of local DCD kidneys,  
01 April 2014 - 30 September 2016**



**3 month survival of local DCD kidneys,  
01 April 2014 - 30 September 2016**



**Table 1 Median cold ischaemia time of imported DBD kidneys by centre and DCD region, 1 April 2014 – 30 September 2016**

		Northern		Midlands		South West		London	
		N	Median	N	Median	N	Median	N	Median
Belfast	Northern	17	18.3	34	16.6	9	13.8	3	
Edinburgh	Northern	46	12.8	8	17.9	4		6	19.8
Glasgow	Northern	85	12.4	13	13.3	16	17.4	11	15.3
Leeds	Northern	75	13.9	25	14.6	20	16	12	15
Liverpool	Northern	48	17.7	7	15	7	18.1	9	16
Manchester	Northern	139	13.8	20	13.1	19	12.9	18	14.3
Newcastle	Northern	36	16.1	9	18	3		7	19.8
Birmingham	Midlands	59	19.2	76	14.5	16	19.6	25	15.6
Cambridge	Midlands	28	15.6	31	14.3	9	17.7	7	12.3
Coventry	Midlands	11	17.7	24	16.4	6	16.3	2	
Leicester	Midlands	45	14.7	61	12.2	11	16.4	10	12.6
Nottingham	Midlands	24	16	24	14.1	7	15.6	8	15.2
Sheffield	Midlands	24	17.5	29	17.7	9	15.5	4	
Bristol	South West	16	15.2	5	14	43	11.6	53	15.7
Cardiff	South West	11	15.5	4		16	13.6	23	11.8
Oxford	South West	23	15.5	8	15.3	29	12.7	35	12.7
Plymouth	South West	14	17.8	3		16	14.7	15	17.4
Portsmouth	South West	14	17	10	14.4	35	13.1	45	11.9
Guy's	London	26	15.9	11	12.5	41	12.6	39	10.9
St George's	London	18	14	10	12.2	43	10.9	27	9
The Royal Free	London	20	15.1	11	17.6	33	12.7	52	11.3
The Royal London	London	21	15.3	11	15.4	51	14.2	54	13.8
WLRTC	London	21	16	15	12.8	54	14.9	65	13.4

**Table 2 Median cold ischaemia time of imported DBD kidneys by centre and DBD region, 1 April 2014 – 30 September 2016**

		SW + London		Midlands		Northern	
		N	Median	N	Median	N	Median
Bristol	SW + London	96	13.6	7	13	14	15.9
Cardiff	SW + London	39	13.3	7	15.5	8	15
Guy's	SW + London	80	12.5	14	13.2	21	15.8
Oxford	SW + London	64	12.7	6	10.5	22	15.7
Plymouth	SW + London	31	15.9	2		13	17.6
Portsmouth	SW + London	81	12.1	11	14.1	12	17
St George's	SW + London	70	10.1	12	12.3	16	14.6
The Royal Free	SW + London	85	12	12	16.6	17	14.7
The Royal London	SW + London	105	13.9	14	13.5	17	16.4
WLRTC	SW + London	119	13.8	17	13.2	18	16
Belfast	Midlands	12	17.5	31	16.7	17	18.3
Birmingham	Midlands	41	16.2	86	15.9	38	19.5
Cambridge	Midlands	16	15.7	28	14.5	24	15.2
Coventry	Midlands	8	16.3	27	17.7	5	17.6
Leicester	Midlands	21	14	63	12.5	31	13.9
Nottingham	Midlands	15	15.5	24	14.8	19	15.9
Edinburgh	Northern	10	18.2	7	16.9	45	12.3
Glasgow	Northern	27	15.4	14	12.2	82	12.5
Leeds	Northern	33	15.9	30	15.8	71	13.7
Liverpool	Northern	16	16.7	10	14.7	43	17.8
Manchester	Northern	38	13.1	17	15.6	138	13.7
Newcastle	Northern	10	19.8	11	16.5	34	16.1

**Table 3** Proportion of patients on the waiting list and proportion of donors in each of the DCD sharing regions

	Transplant list as at 1 October 2016		Donors 1 Sep 2014 – 31 Sep 2016	
	N	%	N	%
<b>Current arrangements</b>				
Northern	1576	30.8	401	33.1
Midlands	1118	21.8	315	26.0
South West	862	16.8	232	19.0
London	1568	30.6	263	21.7
<b>Belfast move to Midlands</b>				
Northern	1464	28.6	365	30.1
Midlands	1230	24.0	351	29.0
South West	862	16.8	232	19.2
London	1568	30.6	263	21.7

**Figure 4** Map of hospitals located in each DCD region

