ANNUAL REPORT ON HEART TRANSPLANTATION

REPORT FOR 2022/2023
(1 APRIL 2013 – 31 MARCH 2023)

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PRODUCED IN COLLABORATION WITH NHS ENGLAND

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EXECUTIVE SUMMARY

1. Executive Summary

This report presents key data about heart transplantation in the UK. The period reported covers 10 years, from 1 April 2013 to 31 March 2023. The data include number of people listed for a transplant, number of transplants performed and [survival rates](#) following heart transplantation; both on a national and centre-specific basis. Data were extracted on 12 July 2023.

Key findings

ADULT HEART TRANSPLANTATION

- On 31 March 2023 there were 254 adults waiting for a heart transplant: 248 non-urgent, 34 urgent and 1 super-urgent. This was similar to 31 March 2022. 47% of those waiting were on long-term [VAD](#) support. 1 year mortality was 5% on the non-urgent waiting list, 3% on the urgent waiting list and 4% on the super-urgent waiting list. Nationally, median waiting time to transplant was 900 days, 48 days and 18 days across these three urgency types, respectively.
- During 2022/2023 there were 185 adult heart transplants performed of which 28% came from [DCD](#) donors. This was 28% higher than the previous year in which there were 145 transplants. 79% of transplants were urgent or super-urgent.
- The national rate of patient survival following adult heart transplant was 92.1% at 30 days, 89.4% at 90 days, 85.9% at 1 year and 71.4% at 5 years.

PAEDIATRIC HEART TRANSPLANTATION

- On 31 March 2023 there were 50 paediatric patients waiting for a heart transplant: 35 non-urgent, 15 urgent and 0 super-urgent. The number has increased over the decade and 18% of those waiting were on mechanical circulatory support. Median waiting time to transplant was 193 days from urgent registration.
- During 2022/2023 there were 28 paediatric heart transplants (2 less than the previous year) of which 2 came from DCD donors. 26 of the 28 transplants were either urgent or super-urgent.
- The national rate of patient survival following paediatric heart transplant was 97.8% at 30 days, 95.5% at 90 days, 90.8% at 1 year and 83.2% at 5 years.

Use of the contents of this report should be acknowledged as follows: *Annual Report on Heart Transplantation 2022/2023, NHS Blood and Transplant*

INTRODUCTION

2.   Introduction

This report presents data on activity and outcomes of heart transplant candidates and recipients between 1 April 2012 and 31 March 2023, for all centres performing heart transplantation in the UK. Data were obtained from the UK Transplant Registry at NHS Blood and Transplant which holds information relating to donors, recipients and outcomes for all heart transplants performed in the UK.

Heart activity results are described separately for adults (aged 16 years or over) and paediatric patients (aged less than 16 years). There are seven heart transplant centres in the UK; six in England and one in Scotland. Five of the seven centres specialise in adult transplantation, one in paediatric transplantation (Great Ormond Street Hospital) and one in both adult and paediatric transplantation (Newcastle). Any transplants carried out at Great Ormond Street Hospital in recipients aged 16 or over are included in the paediatric analysis, and any transplants carried out at adult only centres in recipients less than 16 are included in the adult analysis.

Multi-organ transplants are presented separately in Section 6.5 and are excluded from the rest of the main report.

The time period of analysis covers the introduction of the super-urgent heart allocation scheme in October 2016 (later expanded to paediatric patients in October 2020).

Methods used are described in the Appendix. The centre specific adult survival rates are adjusted for differences in risk factors between the centres. The risk models used are described in the Appendix. The adult heart risk model was revised in August 2022 in consultation with the clinical community.

2.1   Overview

Figure 2.1 shows the number of transplant candidates on the active transplant list at financial year end between 2014 and 2023. The number of people waiting for a heart transplant increased significantly between 2014 and 2020, from 246 to 340. The number fell to 311 on 31 March 2023.

Figure 2.1 Number of people on the national active heart transplant list on 31 March each year, 2014 to 2023
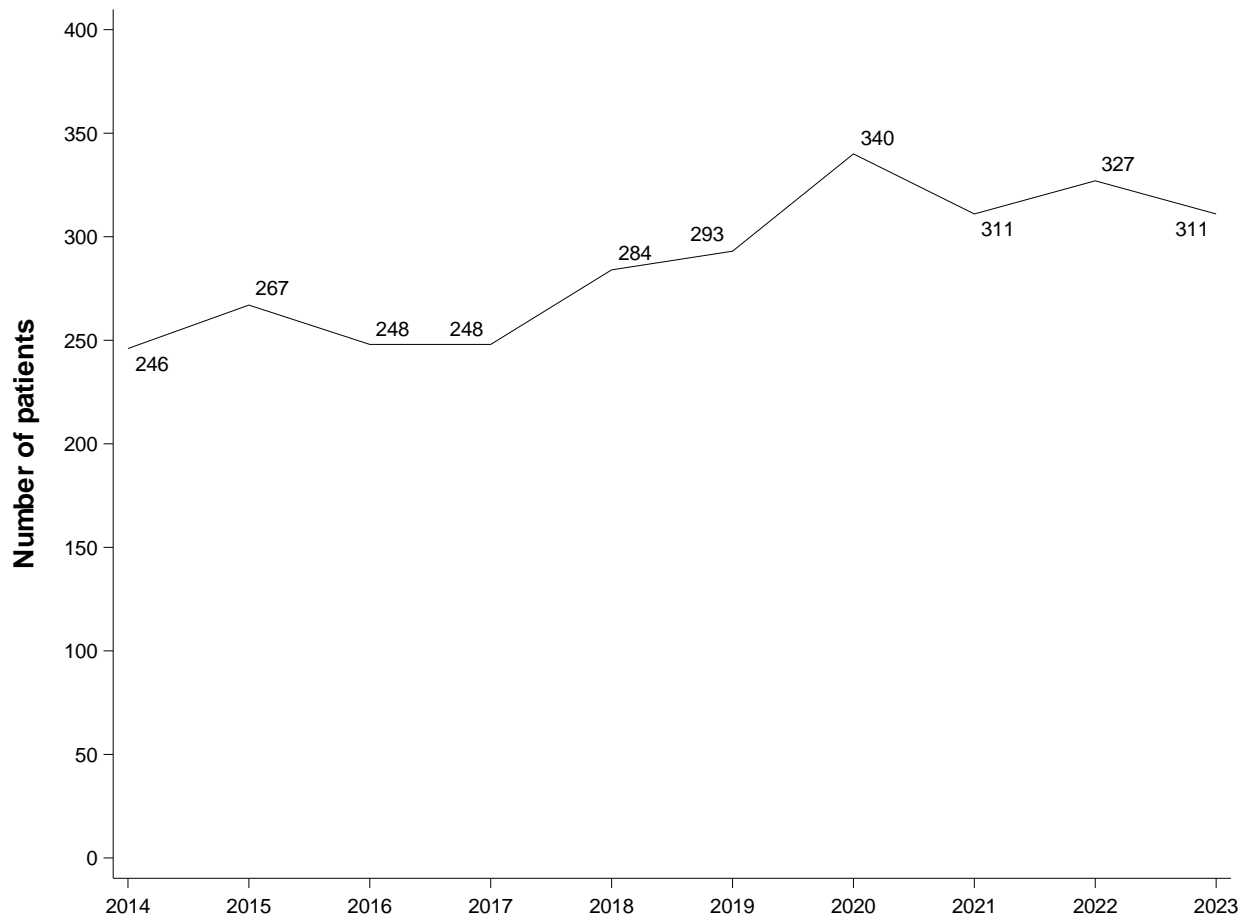
Figure 2.2 and **Figure 2.3** show the number of adult and paediatric patients on the active transplant list on 31 March 2023 at each centre. In total, there were 261 adults and 50 paediatric patients waiting for a heart transplant. Newcastle had the highest number of adults on the heart transplant list. Great Ormond Street Hospital had the highest number of paediatric patients on the heart transplant list. These numbers include 7 people waiting for a multi-organ transplant (5 heart and liver and 2 heart and kidney).

Figure 2.2 Number of adults on the active heart transplant list on 31 March 2023, by centre

No. of patients

Birmingham: 41
Glasgow: 19
Harefield: 59
Manchester: 31
New castle: 74
Papw orth: 37
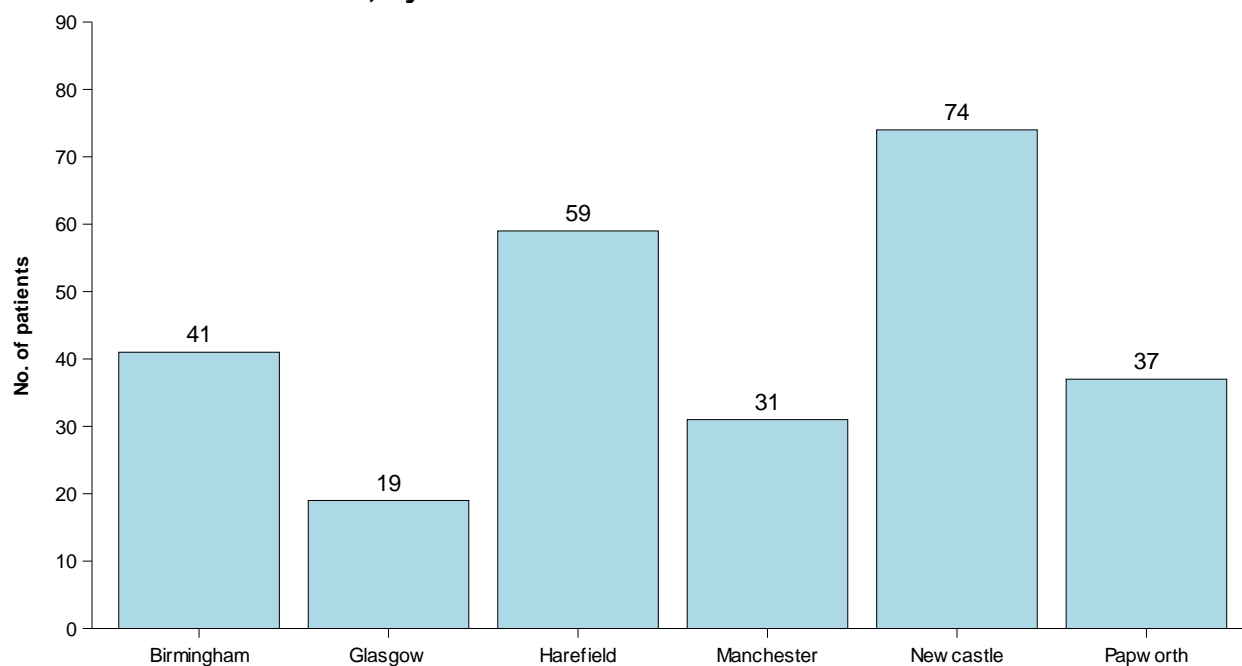
Figure 2.3   Number of paediatric patients on the active heart transplant list on 31 March 2023, by centre

No. of patients

Great Ormond Street: 29
New castle: 21
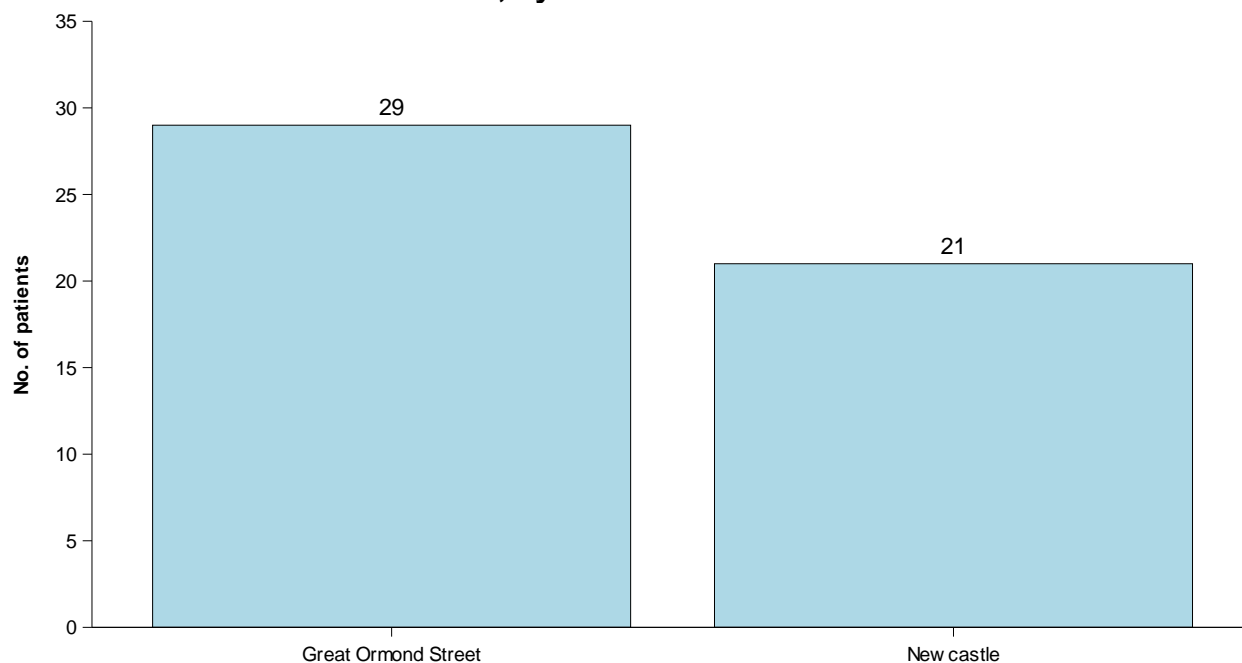
Figure 2.4 shows the total number of transplants performed in each of the last ten financial years. The number of transplants last year was 215, 20% higher than in 2021/2022.

Figure 2.4 Number of heart transplants in the UK, by financial year, 1 April 2013 to 31 March 2023
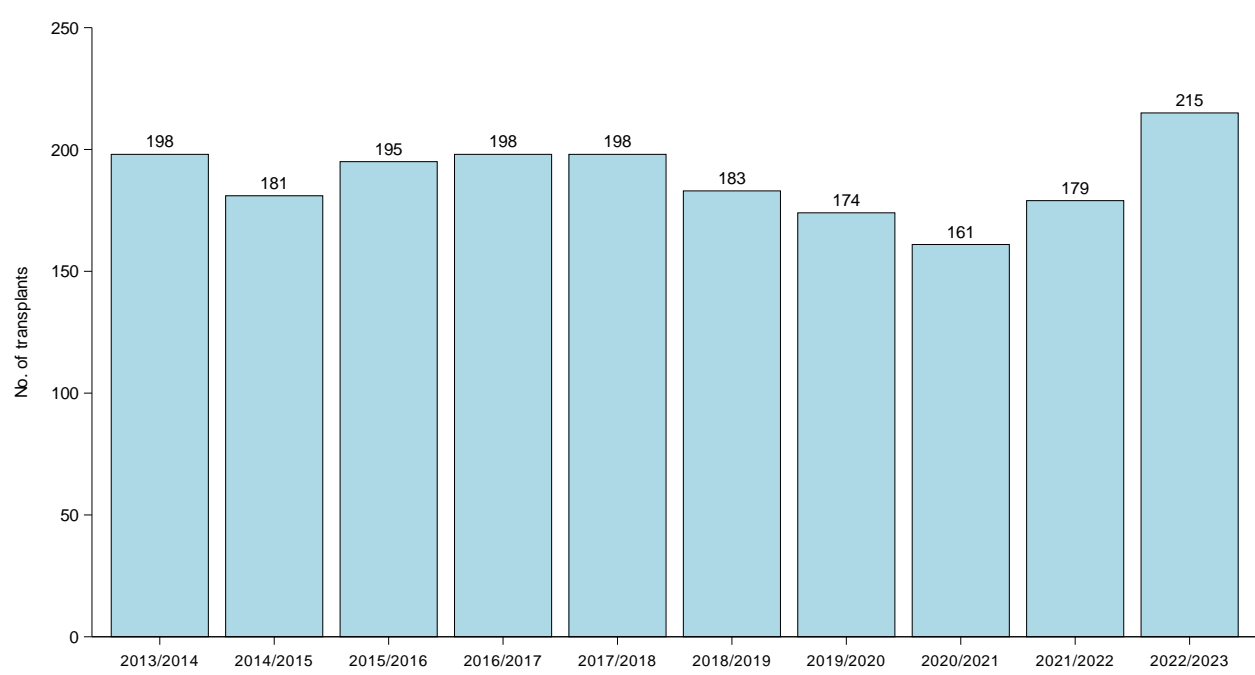
Figure 2.5 and **Figure 2.6** show the number of adult and paediatric transplants carried out in the most recent financial year at each centre. Glasgow performed the highest number of adult transplants. Great Ormond Street Hospital performed the highest number of paediatric transplants.

**Figure 2.5 Number of adult heart transplants in the UK, by centre,
1 April 2022 to 31 March 2023**
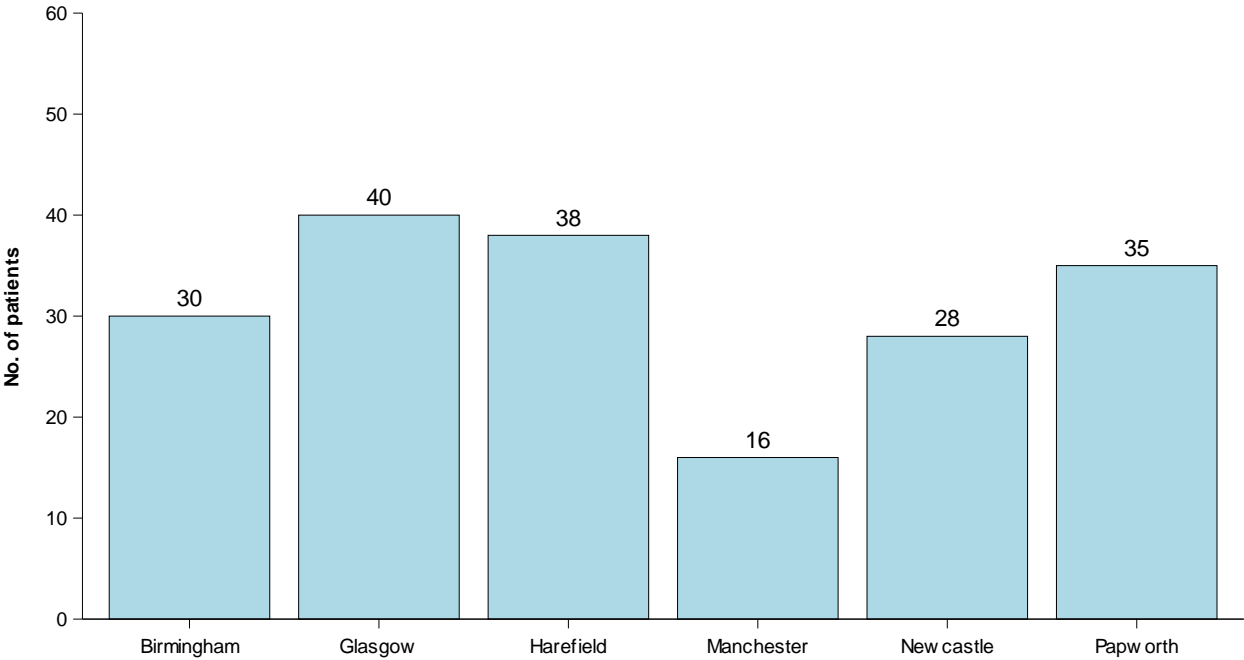
**Figure 2.6 Number of paediatric heart transplants in the UK, by
centre, 1 April 2022 to 31 March 2023**
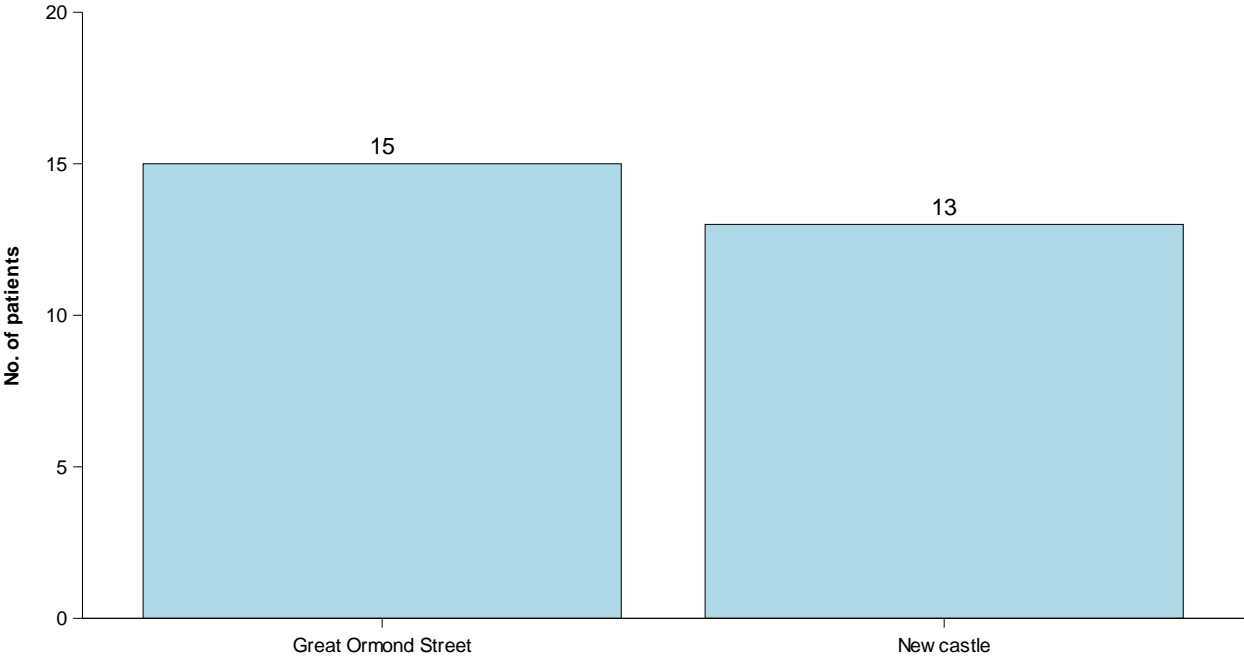
Figure 2.7 shows a breakdown of the 1,622 adult heart transplants performed in the UK in the ten-year period while **Figure 2.8** shows a similar breakdown for the 304 paediatric transplants performed during the same period. Re-transplants are included in the transplant activity sections of this report but excluded from the survival analysis sections. Multi-organ transplants are excluded from the rest of the report apart from the separate multi-organ outcome sections (Section 6.5). Heart-lung transplants are considered in the Annual Report on Lung Transplantation.

Figure 2.7 Adult heart transplants performed in the UK, 1 April 2013 to 31 March 2023

UK adult heart transplants reported
1 April 2013 – 31 March 2023
N= 1622

Multi-organ transplant
N=15[1]

Heart only transplant
N=1566[2]

Heart-lung transplant
N=41

First transplant
N=1548
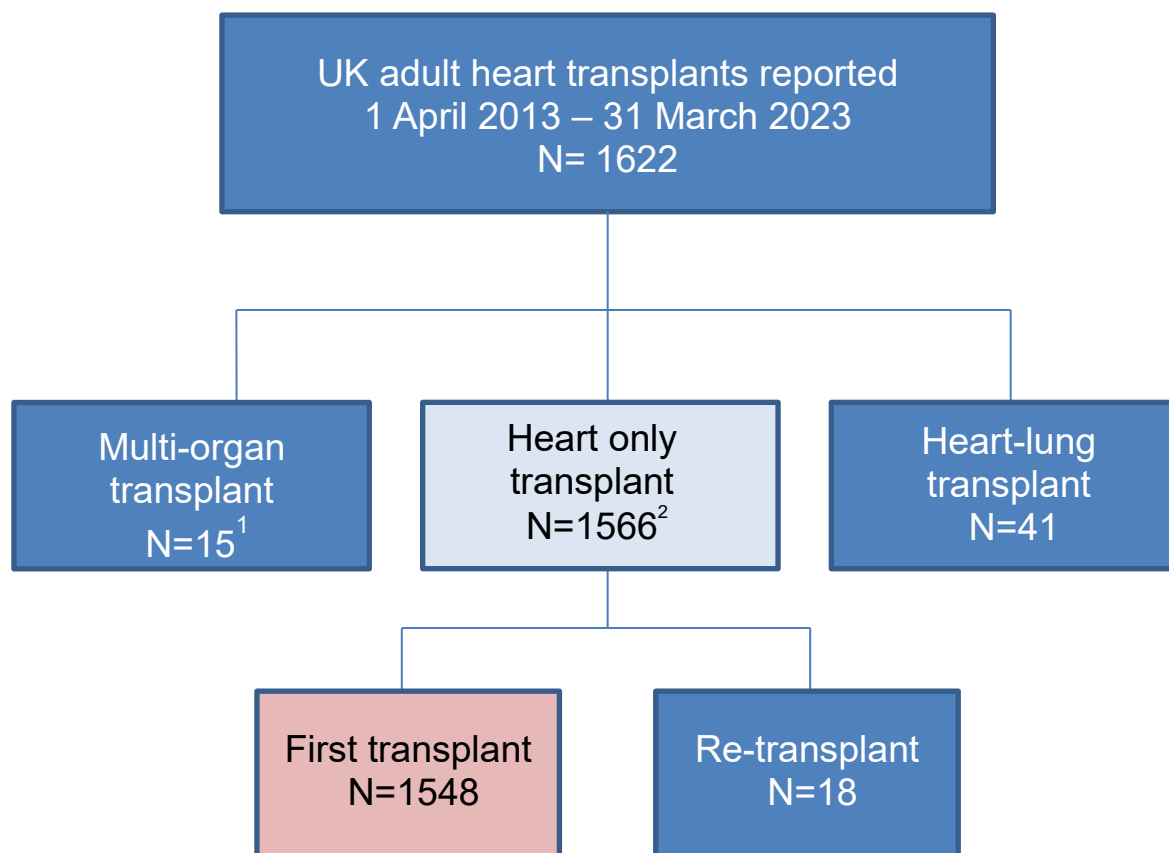
Re-transplant
N=18

[1] Includes 6 heart and kidney, 9 heart and liver
[2] Includes 215 DCD heart transplants

13

Figure 2.8 Paediatric heart transplants performed in the UK, 1 April 2013 to 31 March 2023

UK paediatric heart transplants reported
1 April 2013 – 31 March 2023
N= 304

Multi-organ
transplant
N=0

Heart only
transplant
N=301[1]

Heart-lung
transplant
N=3

First transplant
N=292
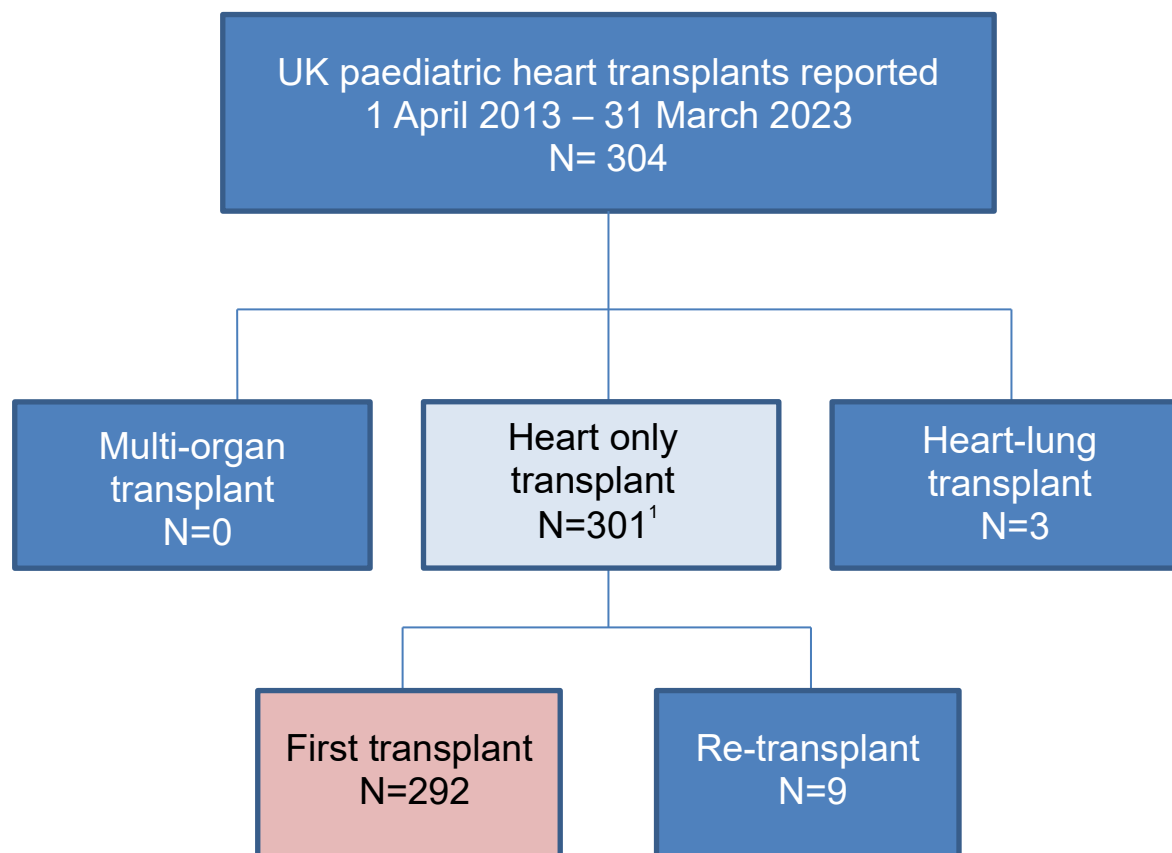
Re-transplant
N=9

[1] Includes 16 DCD heart transplants

2.2   Geographical variation in registration and transplant rates

Figure 2.9 shows rates of registration to the heart transplant list per million population (pmp) between 1 April 2022 and 31 March 2023 compared with heart transplant rates pmp for the same time period, by recipient country/NHS region of residence. **Table 2.1** shows the actual numbers as well as rates. If a patient has had more than one registration/transplant in the period, each registration/transplant is considered. Note that this analysis only considered NHS Group 1 patients. The UK heart registration and transplant rates are 4.7 pmp and 3.2 pmp respectively.

Since there will inevitable be some random variation in rates between areas, the systematic coefficient component of variation (SCV) was used to identify if the variation is more (or less) than a random effect for the different NHS regions in England only. Only first registrations and transplants in this period were considered. The larger the SCV the greater the evidence of a high level of systematic variation between areas. Registration and transplant rates yielded an SCV of 0 (p-value = 0.999) and 0 (p-value = 0.999), respectively. The p-value shows the probability that an SCV of this size (or higher) would be observed by chance if only random variation existed and therefore no evidence of geographical variation beyond what would be expected at random. No adjustment has been made for area-specific demographic characteristics that may impact the rates of registration to the transplant list and transplantation such as age and sex. Therefore, these results should be interpreted with caution.

Figure 2.9 Comparison of heart registration rates (pmp) with transplant rates (pmp) by recipient country/NHS region of residence
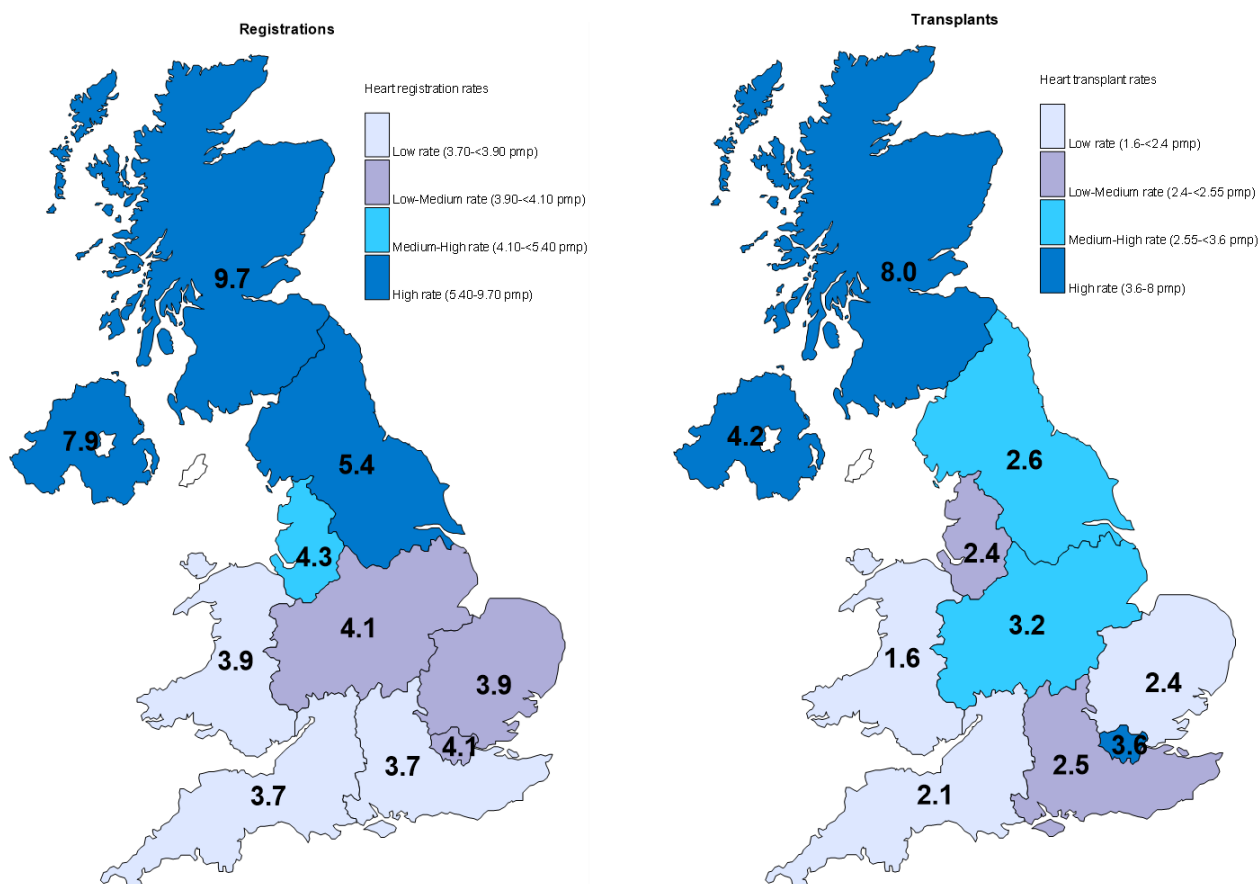
Table 2.1   Heart registration and transplant rates per million population (pmp) in the UK, 1 April 2022 - 31 March 2023, by Country/NHS region

Country/ NHS region	Registrations (pmp)		Transplants (pmp)	
North East and Yorkshire	44	(5.4)	21	(2.6)
North West	32	(4.3)	18	(2.4)
Midlands	44	(4.1)	35	(3.2)
East of England	25	(3.9)	15	(2.4)
London	36	(4.1)	32	(3.6)
South East	34	(3.7)	23	(2.5)
South West	21	(3.7)	12	(2.1)
England	**236**	**(4.2)**	**156**	**(2.8)**
Isle of Man	**0**	**(0.0)**	**0**	**(0.0)**
Channel Islands	**0**	**(0.0)**	**0**	**(0.0)**
Wales	**12**	**(3.9)**	**5**	**(1.6)**
Scotland	**53**	**(9.7)**	**44**	**(8.0)**
Northern Ireland	**15**	**(7.9)**	**8**	**(4.2)**
TOTAL[1,2]	**317**	**(4.7)**	**214**	**(3.2)**

[1] Registrations include 1 recipient whose postcode was unknown and excludes 2 recipients who reside in the Republic of Ireland.
[2] Transplants include 1 recipient whose postcode was unknown and excludes 1 recipient who resides in the Republic of Ireland and 1 recipient who resides overseas.

ADULT HEART TRANSPLANTATION

Transplant List

3.1 Adult heart only transplant list on 31 March, 2014 – 2023

Figure 3.1 shows the number of adult patients on the heart transplant list on 31 March each year between 2014 and 2023, split by urgency status of the patient. The number of adults on the active non-urgent heart transplant list has increased over the decade, from 200 in 2014 up to 271 in 2020, but has since decreased to 219 in 2023. The number of adults on the urgent list increased from 13 in 2014 to 34 in 2023. The super-urgent list was introduced in October 2016 and there was 1 adult waiting on this list on 31 March 2023. There has been a recent increase in the number of adults suspended from the heart waiting list.

Figure 3.1 Number of adults on the heart transplant list on 31 March each year, by urgency status
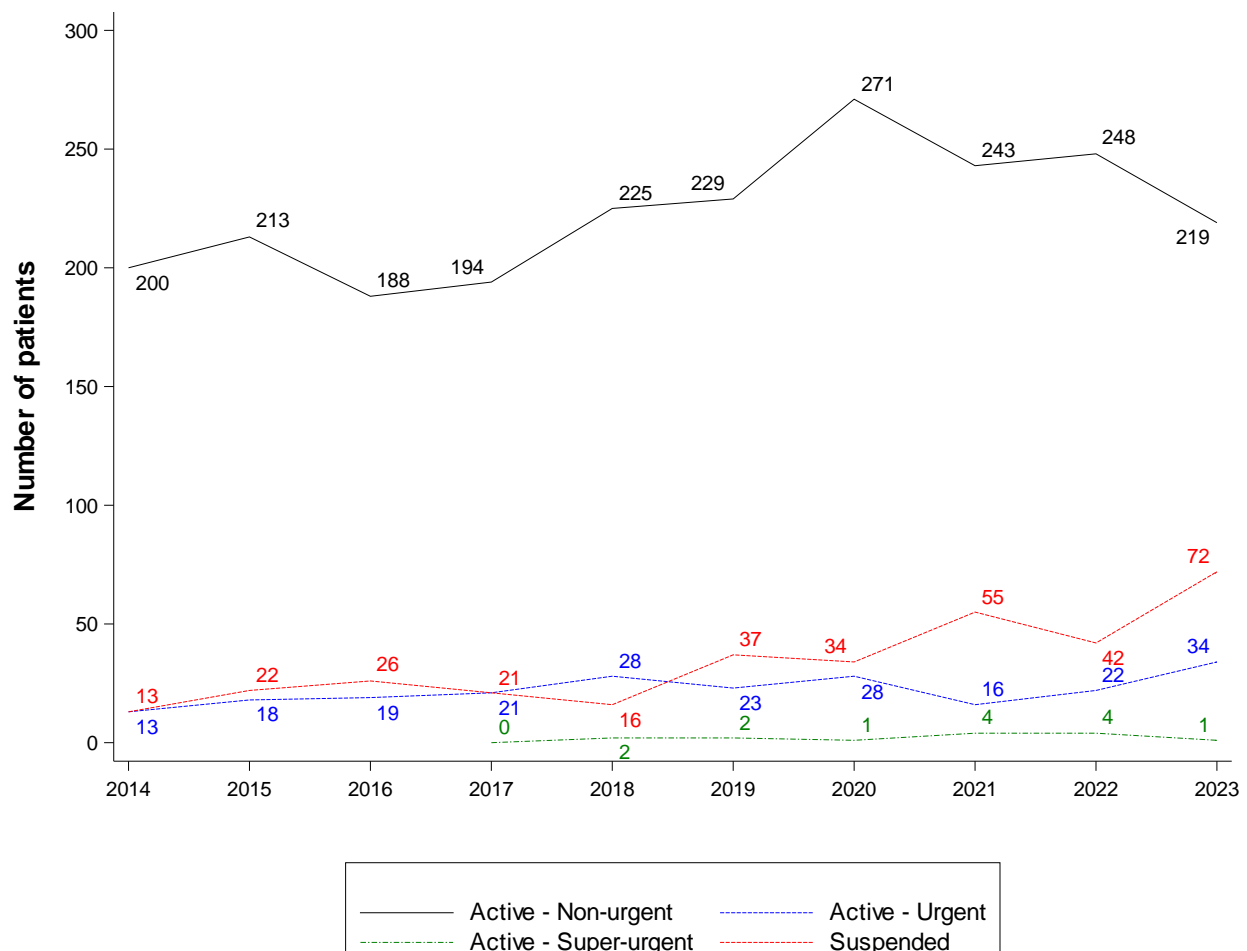
Figure 3.2 shows the number of adults on the active heart transplant list on 31 March 2023, by centre and urgency. **Figure 3.3** provides a similar breakdown by centre and mechanical circulatory support (MCS) status. In total, there were 254 adults waiting for a heart. The number on the urgent transplant list on 31 March 2023 ranged from 2 at Manchester to 12 at Newcastle. Harefield had 1 adult on the super-urgent transplant list. A total of 119 patients were on long-term MCS (including implantable VADs for left, right and biventricular support and total artificial hearts), representing 47% of the national waiting list, but varying between 11% and 84% across centres.

Figure 3.2 Number of adults on the active heart transplant list on 31 March 2023, by centre and urgency
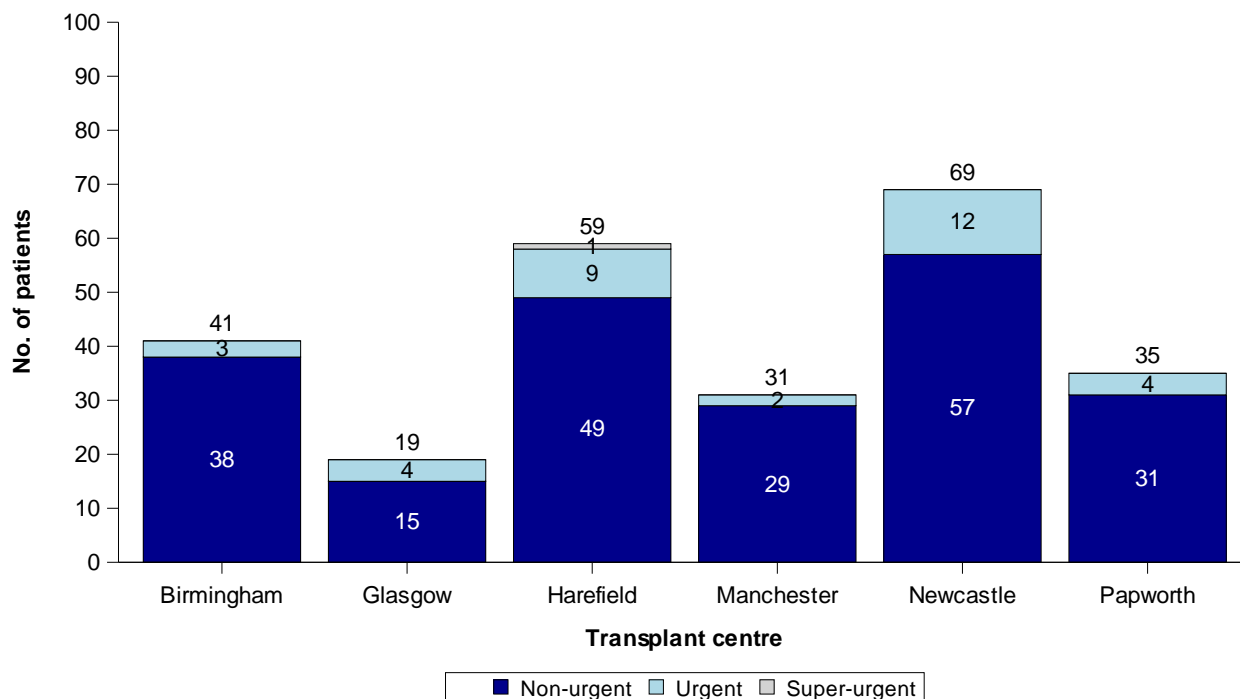
Figure 3.3 Number of adults on the active heart transplant list on 31 March 2023, by centre and mechanical circulatory support status
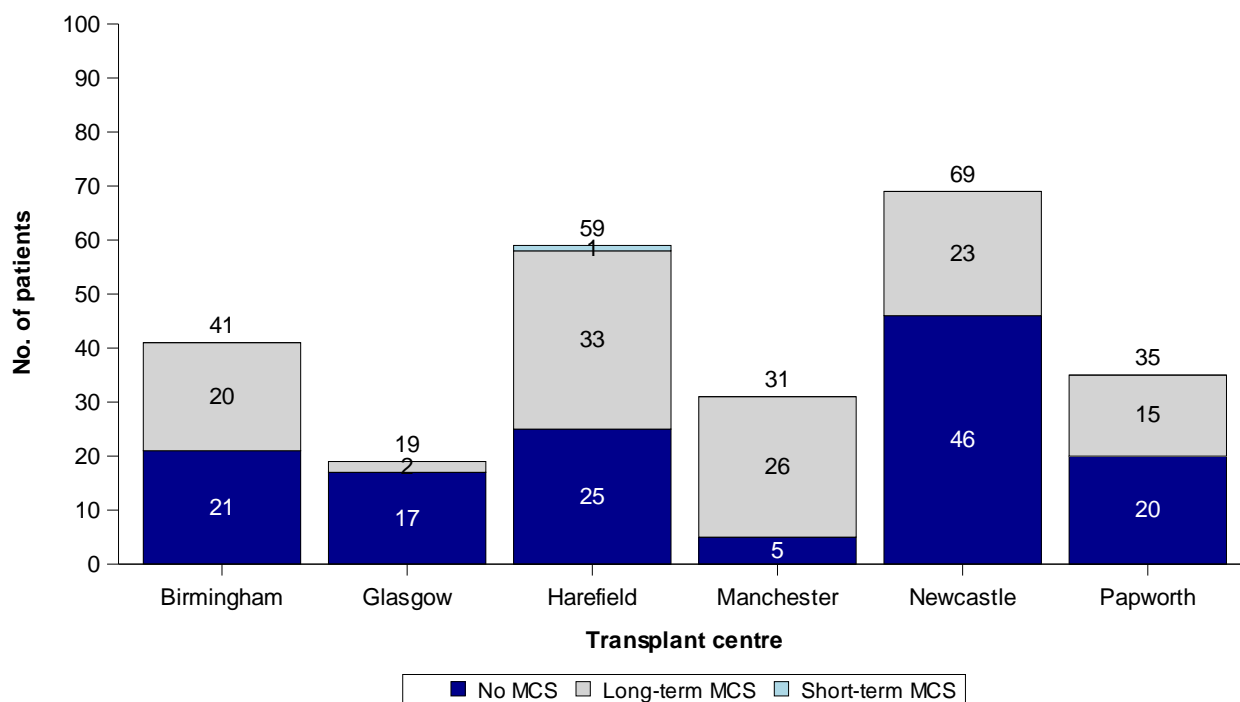
Figure 3.4 shows the trend over time in the number of adults on the heart transplant list on 31 March each year across centres. Birmingham, Manchester and Newcastle have experienced substantial increases in their heart lists over the decade, whilst Glasgow has had a smaller increase. Papworth's list has generally decreased except for an increase between 2018 and 2020, and Harefield's list has remained relatively stable. Manchester has had a noticeable increase in suspended patients in recent years.

Figure 3.4 Number of adults on the heart transplant list on 31 March each year for the last 10 years, by centre
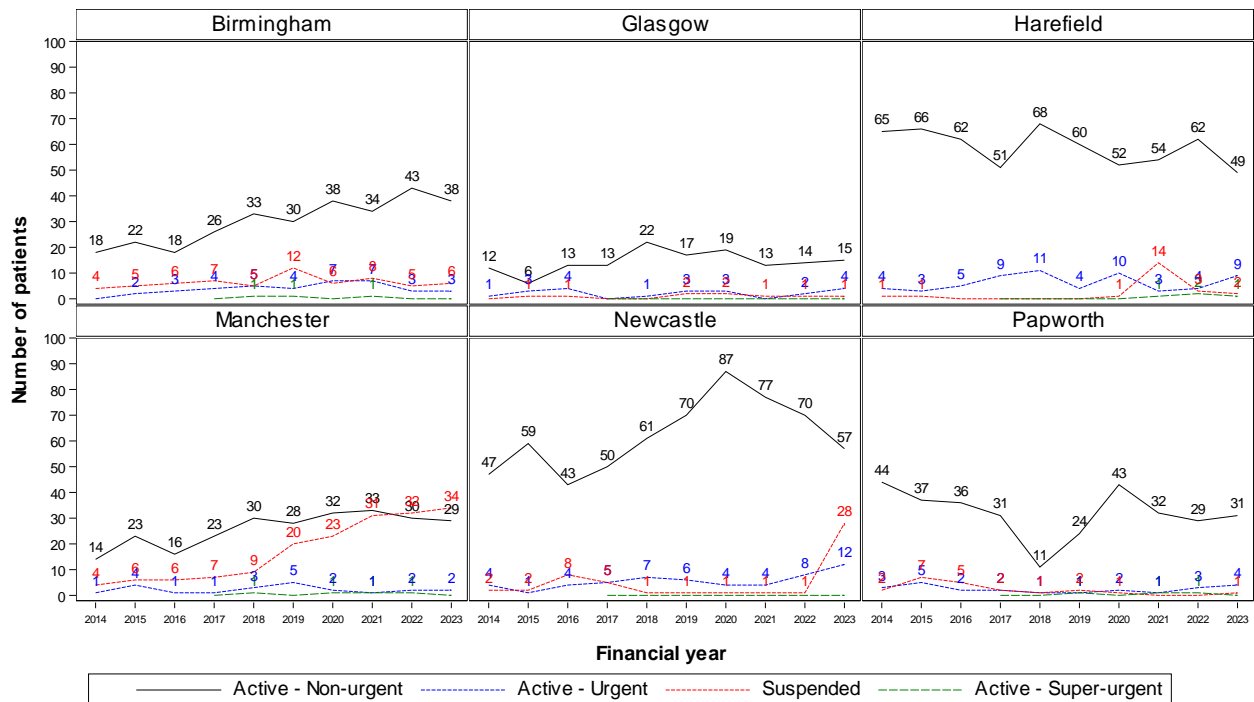
3.2 Demographic characteristics, 1 April 2022 – 31 March 2023

There were 269 adult registrations onto the heart transplant list between 1 April 2022 and 31 March 2023. Demographic characteristics of these patients are shown by centre and overall, in **Table 3.1**. Nationally, 71% were male and the median age was 50 years. The most common primary disease group was cardiomyopathy. For some characteristics, due to rounding, percentages may not add up to 100.

Table 3.1 Demographic characteristics of adult patient registrations onto the heart transplant list between 1 April 2022 and 31 March 2023, by centre, by centre

		Birmingham N (%)	Glasgow N (%)	Harefield N (%)	Manchester N (%)	Newcastle N (%)	Papworth N (%)	TOTAL N (%)
Number of registrations		37 (100)	46 (100)	59 (100)	33 (100)	51 (100)	43 (100)	**269 (100)**
Highest urgency during registration	Non-urgent	15 (41)	14 (30)	18 (31)	15 (45)	21 (41)	19 (44)	**102 (38)**
	Urgent	15 (41)	21 (46)	30 (51)	14 (42)	22 (43)	12 (28)	**114 (42)**
	Super-urgent	7 (19)	11 (24)	11 (19)	4 (12)	8 (16)	12 (28)	**53 (20)**
Recipient sex	Male	22 (59)	37 (80)	42 (71)	23 (70)	35 (69)	32 (74)	**191 (71)**
	Female	14 (38)	9 (20)	17 (29)	10 (30)	16 (31)	11 (26)	**77 (29)**
	Missing	1 (3)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	**1 (0)**
Recipient ethnicity	White	29 (78)	40 (87)	38 (64)	22 (67)	42 (82)	40 (93)	**211 (78)**
	Asian	5 (14)	4 (9)	12 (20)	10 (30)	7 (14)	1 (2)	**39 (15)**
	Black	1 (3)	1 (2)	4 (7)	0 (0)	1 (2)	1 (2)	**8 (3)**
	Other	1 (3)	1 (2)	3 (5)	0 (0)	0 (0)	1 (2)	**6 (2)**
	Missing	1 (3)	0 (0)	2 (3)	1 (3)	1 (2)	0 (0)	**5 (2)**
Recipient age (years)	Median (IQR)	45 (39, 58)	55 (45, 60)	50 (42, 57)	52 (39, 57)	48 (37, 55)	51 (36, 59)	**50 (40, 58)**
	Missing	0	0	0	0	0	0	**0**
Primary Disease	Coronary heart disease	11 (30)	8 (17)	13 (22)	4 (12)	7 (14)	9 (21)	**52 (19)**
	Cardiomyopathy	18 (49)	37 (80)	36 (61)	29 (88)	24 (47)	24 (56)	**168 (63)**
	Congenital heart disease	4 (11)	0 (0)	4 (7)	0 (0)	13 (25)	0 (0)	**21 (8)**
	Graft failure/Rejection	0 (0)	0 (0)	1 (2)	0 (0)	1 (2)	0 (0)	**2 (1)**
	Other/Not reported	4 (11)	1 (2)	5 (8)	0 (0)	6 (12)	10 (23)	**26 (10)**
Previous open heart surgery	None	29 (78)	34 (74)	36 (61)	23 (70)	19 (37)	40 (93)	**181 (67)**
	One	5 (14)	1 (2)	19 (32)	8 (24)	13 (25)	1 (2)	**47 (18)**
	More than one	3 (8)	0 (0)	4 (7)	1 (3)	11 (22)	1 (2)	**20 (7)**
	Missing	0 (0)	11 (24)	0 (0)	1 (3)	8 (16)	1 (2)	**21 (8)**

Table 3.1   Demographic characteristics of adult patient registrations onto the heart transplant list between 1 April 2022 and 31 March 2023, by centre, by centre

		Birmingham N (%)	Glasgow N (%)	Harefield N (%)	Manchester N (%)	Newcastle N (%)	Papworth N (%)	**TOTAL N (%)**
Serum Bilirubin (umol/l)	Median (IQR)	18 (11, 31)	10 (7, 13)	13 (10, 20)	18 (11, 32)	13 (9, 26)	15 (10, 23)	**14 (10, 23)**
	Missing	0	7	0	1	8	1	**17**
Serum Creatinine (umol/l)	Median (IQR)	94 (76, 111)	98 (86, 117)	104 (77, 127)	95 (76, 110)	112 (82, 155)	94 (72, 125)	**98 (77, 125)**
	Missing	0	7	0	1	8	1	**17**

3.3 Post-registration outcomes, 1 April 2018 – 31 March 2020

The registration outcomes of adults listed for a heart transplant between 1 April 2018 and 31 March 2020 are summarised in **Figures 3.5 - 3.9**, nationally and by centre, for non-urgent, urgent and super-urgent registrations respectively. The possible outcomes on the list include receiving a transplant, removal from the list, moving lists, dying on the list, or remaining on the list at a given time point post-registration. In these figures, the *first* outcome is considered, so if an individual was transplanted then died their registration outcome would be "transplanted". If they moved lists, e.g. from the non-urgent to the urgent list, they would be included in both the non-urgent and the urgent charts.

Figure 3.5 shows the non-urgent post-registration outcomes; within six months of listing 10% of non-urgent heart registrations resulted in transplant and 4% had died on the list, while after three years 20% had been transplanted and 10% had died on the list. Also, 16% had moved to the urgent heart list within 6 months, reaching 29% by three years. Removals from the list were for a variety of reasons, most commonly due to deteriorating condition or contra-indication to transplant.

Figure 3.5 Post-registration outcome for 302 non-urgent heart only registrations made in the UK, 1 April 2018 to 31 March 2020

23
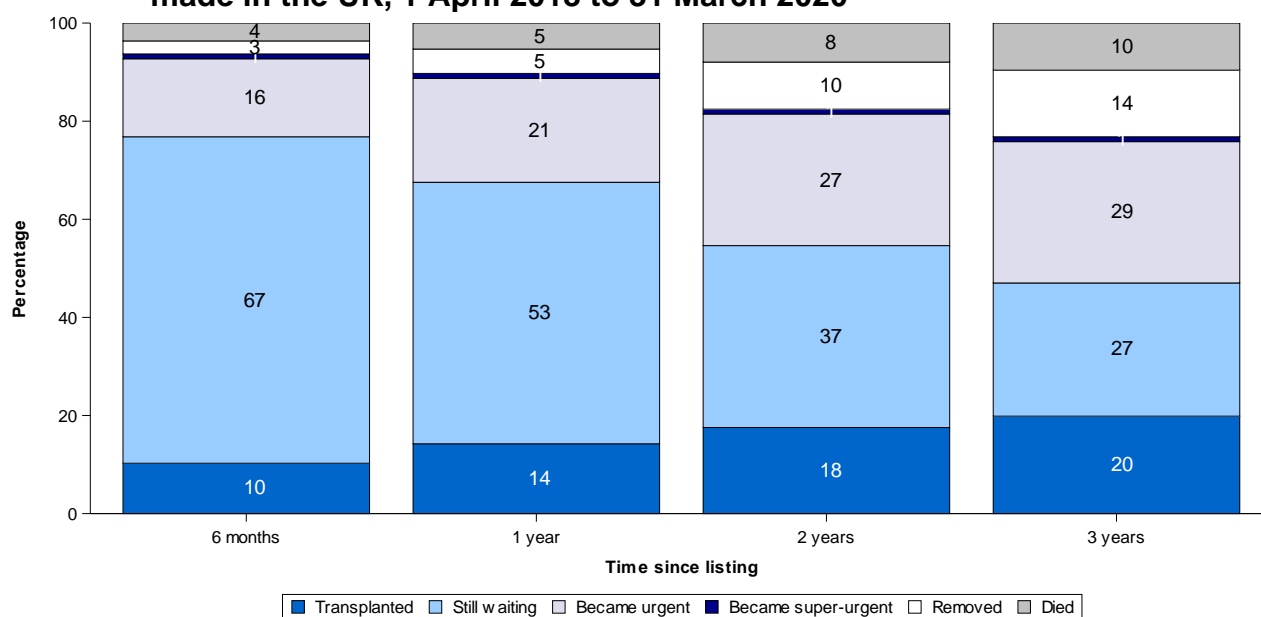
Figure 3.6 shows the three year non-urgent registration outcomes by centre. The non-urgent transplant rate at three years was highest at Papworth (39%) and lowest at Harefield (6%). The mortality rate was highest at Newcastle (20%) and lowest at Glasgow (0%).

Figure 3.6 3 year post-registration outcomes for 302 non-urgent heart only registrations made in the UK, by centre, 1 April 2018 to 31 March 2020
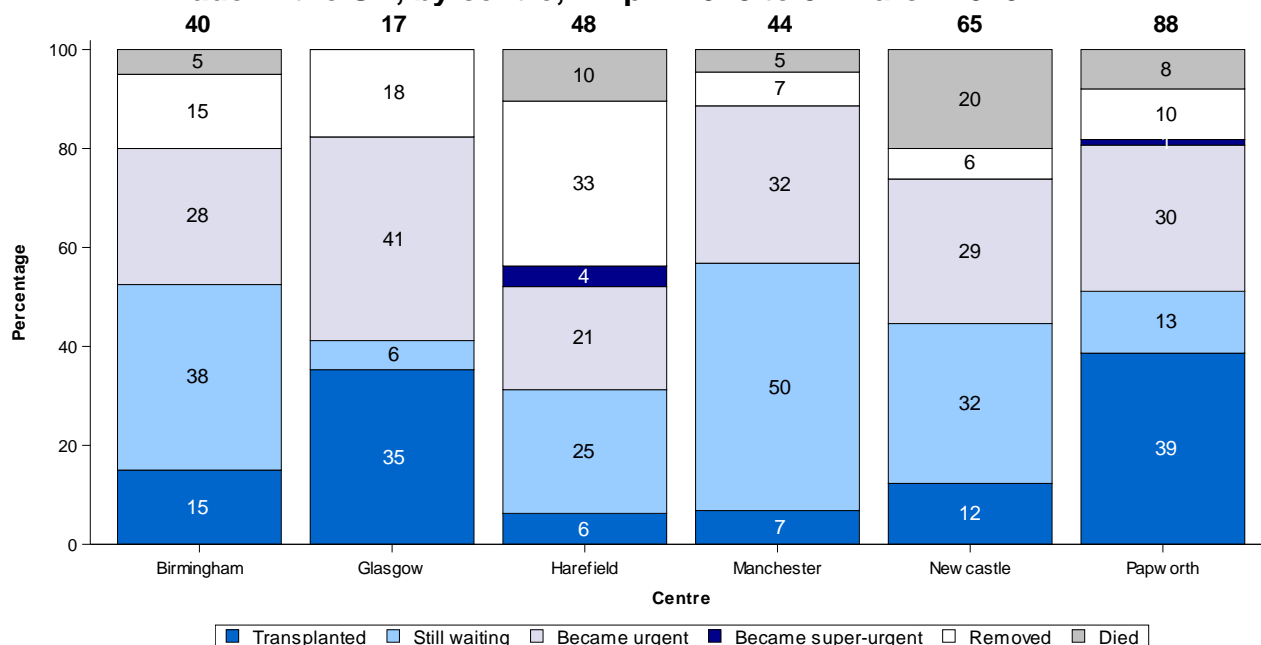
Figure 3.7 shows outcomes on the urgent heart list. The chance of transplant is much higher from the urgent list compared with the non-urgent list; within 6 months, 58% had been transplanted, 3% had died on the list and 19% were removed. Removals from the urgent heart list were due to a variety of reasons, including deteriorating condition or the patient receiving an LVAD.

Figure 3.7 Post-registration outcome for 274 urgent heart only registrations made in the UK, 1 April 2018 to 31 March 2020

24
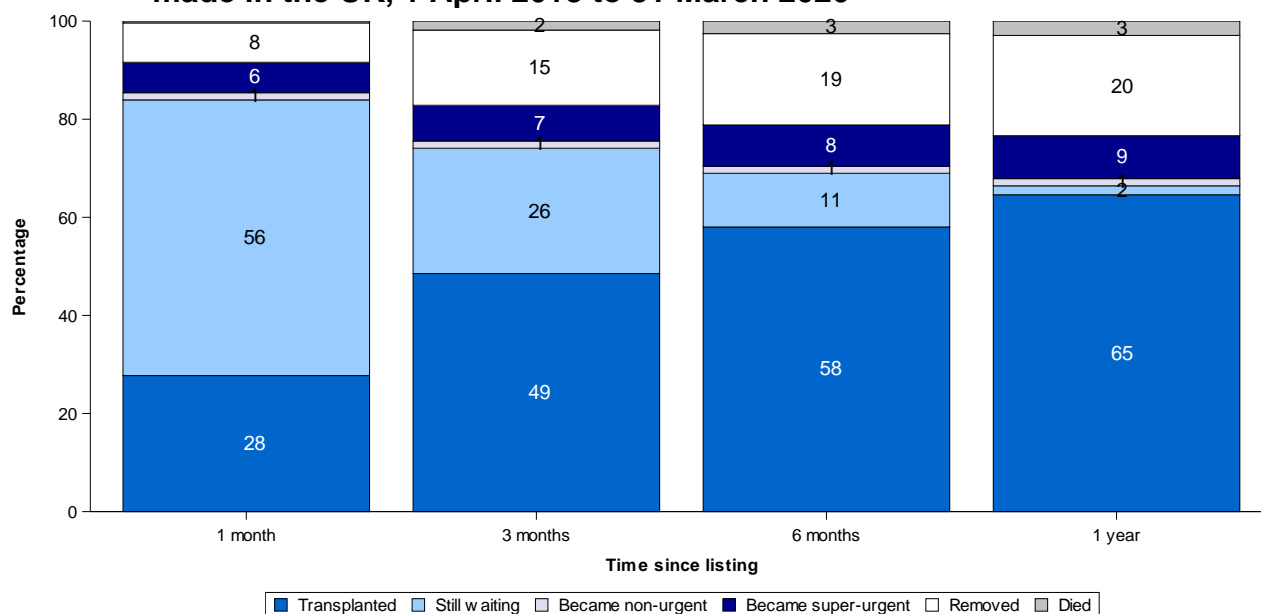
Figure 3.8 shows the one month urgent registration outcomes by centre. The urgent transplant rate at one month was highest at Papworth (54%) and lowest at Glasgow (4%).

Figure 3.8 1 month post-registration outcomes for 274 urgent heart only registrations made in the UK, by centre, 1 April 2018 to 31 March 2020
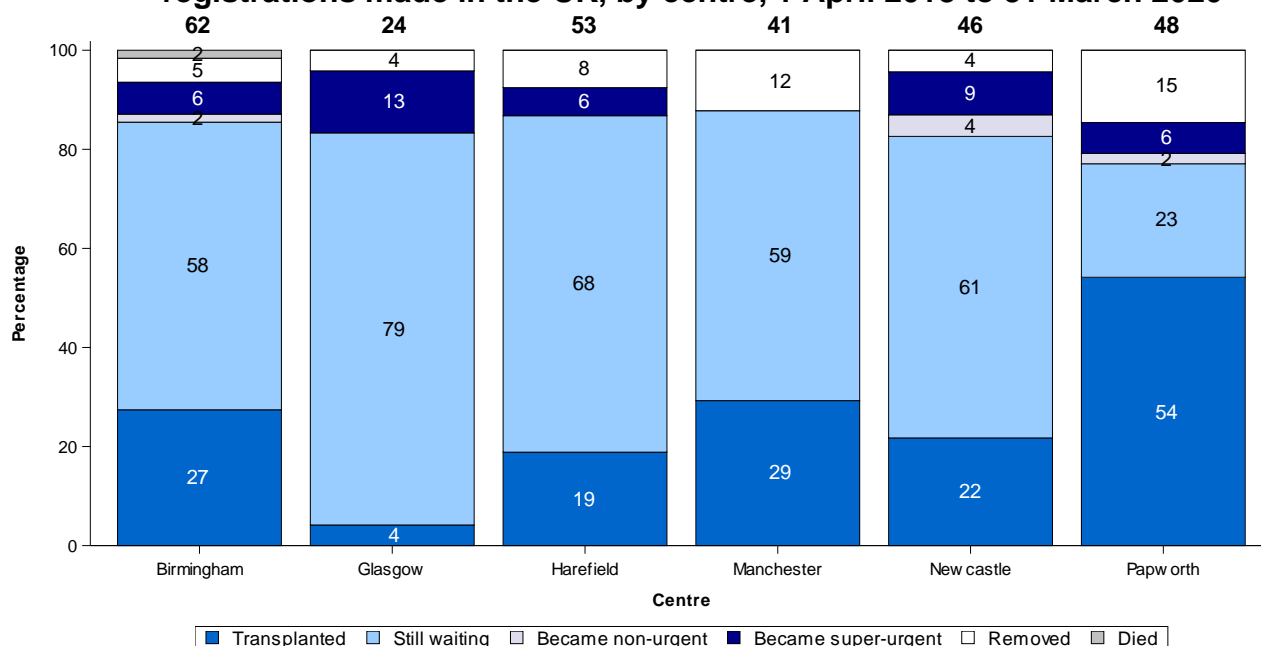
Figure 3.9 shows outcomes on the super-urgent list. The chance of transplant is much higher from the super-urgent list compared with the non-urgent and urgent lists; within 3 months, 65% had been transplanted, 30% were removed and 4% had died on the list. Please note that there is no break down by centre due to the small numbers.

Figure 3.9 Post-registration outcome for 80 super-urgent heart only registrations made in the UK, 1 April 2018 to 31 March 2020


25
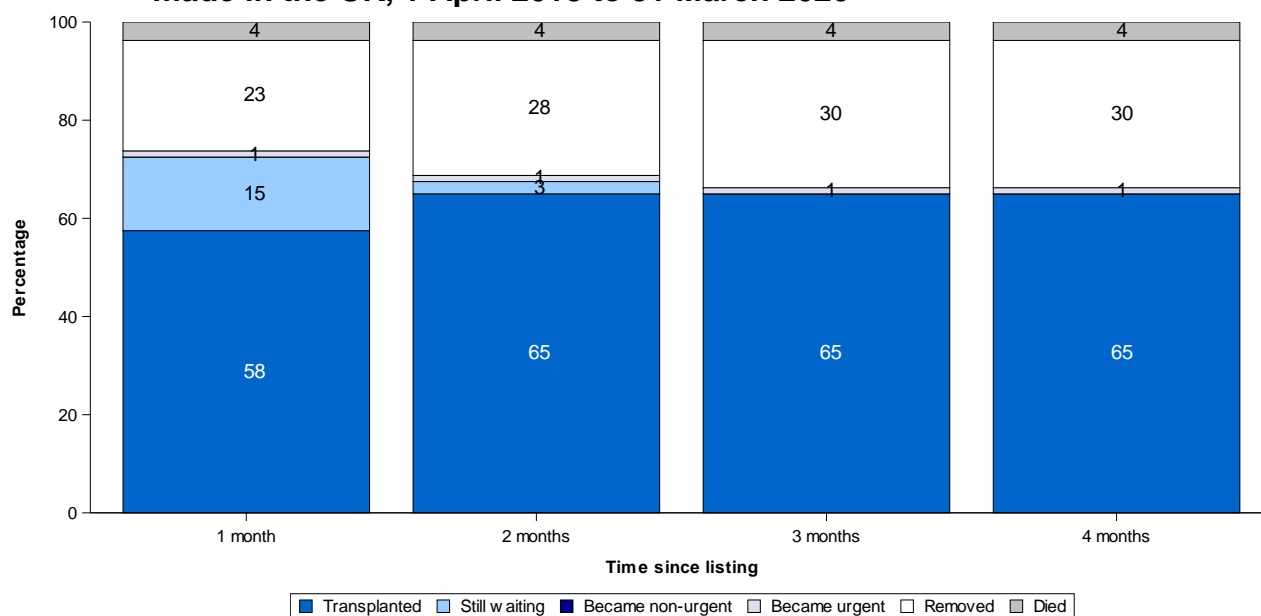
3.4   Median waiting time to transplant, 1 April 2016 - 31 March 2022

The median waiting time to heart transplant from registration for adults is shown in **Figure 3.10** and **Table 3.2**. This is estimated using the Kaplan Meier method for non-urgent registrations onto the heart only transplant list between 1 April 2016 and 31 March 2019 and urgent and super-urgent registrations between 1 April 2019 and 31 March 2022. The urgency groups are defined by urgency at initial registration and all waiting time from initial registration is considered, regardless of any change in urgency. Any suspended time is discounted.

The overall national median waiting time to transplant from non-urgent registration was 900 days (2.5 years) and ranged from 133 days at Papworth to 1434 days at Harefield but could not be calculated for Birmingham or Newcastle due to low transplant rates. For urgent registrations, the national median waiting time was 48 days and ranged from 20 days at Papworth to 91 days at Harefield. The national median waiting time for super-urgent registrations was 18 days. The 95% confidence intervals for some of these medians are very wide, indicating the variation in individual waiting times within groups.

Figure 3.10 Median active waiting time to heart transplant for adults registered on the non-urgent transplant list (1 April 2016 to 31 March 2019) or urgent transplant list (1 April 2019 to 31 March 2022), by centre and urgency status at registration
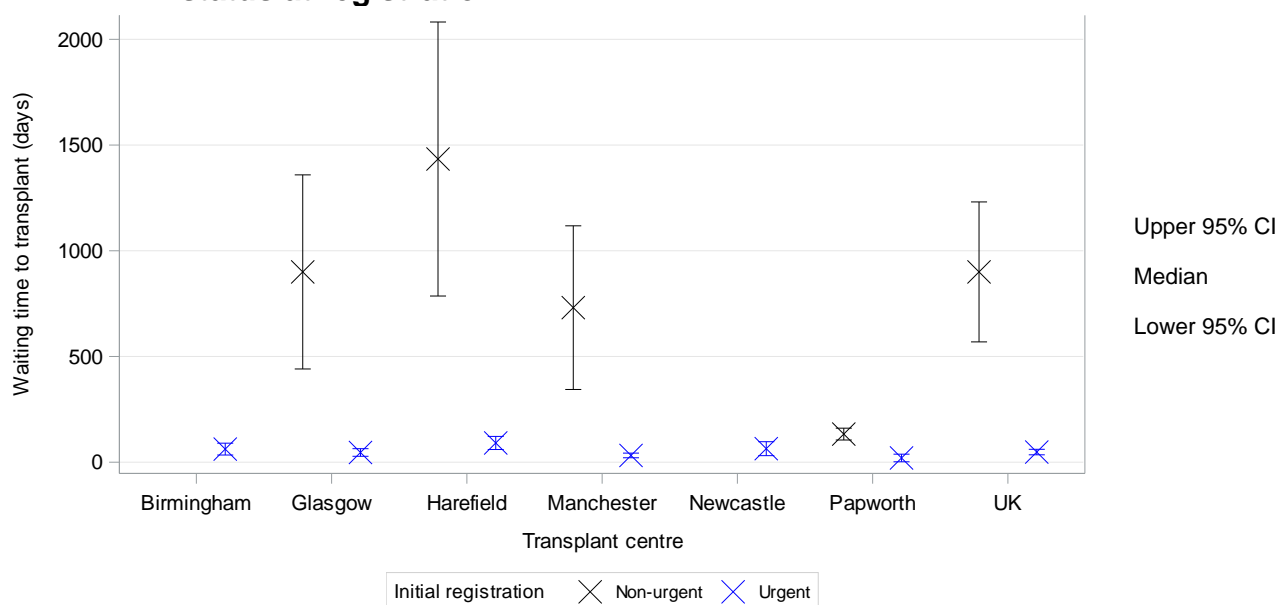
Note: Median waiting times could not be estimated for non-urgent registrations at Birmingham or Newcastle due to low transplant rates

Table 3.2   Median active waiting time to heart transplant for adult patients registered on the non-urgent transplant list (1 April 2016 to 31 March 2019) or urgent/super-urgent transplant list (1 April 2019 to 31 March 2022), by centre

Transplant centre	Number of patients registered	Number transplanted	Median	Waiting time (days) 95% Confidence interval
Non-urgent at initial registration				
Birmingham[1]	65	15	-	-
Glasgow	25	11	900	441 - 1359
Harefield	90	38	1434	786 - 2082
Manchester	66	35	731	344 - 1118
Newcastle[1]	101	34	-	-
Papworth	104	82	133	105 - 161
UK	**451**	**215**	**900**	**569 - 1231**
Urgent at initial registration				
Birmingham	40	31	62	34 - 90
Glasgow	29	25	46	28 - 64
Harefield	62	35	91	60 - 122
Manchester	31	21	32	21 - 43
Newcastle	61	46	64	31 - 97
Papworth	28	22	20	2 - 38
UK	**251**	**180**	**48**	**35 - 61**
Super-urgent at initial registration				
Birmingham	16	14	20	6 - 34
Glasgow[2]	5	4	-	-
Harefield	21	11	28	19 - 37
Manchester	13	8	23	10 - 36
Newcastle	11	5	12	6 - 18
Papworth	18	13	12	10 - 14
UK	**84**	**55**	**18**	**12 - 24**

[1] Medians and 95% confidence intervals could not be calculated due to low transplant rate
[2] Median waiting time for groups with less than 10 are not presented due to small numbers

The median waiting time to heart transplant for adults is also considered by blood group. This is shown in **Figure 3.11** and **Table 3.3** by both blood group and urgency status at registration. For non-urgent registrations, blood group B has the longest average wait compared with the other blood groups and for urgent registrations, blood group O has the longest wait.

Figure 3.11   Median active waiting time to heart transplant for adults registered on the non-urgent transplant list (1 April 2016 to 31 March 2019) or urgent transplant list (1 April 2019 to 31 March 2022), by blood group and urgency at registration
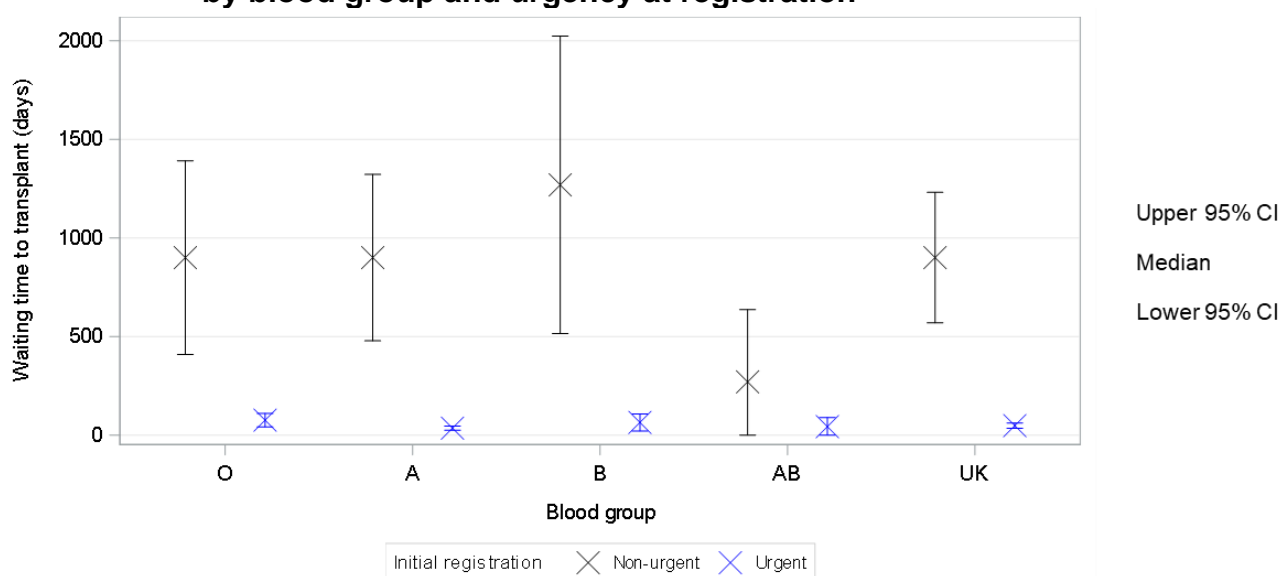
Table 3.3   Median active waiting time to heart transplant for adult patients registered on the non-urgent transplant list (1 April 2016 to 31 March 2019) or urgent/super-urgent transplant list (1 April 2019 to 31 March 2022), by blood group

Blood Group	Number of patients registered	Number transplanted	Waiting time (days) Median	95% Confidence interval
Non-urgent at initial registration				
O	200	89	900	409 - 1391
A	201	99	900	478 - 1322
B	39	20	1269	515 - 2023
AB	11	7	270	0 - 636
UK	**451**	**215**	**900**	**569 - 1231**
Urgent at initial registration				
O	102	67	76	42 - 110
A	102	79	35	25 - 45
B	33	24	64	21 - 107
AB	14	10	43	0 - 89
UK	**251**	**180**	**48**	**35 - 61**
Super-urgent at initial registration				
O	35	18	23	6 - 40
A	32	27	14	7 - 21
B	14	8	23	13 - 33
AB[1]	3	2	-	-
UK	**84**	**55**	**18**	**12 - 24**

[1] Median waiting time for groups with less than 10 are not presented due to small numbers

The median waiting time to heart transplant for adults is shown by VAD status in **Figure 3.12** and **Table 3.4**. This considers whether a patient ever had an implantable left-ventricular assist device (LVAD) as a bridge to heart transplant compared with not and is restricted to those who were initially non-urgent. Median waiting time for those on LVAD support could not be estimated for most centres, nor on a national basis, as not enough patients had been transplanted in this group at time of analysis. However, the national median for those not on LVAD support (328 days) was substantially lower than the overall median for non-urgent patients (900 days).

Figure 3.12 Median waiting time to heart transplant for adults registered on the non-urgent list between 1 April 2016 and 31 March 2019, by centre and VAD status

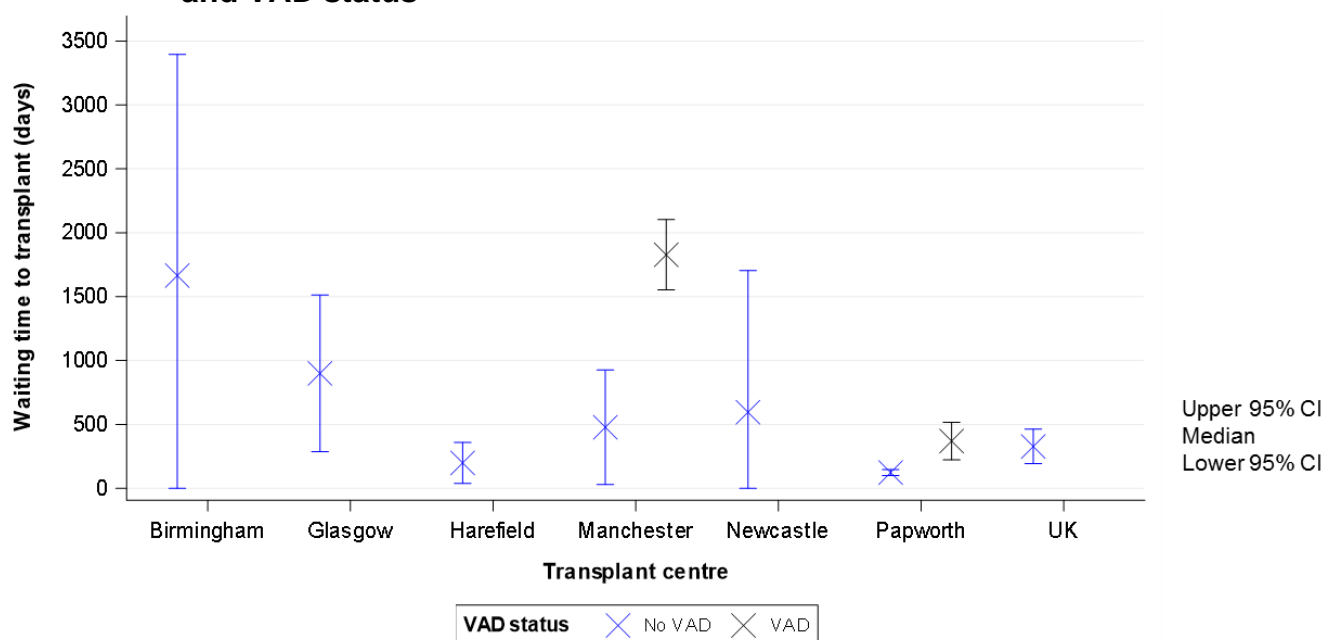Note: Median waiting times for those on LVAD support could only be estimated for Manchester and Papworth

| Table 3.4 | Median active waiting time to heart transplant for adult patients registered on the non-urgent transplant list, by centre and whether the patient had an implantable left-ventricular assist device (LVAD), 1 April 2016 to 31 March 2019 |

Transplant centre	Number of patients registered	Number transplanted	Waiting time (days)	
			Median	95% Confidence interval
Never on LVAD support				
Birmingham	28	11	1665	0 - 3396
Glasgow	23	10	900	287 - 1513
Harefield	37	24	199	39 - 359
Manchester	30	22	478	30 - 926
Newcastle	45	23	596	0 - 1704
Papworth	88	71	124	101 - 147
UK	**251**	**161**	**328**	**193 - 463**
Ever on LVAD support				
Birmingham[1]	37	4	-	-
Glasgow[2]	2	1	-	-
Harefield[1]	53	14	-	-
Manchester	36	13	1828	1553 - 2103
Newcastle[1]	56	11	-	-
Papworth	16	11	370	223 - 517
UK[1]	**200**	**54**	**-**	**-**

[1] Medians and 95% confidence intervals could not be calculated due to low transplant rate
[2] Median waiting time for groups with less than 10 are not presented due to small numbers

ADULT HEART TRANSPLANTATION

Response to Offers

4.   Response to Offers

This section presents an analysis of adult DBD donor heart offer decline rates. This only considers offers of hearts between 1 April 2020 and 31 March 2023 that were eventually transplanted and excludes all fast track offers. Hearts offered as part of a heart-lung block are included. Super-urgent, urgent and non-urgent offers are all considered. Offers to paediatric patients at Newcastle are excluded.

In 2017, group offering for non-urgent cardiothoracic organ offers was introduced, where all centres receive a simultaneous offer for their non-urgent patients but acceptance is determined by a centre's position in the allocation sequence. In this analysis, adjustments have been made to count any centre who is ranked above the accepting centre in the allocation sequence for that donor as declining the heart, even if they did not respond to the group offer, and any declines recorded for a centre ranked below the accepting centre were discounted.

Figure 4.1 compares individual centre decline rates with the national rate using a funnel plot. The offer decline rates for Harefield and Newcastle are above the upper 99.8% confidence limit, indicating a significantly higher decline rate than the national rate. The offer decline rates for both Glasgow and Papworth are below the lower 99.8% confidence limit, indicating a significantly lower decline rate than the national rate. The offer decline rate for Birmingham was below the lower 95% confidence limit, indicating some evidence of a lower decline rate than the national rate.

Figure 4.1 UK adult DBD donor heart offer decline rates by centre, 1 April 2020 to 31 March 2023
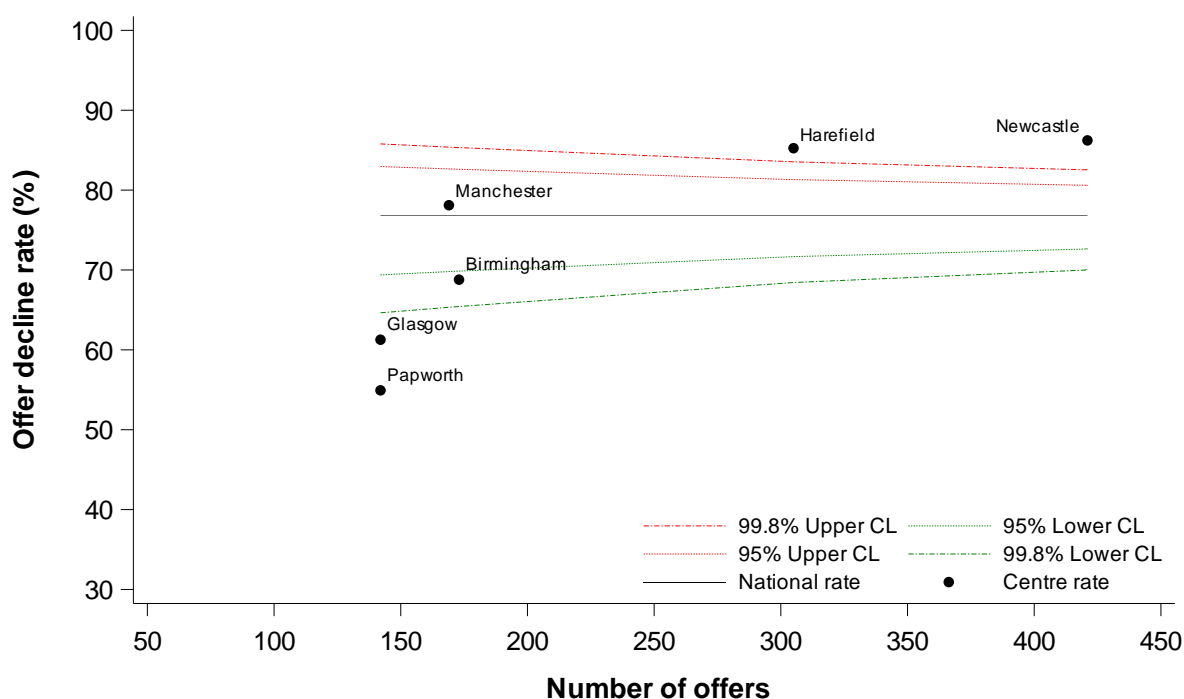
Table 4.1 shows a breakdown of each centre's decline rate across the three years analysed. Nationally, the number of offers has remained similar (for hearts that were eventually transplanted), but the offer decline rate was lowest in the latest year.

Table 4.1 Adult Heart (including cardiac block) offer results by transplant centre, between 1 April 2020 and 31 March 2023

Centre	2020/21		2021/22		2022/23		Overall	
	No. offers	Decline rate (%)	No. offers	Decline rate (%)	No. offers	Decline rate (%)	No. offers	Decline rate (%)
Birmingham	61	(62.3)	53	(81.1)	59	(64.4)	173	(68.8)
Glasgow	41	(68.3)	42	(64.3)	59	(54.2)	142	(61.3)
Harefield	137	(89.8)	81	(86.4)	87	(77.0)	305	(85.2)
Manchester	69	(79.7)	61	(78.7)	39	(74.4)	169	(78.1)
Newcastle	123	(85.4)	161	(87.6)	137	(85.4)	421	(86.2)
Papworth	41	(48.8)	48	(56.3)	53	(58.5)	142	(54.9)
UK	472	(78.2)	446	(79.8)	434	(72.4)	1352	(76.8)

■ (red)	Centre has reached the upper 99.8% confidence limit
■ (pink)	Centre has reached the upper 95% confidence limit
■ (light green)	Centre has reached the lower 95% confidence limit
■ (dark green)	Centre has reached the lower 99.8% confidence limit

ADULT HEART TRANSPLANTATION

Transplants

5.1 Adult heart transplants, 1 April 2013 – 31 March 2023

Figure 5.1 shows the number of adult heart transplants performed per year over the last ten years, by donor type. Last year there were 185 adult heart transplants nationally, 40 more than the previous year and is the most active year over the last decade. Comparing 2022/2023 with the previous year, there has been an increase in the number of DCD heart transplants performed.

Figure 5.1 Number of adult heart transplants in the UK, by financial year and donor type, 1 April 2013 to 31 March 2023
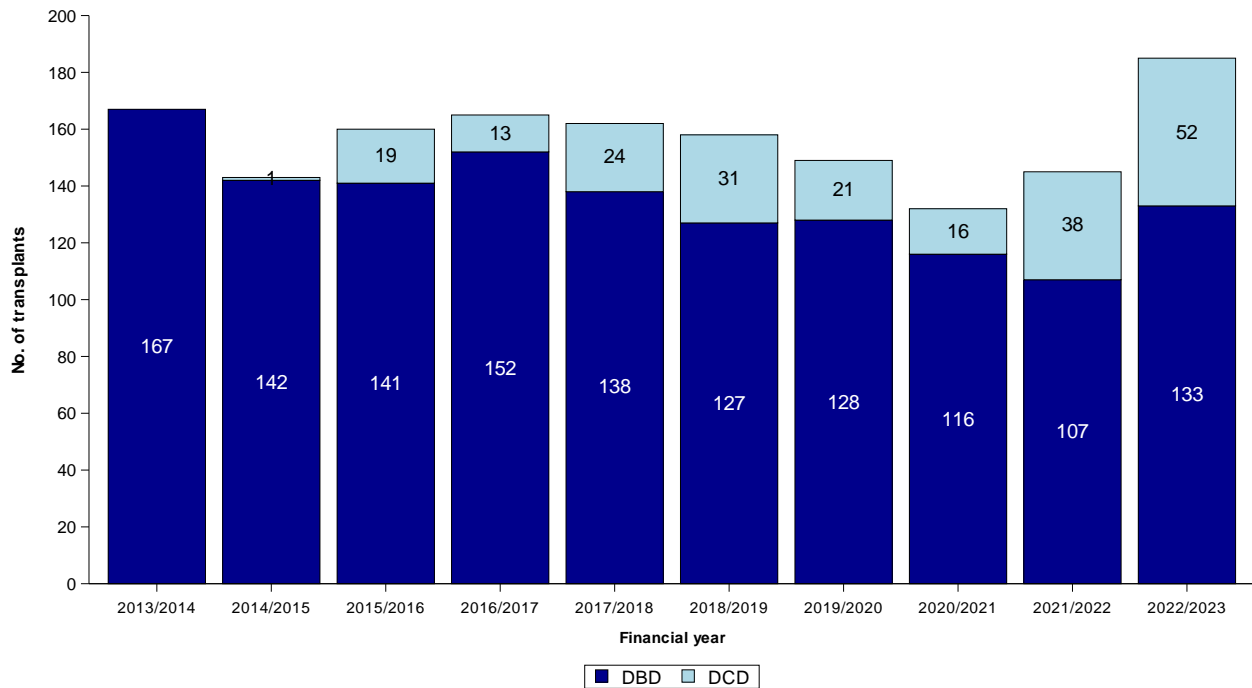
Figure 5.2 shows the number of adult heart transplants performed per centre, per year, over the last ten years, by donor type.

Figure 5.2   Number of adult heart transplants in the UK, by financial year, centre and donor type, 1 April 2013 to 31 March 2023
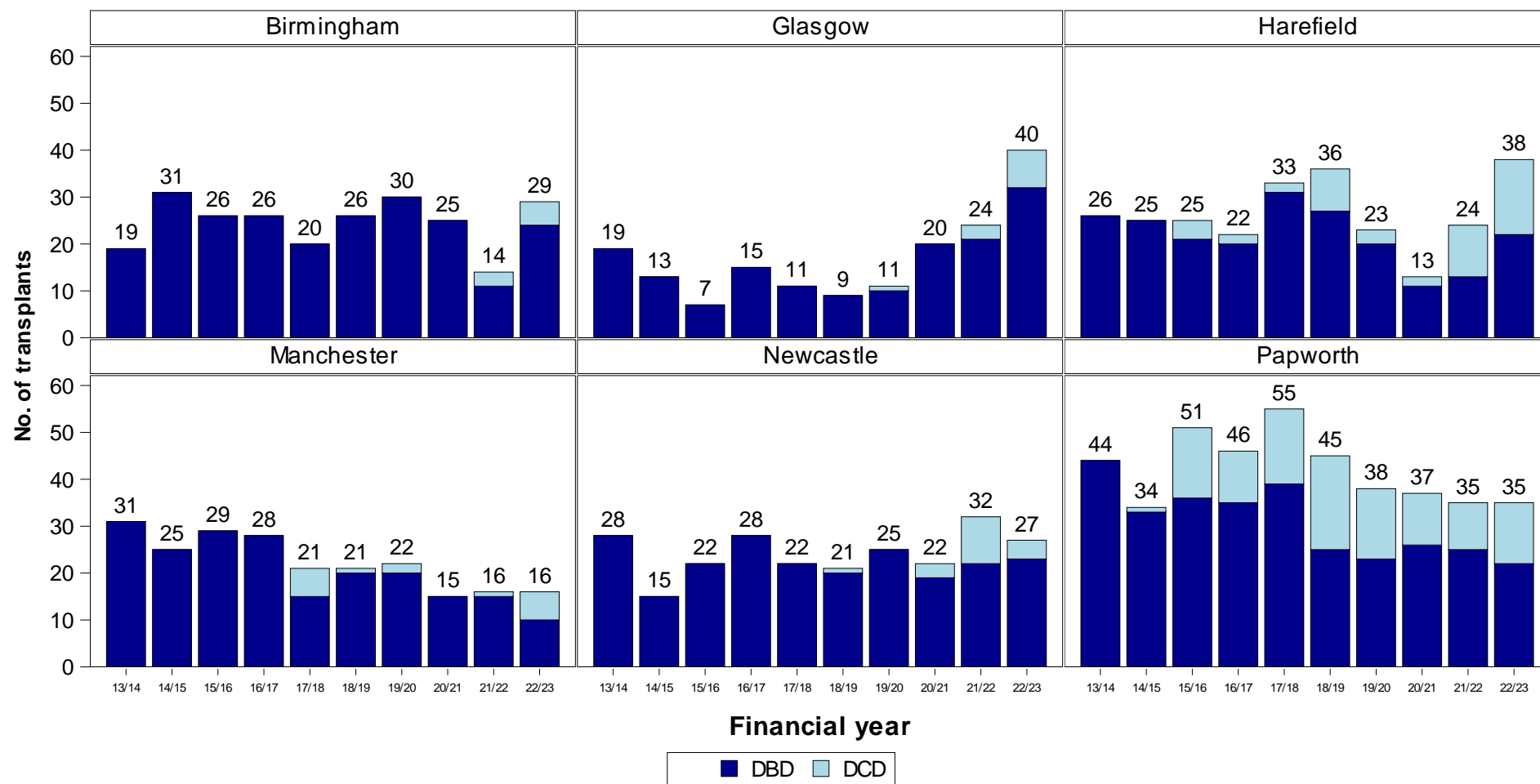
Last year's activity is shown by centre and donor type in **Figure 5.3**. DCD heart transplants represented 28% of last year's adult heart transplant activity The highest number of DBD transplants were performed by Glasgow and the highest number of DCD transplants were performed by Harefield.

Figure 5.3 Number of adult heart transplants in the UK, by centre and donor type, 1 April 2022 to 31 March 2023
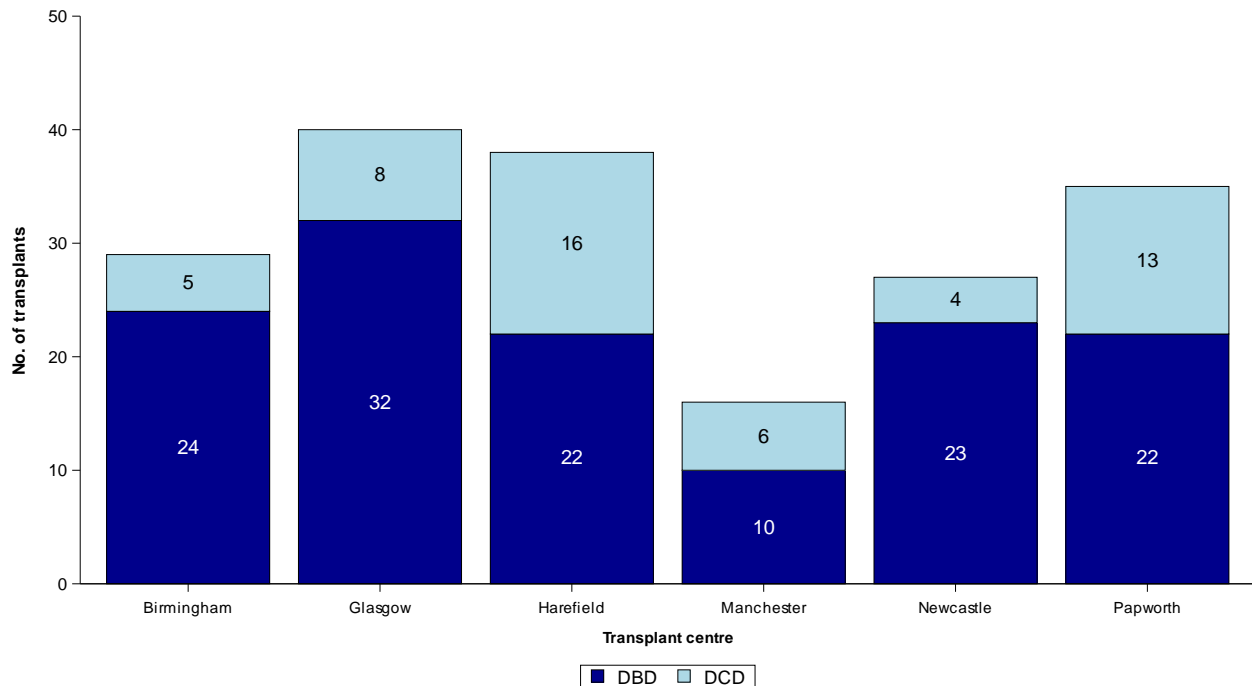
Figure 5.4 and **5.5** show the number of adult heart transplants performed in the last ten years, by urgency status of recipient, nationally and by centre, respectively. Over time, the proportion of urgent transplants has increased slightly; from 75% in 2013/2014 to 79% in 2022/2023, including 50 super-urgent transplants. Papworth performed the highest number of non-urgent transplants over the time period.

Figure 5.4 Number of adult heart transplants in the UK, by financial year and urgency status, 1 April 2013 to 31 March 2023

Figure 5.5 Number of adult heart transplants in the UK, by financial year, centre and urgency status, 1 April 2013 to 31 March 2023
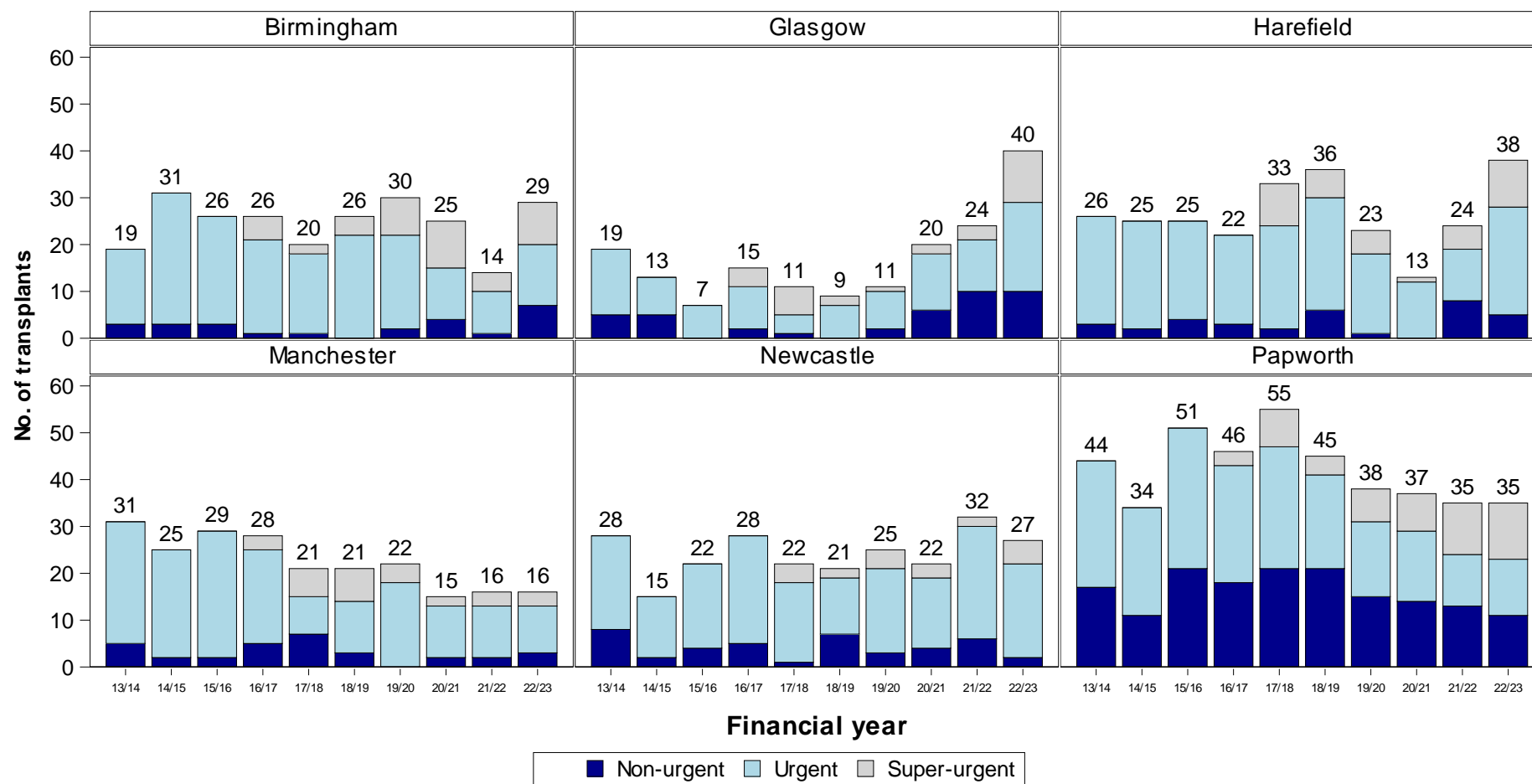
Last year's activity is shown by centre and urgency status in **Figure 5.6**. Papworth performed the highest number of super-urgent transplants.

Figure 5.6 Number of adult heart transplants in the UK, by centre and urgency status, 1 April 2022 to 31 March 2023

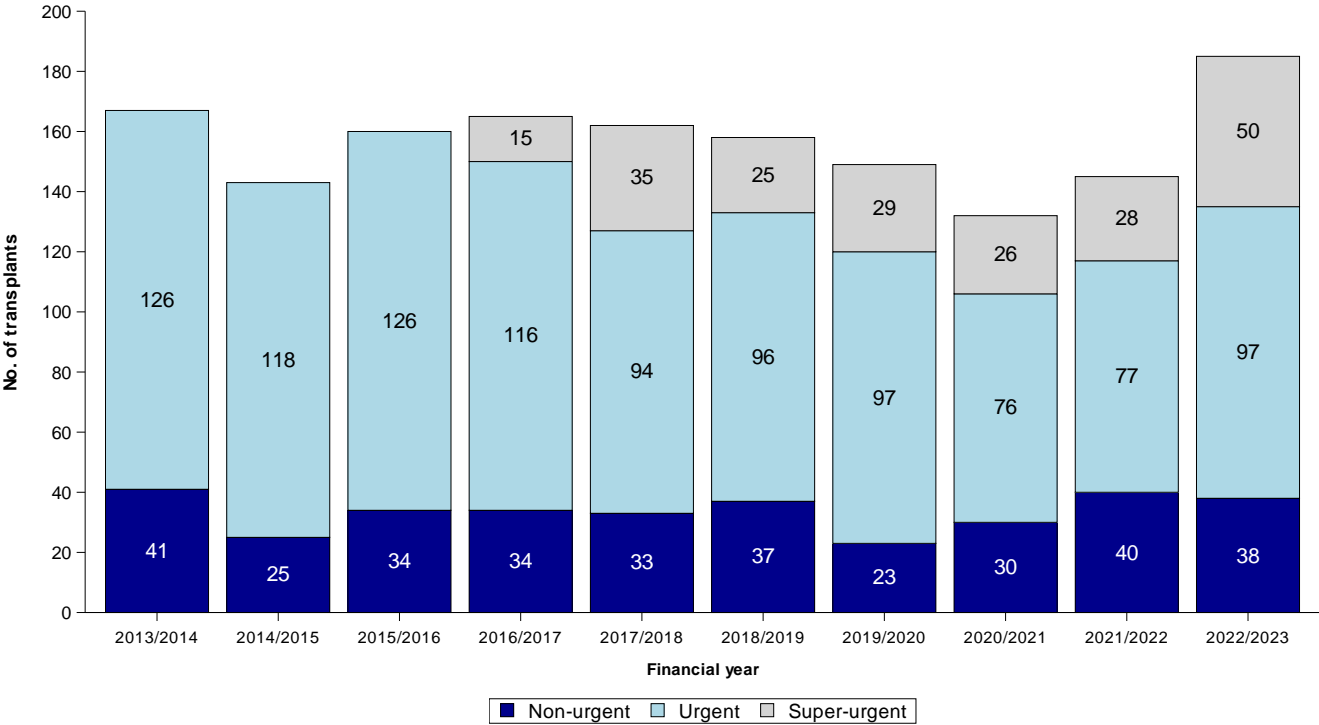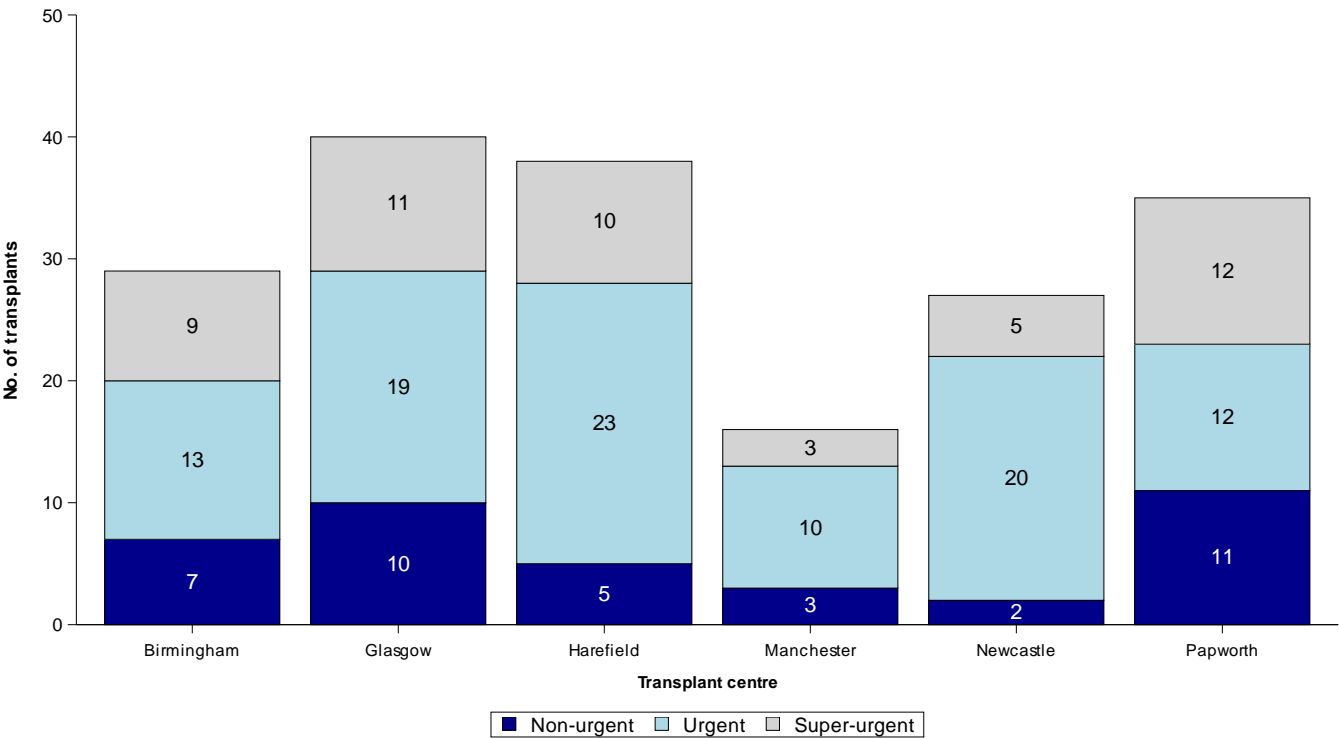## 5.2 Demographic characteristics of transplants, 1 April 2022 – 31 March 2023

The demographic characteristics of the 185 adult heart transplant recipients and donors in the latest year are shown by centre and overall, in **Table 5.1**. Nationally, 68% of heart recipients were male and the median age was 50 years while the median age for donors was 35 years. For some characteristics, due to rounding, percentages may not add up to 100.

Table 5.1	Demographic characteristics of UK adult heart transplants performed between 1 April 2022 and 31 March 2023, by centre						
		Birmingham N (%)	Glasgow N (%)	Harefield N (%)	Manchester N (%)	Newcastle N (%)	Papworth N (%)	**TOTAL N (%)**
Number of transplants		29 (100)	40 (100)	38 (100)	16 (100)	27 (100)	35 (100)	**185 (100)**
Urgency status at transplant	Non-urgent	7 (24)	10 (25)	5 (13)	3 (19)	2 (7)	11 (31)	**38 (21)**
	Urgent	13 (45)	19 (48)	23 (61)	10 (63)	20 (74)	12 (34)	**97 (52)**
	Super-urgent	9 (31)	11 (28)	10 (26)	3 (19)	5 (19)	12 (34)	**50 (27)**
Recipient sex	Male	18 (62)	31 (78)	26 (68)	10 (63)	14 (52)	27 (77)	**126 (68)**
	Female	11 (38)	9 (23)	12 (32)	6 (38)	13 (48)	8 (23)	**59 (32)**
Recipient ethnicity	White	20 (69)	34 (85)	25 (66)	12 (75)	23 (85)	29 (83)	**143 (77)**
	Asian	6 (21)	3 (8)	5 (13)	4 (25)	4 (15)	3 (9)	**25 (14)**
	Black	0 (0)	1 (3)	4 (11)	0 (0)	0 (0)	0 (0)	**5 (3)**
	Other	1 (3)	1 (3)	3 (8)	0 (0)	0 (0)	2 (6)	**7 (4)**
	Missing	2 (7)	1 (3)	1 (3)	0 (0)	0 (0)	1 (3)	**5 (3)**
Recipient age (years)	Median (IQR)	47 (39, 56)	55 (46, 61)	50 (35, 58)	47 (40, 56)	44 (31, 51)	52 (37, 60)	**50 (39, 58)**
	Missing	0	0	0	0	0	0	**0**
Recipient weight (kg)	Median (IQR)	80 (70, 84)	75 (67, 83)	77 (68, 87)	80 (73, 86)	74 (57, 89)	81 (72, 89)	**77 (68, 86)**
	Missing	0	0	0	1	0	0	**1**
Recipient primary disease	Coronary heart disease	7 (24)	8 (20)	6 (16)	3 (19)	0 (0)	10 (29)	**34 (18)**
	Cardiomyopathy	17 (59)	32 (80)	28 (74)	12 (75)	15 (56)	22 (63)	**126 (68)**
	Congenital heart disease	3 (10)	0 (0)	2 (5)	0 (0)	10 (37)	0 (0)	**15 (8)**
	Graft failure/Rejection	0 (0)	0 (0)	0 (0)	0 (0)	1 (4)	0 (0)	**1 (1)**
	Other	2 (7)	0 (0)	2 (5)	1 (6)	1 (4)	3 (9)	**9 (5)**

Table 5.1   Demographic characteristics of UK adult heart transplants performed between 1 April 2022 and 31 March 2023, by centre

		Birmingham N (%)	Glasgow N (%)	Harefield N (%)	Manchester N (%)	Newcastle N (%)	Papworth N (%)	TOTAL N (%)
NYHA class	II	3 (10)	0 (0)	1 (3)	0 (0)	0 (0)	1 (3)	**5 (3)**
	III	3 (10)	13 (33)	16 (42)	4 (25)	5 (19)	17 (49)	**58 (31)**
	IV	15 (52)	15 (38)	18 (47)	11 (69)	21 (78)	17 (49)	**97 (52)**
	Missing	8 (28)	12 (30)	3 (8)	1 (6)	1 (4)	0 (0)	**25 (14)**
Recipient in hospital	No	7 (24)	10 (25)	7 (18)	5 (31)	5 (19)	13 (37)	**47 (25)**
	Yes	21 (72)	22 (55)	31 (82)	11 (69)	21 (78)	22 (63)	**128 (69)**
	Missing	1 (3)	8 (20)	0 (0)	0 (0)	1 (4)	0 (0)	**10 (5)**
In hospital, recipient on ventilator	No	21 (100)	20 (91)	30 (97)	11 (100)	21 (100)	22 (100)	**125 (98)**
	Yes	0 (0)	2 (9)	0 (0)	0 (0)	0 (0)	0 (0)	**2 (2)**
	Missing	0 (0)	0 (0)	1 (3)	0 (0)	0 (0)	0 (0)	**1 (1)**
In hospital, recipient VAD	None	15 (71)	20 (91)	19 (61)	8 (73)	17 (81)	8 (36)	**87 (68)**
	Left	1 (5)	1 (5)	4 (13)	0 (0)	4 (19)	5 (23)	**15 (12)**
	Both	5 (24)	0 (0)	8 (26)	3 (27)	0 (0)	9 (41)	**25 (20)**
	Missing	0 (0)	1 (5)	0 (0)	0 (0)	0 (0)	0 (0)	**1 (1)**
In hospital, recipient TAH	No	21 (100)	22 (100)	31 (100)	11 (100)	21 (100)	22 (100)	**128 (100)**
In hospital, recipient ECMO	No	21 (100)	16 (73)	30 (97)	11 (100)	18 (86)	22 (100)	**118 (92)**
	Yes	0 (0)	4 (18)	1 (3)	0 (0)	3 (14)	0 (0)	**8 (6)**
	Missing	0 (0)	2 (9)	0 (0)	0 (0)	0 (0)	0 (0)	**2 (2)**
In hospital, recipient on inotropes	No	8 (38)	4 (18)	6 (19)	3 (27)	0 (0)	15 (68)	**36 (28)**
	Yes	13 (62)	17 (77)	25 (81)	8 (73)	21 (100)	7 (32)	**91 (71)**
	Missing	0 (0)	1 (5)	0 (0)	0 (0)	0 (0)	0 (0)	**1 (1)**
In hospital, recipient IABP	No	21 (100)	7 (32)	30 (97)	11 (100)	21 (100)	22 (100)	**112 (88)**
	Yes	0 (0)	13 (59)	0 (0)	0 (0)	0 (0)	0 (0)	**13 (10)**
	Missing	0 (0)	2 (9)	1 (3)	0 (0)	0 (0)	0 (0)	**3 (2)**
Recipient CMV status	Negative	14 (48)	17 (43)	16 (42)	10 (63)	15 (56)	18 (51)	**90 (49)**
	Positive	15 (52)	23 (58)	22 (58)	6 (38)	12 (44)	16 (46)	**94 (51)**
	Missing	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (3)	**1 (1)**

Table 5.1   Demographic characteristics of UK adult heart transplants performed between 1 April 2022 and 31 March 2023, by centre

|		Birmingham N (%)	Glasgow N (%)	Harefield N (%)	Manchester N (%)	Newcastle N (%)	Papworth N (%)	TOTAL N (%)
Recipient HCV status	Negative	28 (97)	32 (80)	38 (100)	16 (100)	26 (96)	35 (100)	**175 (95)**
	Positive	0 (0)	1 (3)	0 (0)	0 (0)	0 (0)	0 (0)	**1 (1)**
	Missing	1 (3)	7 (18)	0 (0)	0 (0)	1 (4)	0 (0)	**9 (5)**
Recipient HBV status	Negative	28 (97)	32 (80)	36 (95)	16 (100)	26 (96)	35 (100)	**173 (94)**
	Positive	0 (0)	1 (3)	2 (5)	0 (0)	0 (0)	0 (0)	**3 (2)**
	Missing	1 (3)	7 (18)	0 (0)	0 (0)	1 (4)	0 (0)	**9 (5)**
Recipient HIV status	Negative	27 (93)	33 (83)	37 (97)	16 (100)	26 (96)	35 (100)	**174 (94)**
	Positive	1 (3)	0 (0)	1 (3)	0 (0)	0 (0)	0 (0)	**2 (1)**
	Missing	1 (3)	7 (18)	0 (0)	0 (0)	1 (4)	0 (0)	**9 (5)**
Recipient Serum Creatinine (umol/l)	Median (IQR)	71 (55, 86)	100 (84, 121)	90 (64, 119)	82 (70, 108)	102 (74, 131)	93 (74, 107)	**90 (70, 115)**
	Missing	1	10	1	0	1	1	**14**
Donor sex	Male	20 (69)	20 (50)	22 (58)	12 (75)	17 (63)	26 (74)	**117 (63)**
	Female	9 (31)	20 (50)	16 (42)	4 (25)	10 (37)	9 (26)	**68 (37)**
Donor ethnicity	White	25 (86)	37 (93)	35 (92)	15 (94)	21 (78)	34 (97)	**167 (90)**
	Asian	1 (3)	2 (5)	1 (3)	1 (6)	3 (11)	1 (3)	**9 (5)**
	Other	1 (3)	1 (3)	1 (3)	0 (0)	0 (0)	0 (0)	**3 (2)**
	Missing	2 (7)	0 (0)	1 (3)	0 (0)	3 (11)	0 (0)	**6 (3)**
Donor age (years)	Median (IQR)	34 (29, 45)	41 (32, 47)	38 (30, 44)	27 (22, 36)	33 (23, 39)	34 (25, 43)	**35 (26, 45)**
	Missing	0	0	0	0	0	0	**0**
Donor BMI (kg/m^2)	Median (IQR)	25 (22, 28)	27 (23, 30)	26 (23, 29)	24 (20, 27)	24 (21, 29)	25 (23, 28)	**25 (22, 29)**
	Missing	0	0	0	0	0	0	**0**
Donor cause of death	Intracranial/CVA	24 (83)	35 (88)	33 (87)	9 (56)	23 (85)	33 (94)	**157 (85)**
	Trauma	0 (0)	0 (0)	2 (5)	4 (25)	2 (7)	1 (3)	**9 (5)**
	Others	5 (17)	5 (13)	3 (8)	3 (19)	2 (7)	1 (3)	**19 (10)**
Donor hypotension	No	19 (66)	22 (55)	33 (87)	15 (94)	4 (15)	27 (77)	**120 (65)**
	Yes	8 (28)	4 (10)	5 (13)	1 (6)	4 (15)	6 (17)	**28 (15)**
	Missing	2 (7)	14 (35)	0 (0)	0 (0)	19 (70)	2 (6)	**37 (20)**

Table 5.1	Demographic characteristics of UK adult heart transplants performed between 1 April 2022 and 31 March 2023, by centre							
		Birmingham N (%)	Glasgow N (%)	Harefield N (%)	Manchester N (%)	Newcastle N (%)	Papworth N (%)	**TOTAL N (%)**
Donor past diabetes	No	28 (97)	31 (78)	36 (95)	15 (94)	26 (96)	35 (100)	**171 (92)**
	Yes	0 (0)	1 (3)	2 (5)	1 (6)	0 (0)	0 (0)	**4 (2)**
	Missing	1 (3)	8 (20)	0 (0)	0 (0)	1 (4)	0 (0)	**10 (5)**
Donor past cardio disease	No	28 (97)	40 (100)	38 (100)	16 (100)	26 (96)	34 (97)	**182 (98)**
	Yes	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (3)	**1 (1)**
	Missing	1 (3)	0 (0)	0 (0)	0 (0)	1 (4)	0 (0)	**2 (1)**
Donor past hypertension	No	26 (90)	26 (65)	36 (95)	14 (88)	25 (93)	34 (97)	**161 (87)**
	Yes	1 (3)	6 (15)	2 (5)	2 (13)	1 (4)	1 (3)	**13 (7)**
	Missing	2 (7)	8 (20)	0 (0)	0 (0)	1 (4)	0 (0)	**11 (6)**
Donor past tumour	No	25 (86)	32 (80)	38 (100)	15 (94)	26 (96)	34 (97)	**170 (92)**
	Yes	2 (7)	0 (0)	0 (0)	0 (0)	0 (0)	1 (3)	**3 (2)**
	Missing	2 (7)	8 (20)	0 (0)	1 (6)	1 (4)	0 (0)	**12 (7)**
Donor past smoker	No	9 (31)	17 (43)	18 (47)	7 (44)	12 (44)	18 (51)	**81 (44)**
	Yes	19 (66)	14 (35)	20 (53)	9 (56)	14 (52)	17 (49)	**93 (50)**
	Missing	1 (3)	9 (23)	0 (0)	0 (0)	1 (4)	0 (0)	**11 (6)**
Total ischaemia time (hours)	Median (IQR)	4.0 (3.7, 4.5)	3.7 (2.9, 4.1)	4.4 (3.7, 5.4)	3.8 (2.7, 4.4)	3.7 (3.2, 4.2)	4.0 (3.3, 5.7)	**3.9 (3.3, 4.6)**
	Missing	7	22	6	1	1	2	**39**

5.3   Total ischaemia time, 1 April 2013 – 31 March 2023

Figure 5.7 shows boxplots of the total ischaemia time for DBD donor hearts transplanted into adult recipients over the last 10 years. The total ischaemia time is the difference between donor cross-clamp and recipient reperfusion and can be considered the out of body time. In cases where organ maintenance systems were used (15%) not all of this time duration is ischaemic, and no adjustment has been made for this. The national median total ischaemia time has remained reasonably consistent over the last decade.

Figure 5.7   Boxplots of total ischaemia time for DBD donor hearts transplanted into adult recipients, by financial year, 1 April 2013 to 31 March 2023
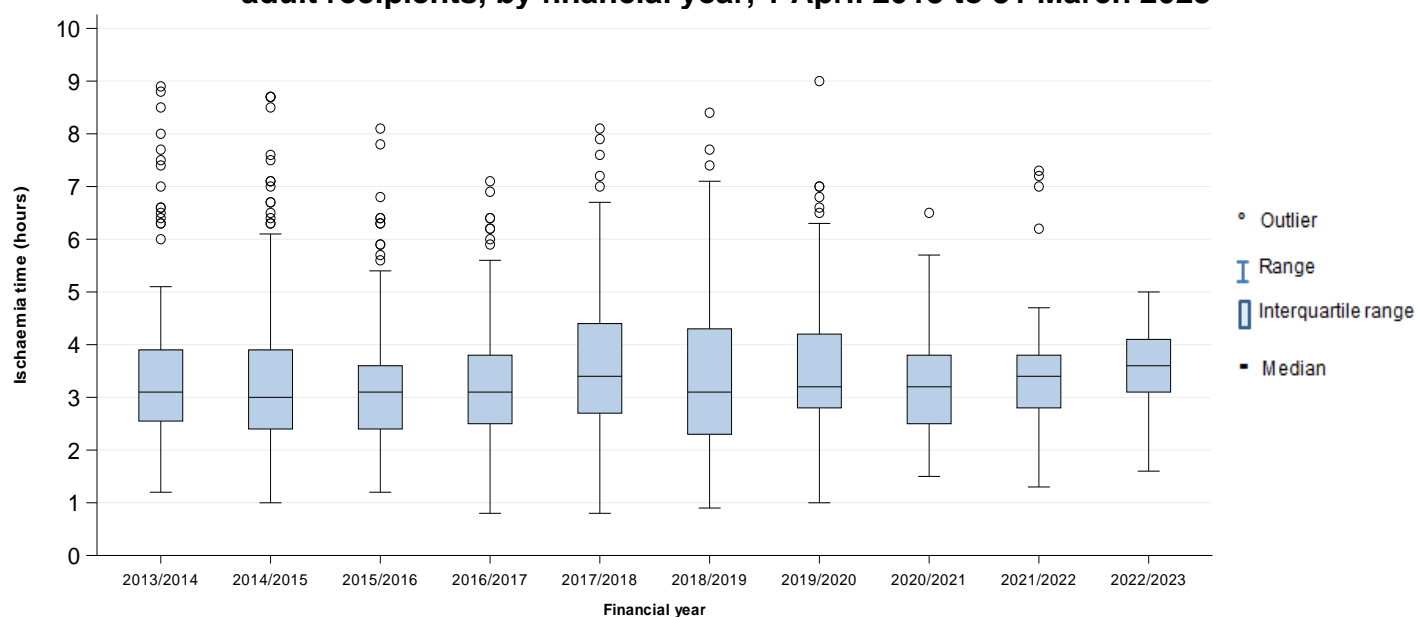
Note: Does not take into account use of donor organ maintenance systems which have been in use since 2013/2014

Figure 5.8 and **Figure 5.9** show boxplots of total ischaemia time by centre in the latest financial year and over the last 10 years, respectively. Between 2013/2014 and 2019/2020, Harefield used the Organ Care System (OCS) for 100% of DBD hearts transplanted, explaining their longer total ischaemia times, compared with 1%-6% for other centres. In 2022/2023, the OCS was not used in any DBD heart transplants.
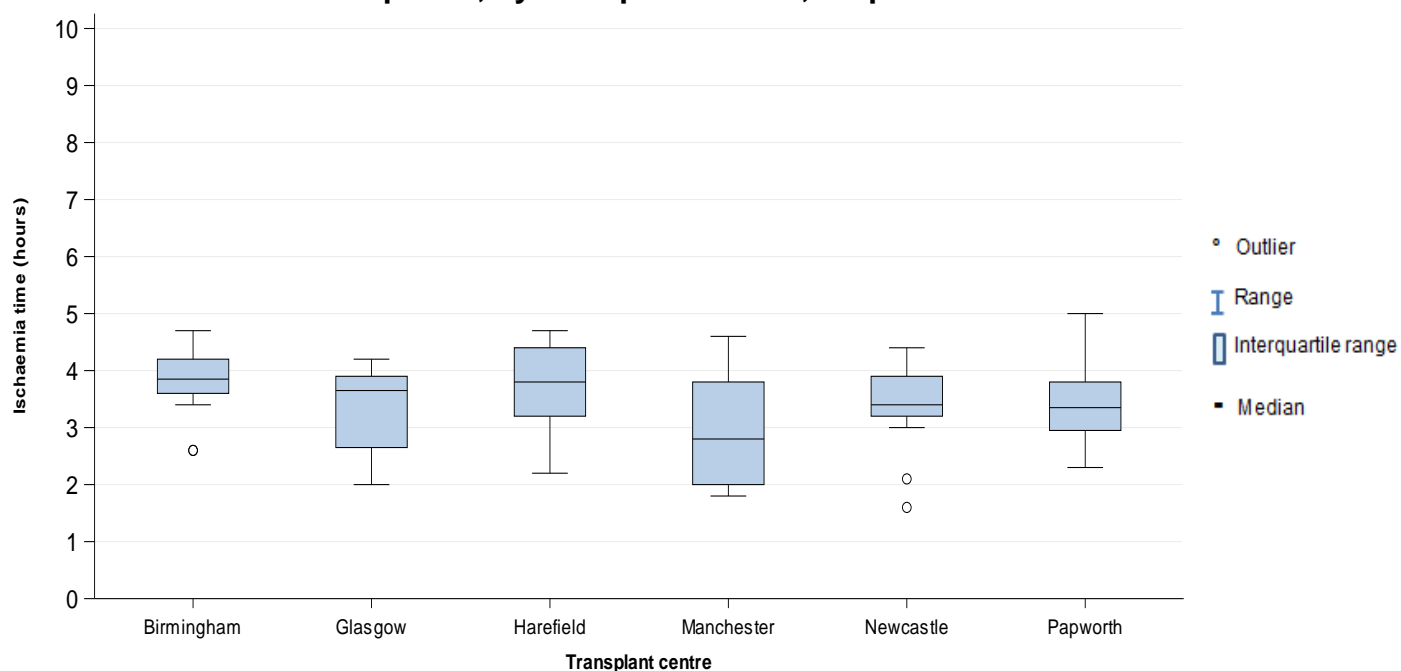
45

Figure 5.8 Boxplots of total ischaemia time in DBD donor hearts transplanted into adult recipients, by transplant centre, 1 April 2022 to 31 March 2023

The Organ Care System (OCS) was not used in any DBD heart transplants in this time period.

Figure 5.9 Boxplots of total ischaemia time in DBD donor hearts transplanted into adult recipients, by transplant centre and financial year, 1 April 2013 to 31 March 2023
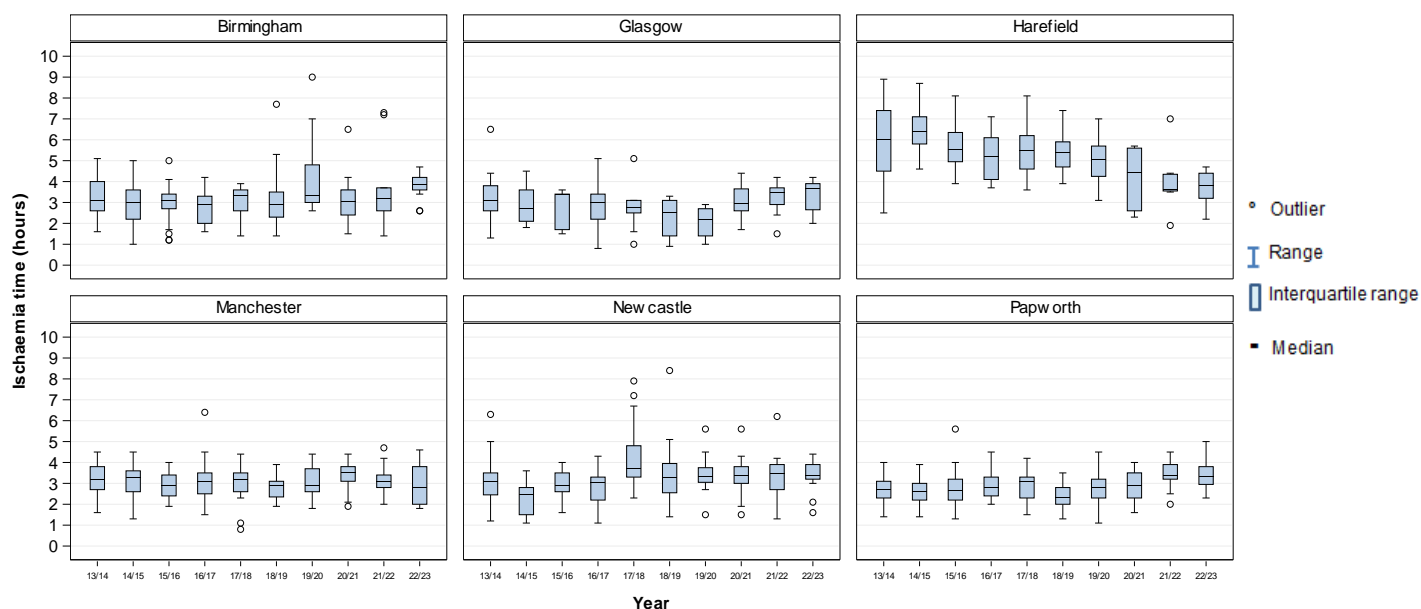
Includes time on the Organ Care System (OCS), where most centres used the OCS in a small proportion of transplants, except Harefield who used the OCS in 100% of transplants from 2013/2014 to 2019/2020. The OCS was not used in any DBD heart transplants in 2022/2023.

ADULT HEART TRANSPLANTATION

Post-Transplant Survival

6. Post-Transplant Survival

This section presents survival post adult heart transplantation. Funnel plots are used to compare the risk-adjusted survival rate at each centre with the national rate. The risk-adjusted rates seek to compare centre performance after accounting for differences in case mix across centres. The unadjusted survival rates are also presented in the tables, showing the observed survival experience at that centre. The risk factors used to produce the risk-adjusted survival rates are listed in **Appendix A3**.

The survival analyses in **Section 6.1-6.3** include first time DBD heart only transplants. Thirty-day, 90-day and 1-year survival rates are based on transplants performed in the period 1 April 2018 to 31 March 2022 while 5-year survival rates are based on transplants performed in the period 1 April 2015 to 31 March 2018. Survival rates are presented by transplant centre in **Tables 6.1-6.4** and **Figures 6.1-6.4**, by disease group in **Tables 6.5-6.6** and by VAD status at time of transplant in **Table 6.7**. Survival following DCD heart transplantation is provided separately in **Section 6.4** and survival outcomes following multi-organ heart transplantation are summarised in **Section 6.5**.

6.1   Survival by centre

Table 6.1, **Figure 6.1a**, and **Figure 6.1b**, show the 30-day post-transplant underlined and risk-adjusted patient survival rates for each centre and nationally for the 471 first adult DBD heart only transplants in the period 1 April 2018 to 31 March 2022. All of the centres' rates were statistically consistent with the national rate of survival which was 92.1%.

Table 6.1 30 day patient survival rates after first adult DBD heart transplant, by centre, 1 April 2018 to 31 March 2022					
Centre	Number of transplants	% 30 day survival (95% CI)			
		Unadjusted		Risk-adjusted	
Birmingham	91	95.6	(88.7 - 98.3)	95.5	(87.9 - 98.3)
Glasgow	60	91.7	(81.1 - 96.4)	91.3	(79.0 - 96.4)
Harefield	70	81.4	(70.2 - 88.8)	89.4	(81.7 - 93.8)
Manchester	69	97.1	(88.9 - 99.3)	96.4	(85.5 - 99.1)
Newcastle	83	89.0	(80.0 - 94.1)	90.6	(82.0 - 95.1)
Papworth	98	95.9	(89.5 - 98.4)	92.1	(79.0 - 97.0)
UK	**471**	**92.1**	**(89.3 - 94.2)**		

Centre has reached the lower 99.8% confidence limit
Centre has reached the lower 95% confidence limit
Centre has reached the upper 95% confidence limit
Centre has reached the upper 99.8% confidence limit

Figure 6.1a Risk-adjusted 30 day patient survival rates for adult DBD heart transplants, by centre, 1 April 2018 to 31 March 2022

Figure 6.1b Unadjusted 30 day patient survival rates for adult DBD heart transplants, by centre, 1 April 2018 to 31 March 2022

Table 6.2, **Figure 6.2a**, and **Figure 6.2b**, show the 90-day post-transplant <u>unadjusted</u> and <u>risk-adjusted</u> patient <u>survival rates</u> for each centre and nationally for the 471 first adult <u>DBD</u> heart only transplants in the period 1 April 2018 to 31 March 2022. All of the centres' rates were statistically consistent with the national rate of survival which was 89.4%.

Table 6.2 90 day patient survival after first adult heart transplant, by centre, 1 April 2018 and 31 March 2022					
Centre	Number of transplants	% 90 day survival (95% CI)			
		Unadjusted		Risk-adjusted	
Birmingham	91	94.5	(87.3 - 97.7)	94.0	(85.7 - 97.5)
Glasgow	60	91.7	(81.1 - 96.4)	91.0	(78.3 - 96.2)
Harefield	70	77.1	(65.4 - 85.3)	85.5	(76.4 - 91.1)
Manchester	69	89.9	(79.9 - 95.0)	89.0	(77.0 - 94.8)
Newcastle	83	87.8	(78.5 - 93.2)	89.6	(80.7 - 94.4)
Papworth	98	92.9	(85.6 - 96.5)	88.3	(75.5 - 94.4)
UK	**471**	**89.4**	**(86.2 - 91.8)**		

Centre has reached the lower 99.8% confidence limit
Centre has reached the lower 95% confidence limit
Centre has reached the upper 95% confidence limit
Centre has reached the upper 99.8% confidence limit

Figure 6.2a Risk-adjusted 90 day patient survival rates for adult DBD heart transplants, by centre, 1 April 2018 to 31 March 2022
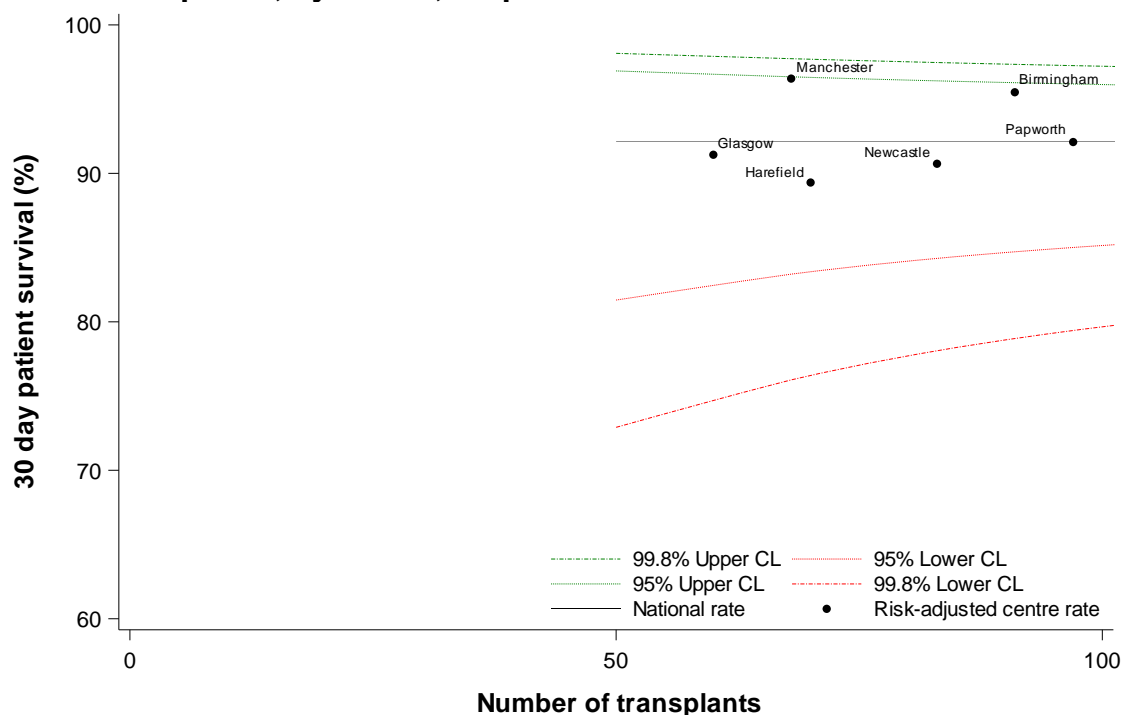

Figure 6.2b Unadjusted 90 day patient survival rates for adult DBD heart transplants, by centre, 1 April 2018 to 31 March 2022
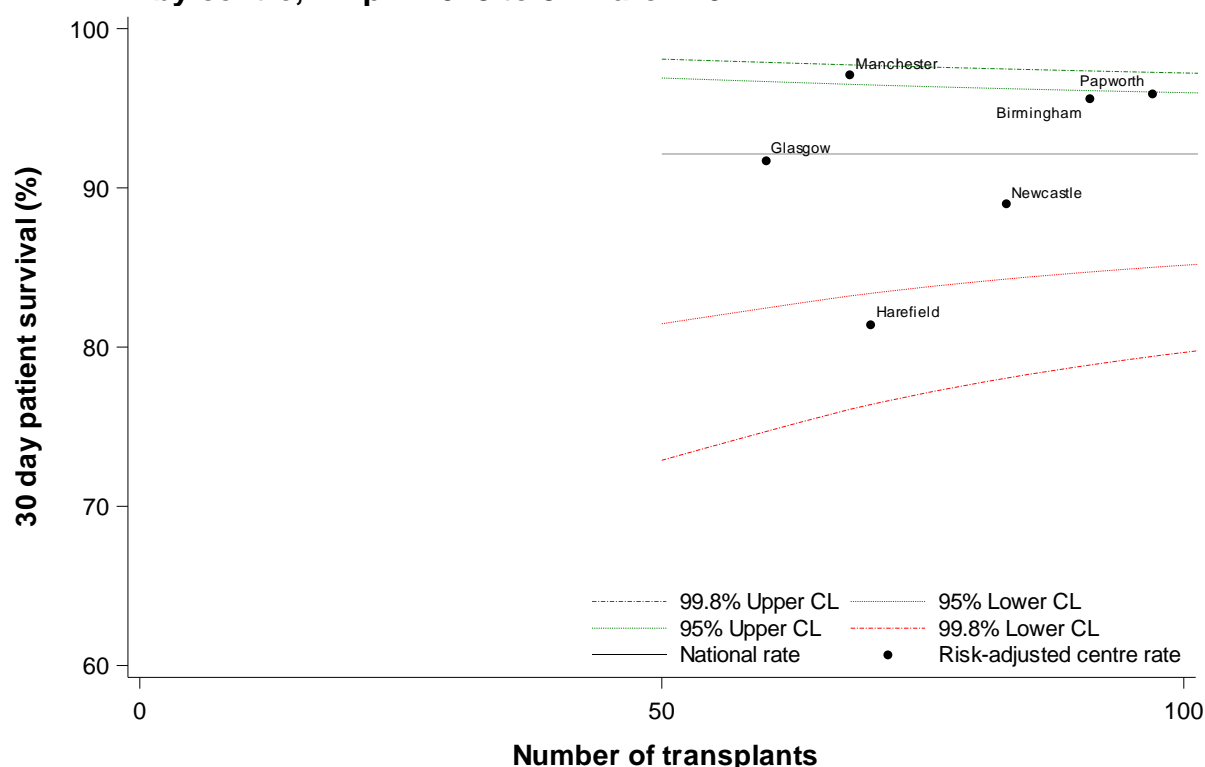
Table 6.3 and **Figure 6.3** show the 1-year post-transplant [unadjusted](#) and [risk-adjusted](#) patient [survival rates](#) for each centre and nationally for the 471 first adult [DBD](#) heart only transplants in the period 1 April 2018 to 31 March 2022. The national rate of survival was 84.5%. The centre specific rates were consistent with the national rate.

Table 6.3 1 year patient survival after first adult heart transplant, by centre, 1 April 2018 and 31 March 2022					
Centre	Number of transplants	% 1 year survival (95% CI)			
		Unadjusted		Risk-adjusted	
Birmingham	91	88.9	(80.4 - 93.9)	89.0	(79.6 - 94.1)
Glasgow	60	89.9	(79.0 - 95.4)	87.1	(71.2 - 94.2)
Harefield	70	72.9	(60.8 - 81.7)	80.4	(69.2 - 87.5)
Manchester	69	89.9	(79.9 - 95.0)	89.0	(76.9 - 94.8)
Newcastle	83	81.5	(71.1 - 88.4)	85.2	(75.5 - 91.1)
Papworth	98	90.8	(83.1 - 95.1)	86.9	(74.7 - 93.2)
UK	**471**	**85.9**	**(82.4 - 88.7)**		

- 🟥 Centre has reached the lower 99.8% confidence limit
- 🟧 Centre has reached the lower 95% confidence limit
- 🟩 Centre has reached the upper 95% confidence limit
- 🟩 Centre has reached the upper 99.8% confidence limit

Figure 6.3a Risk-adjusted one-year patient survival rates for adult DBD heart transplants, by centre, 1 April 2018 to 31 March 2022
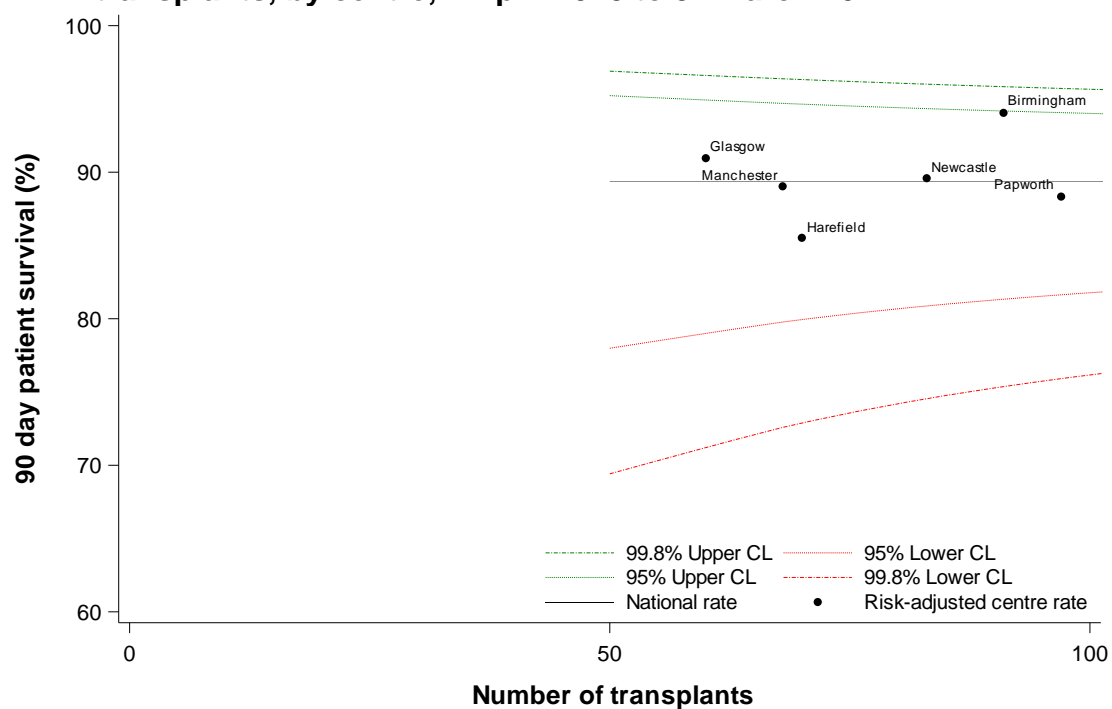
Figure 6.3b Unadjusted one-year patient survival rates for adult DBD heart transplants, by centre, 1 April 2018 to 31 March 2022
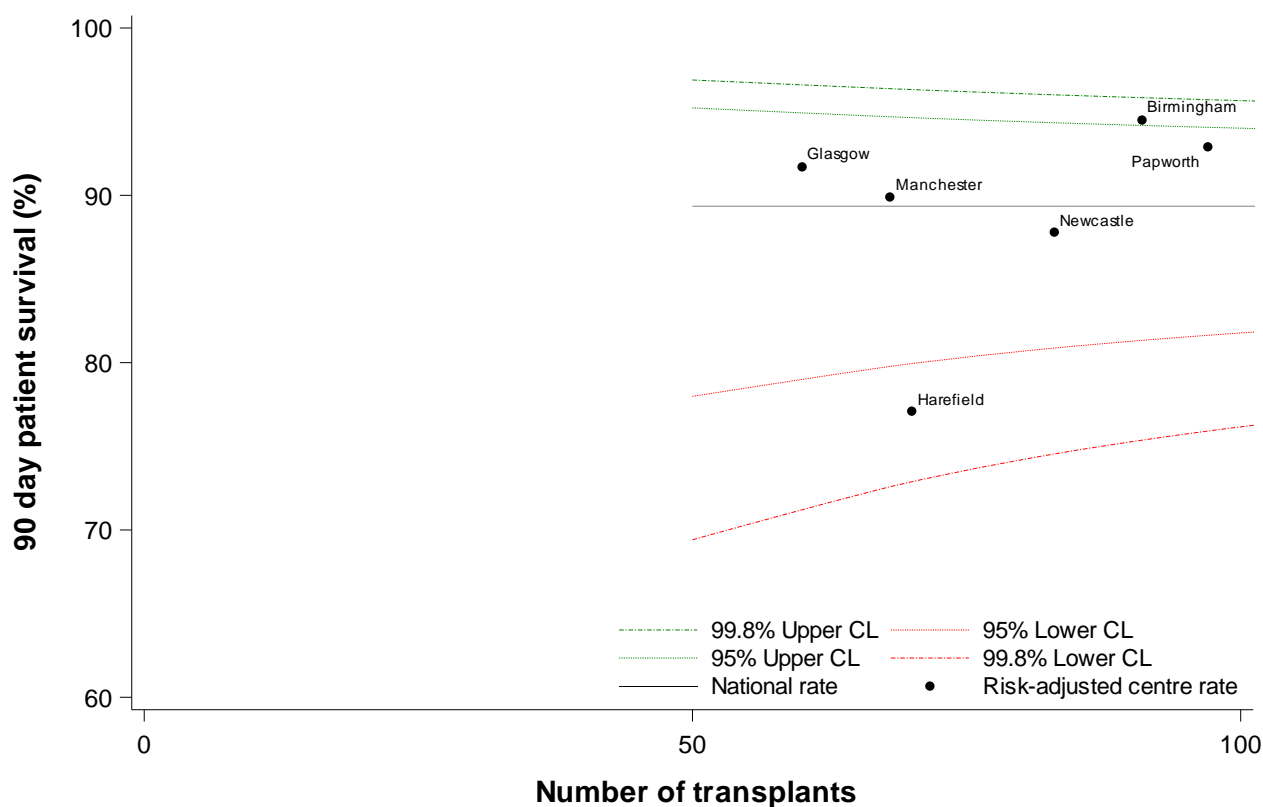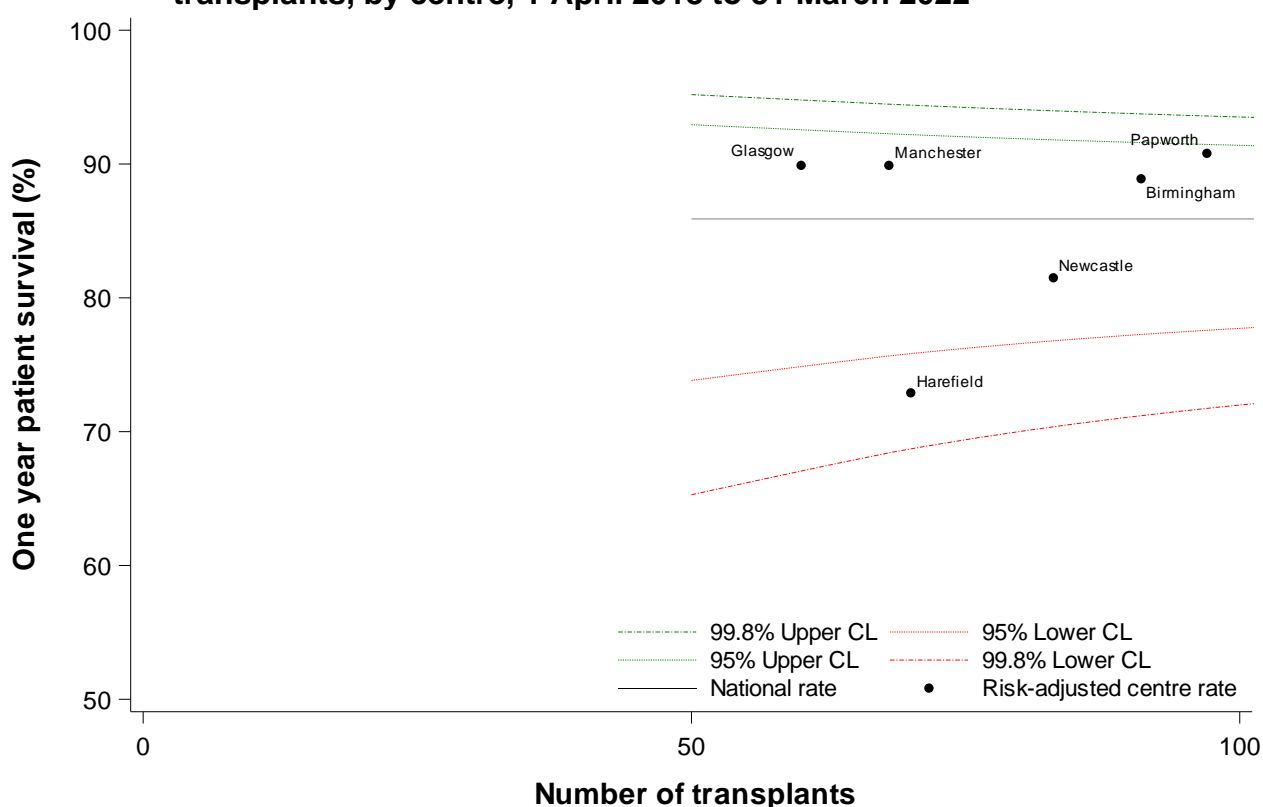

Table 6.4 and **Figure 6.4** show the 5-year post-transplant unadjusted and risk-adjusted patient survival rates for each centre and nationally for the 566 first adult DBD heart only transplants in the period 1 April 2014 to 31 March 2018. The national rate of survival was 71.4%. The centre specific rates were consistent with the national rate.

Table 6.4 5 year patient survival after first adult heart transplant, by centre, 1 April 2014 and 31 March 2018

Centre	Number of transplants	% 5 year survival (95% CI)			
		Unadjusted		Risk-adjusted	
Birmingham	102	66.5	(56.4 - 74.8)	64.6	(50.4 - 74.7)
Glasgow	45	70.5	(54.6 - 81.7)	71.9	(51.7 - 83.7)
Harefield	96	65.6	(55.2 - 74.2)	68.7	(55.9 - 77.7)
Manchester	97	77.3	(67.6 - 84.4)	74.7	(61.5 - 83.3)
Newcastle	85	72.6	(61.7 - 80.9)	73.1	(59.5 - 82.1)
Papworth	141	74.3	(66.2 - 80.7)	75.0	(65.3 - 81.9)
UK	**566**	**71.4**	**(67.5 - 75.0)**		

🟥	Centre has reached the lower 99.8% confidence limit
🟥	Centre has reached the lower 95% confidence limit
🟩	Centre has reached the upper 95% confidence limit
🟩	Centre has reached the upper 99.8% confidence limit

53

Figure 6.4a   Risk-adjusted five year patient survival rates for adult DBD heart transplants, by centre, 1 April 2014 to 31 March 2018
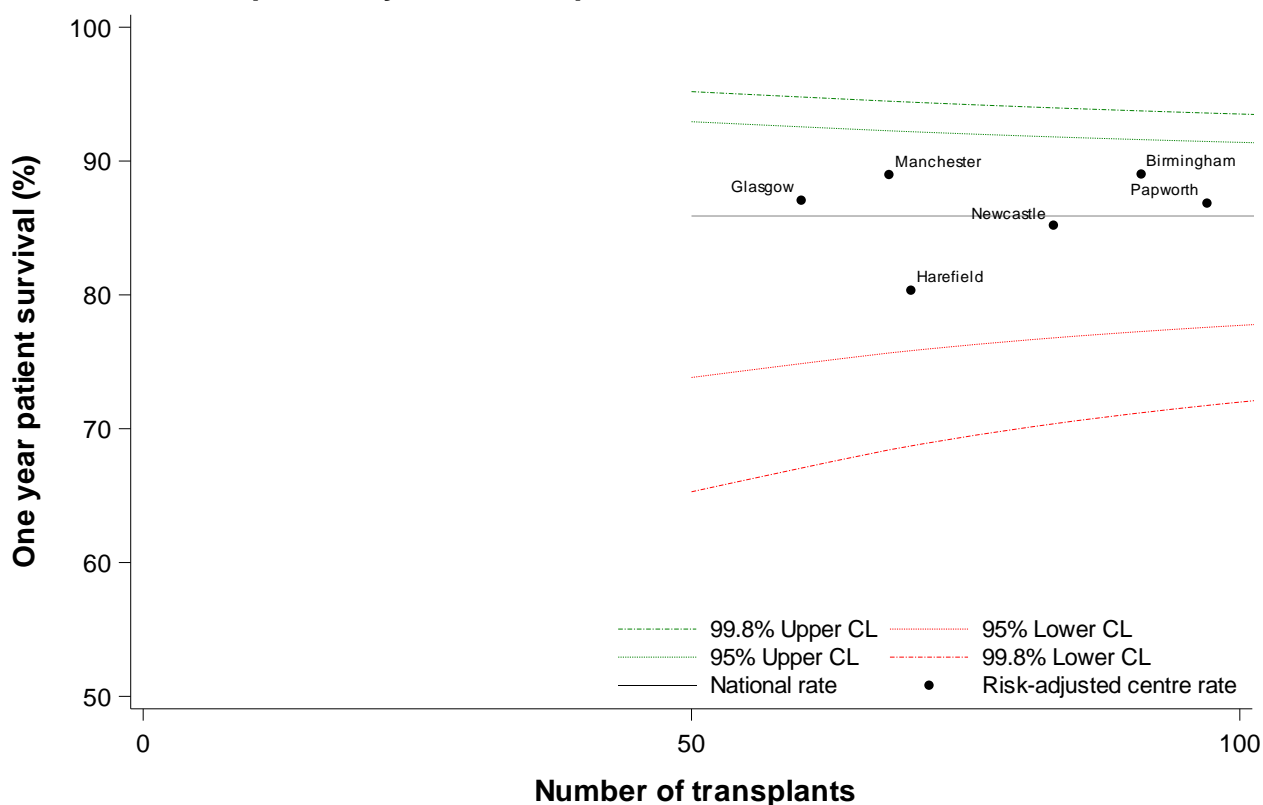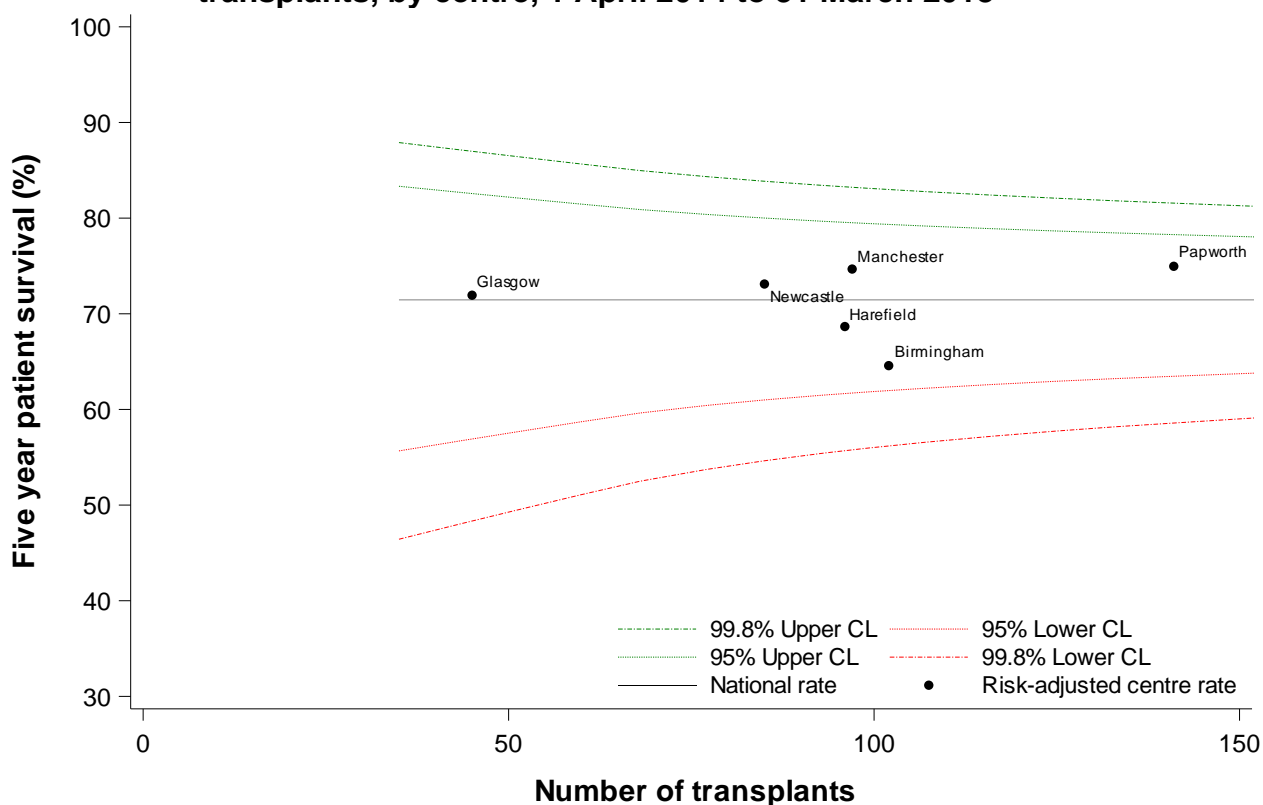

Figure 6.4b Unadjusted five year patient survival rates for adult DBD heart transplants, by centre, 1 April 2014 to 31 March 2018
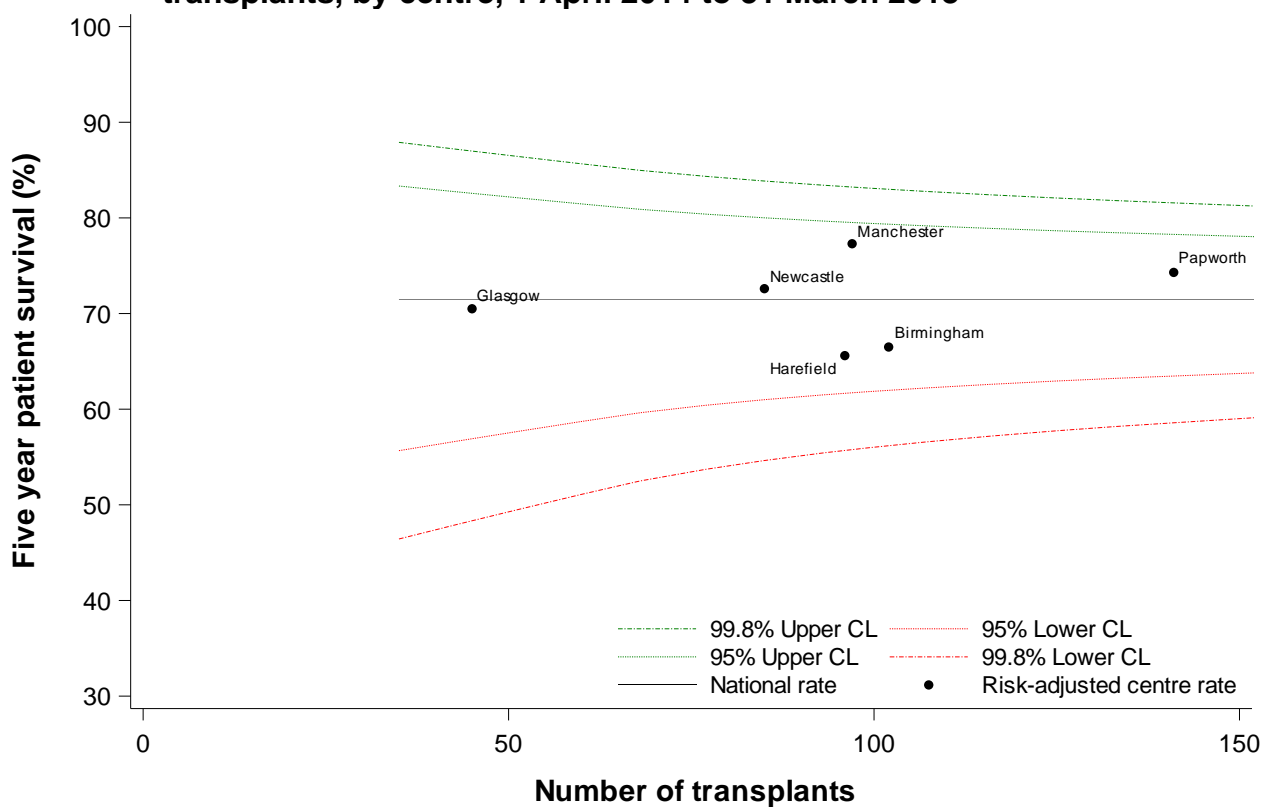
6.2   Survival by disease group

Tables 6.5 and **6.6** present unadjusted and risk-adjusted survival rates by primary disease group, at 1 year and 5 years post-transplant, respectively. The risk factors used to produce the risk-adjusted survival rates are listed in **Appendix A3** (except centre was used in place of disease group). Recipients in the congenital heart disease group had a lower than average risk-adjusted survival rate at 1 year and at 5 years.

Table 6.5 1 year patient survival after first adult heart transplant, by disease group, 1 April 2018 and 31 March 2022

Disease group	Number of transplants	% 1 year survival (95% CI)			
		Unadjusted		Risk-adjusted	
Cardiomyopathy	350	87.1	(83.1 - 90.2)	87.1	(82.7 - 90.4)
Congenital heart disease	31	70.4	(50.6 - 83.4)	69.2	(40.8 - 84.0)
Coronary heart disease	76	88.2	(78.5 - 93.7)	88.2	(77.2 - 93.8)
Other/not reported	14	77.9	(45.9 - 92.3)	79.1	(35.2 - 93.3)
UK	**471**	**85.9**	**(82.4 - 88.7)**		

Table 6.6 5 year patient survival after first adult heart transplant, by disease group, 1 April 2014 and 31 March 2018

Disease group	Number of transplants	% 5 year survival (95% CI)			
		Unadjusted		Risk-adjusted	
Cardiomyopathy	412	72.7	(68.1 - 76.8)	72.8	(67.3 - 77.4)
Congenital heart disease	38	71.1	(53.9 - 82.8)	61.2	(30.0 - 78.5)
Coronary heart disease	86	65.0	(53.9 - 74.1)	68.5	(54.9 - 78.0)
Other/Not reported	30	73.3	(53.7 - 85.7)	71.6	(43.2 - 85.8)
UK	**566**	**71.4**	**(67.5 - 75.0)**		

6.3 Survival by VAD status

Tables 6.7 presents [unadjusted](#) [survival rates](#) by mechanical circulatory support (MCS) status at time of transplant, at 30 days, 90 days and 1 year post-transplant, respectively. Short-term MCS includes CentriMag, percutaneous [VADs](#) and extracorporeal membrane oxygenation and long-term MCS includes implantable VADs for left, right and biventricular support and total artificial hearts. There was a significant difference in 30-day, 90-day, and 1-year survival rates across MCS status in this [unadjusted](#) analysis (log-rank p=0.0001, p<0.0001, and p=0.0002 respectively), with those not on support at time of transplant having superior survival.

Table 6.7   Unadjusted patient survival rates after first adult DBD heart transplant, by mechanical support status, 1 April 2018 and 31 March 2022

Mechanical support status	Number of transplants	% 30 day survival (95% CI) Unadjusted		% 90 day survival (95% CI) Unadjusted		% 1 year survival (95% CI) Unadjusted	
Short-term support	86	93.0	(85.1 - 96.8)	93.0	(85.1 - 96.8)	90.7	(82.3 - 95.2)
Long-term support	66	78.8	(66.8 - 86.8)	71.2	(58.7 - 80.6)	69.7	(57.1 - 79.3)
No support	319	94.7	(91.5 - 96.6)	92.1	(88.6 - 94.6)	87.9	(83.8 - 91.1)
UK	**471**	**92.1**	**(89.3 - 94.2)**	**89.4**	**(86.2 - 91.8)**	**85.9**	**(82.4 - 88.7)**

6.4   Survival post DCD heart transplant

Tables 6.8 - **6.10** present short-term patient survival rates following DCD heart only transplant, by centre and nationally. During the time period 1 April 2014 to 31 March 2022, there were 13 deaths within 1 year.

Table 6.8 30 day patient survival after first DCD adult heart transplant, by centre, 1 April 2014 and 31 March 2022

Centre	Number of patients	Number of deaths	% 30 day survival (95% CI) (unadjusted)	
Birmingham[1]	3	1	-	-
Glasgow[1]	4	0	-	-
Harefield	31	2	93.5	(76.6 - 98.3)
Manchester	10	0	100.0	-
Newcastle	14	1	92.9	(59.1 - 99.0)
Papworth	99	2	98.0	(92.2 - 99.5)
UK	**161**	**6**	**96.3**	**(91.9 - 98.3)**

[1] Survival rates for groups with less than 10 patients are not presented due to small numbers

Table 6.9 90 day patient survival after first DCD adult heart transplant, by centre, 1 April 2014 and 31 March 2022

Centre	Number of patients	Number of deaths	% 90 day survival (95% CI) (unadjusted)	
Birmingham[1]	3	1	-	-
Glasgow[1]	4	0	-	-
Harefield	31	4	87.1	(69.2 - 95.0)
Manchester	10	2	80.0	(40.9 - 94.6)
Newcastle	14	1	92.9	(59.1 - 99.0)
Papworth	99	5	94.9	(88.3 - 97.9)
UK	**161**	**13**	**91.9**	**(86.4 - 95.2)**

[1] Survival rates for groups with less than 10 patients are not presented due to small numbers

Table 6.10	1 year patient survival rates after first adult DCD heart only transplant, by centre, 1 April 2014 and 31 March 2022		
Centre	Number of patients	Number of deaths	% 1 year survival (95% CI) (unadjusted)
Birmingham[1]	3	1	-	-
Glasgow[1]	4	0	-	-
Harefield	31	4	87.1	(69.2 - 95.0)
Manchester	10	2	80.0	(40.9 - 94.6)
Newcastle	14	1	92.9	(59.1 - 99.0)
Papworth	99	5	94.9	(88.3 - 97.9)
UK	**161**	**13**	**91.9**	**(86.4 - 95.2)**

[1] Survival rates for groups with less than 10 patients are not presented due to small numbers

6.5 Survival post multi-organ heart transplant

The survival outcomes of the small number of recipients of multi-organ heart transplants are reported in **Table 6.11**, at 90 days and 1 year post transplant. This includes all first-time multi-organ transplants involving the heart, from DBD or DCD donors, between 1 April 2014 and 31 March 2022. It does not include heart-lung transplants which are reported in the Annual Report on Lung Transplantation.

Table 6.11 Survival outcomes following multi-organ heart transplant performed between 1 April 2014 and 31 March 2022			
Transplant type	Number of transplants	Number of patients alive at 90 days post-transplant	Number of patients alive at 1 year post-transplant
	N	N	N
Heart & kidney	5	4	4
Heart & liver	7	5	5

ADULT HEART TRANSPLANTATION

Survival from Listing

7. Survival from Listing

Survival from listing was analysed for patients 18 years or older registered for the first time for a heart transplant between 1 January 2011 and 31 December 2022. Survival time was defined as the time from joining the transplant list to death, regardless of the length of time on the transplant list, whether or not the patient was transplanted and any factors associated with such a transplant e.g. primary disease. Survival time was censored at either date of removal from the list, or at the last known follow-up date post-transplant when no death date was recorded, or at time of analysis if the patient was still active on the transplant list. The risk factors used to produce the risk-adjusted survival rates are listed in **Appendix A2.1**.

One and five year risk-adjusted survival rates from the point of heart transplant listing are shown as funnel plots in **Figures 7.1** and **7.2,** respectively. These rates are also shown in **Table 7.1**. Note that all rates were calculated from the same cohort of patients, and the number of patients remaining at risk of death after each time horizon (i.e. not already censored or deceased) is included in **Table 7.1** for reference.

The one year and five year survival rates for Manchester both fell above the upper 99.8% confidence limits, indicating significantly high survival from listing at this centre. Newcastle's five year survival rate fell below the lower 99.8% confidence limits, indicating significantly low survival from listing at this time point, and there was also some evidence of lower survival at one year for this centre. There is some evidence of higher survival at five years for Papworth.

		One year			Five year		
Centre	Number at risk[1] at day 0	Survival rate %	(95% CI)	Number at risk[1]	Survival rate %	(95% CI)	Number at risk[1]
Birmingham	389	82.5	(77.8 - 86.2)	271	66.3	(59.5 - 71.9)	123
Glasgow	211	86.0	(80.6 - 90.0)	136	73.6	(65.5 - 79.9)	63
Harefield	456	86.6	(83.0 - 89.4)	317	70.0	(64.3 - 74.8)	134
Manchester	354	91.2	(87.5 - 93.9)	288	77.0	(71.4 - 81.6)	146
Newcastle	475	81.0	(76.4 - 84.7)	336	57.5	(50.1 - 63.8)	133
Papworth	536	86.4	(83.0 - 89.1)	426	73.0	(68.1 - 77.2)	201
UK	**2421**	**85.6**	**(84.0 - 86.9)**	**1774**	**69.3**	**(67.1 - 71.4)**	**800**

Table 7.1   Risk-djusted 1 and 5 year patient survival from listing for first deceased donor heart transplant in patients registered between 1 January 2011 to 31 December 2022

Centre has reached the lower 99.8% confidence limit
Centre has reached the lower 95% confidence limit
Centre has reached the upper 95% confidence limit
Centre has reached the upper 99.8% confidence limit

[1] Number of patients with reported follow-up beyond this time point

Figure 7.1 Risk-adjusted one year patient survival rates from listing by centre, 1 January 2011 – 31 December 2022
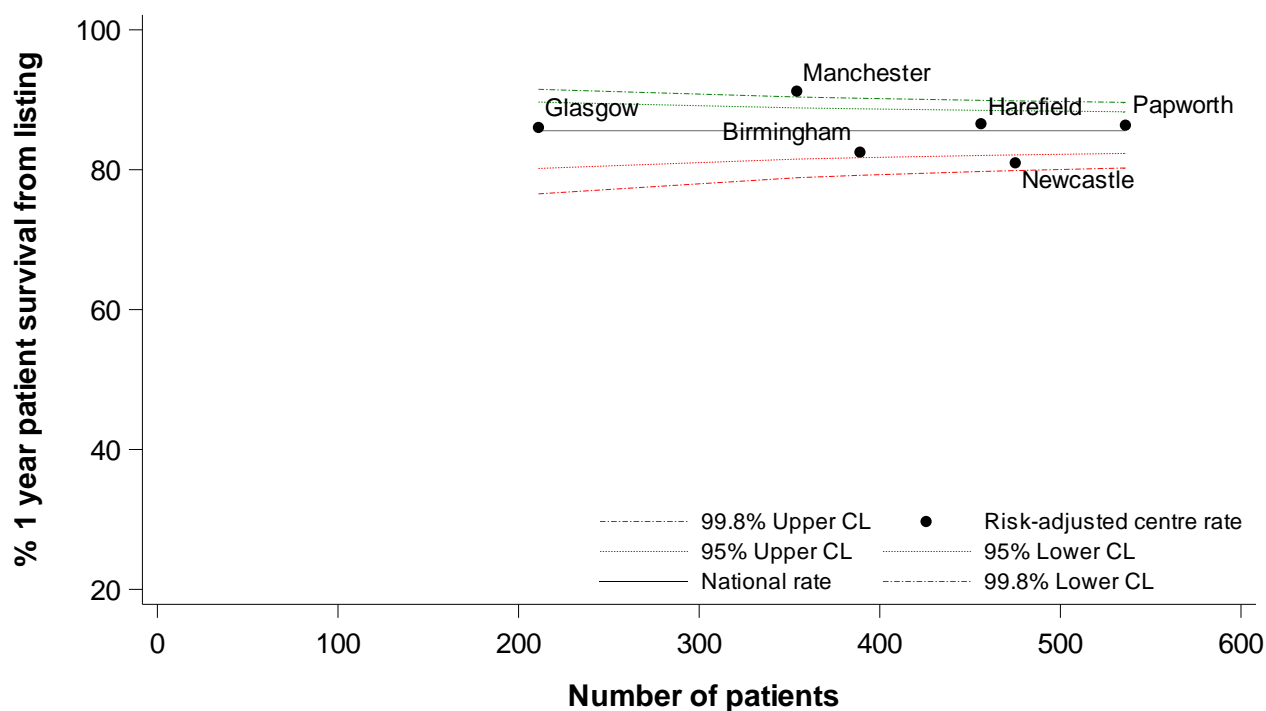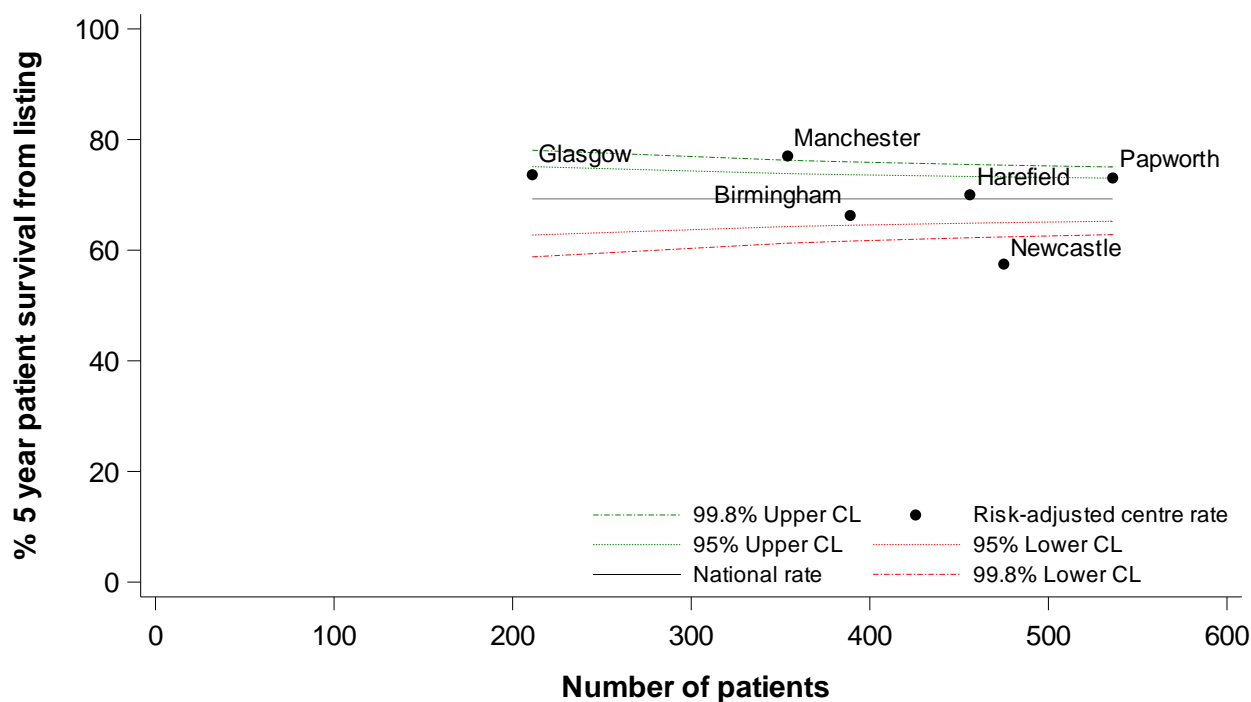

Figure 7.2 Risk-adjusted five year patient survival rates from listing by centre, 1 January 2011 – 31 December 2022

ADULT HEART TRANSPLANTATION

Form Return Rates

8. Adult heart form return rates, 1 January 2022 – 31 December 2022

Form return rates are reported in **Table 8.1** for the cardiothoracic transplant record and the three month and 1 year follow up form, along with lifetime follow up (2 years or more). These include all adult heart transplants between 1 January and 31 December 2022 for the transplant record, and all follow up forms issued in this time period. Centres highlighted are the currently active transplant centres. All active centres have a 90% or greater return rate for this period. Note that any skipped follow-up forms are counted as not returned.

Table 8.1	Form return rates for adult heart transplants, 1 January 2022 to 31 December 2022							
Centre	Transplant record %		3 month follow-up %		1 year follow-up %		Lifetime follow-up %	
	N	Returned	N	Returned	N	Returned	N	Returned
Belfast, Belfast City Hospital	-	-	-	-	-	-	1	100
Birmingham Queen Elizabeth Hospital	23	100	19	100	15	100	266	97
Derby, Royal Derby Hospital	-	-	-	-	-	-	1	100
Royal Devon And Exeter Hospital	-	-	-	-	-	-	1	100
Glasgow Golden Jubilee Hospital	32	100	30	100	25	100	150	99
Harefield, Harefield Hospital	36	100	32	100	18	100	516	98
Manchester, Wythenshawe Hospital	16	100	16	100	13	100	280	99
Newcastle, Freeman Hospital	27	100	26	100	26	92	309	95
Oxford, John Radcliffe Hospital	-	-	-	-	-	-	1	100
Papworth, Papworth Hospital	41	100	36	100	34	100	626	97
Plymouth, Derriford Hospital	-	-	-	-	-	-	1	0
Sheffield, Northern General Hospital	-	-	-	-	-	-	36	72
Truro, Royal Cornwall Hospital	-	-	-	-	-	-	2	100
Overall	**175**	**100**	**159**	**100**	**131**	**98**	**2190**	**97**

PAEDIATRIC HEART TRANSPLANTATION

Transplant List

9.1 Paediatric heart only transplant list on 31 March, 2014 – 2023

Figure 9.1 shows the number of paediatric patients on the heart transplant list on 31 March each year between 2014 and 2023 split by urgency status. The number on the active non-urgent heart transplant list has generally increased over the decade, reaching 35 on 31 March 2023. There has also been an upward trend in the number on the urgent transplant list, with 15 urgent paediatric patients waiting on 31 March 2023. The paediatric super-urgent list was introduced in October 2020 and there were 0 paediatric patients waiting on this list on 31 March 2023.

Figure 9.1 Number of paediatric patients on the heart transplant list at 31 March each year, by urgency status

Figure 9.2 shows the number of paediatric patients on the active heart transplant list at 31 March 2023 by centre and urgency. In total, there were 50 paediatric patients waiting. Great Ormond Street had the largest overall number of paediatric patients on the transplant list. **Figure 9.3** shows the number split by centre and mechanical circulatory support (MCS) status where MCS includes ventricular assist devices and extracorporeal membrane oxygenation. A total of 9 (18%) of the paediatric heart list were on MCS on 31 March 2023.
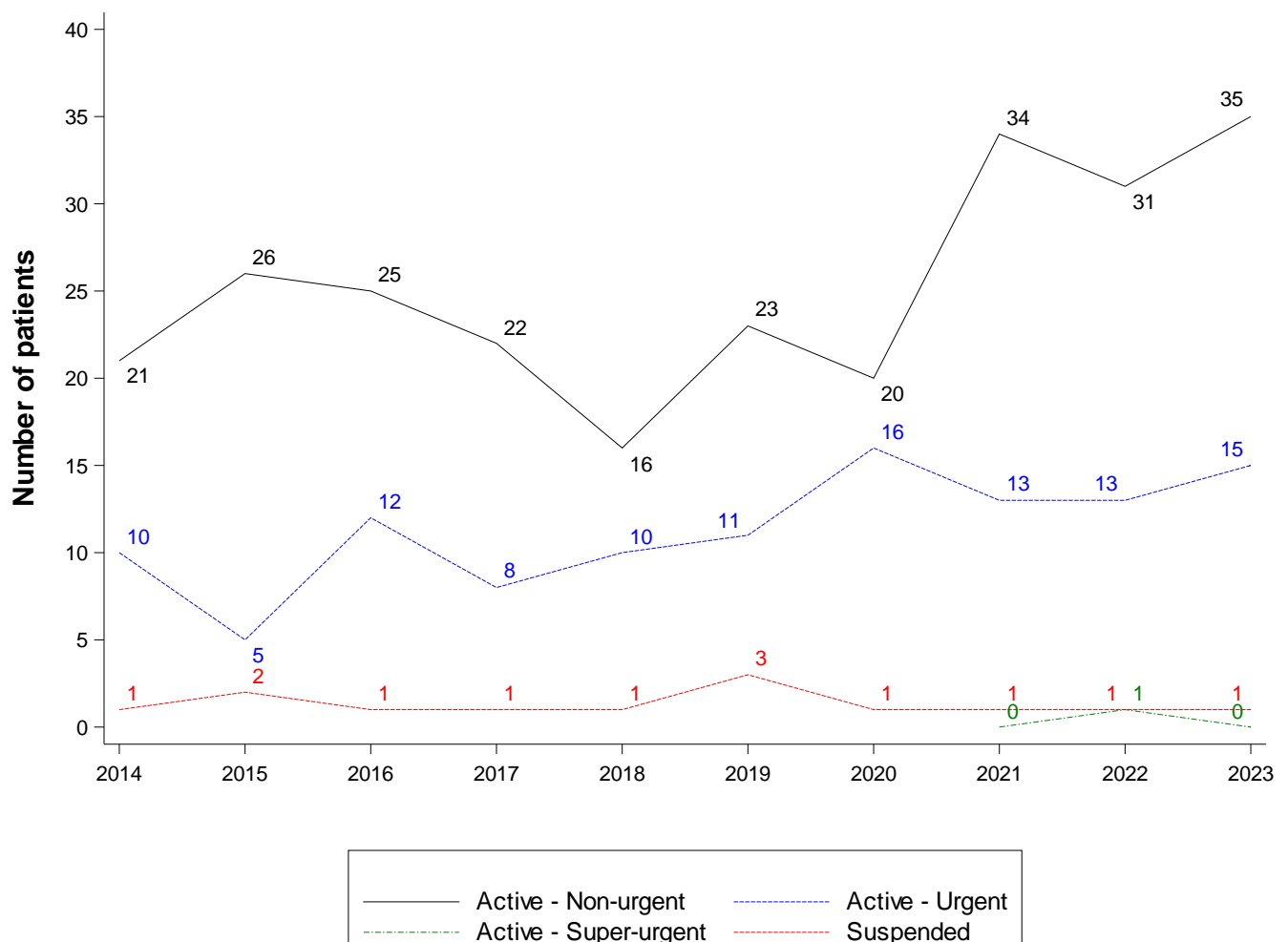
Figure 9.2 Number of paediatric patients on the active heart transplant list at 31 March 2023, by centre and urgency
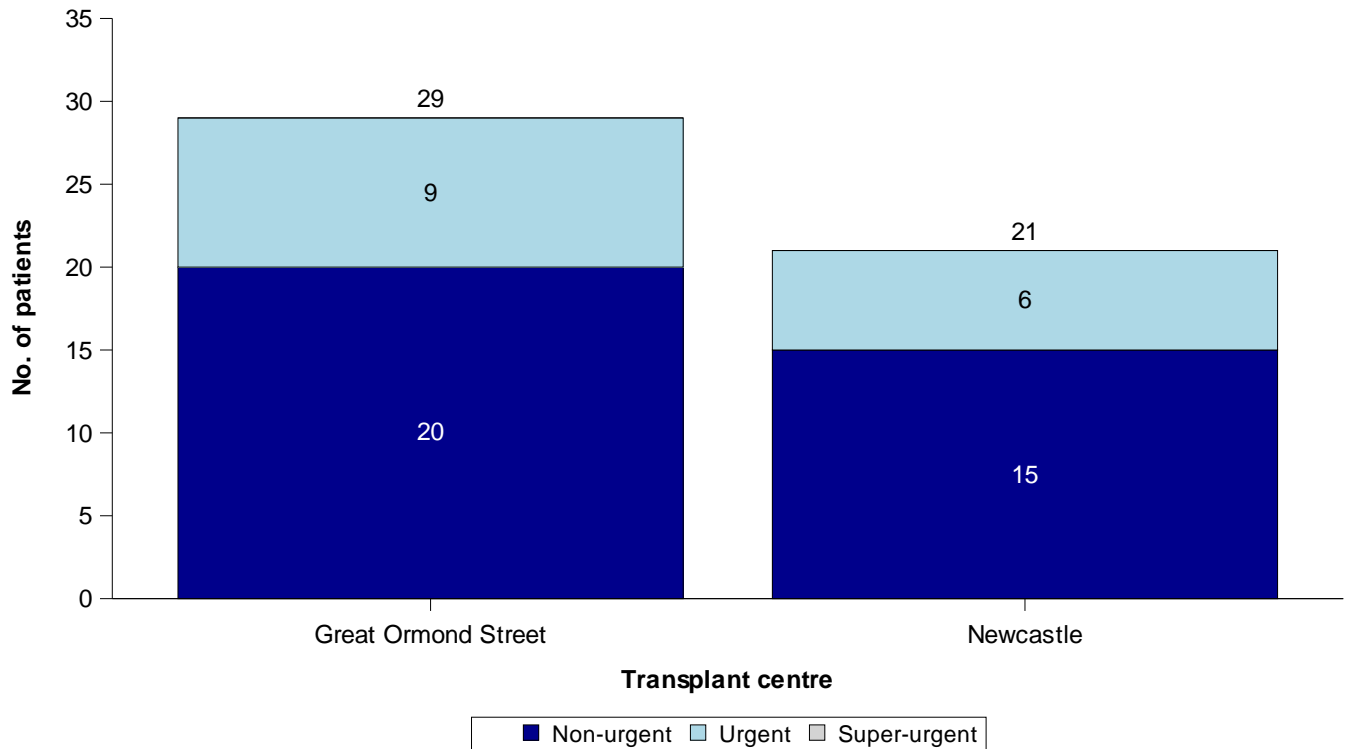
Figure 9.3 Number of paediatric patients on the active heart transplant list at 31 March 2023, by centre and mechanical circulatory support status
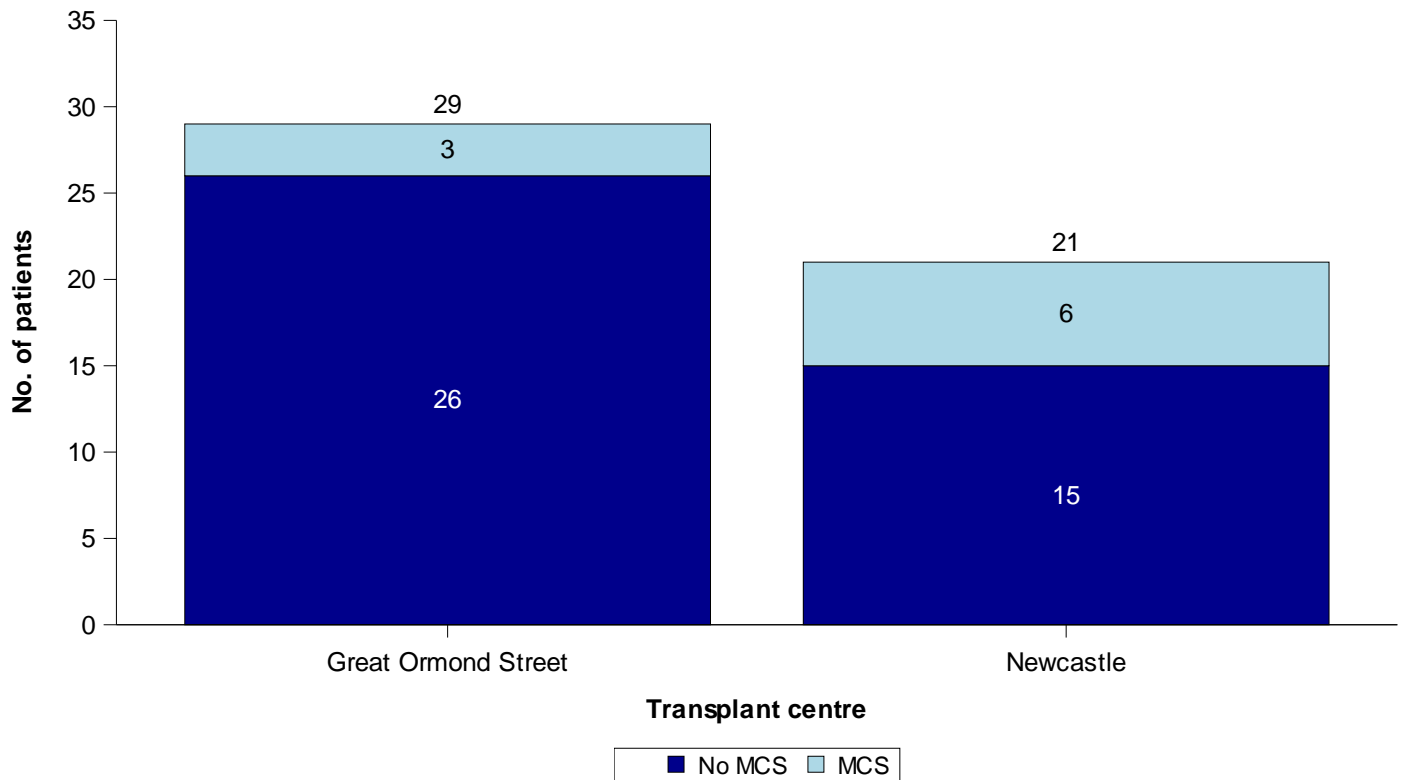
Figure 9.4 shows the trend over time in the number of paediatric patients on the heart transplant list on 31 March each year across each centre. The non-urgent list at Great Ormond Street Hospital has remained relatively unchanged over the past decade, and their urgent list increased recently, while Newcastle's non-urgent and urgent lists have both increased recently.

Figure 9.4 Number of paediatric patients on the heart transplant list at 31 March each year for the last 10 years, by centre
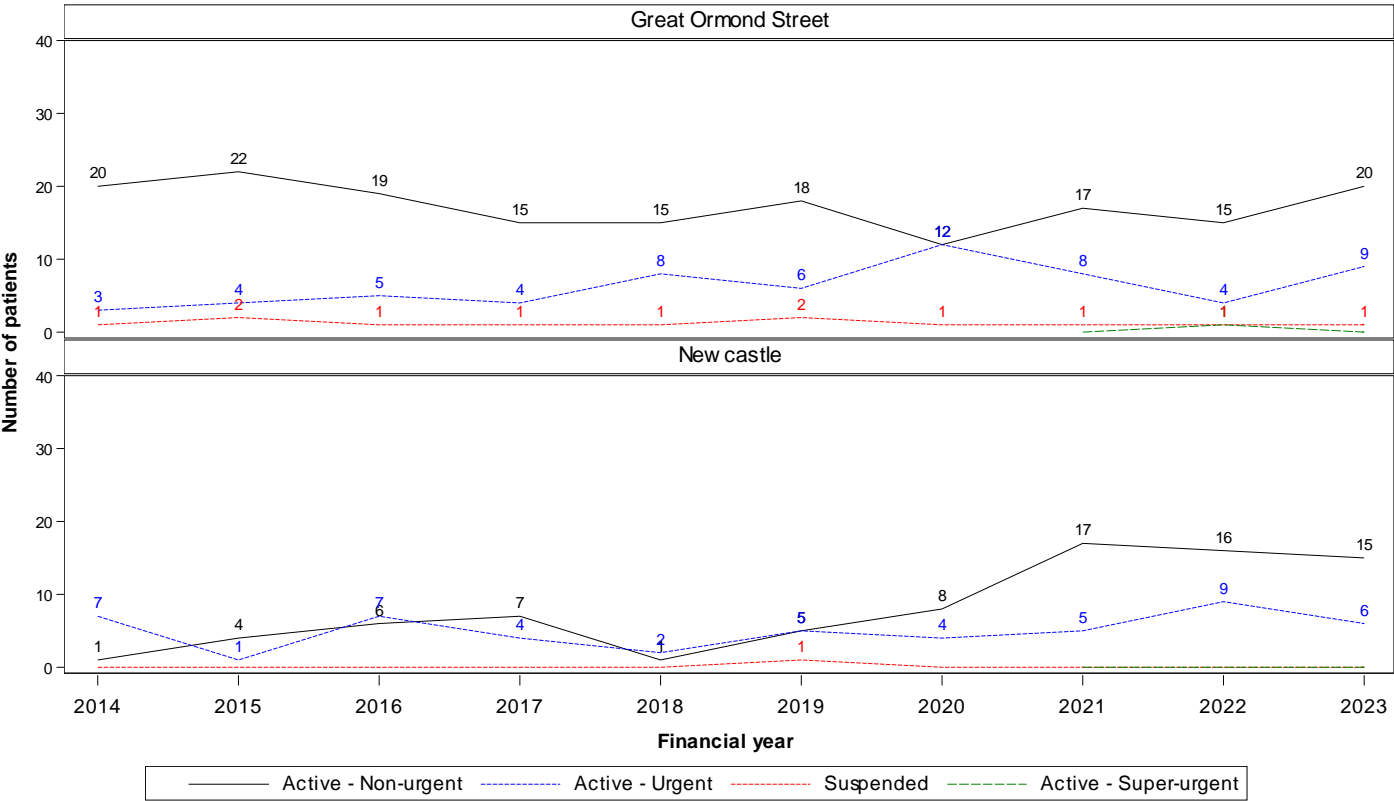
9.2 Demographic characteristics, 1 April 2022 – 31 March 2023

There were 46 paediatric registrations onto the heart transplant list between 1 April 2021 and 31 March 2022. Demographic characteristics of these individuals are shown by centre and overall, in **Table 9.1**. Nationally, 54% were male and the median age was 8 years. The most common primary disease group was cardiomyopathy. For some characteristics, due to rounding, percentages may not add up to 100.

Table 9.1	Demographic characteristics of paediatric patient registrations onto the heart transplant list between 1 April 2022 and 31 March 2023, by centre, by centre		
		Great Ormond Street N (%)	Newcastle N (%)	**TOTAL** **N (%)**
Number of registrations		29 (100)	17 (100)	**46 (100)**
Highest urgency during registration	Non-urgent Urgent Super-urgent	8 (28) 17 (59) 4 (14)	3 (18) 10 (59) 4 (24)	**11 (24)** **27 (59)** **8 (17)**
Recipient sex	Male Female	18 (62) 11 (38)	7 (41) 10 (59)	**25 (54)** **21 (46)**
Recipient ethnicity	White Asian Black Other Missing	22 (76) 2 (7) 3 (10) 1 (3) 1 (3)	10 (59) 7 (41) 0 (0) 0 (0) 0 (0)	**32 (70)** **9 (20)** **3 (7)** **1 (2)** **1 (2)**
Recipient age (years)	Median (IQR) Missing	3 (1, 11) 0	13 (4, 13) 0	**8 (1, 13)** **0**
Height (cm)	Median (IQR) Missing	100 (77, 146) 0	149 (92, 162) 0	**125 (79, 158)** **0**
Weight (kg)	Median (IQR) Missing	14 (9, 39) 0	35 (13, 48) 0	**26 (9, 44)** **0**
Primary Disease	Cardiomyopathy Congenital heart disease Other/Not reported	20 (69) 9 (31) 0 (0)	11 (65) 5 (29) 1 (6)	**31 (67)** **14 (30)** **1 (2)**
Previous open heart surgery	None One More than one Missing	19 (66) 2 (7) 6 (21) 2 (7)	5 (29) 6 (35) 4 (24) 2 (12)	**24 (52)** **8 (17)** **10 (22)** **4 (9)**
Serum Bilirubin (umol/l)	Median (IQR) Missing	11 (6, 22) 4	9 (7, 21) 2	**11 (7, 22)** **6**
Serum Creatinine (umol/l)	Median (IQR) Missing	32 (24, 54) 2	52 (20, 61) 2	**41 (24, 54)** **4**

9.3 Post-registration outcomes, 1 April 2018 – 31 March 2020

The registration outcomes of paediatric patients listed for a heart transplant between 1 April 2018 and 31 March 2020 are summarised in **Figure 9.5** and **Figure 9.6**, for non-urgent and urgent registrations, respectively (super-urgent registration outcomes are not presented due to small numbers). The possible outcomes on the non-urgent or urgent list include receiving a transplant, removal from the list, moving lists, dying on the list, or remaining on the list at a given time point post-registration. In these figures, the *first* outcome is used, so if an individual was transplanted then died their registration outcome would be "transplanted". If they moved lists, e.g. from the non-urgent to the urgent list, they would be included in both the non-urgent and the urgent charts.

Within the first 6 months of listing, it is shown that 9% had received a transplant, 3% had died and 26% had been moved to the urgent list. At 3 years, 26% had been transplanted, however, now 49% of non-urgent recipients have been added to the urgent list. As can be seen in **Figure 9.6**, paediatric patients have a greater chance of transplant on the urgent heart list compared to the non-urgent list, with 38% receiving a transplant by 6 months. Removals from the urgent list were for a mixture of improved and deteriorating condition.

Figure 9.5 Post-registration outcome for 35 new non-urgent heart only registrations made in the UK, 1 April 2018 to 31 March 2020
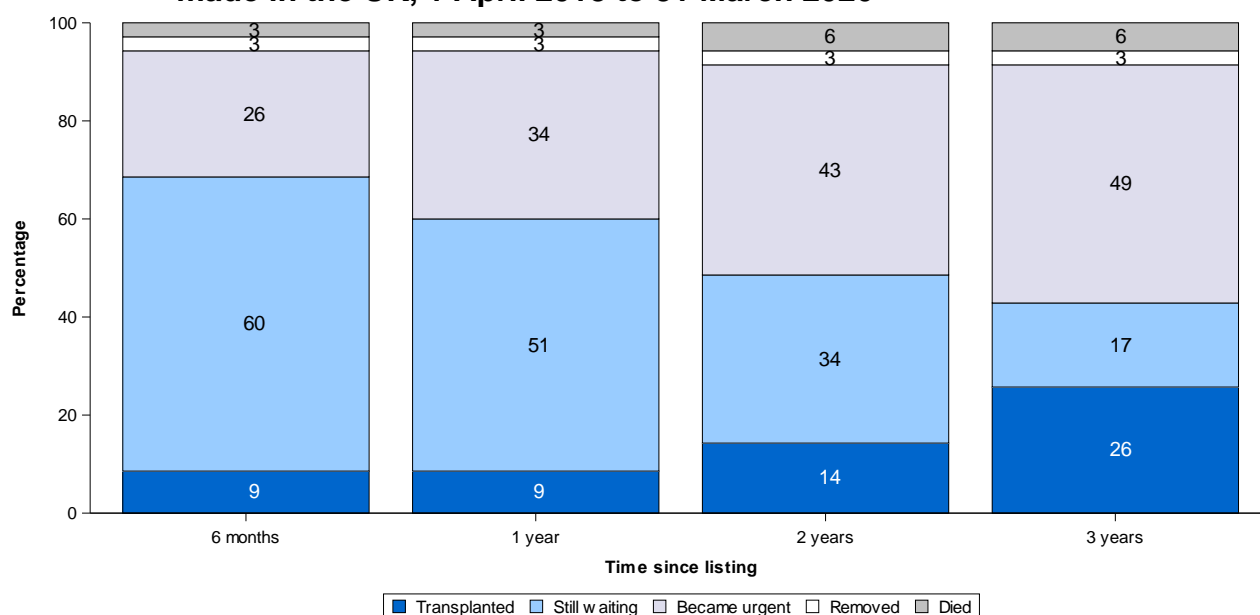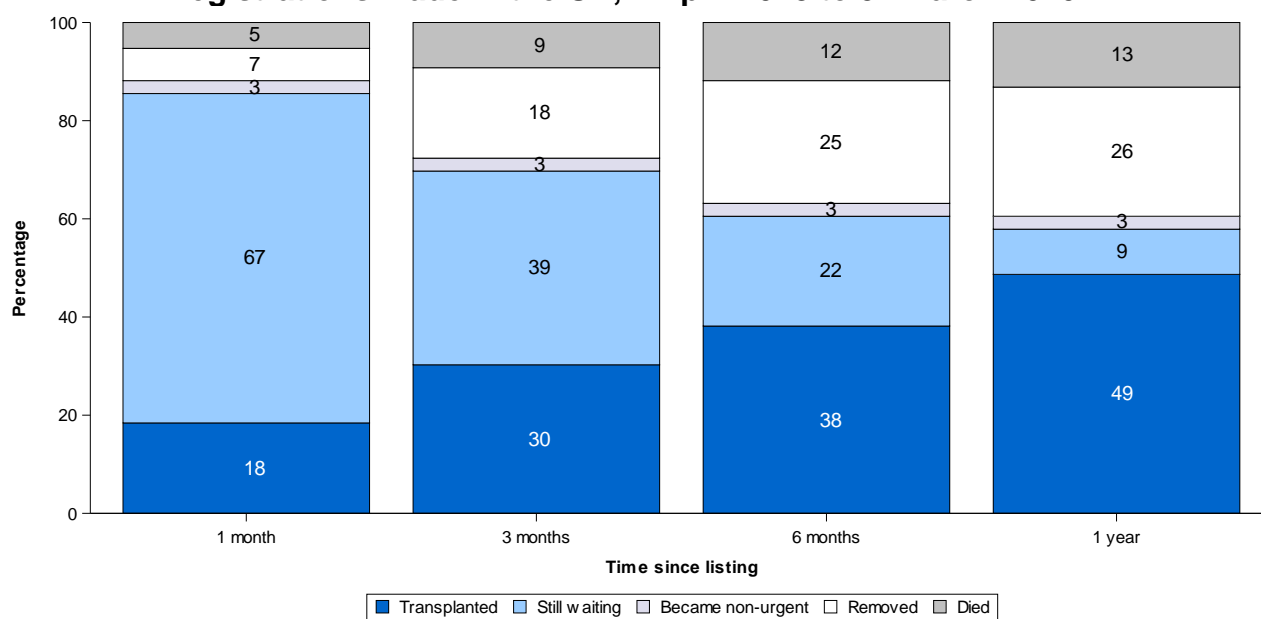
Figure 9.6 Post-registration outcome for 76 new urgent heart only registrations made in the UK, 1 April 2018 to 31 March 2020

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9.4   Median waiting time to transplant, 1 April 2019 - 31 March 2022

Table 9.2 shows the median waiting time to heart transplant from listing for paediatric patients registered between 1 April 2019 and 31 March 2022. This is estimated using the Kaplan Meier method and is split by urgency at initial registration; non-urgent or urgent. All waiting time from initial registration is considered, regardless of any change in urgency. Any suspended time is discounted.

The national median waiting time to paediatric heart transplant was 193 days from urgent registration. The median waiting time for non-urgent registrations could not be calculated due to low transplant rate. The median waiting time to heart transplant for paediatric patients is also considered by blood group in **Table 9.3**. Median waiting time to super-urgent transplant is not presented due to small numbers.

Table 9.2 Median active waiting time to heart transplant for paediatric patients registered on the transplant list, by urgency at registration and centre, 1 April 2019 to 31 March 2022				
Transplant centre	Number registered	Number transplanted	Waiting time (days) Median	95% Confidence interval
Non-urgent at initial registration				
Great Ormond Street[1]	24	9	-	-
Newcastle[1]	24	7	-	-
UK[1]	**48**	**16**	**-**	**-**
Urgent at initial registration				
Great Ormond Street	30	21	237	100 - 374
Newcastle	43	24	191	106 - 276
UK	**73**	**45**	**193**	**128 - 258**

[1] Median and 95% confidence intervals could not be calculated due to low transplant rate

Table 9.3	Median active waiting time to heart transplant for paediatric patients registered on the transplant list, by urgency at registration and blood group, 1 April 2019 to 31 March 2022			
Blood Group	Number registered	Number transplanted	Waiting time (days)	
			Median	95% Confidence interval
Non-urgent at initial registration				
O[1]	25	6	-	-
A	14	7	386	0 - 931
B[2]	8	3	-	-
AB[2]	1	-	-	-
UK[1]	**48**	**16**	**-**	**-**
Urgent at initial registration				
O	27	17	241	94 - 388
A	29	18	109	0 - 252
B	10	6	237	25 - 449
AB[2]	7	4	-	-
UK	**73**	**45**	**193**	**128 - 258**

[1] Median and 95% confidence intervals could not be calculated due to low transplant rate
[2] Median waiting time for groups with less than 10 are not presented due to small numbers

PAEDIATRIC HEART TRANSPLANTATION

Response to Offers

10. Response to Offers

Table 10.1 compares individual centre paediatric heart offer decline rates over the three years between 1 April 2020 and 31 March 2023. This only considers offers of hearts from UK DBDs aged less than 16 that were eventually transplanted and excludes fast track offers. Hearts offered as part of a heart-lung block are included, which may be cases where just the heart is declined or where both the heart and lungs are declined. Non-urgent, urgent and super-urgent offers are all considered. Offers to adults at Newcastle are excluded.

In 2017, group offering for non-urgent cardiothoracic organ offers was introduced, where all centres receive a simultaneous offer for their non-urgent patients, but acceptance is determined by a centre's position in the allocation sequence. In this analysis, adjustments have been made to count any centre who is ranked above the accepting centre in the allocation sequence for that donor as declining the heart, even if they did not respond to the group offer, and any declines recorded for a centre ranked below the accepting centre were discounted.

The number of offers received per year from paediatric donors whose heart was donated, is small. In 2022/2023, there was an overall decline rate for paediatric offers of 54.2%.

Table 10.1 UK paediatric DBD donor heart offer decline rates by transplant centre and year, 1 April 2020 to 31 March 2023								
Centre	2020/21		2021/22		2022/23		Overall	
	No. offers	Decline rate (%)	No. offers	Decline rate (%)	No. offers	Decline rate (%)	No. offers	Decline rate (%)
Great Ormond Street Hospital	15	(53.3)	15	(60.0)	15	(66.7)	45	(60.0)
Newcastle	7	(85.7)	14	(78.6)	9	(33.3)	30	(66.7)
UK	22	(63.6)	29	(69.0)	24	(54.2)	75	(62.7)

PAEDIATRIC HEART TRANSPLANTATION

Transplants

11.1 Paediatric heart transplants, 1 April 2013 – 31 March 2023

Figure 11.1 and **11.2** show the number of paediatric heart transplants performed in the last ten years by donor type, nationally and by centre, respectively. The number of transplants was highest in 2014/2015 and lowest in 2019/2020. Last year's activity is shown by centre in **Figure 11.3**. The 28 transplants carried out in 2022/2023 comprised 15 at Great Ormond Street Hospital and 13 at Newcastle, and there was a total of 2 DCD transplants.

Figure 11.1 Number of paediatric heart transplants in the UK, by financial year and donor type, 1 April 2013 to 31 March 2023
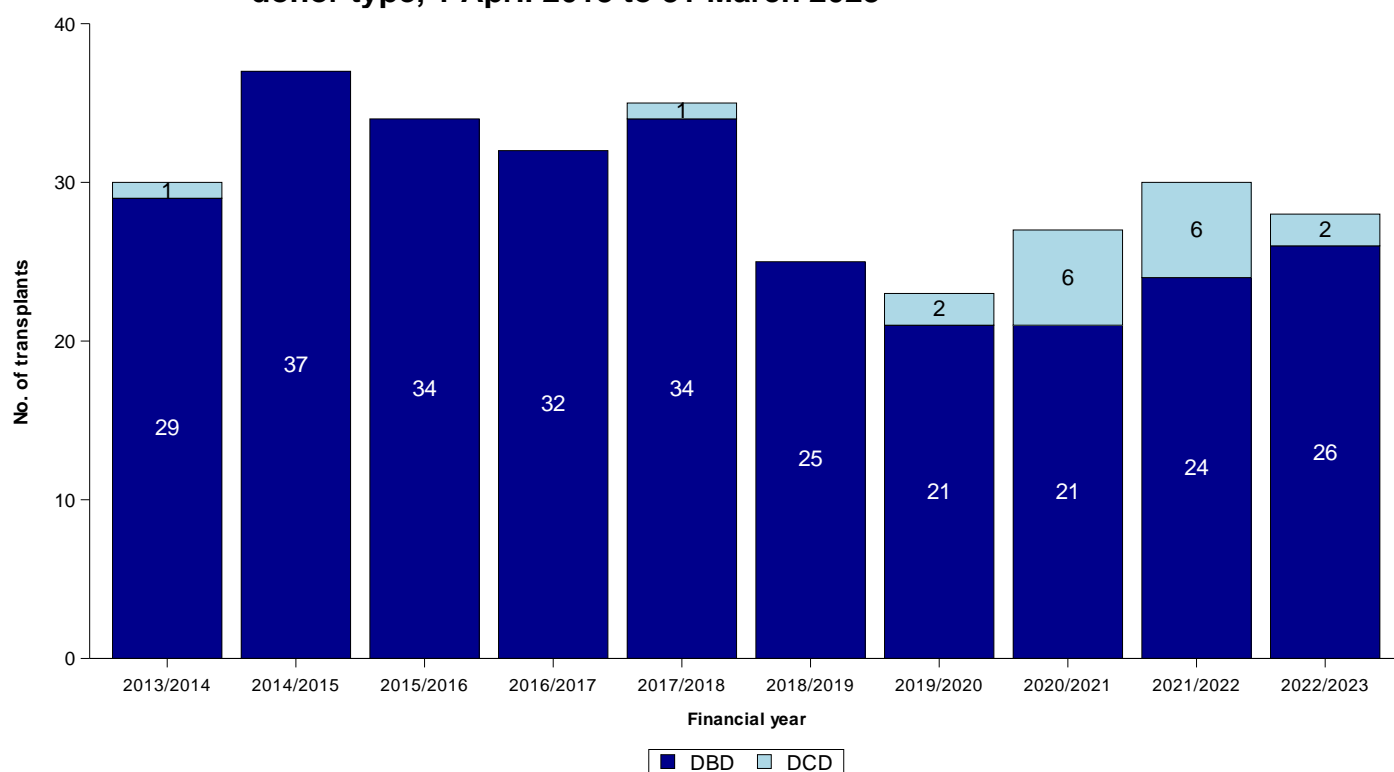

Figure 11.2 Number of paediatric heart transplants in the UK, by financial year, centre and donor type, 1 April 2013 to 31 March 2023

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Figure 11.3 Number of paediatric heart transplants in the UK, by centre and donor type, 1 April 2022 to 31 March 2023

Figure 11.4 and **11.5** show the number of paediatric heart transplants performed in the last ten years, by urgency status of recipient, nationally and by centre, respectively. The majority of transplants were urgent, but in the last year, there were five super-urgent transplants. Last year's activity is shown by centre and urgency status in **Figure 11.6**.

Figure 11.4   Number of paediatric heart transplants in the UK, by financial year and urgency status, 1 April 2013 to 31 March 2023

Figure 11.5 Number of paediatric heart transplants in the UK, by financial year, centre and urgency status, 1 April 2013 to 31 March 2023
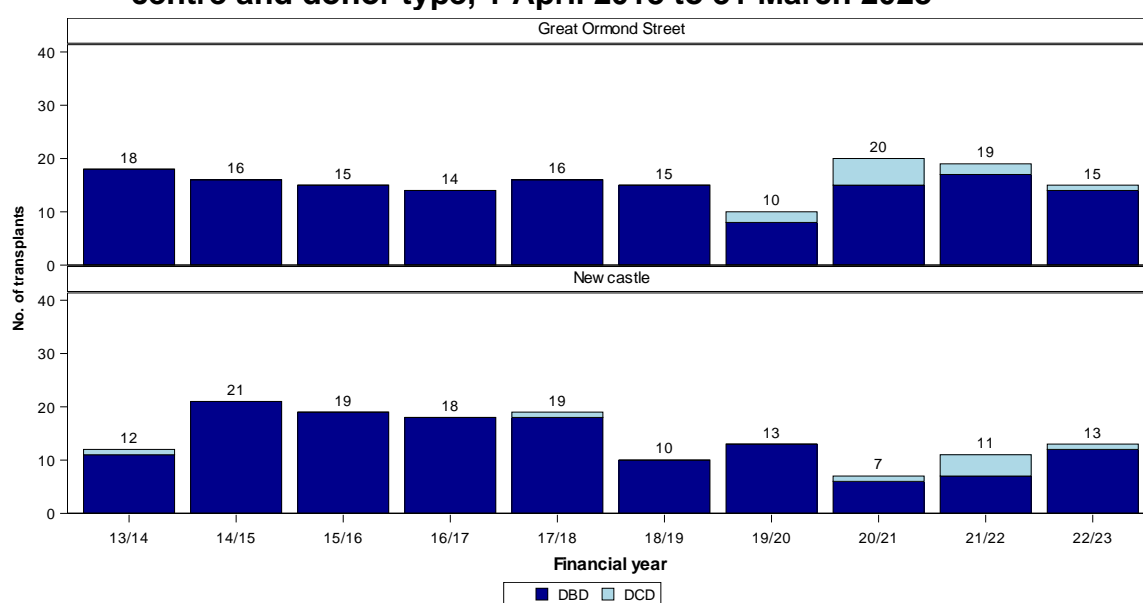

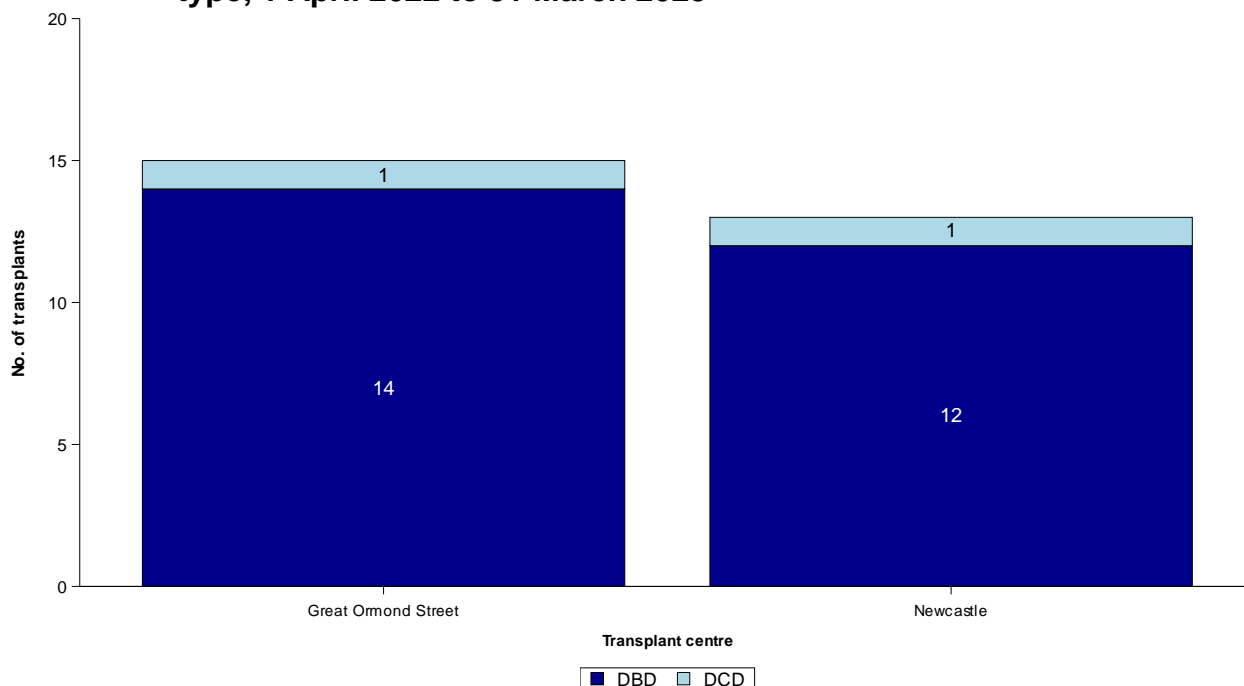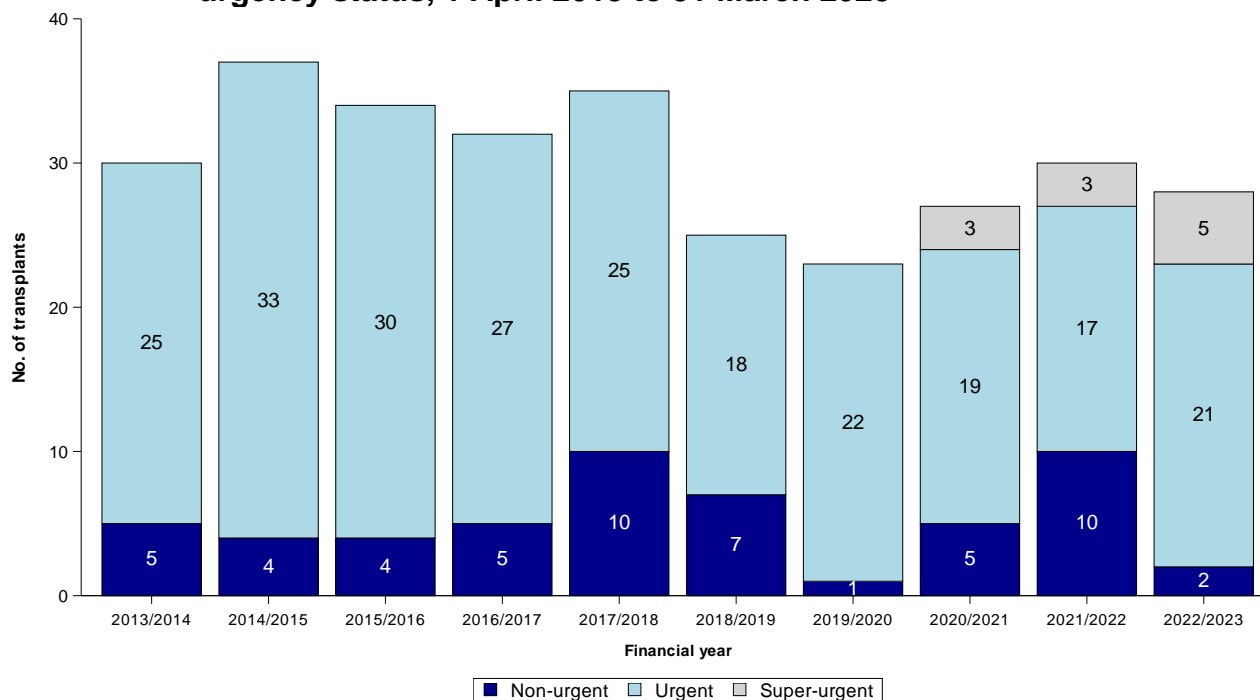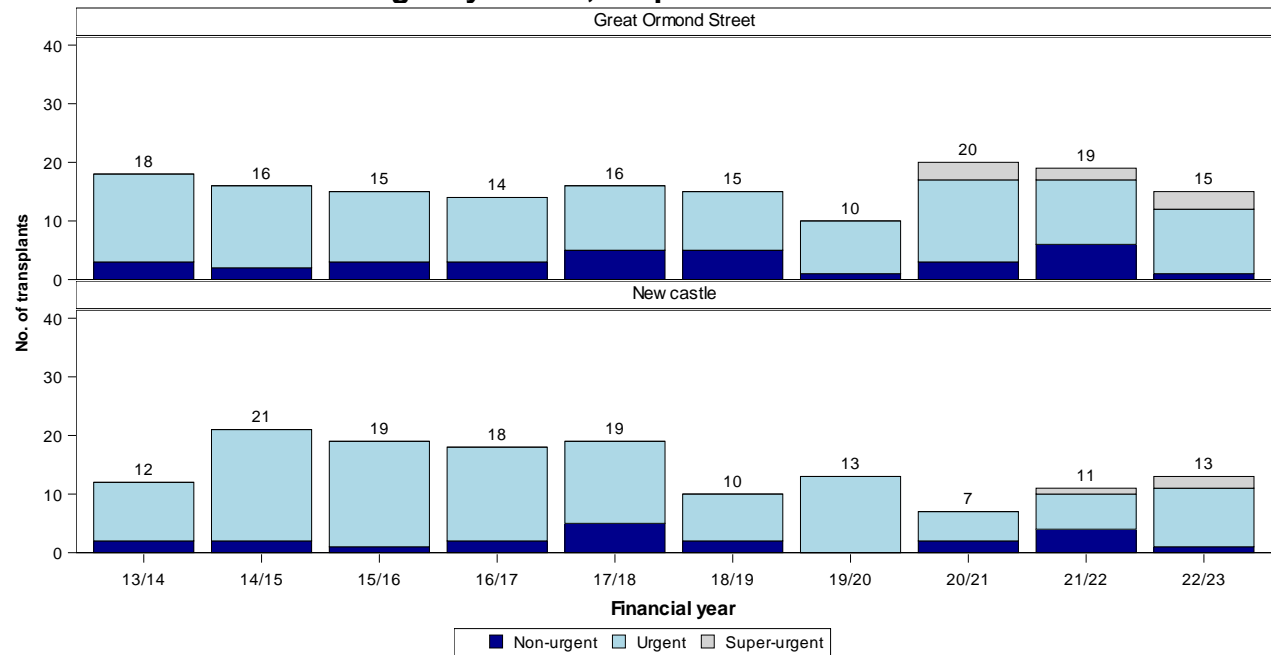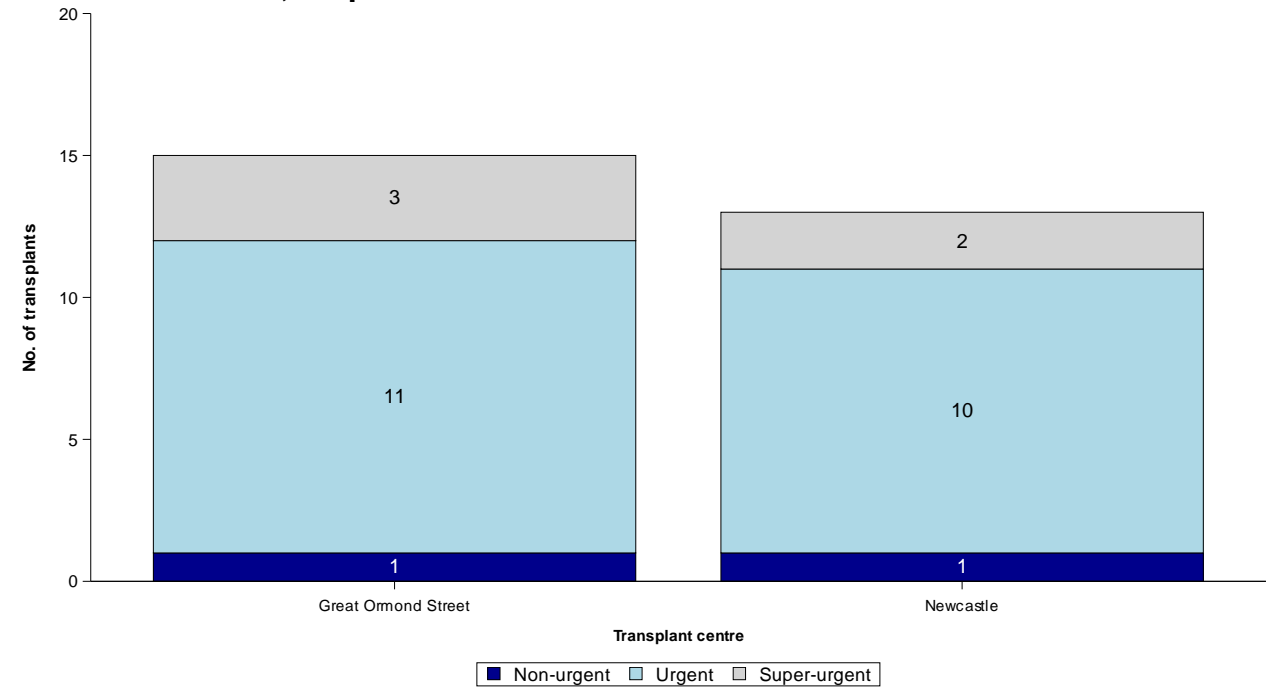**Figure 11.6 Number of paediatric heart transplants in the UK, by centre and urgency status, 1 April 2022 to 31 March 2023**

11.2   Demographic characteristics of transplants, 1 April 2022 – 31 March 2023

The demographic characteristics of the 28 paediatric heart transplant recipients and donors in the latest year are shown by centre and overall in **Table 11.1**. Nationally, 64% of heart recipients were male and the median age was 8 years, while the median age of donors was 14 years. For some characteristics, due to rounding, percentages may not add up to 100.

Table 11.1 Demographic characteristics of UK paediatric heart transplants performed between 1 April 2022 and 31 March 2023, by centre		Great Ormond Street N (%)	Newcastle N (%)	**TOTAL** **N (%)**
Number of transplants		15 (100)	13 (100)	**28 (100)**
Urgency status at transplant	Non-urgent	1 (7)	1 (8)	**2 (7)**
	Urgent	11 (73)	10 (77)	**21 (75)**
	Super-urgent	3 (20)	2 (15)	**5 (18)**
Recipient sex	Male	12 (80)	6 (46)	**18 (64)**
	Female	3 (20)	7 (54)	**10 (36)**
Recipient ethnicity	White	8 (53)	8 (62)	**16 (57)**
	Asian	4 (27)	5 (38)	**9 (32)**
	Black	1 (7)	0 (0)	**1 (4)**
	Other	1 (7)	0 (0)	**1 (4)**
	Missing	1 (7)	0 (0)	**1 (4)**
Recipient age (years)	Median (IQR)	7 (3, 12)	8 (4, 13)	**8 (3, 12)**
	Missing	0	0	**0**
Recipient weight (kg)	Median (IQR)	21 (14, 45)	29 (14, 39)	**25 (14, 43)**
	Missing	0	0	**0**
Recipient primary disease	Cardiomyopathy	14 (93)	8 (62)	**22 (79)**
	Congenital heart disease	1 (7)	4 (31)	**5 (18)**
	Other	0 (0)	1 (8)	**1 (4)**
NYHA class	III	3 (20)	1 (8)	**4 (14)**
	IV	8 (53)	11 (85)	**19 (68)**
	Missing	4 (27)	1 (8)	**5 (18)**
Recipient in hospital	No	3 (20)	2 (15)	**5 (18)**
	Yes	12 (80)	10 (77)	**22 (79)**
	Missing	0 (0)	1 (8)	**1 (4)**
In hospital, recipient on ventilator	No	7 (58)	7 (70)	**14 (64)**
	Yes	5 (42)	3 (30)	**8 (36)**
In hospital, recipient VAD	None	5 (42)	5 (50)	**10 (46)**
	Left	7 (58)	3 (30)	**10 (46)**
	Both	0 (0)	2 (20)	**2 (9)**
In hospital, recipient TAH	No	12 (100)	10 (100)	**22 (100)**
In hospital, recipient ECMO	No	8 (67)	8 (80)	**16 (73)**
	Yes	4 (33)	2 (20)	**6 (27)**

Table 11.1   Demographic characteristics of UK paediatric heart transplants performed between 1 April 2022 and 31 March 2023, by centre

		Great Ormond Street N (%)	Newcastle N (%)	TOTAL N (%)
In hospital, recipient on inotropes	No	5 (42)	3 (30)	**8 (36)**
	Yes	7 (58)	7 (70)	**14 (64)**
In hospital, recipient IABP	No	12 (100)	10 (100)	**22 (100)**
Recipient CMV status	Negative	8 (53)	10 (77)	**18 (64)**
	Yes	7 (47)	3 (23)	**10 (36)**
Recipient HCV status	Negative	15 (100)	12 (92)	**27 (96)**
	Missing	0 (0)	1 (8)	**1 (4)**
Recipient HBV status	Negative	15 (100)	12 (92)	**27 (96)**
	Missing	0 (0)	1 (8)	**1 (4)**
Recipient HIV status	Negative	15 (100)	12 (92)	**27 (96)**
	Missing	0 (0)	1 (8)	**1 (4)**
Recipient Serum Creatinine (umol/l)	Median (IQR)	34 (25, 46)	49 (34, 62)	**38 (29, 52)**
	Missing	0	1	**1**
Donor sex	Male	5 (33)	7 (54)	**12 (43)**
	Female	10 (67)	6 (46)	**16 (57)**
Donor ethnicity	White	10 (67)	10 (77)	**20 (71)**
	Asian	0 (0)	1 (8)	**1 (4)**
	Missing	5 (33)	2 (15)	**7 (25)**
Donor age (years)	Median (IQR)	14 (7, 21)	13 (10, 17)	**14 (9, 21)**
	Missing	0	0	**0**
Donor BMI (kg/m^2)	Median (IQR)	19 (16, 21)	18 (17, 22)	**18 (16, 21)**
	Missing	0	0	**0**
Donor cause of death	Intracranial/CVA	10 (67)	9 (69)	**19 (68)**
	Trauma	1 (7)	0 (0)	**1 (4)**
	Others	4 (27)	4 (31)	**8 (29)**
Donor hypotension	No	11 (73)	3 (23)	**14 (50)**
	Yes	3 (20)	3 (23)	**6 (21)**
	Missing	1 (7)	7 (54)	**8 (29)**
Donor past diabetes	No	15 (100)	12 (92)	**27 (96)**
	Missing	0 (0)	1 (8)	**1 (4)**
Donor past cardio disease	No	11 (73)	10 (77)	**21 (75)**
	Missing	4 (27)	3 (23)	**7 (25)**
Donor past hypertension	No	15 (100)	12 (92)	**27 (96)**
	Missing	0 (0)	1 (8)	**1 (4)**
Donor past tumour	No	15 (100)	12 (92)	**27 (96)**
	Missing	0 (0)	1 (8)	**1 (4)**

Table 11.1	Demographic characteristics of UK paediatric heart transplants performed between 1 April 2022 and 31 March 2023, by centre			
		Great Ormond Street	Newcastle	**TOTAL**
		N (%)	N (%)	**N (%)**
Donor past smoker	No	12 (80)	10 (77)	**22 (79)**
	Yes	3 (20)	2 (15)	**5 (18)**
	Missing	0 (0)	1 (8)	**1 (4)**
Total ischaemia time (hours)	Median (IQR)	4.2 (3.8, 4.9)	3.5 (3.1, 3.7)	**3.8 (3.2, 4.6)**
	Missing	0	2	**2**

11.3   Total ischaemia time, 1 April 2013 – 31 March 2023

Figure 11.7 shows boxplots of total ischaemia time for DBD donor hearts transplanted into paediatric recipients over the last 10 years. The total ischaemia time is the difference between donor cross-clamp and recipient reperfusion and can be considered the out of body time. The national median total ischaemia time varied between 3.4 and 3.9 hours over the decade with no upward or downward trend.

Figure 11.7 Boxplots of total ischaemia time in DBD donor hearts transplanted into paediatric recipients, by financial year, 1 April 2013 to 31 March 2023
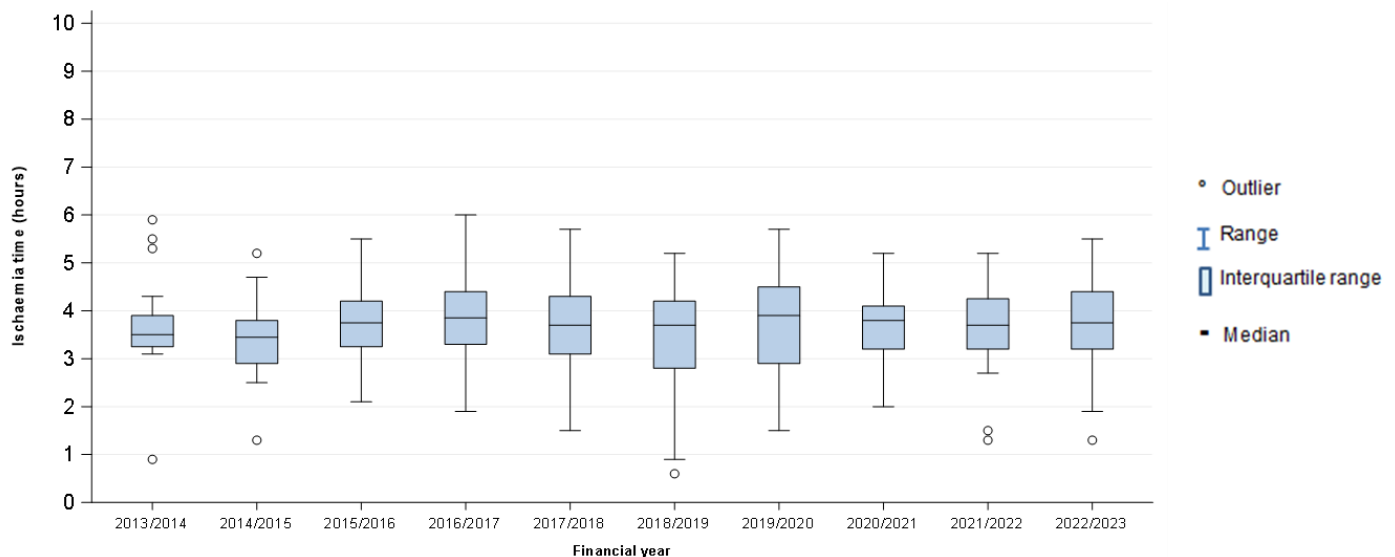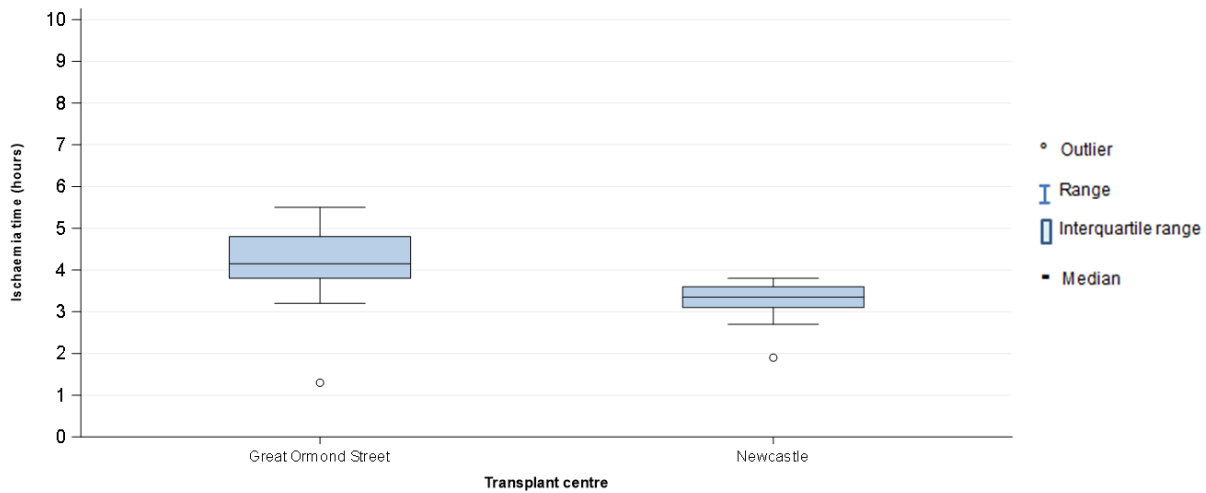
Figure 11.8 and **Figure 11.9** show boxplots of total ischaemia time by centre in the latest financial year (2022/2023) and over the last 10 years, respectively.

Figure 11.8 Boxplots of total ischaemia time for DBD donor hearts transplanted into paediatric recipients, by transplant centre, 1 April 2022 to 31 March 2023

The Organ Care System (OCS) was not used in any paediatric DBD heart transplants in 2022/2023

Figure 11.9 Boxplots of total ischaemia time in DBD donor hearts transplanted into paediatric recipients, by transplant centre and financial year, 1 April 2013 to 31 March 2023
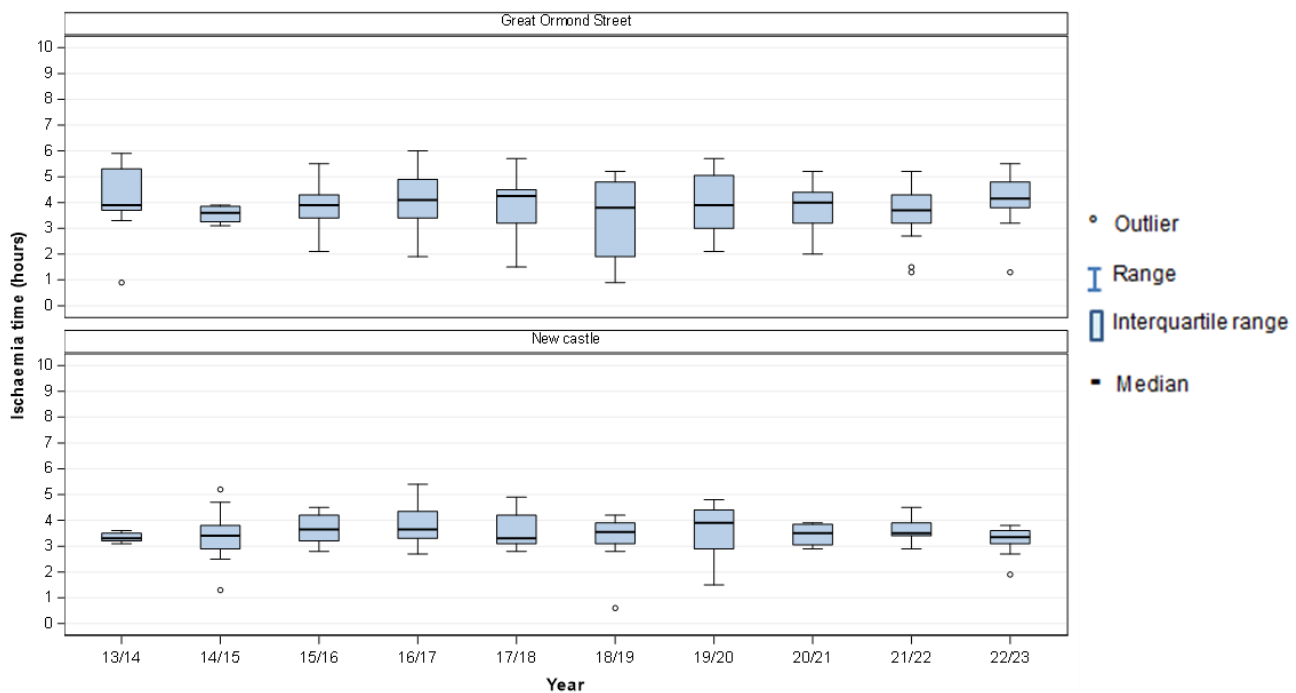
Includes time on the Organ Care System (OCS) for one transplant performed at Newcastle in 2017/2018

PAEDIATRIC HEART TRANSPLANTATION

Post-Transplant Survival

12.   Post-Transplant Survival

The survival analyses presented in this section exclude multi-organ transplants and include first time transplants only. **Section 12.1** includes DBD heart transplants only where thirty-day, ninety-day and 1-year survival rates are based on transplants performed in the period 1 April 2018 to 31 March 2022 and 5-year survival rates are based on transplants performed in the period 1 April 2014 to 31 March 2018. **Section 12.2** summarises survival following DCD heart transplant for the small number of paediatric recipients of DCD hearts.

12.1   Survival post DBD heart transplant

The 30-day post-transplant unadjusted patient survival rates for each centre and nationally are shown in **Table 12.1** for the 89 first DBD paediatric heart only transplants in the period 1 April 2018 to 31 March 2022. There were no deaths within 30 days at Great Ormond Street Hospital. The 90 day survival rates are shown in **Table 12.2**.

Table 12.1 30 day patient survival after first paediatric heart transplant, by centre, 1 April 2018 and 31 March 2022				
Centre	Number of transplants	Number of deaths	% 30 day survival (95% CI) (unadjusted)	
Great Ormond Street Hospital	55	0	100.0	-
Newcastle	34	2	94.1	(78.5 - 98.5)
UK	**89**	**2**	**97.8**	**(91.3 - 99.4)**

Table 12.2 90 day patient survival after first paediatric heart transplant, by centre, 1 April 2018 and 31 March 2022				
Centre	Number of transplants	Number of deaths	% 90 day survival (95% CI) (unadjusted)	
Great Ormond Street	55	1	98.2	(87.8 - 99.7)
Newcastle	34	3	91.2	(75.1 - 97.1)
UK	**89**[1]	**4**	**95.5**	**(88.5 - 98.3)**

The one year post-transplant unadjusted survival rates are shown in **Table 12.3**. There is borderline evidence that Great Ormond Street Hospital's unadjusted survival rate is higher than Newcastle's (log-rank p=0.0723).

Table 12.3 1 year patient survival after first paediatric heart transplant, by centre, 1 April 2018 and 31 March 2022

Centre	Number of transplants	Number of deaths	% 1 year survival (95% CI) (unadjusted)	
Great Ormond Street	55	2	96.1	(85.2 - 99.0)
Newcastle	34	6	82.4	(64.9 - 91.7)
UK	**89**	**8**	**90.8**	**(82.5 - 95.3)**

Five year survival rates were estimated from the 134 first DBD paediatric heart only transplants performed in the period 1 April 2014 to 31 March 2018. The unadjusted patient survival rates are shown in **Table 12.4**.

Table 12.4 5 year patient survival after first paediatric heart transplants, by centre, 1 April 2014 and 31 March 2018

Centre	Number of transplants	Number of deaths	% 5 year survival (95% CI) (unadjusted)	
Great Ormond Street	60	6	89.6	(78.4 - 95.2)
Newcastle	74	16	78.3	(67.0 - 86.1)
UK	**134**	**22**	**83.2**	**(75.6 - 88.6)**

12.2   Survival post DCD heart transplant

The survival outcomes of paediatric recipients of DCD heart only transplants in the period 1 April 2018 to 31 March 2022 are summarised in **Table 12.5**, at 30 days, 90 days and 1 year post-transplant.

Table 12.5 Survival outcomes after first DCD paediatric heart only transplant, by centre, 1 April 2018 to 31 March 2022				
Centre	Number of patients	Number of patients alive at 30 days post-transplant	Number of patients alive at 90 days post-transplant	Number of patients alive at 1 year post-transplant
Great Ormond Street Hospital	8	8	7	7
Newcastle	4	4	3	1
UK	**12**	**12**	**10**	**8**

PAEDIATRIC HEART TRANSPLANTATION

Form Return Rates

13.   Paediatric heart form return rates, 1 January – 31 December 2022

Form return rates are reported in **Table 13.1** for the cardiothoracic transplant record and the three month and 1 year follow up form, along with lifetime follow up (2 years or more). These include all paediatric heart transplants between 1 January and 31 December 2022 for the transplant record, and all follow up forms issued in this time period. There was a small number of lifetime follow-up forms outstanding.

Table 13.1 Form return rates for paediatric heart transplants, 1 January 2022 to 31 December 2022								
Centre	Transplant record		3 month follow-up		1 year follow-up		Lifetime follow-up	
	No. requested	% returned	No. requested	% returned	No. requested	% returned	No. requested	% returned
Great Ormond Street Hospital	13	100	16	100	14	100	108	98
Newcastle, Freeman Hospital	14	100	13	100	9	100	203	96
Overall	**27**	**100**	**29**	**100**	**23**	**100**	**311**	**97**

APPENDIX

A1: Number of patients analysed

The cohort of patients in this report varies by section/analysis. Tables **A1.1** and **A1.2** below summarise the number of adult and paediatric (respectively) transplants in each cohort and the section this applies to. For the survival from listing analysis, see the Methods section in **A2** below.

Table A1.1	Adult transplants analysed		
Time period	**Report Section**	**Exclusion criteria**	**No. heart transplants**
1 April 2013 – 31 March 2023	• Introduction	None	1622
1 April 2013 – 31 March 2023	• Transplants	• Multi-organ transplants	1566
1 April 2018 – 31 March 2022	Post-transplant survival – • 30/90-day • 1-year survival	• Multi-organ transplants • DCD heart transplants excluded from main analysis • Heart-lung transplants • Second (or more) transplants • Group 2 transplants	471
1 April 2014 – 31 March 2018	Post-transplant survival – • 5-year survival	• Multi-organ transplants • DCD heart transplants excluded from main analysis • Heart-lung transplants • Second (or more) transplants • Group 2 transplants	566

Table A1.2	Paediatric transplants analysed		
Time period	**Report Section**	**Exclusion criteria**	**No. heart transplants**
1 April 2013 – 31 March 2023	• Introduction	None	304
1 April 2013 – 31 March 2023	• Transplants	• Multi-organ transplants	301
1 April 2018 – 31 March 2022	Post-transplant survival – • 30/90-day • 1-year survival	• Multi-organ transplants • Heart-lung transplants • Second (or more) transplants • DCD heart transplants • Group 2 transplants	89
1 April 2014 – 31 March 2018	Post-transplant survival – • 5-year survival	• Multi-organ transplants • Heart-lung transplants • Second (or more) transplants • DCD heart transplants • Group 2 transplants	134

Geographical variation analysis

Registration rates

All NHS group 1 patients who were registered onto the heart transplant list with an active status between 1 April 2022 and 31 March 2023 were extracted from the UK Transplant Registry on 29 June 2023 (numerator). Patients registered for a heart-lung block were excluded. Patients were assigned to NHS regions in England using their postcode of residence, as reported at registration. The number of registrations per million population (pmp) by NHS region was obtained using mid-2021 population estimates based on the Office for National Statistics (ONS) 2021 Census figures (denominator). No NHS region age- or sex-specific standardisation of rates was performed.

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

Transplant rates

Transplant rates pmp were obtained as the number of heart transplants on NHS group 1 recipients between 1 April 2022 and 31 March 2023 (numerator), divided by the mid-2021 population estimates from the ONS (denominator). Patients who received a heart-lung block transplant were excluded. Transplant rates pmp were categorised and visualised in a map as done for the registration rates.

Systematic component of variation

Only registrations or transplants in England between 1 April 2022 and 31 March 2023 were included. If a patient was re-registered during the time period, only the first registration was considered. If a patient underwent more than one heart transplant in the time period, only the first transplant was considered.

A2: Methods

Offer decline rates

The offer decline rate analysis was limited to heart offers from DBD donors who died at a UK hospital and the heart was eventually accepted and transplanted. Any offers from DCD donors were excluded.

Funnel plots were used to compare centre specific offer decline rates and indicate how consistent the rates of the individual transplant centres are with the national rate. The overall national offer decline rate is shown by the solid line while the 95% and 99.8% confidence lines are indicated via a thin and thick dotted line, respectively. Each dot in the plot represents an individual transplant centre. Centres that are positioned above the upper limits indicate on offer decline rate that is higher than the national rate, while centres positioned below the lower limits indicates on offer decline

Unadjusted post-transplant survival rates

Kaplan-Meier methods were used to estimate the unadjusted patient survival rates. 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 post-transplant 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 developed in consultation with clinicians and were based on statistical significance as well as previous studies of factors affecting the survival rates of interest. The factors included in the models are shown in **A3**.

Missing values for risk factors were imputed using simple imputation of the median or most common group for the adult heart model (where missing values represented <10% of the cohort). Missing ischaemia time (5% of cohort) was imputed with a centre and year specific median

Funnel plots

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.

Systematic component of variation

For a given individual who is a resident in a given NHS region, registration to the transplant list is modelled as a Bernoulli trial. At the whole area level, this becomes a Binomial process which can be approximated by a Poisson distribution when rare events are modelled. Transplant counts follow similar assumptions.

To allow for the possibility that, even after allowing for area-specific Poisson rates, area differences remain, introduce an additional multiplicative rate factor which varies from area to area. Postulate a non-parametric distribution for the multiplicative factor, with variance σ^2. If the factor is one for all areas, then area differences are fully explained by the area-specific Poisson rate. If the factor varies with a nonzero variance, σ^2, then we conclude that there are unexplained area differences.

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

Survival from listing

Data were obtained for all patients ≥ 18 years registered for the first time for a heart transplant between 1 January 2011 and 31 December 2022. Survival time was defined as the time from joining the transplant list to death, regardless of the length of time on the transplant list, whether or not the patient was transplanted and any factors associated with such a transplant e.g. donor type. Survival time was censored at either the date of removal from the list, or at the last known follow up date post-transplant when no death date was recorded, or on 3 July 2023 if the patient was on the transplant list at time of analysis.

Exclusions from the analysis:
- patients with ethnic group not reported
- patients with unknown gender
- patient registered for a heart-lung block or other multi-organ transplant
- patients who were not listed prior to transplant
- patients first registered on another transplant list (e.g. kidney list)
- patients registered outside the UK or not entitled to NHS treatment
- adult patients registered at paediatric centres
- patients with missing BMI

Patients registered for a heart transplant who were non-urgent and then urgently listed on the same day (or vice-versa) were recorded as urgent at registration. Patients who received a VAD and were registered on the transplant list on the same day were assumed to have received the VAD prior to registration.

In risk-adjusted survival analysis, factors recorded at time of transplant listing were adjusted for. These are detailed in **Table A2.1** and were included in the modelling whether or not statistically significant.

Table A2.1	Factors used in risk-adjusted model for patient survival from listing
Heart	Age, gender, ethnicity, blood group, BMI, urgency status, primary disease, previous heart surgery, in hospital at registration, on VAD/ECMO support at registration, era

Survival rates at one and five years post registration were calculated from the risk adjusted survival rate (RASR), obtained as 1 – {observed number of deaths in follow up period/expected number) x national mortality rate}. The expected survival rates were estimated from fitting a Cox model to the national data, excluding transplant centre, evaluated at each patient's observed survival time. Interval estimates for one and five year rates, and the significance of differences between them across centres, were found using Poisson regression models for the logarithm of the observed number of deaths, with centre as a random effect.

A3: Risk models

Table A3.1	**Risk factors** and categories used in the adult heart risk adjusted 30-day, 90-day, 1-year and 5-year survival models
Donor age	(modelled as continuous variable)
Recipient age 60 or over	Yes
	No
Recipient CMV status	Positive
	Negative
Recipient bilirubin at registration	(continuous, logged)
VAD at transplant	Short-term (including ECMO)
	Long-term (including total artificial hearts)
	None
Recipient IABP at transplant	Yes
	No
Primary disease group	Cardiomyopathy
	Coronary heart disease
	Congenital heart disease
	Other
Recipient eGFR group at transplant	44 ml/min or below
	45-59 ml/min
	60-89 ml/min
	90 or above
Recipient diabetes at registration	Yes
	No
Recipient hypertension at registration	Yes
	No
Recipient blood group	O
	A
	B
	AB
Ischaemia time (hours)	(modelled as continuous variable)
OCS used on heart	Yes
	No
Interaction between ischaemia time and OCS	

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A4: Glossary of terms

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

Boxplots
The length of the box in this plot represents the inter-quartile range. The line inside the box indicates the median value. The vertical lines issuing from the box are called the whiskers and indicate the range of values that are outside of the inter-quartile range but are close enough not to be considered outliers. The circles that are outside the box indicate the outliers (any points that are a distance of more than 1.5*IQR from the box).

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 patient death, across different groups of patients.

Donor after brain death (DBD)
Donation after brainstem death means donation which takes place following the diagnosis of death using neurological criteria.

Donor after circulatory death (DCD)
Donation after circulatory death means donation which takes place following the diagnosis of death using circulatory criteria.

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.

Inter-quartile range
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, when estimating one year patient survival rates, a patient may be followed up for only nine months before they relocate. 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. The Kaplan-Meier method can be used for any time to event analysis, including time to transplant. If not enough events have occurred or if there are not enough patients in the cohort, an estimate of the median may not be possible.

Long-term device
Long-term devices are implantable and intended to support the patient for years. Patients can be discharged from hospital with a long-term device.

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 heart 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.

VAD
Ventricular Assist Device. A mechanical pump used to increase the amount of blood that flows through the body, relieving the symptoms of advanced heart failure.

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