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Blood and Transplant

ANNUAL REPORT ON MECHANICAL CIRCULATORY SUPPORT RELATED TO HEART TRANSPLANTATION

REPORT FOR 2025/2026
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EXECUTIVE SUMMARY



1 Executive Summary

This report summarises key information about mechanical circulatory support (MCS) used in patients in the UK as a bridge to heart transplantation or for post-transplant support. MCS in this context includes long-term ventricular assist devices (VADs), short-term VADs, total artificial hearts (TAH) and veno-arterial extracorporeal membrane oxygenation (ECMO). The period reported covers 10 years, from 1 April 2016 to 31 March 2026. Data were extracted from the UK MCS Database held by NHS Blood and Transplant on 21 September 2026. Results are presented separately for adult and paediatric patients, for long-term and short-term devices and for bridging and post-transplant strategies.

Key findings

Long-term bridging devices in adults:

- During 2025/2026 there were 58 long-term device implants, all long-term VADs. The number of implants has reduced over the decade by 48%.
- The most common INTERMACS profile for this patient group was 3 (stable but inotrope dependent) representing 29% of patients.
- At 3-years post-implant, 72% of patients remained on support, 10% had received a heart transplant, 2% were explanted without transplant and 16% died on support.
- The national 1-year patient survival rate from the point of first long-term VAD implant, irrespective of subsequent intervention (not censored at transplant or explant for recovery) was 90.2%. The 3-year survival rate was 73.1%.

Short-term bridging devices in adults:

- During 2025/2026 there were 188 short-term device implants, comprising 114 VADs and 74 ECMO implants; a 13% increase from the previous financial year.
- The majority (71%) of implants were into INTERMACS profile 1 patients (critical cardiogenic shock).
- The median duration on short-term support was 14 days.
- At 30 days post-implant, 29% of patients remained on short term support, 21% had received a heart transplant, 4% transferred to a long-term device, 17% were explanted without transplant and 29% had died on support.
- The 1-year patient survival rate from the point of first short-term implant (excluding those bridged to long-term support) was 55.7% (not censored at transplant/explant).

Short-term devices used post-heart transplant in adults:

- During 2025/2026 there were 64 adult heart transplants requiring mechanical support within 30 days post-transplant, comprising 57 ECMO only, 7 short-term VAD and ECMO and none involved short-term VAD only. As a percentage of transplants performed, 34% required support.
- The 1-year patient survival rate from the point of implant was 71.4%.
- The median duration on support was 5 days.
- Patient survival rates at 90-days and 1-year for transplants requiring support were significantly worse than transplants without support.

Devices used in paediatric patients:

- During 2025/2026, 31 bridging device implants and 5 post-transplant implants were reported, 23 of which were ECMO and 13 were VADs.
- For 73 patients reported as having a first bridging device between 1 April 2021 and 31 March 2025, the median duration of support was 124 days, 33% of patients received a transplant within 90 days of device implant and the 1-year patient survival rate from the point of implant (irrespective of subsequent intervention) was 88.7%.

Use of the contents of this report should be acknowledged as follows:
Annual Report on Mechanical Circulatory Support Related to Heart Transplantation 2025/2026, NHS Blood and Transplant

INTRODUCTION



2 Introduction

In the United Kingdom, mechanical circulatory support (MCS) therapy is commissioned as a bridge to heart transplantation or for post-transplant support due to primary graft dysfunction (PGD) or rejection. MCS in this context includes long-term ventricular assist devices (VADs), short-term VADs, total artificial hearts (TAH) and veno-arterial extracorporeal membrane oxygenation (ECMO).

The seven centres that provide this service are the same centres that perform heart transplantation: Birmingham Queen Elizabeth Hospital, Harefield Hospital, Manchester Wythenshawe Hospital, Newcastle Freeman Hospital, Royal Papworth Hospital, Great Ormond Street Hospital, and Glasgow Golden Jubilee Hospital. Great Ormond Street Hospital provides a paediatric service only, Newcastle Freeman Hospital provides both adult and paediatric services, and all other centres provide adult services only. For reporting purposes, patients implanted at Newcastle are classified according to age: those aged under 16 years are reported as paediatric patients, while those aged 16 years and over are reported as adults. Data from all other centres are reported according to the type of service provided by the centre (adult or paediatric), regardless of the patient's age.

All centres are required to submit data to the national MCS Database, which is hosted by NHS Blood and Transplant. The database collects detailed information before and at time of device implant, as well as explant, transplant and death, and follow-up at predefined intervals post-implant and post-explant. These data are audited and reported annually to provide centres, commissioners and patients with relevant information about the UK MCS service. The report also incorporates data from the UK Transplant Registry on listing for heart transplantation and survival after transplant for patients receiving MCS.

The cohort covered in this report is from 1 April 2016 to 31 March 2026. Data were extracted for this report on 21 September 2026 by which date it was expected that all devices used during the audit period had been reported to the database.

Prior to the introduction of the General Data Protection Regulation (GDPR) in May 2018, consent had to be gained from patients to record their data on the MCS Database. During the reporting period, 7 patients refused consent and so these patients are excluded from this report. From May 2018, patient data are recorded lawfully without explicit consent under Article 6(1)e of the GDPR and Article 9(2)h “management of healthcare”.

The report is split into four main parts:

- Adult long-term devices used for bridging (long-term VADs and TAH)
- Adult short-term devices used for bridging (short-term VADs and ECMO)
- Adult short-term devices used post-heart transplant (short-term VADs and ECMO)
- Paediatric devices used for bridging (VAD and ECMO)

Each section of the report comprises an activity analysis and a patient outcomes analysis. Activity is analysed on a per-implant basis, whereas outcomes are analysed on a per-patient basis. There are two exceptions to this; short-term devices used post-heart transplant are analysed on a per-transplant basis, and paediatric bridging devices are analysed on a per-episode basis. Activity is reported over the ten years, while patient outcomes are typically analysed using more recent implant cohorts.

Appendix A1 provides a breakdown of the number of observations included in each analysis, together with details of classifications and limitations. Methods used to produce the report are described in Appendix A2.

Patient survival is analysed in two ways. The first measures survival from the time of the initial device implant until death, regardless of any subsequent interventions. The second, referred to as *survival on support*, measures the time from implant to death while on device support; patients are censored at the time of device explant or heart transplant. Readers should note that neither analysis adjusts for differences in patient risk profiles between centres. Variations in patient case mix may therefore contribute to differences in centre-specific survival rates. Consequently, these results should not be used to draw conclusions about differences in the quality of care provided by individual centres.

2.1 Overview

Figure 2.1 shows the number of adult bridging implants reported over the last ten years, split by device type. In general, long-term device implants have decreased over the decade, with 58 in 2025/2026 compared with 111 in 2016/2017, while short-term implants have increased, with 188 in 2025/2026 compared with 73 in 2016/2017.

Figure 2.1 Total number of adult bridging device implants in the UK, by device type and financial year, 1 April 2016 to 31 March 2026

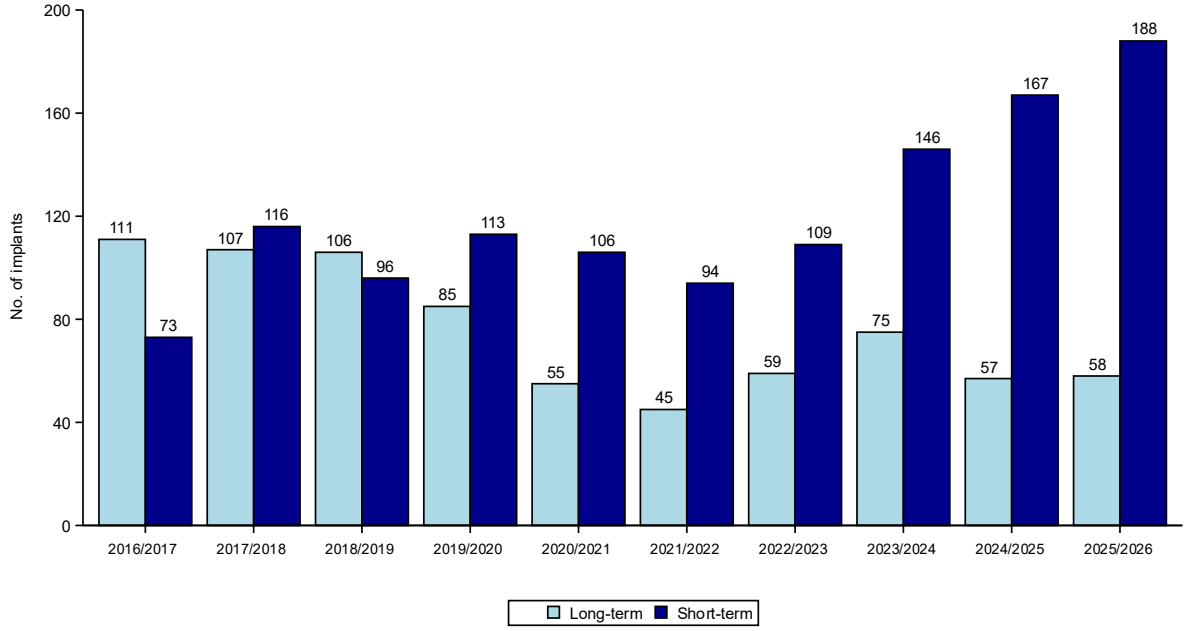
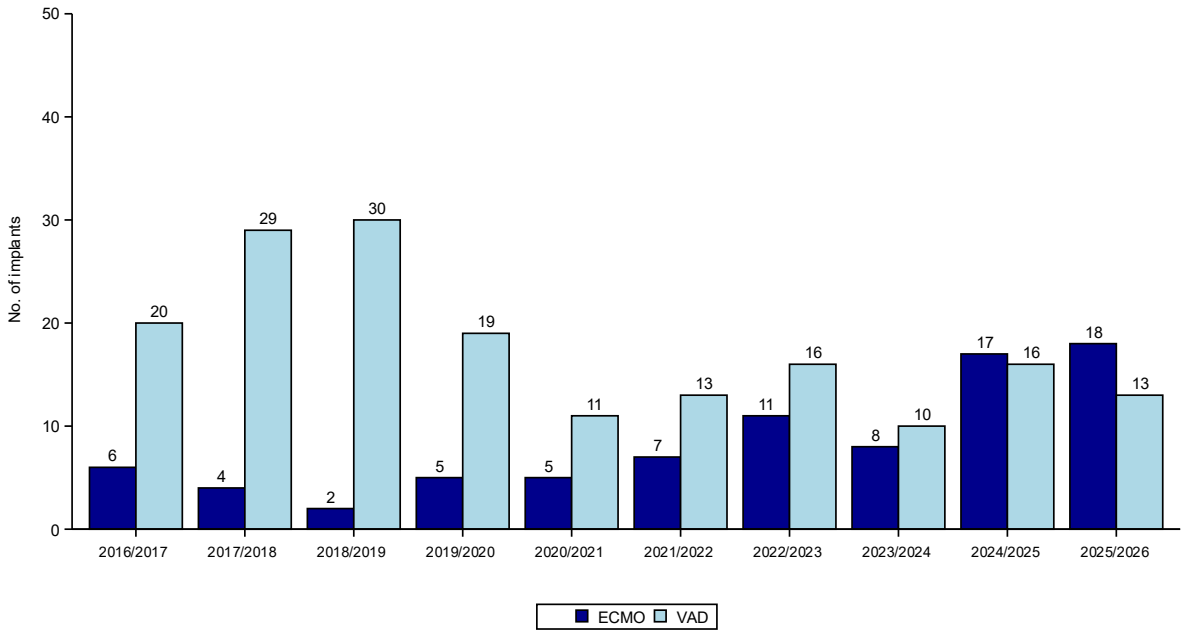


Figure 2.2 shows a breakdown of paediatric bridging implants over the last ten years. The number of VAD implants has reduced since 2018/2019 and the use of ECMO has recently increased.

Figure 2.2 Total number of paediatric bridging device implants in the UK, by device type and financial year, 1 April 2016 to 31 March 2026



In total (adult and paediatric combined) there were 2,226 bridging implants reported across the decade in 1,778 patients; 1,400 (78.7%) patients had a single device implant, 317 (17.8%) had two implants, 54 (3.0%) had three, 5 (0.3%) had four, and 2 (0.1%) had five (see **Table A1.4** and **Table A1.5** in Appendix A1 for details of device histories).

Figure 2.3 shows the number of adult post-heart transplant implants reported over the last ten years, split by primary graft dysfunction (PGD) and rejection (short-term implants beyond 30 days post-transplant) strategies. The number of implants for PGD has increased over the period, with 77 in 2025/2026. Implants for rejection are relatively uncommon, with the highest number recorded in 2021/2022.

Figure 2.3 Total number of adult post-transplant device implants in the UK, by strategy and financial year, 1 April 2016 to 31 March 2026

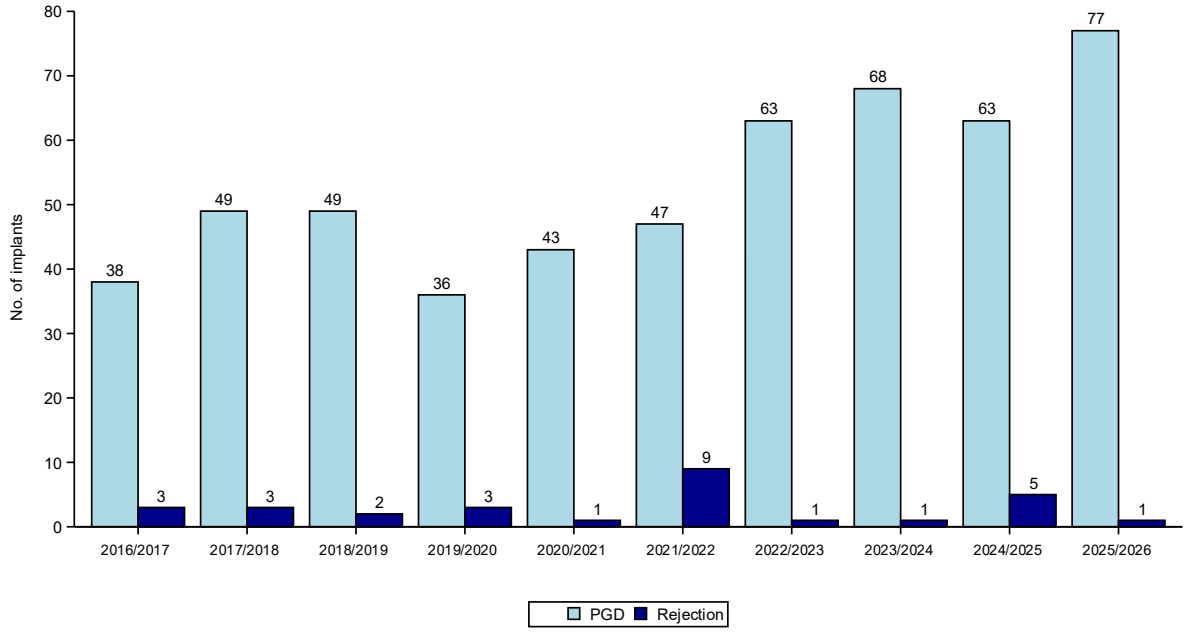
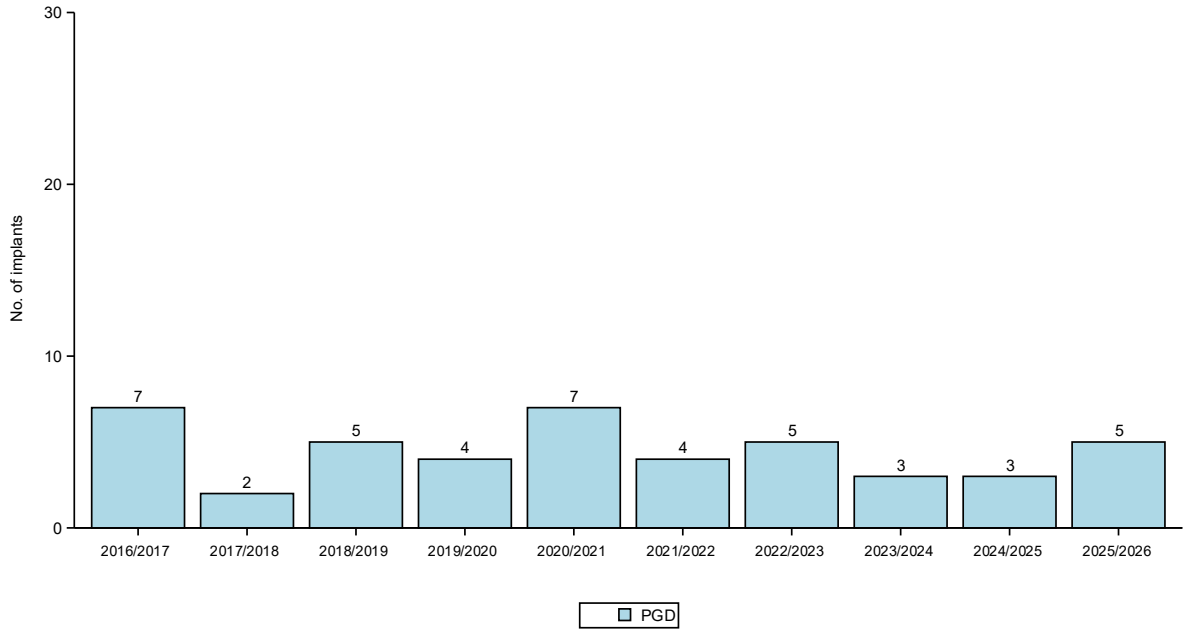


Figure 2.4 shows the same breakdown for paediatric post-transplant implants over the last ten years. There were no devices used for rejection in paediatric patients across the decade.

Figure 2.4 Total number of paediatric post-transplant device implants in the UK, by strategy and financial year, 1 April 2016 to 31 March 2026



In total (adult and paediatric combined) there were 607 post-transplant implants across the decade in 500 patients; 410 (82.0%) patients had a single device implant, 74 (14.8%) had two implants, 15 (3.0%) had three and 1 (0.2%) had four (see **Table A1.4** and **Table A1.5** in Appendix A1 for details of device histories).

Figure 2.5 shows the number of adult patients reported as alive on bridging support as of 31 March 2026 by centre and device type. In total, there were 338 patients alive on a long-term device and 14 alive on short-term support, with Birmingham and Newcastle having the highest number of patients on long-term support. **Figure 2.6** shows the same information but for paediatric patients. There were 11 paediatric patients alive on support on 31 March 2026, 10 of them on VAD support and 1 on ECMO support.

Figure 2.5 Number of adult patients alive on bridging support on 31 March 2026, by device type and centre

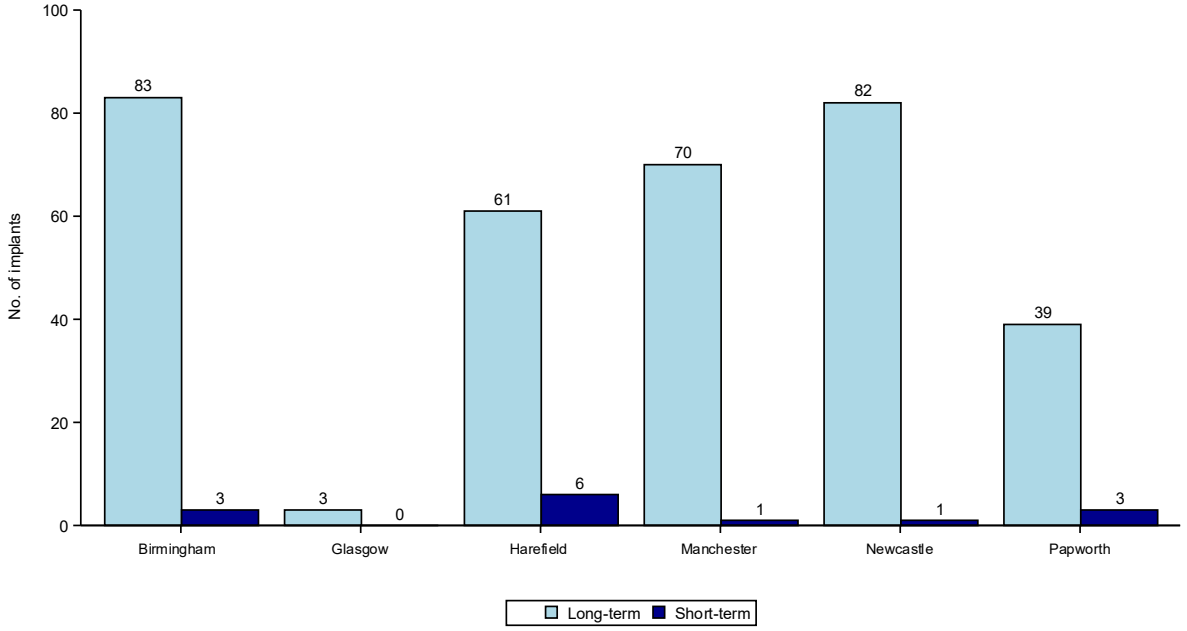
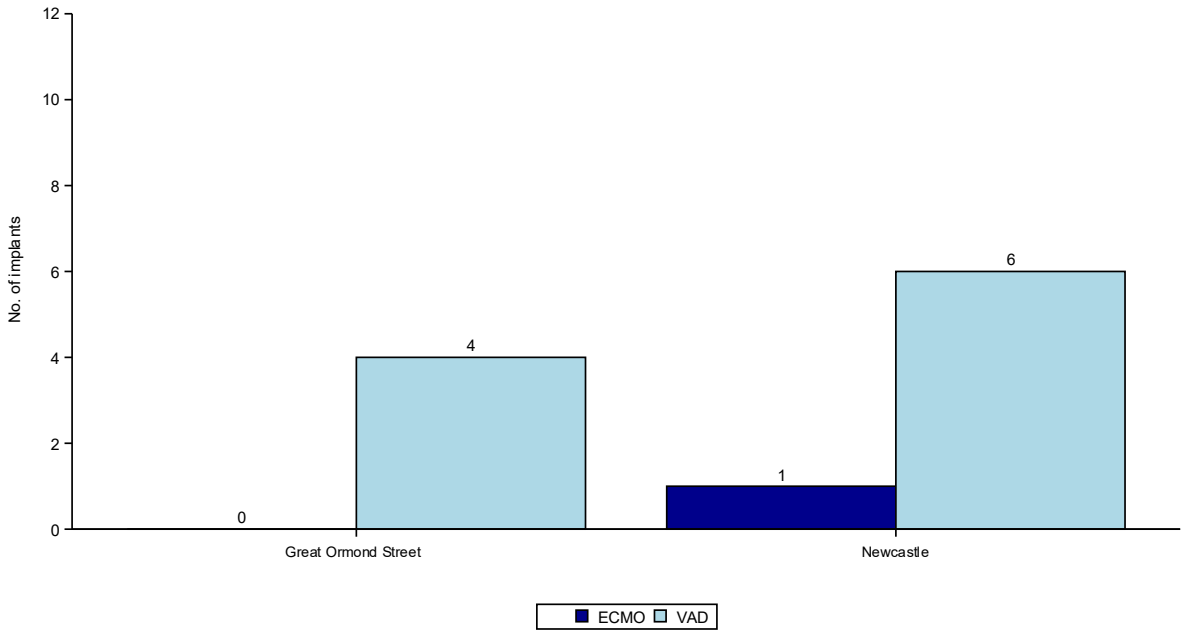


Figure 2.6 Number of paediatric patients alive on bridging support on 31 March 2026, by device type and centre



Tables 2.1 and **2.2** present a summary of the number of adult and paediatric patients and implants that have been reported to the MCS Database by centres for the period 1 April 2016 to 31 March 2026, and separately for the most recent year, 1 April 2025 to 31 March 2026. **Table 2.1** reflects the adult data while **Table 2.2** reflects the paediatric data.

Table 2.1 Number of adult patients receiving devices and number of implants, by strategy and centre, 1 April 2016 to 31 March 2026

Strategy	Centre	1 April 2016 - 31 March 2026						1 April 2025 - 31 March 2026					
		No. of implants	Type of device				No. patients	No. of implants	Type of device				No. patients
			LT VAD	TAH	ST VAD*	ECMO			LT VAD	TAH	ST VAD*	ECMO	
Bridging	Birmingham	395	149	0	180	66	309	58	13	0	28	17	37
	Glasgow[1]	193	6	0	50	137	164	41	0	0	14	27	32
	Harefield	499	175	15	189	120	355	51	11	0	31	9	38
	Manchester	288	124	0	113	51	258	23	7	0	13	3	22
	Newcastle	314	202	0	46	66	271	30	18	0	6	6	28
	Papworth[1]	277	87	0	142	48	226	43	9	0	22	12	29
	Total	**1966**	**743**	**15**	**720**	**488**	**1583**	**246**	**58**	**0**	**114**	**74**	**186**
Post-transplant	Birmingham	167	0	0	56	111	114	18	0	0	2	16	14
	Glasgow	74	0	0	11	63	60	19	0	0	3	16	15
	Harefield	82	0	0	3	79	77	12	0	0	1	11	12
	Manchester	76	0	0	9	67	66	11	0	0	1	10	11
	Newcastle	81	0	0	4	77	72	8	0	0	1	7	8
	Papworth	82	0	0	11	71	67	10	0	0	0	10	10
	Total	**562**	**0**	**0**	**94[2]**	**468[2]**	**456**	**78**	**0**	**0**	**8**	**70[3]**	**70**

* Includes Berlin Heart devices
[1] Includes 7 implants performed at non-transplanting centres where patients were then transferred, 6 to Papworth and 1 to Glasgow
[2] Includes 13 ST VAD and 16 ECMO used for rejection which are excluded from the rest of the report
[3] Includes 1 ECMO used for rejection which is excluded from the rest of the report

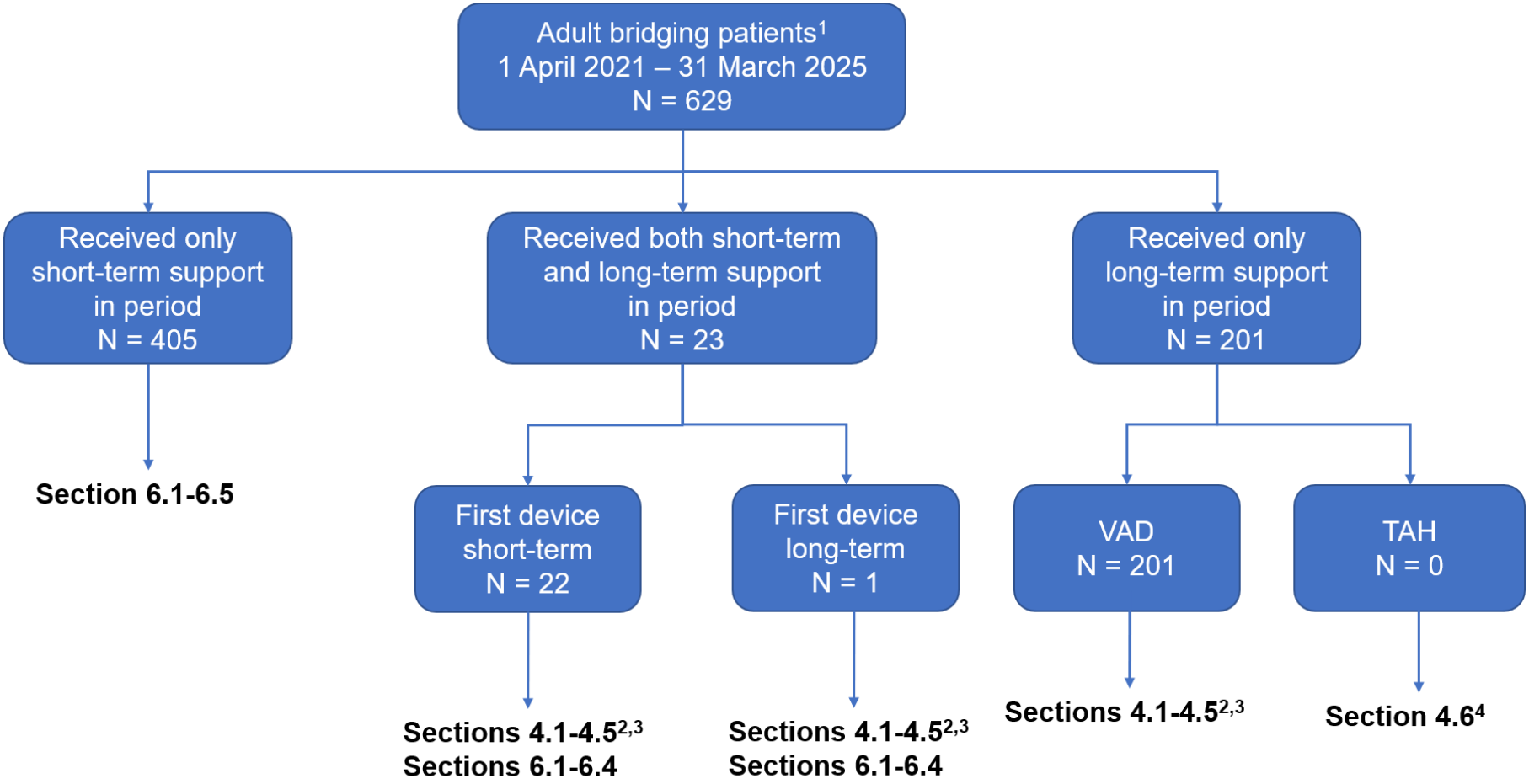
Table 2.2 Number of paediatric patients receiving devices and number of implants, by strategy and centre, 1 April 2016 to 31 March 2026

Strategy	Centre	1 April 2016 - 31 March 2026				1 April 2025 - 31 March 2026			
		No. of implants	Type of device VAD	Type of device ECMO	No. patients	No. of implants	Type of device VAD	Type of device ECMO	No. patients
Bridging	Great Ormond Street[1]	131	78	53	102	16	5	11	11
	Newcastle[1]	129	99	30	93	15	8	7	13
	Total	**260**	**177**	**83**	**195**	**31**	**13**	**18**	**24**
Post-transplant	Great Ormond Street	20	1	19	20	1	0	1	1
	Newcastle	25	0	25	24	4	0	4	4
	Total	**45**	**1**	**44**	**44**	**5**	**0**	**5**	**5**

[1] Includes 9 implants performed at non-transplanting centres where patients were then transferred, 8 to Newcastle and 1 to Great Ormond Street

Figure 2.7 shows a flow diagram of the number of adult patients receiving bridging support between 1 April 2021 and 31 March 2025, which is the cohort used for most of the outcome analyses, and which outcome section they are included in depending on their device history. This includes all patients in the long-term bridging, short-term bridging, and TAH outcomes sections as detailed also in **Table A1.1**. In total, 629 adult patients received bridging support in this period, of which 201 received only long-term support, 405 received only short-term support, and 23 received both long-term and short-term support.

Figure 2.7 Flow diagram of adult patients receiving bridging support, 1 April 2021 – 31 March 2025

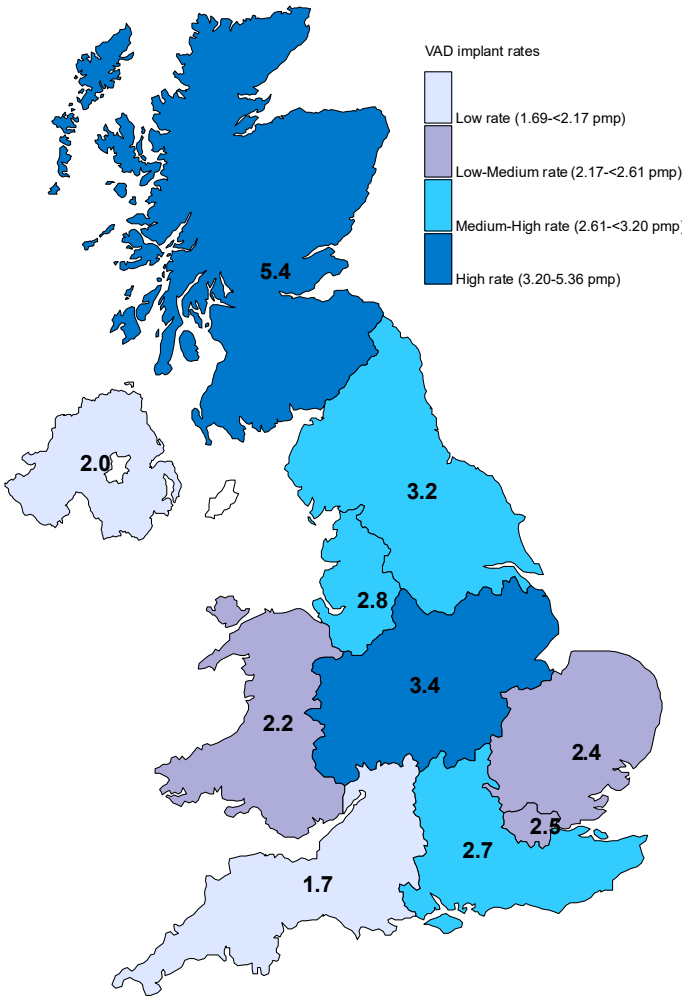


[1] Includes patients whose first long-term or short-term device implant occurred in the period
[2] Section 4.5 uses a wider time period of implants; 1 April 2017 – 31 March 2025
[3] 5 year survival from implant in section 4.6 uses implants during 1 April 2017 – 31 March 2021
[4] Section 4.6 presents TAH activity across the decade; 1 April 2016 – 31 March 2026

Figure 2.8 shows the number of patients receiving MCS as a bridge to heart transplant per million population (pmp) between 1 April 2025 and 31 March 2026, by country/NHS region of patient residence. Overall, the number of patients receiving MCS was 3.0 pmp of the UK.

Since there will inevitably be some random variation in rates between areas, the systematic 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. The larger the SCV the greater the evidence of a high level of systematic variation between areas. Implant rates yielded an SCV of 0 (p-value = >0.999). 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, there is 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 implantation such as age and sex. Therefore, these results should be interpreted with caution.

Figure 2.8 Number of patients receiving MCS as a bridge to heart transplantation per million population (pmp) in the UK, 1 April 2025 - 31 March 2026, by country/NHS region of patient residence



Country/ NHS region	Patients	(pmp)
North East and Yorkshire	27	(3.2)
North West	22	(2.8)
Midlands	38	(3.4)
East of England	16	(2.4)
London	23	(2.5)
South East	26	(2.7)
South West	10	(1.7)
England	**162**	**(2.8)**
Isle of Man	**0**	**(0.0)**
Channel Islands	**0**	**(0.0)**
Wales	**7**	**(2.2)**
Scotland	**30**	**(5.4)**
Northern Ireland	**4**	**(2.0)**
TOTAL[1]	**207**	**(3.0)**

[1] Excludes 1 recipient residing in the Republic of Ireland and 2 NHS Group 2 patients; includes 4 recipients with unknown postcode

ADULT LONG-TERM DEVICES USED FOR BRIDGING

Activity

3 Long-term bridging devices in adults

This section considers all patients who received a long-term device as a bridge to heart transplantation. All figures and tables in this section present information on a per implant basis as opposed to per patient, so if a single patient had more than one long-term device implant in the time period, each is counted. If a patient had a previous short-term device, their long-term device is included.

Figure 3.1 shows the total number of long-term bridging device implants in the last ten years nationally by device type (long-term VAD or TAH). During 2025/2026 there were 58 implants reported; a 48% reduction from 2016/2017 and a similar number to 2024/2025. **Figure 3.2** shows the trend per centre, with Harefield and Birmingham having a marked decline in implants over the decade. Last year's activity is shown by centre and device type in **Figure 3.3**. The highest number of implants last year was performed by Newcastle.

Figure 3.1 Number of adult long-term bridging device implants in the UK, by financial year and device type, 1 April 2016 to 31 March 2026

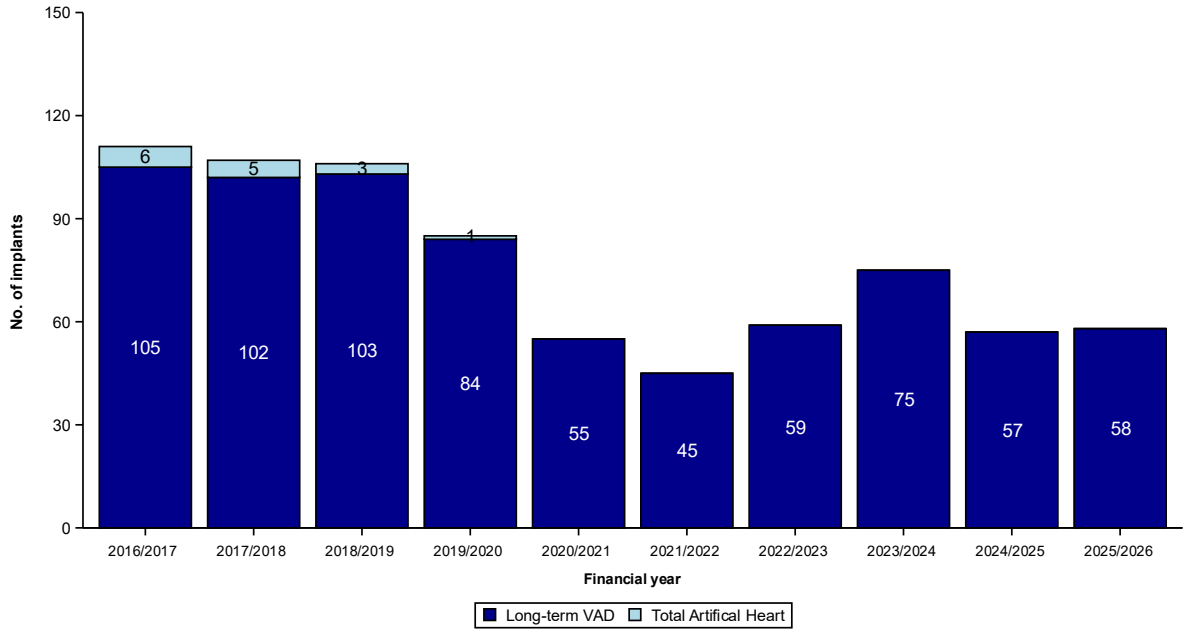


Figure 3.2 Number of adult long-term bridging device implants in the UK, by financial year, centre and device type, 1 April 2016 to 31 March 2026

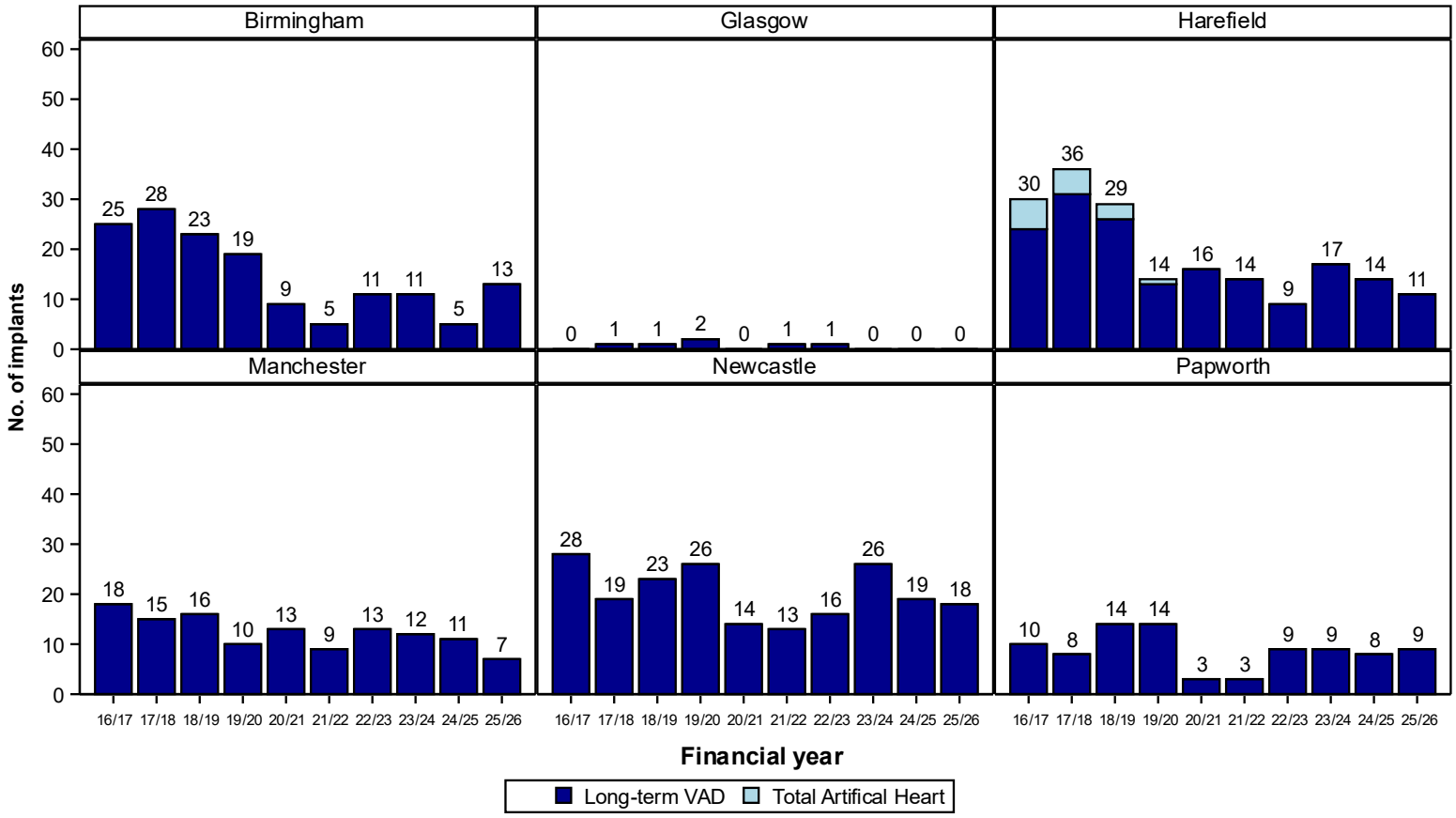


Figure 3.3 Number of adult long-term bridging device implants in the UK, by centre and device type, 1 April 2025 to 31 March 2026

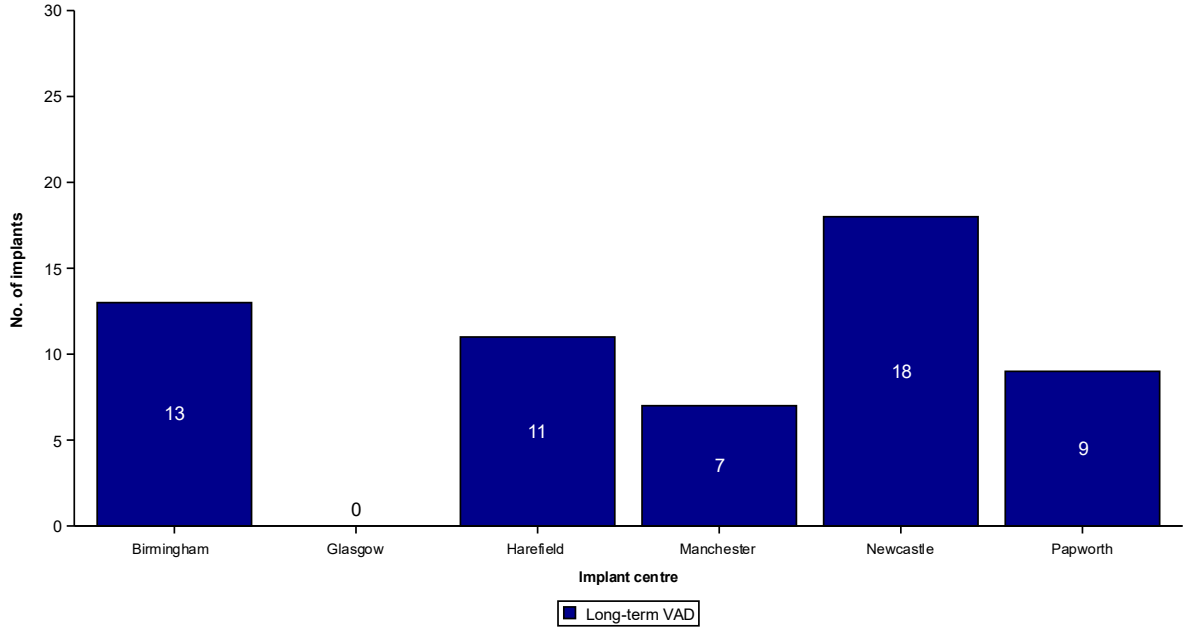
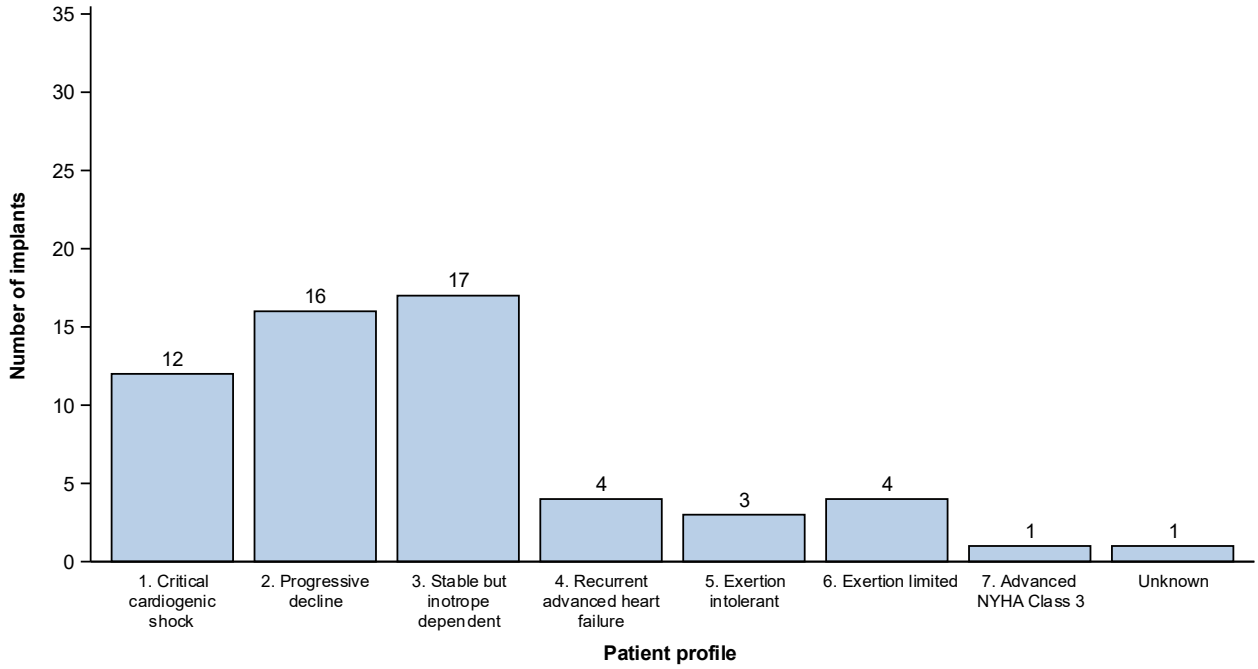


Figure 3.4 shows the INTERMACS patient profile at time of long-term VAD implant for patients implanted during 2025/2026. Level 3 (stable but inotrope dependent) was the most common, followed by levels 2 (progressive decline) and 1 (critical cardiogenic shock).

Figure 3.4 INTERMACS patient profile of adult patients receiving long-term bridging device implants during 1 April 2025 – 31 March 2026



ADULT LONG-TERM DEVICES USED FOR BRIDGING

Patient Outcomes



4 Outcomes for adult patients with long-term bridging devices

This section only considers patients whose first long-term device was a continuous-flow long-term VAD and was implanted between 1 April 2021 and 31 March 2025. Patients who received prior short-term support are included. All patients had follow-up information available (as detailed in **Table A1.3** in Appendix A1). Patients are analysed on a per-patient basis and patients who received a Total Artificial Heart are considered separately in Section 4.6.

4.1 Demographic characteristics

The demographic characteristics of the 224 patients analysed in this section are shown below in **Table 4.1**, by centre and overall. Nationally, 81% of patients were male, the median age was 54 years and 99% of patients received HeartMate 3. Note that there is missing data for some characteristics, such as BMI, and some summary statistics are not presented for Glasgow due to small numbers. Due to rounding, percentages may not sum to 100.

Table 4.1 Characteristics of adult patients who received a first long-term VAD between 1 April 2021 and 31 March 2025, by centre

		Birmingham N (%)	Glasgow N (%)	Harefield N (%)	Manchester N (%)	Newcastle N (%)	Papworth N (%)	**Total N (%)**
Number of patients		29	2	50	42	72	29	**224**
Recipient age (years)	Median (IQR) [1]	53 (48-59)	-	55 (47-60)	54 (46-61)	55 (44-60)	52 (45-59)	**54 (45-60)**
	Missing	0	0	0	0	0	0	**0**
Recipient sex	Male	23 (79)	2 (100)	39 (78)	34 (81)	61 (85)	22 (76)	**181 (81)**
	Female	6 (21)	0 (0)	11 (22)	8 (19)	11 (15)	7 (24)	**43 (19)**
Primary disease	Dilated cardiomyopathy	4 (14)	0 (0)	19 (38)	20 (48)	37 (51)	15 (52)	**95 (42)**
	Ischaemic heart disease	24 (83)	1 (50)	26 (52)	20 (48)	32 (44)	9 (31)	**112 (50)**
	Congenital heart disease	0 (0)	0 (0)	0 (0)	0 (0)	3 (4)	2 (7)	**5 (2)**
	Hypertrophic cardiomyopathy	0 (0)	0 (0)	1 (2)	1 (2)	0 (0)	2 (7)	**4 (2)**
	Valvular heart disease	0 (0)	0 (0)	1 (2)	1 (2)	0 (0)	0 (0)	**2 (1)**
	Other	1 (3)	1 (50)	3 (6)	0 (0)	0 (0)	1 (3)	**6 (3)**
INTERMACS patient profile	1. Critical cardiogenic shock	9 (31)	0 (0)	7 (14)	7 (17)	5 (7)	1 (3)	**29 (13)**
	2. Progressive decline	3 (10)	0 (0)	15 (30)	11 (26)	15 (21)	3 (10)	**47 (21)**
	3. Stable but inotrope dependent	14 (48)	1 (50)	25 (50)	16 (38)	31 (43)	6 (21)	**93 (42)**

Table 4.1 Characteristics of adult patients who received a first long-term VAD between 1 April 2021 and 31 March 2025, by centre

		Birmingham N (%)	Glasgow N (%)	Harefield N (%)	Manchester N (%)	Newcastle N (%)	Papworth N (%)	**Total N (%)**
	4. Recurrent advanced heart failure	3 (10)	1 (50)	3 (6)	7 (17)	21 (29)	2 (7)	**37 (17)**
	5. Exertion intolerant	0 (0)	0 (0)	0 (0)	1 (2)	0 (0)	6 (21)	**7 (3)**
	6. Exertion limited	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	2 (7)	**2 (1)**
	7. Advanced NYHA Class 3	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	9 (31)	**9 (4)**
Pre-implant BMI (kg/m^2)	Median (IQR)[1]	26 (24-28)	-	25 (22-30)	25 (22-29)	28 (24-31)	28 (23-31)	**26 (23-30)**
	Missing	1	0	7	1	22	7	**38**
Pre-implant creatinine (umol/l)	Median (IQR)[1]	83 (68-121)	-	110 (87-136)	78 (63-107)	112 (97-134)	115 (89-132)	**102 (77-129)**
	Missing	1	0	1	0	23	0	**25**
Pre-implant bilirubin (umol/l)	Median (IQR)[1]	18 (13-30)	-	20 (11-26)	14 (9-20)	14 (11-20)	18 (13-31)	**16 (11-25)**
	Missing	1	0	4	0	49	1	**55**
First device implanted	Heartware HVAD	0 (0)	0 (0)	1 (2)	0 (0)	2 (3)	0 (0)	**3 (1)**
	HeartMate 3	29 (100)	2 (100)	49 (98)	42 (100)	70 (97)	29 (100)	**221 (99)**
Device configuration	LVAD	28 (97)	2 (100)	50 (100)	42 (100)	69 (96)	29 (100)	**220 (98)**
	RVAD	0 (0)	0 (0)	0 (0)	0 (0)	2 (3)	0 (0)	**2 (1)**
	BiVAD	1 (3)	0 (0)	0 (0)	0 (0)	1 (1)	0 (0)	**2 (1)**
Conjunction ST RVAD support	No	21 (72)	2 (100)	45 (90)	33 (79)	58 (81)	27 (93)	**186 (83)**
	Yes	8 (28)	0 (0)	5 (10)	9 (21)	14 (19)	2 (7)	**38 (17)**
Previous transplant	No	29 (100)	2 (100)	50 (100)	42 (100)	72 (100)	29 (100)	**224 (100)**
Previous ST support	No	23 (79)	2 (100)	43 (86)	40 (95)	66 (92)	26 (90)	**200 (89)**
	Yes	6 (21)	0 (0)	7 (14)	2 (5)	6 (8)	3 (10)	**24 (11)**

[1] Medians not presented for centres with less than 10 observations reported

4.2 Rate of transplant listing

Figure 4.1 and **Table 4.2** show the rate of transplant listing for patients first implanted between 1 April 2021 and 31 March 2025, by centre. This includes listing on either the super-urgent, urgent or non-urgent heart transplant lists (whichever occurred first). Overall, 21% of patients were on the list at implant, but this proportion varied significantly across centres (chi-squared p=0.0004). The proportion still on a VAD at one year and not listed was 34% overall and was highest at Birmingham (79%). Note that Glasgow's figures are based on just two patients.

Figure 4.1 Heart transplant listing status with respect to long-term VAD implantation for adult patients receiving a first device 1 April 2021 – 31 March 2025, by centre and overall

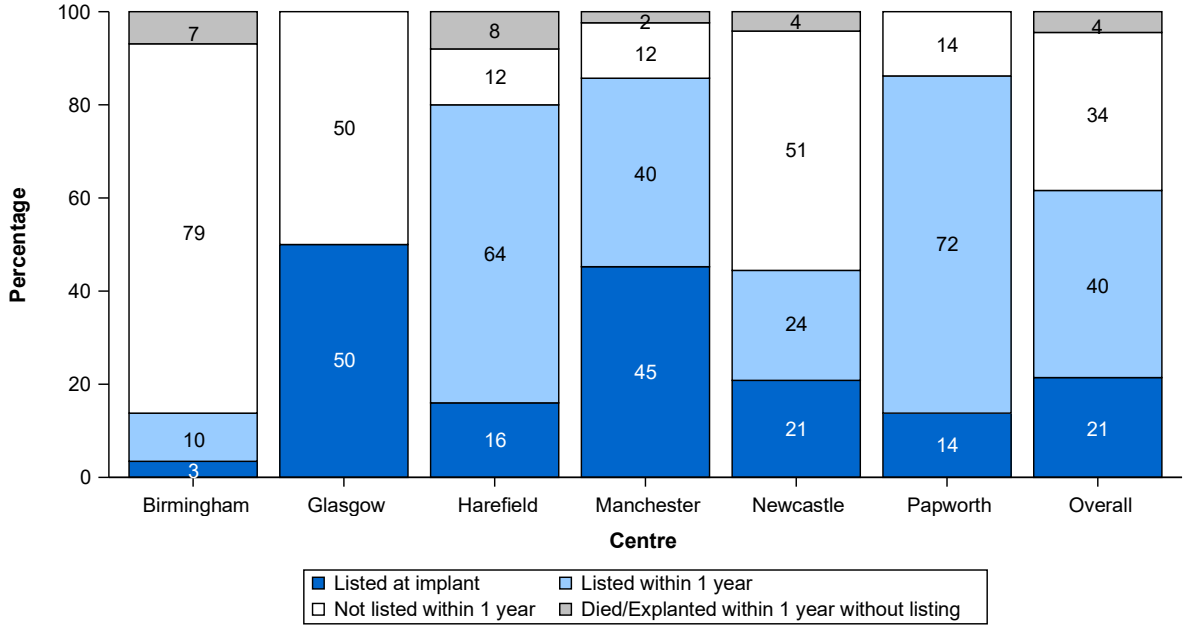


Table 4.2 Heart transplant listing status with respect to long-term VAD implantation for adult patients receiving a first device 1 April 2021 - 31 March 2025, by centre and overall

Centre	Number of patients	Listed at VAD implant	Listed within 1 year	Not listed within 1 year	Died/explanted within 1 year without listing
	N	N (%)	N (%)	N (%)	N (%)
Birmingham	29	1 (3)	3 (10)	23 (79)	2 (7)
Glasgow	2	1 (50)	0 (0)	1 (50)	0 (0)
Harefield	50	8 (16)	32 (64)	6 (12)	4 (8)
Manchester	42	19 (45)	17 (40)	5 (12)	1 (2)
Newcastle	72	15 (21)	17 (24)	37 (51)	3 (4)
Papworth	29	4 (14)	21 (72)	4 (14)	0 (0)
Overall	**224**	**48 (21)**	**90 (40)**	**76 (34)**	**10 (4)**

4.3 Competing outcomes

Whilst on VAD support, patients are susceptible to different outcomes. Death on support, transplant, and explant without transplant (with or without recovery) are all possible outcomes. **Figure 4.2** shows the cumulative incidence of each of these outcomes from time of implant, for the cohort of patients receiving a first long-term device between 1 April 2021 and 31 March 2025. This is calculated using the Aalen-Johansen method to account for competing outcomes. At time zero, 100% of patients are on support and as time passes, patients either experience death on support, transplant or explant without transplant. At any time point, the proportion alive on support plus the proportions experiencing each outcome will sum to 100%. Deaths after transplant are not counted and these patients are classed simply as transplanted. Patients who were explanted and died within 30 days of explant are counted as deaths at time of explant. Any subsequent VAD support post-explant is not counted and any such patients are classed simply as explanted. If a patient is moved from one long-term device to another without a period free of support, this counts as time on support.

For this cohort, nationally, at one year post-long-term implant, 89% of patients remained alive on support, 9% died on support and 1% received a heart transplant. By three years, the incidence of death on support rose to 16%, the incidence of transplant rose to 10%, 2% had been explanted and 72% remained alive on support.

Figure 4.2 Cumulative incidence of transplant, death and explant for adult patients implanted with a first long-term VAD, 1 April 2021 to 31 March 2025

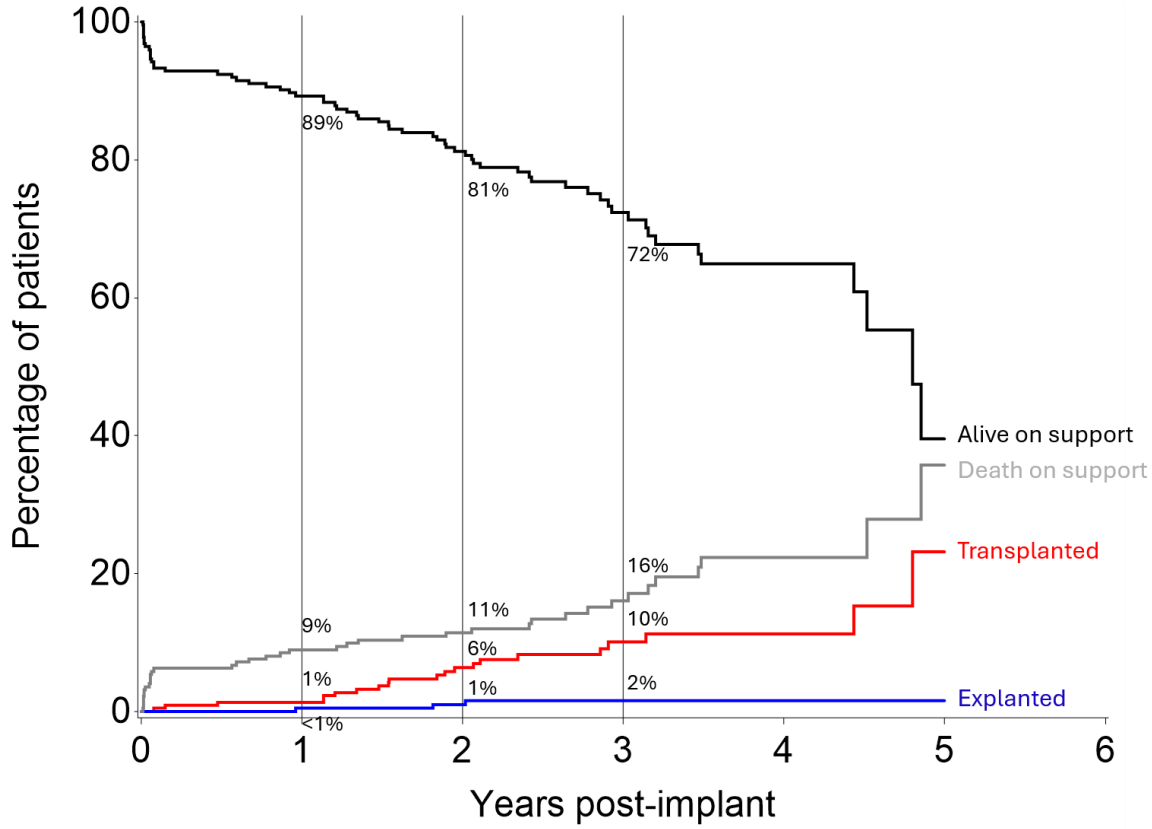


Table 4.3a and **Table 4.3b** shows the centre-specific 1-year and 3-year estimates for each competing outcome, respectively. The incidence of each outcome varies across centres.

Table 4.3a Cumulative incidence of each outcome at 1 year, by centre, for adult patients implanted with a first long-term VAD, 1 April 2021 to 31 March 2025

Centre	Number of patients	Transplanted %	Explanted %	Alive on support %	Death on support %
Birmingham	29	0	0	93	7
Glasgow	2	0	0	100	0
Harefield	50	2	0	86	12
Manchester	42	0	0	86	14
Newcastle	72	1	1	89	8
Papworth	29	3	0	97	0
Overall	**224**	**1**	**0**	**89**	**9**

Table 4.3b Cumulative incidence of each outcome at 3 years, by centre, for adult patients implanted with a first long-term VAD, 1 April 2021 to 31 March 2025

Centre	Number of patients	Transplanted %	Explanted %	Alive on support %	Death on support %
Birmingham	29	0	0	85	15
Glasgow	2	0	0	100	0
Harefield	50	16	0	64	20
Manchester	42	16	0	62	22
Newcastle	72	6	5	72	17
Papworth	29	14	0	86	0
Overall	**224**	**10**	**2**	**72**	**16**

4.4 Survival on support

This section presents Kaplan-Meier estimates of patient survival during long-term VAD support. The cohort used was extended in order to calculate 5-year survival rates, in comparison to the previous sections, but otherwise the inclusion criteria were the same (patients whose first long-term device was a continuous-flow long-term VAD and implanted between 1 April 2017 and 31 March 2025). Survival time is calculated as the time on long-term VAD support only, and death on long-term support (including patients who died within 30 days of explant) is the only event considered. Times were censored if the patient had their long-term VAD explanted for recovery, received a transplant from support or were alive on support at last report. This differs from the analysis in Section 4.5 which considers a patient's overall survival from the point of implant and includes survival time after explant or transplant, as well as time on other subsequent devices.

Figure 4.3 shows survival on long-term support for the UK adult VAD population. **Table 4.4** shows the unadjusted centre-specific survival on support rates at 30 days, 1 year, 3 years and 5 years respectively along with the national rates. There was a significant difference in unadjusted survival on support by centre at 1, 3 and 5 years (log-rank p<0.0001), with weaker evidence of a difference at 30 days (log-rank p=0.05).

Figure 4.3 Patient survival during long-term VAD support for adult patients implanted 1 April 2017 – 31 March 2025

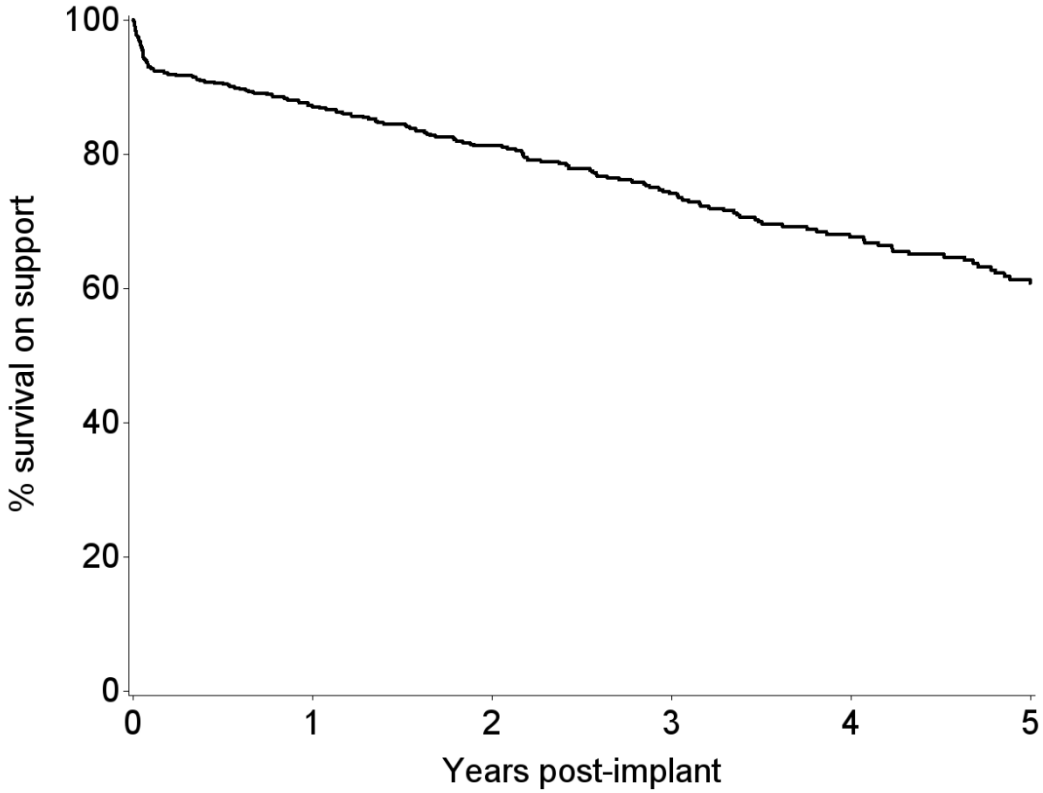


Table 4.4 Unadjusted survival on long-term VAD support, by centre, 1 April 2017 to 31 March 2025

Centre	No. of patients	% 30-day survival (95% CI)		% 1-year survival (95% CI)		% 3-year survival (95% CI)		% 5-year survival (95% CI)	
Birmingham	106	92.4	(85.3 - 96.1)	88.5	(80.6 - 93.3)	76.6	(66.9 - 83.9)	65.1	(54.2 - 74.1)
Glasgow[1]	6	-	-	-	-	-	-	-	-
Harefield	133	88.7	(81.9 - 93.0)	78.5	(70.4 - 84.7)	59.8	(49.9 - 68.3)	42.2	(30.5 - 53.4)
Manchester	95	93.7	(86.5 - 97.1)	91.6	(83.9 - 95.7)	87.2	(77.9 - 92.8)	81.3	(69.7 - 88.8)
Newcastle	150	96.0	(91.3 - 98.2)	87.6	(81.0 - 92.0)	70.1	(60.8 - 77.6)	50.6	(37.7 - 62.1)
Papworth	68	98.5	(90.0 - 99.8)	95.3	(85.9 - 98.5)	89.5	(78.0 - 95.2)	74.6	(45.1 - 89.8)
Number at risk		516		456		250		125	
Log-rank p-value		**0.05**		**<0.0001**		**<0.0001**		**<0.0001**	
UK	**558**	**93.3**	**(90.9 - 95.1)**	**87.0**	**(83.9 - 89.6)**	**74.1**	**(69.9 - 77.9)**	**60.8**	**(55.3 - 65.9)**

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

4.5 Patient survival from implant

Overall survival rates from the point of first long-term VAD implant, not censored for transplant or explant, are presented in this section. Survival data from the UK Transplant Registry were incorporated, as was any additional survival time recorded on the MCS Database for patients who were explanted. Time on additional devices is also counted, for instance if a patient had a period of long-term support, then a period of short-term support, all this time is included. Times are censored if the patient was still alive at last known event or follow-up.

Survival rates are calculated using the Kaplan-Meier method and are based on those patients recorded as receiving a first device between 1 April 2021 and 31 March 2025 for 30-day and 1-year survival, and between 1 April 2019 and 31 March 2023 for 3-year survival, while 5-year survival rates are based on patients receiving a first device between 1 April 2017 and 31 March 2021.

In **Tables 4.5-4.8** and **Figures 4.4-4.7** the centre-specific survival rates are presented for 30 days, 1 year, 3 years and 5 years respectively. The survival rates are compared with the national rate and the uncertainty around this rate using funnel plots, where outliers appear outside of the funnels; rates above the funnel are significantly high while rates below the funnel are significantly low. Rates for Glasgow are not included due to low activity.

The centre-specific rates are not adjusted for differences in risk between patients treated at different centres. These differences can be seen for the 30-day and 1-year survival rates cohort at the start of this section in **Table 4.1** which displays baseline characteristics for implants between 1 April 2021 and 31 March 2025 (including the number of patients who received prior short-term support).

The unadjusted centre-specific 30-day survival rates for patients implanted between 1 April 2021 and 31 March 2025 are shown in **Table 4.5** and **Figure 4.4**. The rate for Papworth exceeds the upper 99.8% confidence limit, indicating a higher unadjusted rate than the national rate. All other centres were consistent with the national rate of 93.8%.

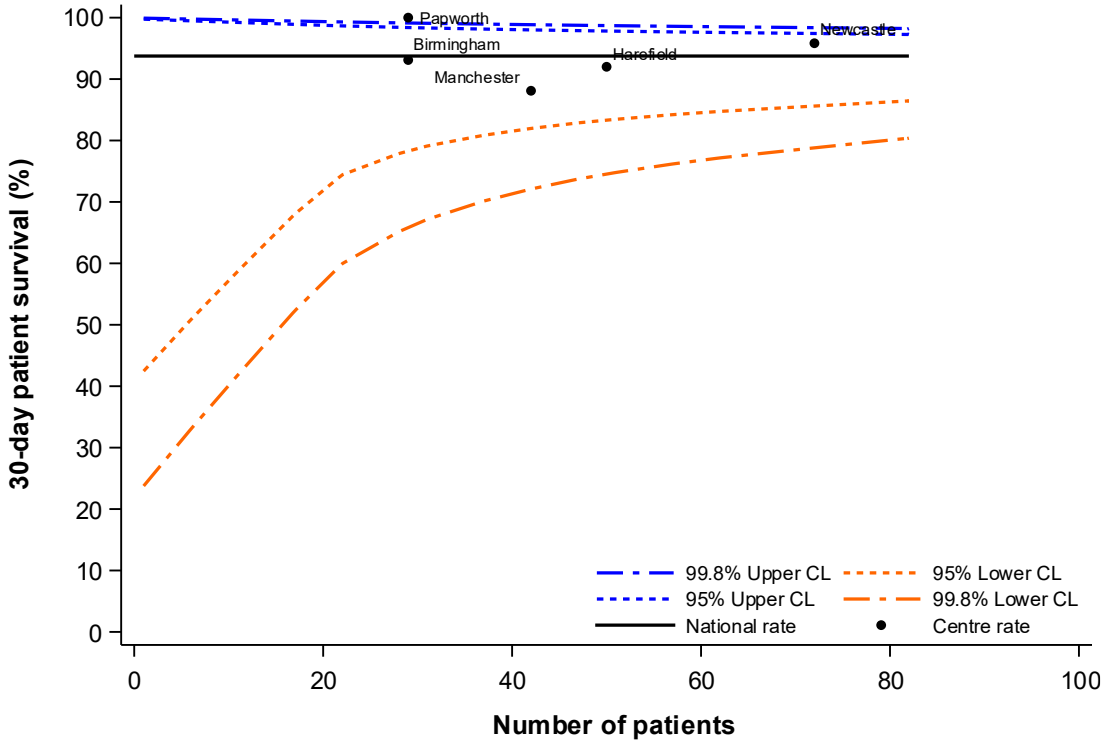
Table 4.5 30-day patient survival rates after long-term VAD implant for adult patients implanted 1 April 2021 - 31 March 2025, by centre

Centre	Number of patients	% 30-day survival (95% CI) Unadjusted	
Birmingham	29	93.1	(75.1 - 98.2)
Glasgow[1]	2	-	-
Harefield	50	92.0	(80.1 - 96.9)
Manchester	42	88.1	(73.7 - 94.9)
Newcastle	72	95.8	(87.6 - 98.6)
Papworth	29	100	-
UK	**224**	**93.8**	**(89.7 - 96.3)**

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

Figure 4.4 Unadjusted 30-day patient survival rates after long-term VAD implant for adult patients implanted 1 April 2021 - 31 March 2025, by centre



The unadjusted centre-specific 1-year survival rates are shown in **Table 4.6** and **Figure 4.5**. The rate for Papworth exceeds the upper 99.8% confidence limit, indicating a higher unadjusted rate than the national rate. All other centres were consistent with the national rate of 90.2%.

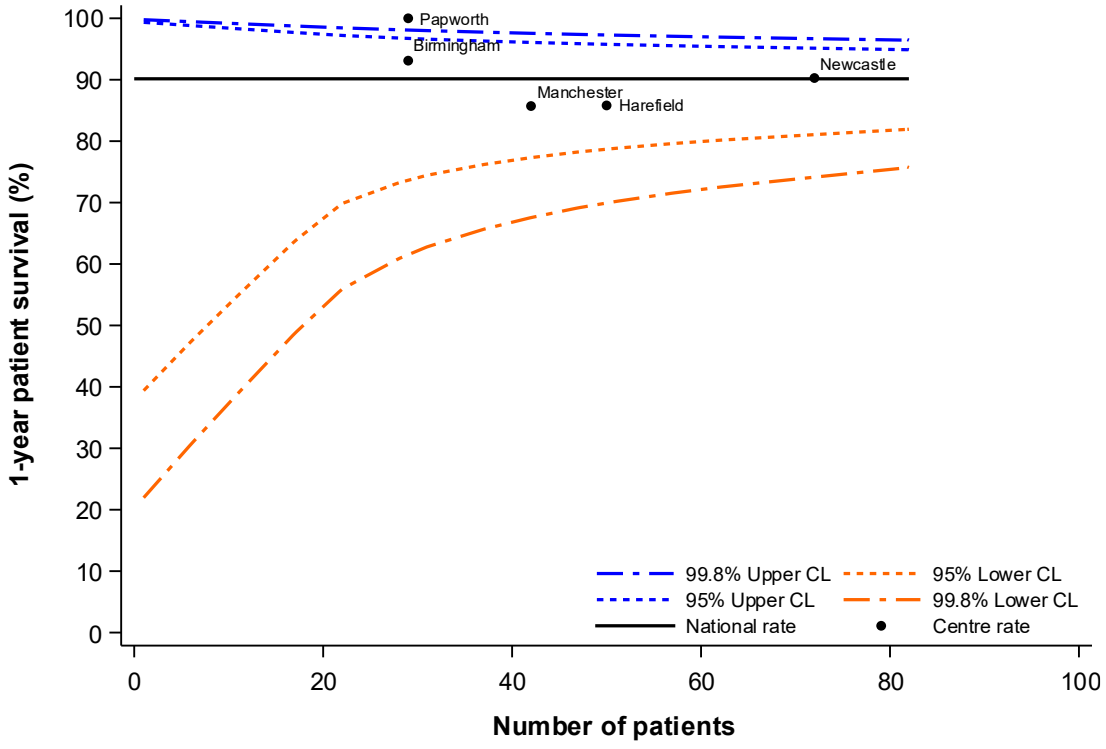
Table 4.6 1-year patient survival rates after long-term VAD implant for adult patients implanted 1 April 2021 - 31 March 2025, by centre

Centre	Number of patients	% 1-year survival (95% CI) Unadjusted	
Birmingham	29	93.1	(75.1 - 98.2)
Glasgow[1]	2	-	-
Harefield	50	85.8	(72.5 - 93.0)
Manchester	42	85.7	(70.9 - 93.3)
Newcastle	72	90.3	(80.7 - 95.2)
Papworth	29	100	-
UK	**224**	**90.2**	**(85.4 - 93.4)**

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

Figure 4.5 Unadjusted 1-year survival rates after long-term VAD implant for adult patients implanted 1 April 2021 - 31 March 2025, by centre



The unadjusted centre-specific 3-year survival rates for patients implanted between 1 April 2019 and 31 March 2023 are shown in **Table 4.7** and **Figure 4.6**. The rate for Manchester exceeds the upper 99.8% confidence limit and the rate for Papworth exceeds the upper 95% confidence limit, indicating higher unadjusted rates than the national rate, while the rate for Harefield was below the lower 95% confidence limit, indicating a lower unadjusted rate than the national rate. Birmingham and Newcastle's rates were consistent with the national rate of 73.1%.

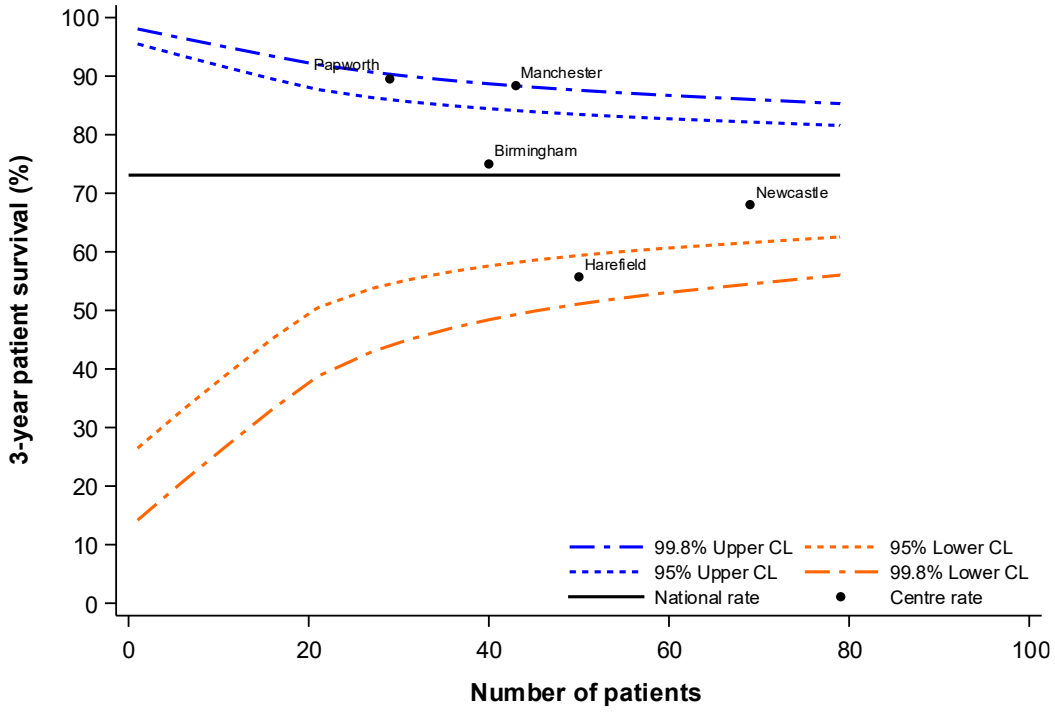
Table 4.7 3-year patient survival rates after long-term VAD implant for adult patients implanted 1 April 2019 - 31 March 2023, by centre

Centre	Number of patients	% 3-year survival (95% CI) Unadjusted	
Birmingham	40	75.0	(58.5 - 85.7)
Glasgow[1]	4	-	-
Harefield	50	55.7	(40.9 - 68.2)
Manchester	43	88.4	(74.3 - 95.0)
Newcastle	69	68.1	(55.7 - 77.7)
Papworth	29	89.5	(70.9 - 96.5)
UK	**235**	**73.1**	**(66.9 - 78.3)**

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

Figure 4.6 Unadjusted 3-year patient survival rates after long-term VAD implant for adult patients implanted 1 April 2019 – 31 March 2023, by centre



The unadjusted centre-specific 5-year survival rates for patients implanted between 1 April 2017 and 31 March 2021 are shown in **Table 4.8** and **Figure 4.7**. The rate for Manchester exceeds the upper 99.8% confidence limit, providing strong statistical evidence of a higher unadjusted rate than the national rate, while the rate for Harefield was below the lower 99.8% confidence limit, providing strong statistical evidence of a lower unadjusted rate than the national rate. The other centres were consistent with the national rate of 54.9%.

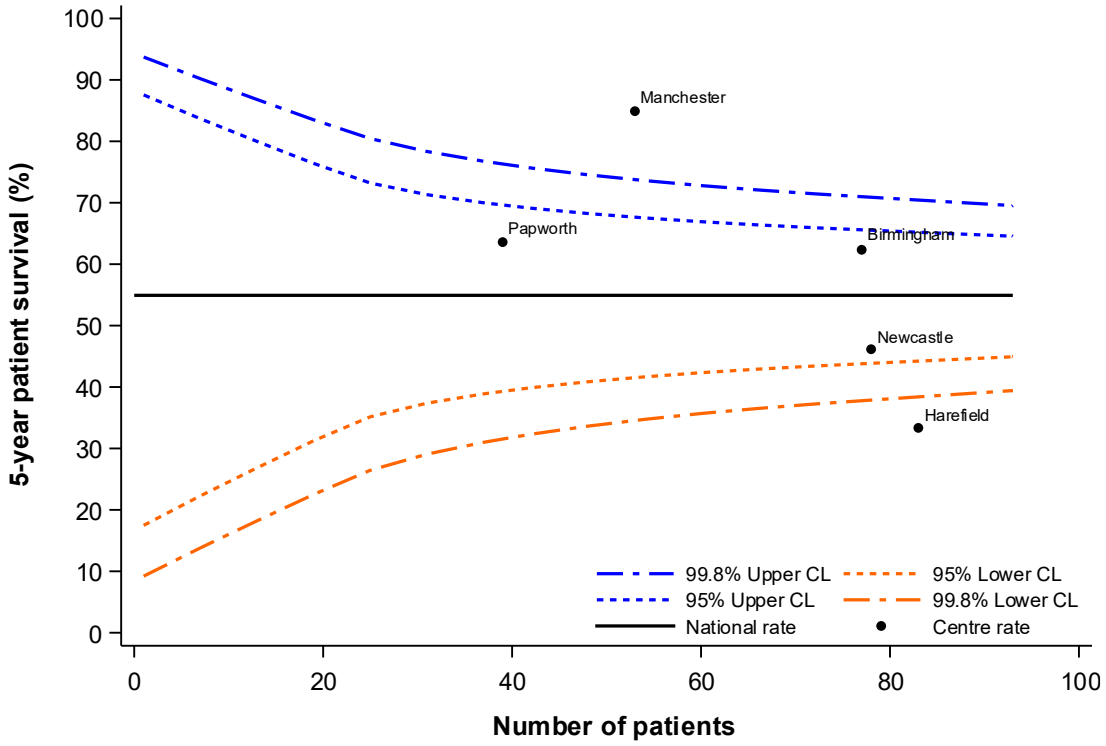
Table 4.8 5-year patient survival rates after long-term VAD implant for adult patients implanted 1 April 2017- 31 March 2021, by centre

Centre	Number of patients	% 5-year survival (95% CI) Unadjusted	
Birmingham	77	62.3	(50.5 - 72.1)
Glasgow[1]	4	-	-
Harefield	83	33.3	(23.4 - 43.6)
Manchester	53	84.9	(72.1 - 92.1)
Newcastle	78	46.2	(34.8 - 56.7)
Papworth	39	63.6	(46.4 - 76.6)
UK	**334**	**54.9**	**(49.4 - 60.1)**

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

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

Figure 4.7 Unadjusted 5-year patient survival rates after long-term VAD implant for adult patients implanted 1 April 2017- 31 March 2021, by centre



4.6 TAH outcomes

Table 4.9 shows the outcomes of the 15 patients who received a TAH as a bridge to transplant between 1 April 2016 and 31 March 2026. All patients are considered, including those who received other MCS prior to the TAH and those who received a TAH post-transplant. Only Harefield used TAH in the time period, however this is historic practice with Harefield not implanting any TAHs since April 2019. **Table 4.10** shows the 30-day and 1-year post-implant survival rates for these patients. The 30-day rate was 80.0% but this fell to 33.3% at 1 year, however caution should be taken when interpreting these rates due to the small cohort.

Table 4.9 Outcomes of TAH recipients, by implant centre, 1 April 2016 to 31 March 2026

Centre	Number of patients N	Alive on support N (%)	Died not on list N (%)	Died on list N (%)	Survived to transplant N (%)
Harefield	15	0 (0)	5 (33)	2 (13)	8 (53)
Overall	**15**	**0 (0)**	**5 (33)**	**2 (13)**	**8 (53)**

Table 4.10 Patient survival rates after TAH implant, 1 April 2016 to 31 March 2026

Number of patients	% 30-day survival (95% CI)	% 1-year survival (95% CI)
15	80 (50.0 - 93.1)	33.3 (12.2 - 56.4)

ADULT SHORT-TERM DEVICES USED FOR BRIDGING

Activity



5 Short-term bridging devices in adults

This section considers all patients who received short-term support as a bridge to heart transplant. All figures and tables present information on a per implant basis as opposed to per patient, so if a single patient had more than one short-term device implant in the time period, each one is counted.

Figure 5.1 shows the total number of short-term bridging device implants over the last ten years nationally by device type (ECMO or short-term VAD). During 2025/2026 there were 188 implants: 13% greater than 2024/2025. Over the decade there have been more short-term VAD implants than ECMO procedures, however, around a quarter of the short-term VAD implants were reported to have involved some form of conjunction ECMO (either transient or ongoing). **Figure 5.2** shows the trend per centre, with most centres experiencing an increase over the decade in the number of short-term device implants. Last year's implant activity is shown by centre and device type in **Figure 5.3**; the highest number of short-term implants were at Birmingham.

Figure 5.1 Number of adult short-term bridging device implants in the UK, by financial year and device type, 1 April 2016 to 31 March 2026

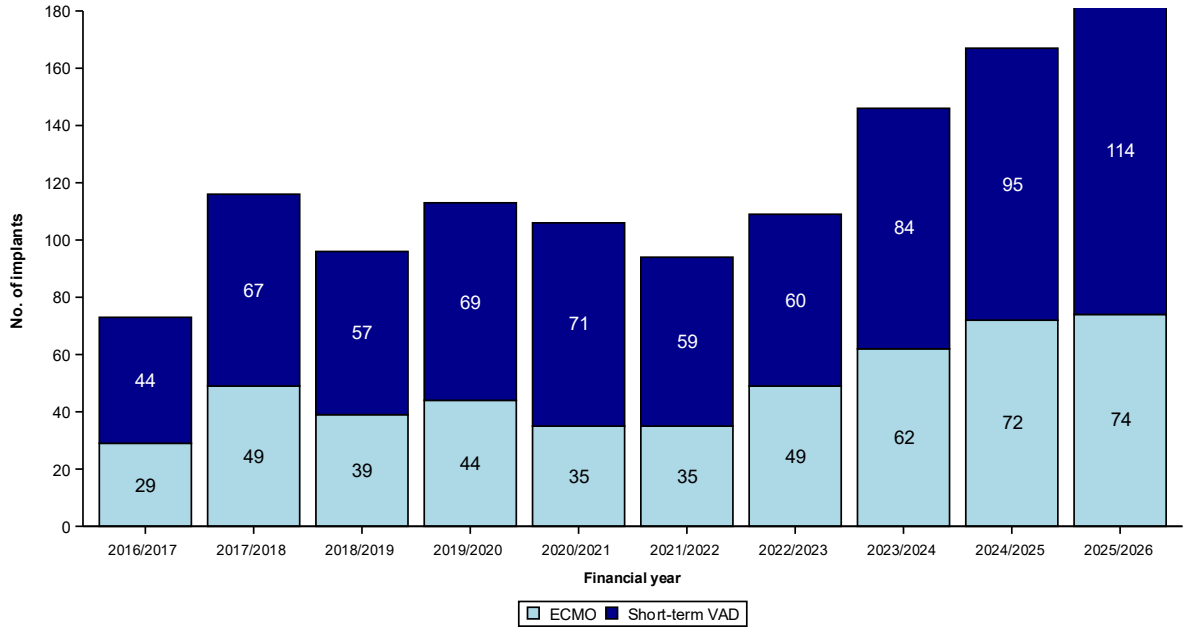


Figure 5.2 Number of adult short-term bridging device implants in the UK, by financial year, centre and device type, 1 April 2016 to 31 March 2026

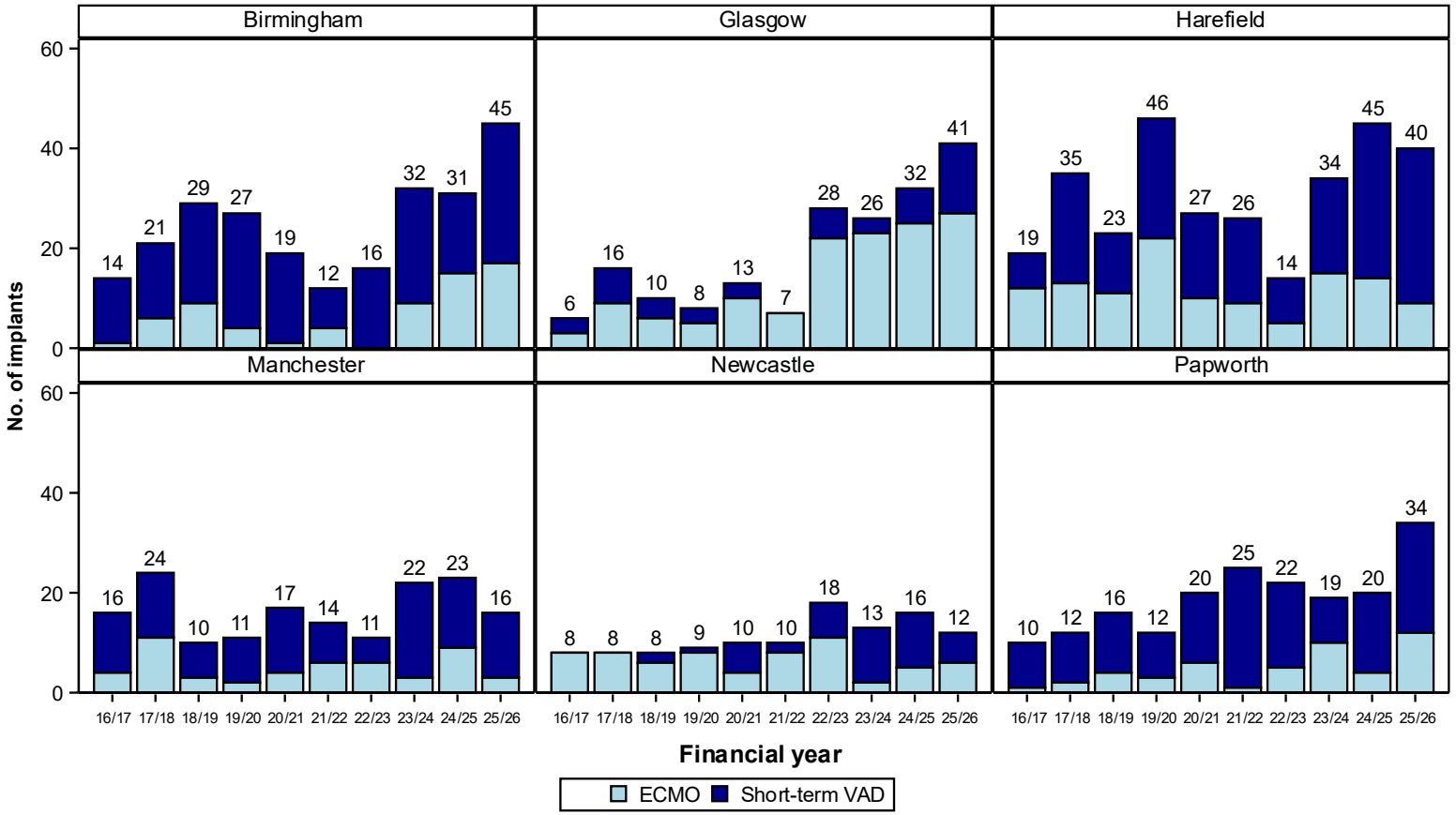


Figure 5.3 Number of adult short-term bridging device implants in the UK, by centre and device type, 1 April 2025 to 31 March 2026

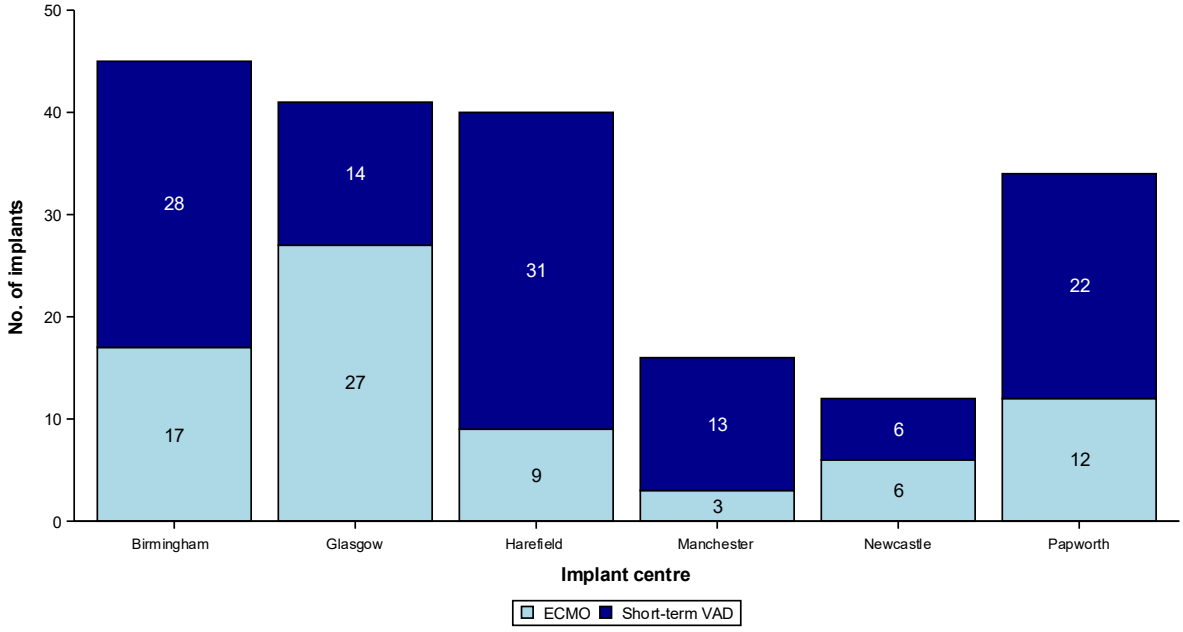
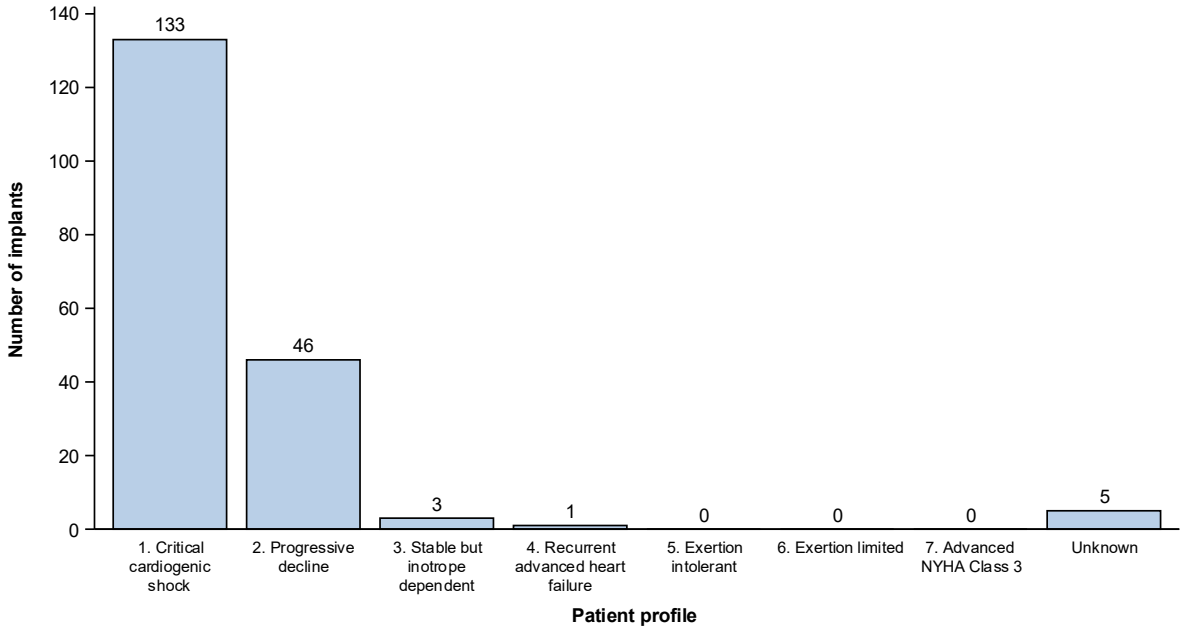


Figure 5.4 shows the INTERMACS patient profile at receipt of short-term support for patients implanted during 2025/2026. Most patients were profile 1 (critical cardiogenic shock).

Figure 5.4 INTERMACS patient profile for all short-term bridging device implants in adult patients in the UK, 1 April 2025 to 31 March 2026



ADULT SHORT-TERM DEVICES USED FOR BRIDGING

Patient Outcomes



6 Outcomes of adult patients receiving short-term bridging devices

This section only considers patients whose first short-term device (including ECMO) as a bridge to transplant was implanted between 1 April 2021 and 31 March 2025. Patients who also received long-term support are included, apart from in Section 6.5 which considers patients who received short-term support only. Patients are analysed on a per-patient basis, as opposed to per implant.

6.1 Demographic characteristics

The demographic characteristics of the 428 patients analysed in **Sections 6.2-6.4** are shown below in **Table 6.1**, by centre and overall. Nationally, 75% of patients were male, the median age was 47 years, 39% of patients received peripheral ECMO as their first device and 5% were bridged to a long-term device. Note that for some characteristics, particularly pre-implant lactate, there is a high proportion of missing data. Also, due to rounding, percentages may not sum to 100.

Table 6.1 Characteristics of adult patients who received a first short-term bridging device between 1 April 2021 and 31 March 2025, by centre

		Birmingham N (%)	Glasgow N (%)	Harefield N (%)	Manchester N (%)	Newcastle N (%)	Papworth N (%)	**Total N (%)**
Number of patients		76	82	88	61	49	72	**428**
Recipient age (years)	Median (IQR)	52 (44-58)	55 (39-61)	43 (28-53)	37 (31-44)	46 (40-54)	45 (30-55)	**47 (35-56)**
	Missing	0	0	0	0	0	0	**0**
Recipient sex	Male	61 (80)	62 (76)	67 (76)	39 (64)	40 (82)	53 (74)	**322 (75)**
	Female	15 (20)	19 (23)	21 (24)	22 (36)	9 (18)	19 (26)	**105 (25)**
	Unknown	0 (0)	1 (1)	0 (0)	0 (0)	0 (0)	0 (0)	**1 (0)**
Primary disease	Dilated cardiomyopathy	31 (41)	12 (15)	48 (55)	34 (56)	15 (31)	45 (63)	**185 (43)**
	Ischaemic heart disease	30 (39)	55 (67)	25 (28)	14 (23)	15 (31)	13 (18)	**152 (36)**
	Congenital heart disease	1 (1)	0 (0)	3 (3)	0 (0)	5 (10)	1 (1)	**10 (2)**
	Hypertrophic cardiomyopathy	2 (3)	2 (2)	0 (0)	0 (0)	2 (4)	2 (3)	**8 (2)**
	Restrictive cardiomyopathy	1 (1)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	**1 (0)**
	Valvular heart disease	3 (4)	1 (1)	3 (3)	4 (7)	1 (2)	3 (4)	**15 (4)**
	Infiltrative heart muscle disease	2 (3)	2 (2)	1 (1)	0 (0)	0 (0)	2 (3)	**7 (2)**
	Other	4 (5)	6 (7)	7 (8)	9 (15)	6 (12)	4 (6)	**36 (8)**
	Unknown	2 (3)	4 (5)	1 (1)	0 (0)	5 (10)	2 (3)	**14 (3)**

Table 6.1 Characteristics of adult patients who received a first short-term bridging device between 1 April 2021 and 31 March 2025, by centre

		Birmingham N (%)	Glasgow N (%)	Harefield N (%)	Manchester N (%)	Newcastle N (%)	Papworth N (%)	**Total N (%)**
INTERMACS patient profile	1. Critical cardiogenic shock	61 (80)	63 (77)	77 (88)	48 (79)	33 (67)	33 (46)	**315 (74)**
	2. Progressive decline	13 (17)	14 (17)	9 (10)	5 (8)	14 (29)	34 (47)	**89 (21)**
	3. Stable but inotrope dependent	2 (3)	4 (5)	0 (0)	1 (2)	2 (4)	2 (3)	**11 (3)**
	4. Recurrent advanced heart failure	0 (0)	0 (0)	1 (1)	4 (7)	0 (0)	1 (1)	**6 (1)**
	5. Exertion intolerant	0 (0)	0 (0)	1 (1)	0 (0)	0 (0)	0 (0)	**1 (0)**
	6. Exertion limited	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	**0 (0)**
	7. Advanced NYHA Class 3	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	**0 (0)**
	Unknown	0 (0)	1 (1)	0 (0)	3 (5)	0 (0)	2 (3)	**6 (1)**
First device implanted	Percutaneous VAD	17 (22)	2 (2)	24 (27)	1 (2)	22 (45)	7 (10)	**73 (17)**
	Ventricular assist (Centrimag)	32 (42)	5 (6)	26 (30)	36 (60)	1 (2)	46 (66)	**146 (34)**
	Paracorporeal devices	0 (0)	0 (0)	0 (0)	0 (0)	1 (2)	0 (0)	**1 (0)**
	Peripheral ECMO	25 (33)	60 (74)	36 (41)	11 (18)	23 (47)	12 (17)	**167 (39)**
	Central ECMO	2 (3)	14 (17)	2 (2)	12 (20)	2 (4)	5 (7)	**37 (9)**
	Other[1]	0 (0)	1 (1)	0 (0)	1 (2)	0 (0)	2 (3)	**4 (1)**
Previous long-term support	No	76 (100)	82 (100)	87 (99)	60 (98)	46 (94)	72 (100)	**423 (99)**
	Yes	0 (0)	0 (0)	1 (1)	1 (2)	3 (6)	0 (0)	**5 (1)**
Bridged to long-term support	No	70 (92)	82 (100)	83 (94)	59 (97)	43 (88)	69 (96)	**406 (95)**
	Yes	6 (8)	0 (0)	5 (6)	2 (3)	6 (12)	3 (4)	**22 (5)**
Pre-implant creatinine (umol/l)	Median (IQR)[2]	128 (92-163)	126 (96-186)	119 (93-149)	119 (85-149)	-	113 (91-148)	**122 (91-162)**
	Missing	8	36	29	24	41	5	**143**
Pre-implant bilirubin (umol/l)	Median (IQR)[2]	37 (21-56)	14 (8-24)	19 (13-34)	28 (15-49)	-	29 (15-55)	**26 (14-44)**
	Missing	8	40	44	28	42	9	**171**
Pre-implant lactate (mmol/l)	Median (IQR)[2]	3 (2-5)	3 (1-6)	2 (1-5)	2 (1-3)	-	3 (2-6)	**3 (1-5)**
	Missing	16	44	41	40	43	49	**233**
Pre-implant cardiac arrest	No	70 (92)	44 (54)	71 (81)	49 (80)	38 (78)	52 (72)	**324 (76)**
	Yes	6 (8)	37 (45)	17 (19)	12 (20)	11 (22)	18 (25)	**101 (24)**
	Unknown	0 (0)	1 (1)	0 (0)	0 (0)	0 (0)	2 (3)	**3 (1)**

Table 6.1 Characteristics of adult patients who received a first short-term bridging device between 1 April 2021 and 31 March 2025, by centre

		Birmingham N (%)	Glasgow N (%)	Harefield N (%)	Manchester N (%)	Newcastle N (%)	Papworth N (%)	**Total N (%)**
Pre-implant intubation and ventilation	No	70 (92)	67 (83)	63 (72)	31 (51)	38 (78)	63 (90)	**332 (78)**
	Yes	6 (8)	14 (17)	25 (28)	30 (49)	11 (22)	7 (10)	**93 (22)**
	Unknown	0 (0)	1 (1)	0 (0)	0 (0)	0 (0)	2 (3)	**3 (1)**
Pre-implant renal replacement therapy	No	75 (99)	78 (95)	81 (92)	54 (89)	33 (67)	68 (94)	**389 (91)**
	Yes	1 (1)	4 (5)	7 (8)	7 (11)	16 (33)	4 (6)	**39 (9)**

[1] 3 were ECMO implants at a non-transplant centre, for which the ECMO type is unknown, and 1 was reported as a Koji device
[2] Medians not presented for centres with less than 10 observations reported

6.2 Duration on support

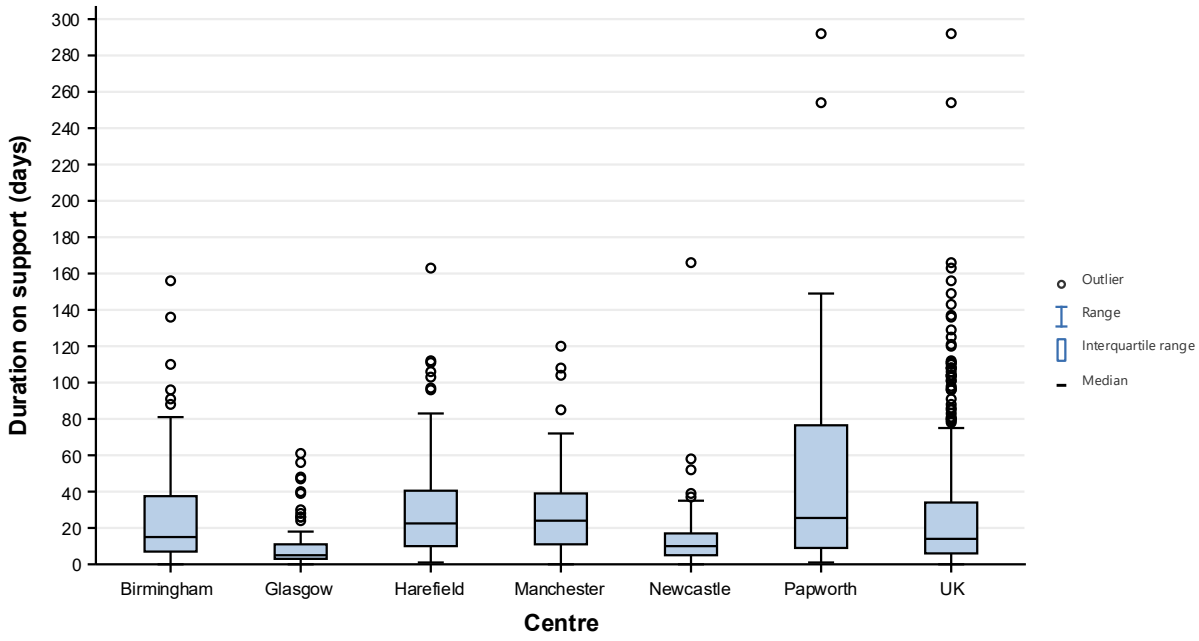
Table 6.2 and **Figure 6.1** summarise the duration on short-term support for patients implanted between 1 April 2021 and 31 March 2025, both nationally and by centre. The median and interquartile range are calculated directly from the observed time each patient spent on short-term support; patients still on support at the time of analysis are included with their time on support up to their latest follow-up (see Appendix A2). Transplant, explant, death or transfer to a long-term device signify end of short-term support. Time on all devices in the first episode of continuous short-term support is counted and days on two devices at the same time are counted only once. Nationally, the median time on support was 14 days (interquartile range 6 - 34 days) and ranged from 5 days at Glasgow to 26 days at Papworth. **Figure 6.1** presents these data as boxplots.

Table 6.2 Median duration on short-term bridging device support for adult patients implanted between 1 April 2021 and 31 March 2025, by centre

Centre	No. of patients	Median (days)	Interquartile range (days)
Birmingham	76	15	7 - 38
Glasgow	82	5	3 - 11
Harefield	88	23	10 - 41
Manchester	61	24	11 - 39
Newcastle	49	10	5 - 17
Papworth	72	26	9 - 77
Overall	**428**[1]	**14**	**6 - 34**

[1] Includes 15 patients whose episode of support had not ended at the time of analysis

Figure 6.1 Boxplots of duration on short-term bridging device support for adult patients implanted between 1 April 2021 and 31 March 2025



6.3 Rate of transplant listing

Figure 6.2 and **Table 6.3** show the rate of transplant listing for patients first implanted between 1 April 2021 and 31 March 2025, by centre. This includes listing on the super-urgent, urgent or non-urgent heart transplant lists (whichever occurred first) and considers time on long-term support if bridged to a long-term device. Overall, 19% of patients were on the list at time of short-term implant, which was a slightly smaller proportion than that observed for long-term implants (21%). This proportion ranged from 10% at Manchester to 25% at Birmingham; however, there was no statistically significant difference between centres (p=0.131). The proportion that died or were explanted within 1 month without listing was 41% overall and ranged significantly across centres (chi-squared p=0.0005).

Figure 6.2 Heart transplant listing status with respect to short-term device implantation for adult patients receiving a first bridging device 1 April 2021 – 31 March 2025, by centre and overall

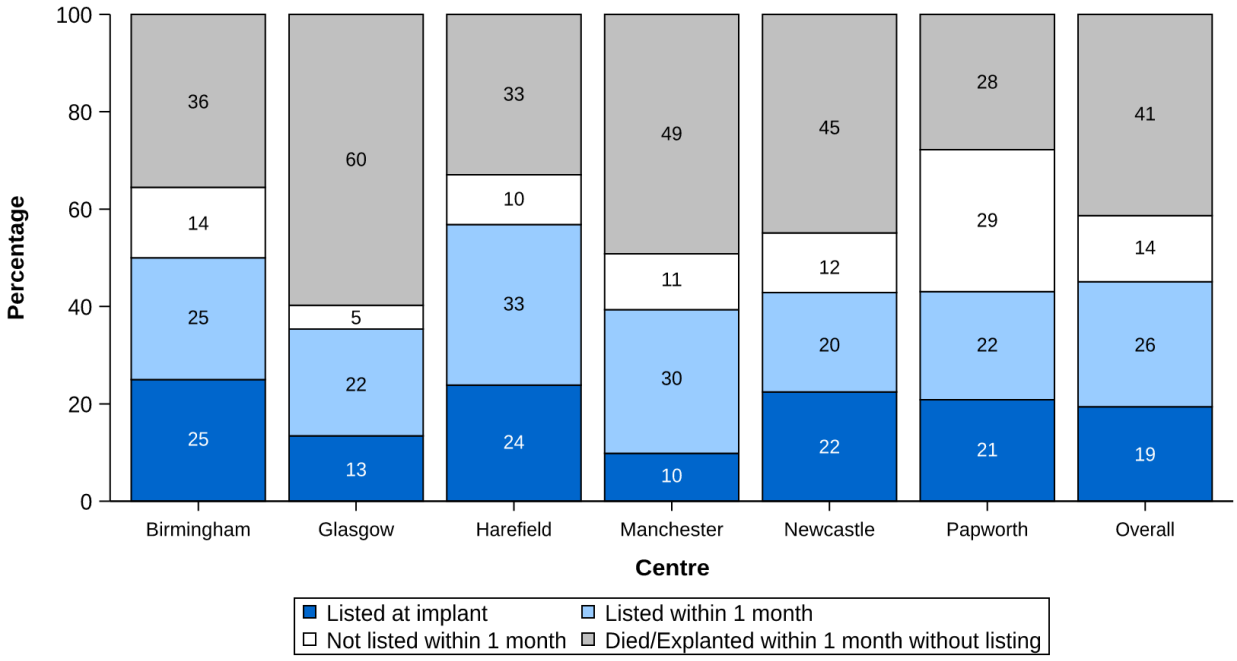


Table 6.3 Heart transplant listing status with respect to short-term device implantation for adult patients receiving a first bridging device 1 April 2021 - 31 March 2025, by centre and overall

Centre	Number of patients N	Listed at implant N (%)	Listed within 1 month N (%)	Not listed within 1 month N (%)	Died/explanted within 1 month without listing N (%)
Birmingham	76	19 (25)	19 (25)	11 (14)	27 (36)
Glasgow	82	11 (13)	18 (22)	4 (5)	49 (60)
Harefield	88	21 (24)	29 (33)	9 (10)	29 (33)
Manchester	61	6 (10)	18 (30)	7 (11)	30 (49)
Newcastle	49	11 (22)	10 (20)	6 (12)	22 (45)
Papworth	72	15 (21)	16 (22)	21 (29)	20 (28)
Overall	**428**	**83 (19)**	**110 (26)**	**58 (14)**	**177 (41)**

6.4 Competing outcomes

Whilst on short-term support, patients are susceptible to different outcomes. Death on support, transplant, transfer to long-term support and explant without transplant are all possible outcomes. **Figure 6.3** shows the cumulative incidence of each of these outcomes from time of implant, for the cohort of adult patients receiving a first short-term device between 1 April 2021 and 31 March 2025. This is calculated using the Aalen-Johansen method to account for competing outcomes. At time zero, 100% of patients are on support and as time passes, patients either experience death on support, transplant, transfer to long-term support or explant without transplant. At any time point, the proportion alive on support plus the proportions experiencing each outcome will sum to 100%. Deaths after transplant are not counted and these patients are classed simply as transplanted. Patients who were explanted and died within 30 days of explant are counted as deaths at time of explant. Any subsequent VAD support post-explant is not counted and any such patients are classed simply as explanted. If a patient is moved from one short-term device to another without a period free of support, this counts as time on support.

For this cohort, nationally, one month after short-term device implant, 17% of patients were explanted, 29% died on short-term support, 29% remained alive on support, 21% received a transplant, and 4% were transferred to a long-term device. At two months, there was an increase in the incidence of transplant to 34% and death to 33%, leading to a reduction in the proportion that remained alive on support, down to 13%.

Figure 6.3 Cumulative incidence of transplant, death, transfer to long-term device and explant for adult patients implanted with a first short-term bridging device, 1 April 2021 to 31 March 2025

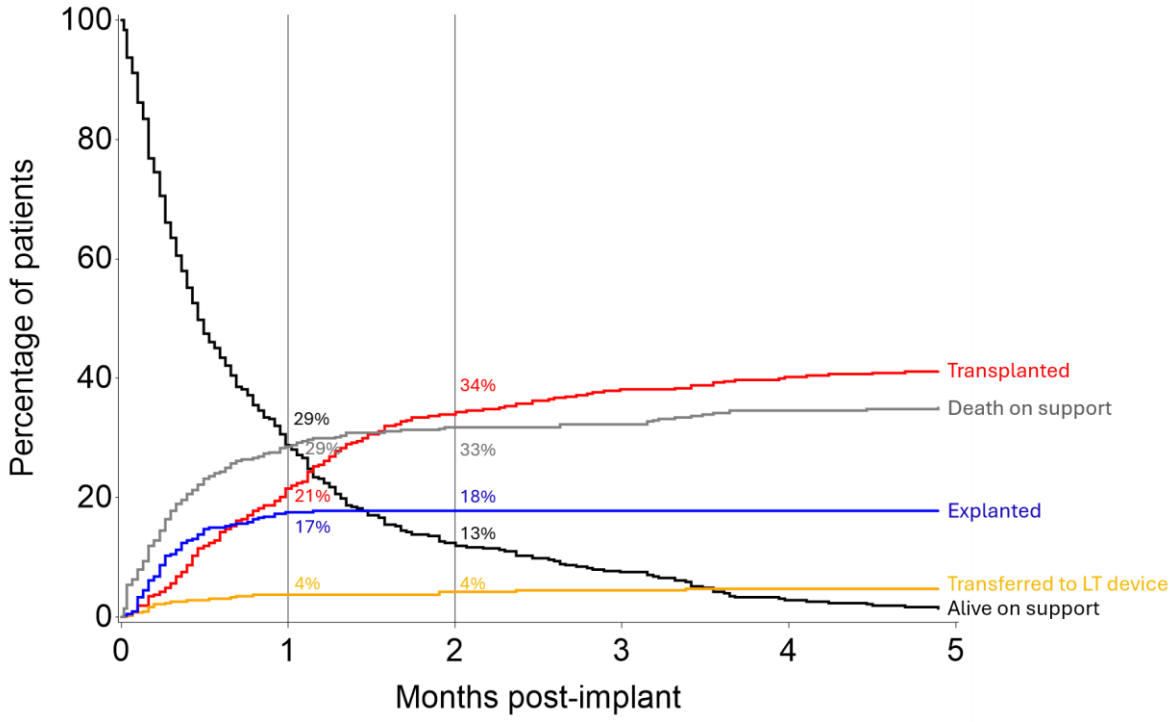


Table 6.4 shows the centre-specific 30-day estimates for each competing outcome. The incidence of each outcome varies across centres. Note that a patient may be counted as explanted but go on to have further support after a period without support, so this does not always represent recovery.

Table 6.4 Cumulative incidence of each outcome at 30 days, by centre, for adult patients implanted with a first short-term bridging device, 1 April 2021 to 31 March 2025

Centre	Number of patients	Transplanted %	Transferred to LT device %	Explanted %	Alive on support %	Death on support %
Birmingham	76	22	8	7	30	33
Glasgow	82	30	0	28	7	34
Harefield	88	19	1	26	39	15
Manchester	61	13	0	18	38	31
Newcastle	49	20	10	16	16	37
Papworth	72	21	4	6	43	26
Overall	**428**	**21**	**4**	**17**	**29**	**29**

6.5 Patient survival from implant

Overall survival rates from the point of first short-term VAD implant, not censored for transplant or explant, are presented in this section. Survival data from the UK Transplant Registry were incorporated, as was any additional survival time recorded on the MCS Database for patients who were explanted. Patients who received a short-term device as a bridge to long-term support are excluded from this analysis and instead included in Section 4.5 (as are patients who received prior long-term support). Times are censored if the patient was still alive at last known event or follow-up.

Survival rates are calculated using the Kaplan-Meier method and are based on those patients recorded as receiving a first device between 1 April 2021 and 31 March 2025. In **Tables 6.6** and **6.7** and **Figures 6.4** and **6.5** the centre-specific survival rates for implants are presented for 90 days and 1 year, respectively. The centre-specific rates are not adjusted for potential differences in risk between patients treated at different centres. These differences can be seen in **Table 6.5** which displays the baseline characteristics of the 401 patients included in this analysis. The survival rates are compared with the national rate and the uncertainty around this rate using funnel plots, where outliers appear outside of the funnels; rates above the funnel are significantly high while rates below the funnel are significantly low.

The demographic characteristics of the 401 patients in this analysis are shown below in **Table 6.5**, by centre and overall. Nationally, 74% of patients were male, the median age was 47 years and 39% of patients received peripheral ECMO as their first device. Note that for some characteristics, particularly pre-implant lactate, there is a high proportion of missing data. Also, due to rounding, percentages may not sum to 100.

Table 6.5 Characteristics of patients who received short-term support only between 1 April 2021 and 31 March 2025, by centre

		Birmingham N (%)	Glasgow N (%)	Harefield N (%)	Manchester N (%)	Newcastle N (%)	Papworth N (%)	**Total N (%)**
Number of patients		70	82	82	58	40	69	**401**
Recipient age (years)	Median (IQR)	53 (42-57)	55 (39-61)	43 (27-53)	38 (31-44)	47 (40-54)	44 (29-53)	**47 (34-56)**
	Missing	0	0	0	0	0	0	**0**
Recipient sex	Male	55 (79)	62 (76)	61 (74)	37 (64)	32 (80)	50 (72)	**297 (74)**
	Female	15 (21)	19 (23)	21 (26)	21 (36)	8 (20)	19 (28)	**103 (26)**
	Unknown	0 (0)	1 (1)	0 (0)	0 (0)	0 (0)	0 (0)	**1 (0)**
Primary disease	Dilated cardiomyopathy	30 (43)	12 (15)	45 (55)	33 (57)	9 (23)	44 (64)	**173 (43)**
	Ischaemic heart disease	25 (36)	55 (67)	22 (27)	13 (22)	12 (30)	12 (17)	**139 (35)**
	Congenital heart disease	1 (1)	0 (0)	3 (4)	0 (0)	5 (13)	0 (0)	**9 (2)**
	Hypertrophic cardiomyopathy	2 (3)	2 (2)	0 (0)	0 (0)	2 (5)	2 (3)	**8 (2)**
	Restrictive cardiomyopathy	1 (1)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	**1 (0)**
	Valvular heart disease	3 (4)	1 (1)	3 (4)	3 (5)	1 (3)	3 (4)	**14 (3)**
	Infiltrative heart muscle disease	2 (3)	2 (2)	1 (1)	0 (0)	0 (0)	2 (3)	**7 (2)**
	Other	4 (6)	6 (7)	7 (9)	9 (16)	6 (15)	4 (6)	**36 (9)**
	Unknown	2 (3)	4 (5)	1 (1)	0 (0)	5 (13)	2 (3)	**14 (3)**
INTERMACS patient profile	1. Critical cardiogenic shock	55 (79)	63 (77)	72 (88)	46 (79)	28 (70)	32 (46)	**296 (74)**
	2. Progressive decline	13 (19)	14 (17)	8 (10)	4 (7)	11 (28)	32 (46)	**82 (20)**
	3. Stable but inotrope dependent	2 (3)	4 (5)	0 (0)	1 (2)	1 (3)	2 (3)	**10 (2)**
	4. Recurrent advanced heart failure	0 (0)	0 (0)	1 (1)	4 (7)	0 (0)	1 (1)	**6 (1)**
	5. Exertion intolerant	0 (0)	0 (0)	1 (1)	0 (0)	0 (0)	0 (0)	**1 (0)**
	6. Exertion limited	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	**0 (0)**
	7. Advanced NYHA Class 3	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	**0 (0)**
	Unknown	0 (0)	1 (1)	0 (0)	3 (5)	0 (0)	2 (3)	**6 (1)**

Table 6.5 Characteristics of patients who received short-term support only between 1 April 2021 and 31 March 2025, by centre

		Birmingham N (%)	Glasgow N (%)	Harefield N (%)	Manchester N (%)	Newcastle N (%)	Papworth N (%)	**Total N (%)**
First device implanted	Percutaneous VAD	14 (20)	2 (2)	22 (27)	1 (2)	17 (43)	5 (7)	**61 (15)**
	Ventricular assist (Centrimag)	32 (46)	5 (6)	25 (30)	35 (61)	1 (3)	46 (69)	**144 (36)**
	Paracorporeal devices	0 (0)	0 (0)	0 (0)	0 (0)	1 (3)	0 (0)	**1 (0)**
	Peripheral ECMO	22 (31)	60 (74)	33 (40)	10 (18)	20 (50)	11 (16)	**156 (39)**
	Central ECMO	2 (3)	14 (17)	2 (2)	11 (19)	1 (3)	5 (7)	**35 (9)**
	Other[1]	0 (0)	1 (1)	0 (0)	1 (2)	0 (0)	2 (3)	**4 (1)**
Pre-implant creatinine (umol/l)	Median (IQR)[2]	128 (91-163)	126 (96-186)	118 (91-149)	123 (85-167)	-	111 (89-146)	**122 (91-163)**
	Missing	8	36	29	24	33	5	**135**
Pre-implant bilirubin (umol/l)	Median (IQR)[2]	37 (21-55)	14 (8-24)	20 (15-35)	32 (15-51)	-	29 (15-54)	**27 (15-45)**
	Missing	8	40	42	28	34	9	**161**
Pre-implant lactate (mmol/l)	Median (IQR)[2]	3 (2-5)	3 (1-6)	2 (1-5)	2 (1-3)	-	3 (2-6)	**3 (1-5)**
	Missing	15	44	38	37	34	48	**216**
Pre-implant cardiac arrest	No	64 (91)	44 (54)	67 (82)	48 (83)	31 (78)	50 (75)	**304 (76)**
	Yes	6 (9)	37 (46)	15 (18)	10 (17)	9 (23)	17 (25)	**94 (24)**
	Unknown	0 (0)	1 (1)	0 (0)	0 (0)	0 (0)	2 (3)	**3 (1)**
Pre-implant intubation and ventilation	No	64 (91)	67 (83)	61 (74)	30 (52)	29 (73)	60 (90)	**311 (78)**
	Yes	6 (9)	14 (17)	21 (26)	28 (48)	11 (28)	7 (10)	**87 (22)**
	Unknown	0 (0)	1 (1)	0 (0)	0 (0)	0 (0)	2 (3)	**3 (1)**
Pre-implant renal replacement therapy	No	69 (99)	78 (95)	75 (91)	51 (88)	28 (70)	65 (94)	**366 (91)**
	Yes	1 (1)	4 (5)	7 (9)	7 (12)	12 (30)	4 (6)	**35 (9)**

[1] 3 were ECMO implants at a non-transplant centre, for which the ECMO type is unknown, and 1 was reported as a Koji device
[2] Medians not presented for centres with less than 10 observations reported

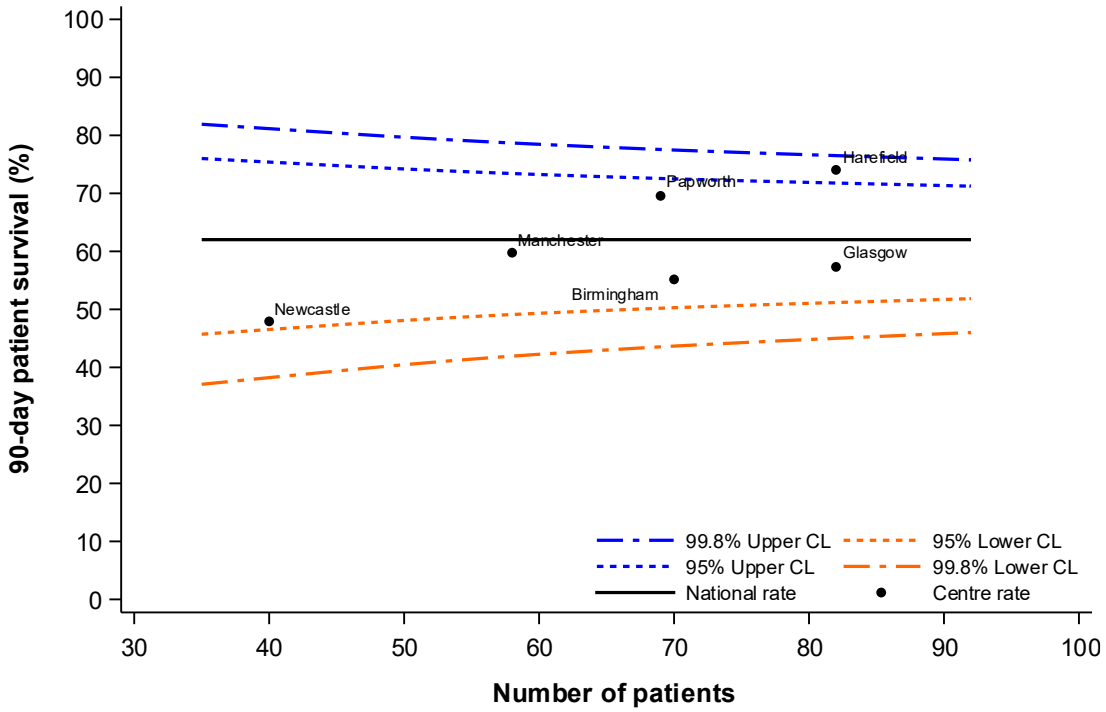
The unadjusted centre-specific 90-day survival rates for patients receiving short-term support between 1 April 2021 and 31 March 2025 are shown in **Table 6.6** and **Figure 6.4**. The national survival rate was 62.0%. The rate for Harefield exceeds the upper 95% confidence limit, indicating a higher unadjusted rate than the national rate, while all other centres lie within the 95% confidence interval indicating consistency with the national rate.

Table 6.6 90-day patient survival rates after short-term bridging device implant for adult patients implanted 1 April 2021 and 31 March 2025, by centre

Centre	Number of patients	% 90-day survival (95% CI) Unadjusted	
Birmingham	70	55.2	(42.7 - 66.0)
Glasgow	82	57.3	(45.9 - 67.2)
Harefield	82	74.0	(63.0 - 82.2)
Manchester	58	59.8	(45.9 - 71.2)
Newcastle	40	47.9	(31.4 - 62.7)
Papworth	69	69.6	(57.2 - 79.0)
UK	**401**	**62.0**	**(57.0 - 66.6)**

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 6.4 Unadjusted 90-day patient survival rates after short-term bridging device implant for adult patients implanted 1 April 2021 and 31 March 2025, by centre



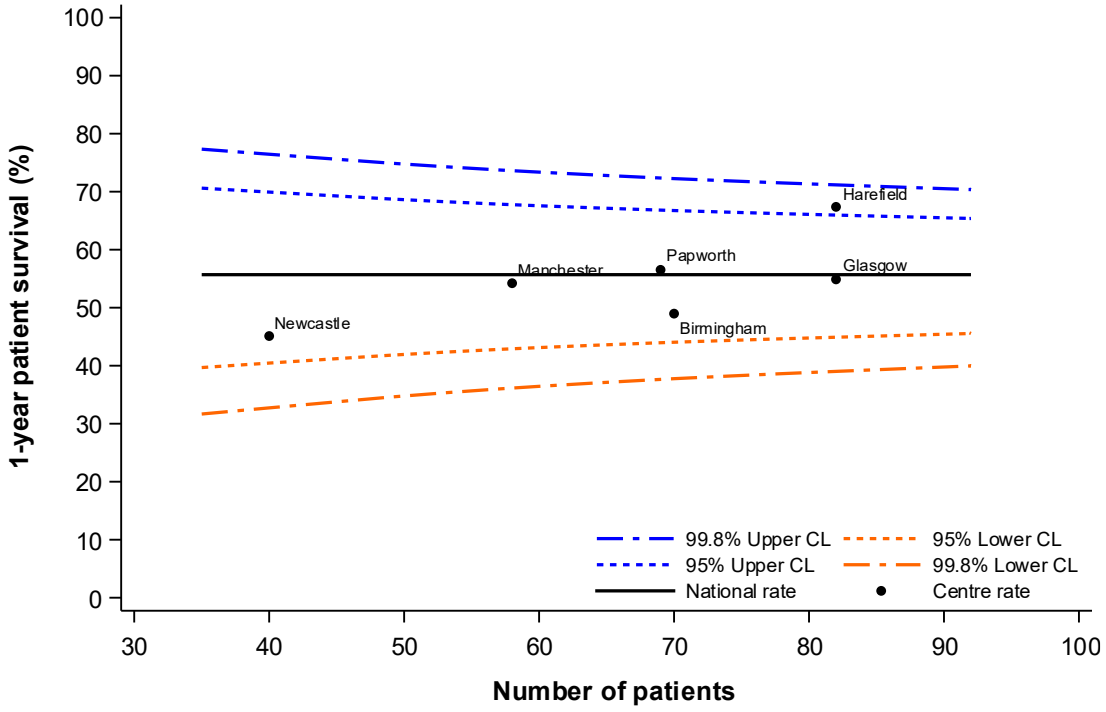
The unadjusted centre-specific 1-year survival rates are shown in **Table 6.7** and **Figure 6.5**. The national survival rate was 55.7%. Again, the rate for Harefield exceeds the upper 95% confidence limit, indicating a higher rate than the national rate, while all other centres were consistent with the national rate.

Table 6.7 1-year patient survival rates after short-term bridging device implant for adult patients implanted 1 April 2021 and 31 March 2025, by centre

Centre	Number of patients	% 1-year survival (95% CI) Unadjusted	
Birmingham	70	49.0	(36.7 - 60.2)
Glasgow	82	54.9	(43.5 - 64.9)
Harefield	82	67.4	(55.9 - 76.5)
Manchester	58	54.2	(40.4 - 66.1)
Newcastle	40	45.1	(28.9 – 60.0)
Papworth	69	56.5	(44.0 - 67.2)
UK	**401**	**55.7**	**(50.6 - 60.4)**

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 6.5 Unadjusted 1-year patient survival rates after short-term bridging device implant for adult patients implanted 1 April 2021 and 31 March 2025, by centre



ADULT SHORT-TERM DEVICES USED POST-HEART TRANSPLANT

Activity



7 Short-term post-transplant devices in adults

This section considers all patients who received short-term support within 30 days following heart transplantation. The International Society for Heart and Lung Transplantation defines primary graft dysfunction (PGD) as graft dysfunction without a discernible cause and defines severe PGD as needing MCS. Therefore, the data in this section predominantly indicates the level of severe PGD in the UK heart transplant population, but also includes a small number of patients with secondary graft dysfunction who required MCS.

All figures and tables present information on a per transplant basis; where more than one device was used after the same transplant, including devices in separate episodes of support, the transplant is counted once and its device type reflects all devices used. Short-term devices used more than 30 days post-heart transplant (rejection) are excluded (29 recorded in the time period) as are long-term devices used post-transplant (classed as bridging devices).

Figure 7.1a shows the total number of transplants requiring short-term device implants within 30 days in the last ten years, nationally, by device type (ECMO, short-term VAD and ECMO and short-term VAD). During 2025/2026 there were 64 transplants requiring support: 21% higher than 2024/2025 and 83% higher than in 2016/2017. **Figure 7.2a** shows the trend per centre and **Figure 7.3a** shows last year's activity by centre and device type, indicating that Glasgow had the highest number of transplants requiring support in 2025/2026 followed closely by Birmingham.

Figures **7.1b, 7.2b** and **7.3b** show the proportion of transplants requiring short-term support within 30 days out of the total number of adult heart transplants performed, by financial year, financial year and centre, and centre, respectively. The denominator of adult heart transplants includes both DBD and DCD heart transplants, any re-transplants, as well as any multi-organ heart transplants (but excluding heart-lung transplants). See **Section 8.4** for a breakdown of the number and proportion of adult heart transplants requiring support by donor type.

Figure 7.1a Number of adult heart transplants requiring short-term support within 30 days, by financial year and device type, 1 April 2016 to 31 March 2026

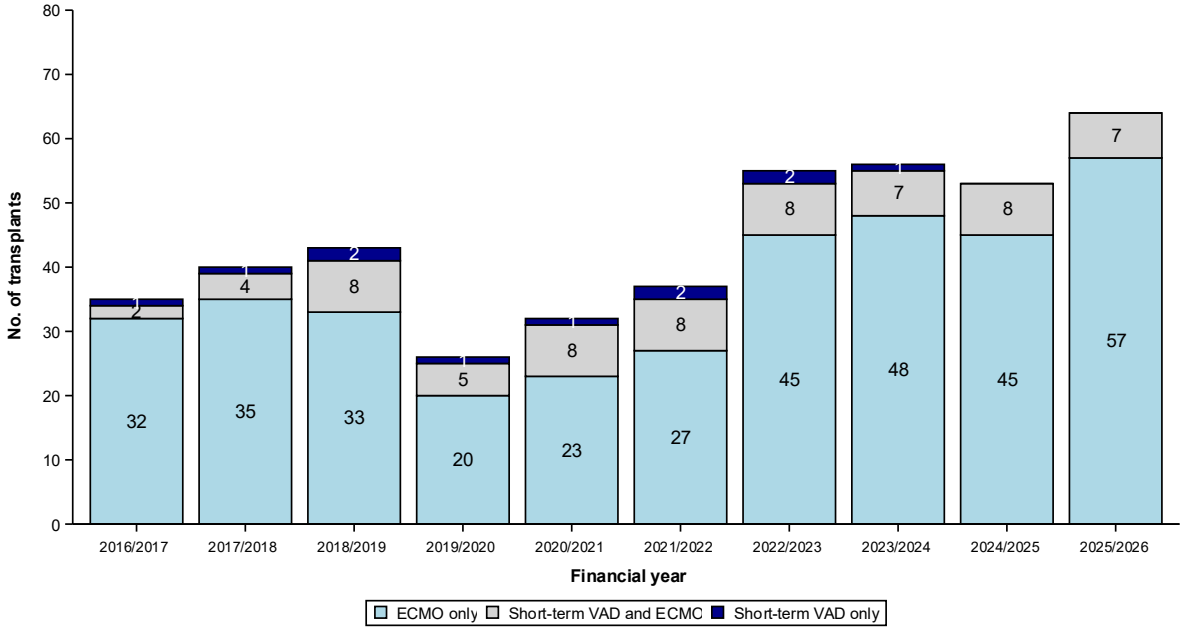


Figure 7.1b Proportion of transplants requiring short-term support within 30 days (PGD), out of total number of adult heart transplants by financial year, 1 April 2016 to 31 March 2026

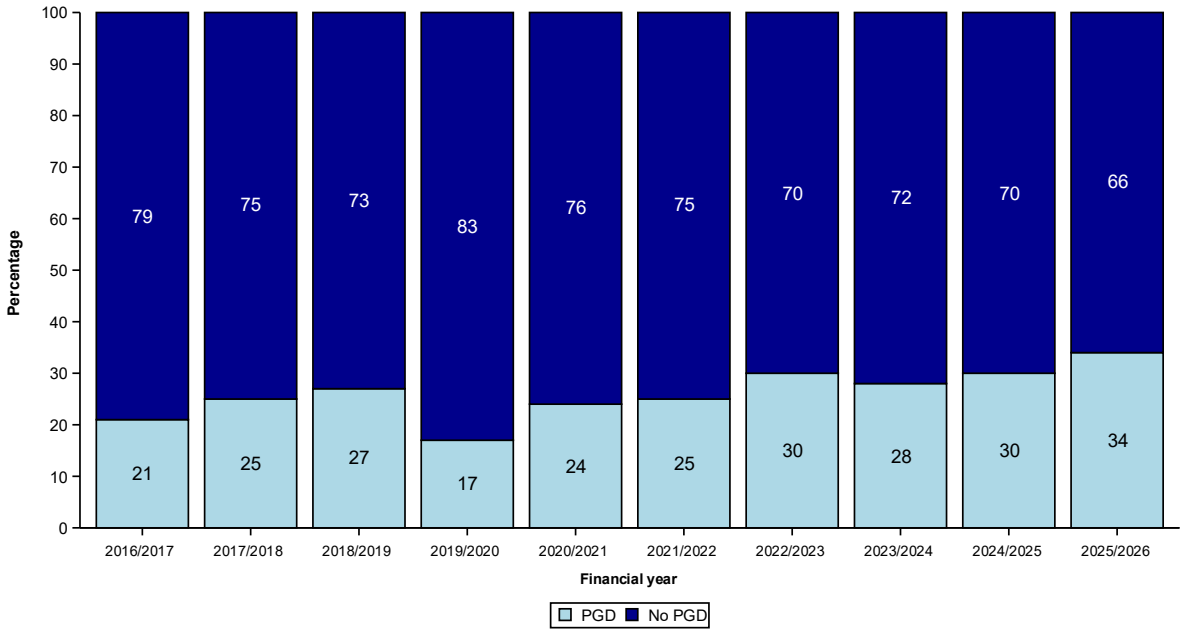


Figure 7.2a Number of adult heart transplants requiring short-term support within 30 days, by financial year, centre and device type, 1 April 2016 to 31 March 2026

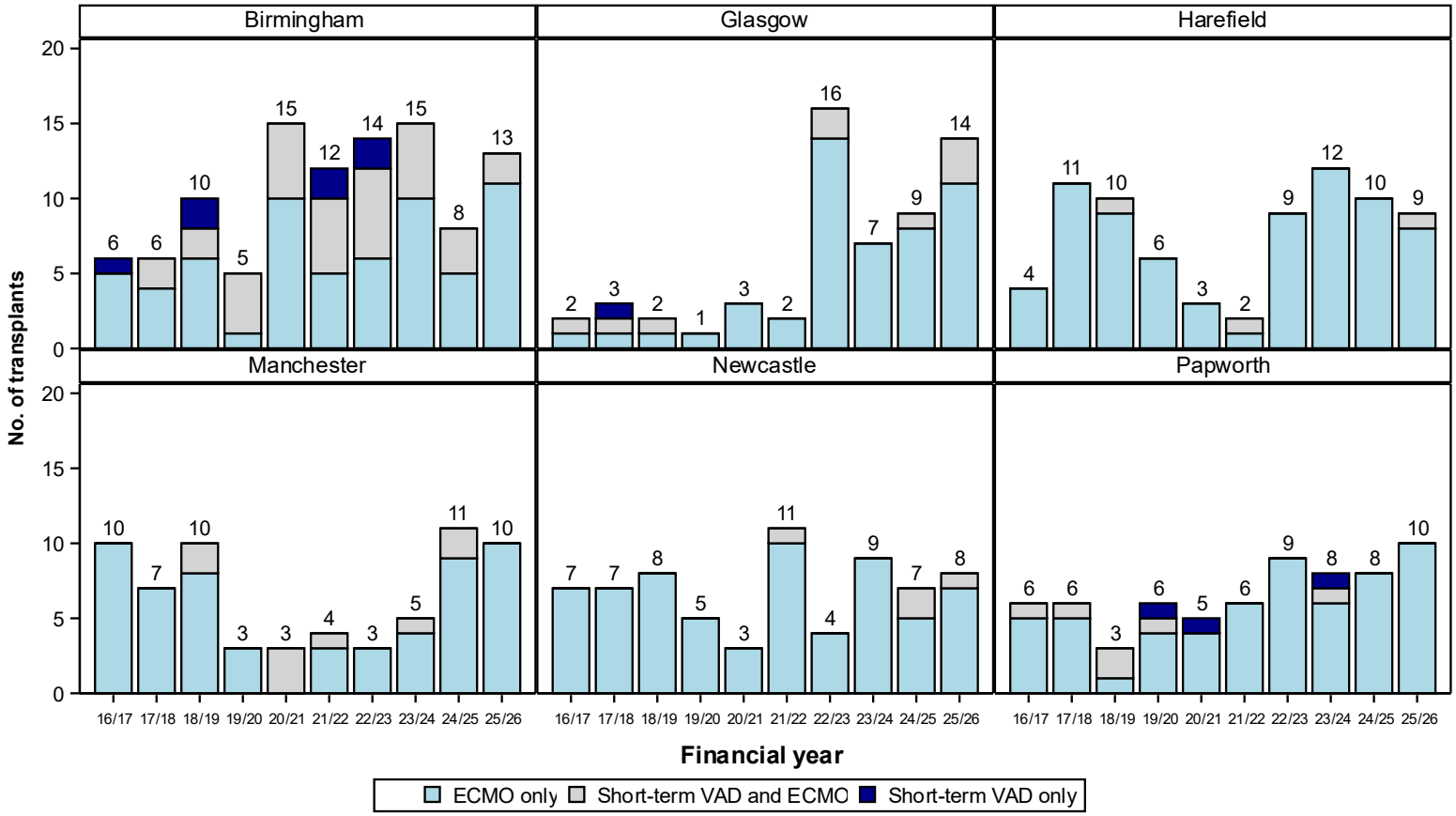


Figure 7.2b Proportion of transplants requiring short-term support within 30 days (PGD), out of total number of adult heart transplants by financial year and centre, 1 April 2016 to 31 March 2026

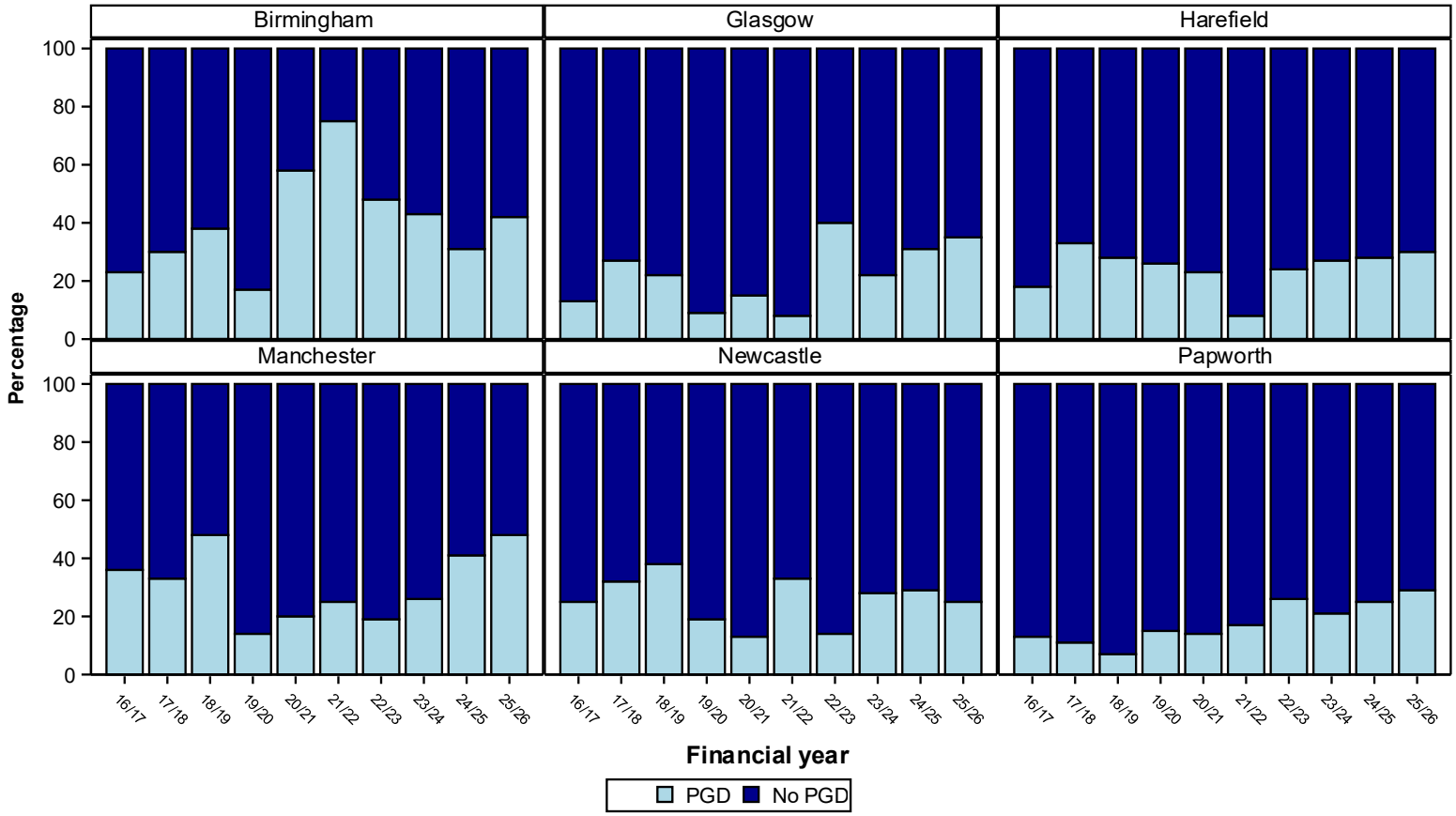


Figure 7.3a Number of adult heart transplants requiring short-term support within 30 days, by centre and device type, 1 April 2025 to 31 March 2026

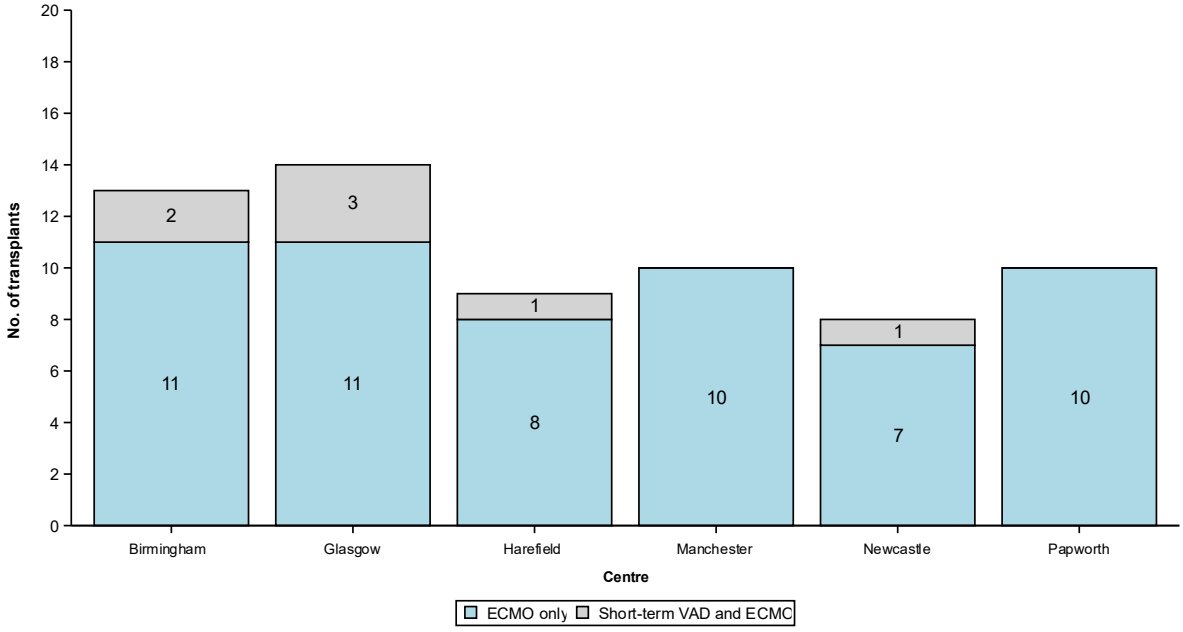
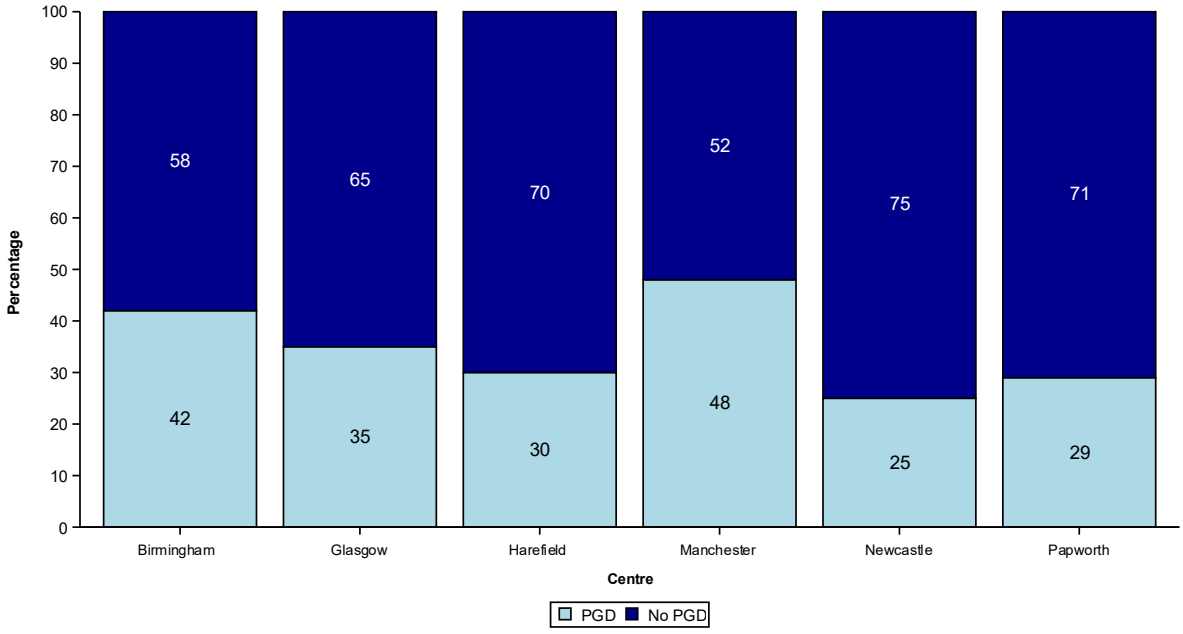


Figure 7.3b Proportion of transplants requiring short-term support within 30 days (PGD), out of total number of adult heart transplants, by centre, 1 April 2025 to 31 March 2026



ADULT SHORT-TERM DEVICES USED POST-HEART TRANSPLANT

Patient Outcomes

8 Outcomes of adult patients receiving short-term devices within 30 days post-heart transplant

This section only considers patients whose first short-term device for PGD was implanted between 1 April 2021 and 31 March 2025. Patients are analysed on a per-patient basis, as opposed to per implant.

8.1 Demographic characteristics

The transplant characteristics (as reported on the UKTR and MCS Database) of the 200 patients analysed in this section are shown in **Table 8.1**, by centre and overall. Nationally, 71% of patients were in hospital pre-transplant, the median age was 47 years and 65% of patients received central ECMO only. The median ischaemia time was 4.0 hours. For some characteristics, due to rounding, percentages may not sum to 100.

Table 8.1 Characteristics of adult patients who received a first short-term device within 30 days post-heart transplant between 1 April 2021 and 31 March 2025, by centre

		Birmingham N (%)	Glasgow N (%)	Harefield N (%)	Manchester N (%)	Newcastle N (%)	Papworth N (%)	**Total N (%)**
Number of patients		49	34	32	23	31	31	**200**
Urgency at transplant	Non-urgent	8 (16)	6 (18)	5 (16)	4 (17)	4 (13)	16 (52)	**43 (22)**
	Urgent	20 (41)	17 (50)	18 (56)	10 (43)	23 (74)	7 (23)	**95 (48)**
	Super-urgent	21 (43)	11 (32)	9 (28)	9 (39)	4 (13)	8 (26)	**62 (31)**
Recipient age at transplant (years)	Median (IQR)	45 (38-55)	54 (37-59)	50 (34-57)	40 (30-53)	46 (37-51)	50 (29-57)	**47 (35-55)**
	Missing	0	0	0	0	0	0	**0**
Diabetes at registration	No	42 (86)	29 (85)	27 (84)	22 (96)	28 (90)	28 (90)	**176 (88)**
	Yes	5 (10)	4 (12)	4 (13)	1 (4)	1 (3)	2 (6)	**17 (9)**
	Missing	2 (4)	1 (3)	1 (3)	0 (0)	2 (6)	1 (3)	**7 (4)**
Recipient primary disease at registration	Coronary heart disease	9 (18)	5 (15)	5 (16)	8 (35)	2 (6)	3 (10)	**32 (16)**
	Cardiomyopathy	30 (61)	28 (82)	21 (66)	12 (52)	15 (48)	20 (65)	**126 (63)**
	Congenital heart disease	6 (12)	0 (0)	1 (3)	1 (4)	12 (39)	1 (3)	**21 (11)**
	Graft failure/Rejection	0 (0)	0 (0)	0 (0)	1 (4)	2 (6)	0 (0)	**3 (2)**
	Other	4 (8)	1 (3)	5 (16)	1 (4)	0 (0)	7 (23)	**18 (9)**

Table 8.1 Characteristics of adult patients who received a first short-term device within 30 days post-heart transplant between 1 April 2021 and 31 March 2025, by centre

		Birmingham N (%)	Glasgow N (%)	Harefield N (%)	Manchester N (%)	Newcastle N (%)	Papworth N (%)	**Total N (%)**
Recipient BMI (kg/m^2)	Median (IQR)	27 (23-29)	28 (24-31)	26 (24-29)	27 (24-30)	23 (21-27)	28 (25-30)	**27 (23-29)**
	Missing	0	0	0	0	0	0	**0**
In hospital at transplant	No	10 (20)	9 (26)	7 (22)	5 (22)	9 (29)	18 (58)	**58 (29)**
	Yes	39 (80)	25 (74)	25 (78)	18 (78)	22 (71)	13 (42)	**142 (71)**
If in hospital, recipient on inotropes	No	18 (46)	2 (8)	5 (20)	11 (61)	2 (10)	8 (62)	**46 (33)**
	Yes	21 (54)	23 (92)	20 (80)	7 (39)	19 (90)	5 (38)	**95 (67)**
	Unknown	0 (0)	0 (0)	0 (0)	0 (0)	1 (5)	0 (0)	**1 (1)**
If in hospital, recipient on VAD	None	21 (54)	20 (80)	15 (60)	6 (33)	17 (77)	5 (38)	**84 (59)**
	LVAD	2 (5)	4 (16)	1 (4)	3 (17)	3 (14)	1 (8)	**14 (10)**
	RVAD	0 (0)	0 (0)	1 (4)	0 (0)	0 (0)	0 (0)	**1 (1)**
	BiVAD	16 (41)	1 (4)	8 (32)	9 (50)	2 (9)	7 (54)	**43 (30)**
If in hospital, recipient on TAH	No	39 (100)	25 (100)	25 (100)	18 (100)	22 (100)	13 (100)	**142 (100)**
If in hospital, recipient on ECMO	No	38 (97)	19 (76)	23 (92)	18 (100)	21 (95)	13 (100)	**132 (93)**
	Yes	1 (3)	5 (20)	2 (8)	0 (0)	1 (5)	0 (0)	**9 (6)**
	Unknown	0 (0)	1 (4)	0 (0)	0 (0)	0 (0)	0 (0)	**1 (1)**
If in hospital, recipient on IABP	No	39 (100)	12 (48)	25 (100)	16 (89)	22 (100)	13 (100)	**127 (89)**
	Yes	0 (0)	13 (52)	0 (0)	2 (11)	0 (0)	0 (0)	**15 (11)**
Recipient serum creatinine (umol/l)	Median (IQR)	73 (57-89)	101 (85-122)	112 (79-137)	72 (46-99)	104 (79-131)	101 (72-129)	**90 (66-121)**
	Missing	0	6	0	0	0	0	**6**
Donor cause of death	CVA	39 (80)	28 (82)	27 (84)	19 (83)	27 (87)	29 (94)	**169 (85)**
	Trauma	2 (4)	0 (0)	1 (3)	2 (9)	4 (13)	0 (0)	**9 (5)**
	Other	8 (16)	6 (18)	4 (13)	2 (9)	0 (0)	2 (6)	**22 (11)**
Donor age (years)	Median (IQR)	39 (29-49)	41 (32-49)	37 (31-47)	37 (26-40)	32 (25-39)	41 (31-46)	**38 (29-46)**
	Missing	0	0	0	0	0	0	**0**

Table 8.1 Characteristics of adult patients who received a first short-term device within 30 days post-heart transplant between 1 April 2021 and 31 March 2025, by centre

		Birmingham N (%)	Glasgow N (%)	Harefield N (%)	Manchester N (%)	Newcastle N (%)	Papworth N (%)	**Total N (%)**
Donor BMI (kg/m^2)	Median (IQR)	26 (24-31)	25 (22-27)	24 (21-28)	25 (21-27)	25 (22-28)	27 (24-29)	**25 (23-28)**
	Missing	0	0	0	0	0	0	**0**
Donor past smoker	No	19 (39)	15 (44)	13 (41)	9 (39)	15 (48)	14 (45)	**85 (43)**
	Yes	29 (59)	19 (56)	18 (56)	14 (61)	16 (52)	17 (55)	**113 (57)**
	Unknown	1 (2)	0 (0)	1 (3)	0 (0)	0 (0)	0 (0)	**2 (1)**
Donor: Recipient sex mismatch	RF:DF	13 (27)	8 (24)	8 (25)	9 (39)	7 (23)	5 (16)	**50 (25)**
	RF:DM	2 (4)	2 (6)	1 (3)	4 (17)	5 (16)	5 (16)	**19 (10)**
	RM:DM	26 (53)	20 (59)	18 (56)	9 (39)	17 (55)	16 (52)	**106 (53)**
	RM:DF	8 (16)	4 (12)	5 (16)	1 (4)	2 (6)	5 (16)	**25 (13)**
Total ischaemia time (hours)	Median (IQR)	3.9 (3.4-5.6)	3.6 (2.9-3.9)	4.3 (3.7-5)	3.7 (3-4.6)	4.1 (3.3-5.4)	4.5 (3.4-6.4)	**4 (3.3-5.1)**
	Missing	4	6	1	1	1	0	**13**
First device implanted	Percutaneous VAD	1 (2)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	**1 (1)**
	Ventricular assist (Centrimag)	5 (10)	0 (0)	1 (3)	0 (0)	1 (3)	1 (3)	**8 (4)**
	Peripheral ECMO	41 (84)	6 (18)	6 (19)	1 (4)	7 (23)	1 (3)	**62 (31)**
	Central ECMO	2 (4)	28 (82)	25 (78)	22 (96)	23 (74)	29 (94)	**129 (65)**

8.2 Duration on support

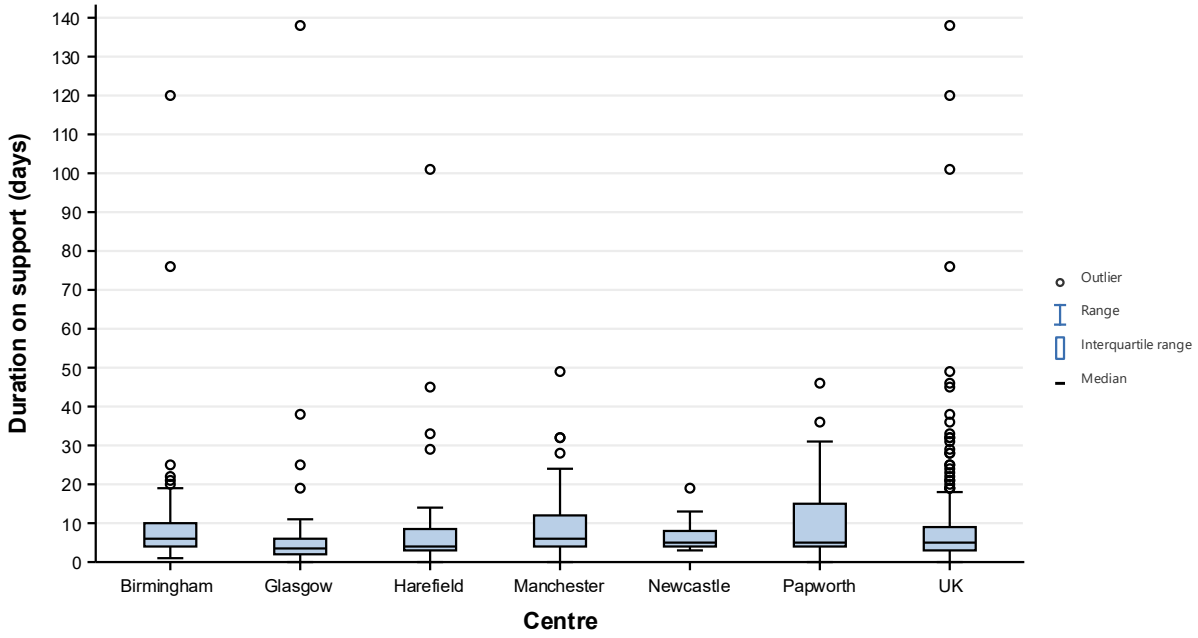
Table 8.2 and **Figure 8.1** summarise the duration on short-term support for patients implanted in the analysis period, both nationally and by centre. The median and interquartile range are calculated directly from the observed time each patient spent on short-term support; patients still on support at the time of analysis are included with their time on support up to their latest follow-up (see Appendix A2). Explant, death, re-transplant or transfer to a long-term device signify end of short-term support. Time on all short-term devices in the first episode of continuous support for PGD is counted and days on two devices at the same time are counted only once. Nationally, the median time on support was 5 days (interquartile range 3–9 days) and was similar across centres. **Figure 8.1** presents these data as boxplots.

Table 8.2 Median duration on short-term device support for PGD for adult patients implanted between 1 April 2021 and 31 March 2025, by centre

Centre	No. of patients	Median (days)	Interquartile range (days)
Birmingham	49	6	4 - 10
Glasgow	34	4	2 - 6
Harefield	32	4	3 - 9
Manchester	23	6	4 - 12
Newcastle	31	5	4 - 8
Papworth	31	5	4 - 15
Overall	**200**[1]	**5**	**3 - 9**

[1]Includes 2 patients whose episode of support had not ended at the time of analysis

Figure 8.1 Boxplots of duration on short-term device support for PGD for adult patients implanted between 1 April 2021 and 31 March 2025



8.3 Patient survival from implant

This analysis looks at the rate of survival from the point of first short-term device implant post-heart transplant. This uses data from the UK Transplant Registry (UKTR) on post-transplant survival. Survival rates are calculated using the Kaplan-Meier method where times are censored if the patient was still alive at last known follow-up. If the patient was re-transplanted, any subsequent survival time is included. The rates are estimated at 90 days and 1 year and are based on the 200 patients recorded as receiving a first short-term device for PGD between 1 April 2021 and 31 March 2025. Survival rates are given nationally and for individual centres. Note that the centre-specific rates are unadjusted for potential differences in risk between patients treated at different centres.

The unadjusted 90-day and 1-year survival rates for patients in the time period are shown in **Tables 8.3** and **8.4**, respectively. The national rates of survival were 78.5% and 71.4%, respectively.

Table 8.3 90-day patient survival rates after short-term device implant post-heart transplant for adult patients implanted 1 April 2021 - 31 March 2025, by centre

Centre	Number of patients	Number of deaths	% 90-day survival (95% CI) Unadjusted	
Birmingham	49	7	85.7	(72.4 - 92.9)
Glasgow	34	7	79.4	(61.6 - 89.6)
Harefield	32	5	84.4	(66.5 - 93.2)
Manchester	23	3	87.0	(64.8 - 95.6)
Newcastle	31	10	67.7	(48.4 - 81.2)
Papworth	31	11	64.5	(45.2 - 78.5)
UK	**200**	**43**	**78.5**	**(72.1 - 83.6)**

Table 8.4 1-year patient survival rates after short-term device implant post-heart transplant for adult patients implanted 1 April 2021- 31 March 2025, by centre

Centre	Number of patients	Number of deaths	% 1-year survival (95% CI) Unadjusted	
Birmingham	49	11	77.5	(63.1 - 86.9)
Glasgow	34	9	73.5	(55.3 - 85.3)
Harefield	32	10	68.6	(49.5 - 81.7)
Manchester	23	3	87.0	(64.8 - 95.6)
Newcastle	31	11	64.5	(45.2 - 78.5)
Papworth	31	13	58.1	(39.0 - 73.1)
UK	**200**	**57**	**71.4**	**(64.6 - 77.2)**

8.4 Patient survival from heart transplant

Table 8.5 shows the number of adult heart transplants performed between 1 April 2021 and 31 March 2025, by centre, donor type and whether the recipient received short-term MCS within 30 days of transplant or not. Note that the total number of transplants requiring support differs slightly from the previous sections, due to differences in transplant/implant dates. Patient survival from point of transplant is also presented for 90-days and 1-year post-transplant. Survival rates are calculated using the Kaplan-Meier method where times are censored if the patient was still alive at last known follow-up. The 513 DBD and 197 DCD adult heart transplants in the table include re-transplants and any multi-organ heart transplant (excluding heart-lung), but the survival rates are based on first transplants only.

Transplants requiring support had significantly worse patient survival rates at both 90-days and 1-year compared to transplants without support in both DBD transplants (p<0.0001) and DCD transplants (p<0.0001).

Table 8.5 Number of adult heart transplants with and without short-term MCS within 30 days, by donor type and centre, and 90 day and 1-year survival rates nationally, 1 April 2021 – 31 March 2025

	DBD			DCD		
	Support required Number of transplants (%)	**No support** Number of transplants (%)	**Total** Number of transplants	**Support required** Number of transplants (%)	**No support** Number of transplants (%)	**Total** Number of transplants
Centre						
Birmingham	35 (44)	45 (56)	80	13 (50)	13 (50)	26
Glasgow	28 (29)	67 (71)	95	6 (20)	24 (80)	30
Harefield	21 (22)	76 (78)	97	9 (20)	36 (80)	45
Manchester	17 (29)	41 (71)	58	6 (30)	14 (70)	20
Newcastle	21 (24)	65 (76)	86	10 (31)	22 (69)	32
Papworth	16 (16)	81 (84)	97	15 (34)	29 (66)	44
UK	**138 (27)**	**375 (73)**	**513**	**59 (30)**	**138 (70)**	**197**
90-day survival (95% CI)	75.6 (67.4-82.0)	96.2 (93.7-97.8)	90.7 (87.9-93.0)	83.1 (70.8-90.5)	98.5 (94.2-99.6)	93.8 (89.4-96.5)
1-year survival (95% CI)	72.6 (64.2-79.3)	92.5 (89.3-94.8)	87.2 (84.0-89.8)	66.0 (52.4-76.6)	94.9 (89.5-97.5)	86.1 (80.4-90.3)

PAEDIATRIC DEVICES USED FOR BRIDGING

Activity

9 Mechanical circulatory support in paediatric patients

This section considers all paediatric patients who received mechanical circulatory support as a bridge to heart transplantation between 1 April 2016 and 31 March 2026, as reported to the MCS Database by 21 September 2026. Note that 45 post-transplant MCS implants were reported in this period, which are excluded from this section. **Figures 9.1a**, **9.2a**, and **9.3a**, as well as all tables in this activity section, present information on a per implant basis as opposed to per patient, so if a single patient had more than one implant in the period, each one is included (see **Table A1.5** in Appendix A1 for details of device histories). **Figures 9.1b**, **9.2b** and **9.3b** present information on a per episode basis as opposed to per implant, so if a single patient had more than one type of device in a continuous period of support, these devices will be grouped and the episode only counted once in the financial year in which the first device of the episode was implanted.

Figure 9.1a shows the total number of bridging device implants each year nationally by device type (VAD and ECMO). In 2025/2026, there were 31 implants, 6% fewer than in 2024/2025, when 33 implants were recorded. Overall, there were 260 implants, with VAD implants making up 68% (however, approximately 13% of the VAD implants were reported to have involved some form of conjunction ECMO, either transient or ongoing). **Figure 9.2a** shows the trend per centre for the two paediatric centres. Last year's activity is shown by centre and device type in **Figure 9.3a**. Figures **9.1b**, **9.2b** and **9.3b** show the same data but on a per episode basis as opposed to a per implant basis, by financial year, financial year and centre, and centre respectively.

Figure 9.1a Number of paediatric bridging device implants in the UK, by financial year and device type, 1 April 2016 to 31 March 2026

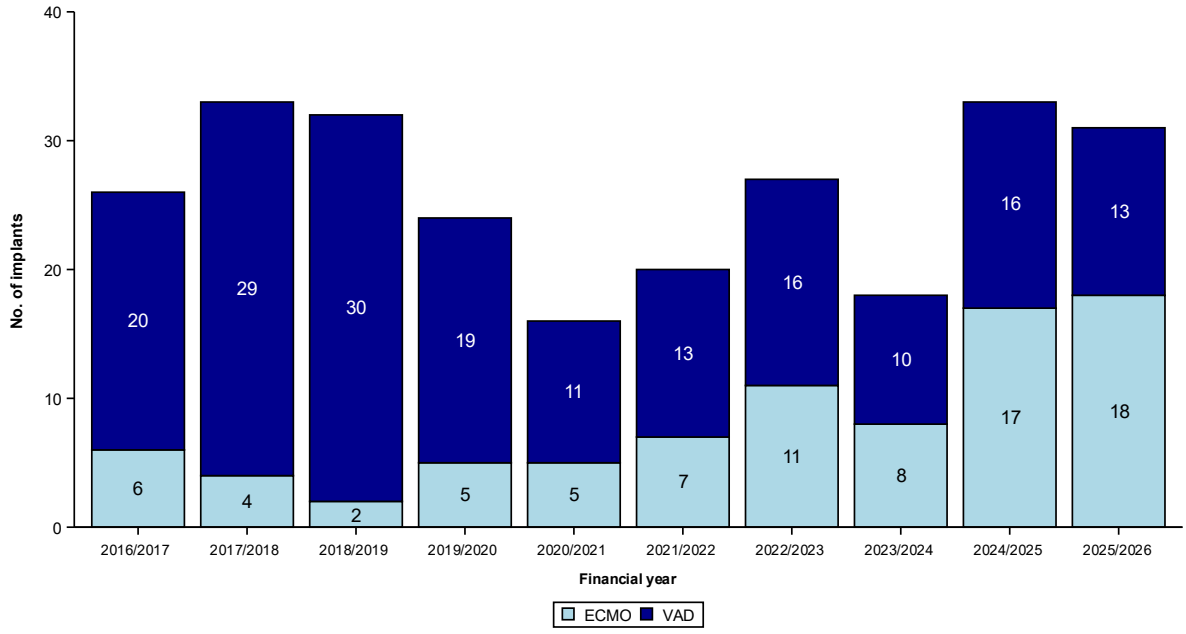


Figure 9.1b Number of paediatric bridging episodes in the UK, by financial year and devices implanted, 1 April 2016 to 31 March 2026

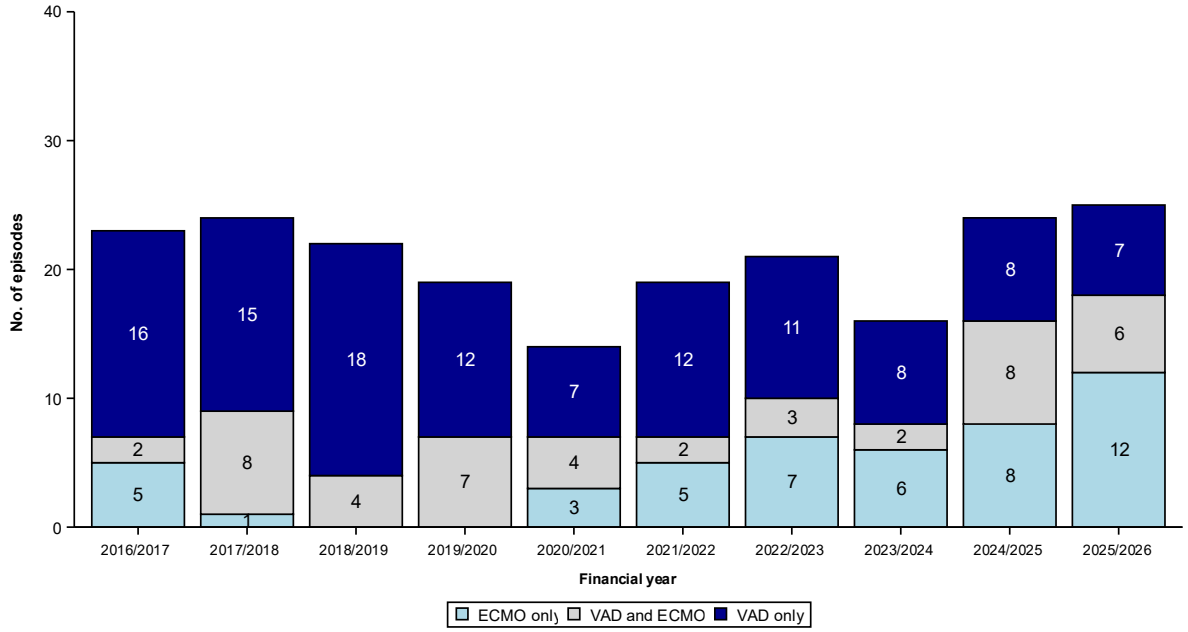


Figure 9.2a Number of paediatric bridging device implants in the UK, by financial year, centre and device type, 1 April 2016 to 31 March 2026

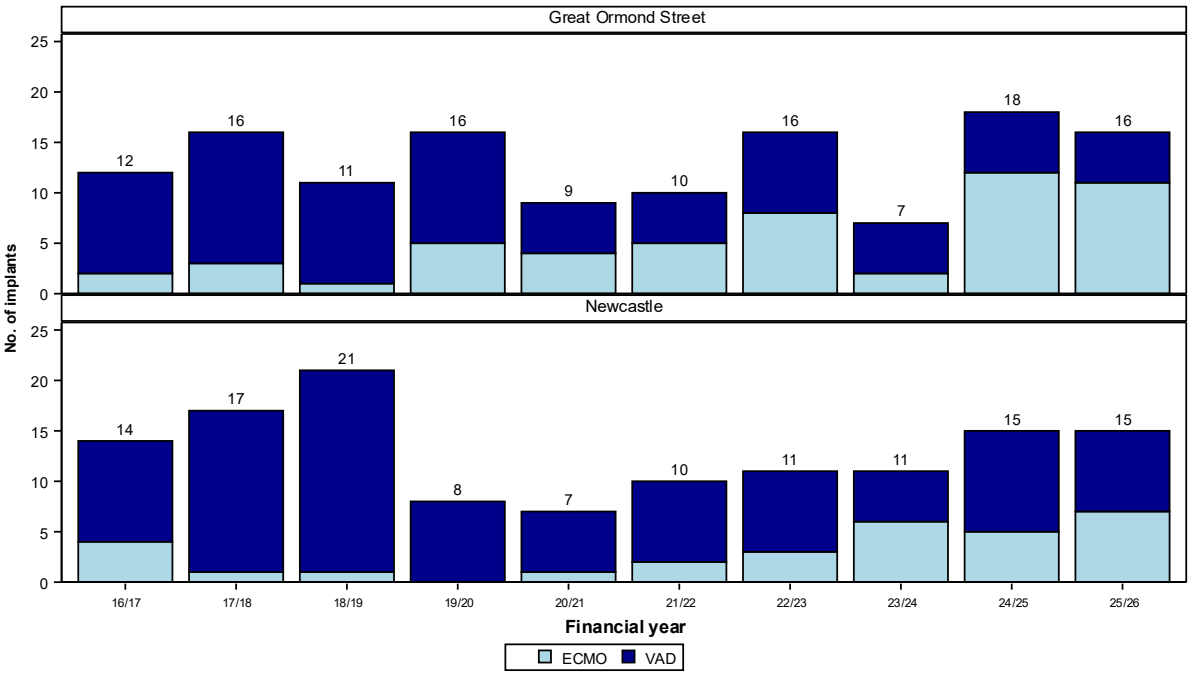


Figure 9.2b Number of paediatric bridging episodes in the UK, by financial year, centre and devices implanted, 1 April 2016 to 31 March 2026

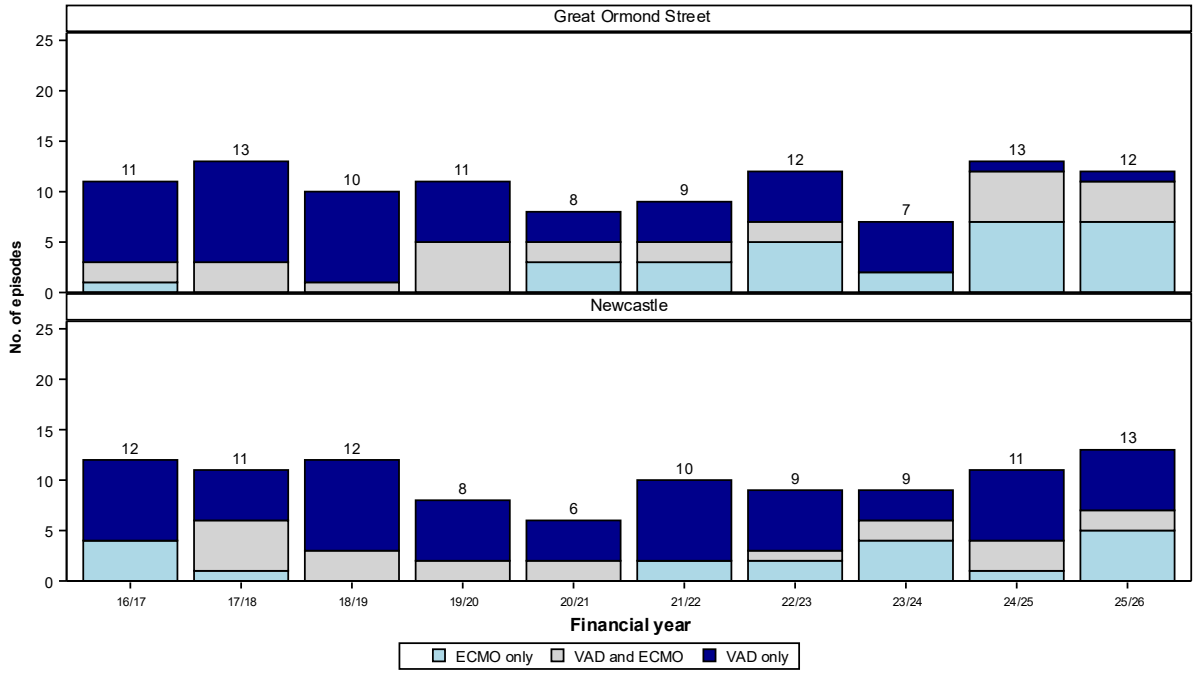


Figure 9.3a Number of paediatric bridging device implants in the UK, by centre and device type, 1 April 2025 to 31 March 2026

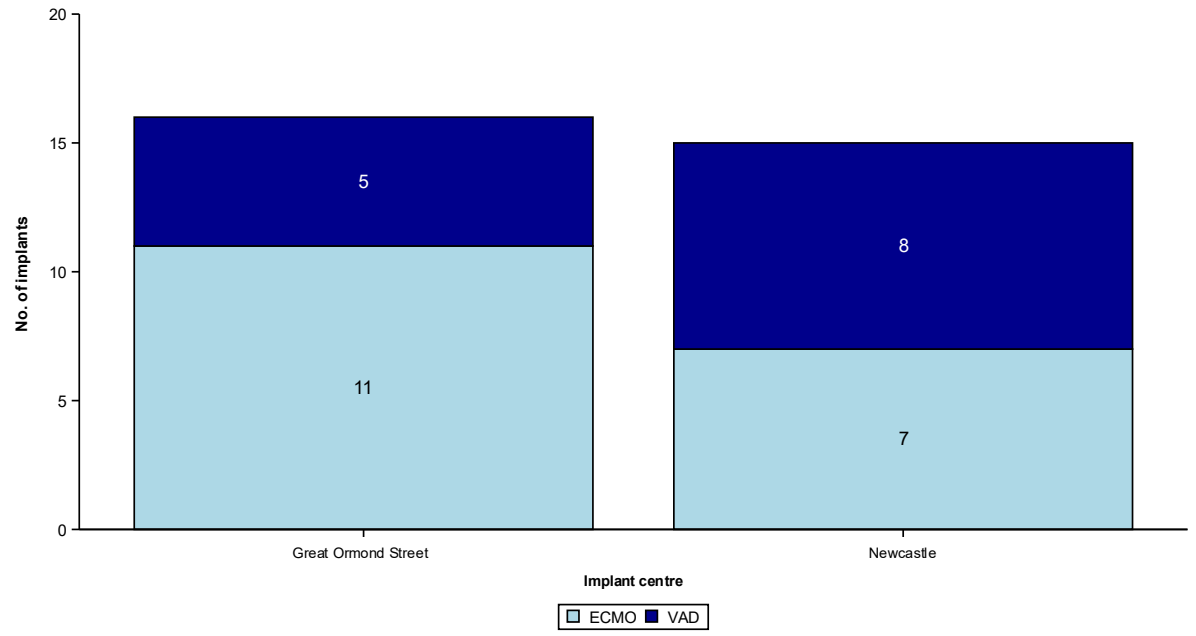


Figure 9.3b Number of paediatric bridging episodes in the UK, by centre and devices implanted, 1 April 2025 to 31 March 2026

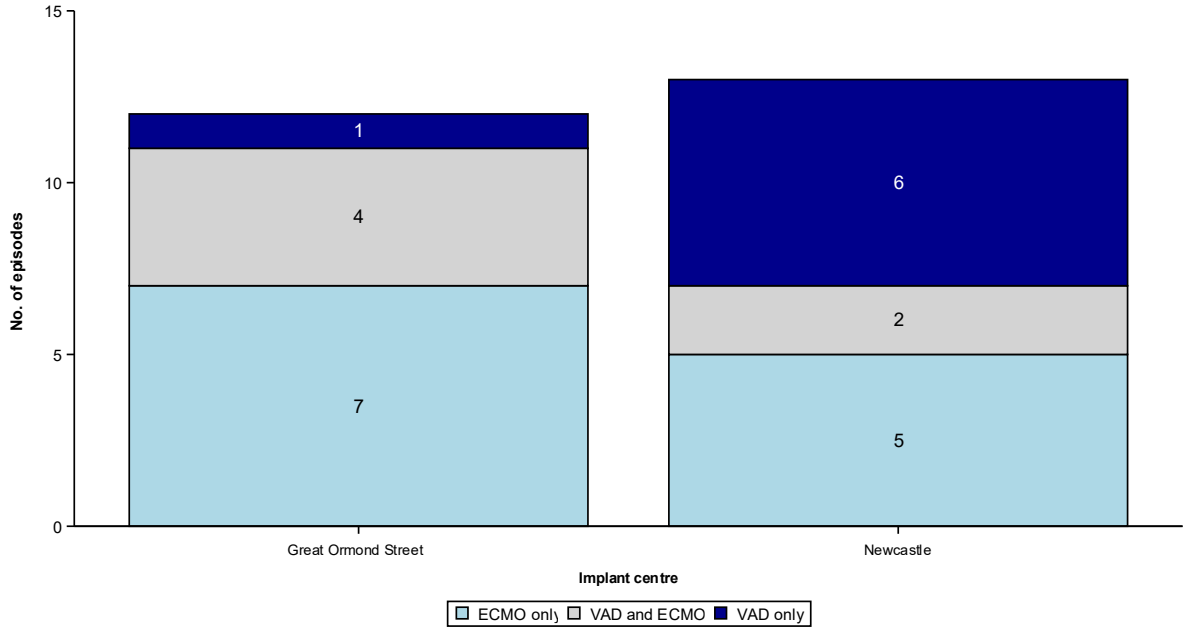
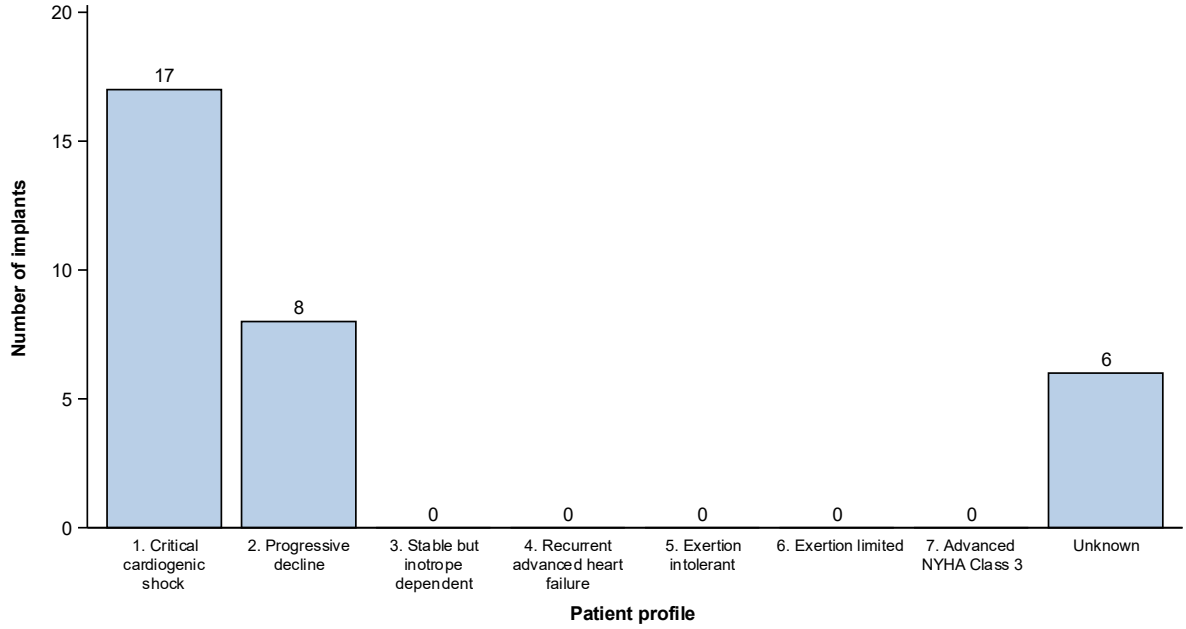


Figure 9.4 shows the INTERMACS patient profile at implant for paediatric patients implanted during 2025/2026. Where reported, patients implanted were either level 1 (critical cardiogenic shock) or level 2 (progressive decline).

Figure 9.4 INTERMACS patient profile for all bridging devices used in paediatric patients in the UK, 1 April 2025 to 31 March 2026



PAEDIATRIC DEVICES USED FOR BRIDGING

Patient Outcomes



10 Outcomes of paediatric patients receiving bridging devices

This section only considers paediatric patients whose first bridging device was implanted between 1 April 2021 and 31 March 2025. Patients are analysed on a per-patient basis, as opposed to per implant.

10.1 Demographic characteristics

The demographic characteristics of the 73 patients who received bridging support in the analysis period are shown below in **Table 10.1**, by centre and overall. Nationally, 52% of patients were male, the median age was 5, and the most common device was ECMO only. Note that for some characteristics there is a high proportion of missing data. Also, due to rounding, percentages may not sum to 100.

Table 10.1 Characteristics of paediatric patients who received a first bridging device between 1 April 2021 and 31 March 2025, by centre

		Great Ormond Street N (%)	Newcastle N (%)	**Total N (%)**
Number of patients		38	35	**73**
Recipient age (years)	Median (IQR)	6 (2-12)	3 (0-8)	5 (1-11)
	Missing	0	0	0
Recipient sex	Male	21 (55)	17 (49)	38 (52)
	Female	17 (45)	18 (51)	35 (48)
Primary disease	Dilated cardiomyopathy	36 (95)	23 (66)	59 (81)
	Ischaemic heart disease	0 (0)	2 (6)	2 (3)
	Congenital heart disease	1 (3)	0 (0)	1 (1)
	Restrictive cardiomyopathy	0 (0)	1 (3)	1 (1)
	Other	0 (0)	5 (14)	5 (7)
	Unknown	1 (3)	4 (11)	5 (7)
INTERMACS patient profile	1. Critical cardiogenic shock	12 (32)	29 (83)	41 (56)
	2. Progressive decline	24 (63)	1 (3)	25 (34)
	3. Stable but inotrope dependent	1 (3)	0 (0)	1 (1)
	4. Recurrent advanced heart failure	1 (3)	1 (3)	2 (3)
	5. Exertion intolerant	0 (0)	0 (0)	0 (0)
	6. Exertion limited	0 (0)	0 (0)	0 (0)
	7. Advanced NYHA Class 3	0 (0)	0 (0)	0 (0)
	Unknown	0 (0)	4 (11)	4 (5)
Height (cm)	Median (IQR)	110 (86-158)	85 (74-115)	100 (79-136)
	Missing	4	12	16
Weight (kg)	Median (IQR)	16 (10-46)	13 (8-23)	14 (9-38)
	Missing	4	7	11
Body surface area (m^2)	Median (IQR)	0.72 (0.49-1.45)	0.54 (0.41-0.75)	0.63 (0.47-1.20)
	Missing	4	13	17
First device implanted	Berlin Heart Excor	14 (37)	0 (0)	14 (19)
	HeartMate 3	1 (3)	2 (6)	3 (4)
	Impella	0 (0)	1 (3)	1 (1)

Table 10.1 Characteristics of paediatric patients who received a first bridging device between 1 April 2021 and 31 March 2025, by centre

	Great Ormond Street N (%)	Newcastle N (%)	**Total N (%)**
Centrimag/Levitronix	0 (0)	18 (51)	18 (25)
Protec	0 (0)	1 (3)	1 (1)
ECMO only	23 (61)	13 (37)	36 (49)

10.2 Duration on support

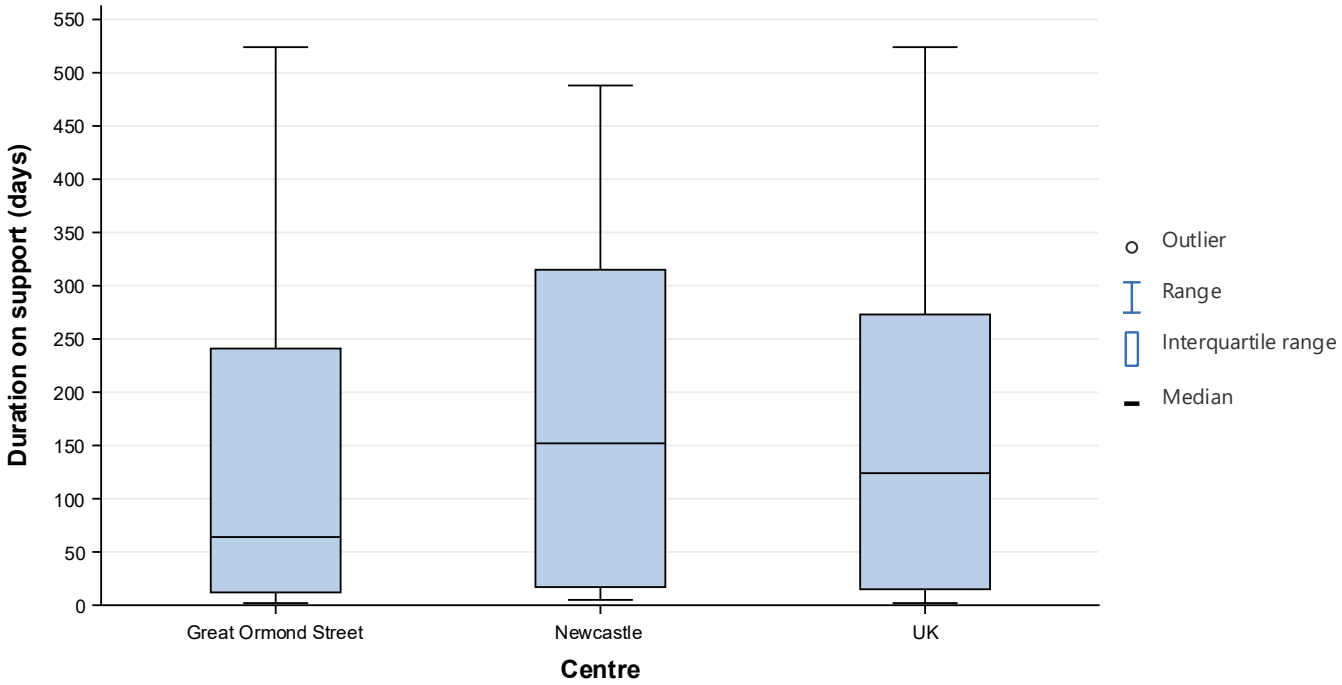
Table 10.2 and **Figure 10.1** summarise the duration on support for patients implanted between 1 April 2021 and 31 March 2025, both nationally and by centre. The median and interquartile range are calculated directly from the observed time each patient spent on support; patients still on support at the time of analysis are included with their time on support up to their latest follow-up (see Appendix A2). Transplant, explant or death signify end of support. Time on all devices in the first episode of continuous support is counted and days on two devices at the same time are counted only once. Nationally, the median time on support was 124 days (interquartile range 15–273 days), ranging from 64 days at Great Ormond Street to 152 days at Newcastle. **Figure 10.1** presents these data as boxplots.

Table 10.2 Median duration on support for paediatric patients implanted with a bridging device between 1 April 2021 and 31 March 2025, by centre

Centre	No. of patients	Median (days)	Interquartile range (days)
Great Ormond Street	38	64	12 - 241
Newcastle	35	152	17 - 315
Overall	**73**[1]	**124**	**15 - 273**

[1] Includes 1 patient whose episode of support had not ended at the time of analysis

Figure 10.1 Boxplots of duration on support for paediatric patients implanted with a bridging device between 1 April 2021 and 31 March 2025



10.3 Rate of transplant listing

Figure 10.2 and **Table 10.3** show the rate of transplant listing for patients implanted between 1 April 2021 and 31 March 2025 by centre. This includes listing on the super-urgent, urgent or non-urgent heart transplant lists (whichever occurred first). Overall, 55% of patients were listed at implant, with a further 41% listed after implant and 4% who had died or been explanted within 1-year post-implant without being listed; no patients remained unlisted at 1-year.

Figure 10.2 Heart transplant listing status with respect to bridging device implantation for paediatric patients implanted 1 April 2021 – 31 March 2025, by centre and overall

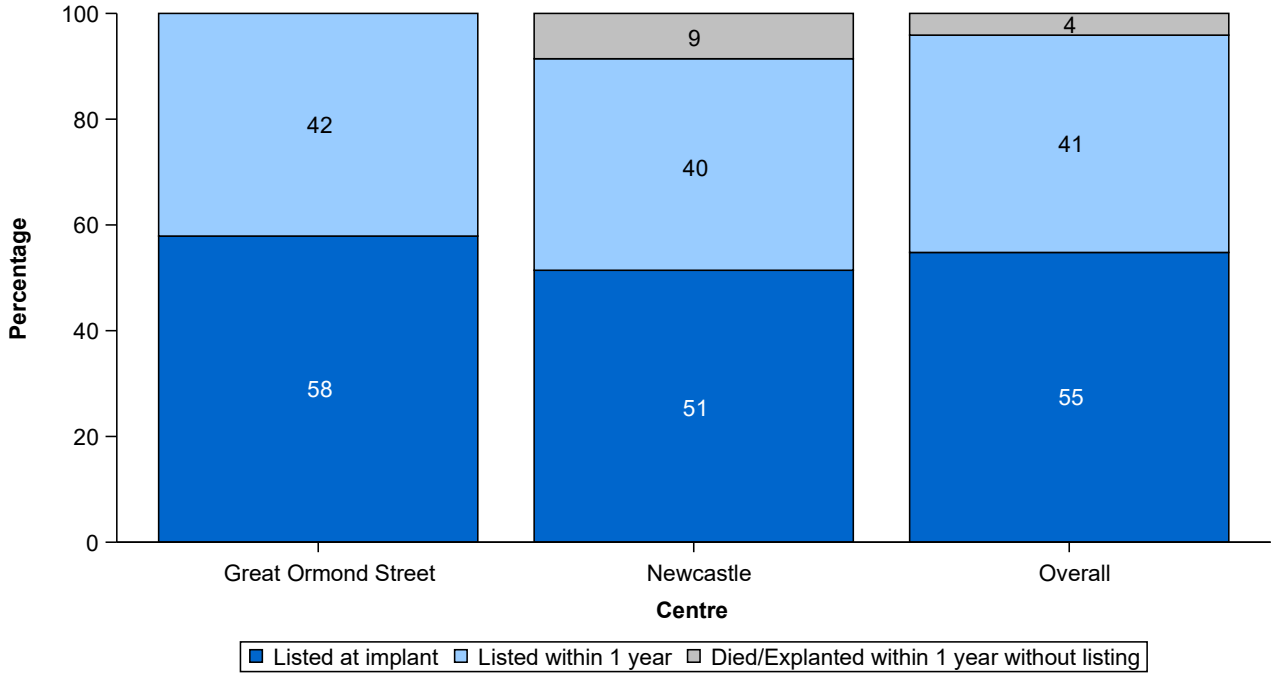


Table 10.3 Heart transplant listing status with respect to bridging device implantation for paediatric patients implanted 1 April 2021 - 31 March 2025, by centre and overall

Centre	Number of patients N	Listed at implant N (%)	Listed within 1 year N (%)	Not listed within 1 year N (%)	Died/explanted within 1 year without listing N (%)
Great Ormond Street	38	22 (58)	16 (42)	0 (0)	0 (0)
Newcastle	35	18 (51)	14 (40)	0 (0)	3 (9)
Overall	**73**	**40 (55)**	**30 (41)**	**0 (0)**	**3 (4)**

10.4 Competing outcomes

Whilst on support, patients are susceptible to different outcomes. Death on support, transplant and explant without transplant (with or without recovery) are all possible outcomes. **Figure 10.3** shows the cumulative incidence of each of these outcomes occurring from time of implant, for the cohort of paediatric patients receiving a first device between 1 April 2021 and 31 March 2025. This is calculated using the Aalen-Johansen method to account for competing outcomes. At time zero, 100% of patients are on support and as time passes, patients either experience death on support, transplant or explant without transplant. At any time point, the proportion alive on support plus the proportions experiencing each outcome will sum to 100%. Deaths after transplant are not counted and these patients are classed simply as transplanted. Patients who were explanted and died within 30 days of explant are counted as deaths at time of explant. Any subsequent device support post-explant is not counted and any such patients are classed simply as explanted. If a patient is moved from one device to another without a period free of support, this counts as time on support.

For this cohort, one month after receiving a device, 58% of patients remained alive on support, 26% received a heart transplant, 11% had their device explanted and 5% died on support. At three months, the incidence of transplantation rose to 33%, the incidence of death remained at 5%, and the proportion explanted remained at 11%, leaving 51% left on support. By six months, 42% had received a heart transplant, 11% were explanted, 5% had died on support, leaving 41% alive on support.

Figure 10.3 Cumulative incidence functions for transplant, death and explant for paediatric patients receiving a bridging device, 1 April 2021 to 31 March 2025

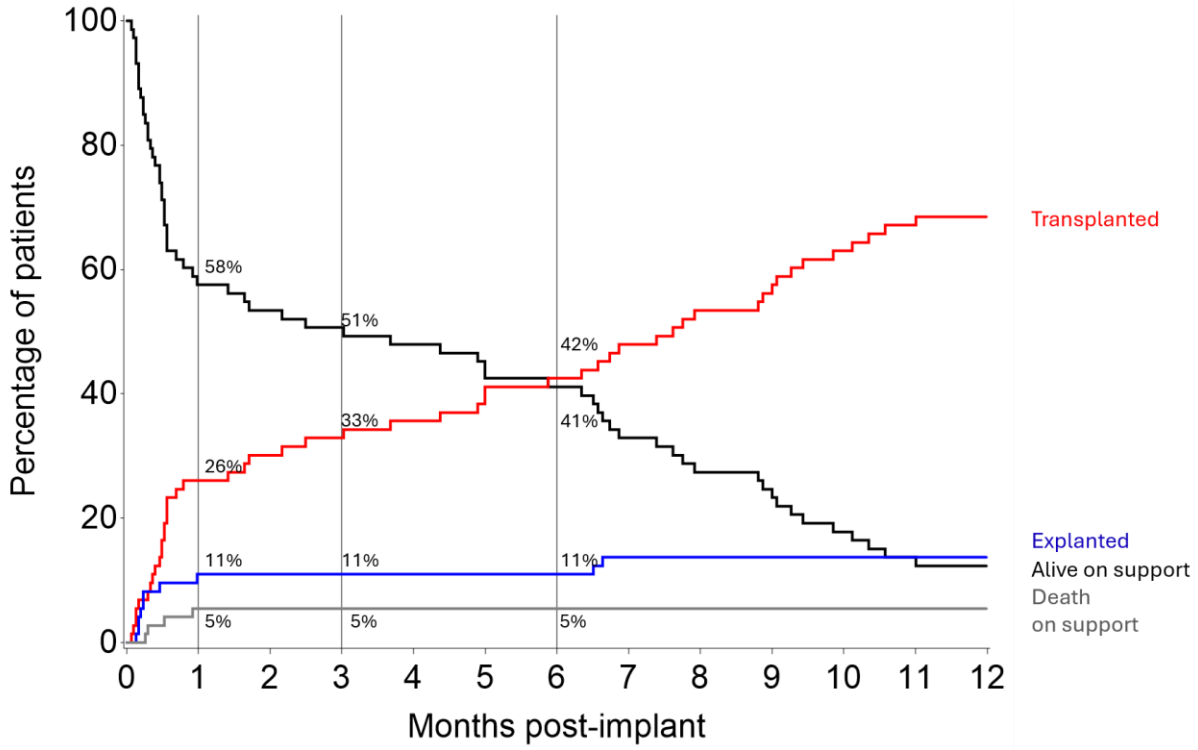


Table 10.4 shows the centre-specific estimates for each competing outcome. A higher proportion of patients had received a transplant by 6 months at Great Ormond Street (55%) compared with Newcastle (29%). Note that these percentages represent a small number of patients. Additionally, a patient may be counted as explanted but go on to have further support after a period without support, so this does not always represent recovery.

Table 10.4 Cumulative incidence of each outcome, by centre, for paediatric patients implanted with a first bridging device, 1 April 2021 to 31 March 2025

Period	Centre	Number of patients	Transplanted %	Explanted %	Alive on support %	Death on support %
30 day	Great Ormond Street	38	39	8	53	0
	Newcastle	35	11	14	63	11
	Overall	**73**	**26**	**11**	**58**	**5**
90 day	Great Ormond Street	38	50	8	42	0
	Newcastle	35	14	14	60	11
	Overall	**73**	**33**	**11**	**51**	**5**
6 month	Great Ormond Street	38	55	8	37	0
	Newcastle	35	29	14	46	11
	Overall	**73**	**42**	**11**	**41**	**5**

10.5 Patient survival from implant

Overall survival rates from the point of first device implant, not censored for transplant or explant, are presented in this section. Survival data from the UK Transplant Registry were incorporated, as was any additional survival time recorded on the MCS Database for patients who were explanted. Time on additional devices is also counted, so for example if a patient had several periods of support, all this time is included. Times are censored if the patient was still alive at last known event or follow-up.

Survival rates are calculated using the Kaplan-Meier method. The rates are estimated at 30 days, 90 days and 1 year and are given nationally and for individual centres in **Tables 10.5**, **10.6** and **10.7**. The centre-specific rates are unadjusted for potential differences in risk between patients treated at different centres. The national rate of survival at each time point was 94.5%, 94.5% and 88.7%, respectively.

Table 10.5 30-day patient survival rates after bridging device implant for paediatric patients implanted 1 April 2021- 31 March 2025, by centre

Centre	Number of patients	Number of deaths	% 30-day survival (95% CI) Unadjusted	
Great Ormond Street	38	0	100	(-)
Newcastle	35	4	88.5	(72.1 - 95.5)
UK	**73**	**4**	**94.5**	**(86.0 - 97.9)**

Table 10.6 90-day patient survival rates after bridging device implant for paediatric patients implanted 1 April 2021- 31 March 2025, by centre

Centre	Number of patients	Number of deaths	% 90-day survival (95% CI) Unadjusted	
Great Ormond Street	38	0	100	(-)
Newcastle	35	4	88.5	(72.1 - 95.5)
UK	**73**	**4**	**94.5**	**(86.0 - 97.9)**

Table 10.7 1-year patient survival rates after bridging device implant for paediatric patients implanted 1 April 2021- 31 March 2025, by centre

Centre	Number of patients	Number of deaths	% 1-year survival (95% CI) Unadjusted	
Great Ormond Street	38	1	97.4	(82.8 - 99.6)
Newcastle	35	7	78.8	(60.4 - 89.3)
UK	**73**	**8**	**88.7**	**(78.6 - 94.2)**

APPENDIX

A1: Data

The cohort of patients in this report varies by section and type of analysis. **Tables A1.1** and **A1.2** summarise the number of adult and paediatric patients/implants (respectively) in each cohort and the section this applies to.

Table A1.1 Data analysed for adults

Time period	Report Section	Exclusion criteria	No. implants/ patients/ transplants
Adult – Long-term bridging			
1 April 2016 – 31 March 2026	• Introduction/Activity	None	758 implants
1 April 2021 – 31 March 2025	• Rate of transplant listing • Competing outcomes • Patient survival from implant (30 day and 1 year)	• TAH and pulsatile devices • Patients with no follow-up information	224 patients
1 April 2019 – 31 March 2023	• 3 year patient survival from implant	• TAH and pulsatile devices • Patients with no follow-up information	235 patients
1 April 2017 – 31 March 2021	• 5 year patient survival from implant	• TAH and pulsatile devices • Patients with no follow-up information	334 patients
1 April 2017 – 31 March 2025	• Survival on support	• TAH and pulsatile devices • Patients with no follow-up information	558 patients
1 April 2016 – 31 March 2026	• TAH outcomes	None	15 patients
Adult – Short-term bridging			
1 April 2016 – 31 March 2026	• Introduction/Activity	None	1208 implants
1 April 2021 – 31 March 2025	• Duration on support • Rate of transplant listing • Competing outcomes	• Patients with no follow-up information	428 patients
1 April 2021 – 31 March 2025	• Patient survival from implant	• Patients who had a long-term device before or after the short-term device • Patients with no follow-up information	401 patients
Adult – Short-term post-transplant			
1 April 2016 – 31 March 2026	• Introduction	• Long-term devices used post-transplant	562 implants
1 April 2016 – 31 March 2026	• Activity	• Implants for rejection • Long-term devices used post-transplant	441 transplants
1 April 2021 – 31 March 2025	• Duration on support • Patient survival from implant	• Implants for rejection • Long-term devices used post-transplant • Patients with no follow-up information	200 patients
1 April 2021 – 31 March 2025	• Patient survival from heart transplant	None	710 transplants

Table A1.2 Data analysed for paediatrics			
Time period	**Report Section**	**Exclusion criteria**	**No. implants/ patients**
Paediatric – Bridging devices			
1 April 2016 – 31 March 2026	• Introduction/Activity	None	260 implants
1 April 2016 – 31 March 2026 1 April 2021 – 31 March 2025	• Activity • Duration on support • Rate of transplant listing • Competing outcomes • Patient survival from implant	None • Patients with no follow-up information	207 episodes 73 patients

Limitations and classifications:

- BiVADs are counted as one implant.
- "Bridging" includes devices entered onto the MCS Database under "bridge to decision" as well as "bridge to transplant" along with any long-term devices used post-transplant.
- Patients who received concurrent short-term support with long-term support are classed simply as long-term device recipients.
- Patients who received concurrent ECMO support with a VAD are classed simply as VAD recipients.
- Any paediatric (age<16) activity reported by an adult only centre is presented in the adult sections.
- Berlin Heart implants into adult patients are counted as short-term support.

Table A1.3 details the number of patients meeting the criteria for each of the four patient outcomes sections, along with how many were excluded due to no follow-up post-implant and the number of patients with no follow-up information received in the previous year. Any patients who have been lost to follow-up are also reported here.

Table A1.3 Follow-up information for patients analysed in the patient outcomes sections of the report

Outcomes section	Centre	Patients meeting section criteria	Patients with no follow-up	Patients analysed	Patients with no follow-up in last year[1] (%)	Patients lost to follow-up (%)
Adult long-term bridging	Birmingham	29	0	29	0 (0)	0 (0)
	Glasgow	2	0	2	0 (0)	0 (0)
	Harefield	50	0	50	2 (4)	0 (0)
	Manchester	42	0	42	0 (0)	0 (0)
	Newcastle	72	0	72	0 (0)	0 (0)
	Papworth	29	0	29	0 (0)	0 (0)
	Overall	**224**	**0**	**224**	**2 (1)**	**0 (0)**
Adult short-term bridging	Birmingham	76	0	76	1 (1)	3 (4)
	Glasgow	82	0	82	2 (2)	0 (0)
	Harefield	89	1	88	1 (1)	17 (19)
	Manchester	61	0	61	3 (5)	2 (3)
	Newcastle	49	0	49	6 (12)	0 (0)
	Papworth	72	0	72	0 (0)	1 (1)
	Overall	**429**	**1[2]**	**428**	**13 (3)**	**23 (5)**
Adult post-transplant	Birmingham	49	0	49	0 (0)	0 (0)
	Glasgow	34	0	34	1 (3)	0 (0)
	Harefield	32	0	32	0 (0)	0 (0)
	Manchester	23	0	23	1 (4)	0 (0)
	Newcastle	31	0	31	0 (0)	0 (0)
	Papworth	31	0	31	0 (0)	0 (0)
	Overall	**200**	**0**	**200**	**2 (1)**	**0 (0)**
Paediatric bridging	Great Ormond Street	38	0	38	0 (0)	0 (0)
	Newcastle	35	0	35	6 (17)	0 (0)
	Overall	**73**	**0**	**73**	**6 (8)**	**0 (0)**

[1] Patients analysed who are not reported as deceased and no information on patient status has been returned via MCS Database or UK Transplant Registry since 1 June 2025
[2] Patient moved abroad before follow-up.

Table A1.4 details the device history of adult patients receiving a device between 1 April 2016 and 31 March 2026 by strategy. **Table A1.5** shows the same information for paediatric recipients. In both these tables, a dash ("-") between devices indicate that the subsequent device was implanted immediately following explant of the prior device and a slash ("/") indicates the patient had a period of no support between the two devices.

Table A1.4 Device history of adult patients receiving device implants, 1 April 2016 to 31 March 2026 by strategy

Device history	No. of bridging patients	No. of post-transplant patients
LT	578	
LT-ECMO	9	1
LT-ECMO-LT	1	
LT-ECMO-ST	2	
LT-ECMO-ST-ST	1	
LT-LT	22	
LT-LT-ECMO	1	
LT-LT-ECMO-ST	1	
LT-LT-LT	1	
LT-ST	4	
LT-ST-ST	1	
LT/ECMO	4	1
LT/ECMO-LT	1	
LT/LT	1	
LT/LT-LT	1	
LT/ST	2	
LT/ST-ST-ST	1	
TAH	6	
ST	399	19
ST-ECMO	11	1
ST-ECMO-ST	3	
ST-LT	44	
ST-LT-LT	1	
ST-LT-LT-ECMO	1	
ST-ST	30	1
ST-ST-ECMO	2	1
ST-ST-ECMO-LT	1	
ST-ST-LT	6	
ST-ST-ST	1	1
ST-ST/ECMO	1	1
ST-TAH	2	
ST/ECMO	2	1
ST/LT	1	
ST/ST	2	
ST/ST-ECMO	1	
ST/ST-LT	1	
ECMO	254	351
ECMO-ECMO	6	3
ECMO-ECMO-ST	1	
ECMO-LT	31	
ECMO-LT-LT	1	
ECMO-LT-LT-ST	1	
ECMO-LT-ST	1	
ECMO-ST	102	49
ECMO-ST-ECMO	2	3
ECMO-ST-LT	11	
ECMO-ST-LT-ST	1	
ECMO-ST-ST	4	2
ECMO-ST-ST-ST-ST	1	
ECMO-ST-ST-ST/LT	1	
ECMO-ST-TAH	1	
ECMO-ST/ECMO		2
ECMO-ST/LT	1	
ECMO-ST/LT-ECMO	1	
ECMO-ST/ST	1	1
ECMO-ST/TAH	1	
ECMO-TAH	5	
ECMO/ECMO	4	14
ECMO/ECMO/ECMO/ECMO		1
ECMO/ECMO/ST	1	

Table A1.4 Device history of adult patients receiving device implants, 1 April 2016 to 31 March 2026 by strategy

Device history	No. of bridging patients	No. of post-transplant patients
ECMO/LT	1	
ECMO/ST	4	1
ECMO/ST-ECMO		1
ECMO/ST/ST		1
Overall	**1583**	**456**

LT = Long-Term VAD, ST = Short-Term VAD, TAH = Total Artificial Heart, ECMO = Extracorporeal Membrane Oxygenation.
Note: a dash ("-") between devices indicates that the subsequent device was implanted immediately following explant of the prior device and a slash ("/") indicates the patient had a period of no support between the two devices

Table A1.5 Device history of paediatric patients receiving device, 1 April 2016 to 31 March 2026 by strategy

Device history	No. of bridging patients	No. of post-transplant patients
PR	1	
BH	33	
BH-ECMO	1	
HVAD	20	
HVAD-CM-ECMO-CM	1	
CM	48	
CM-BH	6	
CM-BH-CM	1	
CM-BH-CM-BH	1	
CM-BH/CM	1	
CM-BH/ECMO	1	
CM-CM	2	
CM-ECMO	1	
CM/CM	1	
ST		1
ECMO	35	43
ECMO-BH	14	
ECMO-CM	6	
ECMO-HM	1	
ECMO-HVAD	5	
ECMO-HVAD-ECMO	1	
ECMO-IM	2	
ECMO-IM-ECMO	1	
ECMO/BH	1	
ECMO/CM	3	
ECMO/ECMO	2	
ECMO/ECMO-BH	1	
ECMO/ECMO/CM	1	
HM	3	
IM	1	
Overall	**195**	**44**

BH = Berlin Heart; HVAD = Heartware HVAD, CM = Centrimag, ECMO = Extracorporeal Membrane Oxygenation, IM = Impella, HM = HeartMate, PR = Protec, ST = Short-Term VAD.
Note: a dash ("-") between devices indicates that the subsequent device was implanted immediately following explant of the prior device and a slash ("/") indicates the patient had a period of no support between the two devices

A2: Methods

Analysis of geographical variation in MCS rates

Patients were assigned to NHS regions in England or country for Wales, Scotland and Northern Ireland using their postcode of residence, as reported at implant. Patients were only counted once regardless of how many devices they received in the period. The number of patients receiving a device per million population (pmp) of NHS region/country was obtained using mid-2022 population estimates based on the Office for National Statistics (ONS) 2022 Census figures (denominator). No NHS region age- or sex-specific standardisation of rates was performed when calculating the systematic component of variation. The MCS 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.

Systematic component of variation

For a given individual who is a resident in a given English NHS region, provision of a bridging device 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.

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

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

A one-sided p-value for the hypothesis that the SCV is greater than zero versus the null hypothesis that the SCV is equal to zero was derived using a parametric bootstrap where data were simulated from the Poisson distribution that would be consistent with the null hypothesis (multiplicative rate factor is equal to one in all areas and σ^2 equal to zero). The observed SCV was then compared against this simulated data to calculate the probability that an SCV of at least this size would be observed due to chance if the null hypothesis were true.

10,000 bootstrap samples of size 7 (number of areas) were simulated, where the bridging implant count in each area was drawn from a Poisson distribution with its expected value being the area-specific expected count (the rate of bridging implants in the total population multiplied by the population of the area) . The SCV was then calculated in each of the 10,000 samples and a bootstrap p-value for the SCV in the observed data was estimated as:

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

where $\#\{SCV_{sim} \geq SCV_{obs}\}$ is the number of SCV values in the simulated datasets which are greater than or equal to the SCV in the observed data. This follows the simulation method given in Ibanez et al., BMC Health Services Research, 2009, 9:60. No adjustment was made for area-specific demographic characteristics that may impact the rates of bridging implantation such as age and sex.

Duration on support

Duration on support (Sections 6.2, 8.2 and 10.2) is summarised using the median and interquartile range, as well as boxplots, of the observed time each patient spent on support. These are calculated directly from the data and are not adjusted for patients whose support had not ended at the time of analysis. Reports published prior to 2025-26 estimated the median and its 95% confidence interval using the Kaplan-Meier method, so these results are not directly comparable with previous reports. Patients still on support at the time of analysis are included with their time on support up to their latest follow-up, and their number is given in a footnote to each table. Because their support has not yet ended, the observed median may underestimate the true median when many patients are still on support, but for short-term device support and paediatric devices, most patients in the analysis cohort have reached the end of support at time of data extraction. For long-term device support in adults, the median duration on support is no longer presented from 2025-26 onwards due to the prolonged time that these devices can be used. Instead the reader is referred to the competing outcome analysis in Section 4.3.

Unadjusted survival rates

The Kaplan-Meier method is used to estimate 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, which means they have not yet experienced the outcome of death.

Funnel plots

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

A3: Glossary of terms

Aalen-Johansen method
A method for calculating the cause-specific cumulative incidence which allows for patients experiencing one of a set of outcomes where each outcome may preclude or change the probability of a patient experiencing any of the others ("competing risks"). It allows for patients with incomplete follow-up to be included as per the Kaplan-Meier method.

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).

Competing outcomes
A situation when patients or subjects can experience one or more events or outcomes which 'compete' with the outcome of interest. For instance, when the event of interest is death on VAD support, receiving a transplant or having one's device explanted and recovering are competing outcomes. Generally, the competing outcomes hinder the observation of the event of interest or modify the chance that this event occurs.

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 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.

Continuous-flow device
An electrically driven rotary pump that pumps blood continuously throughout the cardiac cycle.

Cumulative incidence
The probability of an event (death, transplant or explant in this context) occurring before a particular point in time.

ECMO
Extracorporeal Membrane Oxygenation. The term ECMO is used in this report to describe veno-arterial (VA) ECMO, rather than veno-venous (VV) ECMO.

INTERMACS patient profile

Level 1: Critical cardiogenic shock describes the patient who is "crashing and burning"; in which patients have life–threatening hypotension despite rapidly escalating inotropic support, occasionally with IABP placement as well, with critical organ hypoperfusion often confirmed by worsening acidosis and lactate levels. Patients may have less than 24 hours survival expected without mechanical support.

Level 2: Progressive decline describes the patient who has been demonstrated "dependent" on inotropic support but nonetheless shows signs of continuing deterioration in nutrition, renal function, fluid retention, or other major status indicator. Level 2 can also describe a patient with refractory volume overload, perhaps with evidence of impaired perfusion, in whom inotropic infusions *cannot be maintained* due to tachyarrhythmia, clinical ischemia, or other intolerance.

Level 3: Stable but inotrope dependent describes the patient who is clinically stable on mild–moderate doses of intravenous inotropes after repeated documentation of failure to wean without symptomatic hypotension, worsening symptoms, or progressive organ dysfunction (usually renal). It is critical to monitor nutrition, renal function, fluid balance, and overall status carefully in order to distinguish between patients who are truly stable at Level 3 and those who have unappreciated decline rendering them Level 2.

Level 4: is the level of "recurrent" rather than "refractory" decompensation. After interventions such as hospitalization for intravenous diuretics, these patients can be stabilized briefly on an oral regimen at close to normal volume status. However, they experience brief relapses into fluid retention. These patients should be carefully considered for more intensive management and surveillance programs, by which some may be recognized to have poor compliance that would compromise outcomes with any therapy.

Level 5: describes patients who are comfortable at rest but are exercise intolerant for most activity, living predominantly within the house or housebound. They have no congestive symptoms, but may have chronically elevated volume status, frequently with renal dysfunction, and may be characterized as housebound.

Level 6: is a similar patient who is generally without any evidence of fluid overload and able to do some mild activity. Activities of daily living are comfortable and minor activities outside the home such as visiting friends or going to a restaurant can be performed, but fatigue results within a few minutes or any meaningful physical exertion.

Level 7: describes patients who are clinically stable with a reasonable level of comfortable activity, despite history of previous decompensation that is not recent. Any decompensation requiring intravenous diuretics or hospitalization within the previous 2 weeks should make the person a Level 4 or lower.

ISHLT Mechanically Assisted Circulatory Support Registry Users' Guide (2012). Birmingham, AL (http://www.ishlt.org/ContentDocuments/IMACS_Users_Guide_Final_032414.pdf)

Interquartile range (IQR)

The lower quartile (25th percentile) and the upper quartile (75th percentile) of a set of values, so that the middle half of the values lie within it. In this report it is used with the median to describe the spread of the duration on support.

Kaplan-Meier method
A method that allows patients with incomplete follow-up information to be included in estimating survival rates and other time related statistics. 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 VAD implantation. 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.

Long-term (LT) devices
Long-term devices are implantable and intended to support the patient for years. Patients can be discharged from hospital with a LT device. Most LT devices are continuous-flow devices but some are pulsatile.

MCS
Mechanical Circulatory Support.

MCS Database
Database used for an ongoing extensive audit to capture in-depth data prior to and at implant of device, explant, transplant and death along with follow-up at various time points post-implant and post-explant. The database captures data on long-term and short-term mechanical circulatory support, including VADs, TAH and ECMO, for the purpose of bridge to transplant, bridge to decision (in this report both analysed together as “bridging”), primary graft dysfunction and “other” (allowing capture of devices for rejection). Devices used post-cardiotomy are not funded via the NHS England bridge to transplant or recovery programme and so are excluded from the MCS Database. Destination Therapy is not explicitly captured on the database but these cases may be captured within “bridge to transplant” or “bridge to decision” where the patient never received a transplant.

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

Paediatric
Any patient implanted at Great Ormond Street Hospital and patients implanted at Newcastle aged under 16 years at time of implant.

Patient survival rate
The estimated percentage of patients who are still alive. This is usually specified for a given time period after implant. For example, a 1 year patient survival rate is the estimated percentage of patients who are still alive 1 year after their first device implant.

Primary graft dysfunction
In this report primary graft dysfunction (PGD) is defined as all VADs and ECMOs used for graft failure within 30 days of heart transplantation.

Pulsatile device
A device that mimics the natural pulsing action of the heart.

***p* value**
In the context of comparing listing rates across centres, as an example, 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.

Rejection
Rejection is defined as all VADs and ECMOs used for graft failure more than 30 days after heart transplantation.

Short-term (ST) devices
Short-term devices are intended to support the heart for a short period of time (days or weeks). Patients cannot leave hospital with the device.

Survival on support
The percentage of patients who are still alive and on VAD support. Unlike patient survival from implant, survival on support is censored at time of device explantation or transplantation. This is usually specified for a given time period after implantation. For example, a 3-year survival on support rate is the estimate of patients who are still alive on support three years after their first short-term or long-term VAD implantation.

TAH
Total Artificial Heart.

UK Transplant Registry
A national database held by NHS Blood and Transplant collecting data on all organ transplant procedures. Information is accrued prospectively at recipient registration on the national transplant list, at organ donation, at time of transplantation and at regular intervals thereafter.

Unadjusted survival rate
Unadjusted patient survival rates do not take account of potential confounders and are based only on the number of patients at a given centre and the number and timing of those that die within the post-implant period of interest. In this case, unlike for risk-adjusted rates, all patients are assumed to be equally likely to die at any given time. However, some centres may have lower unadjusted survival rates than others simply because they happen to have patients that have increased risks of death. All results presented in this report are unadjusted as the risk factors affecting survival post-MCS in the UK have not yet been examined.

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.

Prepared by:

Statistics and Clinical Research, NHS Blood and Transplant

Miguel Reyes
Sally Rushton