NHS
Blood and Transplant

ANNUAL REPORT ON LUNG TRANSPLANTATION

REPORT FOR 2024/2025
(1 APRIL 2015 – 31 MARCH 2025)

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PRODUCED IN COLLABORATION WITH NHS ENGLAND

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EXECUTIVE SUMMARY

1. Executive Summary

This report presents key data about lung transplantation in the UK. The period reported covers 10 years, from 1 April 2015 to 31 March 2025. The data include number of people listed for a transplant, number of transplants performed and survival rates following lung transplantation; both on a national and centre-specific basis. Data were extracted on 18 June 2025.

Key findings

ADULT LUNG TRANSPLANTATION

- On 31 March 2025 there were 185 adults waiting for a lung transplant: 152 on the non-urgent list, 23 on the urgent list and 10 waiting for a heart-lung transplant. In comparison to 31 March 2024, the waiting list has fallen by 29%.
- The 1 year waiting list mortality rate was 14% on the non-urgent list and 21% on the waiting list (including removals due to deteriorating condition).
- Median waiting time to lung transplant was 449 days from non-urgent registration and 19 days from urgent registration.
- During 2024/2025 there were 146 adult lung transplants including 2 heart-lung transplants. This was 8% higher than the previous year but remained lower than pre COVID-19 pandemic levels.
- Of the 144 adult lung only transplants, 33% were urgent or super-urgent, the highest percentage since the introduction of the urgent and super-urgent allocation schemes in 2017.
- The national rate of patient survival following adult lung transplant was 90.3% at 90 days, 83.7% at 1 year and 54.8% at 5 years.

PAEDIATRIC LUNG TRANSPLANTATION

- On 31 March 2025 there were 9 paediatric patients waiting for a lung or heart-lung transplant: 6 on the non-urgent list, 2 on the urgent lung list and 1 on the heart-lung list.
- Median waiting time to transplant was 801 days from initial registration onto the waiting list.
- During 2024/2025, there were 5 paediatric lung transplants; 4 of these transplants were performed at Great Ormond Street Hospital, all of which were urgent. Newcastle performed 1 non-urgent transplant.
- The national rate of patient survival following paediatric lung transplant was 100% at 90 days, 90.0% at 1 year and 62.8% at 5 years.

Use of the contents of this report should be acknowledged as follows: *Annual Report on Lung Transplantation 2024/2025, NHS Blood and Transplant*

INTRODUCTION

2. Introduction

This report presents data on activity and outcomes of lung transplant candidates and recipients between 1 April 2015 and 31 March 2025, for all centres performing lung transplantation in the UK. Data were obtained from the UK Transplant Registry at NHS Blood and Transplant which holds information relating to donors, recipients and outcomes for all cardiothoracic organ transplants performed in the UK.

Results are described separately for adults (aged 16 years or over) and paediatric patients (aged less than 16 years). There are six lung transplant centres in the UK. Four of the six centres specialise in adult transplantation, one in paediatric transplantation (Great Ormond Street Hospital) and one in both adult and paediatric transplantation (Newcastle). Any transplants carried out at Great Ormond Street Hospital in recipients aged 16 or over are included in the paediatric analysis, and any transplants carried out at adult only centres in recipients less than 16 are included in the adult analysis.

Heart-lung block transplant activity is included within the adult and paediatric lung sections and post-transplant survival is considered in Section 6.4 for adults only. Other multi-organ transplants are presented separately in Section 6.5 and are excluded from the rest of the main report. In addition, partial lung transplants and patients receiving their second (or subsequent) graft are excluded from all survival analysis calculations.

The time period of analysis covers the introduction of the urgent and super-urgent lung allocation schemes in May 2017.

Methods used are described in the Appendix. The centre specific adult survival rates are adjusted for differences in risk factors between the centres. The risk models used are described in the Appendix. The adult lung risk model was revised in July 2023 in consultation with the clinical community.

2.1 Overview

Figure 2.1 shows the number of lung transplant candidates on the active transplant list at financial year end between 2016 and 2025. The number of people on the active lung and heart-lung transplant list remained reasonably stable until 2020, after which there was a 24% decrease to 271 in 2021 due to a fall in registrations across all disease groups during the COVID-19 pandemic. Since then, whilst the number of registrations for fibrosing lung disease has recovered, the number in other disease groups, in particular cystic fibrosis has remained low. This corresponded with the introduction of an alternative therapy for cystic fibrosis. The further fall in the waiting list in the most recent year was partly due to one centre retrospectively removing a large number of patients from the list in summer 2024.

Figure 2.1 Number of people on the national active lung and heart-lung transplant lists on 31 March each year, 2016 to 2025

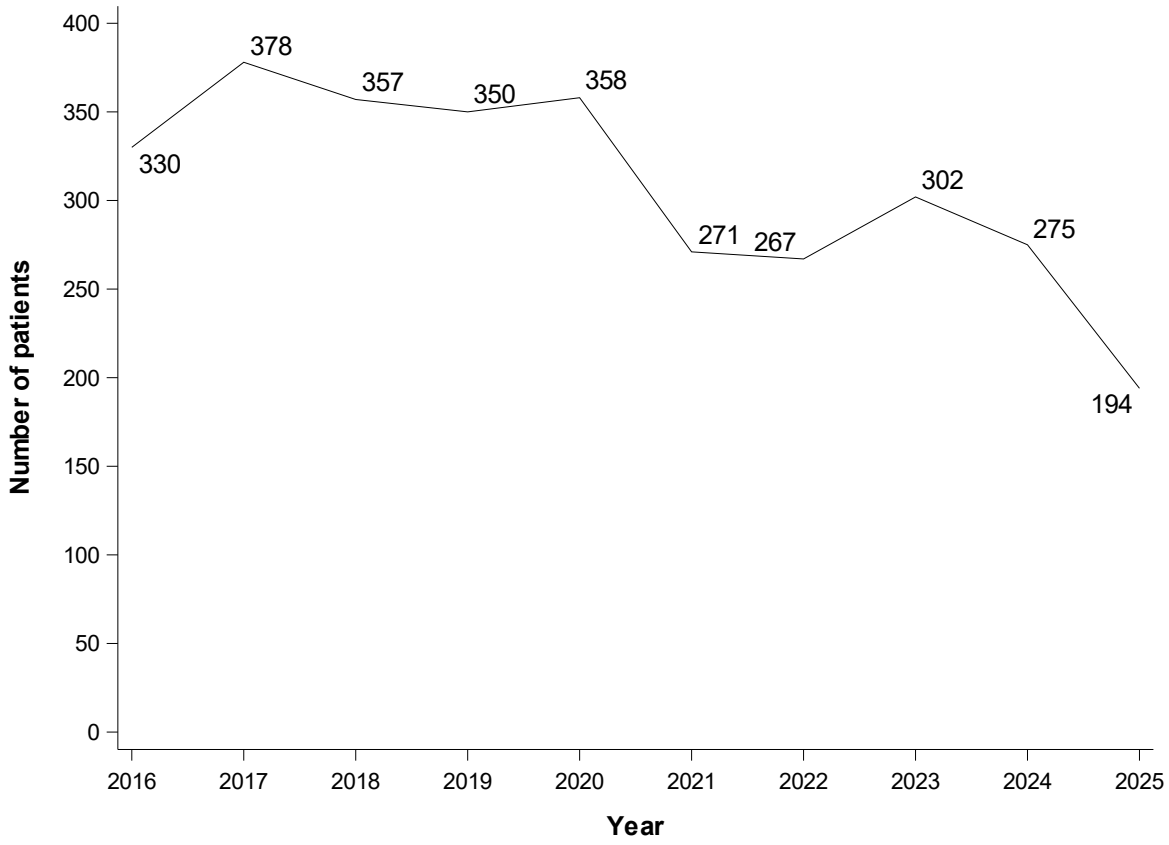


Figure 2.2 and **Figure 2.3** show the number of adult and paediatric patients on the active transplant list on 31 March 2025 at each centre. In total, there were 185 adults and 9 paediatric patients waiting for a lung transplant. Harefield had the highest number of adults on the lung transplant list. All of the 9 paediatric patients were waiting at Great Ormond Street Hospital.

Figure 2.2 Number of adults on the active lung transplant list on 31 March 2025, by centre

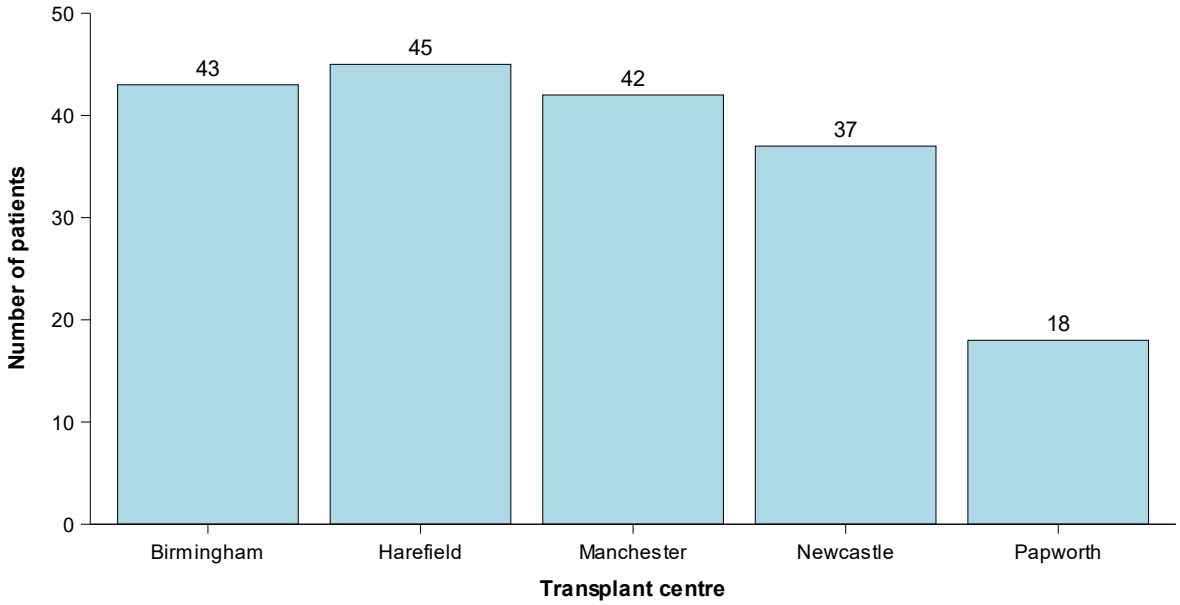


Figure 2.3 Number of paediatric patients on the active lung transplant transplant list on 31 March 2025, by centre

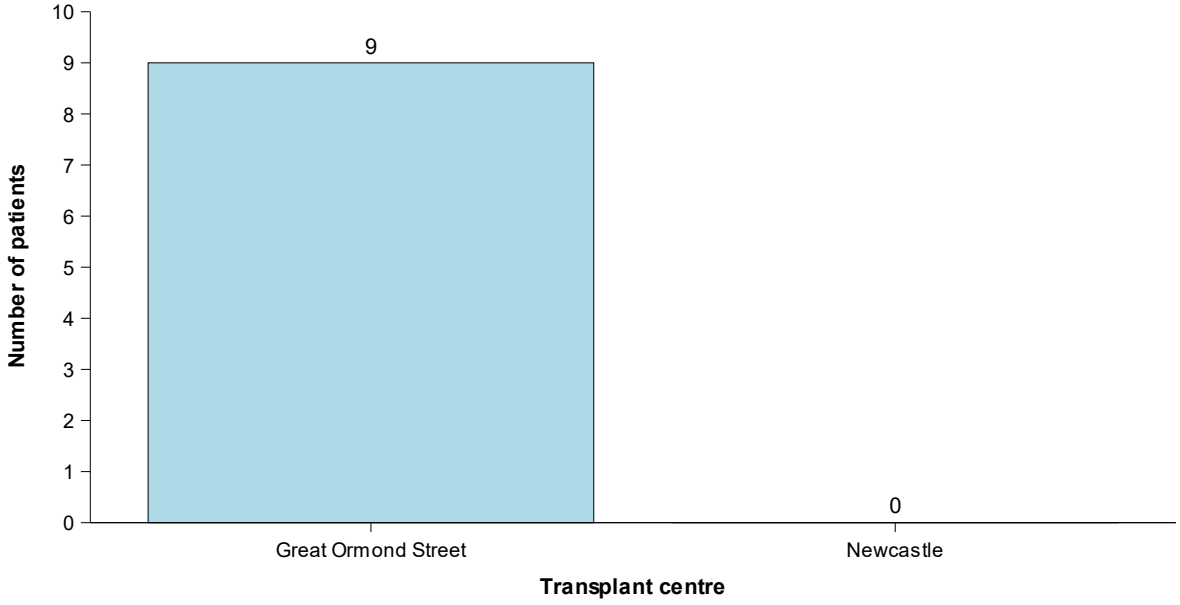


Figure 2.4 shows the total number of transplants performed in each of the last 10 financial years. The number of lung transplants last year increased by 8% to 151 but remained lower than pre COVID-19 pandemic numbers.

Figure 2.4 Number of lung transplants in the UK, by financial year, 1 April 2015 to 31 March 2025

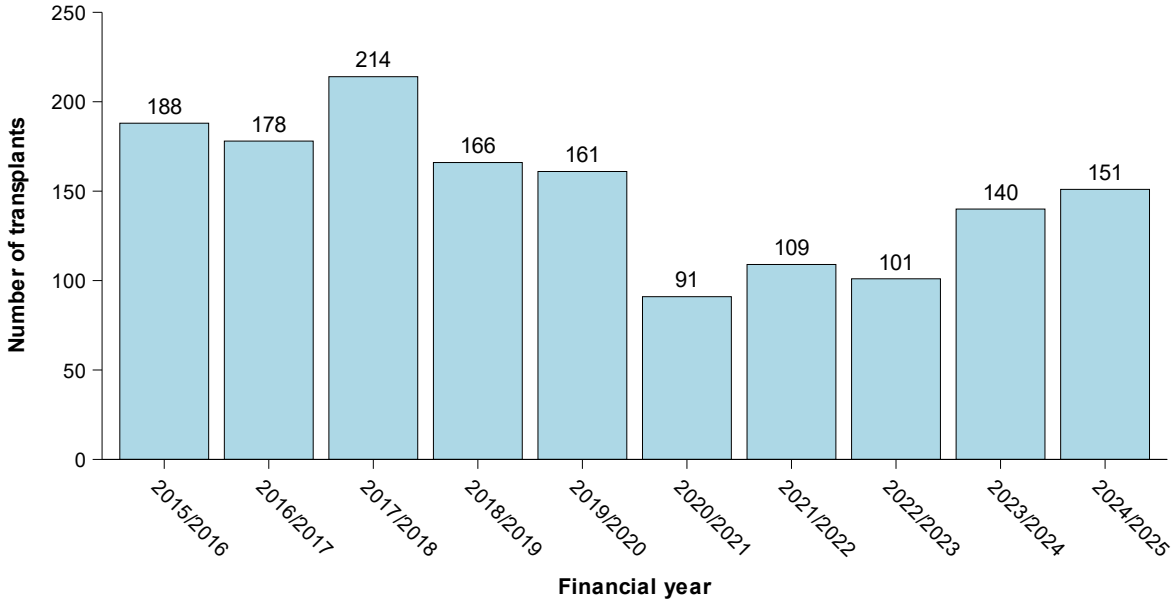


Figure 2.5 and **Figure 2.6** show the number of adult and paediatric transplants carried out in the most recent financial year at each centre. Papworth performed the highest number of adult lung transplants. Great Ormond Street Hospital performed the highest number of paediatric lung transplants. Newcastle performed a paediatric lung transplant for the first time in five years (see Section 11 for more detail).

Figure 2.5 Number of adult lung transplants in the UK, by centre, 1 April 2024 to 31 March 2025

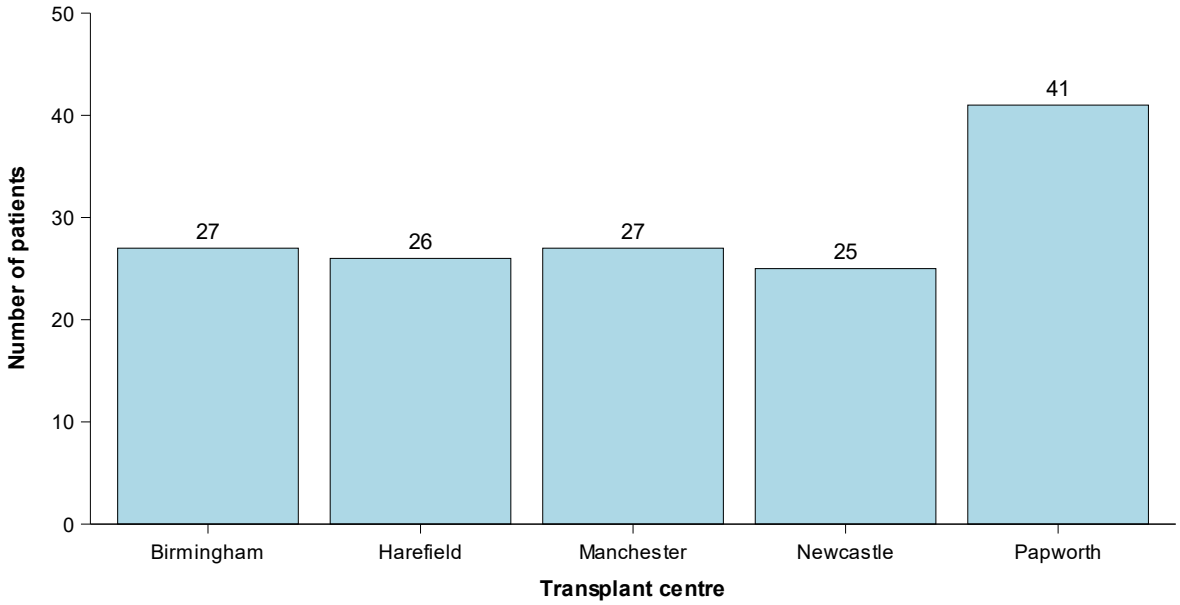


Figure 2.6 Number of paediatric lung transplants in the UK, by centre, 1 April 2024 to 31 March 2025

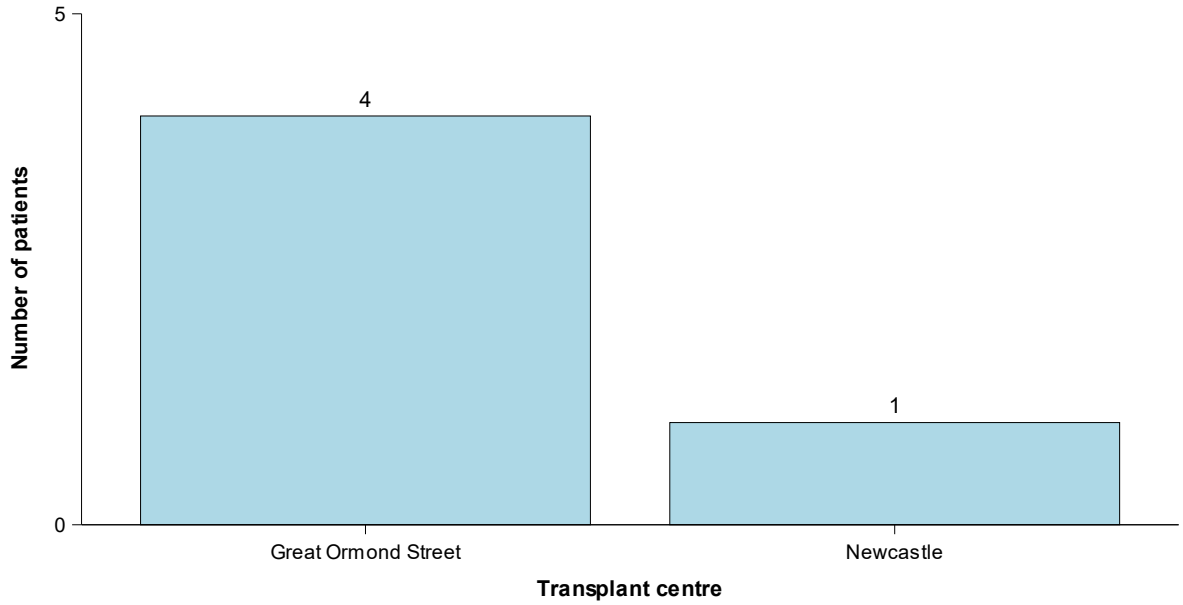
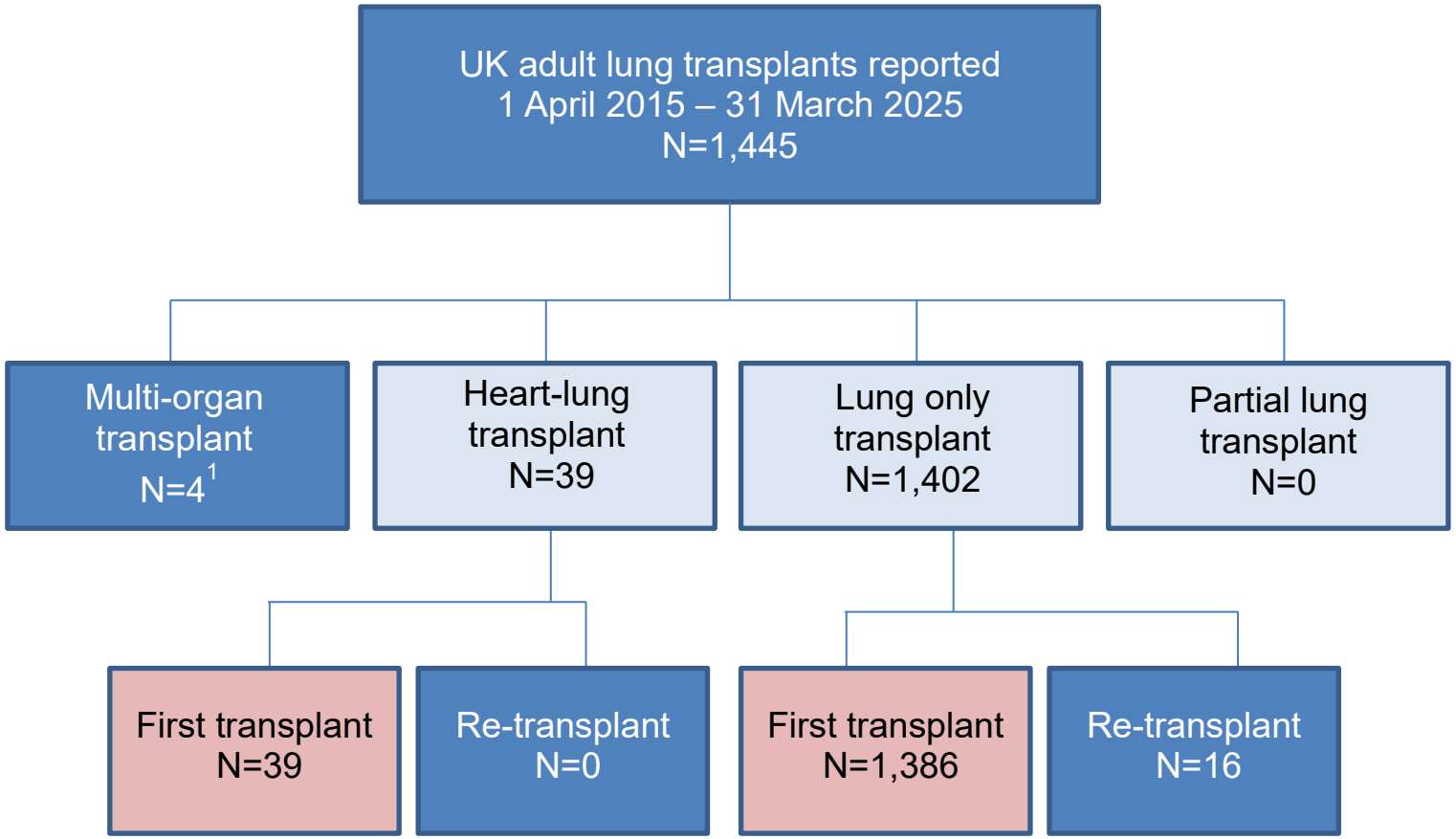


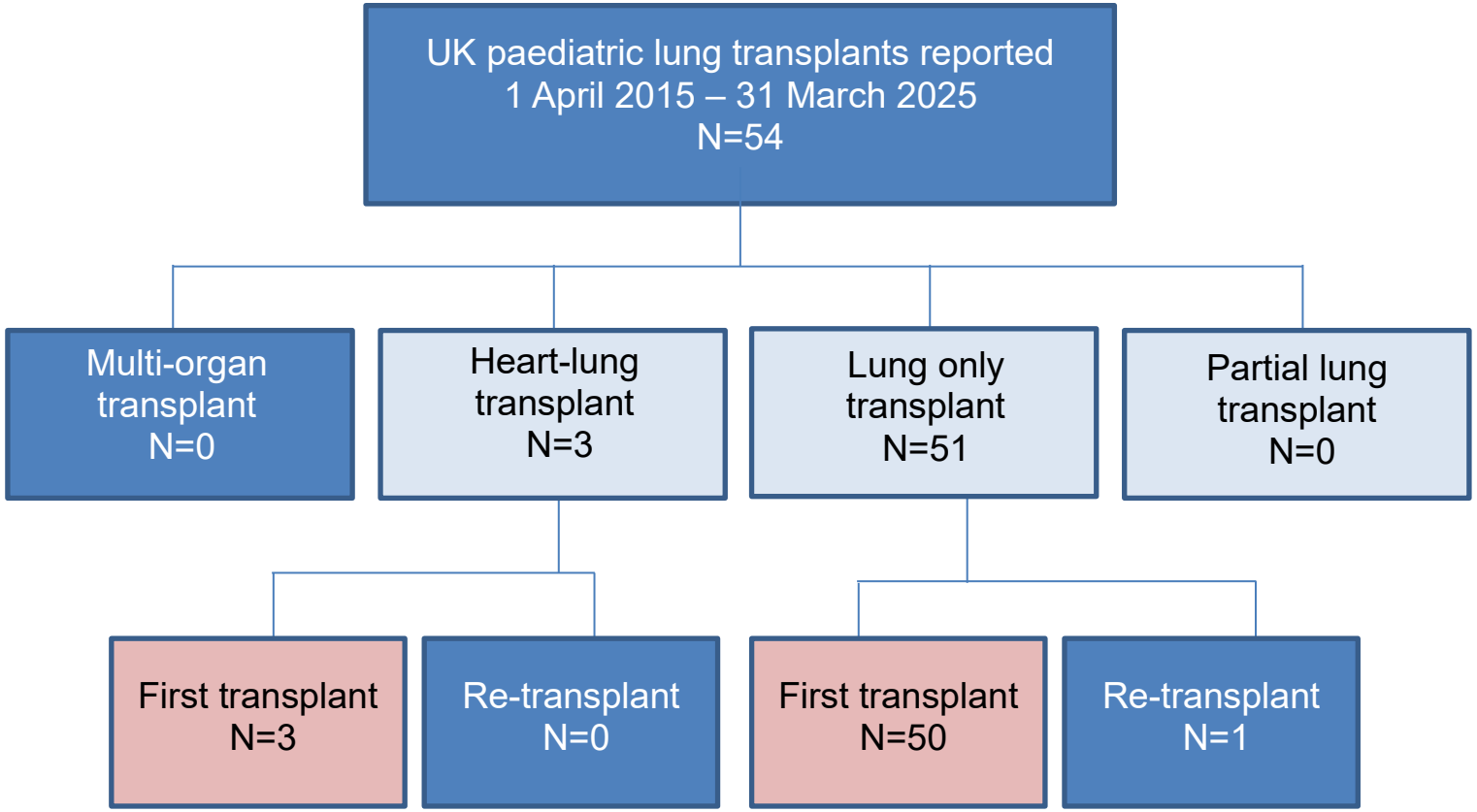
Figure 2.7 shows a breakdown of the 1,445 adult lung transplants performed in the UK in the ten-year period while **Figure 2.8** shows a similar breakdown for the 54 paediatric transplants performed during the same period. Re-transplants are included in the transplant activity sections of this report but excluded from the survival analysis sections. Multi-organ transplants are excluded from the rest of the report apart from the separate multi-organ outcome section (Sections 6.5).

Figure 2.7 Adult lung transplants performed in the UK, 1 April 2015 to 31 March 2025



[1] Includes 4 lung and liver transplants

Figure 2.8 Paediatric lung transplants performed in the UK, 1 April 2015 to 31 March 2025



2.2 Geographical variation in registration and transplant rates

Figure 2.9 shows rates of registration to the lung transplant list per million population (pmp) between 1 April 2024 and 31 March 2025 compared with lung transplant rates pmp for the same time period, by recipient country/NHS region of residence. **Table 2.1** shows the actual numbers as well as rates. If a patient has had more than one registration/transplant in the period, each registration/transplant is considered. The UK lung registration and transplant rates are 2.9 pmp and 2.2 pmp respectively.

Since there will inevitable be some random variation in rates between areas, the systematic coefficient component of variation (SCV) was used to identify if the variation is more (or less) than a random effect for the different NHS regions in England only. Only first registrations and transplants in this period were considered. The larger the SCV the greater the evidence of a high level of systematic variation between areas. Registration and transplant rates yielded an SCV of 0.123 (p-value <0.001) and 0.0002 (p-value = 0.328), respectively. The p-value shows the probability that an SCV of this size (or higher) would be observed by chance if only random variation existed and therefore indicates that there is significant evidence of systematic variation in registration rates between areas but not in transplant rates. No adjustment has been made for area-specific demographic characteristics that may impact the rates of registration to the transplant list and transplantation such as age and sex. Therefore, these results should be interpreted with caution.

Figure 2.9 Comparison of lung registration rates (pmp) with transplant rates (pmp) by recipient country/NHS region of residence

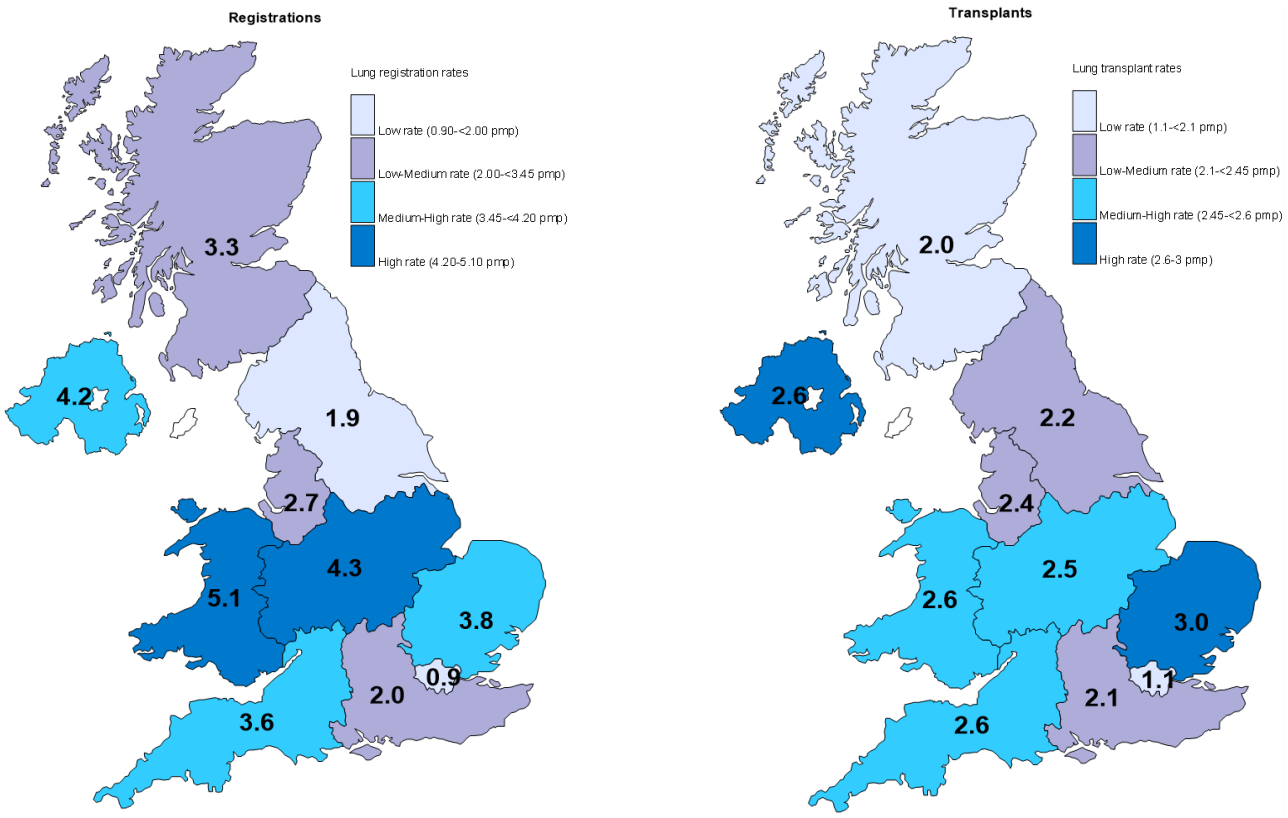


Table 2.1 Lung registration and transplant rates per million population (pmp) in the UK, 1 April 2024 - 31 March 2025, by Country/NHS region

Country/ NHS region	Registrations (pmp)		Transplants (pmp)	
North East and Yorkshire	16	(1.9)	18	(2.2)
North West	20	(2.7)	18	(2.4)
Midlands	47	(4.3)	27	(2.5)
East of England	24	(3.8)	19	(3.0)
London	8	(0.9)	10	(1.1)
South East	19	(2.0)	20	(2.1)
South West	21	(3.6)	15	(2.6)
England	**155**	**(2.7)**	**127**	**(2.2)**
Isle of Man	**0**	**(0.0)**	**0**	**(0.0)**
Channel Islands	**1**	**(5.9)**	**0**	**(0.0)**
Wales	**16**	**(5.1)**	**8**	**(2.6)**
Scotland	**18**	**(3.3)**	**11**	**(2.0)**
Northern Ireland	**8**	**(4.2)**	**5**	**(2.6)**
TOTAL	**198**	**(2.9)**	**151**	**(2.2)**

ADULT LUNG TRANSPLANTATION

Transplant List

3.1 Adult lung and heart-lung transplant list on 31 March, 2016 – 2025

Figure 3.1 shows the number of adults on the lung and heart-lung transplant lists on 31 March each year between 2016 and 2025 split by urgency status. The number on the active non-urgent lung transplant list has decreased substantially over the past decade due to a number of factors, including reduced registrations during the COVID-19 pandemic and the introduction of an alternative therapy for patients with cystic fibrosis. On 31 March 2025 the number of adults on the active non-urgent lung transplant list was 152. The super-urgent and urgent lung allocation schemes were introduced in 2017 and there has been a recent increase in the number of adults on the urgent list, with 23 waiting on 31 March 2025 (none on the super-urgent list). There were 10 adults waiting for a combined heart-lung transplant on 31 March 2025.

Figure 3.1 Number of adults on the lung and heart-lung transplant lists on 31 March each year, by urgency status

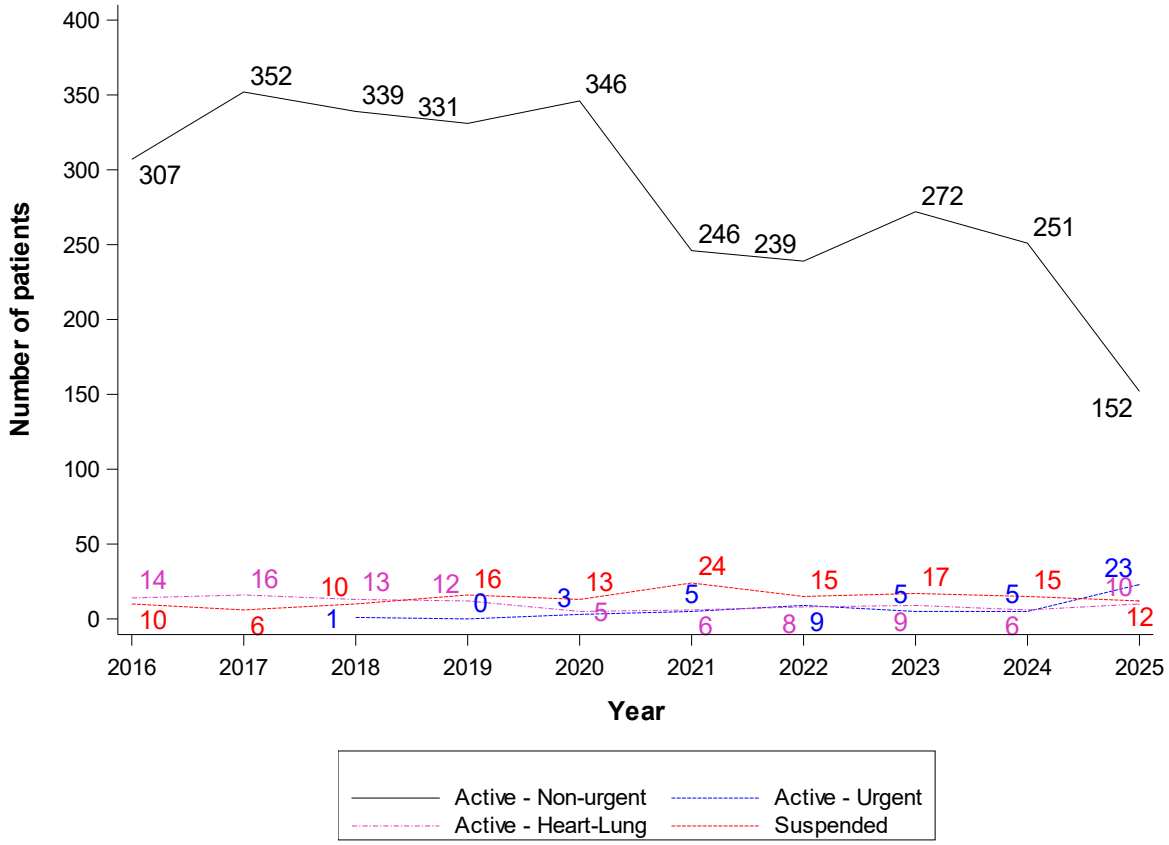


Figure 3.2 shows the number of adults on the active lung and heart-lung transplant lists on 31 March 2025, by centre and urgency. In total, there were 185 adults waiting, including 23 on the urgent lung list. Harefield had the highest number of people registered on the transplant list, with 45 adults waiting.

Figure 3.2 Number of adults on the active lung and heart-lung transplant lists on 31 March 2025, by centre and urgency

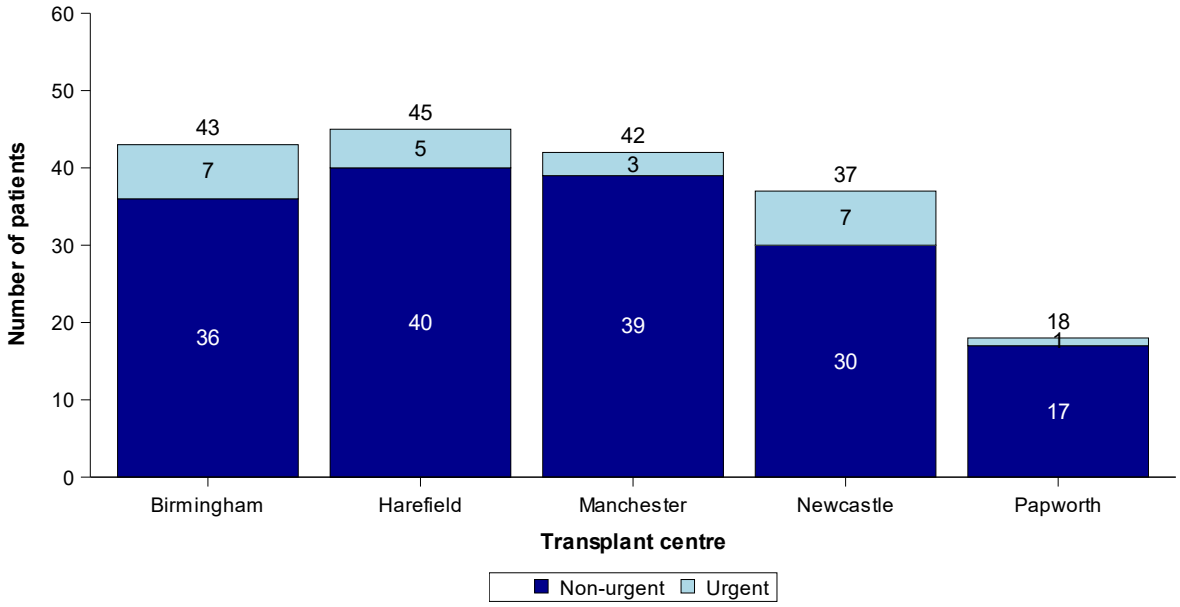
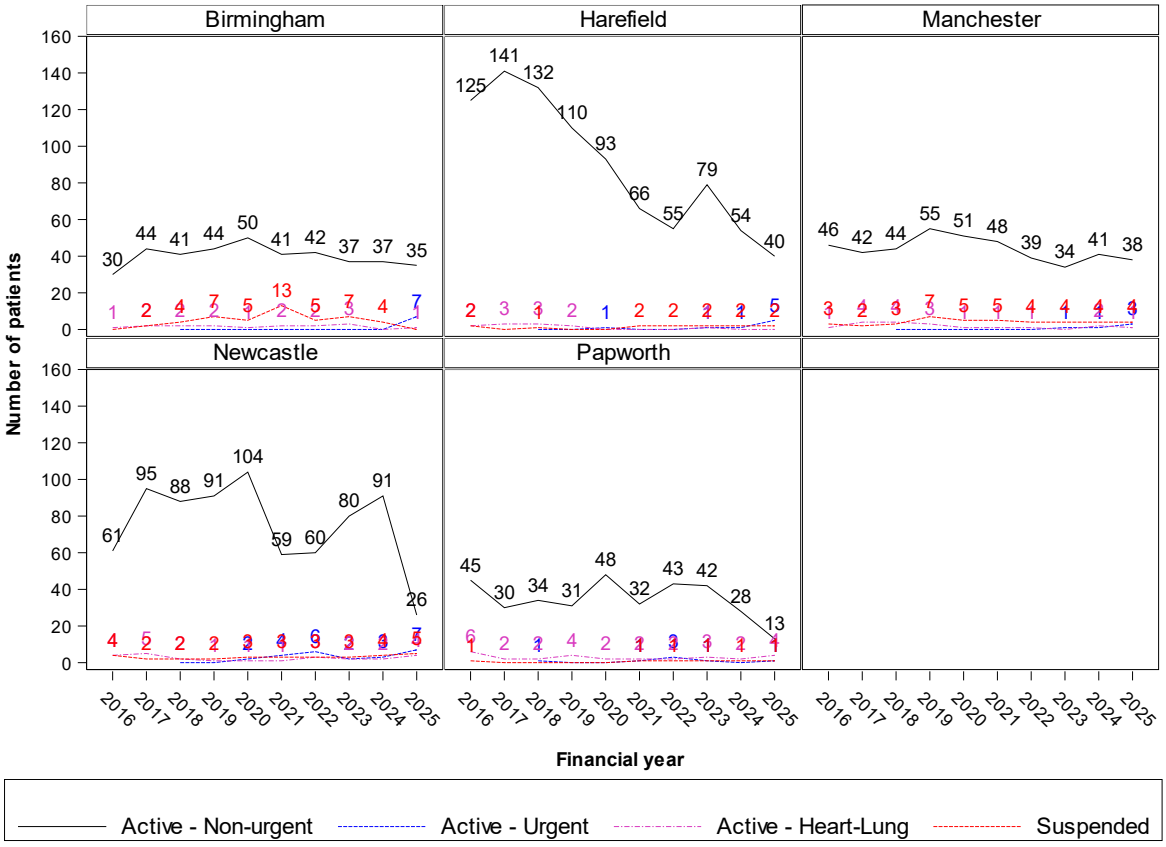


Figure 3.3 shows the trend over time in the number of adults on the lung transplant list on 31 March each year across centres. Harefield, Newcastle and Papworth have experienced substantial decreases in their lung lists in recent years. The sudden decline in Newcastle's waiting list in 2025 is not reflective of the true change, but is due to late notification of deaths and removals from the list to NHSBT leading to a batch of patients being removed in summer 2024. There was no one waiting on the super-urgent list on 31 March in any year.

Figure 3.3 Number of adults on the lung and heart-lung transplant lists on 31 March each year, for the last 10 years, by centre



3.2 Demographic characteristics, 1 April 2024 – 31 March 2025

There were 193 adult registrations onto the lung or heart-lung transplant lists between 1 April 2024 and 31 March 2025. Demographic characteristics of these individuals are shown by centre and overall in **Table 3.1**. Nationally, 72% were male and the median age was 57 years. The most common primary disease group was fibrosing lung disease. For some characteristics, due to rounding, percentages may not add up to 100.

Table 3.1 Demographic characteristics of adult patient registrations onto the lung and heart-lung transplant lists between 1 April 2024 and 31 March 2025, by centre

		Birmingham N (%)	Harefield N (%)	Manchester N (%)	Newcastle N (%)	Papworth N (%)	**TOTAL N (%)**
Number of registrations		42 (100)	33 (100)	32 (100)	36 (100)	50 (100)	**193 (100)**
Highest urgency during registration	Non-urgent	31 (74)	21 (64)	28 (88)	21 (58)	40 (80)	**141 (73)**
	Urgent	10 (24)	9 (27)	4 (13)	14 (39)	9 (18)	**46 (24)**
	Super-urgent	1 (2)	3 (9)	0 (0)	1 (3)	1 (2)	**6 (3)**
Recipient sex	Male	30 (71)	29 (88)	22 (69)	24 (67)	33 (66)	**138 (72)**
	Female	12 (29)	4 (12)	10 (31)	12 (33)	17 (34)	**55 (29)**
Recipient ethnicity	White	35 (83)	24 (73)	29 (91)	33 (92)	45 (90)	**166 (86)**
	Asian	6 (14)	5 (15)	2 (6)	2 (6)	4 (8)	**19 (10)**
	Black	0 (0)	1 (3)	0 (0)	0 (0)	1 (2)	**2 (1)**
	Other	0 (0)	0 (0)	1 (3)	0 (0)	0 (0)	**1 (1)**
	Missing	1 (2)	3 (9)	0 (0)	1 (3)	0 (0)	**5 (3)**
Recipient age (years)	Median (IQR)	57 (49, 61)	52 (44, 59)	60 (53, 63)	57 (51, 61)	58 (51, 61)	**57 (50, 61)**
	Missing	0	0	0	0	0	**0**

Table 3.1 Demographic characteristics of adult patient registrations onto the lung and heart-lung transplant lists between 1 April 2024 and 31 March 2025, by centre

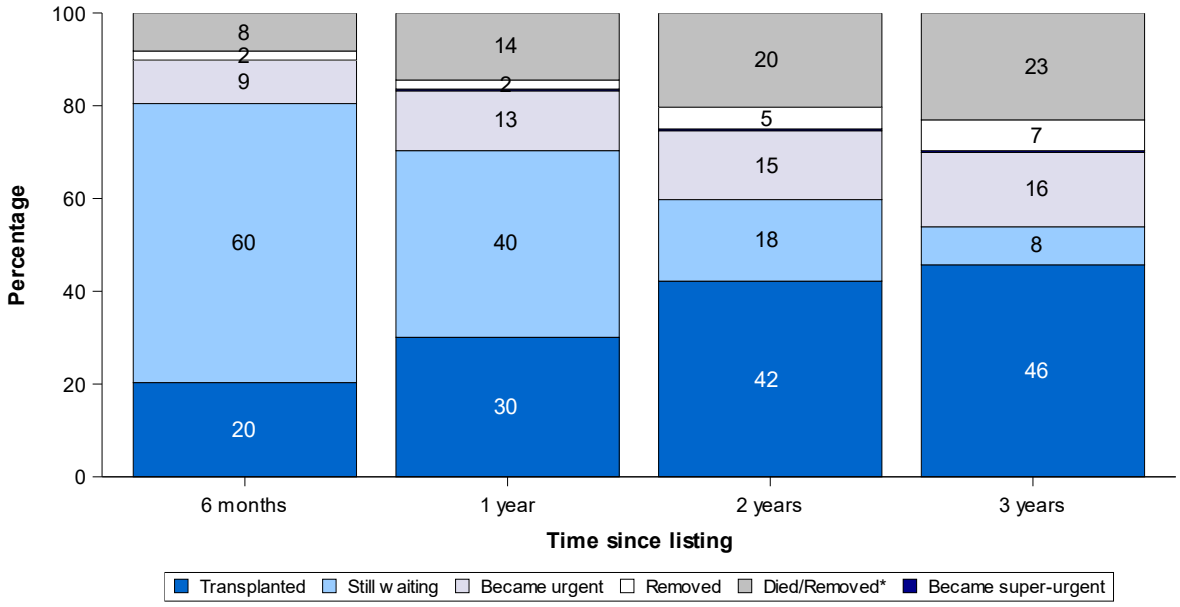
		Birmingham N (%)	Harefield N (%)	Manchester N (%)	Newcastle N (%)	Papworth N (%)	**TOTAL N (%)**
Primary Disease	Cystic fibrosis and bronchiectasis	5 (12)	2 (6)	3 (9)	0 (0)	0 (0)	**10 (5)**
	Fibrosing lung disease	20 (48)	21 (64)	18 (56)	27 (75)	27 (54)	**113 (59)**
	COPD and emphysema	14 (33)	10 (30)	9 (28)	5 (14)	15 (30)	**53 (28)**
	Primary pulmonary hypertension	0 (0)	0 (0)	1 (3)	2 (6)	4 (8)	**7 (4)**
	Other heart/lung disease	3 (7)	0 (0)	1 (3)	2 (6)	4 (8)	**10 (5)**
Smoker	No	42 (100)	33 (100)	31 (97)	34 (94)	50 (100)	**190 (98)**
	Missing	0 (0)	0 (0)	1 (3)	2 (6)	0 (0)	**3 (2)**
Lung function - FEV1 (litres)	Median (IQR)	1.07 (0.78, 1.89)	1.22 (0.75, 2.10)	1.51 (0.84, 2.28)	1.66 (1.13, 2.48)	1.40 (0.94, 1.96)	**1.37 (0.83, 2.10)**
	Missing	2	2	1	3	2	**10**
Lung function - FVC (litres)	Median (IQR)	2.20 (1.74, 2.83)	2.00 (1.43, 2.64)	2.03 (1.50, 3.05)	2.39 (1.78, 3.14)	2.21 (1.73, 2.86)	**2.20 (1.57, 2.85)**
	Missing	2	2	1	3	2	**10**

3.3 Post-registration outcomes, 1 April 2020 – 31 March 2022

The registration outcomes of adults listed for a lung only transplant between 1 April 2020 and 31 March 2022 are summarised in **Figures 3.4** – **3.6**, nationally and by centre, for non-urgent and urgent registrations respectively. The possible outcomes on the list include receiving a transplant, removal from the list, moving lists, dying on the list, or remaining on the list at a given time point post-registration. Removals from the list due to deteriorating condition are grouped with deaths in this analysis. In these figures, the *first* outcome is used, so if an individual was transplanted then died their registration outcome would be "transplanted". If they moved lists, e.g. from the non-urgent to the urgent list, they would be included in both the non-urgent and the urgent charts and analysed according to the outcome on each list.

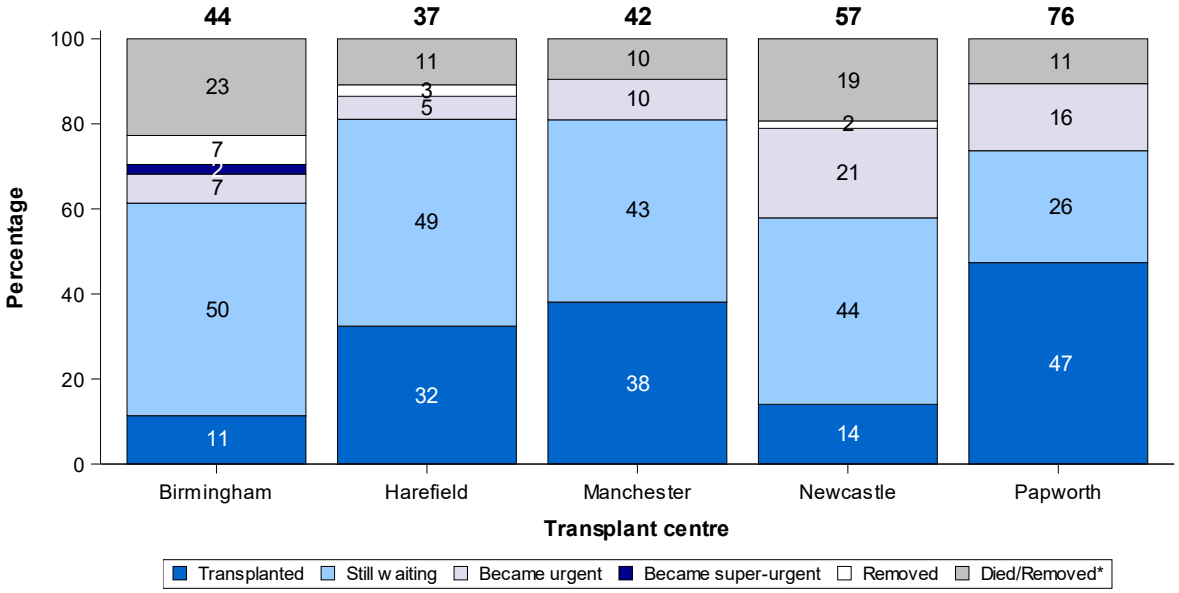
Nationally, within 6 months of non-urgent registration, 20% of lung registrations resulted in transplant and 8% had died. Three years after listing, 46% has received a transplant and 23% had died. By centre (**Figure 3.5**), within 1 year of registration, the proportion transplanted ranged from 11% at Birmingham to 47% at Papworth and the proportion dying on the list ranged from 10% at Manchester to 23% at Birmingham.

Figure 3.4 Post-registration outcome for 256 non-urgent lung only registrations made in the UK, 1 April 2020 to 31 March 2022



*Removals due to condition deteriorating

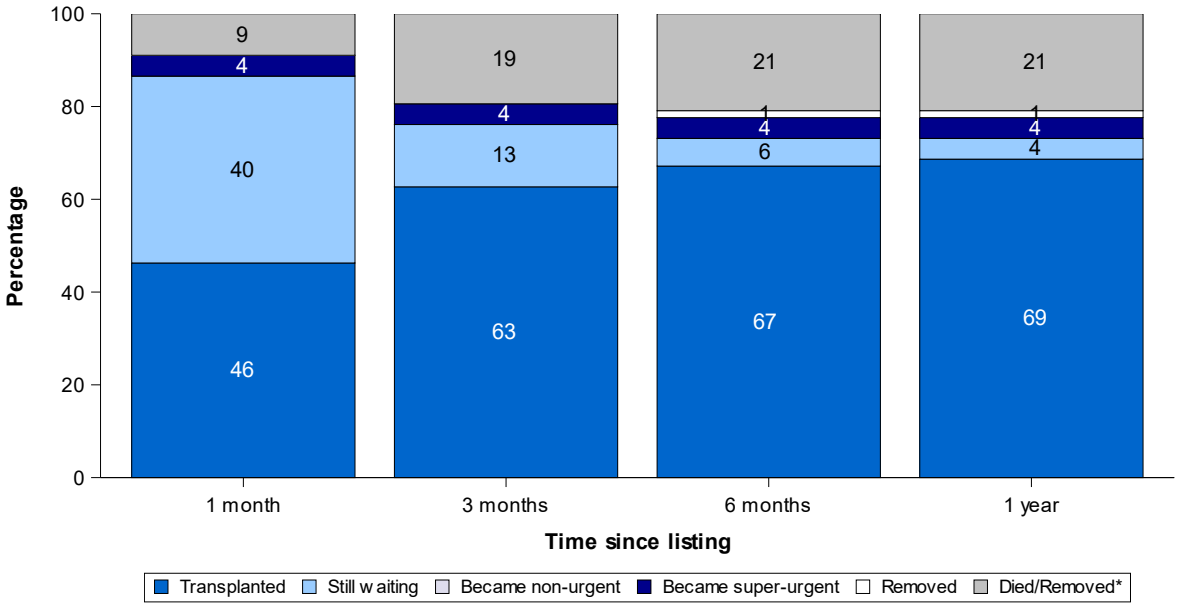
Figure 3.5 1 year post-registration outcomes for 256 non-urgent lung only registrations made in the UK, by centre, 1 April 2020 to 31 March 2022



*Removals due to condition deteriorating

Figure 3.6 shows outcomes on the urgent lung list. The chance of transplant is much higher from the urgent list compared with the non-urgent list; within 6 months, 67% of urgent patients had received a transplant. A centre breakdown is not provided for urgent registrations, nor is a super-urgent registration figure, due to small numbers.

Figure 3.6 Post-registration outcome for 67 urgent lung only registrations made in the UK, 1 April 2020 to 31 March 2022



*Removals due to condition deteriorating

3.4 Median waiting time to transplant, 1 April 2021 - 31 March 2024

The median waiting time to non-urgent lung transplant from registration for adults is shown in **Figure 3.7** and **Table 3.2**. This is estimated for individuals registered initially as non-urgent between 1 April 2021 and 31 March 2024 using the Kaplan Meier method to allow for censoring. The national median waiting time from non-urgent listing was 449 days and ranged from 200 days at Papworth to 700 days at Birmingham (log-rank p<0.0001). The national median waiting time from urgent listing was 19 days. Median waiting time is not presented for super-urgent registrations due to low frequency of patients initially registered as super-urgent.

Figure 3.7 Median active waiting time to non-urgent lung transplant for adults registered between 1 April 2021 and 31 March 2024, by centre

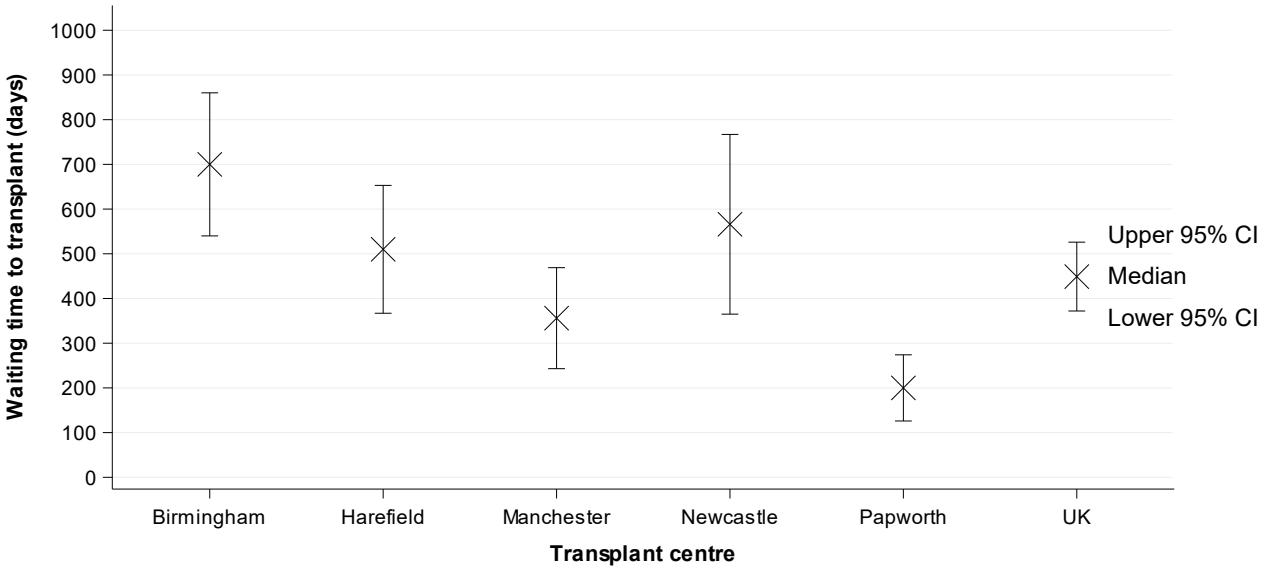


Table 3.2 Median active waiting time to lung transplant for adult patients registered on the transplant list, by urgency at registration and centre, 1 April 2021 to 31 March 2024

Transplant centre	Number of patients registered	Number transplanted	Waiting time (days) Median	95% Confidence interval
Non-urgent at initial registration				
Birmingham	81	30	700	540 - 860
Harefield	113	62	510	367 - 653
Manchester	95	55	356	243 - 469
Newcastle	119	52	566	365 - 767
Papworth	139	96	200	126 - 274
UK	**547**	**295**	**449**	**372 - 526**
Urgent at initial registration				
UK	**22**	**16**	**19**	**14 - 24**

The median waiting time to non-urgent lung transplant for adults is also considered by blood group. This is shown in **Figure 3.8** and **Table 3.3**. Blood group O had the longest median wait (674 days) compared with the other blood groups (log-rank p=0.001).

Figure 3.8 Median active waiting time to non-urgent lung transplant for adults registered between 1 April 2021 to 31 March 2024, by blood group

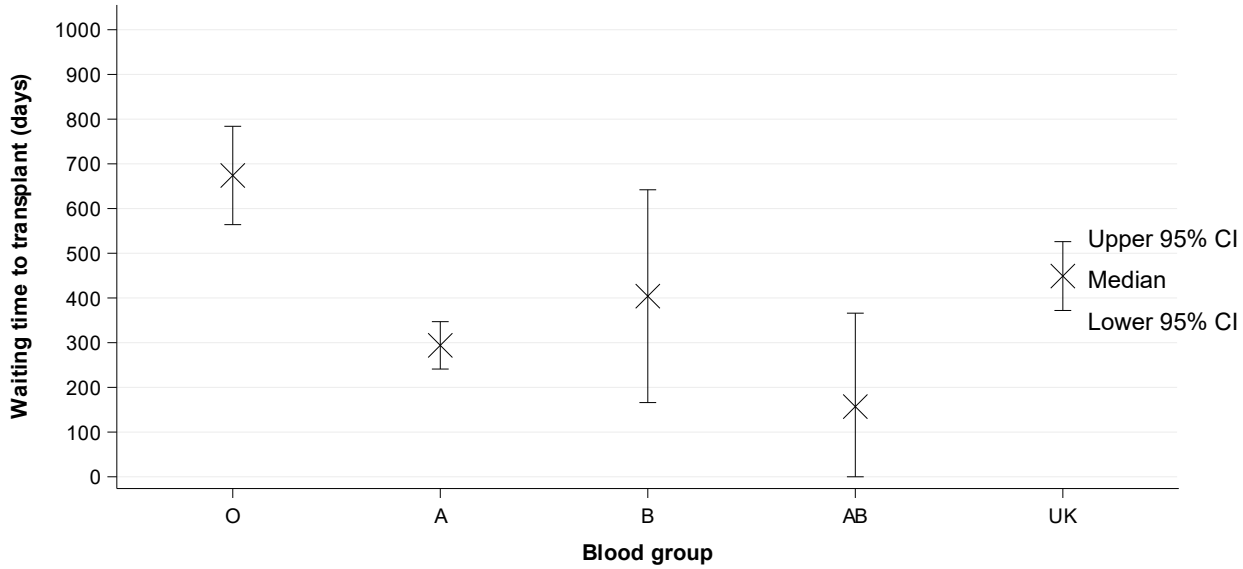


Table 3.3 **Median active waiting time to lung transplant for adult patients registered on the transplant list, by urgency at registration and blood group, 1 April 2021 to 31 March 2024**

Blood Group	Number of patients registered	Number transplanted	Waiting time (days) Median	95% Confidence interval
Non-urgent at initial registration				
O	245	113	674	564 - 784
A	226	136	294	241 - 347
B	56	31	404	166 - 642
AB	20	15	157	0 - 366
UK	**547**	**295**	**449**	**372 - 526**
Urgent at initial registration				
UK	**22**	**16**	**19**	**14 - 24**

ADULT LUNG TRANSPLANTATION

Response to Offers

4. Response to Offers

This section presents an analysis of adult donor lung offer decline rates, separately for DBD and DCD donor offers. This only considers offers of bilateral lungs between 1 April 2022 and 31 March 2025 that were eventually transplanted and excludes all fast track offers. A bilateral lung offer is counted as accepted if either both the lungs were accepted or just a single lung was accepted. Lungs offered as part of a heart-lung block are considered. Super-urgent, urgent and non-urgent offers are all considered. Offers to paediatric patients at Newcastle are excluded.

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

Figure 4.1 compares individual centre decline rates for DBD donors with the national rate using a funnel plot. The offer decline rate for Newcastle is above the higher 99.8% confidence limit, indicating a higher decline rate compared with the national rate, however this may be due to a small number of hard to match patients receiving multiple offers, and no adjustment has been made for this. The offer decline rate for Papworth is below the lower 99.8% confidence limit, indicating a significantly lower decline rate than the national rate.

Figure 4.1 UK adult DBD donor bilateral lung offer decline rates by centre, 1 April 2022 to 31 March 2025

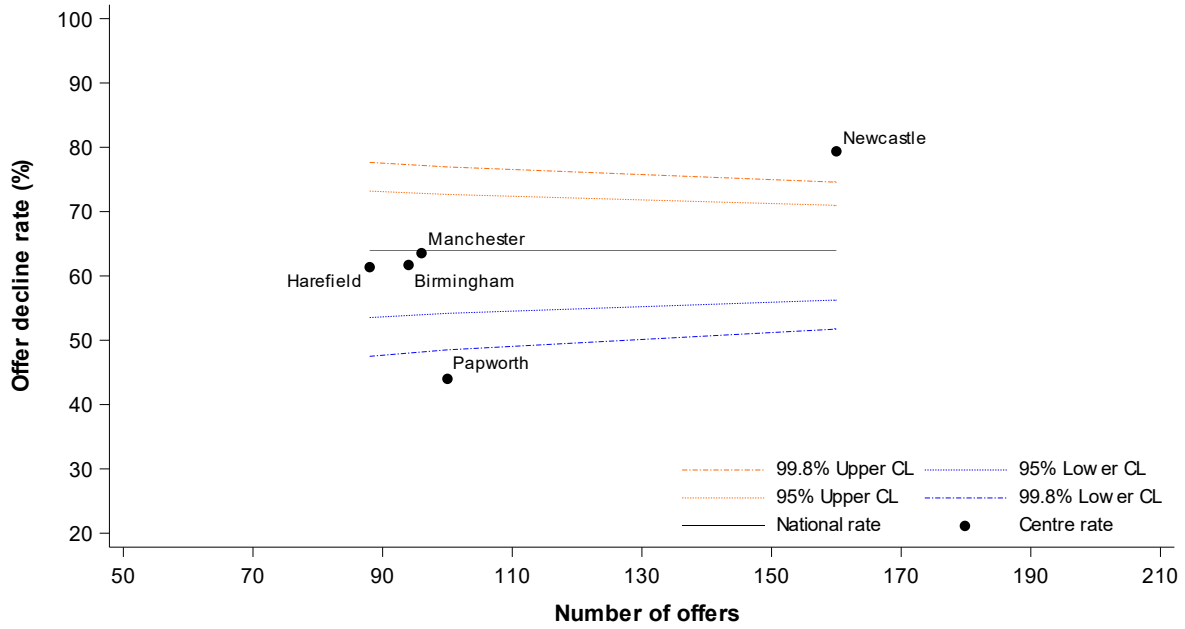


Table 4.1 shows a breakdown of each centre's bilateral lung decline rate for DBD donors across the three years analysed. Nationally, the decline rate for offers of lungs that were eventually transplanted was lowest in the most recent year.

Table 4.1 Adult DBD Bilateral Lung/Cardiac Block/ offer results by transplant centre, between 1 April 2022 and 31 March 2025

Centre	2022/23		2023/24		2024/25		Overall	
	No. offers	Decline rate (%)	No. offers	Decline rate (%)	No. offers	Decline rate (%)	No. offers	Decline rate (%)
Birmingham	24	66.7	35	71.4	35	48.6	94	61.7
Harefield	26	69.2	38	60.5	24	54.2	88	61.4
Manchester	31	77.4	38	57.9	27	55.6	96	63.5
Newcastle	41	80.5	67	79.1	52	78.8	160	79.4
Papworth	33	60.6	40	30.0	27	44.4	100	44.0
UK	155	71.6	218	61.9	165	59.4	538	63.9

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

Figure 4.2 and **Table 4.2** compare individual centre decline rates for DCD. The offer decline rate for Birmingham is above the higher 95% confidence limit, providing some evidence of a higher decline rate compared with the national rate. The offer decline rate for Papworth is below the lower 99.8% confidence limit, indicating a significantly lower decline rate than the national rate. Due to a relatively small number of DCD declines for subsequently transplanted lungs, there is no breakdown by centre and year in **Table 4.2**.

Figure 4.2 UK adult DCD donor bilateral lung offer decline rates by centre, 1 April 2022 to 31 March 2025

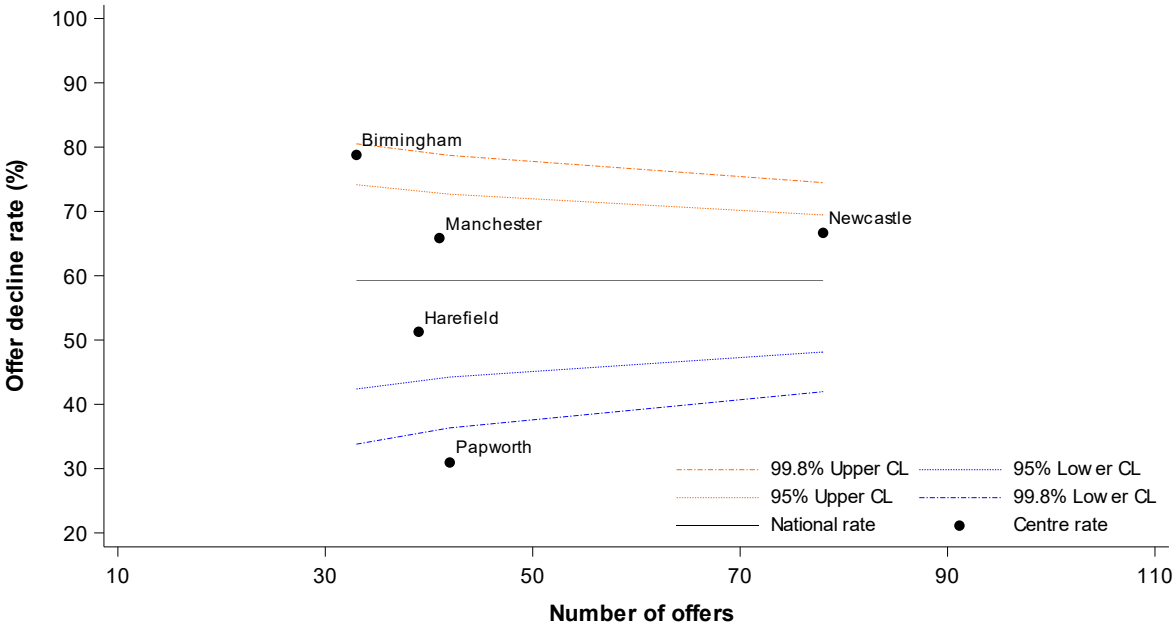


Table 4.2 Adult DCD bilateral lung/cardiac block offer results by transplant centre, between 1 April 2022 and 31 March 2025

Centre	Number of offers	Decline rate (%)
Birmingham	33	78.8
Harefield	39	51.3
Manchester	41	65.9
Newcastle	78	66.7
Papworth	42	31.0
UK	**233**	**59.2**

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

ADULT LUNG TRANSPLANTATION

Transplants

5.1 Adult lung and heart-lung transplants, 1 April 2015 – 31 March 2025

Figure 5.1 and **5.2** show the number of adult lung transplants performed per year over the last 10 years, by donor type, nationally and by centre, respectively. The number of transplants fell dramatically in 2020/2021, to 87, coinciding with the COVID-19 pandemic. Before then, annual numbers were over 150, with a peak of 207 in 2017/2018. In the latest financial year, numbers have risen slightly to 146. **Figure 5.2** shows that, in general, all centres performed at least as many transplants in 2024/2025 compared to the previous year, except for Harefield, which performed 3 fewer. Last year DCD lungs represented 40% of the total transplants. Last year's activity is shown by centre and donor type in **Figure 5.3**. The highest number of transplants were performed by Papworth.

Figure 5.1 Number of adult lung transplants in the UK, by financial year and donor type, 1 April 2015 to 31 March 2025

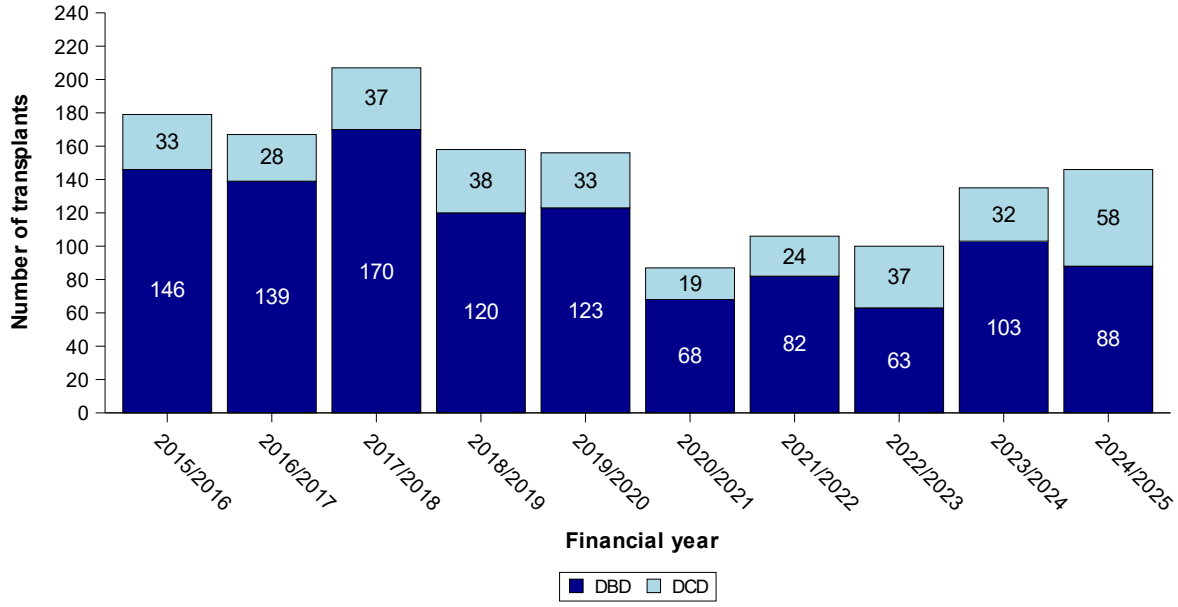


Figure 5.2 Number of adult lung transplants in the UK, by financial year, centre and donor type, 1 April 2015 to 31 March 2025

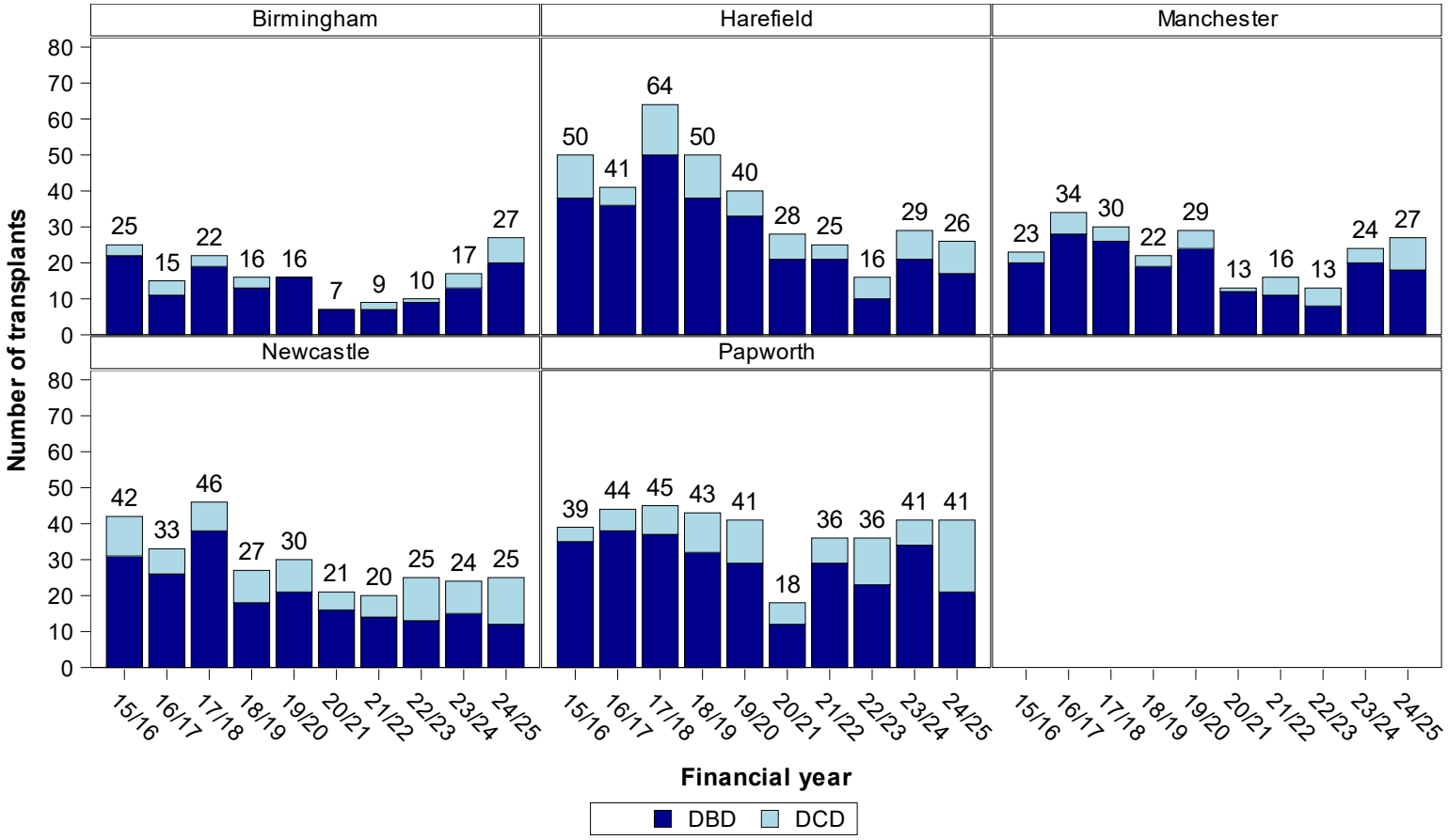


Figure 5.3 Number of adult lung transplants in the UK, by centre and donor type, 1 April 2024 to 31 March 2025

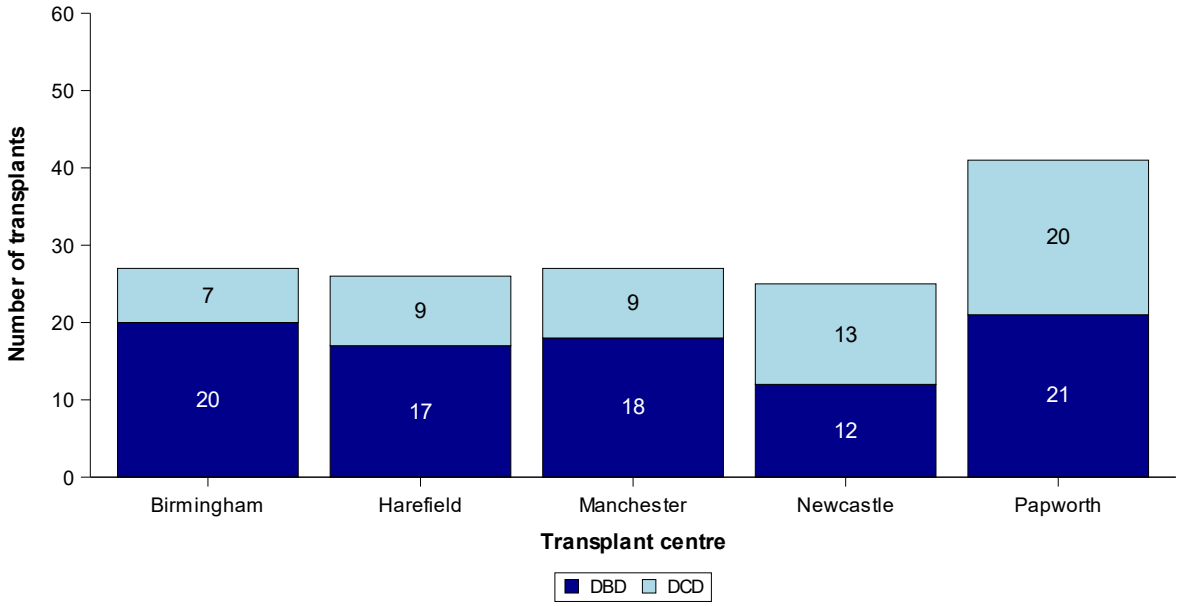


Figure 5.4 and **5.5** show the number of adult lung transplants performed in the last 10 years, by transplant type, nationally and by centre, respectively. There was a total of 39 heart-lung block transplants, and no partial lung transplants, over the last 10 years. The number of single lung transplants has decreased over the decade, with just 3 in the most recent year. When broken down by centre (**Figure 5.5**), all centres have reduced their use of single lungs. In the last financial year, Papworth performed 2 single lung transplants and Manchester performed 1 (**Figure 5.6**).

Figure 5.4 Number of adult lung transplants in the UK, by financial year and transplant type, 1 April 2015 to 31 March 2025

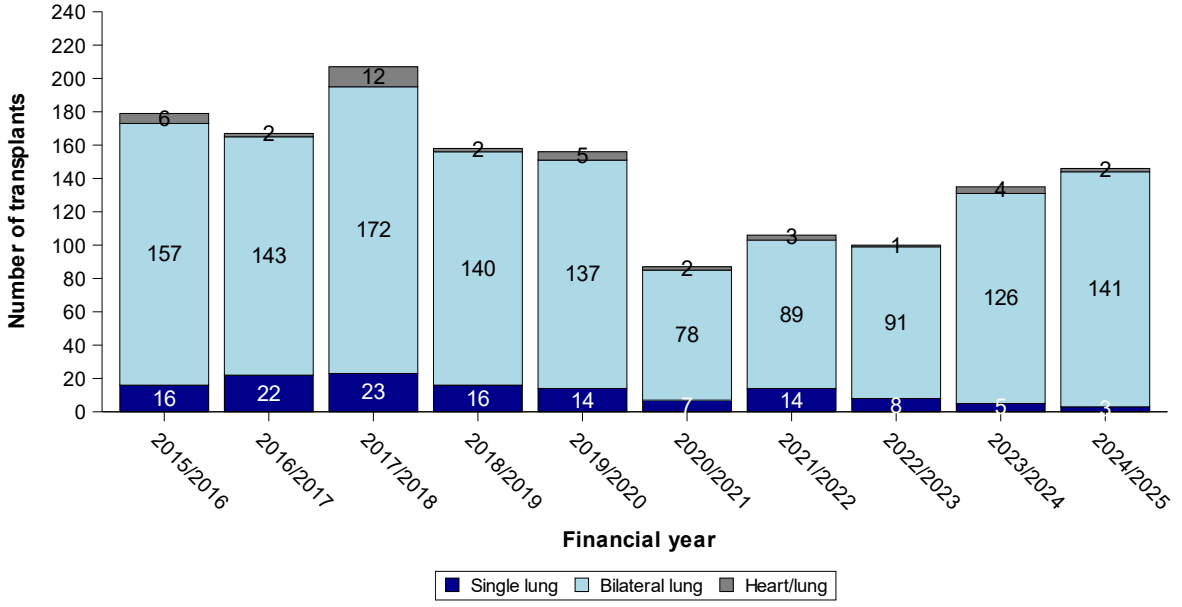


Figure 5.5 Number of adult lung transplants in the UK, by financial year, centre and transplant type, 1 April 2015 to 31 March 2025

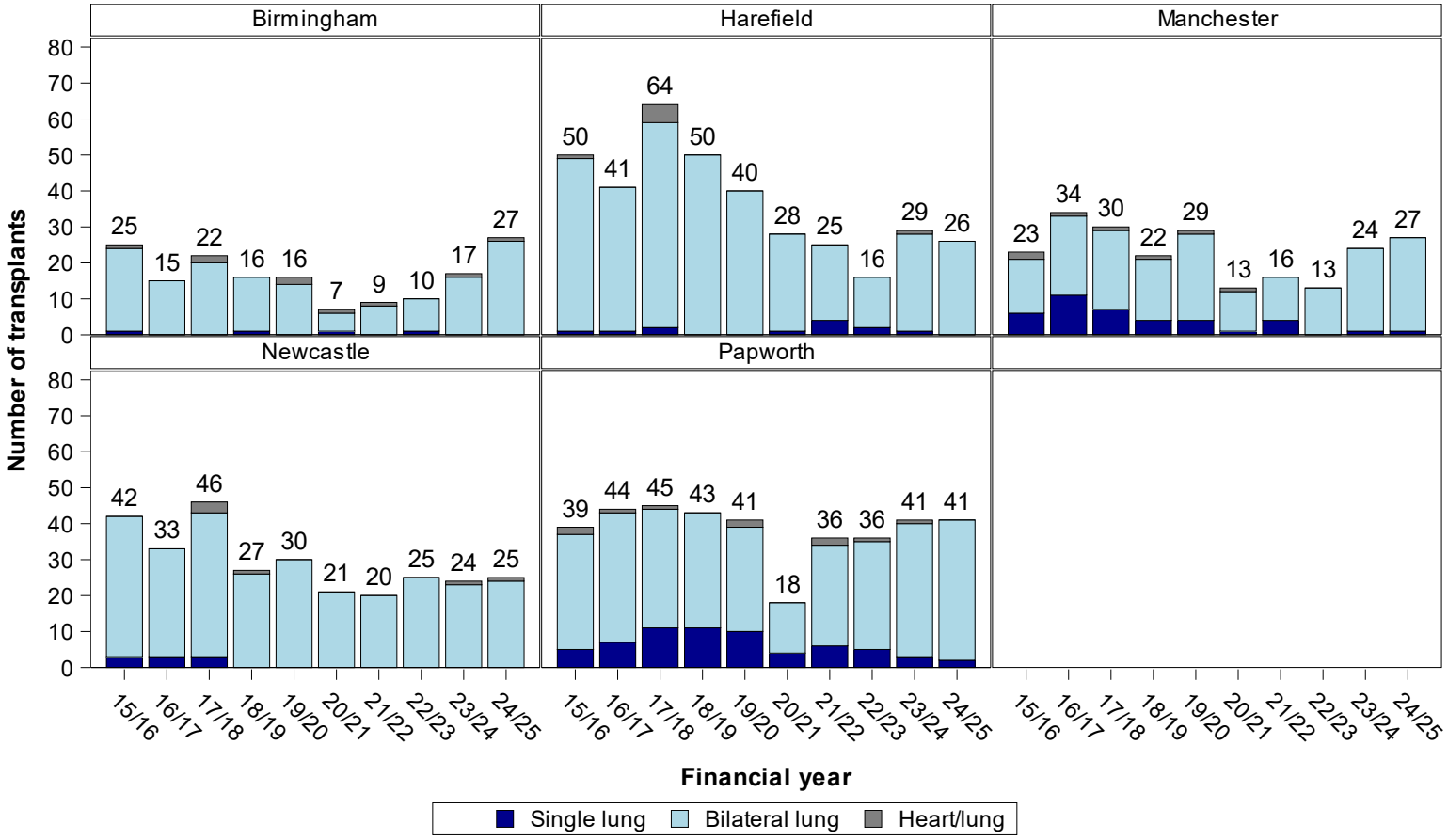
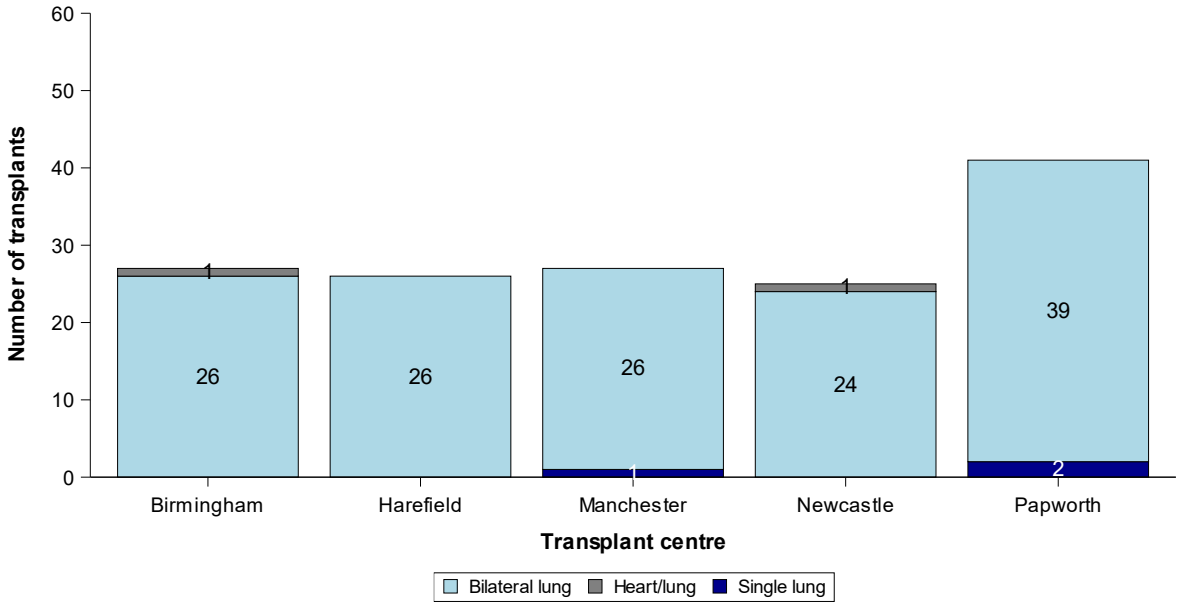


Figure 5.6 Number of adult lung transplants in the UK, by centre and transplant type, 1 April 2024 to 31 March 2025



In May 2017, the super-urgent and urgent lung allocation schemes were introduced, allowing for prioritisation of the sickest patients awaiting a lung transplant nationally. The number of lung only transplants per year by urgency status is shown in **Figure 5.7**; the proportion of urgent or super-urgent lung transplants was highest in 2024/2025, at 33%.

Figure 5.7 Number of adult lung only transplants in the UK, by financial year and urgency status, 1 April 2015 to 31 March 2025

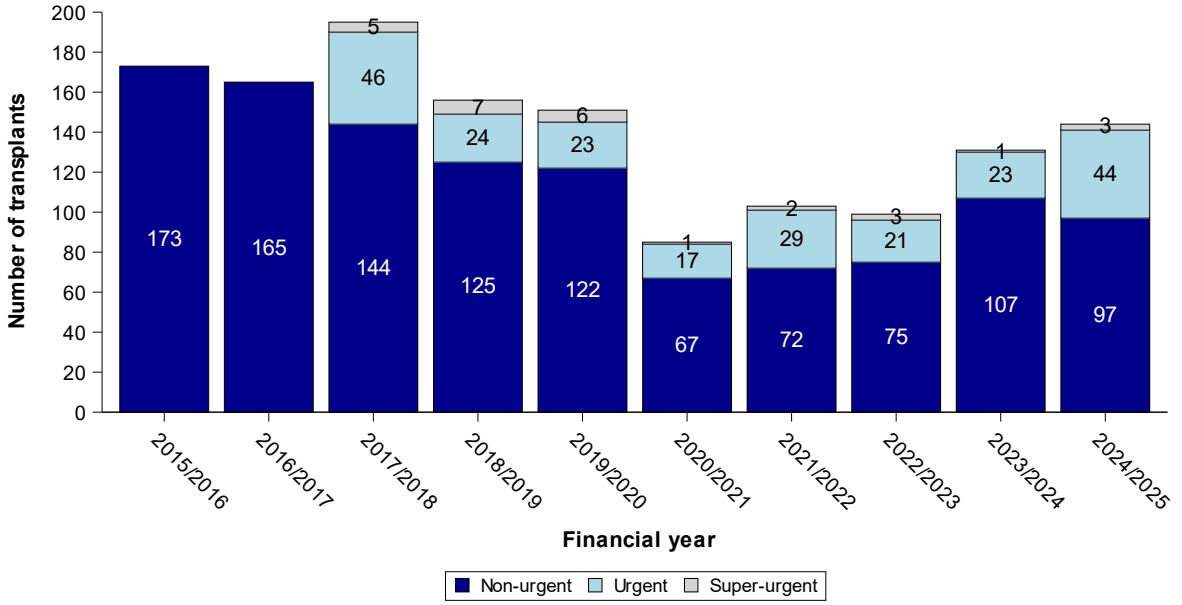


Figure 5.8 provides a breakdown of the number of lung only transplants by centre and urgency for the latest financial year. Newcastle performed the highest number of urgent lung transplants, representing 50% of their transplant activity. There were 3 super-urgent lung only transplants; 2 at Papworth and 1 at Harefield. Two adult heart-lung transplants took place in 2024/2025, 1 was urgent and 1 was super-urgent (not shown in the figure).

Figure 5.8 Number of adult lung only transplants in the UK, by centre and urgency status, 1 April 2024 to 31 March 2025

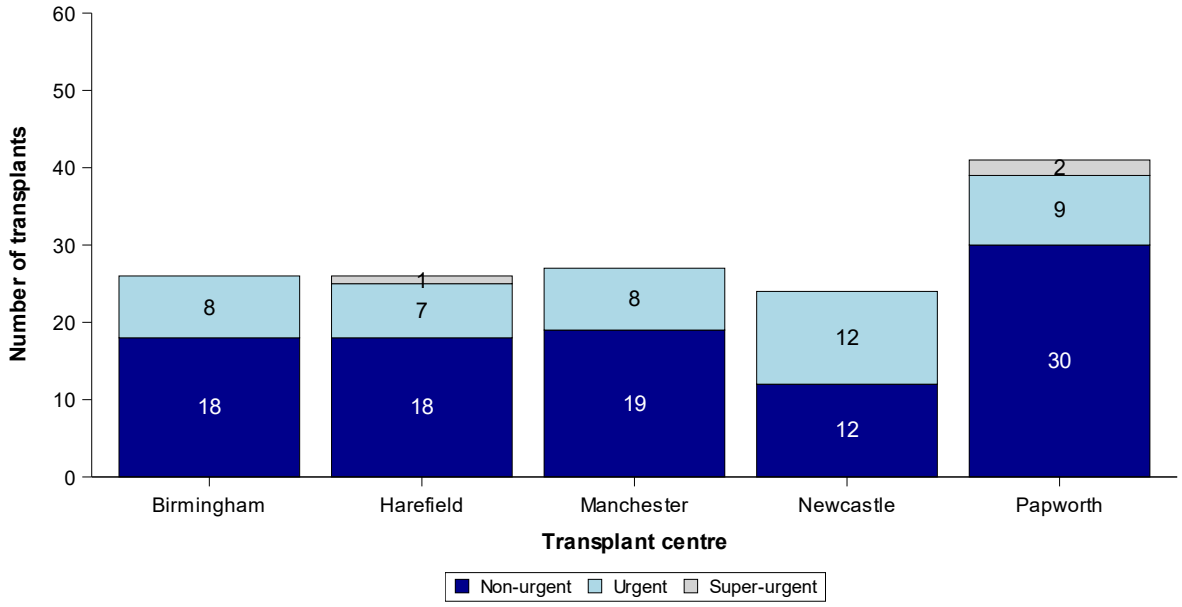


Figure 5.9 shows the number of adult lung only transplants over the previous 10 financial years, by disease group. The majority of lung only transplants in 2024/25 were for recipients with fibrosing lung disease. **Figure 5.10** shows the number of adult lung only transplants over the previous 10 financial years, by disease group and centre.

Figure 5.9 Number of adult lung only transplants in the UK, by financial year and disease group, 1 April 2015 to 31 March 2025

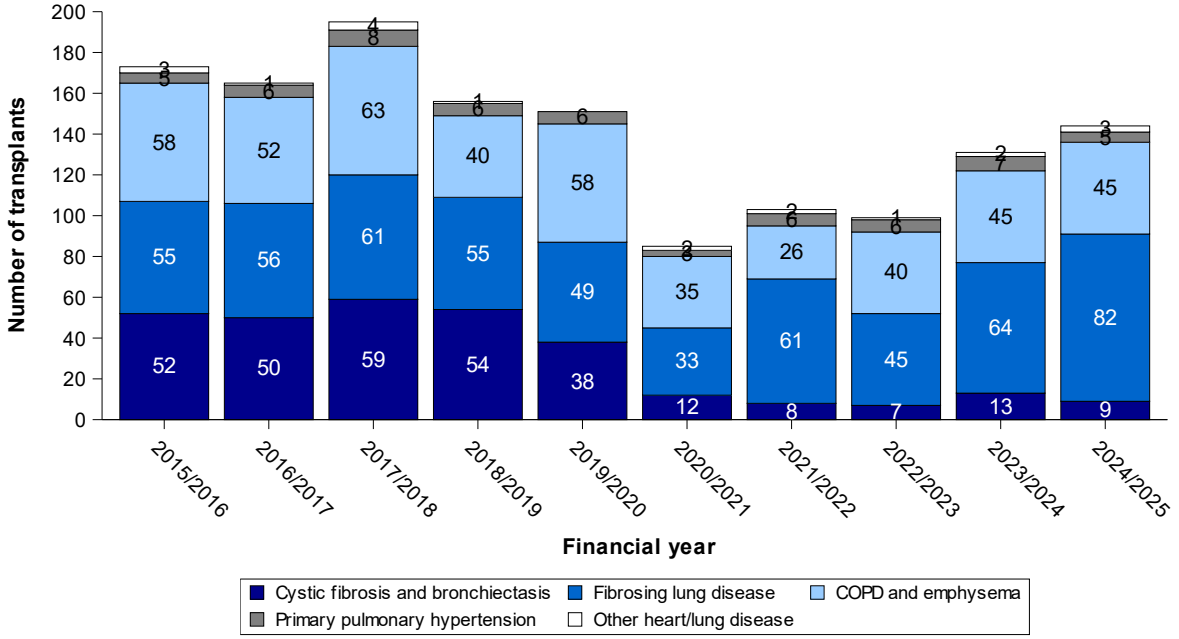
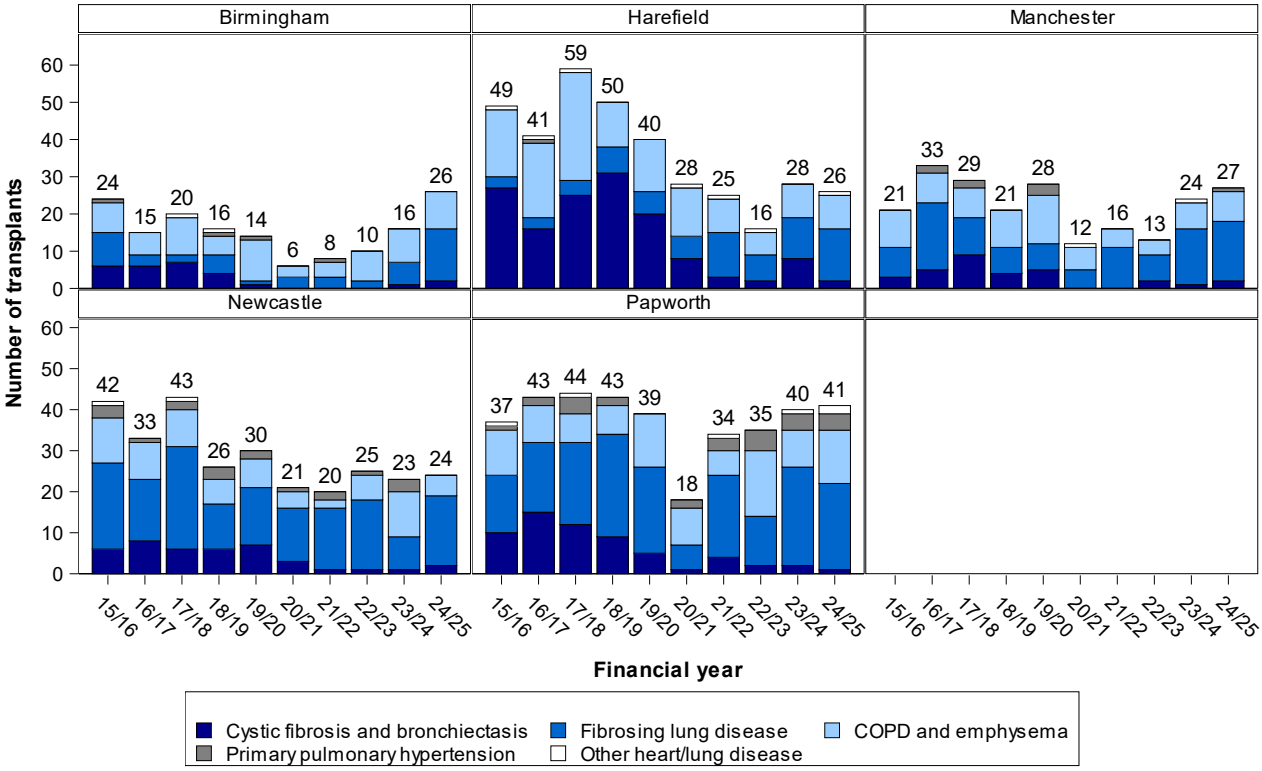


Figure 5.10 Number of adult lung only transplants in the UK, by financial year, centre and disease group, 1 April 2015 to 31 March 2025



5.2 Demographic characteristics of transplants, 1 April 2024 – 31 March 2025

The demographic characteristics of the 146 adult lung and heart-lung transplant recipients and donors in the latest year are shown by centre and overall in **Table 5.1**. Nationally, 80% of lung recipients were male and the median age was 57 years while the median age of donors was 47 years. For some characteristics, due to rounding, percentages may not add up to 100.

Table 5.1 Demographic characteristics of UK adult lung transplants performed between 1 April 2024 and 31 March 2025, by centre

		Birmingham N (%)	Harefield N (%)	Manchester N (%)	Newcastle N (%)	Papworth N (%)	**TOTAL N (%)**
Number of transplants		27 (100)	26 (100)	27 (100)	25 (100)	41 (100)	**146 (100)**
Urgency status at transplant	Non-urgent	18 (67)	18 (69)	19 (70)	12 (48)	30 (73)	**97 (66)**
	Urgent	9 (33)	7 (27)	8 (30)	12 (48)	9 (22)	**45 (31)**
	Super-urgent	0 (0)	1 (4)	0 (0)	1 (4)	2 (5)	**4 (3)**
Recipient sex	Male	22 (81)	20 (77)	20 (74)	24 (96)	31 (76)	**117 (80)**
	Female	5 (19)	6 (23)	7 (26)	1 (4)	10 (24)	**29 (20)**
Recipient ethnicity	White	25 (93)	22 (85)	25 (93)	22 (88)	39 (95)	**133 (91)**
	Asian	2 (7)	2 (8)	1 (4)	1 (4)	2 (5)	**8 (6)**
	Missing	0 (0)	2 (8)	1 (4)	2 (8)	0 (0)	**5 (3)**
Recipient age (years)	Median (IQR)	58 (52, 62)	52 (47, 56)	56 (52, 62)	57 (52, 62)	57 (51, 61)	**57 (50, 61)**
	Missing	0	0	0	0	0	**0**
Recipient weight (kg)	Median (IQR)	73 (69, 88)	66 (60, 78)	75 (63, 83)	73 (65, 82)	77 (63, 88)	**73 (63, 87)**
	Missing	0	0	0	0	0	**0**
Recipient primary disease	Cystic fibrosis and bronchiectasis	2 (7)	2 (8)	2 (7)	2 (8)	1 (2)	**9 (6)**
	Fibrosing lung disease	12 (44)	11 (42)	16 (59)	17 (68)	19 (46)	**75 (51)**
	COPD and emphysema	10 (37)	9 (35)	7 (26)	5 (20)	13 (32)	**44 (30)**
	Primary pulmonary hypertension	0 (0)	0 (0)	1 (4)	1 (4)	4 (10)	**6 (4)**
	Other heart/lung disease	3 (11)	4 (15)	1 (4)	0 (0)	4 (10)	**12 (8)**

Table 5.1 Demographic characteristics of UK adult lung transplants performed between 1 April 2024 and 31 March 2025, by centre

		Birmingham N (%)	Harefield N (%)	Manchester N (%)	Newcastle N (%)	Papworth N (%)	**TOTAL N (%)**
Recipient in hospital	No	21 (78)	25 (96)	25 (93)	20 (80)	33 (80)	**124 (85)**
	Yes	2 (7)	1 (4)	2 (7)	5 (20)	8 (20)	**18 (12)**
	Missing	4 (15)	0 (0)	0 (0)	0 (0)	0 (0)	**4 (3)**
In hospital, recipient on ventilator	No	2 (100)	1 (100)	2 (100)	5 (100)	8 (100)	**18 (100)**
In hospital, recipient ECMO	No	2 (100)	1 (100)	2 (100)	4 (80)	7 (88)	**16 (89)**
	Yes	0 (0)	0 (0)	0 (0)	1 (20)	1 (13)	**2 (11)**
In hospital, recipient on inotropes	No	1 (50)	1 (100)	2 (100)	4 (80)	7 (88)	**15 (83)**
	Yes	1 (50)	0 (0)	0 (0)	1 (20)	1 (13)	**3 (17)**
Recipient CMV status	Negative	16 (59)	11 (42)	16 (59)	16 (64)	21 (51)	**80 (55)**
	Positive	11 (41)	15 (58)	11 (41)	9 (36)	20 (49)	**66 (45)**
Recipient HCV status	Negative	23 (85)	26 (100)	27 (100)	25 (100)	41 (100)	**142 (97)**
	Positive	1 (4)	0 (0)	0 (0)	0 (0)	0 (0)	**1 (1)**
	Missing	3 (11)	0 (0)	0 (0)	0 (0)	0 (0)	**3 (2)**
Recipient HBV status	Negative	23 (85)	26 (100)	27 (100)	25 (100)	41 (100)	**142 (97)**
	Positive	1 (4)	0 (0)	0 (0)	0 (0)	0 (0)	**1 (1)**
	Missing	3 (11)	0 (0)	0 (0)	0 (0)	0 (0)	**3 (2)**
Recipient HIV status	Negative	24 (89)	26 (100)	27 (100)	25 (100)	41 (100)	**143 (98)**
	Missing	3 (11)	0 (0)	0 (0)	0 (0)	0 (0)	**3 (2)**
Recipient serum creatinine (umol/l)	Median (IQR)	68 (64, 81)	77 (55, 86)	71 (58, 79)	68 (60, 80)	67 (57, 82)	**68 (59, 82)**
	Missing	3	0	0	0	1	**4**
Donor sex	Male	15 (56)	12 (46)	11 (41)	12 (48)	24 (59)	**74 (51)**
	Female	12 (44)	14 (54)	16 (59)	13 (52)	17 (41)	**72 (49)**

Table 5.1 Demographic characteristics of UK adult lung transplants performed between 1 April 2024 and 31 March 2025, by centre

		Birmingham N (%)	Harefield N (%)	Manchester N (%)	Newcastle N (%)	Papworth N (%)	**TOTAL N (%)**
Donor ethnicity	White	25 (93)	24 (92)	19 (70)	23 (92)	37 (90)	**128 (88)**
	Asian	2 (7)	2 (8)	4 (15)	1 (4)	1 (2)	**10 (7)**
	Black	0 (0)	0 (0)	1 (4)	0 (0)	2 (5)	**3 (2)**
	Other	0 (0)	0 (0)	1 (4)	1 (4)	0 (0)	**2 (1)**
	Missing	0 (0)	0 (0)	2 (7)	0 (0)	1 (2)	**3 (2)**
Donor age (years)	Median (IQR)	50 (41, 56)	46 (33, 56)	54 (49, 59)	39 (32, 45)	44 (32, 53)	**47 (33, 55)**
	Missing	0	0	0	0	0	**0**
Donor BMI (kg/m^2)	Median (IQR)	26 (22, 32)	26 (23, 32)	26 (25, 30)	25 (23, 30)	25 (22, 27)	**26 (23, 30)**
	Missing	0	0	0	0	0	**0**
Donor cause of death	Intracranial/CVA	22 (81)	24 (92)	26 (96)	23 (92)	40 (98)	**135 (93)**
	Trauma	1 (4)	0 (0)	0 (0)	0 (0)	1 (2)	**2 (1)**
	Others	4 (15)	2 (8)	1 (4)	2 (8)	0 (0)	**9 (6)**
Donor hypotension	No	18 (67)	24 (92)	24 (89)	9 (36)	32 (78)	**107 (73)**
	Yes	5 (19)	2 (8)	3 (11)	4 (16)	7 (17)	**21 (14)**
	Missing	4 (15)	0 (0)	0 (0)	12 (48)	2 (5)	**18 (12)**
Donor history of cardiac disease	No	24 (89)	24 (92)	25 (93)	23 (92)	38 (93)	**134 (92)**
	Yes	3 (11)	2 (8)	2 (7)	2 (8)	2 (5)	**11 (8)**
	Missing	0 (0)	0 (0)	0 (0)	0 (0)	1 (2)	**1 (1)**
Donor history of hypertension	No	16 (59)	20 (77)	16 (59)	20 (80)	35 (85)	**107 (73)**
	Yes	7 (26)	6 (23)	11 (41)	5 (20)	5 (12)	**34 (23)**
	Missing	4 (15)	0 (0)	0 (0)	0 (0)	1 (2)	**5 (3)**
Donor history of cancer/malignancy	No	22 (81)	26 (100)	27 (100)	25 (100)	39 (95)	**139 (95)**
	Yes	1 (4)	0 (0)	0 (0)	0 (0)	1 (2)	**2 (1)**
	Missing	4 (15)	0 (0)	0 (0)	0 (0)	1 (2)	**5 (3)**

Table 5.1 Demographic characteristics of UK adult lung transplants performed between 1 April 2024 and 31 March 2025, by centre

		Birmingham N (%)	Harefield N (%)	Manchester N (%)	Newcastle N (%)	Papworth N (%)	**TOTAL N (%)**
Donor past/current smoker	No	12 (44)	19 (73)	17 (63)	16 (64)	16 (39)	**80 (55)**
	Yes	11 (41)	7 (27)	10 (37)	9 (36)	24 (59)	**61 (42)**
	Missing	4 (15)	0 (0)	0 (0)	0 (0)	1 (2)	**5 (3)**
Total preservation time[1] (hours)	Median (IQR)	6.1 (5.0, 7.5)	10.3 (8.9, 12.3)	7.9 (6.2, 9.5)	7.6 (6.5, 8.9)	9.3 (7.9, 11.8)	**8.1 (6.8, 10.2)**
	Missing	4	1	1	1	0	**7**
Transplant type	Single lung	0 (0)	0 (0)	1 (4)	0 (0)	2 (5)	**3 (2)**
	Bilateral lungs	26 (96)	26 (100)	26 (96)	24 (96)	39 (95)	**141 (97)**
	Heart/lung	1 (4)	0 (0)	0 (0)	1 (4)	0 (0)	**2 (1)**

[1] Time from cross clamp in the donor to reperfusion in the recipient

5.3 Total preservation time, 1 April 2015 – 31 March 2025

Figure 5.11 shows boxplots of the total preservation time for DBD donor lungs transplanted into adult recipients over the last 10 years. The total preservation time is the difference between donor cross-clamp and recipient reperfusion (of second lung if applicable) and can be considered the out of body time. The national median total preservation time has increased from 6.1 hours to 7.6 hours over the last 10 years.

Figure 5.11 Boxplots of total preservation time for DBD donor lungs transplanted into adult recipients, by financial year, 1 April 2015 to 31 March 2025

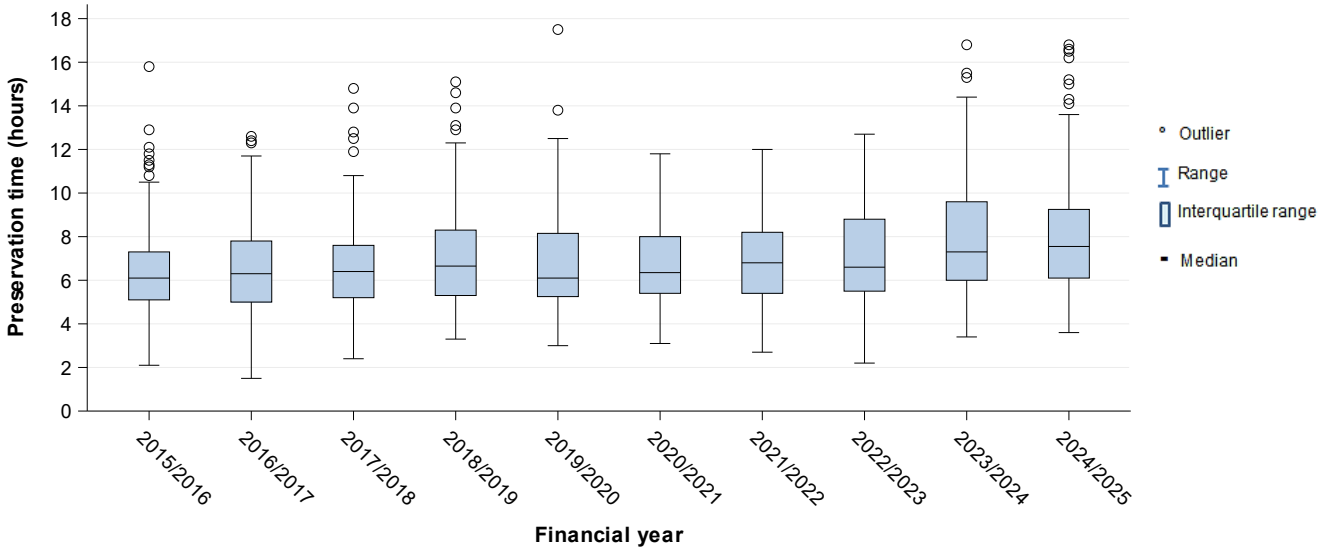


Figure 5.12 and **Figure 5.13** show boxplots of total preservation time by centre in the latest financial year and over the last 10 years, respectively. The median total preservation time for lung transplants in 2024/2025 was longest for lungs transplanted by Harefield and shortest for lungs transplanted by Birmingham. Harefield, Papworth and Manchester have seen recent increases in median total preservation time.

Figure 5.12 Boxplots of total preservation time for DBD donor lungs transplanted into adult recipients, by transplant centre, 1 April 2024 to 31 March 2025

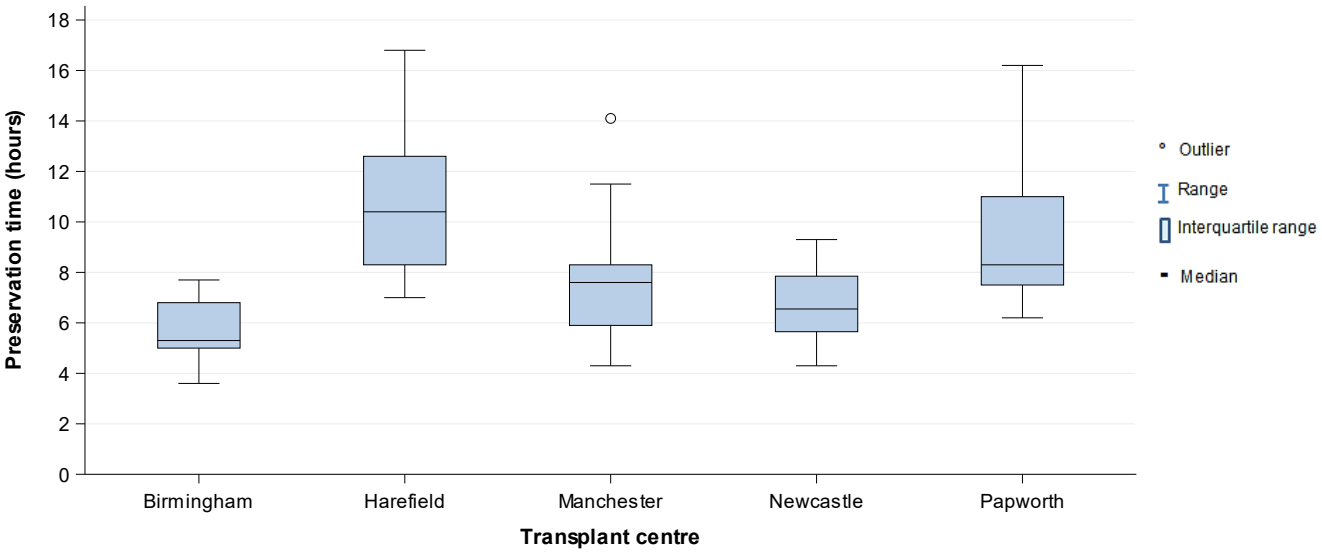
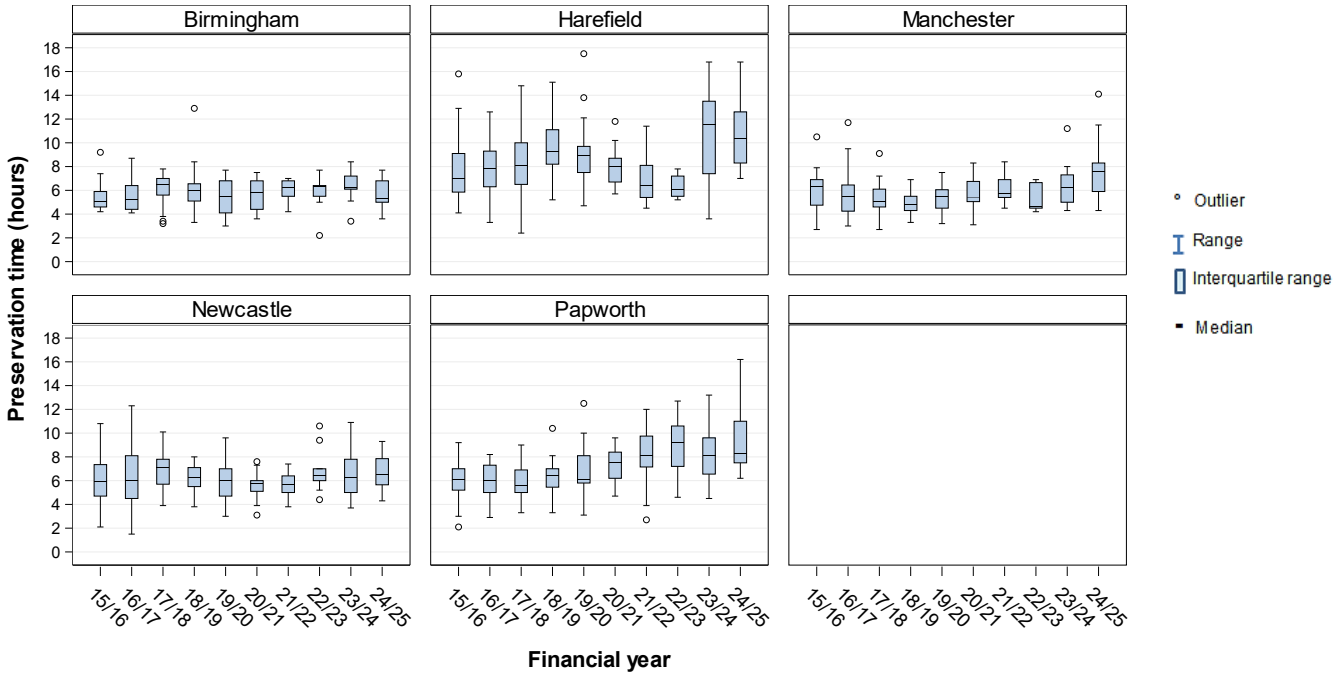
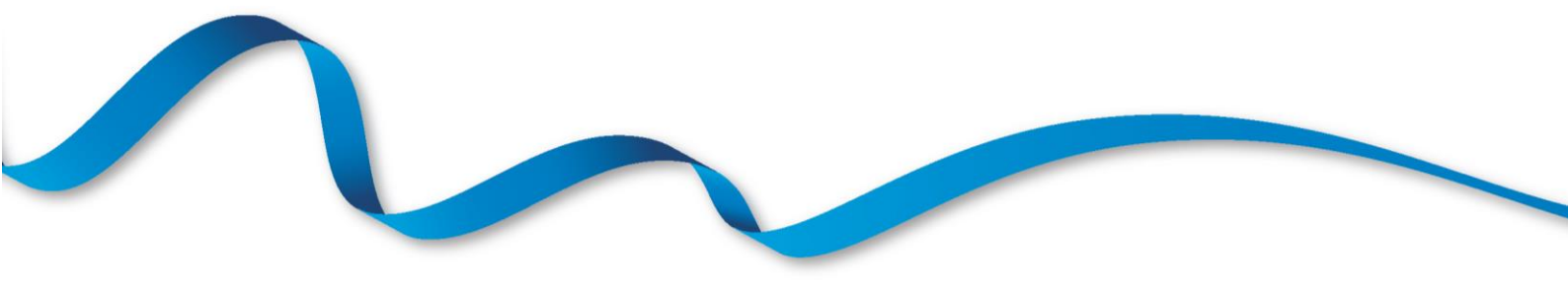


Figure 5.13 Boxplots of total preservation time for DBD donor lungs transplanted into adult recipients, by transplant centre and financial year, 1 April 2015 to 31 March 2025



ADULT LUNG TRANSPLANTATION

Post-Transplant Survival



6. Post-Transplant Survival

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

The survival analyses in **Section 6.1-6.3** include first time lung only transplants. Ninety-day and 1-year survival rates are based on transplants performed in the period 1 April 2020 to 31 March 2024 while 5-year survival rates are based on transplants performed in the period 1 April 2016 to 31 March 2020. Both DBD and DCD lung transplants are included. Survival rates are presented by transplant centre in **Tables 6.1-6.3** and **Figures 6.1-6.3,** by disease group in **Tables 6.4-6.5**, and by transplant type (single or bilateral lungs) in **Table 6.6**. Survival following heart-lung transplantation is provided separately in **Section 6.4** and survival outcomes following multi-organ lung transplantation are summarised in **Section 6.5**.

6.1 Survival by centre

Table 6.1 and **Figure 6.1** show the 90-day post-transplant unadjusted and risk-adjusted patient survival rates for each centre and nationally for the 413 first adult lung only transplants in the period 1 April 2020 to 31 March 2024. All centres were statistically consistent with the national rate of survival which was 90.3%.

Table 6.1 90 day patient survival rates after first adult lung transplant, by centre, 1 April 2020 and 31 March 2024

Centre	Number of transplants	% 90 day survival (95% CI) Unadjusted		Risk-adjusted	
Birmingham	40	95.0	(81.5 - 98.7)	90.6	(62.5 - 97.7)
Harefield	94	86.2	(77.4 - 91.7)	89.4	(81.7 - 93.8)
Manchester	63	90.5	(80.0 - 95.6)	89.1	(75.7 - 95.1)
Newcastle	89	91.0	(82.8 - 95.4)	89.6	(79.2 - 94.8)
Papworth	127	91.3	(84.9 - 95.1)	91.3	(84.4 - 95.2)
UK	**413**	**90.3**	**(87 - 92.8)**		

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

Figure 6.1 Risk-adjusted 90 day patient survival rates for adult lung transplants, by centre, 1 April 2020 to 31 March 2024

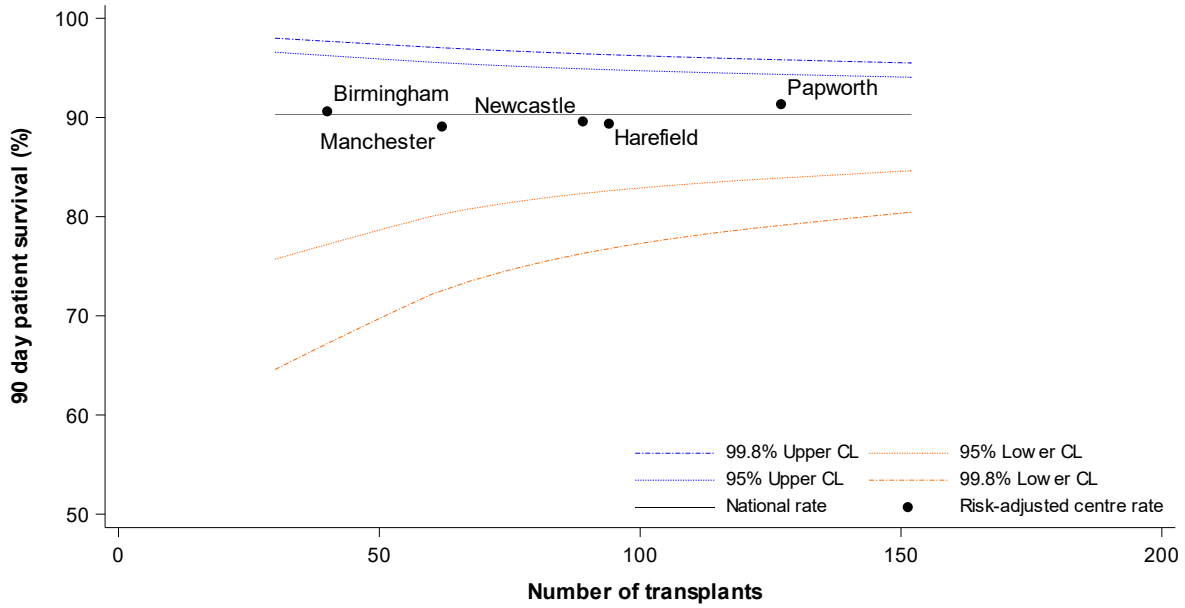


Table 6.2 and **Figure 6.2** show the 1-year post-transplant unadjusted and risk-adjusted patient survival rates for each centre and nationally for the 413 first adult lung only transplants in the period 1 April 2020 to 31 March 2024. The national rate of survival was 83.7%. The rates for all centres were statistically consistent with the national rate.

Table 6.2 1 year patient survival rates after first adult lung transplant, by centre, 1 April 2020 to 31 March 2024

Centre	Number of transplants	% 1 year survival (95% CI) Unadjusted		Risk-adjusted	
Birmingham	40	86.7	(70.6 - 94.3)	83.2	(59.6 - 93.0)
Harefield	94	82.9	(73.6 - 89.2)	84.9	(75.3 - 90.7)
Manchester	63	87.3	(76.2 - 93.4)	85.8	(71.5 - 92.9)
Newcastle	89	82.9	(73.2 - 89.3)	81.3	(69.0 - 88.7)
Papworth	127	81.9	(74.0 - 87.6)	82.7	(73.9 - 88.5)
UK	**413**	**83.7**	**(79.7 - 86.9)**		

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 6.2 Risk-adjusted one year patient survival rates for adult lung transplants, by centre, 1 April 2020 to 31 March 2024

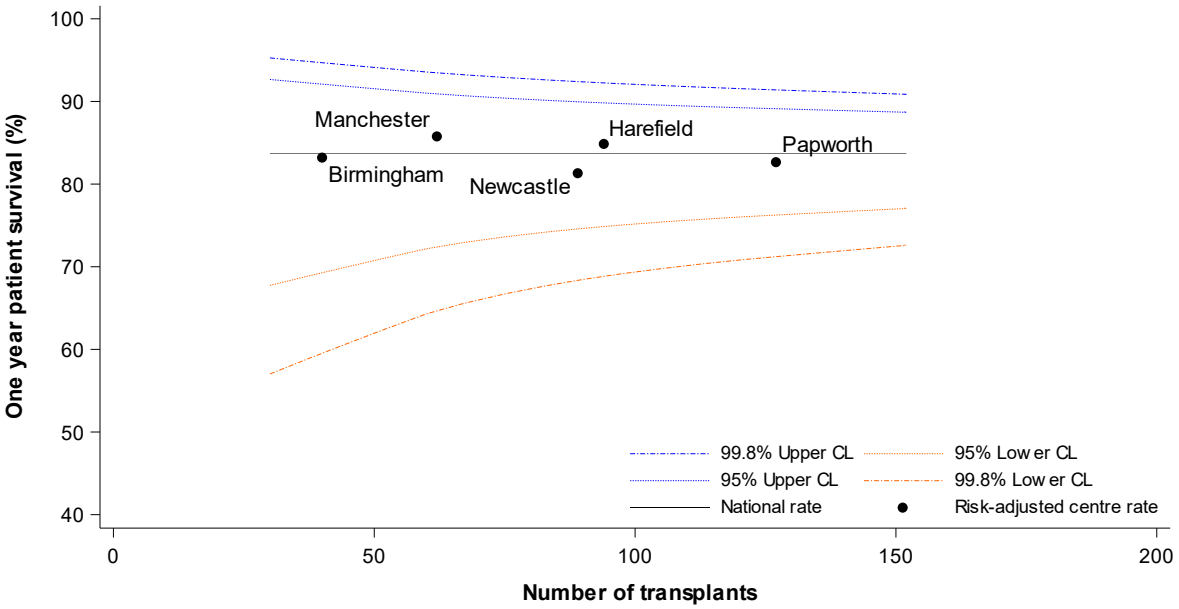


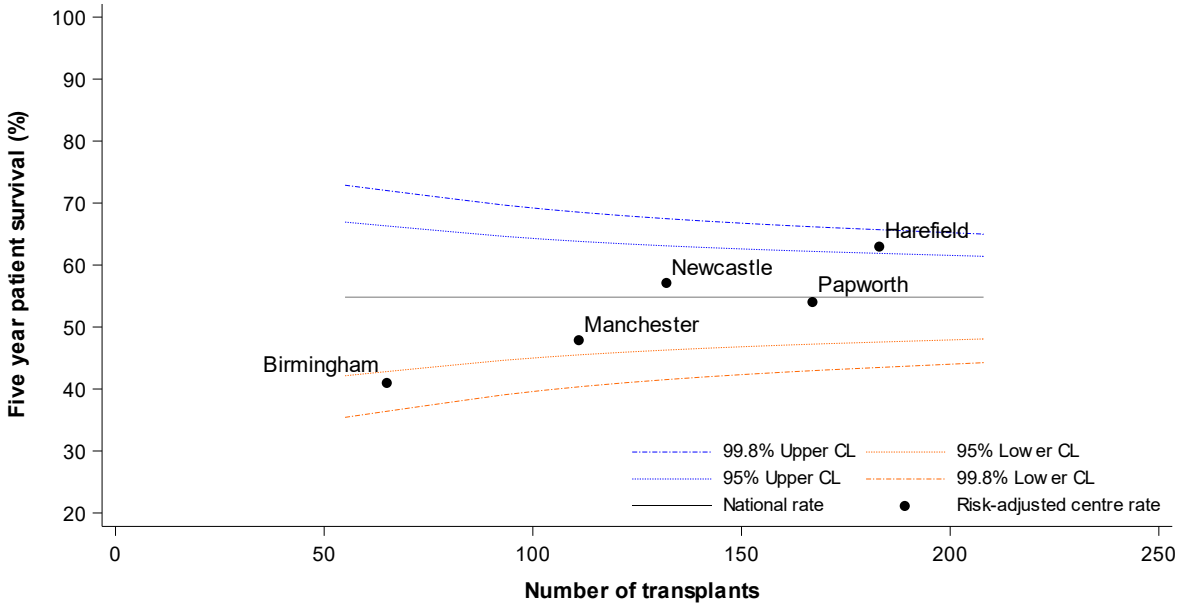
Table 6.3 and **Figure 6.3** show the 5-year post-transplant unadjusted and risk-adjusted patient survival rates for each centre and nationally for the 658 first adult lung only transplants in the period 1 April 2016 to 31 March 2020. Birmingham's survival rate at 5 years falls below the 95% lower confidence limit, indicating somewhat lower survival at this time point, while Harefield's rate is above the 95% upper confidence limit, providing some evidence of higher survival at this time point. All other centres were statistically consistent with the national rate of survival of 54.8%.

Table 6.3 5 year patient survival after first adult lung transplant, by centre, 1 April 2016 and 31 March 2020

Centre	Number of transplants	% 5 year survival (95% CI) Unadjusted		Risk-adjusted	
Birmingham	65	47.5	(35.0 – 59.0)	41.0	(17.4 - 57.8)
Harefield	183	65.3	(57.9 - 71.8)	63.0	(52.6 - 71.1)
Manchester	111	47.7	(38.2 - 56.7)	47.9	(32.6 - 59.7)
Newcastle	132	53.4	(44.5 - 61.6)	57.1	(44.9 - 66.6)
Papworth	167	52.0	(44.2 - 59.3)	54.0	(42.8 - 63.1)
UK	**658**	**54.8**	**(50.9 - 58.6)**		

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 6.3 Risk-adjusted five year patient survival rates for adult lung transplants, by centre, 1 April 2016 to 31 March 2020



6.2 Survival by disease group

Tables 6.4 and **6.5** present unadjusted and risk-adjusted survival rates by primary disease group, at 1 year and 5 years post-transplant, respectively. The risk factors used to produce the risk-adjusted survival rates are listed in **Appendix A3**. There were no statistically significant differences in survival rates across disease groups at 1 year and 5 years.

Table 6.4 1 year patient survival rates after first adult lung transplant, by disease group, 1 April 2020 to 31 March 2024

Disease group	Number of transplants	% 1 year survival (95% CI) Unadjusted		Risk-adjusted	
Cystic fibrosis and bronchiectasis	39	84.5	(68.6 - 92.7)	85.9	(68.5 - 93.6)
COPD and emphysema	143	85.1	(78.1 - 90.1)	83.5	(74.6 - 89.2)
Fibrosing lung disease	184	83.1	(76.9 - 87.8)	83.5	(76.6 - 88.4)
Primary pulmonary hypertension and other diseases	47	80.9	(66.4 - 89.5)	80.7	(62.9 - 90.0)
UK	**413**	**83.7**	**(79.7 - 86.9)**		

Table 6.5 5 year patient survival rates after first adult lung transplant, by disease group, 1 April 2016 to 31 March 2020

Disease group	Number of transplants	% 5 year survival (95% CI) Unadjusted		Risk-adjusted	
Cystic fibrosis and bronchiectasis	198	63.9	(56.8 - 70.2)	59.1	(48.4 - 67.6)
COPD and emphysema	207	54.3	(47.3 - 60.9)	50.9	(39.9 - 59.9)
Fibrosing lung disease	197	47.6	(40.4 - 54.4)	55.6	(46.1 - 63.4)
Primary pulmonary hypertension and other diseases	56	49.9	(36.3 - 62.1)	52.0	(30.5 - 66.9)
UK	**658**	**54.8**	**(50.9 - 58.6)**		

6.3 Survival by transplant type

Table 6.6 presents unadjusted survival rates by transplant type (single lung against bilateral lungs), at 90 days,1 year and 5 years post-transplant, respectively. Survival rates at 90 days and 1 year are based on transplants performed between 1 April 2020 and 31 March 2024 whereas the 5 year survival rates are for transplants performed between 1 April 2016 and 31 March 2020. Survival rates across transplant types were comparable at 90 days and 1 year, however a borderline significant difference was found at 5 years (log-rank p=0.04).

Table 6.6 Unadjusted patient survival rates after first adult lung transplant, by transplant type, 1 April 2020 to 31 March 2024 (90 day and 1 year) and 1 April 2016 to 31 March 2020 (5 year)

Transplant type	90 day			1 year			5 year		
	N*	% survival (95% CI) Unadjusted		N*	% survival (95% CI) Unadjusted		N*	% survival (95% CI) Unadjusted	
Single lung	33	90.9	(74.4 - 97)	33	78.8	(60.6 - 89.3)	73	35.6	(24.9 - 46.5)
Bilateral lungs	380	90.3	(86.8 - 92.8)	380	84.1	(80 - 87.4)	585	57.2	(53.1 - 61.1)
UK	**413**	**90.3**	**(87 - 92.8)**	**413**	**83.7**	**(79.7 - 86.9)**	**658**	**54.8**	**(50.9 - 58.6)**

* Number of transplants

6.4 Survival post heart-lung transplant

Table 6.7 and **Table 6.8** present short-term patient survival rates following combined heart-lung transplant, by centre and nationally. During the time period 1 April 2016 and 1 April 2024, no centre performed more than 10 transplants so centre-specific rates are not presented. The national rates of survival were 87.1% at 90 days and 77.0% at 1 year.

Table 6.7 90 day patient survival after first adult heart-lung transplant, by centre, 1 April 2016 and 1 April 2024

Centre	Number of transplants	Number of deaths	% 90 day survival (95% CI) (unadjusted)	
Birmingham[1]	7	1	-	-
Harefield[1]	6	2	-	-
Manchester[1]	5	0	-	-
Newcastle[1]	5	0	-	-
Papworth[1]	8	1	-	-
UK	**31**	**4**	**87.1**	**(69.2 – 95.0)**

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

Table 6.8 1 year patient survival after first adult heart-lung transplant, by centre, 1 April 2016 and 1 April 2024

Centre	Number of transplants	Number of deaths	% 1 year survival (95% CI) (unadjusted)	
Birmingham[1]	7	1	-	-
Harefield[1]	6	4	-	-
Manchester[1]	5	0	-	-
Newcastle[1]	5	1	-	-
Papworth[1]	8	1	-	-
UK	**31**	**7**	**77.0**	**(57.8 - 88.3)**

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

6.5 Survival post multi-organ lung transplant

The survival outcomes of the small number of recipients of multi-organ lung transplants are reported in **Table 6.9**, at 90 days and 1 year post-transplant. This includes all first-time multi-organ transplants involving the lung, from DBD or DCD donors, between 1 April 2016 and 31 March 2024. It does not include heart-lung transplants which are shown in the previous section.

Table 6.9 Survival outcomes following multi-organ lung transplants performed between 1 April 2016 and 31 March 2024

Transplant type	Number of transplants N	Number of patients alive at 90 days post-transplant N	Number of patients alive at 1 year post-transplant N
Lung & liver	4	3	2

ADULT LUNG TRANSPLANTATION

Survival from Listing

7. Survival from Listing

Survival from listing was analysed for patients 16 years or older registered for the first time for a lung transplant between 1 April 2016 and 31 March 2024. Survival time was defined as the time from joining the transplant list to death, regardless of whether the patient was transplanted, and any factors associated with such a transplant e.g. transplant type. Survival time was censored at the last known follow-up date post-transplant when no death date was recorded, or at time of analysis if the patient was still active on the transplant list, or at date of removal from the list for patients not receiving a transplant (unless removed due to deteriorating condition, in which case this was classed as an event). A review of the risk factors included in the survival-from-listing model was conducted in 2024 and the factors used to produce the risk-adjusted survival rates are listed in **Appendix A2**.

1 and 5 year risk-adjusted survival rates from the point of lung transplant listing are shown as funnel plots in **Figures 7.1** and **7.2**, respectively. These rates are also shown in **Table 7.1** and **7.2**, respectively, along with the unadjusted rates. Note that the rates for 1 year and 5 year survival are calculated from disjoint cohorts of patients, to allow for the full 1 and 5 year follow-up periods to elapse.

The 1 year survival rates from listing for all centres were statistically consistent with the national rate. The 5 year survival rate for Birmingham is just below the 99.8% confidence limit, indicating a significantly lower survival from listing at this centre. There was also evidence of higher survival from listing at 5 years for Papworth.

Table 7.1 1 year patient survival from listing for patients registered between 1 April 2020 to 31 March 2024

Centre	Number of registrations	1 year Survival Rate % (95% CI) Unadjusted		Risk-adjusted	
Birmingham	101	65.3	(55.2 - 73.7)	65.0	(51.2 - 74.8)
Harefield	122	80.9	(72.7 - 86.9)	77.4	(65.9 - 84.9)
Manchester	117	72.5	(63.4 - 79.7)	73.9	(63.0 - 81.5)
Newcastle	153	70.9	(62.9 - 77.4)	72.0	(62.4 - 79.2)
Papworth	167	75.7	(68.4 - 81.6)	76.7	(68.3 - 82.9)
UK	**660**	**73.4**	**(69.8 - 76.6)**		

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 7.1 Risk-adjusted one year patient survival rates from listing, by centre, 1 April 2020 to 31 March 2024

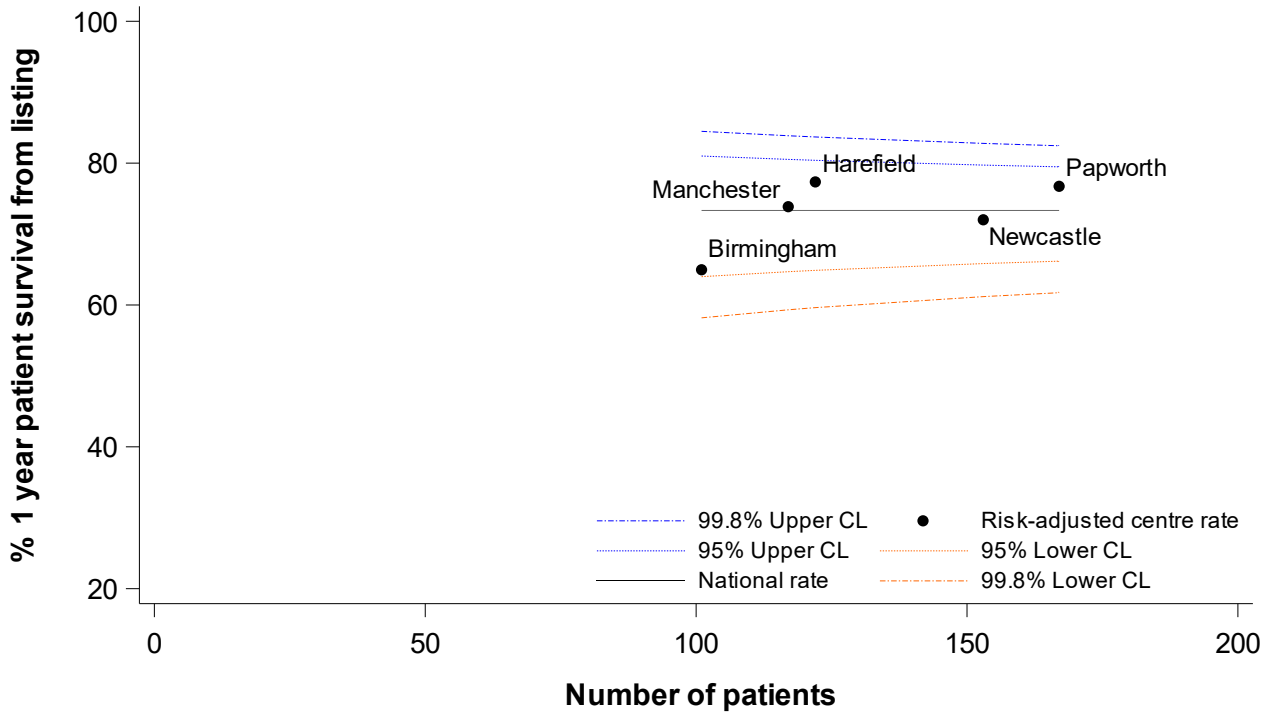
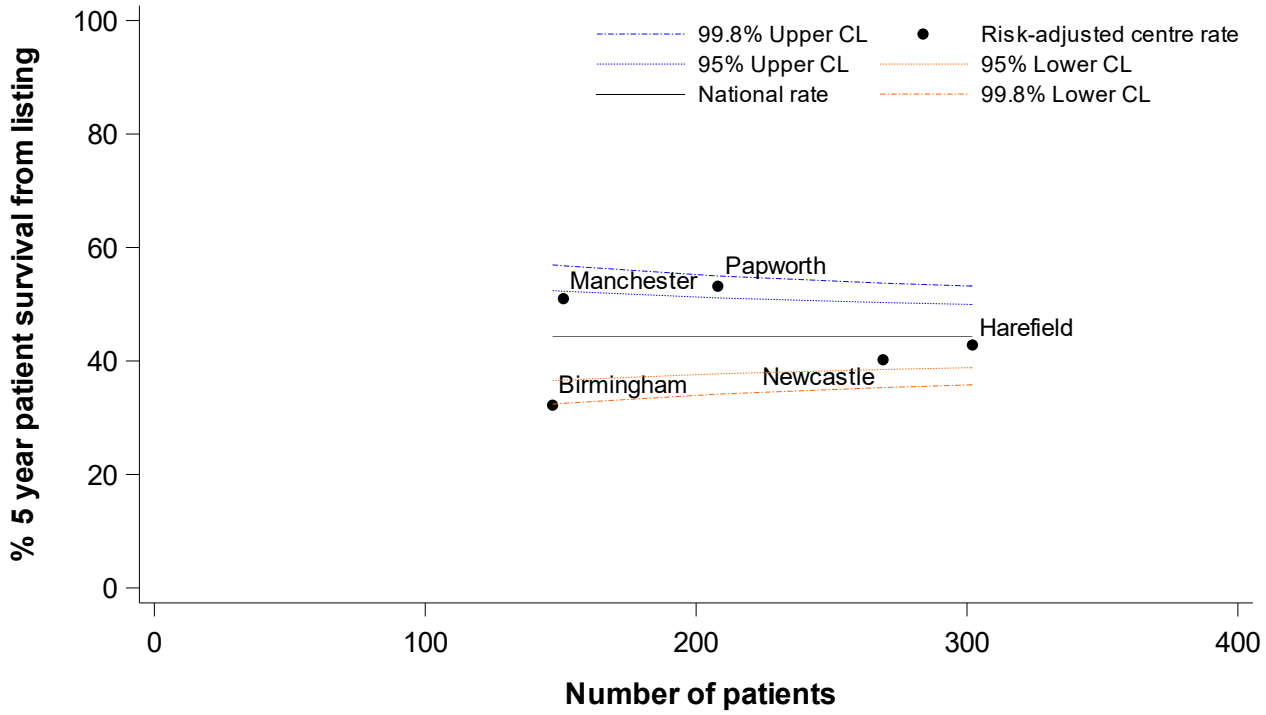


Table 7.2 **5 year patient survival from listing for patients registered between 1 April 2016 to 31 March 2020**

Centre	Number of registrations	5 year Survival Rate % (95% CI) Unadjusted		Risk-adjusted	
Birmingham	147	37.2	(29.3 - 45.2)	32.2	(16.7 - 44.9)
Harefield	302	51.8	(45.8 - 57.4)	42.8	(32.5 - 51.5)
Manchester	151	45.6	(37.1 - 53.6)	51.0	(38.8 - 60.7)
Newcastle	269	37.5	(31.5 - 43.3)	40.2	(30.3 - 48.7)
Papworth	208	46.5	(39.5 - 53.3)	53.2	(43.5 - 61.2)
UK	**1077**	**44.3**	**(41.3 - 47.3)**		

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

Figure 7.2 Risk-adjusted five year patient survival rates from listing, by centre, 1 April 2016 to 31 March 2020



ADULT LUNG TRANSPLANTATION

Form Return Rates

8. Adult lung form return rates, 1 January – 31 December 2024

Form return rates are reported in **Table 8.1** for the cardiothoracic transplant record and the 3 month and 1 year follow up form, along with lifetime follow up (2 years or more). These include all adult lung and heart-lung transplants between 1 January and 31 December 2024 for the transplant record, and all follow up forms issued in this time period. Centres highlighted are the currently active transplant centres. All active centres have a form return rate of 95% or greater for this period. Note that any skipped follow-up forms are counted as not returned.

Table 8.1 Form return rates for adult lung transplants, 1 January 2024 to 31 December 2024

Centre	Transplant record		3 month follow-up		1 year follow-up		Lifetime follow-up	
	No. required	% returned	No. required	% returned	No. required	% returned	No. required	% returned
Aberdeen, Aberdeen Royal Infirmary	-	-	-	-	-	-	1	0
Belfast, Belfast City Hospital	-	-	-	-	-	-	1	100
Birmingham, Queen Elizabeth Hospital	21	100	19	100	15	100	92	99
Edinburgh, Royal Infirmary of Edinburgh	-	-	-	-	-	-	3	0
Harefield, Harefield Hospital	22	100	19	100	26	100	405	98
Leeds, St James Hospice	-	-	-	-	-	-	1	0
Manchester, Wythenshawe Hospital	20	100	16	100	23	100	163	99
Newcastle, Freeman Hospital	24	100	26	100	24	100	273	95
Papworth, Papworth Hospital	39	100	34	100	39	97	299	98
Sheffield, Northern General Hospital	-	-	-	-	-	-	2	100
Overall	126	100	114	100	127	99	1240	97

PAEDIATRIC LUNG TRANSPLANTATION

Transplant List

9.1 Paediatric lung and heart/lung transplant list on 31 March, 2016 – 2025

Figure 9.1 shows the number of paediatric patients on the lung transplant list on 31 March each year between 2016 and 2025 split by urgency status. There has been a recent decrease in the waiting list, with 9 patients active on the lung list on 31 March 2025; 6 on the non-urgent lung list, 2 on the urgent lung list, and 1 on the heart-lung list.

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

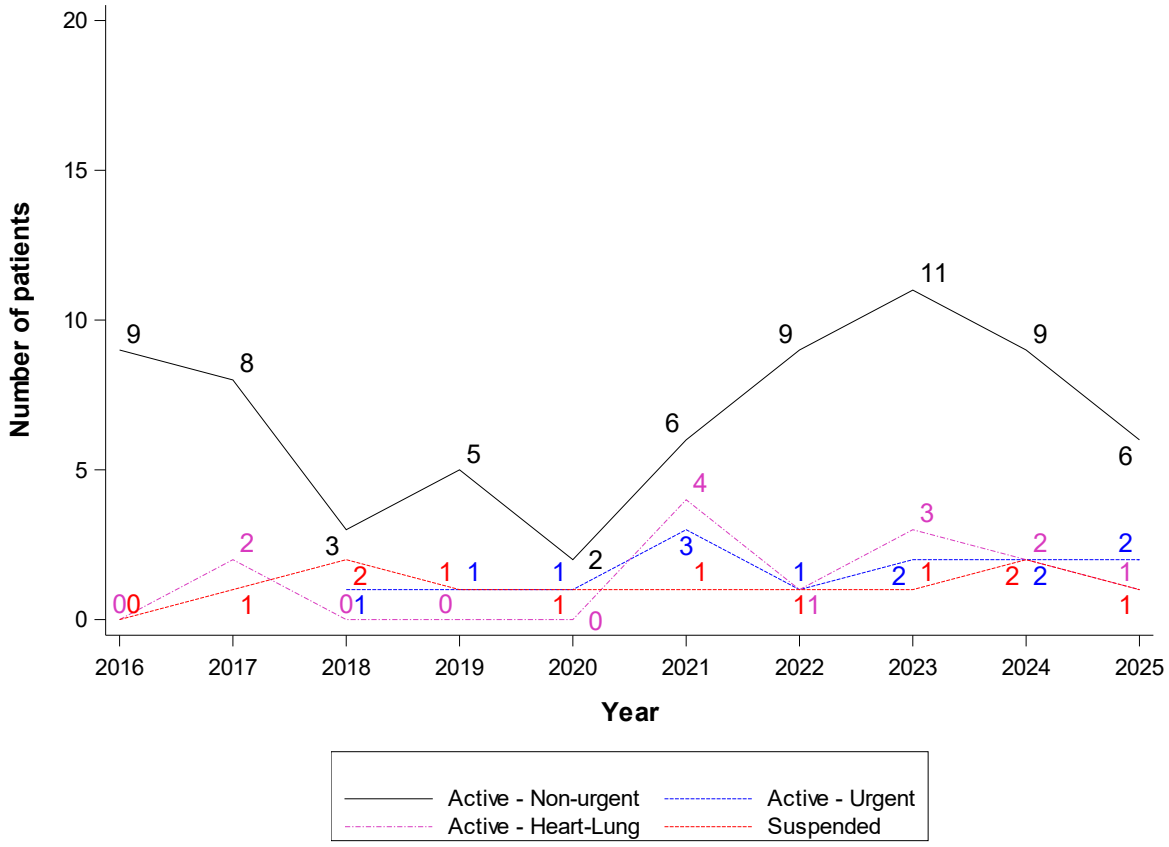


Figure 9.2 shows the number of paediatric patients on the active lung transplant list on 31 March 2025 by centre. The 9 paediatric patients waiting for a lung transplant were all at Great Ormond Street Hospital. Two patients at Great Ormond Street Hospital were on the urgent list, and none were on the super-urgent list.

Figure 9.2 Number of paediatric patients on the active lung transplant list on 31 March 2025, by centre and urgency

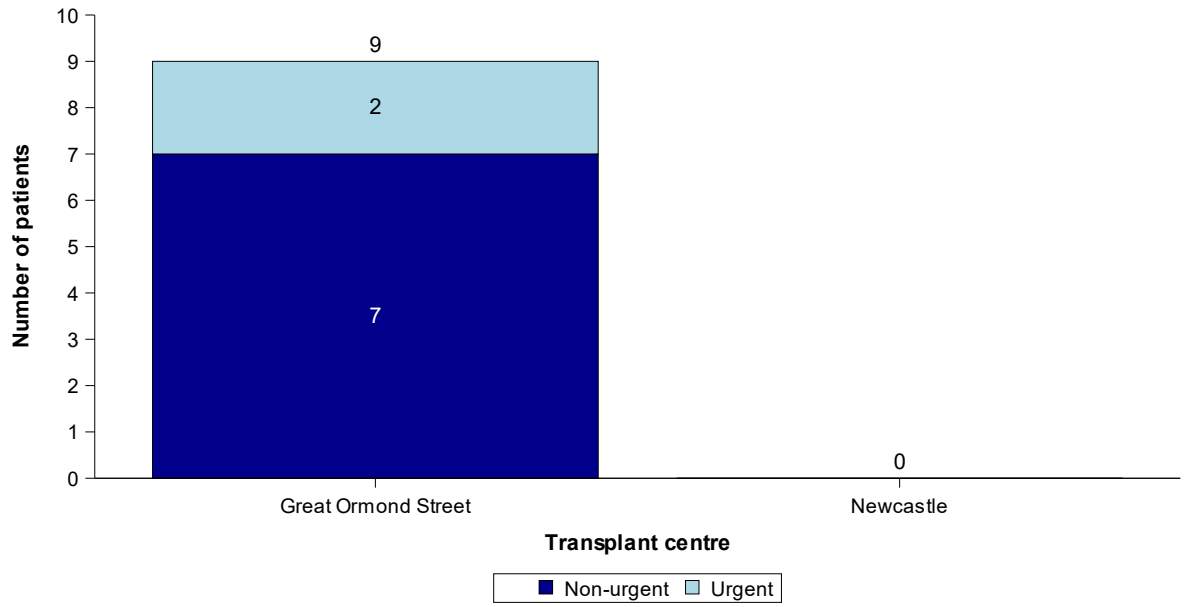
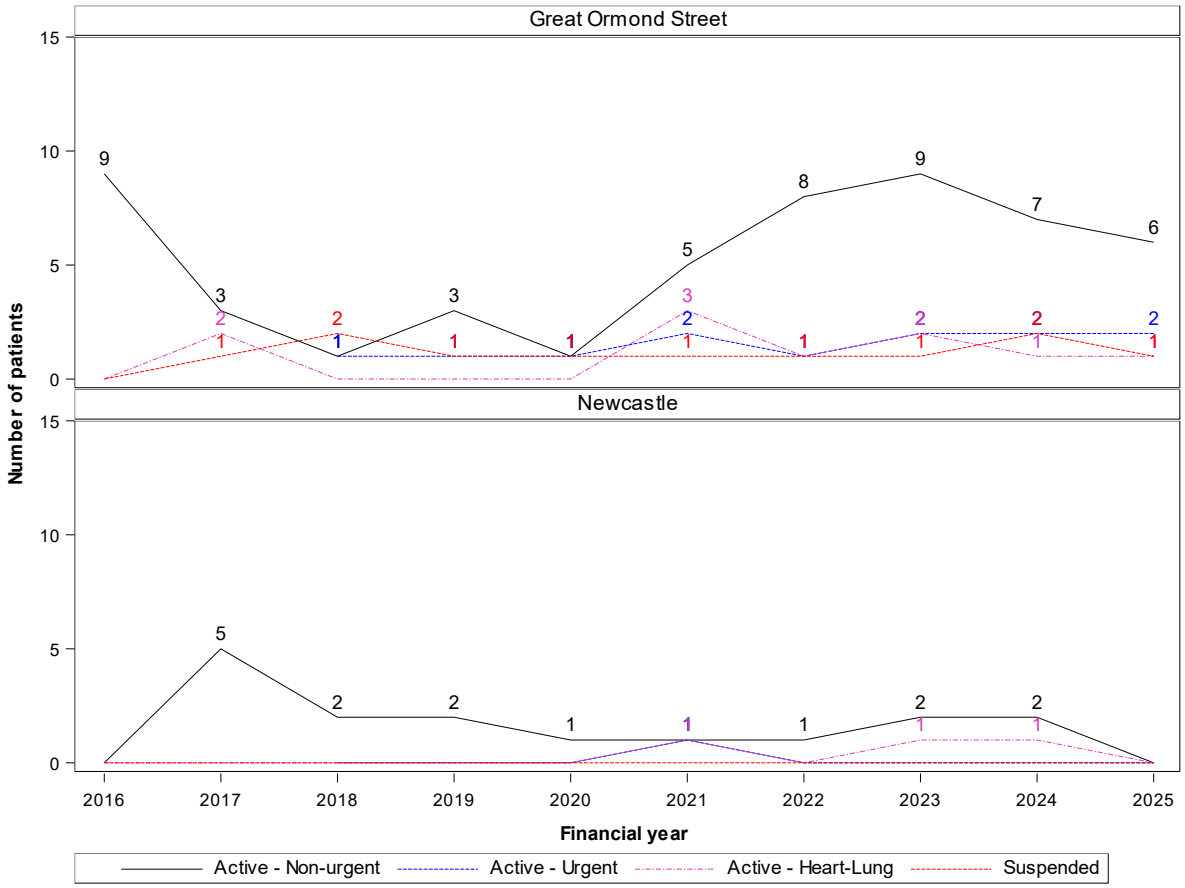


Figure 9.3 shows the trend over time in the number of paediatric patients on the lung transplant list at each centre on 31 March of each year between 2016 and 2025. Great Ormond Street Hospital experienced a decrease in their list between 2017 and 2020 but more recently it has grown to 9 active patients (6 non-urgent, 2 urgent, 1 heart-lung) as of 31 March 2025. Newcastle had a peak of 5 on their list in 2017, but this has now decreased to zero.

Figure 9.3 Number of paediatric patients on the lung transplant list on 31 March each year, for the last 10 years, by centre



9.2 Demographic characteristics, 1 April 2023 – 31 March 2025

There were 9 paediatric registrations onto the lung transplant list between 1 April 2023 and 31 March 2025 (2 years analysed due to small numbers). Demographic characteristics are shown by centre and overall in **Table 9.1**. There were no registrations at Newcastle in this time period, so the national data represents Great Ormond Street Hospital registrations only.

Table 9.1 Demographic characteristics of paediatric patient registrations onto the lung transplant list between 1 April 2023 and 31 March 2025, by centre, by centre

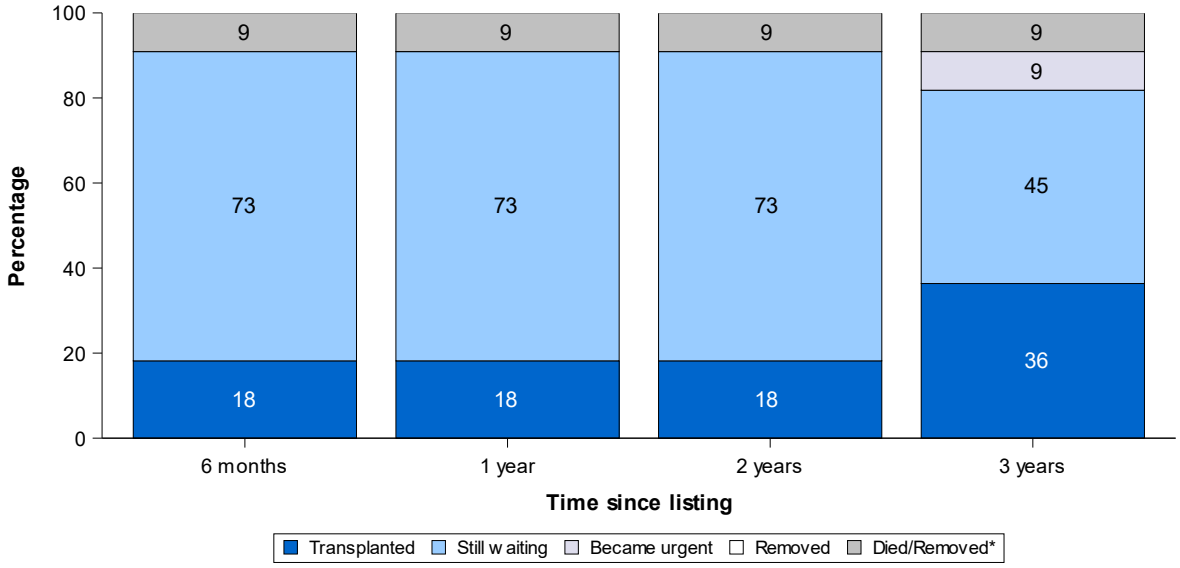
		Great Ormond Street N (%)	Newcastle N (%)	**TOTAL** **N (%)**
Number of registrations		9 (100)	0	**9 (100)**
Year of registration	2023/2024	4 (44)	0	**4 (44)**
	2024/2025	5 (56)	0	**5 (56)**
Highest urgency during registration	Non-urgent	2 (22)	0	**2 (22)**
	Urgent	7 (78)	0	**7 (78)**
Recipient sex	Male	2 (22)	0	**2 (22)**
	Female	7 (78)	0	**7 (78)**
Recipient ethnicity	White	8 (89)	0	**8 (89)**
	Asian	1 (11)	0	**1 (11)**
Recipient age (years)	Median (IQR)	14 (11, 15)	0	**14 (11, 15)**
	Missing	0	0	**0**
Height (cm)	Median (IQR)	155 (141, 165)	0	**155 (141, 165)**
	Missing	0	0	**0**
Weight (kg)	Median (IQR)	40 (27, 45)	0	**40 (27, 45)**
	Missing	0	0	**0**
Primary Disease	Cystic fibrosis and bronchiectasis	1 (11)	0	**1 (11)**
	Fibrosing lung disease	1 (11)	0	**1 (11)**
	Primary pulmonary hypertension	5 (56)	0	**5 (56)**
	Other heart/lung disease	2 (22)	0	**2 (22)**

9.3 Post-registration outcomes, 1 April 2020 – 31 March 2022

The registration outcomes of paediatric patients listed for a non-urgent lung transplant between 1 April 2020 and 31 March 2022 are summarised in **Figure 9.4**. The possible outcomes on the list include receiving a transplant, removal from the list, dying on the list, or remaining on the list at a given time point post-registration. Removals from the list due to deteriorating condition are grouped with deaths in this analysis. In these figures, the *first* outcome is used, so if an individual was transplanted then died their registration outcome would be "transplanted".

Within 6 months of listing, 18% of patients were transplanted, 73% were still waiting and 9% died. After 3 years, the transplant rate had increased to 36% and the percentage moved to the urgent list was 9%, however please note that this is based on just 11 patients. Due to small numbers, outcomes on the urgent or super-urgent lists are not presented.

Figure 9.4 Post-registration outcome for 11 non-urgent paediatric lung only registrations made in the UK, 1 April 2020 to 31 March 2022



*Removals due to condition deteriorating

9.4 Median waiting time to transplant, 1 April 2021 - 31 March 2024

The median waiting time to lung transplant from registration for paediatric patients registered between 1 April 2021 and 31 March 2024 is shown in **Table 9.2**. This is estimated using the Kaplan Meier method which allows for censoring. Due to small numbers, both non-urgent and urgent registrations were combined in this analysis, and the overall median waiting time was estimated at 801 days (although the wide 95% confidence interval indicates a lot of uncertainty in this estimate).

Table 9.2 Median active waiting time to lung transplant for paediatric patients registered on the transplant list, by centre, 1 April 2021 to 31 March 2024

Transplant centre	Number registered	Number transplanted	Waiting time (days) Median	95% Confidence interval
Great Ormond Street	11	6	346	0 - 748
Newcastle[1]	2	1	-	-
UK	**13**	**7**	**801**	**0 - 1712**

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

PAEDIATRIC LUNG TRANSPLANTATION

Response to Offers

10. Response to Offers

Table 10.1 presents individual centre paediatric bilateral lung offer decline rates between 1 April 2022 to 31 March 2025. This only considers offers of lungs from UK DBDs aged less than 16 that were eventually transplanted and excludes fast track offers. A bilateral lung offer is counted as accepted if both lungs or just one lung was accepted. Lungs offered as part of a heart-lung block are considered. Urgent and non-urgent offers are all considered. Offers to adults at Newcastle are excluded.

Table 10.1 shows the number of DBD lung offers and decline rates, by centre and nationally, while **Table 10.2** shows the same information but for DCD lung offers.

Table 10.1 UK paediatric DBD donor bilateral lung offer decline rates by transplant centre, 1 April 2022 and 31 March 2025

Centre	Number of offers	Decline rate (%)
Newcastle	6	83.3
Great Ormond Street	7	85.7
UK	**13**	**84.6**

Table 10.2 UK paediatric DCD donor bilateral lung offer decline rates by transplant centre, 1 April 2022 and 31 March 2025

Centre	Number of offers	Decline rate (%)
Newcastle	5	100
Great Ormond Street	7	85.7
UK	**12**	**91.7**

PAEDIATRIC LUNG TRANSPLANTATION

Transplants

11.1 Paediatric lung and heart-lung transplants, 1 April 2015 – 31 March 2025

Figure 11.1 and **11.2** show the number of paediatric lung and heart-lung transplants performed in the last 10 years by donor type, nationally and by centre, respectively. The number of transplants has decreased since 2016/2017 when there were 11 transplants, down to just 1 performed in 2022/2023. In the last 2 years there have been 5 transplants performed per year. The majority of paediatric lung transplants over the decade were performed by Great Ormond Street Hospital. Newcastle performed 1 paediatric lung transplant in 2024/2025, having not performed any in the previous 4 years. The number of transplants in the latest financial year is shown by centre and donor type in **Figure 11.3**.

Figure 11.1 Number of paediatric lung transplants in the UK, by financial year and donor type, 1 April 2015 to 31 March 2025

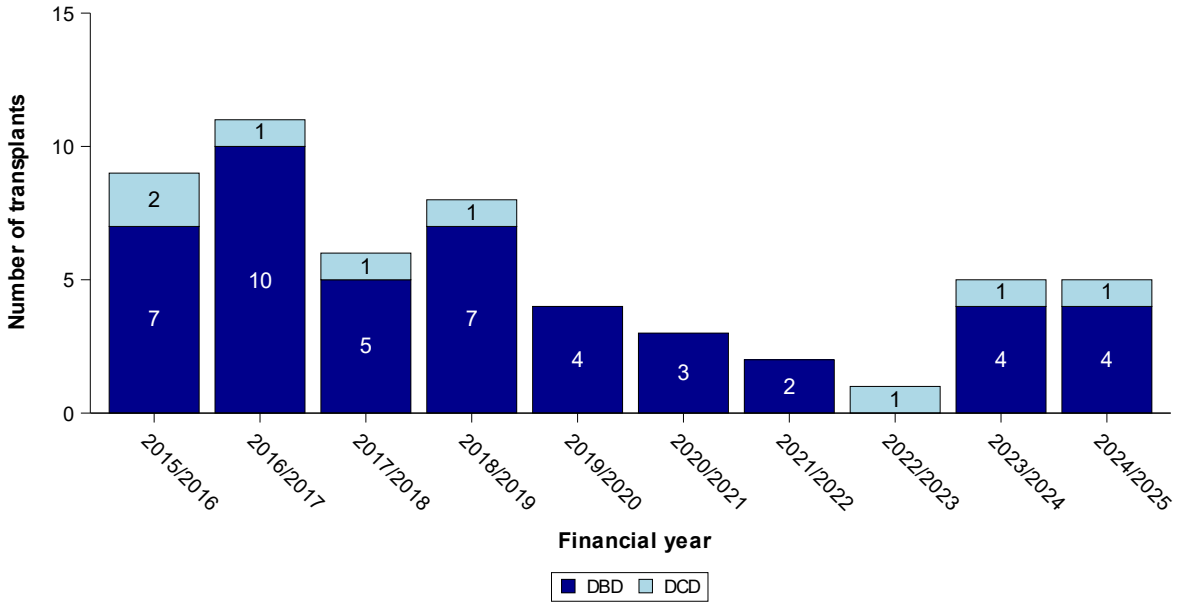


Figure 11.2 Number of paediatric lung transplants in the UK, by financial year, centre and donor type, 1 April 2015 to 31 March 2025

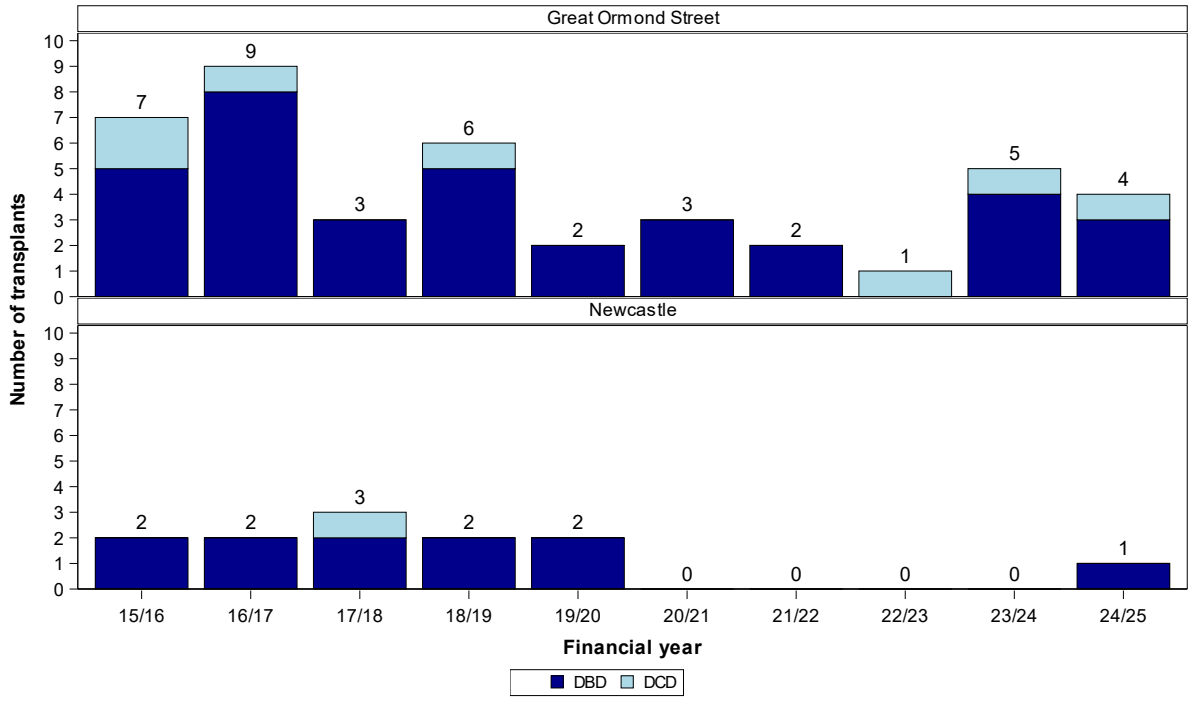


Figure 11.3 Number of paediatric lung transplants in the UK, by centre and donor type, 1 April 2024 to 31 March 2025

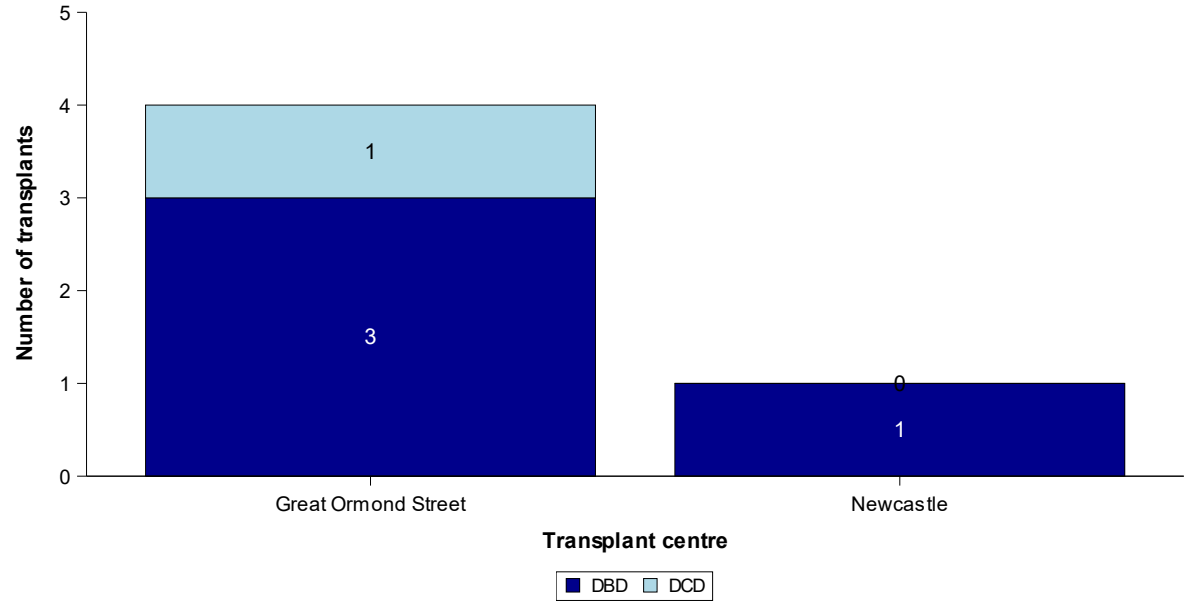


Figure 11.4 and **11.5** show the number of paediatric lung transplants performed in the last 10 years, by transplant type, overall and by centre respectively. Over the time period there have been 3 paediatric heart-lung block transplants.

Figure 11.4 Number of paediatric lung transplants in the UK, by financial year and transplant type, 1 April 2015 to 31 March 2025

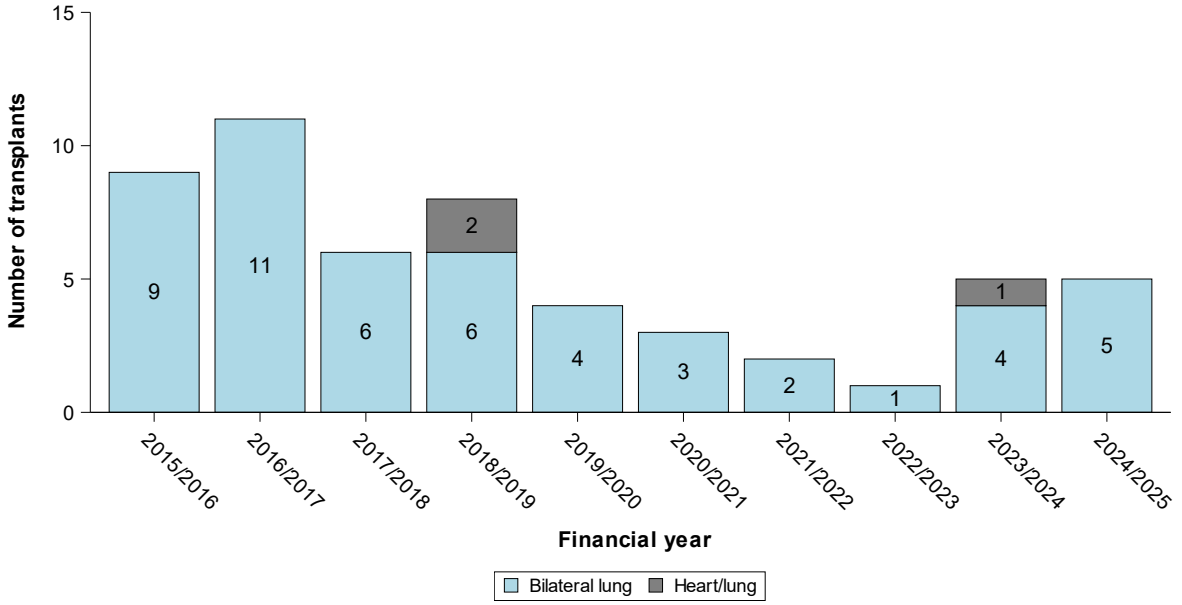
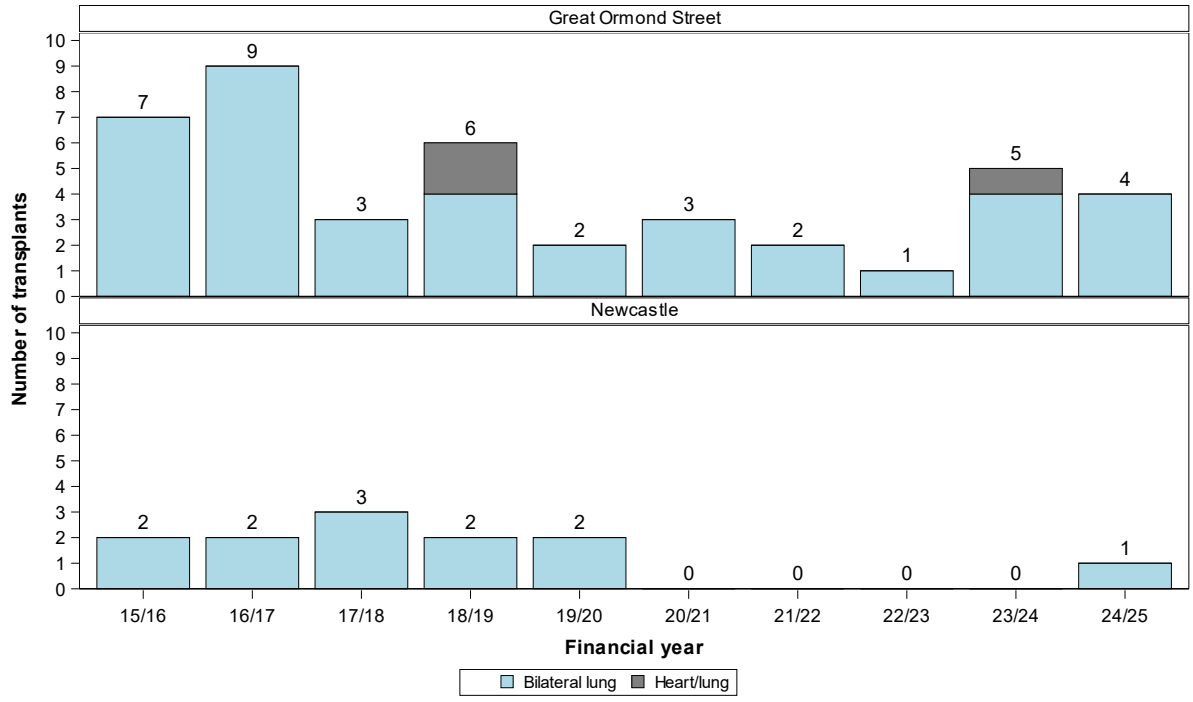


Figure 11.5 Number of paediatric lung transplants in the UK, by financial year, centre and transplant type, 1 April 2015 to 31 March 2025



In May 2017, the super-urgent and urgent lung allocation schemes were introduced, allowing for prioritisation of the sickest patients awaiting a lung transplant nationally. **Figure 11.6** displays the number of paediatric lung only transplants performed in the last 10 financial years by urgency and **Figure 11.7** shows the number in the latest financial year, by centre and urgency. Of the 5 lung only transplants in 2024/2025, 4 were urgent and 1 was non-urgent.

Figure 11.6 Number of paediatric lung only transplants in the UK, by financial year and urgency status, 1 April 2015 to 31 March 2025

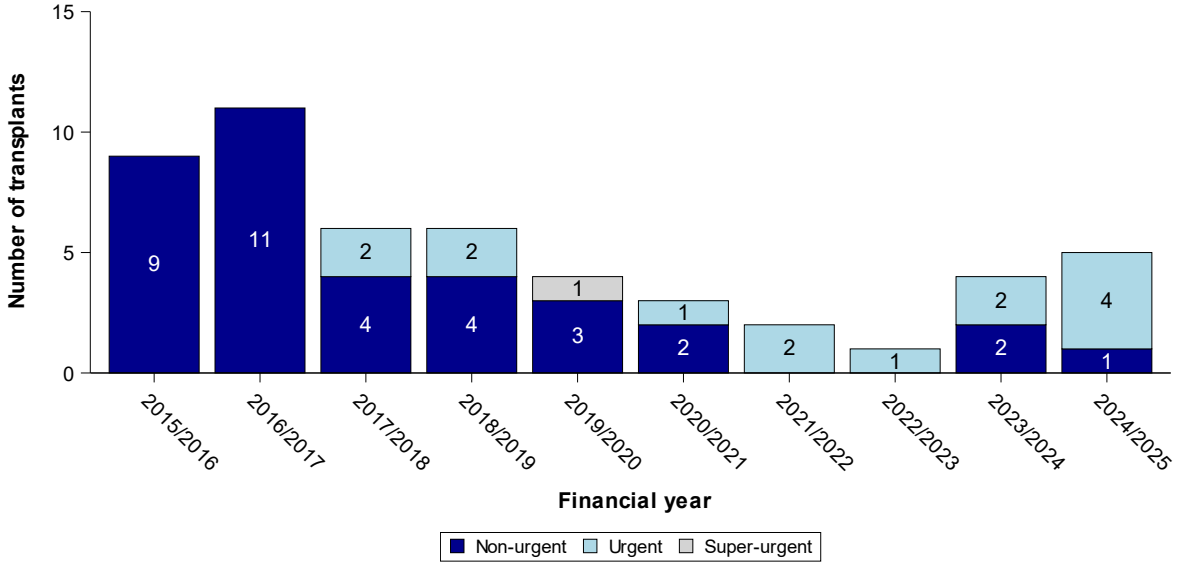
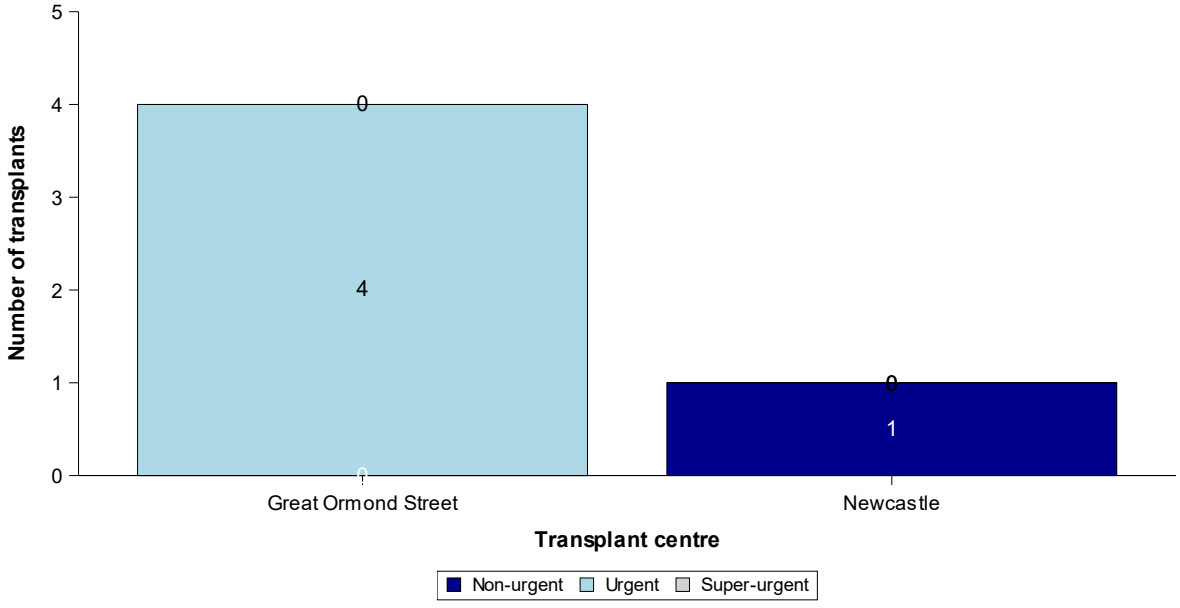


Figure 11.7 Number of paediatric lung only transplants in the UK, by centre and urgency status, 1 April 2024 to 31 March 2025



11.2 Demographic characteristics of transplants, 1 April 2015 – 31 March 2025

The demographic characteristics of the 54 paediatric lung transplant recipients and donors in the last 10 years are shown by centre and overall in **Table 11.1**. Nationally, 57% of lung recipients were female and the median age was 14 years, while the median age of donors was 15 years. For some characteristics, due to rounding, percentages may not add up to 100.

Table 11.1 Demographic characteristics of UK paediatric lung transplants performed between 1 April 2015 and 31 March 2025, by centre

		Great Ormond Street N (%)	Newcastle N (%)	**TOTAL** **N (%)**
Number of transplants		42 (100)	12 (100)	**54 (100)**
Urgency status at transplant	Non-urgent	29 (69)	8 (67)	**37 (69)**
	Urgent	13 (31)	3 (25)	**16 (30)**
	Super-urgent	0 (0)	1 (8)	**1 (2)**
Recipient sex	Male	16 (38)	7 (58)	**23 (43)**
	Female	26 (62)	5 (42)	**31 (57)**
Recipient ethnicity	White	39 (93)	12 (100)	**51 (94)**
	Asian	1 (2)	0 (0)	**1 (2)**
	Black	1 (2)	0 (0)	**1 (2)**
	Other	1 (2)	0 (0)	**1 (2)**
Recipient age (years)	Median (IQR)	14 (10, 15)	13 (10, 15)	**14 (10, 15)**
	Missing	0	0	**0**
Recipient weight (kg)	Median (IQR)	40 (26, 50)	39 (20, 41)	**40 (26, 49)**
	Missing	0	0	**0**
Recipient primary disease	Cystic fibrosis and bronchiectasis	12 (29)	8 (67)	**20 (37)**
	Fibrosing lung disease	2 (5)	2 (17)	**4 (7)**
	Primary pulmonary hypertension	18 (43)	1 (8)	**19 (35)**
	Other heart/lung disease	10 (24)	1 (8)	**11 (20)**
Recipient in hospital	No	31 (74)	6 (50)	**37 (69)**
	Yes	9 (21)	5 (42)	**14 (26)**
	Missing	2 (5)	1 (8)	**3 (6)**
In hospital, recipient on ventilator	No	8 (89)	4 (80)	**12 (86)**
	Yes	1 (11)	1 (20)	**2 (14)**
In hospital, recipient ECMO	No	9 (100)	3 (60)	**12 (86)**
	Yes	0 (0)	1 (20)	**1 (7)**
	Missing	0 (0)	1 (20)	**1 (7)**
In hospital, recipient on inotropes	No	6 (67)	3 (60)	**9 (64)**
	Yes	3 (33)	2 (40)	**5 (36)**
Recipient CMV status	Negative	32 (76)	10 (83)	**42 (78)**
	Positive	10 (24)	1 (8)	**11 (20)**
	Missing	0 (0)	1 (8)	**1 (2)**
Recipient HCV status	Negative	40 (95)	11 (92)	**51 (94)**
	Missing	2 (5)	1 (8)	**3 (6)**

Table 11.1 Demographic characteristics of UK paediatric lung transplants performed between 1 April 2015 and 31 March 2025, by centre

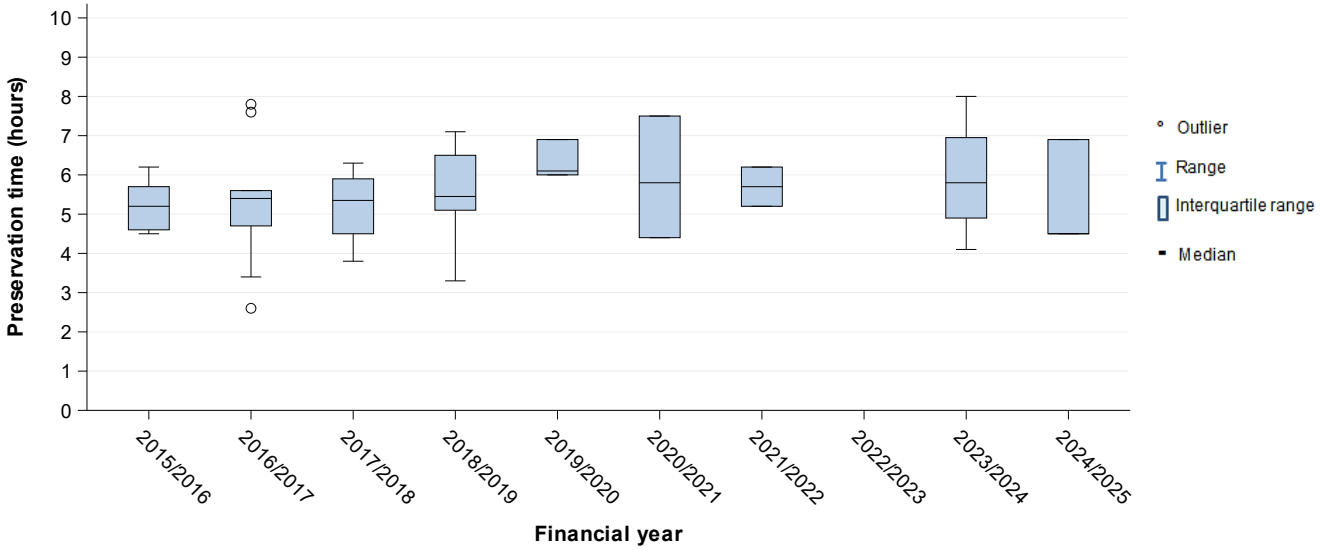
		Great Ormond Street N (%)	Newcastle N (%)	**TOTAL** **N (%)**
Recipient HBV status	Negative	40 (95)	11 (92)	**51 (94)**
	Missing	2 (5)	1 (8)	**3 (6)**
Recipient HIV status	Negative	40 (95)	11 (92)	**51 (94)**
	Missing	2 (5)	1 (8)	**3 (6)**
Recipient serum creatinine (umol/l)	Median (IQR)	45 (33, 55)	40 (23, 55)	**45 (31, 55)**
	Missing	3	2	**5**
Donor sex	Male	18 (43)	5 (42)	**23 (43)**
	Female	24 (57)	7 (58)	**31 (57)**
Donor ethnicity	White	34 (81)	10 (83)	**44 (82)**
	Asian	1 (2)	0 (0)	**1 (2)**
	Other	2 (5)	1 (8)	**3 (6)**
	Missing	5 (12)	1 (8)	**6 (11)**
Donor age (years)	Median (IQR)	22 (11, 39)	10 (6, 14)	**15 (9, 33)**
	Missing	0	0	**0**
Donor BMI (kg/m^2)	Median (IQR)	21 (18, 25)	18 (15, 21)	**21 (17, 24)**
	Missing	0	0	**0**
Donor cause of death	Intracranial/CVA	25 (60)	7 (58)	**32 (59)**
	Trauma	4 (10)	1 (8)	**5 (9)**
	Others	13 (31)	4 (33)	**17 (32)**
Donor hypotension	No	24 (57)	7 (58)	**31 (57)**
	Yes	12 (29)	3 (25)	**15 (28)**
	Missing	6 (14)	2 (17)	**8 (15)**
Donor history of cardiac disease	No	36 (86)	11 (92)	**47 (87)**
	Yes	1 (2)	0 (0)	**1 (2)**
	Missing	5 (12)	1 (8)	**6 (11)**
Donor history of hypertension	No	37 (88)	9 (75)	**46 (85)**
	Yes	0 (0)	1 (8)	**1 (2)**
	Missing	5 (12)	2 (17)	**7 (13)**
Donor history of cancer/malignancy	No	35 (83)	10 (83)	**45 (83)**
	Yes	2 (5)	0 (0)	**2 (4)**
	Missing	5 (12)	2 (17)	**7 (13)**
Donor past/current smoker	No	29 (69)	11 (92)	**40 (74)**
	Yes	9 (21)	0 (0)	**9 (17)**
	Missing	4 (10)	1 (8)	**5 (9)**
Total preservation time[1] (hours)	Median (IQR)	5.7 (4.6, 6.5)	5.5 (5.3, 6.0)	**5.6 (4.7, 6.3)**
	Missing	5	2	**7**
Transplant type	Bilateral lungs	39 (93)	12 (100)	**51 (94)**
	Heart/lung	3 (7)	0 (0)	**3 (6)**

[1] Time from cross clamp in the donor to reperfusion in the recipient

11.3 Total preservation time, 1 April 2015 – 31 March 2025

Figure 11.8 shows boxplots of total preservation time for DBD donor lungs transplanted into paediatric recipients over the last 10 years. The total preservation time is the difference between donor cross-clamp and recipient reperfusion and can be considered the out of body time. The median total preservation time varied substantially over the decade, however these are based on a very small number of transplants per year. No further breakdown by centre is shown due to small numbers. In the financial year 2022/2023, there was only 1 transplant, so the boxplot for that year is not displayed. The median preservation time for DBD donor lungs in 2024/2025 was 4.5 hours.

Figure 11.8 Boxplots of total preservation time for DBD donor lungs transplanted into paediatric recipients, by financial year, 1 April 2015 to 31 March 2025



PAEDIATRIC LUNG TRANSPLANTATION

Post-Transplant Survival

12. Post-Transplant Survival

The survival analyses presented in this section exclude heart-lung transplants and other multi-organ transplants and include first time transplants only. Partial lung transplants are also excluded. Both DBD and DCD lung transplants are included. Ninety-day and 1-year survival rates are based on transplants performed in the period 1 April 2020 and 31 March 2024 while 5-year survival rates are based on transplants performed in the period 1 April 2016 and 31 March 2020.

The 90-day post-transplant unadjusted patient survival rates are shown in **Table 12.1** for the 10 first paediatric lung only transplants in the period 1 April 2020 and 31 March 2024. Nationally, the 90-day survival rate following first paediatric lung transplant was 100%.

Table 12.1 90 day patient survival rates after first paediatric lung transplants, by centre, 1 April 2020 and 31 March 2024

Centre	Number of patients	Number of deaths	% 90 day survival (95% CI) (unadjusted)	
Great Ormond Street Hospital	10	0	100	(-)
Newcastle[1]	0	-	-	-
UK	**10**	**0**	**100**	**(-)**

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

There was 1 death between 90 days and 1 year for the 10 paediatric lung only transplants performed by Great Ormond Street Hospital in the period 1 April 2020 and 31 March 2024; resulting in a national survival rate of 90%.

Table 12.2 1 year patient survival rates after first paediatric lung transplants, by centre, 1 April 2020 and 31 March 2024

Centre	Number of patients	Number of deaths	% 1 year survival (95% CI) (unadjusted)	
Great Ormond Street Hospital	10	1	90.0	(47.3 - 98.5)
Newcastle[1]	0	-	-	-
UK	**10**	**1**	**90.0**	**(47.3 - 98.5)**

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

Five year survival rates were estimated from the 26 first lung only transplants performed in the period 1 April 2016 and 31 March 2020. The unadjusted patient survival rates are shown in **Table 12.3**.

Table 12.3 5 year patient survival rates after first paediatric lung transplants, by centre, 1 April 2016 to 31 March 2020

Centre	Number of patients	Number of deaths	% 5 year survival (95% CI) (unadjusted)	
Great Ormond Street Hospital	18	5	71.1	(43.8 - 86.9)
Newcastle[1]	8	4	-	-
UK	**26**	**9**	**62.8**	**(40.4 - 78.8)**

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

PAEDIATRIC LUNG TRANSPLANTATION

Form Return Rates

13. Paediatric lung form return rates, 1 January – 31 December 2024

Form return rates are reported in **Table 13.1** for the cardiothoracic transplant record and the 3 month and 1 year follow up form, along with lifetime follow up (2 years or more). These include all paediatric lung and heart-lung transplants between 1 January and 31 December 2024 for the transplant record, and all follow up forms issued in this time period. All forms have been returned.

Table 13.1 Form return rates for paediatric lung transplants, 1 January 2024 to 31 December 2024

Centre	Transplant record		3 month follow-up		1 year follow-up		Lifetime follow-up	
	No. requested	% returned	No. requested	% returned	No. requested	% returned	No. requested	% returned
Great Ormond Street Hospital	3	100	4	100	5	100	10	100
Newcastle, Freeman Hospital	1	100	1	100	-	-	12	100
Overall	4	100	5	100	5	100	22	100

APPENDIX

A1: Number of patients analysed

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

Table A1.1 Adult transplants analysed

Time period	Report Section	Exclusion criteria	No. lung (+ heart-lung) transplants
1 April 2015 – 31 March 2025	• Introduction	None	1445
1 April 2015 – 31 March 2025	• Transplants	• Multi-organ transplants	1441
1 April 2020 – 31 March 2024	Post-transplant survival – • 90-day • 1-year survival	• Multi-organ transplants • Heart-lung transplants excluded from main analysis • Partial lung transplants • Second (or more) transplants • Group 2 transplants	413
1 April 2016 – 31 March 2020	Post-transplant survival – • 5-year survival	• Multi-organ transplants • Heart-lung transplants excluded from main analysis • Partial lung transplants • Second (or more) transplants • Group 2 transplants	658

Table A1.2 Paediatric transplants analysed

Time period	Report Section	Exclusion criteria	No. lung (+ heart-lung) transplants
1 April 2015 – 31 March 2025	• Introduction	None	54
1 April 2015 – 31 March 2025	• Transplants	• Multi-organ transplants	54
1 April 2020 – 31 March 2024	Post-transplant survival – • 90-day • 1-year survival	• Multi-organ transplants • Heart-lung transplants • Partial lung transplants • Second (or more) transplants • Group 2 transplants	10
1 April 2016 – 31 March 2020	Post-transplant survival – • 5-year survival	• Multi-organ transplants (including heart-lung transplants) • Partial lung transplants • Second (or more) transplants • Group 2 transplants	26

Geographical variation analysis

Registration rates

All NHS group 1 patients who were registered onto the lung transplant list with an active status between 1 April 2024 and 31 March 2025 were extracted from the UK Transplant Registry on 18 June 2025 (numerator). Patients registered for a heart-lung block were included. Patients were assigned to NHS regions in England using their postcode of residence, as reported at registration. The number of registrations per million population (pmp) by NHS region was obtained using mid-2022 population estimates based on the Office for National Statistics (ONS) 2021 Census figures (denominator). No NHS region age- or sex-specific standardisation of rates was performed.

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

Transplant rates

Transplant rates pmp were obtained as the number of lung transplants on NHS group 1 recipients between 1 April 2024 and 31 March 2025 (numerator), divided by the mid-2022 population estimates from the ONS (denominator). Patients who received a heart-lung block transplant were included. Transplant rates pmp were categorised and visualised in a map as done for the registration rates.

Systematic component of variation

Only registrations or transplants in England between 1 April 2024 and 31 March 2025 were included. If a patient was re-registered during the time period, only the first registration was considered. If a patient underwent more than one lung transplant in the time period, only the first transplant was considered.

A2: Methods

Offer decline rates

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

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

Unadjusted post-transplant survival rates

Kaplan-Meier methods were used to estimate the unadjusted patient survival rates. Patients can be included in this method of analysis irrespective of the length of follow-up recorded. If a patient is alive at the end of the follow-up then information about the survival of the patient is censored.

Risk-adjusted post-transplant survival rates

A risk-adjusted survival rate is an estimate of what the survival rate at a centre would have been if they had had the same mix of patients as that seen nationally. The risk-adjusted rate therefore presents estimates in which differences in patient mix across centres have been removed as much as possible. For that reason, it is valid to only compare centres using risk-adjusted rather than unadjusted rates, as differences among the latter can be attributed to differences in patient mix.

Risk-adjusted survival estimates were obtained through indirect standardisation. A Cox Proportional Hazards model was used to determine the probability of survival for each patient based on their individual risk factor values. The sum of these probabilities for all patients at a centre gives the number, E, of patients or grafts expected to survive at least 1 year or 5 years after transplant at that centre. The number of patients who actually survive the given time period is given by O. The risk-adjusted estimate is then calculated by multiplying the ratio O/E by the overall unadjusted survival rate across all centres. The risk-adjustment models used were developed in consultation with clinicians and were based on statistical significance as well as previous studies of factors affecting the survival rates of interest. The factors included in the model are shown in **A3**.

Missing values for risk factors were imputed using simple imputation of the median or most common group for the adult lung model (where missing values represented <10% of the cohort). Missing total preservation time (2% of cohort) was imputed with a centre and year specific median.

Funnel plots

The funnel plot is a graphical method to show how consistent the survival rates of the different transplant centres are compared to the national rate. The graph shows for each centre, a survival rate plotted against the number of transplants undertaken, with the national rate and confidence limits around this national rate superimposed. In this report,

95% and 99.8% confidence limits were used. Units that lie within the confidence limits have survival rates that are statistically consistent with the national rate. When a unit is close to or outside the limits, this is an indication that the centre may have a rate that is considerably different from the national rate.

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

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

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

Survival from listing
Data were obtained for all patients ≥ 16 years registered for the first time for a heart or lung transplant between 1 April 2016 to 31 March 2024. Survival time was defined as the time from joining the transplant list to death, regardless of the length of time on the transplant list, whether or not the patient was transplanted and any factors associated with such a transplant e.g. donor type. Survival time was censored at either the date of removal from the list, or at the last known follow up date post-transplant when no death date was recorded, or on 18 June 2025 if the patient was on the transplant list at time of analysis.

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

Patients registered for a lung transplant who were non-urgent and then urgently listed on the same day (or vice-versa) were recorded as urgent at registration.

In risk-adjusted survival analysis, factors recorded at time of transplant listing were adjusted for. These are detailed in **Table A2.1** and were included in the modelling whether or not statistically significant. Missing data for these risk factors have been imputed using the median or modal value to ensure that cases with missing data are not excluded from the risk-adjusted analysis.

Table A2.1	Factors used in risk-adjusted model for patient survival from listing
Lung	Age, bilirubin (logarithm), ethnicity, weight, urgency status (non-urgent vs urgent/super-urgent), primary disease, in hospital at registration, daily dose of prednisolone

Survival rates at 1 and 5 years post registration were calculated from the risk adjusted survival rate (RASR), obtained as 1 – {observed number of deaths in follow up period/expected number) x national mortality rate}. The expected survival rates were estimated from fitting a Cox model to the national data, excluding transplant centre, evaluated at each patient's observed survival time. Interval estimates for 1 and 5 year rates, and the significance of differences between them across centres, were found using Poisson regression models for the logarithm of the observed number of deaths, with centre as a fixed effect.

A3: Risk models

Table A3.1	Risk factors and categories used in the adult lung risk adjusted 90-day, 1- year and 5-year survival model
Donor type	DBD DCD
Donor age group	<30 30-<40 40-<50 >=50
Donor respiratory arrest	No Yes
Donor past smoker	No Yes
Recipient BMI group	<25 25-<30 >=30
Recipient ethnic group	White Ethnic minority group
Recipient bilirubin at registration (logged)	(modelled as continuous variable)
Recipient diabetes at registration	No Yes
Recipient eGFR group at transplant	>=90 <90
Recipient hospital status	Outpatient Inpatient
Total preservation time (hours)	Non-linear spline with knots at 2.9, 4.6, 5.8, 9.1
Transplant type	Single lung Bilateral lungs
Donor/recipient blood group mismatch	Identical Compatible
Donor/recipient CMV mismatch	D-R- D+R+ D-R+ D+R-

A4: Glossary of terms

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

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

Case mix
The types of patients treated at a unit for a common condition. This can vary across units depending on the facilities available at the unit as well as the types of people in the catchment area of the unit. The definition of what type of patient a person is depends on the patient characteristics that influence the outcome of the treatment.

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

Confidence limit
The upper and lower bounds of a confidence interval.

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

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

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

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

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

Kaplan-Meier method
A method that allows patients with incomplete follow-up information to be included in estimating survival rates. For example, when estimating 1 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 1 year after transplant. The Kaplan-Meier method allows information about such patients to be used for the length of time that they are followed-up, when this information would otherwise be discarded. Such instances of incomplete follow-up are not uncommon and the Kaplan-Meier method allows the computation of estimates that are more meaningful in these cases. The Kaplan-Meier method can be used for any time to event analysis, including time to transplant. If not enough events have occurred or if there are not enough patients in the cohort, an estimate of the median may not be possible.

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

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

Patient survival rate
The percentage of patients who are still alive (whether the graft is still functioning or not). This is usually specified for a given time period after transplant. For example, a 5-year patient survival rate is the percentage of patients who are still alive 5 years after their first transplant.

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

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

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

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

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