

**NHS BLOOD AND TRANSPLANT**  
**CARDIOTHORACIC ADVISORY GROUP**

**ZONAL BOUNDARIES CHANGES:  
HEART AND LUNG ALLOCATION ZONES**

**SUMMARY**

**INTRODUCTION**

1. The cardiothoracic allocation zones were split into separate heart and lung allocation zones on 18 May 2017 in order to more appropriately match individual organ supply with demand across centres. It was agreed by CTAG in April 2017 that the first 6 months would be a step change between the previously shared zones and the new completely split zones.
2. This report presents the proposed zonal boundary changes required to match as closely as possible the percentage share of registrations at each centre with the percentage share of donors, separately for heart and lung. To do this, up to date registration numbers from the most recent two years, 1 April 2015 to 31 March 2017, and up to date donor numbers from the most recent three years, 1 April 2014 to 31 March 2017, were used.
3. CTAG are asked to approve these proposed changes which will be implemented as soon as possible after 18 November 2017.

**RESULTS AND CONCLUSIONS**

4. When comparing the proportion of heart registrations made by each centre with the proportion of heart donors in each of the current heart allocation zones, as implemented on 18 May 2017, there was a statistically significant difference observed. The same was true, however it was borderline significant, for the comparison of lung registrations and donors.
5. A number of hospital changes are therefore proposed to address these imbalances. The subsequent change in each centre's percentage share of heart and lung donors is as follows:

	% share change in heart donors	% share change in lung donors
Birmingham	+4%	+1%
Glasgow	0%	-
Harefield	-8%	+1%
Manchester	-4%	-6%
Newcastle	+5%	+2%
Papworth	+3%	+2%

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**INTRODUCTION**

6. At the last meeting of the Cardiothoracic Advisory Group it was agreed that the cardiothoracic allocation zones should be split into separate heart and lung zones, as previously planned, but that this should be done in a phased manner so as to stagger the impact of this big change on the number of first offers centres will receive.
7. The first phase of the split zones was implemented on 18 May 2017, on the same day that the new Super-Urgent and Urgent Lung Allocation Schemes went live. Phase two of this change is due to go ahead after 6 months, i.e. after 18 November 2017.
8. This report provides updated figures on each centre's percentage share of registrations onto the national heart and lung transplant lists, for the two year period 1 April 2015 to 31 March 2017. It also provides numbers of heart and lung donors over the three year period 1 April 2014 to 31 March 2017 under each of the current split allocation zones that have been in place since 18 May 2017. Based on the imbalances observed therein, allocation zonal boundary changes are proposed for a number of donor hospitals.
9. CTAG are asked to approve these proposed changes which will be implemented as soon as possible after 18 November 2017.

**DATA AND METHODS**

10. Changes to the cardiothoracic allocation zones are based on a statistically significant difference being observed between the percentage share of registrations and the percentage share of donors for any one allocation zone (at the 5% significant level after adjusting for multiple testing). The cardiothoracic allocation zones are reviewed on an annual basis and presented for endorsement at each Autumn CTAG meeting. This paper presents the first review after implementing separate heart and lung zones, which are known to be imbalanced and therefore require further adjustment.
11. Registrations are defined as:

The total number of UK adult ( $\geq 16$  years at time of registration) Group 1 heart or heart-lung registrations and lung registrations in the latest two year period between 1 April and 31 March, but excluding a) any registrations made by Great Ormond Street Hospital and b) any patients with no active waiting time. Registrations that ended in a domino or live donor transplant, multi-organ registrations and urgent and super-urgent heart registrations are included. Registrations for heart-lung transplantation are

included in the number of heart registrations as heart-lung blocks are allocated according to the heart allocation sequence. Retrospective registrations made after an unlisted patient was transplanted are also included. VAD patients listed for transplant are included.

For patients registered more than once in the registration period, the following rules apply:

- If a patient was registered, removed then reregistered, only the first registration is included.
- If a patient was registered, transplanted then reregistered, both registrations are included.
- If a patient was active, suspended then reactivated, only the first activation is included.
- If a patient moved between the non-urgent, urgent or super-urgent lists (without transplantation in between) they will only be counted once.

## 12. Donors are defined as:

The total number of UK adult ( $\geq 16$  years at time of death) heart and lung donors after brain death over the latest three year period between 1 April and 31 March. Donors whose heart or lungs were not transplanted are excluded. If only one lung from a donor was transplanted, this is included as a lung donor. Paediatric donors who donated to adult patients are included, along with adult donors whose organs are transplanted into paediatric patients. Donors who donate both heart and lung(s) are counted towards both the heart and lung donor pools.

## RESULTS

13. **Table 1** summarises the proportion of heart and lung registrations made by each centre over the two year period, from 1 April 2015 to 31 March 2017, and compares this with the number of heart and lung donors that arose under each allocation zone as they are currently defined (as of 18 May 2017) over the three year period, from 1 April 2014 to 31 March 2017.
14. This shows that the proportion of heart donors in Harefield is significantly higher than the proportion of heart registrations ( $p < 0.01$ ) and the proportion of lung donors in Manchester is borderline significantly higher than the proportion of lung registrations ( $p = 0.05$ ).
15. **Figure 1** shows this information graphically, with the first bar representing the percentage share of donors in the current zones and the third bar representing the percentage share of registrations across centres, which is also the “target” percentage that the heart and lung donors should match to. The middle bar is the percentage share of donors according to the proposed zonal changes that are detailed in **Appendix 1**. The proposed percentages and the registration percentages are matched with less than 1% difference in all centres.

16. **Figure 2** is the UK map which illustrates the proposed zonal boundaries graphically. The red (heart) and blue (lung) polygons represent the proposed zonal boundaries and the coloured circles represent the UK hospitals shaded according to the current allocation zones (in place since 18 May 2017). The difference between the percentage of donors under the proposed zones and the target percentages is shown in the top right hand corners of the maps.
17. **Appendix 2** provides some background statistics including trends in the number of registrations made by each centre on a quarterly basis over the analysis period, plus quarter 1 of 2017/17 during which the zones were split. Any recent increases in numbers of registrations will be reflected in the next analysis in Autumn 2018. The trend in the number of patients waiting on the heart and lung transplant lists at the end of each quarter is also included. Also, the number of transplants performed by each centre before and after the zones were split is shown.

## **ACTION**

18. CTAG are asked to approve the zonal boundary changes presented herein in order to improve equity between individual organ supply and demand across centres. Once endorsed, the changes will be implemented as soon as possible after 18 November 2017. Thereafter, the zones will continue to be monitored and assessed on an annual basis.
19. Members are reminded that this decision affects the adult Super-Urgent, Urgent and Non-Urgent Heart Allocation Schemes as well as the adult Non-Urgent Lung Allocation Scheme, all of which use zonal priority. The Super-Urgent and Urgent Lung Allocation Schemes do not use zonal priority. For this reason, it is proposed that in future analyses any lung registrations in the period that are only ever urgent or super-urgent, and never non-urgent, are excluded from the calculations.

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**Statistics and Clinical Studies**

**September 2017**

<b>Table 1 Number of heart and lung registrations, 1 April 2015 – 31 March 2017, and donors, 1 April 2014 – 31 March 2017 by registering centre/current allocation zone (since 18 May 2017)</b>										
Centre/zone	Heart registrations		Heart donors in current zone		Adjusted p-value	Lung registrations		Lung donors in current zone		Adjusted p-value
	N	%	N	%		N	%	N	%	
Birmingham	91	18.3	73	14.9	0.90	80	13.6	55	12.8	1.00
Glasgow	38	7.7	34	7	1.00	-	-	-	0	-
Harefield	76	15.3	117	23.9	<0.01	193	32.7	137	31.9	1.00
Manchester	74	14.9	91	18.6	0.73	73	12.4	78	18.1	0.05
Newcastle	105	21.2	80	16.4	0.32	134	22.7	88	20.5	1.00
Papworth	112	22.6	94	19.2	1.00	110	18.6	72	16.7	1.00
<b>UK</b>	<b>496</b>	<b>100</b>	<b>489</b>	<b>100</b>		<b>590</b>	<b>100</b>	<b>430</b>	<b>100</b>	

**Figure 1 Comparison of % heart and lung donors in each CURRENT (since 18 May 2017) and PROPOSED allocation zone, 1 April 2014 – 31 March 2017, with % heart and lung registrations (TARGET %) at each centre, 1 April 2015 – 31 March 2017**

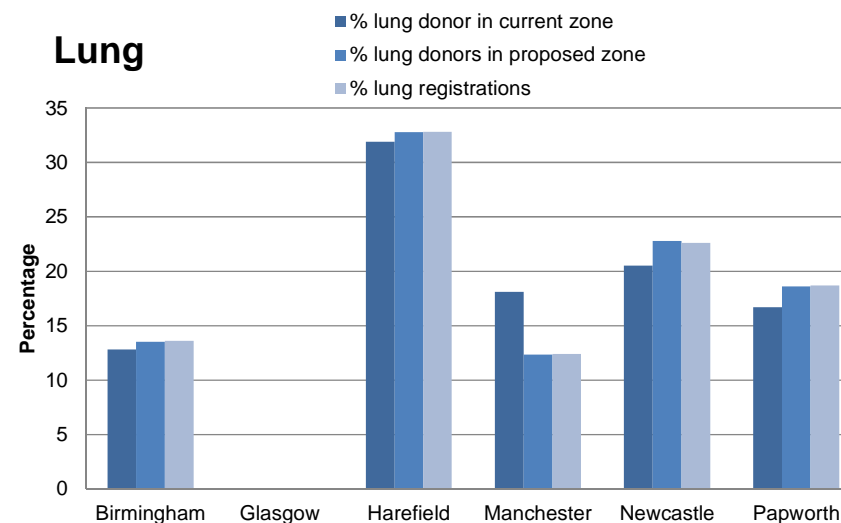
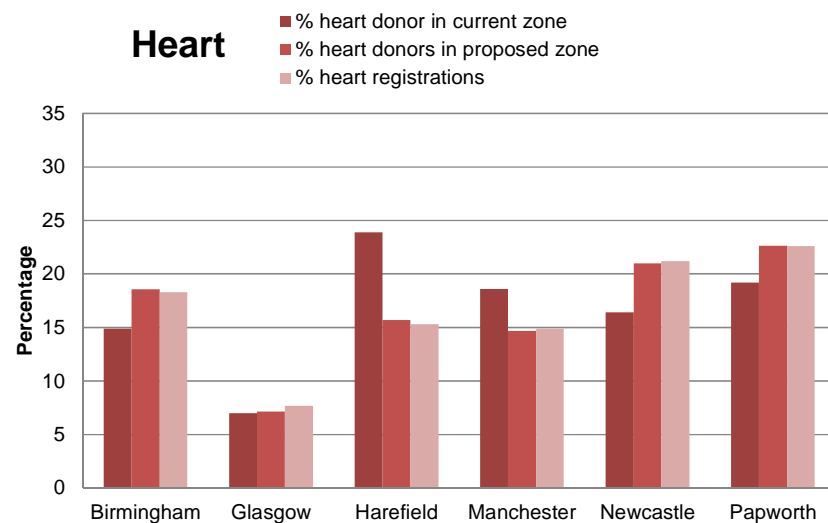
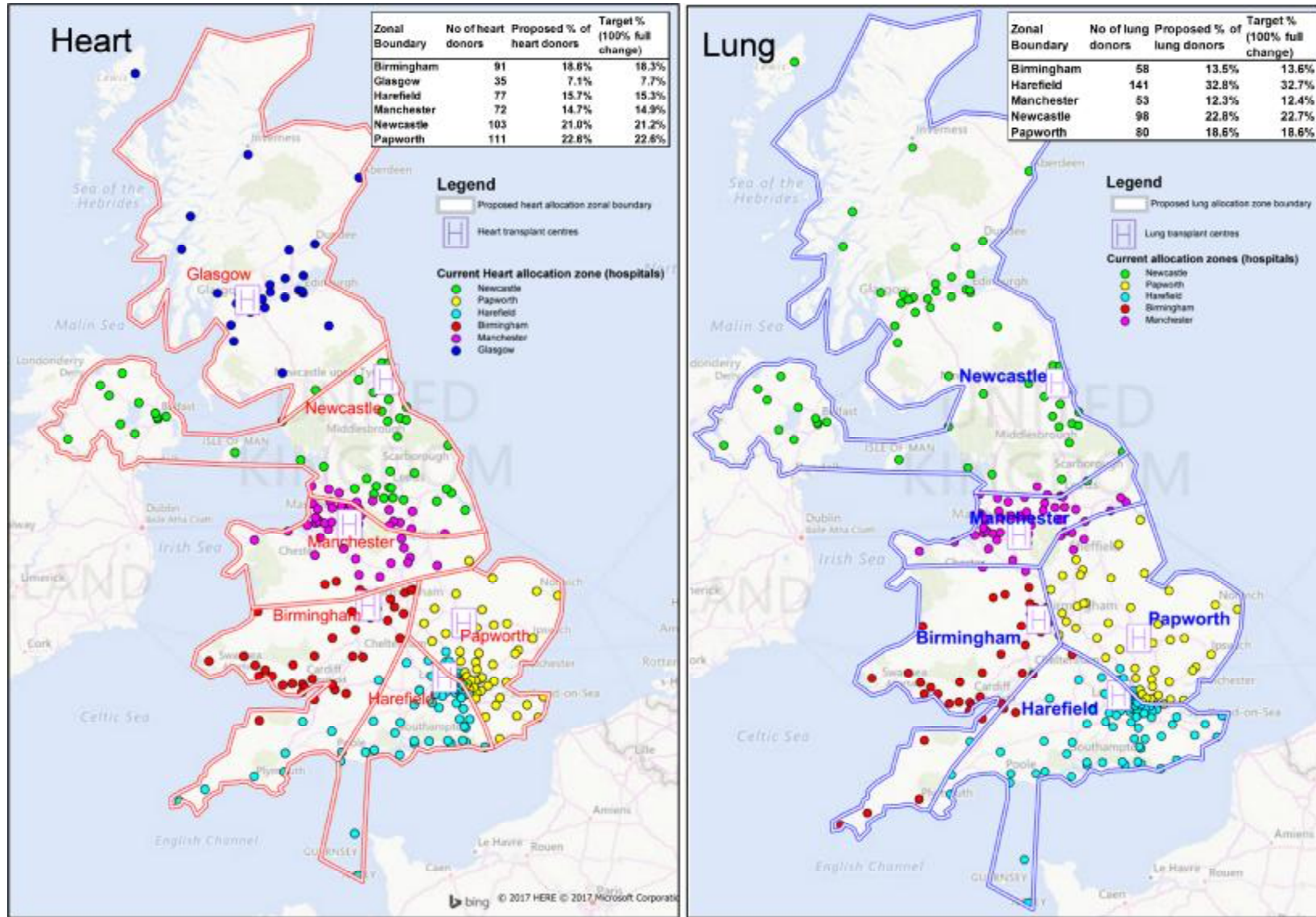


Figure 2 Proposed heart and lung allocation zonal boundaries where donor hospitals are represented as dots shaded according to the current zonal arrangements (in place since 18 May 2017)



## Appendix 1 – List of hospitals that require zonal movement with the proposed zonal boundary changes

Appendix 1A List of hospitals with proposed heart allocation zonal boundary changes			
Current heart zone	Proposed heart zone	Hospital name	Number of heart donors in the most recent 3 years
Birmingham	Manchester	Shrewsbury, Royal Shrewsbury Hospital	0
Birmingham	Manchester	Telford, Princess Royal Hospital	1
Birmingham	Manchester	Walsall, Walsall Manor Hospital	1
Birmingham	Manchester	Wolverhampton, New Cross Hospital	0
Harefield	Papworth	Luton, Luton And Dunstable Hospital	4
Harefield	Papworth	Hemel Hempstead, Hemel Hempstead General Hospital	0
Harefield	Papworth	St Albans, St Albans City Hospital	0
Harefield	Papworth	Watford, Watford General Hospital	1
Harefield	Papworth	Barnet, Barnet General Hospital	1
Harefield	Papworth	Edgware, Edgware Community Hospital	0
Harefield	Papworth	London, St Charles Hospital	0
Harefield	Papworth	London, The Royal Free Hospital	2
Harefield	Papworth	London, University College Hospital	2
Harefield	Papworth	London, UCH At Westmoreland Street	0
Harefield	Papworth	Stanmore, Royal National Orthopaedic Hospital	0
Harefield	Papworth	London, The London Clinic	0
Harefield	Papworth	London, St Thomas' Hospital	3
Harefield	Papworth	Evelina Childrens Hospital	0
Harefield	Birmingham	Dorchester, Dorset County Hospital	2
Harefield	Birmingham	Swindon, Great Western Hospital	2
Harefield	Birmingham	Truro, Royal Cornwall Hospital (Treliske)	0
Harefield	Birmingham	Truro, Royal Cornwall Hospital (City)	0
Harefield	Birmingham	Penzance, West Cornwall Hospital	0
Harefield	Birmingham	Exeter, Royal Devon And Exeter Hospital (Wonford)	3
Harefield	Birmingham	Plymouth, Derriford Hospital	8
Harefield	Birmingham	Torquay, Torbay Hospital	1
Harefield	Birmingham	Taunton, Taunton And Somerset Hospital (Musgrove Park)	4
Harefield	Birmingham	Yeovil, Yeovil District Hospital	0
Harefield	Papworth	London, Great Ormond Street Hospital For Children	0
Harefield	Papworth	London, National Hospital For Neurology And Neurosurgery	7
Harefield	Papworth	Beckenham, Bethlem Hospital	0
Harefield	Papworth	London, The Harley Street Clinic	0
Manchester	Newcastle	Huddersfield, Huddersfield Royal Infirmary	1
Manchester	Newcastle	Lincoln, Lincoln County Hospital	1
Manchester	Newcastle	Worksop, Bassetlaw District General Hospital	0
Manchester	Newcastle	Barnsley, Barnsley District General Hospital	1
Manchester	Newcastle	Doncaster, Doncaster Royal Infirmary	0
Manchester	Newcastle	Rotherham, Rotherham District General Hospital	1
Manchester	Newcastle	Sheffield, Northern General Hospital	6
Manchester	Newcastle	Sheffield, Royal Hallamshire Hospital	4
Manchester	Newcastle	Sheffield, Sheffield Children's Hospital	0
Manchester	Newcastle	Blackpool, Blackpool Victoria Hospital	0

**Appendix 1A List of hospitals with proposed heart allocation zonal boundary changes**

<b>Current heart zone</b>	<b>Proposed heart zone</b>	<b>Hospital name</b>	<b>Number of heart donors in the most recent 3 years</b>
Manchester	Newcastle	Preston, Royal Preston Hospital	8
Manchester	Newcastle	Blackburn, Royal Blackburn Hospital	2
Manchester	Newcastle	Rochdale, Rochdale Infirmary	0
Manchester	Newcastle	Rochdale, Birch Hill Hospital	0
Newcastle	Glasgow	Carlisle, Cumberland Infirmary	1
Newcastle	Glasgow	Whitehaven, West Cumberland Hospital	0
Papworth	Manchester	Boston, Pilgrim Hospital	3
Papworth	Harefield	Uxbridge, Hillingdon Ha	0

**Appendix 1B List of hospitals with proposed lung allocation zonal boundary changes**

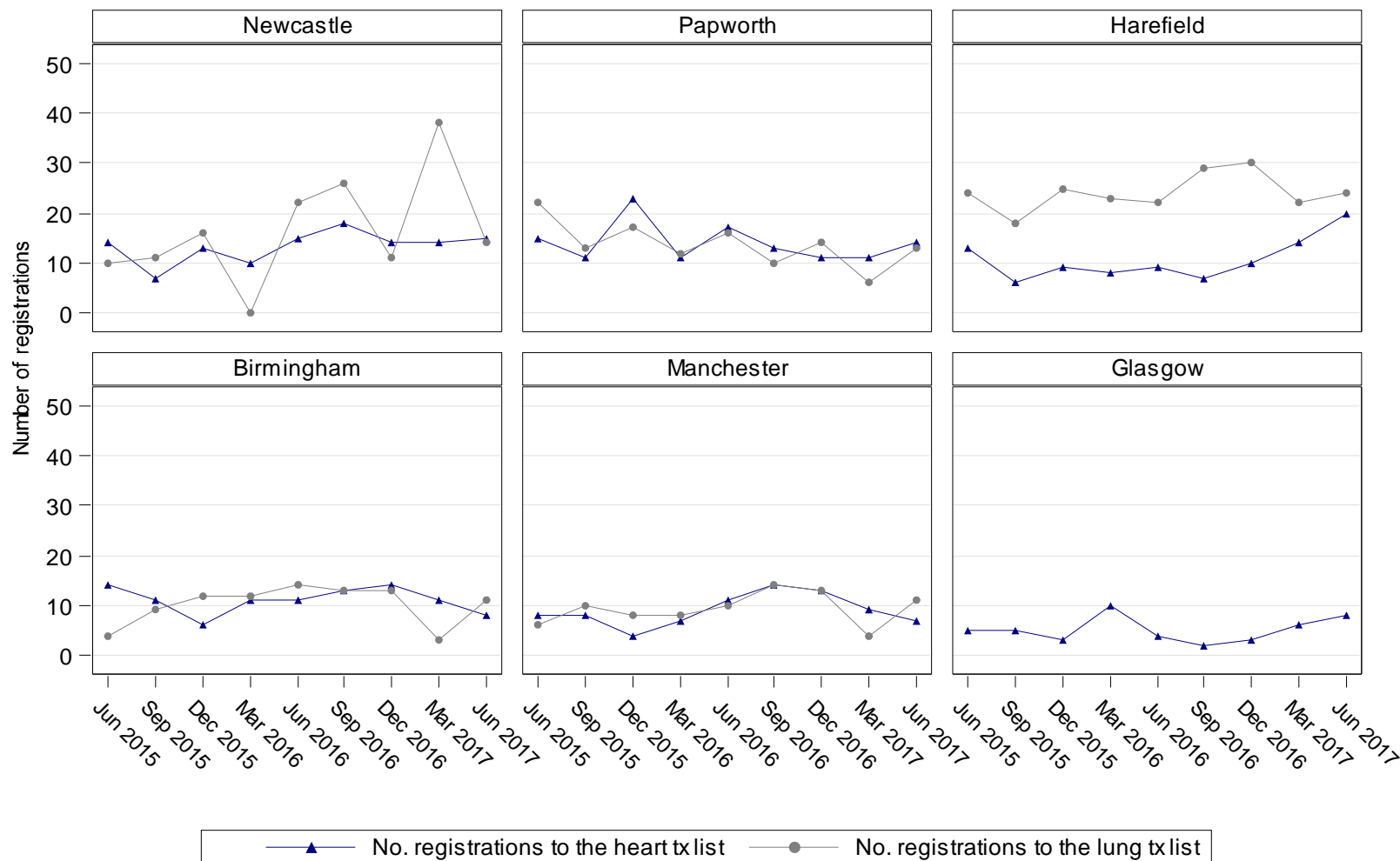
<b>Current lung zone</b>	<b>Proposed lung zone</b>	<b>Hospital name</b>	<b>Number of lung donors in the most recent 3 years</b>
Birmingham	Harefield	Bath, Royal United Hospital	1
Birmingham	Harefield	Banbury, Horton General Hospital	0
Birmingham	Harefield	Bristol, Bristol Royal Infirmary	2
Birmingham	Harefield	Bristol, Bristol Royal Hospital For Children	0
Birmingham	Harefield	Cheltenham, Cheltenham General Hospital	1
Harefield	Papworth	Luton, Luton And Dunstable Hospital	3
Harefield	Papworth	Hemel Hempstead, Hemel Hempstead General Hospital	0
Harefield	Papworth	St Albans, St Albans City Hospital	0
Harefield	Papworth	Barnet, Barnet General Hospital	3
Harefield	Birmingham	Taunton, Taunton And Somerset Hospital (Musgrove Park)	3
Manchester	Newcastle	Bradford, Bradford Royal Infirmary	2
Manchester	Newcastle	Keighley, Airedale General Hospital	0
Manchester	Newcastle	Leeds, Leeds General Infirmary	9
Manchester	Papworth	Chesterfield, Chesterfield And N Derbyshire Royal Hospital	0
Manchester	Papworth	Worksop, Bassetlaw District General Hospital	0
Manchester	Papworth	Doncaster, Doncaster Royal Infirmary	2
Manchester	Papworth	Rotherham, Rotherham District General Hospital	0
Manchester	Papworth	Sheffield, Northern General Hospital	4
Manchester	Papworth	Sheffield, Royal Hallamshire Hospital	5
Manchester	Papworth	Sheffield, Sheffield Children's Hospital	0
Manchester	Birmingham	Stoke-On-Trent, Royal Stoke University Hospital	3
Manchester	Birmingham	Wrexham, Maelor General Hospital	1
Newcastle	Manchester	York, York District Hospital	1
Papworth	Harefield	Uxbridge, Hillingdon HA	0
Papworth	Harefield	Grays, Orsett Hospital	0
Papworth	Harefield	London, The Royal London Hospital (Whitechapel)	9



Appendix 2 – Supporting statistics

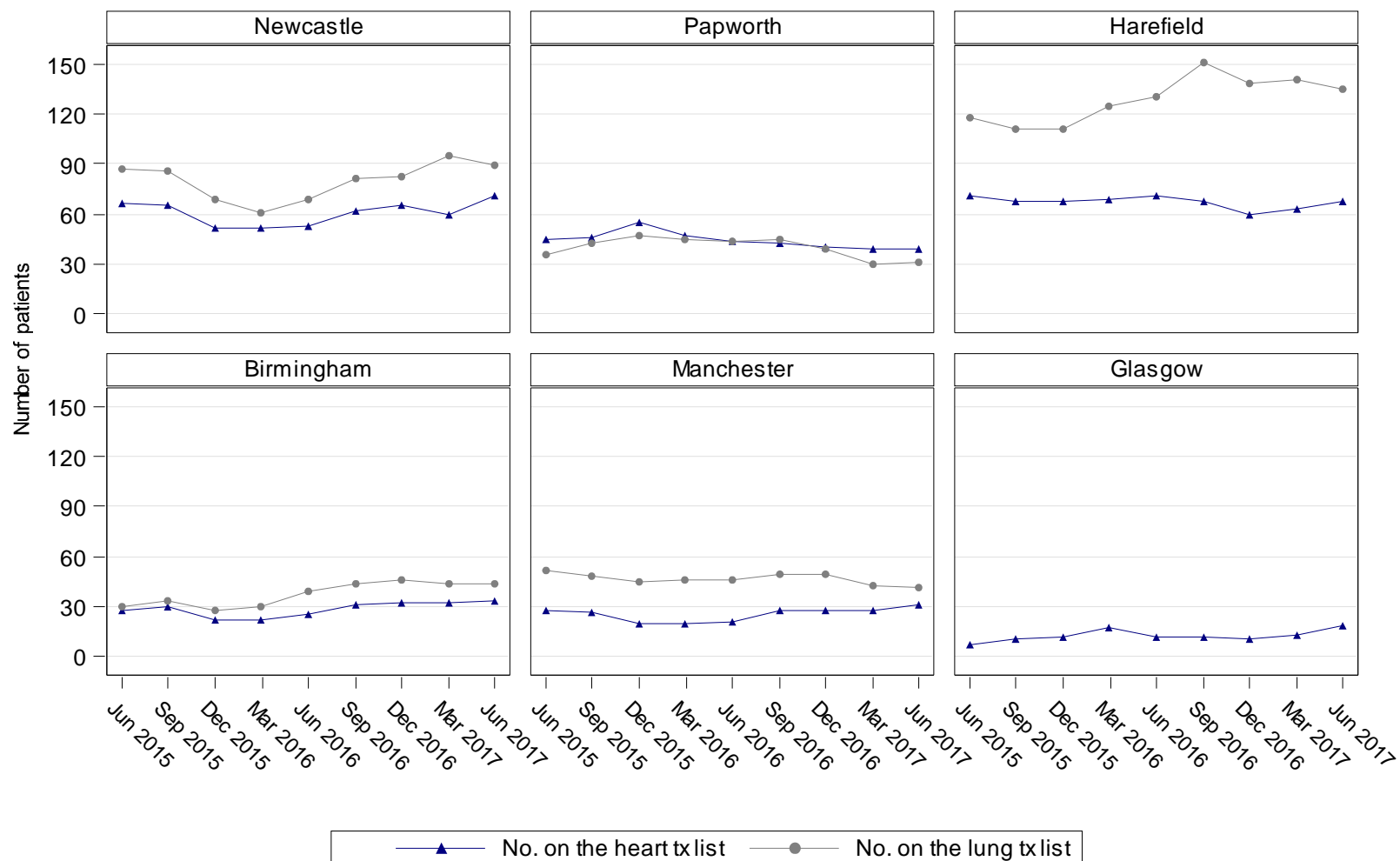
A. Trend in number of heart and lung registrations (including super-urgent, urgent and non-urgent) made by each centre, by quarter since 1 April 2015 (including first quarter of 2017/18 not included in zonal calculations)

Figure 2A Number of heart (including heart-lung) and lung registrations during each quarter, by centre



**B. Trend in number on the heart and lung transplant lists (super-urgent, urgent and non-urgent combined) at the end of each quarter, at each centre, Q1 2015/16 – Q1 2017/18**

**Figure 2B** Number of patients on the heart (including heart-lung) and lung transplant lists at the end of each quarter, by centre



**C. Comparison of number of heart and lung transplants performed by each centre in the 3 months before the zonal split (1 February 2017 – 30 April 2017) and the 3 months after the zone split (1 June 2017 – 31 August 2017)**

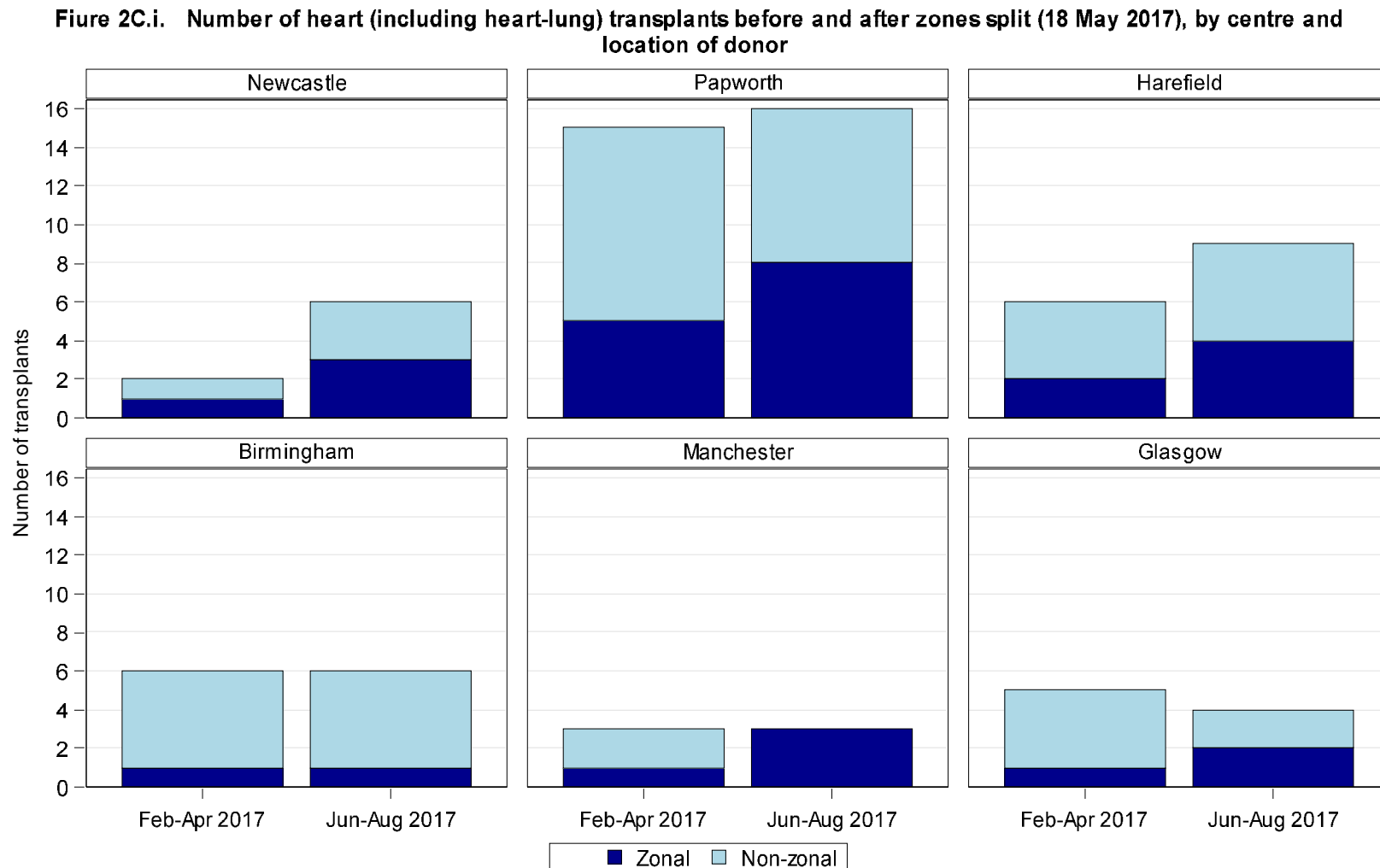


Figure 2C.ii. Number of lung transplants before and after zones split (18 May 2017), by centre and location of donor

