NHS BLOOD AND TRANSPLANT

CARDIOTHORACIC ADVISORY GROUP

TRIGGER FOR ADJUSTING ALLOCATION ZONES

1. Changes to the heart and lung allocation zones are made if a statistically significant difference is observed between the percentage share of registrations and the percentage share of donors for any one allocation zone at a 5% significance level.

2. Statistical significance is determined by multiple chi-squared tests where the p-values are adjusted using the Bonferroni correction. The correction multiplies the p-values by the number of tests performed. The Bonferroni correction is considered quite conservative and requires a large sample size to detect a difference. It is designed to counteract the increase in likelihood of incorrectly rejecting a null hypothesis (making a type I error) when performing multiple hypothesis tests on the same data, but has been shown to increase the probability of false negatives (type II errors).

3. **Table 1** shows the data presented in the most recent review of the allocation zones with the unadjusted p-values and adjusted p-values. None of the p-values were significant before or after adjustment, thus no adjustment was made to the zonal boundaries.

4. The biggest difference can be seen in the comparison of Harefield's proportion of lung registrations and proportion of lung donors; 28% vs 33%, p=0.08 or 0.39 after adjustment. Based on these numbers, had the proportions been 27% vs 34% (7% difference), this would have yielded a p-value of 0.047 before adjustment. To yield a significant difference after adjustment, there would need to be an 9% difference in proportions, e.g. 26% vs 35%, p=0.008 or 0.039 after adjustment.

5. For a centre with a smaller number of lung registrations and thus a smaller lung zone, such as Manchester, roughly a 5% difference would need to be observed between the proportion of registrations and donors to yield a significant unadjusted p-value, but a 6% difference would be required to yield a significant adjusted p-value.

6. For hearts, for Papworth which has the largest proportion of registrations, based on these numbers, an 5% difference between the proportion of registrations and donors would be required to yield a significant unadjusted p-value, while a 6% different would be required to yield a significant adjusted p-value.

7. At the other end of scale, Glasgow would need an 3% difference between the proportion of heart registrations and donors to yield a significant unadjusted p-value, and a 5% difference to yield a significant adjusted p-value.

8. The current approach is based on the approach taken by the Liver Advisory Group and was agreed by CTAG in 2014, however since then the Liver Offering Scheme has been changed considerably and no longer relies heavily on zonal allocation. Therefore, regular monitoring of the liver zones is no longer required.

9. Zonal allocation remains an integral part of cardiothoracic offering in the UK. Adjustments to the heart and lung zones must balance the need for equity with the impact of making too many regular changes.

10. CTAG to consider removal of the Bonferroni correction in order to make the trigger for zonal adjustments more sensitive in future. Without the Bonferroni correction, changes to zonal boundaries would have been required twice in the last three years, rather than no times.

Table 1 Number of heart and lung registrations (1 August 2018 – 31 July 2020) and donors (1 August 2017 – 31 July 2020) by centre/allocation zone

Centre/ zone	Heart Registrations		Heart Donors		p-value	Adjusted p-value	Lung Registrations		Lung Donors		p-value	Adjusted p-value
	N	%	N	%			N	%	N	%		
Birmingham	96	18	82	19	0.81	4.87	67	15	61	15	0.94	4.72
Glasgow	35	7	34	8	0.49	2.92	0		0			
Harefield	101	19	88	20	0.69	4.14	125	28	135	33	0.08	0.39
Manchester	67	13	55	13	0.97	5.79	61	14	51	13	0.68	3.38
Newcastle	106	20	89	20	0.91	5.44	100	22	79	20	0.33	1.65
Papworth	121	23	87	20	0.26	1.56	97	22	79	20	0.46	2.3
UK	**526**	**100**	**435**	**100**			**450**	**100**	**405**	**100**		

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