NHS BLOOD AND TRANSPLANT

CARDIOTHORACIC ADVISORY GROUP

UPDATING BASELINE RATES USED FOR HEART CUSUM

BACKGROUND

1. NHSBT monitors short-term patient outcomes following heart transplantation through centre specific cumulative sum (CUSUM) analyses. CUSUM charts are produced monthly for each centre and compare current centre performance in the monitoring period with a historic baseline period. The baseline period and monitoring period are updated periodically, with the current baseline period being 2015-2018 and the monitoring period beginning on 1 January 2019.

2. It has previously been agreed by CTAG-Heart that the heart CUSUMs should take into account re-transplants. This requires a change to the outcome being monitored, from 90 day mortality, to 90 day transplant failure which is the earlier or patient death or graft failure. A paper was presented on these changes to CTAG-Heart in Spring 2024 in which it was suggested that the CUSUMs should continue to monitor an odds ratio of 2 and the chart limit for adults should be 2.5 but 1.5 should be considered for paediatrics.

3. This report presents the transplant failure rates for the updated baseline period, 1 January 2020 – 31 December 2023. The monitoring period will then change to 1 January 2024 onwards. It is proposed that the change to the outcome being monitored (and the inclusion of re-transplants) is made at the same time as the updates to the baseline and monitoring periods.

UPDATING THE EXPECTED BASELINE RATE

4. The baseline rate is calculated as follows:
    a. All NHS Group 1 deceased donor heart only transplants in the UK are included, from DBD and DCD donors, between 1 January 2020 and 31 December 2023.
    b. Adult and paediatric recipients are considered separately, where any patients aged >=16 at time of transplant at Great Ormond Street Hospital are included in the national adult rate and not the paediatric rates, and any patients aged <16 at an adult only centre are included in the national paediatric rate and not the adult rates.
    c. The number of transplants in each year and the number of transplant failures (patient death or graft failure within 90 days) in each year are calculated by age group and by centre.
    d. The updated baseline rate is then calculated as a weighted average of the failure rates over the four years, where recent transplants are given more weight, using the following formula:

$$\text{Weighted baseline rate} = \frac{\sum(No.\ failures_i * w_i)}{\sum(No.\ txs_i * w_i)}$$

where i = 1,…,4 for 2020,…, 2023

5. **Table 1** shows the updated baseline rates for the period 1 January 2020 and 31 December 2023, by age group and centre. The majority of the 95% confidence intervals for the centre-specific rates included the corresponding national rate, suggesting that individual centre specific rates may just be a manifestation of the inherent variability in outcomes. The national paediatric rate is below the lower 95% confidence limit for Newcastle, indicating a significantly higher failure rate for Newcastle, however this is unadjusted.

Table 1 90-day transplant failure rates by age group and centre, 1 January 2020 – 31 December 2023

Age group	Centre	Number of transplants	90-day transplant failure rate (95% CI)
Adult	Birmingham	98	6.7 (3.6 - 9.7)
	Glasgow	114	6.0 (3.4 - 8.6)
	Harefield	116	6.3 (3.7 - 8.9)
	Manchester	62	6.6 (2.6 - 10.5)
	Newcastle	115	9.4 (6.1 - 12.6)
	Papworth	141	7.1 (4.4 - 9.7)
	UK	**652[1,2]**	**7.0 (5.8 - 8.2)**
Paediatric	Great Ormond Street	73	1.7 (0.0 - 3.6)
	Newcastle	44	13.3 (7.0 - 19.5)
	UK	**117[3]**	**6.2 (3.4 - 9.0)**

[1] Includes 6 patients transplanted at GOSH who were aged 16 at time of transplant; these are excluded from the paediatric rates
[2] Includes 7 re-transplants
[3] Includes 5 re-transplants

6. Centres with a lower centre-specific rate than the national rate will receive two sets of CUSUM charts, one monitoring against the national rate and one monitoring against the centre rate; all other centres will receive just one chart monitoring against the national rate.

7. It had previously been suggested that the signal limit should be lowered to 1.5 for paediatrics, however, this will need further investigation due to the higher paediatric failure rate in the updated baseline period (6.2%), compared with the previous baseline period (4.2%).

8. CUSUMs using the updated baseline rates were run on the 12 March 2025 for transplants performed between 1 January 2024 and 30 September 2024. There was one signal during this time period, at Papworth, against the national rate (replacing a previous signal against the centre-specific rate when monitoring mortality alone), however, note that the limit was 2.5 for the paediatric charts.

ACTION

9. The proposal is to move the expected baseline to 1 January 2020 to 31 December 2023 and the monitoring period to 1 January 2024 onwards. At the same time, re-transplants will be incorporated and the earlier of graft failure or patient death within 90 days will be monitored.

10. Retrospective analysis of transplants since January 2024 using the revised mortality rates, indicated there would have been one signal at Papworth in June 2024 for adult heart transplants against the national rate.

11. Further work is needed to determine whether the limit should be lowered to 1.5 for paediatric charts and the conclusion of this investigation will be brought to the Centre Directors meeting so that that the changes can be implemented as soon as possible.

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