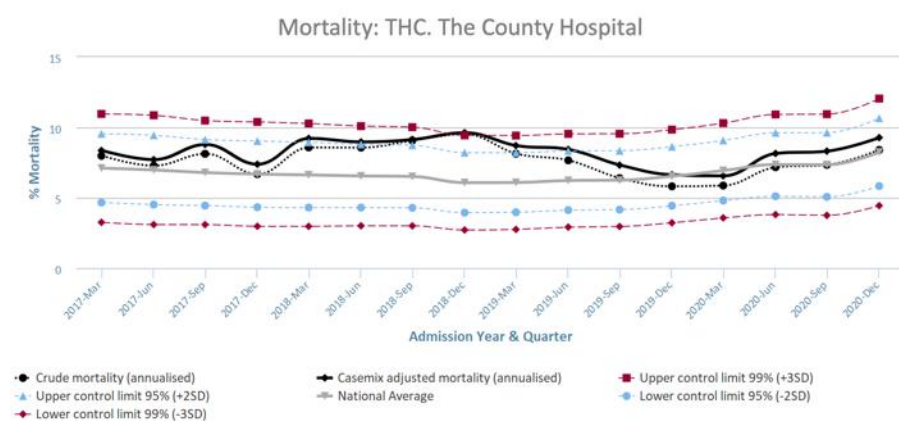


Appendix 1: Mortality outliers

Comparison of any given hospitals' mortality statistics must take into account the potential impact of contributory variables such as age, sex, comorbid state (ie ASA grade), fracture type and residence of patients admitted. In 2020, the NHFD pioneered a new approach to outlier analysis that allowed hospitals to monitor their casemix-adjusted mortality in real time.

Our [casemix-adjusted mortality run charts](#) are updated quarterly and run a few months in arrears to allow linkage to validated Civil Registration Data on mortality. The charts are publicly available so that local clinical teams, health service managers and organisations such as the Care Quality Commission (CQC) all have immediate access to them. An example of such a chart using a fictitious hospital is below.



Crude mortality is casemix adjusted using the same validated model ([Tsang et al 2017](#)) as in previous years, but this model is refined each quarter and [the model coefficients](#) updated accordingly. Clinical teams should refer to our [guide to casemix-adjusted mortality run charts](#), which explains how to understand charts like the example illustrated above.

Local teams therefore no longer need to wait for our annual report to find out whether their casemix-adjusted mortality is outside these limits, as they can see this each quarter and respond immediately. This carries considerable benefits by shortening the response time to any concerning change of performance as measured by the mortality metric.

Each calendar quarter, as per our [outlier policy](#), the NHFD identifies all those hospitals in which mortality over the preceding calendar year is above the upper 99.8% control limit: a threshold that corresponds to three standard deviations (3SD) from the national average.

- Hospitals are notified the first time their mortality rises above this control limit, so that they can consider appropriate action, including examination of the quality of their data.
- Hospitals that remain above the control limit for two or more successive quarters will be considered 'alarm' outliers. The clinical leads, CEOs and MDs of such hospitals will be notified, and they will be formally identified in the NHFD annual report.
- The run charts will also identify hospitals with mortality above the upper 95% (2SD) limit. In any analysis of around 170 hospitals, some will fall outside such a limit simply as a result of expected statistical variation, so clinical leads are made aware of this finding, but these hospitals are not managed as outliers.

Where there is an indication of poor performance, we recommend that hospitals should consider a [British Orthopaedic Association \(BOA\)](#) peer review (contact policy@boa.ac.uk for more information).

Outliers for 2022

Our run charts identified one unit, Birmingham Heartlands Hospital (EBH), as an 'outlier' with casemix-adjusted mortality above the upper 99.8% (3SD) control limit in the year up to and including the third quarter of 2022. As it remained so for the year up to and including the final quarter of 2022, the hospital is therefore an official outlier and we contacted them to let them know.

Their run chart suggested that the quality of submitted data contributed to this outlier position and their investigations confirmed that they had a high level of missing data. However, their crude 30-day mortality figure was also above the 95% (2SD) limit, so the issues in this unit were not entirely attributable to data quality.

The publicly available data on the NHFD website allow hospital managers and clinical teams to review the success of their response to being identified as an outlier. It is encouraging to see EBH's crude mortality returning below the 95% (2SD) control limit for the year including the first quarter of 2023, and that the quality and overall completion of their casemix data has also improved following our discussions with them.