

Design of a binary CUSUM chart for multiple transplant centre monitoring
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We have applied CUSUM chart methodology to detect increases in mortality and graft failure rates following kidney transplantation within individual centres.

Each CUSUM chart requires specification of a 'target' value, a hypothesized increase in the target value that is to be detected, an appropriate false alarm rate and a control limit. Target values, in our case expected mortality or failure rates, were based on each centre's own past data and the charts were set to detect increases of 50%. The false alarm rate for a CUSUM chart is characterised by the average run length (ARL). To allow for different volumes of transplants and failure rates across centres, in-control ARLs were based on a specified number of patient deaths or graft failures.

A separate control limit is required for each target value for a given hypothesis and in-control ARL. Simulations were used to compute the control limits and through this, we noted a linear relationship between the target values and the ARLs for a given limit. We therefore used the same limit for all centres, with the ARLs at that limit estimated using the linear relationship. The next step is to adjust for the False Discovery Rate in our charts.