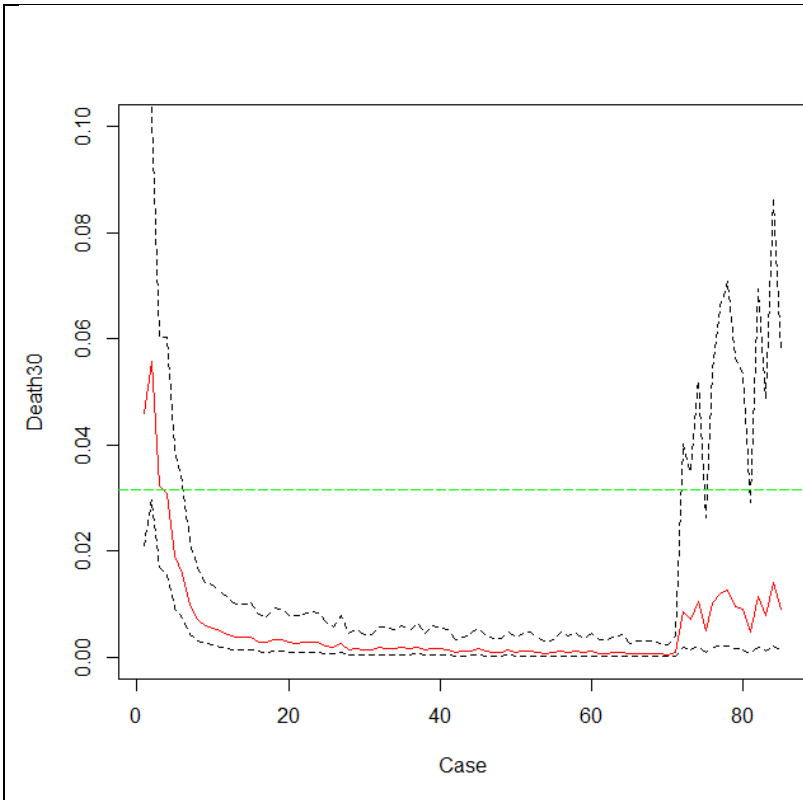
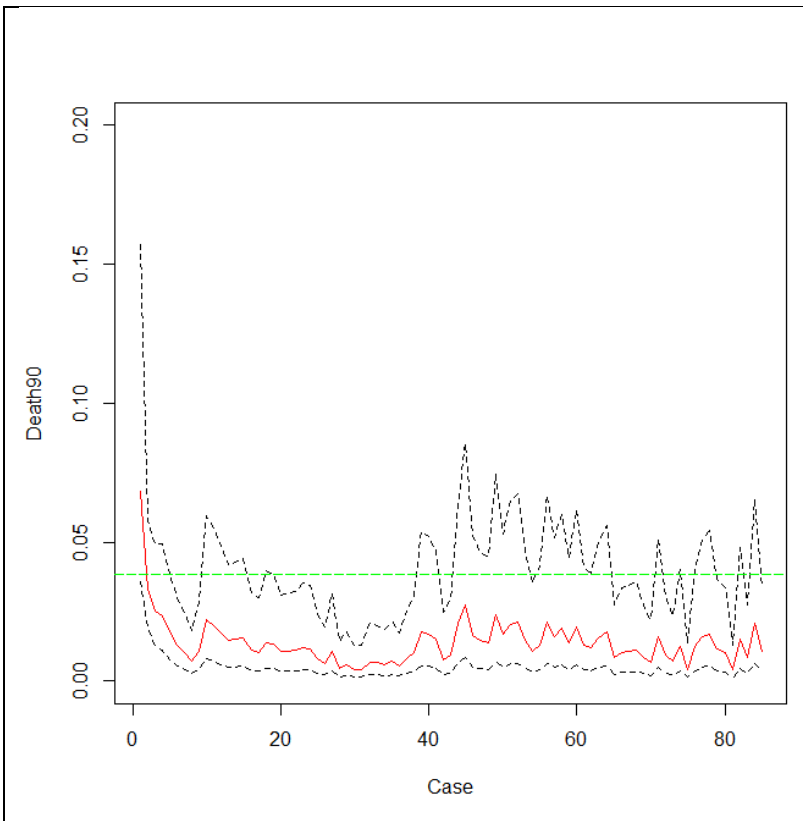


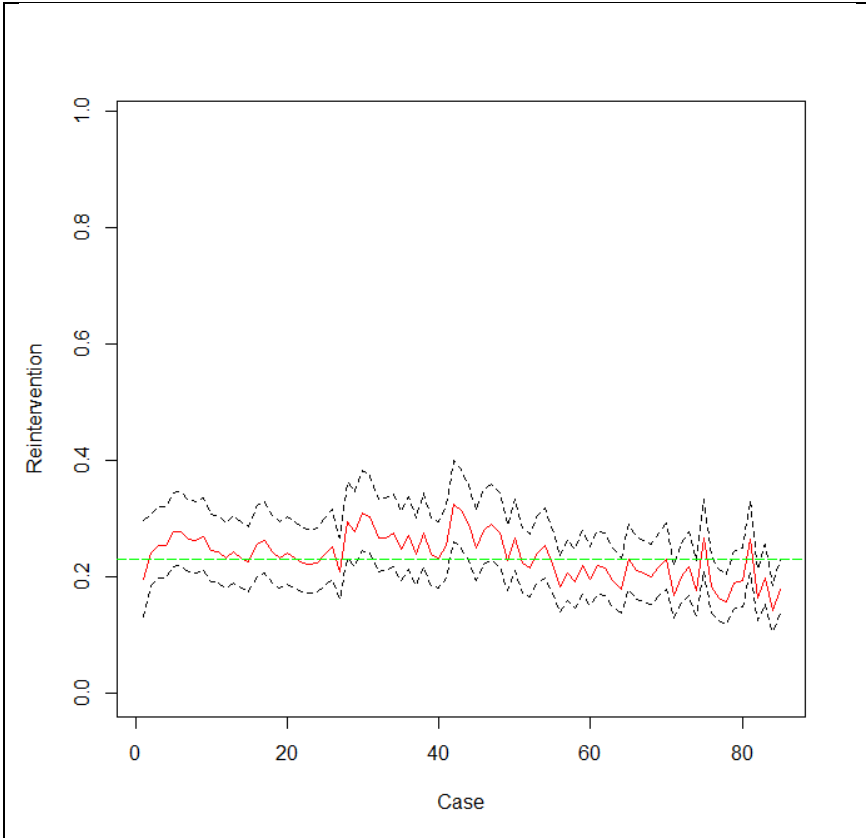
A methodology of analysis described by Steiner and Mackay [17] that adjusted for changes in underlying performance over time was also performed. We estimated expected 30-day mortality by risk adjustment according to patient profile (Charlson co-morbidity index, etc.), and the timing of a case. This was achieved by sorting the cases first by case number (first case, second case, etc) and then within each case number, the date of surgery. Using methods reported in Steiner and Mackay, regression coefficients were re-estimated every time a new case was taken into account. The time-related weightings assigned to each case were computed based on a lambda of 0.01. The updated regression models were used to predict 30-day mortalities and the basis for the new learning curve. The analyses were carried out in R 3.2.3 (Windows). This analysis demonstrates that the learning curve is similar to the RA-CUSUM results presented in the main paper (results presented below), although the change-point is more difficult to identify. The results for 30-day mortality, 90-day mortality, surgery and re-intervention in the cancer population are shown respectively below. In each of the graph, the red line is the mean predicted value, adjusted for risk and for time, the two dotted lines respectively indicates the upper and lower boundaries, the horizontal green line indicates the expected outcome (mean predicted outcome value).



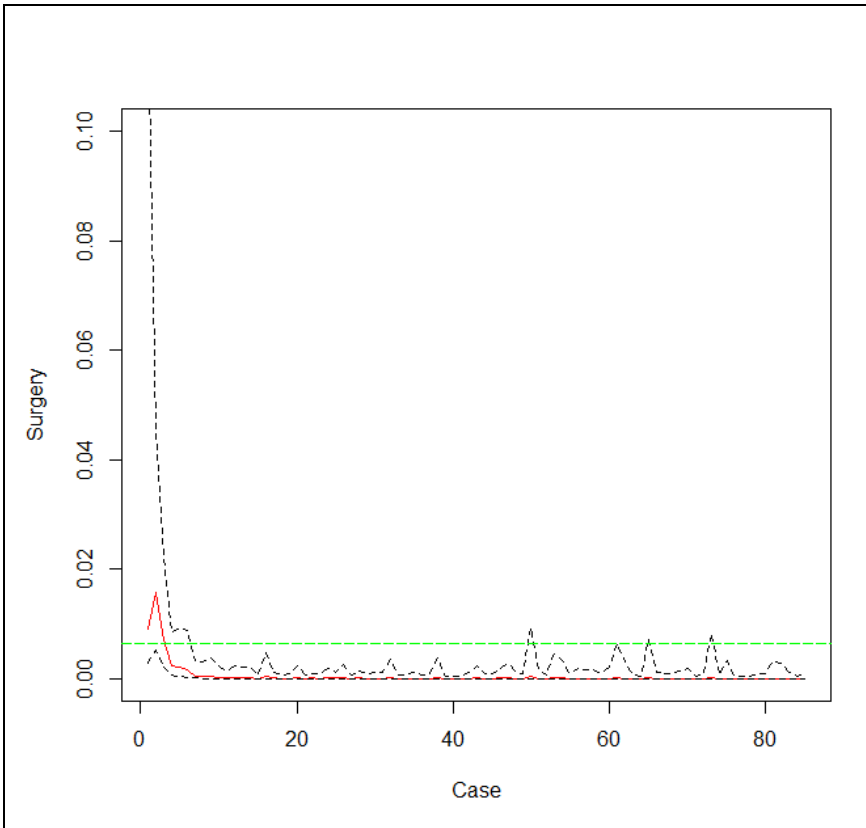
30-DAY MORTALITY:
 Change occurs between Case 6 and Case 7 for 30-day mortality
 We used mean mortality (from time adjusted regression model) as the expected mortality



90-DAY MORTALITY:
 No indication of a change point – the upper range of the time-adjusted predicted 90-day mortality hovers around the expected (mean 90 day mortality).



**EMERGENCY SURGERY:
No change point identified**



**RE-INTERVENTION:
Change point = Case 7 for Surgery**

Although the upper boundary is breached later on (around case 50), there is a trend of decreasing rates.