



Risk-adjusted CUSUM chart to monitor lifetimes in presence of long-term survivors

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There are many applications of statistical process control for health-related monitoring, especially with the use of control charts. Examples include monitoring the performance of hospitals based on variables such as infection rates, rates of patient falls, or time until an event of interest happens. Monitoring schemes in medical context should consider *risk adjustment* (RA) to incorporate the specific risk for each individual. Some authors propose the use of a risk-adjusted survival time CUSUM control chart (RAST CUSUM) to monitor a time-to-event outcome, possibly right censored, using conventional survival models, which do not contemplate the possibility of cure of some patients. We propose to extend this approach considering a risk-adjusted CUSUM chart based on a cure fraction model. We conducted a simulation study to evaluate the performance of proposed chart (RACUF CUSUM) compared with RAST CUSUM, based on optimal control limits in different situations. The proposed chart is applied to real data about the lifetimes of patients with heart failure followed in a study conducted at the Heart Institute of the Faculty of Medicine's Hospital, University of São Paulo (Brazil). For this study the control chart detects an increase in the (mean) survival of patients along time.

Keywords: control chart; survival analysis; cure rate.