ABSTRACT

Control charts were originally developed for monitoring quality characteristics in the manufacturing industry. Recently, control charts have been used as monitoring tools in the healthcare industry. The pre-operative risk of each cardiac patient is different due to the differences in patient characteristics and health conditions. Therefore, it is important to take into account the heterogeneity of patients when monitoring surgical outcomes using control charts. Risk-adjusted charting procedures such as the risk-adjusted cumulative sum (RA-CUSUM) chart and risk-adjusted exponentially weighted moving average (RA-EWMA) chart have been developed for monitoring surgical outcomes and detecting changes in a surgeon's performance. However, existing CUSUM charts which are based on the log-likelihood ratio statistics cannot take full advantage of the penalty-reward scheme. In this thesis, we develop two RA-EWMA charts that are based on the statistics used to calculate the standardized mortality ratio (SMR). We will investigate and compare the effectiveness between the proposed RA-EWMA charts and the RA-CUSUM chart in detecting changes in a surgeon's performance in terms of their average run length (ARL). We also use the RA-EWMA charts to analyse the performances of surgeons.

KEY WORDS: Cumulative sum chart; Logistics regression model; Odds ratio; Parsonnet scores; Risk-distribution; Statistical quality control; Surgical outcomes;