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Modeling the patient mix for risk-adjusted CUSUM charts

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The improvement of surgical quality and the corresponding early detection of its changes is of increasing importance. To this end, sequential monitoring procedures such as the risk-adjusted CUSUM chart are frequently applied. The patient risk score population (patient mix), which considers the patients'perioperative risk, is a core component for this type of quality control chart. Consequently, it is important to be able to adapt different shapes of patient mixes and determine their impact on the monitoring scheme. This article proposes a framework for modeling the patient mix by a discrete beta-binomial and a continuous beta distribution for risk-adjusted CUSUM charts. Since the model-based approach is not limited by data availability, any patient mix can be analyzed. We examine the effects on the control chart's false alarm behavior for more than 100,000 different scenarios for a cardiac surgery data set. Our study finds a negative relationship between the average risk score and the number of false alarms. The results indicate that a changing patient mix has a considerable impact and, in some cases, almost doubles the number of expected false alarms.

Keywords

Average run length; quality control charts; statistical process monitoring

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