Commentary: The importance of objective assessment for the future of residency training

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Central Message

The authors describe using CUSUM to track resident learning curves. This technique can be useful to make assessment quantitative and objective in the era of competency-based training.

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In this issue of the *Journal*, Krebs and colleagues[1] describe the use of cumulative sum (CUSUM) analysis for assessment of resident performance over the course of training. The authors retrospectively assess 19 residents on index cases for the outcome of combined morbidity and mortality. The sum of expected minus observed failure rates were plotted against the number of cases. Institutional expected rates were calculated using the Society of Thoracic Surgeons Predicted Risk of Mortality model. Boundary lines were constructed with an "early-alert" and a "concern" boundary corresponding to 95% and 98% confidence intervals, respectively. Seven residents crossed the early alert boundary and 2 crossed the concern boundary. By the end of training, all residents were below the concern boundary. The average learning curve demonstrated early increase in events, peaking at approximately 70 cases, and then improved thereafter. The authors conclude that CUSUM is potentially a useful tool for resident evaluation.

Current surgical training is predominantly predicated on the apprenticeship model introduced by Halsted at Johns Hopkins more than a century ago.[2] Technical skills are primarily taught in the operating room. Assessment of performance is usually conducted by a supervising surgeon who provides their opinion based on a general impression. However, there is a paradigm shift underway in residency training. In multiple countries, including Canada[3] and the United States,[4] residency programs have shifted toward a competency-based model for advancement and completion of training. In Canada, the Royal College of Physicians and Surgeons has introduced Competency by Design for residents starting training in 2019.[3] Under this system, advancement and completion of training are not predicated on a required number of years and cases but rather on achieving competency at prespecified skills. The success of this framework depends on the ability to objectively assess competency. Quantitative, statistically valid metrics for evaluation of performance are critical. Several systems have been validated as evaluations of surgical skill. For example, the Objective Structured Assessment of Technical Skill score is a widely used and validated measure of technical skill.[5] However, this anchored Likert scale is useful for assessing the performance of a single task but not an entire operation. A meaningful, longitudinal assessment of overall progress is required. This study is timely as the authors have described how CUSUM analysis might fulfill this need.
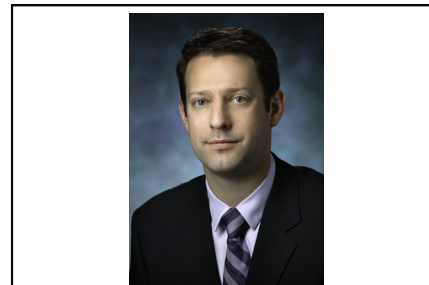
There are important limitations to CUSUM. It is not useful for rigorous statistical comparison or hypothesis testing but rather is a tool for prospective monitoring of performance and quality control. Yet, CUSUM is versatile. The use of lenient early alert boundaries could facilitate early identification of a struggling resident. Implementation of direct interventions to enhance the resident's training might improve surgical and safety outcomes. Furthermore, the analysis could be expanded to include more frequent events such as intraoperative complications not defined by Society of Thoracic Surgeons Predicted Risk of Mortality. The inclusion of issues such as the need to revise a coronary anastomosis or reinitiate cardiopulmonary bypass could be very informative and more sensitive than mortality.

Ultimately, CUSUM analysis alone is not sufficient to assess longitudinal trainee performance. However, as a tool combined with a number of other objective metrics,

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CUSUM offers a potentially helpful methodology in a competency-based training platform.

References

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