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Over the last two decades there has been increasing interest in measuring the quality of medical care and comparing performance between healthcare institutions. Public health authorities, doctors and patients also encourage healthcare institutions to continuously monitor and improve the quality of their care processes. In Critical Care, quality measurements are typically based on patient outcomes such as mortality and length-of-stay. Judicious use of outcome summaries can help to identify the processes of care that result in better or worse outcomes. There exists also a trend toward publishing performance data and performance-based league tables (i.e., rank-order listings). Such publications can lead to disciplinary measures against hospital organizations and to changes in the behaviour of patients and providers. Therefore, the reliability of procedures for performance assessment and performance comparison is increasingly relevant.

Because medical characteristics of admitted patients may differ between institutions and can vary over time, it is important to adjust for these characteristics before drawing conclusions from outcome summaries. To this end, prognostic models are used that provide patient-specific outcome predictions. By summarizing such predic- tions for groups of patients we obtain a yardstick against which to measure care performance. For instance, well-known prognostic models in the field of Intensive Care are the Simplified Acute Physiology Score (SAPS), the Acute Physiology and Chronic Health Evaluation (APACHE) and the Mortality Probability Model (MPM). These are all logistic regression models which predict the proba- bility of in-hospital death for patients that are admitted to the ICU. They use slightly different sets of covariates describing the demography (e.g., age), admission type (e.g., medical, urgent sur- gical), co-morbidity (e.g., chronic dialysis, respiratory insufficiency), and worst physiological status of the patient in the first 24 h of IC admission (e.g., highest body temperature, lowest blood pressure). In many countries, regional or national registries have been established that use one or more of these prognostic models to audit the quality of intensive care. However, the use of prognostic models to obtain case-mix adjusted performance estimates have been the subject of discussion in many studies.

Healthcare institutions also increasingly apply statistical quality control procedures. Most of these procedures were originally developed in industrial settings where quick detection of problems is essential for efficiency. The most commonly used methods of statistical process control are the Shewhart chart, the sequential probability ratio test (SPRT), the exponentially weighted moving average (EWMA), and the cumulative sum (CUSUM). These methods monitor the occurrence rate of an event (such as death or ICU readmission) over time and generate a warning signal when there is sufficient evidence for a persistent change. Among all, the CUSUM has attracted more attention and disseminated in the medical literature due to its simple formulation and an intuitive representation, and to its capability of detecting small changes. Also methods for statistical process control have been subject to debate in the methodological literature.

In my talk, I will discuss different methods for quality comparison and quality monitoring in Intensive Care medicine, including con- struction and validation of prognostic models and quality control charts. Attention will be given to common methodological pitfalls, the lack of reference standards, and the use of simulation methods to compare methods.