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Evaluation of predictive accuracy measures in clinical data with competing risks

In clinical practice, severity indexes are often calculated as a means of classifying patients into low and high risk groups, in order to provide better patient care and management. Derivation and subsequent validation of these severity indexes is frequently based on patient outcomes where competing risks are present, for example length of stay (LOS) in the hospital in the presence of in-hospital mortality. Since statistical significance alone cannot quantify the ability of a severity index to accurately predict patient outcomes, measures of predictive accuracy are important tools for evaluating the usefulness of these indexes or statistical models in general. Measures of predictive accuracy are often categorized into discriminant measures, which discern the ability of an index to separate low and high risk patients, and goodness-of-fit measures, which evaluate the closeness between model predictions and observed data. In this report we review several of these measures developed specifically for competing risks, and apply them to differentiate between two severity index scores for classifying patients with community-acquired pneumonia (CAP). The clinical data which motivated this study come from an international, observational study of patients hospitalized with CAP. A simulation study based on the real clinical data was further conducted to evaluate the relative effectiveness of each measure under different and asymmetrical distributions of the severity index and different effects of the competing risk. Results indicate that the predictive accuracy measures behave differently depending on the asymmetry of the severity index distribution and the occurrence of competing risks, and caution is warranted when applying the measures to indexes that are highly skewed.