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Assessing Risk Indicators in Clinical Practice with Joint Models of Longitudinal and Time-to-Event Data

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Studies in life course epidemiology involve different outcomes and exposures being collected on individuals who are followed over time. These include longitudinally measured responses and the time until an event of interest occurs. These outcomes are usually separately analysed, although studying their association while including key exposures may be interesting. It is desirable to employ methods that simultaneously examine all available information available. This method is referred to as joint modelling of longitudinal and survival data. The idea is to couple linear mixed effects models for longitudinal measurement outcomes and Cox models for censored survival outcomes.

Joint modelling is an active area of statistics research that has received much attention. These models can extract information from multiple markers objectively and employ them to update risk estimates dynamically. An advantage is that the predictions are updated as more measurements become available, reflecting clinical practice. The predictions can be combined with the physician's expertise to improve health outcomes. It is important for physicians to have such a prognostic model to monitor trends over time and plan their next intervention.

Several challenges arise when obtaining predictions using the joint model. Different characteristics of the patient's longitudinal profiles (underlying value, slope, area under the curve) could provide us with different predictions. Using a simulation study, we investigate the impact of misspecifying the association between the outcomes. We present appropriate predictive performance measures for the joint modelling framework to investigate the degree of bias. We present several applications of real-world data in the clinical field.

Keywords

Longitudinal data, survival data, joint models, individualized predictions, dynamic prediction, medical data

Classification

Both methodology and application

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Session Classification: INVITED ISBIS: Methodologies and Applications in Joint Models for Longitudinal and Survival Data

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