Dynamic pseudo-observations: A robust approach to dynamic prediction in competing risks

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In this presentation, we review a new approach to the problem of dynamic prediction of survival data in the presence of competing risks as an extension of the landmark model for ordinary survival data. The key feature of our method is the introduction of dynamic pseudo-observations constructed from the prediction probabilities at different landmark prediction times. They specifically address the issue of estimating covariate effects directly on the cumulative incidence scale in competing risks. A flexible generalized linear model based on these dynamic pseudo-observations and a generalized estimation equations approach to estimate the baseline and covariate effects will result in the desired dynamic predictions and robust standard errors. Our approach has a number of attractive features. It focuses directly on the prediction probabilities of interest, avoiding in this way complex modeling of cause-specific hazards or subdistribution hazards. As a result, it is robust against departures from these omnibus models. From a computational point of view an advantage of our approach is that it can be fitted with existing statistical software and that a variety of link functions and regression models can be considered, once the dynamic pseudo-observations have been estimated. We illustrate our approach on a real data set of chronic myeloid leukemia patients after bone marrow transplantation.