

## **Joint modeling of longitudinal and competing-risk data using cumulative incidence functions for the failure submodels accounting for potential failure cause misclassification through double sampling**

Most of the literature on joint modeling of longitudinal and competing-risk data is based on cause-specific hazards, although modeling of the cumulative incidence function (CIF) is an easier and more direct approach to evaluate the prognosis of an event. We propose a flexible class of shared parameter models to jointly model a normally distributed marker over time and multiple causes of failure using CIFs for the survival submodels, with CIFs depending on the “true” marker value over time (i.e., removing the measurement error). The generalized odds rate transformation is applied, thus a proportional subdistribution hazards model is a special case. The requirement that the all-cause CIF should be bounded by 1 is formally considered. The proposed models are extended to account for potential failure cause misclassification, where the true failure causes are available in a small random sample of individuals. We also provide a multistate representation of the whole population by defining mutually exclusive states based on the marker values and the competing risks. Based solely on the assumed joint model, we derive fully Bayesian posterior samples for state occupation and transition probabilities. The proposed approach is evaluated in a simulation study and, as an illustration, it is fitted to real data from people with HIV.