

A stochastic joint model for longitudinal and survival data with cure patients

ABSTRACT

Many medical investigations generate both repeatedly-measured (longitudinal) biomarker and survival data. One of complex issues arises when investigating the association between longitudinal and time-to-event data when there are cured patients in the population, which leads to a plateau in the survival function $S(t)$ after sufficient follow-up. Thus, usual Cox proportional hazard model Cox (1972) is not applicable since the proportional hazard assumption is violated. An alternative is to consider survival models incorporating a cure fraction. In this paper we present a new class of joint model for univariate longitudinal and survival data in presence of cure fraction. For the longitudinal model, a stochastic Integrated Ornstein-Uhlenbeck process will be presented. For the survival model a semiparametric survival function will be considered which accommodate both zero and non-zero cure fractions of the dynamic disease progression. Moreover, we consider a Bayesian approach which is motivated by the complexity of the model. Posterior and prior specification needs to accommodate parameter constraints due to the nonnegativity of the survival function. A simulation study is presented to evaluate the performance of this joint model.

Keyword: Survival model; Longitudinal model; Cure rate model; Fixed effects; Random effects; Bayesian approach; Integrated Ornstein-Uhlenbeck