

# Semiparametric regression analysis for serial gap times with competing events

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**Abstract:** Recurrent events are common in epidemiological and medical studies and usually followed by medical intervention or treatment in clinical practices. Serial gap times between consecutive interventions due to recurrence are natural outcomes of interest. The occurrence of recurrent events is often in conjunction with an event such as death which terminates the recurrent event process. After each intervention, the two types of subsequent event, recurrent and terminal events, compete with each other and investigating covariate effects on the risks of subsequent recurrent and terminal events is a primary focus in practice. Semiparametric regression models are introduced to model a sequence of episode-cause-specific hazards for serial gap times with episode-cause-specific covariate effects. We construct estimating equations for parameter estimation and study the asymptotic distributions of the proposed estimators without specifying the association pattern among serial gap times. Simulation studies are provided for examining the finite-sample properties of the proposed estimators. We apply the methods to papillary thyroid cancer data and investigate the covariate effects for different types and orders of events.