Joint statistical models for longitudinal prostate-specific antigen (PSA) and time of prostate recurrence: do they improve prediction of recurrence for new patients?

Current protocol for monitoring prostate cancer patients treated by radiotherapy for recurrence of disease is based on either the most recent prostate-specific antigen (PSA) value, or on empirical summaries of the post-radiotherapy PSA sequence, such as whether or not three consecutive increases in PSA have occurred over any time interval. Joint statistical models for serial PSA and time to clinical recurrence applied to a training set of patients can alternatively provide a predicted probability of time to recurrence for a new patient based on his own serial PSA. The formulation of alternative joint statistical models, based on Cox proportional hazards versus cure models, model selection for covariates in the longitudinal and survival components of the model, and methods for evaluating operating characteristics of a time-varying predictor for a time-to-event outcome are discussed in the context of an ongoing study comprising 5,000 prostate cancer patients treated at the University of Michigan Comprehensive Cancer Clinic, Massachusetts General Hospital and Radiation Therapy Oncology Group in Philadelphia, Pennsylvania.