Joint modelling of bivariate longitudinal data: Application to the recovery of sexual function and urinary continence

Federica Nicolussi, Marcella Mazzoleni, Simone Frassoni, Massimo Monturano, Rino Bellocco, Vincenzo Bagnardi

The following methodological issues occur in the context of the longitudinal study of sexual dysfunction and urinary incontinence after radical prostatectomy: (i) high dropout rate due to the extremely sensitive nature of the investigated outcomes; (ii) correlation between the two outcomes; (iii) non-linearity of the recovery trajectories. To address all these issues, we propose the use of a joint modelling approach, including a bivariate linear mixed model with splines for the two outcomes and a proportional hazards model for the time to dropout. We applied the model to data from consecutive patients underwent robotic-assisted radical prostatectomy at European institute of oncology from May 2015 to July 2016. Preand post-surgical sexual and urinary functional conditions were evaluated using the expanded prostate cancer index composite questionnaire. Six hundred forty three patients were included in the analysis. At one year after surgery, only 55% of patients returned the questionnaire. Parameters estimation was based on the maximisation of the likelihood function achieved through the implementation of an EM algorithm. A Gauss Hermite approximation was also used for some of the integrals involved. To assess the effect of nonrandom dropout mechanisms on the parameter estimates, we calculated the index of local sensitivity to non-ignorability.