Bayesian zero-inflated multi-state cure models via INLA

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Multi-state models are a class of stochastic models in which patients are allowed to move among some states with the time. One particular model, the so-called illness-death model results especially useful to approach many scenarios where death and a main disease or health condition appear together. In its easiest version it involves three states: initial, disease or progression, and death. However, some patients might cure from disease, not being expected to progress or worsen anymore, having a cure model setting. Patients could also die at the beginning of the study, which would lead to zero-inflation. Those epidemiological problems are approachable using a mixture of illness-death models and logistic regression, the first modelling state transitions and the latter modelling a cure or a zero probability. We illustrate the application of zero-inflated multi-state cure models with both a real study involving recurrent hip fracture and death, and with a simulated dataset. Our proposal uses a Bayesian methodology through the integrated nested Laplace approximation (INLA).

Keywords: cure rate, illness-death models, integrated nested Laplace approximation.