Empirical Transition Matrix of Multistate Models: The etm Package

Arthur Allignol[1,2,*]**, Martin Schumacher**[2]**, Jan Beyersmann**[1,2]

1. Freiburg Centre for Data Analysis and Modelling, University of Freiburg, Germany
2. Institute for Medical Biometry and Informatics, University Medical Centre, Freiburg, Germany

* Contact author: `arthur.allignol@fdm.uni-freiburg.de`

Keywords: Aalen-Johansen estimator, competing risks, covariance matrix, current leukaemia free survival

When dealing with complex event history data in which individuals may experience more than one single event type, multistate models provide a relevant modelling framework. Well known examples include the competing risks model in which subjects may die from several possible causes, and the illness-death model that permits to study the impact of an intermediate event on a terminal event. Quantities of interest in this framework are the transition probabilities that can be estimated by the empirical transition matrix, that is also referred to as the Aalen-Johansen estimator. In this talk we present the R-package **etm** that computes and displays these transition probabilities. **etm** also features a Greenwood-type estimator of the covariance matrix, which has recently been found to be the preferable estimator in the competing risks situation. The use of the package is illustrated through a prominent example in bone marrow transplant for leukaemia patients.

References

Andersen, P.K., Borgan, O., Gill, R.D. and Keiding, N. (1993). *Statistical Models Based on Counting Processes.* Springer-Verlag, New York.

Klein, J., Szydlo, R., Craddock, C. and GoldmanJ. (2000). Estimation of current Leukaemia-Free Survival Following Donor Lymphocyte Infusion Therapy for Patients with Leukaemia who Relapse after Allografting: Application of a Multistate Model. *Statistics in Medicine*, 19, 3005–3016.

Putter, H., Fiocco, M. and Geskus, R. B. (2007). Tutorial in Biostatistics: Competing Risks and Multi-State Models. *Statistics in Medicine*, 26, 2389–2430.