Estimation of transition probabilities in non-Markov multi-state models

Hein Putter, Leiden University Medical Center
Cristian Spitoni, University of Utrecht

Abstract:

There has been a surge of activity recently developing methodology for estimating transition probabilities in multi-state models that are non-Markov. Two interesting papers addressing this issue have appeared in Biometrics last year. The paper by de Una Alvarez and Meira-Machado (2015) uses a procedure based on the difference between two Kaplan-Meier estimators derived from a subset of the data consisting of all subjects observed to be in the given state at the given time. Titman (2015) was the first to derive estimators of transition probabilities that are consistent (under certain conditions) in general non-Markov multi-state models. We propose a relatively simple and intuitive procedure which we term landmark Aalen-Johansen (LMAJ), based on subsetting, as in de Una Alvarez and Meira-Machado (2015) and the Aalen-Johansen estimate of the state occupation probabilities derived from that subset. We show that the LMAJ estimator yields a consistent estimator of the transition probabilities in general non-Markov multi-state models under the same conditions as needed for consistency of the Aalen-Johansen estimator of the state occupation probabilities. A simulation study shows the LMAJ estimator to have good performance and to be slightly more efficient than the estimator of Titman (2015).