Integrating Relative Survival Framework for Survival Extrapolation in Multi-state Models—An Application to Predicting Quality-Adjusted Life Years for Chronic Myeloid Leukemia Patients

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Background

In cost-utility studies, effectiveness often estimated using quality-adjusted life years (QALYs) over a lifetime horizon. Accurately estimating QALYs usually requires extrapolating short-term follow-up data. Survival extrapolation using a relative survival framework (i.e., extrapolating after partitioning the all-cause hazard into the expected hazard and the excess hazard) has proven to be superior to direct extrapolation of all-case survival for estimating life expectancy. However, this approach has not yet been implemented in multi-state models for predicting QALYs.

Methods

In this study, we propose to incorporate a relative survival framework into survival extrapolation in a multi-state model setting to predict QALYs. We will predict the QALYs for transition intensities that are a mix of semi-Markov and Markov transitions using discrete event simulation, with uncertainty calculated using the bootstrap. We will apply the approach to estimate QALYs for chronic myeloid leukaemia patients in Sweden using data from the Swedish CML Registry.

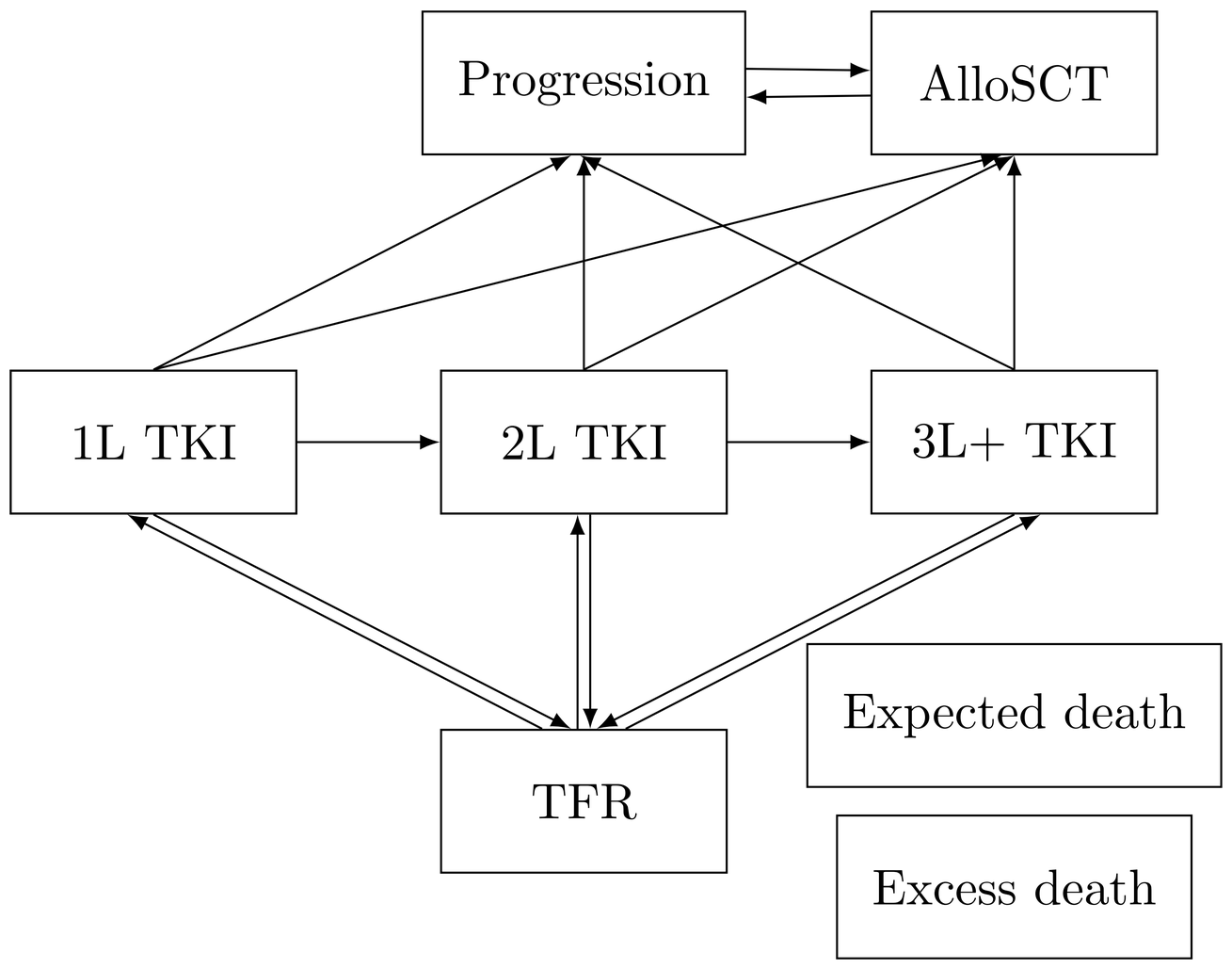

Figure 1. A multi-state model for CML treatments with first-line TKI (1L TKI), second-line (2L TKI), third-line and after TKI (3L+ TKI), TFR (treatment-free remission), progression, allogeneic stem cell transplantation (AlloSCT), and death.
*Arrows also exist from each state to expected/excess death.

Preliminary conclusion

Relative survival modelling should be routinely included for extrapolating survival within multi-state models to estimate QALYs with real-world data.

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