Dynamic prediction approach to analyse the population-attributable fraction of hospital-acquired infections (Maja von Cube)

A main interest in hospital epidemiology is to analyse the impact and consequences of hospital acquired infections. One issue is the analysis and estimation of mortality due to specific pathogens. A framework to study this quantity is the concept of the population-attributable fraction (PAF) which measures the reduction in mortality if the infection could be eliminated. In such an approach it is important to correct for confounding factors as severity of initial illness in order to obtain the impact that is purely due to the infection.
In case of hospital-acquired infections we study a time-dynamic process with discharge as competing event to hospital-death. Schumacher et al. (Methods in Medicine, 2007) proposed to define and estimate the PAF by describing the data with a multi-state model and deriving the quantity of interest in terms of transition probabilities. This allows the estimation of PAF after a specific amount of days spent in the hospital. With this method adjustment for covariates is only possible via stratification but not with regression models.
Therefore, we propose a landmark approach for dynamic prediction of hospital mortality. At each landmark, we use a logistic regression model to account for further covariates. This method accounts for potential change of mortality conditional on being alive and in the hospital for a certain amount of time as well as for the time-dependent nature of the infection and covariates.
We apply this approach to the OUTCOMEREA data set to estimate the PAF due to pneumonia at different landmarks over a specific time-window.