A longitudinal and survival model with health care usage for insured elderly

Ramon Alemany
Montserrat Guillén
Xavier Piulachs

Riskcenter – UB

The gradual development of medical science and technology leads to a larger number of years lived with disabilities, so called dependent life expectancy. This is a key challenge for health insurance companies in forecasting additional costs in order to meet the care needs in the event of a greater elderly people cohort, as they are the principal beneficiaries of life expectancy improvements. Furthermore, policy holders are generally supposed to have a higher socio-economic level to the rest of the population because they can afford private health insurance. Therefore, in this group the probability of surviving more than a hundred years increases, and this fact may create uncertainty to insurers.

The motivating dataset corresponds to the information provided by a Spanish health insurer, containing historical data within the observation window, which started at 1st January 2010, whereas the finalization of active surveillance on mutual members took place on 1st February 2014. In particular, our study has been limited to those 30580 mutual insurers (39% men and 61% women) who had reached the age of 65 before the observation period started.

In the first part of our study, covariates such as gender or cumulative number of medical requests in the four years before study entry play the role of baseline information and become part of a first survival analysis. In the second part, a longitudinal analysis is presented, where the cumulative number of medical visits for each subject divided into annual periods characterizes insurance intensity of use until death. Finally, both models have been considered jointly, thus establishing an association parameter between the longitudinal and the survival processes. The application of joint modeling techniques allow to determine whether a pronounced increase in the cumulative number of visits also implies more risk-death for the subject, quantifying in a personalized manner the health resources of an individual -conditioned by his/her baseline covariates- in the final years of life.

The main results are: 1) To establish main factors influencing changes in survival for a health insurance member, 2) Assess relationships between serial measurements of cumulative requests and longevity, and 3) Obtain dynamic estimations of event probabilities, exploiting the potential of joint models. In summary, our contribution would show that an increase in health care usage intensity is negatively associated with survival, but there its influence varies as usage accumulates and depending on other factors such as sex and cumulative requests at study entry.