Meta-Analysis Of Time-To-Event Data

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Abstract

Meta-analysis is an effective statistical method used to aggregate data across multiple independent studies that all address the same research question. The two most commonly used models in meta-analysis are the fixed effects model and the random effects model. The fixed effects model assumes that all studies estimate the same underlying true effect size, without accounting for between-study heterogeneity. In contrast, random effects meta-analysis aims to account for differences in study circumstances by introducing zero-mean random effects. When the random effects variances are zero, i.e. when the random effects are zero with probability one, the random effects model reduces to the fixed effects model. Originally developed for psychological and educational research, meta-analysis is now widely applied across various fields.

Survival analysis is a statistical method used to analyze the length of time until an event of interest occurs. A key feature of survival analysis is censoring, which occurs when the event of interest is not observed for some participants of the study, due to design constraints and follow-up limitations.

Sometimes, meta-analysis and survival analysis need to be combined to produce more precise and robust estimates on survival outcomes. The combination of these two methods allows for a thorough assessment of heterogeneity and underlying patterns in survival data.

This thesis presents a comprehensive introduction to the complex topics of meta-analysis and survival analysis. The goal of this thesis is to examine how the frequency of the involved time points influences the accuracy of survival probability estimates derived from meta-analyses. We first generate our own survival data via weibull distribution, incorporating censored data via exponential distribution, under the fixed effects model in R. We then perform random effects multivariate meta-analysis on the simulated data using packages such as ”metaSurvival” and ”survival”.