Bayes Sequential Decision Theory in Clinical Trials

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Abstract

We give a Bayesian analysis of the group sequential clinical trial to compare an experimental treatment and the standard treatment. Survival time is modelled as exponential. The trial is monitored at specified time points, either after fixed time intervals or after a fixed number of failures. The group sequential trial may consequently be modelled as a straightforward sequential trial in which survival time is the sum of exponential random variables, that is it has a gamma distribution. We use Bayes sequential decision theory to analyse the trial. The feature of this which is technically demanding is the need, after each observation, to look forward to see whether or not to continue sampling or to stop and make a terminal decision. This typically requires multi-dimensional integration. We compare two approximations: firstly taking the logarithm of the gamma random variable as normal; secondly making a reduction to logrank statistics. Monte Carlo simulations show both approximations to be comparable with respect to frequentist and Bayesian characteristics and to have good robustness with respect to prior specifications.

KEYWORDS:Group sequential clinical trials; Bayes sequential decision theory; Backward induction; logrank statistic

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