Bayesian Approach to Clinical Trials with Dichotomous Outcomes

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With the high cost of clinical trials, traditional methods of sample size determination may be too conservative. Bayesian methods are often used in the clinical trial environment to reduce required sample sizes and/or increase power. Bayesian methods are vital in trials where the observed results have to be extended on more extreme values which are unavailable for ethical reasons. The right choice of prior distribution is a critical step in Bayesian modeling. Knowledge of prior parameters may be based on the observed data in similar clinical trials with similar products. If such data are unavailable, a non-informative prior may be used. If appropriate data are available, the estimation of the prior is done by generalizing a single prior to a class of priors. The Beta distribution is a natural prior for binomial models. Under the empirical Bayes approach, the parameters of this distribution are the maximum likelihood estimator of the marginal beta-binomial distribution. For the sample size calculations, the maximum likelihood solution should be adjusted by a discount factor to reflect a partial exchangeability of historical trials as opposed to current studies. We suggest to measure the exchangeability using the confidence interval for the historical rate of the events.