Optimal Experimental Designs

Controlled Optimal Design

Dose-response studies are routinely conducted in clinical trials to determine viable dose levels for newly developed therapeutic drugs. Due to safety, efficacy, and experimental design considerations, practical constraints are often imposed on (1) dose range (e.g. restricted dose range), (2) dose levels (e.g. the inclusion of placebo), (3) dose numbers (e.g. no more than four dose groups), (4) dose proportions (e.g. exactly or at least 20 percent of the subjects must be allocated to the placebo) and (5) potential missing trials.

We propose the controlled optimal designs, that is, Bayesian multiple-objective optimal designs satisfying one or more of these practical constraints, for dose response studies. The resulting controlled optimal designs satisfying these realistic constraints can be readily adopted by the pharmaceutical researchers for optimal estimation of the parameters of interest such as the median effective dose level, the threshold dose level, the parameters of the underlying dose response model, or a combination of these objectives.

In the following, you can compute your own controlled optimal designs assuming an underlying logistic dose response model: $\log \frac{\pi(x)}{1-\pi(x)} = \beta(x-\alpha)$, where $\pi(x) = \frac{1}{1+e^{-\beta(x-\alpha)}}$ is the probability of a response (for example being cured) at the given dose level x. The parameter β is the slope in the logit scale. The other parameter α is the dose x at which the probability of being cured is 0.5. It is the median in the logit scale and is commonly referred to as the "median effective dose" and denoted by ED50. In the future updates, we will expand our models to other dose response models as well.

Because of the many constraints considered in the controlled optimal design, the optimization process could be time consuming at times. Your process might be terminated prematurely to allow other users' access to the website. To solve this problem, we have prepared **a stand-alone version of this program** (click to download). You can run it on your own computer for as long as you want. You are most welcome to email us at info@optimal-design.org if you have any suggestions or comments for our program.