

This manuscript introduces the new R package BayesPPD and is valuable for the following reasons:

- There has been increasing interest in incorporating historical data in the design of clinical trials. The power prior has emerged as a popular choice for Bayesian clinical trial design due to its easy construction and interpretability. While there are a variety of packages that support data analysis with power priors, there lacks an R package that implements features for Bayesian power and type I error calculation using the power prior for common models, including the generalized linear models (GLMs) which is critical for study design and sample size determination.
- The normalized power prior has been proposed to accommodate modeling the power parameter as random. No software implementation of the normalized power prior for GLMs exists due to the computational difficulty associated with estimating the normalizing constant of the power prior within a Markov chain Monte Carlo (MCMC) sampler. We have developed a novel algorithm which incorporates the approximation of the normalizing constant into the MCMC sampler, enabling the use of the normalized power prior for GLMs.
- The package is extensive. It allows normal, binary, Poisson and exponential outcomes for two group models (i.e., models that allow a separate mean for each of two groups) as well as GLMs. The power parameter can be fixed or modeled as random. Use of multiple historical datasets is supported as well as sample size determination without the use of historical data.
- Another advantage of BayesPPD is its computational speed. BayesPPD implements MCMC algorithms using Rcpp. Functions for design for two group cases run in seconds when the power parameter is fixed, and generally run in less an hour when the power parameter is random. An even faster method based on asymptotic theory has also been implemented to help users obtain a rough estimate of the desired sample size before fine-tuning using MCMC-based methods.
- This manuscript not only provides details on the models implemented, but also describes how to use BayesPPD for different data scenarios and model needs. Two case studies using real data have also been included with example code, covering all methods implemented by the package.