

Meeting1

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1 Chapter 1 Statistical approaches for clinical trials

1.1 Bayesian versus frequentist approaches in clinical research

- Key differences
 - parameters
 - inference input data and prior
 - **flexibility**, sequential learning
 - probability statements, predictive probabilities
 - decision theoretic
 - comment on role of randomization

Additional reading - [Beyond subjective and objective in statistics by Andrew Gelman and Christian Henning](#)
- Bayesian is no more subjective than frequentist - Prior can be used meaningfully both computationally and biologically

1.2 Adaptivity

Bayesian is more commonly used for Phase I and Phase II trials. Some appealing adoption including non-fixed sample-size, early stopping and adaptive randomization.

1.2.1 The book argue “full bayesian” with utility function is awkward.

- the expected utility function given poster distribution of the parameter
- an example utility gain (or loss): $Y(Z=1, \text{treated}) - Y(Z=0, \text{control})$

$$\int u(\theta, x) p(\theta|x) d\theta$$

1.2.2 Bayes as a frequentist tool

- flexibility, sequential learning
- posterior predictive probability
- use of prior, borrow info from other studies
- adaptive randomization
- seamless phase II and III design

2 Chapter 2 Basics of Bayesian

Additional reading on choice of prior - <https://github.com/stan-dev/stan/wiki/Prior-Choice-Recommendations>
 - http://www.stat.columbia.edu/~gelman/research/unpublished/prior_context_2.pdf

Additional reading on model selection (AIC, DIC, WAIC etc): - [Understanding predictive information criteria for Bayesian models, Gelman, Hwang & Vehtari](#)

2.1 Principles of Bayesian clinical trial design

Methods which can be used for clinical decision making

1. Posterior predictive methods
2. Bayesian indifference zone methods

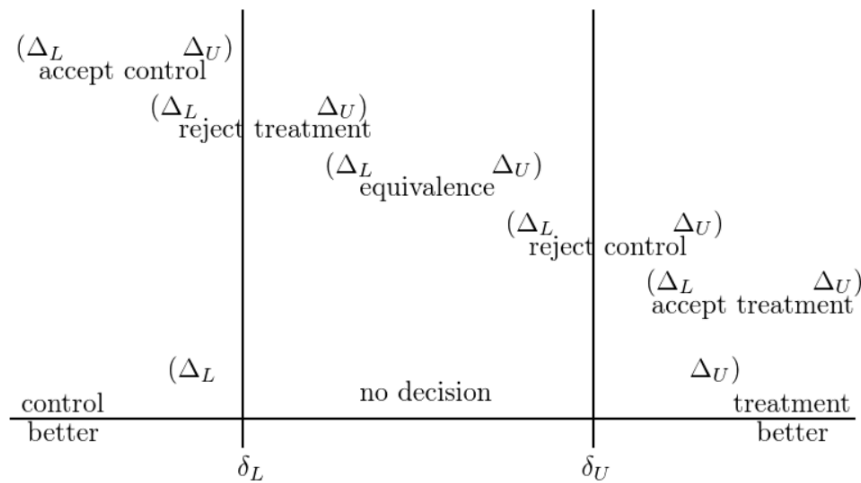


Figure 2.10 Indifference zone (δ_L, δ_U) and corresponding conclusions for a clinical trial based on the location of the 95% posterior credible interval for Δ .

might terminate the trial when

$$P(\Delta > \delta_U | \text{data}) \quad (2.27)$$

is sufficiently small (deciding in favor of the control), or when

$$P(\Delta < \delta_L | \text{data}) \quad (2.28)$$

is sufficiently small (deciding in favor of the treatment). Another rule would

3. Use of priors
4. Operating characteristics - Bayesian trial sample size

Additional reading on Bayesian trial sample size

- [Bayesian techniques for sample size determination in clinical trials: a short review](#)
- [Using historical data for Bayesian sample size determination](#)
- [Clinical Trials and Sample Size Considerations: Another Perspective](#)

Some thing interesting to read: Bayesian and type I error, <https://www.fharrell.com/post/pvalprobs/>

5. Online Bayesian Phase I and II design apps, <https://trialdesign.org/#newsSection>