• EDSA: Power Analysis

• Background Reading:

• What is Statistical Power?
  • Essential concepts include:
    – Examining the null hypothesis $H_0$
    – $\alpha$ (significance levels)
    – Type I & Type II errors

• Two types of Statistical Power
  • More preferred*
    – *Prospective Power Analysis
      • Before collecting data: important for considering design sensitivity
    – Retrospective Power Analysis
      • Used to determine whether or not the study was well designed (after the fact!)
      • Remember: $H_0$ states that findings of study are no different that would have occurred by chance. We calculate the probability of achieving the observed results if $H_0$ were true. If probability is low ($p<0.05$) then we reject $H_0$.
        – Thus, we say statistically significant

• Statistical Testing
  • When performing a statistical test there are 4 possible outcomes:
    – $H_0$ is true or false
    – Rejection or retention of $H_0$
    – Errors

  • When $H_0$ is true and you reject it, Type I error has been committed
    – i.e., when there really is no effect, but the statistical test is significant by chance
    – If $H_0$ is true, the probability of making Type I error is $\alpha$ (the significance level associated with your test)

  • When $H_0$ is false and you fail to reject it, Type II error has been committed
    – If there is really is an effect in the population, but your test is non-significant due to inadequate power or high sampling error
– There really is an effect, but left undetected is called $\beta$  

- Statistical Power by definition is the probability of not missing an effect, due to sampling error, when there really is an effect to be found.
  
  – Depends on:
    
    • Sample size
    
    • Level of $\alpha$
    
    • Minimum effect size (more on this later)

- What is effect size?

- We will use Cohen’s $d$

**Difference between means for groups**

Estimates of population standard deviation

- Rule of Thumb for Cohen’s $d$

- Cohen’s $d$ calculation

- $d = \frac{x_1 - x_2}{S_{pooled}}$

- $S_{pooled} = \sqrt{\frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2}}$

- Decisions to make regarding power

- To make reviewers happy the typical cutoff for statistical power is 80%
  
  – Acceptable risk of Type II error is (1 in 5) 0.2.
  
  – Adequate power $= 1 - 0.2 = 0.8$
  
  – Why do power analyses?

- Experiments are expensive. Project has to be feasible in terms of budget and within an adequate time frame