Power Analysis

Definition:
- Power = 1 − β
- Where β ("Beta") is the chance of making a type II error or false negative rate
- A type II error occurs when you fail to reject the null hypothesis and in fact, the alternative hypothesis is true.

Interpretation:
- Simplistically, power is the chance of NOT making a type II error (β).
- As beta (β) gets smaller so does the likelihood that you will not make a type II error and find a difference if there is in fact a difference to be found.
    - Another way of saying this is "the probability you will say there is no difference between two interventions, when in fact a difference does exist between them."
- Most accept an adequate study power to be 0.8 (80%), which would make β or chance of making a type II error to be 0.2 (20%). Therefore, as power increases, beta or chance of making a type II error will decrease.

Influencing Factors:
- The two factors contributing to the power of study include:
    - Sample size
    - Alpha value (α)
        - α ("Alpha") is the probability of concluding that there is a difference between the groups/interventions studied, but in reality there is no difference (also known as making a "type I error")
        - α is usually set to be 0.05 and a finding is considered to be statistically significant if the p-value is < 0.05 or the chance of making a type I error is < 5%
- *Clinical Application*:
    - If a study or clinical trial fails to find a difference or fails to reject the null hypothesis, one of the most common factors contributing to this is having an insufficient sample size (n). If this occurs, you should recognize that a type II error may have occurred.
        - A study with too small of a sample size is often said to be "under-powered" for this reason.

References:
1. Grunkemeier GL et al. Power and sample size: how many patients do I need? Ann Thorac Surg 2007;83:1934-9.

Editors & Reviewers:
- Anthony J. Busti, MD, PharmD, FNLA, FAHA
- Dylan Kellogg, MD