

Math 150 - Methods in Biostatistics - project Part#2

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Due: Friday, April 19, 2019, in class

Power Analysis

- (1) What is Power Analysis? While conducting tests of hypotheses, the power analysis is how often do commit reject the null hypothesis when shouldn't.

	Truth: T	Truth: F
Null hypothesis	α	$1 - \alpha$
Alternative hypothesis	$1 - \beta$	β

The power analysis is: $1 - \beta$

75% power means you have an 75% chance of getting a significant result when the effect is real.

- (2) How to Calculate the power? To calculate the power there is a common formula we can use it.

$$\beta = \Phi\left(\frac{|\mu_t - \mu_c|\sqrt{N}}{2\sigma}\right) - \Phi^{-1}\left(1 - \frac{\alpha}{2}\right)$$

β is our measure of power. $0 < \beta < 1$

Φ is the CDF of the normal distribution, Φ^{-1} is the inverse.

μ_t is the average outcome in the treatment group. Suppose it's 65

μ_c is the average outcome in the control group. Suppose it's 60

σ is the standard deviation of outcomes.

α is our significance level

The assumption of power analysis is, involves random sampling. This means that the sample on which power analysis is being conducted is drawn by the process of random sampling.

- (3) What are ingredients of Statistical Power? There are three ingredients of that.

First, strength of the treatment. There is positive relationship between the power and strength of the treatment. That mean, when the strength of your treatment increases, the power of your experiment increases.

Second, background noise. There is opposite relationship between the power and background noise. That mean, when the background noise of your outcome variables increases, the power of your experiment decreases.

Third, experimental Design. Traditional power analysis focuses on one element of experimental design: the number of subjects in each experimental group.

- (4) Power analysis for survival analysis In survival analysis, the power is directly related to the number of events observed in the study. The required sample size is therefore determined by the observed number of events. Survival data are commonly analyzed using the log-rank test or the Cox proportional hazards model.

Null Hypothesis to be Tested

$$H_0 : HR = 1$$

where $HR = \frac{h_0(t)}{h_1(t)}$ for all t assuming proportional hazards

Test Statistic

HR estimated from Cox model

Effect Size

$HR = 1$ implies no difference between treatments

$HR > 1$ implies “survival” is longer on treatment 2

$HR < 1$ implies “survival” is longer on treatment 1

Significance Level

$$\alpha = 0.05, z_{\frac{\alpha}{2}} = 1.96$$

Power

Typically desire power of at least 80%,90% or 95%. Recall that for means and proportions, power is a function of sample size. However, for survival data, power is entirely driven by number of events

Power	β	z_β
80%	0.20	0.842
90%	0.10	1.282
95%	0.05	1.645

References: <http://egap.org/methods-guides/10-things-you-need-know-about-statistical-power> Yulia Marchenko, 2007. “Power analysis and sample-size determination in survival models with the new stpower command