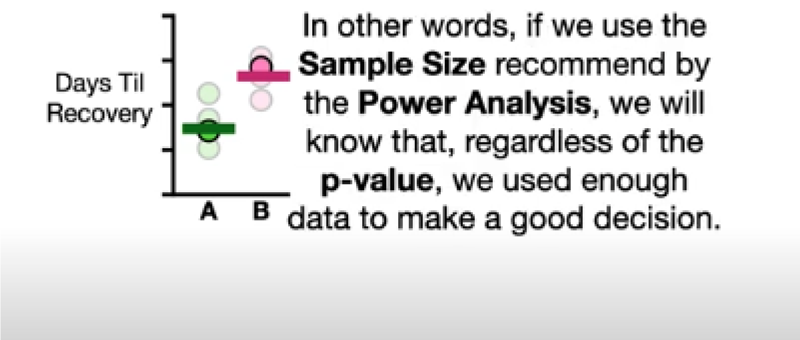
Resources

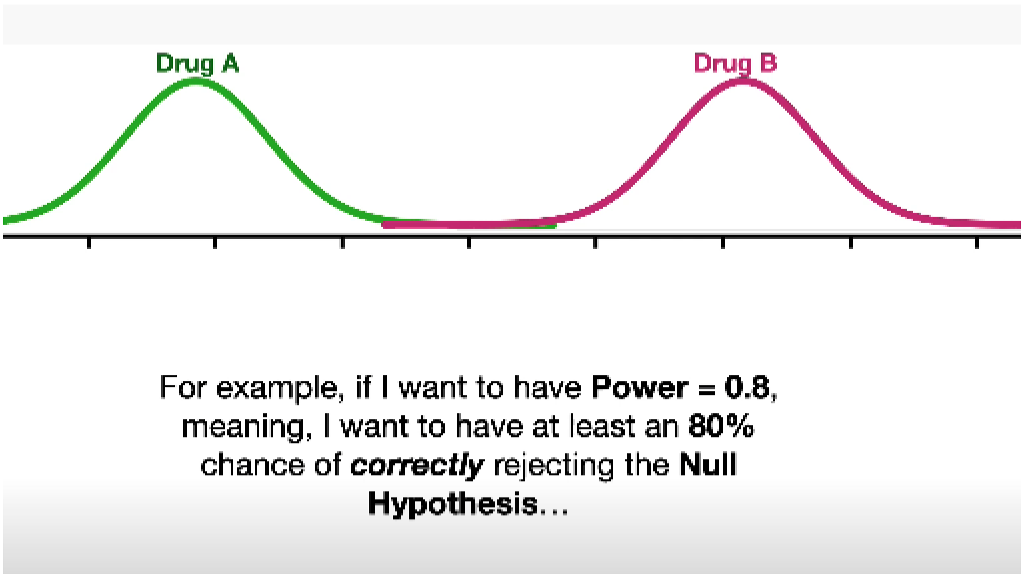
- [statquest: Power Analysis, Clearly Explained!!!]()

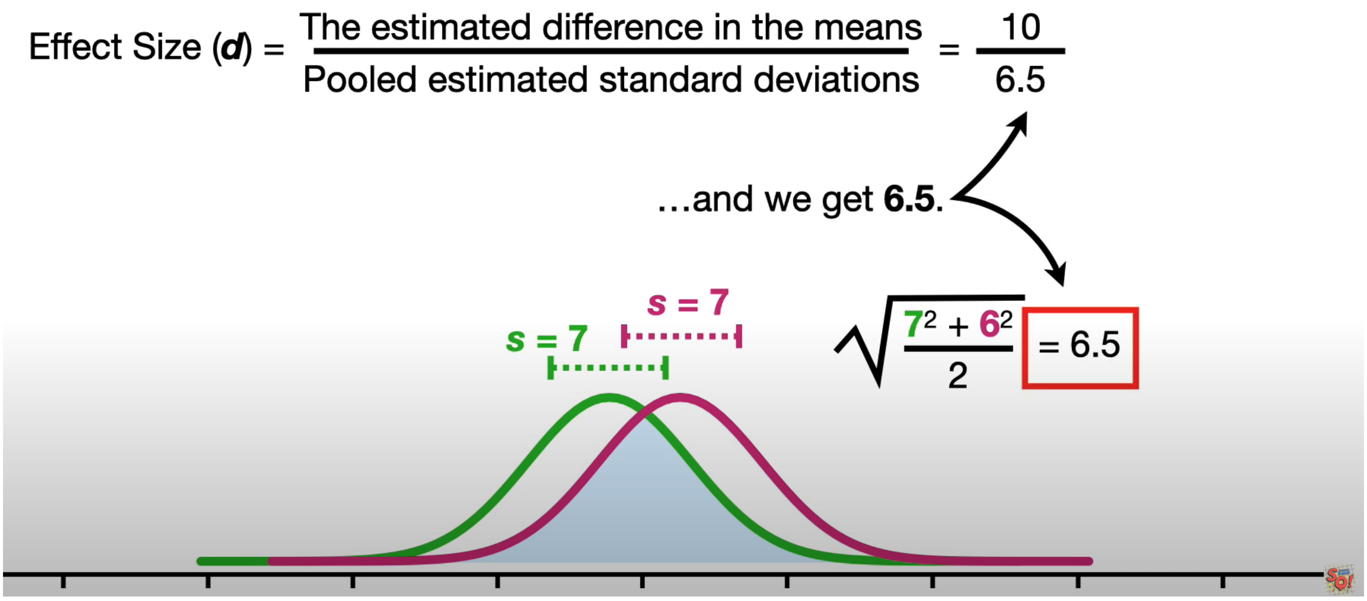
Power Analysis

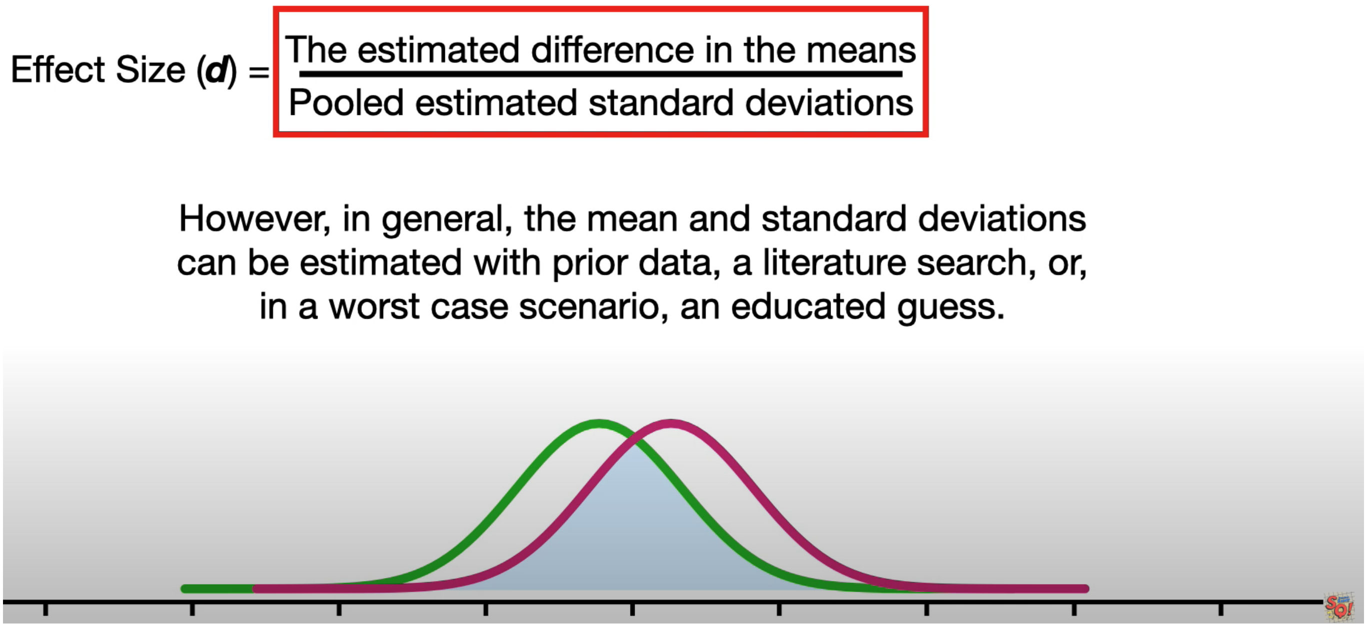
Let's say we have two drugs A and B with 5 samples each. The t-test for means gives us pvalue = 0.06. But the y-axis (recovery days) for drug A looks smaller and we want to add more points to get lower p-value. This is p-hacking, we should not do this. Instead, we should do power analysis to find the large enough sample size. The power gives, regardless of p-value, we have enough information to make a good decision.

Power is affected by: a) Overlap between distributions b) Sample size.









If we have more-overlap, we need more samples to have more power. Even when the distributions overlap, the sample means become separated if we have large enough sample size.

Statistical Power

This is the probability of rejecting null hypothesis when alternative hypothesis is true.

Power = 1 - Type II Error

Higher the statistical power, lower is the probability of making type II error.

If statistic power is low: Large risk of committing type II error. (FN)

If statistic power is large: Small risk of type II error.

NOTE: Type I error: Reject H0 when H0 is true. FP. p-value is optimistically low.

Type II error: Fail to reject H0 when H1 is true. False NEGATIVE.

Sample size

Usually we use power analysis to get the sample size required for a study.

```
# estimate sample size via power analysis
from statsmodels.stats.power import TTestIndPower
# parameters for power analysis
effect_size_d = 0.8
alpha = 0.05
power = 0.8

# perform power analysis
analysis = TTestIndPower()
sample_size = analysis.solve_power(effect_size_d, power=power,
                     nobs1=None, ratio=1.0, alpha=alpha)
print('Sample Size: %d' % int(sample_size)) # Sample Size: 25
```

An effect size refers to the size or magnitude of an effect or result as it would be expected to occur in a population.

The effect size is estimated from samples of data.

Usually effect size is taken as Pearson Correlation r or cohen's d measurement.