Statistical significance

A **statistical significance** test examines what we can conclude about a population from a sample mean.

In other words, does the sample mean provide evidence about the population mean?

- H_0: hypothesized mean for a population = some value, e.g., zero
- H_1: hypothesized mean for a population $\neq$ the value suggested by H_0

The α level, usually set to 0.05 **(α = 0.05)** represents the accepted probability that the result obtained is due to chance.

As we talked about in the last class this is an arbitrary measure, α levels of 0.10, 0.01 and others are also present in your **Appendix B**

How do we measure significance?

t-tests

Formula for t-tests:

$$t = \frac{\bar{X} - \mu_0}{s_{\bar{x}}}$$

Effect size

Why is calculating effect size important?

Although statistical significance is informative, one of its limitations is related to the sample size. This is because very large samples will have a very small standard error value. This means that very small differences between the population and sample means will be considered statistically significant. The effect size checks whether any significant differences are meaningfully large, by comparing them to the standard deviation of the population.

Cohen's d

Cohen's d is a common measure of effect size used for t-tests.
d = (Sample mean - Population mean) $\div$ standard deviation

To calculate this standard deviation we use an adjusted formula from before:
$s_{\bar{x}} = s \div \sqrt{n}$

There are no charts or strict rules for the Cohen's d values, but here are some guidelines:

$d < .20$ = small effect
d in range .20 -.75 = moderate effect
$d > .75$ = large effect

Confidence Intervals

- The confidence interval provides a range of values that we are confident contains the population parameter (e.g., the population mean)
- We always use the α level of the *two tailed* test to find out the *critical t value*, even if we had a one tailed H_0 when testing for statistical significance.

$$CI = X \pm (t) \cdot (s_{\bar{x}})$$