*t*-tests and power in R

Use volunteer dataset

One-sample

1. Compare mean of a variable to 0, using a two-tailed test and with a 95% CI

**t.test(variable)**

* 1. Output: t, df, p-value, confidence interval, sample estimate of mean difference from 0
	2. Also calculate standard deviation to report in results with **sd(variable)**
	3. Options
		1. One- vs. two-tailed: default is two-tailed, use **alternative='less/greater'**
		2. Comparison value: default is 0, use **mu=** for any other value
		3. Confidence level: default is 95%, use **conf.level=<value>** for any other value
1. Effect sizes
	1. Cohen’s d from effectsize package
		1. For null = 0: **cohens\_d(variable)**
		2. For null = something other than 0: **cohens\_d(variable, mu=<value>)**
	2. Hedge’s g – use to correct for small N (<20)
		1. For null = 0: **hedges\_g(variable)**
		2. For null = something other than 0: **hedges\_g (variable, mu=<value>)**
	3. Output: effect size, 95% confidence interval

Matched/paired/related samples

1. Compare two variables for the same set of participants. Data has separate columns for the variables that are being compared

**t.test(variable1, variable2, paired=TRUE)**

* 1. Output: t, df, p-value, confidence interval, sample estimate of the differences between the means
	2. To calculate the standard deviation of the difference scores
		1. Compute difference scores: **mydata$diff <- variable1 – variable2**
		2. Calculate SD: **sd(mydata$diff)**
	3. Options
		1. One- vs. two-tailed: default is two-tailed, use **alternative='less/greater'**
		2. Confidence level: default is 95%, use **conf.level=<value>** for any other value
	4. Effect sizes from effectsize package

**cohens\_d(Pair(variable1, variable2), data = mydata)**

**hedges\_g(Pair(variable1, variable2), data = mydata)**

1. Compare one variable with groups based on a separate grouping variable. Participants could be the same person assessed twice, or different people who are matched or paired.

**t.test(variable ~ group, paired = TRUE, data = mydata)**

1. Output: same as previous (t, df, p-value, confidence interval, sample estimate of the differences between the means)
2. Options: same as previous
3. Effect sizes from effectsize package
4. **cohens\_d(mydata$variable[mydata$group == 1], mydata$variable[mydata$group == 2], paired = TRUE)**
5. **hedges\_g(mydata$variable[mydata$group == 1], mydata$variable[mydata$group == 2], paired = TRUE)**

Independent-samples

1. Determine equality of variances
	1. Calculate variance for each group

**tapply(variable, group, var, na.rm=TRUE)**

* 1. Test for equality of variance with Levene’s test

**leveneTest(variable, group)**

1. All default options

**t.test(variable~group)**

* 1. Output: Welches two sample t-test (equal variances not assumed), t, df, p, 95% confidence interval of the difference between the means, means for each group
	2. Options
		1. Assumption about variance: default is not equal, use **var.equal=TRUE** to get the t-test with equal variances assumed
		2. One- vs. two-tailed: default is two-tailed, use **alternative='less/greater'**
		3. Confidence level: default is 95%, use **conf.level=<value>** for any other value
	3. Effect sizes
		1. From effectsize package

Equal variances assumed: **cohens\_d(variable~group)**

Correct for unequal variances: **cohens\_d(variable~group, var.equal=FALSE)**

* + 1. From compute.es package: outputs several effect sizes

Get sample sizes per group: **table(variable)**

Compute effect sizes: **tes(t=<value>, n.1=<value>, n.2=<value>)** or **tes(t, n1, n2)**

* + - 1. Output for Cohen’s d, Hedges’ g, r, Fisher’s z, odds ratio, log odds ratio
				1. 95% confidence intervals, variances, and p-values

Power and precision analysis

1. Use pwr.t.test function from pwr package
	1. Take out one variable (n, d, sig.level, or power) to calculate that value

**pwr.t.test(n=<value>, d=<value>, sig.level = .05, power = <value>)**

* + 1. Default: two-sample t-test
	1. Use **type="one.sample"** or **type="paired"** to change type of t-test
1. Precision analysis with presize package: calculate N needed for a given mean, SD, confidence interval width, and confidence level

**prec\_meandiff(delta=<value>, sd1=<value>, n1=NULL or <value>, r=1, conf.width=<value>, conf.level=.95)**

1. delta = difference in means between groups
2. r = relative size of groups
3. Default is equal variances assumed
4. Option: for equal variances not assumed, use **variance="unequal"**