New Statistics Short Course

Exercise 4: Replication

Part 1

In this exercise we are going to explore the relationship between sample size and replication. We are going to reuse the church group and motivation to apologize data set (mta_church.csv).

a) Let's start by re-running the *t*-test on the original data.

b) Next, let's simulate a replication dataset of the same size and with $\mu = 19$, $\sigma = 5$ for the "church" group and $\mu = 20$, $\sigma = 5$ for the "no church" group (these are the "population parameters"). Again, run a *t*-test on this data and determine if you reach the same decision regarding reject/don't reject the null hypothesis. Given the sample size, what do you expect?

c) Let's explore the effects of sample size on replication. Select only the first 100 cases from each group as our new smaller dataset. Run the *t*-test to determine if you find a statistically significant difference.

d) Next, let's simulate a replication dataset of the same size ($n = 100$ per group) and again with $\mu = 19$, $\sigma = 5$ for the "church" group and $\mu = 20$, $\sigma = 5$ for the "no church" group. Again, run a *t*-test on this data and determine if you reach the same decision regarding reject/don't reject the null hypothesis as in (c).

Part 2

In this exercise, we are going to evaluate the effects of an optional stopping paradigm on statistical significance. In other words, we will keep adding subjects and see if at some point we reach statistical significance. Note that we are mimicking a situation where you "peak" at the statistical results after every new participant. What makes this exercise interesting is that we will simulate data from populations with the same mean (0) and standard deviation (1). In other words, there is no difference between the populations so if we conclude there is a difference at any point that is a Type I error. The outcome variable will be depression (dep) and the grouping variable will be sex.

a) Start by simulating data for 3 subjects per group and run a *t*-test on the data.

```
dep<-rnorm(6)
sex<-rep(c("m","f"),c(3,3))
dat<-data.frame(dep,sex)
t.test(dep ~ sex)
```

b) Next, incrementally add cases and see if the *p*-value ever drops lower than .05.

```
dat[nrow(dat)+1,1]<-rnorm(1)
dat[nrow(dat),2]<-sample(c("m","f"),1)
t.test(dep ~ sex, data=dat)
```