

R-Exercise on: Sample Size Planning

Prof. Dr. Carolin Strobl

Exercise 1

- a) Install and activate the package `pwr` by using the following commands:

```
install.packages("pwr") # only before first use
library("pwr")          # each time before use
```

- b) Copy the command from the slides to determine the necessary sample size for a one-tailed z-test with a standardized effect size of $\delta = 0.5$, a power of 80%, and an α level of 5%.

Interpret the output.

Think about what you expect before trying out the following:

Do you need more or less subjects if you ...

- c) ... expect a smaller effect?

Set the effect size to 0.2 and compare the results.

- d) ... want to achieve higher power?

Set the power to 0.95 and compare the results.

Exercise 2 Using the help page, try to find out how the function for calculating the sample size for the paired t-test works:

```
?pwr.t.test
```

Calculate the sample size for the following study about the effect of alcohol consumption on reaction time:

Every person's reaction time is measured before and after the consumption of alcohol.

How many subjects need to be tested in order to detect an extension (one-tailed test) of the reaction times by $\delta = 0.4$ (e.g. for a mean difference of 8ms with a standard deviation of the differences of 20ms $\Rightarrow \delta = 8/20 = 0.4$) with a power of 90% and an α level of 5%?

Exercise 3 You now want to examine the effect of alcohol consumption on reaction time specifically for people with post-traumatic stress disorder (PTSD).

Like before, repeated measurements shall be conducted before and after the consumption of alcohol. Realistically, however, within the duration of the study you will only find 10 people with this diagnosis that are willing to participate in the study.

In a sample of this size, how large would the effect size have to be for you to still detect an extension in reaction times with a power of 90% and an α level of 5% (one-tailed test)?

Additional exercise (if you want to play more with R) Plot the required sample size for the z-test as a function of the effect size, for example using:

```
delta <- seq(0.05, 0.6, 0.01)
power <- 0.8
alpha <- 0.05
```

```
sample_size <- numeric(length(delta))
for(i in 1:length(delta)){
  result <- pwr.norm.test(d = delta[i], n = NULL,
    sig.level = alpha, power = power, alternative = "greater")
  sample_size[i] <- result$n
}
plot(delta, sample_size, type = "l")
```