

29.3: The t-test as a Linear Model (Section 28.3)

We can also use `lm()` to implement these t-tests.

The one-sample t-test is basically a test for whether the intercept is different from zero, so we use a model with only an intercept and apply this to the data after subtracting the null hypothesis mean (so that the expectation under the null hypothesis is an intercept of zero):

```
NHANES_BP_sample <- NHANES_BP_sample %>%  
  mutate(BPSysAveDiff = BPSysAve-120)  
lm_result <- lm(BPSysAveDiff ~ 1, data=NHANES_BP_sample)  
summary(lm_result)
```

```
##  
## Call:  
## lm(formula = BPSysAveDiff ~ 1, data = NHANES_BP_sample)  
##  
## Residuals:  
##      Min       1Q   Median       3Q      Max   
## -36.11 -13.11  -1.11   9.39  67.89   
##  
## Coefficients:  
##              Estimate Std. Error t value Pr(>|t|)      
## (Intercept)      3.11        1.41     2.2   0.029 *   
## ---  
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1  
##  
## Residual standard error: 18 on 154 degrees of freedom
```

You will notice that this p-value is twice as big as the one obtained from the one-sample t-test above; this is because that was a one-tailed test, while `lm()` is performing a two-tailed test.

We can also run the two-sample t-test using `lm()` :

```
lm_ttest_result <- lm(BPSysAve ~ SmokeNow, data=sample_df)  
summary(lm_ttest_result)
```

```
##
## Call:
## lm(formula = BPSysAve ~ SmokeNow, data = sample_df)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -45.16  -11.16   -2.16    8.84  101.18
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)  125.160      0.897   139.54 < 2e-16 ***
## SmokeNowYes   -5.341      1.269   -4.21  2.8e-05 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 18 on 784 degrees of freedom
## Multiple R-squared:  0.0221, Adjusted R-squared:  0.0209
## F-statistic: 17.7 on 1 and 784 DF, p-value: 2.84e-05
```

This gives the same p-value for the SmokeNowYes variable as it did for the two-sample t-test above.

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