Title: Project for Inferential Statistics: Understanding the Tooth-Growth Dataset

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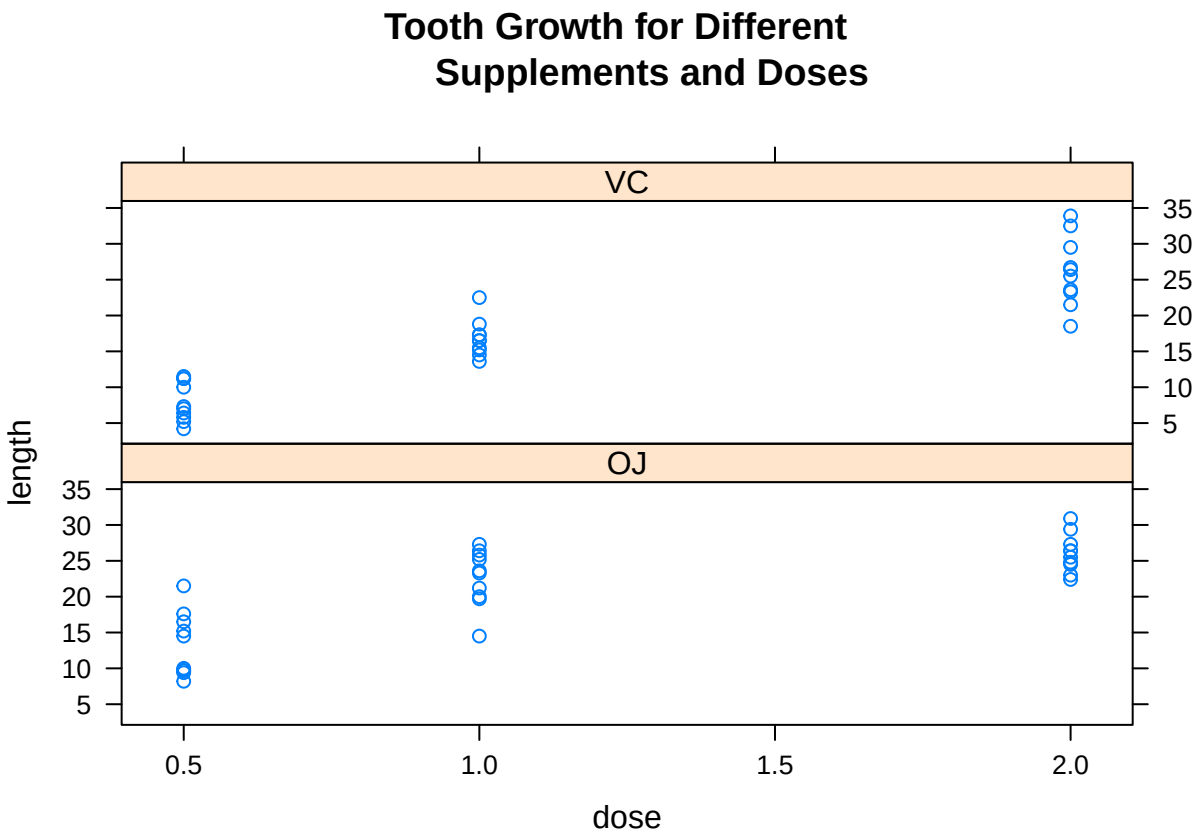
I. Overview

This report summarizes some information about the ToothGrowth dataset and uses confidence intervals to understand the effects of the type of supplement and dosage on the length of teeth. The results, shown below, indicate that at a 95% confidence level, the type of supplement does not result in a significant difference in tooth growth. The results indicate, however, that at a 95% confidence level, higher supplement dosage does result in more growth.

II. Exploratory Results

This section reads in the data and performs some exploratory analysis. The panel plot shows tooth length as a function of dose and supplement. The table that follows compares mean length for the main combinations of supplement and growth.

```
data(ToothGrowth)
library(lattice)
xyplot(len ~ dose | supp, data=ToothGrowth, layout=c(1,2), main="Tooth Growth for Different
       Supplements and Doses", ylab="length")
```



```
library(dplyr)
```

```
##
## Attaching package: 'dplyr'
##
## The following object is masked from 'package:stats':
##
##     filter
##
## The following objects are masked from 'package:base':
##
##     intersect, setdiff, setequal, union
```

```
dt <- group_by(ToothGrowth, supp, dose)
summarise(dt, mean(len))
```

```
## Source: local data frame [6 x 3]
## Groups: supp
##
##   supp dose mean(len)
## 1   OJ  0.5     13.23
## 2   OJ  1.0     22.70
## 3   OJ  2.0     26.06
## 4   VC  0.5      7.98
## 5   VC  1.0     16.77
## 6   VC  2.0     26.14
```

III. Comparing Growth Using Confidence Intervals

This section compares growth for different supplements and dosages using confidence intervals.

(a) comparing the effect of supplement type ("OJ", "VC") on tooth length

The following t test is used to compare the length for each supplement type and we assume the subjects were not paired and that the variances in the two groups was equal.

```
t.test(dt[dt$supp == "OJ", ]$len, dt[dt$supp == "VC", ]$len, paired=FALSE, var.equal=TRUE)
```

```
##
##  Two Sample t-test
##
## data:  dt[dt$supp == "OJ", ]$len and dt[dt$supp == "VC", ]$len
## t = 1.9153, df = 58, p-value = 0.06039
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -0.1670064  7.5670064
## sample estimates:
## mean of x mean of y
##  20.66333  16.96333
```

Since the confidence interval from the test includes 0, we can not conclude that there is a significant difference between the effect of the two supplements on length.

(b) comparing the effect of dosage for OJ supplement

The following t test is used to compare the length for the 0.5 and 2.0 doses for the OJ supplement. A t test is used to compare the length for the two doses and we assume the subjects were not paired and that the variances in the two groups was equal.

```
    t.test(dt[dt$supp == "OJ" & dt$dose == 0.5, ]$len,
           dt[dt$supp == "OJ" & dt$dose == 2.0, ]$len, paired=FALSE, var.equal=TRUE)
```

```
##
##  Two Sample t-test
##
## data:  dt[dt$supp == "OJ" & dt$dose == 0.5, ]$len and dt[dt$supp == "OJ" & dt$dose == 2, ]$len
## t = -7.817, df = 18, p-value = 3.402e-07
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -16.278223  -9.381777
## sample estimates:
## mean of x mean of y
##     13.23     26.06
```

The results suggest that, at the 95% confidence level, the higher OJ supplement dosage results in more teeth growth than the lower supplement dosage.

(c) comparing the effect of dosage for the VC supplement

The following t test is used to compare the length for the 0.5 and 2.0 doses for the VC supplement. A t test is used to compare the length for the two doses and we assume the subjects were not paired and that the variances in the two groups was equal.

```
t.test(dt[dt$supp == "VC" & dt$dose == 0.5, ]$len,
       dt[dt$supp == "VC" & dt$dose == 2.0, ]$len, paired=FALSE, var.equal=TRUE)
```

```
##
##  Two Sample t-test
##
## data:  dt[dt$supp == "VC" & dt$dose == 0.5, ]$len and dt[dt$supp == "VC" & dt$dose == 2, ]$len
## t = -10.3878, df = 18, p-value = 4.957e-09
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -21.83284 -14.48716
## sample estimates:
## mean of x mean of y
##      7.98     26.14
```

The results suggest that, at the 95% confidence level, the higher OJ supplement dosage results in more teeth growth than the lower supplement dosage.

IV. Conclusions and Assumptions

The results from this analysis suggest that there is not a significant difference in the effect of the two supplements on tooth growth. However, the results also suggest that, at the 95% confidence level, a higher dosage leads to more tooth growth. A number of assumptions were used for this analysis, including:

- the test subjects were not paired
- the variances of the different subject groups were equal and constant