Tooth Growth Analysis

James Portman

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Overview of Assignment

Now in the second portion of the class, we're going to analyze the ToothGrowth data in the R datasets package.

1. Load the ToothGrowth data and perform some basic exploratory data analyses
2. Provide a basic summary of the data.
3. Use confidence intervals and hypothesis tests to compare tooth growth by supp and dose. (Only use the techniques from class, even if there's other approaches worth considering)
4. State your conclusions and the assumptions needed for your conclusions.

Some criteria that you will be evaluated on

- Did you perform an exploratory data analysis of at least a single plot or table highlighting basic features of the data?
- Did the student perform some relevant confidence intervals and/or tests?
- Were the results of the tests and/or intervals interpreted in the context of the problem correctly?
- Did the student describe the assumptions needed for their conclusions?

Background information

Source

C. I. Bliss (1952) The Statistics of Bioassay. Academic Press.

Description

The ToothGrowth dataset documents the effect of vitamin C on tooth growth in guinea pigs. The response is the length of odontoblasts (teeth) in each of 10 guinea pigs at each of three dose levels of Vitamin C (0.5, 1, and 2 mg) with each of two delivery methods (orange juice or ascorbic acid).

Format

A data frame with 60 observations on 3 variables:

- len: Tooth length (numeric variable)
- supp: Supplement type (VC or OJ) (factor variable)
- dose: Dose in milligrams (numeric variable)

Step 1: Load the ToothGrowth data and perform basic exploratory data analyses.

```
library(ggplot2)
library(datasets)
data(ToothGrowth)
str(ToothGrowth)
```

```
## 'data.frame':    60 obs. of  3 variables:
##  $ len : num  4.2 11.5 7.3 5.8 6.4 10 11.2 11.2 5.2 7 ...
##  $ supp: Factor w/ 2 levels "OJ","VC": 2 2 2 2 2 2 2 2 2 2 ...
##  $ dose: num  0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 ...
```

Step 2: Provide a basic summary of the data.

```
summary(ToothGrowth)
```

```
##       len        supp         dose
##  Min.   : 4.20   OJ:30   Min.   :0.500
##  1st Qu.:13.07   VC:30   1st Qu.:0.500
##  Median :19.25           Median :1.000
##  Mean   :18.81           Mean   :1.167
##  3rd Qu.:25.27           3rd Qu.:2.000
##  Max.   :33.90           Max.   :2.000
```

Figure 1 shows the Effect of Dosage and Supplement Type on Tooth Growth

Step 3: Use confidence intervals and hypothesis tests to compare tooth growth by Supplement type and Dose.

```
supp.test1 <- t.test(len~supp, paired = FALSE, var.equal = TRUE, data = ToothGrowth)

supp.test2 <- t.test(len~supp, paired = FALSE, var.equal = FALSE, data = ToothGrowth)

supp.result <- data.frame("p-value" =   c(supp.test1$p.value, supp.test2$p.value),
                          "Conf-Low" =  c(supp.test1$conf[1], supp.test2$conf[1]),
                          "Conf-High" = c(supp.test1$conf[2], supp.test2$conf[2]),
                          row.names =   c("Equal Var","Unequal Var"))
supp.result
```

```
##                 p.value   Conf.Low Conf.High
## Equal Var   0.06039337 -0.1670064  7.567006
## Unequal Var 0.06063451 -0.1710156  7.571016
```

Step 4: Conclusions

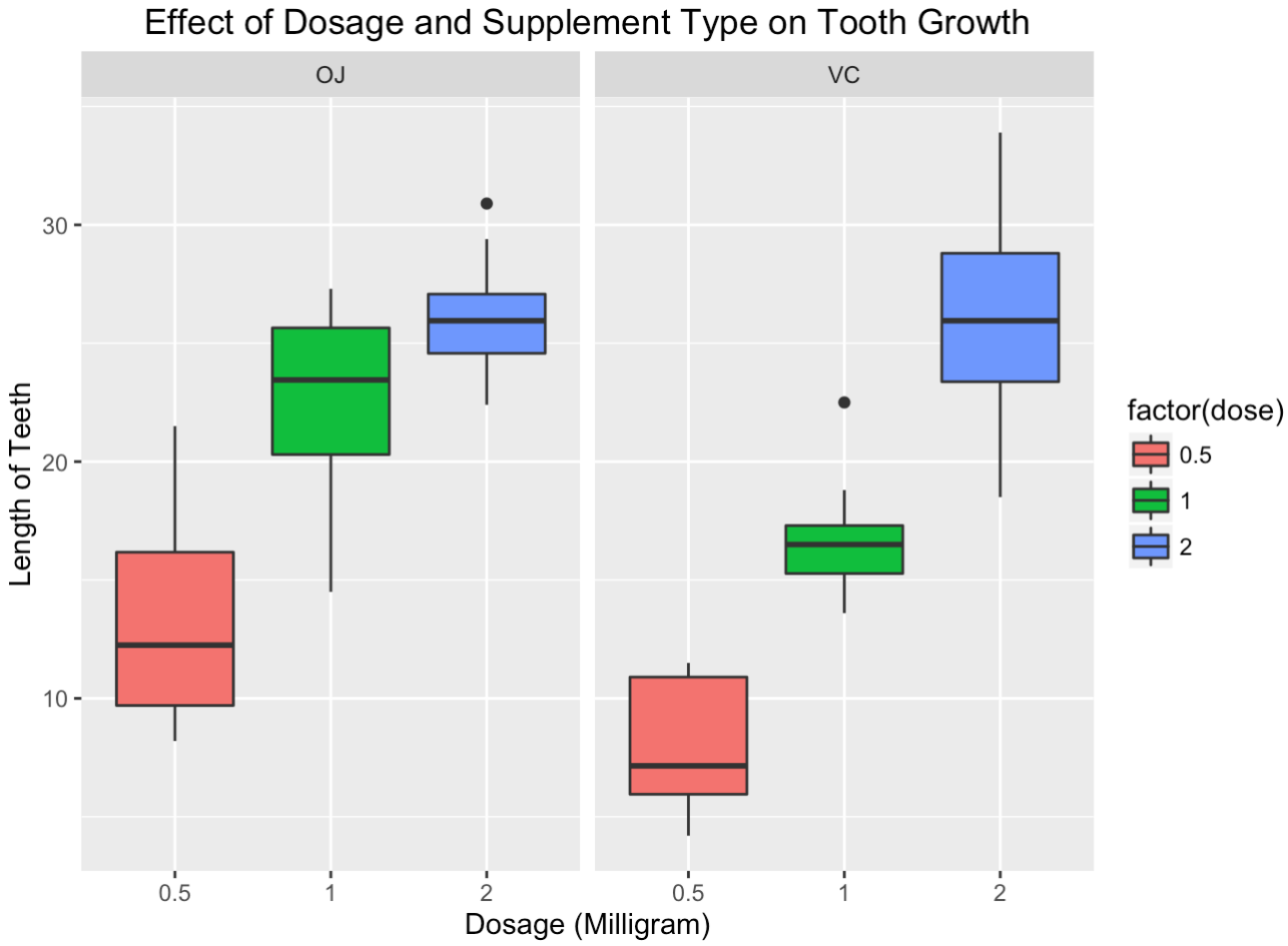
Based on the sample data provided:

1. Orange juice provides more tooth growth than ascorbic acid at lower dosages (.5 mg - 1 mg).
2. The rate of tooth growth is not statistically different between supplement methods at the higher dosage (2 mg).
3. For both supplement methods dosage is a factor in tooth growth.

Appendix

Figure 1: Effect of Dosage and Supplement Type on Tooth Growth

```
plot <- ggplot(ToothGrowth,
               aes(x=factor(dose),y=len,fill=factor(dose)))
plot + geom_boxplot(notch=F) + facet_grid(.~supp) +
     scale_x_discrete("Dosage (Milligram)") +
     scale_y_continuous("Length of Teeth") +
     ggtitle("Effect of Dosage and Supplement Type on Tooth Growth")
```



Reproducibility Information

```
sessionInfo()
```

```
## R version 3.2.4 (2016-03-10)
## Platform: x86_64-apple-darwin13.4.0 (64-bit)
## Running under: OS X 10.10.5 (Yosemite)
##
## locale:
## [1] C
##
## attached base packages:
## [1] stats     graphics  grDevices utils     datasets  methods   base
##
## other attached packages:
## [1] ggplot2_2.1.0
##
## loaded via a namespace (and not attached):
##  [1] Rcpp_0.12.4      digest_0.6.9     grid_3.2.4       plyr_1.8.3
##  [5] gtable_0.2.0     magrittr_1.5     evaluate_0.8.3   scales_0.4.0
##  [9] stringi_1.0-1    reshape2_1.4.1   rmarkdown_0.9.5  labeling_0.3
## [13] tools_3.2.4      stringr_1.0.0    munsell_0.4.3    yaml_2.1.13
## [17] colorspace_1.2-6 htmltools_0.3    knitr_1.12.3
```