Inference About Tooth Growth

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Overview

We will use experimental data from the `ToothGrowth` dataset in R to understand if different doses of Vitamin C had an effect on teeth length. See `?ToothGrowth` for more details about the dataset. The data consist of 60 teeth measurements from guinea pigs given 3 different doses of Vitamin C (0.5, 1,and 2 mg) from 2 different delivery methods (orange juice and ascorbic acid).

```
library("datasets")
data(TootthGrowth)
```

Explorator Data Analysis

```
library("ggplot2")
library("dplyr")

ggplot(ToothGrowth, aes(x=factor(dose),y=len,fill=factor(dose))) +
  geom_boxplot() +
  facet_wrap(~supp) +
  labs(x="Dose of Vitamin C (mg)",y="Tooth Length",
       title="Length of Teeth by Dose Given Delivery Method")
```

Length of Teeth by Dose Given Delivery Method
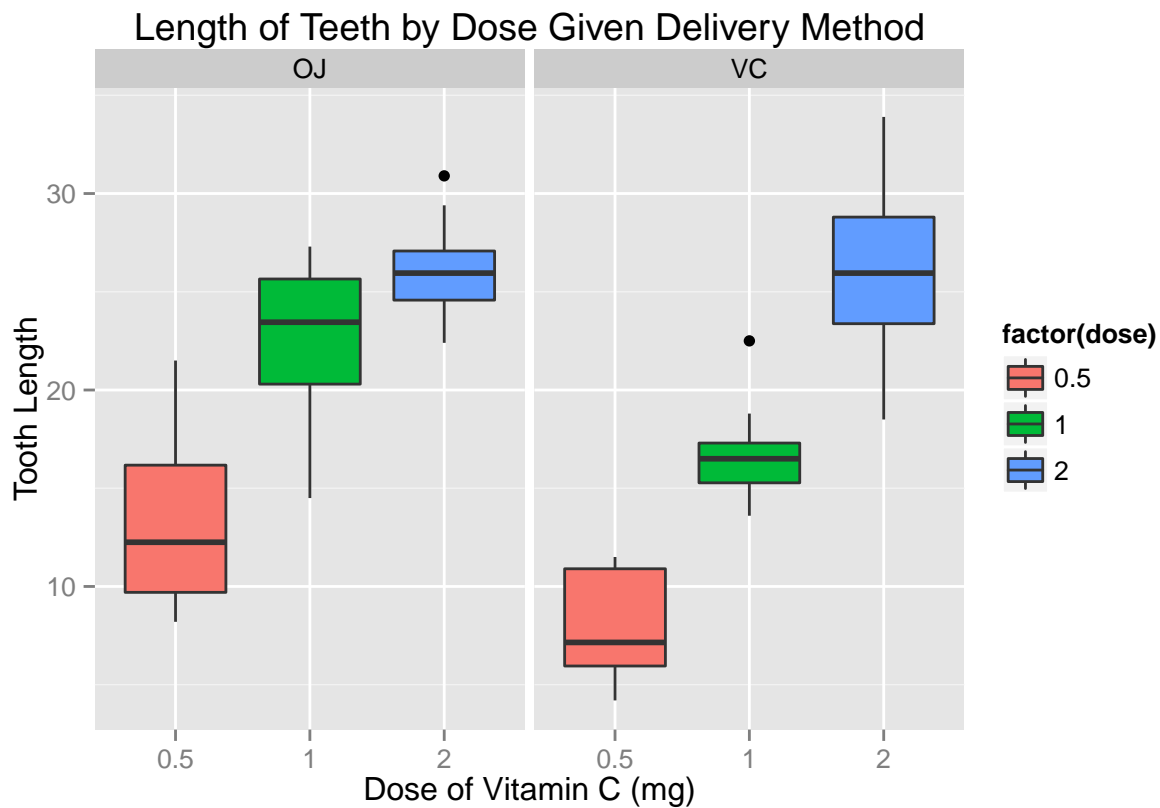

```
ToothGrowth %>%
  group_by(supp,dose) %>%
  summarise(mean(len), sd(len))
```

```
## Source: local data frame [6 x 4]
## Groups: supp
##
##   supp dose mean(len)  sd(len)
## 1   OJ  0.5     13.23 4.459709
## 2   OJ  1.0     22.70 3.910953
## 3   OJ  2.0     26.06 2.655058
## 4   VC  0.5      7.98 2.746634
## 5   VC  1.0     16.77 2.515309
## 6   VC  2.0     26.14 4.797731
```

Here we are able to see how tooth length changes across different doses of Vitamin C and delivery method. It appears that tooth length increases with dose level irreguardless of delivery method. Next we will formalize this hypothesis.

Here we set up two groups to focus on for the purposes of testing the difference in mean tooth length. We will compare 2 mg dose of Vitamin C to 0.5 mg dose to Vitamin C just for the ascorbic acid delivery method.

```
# set up the two groups
g1 <- ToothGrowth %>%
        filter(supp=="VC", dose==2) %>%
```

```
        select(len)

g2 <- ToothGrowth %>%
        filter(supp=="VC", dose==0.5) %>%
        select(len)
```

Inference

Next we will test the hypothesis whether the difference in the mean tooth length in these two groups is different from zero.

```
t.test(x = g1, y=g2)
```

```
##
##  Welch Two Sample t-test
##
## data:  g1 and g2
## t = 10.3878, df = 14.327, p-value = 4.682e-08
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  14.41849 21.90151
## sample estimates:
## mean of x mean of y
##     26.14      7.98
```

Conclusion

From the results of the hypothesis test above we conclude that the difference in tooth length from the 2 mg dose is between (14.4, 21.9) longer than the 0.5 mg dose. Here we are **assuming** that the dosage were randomaly assigned and there were no big differences between these two groups that would be confounded with the results described.