Statistical Inference

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Introduction

This task requires to do some explanatory analysis and make conclusions about data we have. The data for task is ToothGrowth

Explanotory analysis

First we need to load data:

```
data(ToothGrowth)
library(ggplot2)
```

Look for dimensions and collum names:

```
dim(ToothGrowth)
```

```
## [1] 60  3
```

```
names(ToothGrowth)
```

```
## [1] "len"  "supp" "dose"
```

```
head(ToothGrowth)
```

```
##    len supp dose
## 1  4.2   VC  0.5
## 2 11.5   VC  0.5
## 3  7.3   VC  0.5
## 4  5.8   VC  0.5
## 5  6.4   VC  0.5
## 6 10.0   VC  0.5
```

And finally let's look through summary

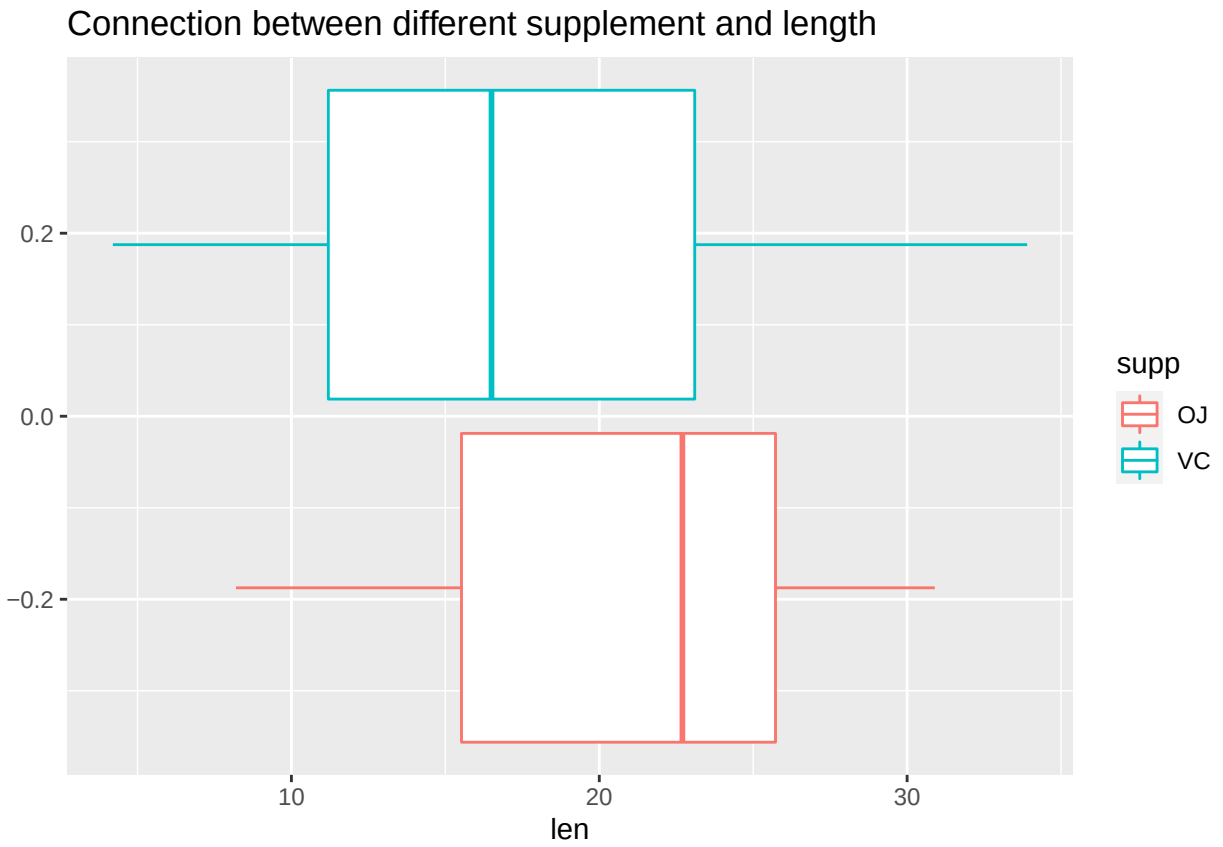
```
summary(ToothGrowth)
```

```
##       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
```

Quick graphs

To finish explanatory analyses, we need to build up a couple graphs. First will be a graph showing conection between supplement type and teeth length.

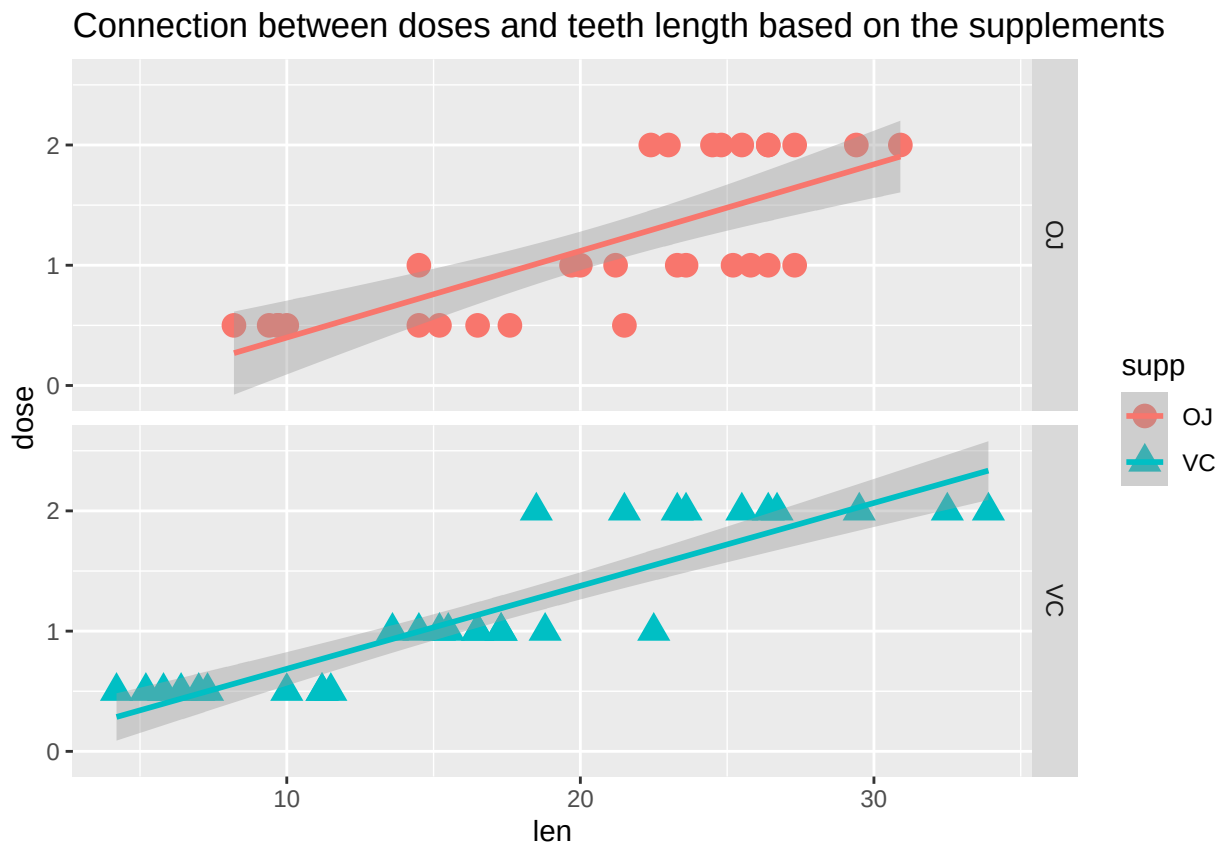
```
g<-ggplot(data = ToothGrowth, aes(len, colour = supp))+geom_boxplot()
g+ggtitle("Connection between different supplement and length")
```



And then let's add more data to this graph to see if there any connection between dose and teeth length.

```
g<-ggplot(data= ToothGrowth, aes(len, dose, shape = supp, col = supp))+
  geom_point(size = 4)+
  facet_grid(supp~.)
g+
  ggtitle("Connection between doses and teeth length based on the supplements")+
  geom_smooth(method = "lm")
```

```
## `geom_smooth()` using formula 'y ~ x'
```



Statistical inference

Let's assume that type of the supplement doesn't affect teeth length. To reject or fail to reject this theory let's conduct a t test.

```
Ojlen<-ToothGrowth[1:30,1] ## length by oj
Vclen<-ToothGrowth[31:60,1] ## length by Vc

t.test(Ojlen, Vclen, paired = TRUE)
```

```
##
##  Paired t-test
##
## data:  Ojlen and Vclen
## t = -3.3026, df = 29, p-value = 0.00255
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -5.991341 -1.408659
## sample estimates:
## mean of the differences
##                    -3.7
```

Based on this test means in two supplements are not equal, as 95 percent confidence interval doesn't include 0 and t value is quite high.

Let's do the same, only based on suplement dose:

```
dose05<-subset(ToothGrowth, dose == 0.5)[,1]
dose1<-subset(ToothGrowth, dose == 1)[,1]
dose2<-subset(ToothGrowth, dose == 2)[,1]


t.test(dose2,dose1, paired = TRUE)$conf
```

```
## [1] 3.471814 9.258186
## attr(,"conf.level")
## [1] 0.95
```

Doubled dozes and normal appears to differ.

```
t.test(dose2,dose05,paired = TRUE)$conf
```

```
## [1] 12.6228 18.3672
## attr(,"conf.level")
## [1] 0.95
```

Difference between halfed and doubled dozes even stronger.

```
t.test(dose1,dose05,paired = TRUE)$conf
```

```
## [1]  6.387121 11.872879
## attr(,"conf.level")
## [1] 0.95
```

And normal dozes and small doesn't appears to be same.

Conslusion

We made a assumptions (null hypothesizes), that teeth length doesn't based on type of supplement and its dose. However, t test showed, that all these hypothesizes were reject. Based on this information, we can assume that teeth length does base on the supplement type and its doze.