Part 2: Basic Inferential Data Analysis

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Load the ToothGrowth Data

```
library(datasets)
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 ...
```

```
data("ToothGrowth")
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
```

Summary

```
#Identifying if there is any NA value in dataset
sum(!complete.cases(ToothGrowth))
```

```
## [1] 0
```

This suggest there is no NA values in the dataset

```
#Computing  summary of ToothGrowth Dataset
summary(ToothGrowth)
```

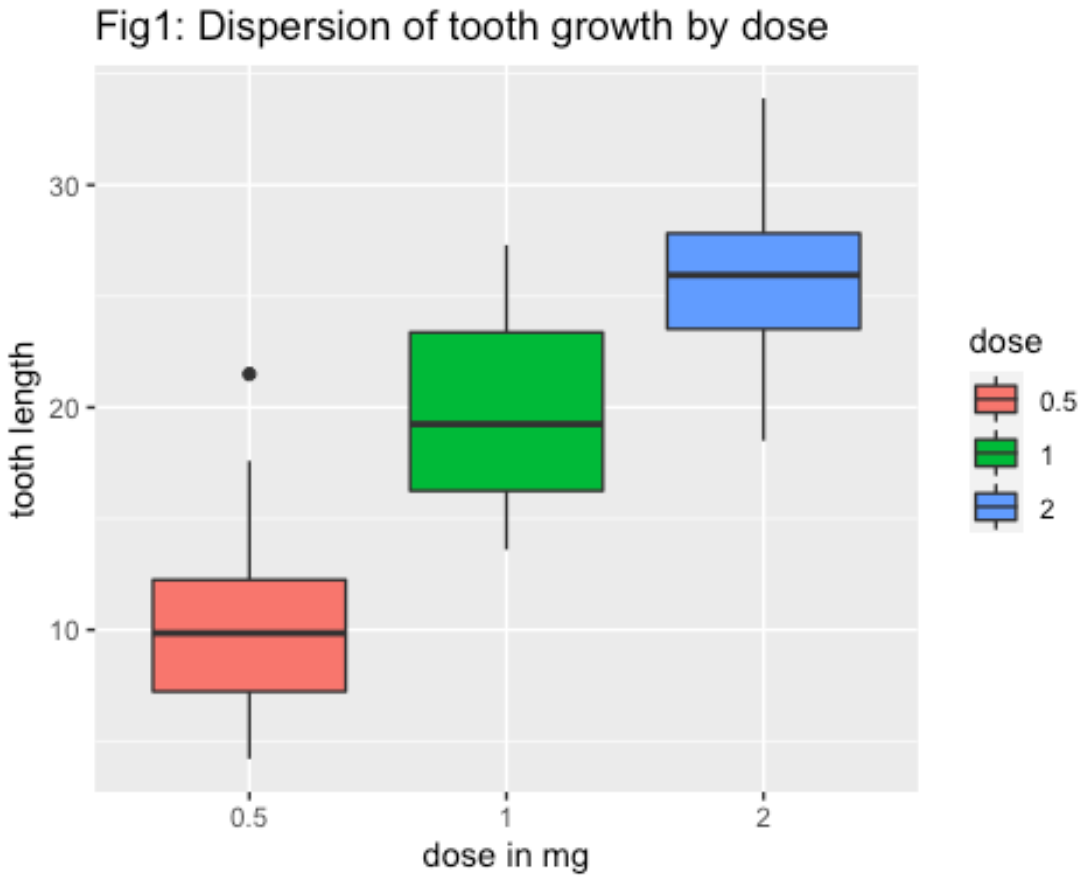
```
##       len        supp         dose
##  Min.   : 4.20   OJ:30   Min.   :0.500
##  1st Qu.:13.07   VC:30   1st Qu.:0.500
##  Median :19.25           Median :1.000
##  Mean   :18.81           Mean   :1.167
##  3rd Qu.:25.27           3rd Qu.:2.000
##  Max.   :33.90           Max.   :2.000
```

##Exploratory Analysis

```
library(ggplot2)
```

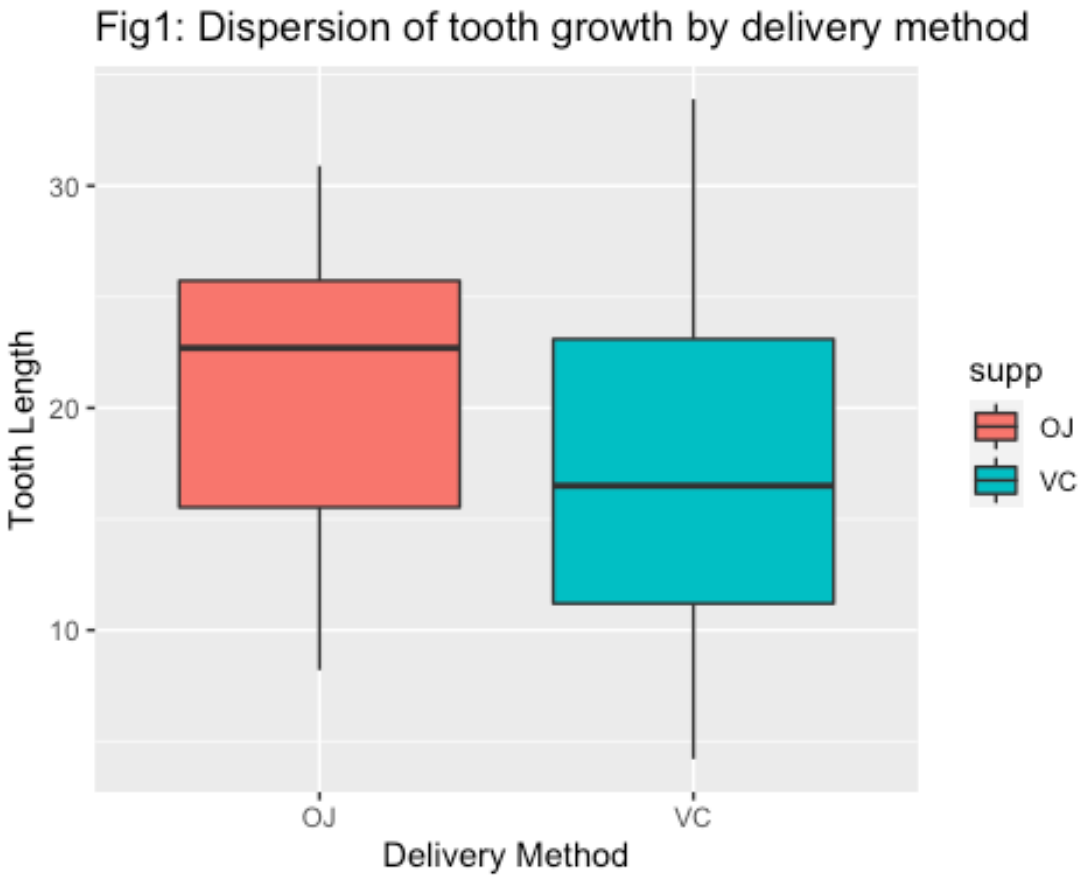
```r
#Computing dose factor
ToothGrowth$dose <- as.factor(ToothGrowth$dose)

#Plotting boxplot to understand how dose impact tooth length
p <- ggplot(ToothGrowth,aes(x=dose,y=len,fill=dose))+ geom_boxplot() +
ggtitle("Fig1: Dispersion of tooth growth by dose")+xlab("dose in
mg")+ylab("tooth length")
p
```



We can see that the higher the dose is, the longer the teeth are. We can notice that for a dose of 1 mg, the mean is nearly twice than for dose 0.5 mg. The progression is then lower when the dose is 2 mg. The position of the boxes are really different; this is a first clue for suggesting that the tooth length depends a lot of the dose.

```r
#plotting boxplot of delivery method of these doses impacting toothlength
p1 <- ggplot(ToothGrowth,aes(x=supp,y=len,fill=supp))+ geom_boxplot() +
ggtitle("Fig1: Dispersion of tooth growth by delivery method")+xlab("Delivery
Method")+ylab("Tooth Length")
p1
```



The boxes are quite similar. However, the median is much higher for Orange Juice than for Vitamin C; that means that for Orange Juice, the high values are more numerous than the low values, in comparison with Vitamin C. ## Hypothesis Tests we will test if the delivery mode has an influence on the tooth growth. nul hypothesis H0 could be formulated as follows :

#H0 : The delivery mode of Vitamin C does not have any influence on the tooth growth

```
dose <-ToothGrowth$dose
supply <- ToothGrowth$supp
len <- ToothGrowth$len
t.test(len[supply=="VC"],len[supply=="OJ"],paired = FALSE)

##
##  Welch Two Sample t-test
##
## data:  len[supply == "VC"] and len[supply == "OJ"]
## t = -1.9153, df = 55.309, p-value = 0.06063
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -7.5710156  0.1710156
## sample estimates:
## mean of x mean of y
##  16.96333  20.66333
```

This first test shows the following :

- The p-value is 0.06, i.e. nearly the significance level α = 0.05.
- So we do not reject the null hypothesis, but as 0.05≦ p-value ≦0.1, it is not clearly obvious that we can reject the null hypothesis.
- The confidence interval contains 0, so the test is not really significant.

Now let's try to test the influence of the dose on the tooth growth

```
t.test(len[dose==0.5],len[dose==1],paired = FALSE)
```

```
##
##  Welch Two Sample t-test
##
## data:  len[dose == 0.5] and len[dose == 1]
## t = -6.4766, df = 37.986, p-value = 1.268e-07
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -11.983781  -6.276219
## sample estimates:
## mean of x mean of y
##    10.605    19.735
```

This second test shows the following :

- The p-value is nearly 0 and hence we can reject H0
- The confidence interval doesn't contain 0

An identical conclusion can be taken comparing the length of dose = 1 and dose = 2. This could already be detected from the boxplot above.

Conclusion

- The dose of Vitamin C is clearly a factor of growth of the teeth.
- The delivery mode does not have much impact on the teeth growth.