Statistical Inference Peer Assessment Part 2 of 2

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Effect of different Viamin C delivery methods in guinea pig tooth growth

Overview

Dataset: The response is the length of odontoblasts (cells responsible for tooth growth) in 60 guinea pigs. Each animal received one of three dose levels of vitamin C (0.5, 1, and 2 mg/day) by one of two delivery methods, (orange juice or ascorbic acid (a form of vitamin C and coded as VC).

This part of the project I will - Load the ToothGrowth data and perform some basic exploratory data analyses - Provide a basic summary of the data. - Used confidence intervals and/or hypothesis tests to compare tooth growth by supp and dose. - State my conclusions and the assumptions needed for your conclusions.

Load libraries

```
data(ToothGrowth)
toothGrowth <- ToothGrowth
toothGrowth$dose <- as.numeric(toothGrowth$dose) # convert to factor
toothGrowth$len <- as.numeric(toothGrowth$len)
```

1.) Load ToothGrowth data

```
str(toothGrowth)
```

2.) Basic Summary of the data

```
## '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 ...
```

```
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
```

```
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
```

Create and average length for each dose, and suppliment

```
ATG <- aggregate(len~dose+supp,toothGrowth,mean)

  mytheme <- gridExtra::ttheme_default(
      core = list(fg_params=list(cex = 1.3)),
      colhead = list(fg_params=list(cex = 1.5)),
      rowhead = list(fg_params=list(cex = .5)))

  table <- gridExtra::tableGrob(ATG, theme = mytheme,rows = NULL)
  title <- textGrob("Supliment Dose/Tooth Growth",gp=gpar(fontsize=10,fontface="bold"))

  footnote <- textGrob(date() , x=0, hjust=0,
                       gp=gpar( fontface="italic",fontsize=5),just = 0)
  padding <- unit(.5,"line")
  table <- gtable_add_rows(table,
                           heights = grobHeight(title) + padding,
                           pos = 0)
  table <- gtable_add_rows(table,
                           heights = grobHeight(footnote)+padding)


  table <- gtable_add_grob(table, list(title,footnote),
                           t=c(1, nrow(table)), l=c(1,2),
                           r=ncol(table))


  grid.newpage()
  grid.draw(table)
```

Supliment Dose/Tooth Growth

dose	supp	len
0.5	OJ	13.23
1.0	OJ	22.70
2.0	OJ	26.06
0.5	VC	7.98
1.0	VC	16.77
2.0	VC	26.14

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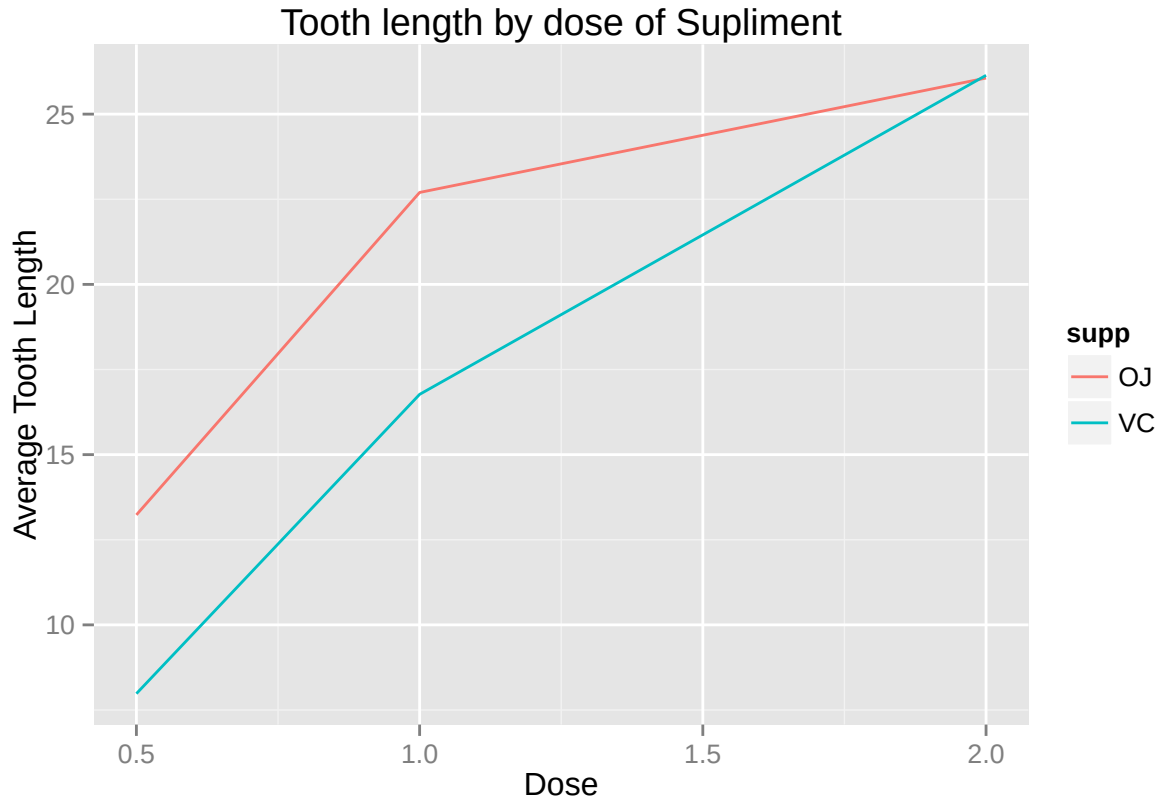
This is the result of the average tooth growth based on dose of supp.

```
ggplot(ATG, aes(x=dose,y=len,colour=supp),size=2) +
    geom_line() +
    ggtitle("Tooth length by dose of Supliment")+
    xlab("Dose")+
    ylab("Average Tooth Length")
```



3.) Use confidence intervals and/or hypothesis tests to compare tooth growth by supp and dose. (Only use the techniques from class, even if there's other approaches worth considering)

```
test1 <- t.test(len~supp, paired=F, var.equal=T, data=ToothGrowth[which(ToothGrowth$dose==.5),])
test2 <- t.test(len~supp, paired=F, var.equal=F, data=ToothGrowth[which(ToothGrowth$dose==.5),])


result <- data.frame("conf"=c(attr(test1$conf,"conf.level"),attr(test2$conf,"conf.level")),
                     "p_value"=c(test1$p.value, test2$p.value),
                     "conf_low"=c(test1$conf[1],test2$conf[1]),
                     "conf_high"=c(test1$conf[2],test2$conf[2]),
                      row.names=c("Equal Var","Unequal Var"))
plow <- min(result$p_value)
phigh <- max(result$p_value)
```

```
  mytheme <- gridExtra::ttheme_default(
      core = list(fg_params=list(cex = .8)),
      colhead = list(fg_params=list(cex = .8)),
      rowhead = list(fg_params=list(cex = .8)))

  table <- gridExtra::tableGrob(result, theme = mytheme)
  title <- textGrob("T Confidence Tests",gp=gpar(fontsize=20))

  footnote <- textGrob("Paired does not make sense in this test as the guinea pigs are supposedly diffe
```

```
                      gp=gpar( fontface="italic",fontsize=8))
padding <- unit(1,"line")
table <- gtable_add_rows(table,
                         heights = grobHeight(title) + padding,
                         pos = 0)
table <- gtable_add_rows(table,
                         heights = grobHeight(footnote)+padding)

table <- gtable_add_grob(table, list(title,footnote),
                         t=c(1, nrow(table)), l=c(1,2),
                         r=ncol(table))

grid.newpage()
grid.draw(table)
```

T Confidence Tests

	conf	p_value	conf_low	conf_high
Equal Var	0.95	0.00530366133992304	1.77026165483515	8.72973834516485
Unequal Var	0.95	0.00635860676409681	1.71905727146767	8.78094272853233

Paired does not make sense in this test as the guinea pigs are supposedly different.

4.) State your conclusions and the assumptions needed for your conclusions.

Conclusion

Based on the data provided, it can be stated that both VC, and OJ have beneficial results with regards to tooth length in guinea pigs with a p-Value of 0.0053037 to 0.0063586. However at smaller doses Orange Juice seems to have a greater impact than ascorbic acid. The difference in the delivery methods diminishes to 0 as doses increase. This is a blended test of all doses.

Assumptions: *There is a coorilation of tooth length in guinea pigs to vitamin C* This is a random sample of guinea pigs *60 is a large enough sample size