

Tooth Growth

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Synopsis

Below is an analysis of the dataset Toothgrowth: The Effect of Vitamin C on Tooth Growth in Guinea Pigs, as per the course project for Statistical Inference. Details of the data can be found here: <http://stat.ethz.ch/R-manual/R-devel/library/datasets/html/ToothGrowth.html> (<http://stat.ethz.ch/R-manual/R-devel/library/datasets/html/ToothGrowth.html>)

Data Processing

In order to maintain the 2 page maximum requirement for this assignment, underlying code has been suppressed in the output. The complete code can be found at [github](https://github.com/rlstober/StatisticalInferenceCP).

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Load the ToothGrowth data and perform some basic exploratory data analyses

The dataset consists of 60 observations of three variables; len, supp and dose. Len or length is the response variable, while supp or supplement and dose are explanatory factors.

```
## '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 ...
##  $ dose: Factor w/ 3 levels "0.5","1","2": 1 1 1 1 1 1 1 1 1 ...
```

Provide a basic summary of the data.

```
##      len      supp      dose
##  Min.   : 4.2    OJ:30    0.5:20
##  1st Qu.:13.1    VC:30    1  :20
##  Median :19.2           2  :20
##  Mean   :18.8
##  3rd Qu.:25.3
##  Max.   :33.9
```

Use confidence intervals and hypothesis tests to compare tooth growth by supp and dose.

Below is a table of the mean, standard deviation, and the low and high confidence intervals for each combination of supplement and dosage.

```
##      supp dose  mean stdDev lowCI highCI
## 1    OJ  0.5 13.23   4.46  4.49 21.97
## 2    OJ   1 22.70   3.91 15.04 30.36
## 3    OJ   2 26.06   2.66 20.85 31.27
## 4    VC  0.5  7.98   2.75  2.59 13.37
## 5    VC   1 16.77   2.52 11.83 21.71
## 6    VC   2 26.14   4.80 16.73 35.55
```

Below is one of the 9 t-tests performed. (Only one t-test output was displayed to save space.)

```
##
## Welch Two Sample t-test
##
## data:  len[supp == "OJ" & dose == 0.5] and len[supp == "VC" & dose == 0.5]
## t = 3.17, df = 14.97, p-value = 0.006359
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  1.719 8.781
## sample estimates:
## mean of x mean of y
##      13.23      7.98
```

Results

State your conclusions and the assumptions needed for your conclusions.

Results indicate that at tooth growth is higher at low dosages of Vitamin C when it is delivered with Orange juice versus delivery with ascorbic acid. At high dosages of Vitamin C, this effect appears to diminish.

This is seen in the t-test, where the null hypothesis is that there is no difference in tooth growth length between orange juice and ascorbic acid. The alternative hypothesis is that there is a difference. The low p-values for OJ at 0.5 and 1.0 mgs of Vitamin C compared to ascorbic acid (.006 and .001) are beyond the 95% confidence interval, so we reject the null hypothesis for those conditions. At a dosage of 2.0 mgs the p-value was .96 indicating no difference in the populations. In that case we fail to reject the null hypothesis.

We can also compare dosage levels for fixed supplement. (output not shown to save space). The null hypothesis is that for delivery with either orange juice or ascorbic acid, tooth growth is the same with different dosages of vitamin C. Under all conditions we see very low p-values, causing us to reject the null hypothesis.

Conclusions are based on the assumptions of normality of the underlying data and that randomization removed any confounding factors.