Assignment 7

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5/25/2022

The goal of this project is to investigate whether the choice between three methods of ventilation during anesthesia affect post-op blood folate levels. The three methods are

- 50% nitrous oxide and 50% oxygen, applied continuously for 24 hours;
- 50% nitrous oxide and 50% oxygen, only during the operation; and
- no nitrous oxide but 35%–50% oxygen continuously for 24 hours.

The task is to identify whether there is evidence for any of these methods being better or worse than others in this sense.

The null hypothesis states that there is no difference in blood folate levels for three methods of ventilation during anesthesia.

Preliminary testing for equality between the means of these groups, we can fit an ANOVA model:

We can inspect boxplots and a histogram of the data in order to check whether there are substantial violations of the equal variances and normality assumptions of the F-test that we will apply:

Distributions of Folate

Distribution of Residuals
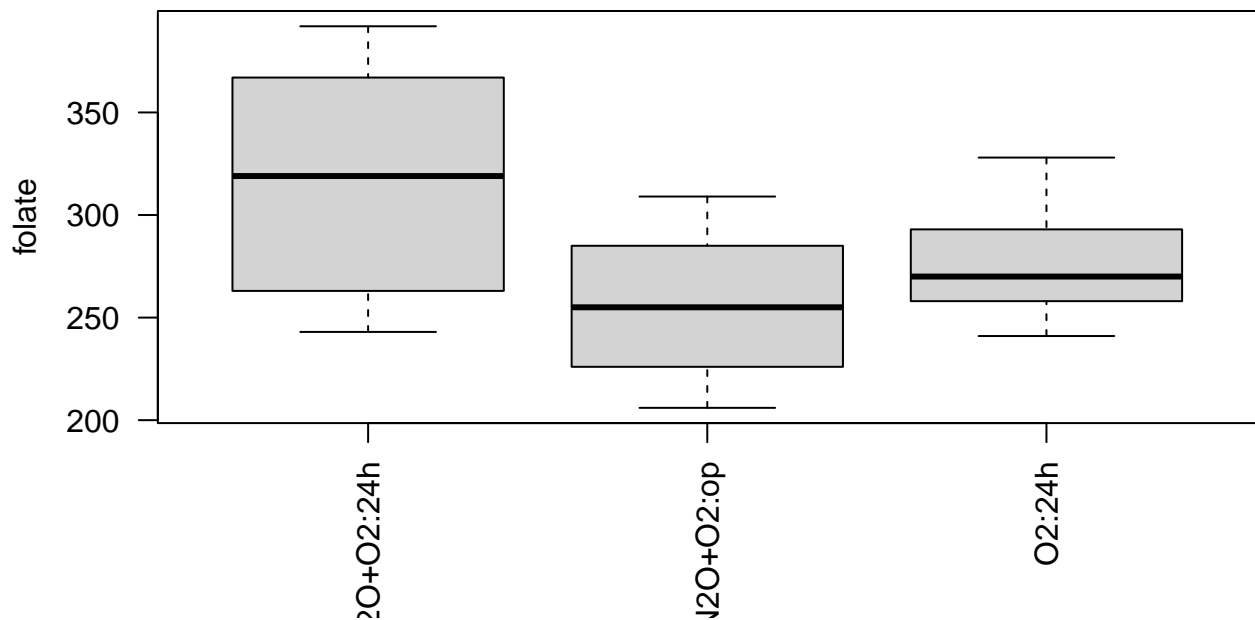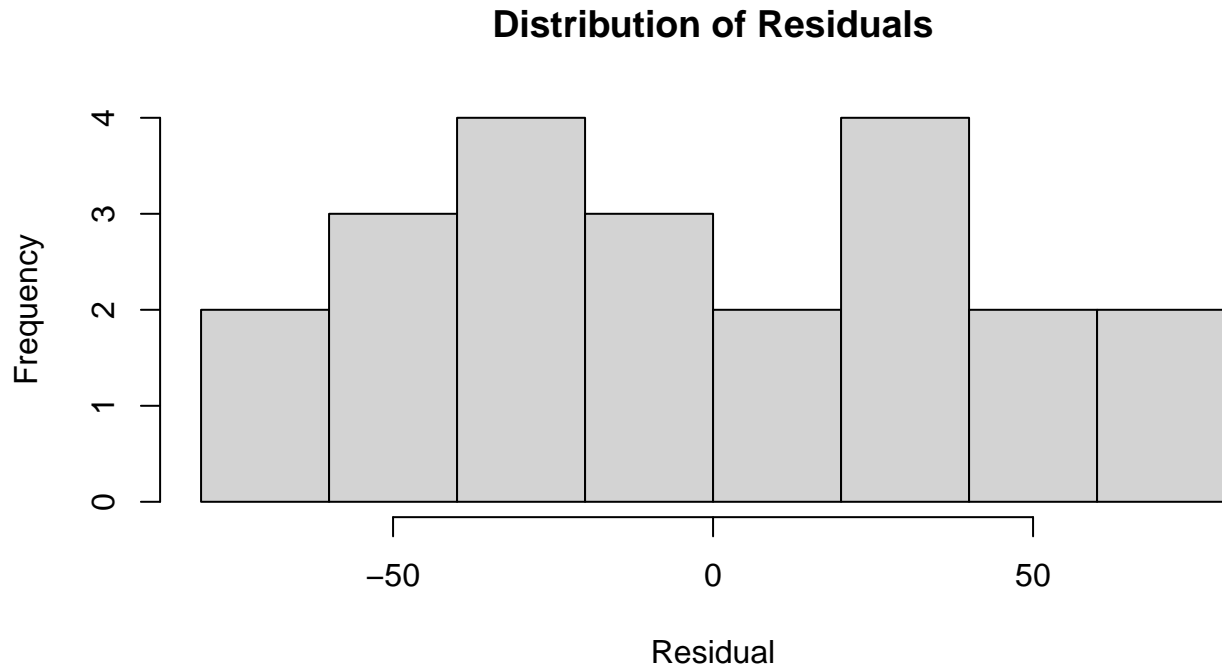
These do not vary to widely. The centers of two data elements appear to be close to each other, but one seems to differ from the rest. The histogram shows a slight right tail. The F-test is now performed.

```
## Analysis of Variance Table
##
## Response: folate
##             Df Sum Sq Mean Sq F value  Pr(>F)
## ventilation  2  15516  7757.9  3.7113 0.04359 *
## Residuals   19  39716  2090.3
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

The p-value obtained is 0.04359. Since we are using a significane level of 0.05, we reject the null hypothesis. Because we have found evidence that the groups are not all the same, let's perform a post-hoc analysis. To do so, we can use Tukey's Honestly Significant Difference procedure, with familywise error rate 0.05

95% family−wise confidence leve

Differences in mean levels of ventilation
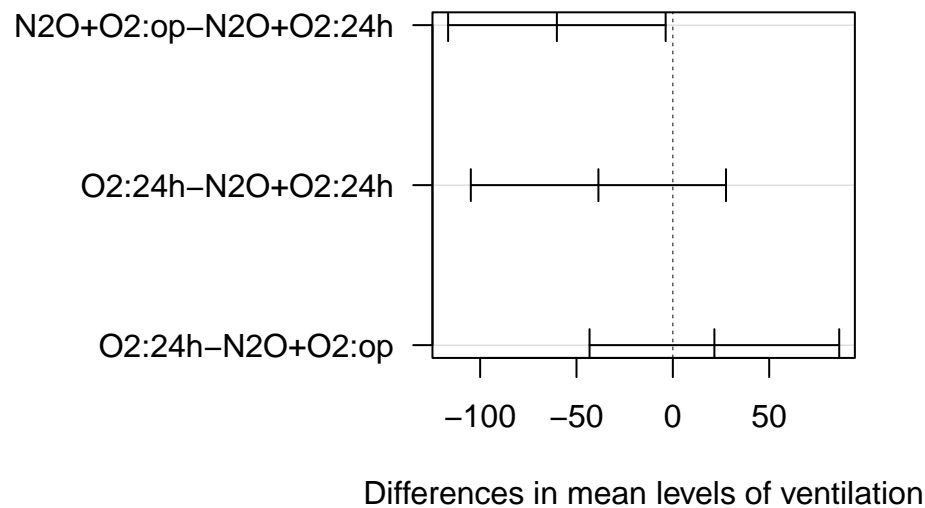
```
##    Tukey multiple comparisons of means
##      95% family-wise confidence level
##
## Fit: aov(formula = folate ~ ventilation, data = data2)
##
## $ventilation
##                          diff       lwr       upr      p adj
## N2O+O2:op-N2O+O2:24h -60.18056 -116.61904  -3.74207 0.0354792
## O2:24h-N2O+O2:24h    -38.62500 -104.84037  27.59037 0.3214767
## O2:24h-N2O+O2:op      21.55556  -43.22951  86.34062 0.6802018
```

Discussion of Results

By rejecting the null hypothesis we establish that there is a difference between the three methods of ventilation. N2O+O2:op has lower group mean than that of N2O+O2:24h. N2O+O2 is worse than others in this sense.

50% nitrous oxide and 50% oxygen, only during the operation results in the lowest post operation blood folate levels as evident by the largest difference in means. Thus it is worse than the other options.

Appendix

```
knitr::opts_chunk$set(echo = FALSE)
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data2 <- read.csv("http://www.stat.ucdavis.edu/~affarris/AnesthesiaVentilation.csv")
fittedModel2 <- aov(folate~ventilation, data = data2)
knitr::opts_chunk$set(echo = FALSE)
boxplot(folate ~ ventilation, data = data2,xlab="",las = 2, main = "Distributions of Folate")
#las = 2 makes vertical labels

hist(fittedModel2$residuals,ylab="Frequency",xlab="Residual",main="Distribution of Residuals")
knitr::opts_chunk$set(echo = FALSE)
anova(fittedModel2)

## Reject the null under alpha=0.05
knitr::opts_chunk$set(echo = FALSE)
par(mfrow=c(1,1))
tuky2 <- TukeyHSD(fittedModel2,
                  conf.level = 0.95
)
#so that labels don't get cut off we need to adjust the margins of the plot
#mar sets the margin sizes in the following order: bottom, left, top, and right.
par(mar=c(6,12,5,2))
plot(tuky2,
     las=1 ## horizontal labels
)
tuky2
```