241 Project (Summer 2017): Effect of Meditation on Blood Pressure

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```
library(data.table)
library(sandwich)
library(lmtest)
```

```
## Loading required package: zoo
```

```
##
## Attaching package: 'zoo'
```

```
## The following objects are masked from 'package:base':
##
##     as.Date, as.Date.numeric
```

Exploring data

```
d <- fread("../data/meditation.csv")
# Should be 30 subjects
nrow(d)
```

```
## [1] 30
```

```
str(d)
```

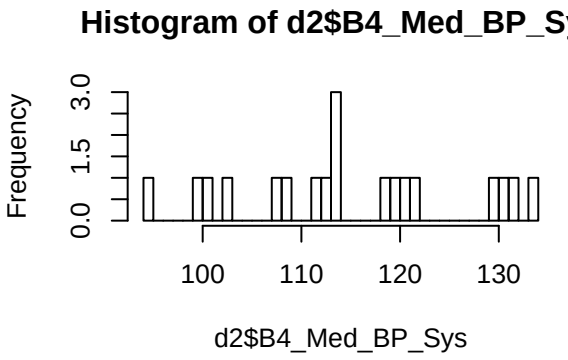
```
## Classes 'data.table' and 'data.frame':   30 obs. of  31 variables:
##  $ ID                                : int  1 2 3 4 5 6 7 8 9 10 ...
##  $ Group                             : int  0 1 0 1 0 1 0 1 0 0 ...
##  $ Name                              : chr  "Sundell, Jenna" "Hanni, Karin" "Roe, Brian" "Aboud, Juli
##  $ Recruited_By                      : chr  "Erika" "Erika" "Erika" "Erika" ...
##  $ Location                          : chr  "San Diego, CA" "Bellingham, WA" "Lopez Island, WA" "San
##  $ Age_Group                         : chr  "40-49" "40-49" "50-59" "50-59" ...
##  $ Gender                            : chr  "F" "F" "M" "F" ...
##  $ Religion                          : chr  "Buddhist" "Buddhist" "Buddhist" "Spiritual" ...
##  $ Pre_existing_blood_pressure       : chr  "Low" "Avg" "Avg" "Low" ...
##  $ Years_practice                    : int  25 10 45 47 24 0 0 0 0 2 ...
##  $ coffee_cups                       : chr  "1/2" "" "2" "1" ...
##  $ hours_since_last_caffeinated_drink: int  6 NA 6 3 5 1 6 6 NA 2 ...
##  $ Online_in_person                  : chr  "0" "" "0" "0" ...
##  $ Experiment_Date                   : chr  "7/25/2017" "8/2/2017" "7/23/2017" "7/23/2017" ...
##  $ Start_Time                        : chr  "3:00 PM" "" "7:45 PM" "1:30 PM" ...
##  $ previous_strenuous_activity       : chr  "Yes" "" "Yes" "Maybe (walking)" ...
##  $ Before_Meditation_how_relaxed     : chr  "a little tense" "" "relaxed" "relaxed" ...
##  $ B4_Med_BP_Sys                     : int  112 NA 114 134 119 131 108 130 NA 114 ...
##  $ B4_Med_BP_DIA                     : int  71 NA 70 97 81 92 69 88 NA 78 ...
##  $ B4_Med_BP_PUL                     : int  55 NA 78 97 75 76 71 71 NA 81 ...
##  $ After_Med_BP_Sys                  : int  96 NA 122 108 121 125 111 121 NA 96 ...
##  $ After_Med_BP_DIA                  : int  59 NA 73 71 81 88 70 77 NA 62 ...
##  $ After_Med_BP_PUL                  : int  59 NA 85 95 79 76 64 68 NA 79 ...
```

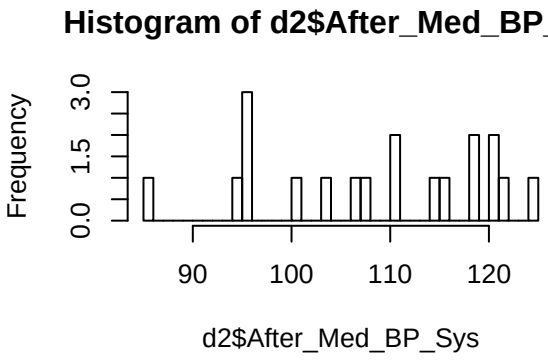
```
##  $ Post_Med_focus                    : int  4 NA 4 3 4 3 4 4 NA 3 ...
##  $ B4_color_BP_Sys                   : int  108 NA 123 121 124 128 111 131 NA 116 ...
##  $ B4_color_BP_DIA                   : int  64 NA 64 91 79 89 70 93 NA 81 ...
##  $ B4_color_BP_Pul                   : int  54 NA 79 100 77 79 63 74 NA 85 ...
##  $ After_color_BP_Sys                : int  94 NA 109 113 116 130 110 128 NA 111 ...
##  $ After_color_BP_DIA                : int  64 NA 69 75 65 92 72 87 NA 75 ...
##  $ After_color_BP_Pul                : int  59 NA 83 93 82 72 68 74 NA 77 ...
##  $ Enjoy_Coloring                    : int  2 NA 4 5 4 2 4 4 NA 4 ...
##  - attr(*, ".internal.selfref")=<externalptr>
```

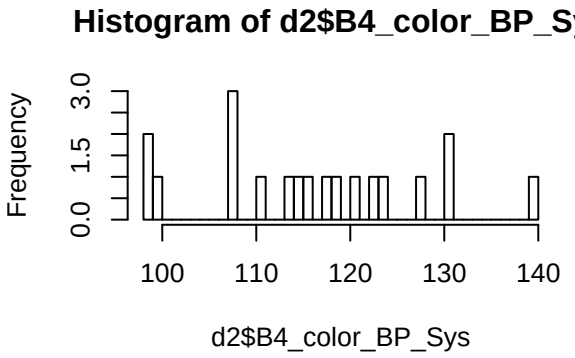
```
d <- data.table(d)
# Reverse group number: 1 is meditation first (treatment), 0 is coloring 1st
d2 <- d[ , .(Group = ifelse(Group == 0, 1, 0),
             is_online = ifelse(Online_in_person == 'O', 1, 0),
             B4_Med_BP_Sys,
             After_Med_BP_Sys,
             B4_color_BP_Sys,
             After_color_BP_Sys) ]
summary(d2)
```

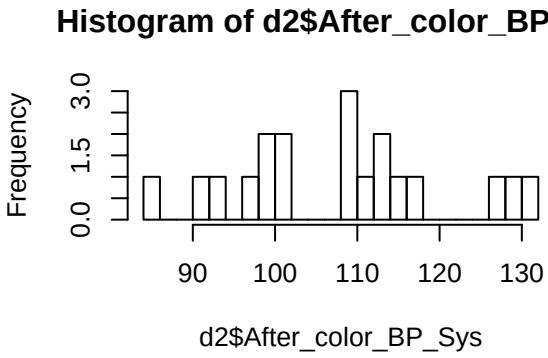
```
##      Group       is_online      B4_Med_BP_Sys   After_Med_BP_Sys
##  Min.   :0.0   Min.   :0.0000   Min.   : 94.0   Min.   : 85.0
##  1st Qu.:0.0   1st Qu.:0.0000   1st Qu.:108.5   1st Qu.: 98.5
##  Median :0.5   Median :0.0000   Median :114.0   Median :111.0
##  Mean   :0.5   Mean   :0.2333   Mean   :115.3   Mean   :108.8
##  3rd Qu.:1.0   3rd Qu.:0.0000   3rd Qu.:121.5   3rd Qu.:119.0
##  Max.   :1.0   Max.   :1.0000   Max.   :134.0   Max.   :125.0
##                                 NA's   :11      NA's   :11
##  B4_color_BP_Sys After_color_BP_Sys
##  Min.   : 98.0   Min.   : 85.0
##  1st Qu.:108.0   1st Qu.: 99.0
##  Median :116.0   Median :109.0
##  Mean   :116.4   Mean   :108.2
##  3rd Qu.:123.5   3rd Qu.:114.5
##  Max.   :140.0   Max.   :131.0
##  NA's   :11      NA's   :11
```

```
#hist(d2$Group)
#hist(d2$is_online, breaks=30)
par(mfrow=c(2,2))
hist(d2$B4_Med_BP_Sys, breaks = 30)
hist(d2$After_Med_BP_Sys, breaks = 30)
hist(d2$B4_color_BP_Sys, breaks = 30)
hist(d2$After_color_BP_Sys, breaks = 30)
```

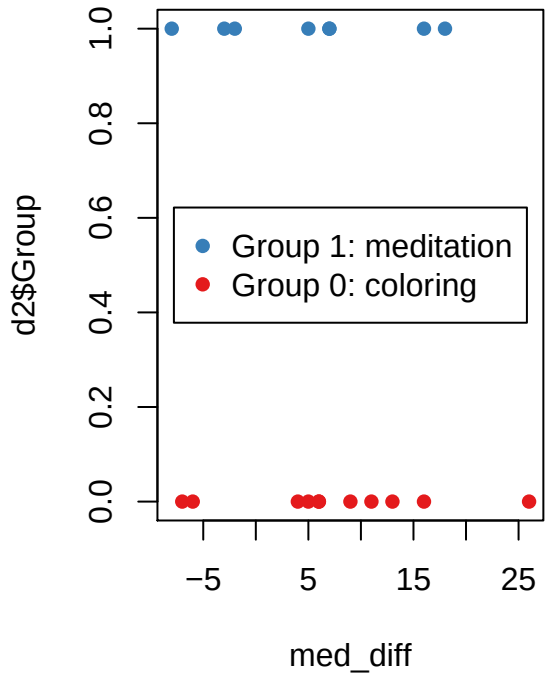


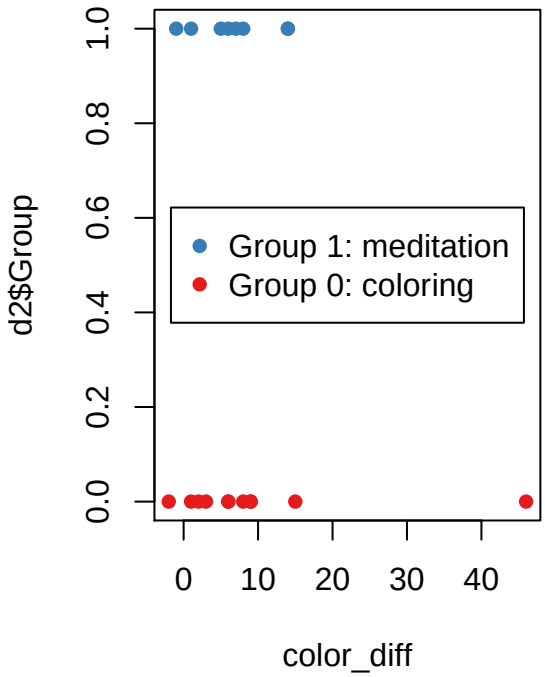






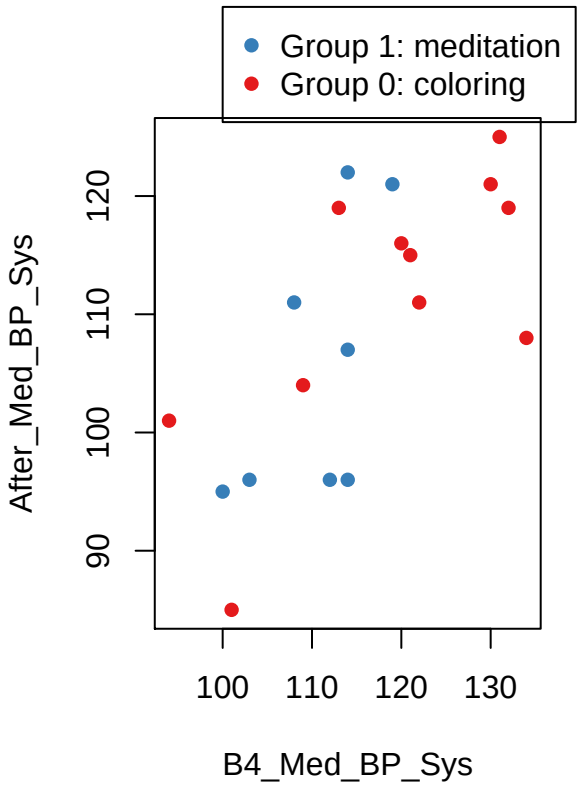

```r
library(RColorBrewer)
#display.brewer.all()
cols<-brewer.pal(n=3,name="Set1")
# Note: Group 0 is treatment group!
cols_t1<-cols[d2$Group+1]
med_diff <- d2$B4_Med_BP_Sys - d2$After_Med_BP_Sys
color_diff <-  d2$B4_color_BP_Sys - d2$After_color_BP_Sys
par(mfrow =c(1,2))
plot(d2$Group ~ med_diff , col=cols_t1, pch=16)
legend("center",legend=c("Group 1: meditation", "Group 0: coloring"), col=cols_t1, pch=16)
plot(d2$Group ~ color_diff , col=cols_t1, pch=16)
legend("center",legend=c("Group 1: meditation", "Group 0: coloring"), col=cols_t1, pch=16)
```

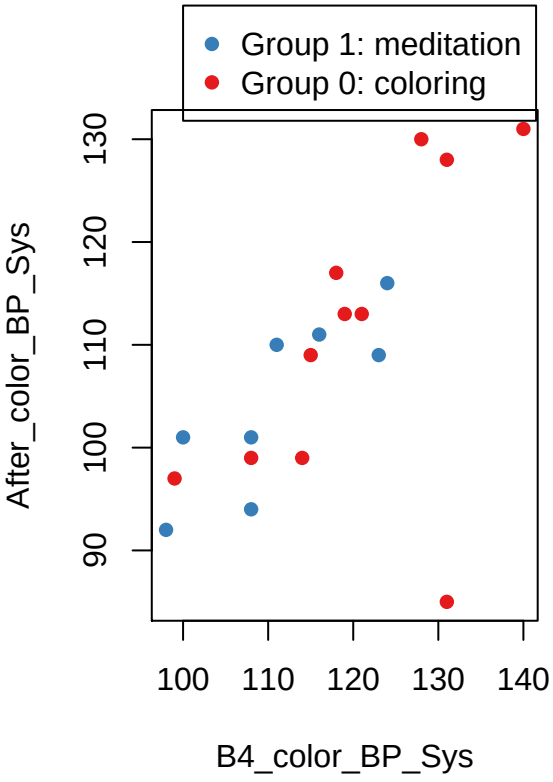





```
# Plot b4 vs after meditation for 2 groups
plot(After_Med_BP_Sys ~ B4_Med_BP_Sys, data=d2 , col=cols_t1, pch=16)
legend(x=100,y=136, legend=c("Group 1: meditation", "Group 0: coloring"), col=cols_t1, pch=16, xpd=TRUE)

# Plot b4 vs after coloring for 2 groups
plot(After_color_BP_Sys ~ B4_color_BP_Sys, data=d2 , col=cols_t1, pch=16)
legend(x=100,y=143, legend=c("Group 1: meditation", "Group 0: coloring"), col=cols_t1, pch=16, xpd=TRUE)
```





Linear Regression model with difference-in-difference Estimate

Coloring first (group 0): placebo

Meditation first (group 1): treatment

```
m <- lm(After_Med_BP_Sys ~ B4_Med_BP_Sys + Group + B4_Med_BP_Sys * Group, data=d2)
coeftest(m, vcovHC(m))
```

```
##
## t test of coefficients:
##
##                      Estimate Std. Error t value Pr(>|t|)
## (Intercept)          37.55064   36.09681  1.0403  0.31469
## B4_Med_BP_Sys         0.62046    0.29415  2.1093  0.05213 .
## Group               -54.61226   57.51046 -0.9496  0.35736
## B4_Med_BP_Sys:Group   0.48869    0.51903  0.9416  0.36134
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
m2 <- lm(After_color_BP_Sys ~ B4_color_BP_Sys + Group + B4_color_BP_Sys * Group, data=d2)
coeftest(m2, vcovHC(m2))
```

```
##
## t test of coefficients:
##
##                       Estimate Std. Error t value Pr(>|t|)
## (Intercept)           25.732342  41.441559  0.6209  0.54397
## B4_color_BP_Sys        0.708417   0.376071  1.8837  0.07914 .
## Group                 -3.787295  47.679638 -0.0794  0.93774
## B4_color_BP_Sys:Group  0.033069   0.430090  0.0769  0.93973
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```