# 20230325_NEAREPORT_ZC

2023-03-25

# SET UP

```
# load packages
library(tidyverse) #data wrangling
```

```
## Warning: package 'tidyverse' was built under R version 4.1.3
```

```
## -- Attaching packages --------------------------------------- tidyverse 1.3.2 --
## v ggplot2 3.3.5      v purrr   0.3.4
## v tibble  3.1.8      v dplyr   1.0.10
## v tidyr   1.2.1      v stringr 1.4.0
## v readr   2.1.3      v forcats 0.5.1
```

```
## Warning: package 'tibble' was built under R version 4.1.3
```

```
## Warning: package 'tidyr' was built under R version 4.1.3
```

```
## Warning: package 'readr' was built under R version 4.1.3
```

```
## Warning: package 'dplyr' was built under R version 4.1.3
```

```
## -- Conflicts ------------------------------------------ tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()
```

```
library(dplyr) # data wrangling
library(ggpubr) # plotting
library(readr) # read_csv
library(psych) # psych statistics - MSSD
```

```
## Warning: package 'psych' was built under R version 4.1.3
```

```
##
## Attaching package: 'psych'
##
## The following objects are masked from 'package:ggplot2':
##
##     %+%, alpha
```

```
library(lme4) # mixed models
```

```
## Loading required package: Matrix
##
## Attaching package: 'Matrix'
##
## The following objects are masked from 'package:tidyr':
##
##     expand, pack, unpack
```

```
library(rstatix) #outlier() function
```

```
##
## Attaching package: 'rstatix'
##
## The following object is masked from 'package:stats':
##
##     filter
```

```
library(MASS) #boxcox function
```

```
##
## Attaching package: 'MASS'
##
## The following object is masked from 'package:rstatix':
##
##     select
##
## The following object is masked from 'package:dplyr':
##
##     select
```

```
library(effectsize) #effect size functions
```

```
## Registered S3 methods overwritten by 'parameters':
##   method                           from
##   as.double.parameters_kurtosis    datawizard
##   as.double.parameters_skewness    datawizard
##   as.double.parameters_smoothness  datawizard
##   as.numeric.parameters_kurtosis   datawizard
##   as.numeric.parameters_skewness   datawizard
##   as.numeric.parameters_smoothness datawizard
##   print.parameters_distribution    datawizard
##   print.parameters_kurtosis        datawizard
##   print.parameters_skewness        datawizard
##   summary.parameters_kurtosis      datawizard
##   summary.parameters_skewness      datawizard
##
## Attaching package: 'effectsize'
##
## The following objects are masked from 'package:rstatix':
##
##     cohens_d, eta_squared
##
## The following object is masked from 'package:psych':
##
##     phi
```

```
library(lubridate) #time variables
```

```
## Warning: package 'lubridate' was built under R version 4.1.3
```

```
##
## Attaching package: 'lubridate'
##
## The following objects are masked from 'package:base':
##
##     date, intersect, setdiff, union
```

# OUTCOME MEAURES

```
# load datasets
filename <- "20230325_phase2data.csv"
outcomedata <- read_csv(filename)
```

```
## Rows: 108 Columns: 9
## -- Column specification --------------------------------------------------------
## Delimiter: ","
## chr (1): event
## dbl (8): id, group, ryff, pss, bdi, bai, fmqi, cerq
##
## i Use `spec()` to retrieve the full column specification for this data.
## i Specify the column types or set `show_col_types = FALSE` to quiet this message.
```

Coded Variables ** Event ** 1 - Baseline 2 - Post 3 - Followup

** Group ** 0 - Control 1 - Treatment

```
outcomedata <- filter(outcomedata, group != "2") # remove Group

outcomedata$id <- factor(outcomedata$id)
outcomedata$event <- factor(outcomedata$event, labels = c("baseline", "post", "followup"))
outcomedata$group <- factor(outcomedata$group, labels = c("control", "treatment"))

view(outcomedata)
```

# Descriptive Statistics

## Mean (SD) Table

```
describe(outcomedata[,4:9])
```

```
##      vars  n  mean    sd median trimmed   mad min max range  skew kurtosis   se
## ryff    1 94 71.39 14.44   73.0   71.79 16.31  24 100    76 -0.39     0.01 1.49
## pss     2 94 21.00  5.80   21.0   20.99  6.67   4  33    29 -0.11    -0.34 0.60
## bdi     3 94 16.13  9.64   15.0   15.16  8.15   1  43    42  0.87     0.33 0.99
## bai     4 94 12.97  8.91   10.5   12.03  8.15   0  42    42  1.00     0.62 0.92
## fmqi    5 94 32.89  6.90   32.0   32.62  7.41  15  50    35  0.31    -0.33 0.71
## cerq    6 93 12.55  3.75   12.0   12.41  4.45   4  20    16  0.18    -0.99 0.39
```

```
#baseline statistics
outcomedata_baseline <- filter(outcomedata, event == "baseline")

outcomedata_baseline %>%
  group_by(group)%>%
  get_summary_stats(type = "mean_sd")
```

```
## # A tibble: 12 x 5
##    group     variable     n  mean    sd
##    <fct>     <chr>    <dbl> <dbl> <dbl>
##  1 control   bai         16  13.7  9.41
##  2 control   bdi         16  17.2  7.81
##  3 control   cerq        16  12.2  3.89
##  4 control   fmqi        16  31.9  6.26
##  5 control   pss         16  21.3  4.64
##  6 control   ryff        16  68.7 14.0
##  7 treatment bai         17  14   10.3
##  8 treatment bdi         17  19.9  9.70
##  9 treatment cerq        17  12    4.03
## 10 treatment fmqi        17  30.1  7.36
## 11 treatment pss         17  22.5  5.70
## 12 treatment ryff        17  67.5 16.3
```

```
outcomedata_baseline%>%
  get_summary_stats(type = "mean_sd")
```

```
## # A tibble: 6 x 4
##   variable     n  mean    sd
##   <chr>    <dbl> <dbl> <dbl>
## 1 bai         33  13.8  9.74
## 2 bdi         33  18.6  8.81
## 3 cerq        33  12.1  3.90
## 4 fmqi        33  30.9  6.80
## 5 pss         33  21.9  5.17
## 6 ryff        33  68.1 15.0
```

```
#BDI clinical significance (score >= 20)
bdi_wlc_sig <- which(outcomedata_baseline$bdi >=20 & outcomedata_baseline$group == 0) #wlc group
bdi_wlc_n <- length(bdi_wlc_sig)
bdi_wlc_perc <- (bdi_wlc_n/16) * 100
bdi_wlc_perc
```

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

```
bdi_ie_sig <- which(outcomedata_baseline$bdi >=20 & outcomedata_baseline$group == 1) #ie group
bdi_ie_n <- length(bdi_ie_sig)
bdi_ie_perc <- (bdi_ie_n/17) * 100
bdi_ie_perc
```

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

```
((bdi_wlc_n + bdi_ie_n)/33)*100 #total
```

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

```
#BAI clinical significance (score >= 16)
bai_wlc_sig <- which(outcomedata_baseline$bai >=16 & outcomedata_baseline$group == 0) #wlc group
bai_wlc_n <- length(bai_wlc_sig)
bai_wlc_perc <- (bai_wlc_n/16) * 100
bai_wlc_perc
```

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

```
bai_ie_sig <- which(outcomedata_baseline$bai >=16 & outcomedata_baseline$group == 1) #ie group
bai_ie_n <- length(bai_ie_sig)
bai_ie_perc <- (bai_ie_n/17) * 100
bai_ie_perc
```

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

```
((bai_wlc_n + bai_ie_n)/33)*100 #total
```

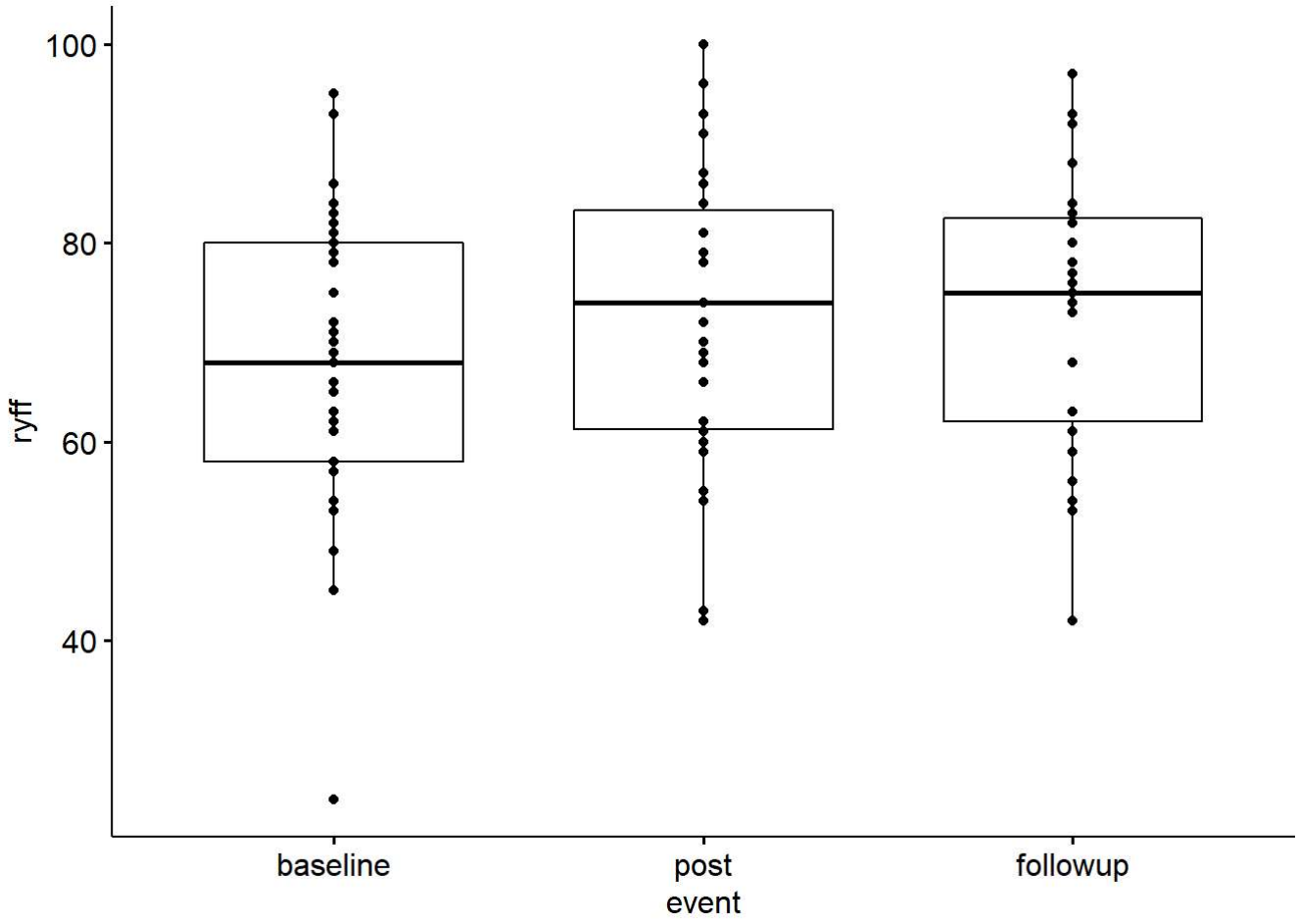
```
## [1] 0
```

# Normality & Distributions

```
#create boxplots
bxp_ryff <- ggboxplot(outcomedata, x = "event", y = "ryff", add = "point")
bxp_ryff
```

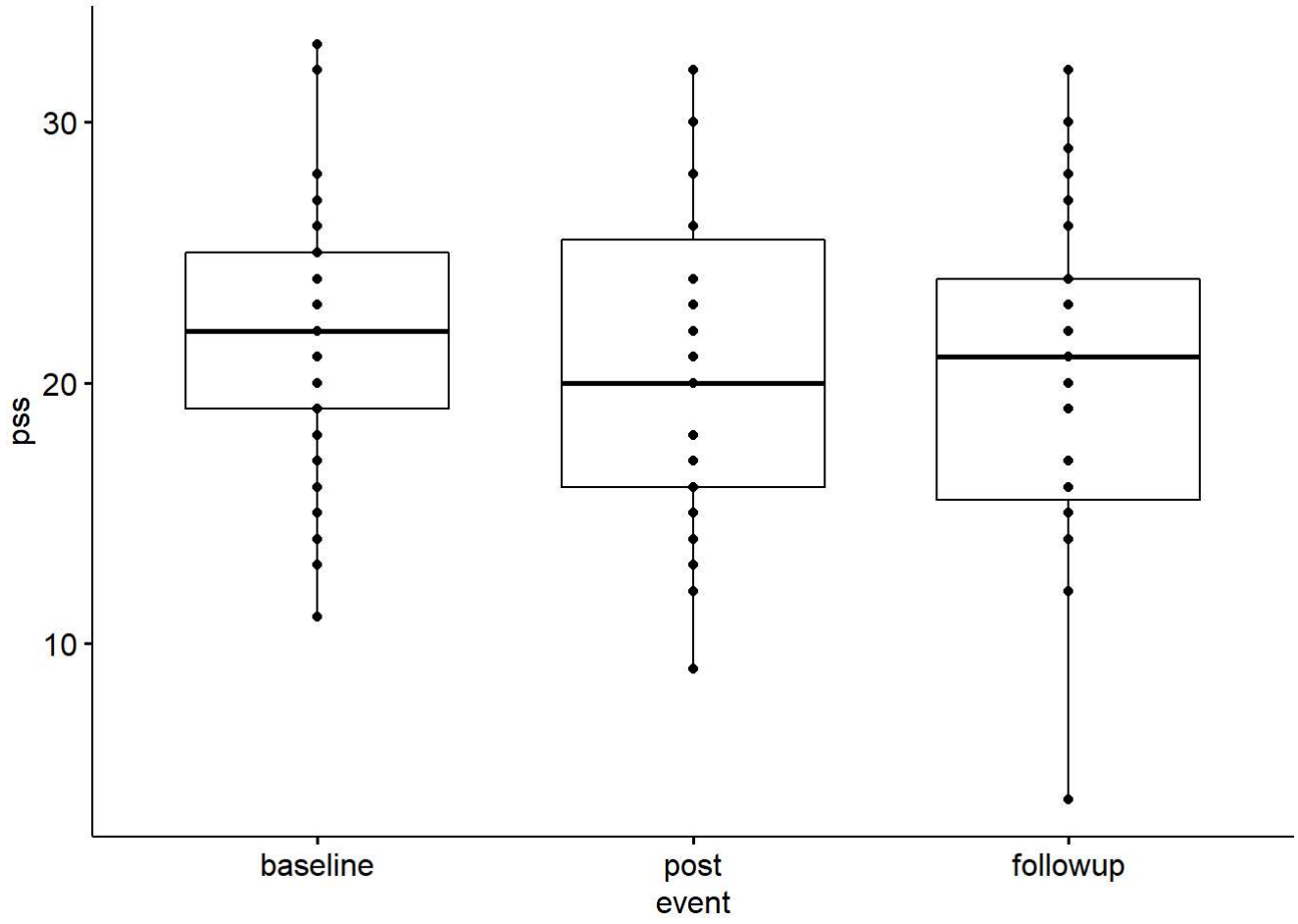
```
## Warning: Removed 5 rows containing non-finite values (stat_boxplot).
```

```
## Warning: Removed 5 rows containing missing values (geom_point).
```



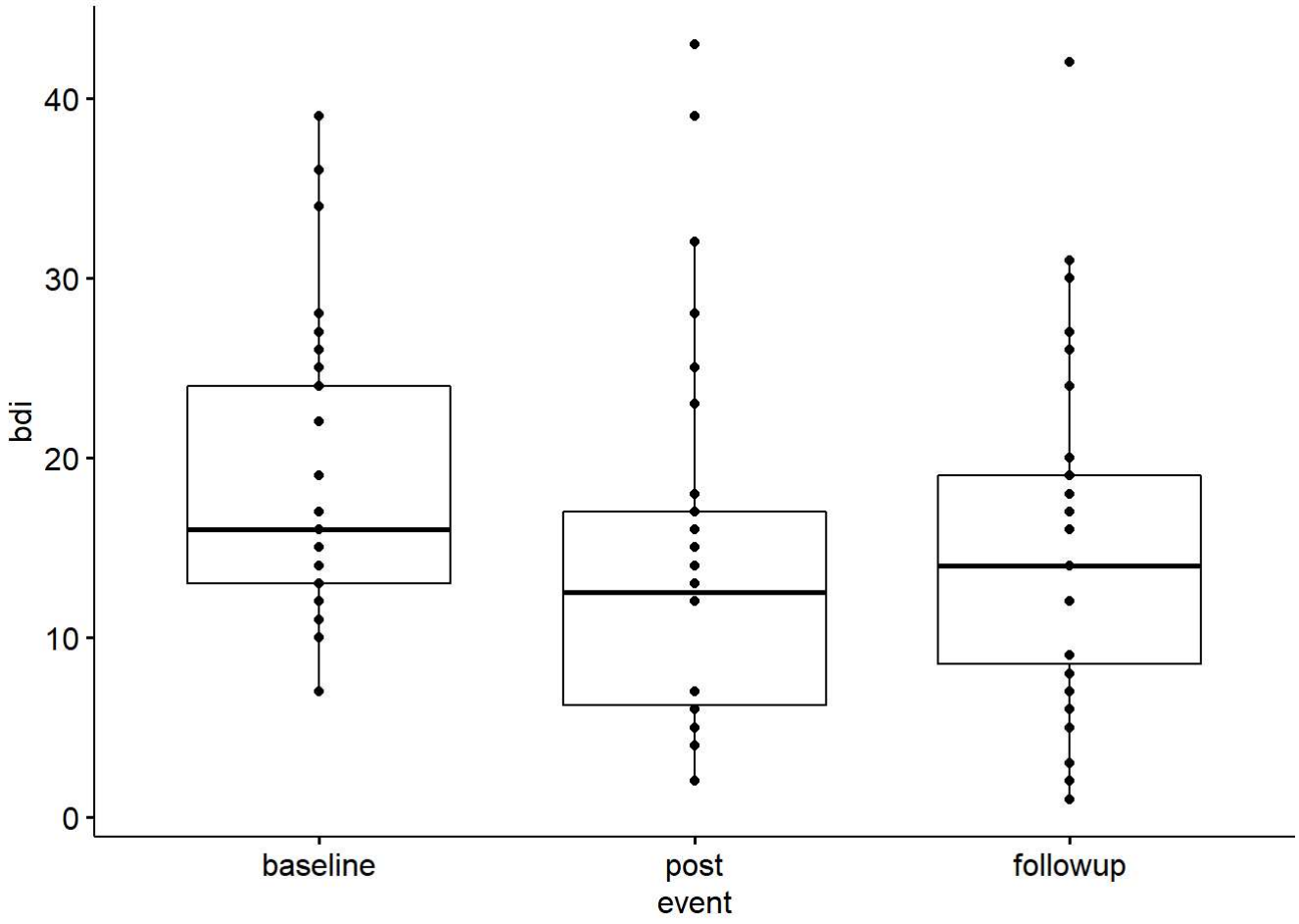

```
bxp_pss <- ggboxplot(outcomedata, x = "event", y = "pss", add = "point")
bxp_pss
```

```
## Warning: Removed 5 rows containing non-finite values (stat_boxplot).
## Removed 5 rows containing missing values (geom_point).
```



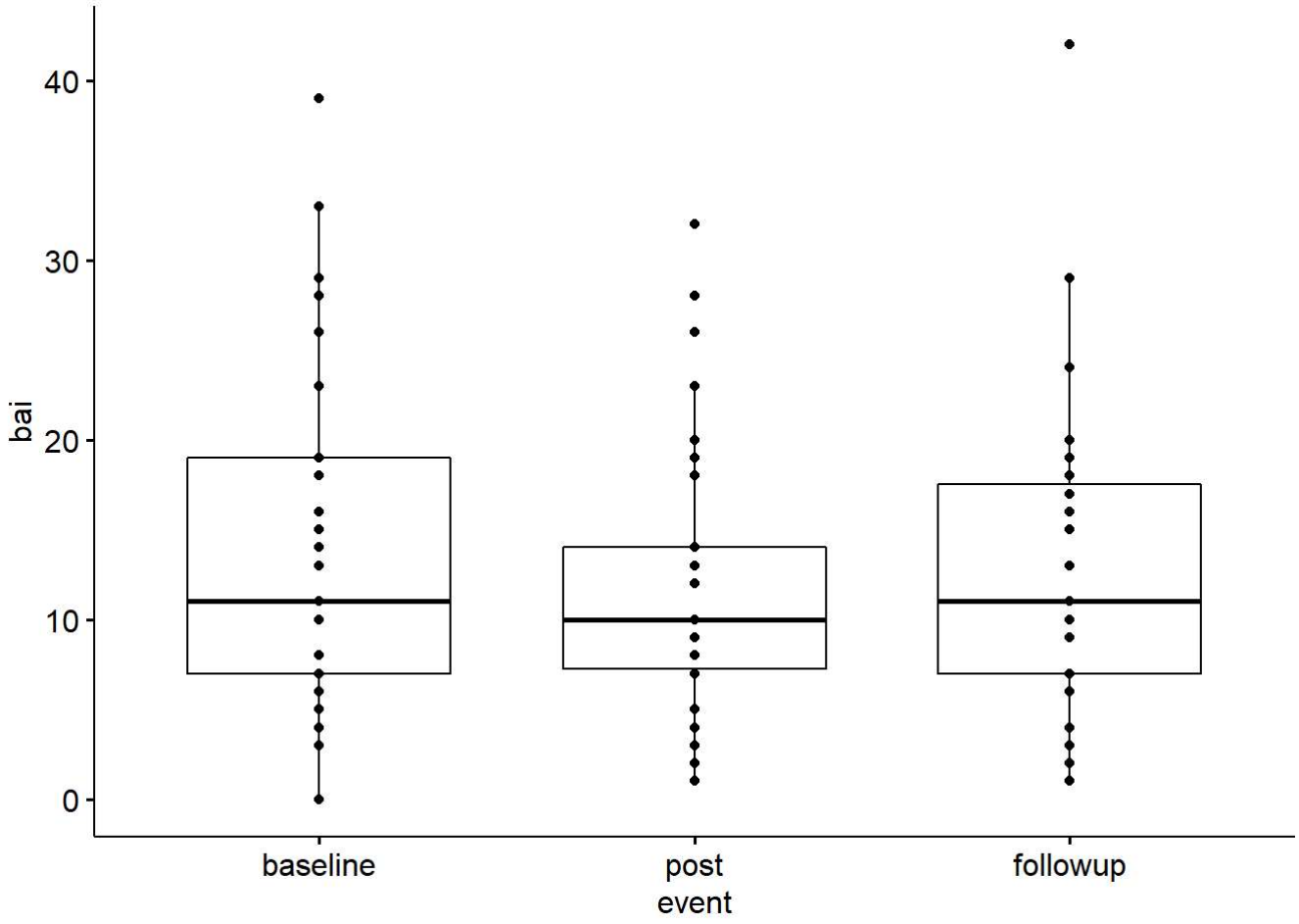

```
bxp_bdi <- ggboxplot(outcomedata, x = "event", y = "bdi", add = "point")
bxp_bdi
```

```
## Warning: Removed 5 rows containing non-finite values (stat_boxplot).
## Removed 5 rows containing missing values (geom_point).
```



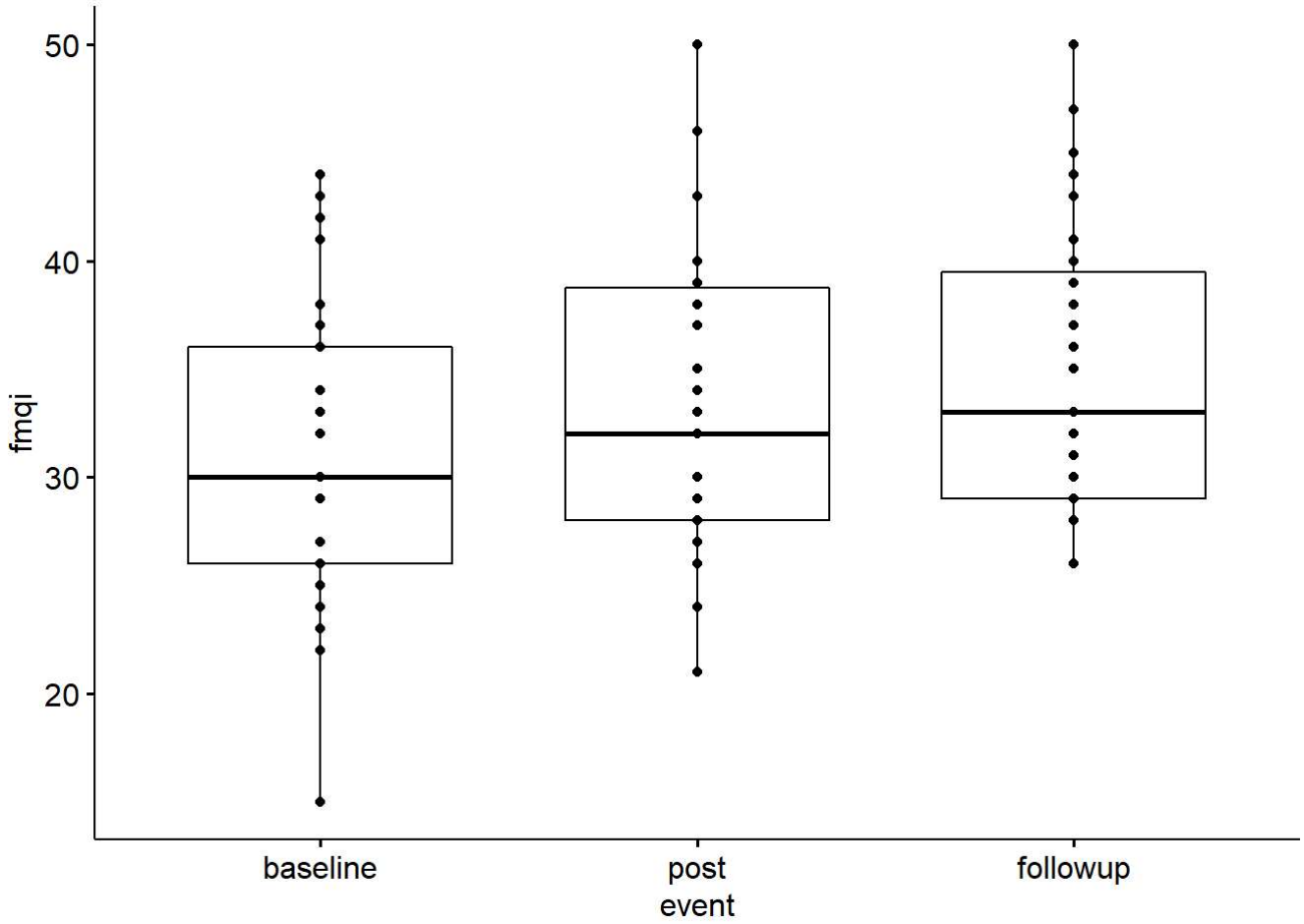

```
bxp_bai <- ggboxplot(outcomedata, x = "event", y = "bai", add = "point")
bxp_bai
```

```
## Warning: Removed 5 rows containing non-finite values (stat_boxplot).
## Removed 5 rows containing missing values (geom_point).
```




```
bxp_mi <- ggboxplot(outcomedata, x = "event", y = "fmqi", add = "point")
bxp_mi
```

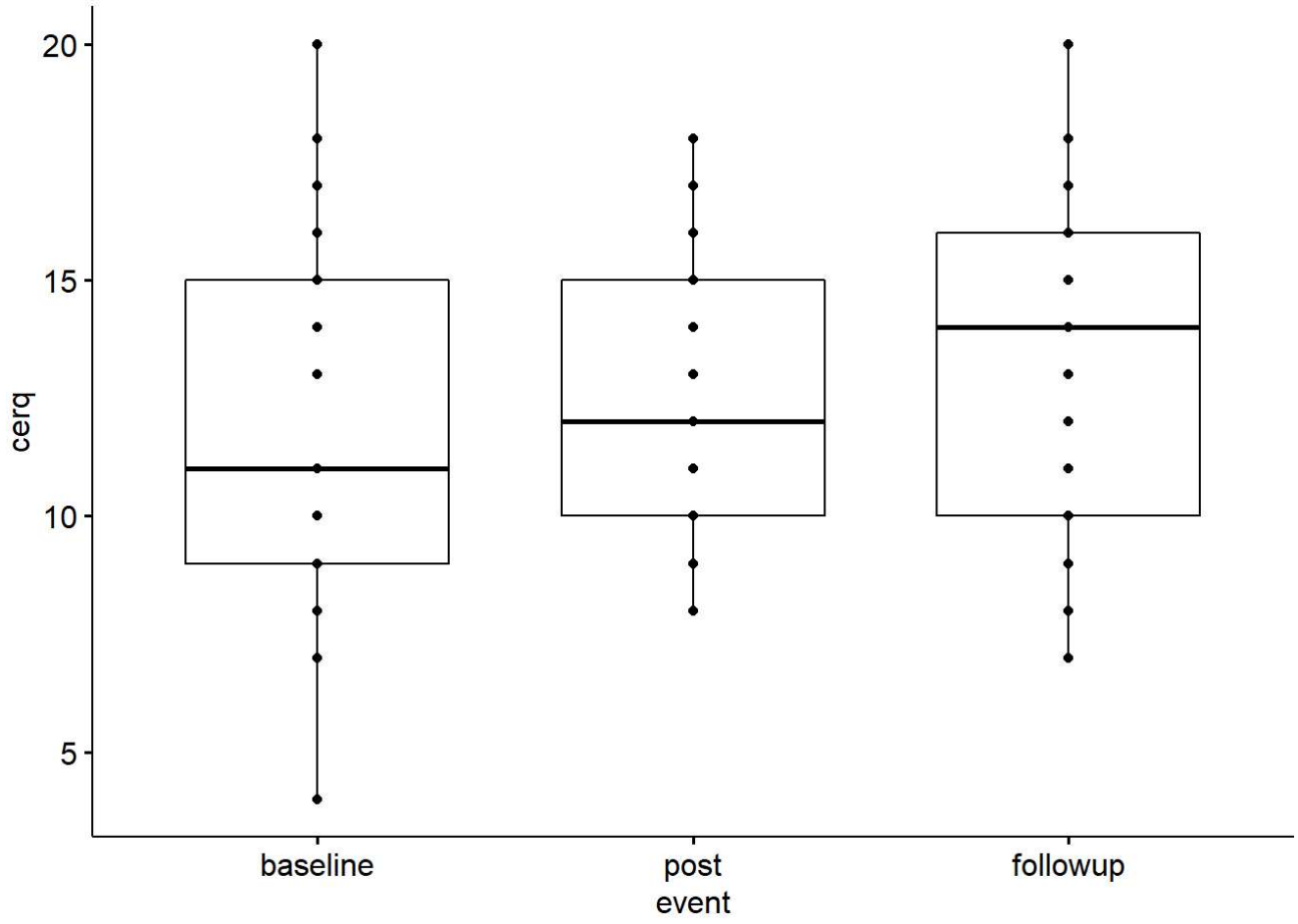
```
## Warning: Removed 5 rows containing non-finite values (stat_boxplot).
## Removed 5 rows containing missing values (geom_point).
```




```
bxp_cerq <- ggboxplot(outcomedata, x = "event", y = "cerq", add = "point")
bxp_cerq
```

```
## Warning: Removed 6 rows containing non-finite values (stat_boxplot).
```

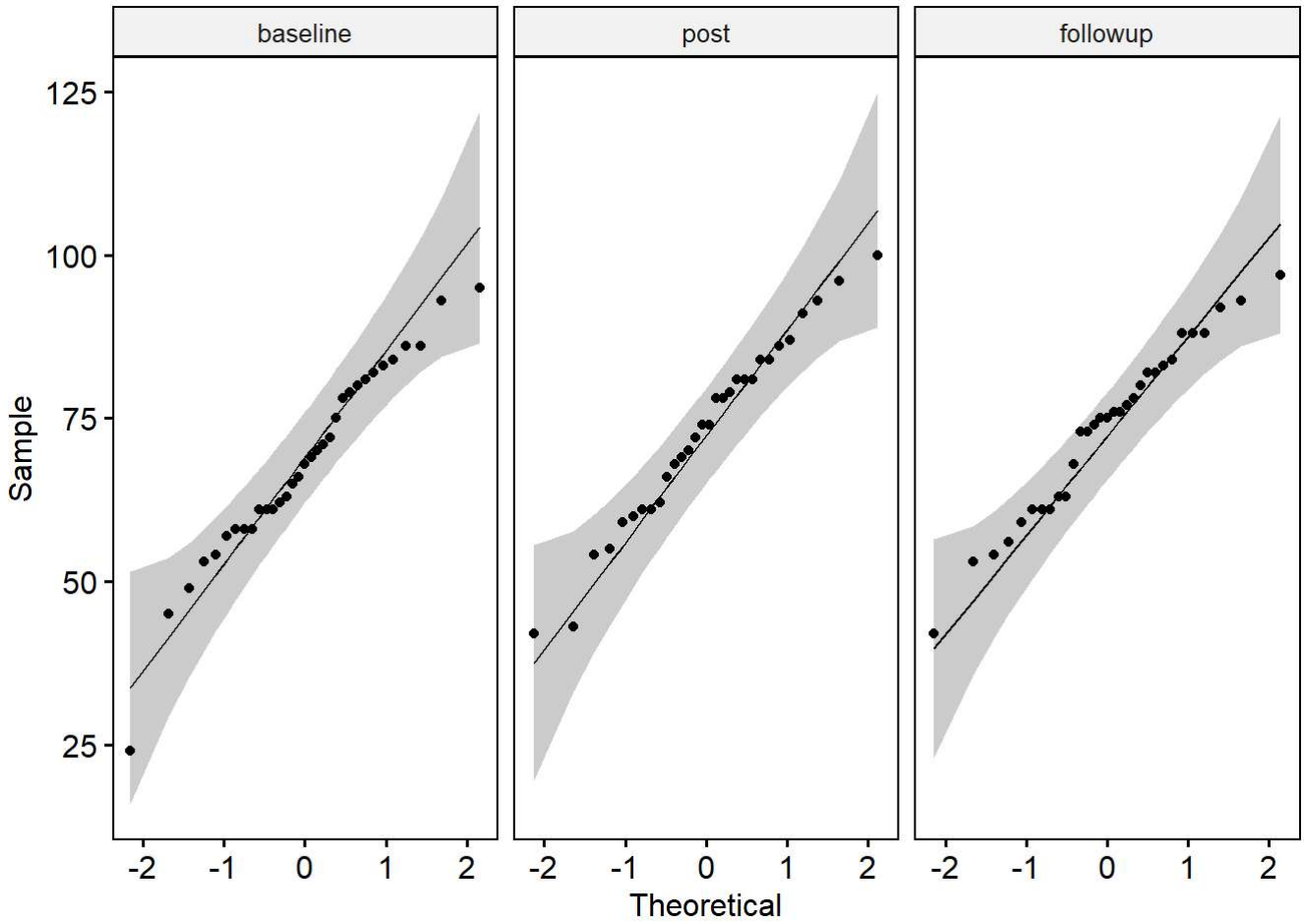
```
## Warning: Removed 6 rows containing missing values (geom_point).
```




```
#create qq plots
qq_ryff <- ggqqplot(outcomedata, "ryff", facet.by = "event")
qq_ryff
```

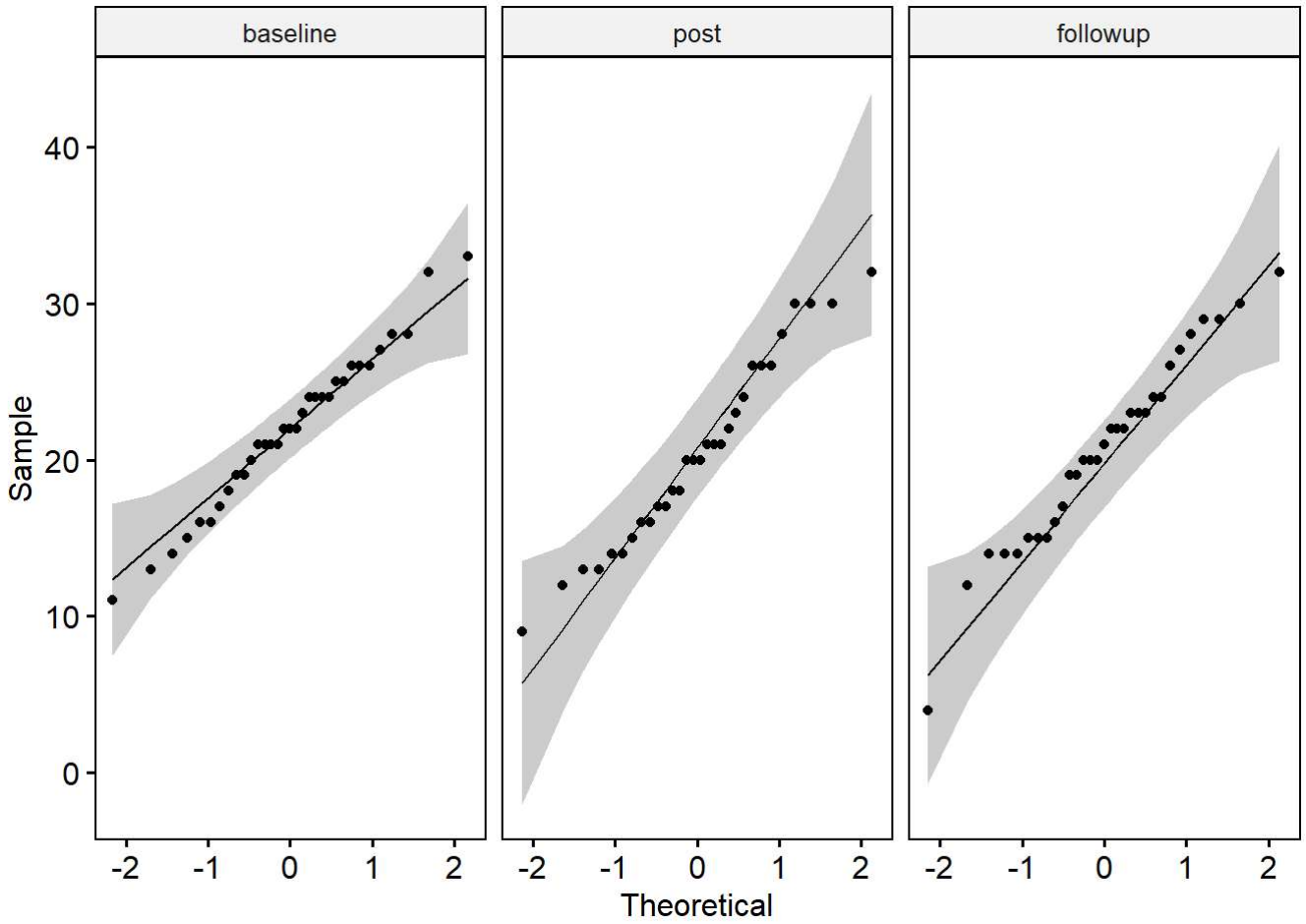
```
## Warning: Removed 5 rows containing non-finite values (stat_qq).
```

```
## Warning: Removed 5 rows containing non-finite values (stat_qq_line).
## Removed 5 rows containing non-finite values (stat_qq_line).
```



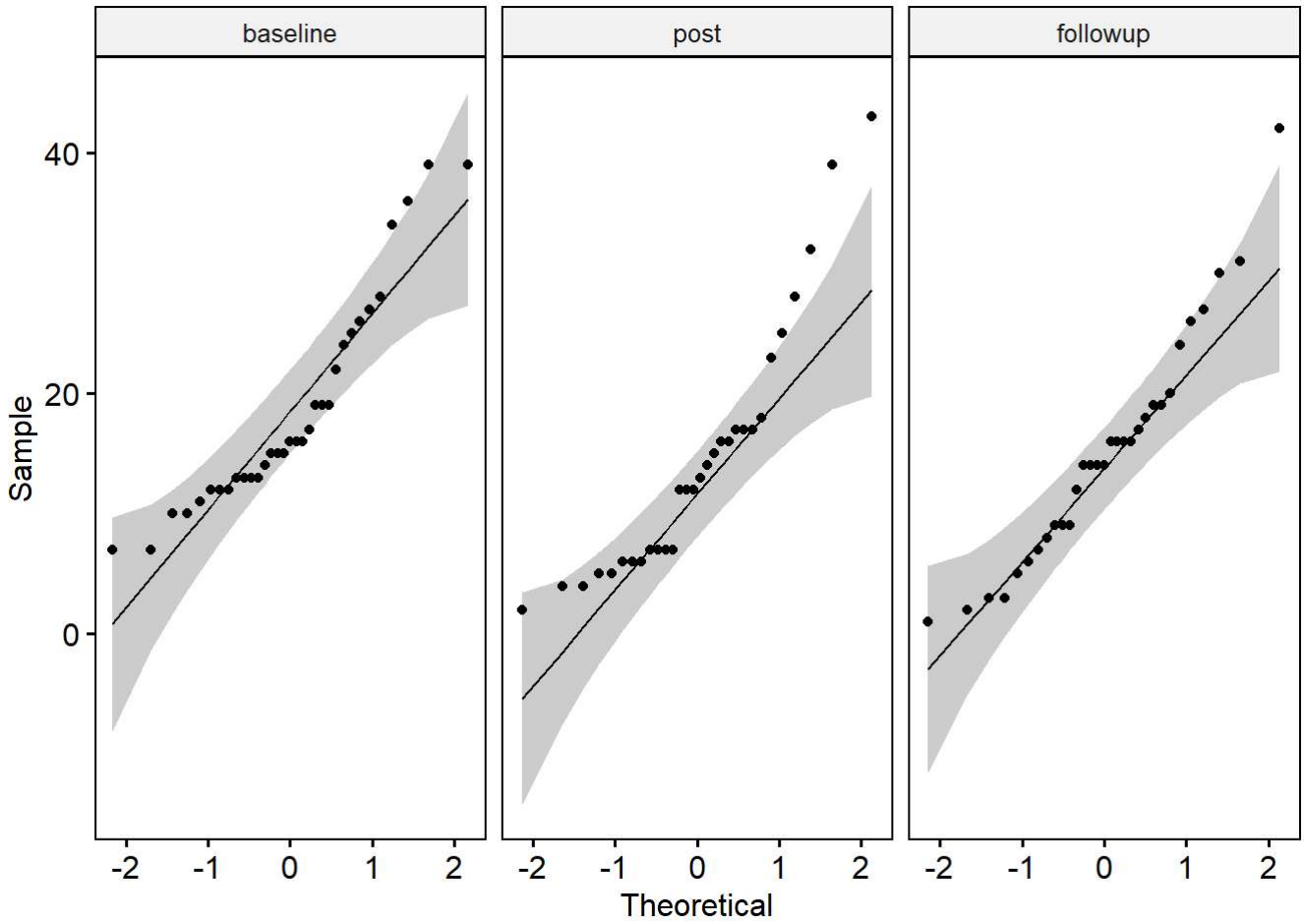

```
qq_pss <- ggqqplot(outcomedata, "pss", facet.by = "event")
qq_pss
```

```
## Warning: Removed 5 rows containing non-finite values (stat_qq).
## Removed 5 rows containing non-finite values (stat_qq_line).
## Removed 5 rows containing non-finite values (stat_qq_line).
```



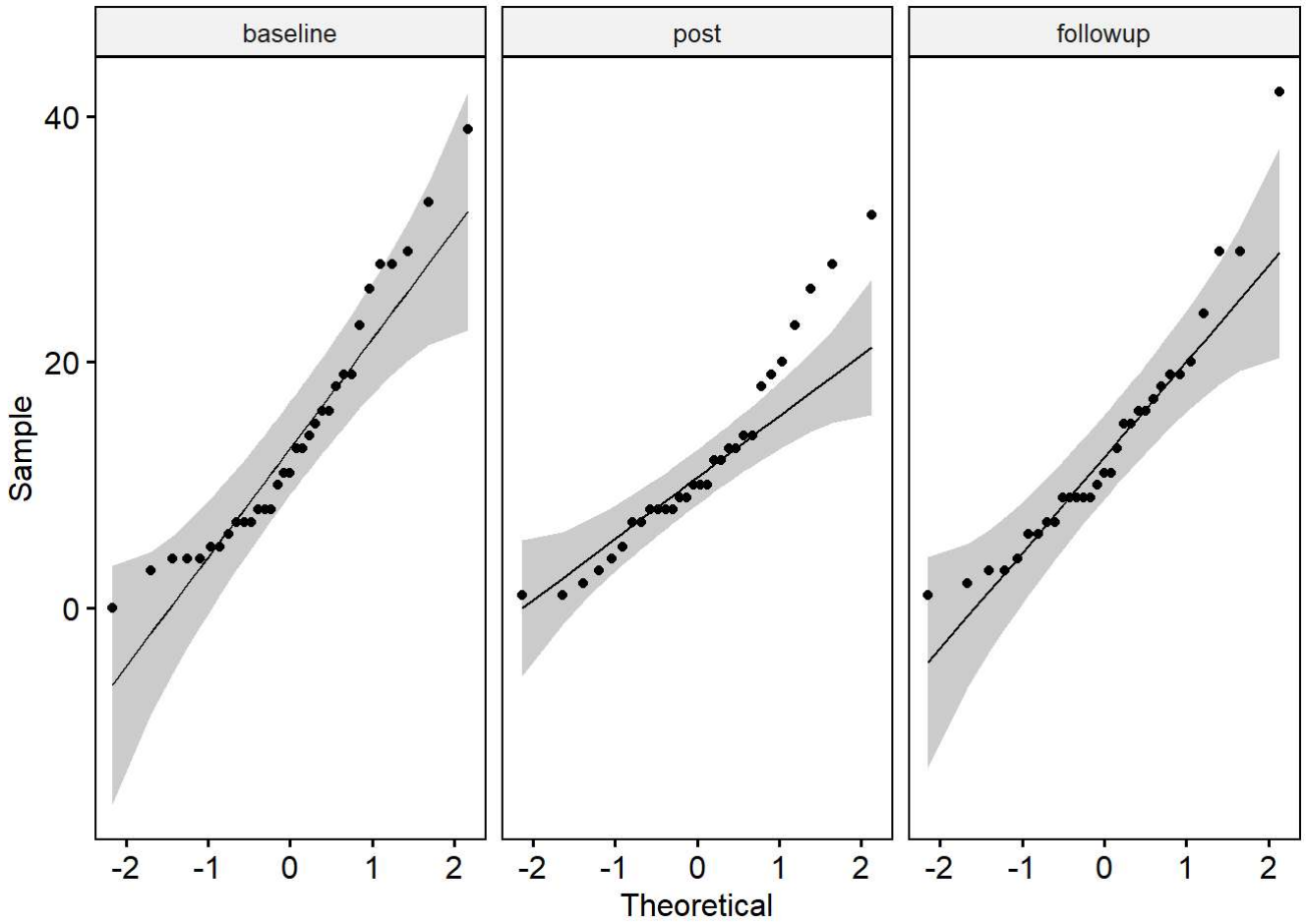

```
qq_bdi <- ggqqplot(outcomedata, "bdi", facet.by = "event")
qq_bdi
```

```
## Warning: Removed 5 rows containing non-finite values (stat_qq).
## Removed 5 rows containing non-finite values (stat_qq_line).
## Removed 5 rows containing non-finite values (stat_qq_line).
```



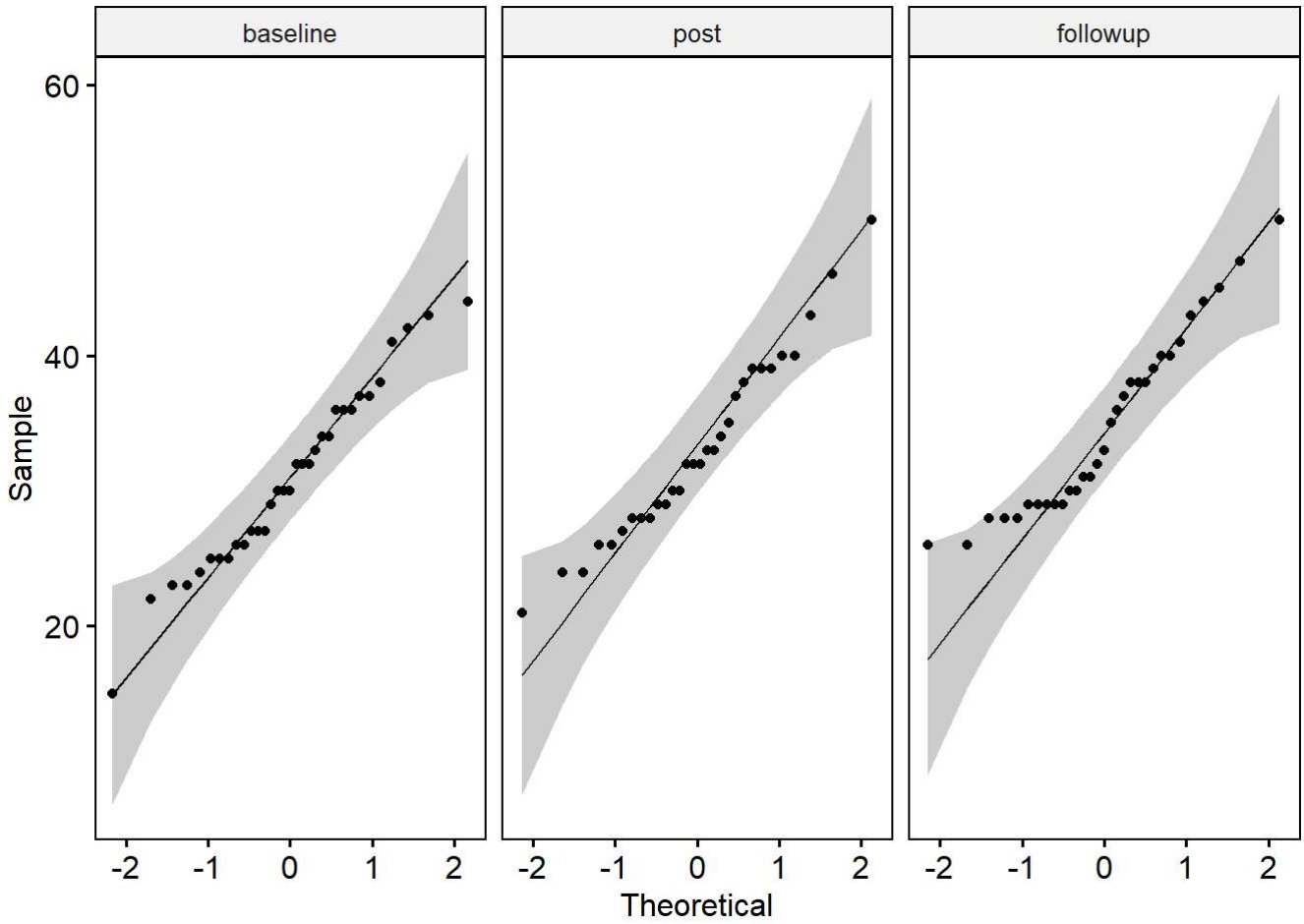

```
qq_bai <- ggqqplot(outcomedata, "bai", facet.by = "event")
qq_bai
```

```
## Warning: Removed 5 rows containing non-finite values (stat_qq).
## Removed 5 rows containing non-finite values (stat_qq_line).
## Removed 5 rows containing non-finite values (stat_qq_line).
```




```
qq_mi <- ggqqplot(outcomedata, "fmqi", facet.by = "event")
qq_mi
```

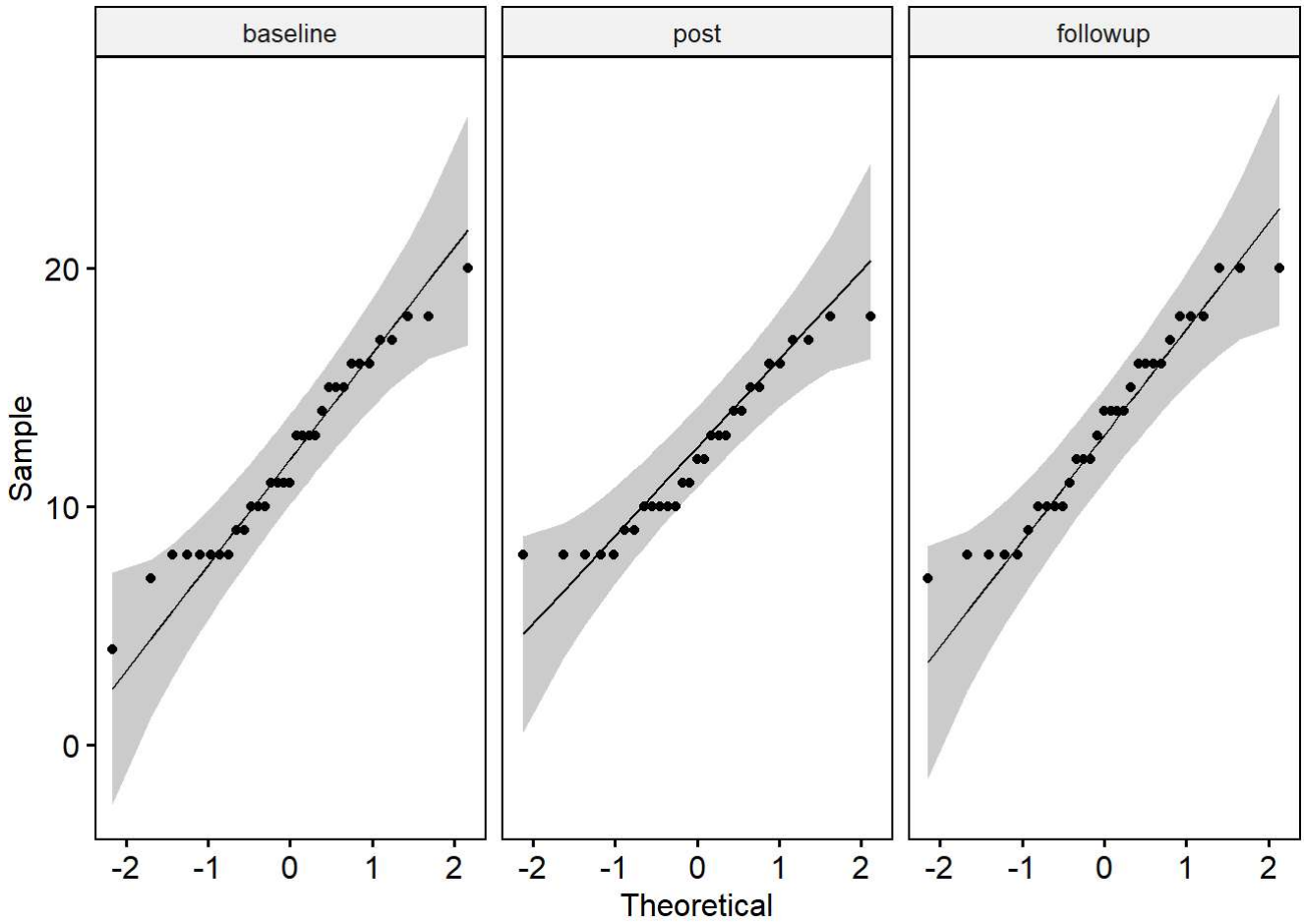
```
## Warning: Removed 5 rows containing non-finite values (stat_qq).
## Removed 5 rows containing non-finite values (stat_qq_line).
## Removed 5 rows containing non-finite values (stat_qq_line).
```




```
qq_cerq <- ggqqplot(outcomedata, "cerq", facet.by = "event")
qq_cerq
```

```
## Warning: Removed 6 rows containing non-finite values (stat_qq).
```

```
## Warning: Removed 6 rows containing non-finite values (stat_qq_line).
## Removed 6 rows containing non-finite values (stat_qq_line).
```




```
#check for outliers
outcomedata %>%
  group_by(event) %>%
  identify_outliers(ryff)
```

```
## # A tibble: 1 x 11
##   event    id    group      ryff   pss   bdi   bai  fmqi  cerq is.outl~1 is.ex~2
##   <fct>    <fct> <fct>     <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <lgl>     <lgl>
## 1 baseline 12039 treatment    24    32    39    39    15     8 TRUE      FALSE
## # ... with abbreviated variable names 1: is.outlier, 2: is.extreme
```

```
outcomedata %>%
  group_by(event) %>%
  identify_outliers(pss)
```

```
##  [1] event      id         group      ryff       pss        bdi
##  [7] bai        fmqi       cerq       is.outlier is.extreme
## <0 rows> (or 0-length row.names)
```

```
outcomedata %>%
  group_by(event) %>%
  identify_outliers(bdi)
```

```
## # A tibble: 3 x 11
##   event    id    group    ryff   pss   bdi   bai  fmqi  cerq is.outlier is.ext~1
##   <fct>    <fct> <fct>   <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <lgl>      <lgl>
## 1 post     12022 control    54    30    39    32    26     8 TRUE       FALSE
## 2 post     12030 control    42    32    43    26    24    11 TRUE       FALSE
## 3 followup 12019 control    42    30    42    42    36    16 TRUE       FALSE
## # ... with abbreviated variable name 1: is.extreme
```

```
outcomedata %>%
  group_by(event) %>%
  identify_outliers(bai)
```

```
## # A tibble: 5 x 11
##   event    id    group      ryff   pss   bdi   bai  fmqi  cerq is.outl~1 is.ex~2
##   <fct>    <fct> <fct>     <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <lgl>     <lgl>
## 1 baseline 12039 treatment    24    32    39    39    15     8 TRUE      FALSE
## 2 post     12022 control      54    30    39    32    26     8 TRUE      FALSE
## 3 post     12030 control      42    32    43    26    24    11 TRUE      FALSE
## 4 post     12035 treatment    70    20    13    28    39    17 TRUE      FALSE
## 5 followup 12019 control      42    30    42    42    36    16 TRUE      FALSE
## # ... with abbreviated variable names 1: is.outlier, 2: is.extreme
```

```
outcomedata %>%
  group_by(event) %>%
  identify_outliers(fmqi)
```

```
##  [1] event      id         group      ryff       pss        bdi
##  [7] bai        fmqi       cerq       is.outlier is.extreme
## <0 rows> (or 0-length row.names)
```

```
outcomedata %>%
  group_by(event) %>%
  identify_outliers(cerq)
```

```
##  [1] event      id         group      ryff       pss        bdi
##  [7] bai        fmqi       cerq       is.outlier is.extreme
## <0 rows> (or 0-length row.names)
```

no extreme outliers

```
#check normality assumption
outcomedata %>%
  group_by(event) %>%
  shapiro_test(ryff)
```

```
## # A tibble: 3 x 4
##   event    variable statistic     p
##   <fct>    <chr>        <dbl> <dbl>
## 1 baseline ryff         0.967 0.404
## 2 post     ryff         0.980 0.828
## 3 followup ryff         0.973 0.598
```

```
outcomedata %>%
  group_by(event) %>%
  shapiro_test(pss)
```

```
## # A tibble: 3 x 4
##   event    variable statistic     p
##   <fct>    <chr>        <dbl> <dbl>
## 1 baseline pss          0.986 0.935
## 2 post     pss          0.968 0.489
## 3 followup pss          0.973 0.601
```

```
outcomedata %>%
  group_by(event) %>%
  shapiro_test(bdi)
```

```
## # A tibble: 3 x 4
##   event    variable statistic       p
##   <fct>    <chr>        <dbl>   <dbl>
## 1 baseline bdi          0.886 0.00236
## 2 post     bdi          0.875 0.00222
## 3 followup bdi          0.949 0.151
```

```
outcomedata %>%
  group_by(event) %>%
  shapiro_test(bai)
```

```
## # A tibble: 3 x 4
##   event    variable statistic      p
##   <fct>    <chr>        <dbl>  <dbl>
## 1 baseline bai          0.920 0.0178
## 2 post     bai          0.923 0.0326
## 3 followup bai          0.909 0.0121
```

```
outcomedata %>%
  group_by(event) %>%
  shapiro_test(fmqi)
```

```
## # A tibble: 3 x 4
##   event    variable statistic      p
##   <fct>    <chr>        <dbl>  <dbl>
## 1 baseline fmqi         0.977 0.694
## 2 post     fmqi         0.969 0.508
## 3 followup fmqi         0.925 0.0319
```

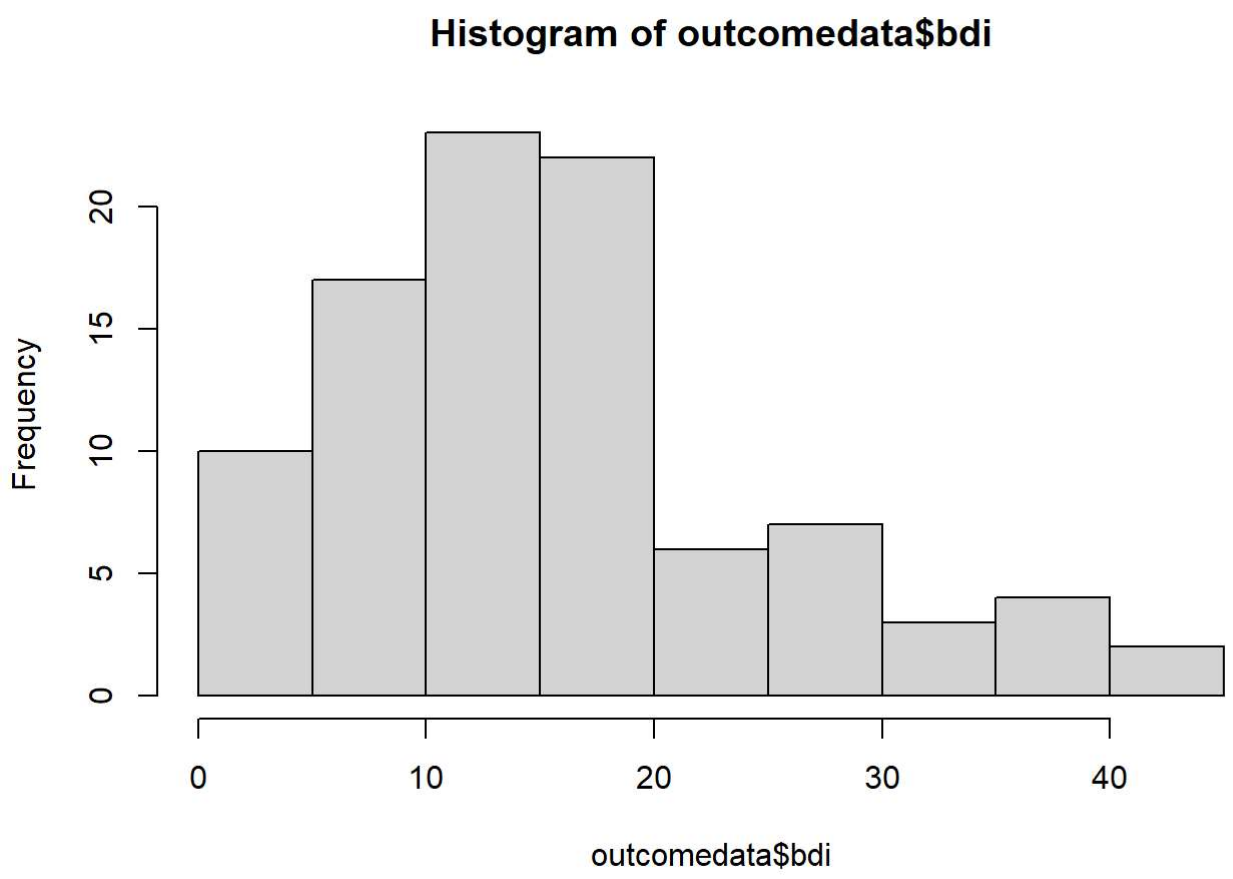
```
outcomedata %>%
  group_by(event) %>%
  shapiro_test(cerq)
```

```
## # A tibble: 3 x 4
##   event    variable statistic      p
##   <fct>    <chr>        <dbl>  <dbl>
## 1 baseline cerq         0.963 0.314
## 2 post     cerq         0.922 0.0348
## 3 followup cerq         0.946 0.119
```

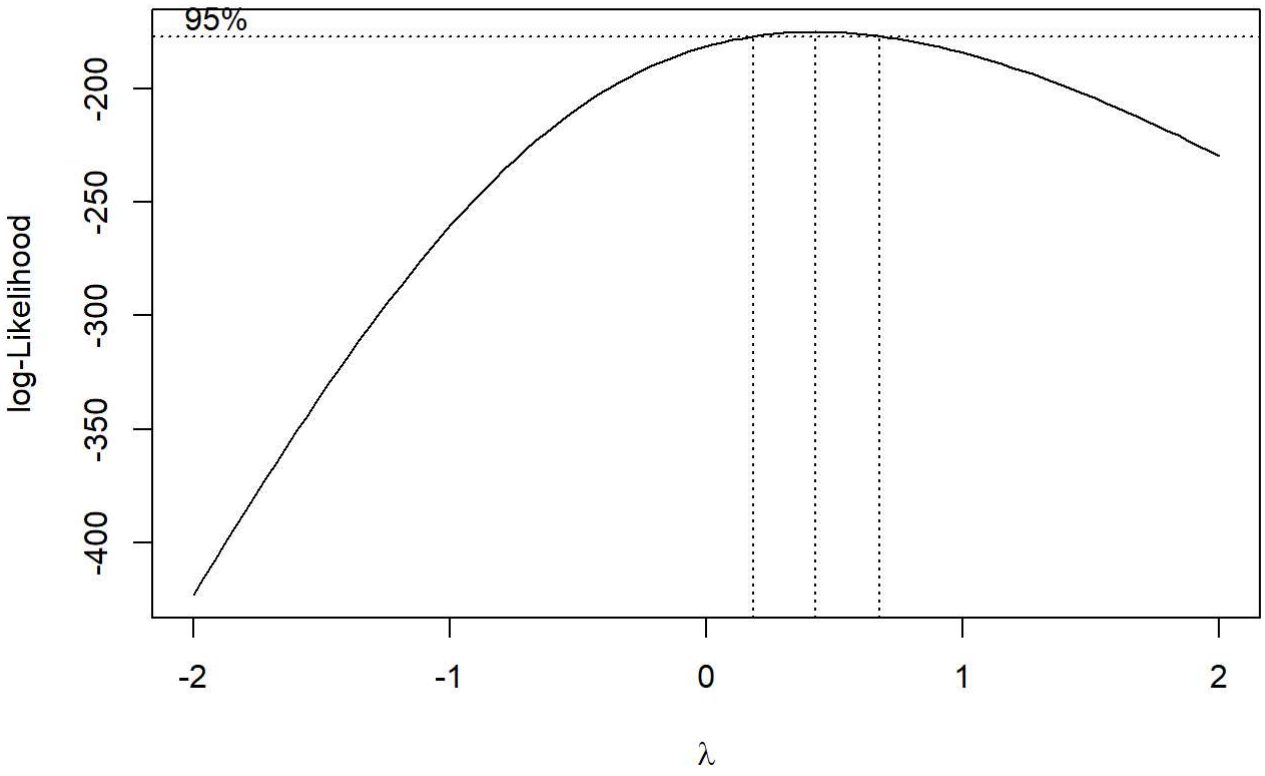
Nonnormal: BDI @ baseline, post BAI @ baseline, post, followup MI @ followup CERQ @ post

# Transformation

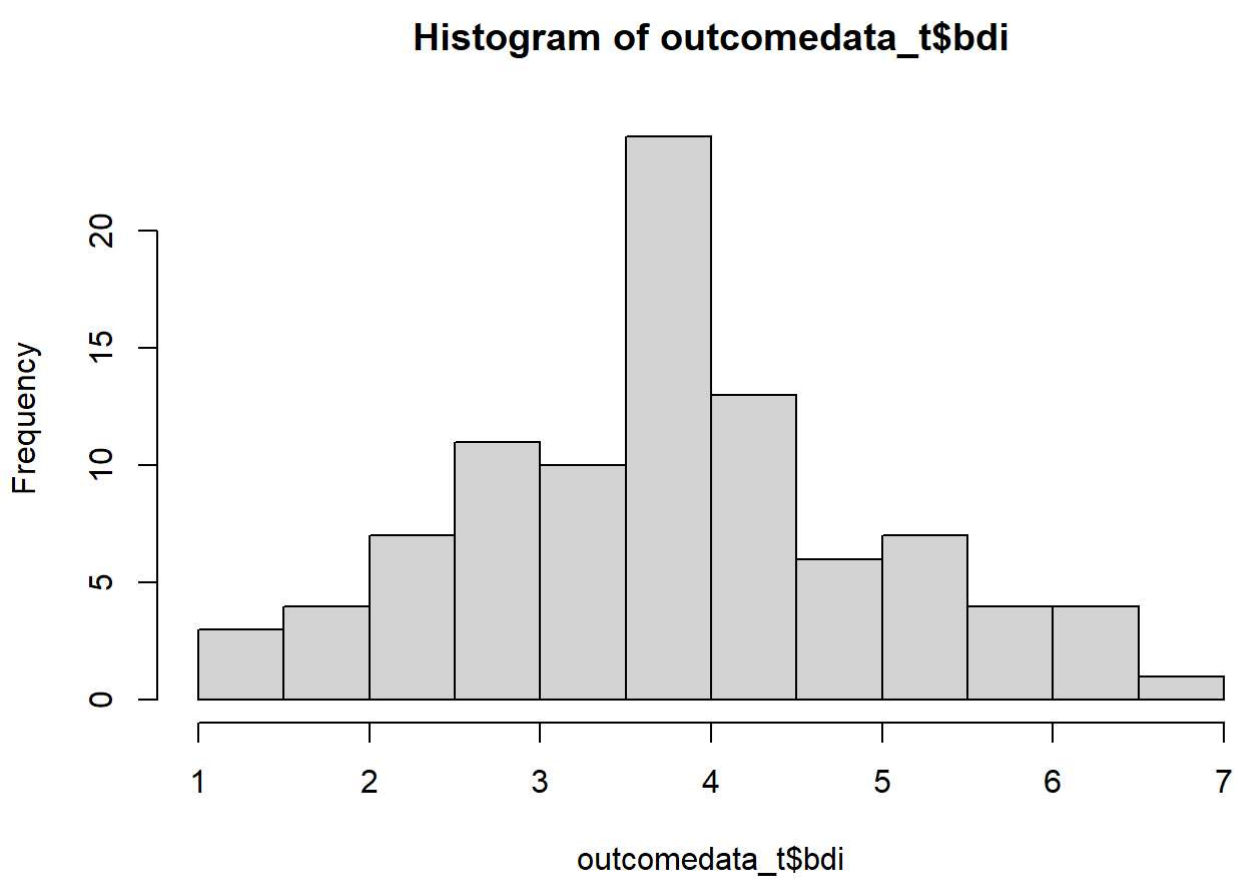
```
outcomedata_t <- outcomedata

# box cox transformation of BDI
hist(outcomedata$bdi)
```



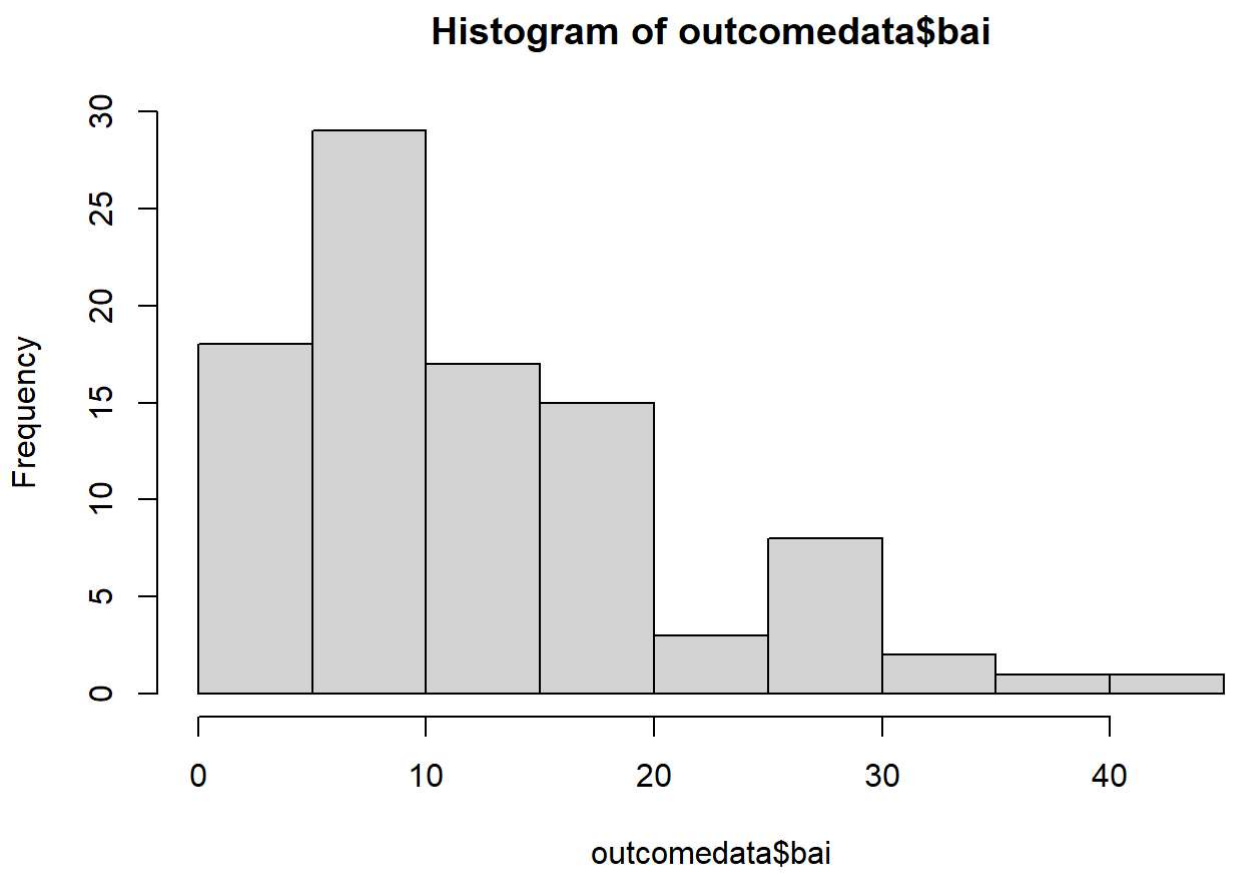

```
boxcox(lm(outcomedata$bdi ~ 1)) #0.5 - sqrt()
```



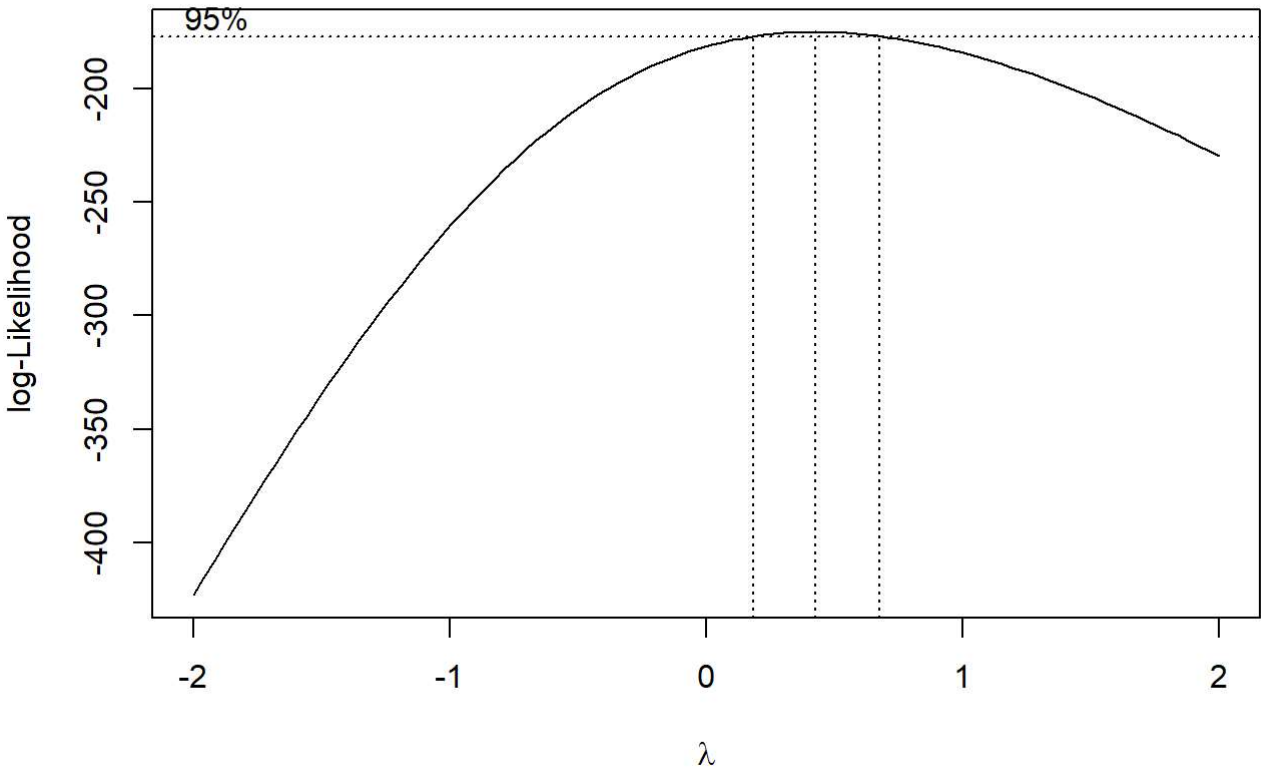

```
outcomedata_t$bdi <- sqrt(outcomedata$bdi)
hist(outcomedata_t$bdi)
```



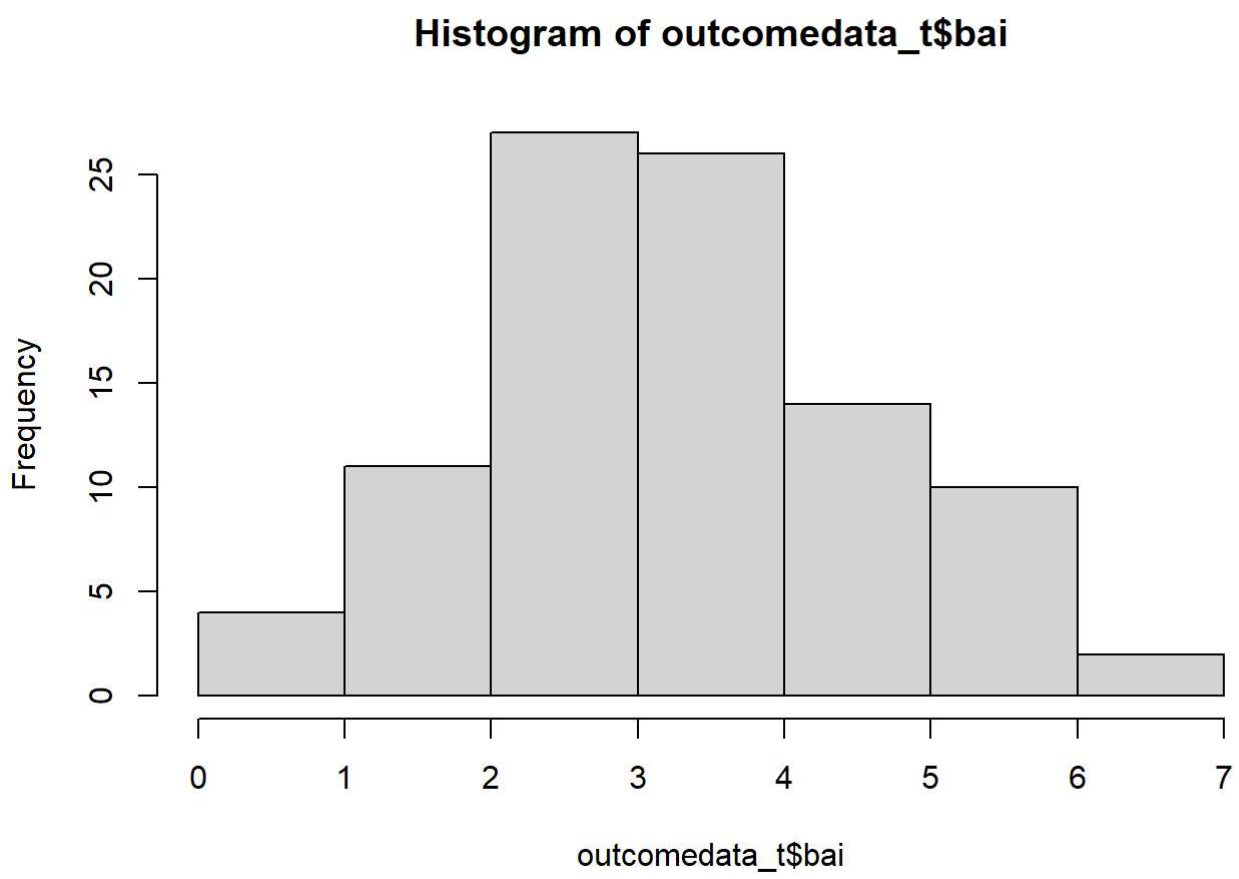

```
# boxcox transformation of BAI
hist(outcomedata$bai)
```



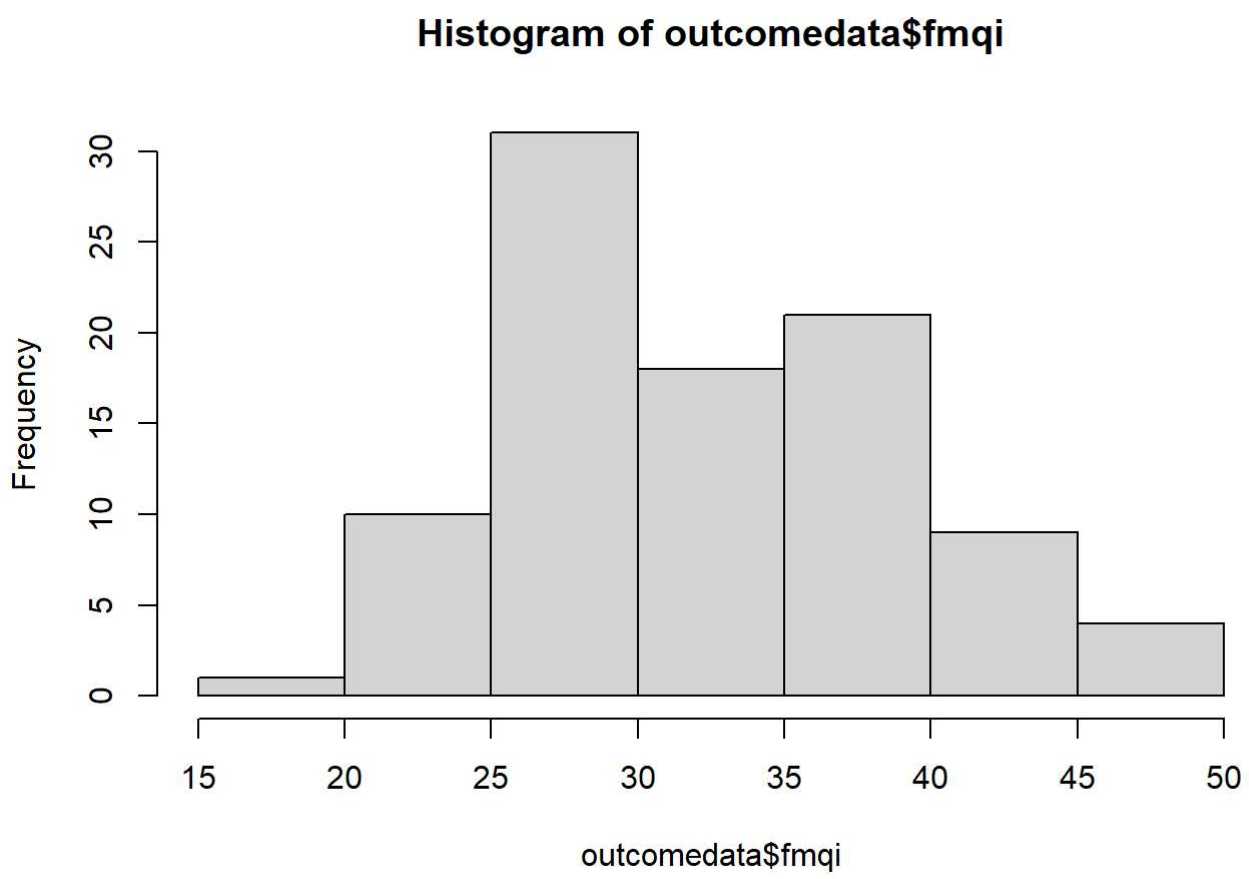

```
boxcox(lm(outcomedata$bdi ~ 1)) #0.5 - sqrt()
```



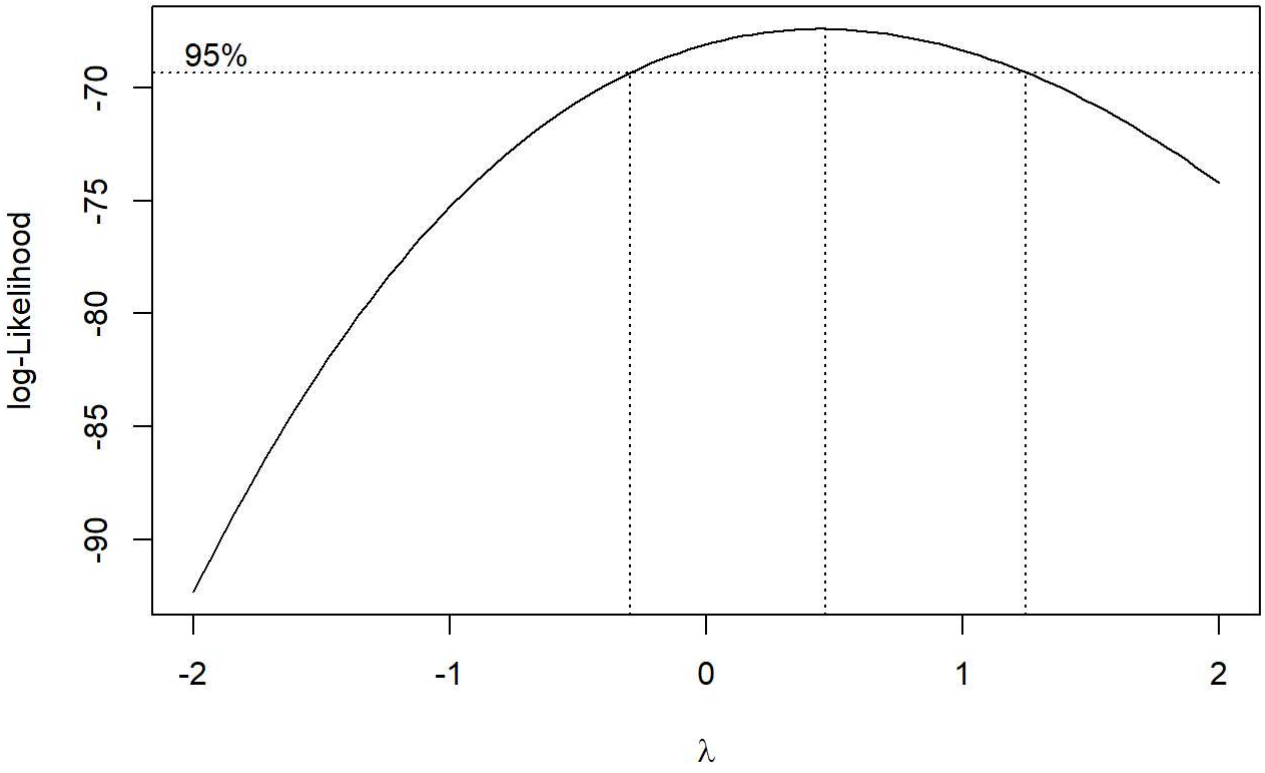

```
outcomedata_t$bai <- sqrt(outcomedata$bai)
hist(outcomedata_t$bai)
```



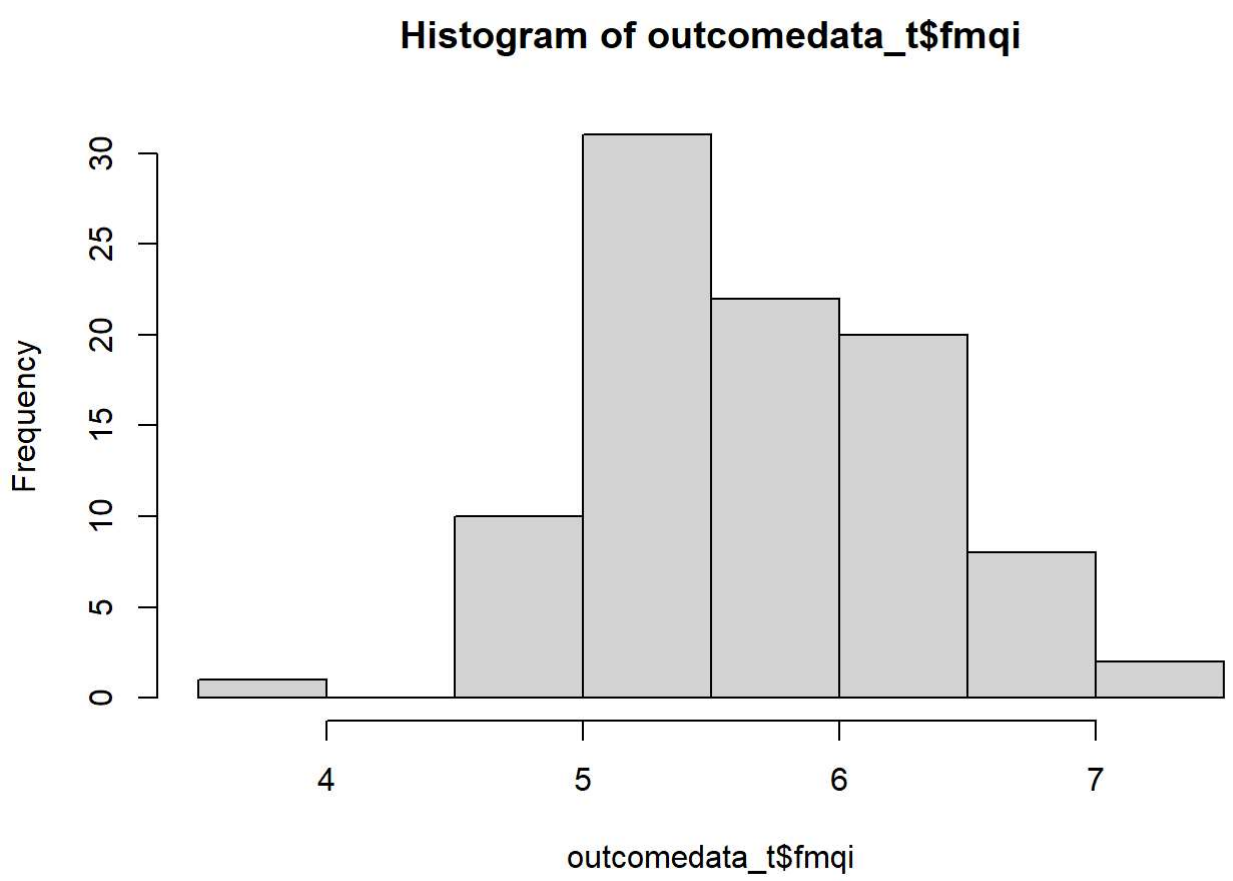

```
# boxcox transformation of MI
hist(outcomedata$fmqi)
```



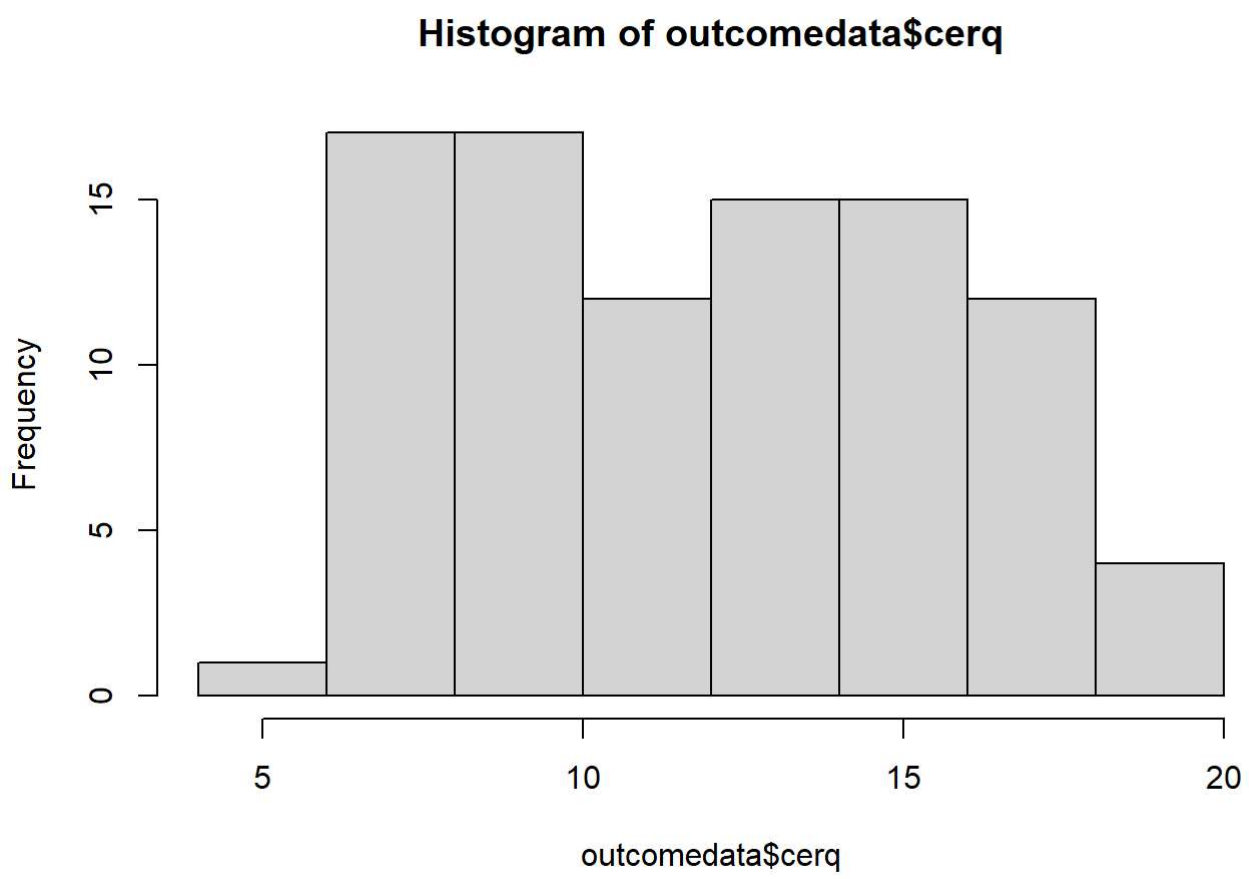

```
boxcox(lm(outcomedata$fmqi ~ 1)) #0.5 - sqrt()
```



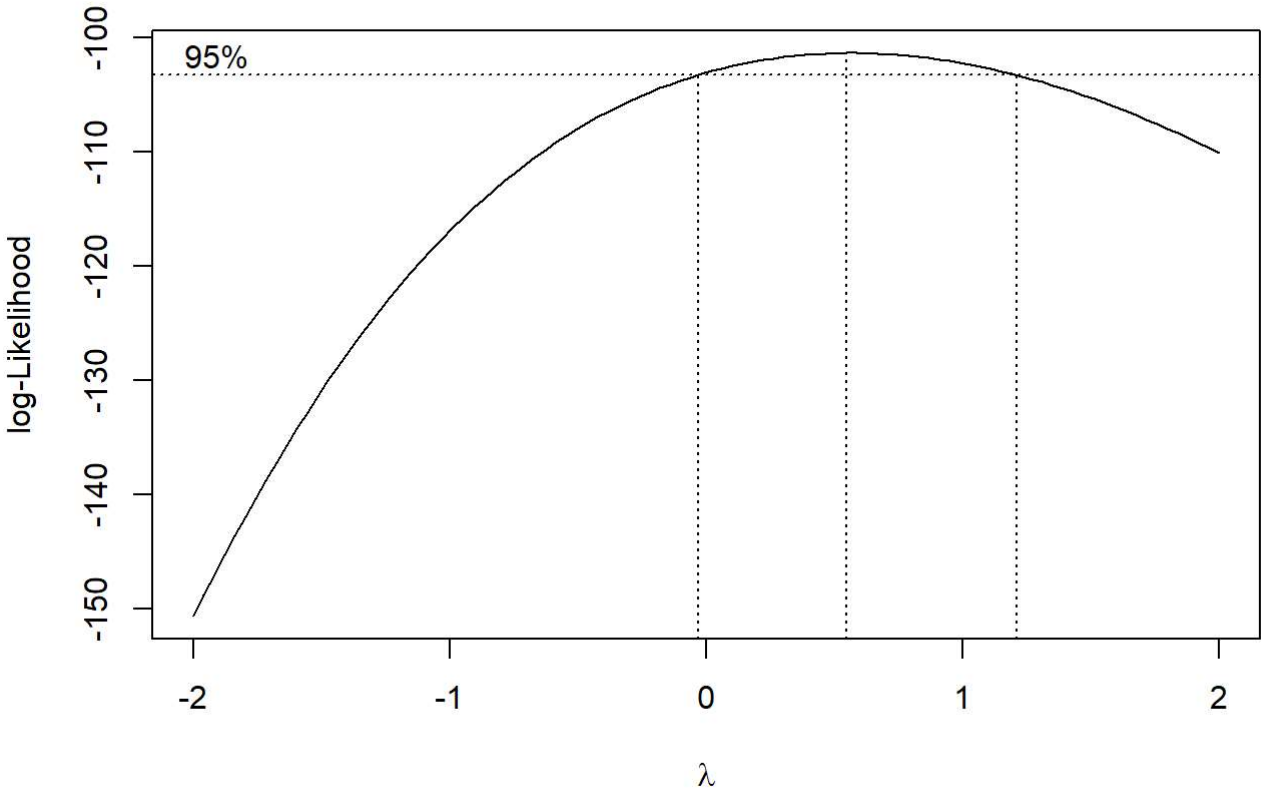

```
outcomedata_t$fmqi <- sqrt(outcomedata$fmqi)
hist(outcomedata_t$fmqi)
```



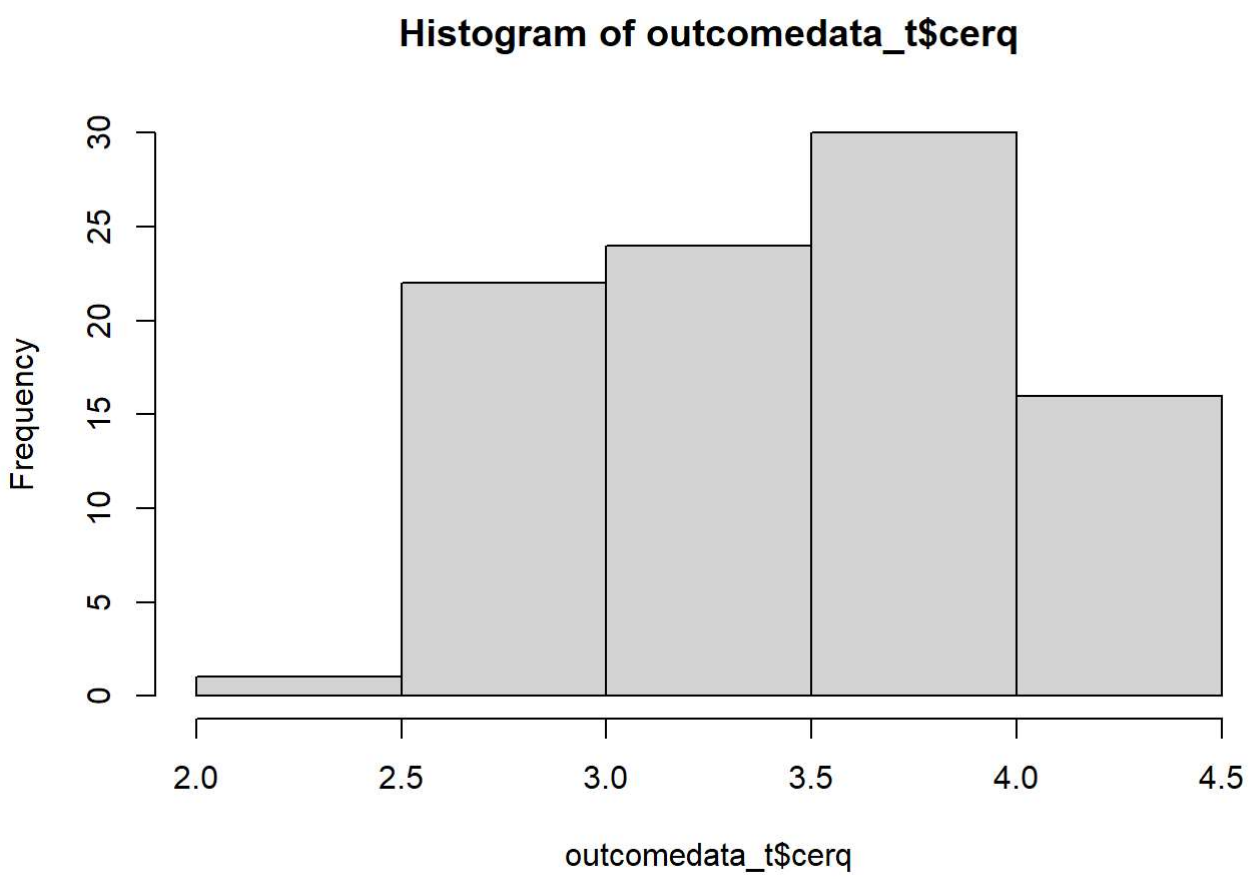

```
# boxcox transformation of CERQ
hist(outcomedata$cerq)
```




```
boxcox(lm(outcomedata$cerq ~ 1)) #0.5 - sqrt()
```




```
outcomedata_t$cerq <- sqrt(outcomedata$cerq)
hist(outcomedata_t$cerq)
```




```
#recheck normality assumption
outcomedata_t %>%
  group_by(event) %>%
  shapiro_test(bdi)
```

```
## # A tibble: 3 x 4
##   event    variable statistic      p
##   <fct>    <chr>        <dbl>  <dbl>
## 1 baseline bdi          0.936 0.0531
## 2 post     bdi          0.952 0.186
## 3 followup bdi          0.983 0.879
```

```
outcomedata_t %>%
  group_by(event) %>%
  shapiro_test(bai)
```

```
## # A tibble: 3 x 4
##   event    variable statistic     p
##   <fct>    <chr>        <dbl> <dbl>
## 1 baseline bai          0.977 0.705
## 2 post     bai          0.975 0.690
## 3 followup bai          0.985 0.929
```

```
outcomedata_t %>%
  group_by(event) %>%
  shapiro_test(fmqi)
```

```
## # A tibble: 3 x 4
##   event    variable statistic      p
##   <fct>    <chr>        <dbl>  <dbl>
## 1 baseline fmqi         0.974 0.590
## 2 post     fmqi         0.981 0.850
## 3 followup fmqi         0.932 0.0513
```

```
outcomedata_t %>%
  group_by(event) %>%
  shapiro_test(cerq)
```

```
## # A tibble: 3 x 4
##   event    variable statistic      p
##   <fct>    <chr>        <dbl>  <dbl>
## 1 baseline cerq         0.962 0.290
## 2 post     cerq         0.928 0.0476
## 3 followup cerq         0.947 0.127
```

# Primary Analysis

## Mixed Models

```
ryff_mm <- lmer(ryff ~ event * group + (1|id), data=outcomedata)
anova(ryff_mm)
```

```
## Analysis of Variance Table
##             npar Sum Sq Mean Sq F value
## event          2 444.04  222.02  3.9845
## group          1 101.37  101.37  1.8193
## event:group    2 746.15  373.07  6.6954
```

```
summary(ryff_mm)
```

```
## Linear mixed model fit by REML ['lmerMod']
## Formula: ryff ~ event * group + (1 | id)
##    Data: outcomedata
##
## REML criterion at convergence: 684
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -3.5244 -0.3774  0.0398  0.4399  3.4440
##
## Random effects:
##  Groups   Name        Variance Std.Dev.
##  id       (Intercept) 137.98   11.747
##  Residual              55.72    7.465
## Number of obs: 94, groups:  id, 33
##
## Fixed effects:
##                              Estimate Std. Error t value
## (Intercept)                   68.6875     3.4794  19.741
## eventpost                     -2.7727     2.7818  -0.997
## eventfollowup                  0.1483     2.7134   0.055
## grouptreatment                -1.1581     4.8477  -0.239
## eventpost:grouptreatment      13.7565     3.8268   3.595
## eventfollowup:grouptreatment   8.8980     3.7774   2.356
##
## Correlation of Fixed Effects:
##             (Intr) evntps evntfl grptrt evntp:
## eventpost   -0.360
## eventfollwp -0.369  0.483
## grouptrtmnt -0.718  0.258  0.265
## evntpst:grp  0.262 -0.727 -0.351 -0.364
## evntfllwp:g  0.265 -0.347 -0.718 -0.369  0.489
```

```
eta_squared(ryff_mm, partial = FALSE)
```

```
## Warning: Currently only supports partial eta squared for this class of objects.
```

```
## # Effect Size for ANOVA (Type III)
##
## Parameter   | Eta2 (partial) |       90% CI
## ------------------------------------------
## event       |           0.11 | [0.00, 0.23]
## group       |           0.06 | [0.00, 0.24]
## event:group |           0.19 | [0.05, 0.32]
```

```
pss_mm <- lmer(pss ~ event * group + (1|id), data=outcomedata)
anova(pss_mm)
```

```
## Analysis of Variance Table
##             npar Sum Sq Mean Sq F value
## event          2 42.865  21.433  1.7458
## group          1  9.337   9.337  0.7606
## event:group    2 93.578  46.789  3.8112
```

```
summary(pss_mm)
```

```
## Linear mixed model fit by REML ['lmerMod']
## Formula: pss ~ event * group + (1 | id)
##    Data: outcomedata
##
## REML criterion at convergence: 540.4
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.77638 -0.51060  0.02961  0.52688  2.08454
##
## Random effects:
##  Groups   Name        Variance Std.Dev.
##  id       (Intercept) 20.40    4.517
##  Residual             12.28    3.504
## Number of obs: 94, groups:  id, 33
##
## Fixed effects:
##                              Estimate Std. Error t value
## (Intercept)                   21.3125     1.4291  14.913
## eventpost                      0.7651     1.3033   0.587
## eventfollowup                  0.7912     1.2719   0.622
## grouptreatment                 1.1581     1.9912   0.582
## eventpost:grouptreatment      -4.2931     1.7934  -2.394
## eventfollowup:grouptreatment  -4.1942     1.7707  -2.369
##
## Correlation of Fixed Effects:
##             (Intr) evntps evntfl grptrt evntp:
## eventpost   -0.412
## eventfollwp -0.422  0.482
## grouptrtmnt -0.718  0.296  0.303
## evntpst:grp  0.299 -0.727 -0.350 -0.417
## evntfllwp:g  0.303 -0.346 -0.718 -0.422  0.488
```

```
eta_squared(pss_mm, partial = FALSE)
```

```
## Warning: Currently only supports partial eta squared for this class of objects.
```

```
## # Effect Size for ANOVA (Type III)
##
## Parameter   | Eta2 (partial) |       90% CI
## -----------------------------------------
## event       |           0.05 | [0.00, 0.15]
## group       |           0.03 | [0.00, 0.18]
## event:group |           0.11 | [0.01, 0.24]
```

```
bdi_mm <- lmer(bdi ~ event * group + (1|id), data=outcomedata_t)
anova(bdi_mm)
```

```
## Analysis of Variance Table
##             npar Sum Sq Mean Sq F value
## event          2 6.8108  3.4054  7.4604
## group          1 1.2215  1.2215  2.6759
## event:group    2 9.3336  4.6668 10.2239
```

```
summary(bdi_mm)
```

```
## Linear mixed model fit by REML ['lmerMod']
## Formula: bdi ~ event * group + (1 | id)
##    Data: outcomedata_t
##
## REML criterion at convergence: 251.2
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -2.12307 -0.54534  0.03704  0.43855  2.10069
##
## Random effects:
##  Groups   Name        Variance Std.Dev.
##  id       (Intercept) 0.7738   0.8797
##  Residual             0.4565   0.6756
## Number of obs: 94, groups:  id, 33
##
## Fixed effects:
##                              Estimate Std. Error t value
## (Intercept)                   4.05845    0.27730  14.636
## eventpost                     0.04239    0.25133   0.169
## eventfollowup                 0.20520    0.24527   0.837
## grouptreatment                0.28680    0.38635   0.742
## eventpost:grouptreatment     -1.24542    0.34584  -3.601
## eventfollowup:grouptreatment -1.41517    0.34145  -4.145
##
## Correlation of Fixed Effects:
##             (Intr) evntps evntfl grptrt evntp:
## eventpost   -0.409
## eventfollwp -0.419  0.482
## grouptrtmnt -0.718  0.294  0.301
## evntpst:grp  0.297 -0.727 -0.350 -0.414
## evntfllwp:g  0.301 -0.346 -0.718 -0.420  0.488
```

```
eta_squared(bdi_mm, partial = FALSE)
```

```
## Warning: Currently only supports partial eta squared for this class of objects.
```

```
## # Effect Size for ANOVA (Type III)
##
## Parameter   | Eta2 (partial) |       90% CI
## ------------------------------------------
## event       |           0.19 | [0.05, 0.32]
## group       |           0.09 | [0.00, 0.27]
## event:group |           0.26 | [0.10, 0.40]
```

```
bai_mm <- lmer(bai ~ event * group + (1|id), data=outcomedata_t)
anova(bai_mm)
```

```
## Analysis of Variance Table
##             npar  Sum Sq Mean Sq F value
## event          2 0.61247 0.30623  0.6610
## group          1 0.26838 0.26838  0.5793
## event:group    2 2.15189 1.07594  2.3223
```

```
summary(bai_mm)
```

```
## Linear mixed model fit by REML ['lmerMod']
## Formula: bai ~ event * group + (1 | id)
##    Data: outcomedata_t
##
## REML criterion at convergence: 261.7
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.76038 -0.43022  0.04025  0.40655  2.58009
##
## Random effects:
##  Groups   Name        Variance Std.Dev.
##  id       (Intercept) 1.1158   1.0563
##  Residual             0.4633   0.6807
## Number of obs: 94, groups:  id, 33
##
## Fixed effects:
##                              Estimate Std. Error t value
## (Intercept)                   3.42412    0.31415  10.900
## eventpost                     0.19925    0.25363   0.786
## eventfollowup                 0.24908    0.24740   1.007
## grouptreatment                0.08909    0.43770   0.204
## eventpost:grouptreatment     -0.72525    0.34892  -2.079
## eventfollowup:grouptreatment -0.52117    0.34442  -1.513
##
## Correlation of Fixed Effects:
##             (Intr) evntps evntfl grptrt evntp:
## eventpost   -0.363
## eventfollwp -0.373  0.483
## grouptrtmnt -0.718  0.261  0.267
## evntpst:grp  0.264 -0.727 -0.351 -0.368
## evntfllwp:g  0.268 -0.347 -0.718 -0.373  0.489
```

```
eta_squared(bai_mm, partial = FALSE)
```

```
## Warning: Currently only supports partial eta squared for this class of objects.
```

```
## # Effect Size for ANOVA (Type III)
##
## Parameter   | Eta2 (partial) |       90% CI
## -----------------------------------------
## event       |           0.02 | [0.00, 0.09]
## group       |           0.02 | [0.00, 0.16]
## event:group |           0.07 | [0.00, 0.19]
```

```
mi_mm <- lmer(fmqi ~ event * group + (1|id), data=outcomedata_t)
anova(mi_mm)
```

```
## Analysis of Variance Table
##             npar  Sum Sq Mean Sq F value
## event          2 1.93095 0.96548  4.8554
## group          1 0.68515 0.68515  3.4456
## event:group    2 2.86568 1.43284  7.2058
```

```
summary(mi_mm)
```

```
## Linear mixed model fit by REML ['lmerMod']
## Formula: fmqi ~ event * group + (1 | id)
##    Data: outcomedata_t
##
## REML criterion at convergence: 152
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -2.6220 -0.5784 -0.1232  0.5548  1.8382
##
## Random effects:
##  Groups   Name        Variance Std.Dev.
##  id       (Intercept) 0.1036   0.3218
##  Residual             0.1988   0.4459
## Number of obs: 94, groups:  id, 33
##
## Fixed effects:
##                              Estimate Std. Error t value
## (Intercept)                   5.62023    0.13748  40.880
## eventpost                    -0.23973    0.16479  -1.455
## eventfollowup                 0.05096    0.16115   0.316
## grouptreatment               -0.17816    0.19155  -0.930
## eventpost:grouptreatment      0.83807    0.22701   3.692
## eventfollowup:grouptreatment  0.57463    0.22437   2.561
##
## Correlation of Fixed Effects:
##             (Intr) evntps evntfl grptrt evntp:
## eventpost   -0.549
## eventfollwp -0.561  0.479
## grouptrtmnt -0.718  0.394  0.403
## evntpst:grp  0.398 -0.726 -0.347 -0.555
## evntfllwp:g  0.403 -0.344 -0.718 -0.561  0.484
```

```
eta_squared(mi_mm, partial = FALSE)
```

```
## Warning: Currently only supports partial eta squared for this class of objects.
```

```
## # Effect Size for ANOVA (Type III)
##
## Parameter   | Eta2 (partial) |       90% CI
## ------------------------------------------
## event       |           0.13 | [0.02, 0.26]
## group       |           0.11 | [0.00, 0.31]
## event:group |           0.20 | [0.05, 0.33]
```

```
cerq_mm <- lmer(cerq ~event * group + (1|id), data=outcomedata_t)
anova(cerq_mm)
```

```
## Analysis of Variance Table
##             npar  Sum Sq Mean Sq F value
## event          2 0.59899 0.29949  2.0378
## group          1 0.13626 0.13626  0.9271
## event:group    2 0.50620 0.25310  1.7221
```

```
summary(cerq_mm)
```

```
## Linear mixed model fit by REML ['lmerMod']
## Formula: cerq ~ event * group + (1 | id)
##    Data: outcomedata_t
##
## REML criterion at convergence: 136.2
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -1.7026 -0.6353 -0.1721  0.7536  1.7683
##
## Random effects:
##  Groups   Name        Variance Std.Dev.
##  id       (Intercept) 0.1384   0.3720
##  Residual             0.1470   0.3834
## Number of obs: 93, groups:  id, 33
##
## Fixed effects:
##                              Estimate Std. Error t value
## (Intercept)                   3.46032    0.13355  25.911
## eventpost                    -0.12442    0.14588  -0.853
## eventfollowup                 0.02203    0.13885   0.159
## grouptreatment               -0.04908    0.18607  -0.264
## eventpost:grouptreatment      0.30570    0.19843   1.541
## eventfollowup:grouptreatment  0.31834    0.19332   1.647
##
## Correlation of Fixed Effects:
##             (Intr) evntps evntfl grptrt evntp:
## eventpost   -0.472
## eventfollwp -0.495  0.468
## grouptrtmnt -0.718  0.338  0.356
## evntpst:grp  0.347 -0.735 -0.344 -0.483
## evntfllwp:g  0.356 -0.336 -0.718 -0.496  0.479
```

```
eta_squared(cerq_mm, partial = FALSE)
```

```
## Warning: Currently only supports partial eta squared for this class of objects.
```

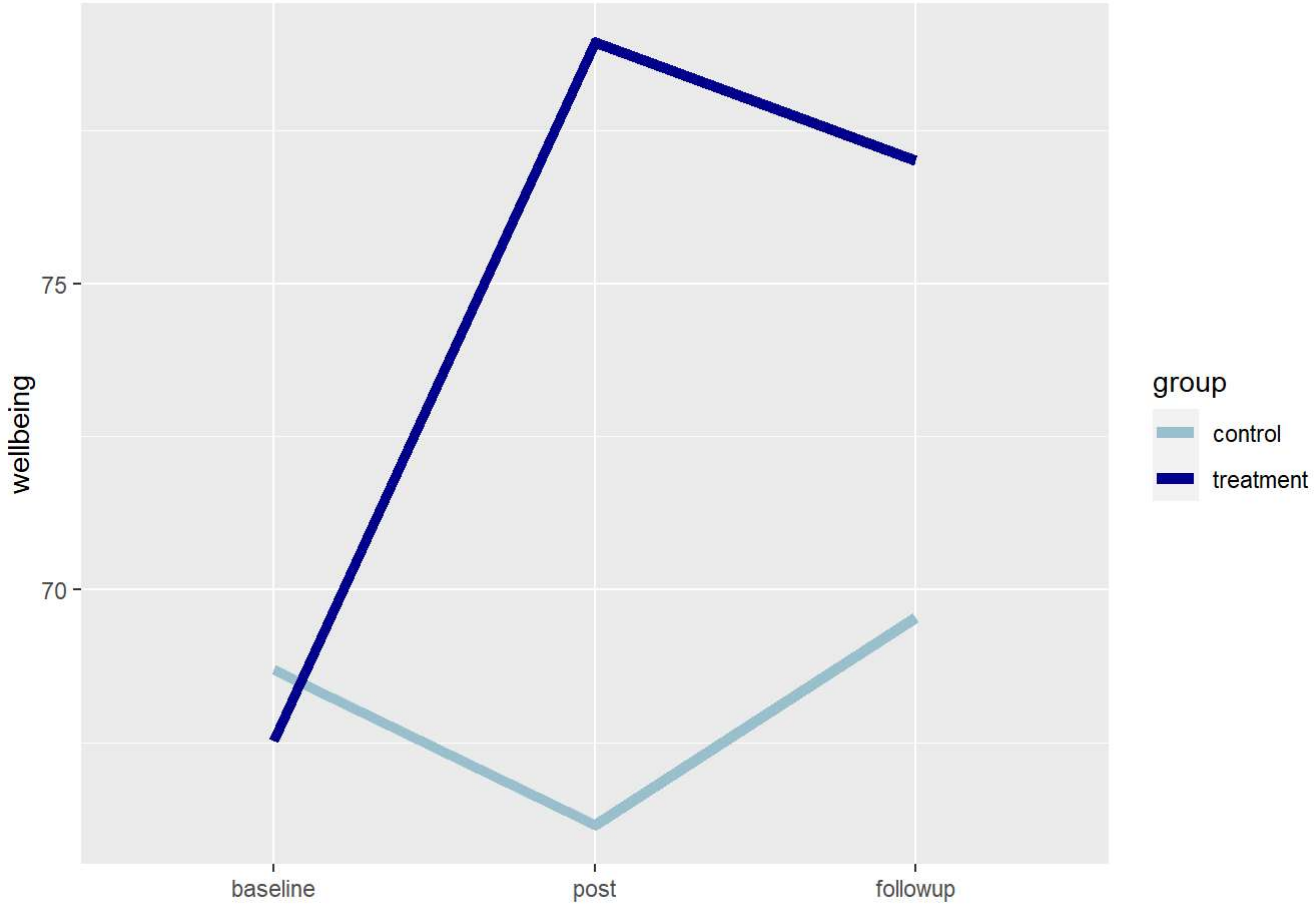
```
## # Effect Size for ANOVA (Type III)
##
## Parameter   | Eta2 (partial) |       90% CI
## -----------------------------------------
## event       |           0.06 | [0.00, 0.17]
## group       |           0.03 | [0.00, 0.19]
## event:group |           0.06 | [0.00, 0.16]
```

# Plots

```
ggplot(outcomedata, aes(x = event, y = ryff)) +
  stat_summary(aes(group=group, color=group), geom="line", size=2, fun.y = mean) +
  ylab("wellbeing") + xlab("") + scale_color_manual(values = c("lightblue3","darkblue"))
```

```
## Warning: `fun.y` is deprecated. Use `fun` instead.
```

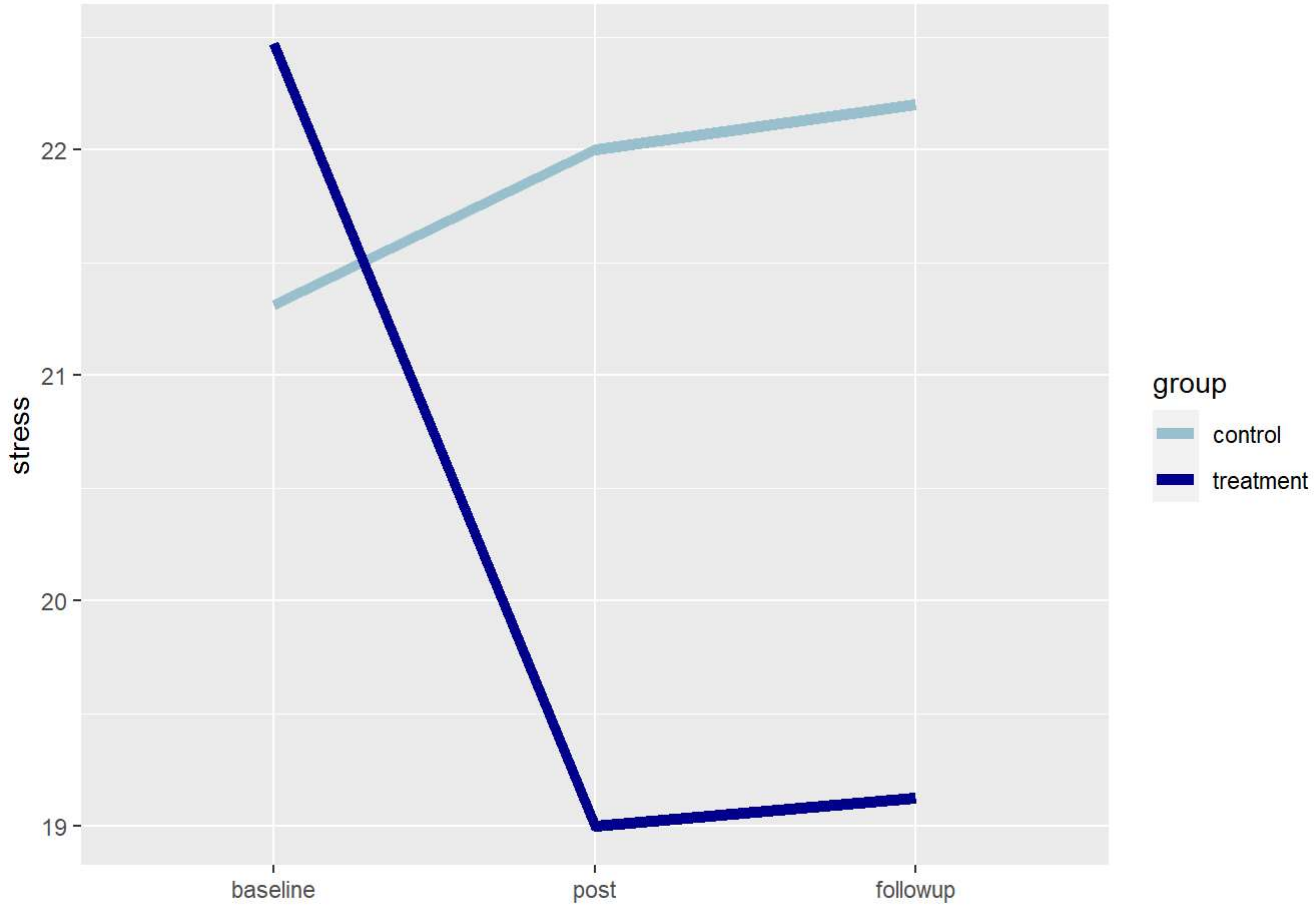
```
## Warning: Removed 5 rows containing non-finite values (stat_summary).
```




```
ggplot(outcomedata, aes(x = event, y = pss)) +
  stat_summary(aes(group=group, color=group), geom="line", size=2, fun.y = mean) +
  ylab("stress") + xlab("") + scale_color_manual(values = c("lightblue3","darkblue"))
```

```
## Warning: `fun.y` is deprecated. Use `fun` instead.
```

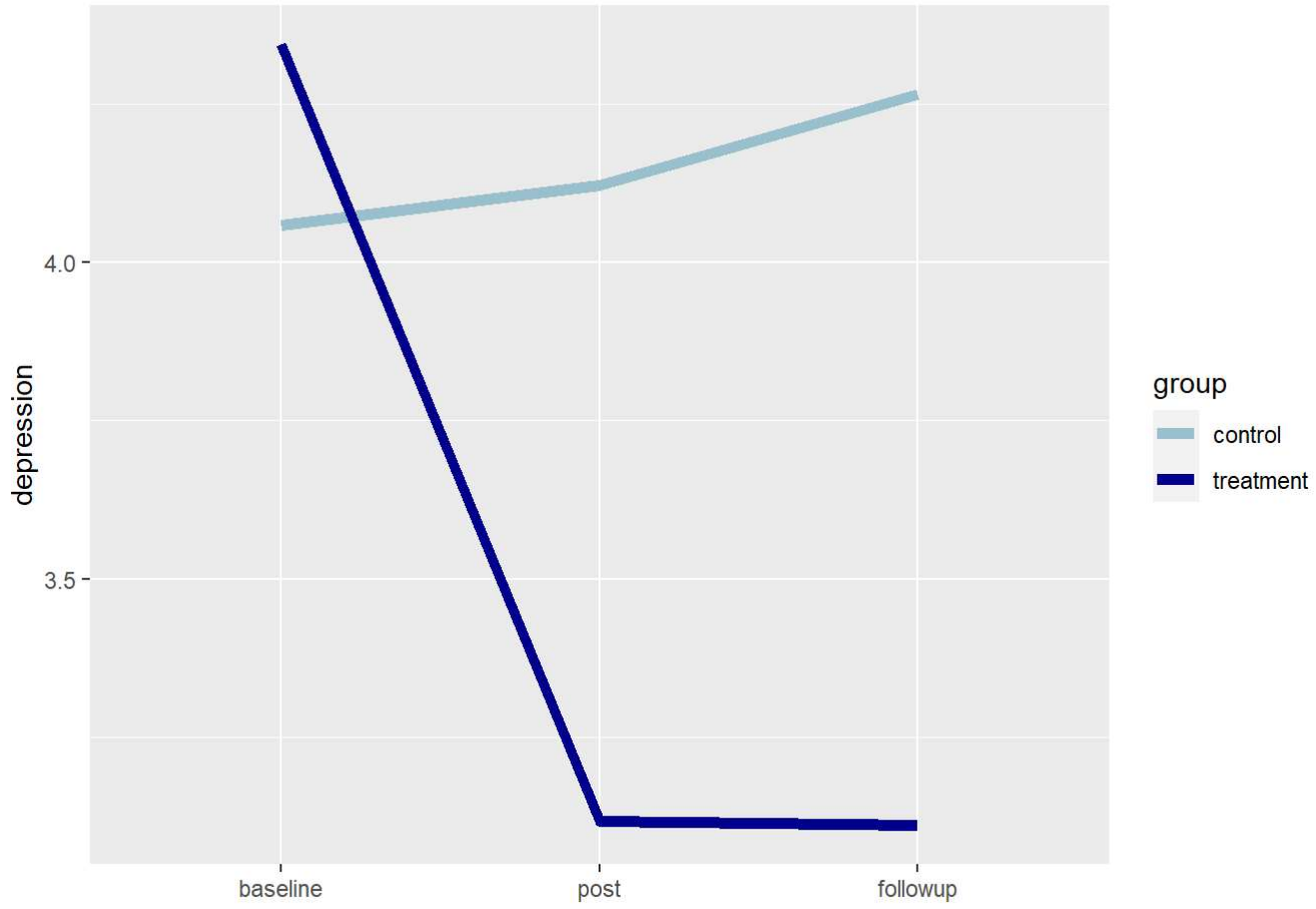
```
## Warning: Removed 5 rows containing non-finite values (stat_summary).
```




```
ggplot(outcomedata_t, aes(x = event, y = bdi)) +
  stat_summary(aes(group=group, color=group), geom="line", size=2, fun.y = mean) +
  ylab("depression") + xlab("") + scale_color_manual(values = c("lightblue3","darkblue"))
```

```
## Warning: `fun.y` is deprecated. Use `fun` instead.
```

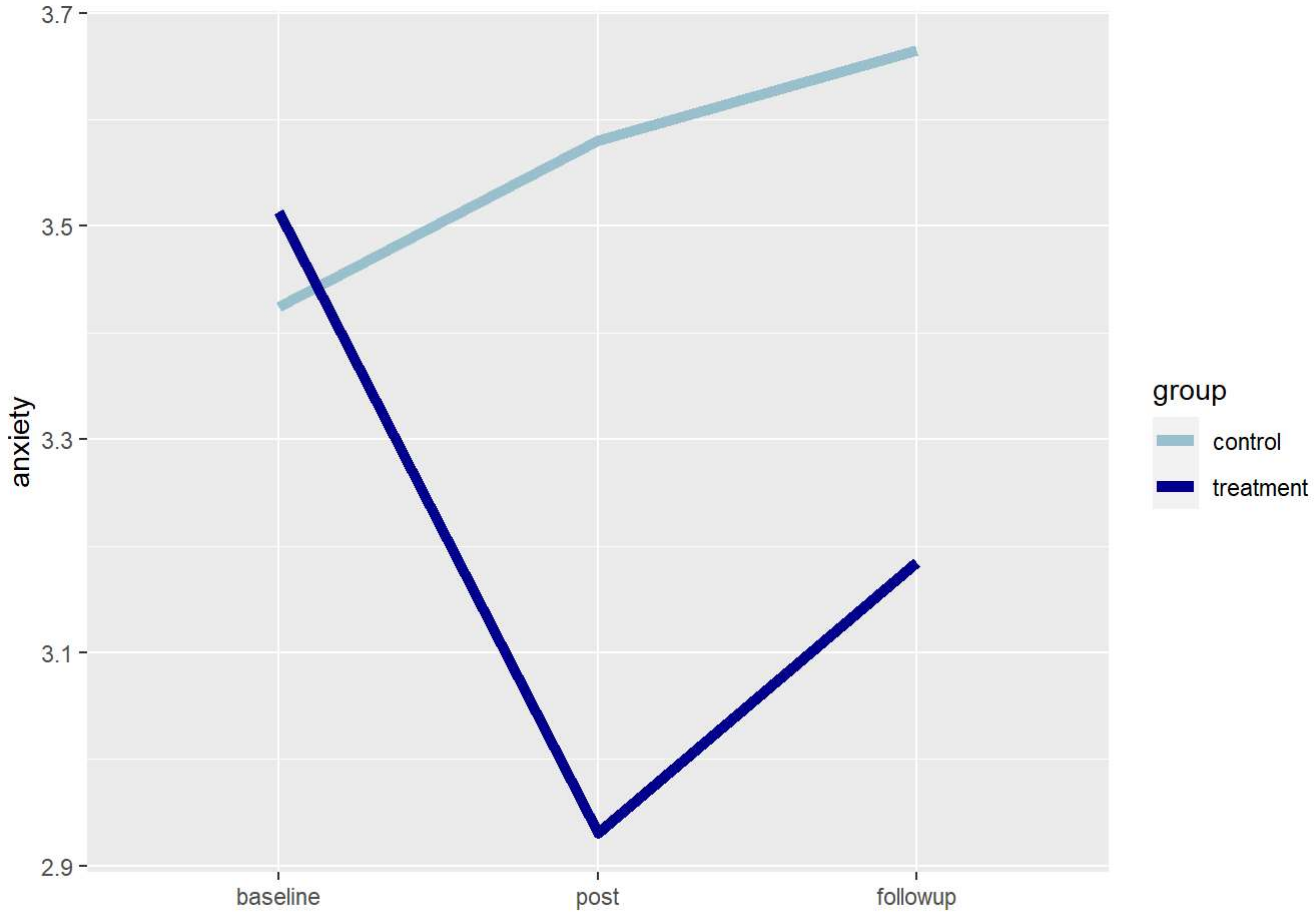
```
## Warning: Removed 5 rows containing non-finite values (stat_summary).
```




```
ggplot(outcomedata_t, aes(x = event, y = bai)) +
  stat_summary(aes(group=group, color=group), geom="line", size=2, fun.y = mean) +
  ylab("anxiety") + xlab("") + scale_color_manual(values = c("lightblue3","darkblue"))
```

```
## Warning: `fun.y` is deprecated. Use `fun` instead.
```

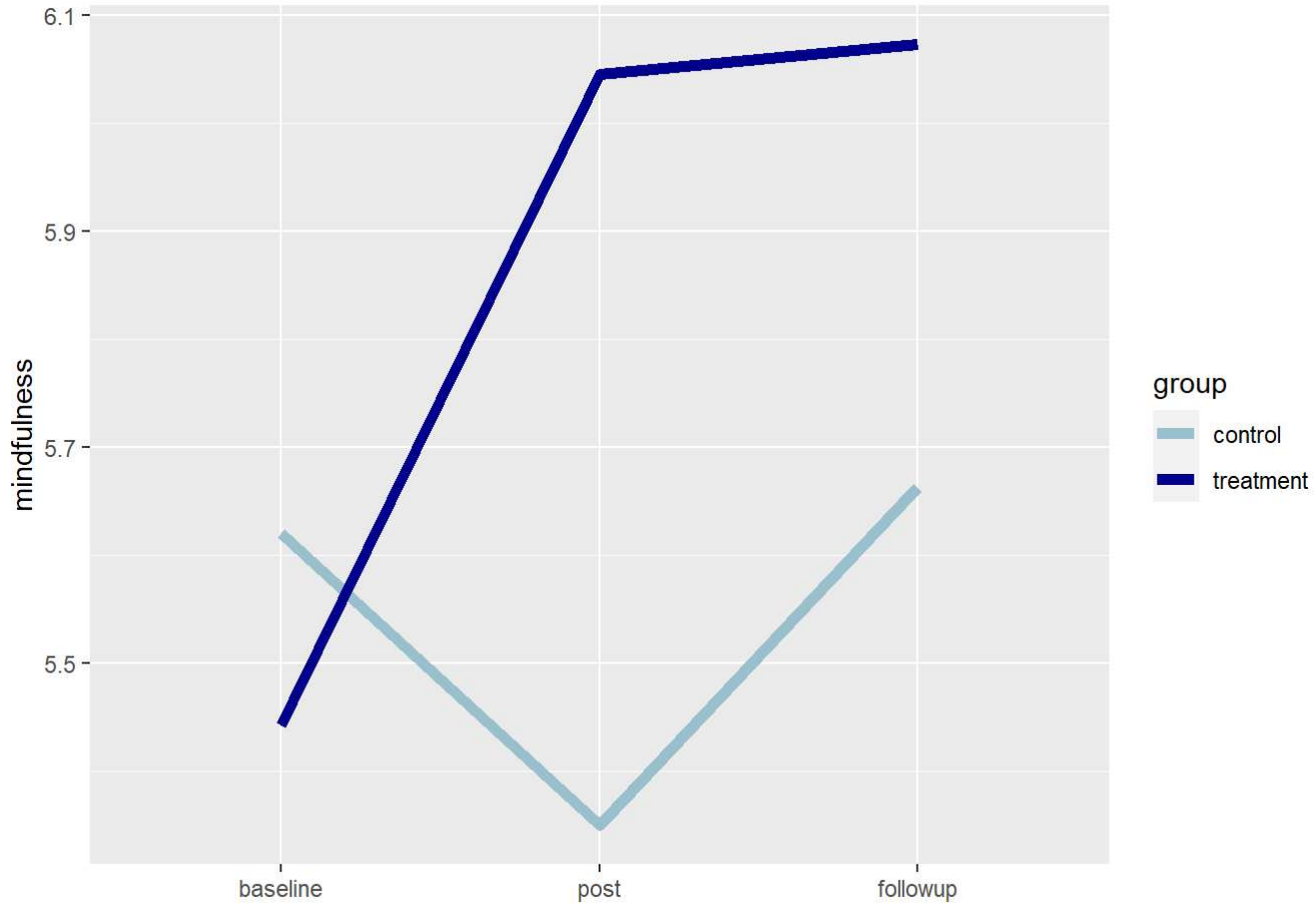
```
## Warning: Removed 5 rows containing non-finite values (stat_summary).
```




```
ggplot(outcomedata_t, aes(x = event, y = fmqi)) +
  stat_summary(aes(group=group, color=group), geom="line", size=2, fun.y = mean) +
  ylab("mindfulness") + xlab("") + scale_color_manual(values = c("lightblue3","darkblue"))
```

```
## Warning: `fun.y` is deprecated. Use `fun` instead.
```

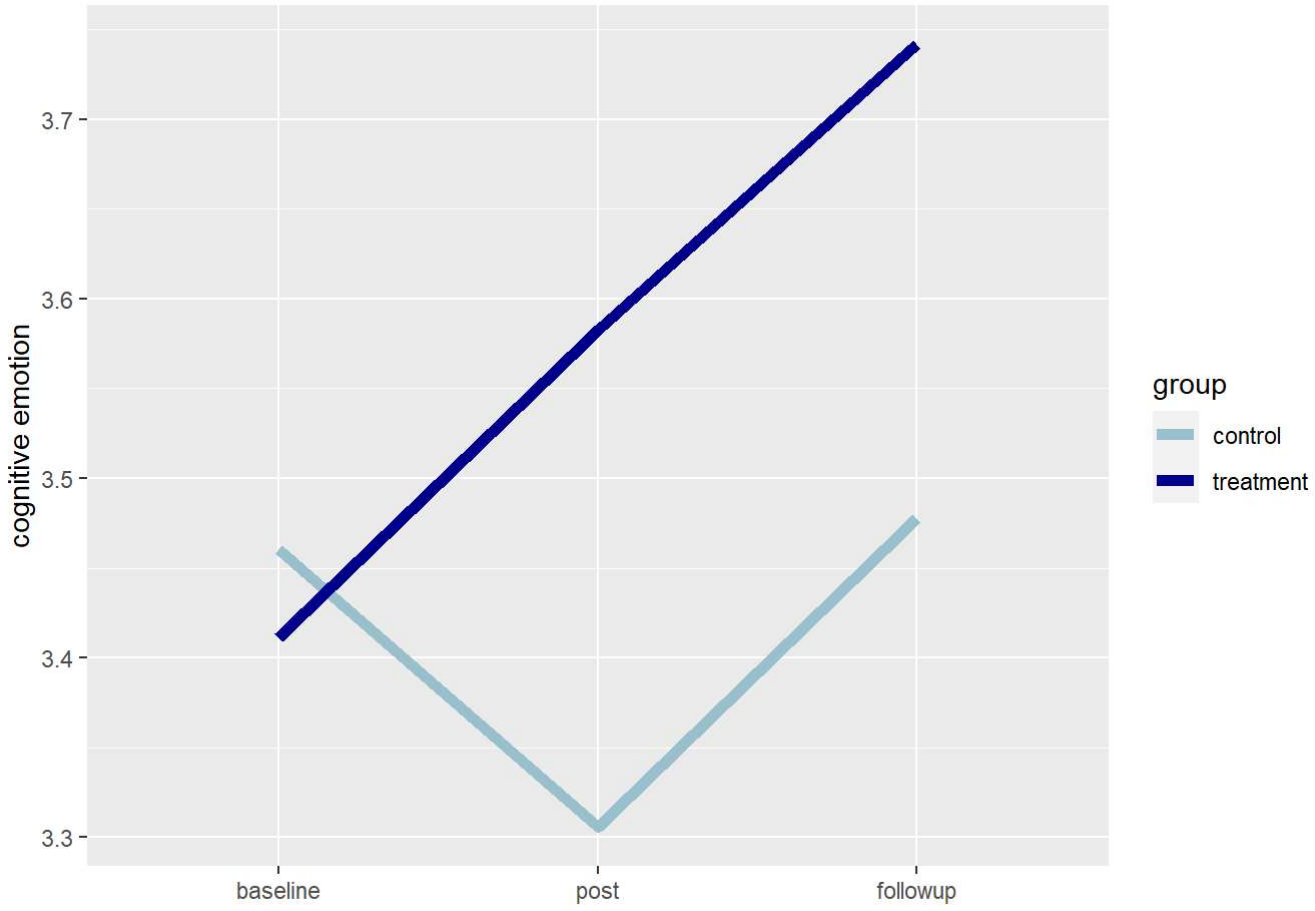
```
## Warning: Removed 5 rows containing non-finite values (stat_summary).
```




```
ggplot(outcomedata_t, aes(x = event, y = cerq)) +
  stat_summary(aes(group=group, color=group), geom="line", size=2, fun.y = mean) +
  ylab("cognitive emotion") + xlab("") + scale_color_manual(values = c("lightblue3","darkblue"))
```

```
## Warning: `fun.y` is deprecated. Use `fun` instead.
```

```
## Warning: Removed 6 rows containing non-finite values (stat_summary).
```




# PRE-POST SESSION

```
#Load dataset
filename <- "20230324_PrePostData.csv"

prepostdata <- read_csv(filename)
```

```
## Rows: 134 Columns: 9
## -- Column specification --------------------------------------------------------
## Delimiter: ","
## dbl (9): id, session, enrollmentgroup, pospre, negpre, pospost, negpost, ios...
##
## i Use `spec()` to retrieve the full column specification for this data.
## i Specify the column types or set `show_col_types = FALSE` to quiet this message.
```

```
#reformat data: pre
predata <- prepostdata %>%
  dplyr::select(id, session, pos = pospre, neg = negpre, ios = iospre)

#create time variable
predata$time <- as.integer(0)
predata <- relocate(predata, time, .after=session)
```

```
#reformat data: post
postdata <- prepostdata %>%
  dplyr::select(id, session, pos = pospost, neg = negpost, ios = iospost)

#create time variable
postdata$time <- as.integer(1)
postdata <- relocate(postdata, time, .after=session)
```

```
#join predata and postdata
prepostdata <- merge(predata, postdata, all=TRUE)

prepostdata$id <- factor(prepostdata$id)
prepostdata$session <- factor(prepostdata$session)
prepostdata$time <- factor(prepostdata$time)
levels(prepostdata$time) <- c("pre", "post")

view(prepostdata)
```

# Descriptive Statistics

## Mean (SD) Table

```
# score means by time
prepostdata %>%
  group_by(time) %>%
  get_summary_stats(pos, neg, ios, type="mean_sd")
```

```
## # A tibble: 6 x 5
##   time  variable     n  mean    sd
##   <fct> <chr>    <dbl> <dbl> <dbl>
## 1 pre   ios        132  3.59  1.73
## 2 pre   neg        131 15.4   6.04
## 3 pre   pos        131 23.9   7.22
## 4 post  ios        130  4.65  1.65
## 5 post  neg        130 12.7   3.72
## 6 post  pos        129 30.5   7.73
```

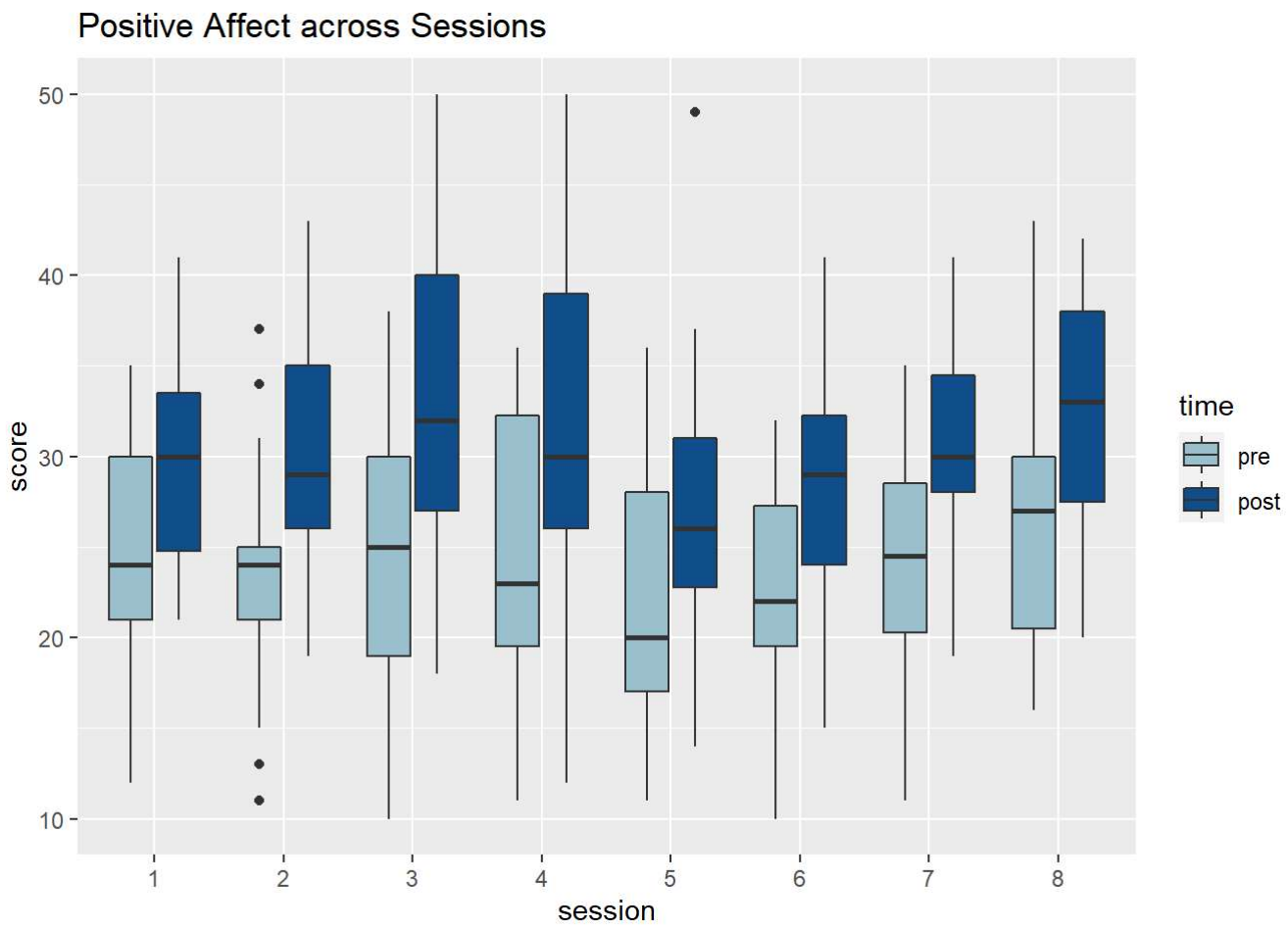
```
# score means by session
prepostdata %>%
  group_by(session) %>%
  get_summary_stats(pos, neg, ios, type="mean_sd")
```

```
## # A tibble: 24 x 5
##    session variable     n  mean    sd
##    <fct>   <chr>    <dbl> <dbl> <dbl>
##  1 1       ios         34  2.53  1.71
##  2 1       neg         34 14.0   3.85
##  3 1       pos         33 27.1   6.76
##  4 2       ios         34  3.35  1.65
##  5 2       neg         34 15.2   4.68
##  6 2       pos         34 27.1   7.56
##  7 3       ios         34  3.91  1.64
##  8 3       neg         34 12.8   3.07
##  9 3       pos         34 28.7   9.71
## 10 4       ios         34  4.41  1.5
## # ... with 14 more rows
```

# Normality & Distribution

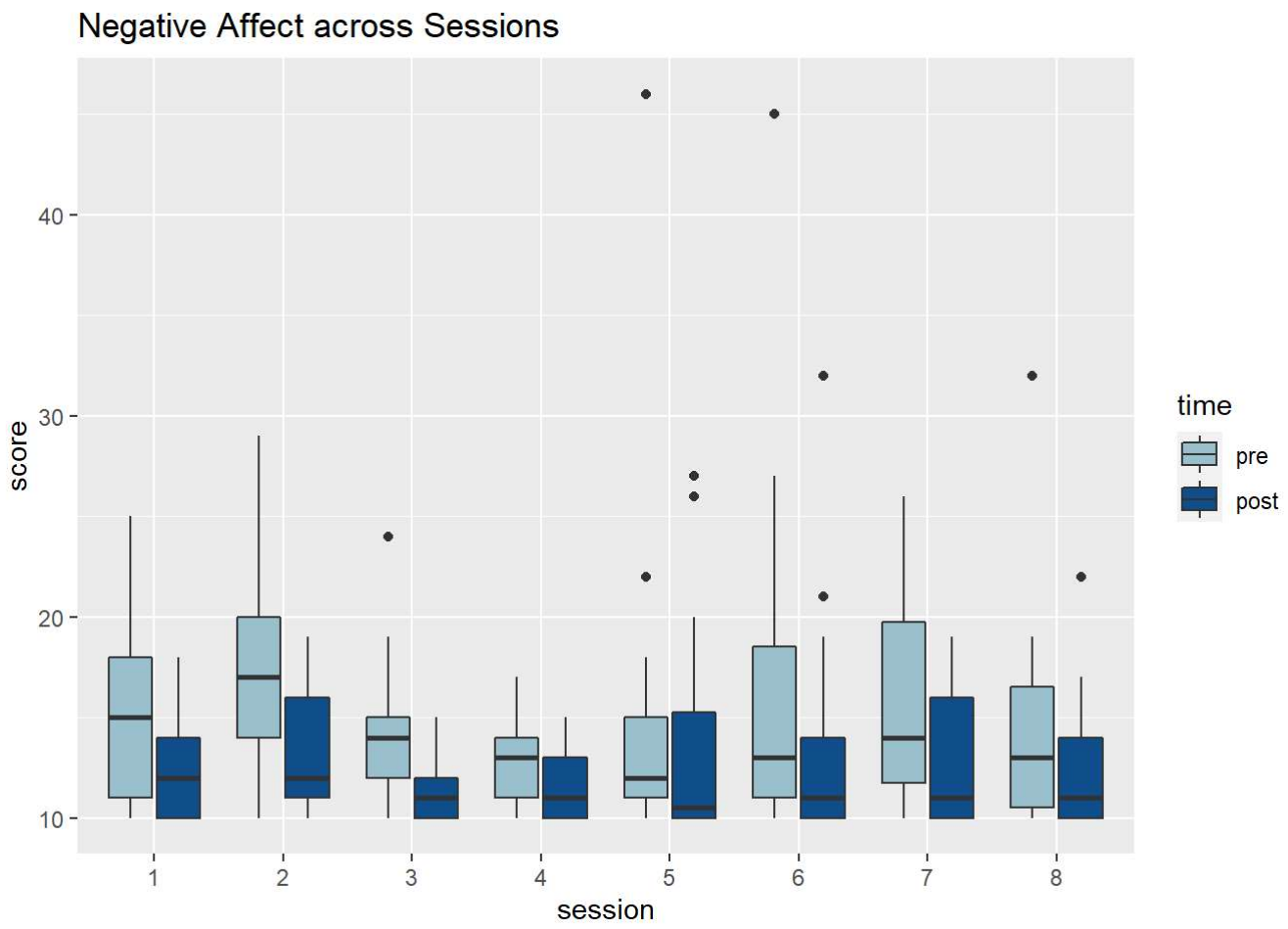
```
# boxplot pos

box_pos <- ggplot(prepostdata, aes(x= session, y= pos, fill= time)) + scale_fill_manual(values =
c("lightblue3", "dodgerblue4")) + geom_boxplot() + xlab("session") + ylab("score") + ggtitle("Po
sitive Affect across Sessions")

box_pos
```

```
## Warning: Removed 8 rows containing non-finite values (stat_boxplot).
```



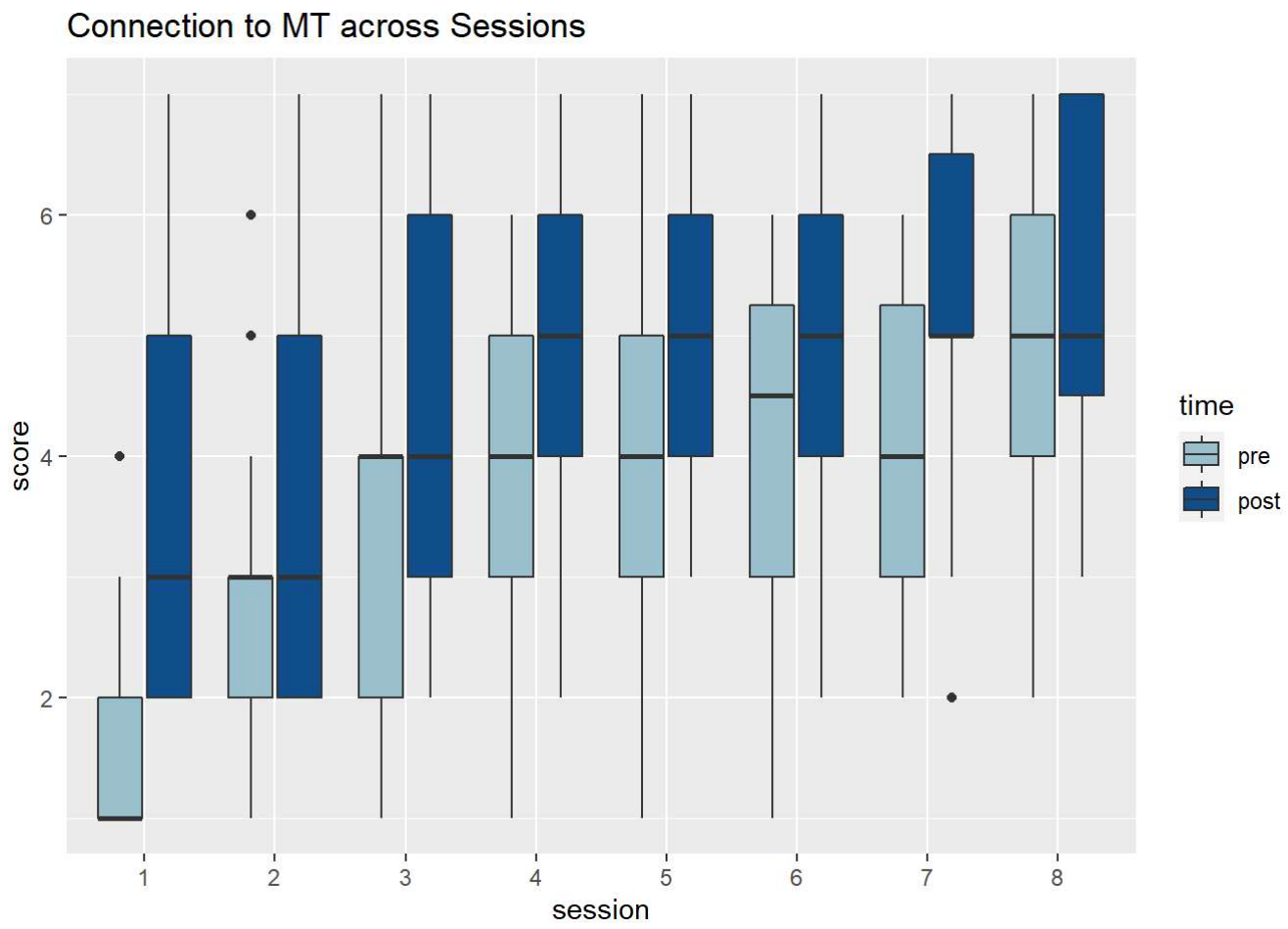

```
# boxplot neg

box_neg <- ggplot(prepostdata, aes(x= session, y= neg, fill= time)) + scale_fill_manual(values =
c("lightblue3", "dodgerblue4")) + geom_boxplot() + xlab("session") + ylab("score") + ggtitle("Ne
gative Affect across Sessions")

box_neg
```

```
## Warning: Removed 7 rows containing non-finite values (stat_boxplot).
```




```
# boxplot ios

box_ios <- ggplot(prepostdata, aes(x= session, y= ios, fill= time)) + scale_fill_manual(values =
c("lightblue3", "dodgerblue4")) + geom_boxplot() + xlab("session") + ylab("score") + ggtitle("Co
nnection to MT across Sessions")

box_ios
```

```
## Warning: Removed 6 rows containing non-finite values (stat_boxplot).
```




```
# check for outliers
prepostdata %>%
  group_by(time) %>%
  identify_outliers(pos)
```

```
## [1] time       id         session    pos        neg        ios        is.outlier
## [8] is.extreme
## <0 rows> (or 0-length row.names)
```

```
prepostdata %>%
  group_by(time) %>%
  identify_outliers(neg)
```

```
## # A tibble: 10 x 8
##    time  id    session   pos   neg   ios is.outlier is.extreme
##    <fct> <fct> <fct>   <dbl> <dbl> <dbl> <lgl>      <lgl>
##  1 pre   12024 2          18    29     3 TRUE       FALSE
##  2 pre   12035 6          29    27     5 TRUE       FALSE
##  3 pre   12039 5          19    46     1 TRUE       TRUE
##  4 pre   12039 6          10    45     5 TRUE       TRUE
##  5 pre   12039 8          16    32     2 TRUE       FALSE
##  6 post  12033 6          32    21     4 TRUE       FALSE
##  7 post  12035 5          25    27     5 TRUE       TRUE
##  8 post  12039 6          15    32     7 TRUE       TRUE
##  9 post  12039 8          20    22     4 TRUE       FALSE
## 10 post  12043 5          14    26     3 TRUE       FALSE
```

```
prepostdata %>%
  group_by(time) %>%
  identify_outliers(ios)
```

```
## [1] time       id         session    pos        neg        ios        is.outlier
## [8] is.extreme
## <0 rows> (or 0-length row.names)
```

extreme outliers: 12035 session 5, post 12039 session 5, pre 12039 session 6, pre 12039 session 6, post

```
#remove outliers
predata01 <- predata[-which(predata$id == "12039" & predata$session == "5"),]
predata01 <- predata01[-which(predata01$id == "12039" & predata01$session == "6"),]


predata01 %>%
  group_by(time) %>%
  identify_outliers(neg)
```

```
## # A tibble: 3 x 8
##    time    id session   pos   neg   ios is.outlier is.extreme
##   <int> <dbl>   <dbl> <dbl> <dbl> <dbl> <lgl>      <lgl>
## 1     0 12024       2    18    29     3 TRUE       FALSE
## 2     0 12035       6    29    27     5 TRUE       FALSE
## 3     0 12039       8    16    32     2 TRUE       FALSE
```

# Mixed Models

## Across Sessions

WITH OUTLIERS

```
#w/ outliers
lmm_pospre <- lmer(pos ~ session + (1|id), data=predata)

anova(lmm_pospre)
```

```
## Analysis of Variance Table
##         npar Sum Sq Mean Sq F value
## session    1 6.5857  6.5857  0.2831
```

```
summary(lmm_pospre)
```

```
## Linear mixed model fit by REML ['lmerMod']
## Formula: pos ~ session + (1 | id)
##    Data: predata
##
## REML criterion at convergence: 821.5
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -2.45960 -0.57460  0.05745  0.59766  2.26834
##
## Random effects:
##  Groups   Name        Variance Std.Dev.
##  id       (Intercept) 29.86    5.464
##  Residual             23.26    4.823
## Number of obs: 131, groups:  id, 17
##
## Fixed effects:
##             Estimate Std. Error t value
## (Intercept)  23.4564     1.6143  14.530
## session       0.0992     0.1864   0.532
##
## Correlation of Fixed Effects:
##         (Intr)
## session -0.507
```

```
eta_squared(lmm_pospre, partial = FALSE)
```

```
## Warning: Currently only supports partial eta squared for this class of objects.
```

```
## # Effect Size for ANOVA (Type III)
##
## Parameter | Eta2 (partial) |       90% CI
## -----------------------------------------
## session   |       2.49e-03 | [0.00, 0.03]
```

```
lmm_negpre <- lmer(neg ~ session + (1|id), data=predata)

anova(lmm_negpre)
```

```
## Analysis of Variance Table
##         npar Sum Sq Mean Sq F value
## session    1 3.5525  3.5525  0.1656
```

```
summary(lmm_negpre)
```

```
## Linear mixed model fit by REML ['lmerMod']
## Formula: neg ~ session + (1 | id)
##    Data: predata
##
## REML criterion at convergence: 803.2
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -2.4299 -0.5677 -0.2019  0.2534  4.0625
##
## Random effects:
##  Groups   Name        Variance Std.Dev.
##  id       (Intercept) 15.77    3.971
##  Residual             21.46    4.632
## Number of obs: 131, groups:  id, 17
##
## Fixed effects:
##             Estimate Std. Error t value
## (Intercept) 15.60584    1.30706  11.940
## session     -0.07293    0.17923  -0.407
##
## Correlation of Fixed Effects:
##         (Intr)
## session -0.600
```

```
eta_squared(lmm_pospre, partial = FALSE)
```

```
## Warning: Currently only supports partial eta squared for this class of objects.
```

```
## # Effect Size for ANOVA (Type III)
##
## Parameter | Eta2 (partial) |       90% CI
## -----------------------------------------
## session   |       2.49e-03 | [0.00, 0.03]
```

```
lmm_iospre <- lmer(ios ~ session + (1|id), data=predata)

anova(lmm_iospre)
```

```
## Analysis of Variance Table
##         npar Sum Sq Mean Sq F value
## session    1 92.501  92.501  117.94
```

```
summary(lmm_iospre)
```

```
## Linear mixed model fit by REML ['lmerMod']
## Formula: ios ~ session + (1 | id)
##    Data: predata
##
## REML criterion at convergence: 393.2
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -3.7485 -0.4934  0.0818  0.5749  2.6481
##
## Random effects:
##  Groups   Name        Variance Std.Dev.
##  id       (Intercept) 1.5297   1.2368
##  Residual             0.7843   0.8856
## Number of obs: 132, groups:  id, 17
##
## Fixed effects:
##             Estimate Std. Error t value
## (Intercept)  1.93744    0.34429   5.627
## session      0.37183    0.03424  10.860
##
## Correlation of Fixed Effects:
##         (Intr)
## session -0.436
```

```
eta_squared(lmm_pospre, partial = FALSE)
```

```
## Warning: Currently only supports partial eta squared for this class of objects.
```

```
## # Effect Size for ANOVA (Type III)
##
## Parameter | Eta2 (partial) |       90% CI
## -----------------------------------------
## session   |       2.49e-03 | [0.00, 0.03]
```

WITHOUT OUTLIERS

```
lmm_negpre01 <- lmer(neg ~ session + (1|id), data=predata01)

anova(lmm_negpre01)
```

```
## Analysis of Variance Table
##         npar Sum Sq Mean Sq F value
## session    1 13.751  13.751  0.8891
```

```
summary(lmm_negpre01)
```

```
## Linear mixed model fit by REML ['lmerMod']
## Formula: neg ~ session + (1 | id)
##    Data: predata01
##
## REML criterion at convergence: 745.3
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -1.4565 -0.5932 -0.2211  0.3495  3.3955
##
## Random effects:
##  Groups   Name        Variance Std.Dev.
##  id       (Intercept)  8.158   2.856
##  Residual             15.466   3.933
## Number of obs: 129, groups:  id, 17
##
## Fixed effects:
##             Estimate Std. Error t value
## (Intercept)  15.5639     1.0213  15.240
## session      -0.1437     0.1525  -0.943
##
## Correlation of Fixed Effects:
##         (Intr)
## session -0.651
```

```
eta_squared(lmm_negpre01, partial=FALSE)
```

```
## Warning: Currently only supports partial eta squared for this class of objects.
```

```
## # Effect Size for ANOVA (Type III)
##
## Parameter | Eta2 (partial) |       90% CI
## -----------------------------------------
## session   |       7.92e-03 | [0.00, 0.06]
```

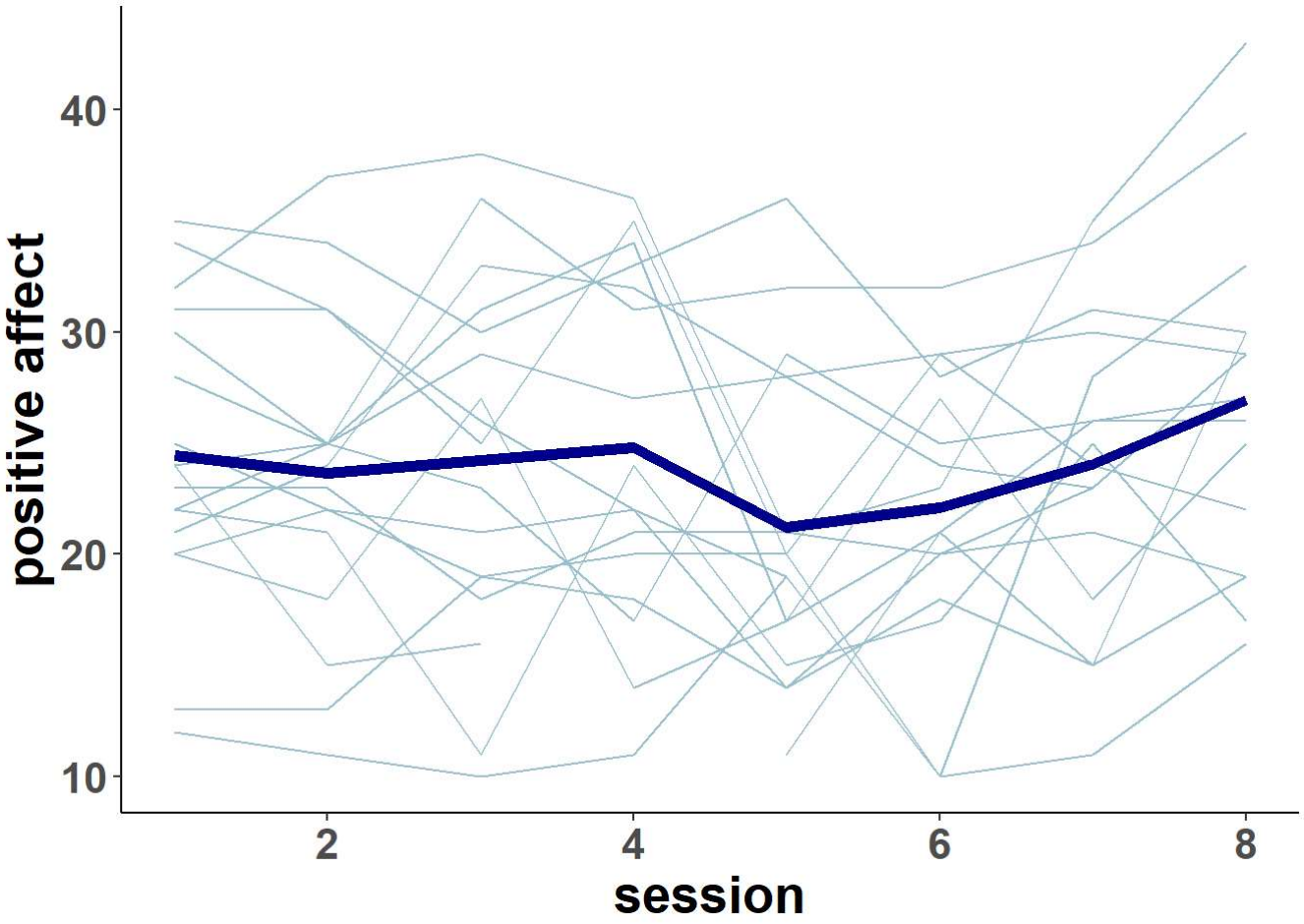
## Plots

```
pos_across_sessions <- ggplot(data = predata, aes(x = session, y = pos)) + geom_line(aes(group=i
d), size=0.5, color="lightblue3") + ylab("positive affect")  +theme_bw() + theme(panel.border =
element_blank(), panel.grid.major = element_blank(), panel.grid.minor = element_blank(), axis.li
ne = element_line(colour = "black"), text = element_text(size=20, face="bold")) + geom_line(stat
="summary", color ="darkblue", size =2)

pos_across_sessions
```

```
## Warning: Removed 3 rows containing non-finite values (stat_summary).
```

```
## No summary function supplied, defaulting to `mean_se()`
```

```
## Warning: Removed 2 row(s) containing missing values (geom_path).
```

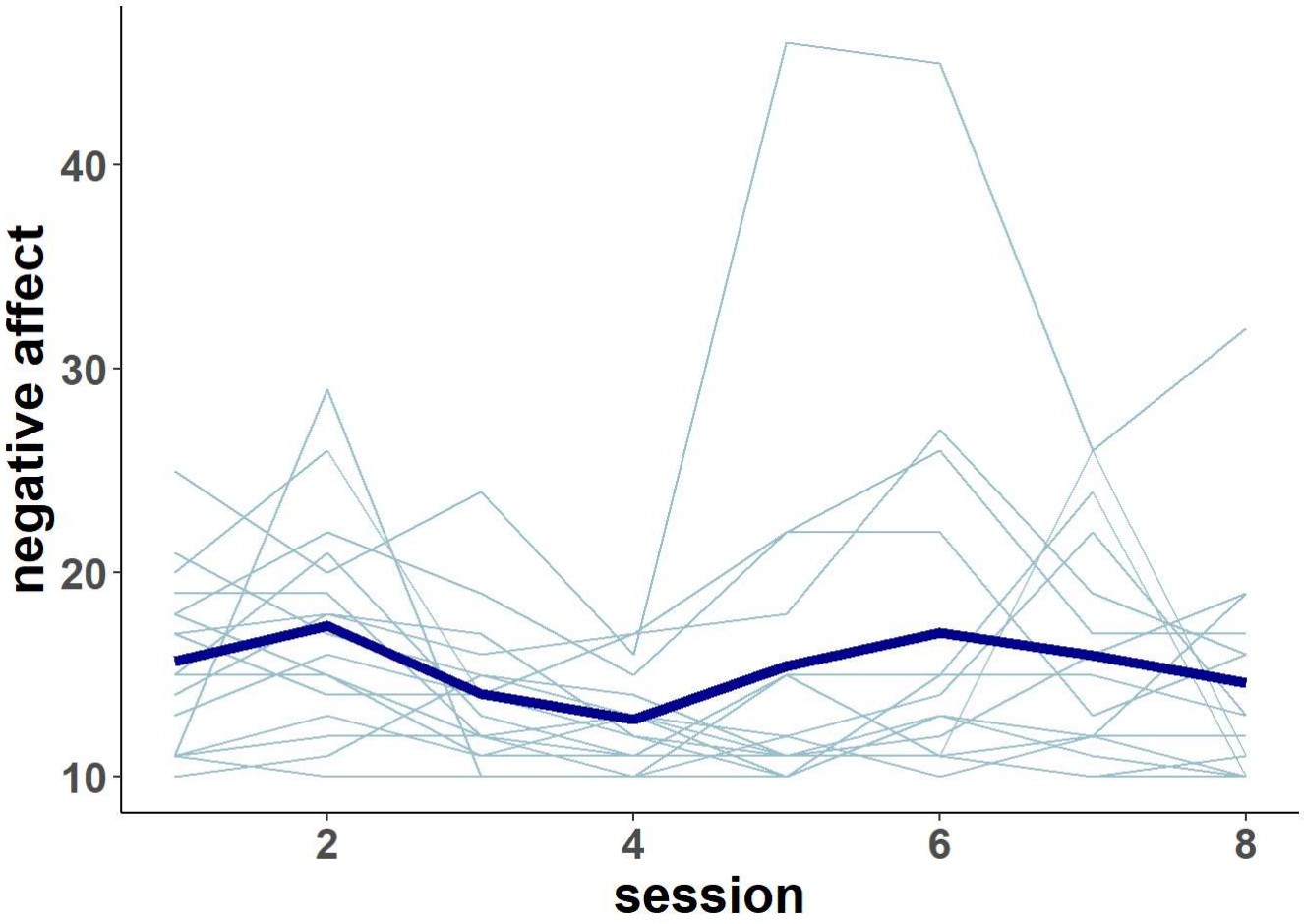


```
neg_across_sessions <- ggplot(data = predata, aes(x = session, y = neg)) + geom_line(aes(group=id), size=0.5, color="lightblue3") + ylab("negative affect")  +theme_bw() + theme(panel.border = element_blank(), panel.grid.major = element_blank(), panel.grid.minor = element_blank(), axis.line = element_line(colour = "black"), text = element_text(size=20, face="bold")) + geom_line(stat="summary", color ="darkblue", size =2)

neg_across_sessions
```

```
## Warning: Removed 3 rows containing non-finite values (stat_summary).
```

```
## No summary function supplied, defaulting to `mean_se()`
```

```
## Warning: Removed 2 row(s) containing missing values (geom_path).
```

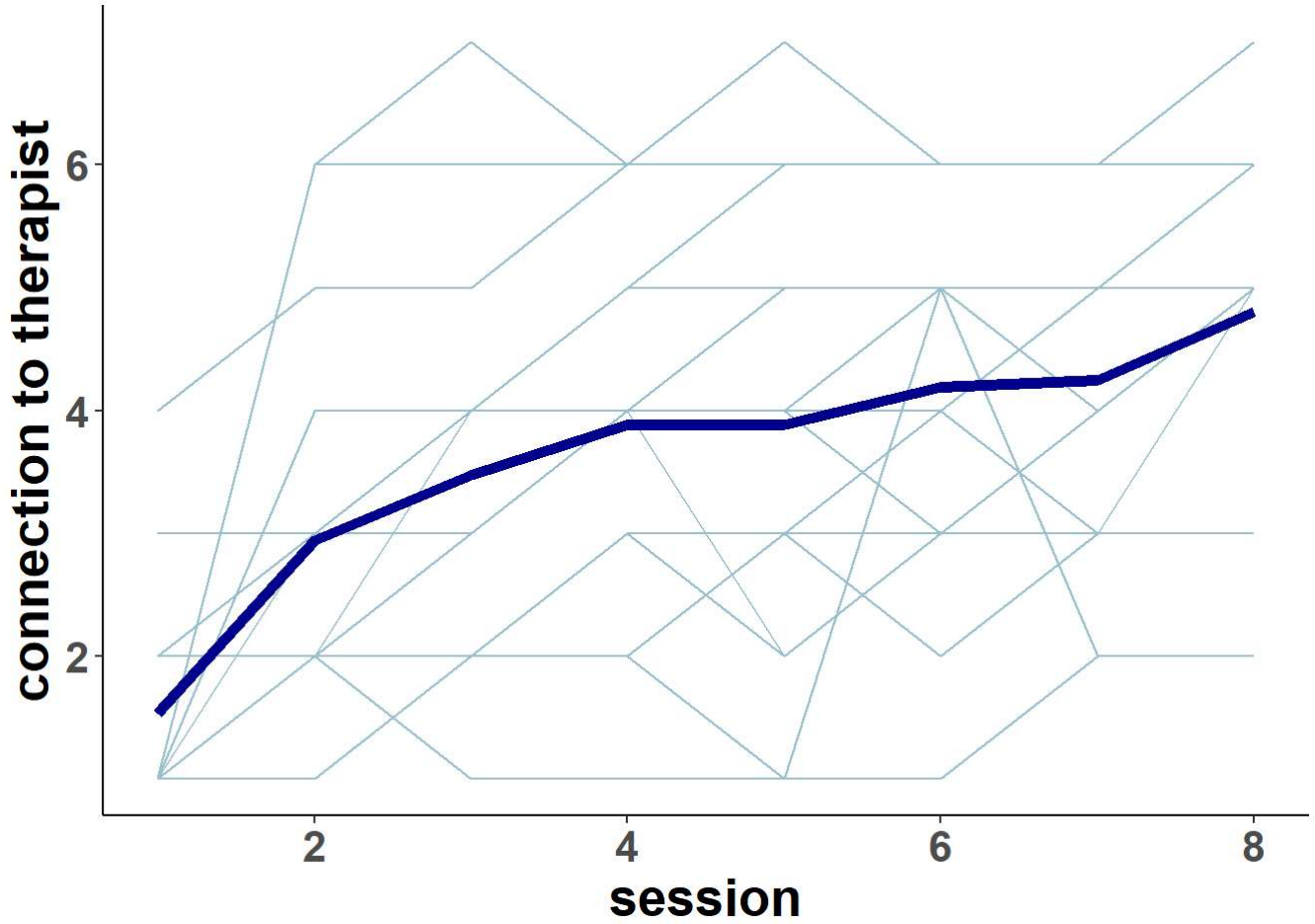


```
ios_across_sessions <- ggplot(data = predata, aes(x = session, y = ios)) + geom_line(aes(group=id), size=0.5, color="lightblue3") + ylab("connection to therapist")  +theme_bw() + theme(panel.border = element_blank(), panel.grid.major = element_blank(), panel.grid.minor = element_blank(), axis.line = element_line(colour = "black"), text = element_text(size=20, face="bold")) + geom_line(stat="summary", color ="darkblue", size =2)

ios_across_sessions
```

```
## Warning: Removed 2 rows containing non-finite values (stat_summary).
```

```
## No summary function supplied, defaulting to `mean_se()`
```

```
## Warning: Removed 2 row(s) containing missing values (geom_path).
```




###

Pre-post Session

```
lmm_pos <- lmer(pos ~ time + (1|id), data=prepostdata)

anova(lmm_pos)
```

```
## Analysis of Variance Table
##      npar Sum Sq Mean Sq F value
## time    1 2916.3  2916.3  82.516
```

```
summary(lmm_pos)
```

```
## Linear mixed model fit by REML ['lmerMod']
## Formula: pos ~ time + (1 | id)
##    Data: prepostdata
##
## REML criterion at convergence: 1698.9
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -2.2977 -0.5905  0.0359  0.5742  3.8357
##
## Random effects:
##  Groups   Name        Variance Std.Dev.
##  id       (Intercept) 21.43    4.630
##  Residual             35.34    5.945
## Number of obs: 260, groups:  id, 17
##
## Fixed effects:
##             Estimate Std. Error t value
## (Intercept)  23.8563     1.2378  19.273
## timepost      6.7014     0.7377   9.084
##
## Correlation of Fixed Effects:
##          (Intr)
## timepost -0.296
```

```
eta_squared(lmm_pos, partial=FALSE)
```

```
## Warning: Currently only supports partial eta squared for this class of objects.
```

```
## # Effect Size for ANOVA (Type III)
##
## Parameter | Eta2 (partial) |       90% CI
## -----------------------------------------
## time      |           0.25 | [0.18, 0.33]
```

```
lmm_neg <- lmer(neg ~ time + (1|id), data=prepostdata)

anova(lmm_neg)
```

```
## Analysis of Variance Table
##      npar Sum Sq Mean Sq F value
## time    1 460.37  460.37  27.318
```

```
summary(lmm_neg)
```

```
## Linear mixed model fit by REML ['lmerMod']
## Formula: neg ~ time + (1 | id)
##    Data: prepostdata
##
## REML criterion at convergence: 1511.1
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -2.2378 -0.4739 -0.1209  0.2807  5.6408
##
## Random effects:
##  Groups   Name        Variance Std.Dev.
##  id       (Intercept)  8.615   2.935
##  Residual             16.852   4.105
## Number of obs: 261, groups:  id, 17
##
## Fixed effects:
##             Estimate Std. Error t value
## (Intercept)  15.3007     0.7976  19.184
## timepost     -2.6571     0.5084  -5.227
##
## Correlation of Fixed Effects:
##          (Intr)
## timepost -0.317
```

```
eta_squared(lmm_neg, partial=FALSE)
```

```
## Warning: Currently only supports partial eta squared for this class of objects.
```

```
## # Effect Size for ANOVA (Type III)
##
## Parameter | Eta2 (partial) |       90% CI
## -----------------------------------------
## time      |           0.10 | [0.05, 0.16]
```

```
lmm_ios <- lmer(ios ~ time + (1|id), data=prepostdata)

anova(lmm_ios)
```

```
## Analysis of Variance Table
##      npar Sum Sq Mean Sq F value
## time    1 72.802  72.802  50.523
```

```
summary(lmm_ios)
```

```
## Linear mixed model fit by REML ['lmerMod']
## Formula: ios ~ time + (1 | id)
##    Data: prepostdata
##
## REML criterion at convergence: 887.6
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -3.8317 -0.4515 -0.0088  0.6801  2.3979
##
## Random effects:
##  Groups   Name        Variance Std.Dev.
##  id       (Intercept) 1.472    1.213
##  Residual             1.441    1.200
## Number of obs: 262, groups:  id, 17
##
## Fixed effects:
##             Estimate Std. Error t value
## (Intercept)   3.5869     0.3123  11.484
## timepost      1.0545     0.1484   7.108
##
## Correlation of Fixed Effects:
##          (Intr)
## timepost -0.236
```

```
eta_squared(lmm_ios, partial=FALSE)
```

```
## Warning: Currently only supports partial eta squared for this class of objects.
```

```
## # Effect Size for ANOVA (Type III)
##
## Parameter | Eta2 (partial) |       90% CI
## -----------------------------------------
## time      |           0.17 | [0.11, 0.24]
```

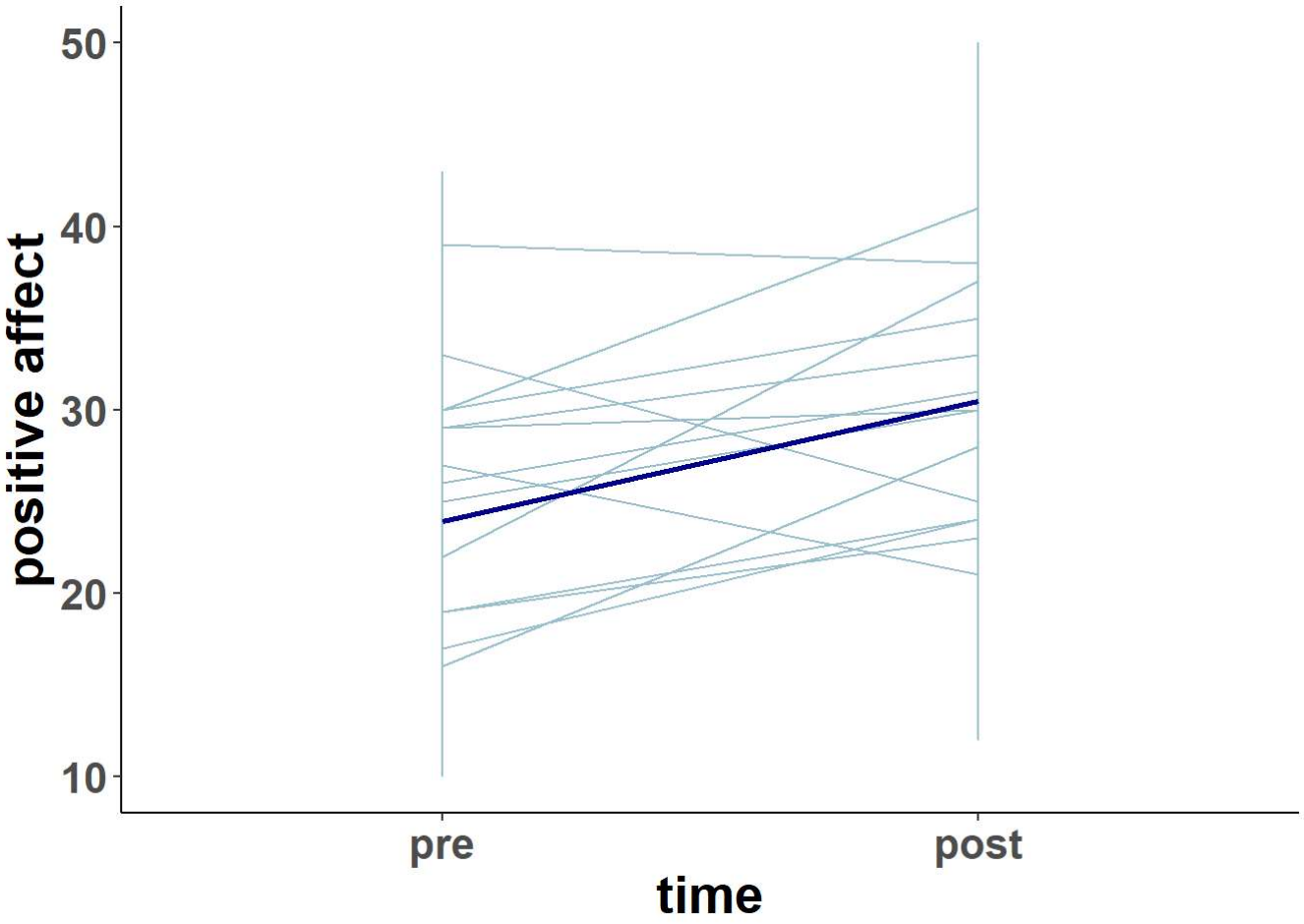
## Plots

```
pos_prepost <- ggplot(data = prepostdata, aes(x = time, y = pos)) + geom_line(aes(group=id), siz
e=0.5, color="lightblue3") + ylab("positive affect")  +theme_bw() + theme(panel.border = element
_blank(), panel.grid.major = element_blank(), panel.grid.minor = element_blank(), axis.line = el
ement_line(colour = "black"), text = element_text(size=20, face="bold")) + geom_line(stat="summa
ry", color ="darkblue", size =1, group = 1)

pos_prepost
```

```
## Warning: Removed 8 rows containing non-finite values (stat_summary).
```

```
## No summary function supplied, defaulting to `mean_se()`
```

```
## Warning: Removed 2 row(s) containing missing values (geom_path).
```

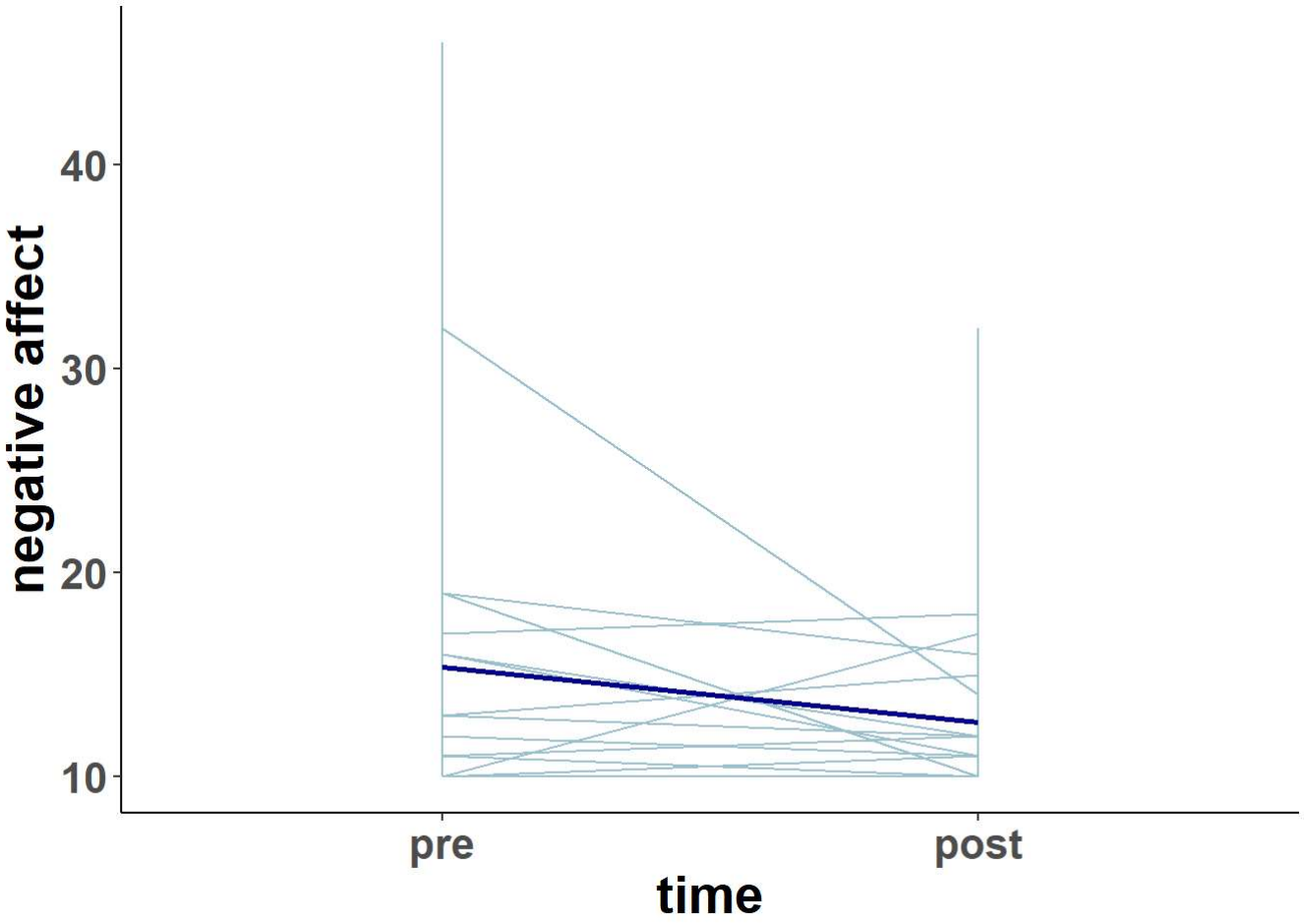


```
neg_prepost <- ggplot(data = prepostdata, aes(x = time, y = neg)) + geom_line(aes(group=id), siz
e=0.5, color="lightblue3") + ylab("negative affect")  +theme_bw() + theme(panel.border = element
_blank(), panel.grid.major = element_blank(), panel.grid.minor = element_blank(), axis.line = el
ement_line(colour = "black"), text = element_text(size=20, face="bold")) + geom_line(stat="summa
ry", color ="darkblue", size =1, group = 1)

neg_prepost
```

```
## Warning: Removed 7 rows containing non-finite values (stat_summary).
```

```
## No summary function supplied, defaulting to `mean_se()`
```

```
## Warning: Removed 2 row(s) containing missing values (geom_path).
```

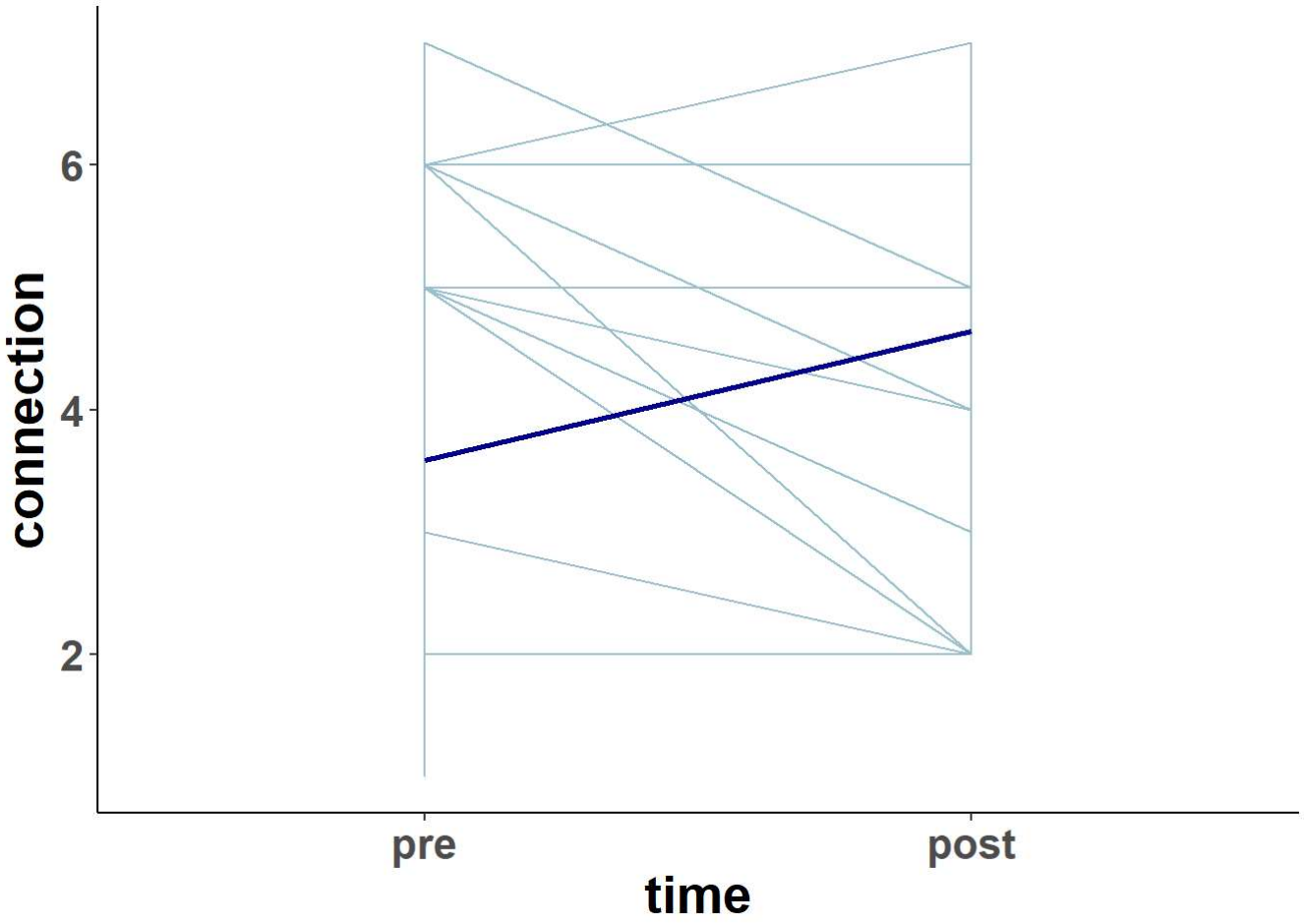


```
ios_prepost <- ggplot(data = prepostdata, aes(x = time, y = ios)) + geom_line(aes(group=id), siz
e=0.5, color="lightblue3") + ylab("connection")  +theme_bw() + theme(panel.border = element_blan
k(), panel.grid.major = element_blank(), panel.grid.minor = element_blank(), axis.line = element
_line(colour = "black"), text = element_text(size=20, face="bold")) + geom_line(stat="summary",
color ="darkblue", size =1, group = 1)

ios_prepost
```

```
## Warning: Removed 6 rows containing non-finite values (stat_summary).
```

```
## No summary function supplied, defaulting to `mean_se()`
```

```
## Warning: Removed 2 row(s) containing missing values (geom_path).
```




#

EMA

```
filename <- "20230321_EMAData.csv"

EMAdata <- read_csv(filename)
```

```
## Rows: 1562 Columns: 34
## -- Column specification --------------------------------------------------------
## Delimiter: ","
## chr   (1): date
## dbl  (30): id, event, day, instance, enrollmentgroup, completed, positive_sc...
## time  (3): time, time_participant, time_interval
##
## i Use `spec()` to retrieve the full column specification for this data.
## i Specify the column types or set `show_col_types = FALSE` to quiet this message.
```

```
#transform variables to factor
EMAdata$id <- as.factor(EMAdata$id)
EMAdata$event <- as.factor(EMAdata$event)
levels(EMAdata$event) <- c("Baseline", "Session 4", "Post")
EMAdata$enrollmentgroup <- as.factor(EMAdata$enrollmentgroup)
levels(EMAdata$enrollmentgroup) <- c("Waitlist Control", "Immediate Enrollment", "Group")
```

# Descriptive Statistics

```
#remove group 2
EMAdata <- filter(EMAdata, enrollmentgroup != "Group")
```

## Missing Data

Missing Instances

```
#create dataframe of missing instances (completed = 0)
missingdata <- filter(EMAdata, completed == '0')
```

```
#create table of n missing: event x group
missing_instance <- matrix(0, 4,4)

colnames(missing_instance) <- c("Baseline", "Session4", "Post", "Total")
rownames(missing_instance) <- c("WLC", "IE", "Group", "Total")
```

```
missing_instance[1,1] <- length(which(missingdata$event == "baseline" & missingdata$enrollmentgr
oup == "0"))
missing_instance[2,1] <- length(which(missingdata$event == "baseline" & missingdata$enrollmentgr
oup == "1"))
missing_instance[3,1] <- length(which(missingdata$event == "baseline" & missingdata$enrollmentgr
oup == "2"))
missing_instance[1,2] <- length(which(missingdata$event == "session4" & missingdata$enrollmentgr
oup == "0"))
missing_instance[2,2] <- length(which(missingdata$event == "session4" & missingdata$enrollmentgr
oup == "1"))
missing_instance[3,2] <- length(which(missingdata$event == "session4" & missingdata$enrollmentgr
oup == "2"))
missing_instance[1,3] <- length(which(missingdata$event == "post" & missingdata$enrollmentgroup
== "0"))
missing_instance[2,3] <- length(which(missingdata$event == "post" & missingdata$enrollmentgroup
== "1"))
missing_instance[3,3] <- length(which(missingdata$event == "post" & missingdata$enrollmentgroup
== "2"))

missing_instance[1,4] <- length(which(missingdata$enrollmentgroup == "0"))
missing_instance[2,4] <- length(which(missingdata$enrollmentgroup == "1"))
missing_instance[3,4] <- length(which(missingdata$enrollmentgroup == "2"))

missing_instance[4,1] <- length(which(missingdata$event == "baseline"))
missing_instance[4,2] <- length(which(missingdata$event == "session4"))
missing_instance[4,3] <- length(which(missingdata$event == "post"))
missing_instance[4,4] <- missing_instance[4,1] + missing_instance[4,2] + missing_instance[4,3]

view(missing_instance)
```

Missing Items

```
#create dataframe of missing items (completed =1, N/A on at least 1 item)
missingitems <- filter(EMAdata, completed == "1" & (is.na(positive_score) | is.na(negative_scor
e))) #n=9

view(missingitems)
```

```
#impute missing items using the average of other neg/pos items
## create function

#function inputs: ID, EVENT, INSTANCE
itemavg <- function(ID, EVENT, INSTANCE){

  # row from id, event, instance
  r <- which(EMAdata$id == ID & EMAdata$event == EVENT & EMAdata$instance == INSTANCE)

  positems <- c()
  negitems <- c()

  #positive items: 1, 3, 5, 9, 10, 12, 14, 16, 17, 19
  positems <- append(positems, as.integer(EMAdata[r,15])) #posq1
  positems <- append(positems, as.integer(EMAdata[r,17])) #posq3
  positems <- append(positems, as.integer(EMAdata[r,19]))#posq5
  positems <- append(positems, as.integer(EMAdata[r,23]))#posq9
  positems <- append(positems, as.integer(EMAdata[r,24])) #posq10
  positems <- append(positems, as.integer(EMAdata[r,26])) #posq12
  positems <- append(positems, as.integer(EMAdata[r,28])) #posq14
  positems <- append(positems, as.integer(EMAdata[r,30])) #posq16
  positems <- append(positems, as.integer(EMAdata[r,31])) #posq17
  positems <- append(positems, as.integer(EMAdata[r,33])) #posq19

  posavg <- mean(positems, na.rm=TRUE)

  #negative items: 2, 4, 6, 7, 8, 11, 13, 15, 18, 20
  negitems <- append(negitems,  as.integer(EMAdata[r,16])) #negq2
  negitems <- append(negitems, as.integer(EMAdata[r,18])) #negq4
  negitems <- append(negitems, as.integer(EMAdata[r,20])) #negq6
  negitems <- append(negitems, as.integer(EMAdata[r,21])) #negq7
  negitems <- append(negitems, as.integer(EMAdata[r,22])) #negq8
  negitems <- append(negitems, as.integer(EMAdata[r,25])) #negq11
  negitems <- append(negitems, as.integer(EMAdata[r,27])) #negq13
  negitems <- append(negitems, as.integer(EMAdata[r,29])) #negq15
  negitems <- append(negitems, as.integer(EMAdata[r,32])) #negq18
  negitems <- append(negitems, as.integer(EMAdata[r,34])) #negq20

  negavg <- mean(negitems, na.rm=TRUE)

  #output posavg, negavg
  out <- list(r, posavg, negavg)

  return(out)
}
```

```
#add all positive items
posscore <- function(r){
  score <- as.integer(EMAdata[r, 15]) + as.integer(EMAdata[r, 17]) +
    as.integer(EMAdata[r, 19]) + as.integer(EMAdata[r, 23]) +
    as.integer(EMAdata[r, 24]) + as.integer(EMAdata[r, 26]) +
    as.integer(EMAdata[r, 28]) + as.integer(EMAdata[r, 30]) +
    as.integer(EMAdata[r, 31]) + as.integer(EMAdata[r, 33])

  return(score)
}

#add all negative items
negscore <- function(r){
  score <- as.integer(EMAdata[r, 16]) + as.integer(EMAdata[r, 18]) +
    as.integer(EMAdata[r, 20]) + as.integer(EMAdata[r, 21]) +
    as.integer(EMAdata[r, 22]) + as.integer(EMAdata[r, 25]) +
    as.integer(EMAdata[r, 27]) + as.integer(EMAdata[r, 29]) +
    as.integer(EMAdata[r, 32]) + as.integer(EMAdata[r, 34])

  return(score)
}
```

```
#12015 session 4:8
out<- itemavg("12015", "Session 4", 8)
EMAdata[23, 17] <- out[2] #posq3
EMAdata[23, 23] <- out[2] #posq9
EMAdata[23,11] <- posscore(23) #positive score

#12015 session4: 12
out<- itemavg("12015", "Session 4", 12)
EMAdata[27, 25] <- out[3] #negq11
EMAdata[27,12] <- negscore(27) #negative score

#12017 post: 3
out <- itemavg("12017", "Post", 3)
EMAdata[123, 30] <- out[2] #posq16
EMAdata[123, 11] <- posscore(123)

#12027 baseline:2
out <- itemavg("12027", "Baseline", 2)
EMAdata[542, 28] <- out[2] #posq14
EMAdata[542, 11] <- posscore(542)

#12027 session4:12
out <- itemavg("12027", "Session 4", 12)
EMAdata[567, 22] <- out[3] #neg8
EMAdata[567, 27] <- out[3] #neg13
EMAdata[567,12] <- negscore(567)

#12033 baseline:15
out<- itemavg("12033", "Baseline", 15)
EMAdata[810, 24] <- out[2] #pos10
EMAdata[810, 11] <- posscore(810)

#12033 session4:11
out<- itemavg("12033", "Session 4", 11)
EMAdata[821, 30] <- out[2] #posq16
EMAdata[821, 11] <- posscore(821)

#12039 post:2
out<- itemavg("12039", "Post", 2)
EMAdata[1097, 31] <- out[2] #posq17
EMAdata[1097,11] <- posscore(1097)

#12039 post:3
out<- itemavg("12039", "Post", 3)
EMAdata[1098, 28] <- out[2] #posq14
EMAdata[1098, 34] <- out[3] #neg20
EMAdata[1098, 11] <- posscore(1098)
EMAdata[1098, 12] <- negscore(1098)
```

```
#check missing items (completed =1, N/A on at least 1 item)
missingitems <- filter(EMAdata, completed == "1" & (is.na(positive_score) | is.na(negative_scor
e))) #n=9

view(missingitems)
```

# Survey Completion

Compliance Rate

```
#create dataframe of id x completion
compliance_rate <- matrix(0, 35, 3)

colnames(compliance_rate) <- c("Group", "Completed", "ComplianceRate")
id_names <- c("12015", "12016", "12017", "12018", "12019", "12020","12021", "12022", "12023", "1
2024","12025", "12026", "12027", "12028", "12029", "12030", "12031", "12032", "12033", "12034",
"12035", "12036", "12037", "12038", "12039", "12040", "12041","12043", "12044", "12045", "1204
8","12050", "12055","12056", "12057")
rownames(compliance_rate) <- id_names
```

```
#fill matrix col 1 with enrollment group
r = 1
n = 1

for(n in 1:35){
  ind <- which(EMAdata$id == id_names[n])
  compliance_rate[r,1] <- EMAdata$enrollmentgroup[ind[1]]
  r <- r + 1
  n <- n + 1
}
```

```
#fill matrix col 2 with n completed by id
r = 1
n = 1

for(n in 1:35){
  compliance_rate[r,2] <- length(which(EMAdata$id == id_names[n]))
  r <- r + 1
  n <- n + 1
  }
```

```
#fill matrix col 3 with compliance rate
r = 1
n = 1

for (n in 1:35){
  compliance_rate[r, 3] <- compliance_rate[r, 2]/45
  r <- r + 1
  n <- n + 1
}
```

```
#output min and max values
max <- which(compliance_rate == max(compliance_rate[,3]), arr.ind=TRUE)
min <- which(compliance_rate == min(compliance_rate[,3]), arr.ind=TRUE)

print(paste("Maximum compliance rate:", compliance_rate[max[1]]))
```

```
## [1] "Maximum compliance rate: 1"
```

```
print(paste("Minimum compliance rate:", compliance_rate[min]))
```

```
## [1] "Minimum compliance rate: 0" "Minimum compliance rate: 0"
## [3] "Minimum compliance rate: 0" "Minimum compliance rate: 0"
## [5] "Minimum compliance rate: 0" "Minimum compliance rate: 0"
```

# Mean (SD) Table

```
summarise_at(EMAdata, vars(positive_score, negative_score), list(mean=mean, sd=sd), na.rm=TRUE)
```

```
## # A tibble: 1 x 4
##   positive_score_mean negative_score_mean positive_score_sd negative_score_sd
##                 <dbl>               <dbl>             <dbl>             <dbl>
## 1                22.5                15.9              7.82              4.61
```

```
#group by event
EMAdata%>%
  group_by(event) %>%
  summarise_at(vars(positive_score, negative_score), list(mean=mean, sd=sd), na.rm=TRUE)
```

```
## # A tibble: 3 x 5
##   event     positive_score_mean negative_score_mean positive_score_sd negative~1
##   <fct>                   <dbl>               <dbl>             <dbl>      <dbl>
## 1 Baseline                 21.5                16.0              7.10       4.73
## 2 Session 4                21.8                16.0              7.56       4.89
## 3 Post                     24.4                15.7              8.43       4.15
## # ... with abbreviated variable name 1: negative_score_sd
```

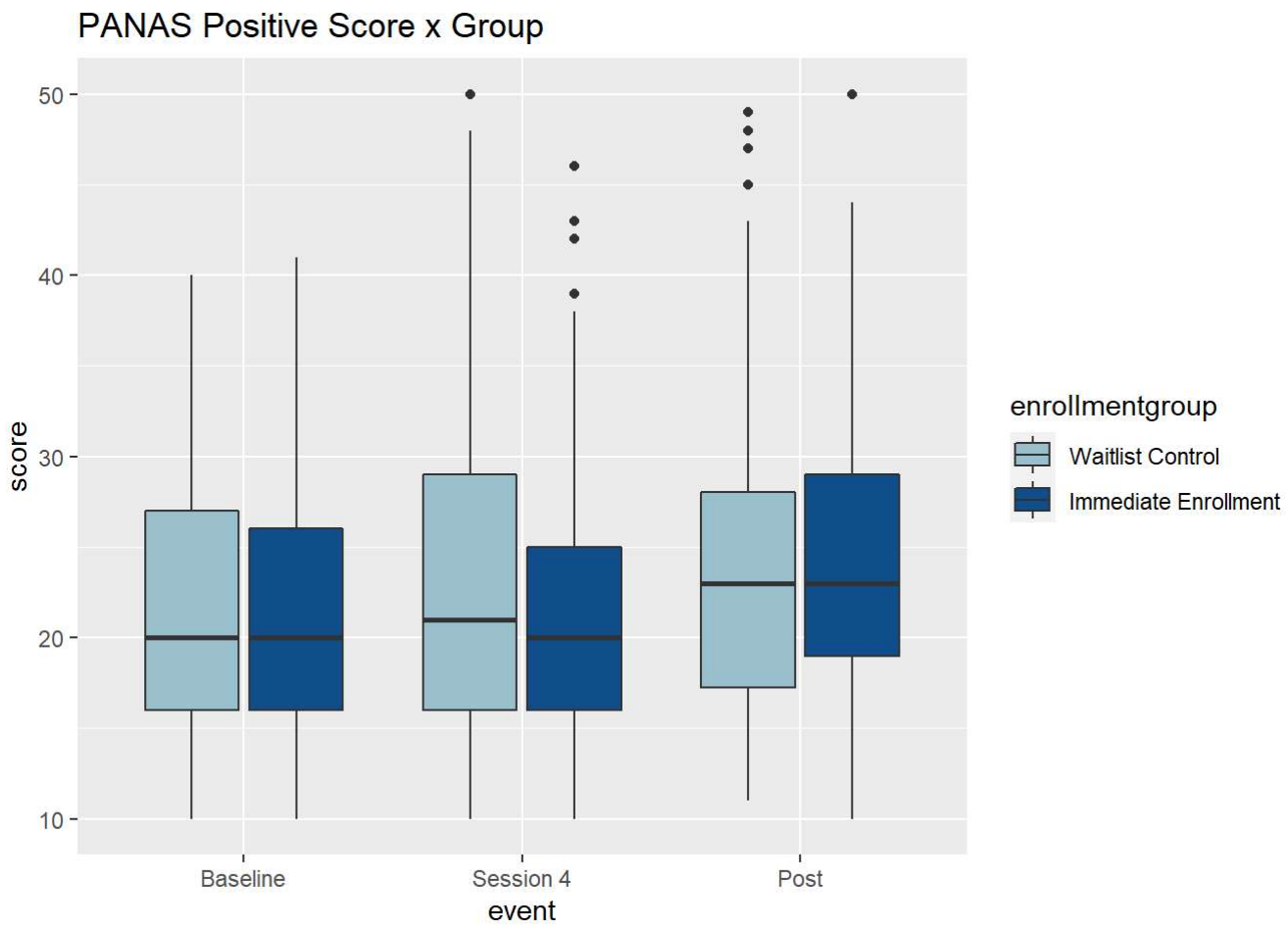
```
#group by enrollment
EMAdata%>%
  group_by(enrollmentgroup) %>%
  summarise_at(vars(positive_score, negative_score), list(mean=mean, sd=sd), na.rm=TRUE)
```

```
## # A tibble: 2 x 5
##   enrollmentgroup      positive_score_mean negative_score_mean positiv~1 negat~2
##   <fct>                              <dbl>               <dbl>     <dbl>   <dbl>
## 1 Waitlist Control                    22.8                16.0      7.97    4.23
## 2 Immediate Enrollment                22.3                15.8      7.67    4.94
## # ... with abbreviated variable names 1: positive_score_sd,
## #   2: negative_score_sd
```

# Normality & Distribution

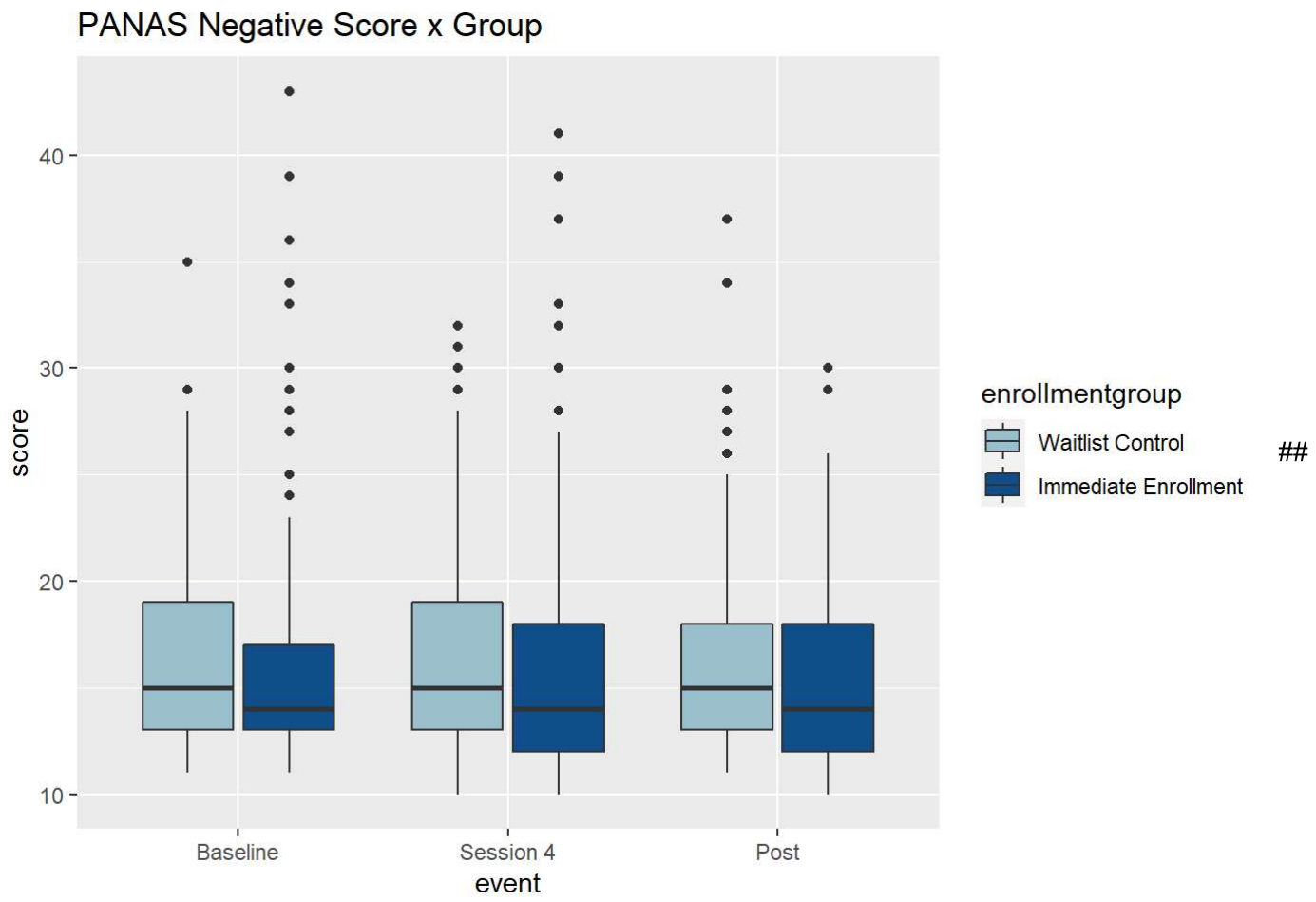
```
#create grouped boxplot - positive

ggplot(EMAdata, aes(x=event, y=positive_score, fill=enrollmentgroup)) + scale_fill_manual(values
= c("lightblue3", "dodgerblue4")) + geom_boxplot() + xlab("event") + ylab("score") + ggtitle("PA
NAS Positive Score x Group")
```

```
## Warning: Removed 185 rows containing non-finite values (stat_boxplot).
```




```
#create grouped boxplot - negative

ggplot(EMAdata, aes(x=event, y=negative_score, fill=enrollmentgroup)) +
  scale_fill_manual(values = c("lightblue3", "dodgerblue4")) +
  geom_boxplot() + xlab("event") + ylab("score") +
  ggtitle("PANAS Negative Score x Group")
```

```
## Warning: Removed 185 rows containing non-finite values (stat_boxplot).
```



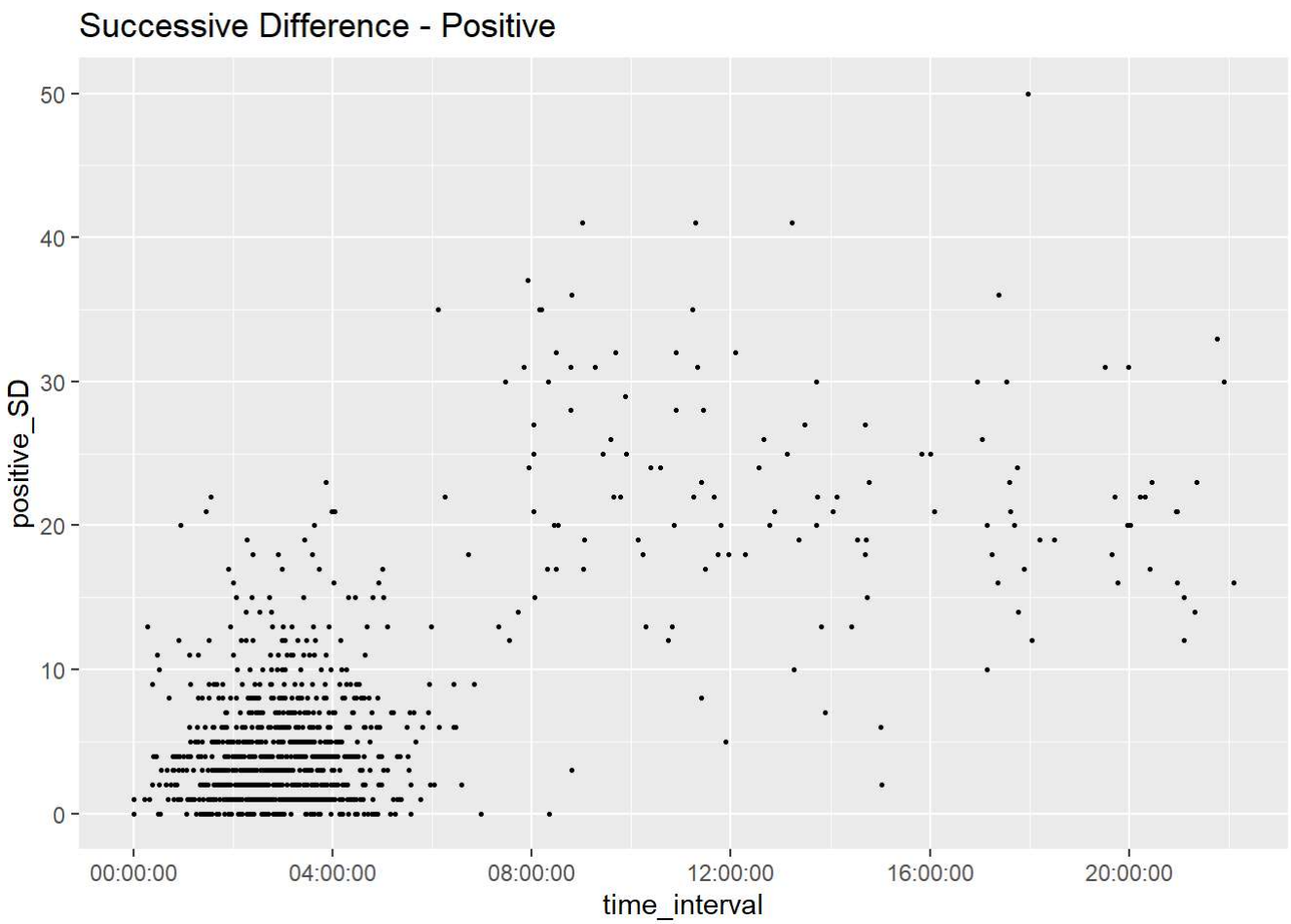

Reformat Variables ### Within-day

```
withinday <- EMAdata[,c('id', 'event', 'day', 'instance', 'enrollmentgroup', 'time_interval', 'p
ositive_score', 'negative_score', "positive_SD","negative_SD")]
```

```
#convert time_interval from h:m:s to minutes
withinday$time_interval_min <- hour(withinday$time_interval)*60 + minute(withinday$time_interva
l)

withinday <- withinday %>%
  relocate("time_interval_min", .after="time_interval")
```

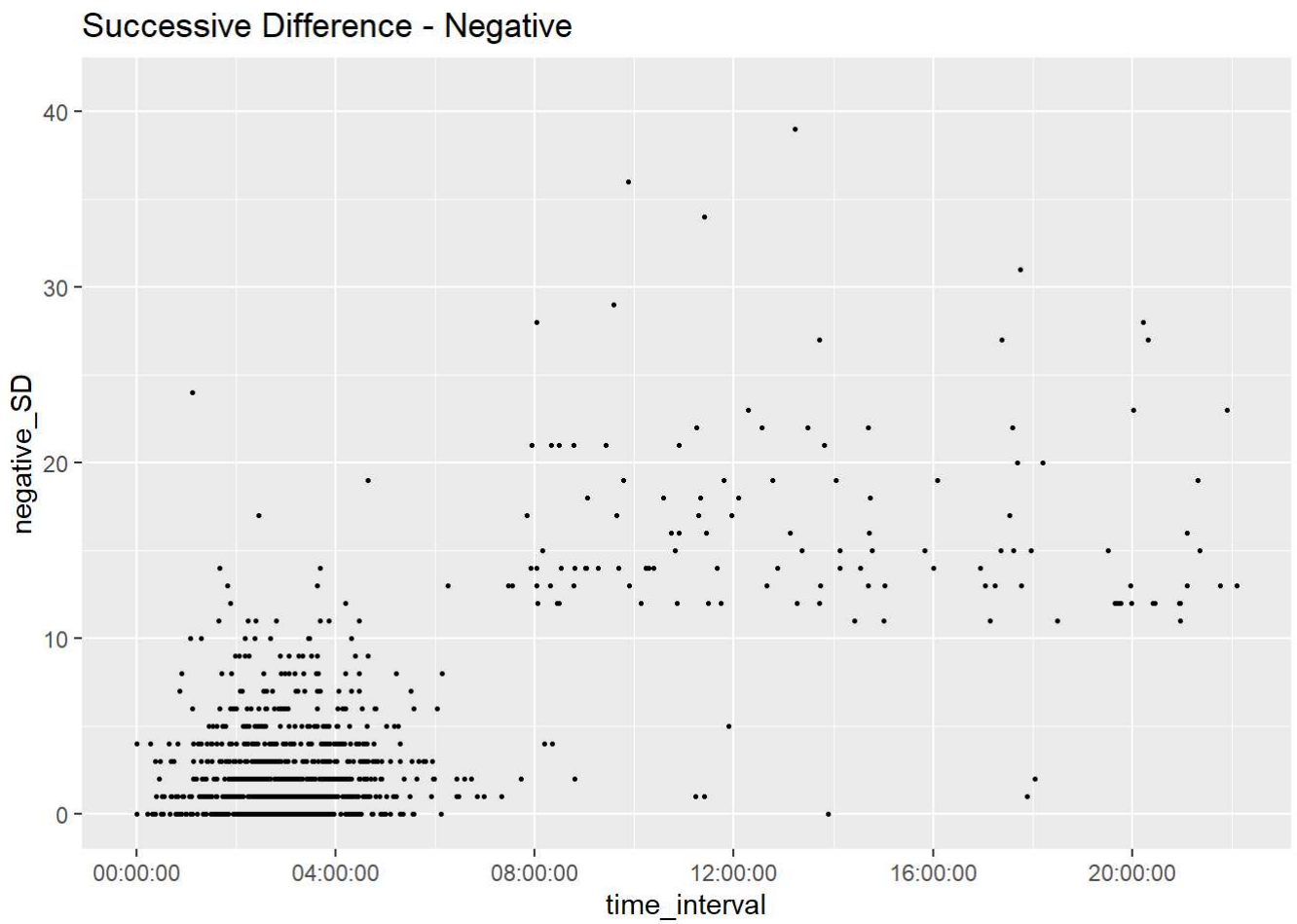
```
# scatter plot of ASD x time interval (hour)
ggplot(withinday, aes(x = time_interval, y=positive_SD)) + geom_point(size = 0.5) +
  ggtitle("Successive Difference - Positive")
```

```
## Warning: Removed 406 rows containing missing values (geom_point).
```




```
ggplot(withinday, aes(x = time_interval, y=negative_SD)) + geom_point(size = 0.5) +
  ggtitle("Successive Difference - Negative")
```

```
## Warning: Removed 406 rows containing missing values (geom_point).
```




```
#ASD = positive_SD[i] / time_interval[i]
pos_ASD <- vector()

for(i in 1:1427){
  pos_ASD <- append(pos_ASD, c(withinday$positive_SD[i] / withinday$time_interval_min[i]))

  i = i + 1
}

head(pos_ASD)
```

```
## [1]          NA 0.007246377 0.000000000 0.003745318 0.024752475          NA
```

```
#create positive ASD variable
withinday$positive_ASD <- pos_ASD
```

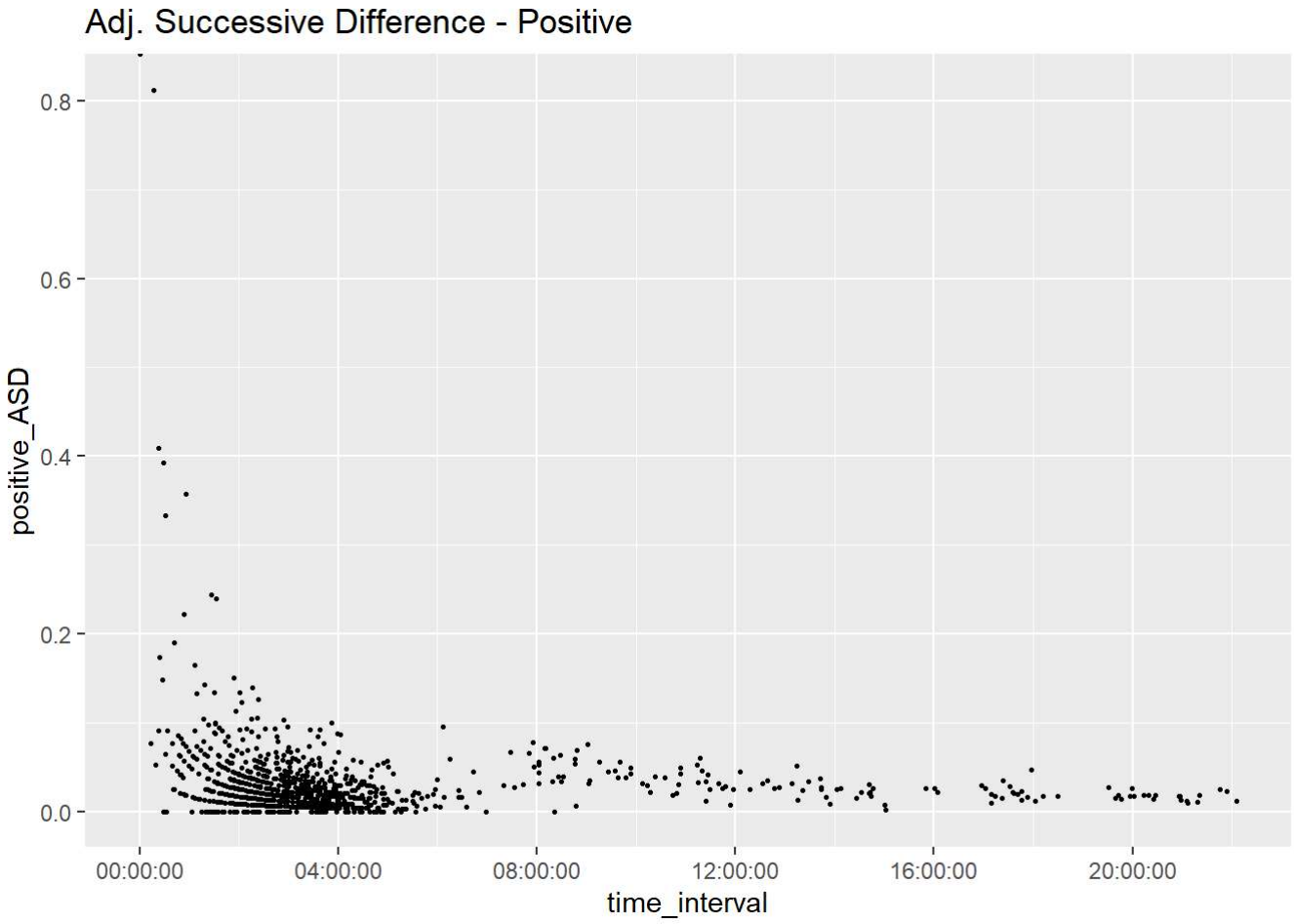
```
neg_ASD <- vector()

for(i in 1:1427){
  neg_ASD <- append(neg_ASD, c(withinday$negative_SD[i] / withinday$time_interval_min[i]))

  i = i + 1
}

head(neg_ASD)
```

```
## [1]         NA 0.01449275 0.00000000 0.00000000 0.00000000         NA
```

```
#create negative ASD variable
withinday$negative_ASD <- neg_ASD
```

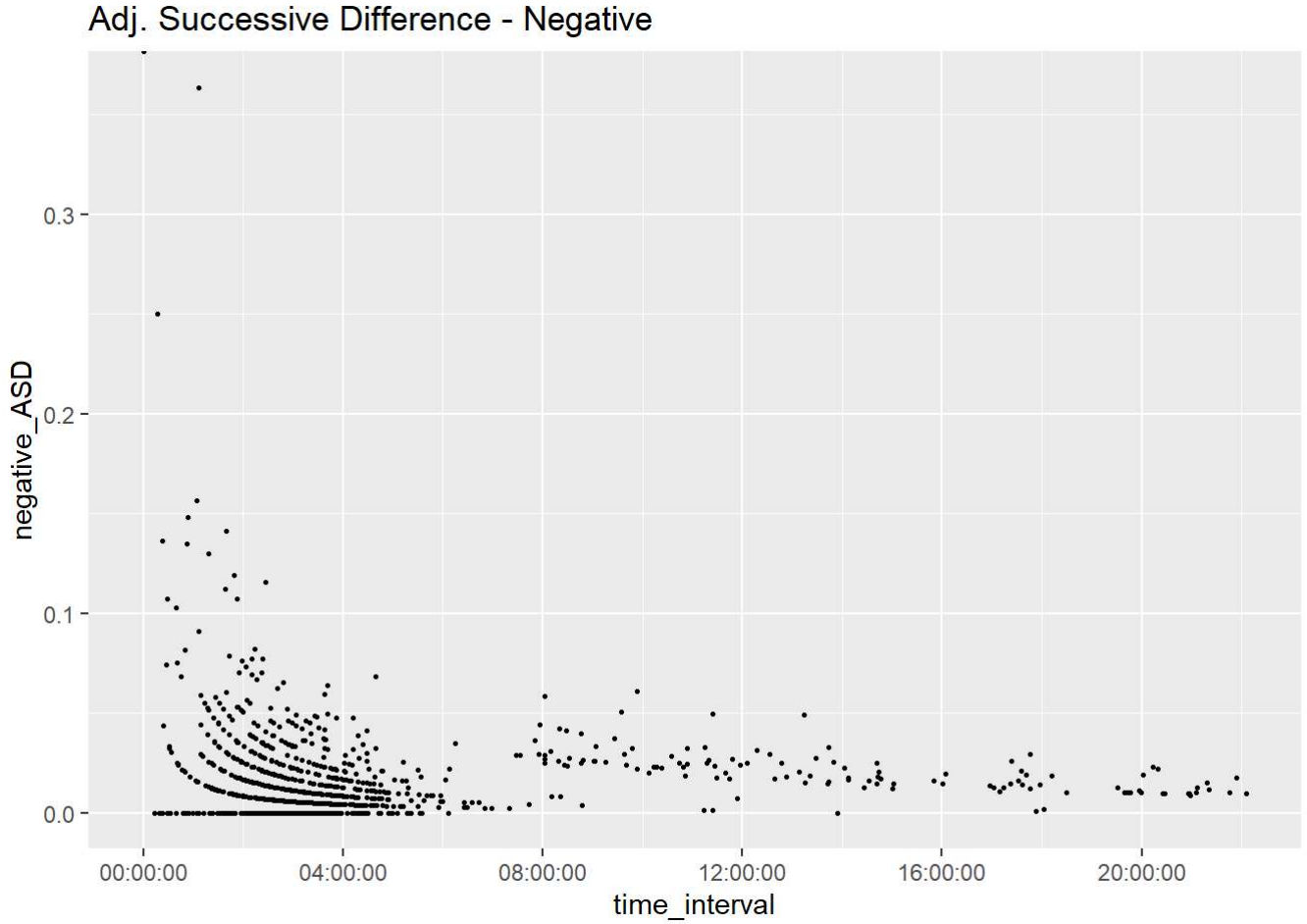
```
# scatter plot of ASD x time interval (hour)
ggplot(withinday, aes(x = time_interval, y=positive_ASD)) + geom_point(size = 0.5) +
  ggtitle("Adj. Successive Difference - Positive")
```

```
## Warning: Removed 413 rows containing missing values (geom_point).
```



```
ggplot(withinday, aes(x = time_interval, y=negative_ASD)) + geom_point(size = 0.5) +
  ggtitle("Adj. Successive Difference - Negative")
```

```
## Warning: Removed 413 rows containing missing values (geom_point).
```




###

Between-day calculated in excel - kept running into issues doing it in R

```
filename <- "20230325_betweenday.csv"

betweenday <- read_csv(filename)
```

```
## Rows: 283 Columns: 16
## -- Column specification --------------------------------------------------------
## Delimiter: ","
## chr   (1): date
## dbl  (12): id, event, day, instance, enrollmentgroup, completed, positive_sc...
## time  (3): time, time_participant, time_interval
##
## i Use `spec()` to retrieve the full column specification for this data.
## i Specify the column types or set `show_col_types = FALSE` to quiet this message.
```

# Preliminary Analyses

mixed model w REML fixed effects: enrollment group, event, event*enrollmentgroup random effects: id

## x Events

```
lmm_emapos <- lmer(positive_mean ~ enrollmentgroup * event + (1|id), data=betweenday)

summary(lmm_emapos)
```

```
## Linear mixed model fit by REML ['lmerMod']
## Formula: positive_mean ~ enrollmentgroup * event + (1 | id)
##    Data: betweenday
##
## REML criterion at convergence: 1729.5
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -2.9201 -0.5531 -0.1101  0.5542  2.6795
##
## Random effects:
##  Groups   Name        Variance Std.Dev.
##  id       (Intercept) 24.04    4.903
##  Residual             20.68    4.548
## Number of obs: 283, groups:  id, 33
##
## Fixed effects:
##                       Estimate Std. Error t value
## (Intercept)            21.9437     1.6064  13.660
## enrollmentgroup        -1.2525     2.2292  -0.562
## event                   0.6044     0.4806   1.258
## enrollmentgroup:event   0.1940     0.6660   0.291
##
## Correlation of Fixed Effects:
##             (Intr) enrllm event
## enrllmntgrp -0.721
## event       -0.593  0.428
## enrllmntgr:  0.428 -0.592 -0.722
```

```
anova(lmm_emapos)
```

```
## Analysis of Variance Table
##                       npar Sum Sq Mean Sq F value
## enrollmentgroup          1  4.872   4.872  0.2356
## event                    1 92.984  92.984  4.4961
## enrollmentgroup:event    1  1.755   1.755  0.0849
```

```
eta_squared(lmm_emapos, partial=FALSE)
```

```
## Warning: Currently only supports partial eta squared for this class of objects.
```

```
## # Effect Size for ANOVA (Type III)
##
## Parameter             | Eta2 (partial) |       90% CI
## -----------------------------------------------------
## enrollmentgroup       |       4.44e-03 | [0.00, 0.06]
## event                 |       6.32e-03 | [0.00, 0.03]
## enrollmentgroup:event |       3.41e-04 | [0.00, 0.01]
```

```
lmm_emaneg <- lmer(negative_mean ~ enrollmentgroup * event + (1|id), data=betweenday)

summary(lmm_emaneg)
```

```
## Linear mixed model fit by REML ['lmerMod']
## Formula: negative_mean ~ enrollmentgroup * event + (1 | id)
##    Data: betweenday
##
## REML criterion at convergence: 1361.5
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -2.4655 -0.6459 -0.0633  0.4641  4.3345
##
## Random effects:
##  Groups   Name        Variance Std.Dev.
##  id       (Intercept) 0.9872   0.9936
##  Residual             6.5709   2.5634
## Number of obs: 283, groups:  id, 33
##
## Fixed effects:
##                       Estimate Std. Error t value
## (Intercept)           16.49769    0.63478  25.990
## enrollmentgroup        1.15568    0.87778   1.317
## event                 -0.03775    0.27048  -0.140
## enrollmentgroup:event -0.53124    0.37478  -1.417
##
## Correlation of Fixed Effects:
##             (Intr) enrllm event
## enrllmntgrp -0.723
## event       -0.850  0.615
## enrllmntgr:  0.613 -0.849 -0.722
```

```
anova(lmm_emaneg)
```

```
## Analysis of Variance Table
##                       npar  Sum Sq Mean Sq F value
## enrollmentgroup          1  0.3255  0.3255  0.0495
## event                    1 18.5346 18.5346  2.8207
## enrollmentgroup:event    1 13.2022 13.2022  2.0092
```

```
eta_squared(lmm_emaneg, partial=FALSE)
```

```
## Warning: Currently only supports partial eta squared for this class of objects.
```

```
## # Effect Size for ANOVA (Type III)
##
## Parameter             | Eta2 (partial) |       90% CI
## -----------------------------------------------------
## enrollmentgroup       |       7.90e-03 | [0.00, 0.04]
## event                 |       7.79e-05 | [0.00, 0.01]
## enrollmentgroup:event |       7.97e-03 | [0.00, 0.04]
```

## Plots

```
# Positive Affect plot
xlabels <- c("Baseline", "Session 4", "Post")

#create trendline
ci_panaspos <- confint(lmm_emapos, method="boot", nsim=10)
```

```
## Computing bootstrap confidence intervals ...
```

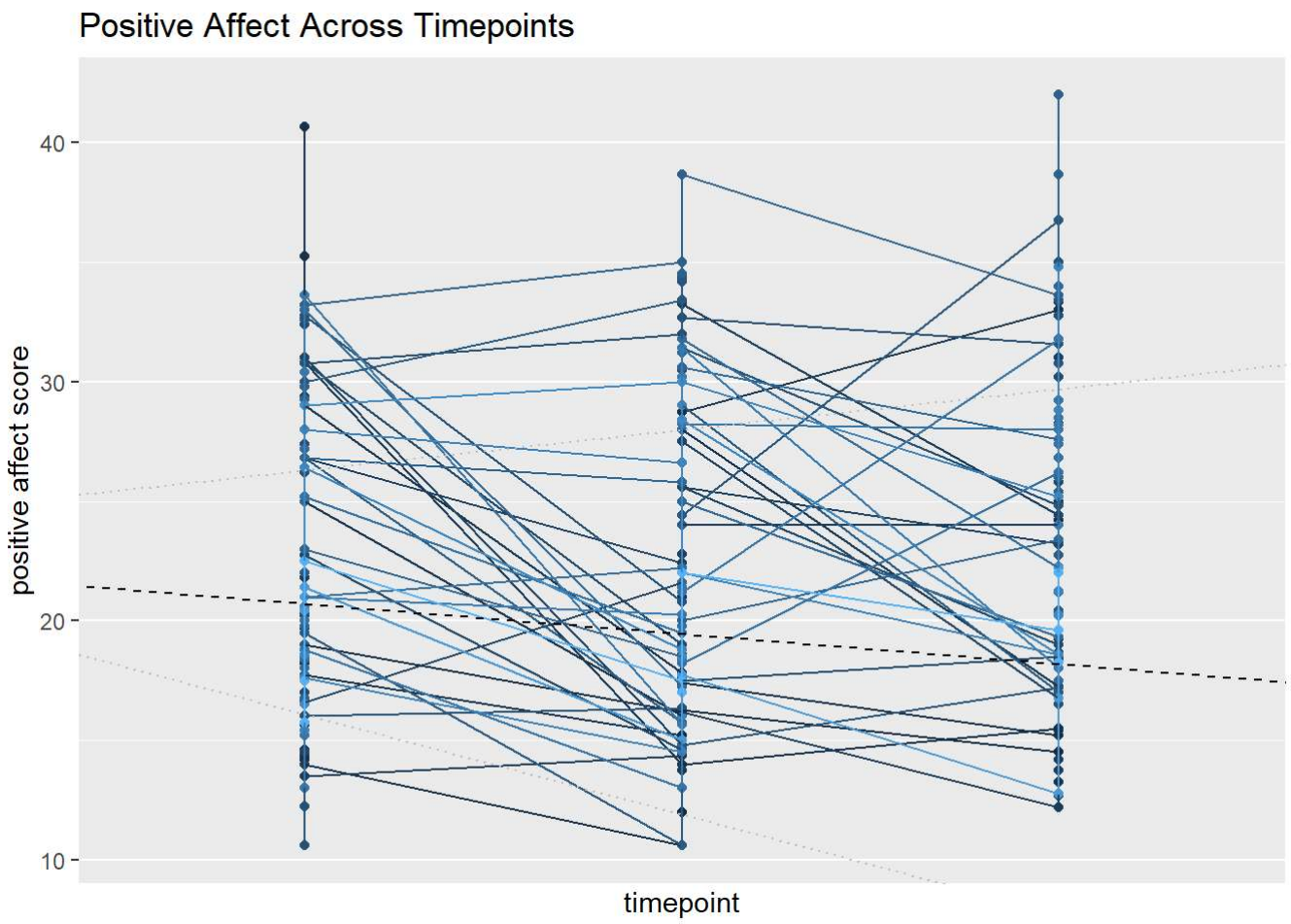
```
## Warning in norm.inter(t, alpha): extreme order statistics used as endpoints

## Warning in norm.inter(t, alpha): extreme order statistics used as endpoints

## Warning in norm.inter(t, alpha): extreme order statistics used as endpoints

## Warning in norm.inter(t, alpha): extreme order statistics used as endpoints

## Warning in norm.inter(t, alpha): extreme order statistics used as endpoints

## Warning in norm.inter(t, alpha): extreme order statistics used as endpoints
```

```
ci_panaspos <- tibble::rownames_to_column(data.frame(ci_panaspos), "Term")
colnames(ci_panaspos)<- c("Term", "CI 2.5%", "CI 97.5%")
as.tibble(ci_panaspos)
```

```
## Warning: `as.tibble()` was deprecated in tibble 2.0.0.
## Please use `as_tibble()` instead.
## The signature and semantics have changed, see `?as_tibble`.
```

```
## # A tibble: 6 x 3
##   Term                  `CI 2.5%` `CI 97.5%`
##   <chr>                     <dbl>      <dbl>
## 1 .sig01                   3.85        6.41
## 2 .sigma                   4.05        4.78
## 3 (Intercept)             20.3        24.6
## 4 enrollmentgroup         -4.18        1.70
## 5 event                   -0.0105      1.66
## 6 enrollmentgroup:event   -1.46        1.07
```

```
#Plot model - positive
panaspos_ggplot<- ggplot(data= betweenday,
       aes(y=positive_mean, x=event, color=id, group=id)) +
  geom_point() + geom_line() +
  ggtitle("Positive Affect Across Timepoints") +
  labs(y = "positive affect score", x = "timepoint") +
  theme(legend.position = "none") +
  scale_x_discrete(labels = xlabels) +
  geom_abline(intercept = fixef(lmm_emapos)[1], #Regression Line (RL).
              slope=fixef(lmm_emapos)[2], col="black", linetype = "dashed") +
  geom_abline(intercept = ci_panaspos$`CI 97.5%`[3],
              slope=ci_panaspos$`CI 97.5%`[4], col="grey", linetype = "dotted") + #Upper Bound o
f RL
  geom_abline(intercept = ci_panaspos$`CI 2.5%`[3],
              slope=ci_panaspos$`CI 2.5%`[4], col="grey", linetype= "dotted") #Lower Bound of RL

panaspos_ggplot
```




```
# Negative Affect plot
xlabels <- c("Baseline", "Session 4", "Post")

#create trendline
ci_panasneg <- confint(lmm_emaneg, method="boot", nsim=10)
```

```
## Computing bootstrap confidence intervals ...
```

```
## Warning in norm.inter(t, alpha): extreme order statistics used as endpoints

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```
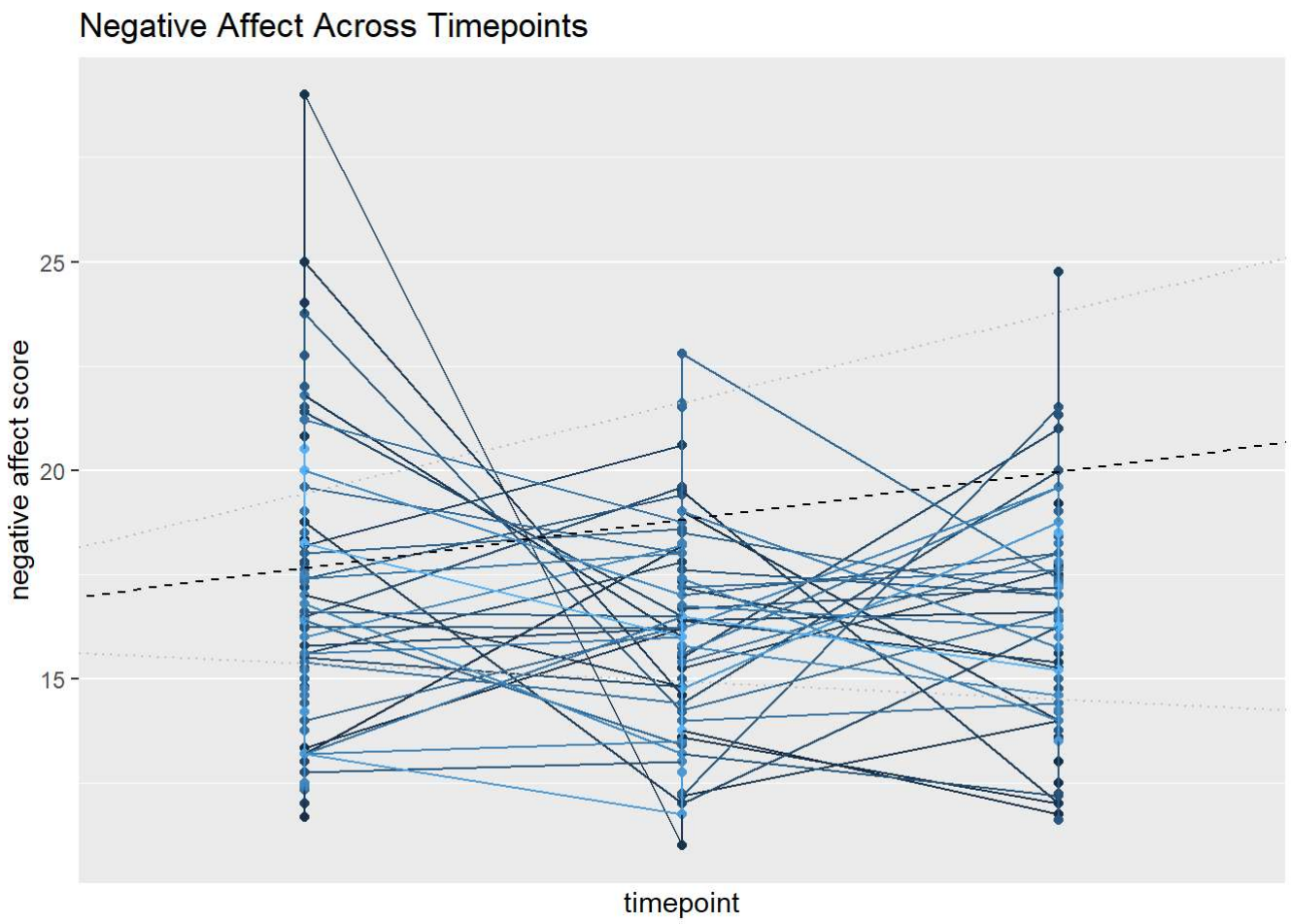

```
ci_panasneg <- tibble::rownames_to_column(data.frame(ci_panasneg), "Term")
colnames(ci_panasneg)<- c("Term", "CI 2.5%", "CI 97.5%")
as.tibble(ci_panasneg)
```

```
## # A tibble: 6 x 3
##   Term                  `CI 2.5%` `CI 97.5%`
##   <chr>                     <dbl>      <dbl>
## 1 .sig01                    0.452      1.22
## 2 .sigma                    2.41       2.77
## 3 (Intercept)              15.8       17.3
## 4 enrollmentgroup          -0.428      2.17
## 5 event                    -0.580      0.239
## 6 enrollmentgroup:event    -0.885      0.116
```

```
#Plot model
panasneg_ggplot<- ggplot(data= betweenday,
       aes(y=negative_mean, x=event, color=id, group=id)) +
  geom_point() + geom_line() +
  ggtitle("Negative Affect Across Timepoints") +
  labs(y = "negative affect score", x = "timepoint") +
  theme(legend.position = "none") +
  scale_x_discrete(labels = xlabels) +
  geom_abline(intercept = fixef(lmm_emaneg)[1], #Regression Line (RL).
              slope=fixef(lmm_emaneg)[2], col="black", linetype = "dashed") +
  geom_abline(intercept = ci_panasneg$`CI 97.5%`[3],
              slope=ci_panasneg$`CI 97.5%`[4], col="grey", linetype = "dotted") + #Upper Bound o
f RL
  geom_abline(intercept = ci_panasneg$`CI 2.5%`[3],
              slope=ci_panasneg$`CI 2.5%`[4], col="grey", linetype= "dotted") #Lower Bound of RL

panasneg_ggplot
```




# x Days

```
betweenday$day <- as.factor(betweenday$day)
levels(betweenday$day) <- c("Day 1", "Day 2", "Day 3", "Day 4", "Day 5", "Day 6", "Day 7", "Day 8", "Day 9")
```

```
lmm_emapos <- lmer(positive_mean ~ enrollmentgroup * day + (1|id), data=betweenday)

anova(lmm_emapos)
```

```
## Analysis of Variance Table
##                      npar  Sum Sq Mean Sq F value
## enrollmentgroup         1   4.865  4.8647  0.2369
## day                     8 236.891 29.6114  1.4420
## enrollmentgroup:day     8 185.041 23.1302  1.1264
```

```
summary(lmm_emapos)
```

```
## Linear mixed model fit by REML ['lmerMod']
## Formula: positive_mean ~ enrollmentgroup * day + (1 | id)
##    Data: betweenday
##
## REML criterion at convergence: 1676
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -2.53516 -0.57192 -0.01372  0.53747  2.70835
##
## Random effects:
##  Groups   Name        Variance Std.Dev.
##  id       (Intercept) 23.92    4.891
##  Residual             20.53    4.531
## Number of obs: 283, groups:  id, 33
##
## Fixed effects:
##                            Estimate Std. Error t value
## (Intercept)                 22.8416     1.6514  13.831
## enrollmentgroup              0.7329     2.3113   0.317
## dayDay 2                    -0.8544     1.6393  -0.521
## dayDay 3                    -0.6758     1.6722  -0.404
## dayDay 4                     1.2023     1.6393   0.733
## dayDay 5                     0.9223     1.6393   0.563
## dayDay 6                     0.2023     1.6393   0.123
## dayDay 7                    -0.2288     1.6393  -0.140
## dayDay 8                     0.9823     1.6393   0.599
## dayDay 9                     1.2245     1.6393   0.747
## enrollmentgroup:dayDay 2    -1.1662     2.2590  -0.516
## enrollmentgroup:dayDay 3    -1.4060     2.3023  -0.611
## enrollmentgroup:dayDay 4    -3.3680     2.2590  -1.491
## enrollmentgroup:dayDay 5    -5.0058     2.2776  -2.198
## enrollmentgroup:dayDay 6    -2.3069     2.2776  -1.013
## enrollmentgroup:dayDay 7    -0.3644     2.2785  -0.160
## enrollmentgroup:dayDay 8     0.4162     2.2785   0.183
## enrollmentgroup:dayDay 9    -1.1573     2.2785  -0.508
```

```
##
## Correlation matrix not shown by default, as p = 18 > 12.
## Use print(x, correlation=TRUE)  or
##     vcov(x)        if you need it
```

```
eta_squared(lmm_emapos, partial = FALSE)
```

```
## Warning: Currently only supports partial eta squared for this class of objects.
```

```
## # Effect Size for ANOVA (Type III)
##
## Parameter           | Eta2 (partial) |       90% CI
## -------------------------------------------------
## enrollmentgroup     |       7.43e-03 | [0.00, 0.12]
## day                 |           0.02 | [0.00, 0.01]
## enrollmentgroup:day |           0.04 | [0.00, 0.05]
```

```
lmm_emaneg <- lmer(negative_mean ~ enrollmentgroup * day + (1|id), data=betweenday)

anova(lmm_emaneg)
```

```
## Analysis of Variance Table
##                     npar Sum Sq Mean Sq F value
## enrollmentgroup        1  0.330  0.3295  0.0503
## day                    8 75.042  9.3803  1.4310
## enrollmentgroup:day    8 54.495  6.8118  1.0392
```

```
summary(lmm_emaneg)
```

```
## Linear mixed model fit by REML ['lmerMod']
## Formula: negative_mean ~ enrollmentgroup * day + (1 | id)
##    Data: betweenday
##
## REML criterion at convergence: 1325
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -2.3481 -0.6159 -0.0443  0.4982  4.5235
##
## Random effects:
##  Groups   Name        Variance Std.Dev.
##  id       (Intercept) 0.9708   0.9853
##  Residual             6.5552   2.5603
## Number of obs: 283, groups:  id, 33
##
## Fixed effects:
##                            Estimate Std. Error t value
## (Intercept)                 17.0253     0.6699  25.416
## enrollmentgroup             -0.1939     0.9442  -0.205
## dayDay 2                    -0.4528     0.9131  -0.496
## dayDay 3                    -0.6556     0.9312  -0.704
## dayDay 4                    -0.7484     0.9131  -0.820
## dayDay 5                    -1.2128     0.9131  -1.328
## dayDay 6                    -1.2306     0.9131  -1.348
## dayDay 7                    -0.3839     0.9131  -0.420
## dayDay 8                    -0.7661     0.9131  -0.839
## dayDay 9                    -0.1261     0.9131  -0.138
## enrollmentgroup:dayDay 2     0.3254     1.2669   0.257
## enrollmentgroup:dayDay 3     2.2505     1.2902   1.744
## enrollmentgroup:dayDay 4     0.5052     1.2669   0.399
## enrollmentgroup:dayDay 5     0.6789     1.2770   0.532
## enrollmentgroup:dayDay 6    -0.2686     1.2770  -0.210
## enrollmentgroup:dayDay 7     0.3049     1.2772   0.239
## enrollmentgroup:dayDay 8     0.3694     1.2772   0.289
## enrollmentgroup:dayDay 9    -1.3633     1.2772  -1.067
```

```
##
## Correlation matrix not shown by default, as p = 18 > 12.
## Use print(x, correlation=TRUE)  or
##     vcov(x)        if you need it
```

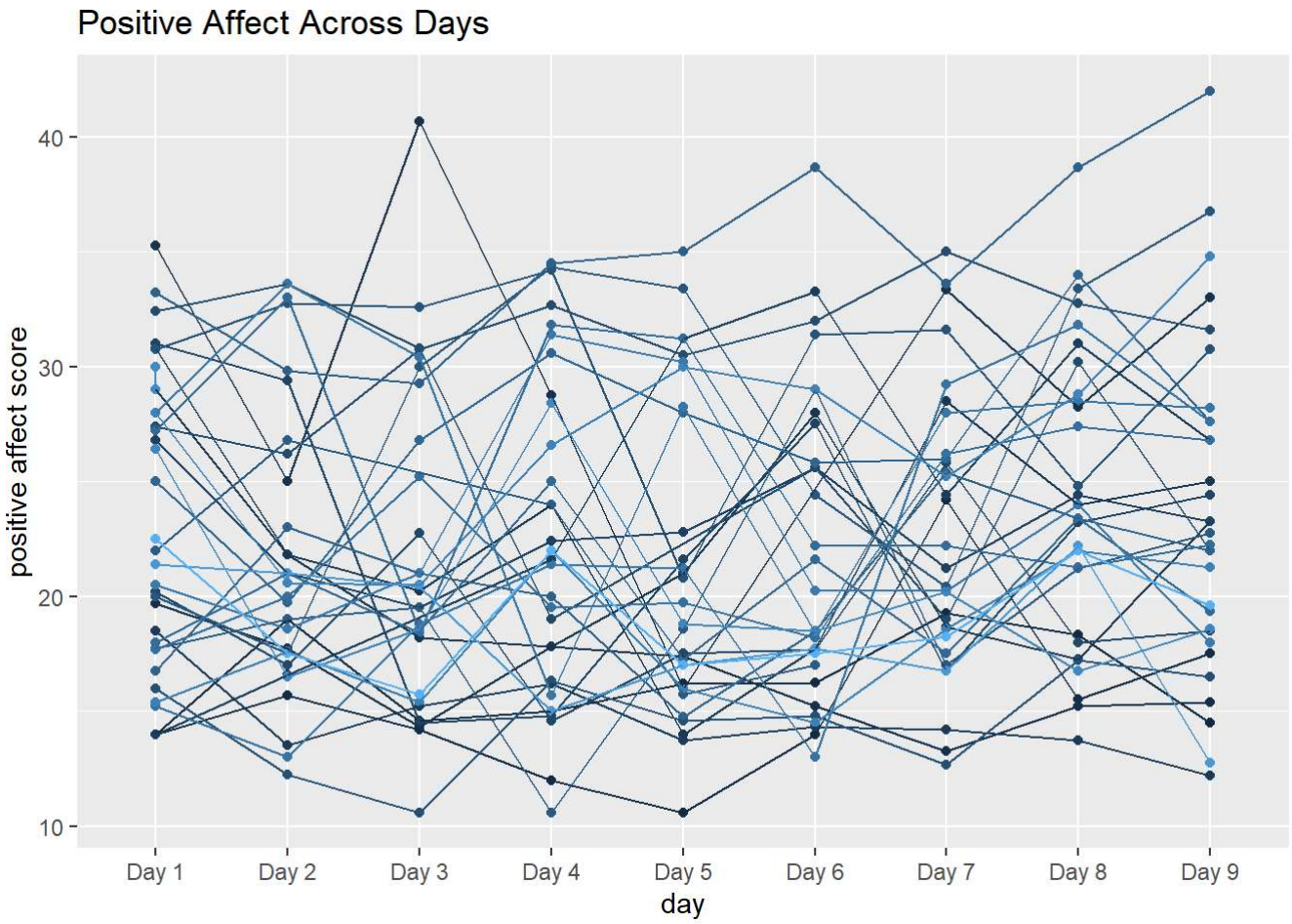
```
eta_squared(lmm_emaneg, partial = FALSE)
```

```
## Warning: Currently only supports partial eta squared for this class of objects.
```

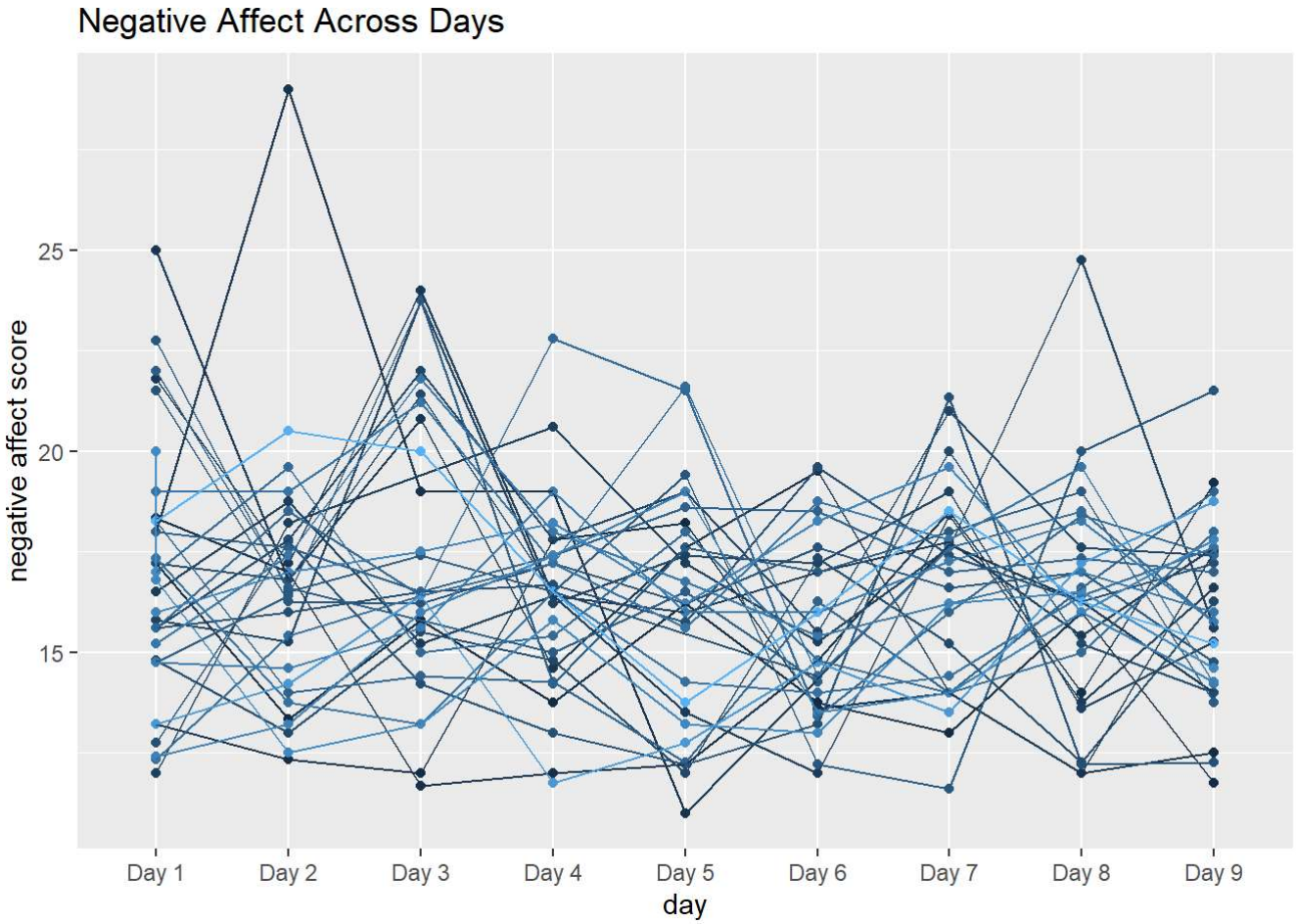
```
## # Effect Size for ANOVA (Type III)
##
## Parameter           | Eta2 (partial) |       90% CI
## -------------------------------------------------
## enrollmentgroup     |       2.07e-03 | [0.00, 0.08]
## day                 |           0.01 | [0.00, 0.01]
## enrollmentgroup:day |           0.03 | [0.00, 0.05]
```

## Plots

```
# Positive Affect plot
xlabels <- c("Day 1", "Day 2", "Day 3", "Day 4", "Day 5", "Day 6", "Day 7", "Day 8", "Day 9")

#Plot model - positive
panaspos_ggplot<- ggplot(data= betweenday,
       aes(y=positive_mean, x=day, color=id, group=id)) +
  geom_point() + geom_line() +
  ggtitle("Positive Affect Across Days") +
  labs(y = "positive affect score", x = "day") +
  theme(legend.position = "none") +
  scale_x_discrete(labels = xlabels)

panaspos_ggplot
```



```
# Negative Affect plot
xlabels <- c("Day 1", "Day 2", "Day 3", "Day 4", "Day 5", "Day 6", "Day 7", "Day 8", "Day 9")

#Plot model - positive
panaspos_ggplot<- ggplot(data= betweenday,
       aes(y=negative_mean, x=day, color=id, group=id)) +
  geom_point() + geom_line() +
  ggtitle("Negative Affect Across Days") +
  labs(y = "negative affect score", x = "day") +
  theme(legend.position = "none") +
  scale_x_discrete(labels = xlabels)

panaspos_ggplot
```




# x Instances

```
EMAdata$instance <- as.factor(EMAdata$instance)
levels(EMAdata$instance) <- c("1","2","3","4","5","6","7","8","9","10","11","12","13","14","15")
```

```
lmm_emapos <- lmer(positive_score ~ enrollmentgroup * instance + (1|id), data= EMAdata)

anova(lmm_emapos)
```

```
## Analysis of Variance Table
##                           npar  Sum Sq Mean Sq F value
## enrollmentgroup              1    0.89   0.887  0.0268
## instance                    14 2986.95 213.353  6.4483
## enrollmentgroup:instance    14  473.82  33.845  1.0229
```

```
summary(lmm_emapos)
```

```
## Linear mixed model fit by REML ['lmerMod']
## Formula: positive_score ~ enrollmentgroup * instance + (1 | id)
##    Data: EMAdata
##
## REML criterion at convergence: 7896.8
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -3.6314 -0.5667 -0.0795  0.5492  4.7119
##
## Random effects:
##  Groups   Name        Variance Std.Dev.
##  id       (Intercept) 27.08    5.204
##  Residual             33.09    5.752
## Number of obs: 1242, groups:  id, 33
##
## Fixed effects:
##                                                Estimate Std. Error t value
## (Intercept)                                    24.96158    1.62308  15.379
## enrollmentgroupImmediate Enrollment            -3.06792    2.22861  -1.377
## instance2                                       0.03676    1.29416   0.028
## instance3                                      -1.31717    1.32381  -0.995
## instance4                                      -2.50545    1.29935  -1.928
## instance5                                      -5.40576    1.30753  -4.134
## instance6                                      -2.42108    1.30664  -1.853
## instance7                                       0.46633    1.31510   0.355
## instance8                                      -1.14320    1.29980  -0.880
## instance9                                      -2.95746    1.28561  -2.300
## instance10                                     -3.91047    1.34222  -2.913
## instance11                                     -1.43807    1.32299  -1.087
## instance12                                     -1.27751    1.31507  -0.971
## instance13                                     -1.30025    1.29934  -1.001
## instance14                                     -1.55438    1.31513  -1.182
## instance15                                     -5.22615    1.31547  -3.973
## enrollmentgroupImmediate Enrollment:instance2   2.71039    1.78096   1.522
## enrollmentgroupImmediate Enrollment:instance3   3.26754    1.81916   1.796
## enrollmentgroupImmediate Enrollment:instance4   4.25859    1.80876   2.354
## enrollmentgroupImmediate Enrollment:instance5   4.00111    1.81513   2.204
## enrollmentgroupImmediate Enrollment:instance6   2.63457    1.77656   1.483
## enrollmentgroupImmediate Enrollment:instance7   2.57019    1.79726   1.430
## enrollmentgroupImmediate Enrollment:instance8   1.39434    1.79168   0.778
## enrollmentgroupImmediate Enrollment:instance9   3.87343    1.80248   2.149
## enrollmentgroupImmediate Enrollment:instance10  1.74580    1.82771   0.955
## enrollmentgroupImmediate Enrollment:instance11  0.99683    1.80811   0.551
## enrollmentgroupImmediate Enrollment:instance12  4.11750    1.81197   2.272
## enrollmentgroupImmediate Enrollment:instance13  3.99321    1.78039   2.243
## enrollmentgroupImmediate Enrollment:instance14  2.85621    1.81530   1.573
## enrollmentgroupImmediate Enrollment:instance15  3.76380    1.82505   2.062
```

```
##
## Correlation matrix not shown by default, as p = 30 > 12.
## Use print(x, correlation=TRUE)  or
##     vcov(x)        if you need it
```

```
lme_emaneg <- lmer(negative_score ~ enrollmentgroup * instance + (1|id), data= EMAdata)

anova(lme_emaneg)
```

```
## Analysis of Variance Table
##                          npar Sum Sq Mean Sq F value
## enrollmentgroup             1   1.20   1.197  0.0942
## instance                   14 601.54  42.967  3.3811
## enrollmentgroup:instance   14  90.62   6.473  0.5093
```

```
summary(lme_emaneg)
```

```
## Linear mixed model fit by REML ['lmerMod']
## Formula: negative_score ~ enrollmentgroup * instance + (1 | id)
##    Data: EMAdata
##
## REML criterion at convergence: 6730.9
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -2.6836 -0.5522 -0.1338  0.3839  6.0894
##
## Random effects:
##  Groups   Name        Variance Std.Dev.
##  id       (Intercept)  8.447   2.906
##  Residual             12.708   3.565
## Number of obs: 1242, groups:  id, 33
##
## Fixed effects:
##                                                Estimate Std. Error t value
## (Intercept)                                    16.96455    0.94258  17.998
## enrollmentgroupImmediate Enrollment            -0.27901    1.29204  -0.216
## instance2                                       0.37199    0.80162   0.464
## instance3                                      -0.50098    0.82041  -0.611
## instance4                                      -0.73212    0.80526  -0.909
## instance5                                      -1.40252    0.81033  -1.731
## instance6                                      -0.63540    0.80978  -0.785
## instance7                                      -0.41365    0.81502  -0.508
## instance8                                      -0.45366    0.80554  -0.563
## instance9                                      -1.01297    0.79675  -1.271
## instance10                                     -1.79199    0.83182  -2.154
## instance11                                      0.01560    0.81991   0.019
## instance12                                     -0.33090    0.81500  -0.406
## instance13                                     -1.66764    0.80525  -2.071
## instance14                                     -1.32012    0.81504  -1.620
## instance15                                     -1.86610    0.81525  -2.289
## enrollmentgroupImmediate Enrollment:instance2   0.04248    1.10341   0.039
## enrollmentgroupImmediate Enrollment:instance3  -1.18564    1.12738  -1.052
## enrollmentgroupImmediate Enrollment:instance4  -0.58221    1.12092  -0.519
## enrollmentgroupImmediate Enrollment:instance5  -0.53164    1.12486  -0.473
## enrollmentgroupImmediate Enrollment:instance6  -0.25795    1.10099  -0.234
## enrollmentgroupImmediate Enrollment:instance7   0.47638    1.11381   0.428
## enrollmentgroupImmediate Enrollment:instance8  -0.36636    1.11034  -0.330
## enrollmentgroupImmediate Enrollment:instance9   0.60958    1.11705   0.546
## enrollmentgroupImmediate Enrollment:instance10  0.35344    1.13267   0.312
## enrollmentgroupImmediate Enrollment:instance11  0.02329    1.12053   0.021
## enrollmentgroupImmediate Enrollment:instance12  0.49568    1.12293   0.441
## enrollmentgroupImmediate Enrollment:instance13  0.98644    1.10336   0.894
## enrollmentgroupImmediate Enrollment:instance14 -0.35677    1.12497  -0.317
## enrollmentgroupImmediate Enrollment:instance15 -0.36472    1.13103  -0.322
```

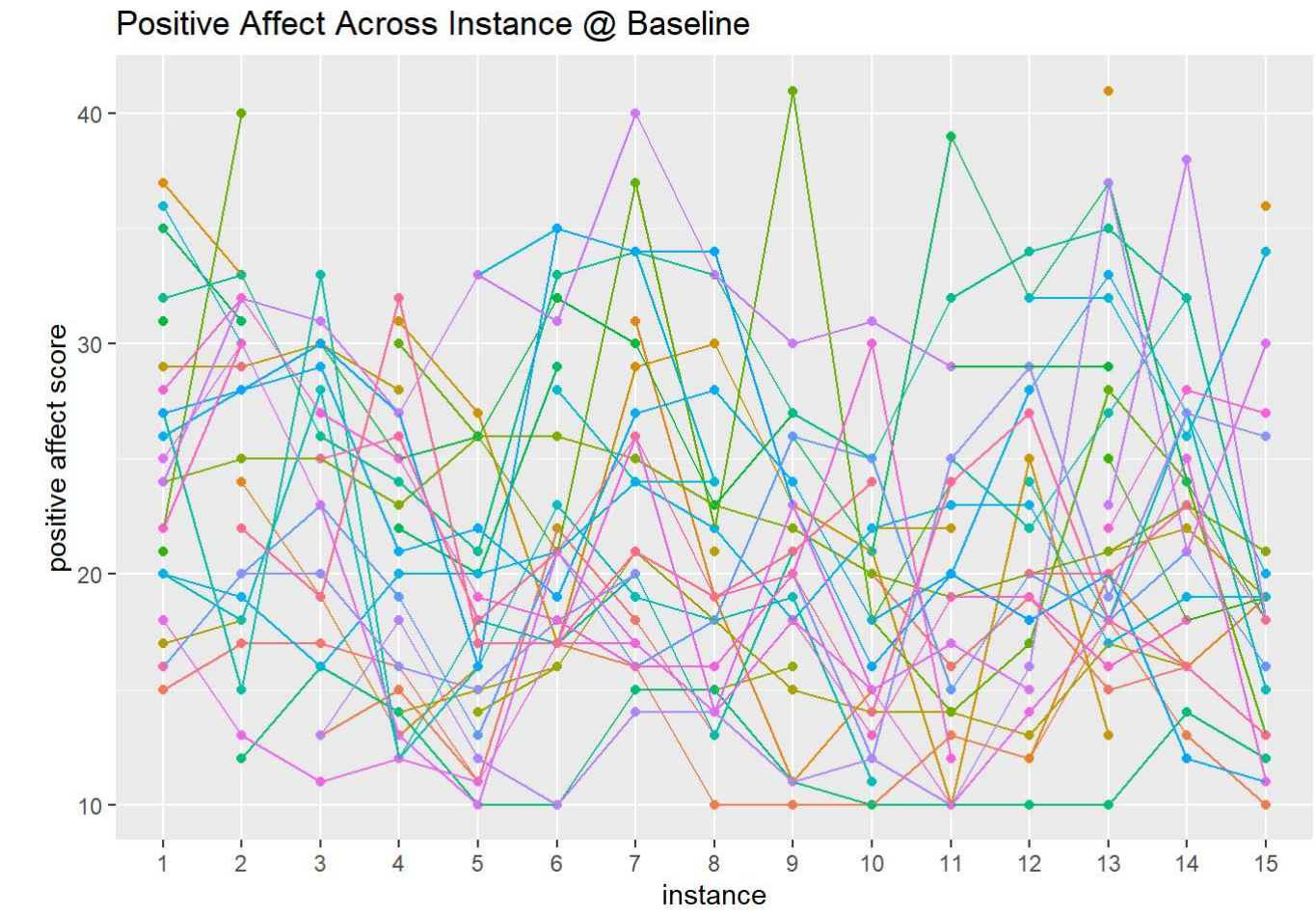
```
##
## Correlation matrix not shown by default, as p = 30 > 12.
## Use print(x, correlation=TRUE)  or
##     vcov(x)        if you need it
```

## Plots

```
# Positive Affect plot @ Baseline
EMA_baseline <- filter(EMAdata, event == "Baseline")

#Plot model - positive
instance_pos<- ggplot(data= EMA_baseline,
       aes(y=positive_score, x=instance, color=id, group=id)) +
  geom_point() + geom_line() +
  ggtitle("Positive Affect Across Instance @ Baseline") +
  labs(y = "positive affect score", x = "instance") +
  theme(legend.position = "none")

instance_pos
```

```
## Warning: Removed 82 rows containing missing values (geom_point).
```

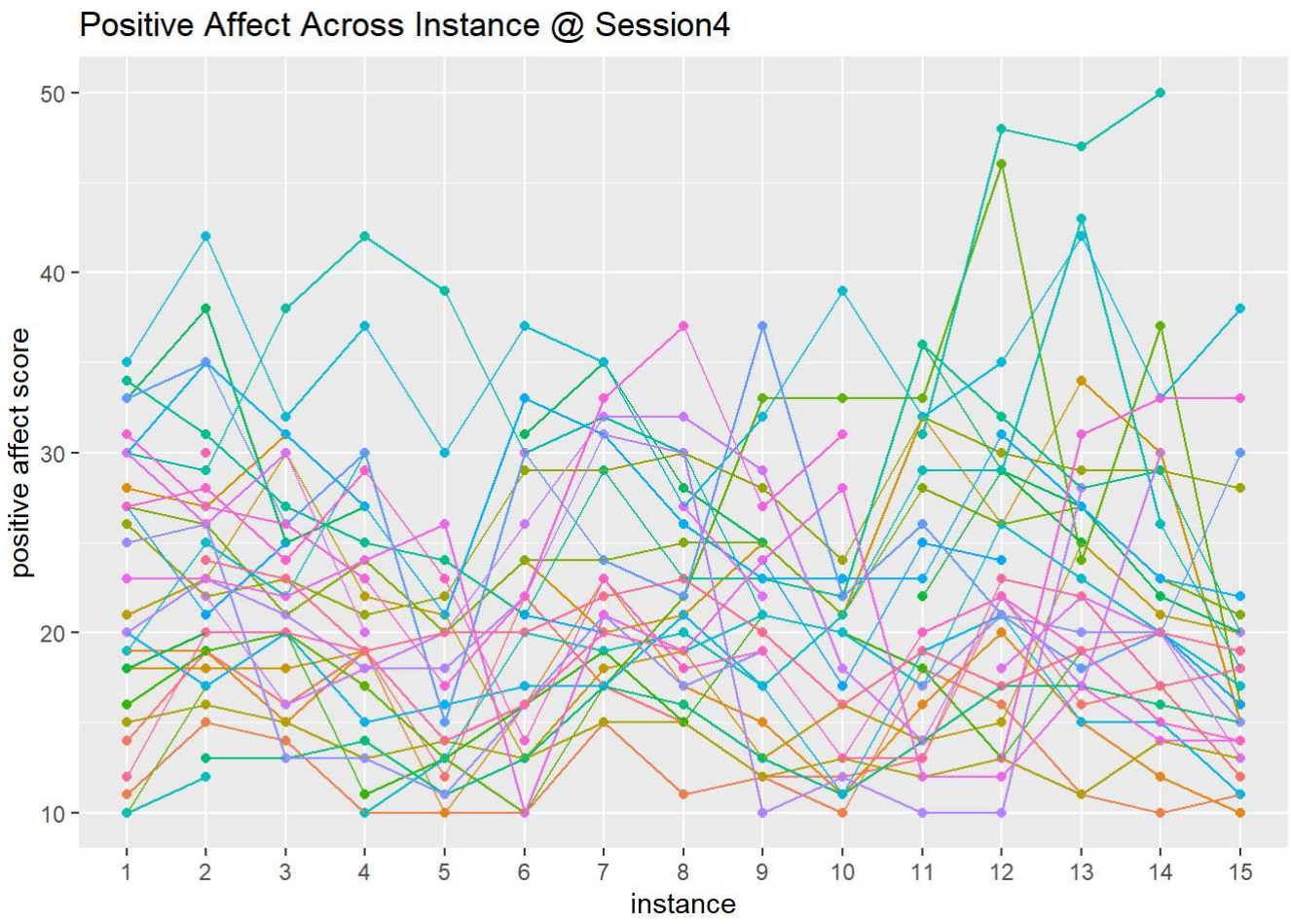
```
## Warning: Removed 24 row(s) containing missing values (geom_path).
```



```
# Positive Affect plot @ Session 4
EMA_session4 <- filter(EMAdata, event == "Session 4")

#Plot model - positive
instance_pos<- ggplot(data= EMA_session4,
       aes(y=positive_score, x=instance, color=id, group=id)) +
  geom_point() + geom_line() +
  ggtitle("Positive Affect Across Instance @ Session4") +
  labs(y = "positive affect score", x = "instance") +
  theme(legend.position = "none")

instance_pos
```

```
## Warning: Removed 44 rows containing missing values (geom_point).
```

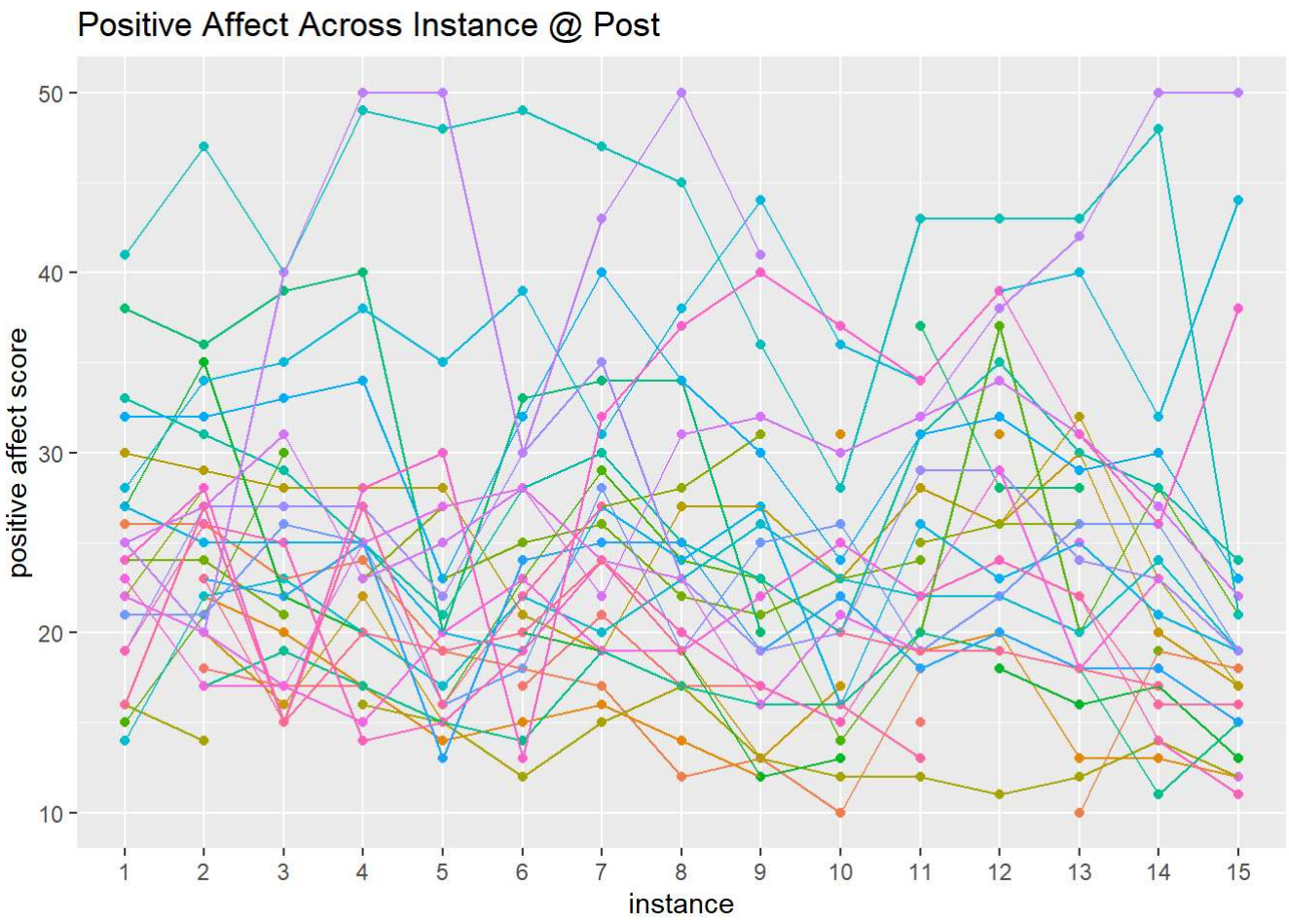
```
## Warning: Removed 16 row(s) containing missing values (geom_path).
```



```
# Positive Affect plot @ Post
EMA_post <- filter(EMAdata, event == "Post")

#Plot model - positive
instance_pos<- ggplot(data= EMA_post,
       aes(y=positive_score, x=instance, color=id, group=id)) +
  geom_point() + geom_line() +
  ggtitle("Positive Affect Across Instance @ Post") +
  labs(y = "positive affect score", x = "instance") +
  theme(legend.position = "none")

instance_pos
```

```
## Warning: Removed 59 rows containing missing values (geom_point).
```

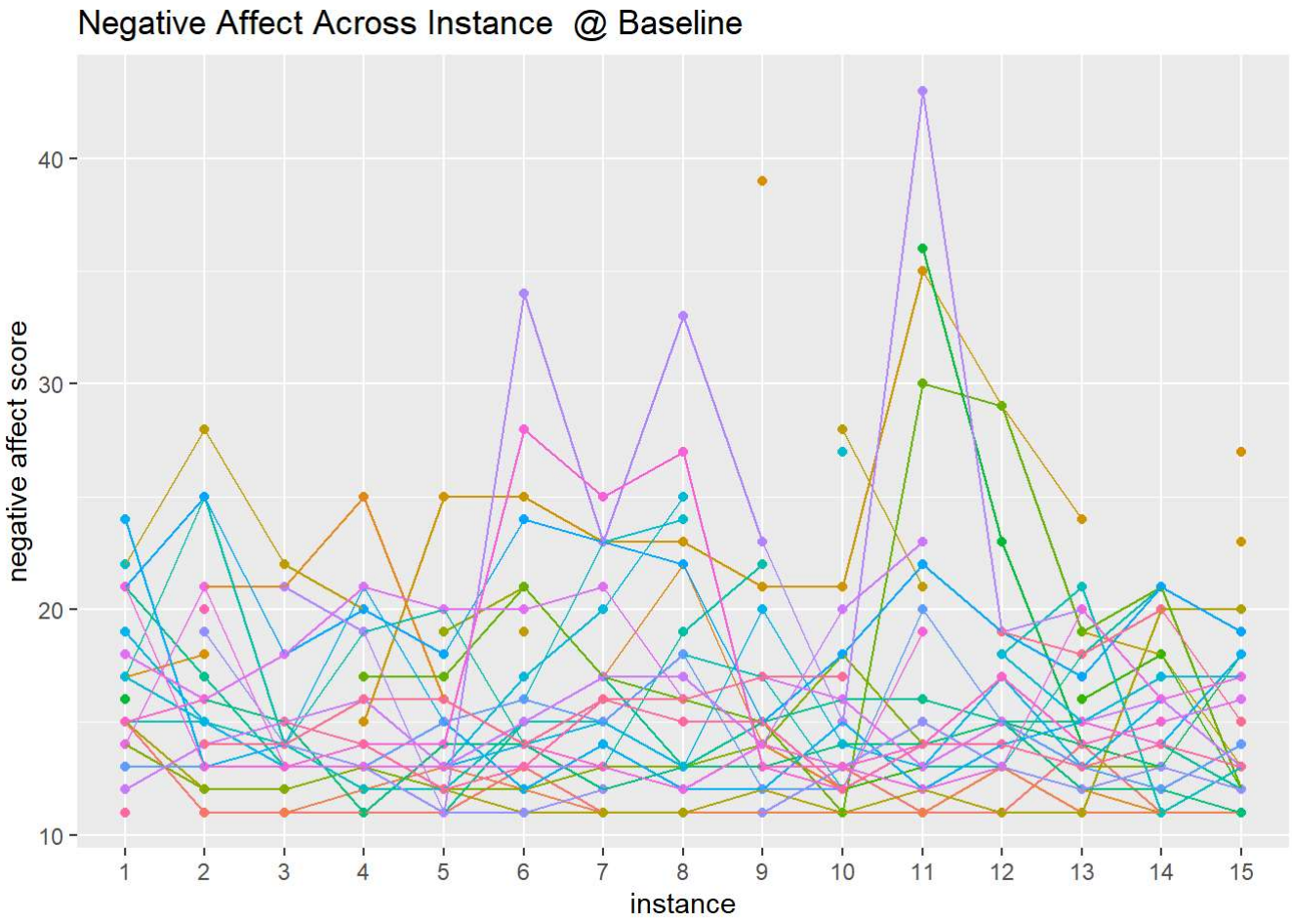
```
## Warning: Removed 17 row(s) containing missing values (geom_path).
```



```
# Negative Affect plot @ Baseline

instance_neg<- ggplot(data= EMA_baseline,
       aes(y=negative_score, x=instance, color=id, group=id)) +
  geom_point() + geom_line() +
  ggtitle("Negative Affect Across Instance  @ Baseline") +
  labs(y = "negative affect score", x = "instance") +
  theme(legend.position = "none")

instance_neg
```

```
## Warning: Removed 82 rows containing missing values (geom_point).
```

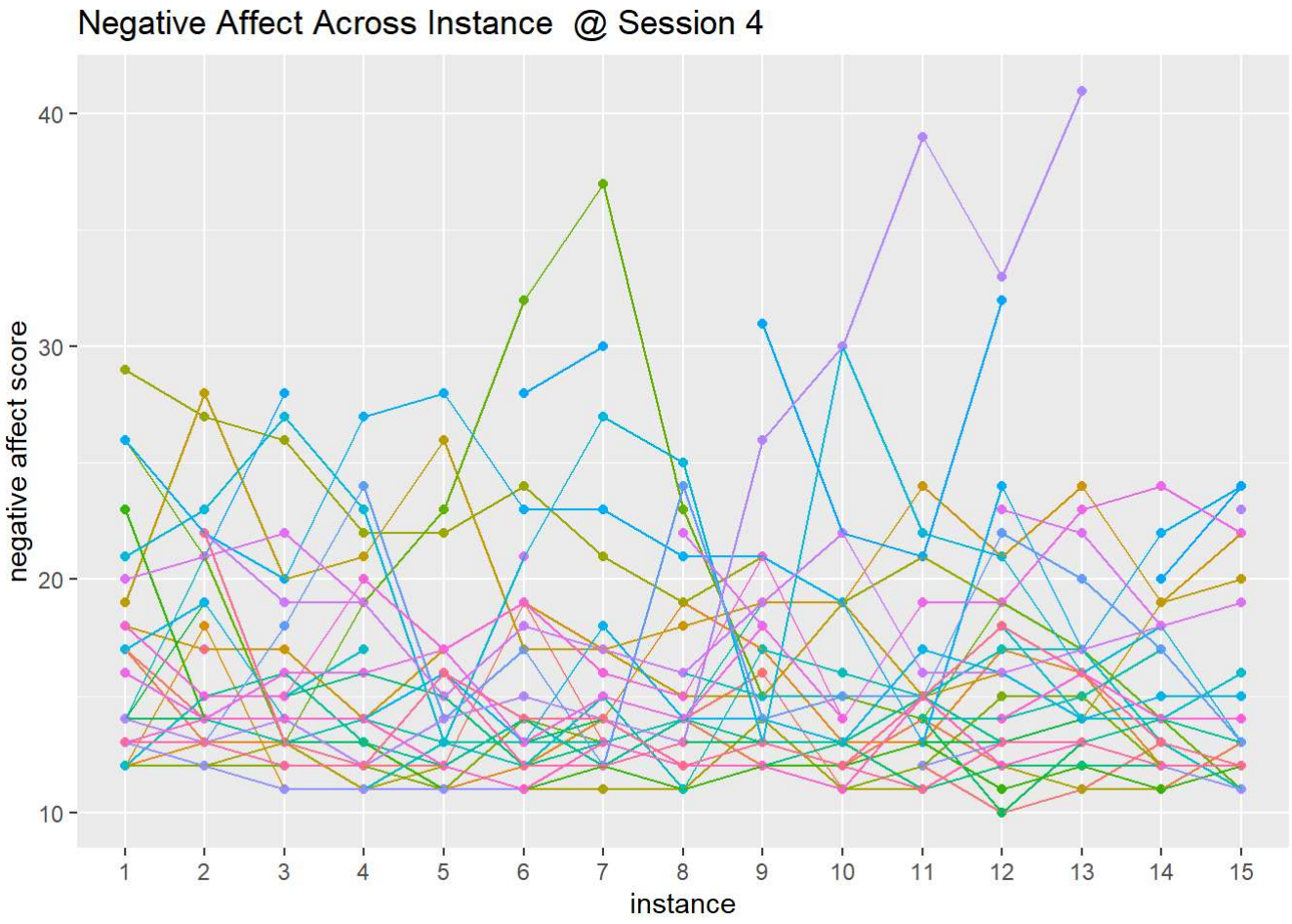
```
## Warning: Removed 24 row(s) containing missing values (geom_path).
```



```
# Negative Affect plot @ Session 4

instance_neg<- ggplot(data= EMA_session4,
       aes(y=negative_score, x=instance, color=id, group=id)) +
  geom_point() + geom_line() +
  ggtitle("Negative Affect Across Instance  @ Session 4") +
  labs(y = "negative affect score", x = "instance") +
  theme(legend.position = "none")

instance_neg
```

```
## Warning: Removed 44 rows containing missing values (geom_point).
```

```
## Warning: Removed 16 row(s) containing missing values (geom_path).
```



```
# Negative Affect plot @ Post

instance_neg<- ggplot(data= EMA_post,
       aes(y=negative_score, x=instance, color=id, group=id)) +
  geom_point() + geom_line() +
  ggtitle("Negative Affect Across Instance  @ Post") +
  labs(y = "negative affect score", x = "instance") +
  theme(legend.position = "none")

instance_neg
```

```
## Warning: Removed 59 rows containing missing values (geom_point).
```

```
## Warning: Removed 17 row(s) containing missing values (geom_path).
```