Linear Mixed-Effects Models for Temporal Properties

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# Load packages  
library(emmeans)  
library(nlme)  
library(effectsize)  
library(rstatix)  
library(dabestr)

# Turn off scientific notation  
options(scipen = 999)

# Microstate 1/A GEV

# Read data  
data <- read.csv("lmem\_full\_temp\_prop\_data.csv")  
data <- data[data$microstate == 'A', ]  
  
data$simple\_id <- as.factor(data$simple\_id)  
  
data$time <- ifelse(data$time == 1, "1one",  
 ifelse(data$time == 2, "2two",  
 ifelse(data$time == 3, "3three",  
 ifelse(data$time == 4, "4four",  
 ifelse(data$time == 5, "5five", "other")))))  
  
data$time <- as.factor(data$time)  
contrasts(data$time) <- contr.sum  
contrasts(data$time)

## [,1] [,2] [,3] [,4]  
## 1one 1 0 0 0  
## 2two 0 1 0 0  
## 3three 0 0 1 0  
## 4four 0 0 0 1  
## 5five -1 -1 -1 -1

# Outliers (this is a simple univariate measure)  
# Outlier = above Q3 + 1.5xIQR or below Q1 - 1.5xIQR  
# Extreme outlier = above Q3 + 3xIQR or below Q1 - 3xIQR   
# Only exclude extreme outliers  
outliers <- data %>%  
 group\_by(time) %>%  
 identify\_outliers(gev)  
outliers

## # A tibble: 1 × 9  
## time simple\_id microstate gev duration coverage occurrence is.outlier is.extreme  
## <fct> <fct> <chr> <dbl> <dbl> <dbl> <dbl> <lgl> <lgl>   
## 1 2two 389 A 0.128 88.3 23.8 2.26 TRUE FALSE

# NO EXTREME VALUES

# Correlations  
data\_one <- data %>% filter(time == "1one")  
data\_two <- data %>% filter(time == "2two")  
data\_three <- data %>% filter(time == "3three")  
data\_four <- data %>% filter(time == "4four")  
data\_five <- data %>% filter(time == "5five")  
  
cor(data\_one$gev, data\_two$gev)

## [1] 0.8809816

cor(data\_one$gev, data\_three$gev)

## [1] 0.8427265

cor(data\_one$gev, data\_four$gev)

## [1] 0.8175993

cor(data\_one$gev, data\_five$gev)

## [1] 0.8034276

cor(data\_two$gev, data\_three$gev)

## [1] 0.9614997

cor(data\_two$gev, data\_four$gev)

## [1] 0.9327757

cor(data\_two$gev, data\_five$gev)

## [1] 0.915522

cor(data\_three$gev, data\_four$gev)

## [1] 0.9802645

cor(data\_three$gev, data\_five$gev)

## [1] 0.9608894

cor(data\_four$gev, data\_five$gev)

## [1] 0.9849152

# Model  
m1\_gev\_model <- lme(gev ~ time, random = ~1|simple\_id,   
 correlation = corAR1(form = ~1|simple\_id), data = data)  
anova(m1\_gev\_model)

## numDF denDF F-value p-value  
## (Intercept) 1 188 736.1583 <.0001  
## time 4 188 5.8320 0.0002

effectsize::eta\_squared(m1\_gev\_model, partial = TRUE)

## # Effect Size for ANOVA  
##   
## Parameter | Eta2 (partial) | 95% CI  
## -----------------------------------------  
## time | 0.11 | [0.04, 1.00]  
##   
## - One-sided CIs: upper bound fixed at [1.00].

emmeans(m1\_gev\_model, list(pairwise ~ time), adjust = "scheffe")

## Warning: contrasts dropped from factor time

## $`emmeans of time`  
## time emmean SE df lower.CL upper.CL  
## 1one 0.0736 0.00278 47 0.0680 0.0792  
## 2two 0.0736 0.00278 47 0.0680 0.0792  
## 3three 0.0753 0.00278 47 0.0697 0.0809  
## 4four 0.0718 0.00278 47 0.0662 0.0774  
## 5five 0.0699 0.00278 47 0.0643 0.0755  
##   
## Degrees-of-freedom method: containment   
## Confidence level used: 0.95   
##   
## $`pairwise differences of time`  
## 1 estimate SE df t.ratio p.value  
## 1one - 2two -0.0000214 0.000887 188 -0.024 1.0000  
## 1one - 3three -0.0016626 0.001238 188 -1.343 0.7718  
## 1one - 4four 0.0018586 0.001497 188 1.241 0.8191  
## 1one - 5five 0.0036864 0.001707 188 2.159 0.3274  
## 2two - 3three -0.0016412 0.000887 188 -1.851 0.4914  
## 2two - 4four 0.0018800 0.001238 188 1.518 0.6801  
## 2two - 5five 0.0037078 0.001497 188 2.476 0.1943  
## 3three - 4four 0.0035211 0.000887 188 3.970 0.0043  
## 3three - 5five 0.0053490 0.001238 188 4.320 0.0013  
## 4four - 5five 0.0018278 0.000887 188 2.061 0.3767  
##   
## Degrees-of-freedom method: containment   
## P value adjustment: scheffe method with rank 4

# Estimation statistics-based effect sizes and confidence intervals  
paired\_mean\_diff <- dabest(data, time, gev,  
 idx = list(c("2two", "1one"),  
 c("3three", "1one"),  
 c("4four", "1one"),  
 c("5five", "1one"),  
 c("3three", "2two"),  
 c("4four", "2two"),  
 c("5five", "2two"),  
 c("4four", "3three"),  
 c("5five", "3three"),  
 c("5five", "4four")),  
 paired = TRUE, id.col = simple\_id) %>%   
 mean\_diff()  
paired\_mean\_diff

## dabestr (Data Analysis with Bootstrap Estimation in R) v0.3.0  
## =============================================================  
##   
## Good evening!  
## The current time is 23:36 PM on Sunday January 21, 2024.  
##   
## Dataset : data  
## X Variable : time  
## Y Variable : gev  
##   
## Paired mean difference of 1one (n = 48) minus 2two (n = 48)  
## -0.0000214 [95CI -0.00825; 0.00803]  
##   
## Paired mean difference of 1one (n = 48) minus 3three (n = 48)  
## -0.00166 [95CI -0.00991; 0.00654]  
##   
## Paired mean difference of 1one (n = 48) minus 4four (n = 48)  
## 0.00186 [95CI -0.00616; 0.01]  
##   
## Paired mean difference of 1one (n = 48) minus 5five (n = 48)  
## 0.00369 [95CI -0.00424; 0.0116]  
##   
## Paired mean difference of 2two (n = 48) minus 3three (n = 48)  
## -0.00164 [95CI -0.00938; 0.00628]  
##   
## Paired mean difference of 2two (n = 48) minus 4four (n = 48)  
## 0.00188 [95CI -0.00563; 0.0096]  
##   
## Paired mean difference of 2two (n = 48) minus 5five (n = 48)  
## 0.00371 [95CI -0.00372; 0.0111]  
##   
## Paired mean difference of 3three (n = 48) minus 4four (n = 48)  
## 0.00352 [95CI -0.00441; 0.0113]  
##   
## Paired mean difference of 3three (n = 48) minus 5five (n = 48)  
## 0.00535 [95CI -0.00238; 0.0129]  
##   
## Paired mean difference of 4four (n = 48) minus 5five (n = 48)  
## 0.00183 [95CI -0.00567; 0.00924]  
##   
##   
## 5000 bootstrap resamples.  
## All confidence intervals are bias-corrected and accelerated.

# Microstate 2/B GEV

# Read data  
data <- read.csv("lmem\_full\_temp\_prop\_data.csv")  
data <- data[data$microstate == 'B', ]  
  
data$simple\_id <- as.factor(data$simple\_id)  
  
data$time <- ifelse(data$time == 1, "1one",  
 ifelse(data$time == 2, "2two",  
 ifelse(data$time == 3, "3three",  
 ifelse(data$time == 4, "4four",  
 ifelse(data$time == 5, "5five", "other")))))  
  
data$time <- as.factor(data$time)  
contrasts(data$time) <- contr.sum  
contrasts(data$time)

## [,1] [,2] [,3] [,4]  
## 1one 1 0 0 0  
## 2two 0 1 0 0  
## 3three 0 0 1 0  
## 4four 0 0 0 1  
## 5five -1 -1 -1 -1

# Outliers (this is a simple univariate measure)  
# Outlier = above Q3 + 1.5xIQR or below Q1 - 1.5xIQR  
# Extreme outlier = above Q3 + 3xIQR or below Q1 - 3xIQR   
# Only exclude extreme outliers  
outliers <- data %>%  
 group\_by(time) %>%  
 identify\_outliers(gev)  
outliers

## # A tibble: 3 × 9  
## time simple\_id microstate gev duration coverage occurrence is.outlier is.extreme  
## <fct> <fct> <chr> <dbl> <dbl> <dbl> <dbl> <lgl> <lgl>   
## 1 2two 280 B 0.167 92.7 26.4 2.40 TRUE FALSE   
## 2 4four 280 B 0.155 92.3 26.8 2.43 TRUE FALSE   
## 3 5five 280 B 0.152 91.2 26.3 2.41 TRUE FALSE

# NO EXTREME VALUES

# Correlations  
data\_one <- data %>% filter(time == "1one")  
data\_two <- data %>% filter(time == "2two")  
data\_three <- data %>% filter(time == "3three")  
data\_four <- data %>% filter(time == "4four")  
data\_five <- data %>% filter(time == "5five")  
  
cor(data\_one$gev, data\_two$gev)

## [1] 0.9324434

cor(data\_one$gev, data\_three$gev)

## [1] 0.9331413

cor(data\_one$gev, data\_four$gev)

## [1] 0.9012868

cor(data\_one$gev, data\_five$gev)

## [1] 0.8993682

cor(data\_two$gev, data\_three$gev)

## [1] 0.9641924

cor(data\_two$gev, data\_four$gev)

## [1] 0.9508494

cor(data\_two$gev, data\_five$gev)

## [1] 0.9467348

cor(data\_three$gev, data\_four$gev)

## [1] 0.9701106

cor(data\_three$gev, data\_five$gev)

## [1] 0.9727813

cor(data\_four$gev, data\_five$gev)

## [1] 0.9924571

# Model  
m2\_gev\_model <- lme(gev ~ time, random = ~1|simple\_id,   
 correlation = corAR1(form = ~1|simple\_id), data = data)  
anova(m2\_gev\_model)

## numDF denDF F-value p-value  
## (Intercept) 1 188 562.2603 <.0001  
## time 4 188 13.5008 <.0001

effectsize::eta\_squared(m2\_gev\_model, partial = TRUE)

## # Effect Size for ANOVA  
##   
## Parameter | Eta2 (partial) | 95% CI  
## -----------------------------------------  
## time | 0.22 | [0.13, 1.00]  
##   
## - One-sided CIs: upper bound fixed at [1.00].

emmeans(m2\_gev\_model, list(pairwise ~ time), adjust = "scheffe")

## Warning: contrasts dropped from factor time

## $`emmeans of time`  
## time emmean SE df lower.CL upper.CL  
## 1one 0.0874 0.00367 47 0.0800 0.0948  
## 2two 0.0856 0.00367 47 0.0782 0.0930  
## 3three 0.0797 0.00367 47 0.0723 0.0871  
## 4four 0.0844 0.00367 47 0.0770 0.0918  
## 5five 0.0829 0.00367 47 0.0755 0.0903  
##   
## Degrees-of-freedom method: containment   
## Confidence level used: 0.95   
##   
## $`pairwise differences of time`  
## 1 estimate SE df t.ratio p.value  
## 1one - 2two 0.00180 0.00103 188 1.752 0.5477  
## 1one - 3three 0.00764 0.00136 188 5.627 <.0001  
## 1one - 4four 0.00298 0.00156 188 1.914 0.4556  
## 1one - 5five 0.00447 0.00169 188 2.647 0.1405  
## 2two - 3three 0.00584 0.00103 188 5.672 <.0001  
## 2two - 4four 0.00118 0.00136 188 0.868 0.9443  
## 2two - 5five 0.00267 0.00156 188 1.714 0.5693  
## 3three - 4four -0.00466 0.00103 188 -4.527 0.0006  
## 3three - 5five -0.00317 0.00136 188 -2.333 0.2493  
## 4four - 5five 0.00149 0.00103 188 1.449 0.7174  
##   
## Degrees-of-freedom method: containment   
## P value adjustment: scheffe method with rank 4

# Estimation statistics-based effect sizes and confidence intervals  
paired\_mean\_diff <- dabest(data, time, gev,  
 idx = list(c("2two", "1one"),  
 c("3three", "1one"),  
 c("4four", "1one"),  
 c("5five", "1one"),  
 c("3three", "2two"),  
 c("4four", "2two"),  
 c("5five", "2two"),  
 c("4four", "3three"),  
 c("5five", "3three"),  
 c("5five", "4four")),  
 paired = TRUE, id.col = simple\_id) %>%   
 mean\_diff()  
paired\_mean\_diff

## dabestr (Data Analysis with Bootstrap Estimation in R) v0.3.0  
## =============================================================  
##   
## Good evening!  
## The current time is 23:36 PM on Sunday January 21, 2024.  
##   
## Dataset : data  
## X Variable : time  
## Y Variable : gev  
##   
## Paired mean difference of 1one (n = 48) minus 2two (n = 48)  
## 0.0018 [95CI -0.00922; 0.0123]  
##   
## Paired mean difference of 1one (n = 48) minus 3three (n = 48)  
## 0.00764 [95CI -0.00258; 0.0179]  
##   
## Paired mean difference of 1one (n = 48) minus 4four (n = 48)  
## 0.00298 [95CI -0.00764; 0.013]  
##   
## Paired mean difference of 1one (n = 48) minus 5five (n = 48)  
## 0.00447 [95CI -0.00601; 0.0147]  
##   
## Paired mean difference of 2two (n = 48) minus 3three (n = 48)  
## 0.00584 [95CI -0.00386; 0.0156]  
##   
## Paired mean difference of 2two (n = 48) minus 4four (n = 48)  
## 0.00118 [95CI -0.00865; 0.0108]  
##   
## Paired mean difference of 2two (n = 48) minus 5five (n = 48)  
## 0.00267 [95CI -0.00728; 0.0123]  
##   
## Paired mean difference of 3three (n = 48) minus 4four (n = 48)  
## -0.00466 [95CI -0.0143; 0.004]  
##   
## Paired mean difference of 3three (n = 48) minus 5five (n = 48)  
## -0.00317 [95CI -0.0127; 0.00557]  
##   
## Paired mean difference of 4four (n = 48) minus 5five (n = 48)  
## 0.00149 [95CI -0.00799; 0.0103]  
##   
##   
## 5000 bootstrap resamples.  
## All confidence intervals are bias-corrected and accelerated.

# Microstate 3/C GEV

# Read data  
data <- read.csv("lmem\_full\_temp\_prop\_data.csv")  
data <- data[data$microstate == 'C', ]  
  
data$simple\_id <- as.factor(data$simple\_id)  
  
data$time <- ifelse(data$time == 1, "1one",  
 ifelse(data$time == 2, "2two",  
 ifelse(data$time == 3, "3three",  
 ifelse(data$time == 4, "4four",  
 ifelse(data$time == 5, "5five", "other")))))  
  
data$time <- as.factor(data$time)  
contrasts(data$time) <- contr.sum  
contrasts(data$time)

## [,1] [,2] [,3] [,4]  
## 1one 1 0 0 0  
## 2two 0 1 0 0  
## 3three 0 0 1 0  
## 4four 0 0 0 1  
## 5five -1 -1 -1 -1

# Outliers (this is a simple univariate measure)  
# Outlier = above Q3 + 1.5xIQR or below Q1 - 1.5xIQR  
# Extreme outlier = above Q3 + 3xIQR or below Q1 - 3xIQR   
# Only exclude extreme outliers  
outliers <- data %>%  
 group\_by(time) %>%  
 identify\_outliers(gev)  
outliers

## # A tibble: 7 × 9  
## time simple\_id microstate gev duration coverage occurrence is.outlier is.extreme  
## <fct> <fct> <chr> <dbl> <dbl> <dbl> <dbl> <lgl> <lgl>   
## 1 2two 394 C 0.375 114. 42.3 2.93 TRUE FALSE   
## 2 2two 529 C 0.155 89.2 24.4 2.37 TRUE FALSE   
## 3 3three 394 C 0.366 115. 42.5 2.93 TRUE FALSE   
## 4 3three 404 C 0.367 114. 40.6 2.95 TRUE FALSE   
## 5 3three 529 C 0.167 93.3 25.2 2.34 TRUE FALSE   
## 6 4four 529 C 0.159 91.4 23.9 2.26 TRUE FALSE   
## 7 5five 529 C 0.156 91.0 24.3 2.31 TRUE FALSE

# NO EXTREME VALUES

# Correlations  
data\_one <- data %>% filter(time == "1one")  
data\_two <- data %>% filter(time == "2two")  
data\_three <- data %>% filter(time == "3three")  
data\_four <- data %>% filter(time == "4four")  
data\_five <- data %>% filter(time == "5five")  
  
cor(data\_one$gev, data\_two$gev)

## [1] 0.9187898

cor(data\_one$gev, data\_three$gev)

## [1] 0.8874548

cor(data\_one$gev, data\_four$gev)

## [1] 0.8767887

cor(data\_one$gev, data\_five$gev)

## [1] 0.8396536

cor(data\_two$gev, data\_three$gev)

## [1] 0.9593257

cor(data\_two$gev, data\_four$gev)

## [1] 0.9335633

cor(data\_two$gev, data\_five$gev)

## [1] 0.9079037

cor(data\_three$gev, data\_four$gev)

## [1] 0.9846219

cor(data\_three$gev, data\_five$gev)

## [1] 0.9606616

cor(data\_four$gev, data\_five$gev)

## [1] 0.9844537

# Model  
m3\_gev\_model <- lme(gev ~ time, random = ~1|simple\_id,   
 correlation = corAR1(form = ~1|simple\_id), data = data)  
anova(m3\_gev\_model)

## numDF denDF F-value p-value  
## (Intercept) 1 188 1887.4220 <.0001  
## time 4 188 1.7796 0.1346

effectsize::eta\_squared(m3\_gev\_model, partial = TRUE)

## # Effect Size for ANOVA  
##   
## Parameter | Eta2 (partial) | 95% CI  
## -----------------------------------------  
## time | 0.04 | [0.00, 1.00]  
##   
## - One-sided CIs: upper bound fixed at [1.00].

emmeans(m3\_gev\_model, list(pairwise ~ time), adjust = "scheffe")

## Warning: contrasts dropped from factor time

## $`emmeans of time`  
## time emmean SE df lower.CL upper.CL  
## 1one 0.269 0.0064 47 0.257 0.282  
## 2two 0.268 0.0064 47 0.255 0.281  
## 3three 0.270 0.0064 47 0.257 0.283  
## 4four 0.267 0.0064 47 0.254 0.280  
## 5five 0.264 0.0064 47 0.251 0.277  
##   
## Degrees-of-freedom method: containment   
## Confidence level used: 0.95   
##   
## $`pairwise differences of time`  
## 1 estimate SE df t.ratio p.value  
## 1one - 2two 0.001734 0.00185 188 0.936 0.9275  
## 1one - 3three -0.000549 0.00259 188 -0.212 0.9997  
## 1one - 4four 0.002608 0.00314 188 0.831 0.9523  
## 1one - 5five 0.005091 0.00359 188 1.419 0.7334  
## 2two - 3three -0.002283 0.00185 188 -1.233 0.8226  
## 2two - 4four 0.000874 0.00259 188 0.337 0.9984  
## 2two - 5five 0.003357 0.00314 188 1.069 0.8870  
## 3three - 4four 0.003157 0.00185 188 1.705 0.5746  
## 3three - 5five 0.005641 0.00259 188 2.177 0.3189  
## 4four - 5five 0.002483 0.00185 188 1.341 0.7726  
##   
## Degrees-of-freedom method: containment   
## P value adjustment: scheffe method with rank 4

# Estimation statistics-based effect sizes and confidence intervals  
paired\_mean\_diff <- dabest(data, time, gev,  
 idx = list(c("2two", "1one"),  
 c("3three", "1one"),  
 c("4four", "1one"),  
 c("5five", "1one"),  
 c("3three", "2two"),  
 c("4four", "2two"),  
 c("5five", "2two"),  
 c("4four", "3three"),  
 c("5five", "3three"),  
 c("5five", "4four")),  
 paired = TRUE, id.col = simple\_id) %>%   
 mean\_diff()  
paired\_mean\_diff

## dabestr (Data Analysis with Bootstrap Estimation in R) v0.3.0  
## =============================================================  
##   
## Good evening!  
## The current time is 23:36 PM on Sunday January 21, 2024.  
##   
## Dataset : data  
## X Variable : time  
## Y Variable : gev  
##   
## Paired mean difference of 1one (n = 48) minus 2two (n = 48)  
## 0.00173 [95CI -0.0166; 0.021]  
##   
## Paired mean difference of 1one (n = 48) minus 3three (n = 48)  
## -0.000549 [95CI -0.0181; 0.0175]  
##   
## Paired mean difference of 1one (n = 48) minus 4four (n = 48)  
## 0.00261 [95CI -0.0143; 0.0202]  
##   
## Paired mean difference of 1one (n = 48) minus 5five (n = 48)  
## 0.00509 [95CI -0.0118; 0.0221]  
##   
## Paired mean difference of 2two (n = 48) minus 3three (n = 48)  
## -0.00228 [95CI -0.0189; 0.0154]  
##   
## Paired mean difference of 2two (n = 48) minus 4four (n = 48)  
## 0.000874 [95CI -0.0154; 0.0178]  
##   
## Paired mean difference of 2two (n = 48) minus 5five (n = 48)  
## 0.00336 [95CI -0.0127; 0.0203]  
##   
## Paired mean difference of 3three (n = 48) minus 4four (n = 48)  
## 0.00316 [95CI -0.0127; 0.0194]  
##   
## Paired mean difference of 3three (n = 48) minus 5five (n = 48)  
## 0.00564 [95CI -0.00981; 0.0219]  
##   
## Paired mean difference of 4four (n = 48) minus 5five (n = 48)  
## 0.00248 [95CI -0.0126; 0.0179]  
##   
##   
## 5000 bootstrap resamples.  
## All confidence intervals are bias-corrected and accelerated.

# Microstate 4/D GEV

# Read data  
data <- read.csv("lmem\_full\_temp\_prop\_data.csv")  
data <- data[data$microstate == 'D', ]  
  
data$simple\_id <- as.factor(data$simple\_id)  
  
data$time <- ifelse(data$time == 1, "1one",  
 ifelse(data$time == 2, "2two",  
 ifelse(data$time == 3, "3three",  
 ifelse(data$time == 4, "4four",  
 ifelse(data$time == 5, "5five", "other")))))  
  
data$time <- as.factor(data$time)  
contrasts(data$time) <- contr.sum  
contrasts(data$time)

## [,1] [,2] [,3] [,4]  
## 1one 1 0 0 0  
## 2two 0 1 0 0  
## 3three 0 0 1 0  
## 4four 0 0 0 1  
## 5five -1 -1 -1 -1

# Outliers (this is a simple univariate measure)  
# Outlier = above Q3 + 1.5xIQR or below Q1 - 1.5xIQR  
# Extreme outlier = above Q3 + 3xIQR or below Q1 - 3xIQR   
# Only exclude extreme outliers  
outliers <- data %>%  
 identify\_outliers(gev)  
outliers

## simple\_id time microstate gev duration coverage occurrence is.outlier is.extreme  
## 1 230 1one D 0.148212 102.0689 24.70045 2.021077 TRUE FALSE  
## 2 338 1one D 0.149801 102.1454 24.39454 1.918474 TRUE FALSE  
## 3 529 4four D 0.148537 93.7311 25.52660 2.357039 TRUE FALSE

# NO EXTREME VALUES

# Correlations  
data\_one <- data %>% filter(time == "1one")  
data\_two <- data %>% filter(time == "2two")  
data\_three <- data %>% filter(time == "3three")  
data\_four <- data %>% filter(time == "4four")  
data\_five <- data %>% filter(time == "5five")  
  
cor(data\_one$gev, data\_two$gev)

## [1] 0.9397246

cor(data\_one$gev, data\_three$gev)

## [1] 0.9258478

cor(data\_one$gev, data\_four$gev)

## [1] 0.9082556

cor(data\_one$gev, data\_five$gev)

## [1] 0.9034386

cor(data\_two$gev, data\_three$gev)

## [1] 0.983298

cor(data\_two$gev, data\_four$gev)

## [1] 0.960106

cor(data\_two$gev, data\_five$gev)

## [1] 0.9514339

cor(data\_three$gev, data\_four$gev)

## [1] 0.9888134

cor(data\_three$gev, data\_five$gev)

## [1] 0.9818954

cor(data\_four$gev, data\_five$gev)

## [1] 0.9949199

# Model  
m4\_gev\_model <- lme(gev ~ time, random = ~1|simple\_id,   
 correlation = corAR1(form = ~1|simple\_id), data = data)  
anova(m4\_gev\_model)

## numDF denDF F-value p-value  
## (Intercept) 1 188 398.0288 <.0001  
## time 4 188 21.1022 <.0001

effectsize::eta\_squared(m4\_gev\_model, partial = TRUE)

## # Effect Size for ANOVA  
##   
## Parameter | Eta2 (partial) | 95% CI  
## -----------------------------------------  
## time | 0.31 | [0.21, 1.00]  
##   
## - One-sided CIs: upper bound fixed at [1.00].

emmeans(m4\_gev\_model, list(pairwise ~ time), adjust = "scheffe")

## Warning: contrasts dropped from factor time

## $`emmeans of time`  
## time emmean SE df lower.CL upper.CL  
## 1one 0.0764 0.00403 47 0.0683 0.0845  
## 2two 0.0721 0.00403 47 0.0640 0.0803  
## 3three 0.0773 0.00403 47 0.0692 0.0854  
## 4four 0.0822 0.00403 47 0.0741 0.0903  
## 5five 0.0805 0.00403 47 0.0723 0.0886  
##   
## Degrees-of-freedom method: containment   
## Confidence level used: 0.95   
##   
## $`pairwise differences of time`  
## 1 estimate SE df t.ratio p.value  
## 1one - 2two 0.004268 0.000916 188 4.659 0.0004  
## 1one - 3three -0.000875 0.001287 188 -0.680 0.9769  
## 1one - 4four -0.005764 0.001566 188 -3.680 0.0106  
## 1one - 5five -0.004045 0.001797 188 -2.251 0.2847  
## 2two - 3three -0.005142 0.000916 188 -5.614 <.0001  
## 2two - 4four -0.010031 0.001287 188 -7.794 <.0001  
## 2two - 5five -0.008312 0.001566 188 -5.307 <.0001  
## 3three - 4four -0.004889 0.000916 188 -5.337 <.0001  
## 3three - 5five -0.003170 0.001287 188 -2.463 0.1991  
## 4four - 5five 0.001719 0.000916 188 1.877 0.4767  
##   
## Degrees-of-freedom method: containment   
## P value adjustment: scheffe method with rank 4

# Estimation statistics-based effect sizes and confidence intervals  
paired\_mean\_diff <- dabest(data, time, gev,  
 idx = list(c("2two", "1one"),  
 c("3three", "1one"),  
 c("4four", "1one"),  
 c("5five", "1one"),  
 c("3three", "2two"),  
 c("4four", "2two"),  
 c("5five", "2two"),  
 c("4four", "3three"),  
 c("5five", "3three"),  
 c("5five", "4four")),  
 paired = TRUE, id.col = simple\_id) %>%   
 mean\_diff()  
paired\_mean\_diff

## dabestr (Data Analysis with Bootstrap Estimation in R) v0.3.0  
## =============================================================  
##   
## Good evening!  
## The current time is 23:36 PM on Sunday January 21, 2024.  
##   
## Dataset : data  
## X Variable : time  
## Y Variable : gev  
##   
## Paired mean difference of 1one (n = 48) minus 2two (n = 48)  
## 0.00427 [95CI -0.00684; 0.0159]  
##   
## Paired mean difference of 1one (n = 48) minus 3three (n = 48)  
## -0.000875 [95CI -0.0119; 0.0108]  
##   
## Paired mean difference of 1one (n = 48) minus 4four (n = 48)  
## -0.00576 [95CI -0.0168; 0.00603]  
##   
## Paired mean difference of 1one (n = 48) minus 5five (n = 48)  
## -0.00404 [95CI -0.0149; 0.00754]  
##   
## Paired mean difference of 2two (n = 48) minus 3three (n = 48)  
## -0.00514 [95CI -0.0154; 0.00528]  
##   
## Paired mean difference of 2two (n = 48) minus 4four (n = 48)  
## -0.01 [95CI -0.0205; 0.000414]  
##   
## Paired mean difference of 2two (n = 48) minus 5five (n = 48)  
## -0.00831 [95CI -0.0184; 0.00214]  
##   
## Paired mean difference of 3three (n = 48) minus 4four (n = 48)  
## -0.00489 [95CI -0.0154; 0.00545]  
##   
## Paired mean difference of 3three (n = 48) minus 5five (n = 48)  
## -0.00317 [95CI -0.0135; 0.00705]  
##   
## Paired mean difference of 4four (n = 48) minus 5five (n = 48)  
## 0.00172 [95CI -0.00845; 0.012]  
##   
##   
## 5000 bootstrap resamples.  
## All confidence intervals are bias-corrected and accelerated.

# Microstate 5/F GEV

# Read data  
data <- read.csv("lmem\_full\_temp\_prop\_data.csv")  
data <- data[data$microstate == 'F', ]  
  
data$simple\_id <- as.factor(data$simple\_id)  
  
data$time <- ifelse(data$time == 1, "1one",  
 ifelse(data$time == 2, "2two",  
 ifelse(data$time == 3, "3three",  
 ifelse(data$time == 4, "4four",  
 ifelse(data$time == 5, "5five", "other")))))  
  
data$time <- as.factor(data$time)  
contrasts(data$time) <- contr.sum  
contrasts(data$time)

## [,1] [,2] [,3] [,4]  
## 1one 1 0 0 0  
## 2two 0 1 0 0  
## 3three 0 0 1 0  
## 4four 0 0 0 1  
## 5five -1 -1 -1 -1

# Outliers (this is a simple univariate measure)  
# Outlier = above Q3 + 1.5xIQR or below Q1 - 1.5xIQR  
# Extreme outlier = above Q3 + 3xIQR or below Q1 - 3xIQR   
# Only exclude extreme outliers  
outliers <- data %>%  
 group\_by(time) %>%  
 identify\_outliers(gev)  
outliers

## # A tibble: 15 × 9  
## time simple\_id microstate gev duration coverage occurrence is.outlier is.extreme  
## <fct> <fct> <chr> <dbl> <dbl> <dbl> <dbl> <lgl> <lgl>   
## 1 1one 408 F 0.141 92.2 24.3 2.31 TRUE FALSE   
## 2 2two 408 F 0.160 91.8 25.9 2.42 TRUE FALSE   
## 3 3three 280 F 0.0442 81.2 12.8 1.38 TRUE FALSE   
## 4 3three 315 F 0.0383 73.8 10.5 1.28 TRUE FALSE   
## 5 3three 389 F 0.0368 79.2 10.1 1.13 TRUE FALSE   
## 6 3three 408 F 0.136 89.3 24.7 2.38 TRUE FALSE   
## 7 4four 280 F 0.0291 75.4 10.1 1.17 TRUE FALSE   
## 8 4four 315 F 0.0400 73.2 10.4 1.28 TRUE FALSE   
## 9 4four 389 F 0.0331 78.0 9.14 1.06 TRUE FALSE   
## 10 4four 390 F 0.0447 73.0 11.5 1.41 TRUE FALSE   
## 11 4four 408 F 0.134 89.7 24.0 2.29 TRUE TRUE   
## 12 5five 280 F 0.0357 79.0 11.1 1.24 TRUE FALSE   
## 13 5five 315 F 0.0458 76.6 11.5 1.35 TRUE FALSE   
## 14 5five 389 F 0.0417 78.1 10.7 1.22 TRUE FALSE   
## 15 5five 408 F 0.146 91.5 25.1 2.34 TRUE TRUE

# TWO EXTREME VALUES  
  
# Remove Extreme Observations  
data <- data %>%  
 filter(!(simple\_id == 408))

# Correlations  
data\_one <- data %>% filter(time == "1one")  
data\_two <- data %>% filter(time == "2two")  
data\_three <- data %>% filter(time == "3three")  
data\_four <- data %>% filter(time == "4four")  
data\_five <- data %>% filter(time == "5five")  
  
cor(data\_one$gev, data\_two$gev)

## [1] 0.8224504

cor(data\_one$gev, data\_three$gev)

## [1] 0.7389887

cor(data\_one$gev, data\_four$gev)

## [1] 0.6470245

cor(data\_one$gev, data\_five$gev)

## [1] 0.6039995

cor(data\_two$gev, data\_three$gev)

## [1] 0.9378903

cor(data\_two$gev, data\_four$gev)

## [1] 0.8308322

cor(data\_two$gev, data\_five$gev)

## [1] 0.7961884

cor(data\_three$gev, data\_four$gev)

## [1] 0.9266806

cor(data\_three$gev, data\_five$gev)

## [1] 0.9100787

cor(data\_four$gev, data\_five$gev)

## [1] 0.9790473

# Model  
m5\_gev\_model <- lme(gev ~ time, random = ~1|simple\_id,   
 correlation = corAR1(form = ~1|simple\_id), data = data)  
anova(m5\_gev\_model)

## numDF denDF F-value p-value  
## (Intercept) 1 184 1159.0384 <.0001  
## time 4 184 22.0864 <.0001

effectsize::eta\_squared(m5\_gev\_model, partial = TRUE)

## # Effect Size for ANOVA  
##   
## Parameter | Eta2 (partial) | 95% CI  
## -----------------------------------------  
## time | 0.32 | [0.23, 1.00]  
##   
## - One-sided CIs: upper bound fixed at [1.00].

emmeans(m5\_gev\_model, list(pairwise ~ time), adjust = "scheffe")

## Warning: contrasts dropped from factor time

## $`emmeans of time`  
## time emmean SE df lower.CL upper.CL  
## 1one 0.0841 0.00257 46 0.0789 0.0893  
## 2two 0.0845 0.00257 46 0.0793 0.0897  
## 3three 0.0781 0.00257 46 0.0729 0.0833  
## 4four 0.0719 0.00257 46 0.0667 0.0770  
## 5five 0.0769 0.00257 46 0.0717 0.0820  
##   
## Degrees-of-freedom method: containment   
## Confidence level used: 0.95   
##   
## $`pairwise differences of time`  
## 1 estimate SE df t.ratio p.value  
## 1one - 2two -0.000407 0.00108 184 -0.377 0.9976  
## 1one - 3three 0.005989 0.00149 184 4.008 0.0038  
## 1one - 4four 0.012218 0.00179 184 6.827 <.0001  
## 1one - 5five 0.007218 0.00202 184 3.570 0.0147  
## 2two - 3three 0.006396 0.00108 184 5.918 <.0001  
## 2two - 4four 0.012625 0.00149 184 8.449 <.0001  
## 2two - 5five 0.007625 0.00179 184 4.261 0.0016  
## 3three - 4four 0.006229 0.00108 184 5.763 <.0001  
## 3three - 5five 0.001229 0.00149 184 0.823 0.9539  
## 4four - 5five -0.005000 0.00108 184 -4.626 0.0004  
##   
## Degrees-of-freedom method: containment   
## P value adjustment: scheffe method with rank 4

# Estimation statistics-based effect sizes and confidence intervals  
paired\_mean\_diff <- dabest(data, time, gev,  
 idx = list(c("2two", "1one"),  
 c("3three", "1one"),  
 c("4four", "1one"),  
 c("5five", "1one"),  
 c("3three", "2two"),  
 c("4four", "2two"),  
 c("5five", "2two"),  
 c("4four", "3three"),  
 c("5five", "3three"),  
 c("5five", "4four")),  
 paired = TRUE, id.col = simple\_id) %>%   
 mean\_diff()  
paired\_mean\_diff

## dabestr (Data Analysis with Bootstrap Estimation in R) v0.3.0  
## =============================================================  
##   
## Good evening!  
## The current time is 23:36 PM on Sunday January 21, 2024.  
##   
## Dataset : data  
## X Variable : time  
## Y Variable : gev  
##   
## Paired mean difference of 1one (n = 47) minus 2two (n = 47)  
## -0.000407 [95CI -0.00807; 0.00716]  
##   
## Paired mean difference of 1one (n = 47) minus 3three (n = 47)  
## 0.00599 [95CI -0.00112; 0.0133]  
##   
## Paired mean difference of 1one (n = 47) minus 4four (n = 47)  
## 0.0122 [95CI 0.00508; 0.0193]  
##   
## Paired mean difference of 1one (n = 47) minus 5five (n = 47)  
## 0.00722 [95CI 0.000113; 0.0144]  
##   
## Paired mean difference of 2two (n = 47) minus 3three (n = 47)  
## 0.0064 [95CI -0.000399; 0.0134]  
##   
## Paired mean difference of 2two (n = 47) minus 4four (n = 47)  
## 0.0126 [95CI 0.00582; 0.0196]  
##   
## Paired mean difference of 2two (n = 47) minus 5five (n = 47)  
## 0.00763 [95CI 0.000793; 0.0145]  
##   
## Paired mean difference of 3three (n = 47) minus 4four (n = 47)  
## 0.00623 [95CI -0.000126; 0.0127]  
##   
## Paired mean difference of 3three (n = 47) minus 5five (n = 47)  
## 0.00123 [95CI -0.00515; 0.00767]  
##   
## Paired mean difference of 4four (n = 47) minus 5five (n = 47)  
## -0.005 [95CI -0.0114; 0.00136]  
##   
##   
## 5000 bootstrap resamples.  
## All confidence intervals are bias-corrected and accelerated.

# Microstate 1/A Duration

# Read data  
data <- read.csv("lmem\_full\_temp\_prop\_data.csv")  
data <- data[data$microstate == 'A', ]  
  
data$simple\_id <- as.factor(data$simple\_id)  
  
data$time <- ifelse(data$time == 1, "1one",  
 ifelse(data$time == 2, "2two",  
 ifelse(data$time == 3, "3three",  
 ifelse(data$time == 4, "4four",  
 ifelse(data$time == 5, "5five", "other")))))  
  
data$time <- as.factor(data$time)  
contrasts(data$time) <- contr.sum  
contrasts(data$time)

## [,1] [,2] [,3] [,4]  
## 1one 1 0 0 0  
## 2two 0 1 0 0  
## 3three 0 0 1 0  
## 4four 0 0 0 1  
## 5five -1 -1 -1 -1

# Outliers (this is a simple univariate measure)  
# Outlier = above Q3 + 1.5xIQR or below Q1 - 1.5xIQR  
# Extreme outlier = above Q3 + 3xIQR or below Q1 - 3xIQR   
# Only exclude extreme outliers  
outliers <- data %>%  
 group\_by(time) %>%  
 identify\_outliers(duration)  
outliers

## # A tibble: 1 × 9  
## time simple\_id microstate gev duration coverage occurrence is.outlier is.extreme  
## <fct> <fct> <chr> <dbl> <dbl> <dbl> <dbl> <lgl> <lgl>   
## 1 2two 389 A 0.128 88.3 23.8 2.26 TRUE FALSE

# NO EXTREME VALUES

# Correlations  
data\_one <- data %>% filter(time == "1one")  
data\_two <- data %>% filter(time == "2two")  
data\_three <- data %>% filter(time == "3three")  
data\_four <- data %>% filter(time == "4four")  
data\_five <- data %>% filter(time == "5five")  
  
cor(data\_one$duration, data\_two$duration)

## [1] 0.845874

cor(data\_one$duration, data\_three$duration)

## [1] 0.7692766

cor(data\_one$duration, data\_four$duration)

## [1] 0.7151836

cor(data\_one$duration, data\_five$duration)

## [1] 0.6628136

cor(data\_two$duration, data\_three$duration)

## [1] 0.8854604

cor(data\_two$duration, data\_four$duration)

## [1] 0.8461657

cor(data\_two$duration, data\_five$duration)

## [1] 0.7820521

cor(data\_three$duration, data\_four$duration)

## [1] 0.9295893

cor(data\_three$duration, data\_five$duration)

## [1] 0.885315

cor(data\_four$duration, data\_five$duration)

## [1] 0.9472945

# Model  
m1\_duration\_model <- lme(duration ~ time, random = ~1|simple\_id,  
 correlation = corAR1(form = ~1|simple\_id), data = data)  
anova(m1\_duration\_model)

## numDF denDF F-value p-value  
## (Intercept) 1 188 18023.093 <.0001  
## time 4 188 1.606 0.1745

effectsize::eta\_squared(m1\_duration\_model, partial = TRUE)

## # Effect Size for ANOVA  
##   
## Parameter | Eta2 (partial) | 95% CI  
## -----------------------------------------  
## time | 0.03 | [0.00, 1.00]  
##   
## - One-sided CIs: upper bound fixed at [1.00].

emmeans(m1\_duration\_model, list(pairwise ~ time), adjust = "scheffe")

## Warning: contrasts dropped from factor time

## $`emmeans of time`  
## time emmean SE df lower.CL upper.CL  
## 1one 78.8 0.645 47 77.5 80.1  
## 2two 78.8 0.645 47 77.5 80.1  
## 3three 79.1 0.645 47 77.8 80.4  
## 4four 78.5 0.645 47 77.2 79.8  
## 5five 78.2 0.645 47 76.9 79.5  
##   
## Degrees-of-freedom method: containment   
## Confidence level used: 0.95   
##   
## $`pairwise differences of time`  
## 1 estimate SE df t.ratio p.value  
## 1one - 2two 0.0649 0.294 188 0.221 0.9997  
## 1one - 3three -0.2749 0.404 188 -0.680 0.9768  
## 1one - 4four 0.2825 0.482 188 0.586 0.9867  
## 1one - 5five 0.6391 0.542 188 1.180 0.8453  
## 2two - 3three -0.3398 0.294 188 -1.157 0.8542  
## 2two - 4four 0.2175 0.404 188 0.538 0.9904  
## 2two - 5five 0.5741 0.482 188 1.192 0.8402  
## 3three - 4four 0.5573 0.294 188 1.898 0.4645  
## 3three - 5five 0.9139 0.404 188 2.262 0.2796  
## 4four - 5five 0.3566 0.294 188 1.215 0.8306  
##   
## Degrees-of-freedom method: containment   
## P value adjustment: scheffe method with rank 4

# Estimation statistics-based effect sizes and confidence intervals  
paired\_mean\_diff <- dabest(data, time, duration,  
 idx = list(c("2two", "1one"),  
 c("3three", "1one"),  
 c("4four", "1one"),  
 c("5five", "1one"),  
 c("3three", "2two"),  
 c("4four", "2two"),  
 c("5five", "2two"),  
 c("4four", "3three"),  
 c("5five", "3three"),  
 c("5five", "4four")),  
 paired = TRUE, id.col = simple\_id) %>%   
 mean\_diff()  
paired\_mean\_diff

## dabestr (Data Analysis with Bootstrap Estimation in R) v0.3.0  
## =============================================================  
##   
## Good evening!  
## The current time is 23:36 PM on Sunday January 21, 2024.  
##   
## Dataset : data  
## X Variable : time  
## Y Variable : duration  
##   
## Paired mean difference of 1one (n = 48) minus 2two (n = 48)  
## 0.0649 [95CI -1.84; 2.06]  
##   
## Paired mean difference of 1one (n = 48) minus 3three (n = 48)  
## -0.275 [95CI -2.15; 1.59]  
##   
## Paired mean difference of 1one (n = 48) minus 4four (n = 48)  
## 0.282 [95CI -1.55; 2.16]  
##   
## Paired mean difference of 1one (n = 48) minus 5five (n = 48)  
## 0.639 [95CI -1.15; 2.48]  
##   
## Paired mean difference of 2two (n = 48) minus 3three (n = 48)  
## -0.34 [95CI -2.09; 1.46]  
##   
## Paired mean difference of 2two (n = 48) minus 4four (n = 48)  
## 0.218 [95CI -1.51; 1.99]  
##   
## Paired mean difference of 2two (n = 48) minus 5five (n = 48)  
## 0.574 [95CI -1.08; 2.32]  
##   
## Paired mean difference of 3three (n = 48) minus 4four (n = 48)  
## 0.557 [95CI -1.15; 2.24]  
##   
## Paired mean difference of 3three (n = 48) minus 5five (n = 48)  
## 0.914 [95CI -0.733; 2.52]  
##   
## Paired mean difference of 4four (n = 48) minus 5five (n = 48)  
## 0.357 [95CI -1.23; 1.98]  
##   
##   
## 5000 bootstrap resamples.  
## All confidence intervals are bias-corrected and accelerated.

# Microstate 2/B Duration

# Read data  
data <- read.csv("lmem\_full\_temp\_prop\_data.csv")  
data <- data[data$microstate == 'B', ]  
  
data$simple\_id <- as.factor(data$simple\_id)  
  
data$time <- ifelse(data$time == 1, "1one",  
 ifelse(data$time == 2, "2two",  
 ifelse(data$time == 3, "3three",  
 ifelse(data$time == 4, "4four",  
 ifelse(data$time == 5, "5five", "other")))))  
  
data$time <- as.factor(data$time)  
contrasts(data$time) <- contr.sum  
contrasts(data$time)

## [,1] [,2] [,3] [,4]  
## 1one 1 0 0 0  
## 2two 0 1 0 0  
## 3three 0 0 1 0  
## 4four 0 0 0 1  
## 5five -1 -1 -1 -1

# Outliers (this is a simple univariate measure)  
# Outlier = above Q3 + 1.5xIQR or below Q1 - 1.5xIQR  
# Extreme outlier = above Q3 + 3xIQR or below Q1 - 3xIQR   
# Only exclude extreme outliers  
outliers <- data %>%  
 group\_by(time) %>%  
 identify\_outliers(duration)  
outliers

## # A tibble: 9 × 9  
## time simple\_id microstate gev duration coverage occurrence is.outlier is.extreme  
## <fct> <fct> <chr> <dbl> <dbl> <dbl> <dbl> <lgl> <lgl>   
## 1 1one 207 B 0.147 101. 25.1 2.05 TRUE FALSE   
## 2 2two 207 B 0.150 100. 23.7 1.99 TRUE TRUE   
## 3 2two 280 B 0.167 92.7 26.4 2.40 TRUE FALSE   
## 4 3three 207 B 0.126 93.7 20.9 1.88 TRUE FALSE   
## 5 3three 280 B 0.145 92.1 24.9 2.29 TRUE FALSE   
## 6 4four 207 B 0.121 92.8 21.2 1.92 TRUE FALSE   
## 7 4four 280 B 0.155 92.3 26.8 2.43 TRUE FALSE   
## 8 5five 207 B 0.120 95.7 21.1 1.86 TRUE FALSE   
## 9 5five 280 B 0.152 91.2 26.3 2.41 TRUE FALSE

# ONE EXTREME VALUE  
  
# Remove Extreme Observations  
data <- data %>%  
 filter(!(simple\_id == 207))

# Correlations  
data\_one <- data %>% filter(time == "1one")  
data\_two <- data %>% filter(time == "2two")  
data\_three <- data %>% filter(time == "3three")  
data\_four <- data %>% filter(time == "4four")  
data\_five <- data %>% filter(time == "5five")  
  
cor(data\_one$duration, data\_two$duration)

## [1] 0.8123154

cor(data\_one$duration, data\_three$duration)

## [1] 0.7349442

cor(data\_one$duration, data\_four$duration)

## [1] 0.7002862

cor(data\_one$duration, data\_five$duration)

## [1] 0.6828089

cor(data\_two$duration, data\_three$duration)

## [1] 0.879673

cor(data\_two$duration, data\_four$duration)

## [1] 0.859978

cor(data\_two$duration, data\_five$duration)

## [1] 0.835005

cor(data\_three$duration, data\_four$duration)

## [1] 0.8718062

cor(data\_three$duration, data\_five$duration)

## [1] 0.8910937

cor(data\_four$duration, data\_five$duration)

## [1] 0.9344183

# Model  
m2\_duration\_model <- lme(duration ~ time, random = ~1|simple\_id,  
 correlation = corAR1(form = ~1|simple\_id), data = data)  
anova(m2\_duration\_model)

## numDF denDF F-value p-value  
## (Intercept) 1 184 21461.958 <.0001  
## time 4 184 2.328 0.0579

effectsize::eta\_squared(m2\_duration\_model, partial = TRUE)

## # Effect Size for ANOVA  
##   
## Parameter | Eta2 (partial) | 95% CI  
## -----------------------------------------  
## time | 0.05 | [0.00, 1.00]  
##   
## - One-sided CIs: upper bound fixed at [1.00].

emmeans(m2\_duration\_model, list(pairwise ~ time), adjust = "scheffe")

## Warning: contrasts dropped from factor time

## $`emmeans of time`  
## time emmean SE df lower.CL upper.CL  
## 1one 80.2 0.599 46 79.0 81.4  
## 2two 79.5 0.599 46 78.3 80.7  
## 3three 79.5 0.599 46 78.3 80.7  
## 4four 80.0 0.599 46 78.8 81.2  
## 5five 79.5 0.599 46 78.3 80.7  
##   
## Degrees-of-freedom method: containment   
## Confidence level used: 0.95   
##   
## $`pairwise differences of time`  
## 1 estimate SE df t.ratio p.value  
## 1one - 2two 0.66051 0.314 184 2.101 0.3565  
## 1one - 3three 0.71685 0.397 184 1.804 0.5181  
## 1one - 4four 0.15744 0.440 184 0.358 0.9980  
## 1one - 5five 0.66787 0.463 184 1.442 0.7210  
## 2two - 3three 0.05635 0.314 184 0.179 0.9999  
## 2two - 4four -0.50306 0.397 184 -1.266 0.8081  
## 2two - 5five 0.00736 0.440 184 0.017 1.0000  
## 3three - 4four -0.55941 0.314 184 -1.779 0.5322  
## 3three - 5five -0.04899 0.397 184 -0.123 1.0000  
## 4four - 5five 0.51042 0.314 184 1.623 0.6214  
##   
## Degrees-of-freedom method: containment   
## P value adjustment: scheffe method with rank 4

# Estimation statistics-based effect sizes and confidence intervals  
paired\_mean\_diff <- dabest(data, time, duration,  
 idx = list(c("2two", "1one"),  
 c("3three", "1one"),  
 c("4four", "1one"),  
 c("5five", "1one"),  
 c("3three", "2two"),  
 c("4four", "2two"),  
 c("5five", "2two"),  
 c("4four", "3three"),  
 c("5five", "3three"),  
 c("5five", "4four")),  
 paired = TRUE, id.col = simple\_id) %>%   
 mean\_diff()  
paired\_mean\_diff

## dabestr (Data Analysis with Bootstrap Estimation in R) v0.3.0  
## =============================================================  
##   
## Good evening!  
## The current time is 23:36 PM on Sunday January 21, 2024.  
##   
## Dataset : data  
## X Variable : time  
## Y Variable : duration  
##   
## Paired mean difference of 1one (n = 47) minus 2two (n = 47)  
## 0.661 [95CI -1.25; 2.48]  
##   
## Paired mean difference of 1one (n = 47) minus 3three (n = 47)  
## 0.717 [95CI -1.04; 2.42]  
##   
## Paired mean difference of 1one (n = 47) minus 4four (n = 47)  
## 0.157 [95CI -1.48; 1.84]  
##   
## Paired mean difference of 1one (n = 47) minus 5five (n = 47)  
## 0.668 [95CI -0.985; 2.33]  
##   
## Paired mean difference of 2two (n = 47) minus 3three (n = 47)  
## 0.0563 [95CI -1.68; 1.75]  
##   
## Paired mean difference of 2two (n = 47) minus 4four (n = 47)  
## -0.503 [95CI -2.15; 1.14]  
##   
## Paired mean difference of 2two (n = 47) minus 5five (n = 47)  
## 0.00736 [95CI -1.59; 1.68]  
##   
## Paired mean difference of 3three (n = 47) minus 4four (n = 47)  
## -0.559 [95CI -2.04; 0.957]  
##   
## Paired mean difference of 3three (n = 47) minus 5five (n = 47)  
## -0.049 [95CI -1.5; 1.43]  
##   
## Paired mean difference of 4four (n = 47) minus 5five (n = 47)  
## 0.51 [95CI -0.899; 1.94]  
##   
##   
## 5000 bootstrap resamples.  
## All confidence intervals are bias-corrected and accelerated.

# Microstate 3/C Duration

# Read data  
data <- read.csv("lmem\_full\_temp\_prop\_data.csv")  
data <- data[data$microstate == 'C', ]  
  
data$simple\_id <- as.factor(data$simple\_id)  
  
data$time <- ifelse(data$time == 1, "1one",  
 ifelse(data$time == 2, "2two",  
 ifelse(data$time == 3, "3three",  
 ifelse(data$time == 4, "4four",  
 ifelse(data$time == 5, "5five", "other")))))  
  
data$time <- as.factor(data$time)  
contrasts(data$time) <- contr.sum  
contrasts(data$time)

## [,1] [,2] [,3] [,4]  
## 1one 1 0 0 0  
## 2two 0 1 0 0  
## 3three 0 0 1 0  
## 4four 0 0 0 1  
## 5five -1 -1 -1 -1

# Outliers (this is a simple univariate measure)  
# Outlier = above Q3 + 1.5xIQR or below Q1 - 1.5xIQR  
# Extreme outlier = above Q3 + 3xIQR or below Q1 - 3xIQR   
# Only exclude extreme outliers  
outliers <- data %>%  
 group\_by(time) %>%  
 identify\_outliers(duration)  
outliers

## [1] time simple\_id microstate gev duration coverage occurrence is.outlier is.extreme  
## <0 rows> (or 0-length row.names)

# NO EXTREME VALUES

# Correlations  
data\_one <- data %>% filter(time == "1one")  
data\_two <- data %>% filter(time == "2two")  
data\_three <- data %>% filter(time == "3three")  
data\_four <- data %>% filter(time == "4four")  
data\_five <- data %>% filter(time == "5five")  
  
cor(data\_one$duration, data\_two$duration)

## [1] 0.8762292

cor(data\_one$duration, data\_three$duration)

## [1] 0.8103702

cor(data\_one$duration, data\_four$duration)

## [1] 0.8468169

cor(data\_one$duration, data\_five$duration)

## [1] 0.8104913

cor(data\_two$duration, data\_three$duration)

## [1] 0.9081696

cor(data\_two$duration, data\_four$duration)

## [1] 0.9079865

cor(data\_two$duration, data\_five$duration)

## [1] 0.8429899

cor(data\_three$duration, data\_four$duration)

## [1] 0.9475722

cor(data\_three$duration, data\_five$duration)

## [1] 0.9146523

cor(data\_four$duration, data\_five$duration)

## [1] 0.9570476

# Model  
m3\_duration\_model <- lme(duration ~ time, random = ~1|simple\_id,  
 correlation = corAR1(form = ~1|simple\_id), data = data)  
anova(m3\_duration\_model)

## numDF denDF F-value p-value  
## (Intercept) 1 188 12576.231 <.0001  
## time 4 188 2.542 0.0412

effectsize::eta\_squared(m3\_duration\_model, partial = TRUE)

## # Effect Size for ANOVA  
##   
## Parameter | Eta2 (partial) | 95% CI  
## -----------------------------------------  
## time | 0.05 | [0.00, 1.00]  
##   
## - One-sided CIs: upper bound fixed at [1.00].

emmeans(m3\_duration\_model, list(pairwise ~ time), adjust = "scheffe")

## Warning: contrasts dropped from factor time

## $`emmeans of time`  
## time emmean SE df lower.CL upper.CL  
## 1one 101 0.977 47 99.1 103  
## 2two 102 0.977 47 100.1 104  
## 3three 103 0.977 47 100.7 105  
## 4four 102 0.977 47 100.4 104  
## 5five 102 0.977 47 99.9 104  
##   
## Degrees-of-freedom method: containment   
## Confidence level used: 0.95   
##   
## $`pairwise differences of time`  
## 1 estimate SE df t.ratio p.value  
## 1one - 2two -1.057 0.412 188 -2.565 0.1648  
## 1one - 3three -1.639 0.555 188 -2.954 0.0726  
## 1one - 4four -1.331 0.648 188 -2.053 0.3811  
## 1one - 5five -0.889 0.715 188 -1.243 0.8182  
## 2two - 3three -0.582 0.412 188 -1.413 0.7363  
## 2two - 4four -0.274 0.555 188 -0.493 0.9931  
## 2two - 5five 0.168 0.648 188 0.259 0.9994  
## 3three - 4four 0.309 0.412 188 0.749 0.9671  
## 3three - 5five 0.750 0.555 188 1.352 0.7675  
## 4four - 5five 0.441 0.412 188 1.071 0.8863  
##   
## Degrees-of-freedom method: containment   
## P value adjustment: scheffe method with rank 4

# Estimation statistics-based effect sizes and confidence intervals  
paired\_mean\_diff <- dabest(data, time, duration,  
 idx = list(c("2two", "1one"),  
 c("3three", "1one"),  
 c("4four", "1one"),  
 c("5five", "1one"),  
 c("3three", "2two"),  
 c("4four", "2two"),  
 c("5five", "2two"),  
 c("4four", "3three"),  
 c("5five", "3three"),  
 c("5five", "4four")),  
 paired = TRUE, id.col = simple\_id) %>%   
 mean\_diff()  
paired\_mean\_diff

## dabestr (Data Analysis with Bootstrap Estimation in R) v0.3.0  
## =============================================================  
##   
## Good evening!  
## The current time is 23:36 PM on Sunday January 21, 2024.  
##   
## Dataset : data  
## X Variable : time  
## Y Variable : duration  
##   
## Paired mean difference of 1one (n = 48) minus 2two (n = 48)  
## -1.06 [95CI -4.17; 1.9]  
##   
## Paired mean difference of 1one (n = 48) minus 3three (n = 48)  
## -1.64 [95CI -4.73; 1.33]  
##   
## Paired mean difference of 1one (n = 48) minus 4four (n = 48)  
## -1.33 [95CI -4.22; 1.47]  
##   
## Paired mean difference of 1one (n = 48) minus 5five (n = 48)  
## -0.889 [95CI -3.61; 1.83]  
##   
## Paired mean difference of 2two (n = 48) minus 3three (n = 48)  
## -0.582 [95CI -3.17; 2.02]  
##   
## Paired mean difference of 2two (n = 48) minus 4four (n = 48)  
## -0.274 [95CI -2.72; 2.2]  
##   
## Paired mean difference of 2two (n = 48) minus 5five (n = 48)  
## 0.168 [95CI -2.11; 2.54]  
##   
## Paired mean difference of 3three (n = 48) minus 4four (n = 48)  
## 0.309 [95CI -2.02; 2.74]  
##   
## Paired mean difference of 3three (n = 48) minus 5five (n = 48)  
## 0.75 [95CI -1.43; 3.01]  
##   
## Paired mean difference of 4four (n = 48) minus 5five (n = 48)  
## 0.441 [95CI -1.6; 2.52]  
##   
##   
## 5000 bootstrap resamples.  
## All confidence intervals are bias-corrected and accelerated.

# Microstate 4/D Duration

# Read data  
data <- read.csv("lmem\_full\_temp\_prop\_data.csv")  
data <- data[data$microstate == 'D', ]  
  
data$simple\_id <- as.factor(data$simple\_id)  
  
data$time <- ifelse(data$time == 1, "1one",  
 ifelse(data$time == 2, "2two",  
 ifelse(data$time == 3, "3three",  
 ifelse(data$time == 4, "4four",  
 ifelse(data$time == 5, "5five", "other")))))  
  
data$time <- as.factor(data$time)  
contrasts(data$time) <- contr.sum  
contrasts(data$time)

## [,1] [,2] [,3] [,4]  
## 1one 1 0 0 0  
## 2two 0 1 0 0  
## 3three 0 0 1 0  
## 4four 0 0 0 1  
## 5five -1 -1 -1 -1

# Outliers (this is a simple univariate measure)  
# Outlier = above Q3 + 1.5xIQR or below Q1 - 1.5xIQR  
# Extreme outlier = above Q3 + 3xIQR or below Q1 - 3xIQR   
# Only exclude extreme outliers  
outliers <- data %>%  
 group\_by(time) %>%  
 identify\_outliers(duration)  
outliers

## [1] time simple\_id microstate gev duration coverage occurrence is.outlier is.extreme  
## <0 rows> (or 0-length row.names)

# NO EXTREME VALUES

# Correlations  
data\_one <- data %>% filter(time == "1one")  
data\_two <- data %>% filter(time == "2two")  
data\_three <- data %>% filter(time == "3three")  
data\_four <- data %>% filter(time == "4four")  
data\_five <- data %>% filter(time == "5five")  
  
cor(data\_one$duration, data\_two$duration)

## [1] 0.9069591

cor(data\_one$duration, data\_three$duration)

## [1] 0.8703178

cor(data\_one$duration, data\_four$duration)

## [1] 0.8274391

cor(data\_one$duration, data\_five$duration)

## [1] 0.8180168

cor(data\_two$duration, data\_three$duration)

## [1] 0.9357226

cor(data\_two$duration, data\_four$duration)

## [1] 0.8967104

cor(data\_two$duration, data\_five$duration)

## [1] 0.8914767

cor(data\_three$duration, data\_four$duration)

## [1] 0.9649585

cor(data\_three$duration, data\_five$duration)

## [1] 0.9688389

cor(data\_four$duration, data\_five$duration)

## [1] 0.9859614

# Model  
m4\_duration\_model <- lme(duration ~ time, random = ~1|simple\_id,  
 correlation = corAR1(form = ~1|simple\_id), data = data)  
anova(m4\_duration\_model)

## numDF denDF F-value p-value  
## (Intercept) 1 188 6274.321 <.0001  
## time 4 188 3.839 0.005

effectsize::eta\_squared(m4\_duration\_model, partial = TRUE)

## # Effect Size for ANOVA  
##   
## Parameter | Eta2 (partial) | 95% CI  
## -----------------------------------------  
## time | 0.08 | [0.01, 1.00]  
##   
## - One-sided CIs: upper bound fixed at [1.00].

emmeans(m4\_duration\_model, list(pairwise ~ time), adjust = "scheffe")

## Warning: contrasts dropped from factor time

## $`emmeans of time`  
## time emmean SE df lower.CL upper.CL  
## 1one 83.0 1.11 47 80.8 85.2  
## 2two 82.4 1.11 47 80.2 84.7  
## 3three 82.5 1.11 47 80.3 84.7  
## 4four 83.8 1.11 47 81.6 86.0  
## 5five 83.3 1.11 47 81.1 85.5  
##   
## Degrees-of-freedom method: containment   
## Confidence level used: 0.95   
##   
## $`pairwise differences of time`  
## 1 estimate SE df t.ratio p.value  
## 1one - 2two 0.571 0.377 188 1.515 0.6821  
## 1one - 3three 0.504 0.525 188 0.959 0.9213  
## 1one - 4four -0.786 0.634 188 -1.239 0.8199  
## 1one - 5five -0.289 0.722 188 -0.400 0.9969  
## 2two - 3three -0.067 0.377 188 -0.178 0.9999  
## 2two - 4four -1.357 0.525 188 -2.583 0.1591  
## 2two - 5five -0.860 0.634 188 -1.356 0.7652  
## 3three - 4four -1.290 0.377 188 -3.422 0.0222  
## 3three - 5five -0.793 0.525 188 -1.509 0.6850  
## 4four - 5five 0.497 0.377 188 1.319 0.7835  
##   
## Degrees-of-freedom method: containment   
## P value adjustment: scheffe method with rank 4

# Estimation statistics-based effect sizes and confidence intervals  
paired\_mean\_diff <- dabest(data, time, duration,  
 idx = list(c("2two", "1one"),  
 c("3three", "1one"),  
 c("4four", "1one"),  
 c("5five", "1one"),  
 c("3three", "2two"),  
 c("4four", "2two"),  
 c("5five", "2two"),  
 c("4four", "3three"),  
 c("5five", "3three"),  
 c("5five", "4four")),  
 paired = TRUE, id.col = simple\_id) %>%   
 mean\_diff()  
paired\_mean\_diff

## dabestr (Data Analysis with Bootstrap Estimation in R) v0.3.0  
## =============================================================  
##   
## Good evening!  
## The current time is 23:36 PM on Sunday January 21, 2024.  
##   
## Dataset : data  
## X Variable : time  
## Y Variable : duration  
##   
## Paired mean difference of 1one (n = 48) minus 2two (n = 48)  
## 0.571 [95CI -2.83; 3.93]  
##   
## Paired mean difference of 1one (n = 48) minus 3three (n = 48)  
## 0.504 [95CI -2.61; 3.87]  
##   
## Paired mean difference of 1one (n = 48) minus 4four (n = 48)  
## -0.786 [95CI -3.95; 2.47]  
##   
## Paired mean difference of 1one (n = 48) minus 5five (n = 48)  
## -0.289 [95CI -3.35; 2.95]  
##   
## Paired mean difference of 2two (n = 48) minus 3three (n = 48)  
## -0.067 [95CI -2.79; 2.89]  
##   
## Paired mean difference of 2two (n = 48) minus 4four (n = 48)  
## -1.36 [95CI -4.14; 1.52]  
##   
## Paired mean difference of 2two (n = 48) minus 5five (n = 48)  
## -0.86 [95CI -3.56; 2]  
##   
## Paired mean difference of 3three (n = 48) minus 4four (n = 48)  
## -1.29 [95CI -3.88; 1.36]  
##   
## Paired mean difference of 3three (n = 48) minus 5five (n = 48)  
## -0.793 [95CI -3.29; 1.84]  
##   
## Paired mean difference of 4four (n = 48) minus 5five (n = 48)  
## 0.497 [95CI -1.91; 3.05]  
##   
##   
## 5000 bootstrap resamples.  
## All confidence intervals are bias-corrected and accelerated.

# Microstate 5/F Duration

# Read data  
data <- read.csv("lmem\_full\_temp\_prop\_data.csv")  
data <- data[data$microstate == 'F', ]  
  
data$simple\_id <- as.factor(data$simple\_id)  
  
data$time <- ifelse(data$time == 1, "1one",  
 ifelse(data$time == 2, "2two",  
 ifelse(data$time == 3, "3three",  
 ifelse(data$time == 4, "4four",  
 ifelse(data$time == 5, "5five", "other")))))  
  
data$time <- as.factor(data$time)  
contrasts(data$time) <- contr.sum  
contrasts(data$time)

## [,1] [,2] [,3] [,4]  
## 1one 1 0 0 0  
## 2two 0 1 0 0  
## 3three 0 0 1 0  
## 4four 0 0 0 1  
## 5five -1 -1 -1 -1

# Outliers (this is a simple univariate measure)  
# Outlier = above Q3 + 1.5xIQR or below Q1 - 1.5xIQR  
# Extreme outlier = above Q3 + 3xIQR or below Q1 - 3xIQR   
# Only exclude extreme outliers  
outliers <- data %>%  
 group\_by(time) %>%  
 identify\_outliers(duration)  
outliers

## # A tibble: 1 × 9  
## time simple\_id microstate gev duration coverage occurrence is.outlier is.extreme  
## <fct> <fct> <chr> <dbl> <dbl> <dbl> <dbl> <lgl> <lgl>   
## 1 1one 230 F 0.118 100. 20.9 1.75 TRUE FALSE

# NO EXTREME VALUES

# Correlations  
data\_one <- data %>% filter(time == "1one")  
data\_two <- data %>% filter(time == "2two")  
data\_three <- data %>% filter(time == "3three")  
data\_four <- data %>% filter(time == "4four")  
data\_five <- data %>% filter(time == "5five")  
  
cor(data\_one$duration, data\_two$duration)

## [1] 0.7612548

cor(data\_one$duration, data\_three$duration)

## [1] 0.7625118

cor(data\_one$duration, data\_four$duration)

## [1] 0.6927676

cor(data\_one$duration, data\_five$duration)

## [1] 0.7402757

cor(data\_two$duration, data\_three$duration)

## [1] 0.8749151

cor(data\_two$duration, data\_four$duration)

## [1] 0.8018147

cor(data\_two$duration, data\_five$duration)

## [1] 0.8022236

cor(data\_three$duration, data\_four$duration)

## [1] 0.9009253

cor(data\_three$duration, data\_five$duration)

## [1] 0.9030779

cor(data\_four$duration, data\_five$duration)

## [1] 0.9583406

# Model  
m5\_duration\_model <- lme(duration ~ time, random = ~1|simple\_id,  
 correlation = corAR1(form = ~1|simple\_id), data = data)  
anova(m5\_duration\_model)

## numDF denDF F-value p-value  
## (Intercept) 1 188 15309.887 <.0001  
## time 4 188 4.134 0.0031

effectsize::eta\_squared(m5\_duration\_model, partial = TRUE)

## # Effect Size for ANOVA  
##   
## Parameter | Eta2 (partial) | 95% CI  
## -----------------------------------------  
## time | 0.08 | [0.02, 1.00]  
##   
## - One-sided CIs: upper bound fixed at [1.00].

emmeans(m5\_duration\_model, list(pairwise ~ time), adjust = "scheffe")

## Warning: contrasts dropped from factor time

## $`emmeans of time`  
## time emmean SE df lower.CL upper.CL  
## 1one 83.4 0.73 47 82.0 84.9  
## 2two 83.5 0.73 47 82.0 85.0  
## 3three 82.3 0.73 47 80.8 83.8  
## 4four 81.8 0.73 47 80.3 83.2  
## 5five 82.5 0.73 47 81.0 83.9  
##   
## Degrees-of-freedom method: containment   
## Confidence level used: 0.95   
##   
## $`pairwise differences of time`  
## 1 estimate SE df t.ratio p.value  
## 1one - 2two -0.0696 0.376 188 -0.185 0.9999  
## 1one - 3three 1.1266 0.471 188 2.394 0.2248  
## 1one - 4four 1.6695 0.517 188 3.232 0.0369  
## 1one - 5five 0.9486 0.541 188 1.754 0.5463  
## 2two - 3three 1.1962 0.376 188 3.180 0.0421  
## 2two - 4four 1.7391 0.471 188 3.695 0.0101  
## 2two - 5five 1.0182 0.517 188 1.971 0.4243  
## 3three - 4four 0.5429 0.376 188 1.443 0.7206  
## 3three - 5five -0.1780 0.471 188 -0.378 0.9975  
## 4four - 5five -0.7209 0.376 188 -1.916 0.4545  
##   
## Degrees-of-freedom method: containment   
## P value adjustment: scheffe method with rank 4

# Estimation statistics-based effect sizes and confidence intervals  
paired\_mean\_diff <- dabest(data, time, duration,  
 idx = list(c("2two", "1one"),  
 c("3three", "1one"),  
 c("4four", "1one"),  
 c("5five", "1one"),  
 c("3three", "2two"),  
 c("4four", "2two"),  
 c("5five", "2two"),  
 c("4four", "3three"),  
 c("5five", "3three"),  
 c("5five", "4four")),  
 paired = TRUE, id.col = simple\_id) %>%   
 mean\_diff()  
paired\_mean\_diff

## dabestr (Data Analysis with Bootstrap Estimation in R) v0.3.0  
## =============================================================  
##   
## Good evening!  
## The current time is 23:36 PM on Sunday January 21, 2024.  
##   
## Dataset : data  
## X Variable : time  
## Y Variable : duration  
##   
## Paired mean difference of 1one (n = 48) minus 2two (n = 48)  
## -0.0696 [95CI -2.19; 2.14]  
##   
## Paired mean difference of 1one (n = 48) minus 3three (n = 48)  
## 1.13 [95CI -0.862; 3.31]  
##   
## Paired mean difference of 1one (n = 48) minus 4four (n = 48)  
## 1.67 [95CI -0.369; 3.83]  
##   
## Paired mean difference of 1one (n = 48) minus 5five (n = 48)  
## 0.949 [95CI -1.11; 3.08]  
##   
## Paired mean difference of 2two (n = 48) minus 3three (n = 48)  
## 1.2 [95CI -0.594; 3.06]  
##   
## Paired mean difference of 2two (n = 48) minus 4four (n = 48)  
## 1.74 [95CI -0.0616; 3.63]  
##   
## Paired mean difference of 2two (n = 48) minus 5five (n = 48)  
## 1.02 [95CI -0.83; 2.91]  
##   
## Paired mean difference of 3three (n = 48) minus 4four (n = 48)  
## 0.543 [95CI -1.25; 2.37]  
##   
## Paired mean difference of 3three (n = 48) minus 5five (n = 48)  
## -0.178 [95CI -2.03; 1.68]  
##   
## Paired mean difference of 4four (n = 48) minus 5five (n = 48)  
## -0.721 [95CI -2.51; 1.15]  
##   
##   
## 5000 bootstrap resamples.  
## All confidence intervals are bias-corrected and accelerated.

# Microstate 1/A Coverage

# Read data  
data <- read.csv("lmem\_full\_temp\_prop\_data.csv")  
data <- data[data$microstate == 'A', ]  
  
data$simple\_id <- as.factor(data$simple\_id)  
  
data$time <- ifelse(data$time == 1, "1one",  
 ifelse(data$time == 2, "2two",  
 ifelse(data$time == 3, "3three",  
 ifelse(data$time == 4, "4four",  
 ifelse(data$time == 5, "5five", "other")))))  
  
data$time <- as.factor(data$time)  
contrasts(data$time) <- contr.sum  
contrasts(data$time)

## [,1] [,2] [,3] [,4]  
## 1one 1 0 0 0  
## 2two 0 1 0 0  
## 3three 0 0 1 0  
## 4four 0 0 0 1  
## 5five -1 -1 -1 -1

# Outliers (this is a simple univariate measure)  
# Outlier = above Q3 + 1.5xIQR or below Q1 - 1.5xIQR  
# Extreme outlier = above Q3 + 3xIQR or below Q1 - 3xIQR   
# Only exclude extreme outliers  
outliers <- data %>%  
 group\_by(time) %>%  
 identify\_outliers(coverage)  
outliers

## # A tibble: 2 × 9  
## time simple\_id microstate gev duration coverage occurrence is.outlier is.extreme  
## <fct> <fct> <chr> <dbl> <dbl> <dbl> <dbl> <lgl> <lgl>   
## 1 1one 389 A 0.117 89.0 23.1 2.18 TRUE FALSE   
## 2 1one 395 A 0.106 89.6 23.4 2.21 TRUE FALSE

# NO EXTREME VALUES

# Correlations  
data\_one <- data %>% filter(time == "1one")  
data\_two <- data %>% filter(time == "2two")  
data\_three <- data %>% filter(time == "3three")  
data\_four <- data %>% filter(time == "4four")  
data\_five <- data %>% filter(time == "5five")  
  
cor(data\_one$coverage, data\_two$coverage)

## [1] 0.905357

cor(data\_one$coverage, data\_three$coverage)

## [1] 0.8655097

cor(data\_one$coverage, data\_four$coverage)

## [1] 0.8322078

cor(data\_one$coverage, data\_five$coverage)

## [1] 0.8098856

cor(data\_two$coverage, data\_three$coverage)

## [1] 0.9525043

cor(data\_two$coverage, data\_four$coverage)

## [1] 0.9124325

cor(data\_two$coverage, data\_five$coverage)

## [1] 0.8935173

cor(data\_three$coverage, data\_four$coverage)

## [1] 0.9696983

cor(data\_three$coverage, data\_five$coverage)

## [1] 0.9553492

cor(data\_four$coverage, data\_five$coverage)

## [1] 0.9855178

# Model  
m1\_coverage\_model <- lme(coverage ~ time, random = ~1|simple\_id,  
 correlation = corAR1(form = ~1|simple\_id), data = data)  
anova(m1\_coverage\_model)

## numDF denDF F-value p-value  
## (Intercept) 1 188 1690.6906 <.0001  
## time 4 188 11.3611 <.0001

effectsize::eta\_squared(m1\_coverage\_model, partial = TRUE)

## # Effect Size for ANOVA  
##   
## Parameter | Eta2 (partial) | 95% CI  
## -----------------------------------------  
## time | 0.19 | [0.11, 1.00]  
##   
## - One-sided CIs: upper bound fixed at [1.00].

emmeans(m1\_coverage\_model, list(pairwise ~ time), adjust = "scheffe")

## Warning: contrasts dropped from factor time

## $`emmeans of time`  
## time emmean SE df lower.CL upper.CL  
## 1one 16.1 0.406 47 15.3 17.0  
## 2two 16.6 0.406 47 15.8 17.4  
## 3three 16.5 0.406 47 15.7 17.3  
## 4four 15.9 0.406 47 15.1 16.7  
## 5five 15.7 0.406 47 14.8 16.5  
##   
## Degrees-of-freedom method: containment   
## Confidence level used: 0.95   
##   
## $`pairwise differences of time`  
## 1 estimate SE df t.ratio p.value  
## 1one - 2two -0.4852 0.125 188 -3.891 0.0055  
## 1one - 3three -0.3895 0.174 188 -2.235 0.2917  
## 1one - 4four 0.2554 0.211 188 1.211 0.8321  
## 1one - 5five 0.4910 0.241 188 2.040 0.3876  
## 2two - 3three 0.0957 0.125 188 0.768 0.9640  
## 2two - 4four 0.7406 0.174 188 4.251 0.0017  
## 2two - 5five 0.9762 0.211 188 4.629 0.0004  
## 3three - 4four 0.6449 0.125 188 5.172 <.0001  
## 3three - 5five 0.8805 0.174 188 5.053 0.0001  
## 4four - 5five 0.2356 0.125 188 1.889 0.4696  
##   
## Degrees-of-freedom method: containment   
## P value adjustment: scheffe method with rank 4

# Estimation statistics-based effect sizes and confidence intervals  
paired\_mean\_diff <- dabest(data, time, coverage,  
 idx = list(c("2two", "1one"),  
 c("3three", "1one"),  
 c("4four", "1one"),  
 c("5five", "1one"),  
 c("3three", "2two"),  
 c("4four", "2two"),  
 c("5five", "2two"),  
 c("4four", "3three"),  
 c("5five", "3three"),  
 c("5five", "4four")),  
 paired = TRUE, id.col = simple\_id) %>%   
 mean\_diff()  
paired\_mean\_diff

## dabestr (Data Analysis with Bootstrap Estimation in R) v0.3.0  
## =============================================================  
##   
## Good evening!  
## The current time is 23:36 PM on Sunday January 21, 2024.  
##   
## Dataset : data  
## X Variable : time  
## Y Variable : coverage  
##   
## Paired mean difference of 1one (n = 48) minus 2two (n = 48)  
## -0.485 [95CI -1.65; 0.639]  
##   
## Paired mean difference of 1one (n = 48) minus 3three (n = 48)  
## -0.389 [95CI -1.58; 0.764]  
##   
## Paired mean difference of 1one (n = 48) minus 4four (n = 48)  
## 0.255 [95CI -0.921; 1.41]  
##   
## Paired mean difference of 1one (n = 48) minus 5five (n = 48)  
## 0.491 [95CI -0.673; 1.63]  
##   
## Paired mean difference of 2two (n = 48) minus 3three (n = 48)  
## 0.0957 [95CI -1.02; 1.24]  
##   
## Paired mean difference of 2two (n = 48) minus 4four (n = 48)  
## 0.741 [95CI -0.383; 1.88]  
##   
## Paired mean difference of 2two (n = 48) minus 5five (n = 48)  
## 0.976 [95CI -0.122; 2.08]  
##   
## Paired mean difference of 3three (n = 48) minus 4four (n = 48)  
## 0.645 [95CI -0.503; 1.76]  
##   
## Paired mean difference of 3three (n = 48) minus 5five (n = 48)  
## 0.88 [95CI -0.255; 1.98]  
##   
## Paired mean difference of 4four (n = 48) minus 5five (n = 48)  
## 0.236 [95CI -0.891; 1.34]  
##   
##   
## 5000 bootstrap resamples.  
## All confidence intervals are bias-corrected and accelerated.

# Microstate 2/B Coverage

# Read data  
data <- read.csv("lmem\_full\_temp\_prop\_data.csv")  
data <- data[data$microstate == 'B', ]  
  
data$simple\_id <- as.factor(data$simple\_id)  
  
data$time <- ifelse(data$time == 1, "1one",  
 ifelse(data$time == 2, "2two",  
 ifelse(data$time == 3, "3three",  
 ifelse(data$time == 4, "4four",  
 ifelse(data$time == 5, "5five", "other")))))  
  
data$time <- as.factor(data$time)  
contrasts(data$time) <- contr.sum  
contrasts(data$time)

## [,1] [,2] [,3] [,4]  
## 1one 1 0 0 0  
## 2two 0 1 0 0  
## 3three 0 0 1 0  
## 4four 0 0 0 1  
## 5five -1 -1 -1 -1

# Outliers (this is a simple univariate measure)  
# Outlier = above Q3 + 1.5xIQR or below Q1 - 1.5xIQR  
# Extreme outlier = above Q3 + 3xIQR or below Q1 - 3xIQR   
# Only exclude extreme outliers  
outliers <- data %>%  
 group\_by(time) %>%  
 identify\_outliers(coverage)  
outliers

## # A tibble: 3 × 9  
## time simple\_id microstate gev duration coverage occurrence is.outlier is.extreme  
## <fct> <fct> <chr> <dbl> <dbl> <dbl> <dbl> <lgl> <lgl>   
## 1 2two 280 B 0.167 92.7 26.4 2.40 TRUE FALSE   
## 2 4four 280 B 0.155 92.3 26.8 2.43 TRUE FALSE   
## 3 5five 280 B 0.152 91.2 26.3 2.41 TRUE FALSE

# NO EXTREME VALUES

# Correlations  
data\_one <- data %>% filter(time == "1one")  
data\_two <- data %>% filter(time == "2two")  
data\_three <- data %>% filter(time == "3three")  
data\_four <- data %>% filter(time == "4four")  
data\_five <- data %>% filter(time == "5five")  
  
cor(data\_one$coverage, data\_two$coverage)

## [1] 0.9243601

cor(data\_one$coverage, data\_three$coverage)

## [1] 0.8972774

cor(data\_one$coverage, data\_four$coverage)

## [1] 0.8673032

cor(data\_one$coverage, data\_five$coverage)

## [1] 0.8591424

cor(data\_two$coverage, data\_three$coverage)

## [1] 0.9565568

cor(data\_two$coverage, data\_four$coverage)

## [1] 0.9421744

cor(data\_two$coverage, data\_five$coverage)

## [1] 0.9390324

cor(data\_three$coverage, data\_four$coverage)

## [1] 0.9654727

cor(data\_three$coverage, data\_five$coverage)

## [1] 0.9702334

cor(data\_four$coverage, data\_five$coverage)

## [1] 0.9873431

# Model  
m2\_coverage\_model <- lme(coverage ~ time, random = ~1|simple\_id,  
 correlation = corAR1(form = ~1|simple\_id), data = data)  
anova(m2\_coverage\_model)

## numDF denDF F-value p-value  
## (Intercept) 1 188 1322.2438 <.0001  
## time 4 188 18.8579 <.0001

effectsize::eta\_squared(m2\_coverage\_model, partial = TRUE)

## # Effect Size for ANOVA  
##   
## Parameter | Eta2 (partial) | 95% CI  
## -----------------------------------------  
## time | 0.29 | [0.19, 1.00]  
##   
## - One-sided CIs: upper bound fixed at [1.00].

emmeans(m2\_coverage\_model, list(pairwise ~ time), adjust = "scheffe")

## Warning: contrasts dropped from factor time

## $`emmeans of time`  
## time emmean SE df lower.CL upper.CL  
## 1one 17.6 0.496 47 16.6 18.6  
## 2two 16.9 0.496 47 15.9 17.9  
## 3three 16.6 0.496 47 15.6 17.6  
## 4four 17.6 0.496 47 16.6 18.6  
## 5five 17.3 0.496 47 16.3 18.3  
##   
## Degrees-of-freedom method: containment   
## Confidence level used: 0.95   
##   
## $`pairwise differences of time`  
## 1 estimate SE df t.ratio p.value  
## 1one - 2two 0.7411 0.146 188 5.085 0.0001  
## 1one - 3three 1.0337 0.199 188 5.182 <.0001  
## 1one - 4four 0.0554 0.237 188 0.234 0.9996  
## 1one - 5five 0.3696 0.265 188 1.395 0.7454  
## 2two - 3three 0.2926 0.146 188 2.008 0.4045  
## 2two - 4four -0.6856 0.199 188 -3.437 0.0213  
## 2two - 5five -0.3715 0.237 188 -1.570 0.6515  
## 3three - 4four -0.9783 0.146 188 -6.713 <.0001  
## 3three - 5five -0.6641 0.199 188 -3.329 0.0286  
## 4four - 5five 0.3142 0.146 188 2.156 0.3292  
##   
## Degrees-of-freedom method: containment   
## P value adjustment: scheffe method with rank 4

# Estimation statistics-based effect sizes and confidence intervals  
paired\_mean\_diff <- dabest(data, time, coverage,  
 idx = list(c("2two", "1one"),  
 c("3three", "1one"),  
 c("4four", "1one"),  
 c("5five", "1one"),  
 c("3three", "2two"),  
 c("4four", "2two"),  
 c("5five", "2two"),  
 c("4four", "3three"),  
 c("5five", "3three"),  
 c("5five", "4four")),  
 paired = TRUE, id.col = simple\_id) %>%   
 mean\_diff()  
paired\_mean\_diff

## dabestr (Data Analysis with Bootstrap Estimation in R) v0.3.0  
## =============================================================  
##   
## Good evening!  
## The current time is 23:36 PM on Sunday January 21, 2024.  
##   
## Dataset : data  
## X Variable : time  
## Y Variable : coverage  
##   
## Paired mean difference of 1one (n = 48) minus 2two (n = 48)  
## 0.741 [95CI -0.698; 2.15]  
##   
## Paired mean difference of 1one (n = 48) minus 3three (n = 48)  
## 1.03 [95CI -0.401; 2.42]  
##   
## Paired mean difference of 1one (n = 48) minus 4four (n = 48)  
## 0.0554 [95CI -1.36; 1.42]  
##   
## Paired mean difference of 1one (n = 48) minus 5five (n = 48)  
## 0.37 [95CI -1.06; 1.75]  
##   
## Paired mean difference of 2two (n = 48) minus 3three (n = 48)  
## 0.293 [95CI -1.05; 1.54]  
##   
## Paired mean difference of 2two (n = 48) minus 4four (n = 48)  
## -0.686 [95CI -2.03; 0.566]  
##   
## Paired mean difference of 2two (n = 48) minus 5five (n = 48)  
## -0.371 [95CI -1.7; 0.873]  
##   
## Paired mean difference of 3three (n = 48) minus 4four (n = 48)  
## -0.978 [95CI -2.28; 0.19]  
##   
## Paired mean difference of 3three (n = 48) minus 5five (n = 48)  
## -0.664 [95CI -1.97; 0.532]  
##   
## Paired mean difference of 4four (n = 48) minus 5five (n = 48)  
## 0.314 [95CI -0.998; 1.5]  
##   
##   
## 5000 bootstrap resamples.  
## All confidence intervals are bias-corrected and accelerated.

# Microstate 3/C Coverage

# Read data  
data <- read.csv("lmem\_full\_temp\_prop\_data.csv")  
data <- data[data$microstate == 'C', ]  
  
data$simple\_id <- as.factor(data$simple\_id)  
  
data$time <- ifelse(data$time == 1, "1one",  
 ifelse(data$time == 2, "2two",  
 ifelse(data$time == 3, "3three",  
 ifelse(data$time == 4, "4four",  
 ifelse(data$time == 5, "5five", "other")))))  
  
data$time <- as.factor(data$time)  
contrasts(data$time) <- contr.sum  
contrasts(data$time)

## [,1] [,2] [,3] [,4]  
## 1one 1 0 0 0  
## 2two 0 1 0 0  
## 3three 0 0 1 0  
## 4four 0 0 0 1  
## 5five -1 -1 -1 -1

# Outliers (this is a simple univariate measure)  
# Outlier = above Q3 + 1.5xIQR or below Q1 - 1.5xIQR  
# Extreme outlier = above Q3 + 3xIQR or below Q1 - 3xIQR   
# Only exclude extreme outliers  
outliers <- data %>%  
 group\_by(time) %>%  
 identify\_outliers(coverage)  
outliers

## # A tibble: 6 × 9  
## time simple\_id microstate gev duration coverage occurrence is.outlier is.extreme  
## <fct> <fct> <chr> <dbl> <dbl> <dbl> <dbl> <lgl> <lgl>   
## 1 2two 394 C 0.375 114. 42.3 2.93 TRUE FALSE   
## 2 2two 529 C 0.155 89.2 24.4 2.37 TRUE FALSE   
## 3 3three 394 C 0.366 115. 42.5 2.93 TRUE FALSE   
## 4 3three 529 C 0.167 93.3 25.2 2.34 TRUE FALSE   
## 5 4four 529 C 0.159 91.4 23.9 2.26 TRUE FALSE   
## 6 5five 529 C 0.156 91.0 24.3 2.31 TRUE FALSE

# NO EXTREME VALUES

# Correlations  
data\_one <- data %>% filter(time == "1one")  
data\_two <- data %>% filter(time == "2two")  
data\_three <- data %>% filter(time == "3three")  
data\_four <- data %>% filter(time == "4four")  
data\_five <- data %>% filter(time == "5five")  
  
cor(data\_one$coverage, data\_two$coverage)

## [1] 0.9012245

cor(data\_one$coverage, data\_three$coverage)

## [1] 0.8836482

cor(data\_one$coverage, data\_four$coverage)

## [1] 0.883579

cor(data\_one$coverage, data\_five$coverage)

## [1] 0.8590676

cor(data\_two$coverage, data\_three$coverage)

## [1] 0.9537001

cor(data\_two$coverage, data\_four$coverage)

## [1] 0.9261571

cor(data\_two$coverage, data\_five$coverage)

## [1] 0.91392

cor(data\_three$coverage, data\_four$coverage)

## [1] 0.9795396

cor(data\_three$coverage, data\_five$coverage)

## [1] 0.9630018

cor(data\_four$coverage, data\_five$coverage)

## [1] 0.9794059

# Model  
m3\_coverage\_model <- lme(coverage ~ time, random = ~1|simple\_id,  
 correlation = corAR1(form = ~1|simple\_id), data = data)  
anova(m3\_coverage\_model)

## numDF denDF F-value p-value  
## (Intercept) 1 188 4297.824 <.0001  
## time 4 188 4.162 0.003

effectsize::eta\_squared(m3\_coverage\_model, partial = TRUE)

## # Effect Size for ANOVA  
##   
## Parameter | Eta2 (partial) | 95% CI  
## -----------------------------------------  
## time | 0.08 | [0.02, 1.00]  
##   
## - One-sided CIs: upper bound fixed at [1.00].

emmeans(m3\_coverage\_model, list(pairwise ~ time), adjust = "scheffe")

## Warning: contrasts dropped from factor time

## $`emmeans of time`  
## time emmean SE df lower.CL upper.CL  
## 1one 32.9 0.531 47 31.8 34.0  
## 2two 33.4 0.531 47 32.4 34.5  
## 3three 33.8 0.531 47 32.7 34.9  
## 4four 33.6 0.531 47 32.5 34.6  
## 5five 33.5 0.531 47 32.4 34.6  
##   
## Degrees-of-freedom method: containment   
## Confidence level used: 0.95   
##   
## $`pairwise differences of time`  
## 1 estimate SE df t.ratio p.value  
## 1one - 2two -0.5328 0.173 188 -3.072 0.0550  
## 1one - 3three -0.9157 0.236 188 -3.888 0.0056  
## 1one - 4four -0.6581 0.277 188 -2.373 0.2329  
## 1one - 5five -0.5964 0.308 188 -1.935 0.4441  
## 2two - 3three -0.3828 0.173 188 -2.207 0.3046  
## 2two - 4four -0.1253 0.236 188 -0.532 0.9908  
## 2two - 5five -0.0636 0.277 188 -0.229 0.9997  
## 3three - 4four 0.2576 0.173 188 1.485 0.6982  
## 3three - 5five 0.3192 0.236 188 1.355 0.7655  
## 4four - 5five 0.0617 0.173 188 0.355 0.9981  
##   
## Degrees-of-freedom method: containment   
## P value adjustment: scheffe method with rank 4

# Estimation statistics-based effect sizes and confidence intervals  
paired\_mean\_diff <- dabest(data, time, coverage,  
 idx = list(c("2two", "1one"),  
 c("3three", "1one"),  
 c("4four", "1one"),  
 c("5five", "1one"),  
 c("3three", "2two"),  
 c("4four", "2two"),  
 c("5five", "2two"),  
 c("4four", "3three"),  
 c("5five", "3three"),  
 c("5five", "4four")),  
 paired = TRUE, id.col = simple\_id) %>%   
 mean\_diff()  
paired\_mean\_diff

## dabestr (Data Analysis with Bootstrap Estimation in R) v0.3.0  
## =============================================================  
##   
## Good evening!  
## The current time is 23:36 PM on Sunday January 21, 2024.  
##   
## Dataset : data  
## X Variable : time  
## Y Variable : coverage  
##   
## Paired mean difference of 1one (n = 48) minus 2two (n = 48)  
## -0.533 [95CI -2.12; 1.08]  
##   
## Paired mean difference of 1one (n = 48) minus 3three (n = 48)  
## -0.916 [95CI -2.44; 0.589]  
##   
## Paired mean difference of 1one (n = 48) minus 4four (n = 48)  
## -0.658 [95CI -2.13; 0.801]  
##   
## Paired mean difference of 1one (n = 48) minus 5five (n = 48)  
## -0.596 [95CI -2.05; 0.826]  
##   
## Paired mean difference of 2two (n = 48) minus 3three (n = 48)  
## -0.383 [95CI -1.78; 1.1]  
##   
## Paired mean difference of 2two (n = 48) minus 4four (n = 48)  
## -0.125 [95CI -1.49; 1.32]  
##   
## Paired mean difference of 2two (n = 48) minus 5five (n = 48)  
## -0.0636 [95CI -1.4; 1.35]  
##   
## Paired mean difference of 3three (n = 48) minus 4four (n = 48)  
## 0.258 [95CI -1.01; 1.65]  
##   
## Paired mean difference of 3three (n = 48) minus 5five (n = 48)  
## 0.319 [95CI -0.933; 1.68]  
##   
## Paired mean difference of 4four (n = 48) minus 5five (n = 48)  
## 0.0617 [95CI -1.17; 1.34]  
##   
##   
## 5000 bootstrap resamples.  
## All confidence intervals are bias-corrected and accelerated.

# Microstate 4/D Coverage

# Read data  
data <- read.csv("lmem\_full\_temp\_prop\_data.csv")  
data <- data[data$microstate == 'D', ]  
  
data$simple\_id <- as.factor(data$simple\_id)  
  
data$time <- ifelse(data$time == 1, "1one",  
 ifelse(data$time == 2, "2two",  
 ifelse(data$time == 3, "3three",  
 ifelse(data$time == 4, "4four",  
 ifelse(data$time == 5, "5five", "other")))))  
  
data$time <- as.factor(data$time)  
contrasts(data$time) <- contr.sum  
contrasts(data$time)

## [,1] [,2] [,3] [,4]  
## 1one 1 0 0 0  
## 2two 0 1 0 0  
## 3three 0 0 1 0  
## 4four 0 0 0 1  
## 5five -1 -1 -1 -1

# Outliers (this is a simple univariate measure)  
# Outlier = above Q3 + 1.5xIQR or below Q1 - 1.5xIQR  
# Extreme outlier = above Q3 + 3xIQR or below Q1 - 3xIQR   
# Only exclude extreme outliers  
outliers <- data %>%  
 group\_by(time) %>%  
 identify\_outliers(coverage)  
outliers

## [1] time simple\_id microstate gev duration coverage occurrence is.outlier is.extreme  
## <0 rows> (or 0-length row.names)

# NO EXTREME VALUES

# Correlations  
data\_one <- data %>% filter(time == "1one")  
data\_two <- data %>% filter(time == "2two")  
data\_three <- data %>% filter(time == "3three")  
data\_four <- data %>% filter(time == "4four")  
data\_five <- data %>% filter(time == "5five")  
  
cor(data\_one$coverage, data\_two$coverage)

## [1] 0.9405635

cor(data\_one$coverage, data\_three$coverage)

## [1] 0.9294363

cor(data\_one$coverage, data\_four$coverage)

## [1] 0.9094172

cor(data\_one$coverage, data\_five$coverage)

## [1] 0.9050317

cor(data\_two$coverage, data\_three$coverage)

## [1] 0.9800145

cor(data\_two$coverage, data\_four$coverage)

## [1] 0.9629709

cor(data\_two$coverage, data\_five$coverage)

## [1] 0.9552417

cor(data\_three$coverage, data\_four$coverage)

## [1] 0.9886349

cor(data\_three$coverage, data\_five$coverage)

## [1] 0.9826189

cor(data\_four$coverage, data\_five$coverage)

## [1] 0.9942621

# Model  
m4\_coverage\_model <- lme(coverage ~ time, random = ~1|simple\_id,  
 correlation = corAR1(form = ~1|simple\_id), data = data)  
anova(m4\_coverage\_model)

## numDF denDF F-value p-value  
## (Intercept) 1 188 887.2812 <.0001  
## time 4 188 15.5699 <.0001

effectsize::eta\_squared(m4\_coverage\_model, partial = TRUE)

## # Effect Size for ANOVA  
##   
## Parameter | Eta2 (partial) | 95% CI  
## -----------------------------------------  
## time | 0.25 | [0.16, 1.00]  
##   
## - One-sided CIs: upper bound fixed at [1.00].

emmeans(m4\_coverage\_model, list(pairwise ~ time), adjust = "scheffe")

## Warning: contrasts dropped from factor time

## $`emmeans of time`  
## time emmean SE df lower.CL upper.CL  
## 1one 16.1 0.571 47 15.0 17.3  
## 2two 16.0 0.571 47 14.9 17.2  
## 3three 16.3 0.571 47 15.1 17.4  
## 4four 17.2 0.571 47 16.1 18.4  
## 5five 17.1 0.571 47 15.9 18.2  
##   
## Degrees-of-freedom method: containment   
## Confidence level used: 0.95   
##   
## $`pairwise differences of time`  
## 1 estimate SE df t.ratio p.value  
## 1one - 2two 0.117 0.129 188 0.908 0.9349  
## 1one - 3three -0.134 0.182 188 -0.738 0.9688  
## 1one - 4four -1.105 0.221 188 -5.000 0.0001  
## 1one - 5five -0.958 0.254 188 -3.778 0.0079  
## 2two - 3three -0.251 0.129 188 -1.945 0.4389  
## 2two - 4four -1.222 0.182 188 -6.731 <.0001  
## 2two - 5five -1.075 0.221 188 -4.865 0.0002  
## 3three - 4four -0.971 0.129 188 -7.513 <.0001  
## 3three - 5five -0.824 0.182 188 -4.536 0.0006  
## 4four - 5five 0.147 0.129 188 1.139 0.8616  
##   
## Degrees-of-freedom method: containment   
## P value adjustment: scheffe method with rank 4

# Estimation statistics-based effect sizes and confidence intervals  
paired\_mean\_diff <- dabest(data, time, coverage,  
 idx = list(c("2two", "1one"),  
 c("3three", "1one"),  
 c("4four", "1one"),  
 c("5five", "1one"),  
 c("3three", "2two"),  
 c("4four", "2two"),  
 c("5five", "2two"),  
 c("4four", "3three"),  
 c("5five", "3three"),  
 c("5five", "4four")),  
 paired = TRUE, id.col = simple\_id) %>%   
 mean\_diff()  
paired\_mean\_diff

## dabestr (Data Analysis with Bootstrap Estimation in R) v0.3.0  
## =============================================================  
##   
## Good evening!  
## The current time is 23:36 PM on Sunday January 21, 2024.  
##   
## Dataset : data  
## X Variable : time  
## Y Variable : coverage  
##   
## Paired mean difference of 1one (n = 48) minus 2two (n = 48)  
## 0.117 [95CI -1.44; 1.78]  
##   
## Paired mean difference of 1one (n = 48) minus 3three (n = 48)  
## -0.134 [95CI -1.7; 1.51]  
##   
## Paired mean difference of 1one (n = 48) minus 4four (n = 48)  
## -1.11 [95CI -2.68; 0.532]  
##   
## Paired mean difference of 1one (n = 48) minus 5five (n = 48)  
## -0.958 [95CI -2.49; 0.662]  
##   
## Paired mean difference of 2two (n = 48) minus 3three (n = 48)  
## -0.251 [95CI -1.77; 1.3]  
##   
## Paired mean difference of 2two (n = 48) minus 4four (n = 48)  
## -1.22 [95CI -2.76; 0.305]  
##   
## Paired mean difference of 2two (n = 48) minus 5five (n = 48)  
## -1.08 [95CI -2.54; 0.451]  
##   
## Paired mean difference of 3three (n = 48) minus 4four (n = 48)  
## -0.971 [95CI -2.44; 0.541]  
##   
## Paired mean difference of 3three (n = 48) minus 5five (n = 48)  
## -0.824 [95CI -2.26; 0.659]  
##   
## Paired mean difference of 4four (n = 48) minus 5five (n = 48)  
## 0.147 [95CI -1.31; 1.63]  
##   
##   
## 5000 bootstrap resamples.  
## All confidence intervals are bias-corrected and accelerated.

# Microstate 5/F Coverage

# Read data  
data <- read.csv("lmem\_full\_temp\_prop\_data.csv")  
data <- data[data$microstate == 'F', ]  
  
data$simple\_id <- as.factor(data$simple\_id)  
  
data$time <- ifelse(data$time == 1, "1one",  
 ifelse(data$time == 2, "2two",  
 ifelse(data$time == 3, "3three",  
 ifelse(data$time == 4, "4four",  
 ifelse(data$time == 5, "5five", "other")))))  
  
data$time <- as.factor(data$time)  
contrasts(data$time) <- contr.sum  
contrasts(data$time)

## [,1] [,2] [,3] [,4]  
## 1one 1 0 0 0  
## 2two 0 1 0 0  
## 3three 0 0 1 0  
## 4four 0 0 0 1  
## 5five -1 -1 -1 -1

# Outliers (this is a simple univariate measure)  
# Outlier = above Q3 + 1.5xIQR or below Q1 - 1.5xIQR  
# Extreme outlier = above Q3 + 3xIQR or below Q1 - 3xIQR   
# Only exclude extreme outliers  
outliers <- data %>%  
 group\_by(time) %>%  
 identify\_outliers(coverage)  
outliers

## # A tibble: 11 × 9  
## time simple\_id microstate gev duration coverage occurrence is.outlier is.extreme  
## <fct> <fct> <chr> <dbl> <dbl> <dbl> <dbl> <lgl> <lgl>   
## 1 2two 315 F 0.0405 71.6 10.4 1.32 TRUE FALSE   
## 2 2two 389 F 0.0423 82.5 11.0 1.19 TRUE FALSE   
## 3 2two 408 F 0.160 91.8 25.9 2.42 TRUE FALSE   
## 4 3three 315 F 0.0383 73.8 10.5 1.28 TRUE FALSE   
## 5 3three 389 F 0.0368 79.2 10.1 1.13 TRUE FALSE   
## 6 3three 394 F 0.0518 78.1 11.2 1.26 TRUE FALSE   
## 7 3three 408 F 0.136 89.3 24.7 2.38 TRUE FALSE   
## 8 4four 389 F 0.0331 78.0 9.14 1.06 TRUE FALSE   
## 9 4four 408 F 0.134 89.7 24.0 2.29 TRUE FALSE   
## 10 5five 389 F 0.0417 78.1 10.7 1.22 TRUE FALSE   
## 11 5five 408 F 0.146 91.5 25.1 2.34 TRUE FALSE

# NO EXTREME VALUES  
  
# Remove Extreme Observations  
data <- data %>%  
 filter(!(simple\_id == 280))

# Correlations  
data\_one <- data %>% filter(time == "1one")  
data\_two <- data %>% filter(time == "2two")  
data\_three <- data %>% filter(time == "3three")  
data\_four <- data %>% filter(time == "4four")  
data\_five <- data %>% filter(time == "5five")  
  
cor(data\_one$coverage, data\_two$coverage)

## [1] 0.8842813

cor(data\_one$coverage, data\_three$coverage)

## [1] 0.8258249

cor(data\_one$coverage, data\_four$coverage)

## [1] 0.7863881

cor(data\_one$coverage, data\_five$coverage)

## [1] 0.7404427

cor(data\_two$coverage, data\_three$coverage)

## [1] 0.9560161

cor(data\_two$coverage, data\_four$coverage)

## [1] 0.896821

cor(data\_two$coverage, data\_five$coverage)

## [1] 0.8685806

cor(data\_three$coverage, data\_four$coverage)

## [1] 0.9499172

cor(data\_three$coverage, data\_five$coverage)

## [1] 0.9329915

cor(data\_four$coverage, data\_five$coverage)

## [1] 0.9811754

# Model  
m5\_coverage\_model <- lme(coverage ~ time, random = ~1|simple\_id,  
 correlation = corAR1(form = ~1|simple\_id), data = data)  
anova(m5\_coverage\_model)

## numDF denDF F-value p-value  
## (Intercept) 1 184 2005.2069 <.0001  
## time 4 184 21.5525 <.0001

effectsize::eta\_squared(m5\_coverage\_model, partial = TRUE)

## # Effect Size for ANOVA  
##   
## Parameter | Eta2 (partial) | 95% CI  
## -----------------------------------------  
## time | 0.32 | [0.22, 1.00]  
##   
## - One-sided CIs: upper bound fixed at [1.00].

emmeans(m5\_coverage\_model, list(pairwise ~ time), adjust = "scheffe")

## Warning: contrasts dropped from factor time

## $`emmeans of time`  
## time emmean SE df lower.CL upper.CL  
## 1one 17.2 0.399 46 16.4 18.0  
## 2two 17.1 0.399 46 16.3 17.9  
## 3three 16.9 0.399 46 16.1 17.7  
## 4four 15.9 0.399 46 15.1 16.7  
## 5five 16.6 0.399 46 15.8 17.4  
##   
## Degrees-of-freedom method: containment   
## Confidence level used: 0.95   
##   
## $`pairwise differences of time`  
## 1 estimate SE df t.ratio p.value  
## 1one - 2two 0.102 0.136 184 0.745 0.9677  
## 1one - 3three 0.312 0.190 184 1.642 0.6109  
## 1one - 4four 1.322 0.229 184 5.762 <.0001  
## 1one - 5five 0.570 0.261 184 2.182 0.3165  
## 2two - 3three 0.210 0.136 184 1.542 0.6669  
## 2two - 4four 1.221 0.190 184 6.419 <.0001  
## 2two - 5five 0.468 0.229 184 2.040 0.3875  
## 3three - 4four 1.010 0.136 184 7.402 <.0001  
## 3three - 5five 0.258 0.190 184 1.356 0.7654  
## 4four - 5five -0.752 0.136 184 -5.513 <.0001  
##   
## Degrees-of-freedom method: containment   
## P value adjustment: scheffe method with rank 4

# Estimation statistics-based effect sizes and confidence intervals  
paired\_mean\_diff <- dabest(data, time, coverage,  
 idx = list(c("2two", "1one"),  
 c("3three", "1one"),  
 c("4four", "1one"),  
 c("5five", "1one"),  
 c("3three", "2two"),  
 c("4four", "2two"),  
 c("5five", "2two"),  
 c("4four", "3three"),  
 c("5five", "3three"),  
 c("5five", "4four")),  
 paired = TRUE, id.col = simple\_id) %>%   
 mean\_diff()  
paired\_mean\_diff

## dabestr (Data Analysis with Bootstrap Estimation in R) v0.3.0  
## =============================================================  
##   
## Good evening!  
## The current time is 23:36 PM on Sunday January 21, 2024.  
##   
## Dataset : data  
## X Variable : time  
## Y Variable : coverage  
##   
## Paired mean difference of 1one (n = 47) minus 2two (n = 47)  
## 0.102 [95CI -1.04; 1.24]  
##   
## Paired mean difference of 1one (n = 47) minus 3three (n = 47)  
## 0.312 [95CI -0.753; 1.46]  
##   
## Paired mean difference of 1one (n = 47) minus 4four (n = 47)  
## 1.32 [95CI 0.229; 2.44]  
##   
## Paired mean difference of 1one (n = 47) minus 5five (n = 47)  
## 0.57 [95CI -0.51; 1.68]  
##   
## Paired mean difference of 2two (n = 47) minus 3three (n = 47)  
## 0.21 [95CI -0.901; 1.31]  
##   
## Paired mean difference of 2two (n = 47) minus 4four (n = 47)  
## 1.22 [95CI 0.126; 2.31]  
##   
## Paired mean difference of 2two (n = 47) minus 5five (n = 47)  
## 0.468 [95CI -0.637; 1.54]  
##   
## Paired mean difference of 3three (n = 47) minus 4four (n = 47)  
## 1.01 [95CI -0.0943; 2.07]  
##   
## Paired mean difference of 3three (n = 47) minus 5five (n = 47)  
## 0.258 [95CI -0.836; 1.31]  
##   
## Paired mean difference of 4four (n = 47) minus 5five (n = 47)  
## -0.752 [95CI -1.82; 0.323]  
##   
##   
## 5000 bootstrap resamples.  
## All confidence intervals are bias-corrected and accelerated.

# Microstate 1/A Occurrence

# Read data  
data <- read.csv("lmem\_full\_temp\_prop\_data.csv")  
data <- data[data$microstate == 'A', ]  
  
data$simple\_id <- as.factor(data$simple\_id)  
  
data$time <- ifelse(data$time == 1, "1one",  
 ifelse(data$time == 2, "2two",  
 ifelse(data$time == 3, "3three",  
 ifelse(data$time == 4, "4four",  
 ifelse(data$time == 5, "5five", "other")))))  
  
data$time <- as.factor(data$time)  
contrasts(data$time) <- contr.sum  
contrasts(data$time)

## [,1] [,2] [,3] [,4]  
## 1one 1 0 0 0  
## 2two 0 1 0 0  
## 3three 0 0 1 0  
## 4four 0 0 0 1  
## 5five -1 -1 -1 -1

# Outliers (this is a simple univariate measure)  
# Outlier = above Q3 + 1.5xIQR or below Q1 - 1.5xIQR  
# Extreme outlier = above Q3 + 3xIQR or below Q1 - 3xIQR   
# Only exclude extreme outliers  
outliers <- data %>%  
 group\_by(time) %>%  
 identify\_outliers(occurrence)  
outliers

## # A tibble: 1 × 9  
## time simple\_id microstate gev duration coverage occurrence is.outlier is.extreme  
## <fct> <fct> <chr> <dbl> <dbl> <dbl> <dbl> <lgl> <lgl>   
## 1 1one 286 A 0.106 73.3 20.2 2.50 TRUE FALSE

# NO EXTREME VALUES

# Correlations  
data\_one <- data %>% filter(time == "1one")  
data\_two <- data %>% filter(time == "2two")  
data\_three <- data %>% filter(time == "3three")  
data\_four <- data %>% filter(time == "4four")  
data\_five <- data %>% filter(time == "5five")  
  
cor(data\_one$occurrence, data\_two$occurrence)

## [1] 0.8896903

cor(data\_one$occurrence, data\_three$occurrence)

## [1] 0.8276843

cor(data\_one$occurrence, data\_four$occurrence)

## [1] 0.8092501

cor(data\_one$occurrence, data\_five$occurrence)

## [1] 0.78183

cor(data\_two$occurrence, data\_three$occurrence)

## [1] 0.9386198

cor(data\_two$occurrence, data\_four$occurrence)

## [1] 0.9018945

cor(data\_two$occurrence, data\_five$occurrence)

## [1] 0.8811258

cor(data\_three$occurrence, data\_four$occurrence)

## [1] 0.9609577

cor(data\_three$occurrence, data\_five$occurrence)

## [1] 0.9402328

cor(data\_four$occurrence, data\_five$occurrence)

## [1] 0.979744

# Model  
m1\_occurrence\_model <- lme(occurrence ~ time, random = ~1|simple\_id,  
 correlation = corAR1(form = ~1|simple\_id), data = data)  
anova(m1\_occurrence\_model)

## numDF denDF F-value p-value  
## (Intercept) 1 188 2744.4842 <.0001  
## time 4 188 8.7186 <.0001

effectsize::eta\_squared(m1\_occurrence\_model, partial = TRUE)

## # Effect Size for ANOVA  
##   
## Parameter | Eta2 (partial) | 95% CI  
## -----------------------------------------  
## time | 0.16 | [0.07, 1.00]  
##   
## - One-sided CIs: upper bound fixed at [1.00].

emmeans(m1\_occurrence\_model, list(pairwise ~ time), adjust = "scheffe")

## Warning: contrasts dropped from factor time

## $`emmeans of time`  
## time emmean SE df lower.CL upper.CL  
## 1one 1.81 0.0362 47 1.74 1.89  
## 2two 1.85 0.0362 47 1.78 1.93  
## 3three 1.84 0.0362 47 1.77 1.91  
## 4four 1.78 0.0362 47 1.71 1.86  
## 5five 1.77 0.0362 47 1.69 1.84  
##   
## Degrees-of-freedom method: containment   
## Confidence level used: 0.95   
##   
## $`pairwise differences of time`  
## 1 estimate SE df t.ratio p.value  
## 1one - 2two -0.0411 0.0123 188 -3.343 0.0275  
## 1one - 3three -0.0257 0.0171 188 -1.501 0.6896  
## 1one - 4four 0.0303 0.0206 188 1.469 0.7071  
## 1one - 5five 0.0473 0.0234 188 2.021 0.3976  
## 2two - 3three 0.0154 0.0123 188 1.255 0.8128  
## 2two - 4four 0.0714 0.0171 188 4.173 0.0022  
## 2two - 5five 0.0885 0.0206 188 4.291 0.0014  
## 3three - 4four 0.0560 0.0123 188 4.550 0.0006  
## 3three - 5five 0.0730 0.0171 188 4.268 0.0016  
## 4four - 5five 0.0171 0.0123 188 1.388 0.7493  
##   
## Degrees-of-freedom method: containment   
## P value adjustment: scheffe method with rank 4

# Estimation statistics-based effect sizes and confidence intervals  
paired\_mean\_diff <- dabest(data, time, occurrence,  
 idx = list(c("2two", "1one"),  
 c("3three", "1one"),  
 c("4four", "1one"),  
 c("5five", "1one"),  
 c("3three", "2two"),  
 c("4four", "2two"),  
 c("5five", "2two"),  
 c("4four", "3three"),  
 c("5five", "3three"),  
 c("5five", "4four")),  
 paired = TRUE, id.col = simple\_id) %>%   
 mean\_diff()  
paired\_mean\_diff

## dabestr (Data Analysis with Bootstrap Estimation in R) v0.3.0  
## =============================================================  
##   
## Good evening!  
## The current time is 23:36 PM on Sunday January 21, 2024.  
##   
## Dataset : data  
## X Variable : time  
## Y Variable : occurrence  
##   
## Paired mean difference of 1one (n = 48) minus 2two (n = 48)  
## -0.0411 [95CI -0.14; 0.0603]  
##   
## Paired mean difference of 1one (n = 48) minus 3three (n = 48)  
## -0.0257 [95CI -0.128; 0.0779]  
##   
## Paired mean difference of 1one (n = 48) minus 4four (n = 48)  
## 0.0303 [95CI -0.0704; 0.133]  
##   
## Paired mean difference of 1one (n = 48) minus 5five (n = 48)  
## 0.0473 [95CI -0.0525; 0.151]  
##   
## Paired mean difference of 2two (n = 48) minus 3three (n = 48)  
## 0.0154 [95CI -0.0795; 0.106]  
##   
## Paired mean difference of 2two (n = 48) minus 4four (n = 48)  
## 0.0714 [95CI -0.0219; 0.163]  
##   
## Paired mean difference of 2two (n = 48) minus 5five (n = 48)  
## 0.0885 [95CI -0.00551; 0.178]  
##   
## Paired mean difference of 3three (n = 48) minus 4four (n = 48)  
## 0.056 [95CI -0.0404; 0.147]  
##   
## Paired mean difference of 3three (n = 48) minus 5five (n = 48)  
## 0.073 [95CI -0.0239; 0.163]  
##   
## Paired mean difference of 4four (n = 48) minus 5five (n = 48)  
## 0.0171 [95CI -0.0771; 0.108]  
##   
##   
## 5000 bootstrap resamples.  
## All confidence intervals are bias-corrected and accelerated.

# Microstate 2/B Occurrence

# Read data  
data <- read.csv("lmem\_full\_temp\_prop\_data.csv")  
data <- data[data$microstate == 'B', ]  
  
data$simple\_id <- as.factor(data$simple\_id)  
  
data$time <- ifelse(data$time == 1, "1one",  
 ifelse(data$time == 2, "2two",  
 ifelse(data$time == 3, "3three",  
 ifelse(data$time == 4, "4four",  
 ifelse(data$time == 5, "5five", "other")))))  
  
data$time <- as.factor(data$time)  
contrasts(data$time) <- contr.sum  
contrasts(data$time)

## [,1] [,2] [,3] [,4]  
## 1one 1 0 0 0  
## 2two 0 1 0 0  
## 3three 0 0 1 0  
## 4four 0 0 0 1  
## 5five -1 -1 -1 -1

# Outliers (this is a simple univariate measure)  
# Outlier = above Q3 + 1.5xIQR or below Q1 - 1.5xIQR  
# Extreme outlier = above Q3 + 3xIQR or below Q1 - 3xIQR   
# Only exclude extreme outliers  
outliers <- data %>%  
 group\_by(time) %>%  
 identify\_outliers(occurrence)  
outliers

## [1] time simple\_id microstate gev duration coverage occurrence is.outlier is.extreme  
## <0 rows> (or 0-length row.names)

# NO EXTREME VALUES

# Correlations  
data\_one <- data %>% filter(time == "1one")  
data\_two <- data %>% filter(time == "2two")  
data\_three <- data %>% filter(time == "3three")  
data\_four <- data %>% filter(time == "4four")  
data\_five <- data %>% filter(time == "5five")  
  
cor(data\_one$occurrence, data\_two$occurrence)

## [1] 0.9155351

cor(data\_one$occurrence, data\_three$occurrence)

## [1] 0.9112126

cor(data\_one$occurrence, data\_four$occurrence)

## [1] 0.8964905

cor(data\_one$occurrence, data\_five$occurrence)

## [1] 0.875327

cor(data\_two$occurrence, data\_three$occurrence)

## [1] 0.9471651

cor(data\_two$occurrence, data\_four$occurrence)

## [1] 0.9302314

cor(data\_two$occurrence, data\_five$occurrence)

## [1] 0.9272464

cor(data\_three$occurrence, data\_four$occurrence)

## [1] 0.9409056

cor(data\_three$occurrence, data\_five$occurrence)

## [1] 0.9527659

cor(data\_four$occurrence, data\_five$occurrence)

## [1] 0.9783466

# Model  
m2\_occurrence\_model <- lme(occurrence ~ time, random = ~1|simple\_id,  
 correlation = corAR1(form = ~1|simple\_id), data = data)  
anova(m2\_occurrence\_model)

## numDF denDF F-value p-value  
## (Intercept) 1 188 2281.5725 <.0001  
## time 4 188 14.9994 <.0001

effectsize::eta\_squared(m2\_occurrence\_model, partial = TRUE)

## # Effect Size for ANOVA  
##   
## Parameter | Eta2 (partial) | 95% CI  
## -----------------------------------------  
## time | 0.24 | [0.15, 1.00]  
##   
## - One-sided CIs: upper bound fixed at [1.00].

emmeans(m2\_occurrence\_model, list(pairwise ~ time), adjust = "scheffe")

## Warning: contrasts dropped from factor time

## $`emmeans of time`  
## time emmean SE df lower.CL upper.CL  
## 1one 1.92 0.0409 47 1.83 2.00  
## 2two 1.85 0.0409 47 1.76 1.93  
## 3three 1.82 0.0409 47 1.74 1.91  
## 4four 1.91 0.0409 47 1.83 2.00  
## 5five 1.89 0.0409 47 1.81 1.98  
##   
## Degrees-of-freedom method: containment   
## Confidence level used: 0.95   
##   
## $`pairwise differences of time`  
## 1 estimate SE df t.ratio p.value  
## 1one - 2two 0.07017 0.0142 188 4.948 0.0001  
## 1one - 3three 0.09272 0.0173 188 5.347 <.0001  
## 1one - 4four 0.00235 0.0187 188 0.126 1.0000  
## 1one - 5five 0.02185 0.0194 188 1.129 0.8652  
## 2two - 3three 0.02255 0.0142 188 1.590 0.6401  
## 2two - 4four -0.06782 0.0173 188 -3.911 0.0052  
## 2two - 5five -0.04832 0.0187 188 -2.582 0.1594  
## 3three - 4four -0.09037 0.0142 188 -6.373 <.0001  
## 3three - 5five -0.07087 0.0173 188 -4.086 0.0029  
## 4four - 5five 0.01950 0.0142 188 1.375 0.7555  
##   
## Degrees-of-freedom method: containment   
## P value adjustment: scheffe method with rank 4

# Estimation statistics-based effect sizes and confidence intervals  
paired\_mean\_diff <- dabest(data, time, occurrence,  
 idx = list(c("2two", "1one"),  
 c("3three", "1one"),  
 c("4four", "1one"),  
 c("5five", "1one"),  
 c("3three", "2two"),  
 c("4four", "2two"),  
 c("5five", "2two"),  
 c("4four", "3three"),  
 c("5five", "3three"),  
 c("5five", "4four")),  
 paired = TRUE, id.col = simple\_id) %>%   
 mean\_diff()  
paired\_mean\_diff

## dabestr (Data Analysis with Bootstrap Estimation in R) v0.3.0  
## =============================================================  
##   
## Good evening!  
## The current time is 23:36 PM on Sunday January 21, 2024.  
##   
## Dataset : data  
## X Variable : time  
## Y Variable : occurrence  
##   
## Paired mean difference of 1one (n = 48) minus 2two (n = 48)  
## 0.0702 [95CI -0.0503; 0.191]  
##   
## Paired mean difference of 1one (n = 48) minus 3three (n = 48)  
## 0.0927 [95CI -0.0259; 0.214]  
##   
## Paired mean difference of 1one (n = 48) minus 4four (n = 48)  
## 0.00235 [95CI -0.118; 0.118]  
##   
## Paired mean difference of 1one (n = 48) minus 5five (n = 48)  
## 0.0219 [95CI -0.0985; 0.139]  
##   
## Paired mean difference of 2two (n = 48) minus 3three (n = 48)  
## 0.0226 [95CI -0.0896; 0.129]  
##   
## Paired mean difference of 2two (n = 48) minus 4four (n = 48)  
## -0.0678 [95CI -0.178; 0.0328]  
##   
## Paired mean difference of 2two (n = 48) minus 5five (n = 48)  
## -0.0483 [95CI -0.16; 0.0549]  
##   
## Paired mean difference of 3three (n = 48) minus 4four (n = 48)  
## -0.0904 [95CI -0.203; 0.0102]  
##   
## Paired mean difference of 3three (n = 48) minus 5five (n = 48)  
## -0.0709 [95CI -0.184; 0.0308]  
##   
## Paired mean difference of 4four (n = 48) minus 5five (n = 48)  
## 0.0195 [95CI -0.0877; 0.119]  
##   
##   
## 5000 bootstrap resamples.  
## All confidence intervals are bias-corrected and accelerated.

# Microstate 3/C Occurrence

# Read data  
data <- read.csv("lmem\_full\_temp\_prop\_data.csv")  
data <- data[data$microstate == 'C', ]  
  
data$simple\_id <- as.factor(data$simple\_id)  
  
data$time <- ifelse(data$time == 1, "1one",  
 ifelse(data$time == 2, "2two",  
 ifelse(data$time == 3, "3three",  
 ifelse(data$time == 4, "4four",  
 ifelse(data$time == 5, "5five", "other")))))  
  
data$time <- as.factor(data$time)  
contrasts(data$time) <- contr.sum  
contrasts(data$time)

## [,1] [,2] [,3] [,4]  
## 1one 1 0 0 0  
## 2two 0 1 0 0  
## 3three 0 0 1 0  
## 4four 0 0 0 1  
## 5five -1 -1 -1 -1

# Outliers (this is a simple univariate measure)  
# Outlier = above Q3 + 1.5xIQR or below Q1 - 1.5xIQR  
# Extreme outlier = above Q3 + 3xIQR or below Q1 - 3xIQR   
# Only exclude extreme outliers  
outliers <- data %>%  
 group\_by(time) %>%  
 identify\_outliers(occurrence)  
outliers

## # A tibble: 2 × 9  
## time simple\_id microstate gev duration coverage occurrence is.outlier is.extreme  
## <fct> <fct> <chr> <dbl> <dbl> <dbl> <dbl> <lgl> <lgl>   
## 1 1one 207 C 0.192 102. 26.7 2.09 TRUE FALSE   
## 2 4four 529 C 0.159 91.4 23.9 2.26 TRUE FALSE

# NO EXTREME VALUES

# Correlations  
data\_one <- data %>% filter(time == "1one")  
data\_two <- data %>% filter(time == "2two")  
data\_three <- data %>% filter(time == "3three")  
data\_four <- data %>% filter(time == "4four")  
data\_five <- data %>% filter(time == "5five")  
  
cor(data\_one$occurrence, data\_two$occurrence)

## [1] 0.8909966

cor(data\_one$occurrence, data\_three$occurrence)

## [1] 0.8766808

cor(data\_one$occurrence, data\_four$occurrence)

## [1] 0.8619303

cor(data\_one$occurrence, data\_five$occurrence)

## [1] 0.8590575

cor(data\_two$occurrence, data\_three$occurrence)

## [1] 0.8953776

cor(data\_two$occurrence, data\_four$occurrence)

## [1] 0.8832618

cor(data\_two$occurrence, data\_five$occurrence)

## [1] 0.8845756

cor(data\_three$occurrence, data\_four$occurrence)

## [1] 0.9760112

cor(data\_three$occurrence, data\_five$occurrence)

## [1] 0.9686475

cor(data\_four$occurrence, data\_five$occurrence)

## [1] 0.9824247

# Model  
m3\_occurrence\_model <- lme(occurrence ~ time, random = ~1|simple\_id,  
 correlation = corAR1(form = ~1|simple\_id), data = data)  
anova(m3\_occurrence\_model)

## numDF denDF F-value p-value  
## (Intercept) 1 188 7521.647 <.0001  
## time 4 188 1.463 0.215

effectsize::eta\_squared(m3\_occurrence\_model, partial = TRUE)

## # Effect Size for ANOVA  
##   
## Parameter | Eta2 (partial) | 95% CI  
## -----------------------------------------  
## time | 0.03 | [0.00, 1.00]  
##   
## - One-sided CIs: upper bound fixed at [1.00].

emmeans(m3\_occurrence\_model, list(pairwise ~ time), adjust = "scheffe")

## Warning: contrasts dropped from factor time

## $`emmeans of time`  
## time emmean SE df lower.CL upper.CL  
## 1one 2.73 0.0332 47 2.66 2.80  
## 2two 2.74 0.0332 47 2.68 2.81  
## 3three 2.76 0.0332 47 2.70 2.83  
## 4four 2.75 0.0332 47 2.68 2.81  
## 5five 2.76 0.0332 47 2.69 2.82  
##   
## Degrees-of-freedom method: containment   
## Confidence level used: 0.95   
##   
## $`pairwise differences of time`  
## 1 estimate SE df t.ratio p.value  
## 1one - 2two -0.01629 0.0125 188 -1.299 0.7926  
## 1one - 3three -0.03340 0.0158 188 -2.114 0.3498  
## 1one - 4four -0.01748 0.0174 188 -1.002 0.9087  
## 1one - 5five -0.02669 0.0183 188 -1.456 0.7141  
## 2two - 3three -0.01711 0.0125 188 -1.365 0.7609  
## 2two - 4four -0.00119 0.0158 188 -0.075 1.0000  
## 2two - 5five -0.01040 0.0174 188 -0.596 0.9858  
## 3three - 4four 0.01592 0.0125 188 1.270 0.8062  
## 3three - 5five 0.00671 0.0158 188 0.425 0.9961  
## 4four - 5five -0.00921 0.0125 188 -0.734 0.9693  
##   
## Degrees-of-freedom method: containment   
## P value adjustment: scheffe method with rank 4

# Estimation statistics-based effect sizes and confidence intervals  
paired\_mean\_diff <- dabest(data, time, occurrence,  
 idx = list(c("2two", "1one"),  
 c("3three", "1one"),  
 c("4four", "1one"),  
 c("5five", "1one"),  
 c("3three", "2two"),  
 c("4four", "2two"),  
 c("5five", "2two"),  
 c("4four", "3three"),  
 c("5five", "3three"),  
 c("5five", "4four")),  
 paired = TRUE, id.col = simple\_id) %>%   
 mean\_diff()  
paired\_mean\_diff

## dabestr (Data Analysis with Bootstrap Estimation in R) v0.3.0  
## =============================================================  
##   
## Good evening!  
## The current time is 23:36 PM on Sunday January 21, 2024.  
##   
## Dataset : data  
## X Variable : time  
## Y Variable : occurrence  
##   
## Paired mean difference of 1one (n = 48) minus 2two (n = 48)  
## -0.0163 [95CI -0.118; 0.0834]  
##   
## Paired mean difference of 1one (n = 48) minus 3three (n = 48)  
## -0.0334 [95CI -0.129; 0.0608]  
##   
## Paired mean difference of 1one (n = 48) minus 4four (n = 48)  
## -0.0175 [95CI -0.11; 0.0734]  
##   
## Paired mean difference of 1one (n = 48) minus 5five (n = 48)  
## -0.0267 [95CI -0.12; 0.063]  
##   
## Paired mean difference of 2two (n = 48) minus 3three (n = 48)  
## -0.0171 [95CI -0.112; 0.0722]  
##   
## Paired mean difference of 2two (n = 48) minus 4four (n = 48)  
## -0.00119 [95CI -0.094; 0.0834]  
##   
## Paired mean difference of 2two (n = 48) minus 5five (n = 48)  
## -0.0104 [95CI -0.102; 0.0741]  
##   
## Paired mean difference of 3three (n = 48) minus 4four (n = 48)  
## 0.0159 [95CI -0.0692; 0.099]  
##   
## Paired mean difference of 3three (n = 48) minus 5five (n = 48)  
## 0.00671 [95CI -0.0791; 0.0888]  
##   
## Paired mean difference of 4four (n = 48) minus 5five (n = 48)  
## -0.00921 [95CI -0.0908; 0.0688]  
##   
##   
## 5000 bootstrap resamples.  
## All confidence intervals are bias-corrected and accelerated.

# Microstate 4/D Occurrence

# Read data  
data <- read.csv("lmem\_full\_temp\_prop\_data.csv")  
data <- data[data$microstate == 'D', ]  
  
data$simple\_id <- as.factor(data$simple\_id)  
  
data$time <- ifelse(data$time == 1, "1one",  
 ifelse(data$time == 2, "2two",  
 ifelse(data$time == 3, "3three",  
 ifelse(data$time == 4, "4four",  
 ifelse(data$time == 5, "5five", "other")))))  
  
data$time <- as.factor(data$time)  
contrasts(data$time) <- contr.sum  
contrasts(data$time)

## [,1] [,2] [,3] [,4]  
## 1one 1 0 0 0  
## 2two 0 1 0 0  
## 3three 0 0 1 0  
## 4four 0 0 0 1  
## 5five -1 -1 -1 -1

# Outliers (this is a simple univariate measure)  
# Outlier = above Q3 + 1.5xIQR or below Q1 - 1.5xIQR  
# Extreme outlier = above Q3 + 3xIQR or below Q1 - 3xIQR   
# Only exclude extreme outliers  
outliers <- data %>%  
 group\_by(time) %>%  
 identify\_outliers(occurrence)  
outliers

## # A tibble: 14 × 9  
## time simple\_id microstate gev duration coverage occurrence is.outlier is.extreme  
## <fct> <fct> <chr> <dbl> <dbl> <dbl> <dbl> <lgl> <lgl>   
## 1 1one 395 D 0.0189 68.9 5.51 0.718 TRUE FALSE   
## 2 1one 529 D 0.144 83.0 23.2 2.46 TRUE FALSE   
## 3 2two 280 D 0.0239 76.2 8.54 1.01 TRUE FALSE   
## 4 2two 389 D 0.0228 72.6 7.56 0.959 TRUE FALSE   
## 5 2two 395 D 0.0219 68.4 6.89 0.922 TRUE FALSE   
## 6 3three 280 D 0.0260 77.4 8.62 0.992 TRUE FALSE   
## 7 3three 389 D 0.0244 72.8 7.87 0.985 TRUE FALSE   
## 8 3three 395 D 0.0273 69.1 7.45 0.969 TRUE FALSE   
## 9 4four 280 D 0.0280 77.7 9.20 1.06 TRUE FALSE   
## 10 4four 389 D 0.0289 75.4 8.93 1.07 TRUE FALSE   
## 11 4four 395 D 0.0327 73.9 9.21 1.10 TRUE FALSE   
## 12 5five 280 D 0.0268 78.1 8.85 1.00 TRUE FALSE   
## 13 5five 389 D 0.0292 74.6 9.01 1.09 TRUE FALSE   
## 14 5five 395 D 0.0334 73.1 9.43 1.14 TRUE FALSE

# NO EXTREME VALUES

# Correlations  
data\_one <- data %>% filter(time == "1one")  
data\_two <- data %>% filter(time == "2two")  
data\_three <- data %>% filter(time == "3three")  
data\_four <- data %>% filter(time == "4four")  
data\_five <- data %>% filter(time == "5five")  
  
cor(data\_one$occurrence, data\_two$occurrence)

## [1] 0.9191438

cor(data\_one$occurrence, data\_three$occurrence)

## [1] 0.8992857

cor(data\_one$occurrence, data\_four$occurrence)

## [1] 0.8933717

cor(data\_one$occurrence, data\_five$occurrence)

## [1] 0.8676974

cor(data\_two$occurrence, data\_three$occurrence)

## [1] 0.9685965

cor(data\_two$occurrence, data\_four$occurrence)

## [1] 0.9584841

cor(data\_two$occurrence, data\_five$occurrence)

## [1] 0.9284763

cor(data\_three$occurrence, data\_four$occurrence)

## [1] 0.9868879

cor(data\_three$occurrence, data\_five$occurrence)

## [1] 0.971242

cor(data\_four$occurrence, data\_five$occurrence)

## [1] 0.9860509

# Model  
m4\_occurrence\_model <- lme(occurrence ~ time, random = ~1|simple\_id,  
 correlation = corAR1(form = ~1|simple\_id), data = data)  
anova(m4\_occurrence\_model)

## numDF denDF F-value p-value  
## (Intercept) 1 188 1839.4803 <.0001  
## time 4 188 12.1258 <.0001

effectsize::eta\_squared(m4\_occurrence\_model, partial = TRUE)

## # Effect Size for ANOVA  
##   
## Parameter | Eta2 (partial) | 95% CI  
## -----------------------------------------  
## time | 0.21 | [0.12, 1.00]  
##   
## - One-sided CIs: upper bound fixed at [1.00].

emmeans(m4\_occurrence\_model, list(pairwise ~ time), adjust = "scheffe")

## Warning: contrasts dropped from factor time

## $`emmeans of time`  
## time emmean SE df lower.CL upper.CL  
## 1one 1.68 0.0417 47 1.60 1.76  
## 2two 1.68 0.0417 47 1.60 1.76  
## 3three 1.70 0.0417 47 1.62 1.79  
## 4four 1.78 0.0417 47 1.69 1.86  
## 5five 1.78 0.0417 47 1.69 1.86  
##   
## Degrees-of-freedom method: containment   
## Confidence level used: 0.95   
##   
## $`pairwise differences of time`  
## 1 estimate SE df t.ratio p.value  
## 1one - 2two 0.000297 0.0113 188 0.026 1.0000  
## 1one - 3three -0.024431 0.0157 188 -1.553 0.6611  
## 1one - 4four -0.098197 0.0191 188 -5.154 0.0001  
## 1one - 5five -0.095578 0.0218 188 -4.393 0.0010  
## 2two - 3three -0.024728 0.0113 188 -2.198 0.3092  
## 2two - 4four -0.098494 0.0157 188 -6.260 <.0001  
## 2two - 5five -0.095875 0.0191 188 -5.032 0.0001  
## 3three - 4four -0.073766 0.0113 188 -6.555 <.0001  
## 3three - 5five -0.071147 0.0157 188 -4.522 0.0006  
## 4four - 5five 0.002619 0.0113 188 0.233 0.9996  
##   
## Degrees-of-freedom method: containment   
## P value adjustment: scheffe method with rank 4

# Estimation statistics-based effect sizes and confidence intervals  
paired\_mean\_diff <- dabest(data, time, occurrence,  
 idx = list(c("2two", "1one"),  
 c("3three", "1one"),  
 c("4four", "1one"),  
 c("5five", "1one"),  
 c("3three", "2two"),  
 c("4four", "2two"),  
 c("5five", "2two"),  
 c("4four", "3three"),  
 c("5five", "3three"),  
 c("5five", "4four")),  
 paired = TRUE, id.col = simple\_id) %>%   
 mean\_diff()  
paired\_mean\_diff

## dabestr (Data Analysis with Bootstrap Estimation in R) v0.3.0  
## =============================================================  
##   
## Good evening!  
## The current time is 23:36 PM on Sunday January 21, 2024.  
##   
## Dataset : data  
## X Variable : time  
## Y Variable : occurrence  
##   
## Paired mean difference of 1one (n = 48) minus 2two (n = 48)  
## 0.000297 [95CI -0.114; 0.119]  
##   
## Paired mean difference of 1one (n = 48) minus 3three (n = 48)  
## -0.0244 [95CI -0.135; 0.095]  
##   
## Paired mean difference of 1one (n = 48) minus 4four (n = 48)  
## -0.0982 [95CI -0.208; 0.0186]  
##   
## Paired mean difference of 1one (n = 48) minus 5five (n = 48)  
## -0.0956 [95CI -0.202; 0.0202]  
##   
## Paired mean difference of 2two (n = 48) minus 3three (n = 48)  
## -0.0247 [95CI -0.135; 0.0911]  
##   
## Paired mean difference of 2two (n = 48) minus 4four (n = 48)  
## -0.0985 [95CI -0.207; 0.0146]  
##   
## Paired mean difference of 2two (n = 48) minus 5five (n = 48)  
## -0.0959 [95CI -0.205; 0.0147]  
##   
## Paired mean difference of 3three (n = 48) minus 4four (n = 48)  
## -0.0738 [95CI -0.181; 0.0366]  
##   
## Paired mean difference of 3three (n = 48) minus 5five (n = 48)  
## -0.0711 [95CI -0.178; 0.0377]  
##   
## Paired mean difference of 4four (n = 48) minus 5five (n = 48)  
## 0.00262 [95CI -0.102; 0.11]  
##   
##   
## 5000 bootstrap resamples.  
## All confidence intervals are bias-corrected and accelerated.

# Microstate 5/F Occurrence

# Read data  
data <- read.csv("lmem\_full\_temp\_prop\_data.csv")  
data <- data[data$microstate == 'F', ]  
  
data$simple\_id <- as.factor(data$simple\_id)  
  
data$time <- ifelse(data$time == 1, "1one",  
 ifelse(data$time == 2, "2two",  
 ifelse(data$time == 3, "3three",  
 ifelse(data$time == 4, "4four",  
 ifelse(data$time == 5, "5five", "other")))))  
  
data$time <- as.factor(data$time)  
contrasts(data$time) <- contr.sum  
contrasts(data$time)

## [,1] [,2] [,3] [,4]  
## 1one 1 0 0 0  
## 2two 0 1 0 0  
## 3three 0 0 1 0  
## 4four 0 0 0 1  
## 5five -1 -1 -1 -1

# Outliers (this is a simple univariate measure)  
# Outlier = above Q3 + 1.5xIQR or below Q1 - 1.5xIQR  
# Extreme outlier = above Q3 + 3xIQR or below Q1 - 3xIQR   
# Only exclude extreme outliers  
outliers <- data %>%  
 group\_by(time) %>%  
 identify\_outliers(occurrence)  
outliers

## # A tibble: 8 × 9  
## time simple\_id microstate gev duration coverage occurrence is.outlier is.extreme  
## <fct> <fct> <chr> <dbl> <dbl> <dbl> <dbl> <lgl> <lgl>   
## 1 1one 207 F 0.0527 85.6 12.0 1.21 TRUE FALSE   
## 2 1one 389 F 0.0393 79.7 10.3 1.18 TRUE FALSE   
## 3 2two 408 F 0.160 91.8 25.9 2.42 TRUE FALSE   
## 4 3three 315 F 0.0383 73.8 10.5 1.28 TRUE FALSE   
## 5 3three 389 F 0.0368 79.2 10.1 1.13 TRUE FALSE   
## 6 3three 394 F 0.0518 78.1 11.2 1.26 TRUE FALSE   
## 7 3three 408 F 0.136 89.3 24.7 2.38 TRUE FALSE   
## 8 4four 389 F 0.0331 78.0 9.14 1.06 TRUE FALSE

# NO EXTREME VALUES

# Correlations  
data\_one <- data %>% filter(time == "1one")  
data\_two <- data %>% filter(time == "2two")  
data\_three <- data %>% filter(time == "3three")  
data\_four <- data %>% filter(time == "4four")  
data\_five <- data %>% filter(time == "5five")  
  
cor(data\_one$occurrence, data\_two$occurrence)

## [1] 0.8720197

cor(data\_one$occurrence, data\_three$occurrence)

## [1] 0.802996

cor(data\_one$occurrence, data\_four$occurrence)

## [1] 0.7616122

cor(data\_one$occurrence, data\_five$occurrence)

## [1] 0.7099361

cor(data\_two$occurrence, data\_three$occurrence)

## [1] 0.9439779

cor(data\_two$occurrence, data\_four$occurrence)

## [1] 0.8921744

cor(data\_two$occurrence, data\_five$occurrence)

## [1] 0.8625996

cor(data\_three$occurrence, data\_four$occurrence)

## [1] 0.9512266

cor(data\_three$occurrence, data\_five$occurrence)

## [1] 0.937335

cor(data\_four$occurrence, data\_five$occurrence)

## [1] 0.9751691

# Model  
m5\_occurrence\_model <- lme(occurrence ~ time, random = ~1|simple\_id,  
 correlation = corAR1(form = ~1|simple\_id), data = data)  
anova(m5\_occurrence\_model)

## numDF denDF F-value p-value  
## (Intercept) 1 188 2930.6531 <.0001  
## time 4 188 19.7133 <.0001

effectsize::eta\_squared(m5\_occurrence\_model, partial = TRUE)

## # Effect Size for ANOVA  
##   
## Parameter | Eta2 (partial) | 95% CI  
## -----------------------------------------  
## time | 0.30 | [0.20, 1.00]  
##   
## - One-sided CIs: upper bound fixed at [1.00].

emmeans(m5\_occurrence\_model, list(pairwise ~ time), adjust = "scheffe")

## Warning: contrasts dropped from factor time

## $`emmeans of time`  
## time emmean SE df lower.CL upper.CL  
## 1one 1.81 0.035 47 1.74 1.88  
## 2two 1.79 0.035 47 1.72 1.86  
## 3three 1.79 0.035 47 1.72 1.86  
## 4four 1.69 0.035 47 1.62 1.76  
## 5five 1.75 0.035 47 1.68 1.82  
##   
## Degrees-of-freedom method: containment   
## Confidence level used: 0.95   
##   
## $`pairwise differences of time`  
## 1 estimate SE df t.ratio p.value  
## 1one - 2two 0.0253573 0.0127 188 2.000 0.4089  
## 1one - 3three 0.0253942 0.0176 188 1.440 0.7223  
## 1one - 4four 0.1186516 0.0212 188 5.585 <.0001  
## 1one - 5five 0.0584310 0.0241 188 2.421 0.2145  
## 2two - 3three 0.0000369 0.0127 188 0.003 1.0000  
## 2two - 4four 0.0932943 0.0176 188 5.290 <.0001  
## 2two - 5five 0.0330737 0.0212 188 1.557 0.6589  
## 3three - 4four 0.0932574 0.0127 188 7.355 <.0001  
## 3three - 5five 0.0330368 0.0176 188 1.873 0.4786  
## 4four - 5five -0.0602206 0.0127 188 -4.749 0.0003  
##   
## Degrees-of-freedom method: containment   
## P value adjustment: scheffe method with rank 4

# Estimation statistics-based effect sizes and confidence intervals  
paired\_mean\_diff <- dabest(data, time, occurrence,  
 idx = list(c("2two", "1one"),  
 c("3three", "1one"),  
 c("4four", "1one"),  
 c("5five", "1one"),  
 c("3three", "2two"),  
 c("4four", "2two"),  
 c("5five", "2two"),  
 c("4four", "3three"),  
 c("5five", "3three"),  
 c("5five", "4four")),  
 paired = TRUE, id.col = simple\_id) %>%   
 mean\_diff()  
paired\_mean\_diff

## dabestr (Data Analysis with Bootstrap Estimation in R) v0.3.0  
## =============================================================  
##   
## Good evening!  
## The current time is 23:36 PM on Sunday January 21, 2024.  
##   
## Dataset : data  
## X Variable : time  
## Y Variable : occurrence  
##   
## Paired mean difference of 1one (n = 48) minus 2two (n = 48)  
## 0.0254 [95CI -0.071; 0.123]  
##   
## Paired mean difference of 1one (n = 48) minus 3three (n = 48)  
## 0.0254 [95CI -0.0681; 0.122]  
##   
## Paired mean difference of 1one (n = 48) minus 4four (n = 48)  
## 0.119 [95CI 0.0246; 0.215]  
##   
## Paired mean difference of 1one (n = 48) minus 5five (n = 48)  
## 0.0584 [95CI -0.0353; 0.152]  
##   
## Paired mean difference of 2two (n = 48) minus 3three (n = 48)  
## 0.0000369 [95CI -0.0952; 0.0955]  
##   
## Paired mean difference of 2two (n = 48) minus 4four (n = 48)  
## 0.0933 [95CI -0.00294; 0.19]  
##   
## Paired mean difference of 2two (n = 48) minus 5five (n = 48)  
## 0.0331 [95CI -0.0616; 0.128]  
##   
## Paired mean difference of 3three (n = 48) minus 4four (n = 48)  
## 0.0933 [95CI -0.00295; 0.187]  
##   
## Paired mean difference of 3three (n = 48) minus 5five (n = 48)  
## 0.033 [95CI -0.0626; 0.125]  
##   
## Paired mean difference of 4four (n = 48) minus 5five (n = 48)  
## -0.0602 [95CI -0.156; 0.033]  
##   
##   
## 5000 bootstrap resamples.  
## All confidence intervals are bias-corrected and accelerated.

# Correction for Multiple Comparisons

# With Outliers Removed  
p = c(  
 0.0002,  
 0.000000001080395,  
 0.1346235,  
 0.00000000000002176037,  
 0.000000000000006661338,  
   
 0.1744792,  
 0.05787526,  
 0.04116499,  
 0.005043416,  
 0.00311029,  
   
 0.00000002799927,  
 0.0000000000004719558,  
 0.002970316,  
 0.00000000005082268,  
 0.000000000000004662937,  
   
 0.000001775535,  
 0.0000000001170206,  
 0.2150346,  
 0.000000008653745,  
 0.000000000000144551  
)  
p.adjust(p, method = "bonferroni")

## [1] 0.00400000000000000008 0.00000002160790000000 1.00000000000000000000 0.00000000000043520740 0.00000000000013322676  
## [6] 1.00000000000000000000 1.00000000000000000000 0.82329980000000002605 0.10086832000000001131 0.06220579999999999860  
## [11] 0.00000055998540000000 0.00000000000943911600 0.05940632000000000551 0.00000000101645360000 0.00000000000009325874  
## [16] 0.00003551070000000000 0.00000000234041200000 1.00000000000000000000 0.00000017307490000000 0.00000000000289102000

# Without Outliers Removed  
p = c(  
 0.0002,  
 0.000000001080395,  
 0.1346235,  
 0.00000000000002176037,  
 0.000000000000002442491, # Change 1  
   
 0.1744792,  
 0.06670067, # Change 2  
 0.04116499,  
 0.005043416,  
 0.00311029,  
   
 0.00000002799927,  
 0.0000000000004719558,  
 0.002970316,  
 0.00000000005082268,  
 0.000000000000004662937,  
   
 0.000001775535,  
 0.0000000001170206,  
 0.2150346,  
 0.000000008653745,  
 0.000000000000144551  
)  
p.adjust(p, method = "bonferroni")

## [1] 0.00400000000000000008 0.00000002160790000000 1.00000000000000000000 0.00000000000043520740 0.00000000000004884982  
## [6] 1.00000000000000000000 1.00000000000000000000 0.82329980000000002605 0.10086832000000001131 0.06220579999999999860  
## [11] 0.00000055998540000000 0.00000000000943911600 0.05940632000000000551 0.00000000101645360000 0.00000000000009325874  
## [16] 0.00003551070000000000 0.00000000234041200000 1.00000000000000000000 0.00000017307490000000 0.00000000000289102000