Pain Research - Dr. Jamison Data

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Objective 1.1 Day-to-day (Concurrent) associations

```
#Analyses; Day-to-day; Univariate multilevel linear regressions
#- Outcome: Lev1 daily pain intensity
#- Examine Lev1 association; between daily mood and pain (Same-day Lev1 units)
#- Examine Lev1 association; between daily sleep and pain (Same-day Lev1 units)
#- All these multlev must be done with Lev1 centered data
model_Pain1 <- lmer(Today_PainAve ~ Today_Mood_c  + (1|ID), data = df_new)
summary(model_Pain1)
```

```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: Today_PainAve ~ Today_Mood_c + (1 | ID)
##    Data: df_new
##
## REML criterion at convergence: 15011.6
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -5.7045 -0.5554 -0.0477  0.5334  5.7811
##
## Random effects:
##  Groups   Name        Variance Std.Dev.
##  ID       (Intercept) 3.680    1.918
##  Residual             1.302    1.141
## Number of obs: 4550, groups:  ID, 222
##
## Fixed effects:
##               Estimate Std. Error        df t value Pr(>|t|)
## (Intercept)  5.327e+00  1.300e-01 2.213e+02   40.97   <2e-16 ***
## Today_Mood_c 2.530e-01  1.481e-02 4.327e+03   17.09   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##             (Intr)
## Today_Mod_c 0.000
```

```r
confint(model_Pain1)
```

```
## Computing profile confidence intervals ...
```

```
##                   2.5 %    97.5 %
## .sig01       1.7454201 2.1101539
## .sigma       1.1172842 1.1653647
## (Intercept)  5.0717382 5.5824304
## Today_Mood_c 0.2239451 0.2819929
```

```r
model_Pain2 <- lmer(Today_PainAve ~ Today_Sleep_c + (1|ID), data = df_new)
summary(model_Pain2)
```

```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: Today_PainAve ~ Today_Sleep_c + (1 | ID)
##    Data: df_new
##
## REML criterion at convergence: 10933.3
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -6.5284 -0.5819 -0.0394  0.5142  5.9042
##
## Random effects:
##  Groups   Name        Variance Std.Dev.
##  ID       (Intercept) 3.657    1.912
##  Residual             1.258    1.122
## Number of obs: 3303, groups:  ID, 221
##
## Fixed effects:
##                Estimate Std. Error        df t value Pr(>|t|)
## (Intercept)   5.323e+00  1.311e-01 2.222e+02   40.59   <2e-16 ***
## Today_Sleep_c 1.845e-01  1.646e-02 3.101e+03   11.21   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##             (Intr)
## Today_Slp_c 0.006
```

```r
confint(model_Pain2)
```

```
## Computing profile confidence intervals ...
```

```
##                   2.5 %    97.5 %
## .sig01        1.7374495 2.1066502
## .sigma        1.0939984 1.1499834
## (Intercept)   5.0649905 5.5800950
## Today_Sleep_c 0.1521968 0.2167286
```

```r
# Analyses; Multivariable models
#- Outcome: Lev1 daily pain intensity
#- Ivs entered simulatenously: daily (Lev1) mood, sleep
#- All these multlev must be done with Lev1 centered data
#- Same-day Lev1 units
model_Pain3 <- lmer(Today_PainAve ~ Today_Sleep_c + Today_Mood_c + (1|ID), data = df_new)
summary(model_Pain3)
```

```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: Today_PainAve ~ Today_Sleep_c + Today_Mood_c + (1 | ID)
##    Data: df_new
##
## REML criterion at convergence: 10777.6
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -5.8858 -0.5809 -0.0514  0.5217  6.2497
##
## Random effects:
##  Groups   Name        Variance Std.Dev.
##  ID       (Intercept) 3.659    1.913
##  Residual             1.195    1.093
## Number of obs: 3302, groups:  ID, 221
##
## Fixed effects:
##                Estimate Std. Error        df t value Pr(>|t|)
## (Intercept)   5.321e+00  1.310e-01 2.221e+02  40.603   <2e-16 ***
## Today_Sleep_c 1.548e-01  1.621e-02 3.098e+03   9.547   <2e-16 ***
## Today_Mood_c  2.227e-01  1.751e-02 3.091e+03  12.716   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##             (Intr) Tdy_S_
## Today_Slp_c  0.006
## Today_Mod_c -0.001 -0.141
```

```r
confint(model_Pain3)
```

```
## Computing profile confidence intervals ...

##                    2.5 %    97.5 %
## .sig01        1.7382149 2.1069537
## .sigma        1.0662030 1.1207757
## (Intercept)   5.0638525 5.5786317
## Today_Sleep_c 0.1230106 0.1865591
## Today_Mood_c  0.1883642 0.2570086
```

```r
# Analyses; Day-to-day; Univariate multilevel linear regressions
#-Outcome: Lev1 Sleep
#-Examine Lev1 association; between daily mood and sleep (Same-day Lev1 units)
```

```r
#-Examine Lev1 association; between daily pain and sleep (Same-day Lev1 units)
#-All these multlev must be done with Lev1 centered data
model_Pain4 <- lmer(Today_Sleep ~ Today_Mood_c + (1|ID), data = df_new)
summary(model_Pain4)
```

```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: Today_Sleep ~ Today_Mood_c + (1 | ID)
##    Data: df_new
##
## REML criterion at convergence: 11558
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -5.0222 -0.4542 -0.0430  0.3844  4.7405
##
## Random effects:
##  Groups   Name        Variance Std.Dev.
##  ID       (Intercept) 7.051    2.655
##  Residual             1.472    1.213
## Number of obs: 3303, groups:  ID, 221
##
## Fixed effects:
##               Estimate Std. Error        df t value Pr(>|t|)
## (Intercept)  4.198e+00  1.808e-01 2.201e+02  23.223  < 2e-16 ***
## Today_Mood_c 1.530e-01  1.924e-02 3.088e+03   7.952 2.54e-15 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##             (Intr)
## Today_Mod_c 0.000
```

```r
confint(model_Pain4)
```

```
## Computing profile confidence intervals ...
```

```
##                  2.5 %    97.5 %
## .sig01       2.4146433 2.9228138
## .sigma       1.1833356 1.2439177
## (Intercept)  3.8429193 4.5529965
## Today_Mood_c 0.1152788 0.1907008
```

```r
model_Pain5 <- lmer(Today_Sleep ~ Today_PainAve_c + (1|ID), data = df_new)
summary(model_Pain5)
```

```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: Today_Sleep ~ Today_PainAve_c + (1 | ID)
##    Data: df_new
##
```

```
## REML criterion at convergence: 11499.1
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -5.0919 -0.4400 -0.0457  0.3781  4.8290
##
## Random effects:
##  Groups   Name        Variance Std.Dev.
##  ID       (Intercept) 7.037    2.653
##  Residual             1.444    1.202
## Number of obs: 3303, groups:  ID, 221
##
## Fixed effects:
##                  Estimate Std. Error        df t value Pr(>|t|)
## (Intercept)     4.200e+00  1.805e-01 2.202e+02   23.26   <2e-16 ***
## Today_PainAve_c 2.117e-01  1.891e-02 3.086e+03   11.19   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##             (Intr)
## Tody_PnAv_c 0.001
```

```
confint(model_Pain5)
```

```
## Computing profile confidence intervals ...

##                     2.5 %    97.5 %
## .sig01          2.4123271 2.9196923
## .sigma          1.1721656 1.2321750
## (Intercept)     3.8457760 4.5549940
## Today_PainAve_c 0.1745975 0.2487484
```

```
# Analyses; Multivariable models
#- Outcome: Lev1 sleep
#- Ivs entered simulatenously: daily (Lev1) mood, pain
#- All these multlev must be done with Lev1 centered data
#- Same-day Lev1 units
model_Pain6 <- lmer(Today_Sleep ~ Today_PainAve_c + Today_Mood_c + (1|ID), data = df_new)
summary(model_Pain6)
```

```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: Today_Sleep ~ Today_PainAve_c + Today_Mood_c + (1 | ID)
##    Data: df_new
##
## REML criterion at convergence: 11472.2
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -5.0471 -0.4440 -0.0444  0.3613  4.9110
##
```

```
## Random effects:
##  Groups   Name        Variance Std.Dev.
##  ID       (Intercept) 7.031    2.652
##  Residual             1.431    1.196
## Number of obs: 3302, groups:  ID, 221
##
## Fixed effects:
##                  Estimate Std. Error        df t value Pr(>|t|)
## (Intercept)     4.200e+00  1.805e-01 2.202e+02  23.274  < 2e-16 ***
## Today_PainAve_c 1.852e-01  1.942e-02 3.084e+03   9.532  < 2e-16 ***
## Today_Mood_c    1.073e-01  1.957e-02 3.086e+03   5.482 4.54e-08 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##             (Intr) Td_PA_
## Tody_PnAv_c  0.001
## Today_Mod_c -0.001 -0.245
```

```
confint(model_Pain6)
```

```
## Computing profile confidence intervals ...

##                      2.5 %    97.5 %
## .sig01          2.4114685 2.9185218
## .sigma          1.1665697 1.2263023
## (Intercept)     3.8456850 4.5545636
## Today_PainAve_c 0.1470809 0.2232211
## Today_Mood_c    0.0689274 0.1456310
```

Objective 1.2: Time-lag effects

```
# Yesterday sleep -> Toady Pain
model_SleepPain <- lmer(Today_PainAve ~ LastDay_Sleep_c + (1|ID), data = df_new)
model_SleepPain2 <- lmer(Today_PainAve ~ Today_Sleep + (1|ID), data = df_new)
AIC(model_SleepPain, model_SleepPain2)
```

```
## Warning in AIC.default(model_SleepPain, model_SleepPain2): models are not all
## fitted to the same number of observations

##                  df      AIC
## model_SleepPain   4 14191.20
## model_SleepPain2  4 10840.18
```

```
icc(model_SleepPain2)
```

```
## # Intraclass Correlation Coefficient
##
##     Adjusted ICC: 0.627
##   Unadjusted ICC: 0.544
```

```r
summary(model_SleepPain)
```

```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: Today_PainAve ~ LastDay_Sleep_c + (1 | ID)
##    Data: df_new
##
## REML criterion at convergence: 14183.2
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -6.7956 -0.5835 -0.0156  0.5409  5.6682
##
## Random effects:
##  Groups   Name        Variance Std.Dev.
##  ID       (Intercept) 3.694    1.922
##  Residual             1.076    1.037
## Number of obs: 4549, groups:  ID, 222
##
## Fixed effects:
##                  Estimate Std. Error        df t value Pr(>|t|)
## (Intercept)     5.327e+00  1.300e-01 2.213e+02   40.96   <2e-16 ***
## LastDay_Sleep_c 4.255e-01  1.196e-02 4.326e+03   35.59   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##             (Intr)
## LstDy_Slp_c 0.000
```

```r
confint(model_SleepPain)
```

```
## Computing profile confidence intervals ...
```

```
##                      2.5 %    97.5 %
## .sig01           1.7495327 2.1138023
## .sigma           1.0156199 1.0593308
## (Intercept)      5.0718626 5.5827192
## LastDay_Sleep_c  0.4020557 0.4489307
```

```r
# Yesterday pain -> Today sleep
model_PainSleep <- lmer(Today_Sleep ~ LastDay_PainAve_c + (1|ID), data = df_new)
summary(model_PainSleep)
```

```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: Today_Sleep ~ LastDay_PainAve_c + (1 | ID)
##    Data: df_new
##
## REML criterion at convergence: 11418.6
##
```

```
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -4.9873 -0.4373 -0.0525  0.3856  5.3624
##
## Random effects:
##  Groups   Name        Variance Std.Dev.
##  ID       (Intercept) 7.177    2.679
##  Residual             1.488    1.220
## Number of obs: 3249, groups:  ID, 220
##
## Fixed effects:
##                     Estimate Std. Error        df t value Pr(>|t|)
## (Intercept)          4.2056     0.1827  218.5013  23.021  < 2e-16 ***
## LastDay_PainAve_c    0.1072     0.0191 3033.6008   5.616 2.14e-08 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##             (Intr)
## LstDy_PnAv_ 0.002
```

```
confint(model_PainSleep)
```

```
## Computing profile confidence intervals ...

##                         2.5 %    97.5 %
## .sig01             2.43545667 2.9494551
## .sigma             1.18959773 1.2510508
## (Intercept)        3.84678260 4.5644047
## LastDay_PainAve_c 0.06981079 0.1446839
```

Objective 2: Anayses: Perceived Improvement

```
# Analyses; Univariate multilevel linear regressions
# Outcome: Lev1 perceived improvement
# Examine Lev1 association; between daily pain and perceived improvement (Same-day Lev1 units)
model_painimprove <- lmer(GlobalImprovement ~ AvePain_c + (1|ID), data = df_new)
summary(model_painimprove)
```

```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: GlobalImprovement ~ AvePain_c + (1 | ID)
##    Data: df_new
##
## REML criterion at convergence: 15753.6
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -4.8904 -0.5018 -0.0428  0.4359  5.8656
##
## Random effects:
```

```
##  Groups   Name        Variance Std.Dev.
##  ID       (Intercept) 1.157    1.076
##  Residual             1.634    1.278
## Number of obs: 4551, groups:  ID, 222
##
## Fixed effects:
##               Estimate Std. Error         df t value Pr(>|t|)
## (Intercept)    6.02260    0.07497  219.50479   80.33   <2e-16 ***
## AvePain_c     -0.56930    0.01648 4326.95685  -34.55   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##           (Intr)
## AvePain_c 0.000
```

```
confint(model_painimprove)
```

```
## Computing profile confidence intervals ...

##                   2.5 %     97.5 %
## .sig01        0.9727485  1.1897264
## .sigma        1.2515144  1.3053738
## (Intercept)   5.8753590  6.1698673
## AvePain_c    -0.6016027 -0.5370068
```

```
# Examine Lev1 association; between daily mood and perceived improvement (Same-day Lev1 units)
model_moodimprove <- lmer(GlobalImprovement ~ Mood_c + (1|ID), data = df_new)
summary(model_moodimprove)
```

```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: GlobalImprovement ~ Mood_c + (1 | ID)
##    Data: df_new
##
## REML criterion at convergence: 16284.1
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -4.7165 -0.4527 -0.0031  0.4594  4.7921
##
## Random effects:
##  Groups   Name        Variance Std.Dev.
##  ID       (Intercept) 1.148    1.071
##  Residual             1.846    1.359
## Number of obs: 4551, groups:  ID, 222
##
## Fixed effects:
##               Estimate Std. Error         df t value Pr(>|t|)
## (Intercept)    6.02342    0.07503  219.43605   80.28   <2e-16 ***
## Mood_c        -0.41725    0.01763 4327.04478  -23.67   <2e-16 ***
## ---
```

```
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##        (Intr)
## Mood_c 0.000
```

```
confint(model_moodimprove)
```

```
## Computing profile confidence intervals ...
```

```
##                  2.5 %     97.5 %
## .sig01       0.9676451  1.1858657
## .sigma       1.3305648  1.3878259
## (Intercept)  5.8760587  6.1708057
## Mood_c      -0.4518087 -0.3826932
```

```
# Examine Lev1 association; between daily sleep and perceived improvement (Same-day Lev1 unit)
model_sleepimprove <- lmer(GlobalImprovement ~ Sleep_c + (1|ID), data = df_new)
summary(model_sleepimprove)
```

```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: GlobalImprovement ~ Sleep_c + (1 | ID)
##    Data: df_new
##
## REML criterion at convergence: 16176.7
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -5.1334 -0.4733 -0.0108  0.4473  5.4262
##
## Random effects:
##  Groups   Name        Variance Std.Dev.
##  ID       (Intercept) 1.151    1.073
##  Residual             1.803    1.343
## Number of obs: 4550, groups:  ID, 222
##
## Fixed effects:
##               Estimate Std. Error         df t value Pr(>|t|)
## (Intercept)    6.02181    0.07507  219.56667   80.21   <2e-16 ***
## Sleep_c       -0.40231    0.01548 4326.12350  -25.99   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##         (Intr)
## Sleep_c 0.000
```

```
confint(model_sleepimprove)
```

```
## Computing profile confidence intervals ...
```

```
##                   2.5 %     97.5 %
## .sig01       0.9693305  1.1873852
## .sigma       1.3146478  1.3712297
## (Intercept)  5.8743714  6.1692689
## Sleep_c     -0.4326473 -0.3719721
```

```
# Examine Lev1 association; between daily ActivityInt and perceived improvement (Same-day Lev1 unit)
model_actimprove <- lmer(GlobalImprovement ~ ActivityInt_c + (1|ID), data = df_new)
summary(model_actimprove)
```

```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: GlobalImprovement ~ ActivityInt_c + (1 | ID)
##    Data: df_new
##
## REML criterion at convergence: 15895.9
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -4.7369 -0.4823 -0.0091  0.4385  6.0088
##
## Random effects:
##  Groups   Name        Variance Std.Dev.
##  ID       (Intercept) 1.156    1.075
##  Residual             1.688    1.299
## Number of obs: 4551, groups:  ID, 222
##
## Fixed effects:
##                 Estimate Std. Error         df t value Pr(>|t|)
## (Intercept)      6.02303    0.07502  219.50622   80.29   <2e-16 ***
## ActivityInt_c   -0.49764    0.01560 4327.00419  -31.90   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##             (Intr)
## ActvtyInt_c 0.000
```

```
confint(model_actimprove)
```

```
## Computing profile confidence intervals ...
```

```
##                     2.5 %     97.5 %
## .sig01         0.9718338  1.1891921
## .sigma         1.2722037  1.3269534
## (Intercept)    5.8756991  6.1703749
## ActivityInt_c -0.5282147 -0.4670559
```

```
# All these multlev must be done with Lev1 centered data
```

```r
# Analysis; Multvariable/multilevel linear regression
# Outcome: Perceived improvement
# Ivs entered simulatenously: daily (Lev1) pain, mood, sleep, ActivityInt
model_compimprove <- lmer(GlobalImprovement ~ Sleep_c + AvePain_c + Mood_c + ActivityInt_c + (1|ID), da
summary(model_compimprove)
```

```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: GlobalImprovement ~ Sleep_c + AvePain_c + Mood_c + ActivityInt_c +
##     (1 | ID)
##    Data: df_new
##
## REML criterion at convergence: 15264.6
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -4.9588 -0.4953 -0.0213  0.4476  5.4574
##
## Random effects:
##  Groups   Name        Variance Std.Dev.
##  ID       (Intercept) 1.167    1.081
##  Residual             1.458    1.208
## Number of obs: 4547, groups:  ID, 222
##
## Fixed effects:
##                 Estimate Std. Error         df t value Pr(>|t|)
## (Intercept)      6.02109    0.07500  219.63353  80.286  < 2e-16 ***
## Sleep_c         -0.13345    0.01637 4319.99960  -8.153 4.61e-16 ***
## AvePain_c       -0.31707    0.02058 4319.99960 -15.406  < 2e-16 ***
## Mood_c          -0.23456    0.01669 4319.99960 -14.055  < 2e-16 ***
## ActivityInt_c   -0.18611    0.01913 4319.99960  -9.728  < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##             (Intr) Slep_c AvPn_c Mood_c
## Sleep_c      0.000
## AvePain_c    0.000 -0.279
## Mood_c       0.000 -0.123 -0.041
## ActvtyInt_c  0.000 -0.195 -0.492 -0.178
```

```r
confint(model_compimprove)
```

```
## Computing profile confidence intervals ...

##                    2.5 %     97.5 %
## .sig01         0.9778873  1.1940124
## .sigma         1.1819700  1.2328602
## (Intercept)    5.8738056  6.1683978
## Sleep_c       -0.1655270 -0.1013790
## AvePain_c     -0.3573965 -0.2767410
## Mood_c        -0.2672611 -0.2018564
## ActivityInt_c -0.2235920 -0.1486184
```

```r
# All these multlev must be done with Lev1 centered data
# Perhaps get some colinearity indicator to know to what extent colinearity is an issue
collinear_test <- check_collinearity(model_compimprove)
print(collinear_test)
```

```
## # Check for Multicollinearity
##
## Low Correlation
##
##           Term  VIF   VIF 95% CI Increased SE Tolerance Tolerance 95% CI
##        Sleep_c 1.38 [1.33, 1.44]         1.18      0.72     [0.70, 0.75]
##      AvePain_c 1.75 [1.68, 1.82]         1.32      0.57     [0.55, 0.60]
##         Mood_c 1.13 [1.10, 1.18]         1.06      0.88     [0.85, 0.91]
##  ActivityInt_c 1.74 [1.67, 1.81]         1.32      0.58     [0.55, 0.60]
```

```r
## Some comments on how to read this result: The VIF is around 1 => Low Multicollinearity
## The VIF is between 2 to 5, Moderate Multicollinearity
## The VIF >5 (or 10 sometimes), High Multicollinearity
## Low Tolerance (~ 0), High Multicollinearity
```

We have low multicollinearity in this case!

Objective 2.2 Analyses: Moderators of perceived impovement

```r
# Test if any of the baseline (Lev2) socio-demog variables are linked to perceived improvements; Univar
# B_Demog_Gender
model_genderimprove <- lmer(GlobalImprovement ~ B_Demog_Gender + (1|ID), data = df_new)
summary(model_genderimprove)
```

```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: GlobalImprovement ~ B_Demog_Gender + (1 | ID)
##    Data: df_new
##
## REML criterion at convergence: 16807
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -4.4120 -0.4415 -0.0034  0.4388  4.9641
##
## Random effects:
##  Groups   Name        Variance Std.Dev.
##  ID       (Intercept) 1.129    1.063
##  Residual             2.084    1.444
## Number of obs: 4552, groups:  ID, 222
##
## Fixed effects:
##                Estimate Std. Error       df t value Pr(>|t|)
## (Intercept)      5.5544     0.3340 221.1166  16.630   <2e-16 ***
## B_Demog_Gender   0.2626     0.1823 220.5723   1.441    0.151
```

```
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##             (Intr)
## B_Demg_Gndr -0.975
```

```
confint(model_genderimprove)
```

```
## Computing profile confidence intervals ...

##                      2.5 %    97.5 %
## .sig01          0.95610501 1.1745618
## .sigma          1.41389130 1.4747295
## (Intercept)     4.89983087 6.2088010
## B_Demog_Gender -0.09460566 0.6199379
```

```
# B_Demog_Ethnicity
model_ethnimprove <- lmer(GlobalImprovement ~ B_Demog_Ethnicity + (1|ID), data = df_new)
summary(model_ethnimprove)
```

```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: GlobalImprovement ~ B_Demog_Ethnicity + (1 | ID)
##    Data: df_new
##
## REML criterion at convergence: 16810.8
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -4.4097 -0.4419 -0.0007  0.4351  4.9691
##
## Random effects:
##  Groups   Name        Variance Std.Dev.
##  ID       (Intercept) 1.140    1.068
##  Residual             2.085    1.444
## Number of obs: 4552, groups:  ID, 222
##
## Fixed effects:
##                    Estimate Std. Error        df t value Pr(>|t|)
## (Intercept)         6.00103    0.12719 217.53061  47.180   <2e-16 ***
## B_Demog_Ethnicity   0.01584    0.07313 216.10493   0.217    0.829
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##             (Intr)
## B_Dmg_Ethnc -0.807
```

```
confint(model_ethnimprove)
```

```
## Computing profile confidence intervals ...
```

```
##                         2.5 %    97.5 %
## .sig01              0.9608634 1.1802628
## .sigma              1.4139012 1.4747407
## (Intercept)         5.7518051 6.2502987
## B_Demog_Ethnicity -0.1274734 0.1591333
```

```
# B_Demog_Age
model_ageimprove <- lmer(GlobalImprovement ~ B_Demog_Age + (1|ID), data = df_new)
summary(model_ageimprove)
```

```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: GlobalImprovement ~ B_Demog_Age + (1 | ID)
##    Data: df_new
##
## REML criterion at convergence: 16806.1
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -4.4221 -0.4320  0.0060  0.4383  4.9723
##
## Random effects:
##  Groups   Name        Variance Std.Dev.
##  ID       (Intercept) 1.085    1.042
##  Residual             2.084    1.444
## Number of obs: 4552, groups:  ID, 222
##
## Fixed effects:
##              Estimate Std. Error        df t value Pr(>|t|)
## (Intercept) 5.174e+00  2.756e-01 2.192e+02  18.771  < 2e-16 ***
## B_Demog_Age 1.643e-02  5.139e-03 2.185e+02   3.197  0.00159 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##             (Intr)
## B_Demog_Age -0.964
```

```
confint(model_ageimprove)
```

```
## Computing profile confidence intervals ...
```

```
##                    2.5 %     97.5 %
## .sig01      0.936999138 1.15191933
## .sigma      1.413883734 1.47472084
## (Intercept) 4.633722247 5.71393232
## B_Demog_Age 0.006362664 0.02650471
```

Age tends to be associated with the improvement, older patients have better improvements.

```r
# Test if any of the baseline (Lev2) clinical variables are linked to perceived improvements; Univariat
# B_Clin_PainDur"
model_paindurimprove <- lmer(GlobalImprovement ~ B_Clin_PainDur + (1|ID), data = df_new)
summary(model_paindurimprove)
```

```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: GlobalImprovement ~ B_Clin_PainDur + (1 | ID)
##    Data: df_new
##
## REML criterion at convergence: 15755.7
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -4.4949 -0.4460  0.0026  0.4333  5.0739
##
## Random effects:
##  Groups   Name        Variance Std.Dev.
##  ID       (Intercept) 1.140    1.068
##  Residual             2.009    1.417
## Number of obs: 4307, groups:  ID, 208
##
## Fixed effects:
##                 Estimate Std. Error        df t value Pr(>|t|)
## (Intercept)    5.853e+00  1.150e-01 2.023e+02  50.897   <2e-16 ***
## B_Clin_PainDur 1.054e-02  6.443e-03 2.008e+02   1.636    0.103
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##             (Intr)
## B_Clin_PnDr -0.739
```

```r
confint(model_paindurimprove)
```

```
## Computing profile confidence intervals ...

##                       2.5 %     97.5 %
## .sig01          0.957201880 1.18347983
## .sigma          1.387215156 1.44861026
## (Intercept)     5.627911643 6.07861770
## B_Clin_PainDur -0.002087504 0.02316534
```

```r
# B_Clin_BMI"
model_BMIimprove <- lmer(GlobalImprovement ~ B_Clin_BMI + (1|ID), data = df_new)
summary(model_BMIimprove)
```

```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: GlobalImprovement ~ B_Clin_BMI + (1 | ID)
##    Data: df_new
```

```
##
## REML criterion at convergence: 16744.6
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -4.3929 -0.4468 -0.0041  0.4384  4.9859
##
## Random effects:
##  Groups   Name        Variance Std.Dev.
##  ID       (Intercept) 1.127    1.062
##  Residual             2.091    1.446
## Number of obs: 4530, groups:  ID, 221
##
## Fixed effects:
##               Estimate Std. Error         df t value Pr(>|t|)
## (Intercept)   6.549705   0.307229 217.553450  21.319   <2e-16 ***
## B_Clin_BMI   -0.017618   0.009996 218.596599  -1.762   0.0794 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##            (Intr)
## B_Clin_BMI -0.970
```

```
confint(model_BMIimprove)
```

```
## Computing profile confidence intervals ...
```

```
##                   2.5 %      97.5 %
## .sig01       0.95483504 1.173896041
## .sigma       1.41600771 1.477091251
## (Intercept)  5.94756133 7.151656409
## B_Clin_BMI  -0.03720348 0.001974141
```

```
# All the medications below;
# separately/independently; association with perceived improivement; Univariate
# B_Med_Tramadol
model_Tramadolimprove <- lmer(GlobalImprovement ~ B_Med_Tramadol + (1|ID), data = df_new)
summary(model_Tramadolimprove)
```

```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: GlobalImprovement ~ B_Med_Tramadol + (1 | ID)
##    Data: df_new
##
## REML criterion at convergence: 16803.3
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -4.3805 -0.4434 -0.0029  0.4466  4.9618
##
## Random effects:
```

```
##  Groups   Name        Variance Std.Dev.
##  ID       (Intercept) 1.113    1.055
##  Residual             2.085    1.444
## Number of obs: 4552, groups:  ID, 222
##
## Fixed effects:
##                 Estimate Std. Error        df t value Pr(>|t|)
## (Intercept)      6.06720    0.07706 218.39971  78.738   <2e-16 ***
## B_Med_Tramadol  -0.64456    0.29501 214.59198  -2.185     0.03 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##             (Intr)
## B_Med_Trmdl -0.261
```

```
confint(model_Tramadolimprove)
```

```
## Computing profile confidence intervals ...

##                     2.5 %      97.5 %
## .sig01          0.9490154  1.16639513
## .sigma          1.4139247  1.47476718
## (Intercept)     5.9162106  6.21819605
## B_Med_Tramadol -1.2226186 -0.06639294
```

```
# B_Med_Suboxone
model_Suboxoneimprove <- lmer(GlobalImprovement ~ B_Med_Suboxone + (1|ID), data = df_new)
summary(model_Suboxoneimprove)
```

```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: GlobalImprovement ~ B_Med_Suboxone + (1 | ID)
##    Data: df_new
##
## REML criterion at convergence: 16806.8
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -4.4100 -0.4422 -0.0010  0.4347  4.9697
##
## Random effects:
##  Groups   Name        Variance Std.Dev.
##  ID       (Intercept) 1.141    1.068
##  Residual             2.085    1.444
## Number of obs: 4552, groups:  ID, 222
##
## Fixed effects:
##                 Estimate Std. Error        df t value Pr(>|t|)
## (Intercept)      6.02424    0.07589 218.40722  79.378   <2e-16 ***
## B_Med_Suboxone  -0.05481    0.56592 219.61262  -0.097    0.923
## ---
```

```
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##             (Intr)
## B_Med_Subxn -0.134
```

```
confint(model_Suboxoneimprove)
```

```
## Computing profile confidence intervals ...
```

```
##                     2.5 %   97.5 %
## .sig01          0.9609876 1.180399
## .sigma          1.4138995 1.474739
## (Intercept)     5.8755257 6.172964
## B_Med_Suboxone -1.1638748 1.054071
```

```
# B_Med_Marijuana
model_Marijuanaimprove <- lmer(GlobalImprovement ~ B_Med_Marijuana + (1|ID), data = df_new)
summary(model_Marijuanaimprove)
```

```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: GlobalImprovement ~ B_Med_Marijuana + (1 | ID)
##    Data: df_new
##
## REML criterion at convergence: 16806
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -4.4099 -0.4421 -0.0009  0.4349  4.9698
##
## Random effects:
##  Groups   Name        Variance Std.Dev.
##  ID       (Intercept) 1.140    1.068
##  Residual             2.085    1.444
## Number of obs: 4552, groups:  ID, 222
##
## Fixed effects:
##                  Estimate Std. Error        df t value Pr(>|t|)
## (Intercept)       6.02149    0.07553 218.34053  79.724   <2e-16 ***
## B_Med_Marijuana   0.19885    0.80349 227.64451   0.247    0.805
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##             (Intr)
## B_Med_Marjn -0.094
```

```
confint(model_Marijuanaimprove)
```

```
## Computing profile confidence intervals ...
```

```
##                       2.5 %   97.5 %
## .sig01           0.9608479 1.180237
## .sigma           1.4139001 1.474740
## (Intercept)      5.8734877 6.169513
## B_Med_Marijuana -1.3756156 1.773272
```

```
# B_Med_NSAIDS
model_NSAIDSimprove <- lmer(GlobalImprovement ~ B_Med_NSAIDS + (1|ID), data = df_new)
summary(model_NSAIDSimprove)
```

```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: GlobalImprovement ~ B_Med_NSAIDS + (1 | ID)
##    Data: df_new
##
## REML criterion at convergence: 16807.8
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -4.4105 -0.4427 -0.0016  0.4340  4.9685
##
## Random effects:
##  Groups   Name        Variance Std.Dev.
##  ID       (Intercept) 1.138    1.067
##  Residual             2.085    1.444
## Number of obs: 4552, groups:  ID, 222
##
## Fixed effects:
##               Estimate Std. Error        df t value Pr(>|t|)
## (Intercept)    6.03765    0.07839 218.53613  77.018   <2e-16 ***
## B_Med_NSAIDS  -0.17721    0.27499 217.56200  -0.644     0.52
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##             (Intr)
## B_Md_NSAIDS -0.285
```

```
confint(model_NSAIDSimprove)
```

```
## Computing profile confidence intervals ...
```

```
##                   2.5 %   97.5 %
## .sig01        0.9600212 1.179243
## .sigma        1.4138980 1.474737
## (Intercept)   5.8840426 6.191277
## B_Med_NSAIDS -0.7161135 0.361628
```

```
# B_Med_Anticonvulsant
model_Anticonimprove <- lmer(GlobalImprovement ~ B_Med_Anticonvulsant + (1|ID), data = df_new)
summary(model_Anticonimprove)
```

```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: GlobalImprovement ~ B_Med_Anticonvulsant + (1 | ID)
##    Data: df_new
##
## REML criterion at convergence: 16805.1
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -4.3967 -0.4454 -0.0048  0.4421  4.9595
##
## Random effects:
##  Groups   Name        Variance Std.Dev.
##  ID       (Intercept) 1.117    1.057
##  Residual             2.085    1.444
## Number of obs: 4552, groups:  ID, 222
##
## Fixed effects:
##                       Estimate Std. Error        df t value Pr(>|t|)
## (Intercept)            6.11123    0.08635 217.49113  70.775   <2e-16 ***
## B_Med_Anticonvulsant  -0.34396    0.17071 219.00087  -2.015   0.0451 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##             (Intr)
## B_Md_Antcnv -0.506
```

```
confint(model_Anticonimprove)
```

```
## Computing profile confidence intervals ...

##                            2.5 %       97.5 %
## .sig01                 0.9505424  1.168264279
## .sigma                 1.4139343  1.474778015
## (Intercept)            5.9420200  6.280433914
## B_Med_Anticonvulsant -0.6784171 -0.009370955
```

```
# B_Med_MuscleRelaxer
model_MuscleRelimprove <- lmer(GlobalImprovement ~ B_Med_MuscleRelaxer + (1|ID), data = df_new)
summary(model_MuscleRelimprove)
```

```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: GlobalImprovement ~ B_Med_MuscleRelaxer + (1 | ID)
##    Data: df_new
##
## REML criterion at convergence: 16807.5
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -4.4115 -0.4391 -0.0029  0.4405  4.9801
```

```
##
## Random effects:
##  Groups   Name        Variance Std.Dev.
##  ID       (Intercept) 1.132    1.064
##  Residual             2.085    1.444
## Number of obs: 4552, groups:  ID, 222
##
## Fixed effects:
##                       Estimate Std. Error        df t value Pr(>|t|)
## (Intercept)           6.06699    0.08328 218.74597  72.848   <2e-16 ***
## B_Med_MuscleRelaxer  -0.22996    0.19094 216.50016  -1.204     0.23
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##             (Intr)
## B_Md_MsclRl -0.436
```

```
confint(model_MuscleRelimprove)
```

```
## Computing profile confidence intervals ...

##                           2.5 %    97.5 %
## .sig01                0.9571279 1.1759473
## .sigma                1.4139180 1.4747596
## (Intercept)           5.9037877 6.2301813
## B_Med_MuscleRelaxer -0.6040729 0.1442792
```

```
# B_Med_Antidepressants
model_Antidepimprove <- lmer(GlobalImprovement ~ B_Med_Antidepressants + (1|ID), data = df_new)
summary(model_Antidepimprove)
```

```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: GlobalImprovement ~ B_Med_Antidepressants + (1 | ID)
##    Data: df_new
##
## REML criterion at convergence: 16808.5
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -4.4058 -0.4428 -0.0016  0.4339  4.9685
##
## Random effects:
##  Groups   Name        Variance Std.Dev.
##  ID       (Intercept) 1.139    1.067
##  Residual             2.085    1.444
## Number of obs: 4552, groups:  ID, 222
##
## Fixed effects:
##                         Estimate Std. Error        df t value Pr(>|t|)
## (Intercept)             6.03880    0.08141 217.81422  74.182   <2e-16 ***
```

```
## B_Med_Antidepressants  -0.10539    0.21191 220.93126  -0.497    0.619
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##             (Intr)
## B_Md_Antdpr -0.384
```

```
confint(model_Antidepimprove)
```

```
## Computing profile confidence intervals ...

##                              2.5 %    97.5 %
## .sig01                  0.9602830 1.1796099
## .sigma                  1.4139059 1.4747460
## (Intercept)             5.8792776 6.1983259
## B_Med_Antidepressants -0.5205751 0.3099154
```

```
# B_Med_Benzodiazepine
model_Benzoimprove <- lmer(GlobalImprovement ~ B_Med_Benzodiazepine + (1|ID), data = df_new)
summary(model_Benzoimprove)
```

```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: GlobalImprovement ~ B_Med_Benzodiazepine + (1 | ID)
##    Data: df_new
##
## REML criterion at convergence: 16808.2
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -4.4100 -0.4422 -0.0010  0.4348  4.9693
##
## Random effects:
##  Groups   Name        Variance Std.Dev.
##  ID       (Intercept) 1.141    1.068
##  Residual             2.085    1.444
## Number of obs: 4552, groups:  ID, 222
##
## Fixed effects:
##                       Estimate Std. Error        df t value Pr(>|t|)
## (Intercept)            6.02259    0.07847 218.53625   76.75   <2e-16 ***
## B_Med_Benzodiazepine   0.00818    0.27512 217.28816    0.03    0.976
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##             (Intr)
## B_Md_Bnzdzp -0.285
```

```r
confint(model_Benzoimprove)
```

```
## Computing profile confidence intervals ...

##                             2.5 %    97.5 %
## .sig01                 0.9610017 1.1804179
## .sigma                 1.4138998 1.4747392
## (Intercept)            5.8688229 6.1763525
## B_Med_Benzodiazepine -0.5308821 0.5473554
```

```r
# B_Med_Stimulants
model_Stimuimprove <- lmer(GlobalImprovement ~ B_Med_Stimulants + (1|ID), data = df_new)
summary(model_Stimuimprove)
```

```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: GlobalImprovement ~ B_Med_Stimulants + (1 | ID)
##    Data: df_new
##
## REML criterion at convergence: 16804.8
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -4.4087 -0.4413 -0.0004  0.4352  4.9687
##
## Random effects:
##  Groups   Name        Variance Std.Dev.
##  ID       (Intercept) 1.130    1.063
##  Residual             2.085    1.444
## Number of obs: 4552, groups:  ID, 222
##
## Fixed effects:
##                    Estimate Std. Error        df t value Pr(>|t|)
## (Intercept)         6.00902    0.07556 218.44470  79.524   <2e-16 ***
## B_Med_Stimulants    0.78498    0.56133 216.51366   1.398    0.163
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##             (Intr)
## B_Md_Stmlnt -0.135
```

```r
confint(model_Stimuimprove)
```

```
## Computing profile confidence intervals ...

##                        2.5 %   97.5 %
## .sig01             0.9562009 1.174741
## .sigma             1.4139019 1.474741
## (Intercept)        5.8609556 6.157096
## B_Med_Stimulants -0.3149942 1.884988
```

```r
# B_Med_OtherMed
model_OtherMedimprove <- lmer(GlobalImprovement ~ B_Med_OtherMed + (1|ID), data = df_new)
summary(model_OtherMedimprove)
```

```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: GlobalImprovement ~ B_Med_OtherMed + (1 | ID)
##    Data: df_new
##
## REML criterion at convergence: 16738.4
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -4.4002 -0.4395 -0.0022  0.4316  4.9531
##
## Random effects:
##  Groups   Name        Variance Std.Dev.
##  ID       (Intercept) 1.131    1.063
##  Residual             2.094    1.447
## Number of obs: 4528, groups:  ID, 221
##
## Fixed effects:
##                 Estimate Std. Error        df t value Pr(>|t|)
## (Intercept)      6.05563    0.07744 218.03753   78.20   <2e-16 ***
## B_Med_OtherMed  -0.53378    0.31773 213.76851   -1.68   0.0944 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##             (Intr)
## B_Md_OthrMd -0.244
```

```r
confint(model_OtherMedimprove)
```

```
## Computing profile confidence intervals ...
```

```
##                    2.5 %     97.5 %
## .sig01          0.956518 1.17558861
## .sigma          1.417199 1.47834351
## (Intercept)     5.903905 6.20738424
## B_Med_OtherMed -1.156587 0.08870723
```

```r
# B_Med_OTC
model_OTCimprove <- lmer(GlobalImprovement ~ B_Med_OTC + (1|ID), data = df_new)
summary(model_OTCimprove)
```

```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: GlobalImprovement ~ B_Med_OTC + (1 | ID)
##    Data: df_new
##
```

```
## REML criterion at convergence: 16808.1
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -4.4053 -0.4394  0.0028  0.4369  4.9746
##
## Random effects:
##  Groups   Name        Variance Std.Dev.
##  ID       (Intercept) 1.134    1.065
##  Residual             2.084    1.444
## Number of obs: 4552, groups:  ID, 222
##
## Fixed effects:
##             Estimate Std. Error       df t value Pr(>|t|)
## (Intercept)   5.9290     0.1113 219.0857  53.284   <2e-16 ***
## B_Med_OTC     0.1726     0.1506 218.5990   1.146    0.253
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##           (Intr)
## B_Med_OTC -0.739
```

```
confint(model_OTCimprove)
```

```
## Computing profile confidence intervals ...

##                  2.5 %    97.5 %
## .sig01       0.9579311 1.1767401
## .sigma       1.4138921 1.4747306
## (Intercept)  5.7109624 6.1470576
## B_Med_OTC   -0.1224755 0.4678271
```

```
# B_Med_OpioidsYN
model_Opioid_improve <- lmer(GlobalImprovement ~ B_Med_OpioidsYN + (1|ID), data = df_new)
summary(model_Opioid_improve)
```

```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: GlobalImprovement ~ B_Med_OpioidsYN + (1 | ID)
##    Data: df_new
##
## REML criterion at convergence: 16796.7
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -4.3877 -0.4486 -0.0084  0.4470  4.9455
##
## Random effects:
##  Groups   Name        Variance Std.Dev.
##  ID       (Intercept) 1.074    1.036
##  Residual             2.084    1.444
```

```
## Number of obs: 4552, groups:  ID, 222
##
## Fixed effects:
##                  Estimate Std. Error        df t value Pr(>|t|)
## (Intercept)       6.20058    0.08827 217.86764  70.247  < 2e-16 ***
## B_Med_OpioidsYN  -0.56716    0.15783 221.19294  -3.593 0.000402 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##             (Intr)
## B_Md_OpdsYN -0.559
```

```
confint(model_Opioid_improve)
```

```
## Computing profile confidence intervals ...

##                      2.5 %     97.5 %
## .sig01           0.9320611  1.1456483
## .sigma           1.4138145  1.4746427
## (Intercept)      6.0276537  6.3736066
## B_Med_OpioidsYN -0.8765529 -0.2579604
```

```
# Test if any of the baseline (Lev2) psych variables are linked to perceived improvements; Univariate
# B_Psych_PCS"
model_PCSimprove <- lmer(GlobalImprovement ~ B_Psych_PCS + (1|ID), data = df_new)
summary(model_PCSimprove)
```

```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: GlobalImprovement ~ B_Psych_PCS + (1 | ID)
##    Data: df_new
##
## REML criterion at convergence: 16794.9
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -4.4284 -0.4347 -0.0002  0.4339  4.9977
##
## Random effects:
##  Groups   Name        Variance Std.Dev.
##  ID       (Intercept) 1.027    1.013
##  Residual             2.084    1.444
## Number of obs: 4552, groups:  ID, 222
##
## Fixed effects:
##               Estimate Std. Error         df t value Pr(>|t|)
## (Intercept)   6.522346   0.128253 219.069009  50.855  < 2e-16 ***
## B_Psych_PCS  -0.025840   0.005504 220.087865  -4.695 4.69e-06 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
```

```
## Correlation of Fixed Effects:
##             (Intr)
## B_Psych_PCS -0.829
```

```
confint(model_PCSimprove)
```

```
## Computing profile confidence intervals ...
```

```
##                    2.5 %      97.5 %
## .sig01       0.91090586  1.12099293
## .sigma       1.41387693  1.47471229
## (Intercept)  6.27105135  6.77370231
## B_Psych_PCS -0.03662589 -0.01505529
```

```
# B_Psych_HADS"
model_HADSimprove <- lmer(GlobalImprovement ~ B_Psych_HADS + (1|ID), data = df_new)
summary(model_HADSimprove)
```

```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: GlobalImprovement ~ B_Psych_HADS + (1 | ID)
##    Data: df_new
##
## REML criterion at convergence: 16799
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -4.4170 -0.4304 -0.0055  0.4386  4.9812
##
## Random effects:
##  Groups   Name        Variance Std.Dev.
##  ID       (Intercept) 1.055    1.027
##  Residual             2.084    1.444
## Number of obs: 4552, groups:  ID, 222
##
## Fixed effects:
##                Estimate Std. Error         df t value Pr(>|t|)
## (Intercept)    6.587636   0.156523 219.009063   42.09  < 2e-16 ***
## B_Psych_HADS  -0.035892   0.008818 219.764835   -4.07 6.55e-05 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##             (Intr)
## B_Psyc_HADS -0.886
```

```
confint(model_HADSimprove)
```

```
## Computing profile confidence intervals ...
```

```
##                     2.5 %      97.5 %
```

```
## .sig01        0.92341224  1.13559144
## .sigma        1.41384078  1.47467228
## (Intercept)   6.28098471  6.89443548
## B_Psych_HADS -0.05317654 -0.01861603
```