PUSH data correlation models

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Introduction

The main goals of this exploratory analysis are to:

1. Create a single data set that merges daily data with individual survey level data.
2. Examine bivariate correlations between the identified sleep variables (e.g. average sleep time, etc.), the covariates (e.g. age, sex, etc.), and the environmental variables (COI index, P_COHESION, etc.).
3. Create models for dependent variables of interest with independent variables that represent neighborhood factors, family factors, and sleep environment characteristics.

```
library(corrplot)
library(tidyverse)
library(lme4)
library(easystats)
library(lubridate)

# push_wide <- read_csv("./data/PUSH_actigraph_geo_wide_8.7.25.csv")
# push_long <- read_csv("./data/PUSH_long_geo.csv")
push_wide <- read_csv("PUSH_actigraph_geo_wide_8.7.25.csv")
push_long <- read_csv("PUSH_long_geo.csv")
```

Merging long and wide data sets

For the PUSH data, there is a wide dataset with all the survey information for the participants of the study. The long dataset has day-by-day data for metrics from each night of sleep for the participants. These datasets were merged into a single dataset. The merged file is named "PUSH_Sleep_merged.csv". This file contained 204 rows and 1179 columns. There are 29 unique participant IDs all of whom have either 6, 7, or 8 measured days with the majority (20 out of 29) having 7 days measured.

```r
# Perform a left join
all <- left_join(push_long, push_wide, by = "ParticipantID")
dim(all)
```

```
[1]  204 1179
```

```r
all %>% group_by(ParticipantID) %>% summarize(days = n())
```

```
# A tibble: 29 x 2
   ParticipantID  days
   <chr>         <int>
 1 PUSH_102          6
 2 PUSH_104          6
 3 PUSH_105          8
 4 PUSH_106          8
 5 PUSH_107          7
 6 PUSH_110          7
 7 PUSH_112          7
 8 PUSH_113          8
 9 PUSH_114          7
10 PUSH_116          8
# i 19 more rows
```

```r
all %>% group_by(ParticipantID) %>% summarize(days = n()) %>% ungroup() %>% group_by(days) %
```

```
# A tibble: 3 x 2
   days     n
  <int> <int>
1     6     4
2     7    20
3     8     5
```

```r
#Output all
#write.csv(all, file = "/Users/gregorymatthews/Dropbox/PUSH-Sleep_git/data/PUSH_Sleep_merged
```

Exploratory Data Analysis

We began by observing the distribution of the independent variables of interest (dependent variable distributions are observed with their models below).

```
vars <- all %>% select(ParticipantID, StudyDay, C_ACTI_Date,
                           # dependent vars
                           C_ACTI_SleepTime,
                           C_ACTI_WT_DEC,
                           C_ACTI_SOL,
                           C_ACTI_SleepOnsetTime_TRM,
                           C_ACTI_Efficiency,
                           C_ACTI_Waso,
                           C_ACTI_SleepTime_sd,
                           C_ACTI_WakeTime_sd,
                           C_ACTI_SleepTime_sd,
                           # covariates
                           c_demo_8_v2,
                           c_demo_6_v2,
                           C_DD_PM_DayType,
                           #fixed effects
                           geo_COI_3.0,
                           geo_COI_ED_3.0,
                           geo_COI_HE_3.0,
                           geo_COI_SE_3.0,
                           P_COHESION,
                           C_MESA_FT,
                           C_MESA_ES,
                           C_CHAOS,
                           c_se_12_v2,
                           c_se_8_v2,
                           c_se_11_v2) %>%
  mutate(c_demo_8_v2 = as.factor(c_demo_8_v2),
         C_DD_PM_DayType = as.factor(C_DD_PM_DayType),
         c_se_12_v2 = as.factor(c_se_12_v2),
         c_se_8_v2 = as.factor(c_se_8_v2),
         c_se_11_v2 = as.factor(c_se_11_v2))
```

Covariates

Because the datasets are merged, each row represents a recorded study day. The covariates, which are the same for an individual throughout the study, are not a count of the individuals,

but rather a count of the number of study days.

Looking at the covariates, there are more study days recorded for females (139) than for males (65).

For grade in school, there are 49 recorded days for 8th graders, 55 for 9th graders, 50 for 10th graders, 21 for 11th graders, and 7 for 12th graders (likely one individual). There are also 8 observations with "7" as the level for this variable, which is not a valid level in the data dictionary. This individual is 13 years old, which is likely a 7th or 8th grader, so this observation was adjusted to level 1. The levels were renamed to match the grade (1 turns into 8 to indicate 8th grade, 2 into 9, etc.).

More study days were recorded in the summer (86) than during the academic school year (76).

We also created a variable to indicate whether the day was a Friday or Saturday night (called weekend).

```
# c_demo_8_v2 -- Biological Sex
# MALE (1), FEMALE (2), DON'T KNOW (3), PREFER NOT TO ANSWER (4)
table(vars$c_demo_8_v2, useNA = "always")
```

```
   1    2 <NA>
  65  139    0
```

```
# c_demo_6_v2 -- Grade in School
# 8th (1), 9th (2), 10th (3), 11th (4), 12th (5)
table(vars$c_demo_6_v2, useNA = "always")
```

```
   1    2    3    4    5    7 <NA>
  49   55   50   21    7    8   14
```

```
all %>% filter(c_demo_6_v2 == 7) %>% select(c_demo_6_v2, c_demo_2_v2)
```

```
# A tibble: 8 x 2
  c_demo_6_v2 c_demo_2_v2
        <dbl>       <dbl>
1           7          13
2           7          13
3           7          13
```

```
4           7          13
5           7          13
6           7          13
7           7          13
8           7          13
```

```
model <- vars %>% mutate(c_demo_6_v2 = case_when(
  c_demo_6_v2 == 1 ~ 8,
  c_demo_6_v2 == 2 ~ 9,
  c_demo_6_v2 == 3 ~ 10,
  c_demo_6_v2 == 4 ~ 11,
  c_demo_6_v2 == 5 ~ 12,
  c_demo_6_v2 == 7 ~ 8))
table(model$c_demo_6_v2, useNA = "always")
```

```
   8    9   10   11   12 <NA>
  57   55   50   21    7   14
```

```
# C_DD_PM_DayType -- School or Summer
# Summer (0), Academic School Year (1)
table(model$C_DD_PM_DayType)
```

```
 0  1
86 76
```

```
# add weekend variable
  # weekend = Friday or Saturday night
models <- model %>% mutate(weekday = wday(model$C_ACTI_Date, label = TRUE),
                           weekend =
                             case_when(weekday == 'Fri' | weekday == 'Sat' ~ 1,
                                       .default = 0))
```

Sleep Environment Variables

The three sleep environment variables are sleep disruptions, sleep quiet, and sleep dark. Notably, sleep dark is true for all individuals except for one. Because only one person does not have a dark sleep environment, this variable cannot be used in the models.

```
# c_se_12_v2 -- sleep disruptions
# YES (1), NO (2)
table(models$c_se_12_v2, useNA = "always")
```

```
   1    2 <NA>
  28  168    8
```

```
# c_se_8_v2 -- sleep quiet
# YES (1), NO (2)
table(models$c_se_8_v2, useNA = "always")
```

```
   1    2 <NA>
 175   29    0
```

```
# # c_se_11_v2 -- sleep dark
# YES (1), NO (2)
table(models$c_se_11_v2, useNA = "always")
```

```
   1    2 <NA>
 182    7   15
```

Correlation Matrix

A correlation matrix was created for the variables of interest (dependent variables, covariates, and fixed effects). On the correlation matrix, darker colors (blue for positive; red for negative correlation) and bigger squares mean a stronger correlation. The area of the correlation matrix of most interest is the upper right most rectangle indicating correlations between the sleep variables (labeled "dependent variables") and the environment variables (labeled "fixed effects").

Variables of interest

DVs (sleep variables with models run for each sleep DV):

Sleep Variables [weekly level]-

1. Duration (C_ACTI_SleepTimeAvg)
2. Timing

- offset/waketime (C_ACTI_WTmean)
- onset/falling asleep (C_ACTI_SleepOnsetTime_mean)

3. Quality

- efficiency (C_ACTI_EfficiencyAvg)
- awakenings (C_ACTI_WasoAvg)

4. Variability

- Duration (C_ACTI_SleepTime_sd)
- Timing
- offset/waketime (C_ACTI_WTsd)
- onset/falling asleep (C_ACTI_SleepOnsetTime_sd)

Covariates:

1. Sex (c_demo_8_v2)
2. Age (c_demo_2_v2)
3. Grade in School (c_demo_6_v2)
4. Caregiver Highest Education (parent 1: p_demo_26_v2; parent 2: p_demo_27_v2)
5. School Year/Summer (C_DD_PM_DayType)

- Note that this is only for Daily Diary
- Needs to be calculated for Actigraphy (Use Date: C_ACTI_Date)

Fixed Effects:

Neighborhood Factors

1. COI Total (geo_COI_3.0)
2. COI Domains (3)

- Education (geo_COI_ED_3.0)
- Health & Environment (geo_COI_HE_3.0)
- Social & Economic (geo_COI_SE_3.0)

Family Factors

1. Family Cohesion Subscale [higher = more cohesion]

- Parent report (P_COHESION)
- Child report (C_COHESION; individual items are named frm)

2. MESA

- MESA Family Trouble Subscale [score is event count; higher=more family trouble events] (C_MESA_FT)
- MESA Economic Stress Subscale [score is event count; higher=more econ stress events] (C_MESA_ES)

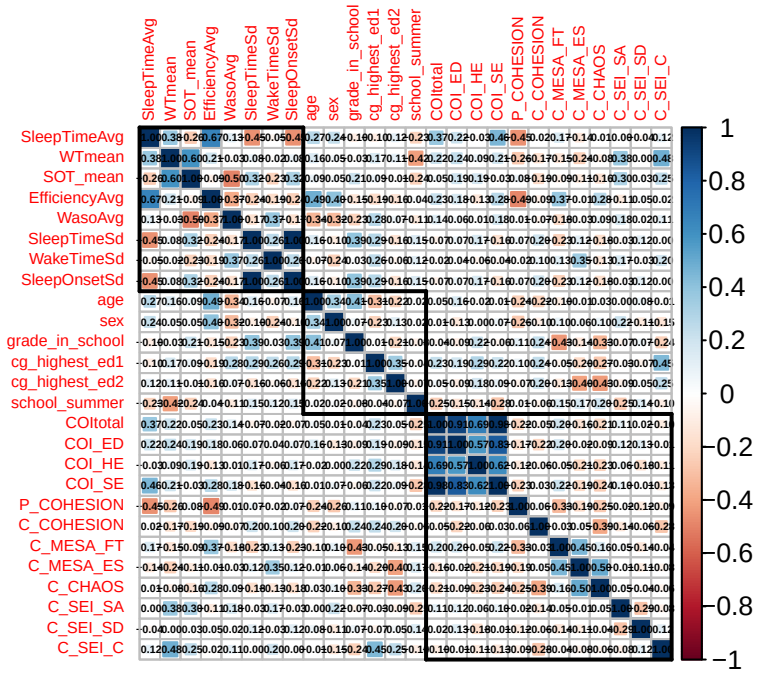
3. Adol CHAOS Subscale [higher=more chaos] (C_CHAOS)

Sleep Environment Inventory

1. SEI Sleep Aids Subscale [interpret so that higher score reflects more sleep aids] (C_SEI_SA)
2. SEI Sleep Disturbances Subscale [interpret so that higher score means less disturbance] (C_SEI_SD)
3. SEI Comfort Subscale [interpret so that higher score means more comfortable environment] (C_SEI_C)

```
all %>%
  select(
    SleepTimeAvg = C1_ACTI_SL_SleepTimeAvg,
    WTmean = C1_ACTI_WTmean,
    SOT_mean = C1_ACTI_SleepOnsetTime_mean,
    EfficiencyAvg = C1_ACTI_SL_EfficiencyAvg,
    WasoAvg = C1_ACTI_SL_WasoAvg,
    SleepTimeSd = C1_ACTI_SL_SleepTimeSd,
    WakeTimeSd = C1_ACTI_SL_WakeTimeSd,
    SleepOnsetSd = C1_ACTI_SL_SleepTimeSd,
    age = c_demo_2_v2,
    sex = c_demo_8_v2,
    grade_in_school = c_demo_6_v2,
    cg_highest_ed1 = p_demo_26_v2,
    cg_highest_ed2 = p_demo_27_v2,
    school_summer = C_DD_PM_DayType,
    COItotal = geo_COI_3.0,
```

```
    COI_ED = geo_COI_ED_3.0,
    COI_HE = geo_COI_HE_3.0,
    COI_SE = geo_COI_SE_3.0,
    P_COHESION,
    C_COHESION,
    C_MESA_FT,
    C_MESA_ES,
    C_CHAOS,
    C_SEI_SA,
    C_SEI_SD,
    C_SEI_C
  ) %>% cor(use = "pairwise.complete.obs") %>% corrplot(method = "square", tl.cex = 0.5, add
```



Notably, there is a moderate positive correlation between average sleep time and COI total and COI Social and Economic. There is a moderate negative correlation between average sleep time and parent report of family cohesion.

There is a moderate positive correlation between mean wake time and SEI Sleep Aids Subscale. Mean wake time does not have a significant negative correlation with any environmental variables.

Falling asleep time has a moderate positive correlation with SEI Sleep Aids Subscale, but no significant negative correlations with another variable.

Average efficiency has a moderate positive correlation with MESA Family Trouble Subscale and a moderate negative correlation with parent report of family cohesion.

Wake time standard deviation has a moderate positive correlation with MESA Economic Stress Subscale, but it does not have a significant negative correlation with any environmental variables.

Awakenings quality (WASO), sleep duration standard deviation, and sleep onset time standard deviation do not have any significant correlations with environmental variables.

Models

We are interested in 8 dependent variables: sleep duration, offset/waketime, onset/falling asleep time, efficiency, duration variability, offset variation, and onset variation. There are 3 models for each dependent variable. The first model includes neighborhood factors (COI domains), the second model includes family factors (family cohesion, MESA variables, and CHAOS), and the third model includes sleep environment characteristics (number of sleep disruptions and if the environment was quiet). Originally, the third model was to also include if the environment was dark, but only one individual had a light environment, so this variable is not usable in the model.

Each model also includes covariates: sex, grade, whether the study day was during the school year or summer, and whether the study day was a weekend (Friday or Saturday night). The levels in the grade in school variable were renamed to reflect the number of the grade. An individual also had grade level 7, which was not defined on the scale. Because the individual was 13, we put them into grade level 1, which is 8th grade.

Model Analysis Summary

The models that had residual/homoskedascity plots that did not meet assumptions were transformed using a log transformation. The untransformed and transformed models were compared using AIC, and the model with the lower AIC is the final model. After the models were made, we identified significant variables. Below is a summary list of all the models with their significant variables (if any) and whether a transformation was used.

1. Duration (C_ACTI_SleepTime)

- no tranformation

i. None (only COI total in model 1)
ii. None

2. Offset/Waketime (C_ACTI_WT_DEC)

- no transformation

i. None
ii. P_COHESION has a negative coefficient (-0.7401, CI: -1.458, -0.042)

3. Onset/Falling Asleep (Time from laying down to falling sleep) (C_ACTI_SOL)

- log transformation for both models

i. None
ii. None

4. Onset/Falling Asleep (Fell Asleep Time) (C_ACTI_SleepOnsetTime_TRM)

- no log transformation

i. None
ii. None

5. Efficiency (C_ACTI_Efficiency)

- no log transformation

i. None
ii. C_MESA_FT has positive coefficient (1.0892, CI: 0.3695, 1.8128). C_MESA_ES has a negative coefficient (-2.555, CI: -4.937, -0.1739)

6. Duration Variability (C_ACTI_SleepTime_sd)

- no log transformation

i. None
ii. MESA_ES has positive coefficient (23.173, CI: 1.599, 44.747)

7. Offset Variability (C_ACTI_WakeTime_sd)

- no log transformation (but could do it)

i. None
ii. C_MESA_ES has positive coefficient (11.39, CI: 6.074, 16.706). CHAOS has a negative coefficient (-11.972, CI: -20.200, -3.745).

8. Onset Variability (C_ACTI_SleepOnsetTime_TRM)

- no log transformation (but could do it)

i. None
ii. MESA_ES has positive coefficient (1.4751, CI: 0.7138, 2.2364). CHAOS has a negative coefficient (-1.6486, CI: -2.8269, -0.4703).

Changes 9/2

- take out model 3
- take out awakenings model
- take out daytype (school/summer) covariate in each model
- do coi total in model 1
- write up what actually exists

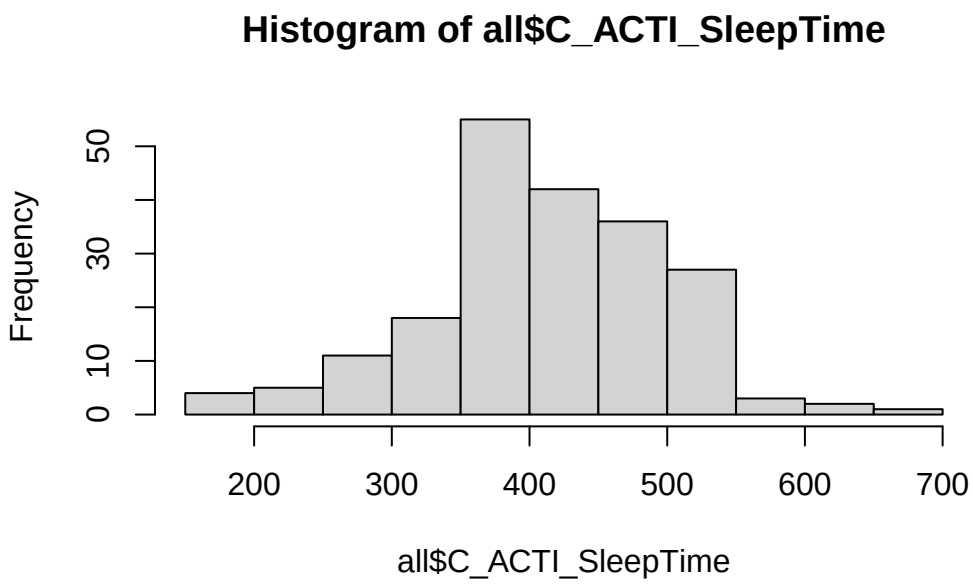
Model Code

BASIC MODEL: includes c_demo_8_v2 + c_demo_6_v2 + C_DD_PM_DayType + weekend

Daily Variables

Duration (C_ACTI_SleepTime)

```
hist(all$C_ACTI_SleepTime)
```




```
summary(all$C_ACTI_SleepTime)
```

```
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
  158.0   362.8   413.0   412.4   475.0   676.0
```

```
################################
#Model 1: Neighborhood Factors
################################
mod1_duration <- lmer(C_ACTI_SleepTime ~ c_demo_8_v2 + c_demo_6_v2 + weekend + geo_COI_3.0 +
summary(mod1_duration)
```

```
Linear mixed model fit by REML ['lmerMod']
Formula:
C_ACTI_SleepTime ~ c_demo_8_v2 + c_demo_6_v2 + weekend + geo_COI_3.0 +
    (1 | ParticipantID)
   Data: models

REML criterion at convergence: 2022.5

Scaled residuals:
     Min       1Q   Median       3Q      Max
-2.32093 -0.67290  0.01013  0.54558  3.00825

Random effects:
 Groups        Name        Variance Std.Dev.
 ParticipantID (Intercept) 2236     47.28
 Residual                  5596     74.81
Number of obs: 177, groups:  ParticipantID, 25

Fixed effects:
             Estimate Std. Error t value
(Intercept)   302.027     95.897   3.149
c_demo_8_v22   13.440     25.719   0.523
c_demo_6_v2     8.396     10.597   0.792
weekend        46.779     12.931   3.617
geo_COI_3.0    23.258     16.268   1.430

Correlation of Fixed Effects:
            (Intr) c__8_2 c__6_2 weeknd
c_dem_8_v22  0.129
c_demo_6_v2 -0.975 -0.308
weekend     -0.040  0.015  0.004
geo_COI_3.0  0.033 -0.032 -0.082 -0.050
```

```
ci <- confint(mod1_duration)
```

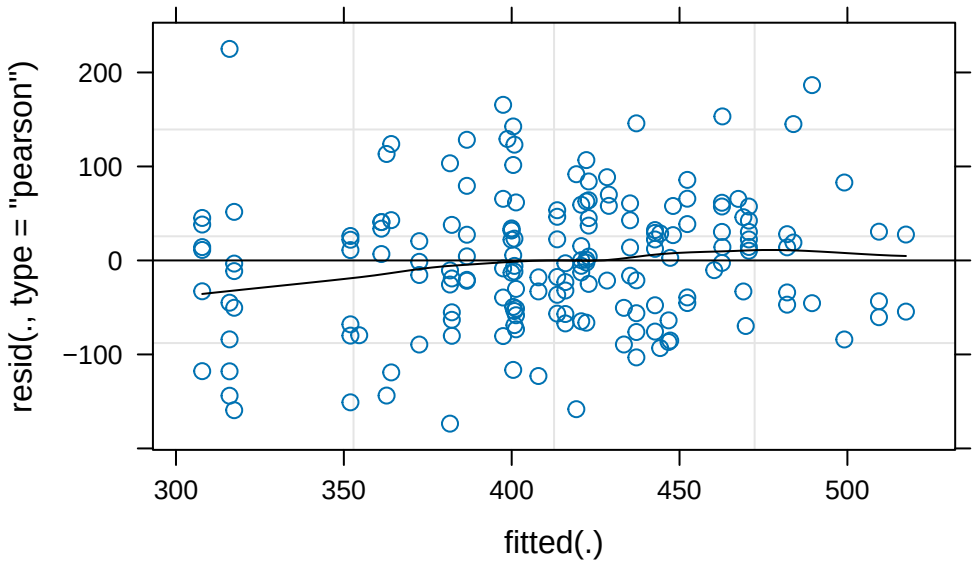
```
Computing profile confidence intervals ...
```

```
print(ci)
```

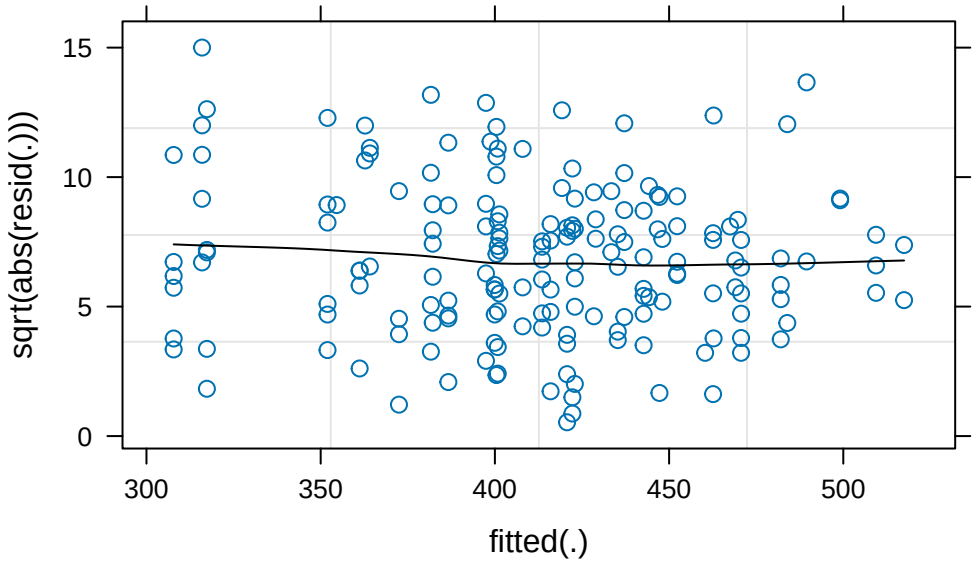
```
                2.5 %    97.5 %
.sig01        26.902556  62.42684
```

```
.sigma         66.907814  83.79323
(Intercept)   122.959115 481.07421
c_demo_8_v22  -34.576385  61.46286
c_demo_6_v2   -11.390395  28.18430
weekend        21.310873  72.08986
geo_COI_3.0    -7.111551  53.64448
```

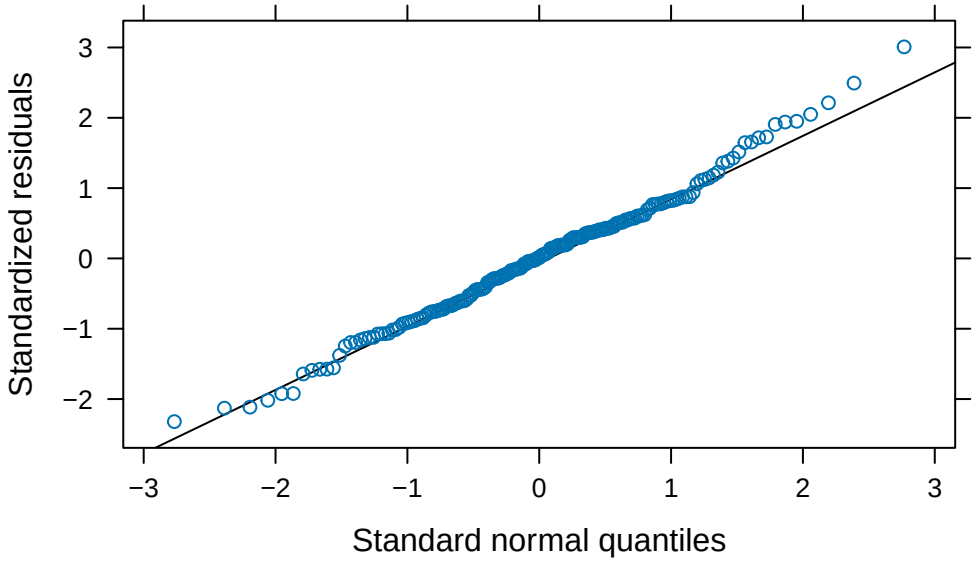
```
plot(mod1_duration, type=c("p","smooth"), col.line=1)
```




```
plot(mod1_duration,
     sqrt(abs(resid(.)))~fitted(.),
     type=c("p","smooth"), col.line=1)
```




```
lattice::qqmath(mod1_duration)
```



```r
################################
#Model 2: Family Factors
################################
mod2_duration <- lmer(C_ACTI_SleepTime ~ c_demo_8_v2 + c_demo_6_v2 + weekend + P_COHESION + C
summary(mod2_duration)
```

```
Linear mixed model fit by REML ['lmerMod']
Formula: C_ACTI_SleepTime ~ c_demo_8_v2 + c_demo_6_v2 + weekend + P_COHESION +
    C_MESA_FT + C_MESA_ES + C_CHAOS + (1 | ParticipantID)
   Data: models

REML criterion at convergence: 1973.1

Scaled residuals:
     Min       1Q   Median       3Q      Max
-2.25166 -0.68597  0.06918  0.55904  3.02176

Random effects:
 Groups        Name        Variance Std.Dev.
 ParticipantID (Intercept) 2167     46.55
 Residual                  5517     74.28
Number of obs: 175, groups:  ParticipantID, 25

Fixed effects:
             Estimate Std. Error t value
(Intercept)   459.580    192.275   2.390
c_demo_8_v22    0.387     25.091   0.015
c_demo_6_v2     8.256     11.607   0.711
weekend        45.022     13.089   3.440
P_COHESION    -36.489     24.637  -1.481
C_MESA_FT       4.647      5.263   0.883
C_MESA_ES     -16.224     17.270  -0.939
C_CHAOS         2.703     22.260   0.121

Correlation of Fixed Effects:
            (Intr) c__8_2 c__6_2 weeknd P_COHE C_MESA_F C_MESA_E
c_dem_8_v22  0.051
c_demo_6_v2 -0.696 -0.362
weekend     -0.043  0.018  0.002
P_COHESION  -0.809  0.128  0.231  0.018
C_MESA_FT   -0.526 -0.137  0.345  0.004  0.376
C_MESA_ES    0.329 -0.023 -0.020 -0.032 -0.266 -0.444
```

```
C_CHAOS      -0.487   0.041   0.039   0.053   0.353   0.214   -0.617
```

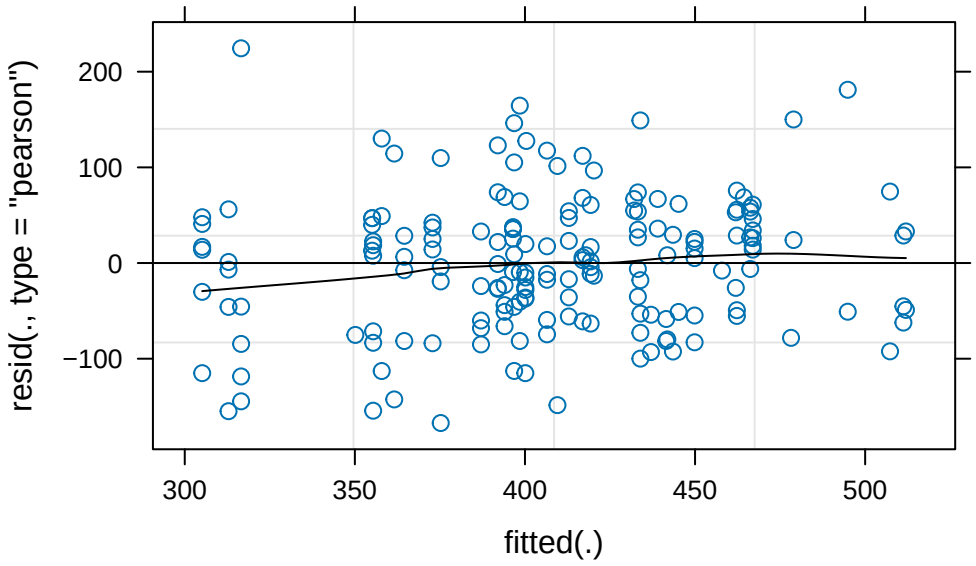
```
ci <- confint(mod2_duration)
```

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

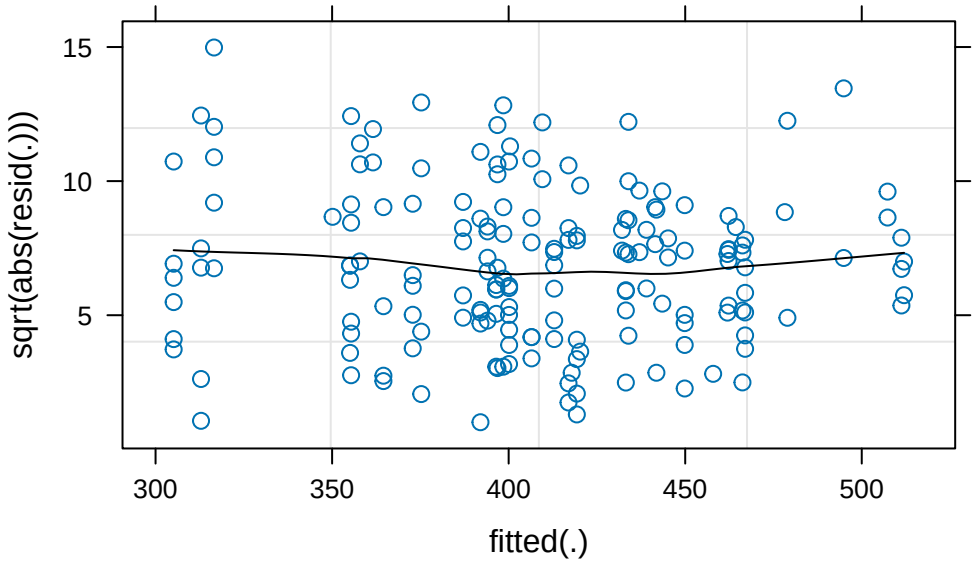
```
print(ci)
```

```
                   2.5 %     97.5 %
.sig01         22.012360  56.083888
.sigma         66.366658  83.221124
(Intercept)   126.412169 792.320527
c_demo_8_v22  -42.971213  43.875241
c_demo_6_v2   -11.818131  28.373160
weekend        19.359631  70.707117
P_COHESION    -79.171636   6.169231
C_MESA_FT      -4.451489  13.773819
C_MESA_ES     -46.216544  13.699541
C_CHAOS       -35.844663  41.277174
```

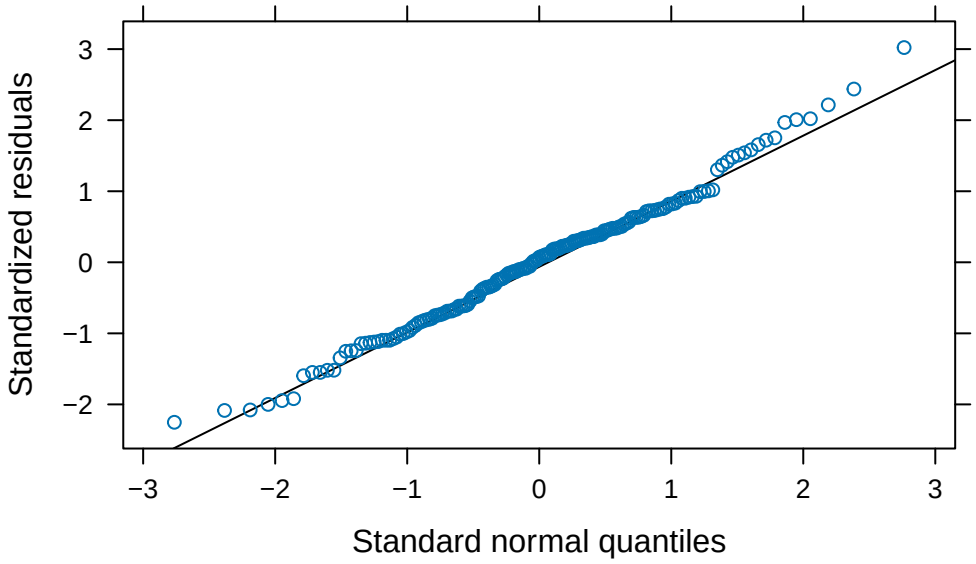
```
plot(mod2_duration, type=c("p","smooth"), col.line=1)
```



```
plot(mod2_duration,
     sqrt(abs(resid(.)))~fitted(.),
     type=c("p","smooth"), col.line=1)
```

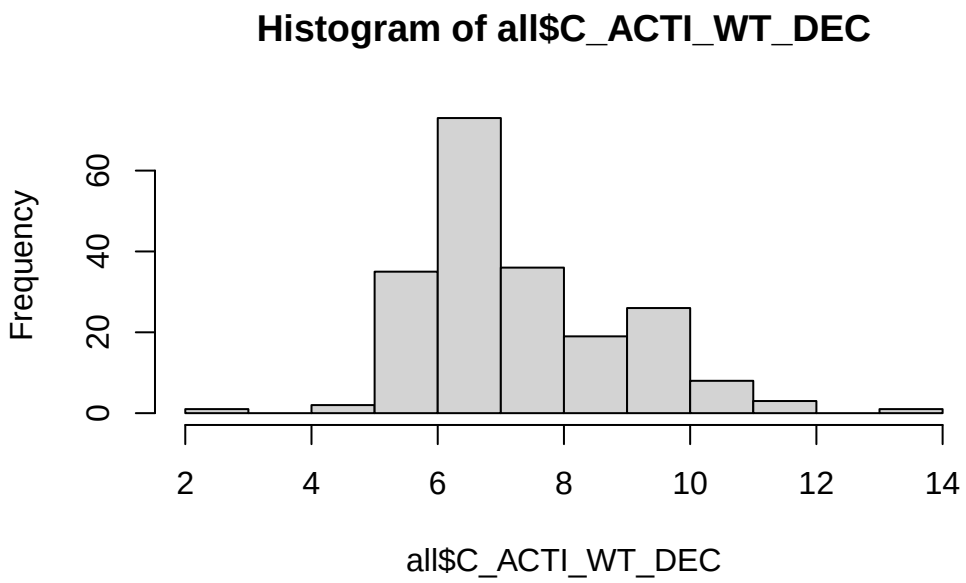



```
lattice::qqmath(mod2_duration)
```


Standardized residuals
3
2
1
0
−1
−2
−3
−2
−1
0
1
2
3
Standard normal quantiles

Offset/Wake Time (C_ACTI_WT_DEC)

```
hist(all$C_ACTI_WT_DEC)
```




```
summary(all$C_ACTI_WT_DEC)
```

```
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
  2.320   6.230   6.840   7.332   8.390  13.120
```

```
################################
#Model 1: Neighborhood Factors
################################
mod1_offset <- lmer(C_ACTI_WT_DEC ~ c_demo_8_v2 + c_demo_6_v2 + weekend + geo_COI_3.0 + (1|Pa
summary(mod1_offset)
```

```
Linear mixed model fit by REML ['lmerMod']
Formula: C_ACTI_WT_DEC ~ c_demo_8_v2 + c_demo_6_v2 + weekend + geo_COI_3.0 +
    (1 | ParticipantID)
   Data: models
```

```
REML criterion at convergence: 634.3

Scaled residuals:
    Min      1Q  Median      3Q     Max
-2.8196 -0.5272 -0.1479  0.3931  4.4951

Random effects:
 Groups        Name        Variance Std.Dev.
 ParticipantID (Intercept) 0.6074   0.7793
 Residual                  1.7724   1.3313
Number of obs: 177, groups:  ParticipantID, 25

Fixed effects:
             Estimate Std. Error t value
(Intercept)   5.75811    1.61455   3.566
c_demo_8_v22 -0.19968    0.43287  -0.461
c_demo_6_v2   0.14901    0.17842   0.835
weekend       1.45117    0.22997   6.310
geo_COI_3.0   0.05533    0.27400   0.202

Correlation of Fixed Effects:
            (Intr) c__8_2 c__6_2 weeknd
c_dem_8_v22  0.129
c_demo_6_v2 -0.975 -0.308
weekend     -0.042  0.016  0.004
geo_COI_3.0  0.034 -0.033 -0.082 -0.052
```

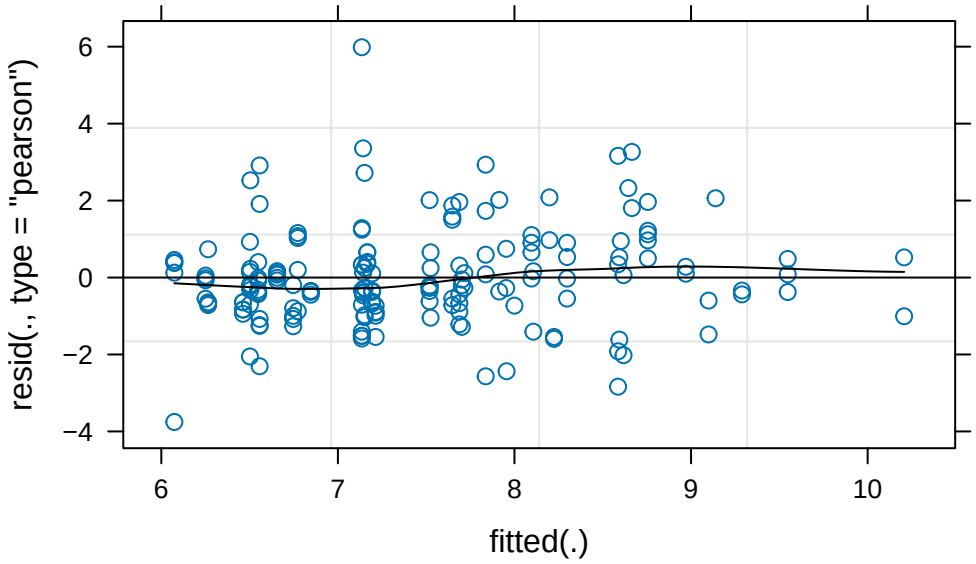
```
ci <- confint(mod1_offset)
```

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

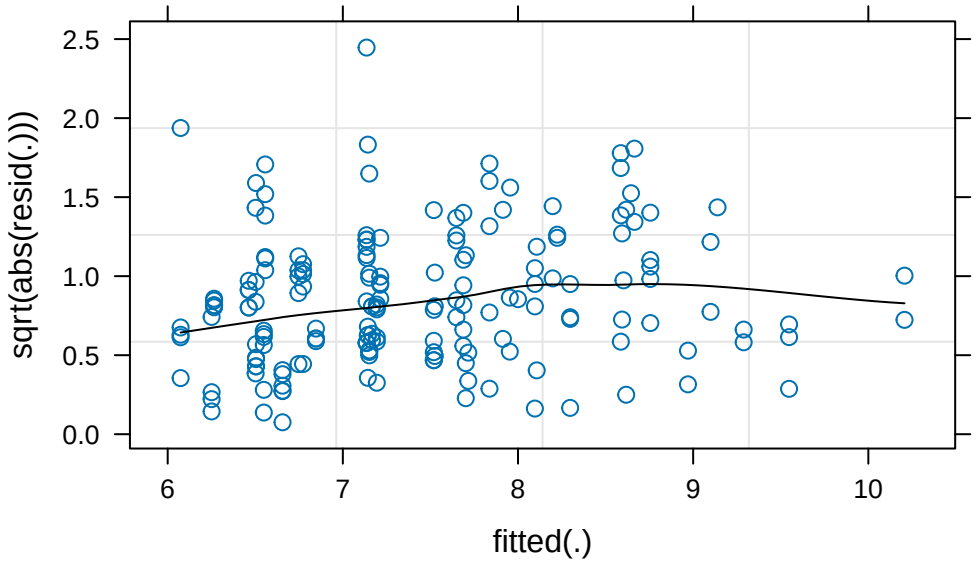
```
print(ci)
```

```
                  2.5 %    97.5 %
.sig01        0.4196132 1.0388267
.sigma        1.1907590 1.4914006
(Intercept)   2.7440324 8.7719182
c_demo_8_v22 -1.0076519 0.6083926
c_demo_6_v2  -0.1840368 0.4820764
weekend       0.9992204 1.9021161
geo_COI_3.0  -0.4561907 0.5668449
```

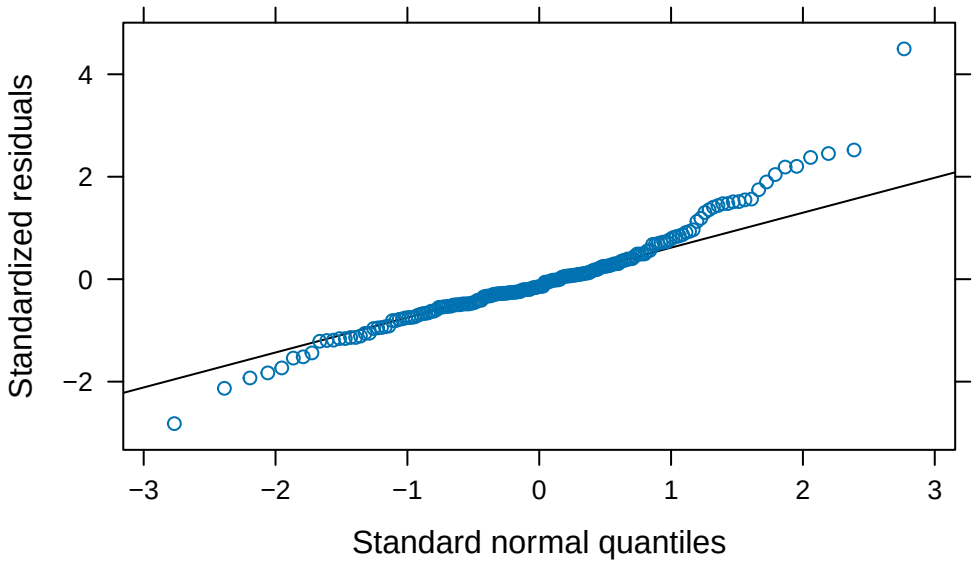
```
plot(mod1_offset, type=c("p","smooth"), col.line=1)
```




```
plot(mod1_offset,
     sqrt(abs(resid(.)))~fitted(.),
     type=c("p","smooth"), col.line=1)
```




```
lattice::qqmath(mod1_offset)
```



```r
################################
#Model 2: Family Factors
################################
mod2_offset <- lmer(C_ACTI_WT_DEC ~ c_demo_8_v2 + c_demo_6_v2 + weekend + P_COHESION + C_MES
summary(mod2_offset)
```

```
Linear mixed model fit by REML ['lmerMod']
Formula: C_ACTI_WT_DEC ~ c_demo_8_v2 + c_demo_6_v2 + weekend + P_COHESION +
    C_MESA_FT + C_MESA_ES + C_CHAOS + (1 | ParticipantID)
   Data: models

REML criterion at convergence: 624.6

Scaled residuals:
    Min      1Q  Median      3Q     Max
-2.8330 -0.5127 -0.1058  0.3339  4.5169

Random effects:
 Groups        Name        Variance Std.Dev.
 ParticipantID (Intercept) 0.567    0.753
 Residual                  1.742    1.320
Number of obs: 175, groups:  ParticipantID, 25

Fixed effects:
             Estimate Std. Error t value
(Intercept)   9.264345   3.194501   2.900
c_demo_8_v22 -0.116144   0.416664  -0.279
c_demo_6_v2   0.173829   0.192814   0.902
weekend       1.344690   0.232444   5.785
P_COHESION   -0.750097   0.409382  -1.832
C_MESA_FT    -0.046892   0.087433  -0.536
C_MESA_ES    -0.004295   0.287323  -0.015
C_CHAOS      -0.159031   0.369944  -0.430

Correlation of Fixed Effects:
            (Intr) c__8_2 c__6_2 weeknd P_COHE C_MESA_F C_MESA_E
c_dem_8_v22  0.052
c_demo_6_v2 -0.696 -0.362
weekend     -0.046  0.020  0.002
P_COHESION  -0.809  0.127  0.231  0.019
C_MESA_FT   -0.525 -0.137  0.345  0.004  0.375
C_MESA_ES    0.329 -0.022 -0.020 -0.034 -0.266 -0.442
```

```
C_CHAOS      -0.487   0.040   0.039   0.057   0.354   0.214    -0.618
```

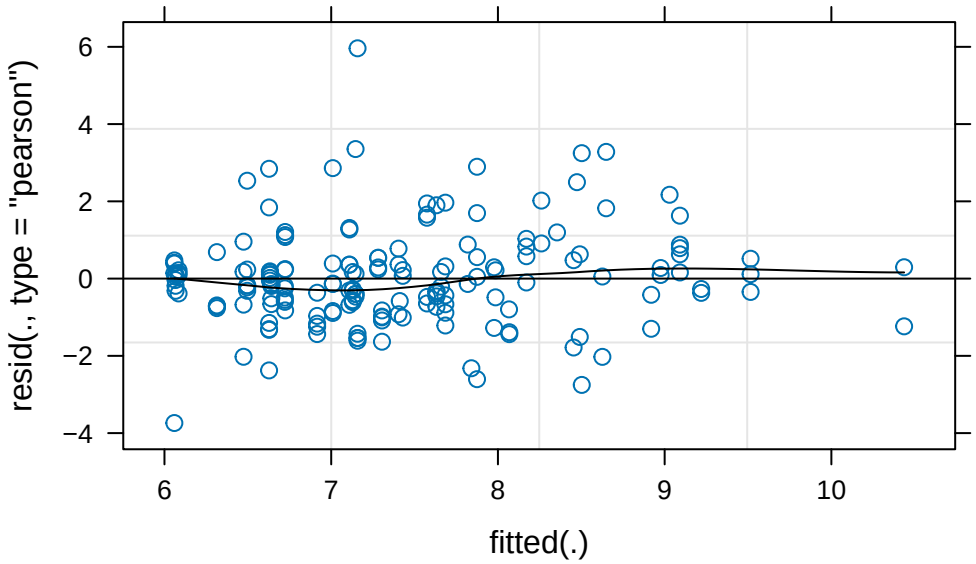
```
ci <- confint(mod2_offset)
```

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

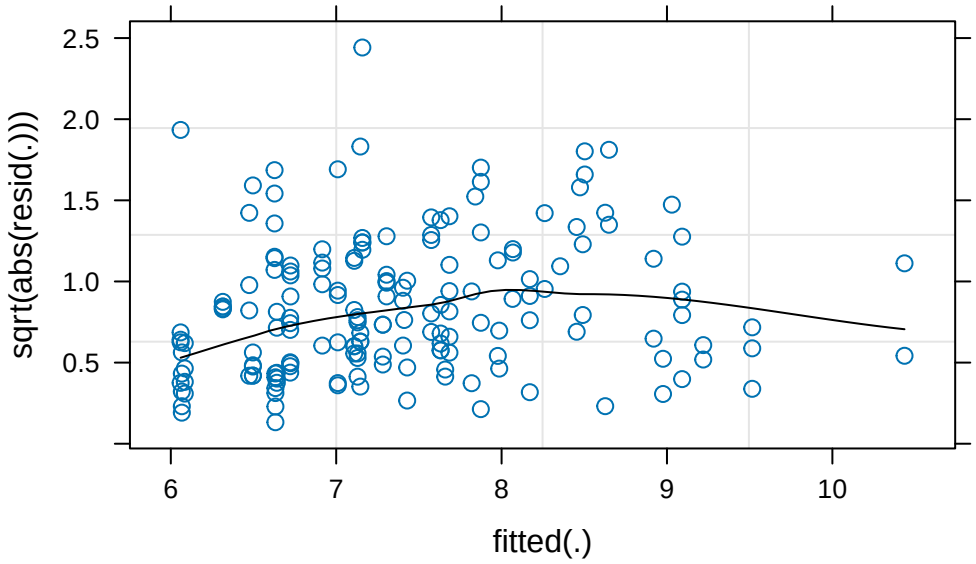
```
print(ci)
```

```
                   2.5 %      97.5 %
.sig01         0.3107991  0.91489305
.sigma         1.1795662  1.47953004
(Intercept)    3.7330765 14.78070070
c_demo_8_v22  -0.8358125  0.60413662
c_demo_6_v2   -0.1593293  0.50730407
weekend        0.8936809  1.80571267
P_COHESION    -1.4580711 -0.04198133
C_MESA_FT     -0.1977633  0.10454195
C_MESA_ES     -0.5021310  0.49351876
C_CHAOS       -0.7971754  0.48277828
```

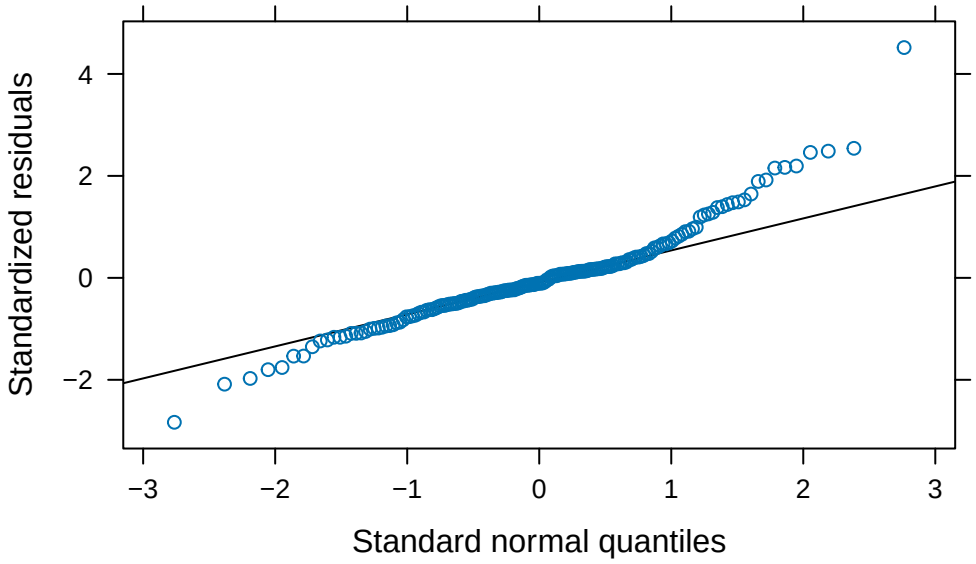
```
plot(mod2_offset, type=c("p","smooth"), col.line=1)
```



```
plot(mod2_offset,
     sqrt(abs(resid(.)))~fitted(.),
     type=c("p","smooth"), col.line=1)
```

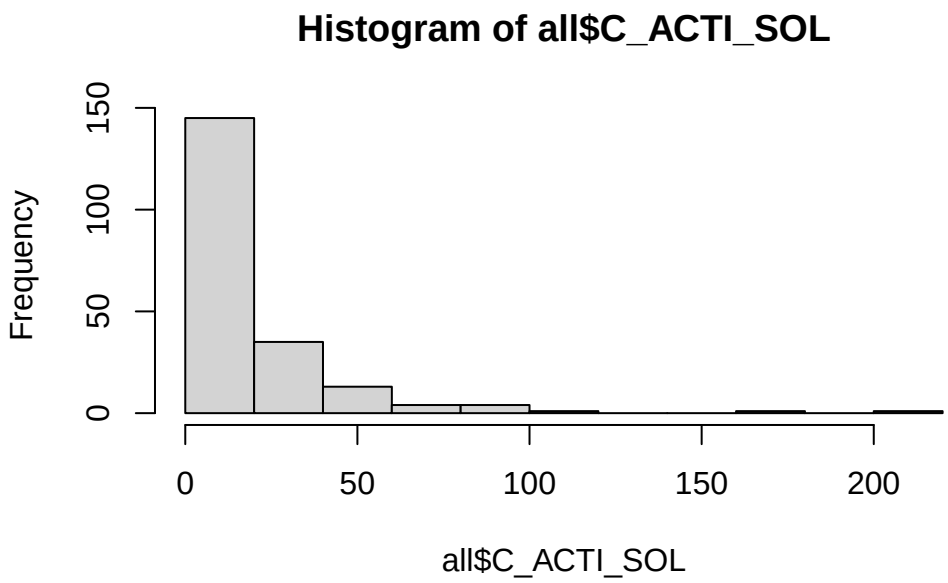



```
lattice::qqmath(mod2_offset)
```


Standardized residuals
4
2
0
−2
−3
−2
−1
0
1
2
3
Standard normal quantiles

Onset/Falling Asleep (C_ACTI_SOL)

```
hist(all$C_ACTI_SOL)
```




```
summary(all$C_ACTI_SOL)
```

```
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
   0.00    3.00   10.00   18.34   23.50  215.00
```

```
################################
#Model 1: Neighborhood Factors
################################
mod1_onset1 <- lmer(C_ACTI_SOL ~ c_demo_8_v2 + c_demo_6_v2 + weekend + geo_COI_3.0 + (1|Parti
summary(mod1_onset1)
```

```
Linear mixed model fit by REML ['lmerMod']
Formula: C_ACTI_SOL ~ c_demo_8_v2 + c_demo_6_v2 + weekend + geo_COI_3.0 +
    (1 | ParticipantID)
   Data: models
```

```
REML criterion at convergence: 1632.9

Scaled residuals:
    Min      1Q  Median      3Q     Max
-2.1428 -0.4712 -0.1831  0.2324  6.5255

Random effects:
 Groups        Name        Variance Std.Dev.
 ParticipantID (Intercept) 120.6    10.98
 Residual                  615.2    24.80
Number of obs: 177, groups:  ParticipantID, 25

Fixed effects:
             Estimate Std. Error t value
(Intercept)    68.578     25.117   2.730
c_demo_8_v22   -6.008      6.725  -0.893
c_demo_6_v2    -4.227      2.775  -1.523
weekend        -8.335      4.271  -1.951
geo_COI_3.0    -7.052      4.270  -1.652

Correlation of Fixed Effects:
            (Intr) c__8_2 c__6_2 weeknd
c_dem_8_v22  0.131
c_demo_6_v2 -0.974 -0.309
weekend     -0.051  0.019  0.005
geo_COI_3.0  0.035 -0.034 -0.083 -0.062
```

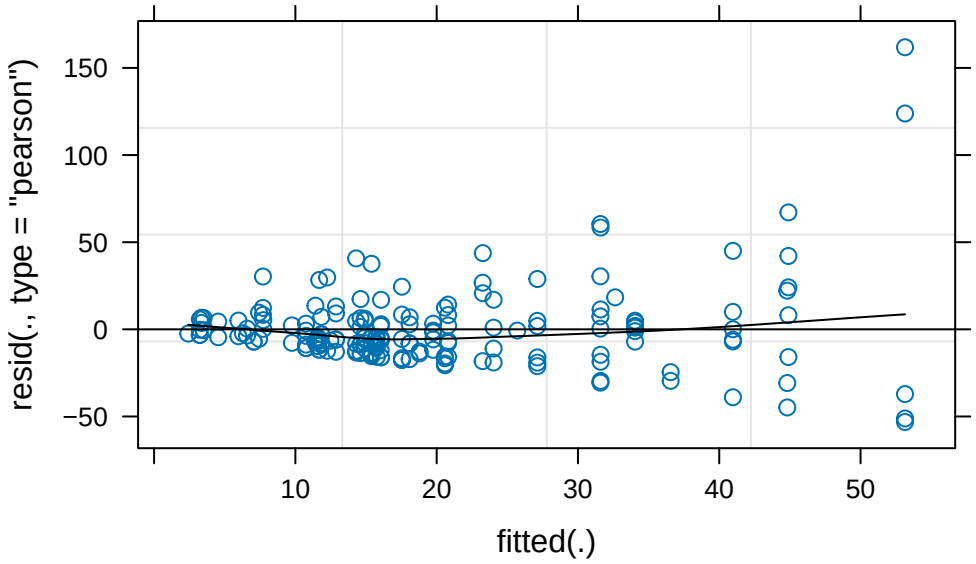
```
ci <- confint(mod1_onset1)
```

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

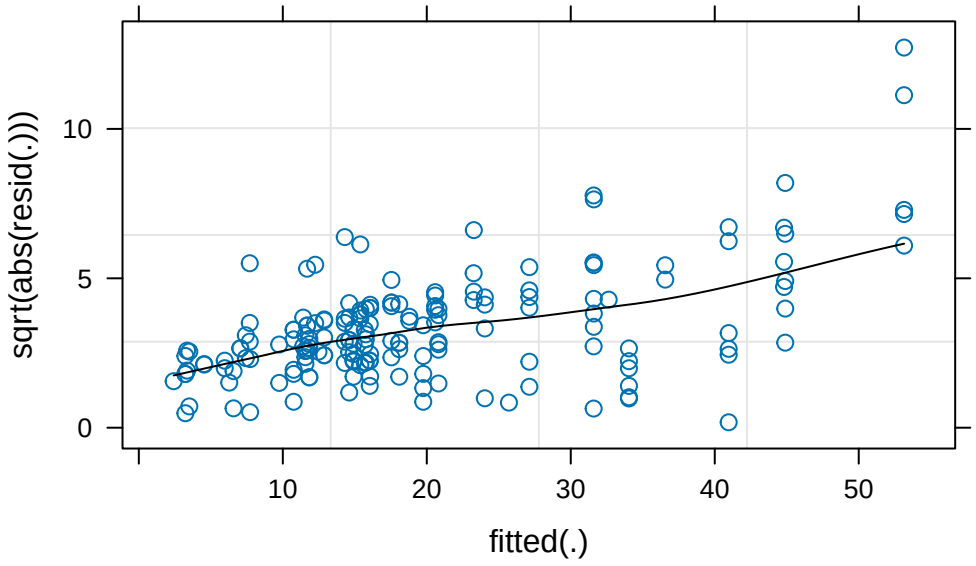
```
print(ci)
```

```
                   2.5 %      97.5 %
.sig01          4.007411  15.3176363
.sigma         22.182704  27.7698751
(Intercept)    21.660152 115.5154757
c_demo_8_v22 -18.571039   6.5568284
c_demo_6_v2   -9.413497   0.9570636
weekend      -16.626209   0.1414572
geo_COI_3.0  -15.031633   0.9240702
```

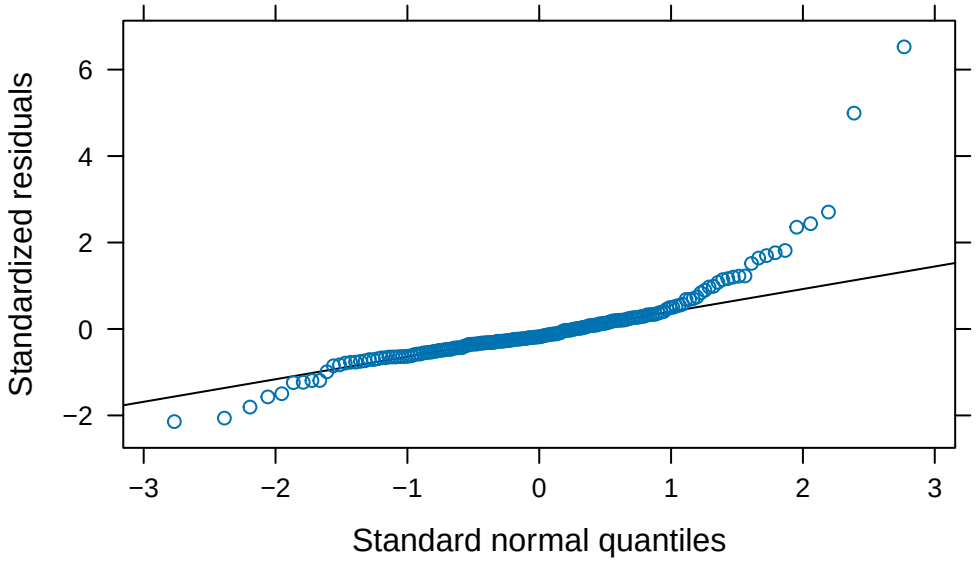
```
plot(mod1_onset1, type=c("p","smooth"), col.line=1)
```




```
plot(mod1_onset1,
     sqrt(abs(resid(.)))~fitted(.),
     type=c("p","smooth"), col.line=1)
```




```
lattice::qqmath(mod1_onset1)
```



```r
# log
mod1_onset1_log <- lmer(log(C_ACTI_SOL + 1) ~ c_demo_8_v2 + c_demo_6_v2 + weekend + geo_COI_3
summary(mod1_onset1_log)
```

```
Linear mixed model fit by REML ['lmerMod']
Formula:
log(C_ACTI_SOL + 1) ~ c_demo_8_v2 + c_demo_6_v2 + weekend + geo_COI_3.0 +
    (1 | ParticipantID)
   Data: models

REML criterion at convergence: 577.3

Scaled residuals:
     Min       1Q   Median       3Q      Max
-2.47750 -0.58170  0.07436  0.68503  2.21198

Random effects:
 Groups        Name        Variance Std.Dev.
 ParticipantID (Intercept) 0.3035   0.5509
 Residual                  1.3139   1.1462
Number of obs: 177, groups:  ParticipantID, 25

Fixed effects:
             Estimate Std. Error t value
(Intercept)   4.55103    1.21924   3.733
c_demo_8_v22 -0.07836    0.32659  -0.240
c_demo_6_v2  -0.21028    0.13472  -1.561
weekend      -0.36135    0.19758  -1.829
geo_COI_3.0  -0.26117    0.20715  -1.261

Correlation of Fixed Effects:
            (Intr) c__8_2 c__6_2 weeknd
c_dem_8_v22  0.130
c_demo_6_v2 -0.974 -0.309
weekend     -0.048  0.018  0.004
geo_COI_3.0  0.034 -0.033 -0.082 -0.059
```

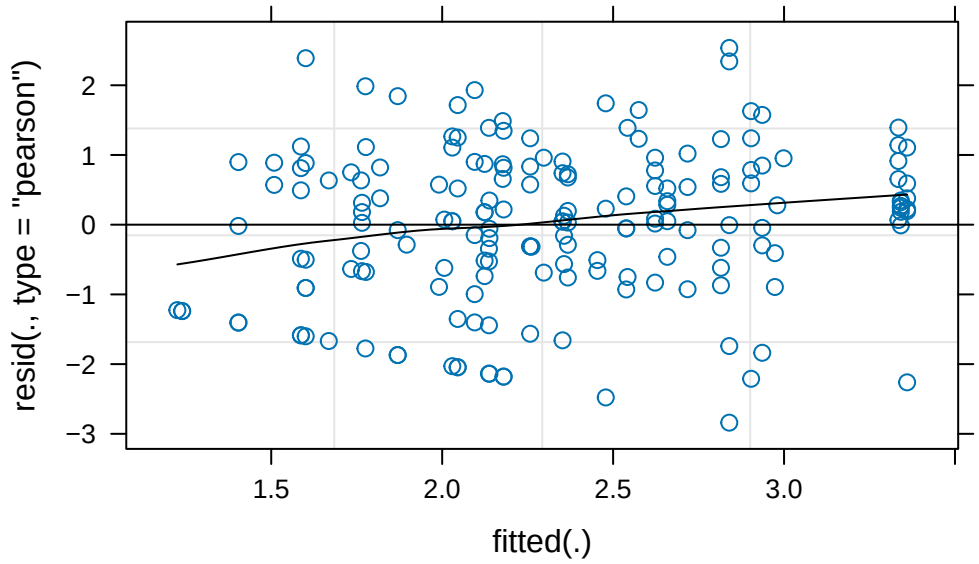
```r
ci <- confint(mod1_onset1_log)
```

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

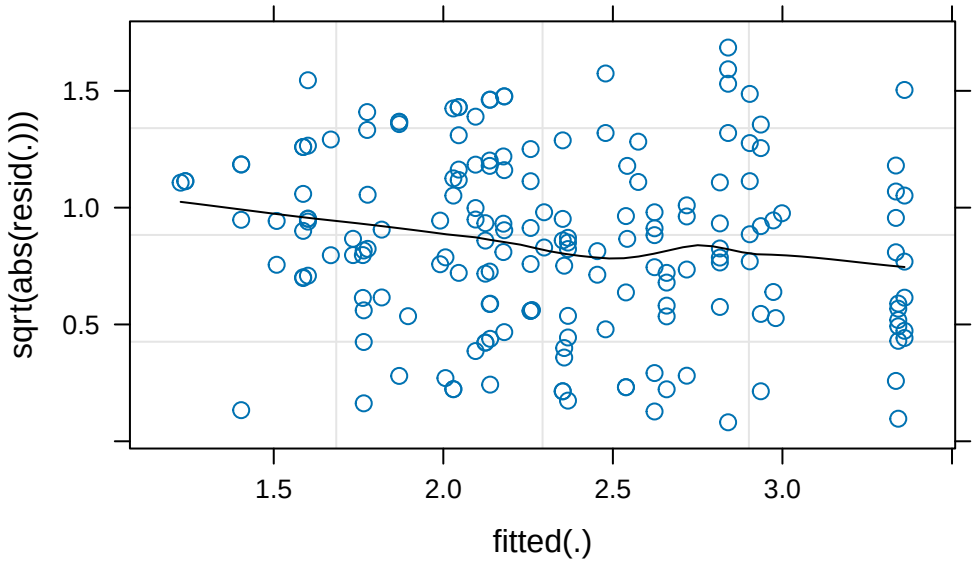
```
print(ci)
```

```
                  2.5 %     97.5 %
.sig01        0.2341030 0.75709986
.sigma        1.0252291 1.28403894
(Intercept)   2.2756185 6.82725332
c_demo_8_v22 -0.6877632 0.53150109
c_demo_6_v2  -0.4618201 0.04113675
weekend      -0.7481116 0.02731152
geo_COI_3.0  -0.6478575 0.12552302
```

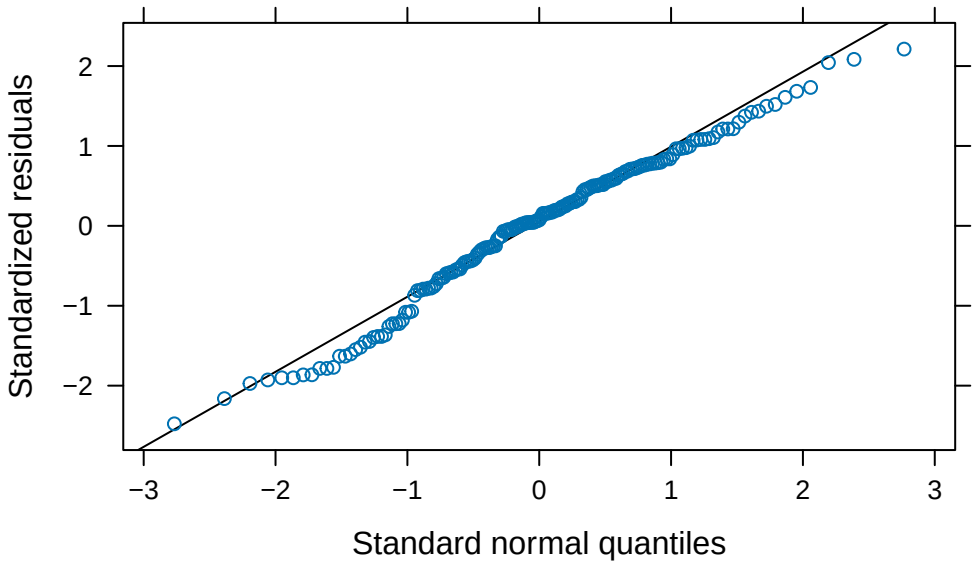
```
plot(mod1_onset1_log, type=c("p","smooth"), col.line=1)
```




```
plot(mod1_onset1_log,
     sqrt(abs(resid(.)))~fitted(.),
     type=c("p","smooth"), col.line=1)
```




```
lattice::qqmath(mod1_onset1_log)
```



```r
# compare
performance_aic(mod1_onset1)
```

```
[1] 1646.873
```

```r
performance_aic(mod1_onset1_log)
```

```
Warning: Could not compute corrected log-likelihood for models with transformed
  response. Log-likelihood value is probably inaccurate.
```

```
[1] 591.3126
```

```r
### Log model is way better


################################
#Model 2: Family Factors
################################
mod2_onset1 <- lmer(C_ACTI_SOL ~ c_demo_8_v2 + c_demo_6_v2 + weekend + P_COHESION + C_MESA_F
summary(mod2_onset1)
```

```
Linear mixed model fit by REML ['lmerMod']
Formula: C_ACTI_SOL ~ c_demo_8_v2 + c_demo_6_v2 + weekend + P_COHESION +
    C_MESA_FT + C_MESA_ES + C_CHAOS + (1 | ParticipantID)
   Data: models

REML criterion at convergence: 1595.2

Scaled residuals:
    Min      1Q  Median      3Q     Max
-2.3738 -0.4828 -0.1205  0.2487  6.3132

Random effects:
 Groups        Name        Variance Std.Dev.
 ParticipantID (Intercept)  91.77    9.58
 Residual                  612.55   24.75
Number of obs: 175, groups:  ParticipantID, 25

Fixed effects:
             Estimate Std. Error t value
```

```
(Intercept)    62.799     47.342   1.326
c_demo_8_v22    1.266      6.161   0.206
c_demo_6_v2    -3.847      2.855  -1.347
weekend        -8.855      4.344  -2.038
P_COHESION      6.583      6.072   1.084
C_MESA_FT      -1.281      1.295  -0.989
C_MESA_ES       3.506      4.286   0.818
C_CHAOS       -13.314      5.489  -2.425

Correlation of Fixed Effects:
            (Intr) c__8_2 c__6_2 weeknd P_COHE C_MESA_F C_MESA_E
c_dem_8_v22  0.055
c_demo_6_v2 -0.695 -0.361
weekend     -0.059  0.025  0.003
P_COHESION  -0.810  0.123  0.231  0.024
C_MESA_FT   -0.523 -0.137  0.343  0.004  0.375
C_MESA_ES    0.327 -0.017 -0.016 -0.042 -0.267 -0.437
C_CHAOS     -0.487  0.037  0.036  0.071  0.356  0.210   -0.619
```

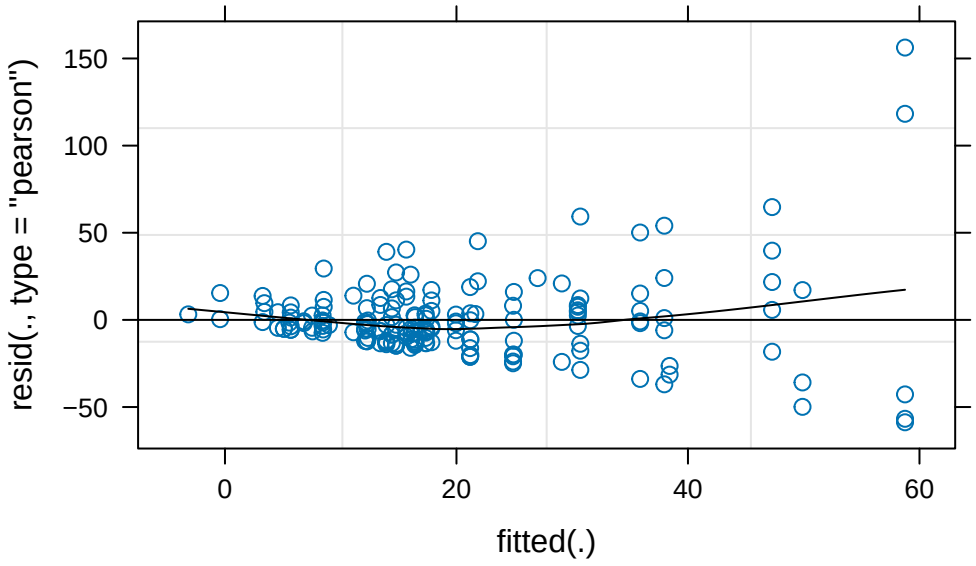
```
ci <- confint(mod2_onset1)
```

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

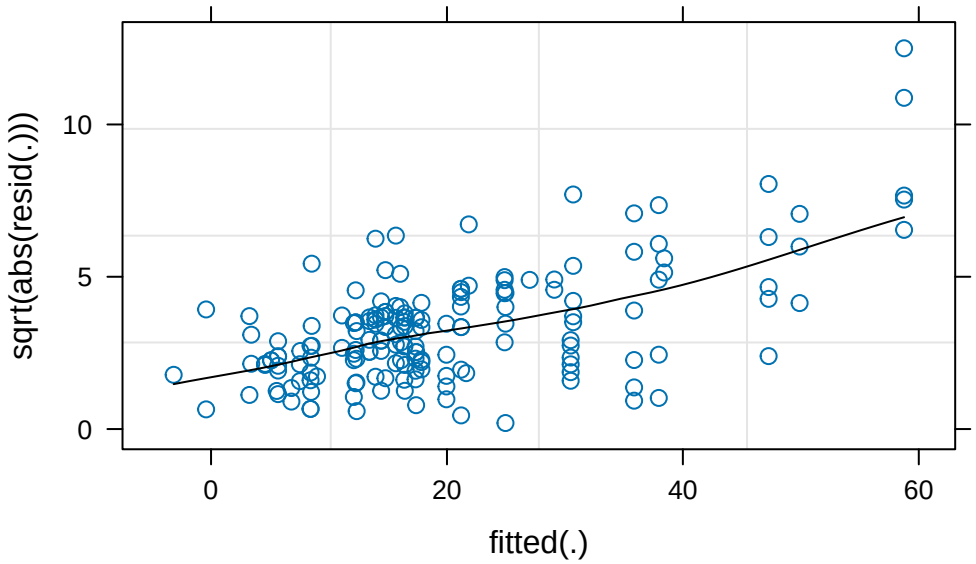
```
print(ci)
```

```
                  2.5 %      97.5 %
.sig01         0.000000  12.3289566
.sigma        22.118071  27.7413844
(Intercept)  -18.805303 144.9162673
c_demo_8_v22  -9.393356  11.8868861
c_demo_6_v2   -8.799256   1.0703721
weekend      -17.431862  -0.4108120
P_COHESION    -3.918746  17.0847323
C_MESA_FT     -3.528701   0.9474789
C_MESA_ES     -3.898795  10.9697040
C_CHAOS      -22.821093  -3.8279636
```

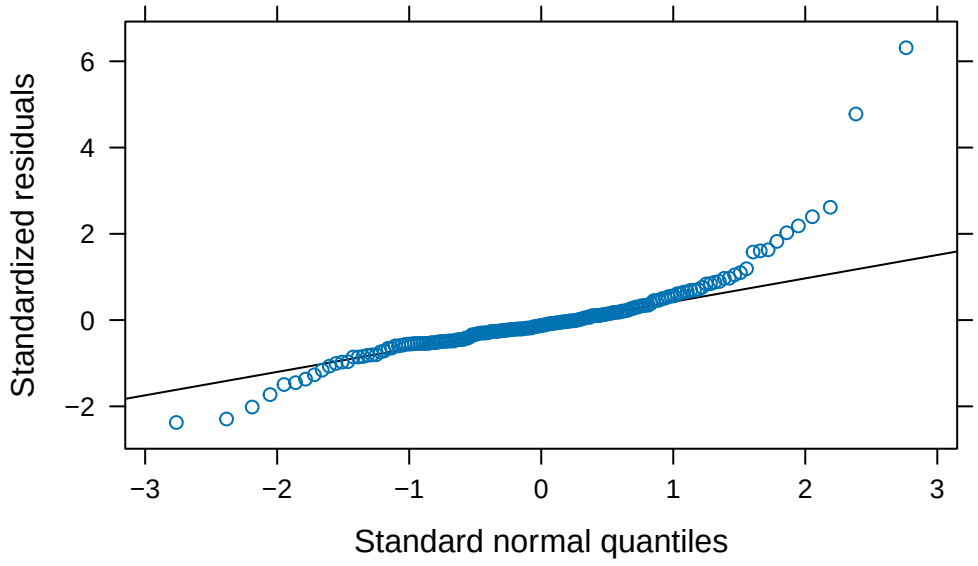
```
plot(mod2_onset1, type=c("p","smooth"), col.line=1)
```




```
plot(mod2_onset1,
     sqrt(abs(resid(.)))~fitted(.),
     type=c("p","smooth"), col.line=1)
```



```
lattice::qqmath(mod2_onset1)
```




```
# log
mod2_onset1_log <- lmer(log(C_ACTI_SOL + 1) ~ c_demo_8_v2 + c_demo_6_v2 + weekend + P_COHESI
summary(mod2_onset1_log)
```

```
Linear mixed model fit by REML ['lmerMod']
Formula:
log(C_ACTI_SOL + 1) ~ c_demo_8_v2 + c_demo_6_v2 + weekend + P_COHESION +
    C_MESA_FT + C_MESA_ES + C_CHAOS + (1 | ParticipantID)
   Data: models

REML criterion at convergence: 573.1

Scaled residuals:
     Min       1Q   Median       3Q      Max
-2.51079 -0.58434  0.08705  0.66406  2.19824

Random effects:
 Groups        Name        Variance Std.Dev.
 ParticipantID (Intercept) 0.3319   0.5761
 Residual                  1.3030   1.1415
```

```
Number of obs: 175, groups:  ParticipantID, 25

Fixed effects:
             Estimate Std. Error t value
(Intercept)   1.65035    2.54529   0.648
c_demo_8_v22  0.20030    0.33176   0.604
c_demo_6_v2  -0.12345    0.15359  -0.804
weekend      -0.36223    0.20082  -1.804
P_COHESION    0.49848    0.32626   1.528
C_MESA_FT     0.03550    0.06965   0.510
C_MESA_ES    -0.09995    0.22938  -0.436
C_CHAOS      -0.18082    0.29488  -0.613

Correlation of Fixed Effects:
            (Intr) c__8_2 c__6_2 weeknd P_COHE C_MESA_F C_MESA_E
c_dem_8_v22  0.053
c_demo_6_v2 -0.695 -0.362
weekend     -0.050  0.021  0.003
P_COHESION  -0.809  0.126  0.231  0.021
C_MESA_FT   -0.525 -0.137  0.344  0.004  0.375
C_MESA_ES    0.328 -0.020 -0.019 -0.037 -0.266 -0.441
C_CHAOS     -0.487  0.039  0.038  0.062  0.354  0.212   -0.618
```

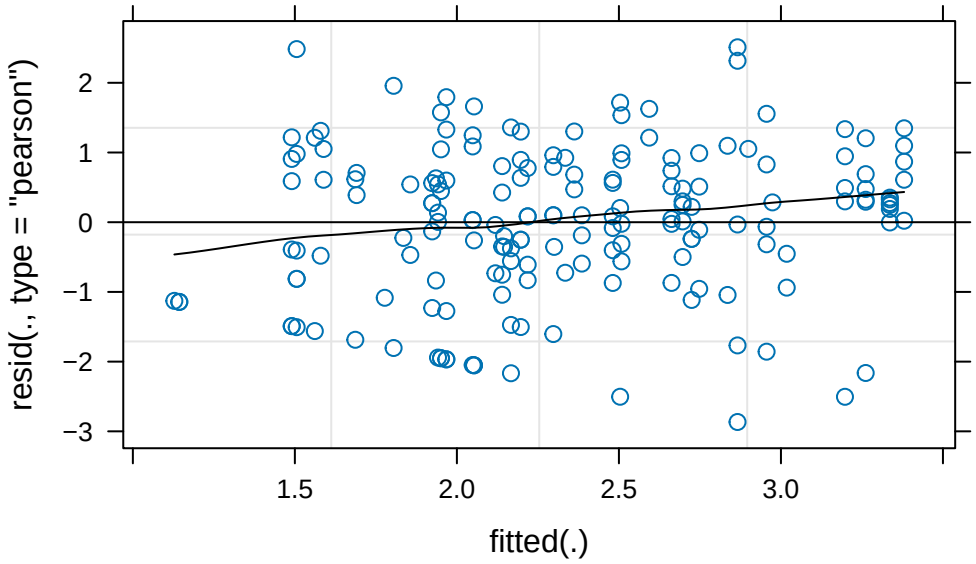
```
ci <- confint(mod2_onset1_log)
```

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

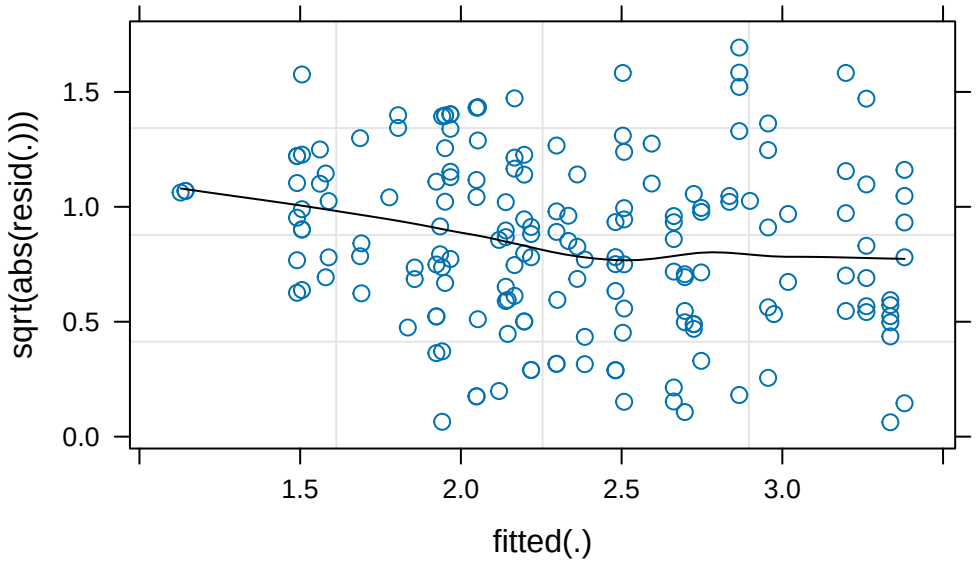
```
print(ci)
```

```
                   2.5 %     97.5 %
.sig01        0.17551739 0.70991316
.sigma        1.02013416 1.27957479
(Intercept)  -2.75058225 6.04961952
c_demo_8_v22 -0.37188102 0.77424584
c_demo_6_v2  -0.38957346 0.14131791
weekend      -0.75349605 0.03405609
P_COHESION   -0.06496675 1.06337627
C_MESA_FT    -0.08494331 0.15579694
C_MESA_ES    -0.49719710 0.29773338
C_CHAOS      -0.68915978 0.33089425
```

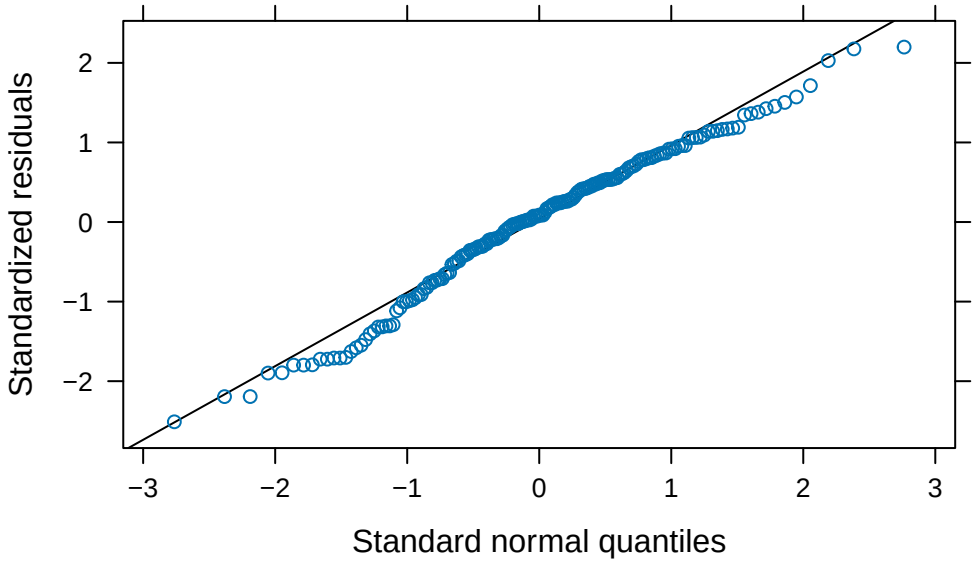
```
plot(mod2_onset1_log, type=c("p","smooth"), col.line=1)
```




```
plot(mod2_onset1_log,
     sqrt(abs(resid(.)))~fitted(.),
     type=c("p","smooth"), col.line=1)
```




```
lattice::qqmath(mod2_onset1_log)
```



```
# compare
performance_aic(mod2_onset1)
```

```
[1] 1615.173
```

```
performance_aic(mod2_onset1_log)
```

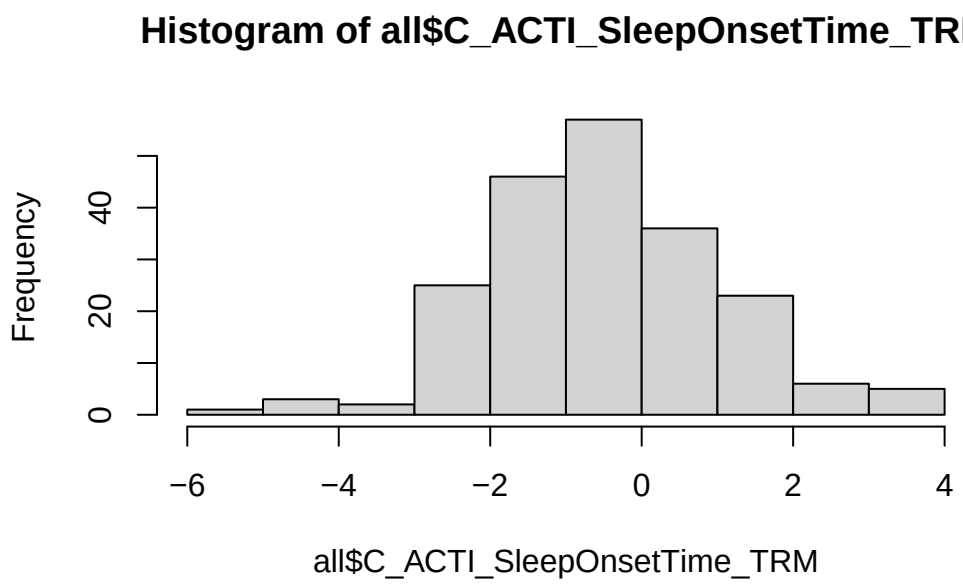
```
Warning: Could not compute corrected log-likelihood for models with transformed
  response. Log-likelihood value is probably inaccurate.
```

```
[1] 593.1287
```

```
# Log model is better
```

Onset/Falling Asleep 2 (C_ACTI_SleepOnsetTime_TRM)

```
hist(all$C_ACTI_SleepOnsetTime_TRM)
```




```
summary(all$C_ACTI_SleepOnsetTime_TRM)
```

```
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
-5.3700 -1.5700 -0.6000 -0.5149  0.4425  3.4500
```

```
################################
#Model 1: Neighborhood Factors
################################
mod1_onset2 <- lmer(C_ACTI_SleepOnsetTime_TRM ~ c_demo_8_v2 + c_demo_6_v2 + weekend + geo_COI
summary(mod1_onset2)
```

```
Linear mixed model fit by REML ['lmerMod']
Formula: C_ACTI_SleepOnsetTime_TRM ~ c_demo_8_v2 + c_demo_6_v2 + weekend +
    geo_COI_3.0 + (1 | ParticipantID)
   Data: models
```

```
REML criterion at convergence: 613

Scaled residuals:
    Min      1Q  Median      3Q     Max
-3.7448 -0.5661 -0.0734  0.4923  3.7116

Random effects:
 Groups        Name        Variance Std.Dev.
 ParticipantID (Intercept) 0.9557   0.9776
 Residual                  1.4755   1.2147
Number of obs: 177, groups:  ParticipantID, 25

Fixed effects:
             Estimate Std. Error t value
(Intercept)  -0.19720    1.88074  -0.105
c_demo_8_v22 -0.24748    0.50482  -0.490
c_demo_6_v2  -0.00235    0.20785  -0.011
weekend       0.53290    0.21039   2.533
geo_COI_3.0  -0.28678    0.31870  -0.900

Correlation of Fixed Effects:
            (Intr) c__8_2 c__6_2 weeknd
c_dem_8_v22  0.128
c_demo_6_v2 -0.975 -0.307
weekend     -0.033  0.012  0.003
geo_COI_3.0  0.032 -0.032 -0.082 -0.041
```

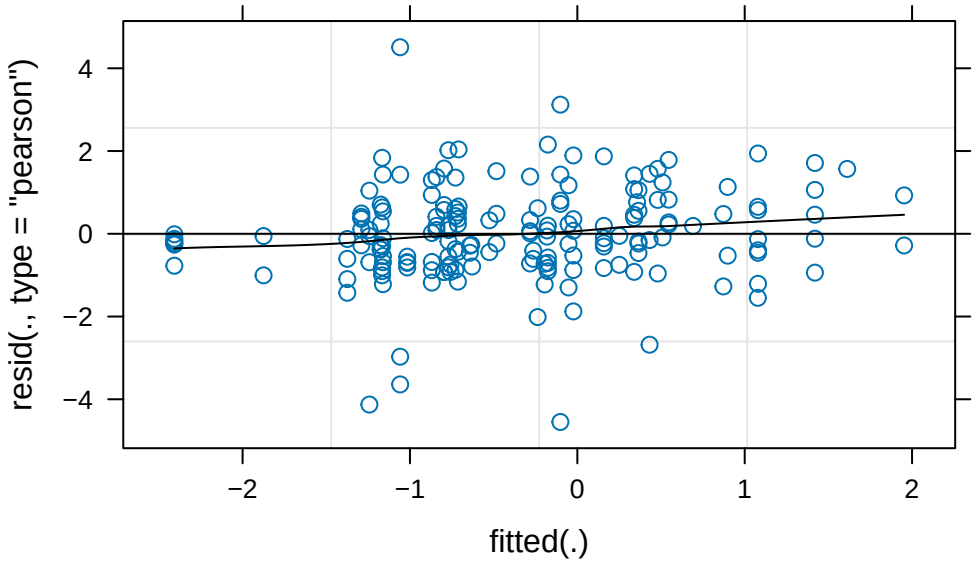
```
ci <- confint(mod1_onset2)
```

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

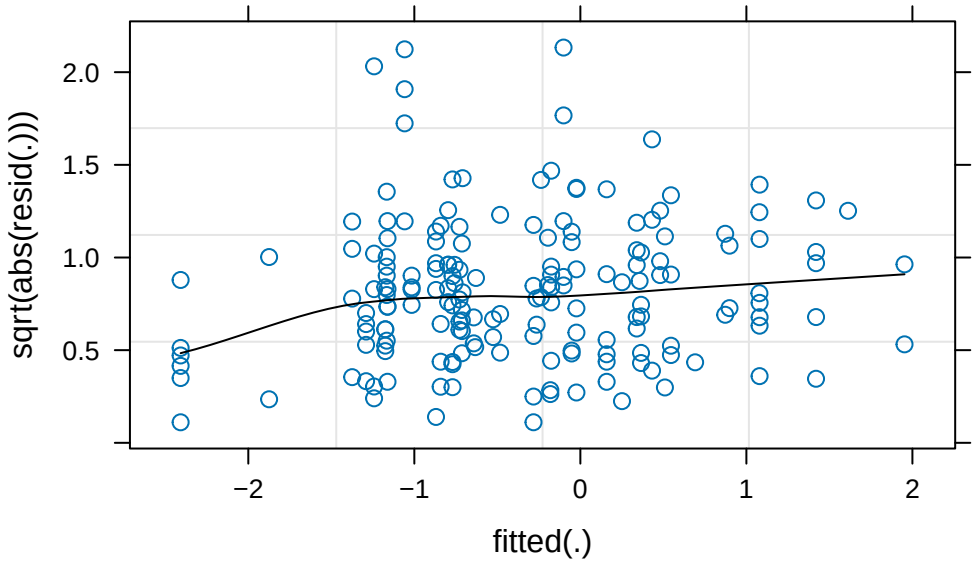
```
print(ci)
```

```
                  2.5 %    97.5 %
.sig01        0.6135177 1.2627217
.sigma        1.0864107 1.3607457
(Intercept)  -3.7083388 3.3142107
c_demo_8_v22 -1.1899646 0.6949317
c_demo_6_v2  -0.3904155 0.3856887
weekend       0.1198223 0.9463220
geo_COI_3.0  -0.8819319 0.3081326
```

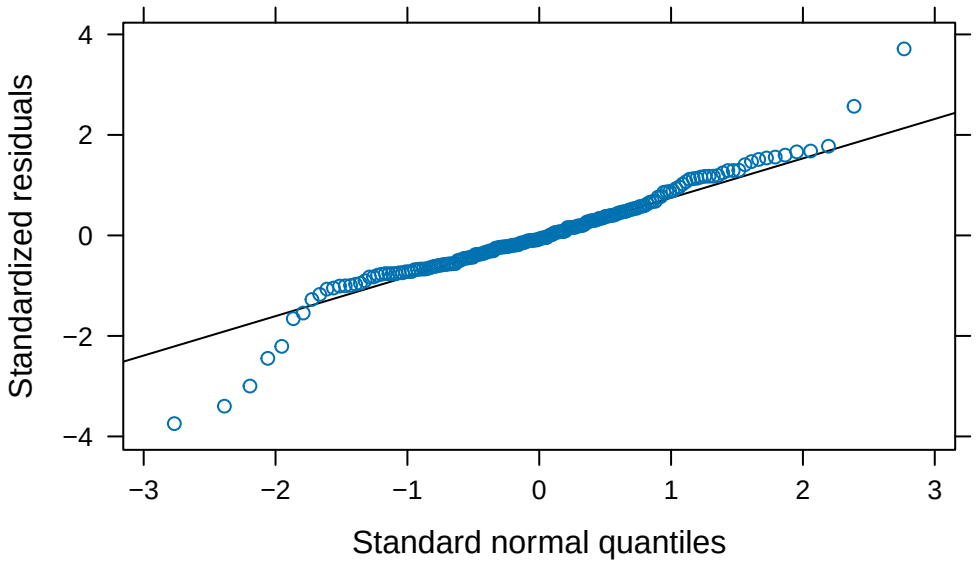
```
plot(mod1_onset2, type=c("p","smooth"), col.line=1)
```




```
plot(mod1_onset2,
     sqrt(abs(resid(.)))~fitted(.),
     type=c("p","smooth"), col.line=1)
```




```
lattice::qqmath(mod1_onset2)
```



```r
################################
#Model 2: Family Factors
################################
mod2_onset2 <- lmer(C_ACTI_SleepOnsetTime_TRM ~ c_demo_8_v2 + c_demo_6_v2 + weekend + P_COHES
summary(mod2_onset2)
```

```
Linear mixed model fit by REML ['lmerMod']
Formula: C_ACTI_SleepOnsetTime_TRM ~ c_demo_8_v2 + c_demo_6_v2 + weekend +
    P_COHESION + C_MESA_FT + C_MESA_ES + C_CHAOS + (1 | ParticipantID)
   Data: models

REML criterion at convergence: 611.1

Scaled residuals:
    Min      1Q  Median      3Q     Max
-3.7667 -0.5262 -0.0386  0.4999  3.6683

Random effects:
 Groups        Name        Variance Std.Dev.
 ParticipantID (Intercept) 1.229    1.109
 Residual                  1.486    1.219
Number of obs: 175, groups:  ParticipantID, 25

Fixed effects:
             Estimate Std. Error t value
(Intercept)   0.91403    4.24670   0.215
c_demo_8_v22  0.14764    0.55497   0.266
c_demo_6_v2   0.05722    0.25651   0.223
weekend       0.46744    0.21533   2.171
P_COHESION   -0.20510    0.54386  -0.377
C_MESA_FT    -0.10917    0.11630  -0.939
C_MESA_ES     0.31325    0.37978   0.825
C_CHAOS      -0.39603    0.49120  -0.806

Correlation of Fixed Effects:
            (Intr) c__8_2 c__6_2 weeknd P_COHE C_MESA_F C_MESA_E
c_dem_8_v22  0.049
c_demo_6_v2 -0.697 -0.362
weekend     -0.032  0.014  0.001
P_COHESION  -0.808  0.131  0.231  0.013
C_MESA_FT   -0.527 -0.136  0.346  0.003  0.376
C_MESA_ES    0.330 -0.026 -0.023 -0.024 -0.265 -0.447
```

```
C_CHAOS      -0.487  0.044  0.041  0.040  0.351  0.217   -0.617
```

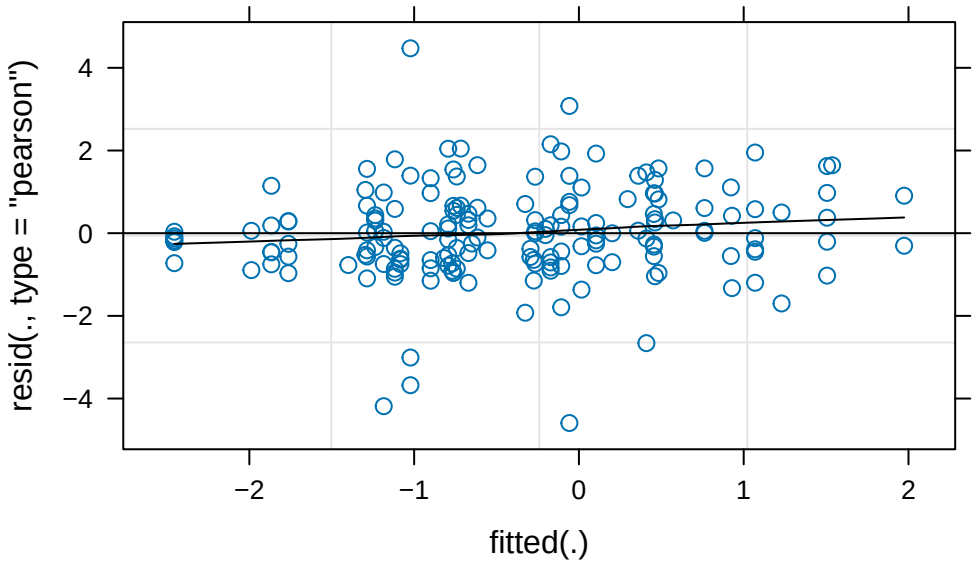
```
ci <- confint(mod2_onset2)
```

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

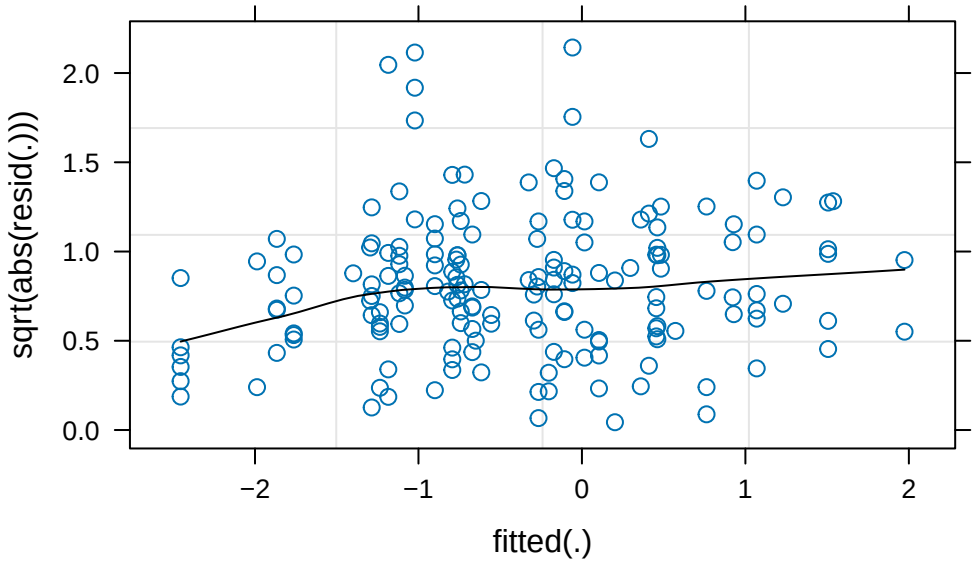
```
print(ci)
```

```
                   2.5 %     97.5 %
.sig01         0.64113941 1.30456199
.sigma         1.08949243 1.36650873
(Intercept)   -6.43183678 8.25884683
c_demo_8_v22  -0.81299741 1.10622229
c_demo_6_v2   -0.38657035 0.50066295
weekend        0.04594194 0.89159352
P_COHESION    -1.14581568 0.73578606
C_MESA_FT     -0.31032799 0.09196527
C_MESA_ES     -0.34352744 0.97156646
C_CHAOS       -1.24498382 0.45461570
```

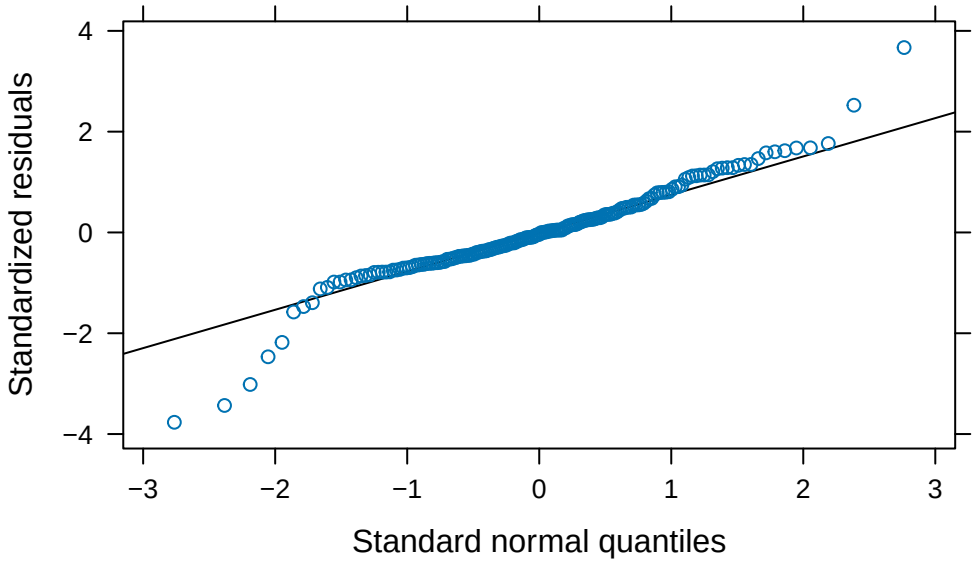
```
plot(mod2_onset2, type=c("p","smooth"), col.line=1)
```



```
plot(mod2_onset2,
     sqrt(abs(resid(.)))~fitted(.),
     type=c("p","smooth"), col.line=1)
```

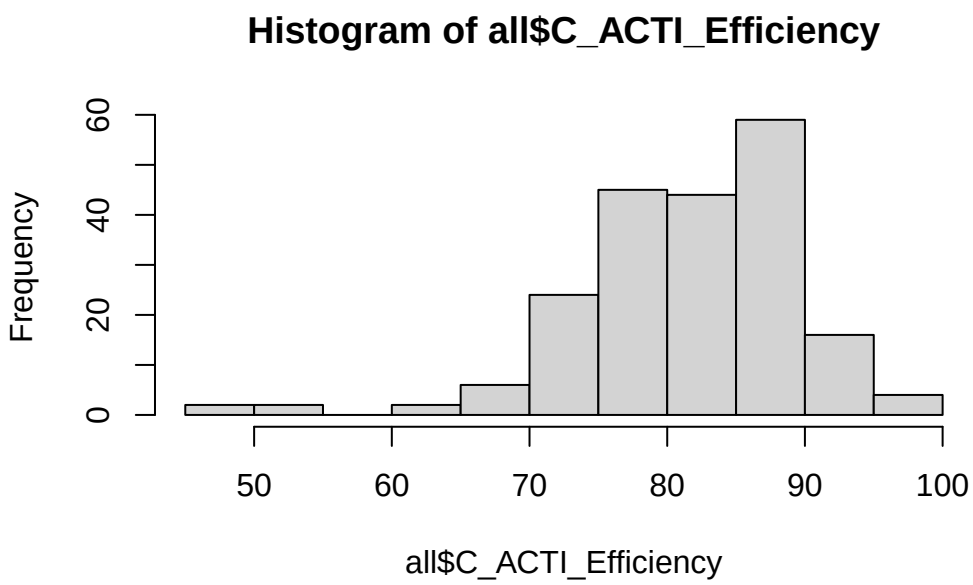



```
lattice::qqmath(mod2_onset2)
```


Standardized residuals
4
2
0
−2
−4
−3
−2
−1
0
1
2
3
Standard normal quantiles

Efficiency (C_ACTI_Efficiency)

```
hist(all$C_ACTI_Efficiency)
```




```
summary(all$C_ACTI_Efficiency)
```

```
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
  46.23   77.31   83.20   81.68   87.31  100.00
```

```
################################
#Model 1: Neighborhood Factors
################################
mod1_efficiency <- lmer(C_ACTI_Efficiency ~ c_demo_8_v2 + c_demo_6_v2 + weekend + geo_COI_3.0
summary(mod1_efficiency)
```

```
Linear mixed model fit by REML ['lmerMod']
Formula:
C_ACTI_Efficiency ~ c_demo_8_v2 + c_demo_6_v2 + weekend + geo_COI_3.0 +
    (1 | ParticipantID)
   Data: models
```

```
REML criterion at convergence: 1204.9

Scaled residuals:
    Min      1Q  Median      3Q     Max
-4.0637 -0.5496  0.0956  0.5317  2.3387

Random effects:
 Groups        Name        Variance Std.Dev.
 ParticipantID (Intercept) 20.38    4.515
 Residual                  47.98    6.927
Number of obs: 177, groups:  ParticipantID, 25

Fixed effects:
             Estimate Std. Error t value
(Intercept)    67.617      9.085   7.443
c_demo_8_v22    3.280      2.437   1.346
c_demo_6_v2     1.169      1.004   1.164
weekend         1.089      1.198   0.909
geo_COI_3.0     1.678      1.541   1.089

Correlation of Fixed Effects:
            (Intr) c__8_2 c__6_2 weeknd
c_dem_8_v22  0.129
c_demo_6_v2 -0.975 -0.308
weekend     -0.039  0.015  0.004
geo_COI_3.0  0.033 -0.032 -0.082 -0.048
```

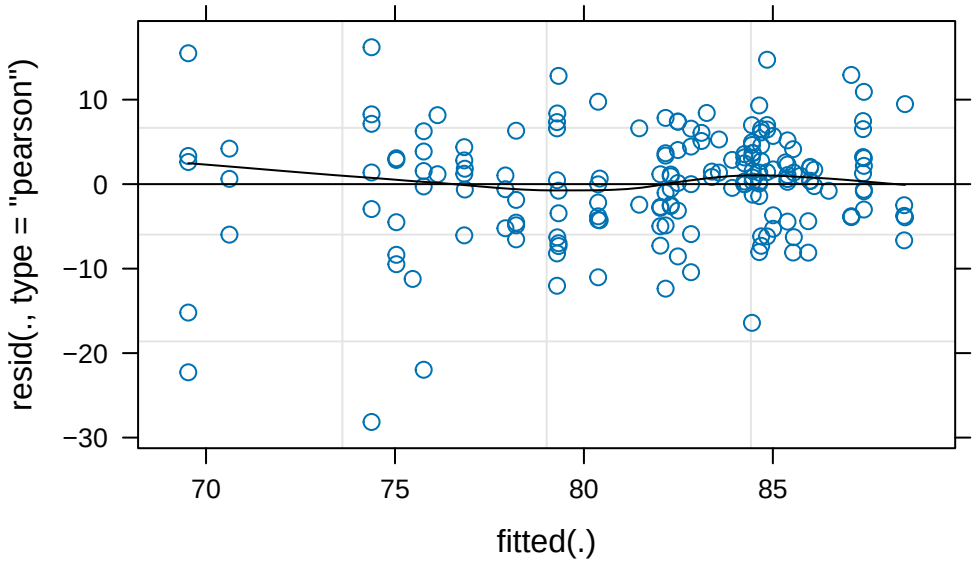
```
ci <- confint(mod1_efficiency)
```

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

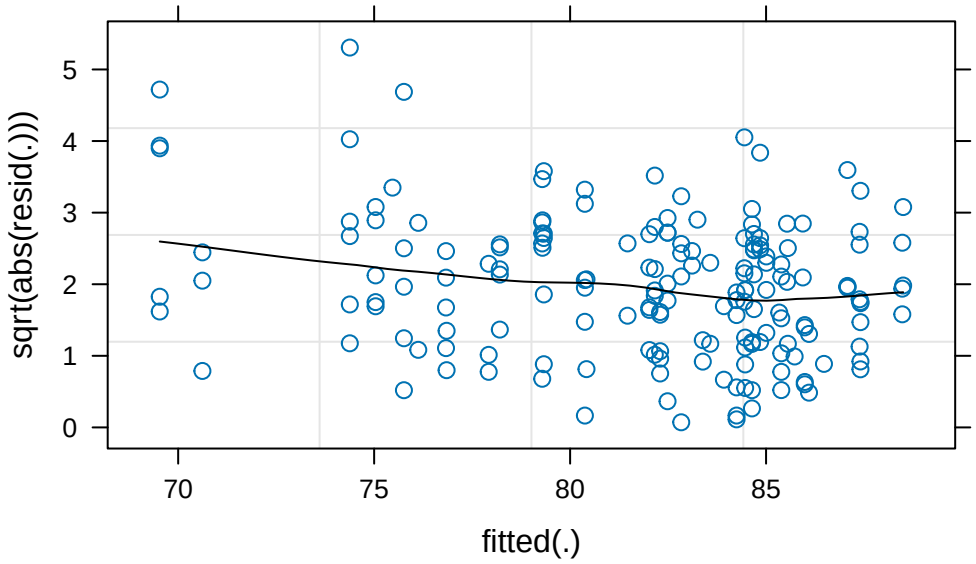
```
print(ci)
```

```
                   2.5 %    97.5 %
.sig01         2.6445347  5.934363
.sigma         6.1950293  7.755414
(Intercept)   50.6373843 84.593873
c_demo_8_v22  -1.2742110  7.833477
c_demo_6_v2   -0.7074892  3.045056
weekend       -1.2956125  3.411426
geo_COI_3.0   -1.2011500  4.558575
```

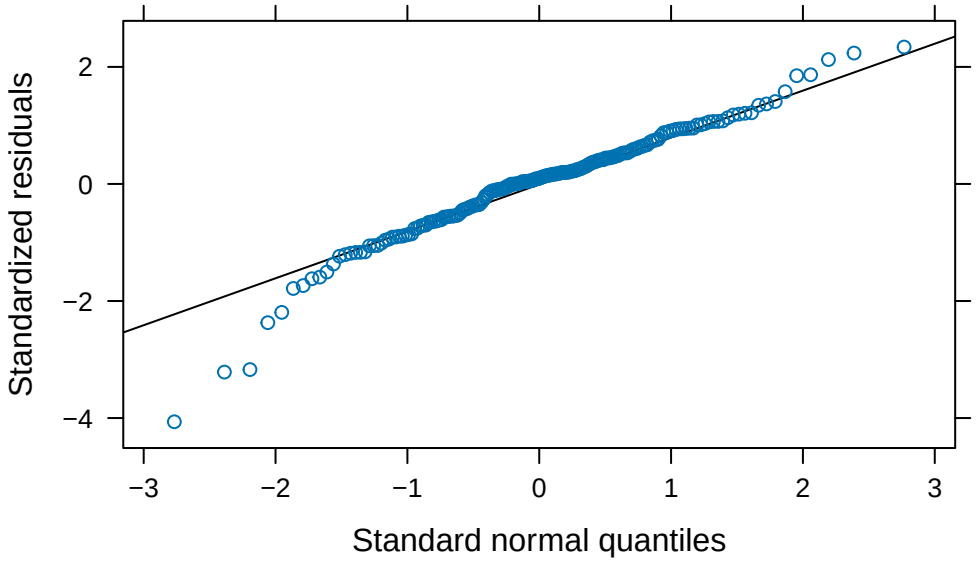
```
plot(mod1_efficiency, type=c("p","smooth"), col.line=1)
```




```
plot(mod1_efficiency,
     sqrt(abs(resid(.)))~fitted(.),
     type=c("p","smooth"), col.line=1)
```




```
lattice::qqmath(mod1_efficiency)
```



```r
# log
mod1_efficiency_log <- lmer(log(C_ACTI_Efficiency) ~ c_demo_8_v2 + c_demo_6_v2 + weekend + g
summary(mod1_efficiency_log)
```

```
Linear mixed model fit by REML ['lmerMod']
Formula: log(C_ACTI_Efficiency) ~ c_demo_8_v2 + c_demo_6_v2 + weekend +
    geo_COI_3.0 + (1 | ParticipantID)
   Data: models

REML criterion at convergence: -276.1

Scaled residuals:
    Min      1Q  Median      3Q     Max
-4.8842 -0.4734  0.1019  0.5398  2.2882

Random effects:
 Groups        Name        Variance Std.Dev.
 ParticipantID (Intercept) 0.003415 0.05844
 Residual                  0.008813 0.09388
Number of obs: 177, groups:  ParticipantID, 25

Fixed effects:
             Estimate Std. Error t value
(Intercept)   4.20378    0.11901  35.324
c_demo_8_v22  0.04383    0.03191   1.373
c_demo_6_v2   0.01605    0.01315   1.220
weekend       0.01661    0.01623   1.024
geo_COI_3.0   0.02362    0.02019   1.170

Correlation of Fixed Effects:
            (Intr) c__8_2 c__6_2 weeknd
c_dem_8_v22  0.129
c_demo_6_v2 -0.975 -0.308
weekend     -0.040  0.015  0.004
geo_COI_3.0  0.033 -0.032 -0.082 -0.050
```

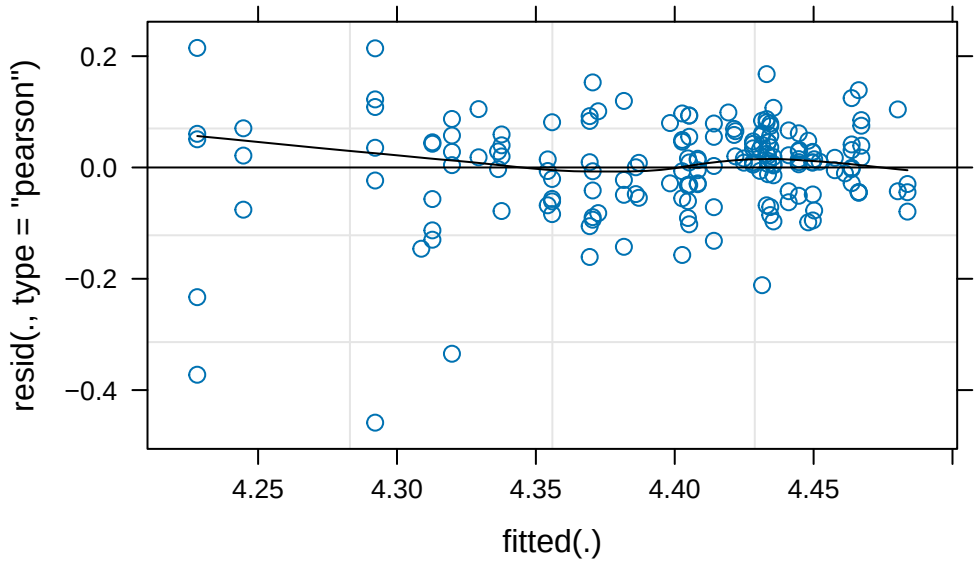
```r
ci <- confint(mod1_efficiency_log)
```

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

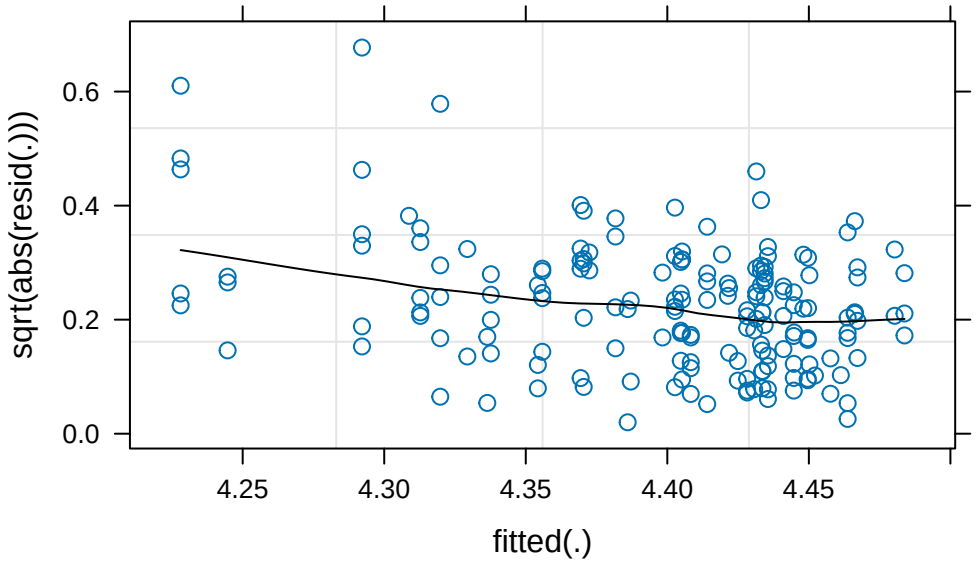
```
print(ci)
```

```
                    2.5 %     97.5 %
.sig01         0.033449430 0.07720285
.sigma         0.083955122 0.10509477
(Intercept)    3.981333751 4.42619856
c_demo_8_v22  -0.015828927 0.10346925
c_demo_6_v2   -0.008531246 0.04063025
weekend       -0.015711770 0.04805235
geo_COI_3.0   -0.014110244 0.06136593
```

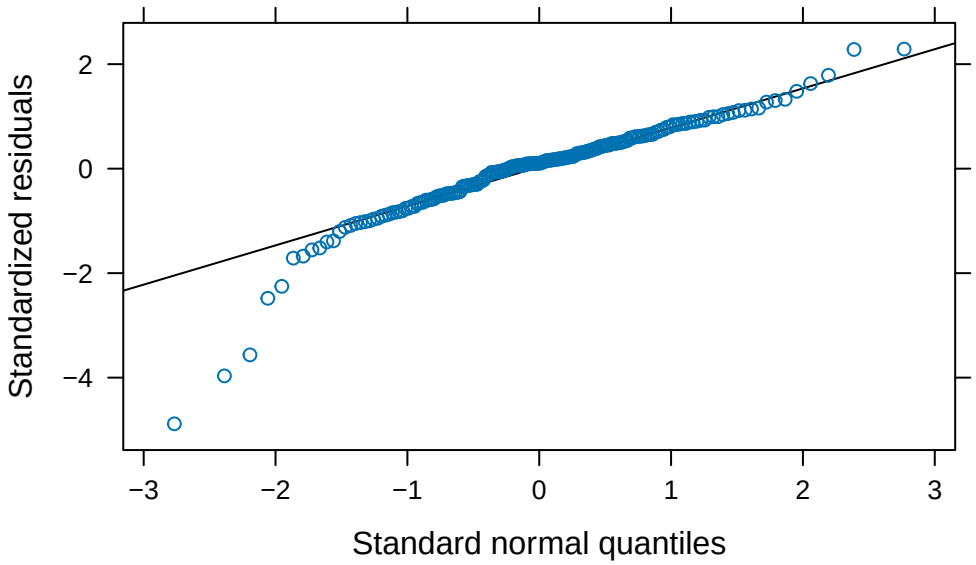
```
plot(mod1_efficiency_log, type=c("p","smooth"), col.line=1)
```




```
plot(mod1_efficiency_log,
     sqrt(abs(resid(.)))~fitted(.),
     type=c("p","smooth"), col.line=1)
```




```
lattice::qqmath(mod1_efficiency_log)
```



```
# compare
performance_aic(mod1_efficiency)
```

```
[1] 1218.932
```

```
performance_aic(mod1_efficiency_log)
```

```
Warning: Log-likelihood is corrected for models with transformed response.
  However, this ignores `REML=TRUE`. Log-likelihood value is probably
  inaccurate.
```

```
[1] 1295.046
```

```
# Model without log is better


################################
#Model 2: Family Factors
################################
mod2_efficiency <- lmer(C_ACTI_Efficiency ~ c_demo_8_v2 + c_demo_6_v2 + weekend + P_COHESION
summary(mod2_efficiency)
```

```
Linear mixed model fit by REML ['lmerMod']
Formula:
C_ACTI_Efficiency ~ c_demo_8_v2 + c_demo_6_v2 + weekend + P_COHESION +
    C_MESA_FT + C_MESA_ES + C_CHAOS + (1 | ParticipantID)
   Data: models

REML criterion at convergence: 1166.7

Scaled residuals:
    Min      1Q  Median      3Q     Max
-4.1528 -0.5611  0.0846  0.6050  2.5221

Random effects:
 Groups        Name        Variance Std.Dev.
 ParticipantID (Intercept) 12.04    3.470
 Residual                  45.42    6.739
Number of obs: 175, groups:  ParticipantID, 25
```

```
Fixed effects:
             Estimate Std. Error t value
(Intercept)   62.8051    15.2243   4.125
c_demo_8_v22   1.7455     1.9846   0.880
c_demo_6_v2    1.7036     0.9187   1.854
weekend        1.6848     1.1859   1.421
P_COHESION    -1.8482     1.9514  -0.947
C_MESA_FT      1.0892     0.4166   2.614
C_MESA_ES     -2.5555     1.3715  -1.863
C_CHAOS        2.6629     1.7636   1.510

Correlation of Fixed Effects:
            (Intr) c__8_2 c__6_2 weeknd P_COHE C_MESA_F C_MESA_E
c_dem_8_v22  0.052
c_demo_6_v2 -0.695 -0.362
weekend     -0.050  0.021  0.003
P_COHESION  -0.809  0.126  0.231  0.020
C_MESA_FT   -0.525 -0.137  0.344  0.004  0.375
C_MESA_ES    0.329 -0.021 -0.019 -0.036 -0.266 -0.441
C_CHAOS     -0.487  0.039  0.038  0.061  0.354  0.213   -0.618
```

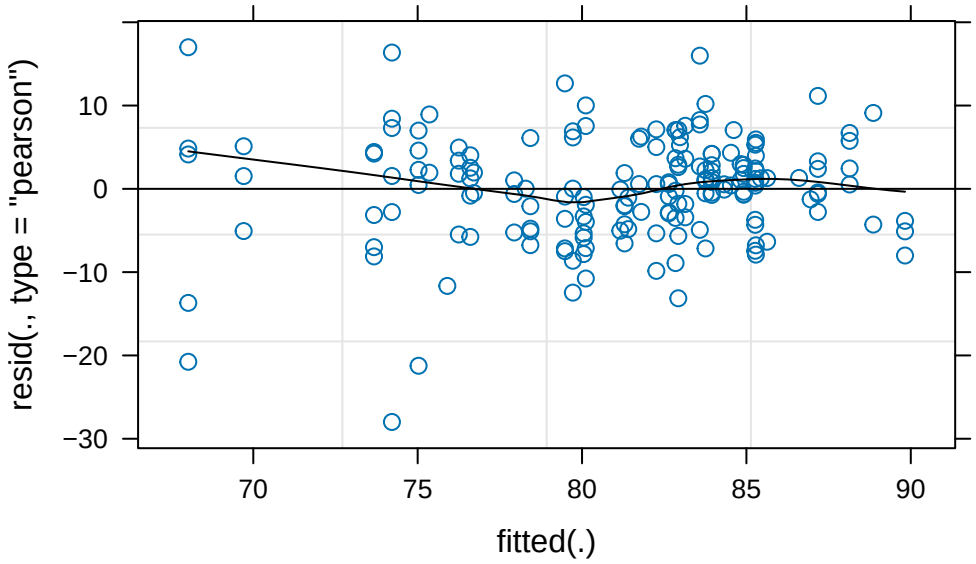
```
ci <- confint(mod2_efficiency)
```

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

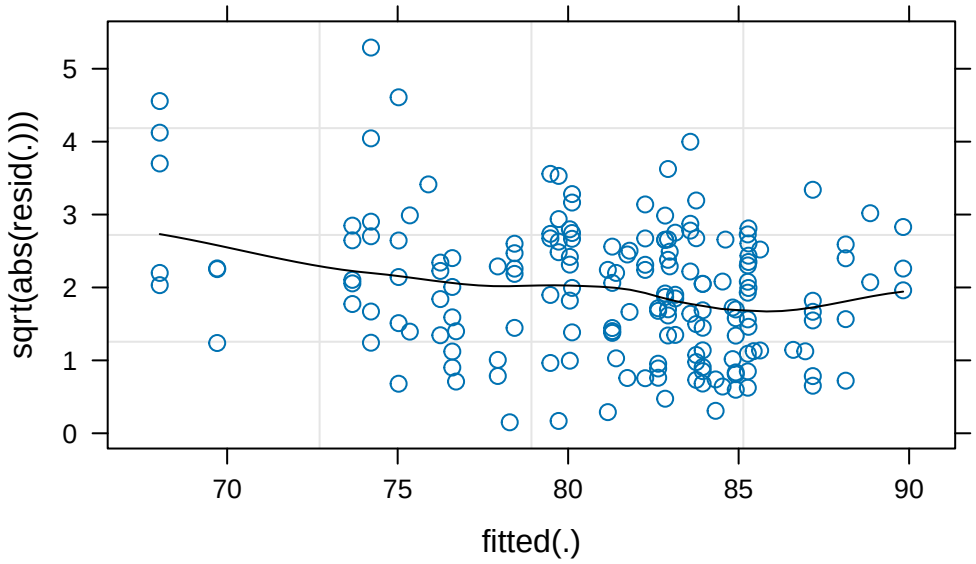
```
print(ci)
```

```
                  2.5 %     97.5 %
.sig01        1.1902086  4.2682851
.sigma        6.0214979  7.5498321
(Intercept)  36.4100125 89.1647785
c_demo_8_v22 -1.7041119  5.1682919
c_demo_6_v2   0.1154726  3.2981388
weekend      -0.6927821  3.9606177
P_COHESION   -5.2335732  1.5301387
C_MESA_FT     0.3695291  1.8128446
C_MESA_ES    -4.9371368 -0.1738573
C_CHAOS      -0.3887922  5.7252928
```

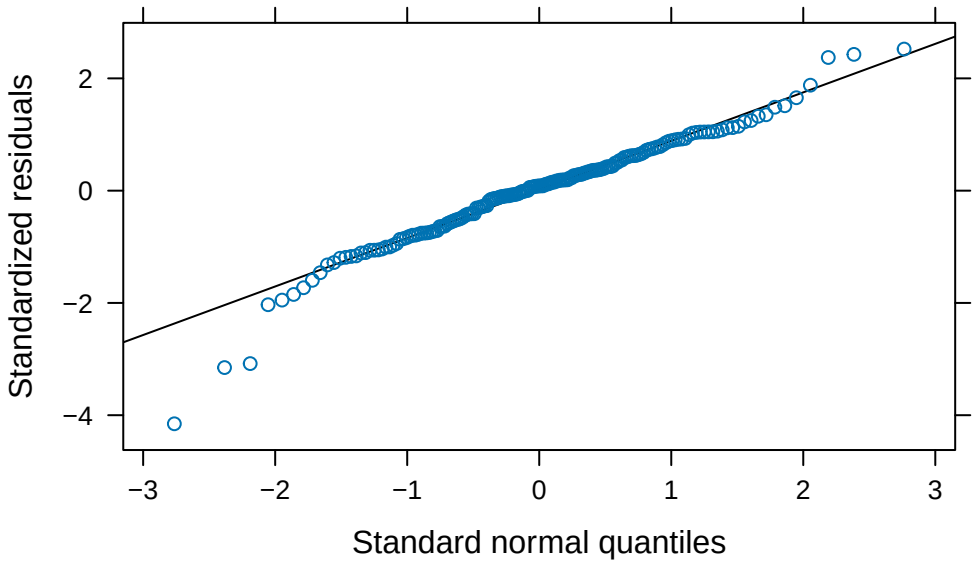
```
plot(mod2_efficiency, type=c("p","smooth"), col.line=1)
```




```
plot(mod2_efficiency,
     sqrt(abs(resid(.)))~fitted(.),
     type=c("p","smooth"), col.line=1)
```




```
lattice::qqmath(mod2_efficiency)
```

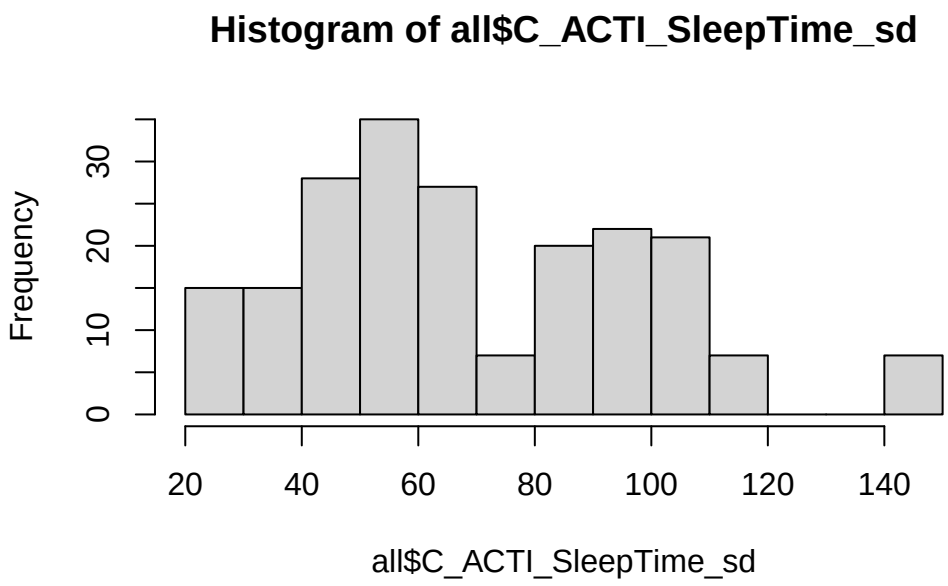


Weekly Variables

```
weekly <- models %>% filter(StudyDay == 1)
```

Duration Variability (C_ACTI_SleepTime_sd)

```
hist(all$C_ACTI_SleepTime_sd)
```




```
summary(all$C_ACTI_SleepTime_sd)
```

```
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
  26.65   46.06   61.24   69.16   90.66  145.98
```

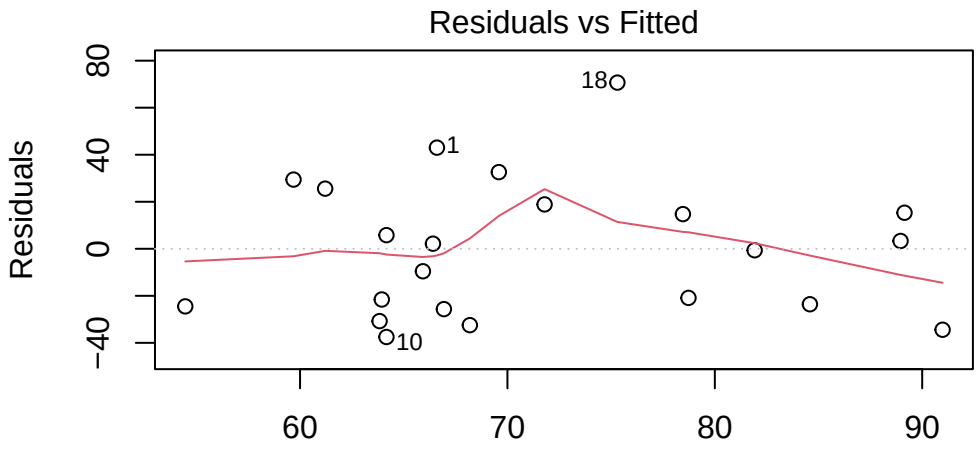
```
##################################
#Model 1: Neighborhood Factors
##################################
mod1_dur_var <- lm(C_ACTI_SleepTime_sd ~ c_demo_8_v2 + c_demo_6_v2 + weekend + geo_COI_3.0, d
summary(mod1_dur_var)
```

```
Call:
lm(formula = C_ACTI_SleepTime_sd ~ c_demo_8_v2 + c_demo_6_v2 +
    weekend + geo_COI_3.0, data = weekly)

Residuals:
    Min      1Q  Median      3Q     Max
-37.512 -24.269   0.767  17.987  70.677

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept)    24.710     61.623   0.401    0.693
c_demo_8_v22  -16.620     15.749  -1.055    0.306
c_demo_6_v2     6.629      6.686   0.991    0.335
weekend        -8.502     17.918  -0.475    0.641
geo_COI_3.0    -4.243     11.521  -0.368    0.717

Residual standard error: 32.26 on 17 degrees of freedom
  (4 observations deleted due to missingness)
Multiple R-squared:  0.1136,    Adjusted R-squared:  -0.09499
F-statistic: 0.5446 on 4 and 17 DF,  p-value: 0.7053
```

```
ci <- confint(mod1_dur_var)
print(ci)
```

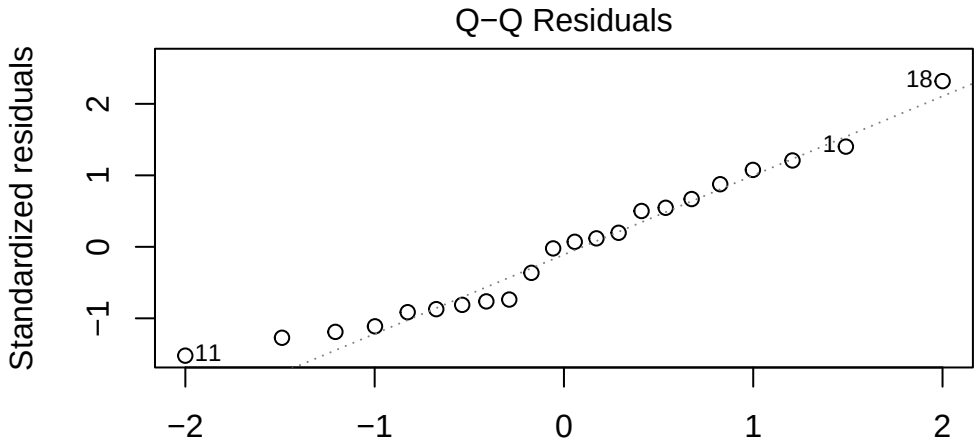
```
                 2.5 %    97.5 %
(Intercept)  -105.30260 154.72287
c_demo_8_v22  -49.84752  16.60708
c_demo_6_v2    -7.47840  20.73611
weekend       -46.30633  29.30169
geo_COI_3.0   -28.54981  20.06345
```

```
plot(mod1_dur_var, 1)
```



:_ACTI_SleepTime_sd ~ c_demo_8_v2 + c_demo_6_v2 + weekend + geo_

```
plot(mod1_dur_var, 2)
```



:_ACTI_SleepTime_sd ~ c_demo_8_v2 + c_demo_6_v2 + weekend + geo_

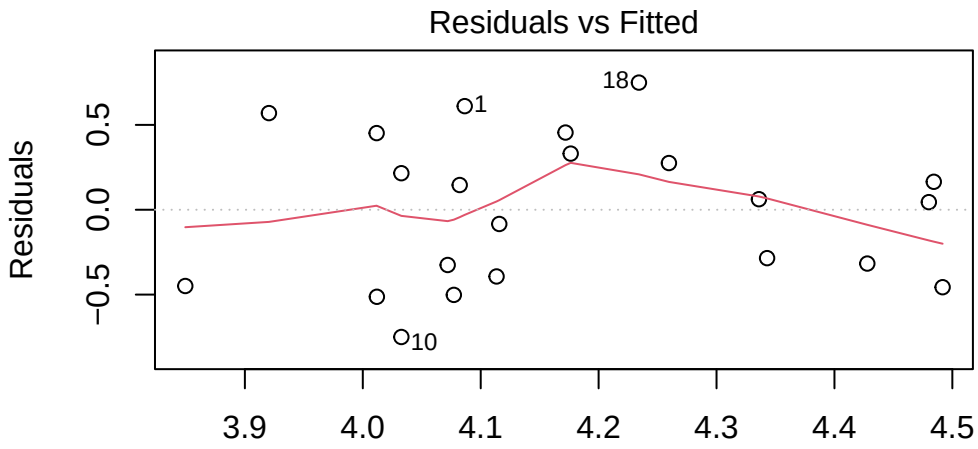
```r
# log
mod1_dur_var_log <- lm(log(C_ACTI_SleepTime_sd) ~ c_demo_8_v2 + c_demo_6_v2 + weekend + geo_
summary(mod1_dur_var_log)
```

```
Call:
lm(formula = log(C_ACTI_SleepTime_sd) ~ c_demo_8_v2 + c_demo_6_v2 +
    weekend + geo_COI_3.0, data = weekly)

Residuals:
     Min       1Q   Median       3Q      Max
-0.74979 -0.37620  0.05342  0.31693  0.74929

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept)   3.50486    0.91408   3.834  0.00133 **
c_demo_8_v22 -0.31131    0.23361  -1.333  0.20025
c_demo_6_v2   0.10203    0.09918   1.029  0.31805
weekend      -0.15682    0.26579  -0.590  0.56295
geo_COI_3.0  -0.09363    0.17089  -0.548  0.59090
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.4785 on 17 degrees of freedom
  (4 observations deleted due to missingness)
Multiple R-squared:  0.1572,    Adjusted R-squared:  -0.04105
F-statistic: 0.793 on 4 and 17 DF,  p-value: 0.5458
```

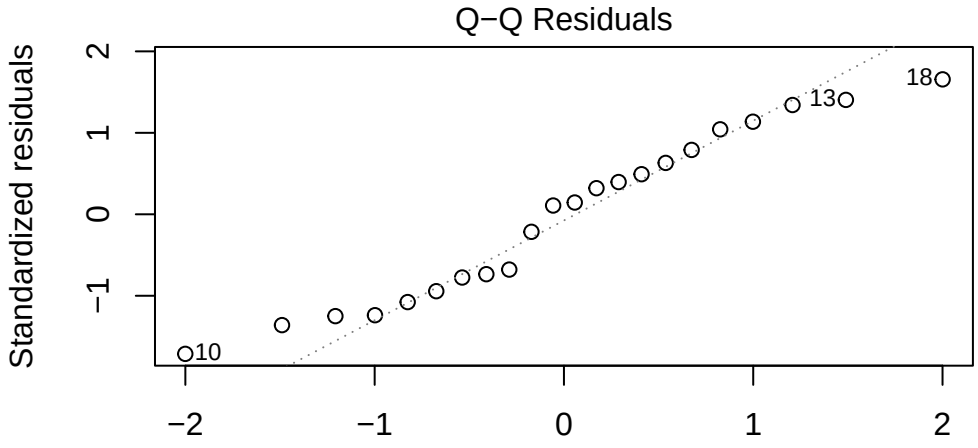
```r
ci <- confint(mod1_dur_var_log)
print(ci)
```

```
                 2.5 %    97.5 %
(Intercept)   1.5763252 5.4333857
c_demo_8_v22 -0.8041798 0.1815674
c_demo_6_v2  -0.1072328 0.3112842
weekend      -0.7175775 0.4039461
geo_COI_3.0  -0.4541777 0.2669219
```

```r
plot(mod1_dur_var_log, 1)
```




```
plot(mod1_dur_var_log, 2)
```



```r
# compare
performance_aic(mod1_dur_var)
```

```
[1] 221.6038
```

```r
performance_aic(mod1_dur_var_log)
```

```
[1] 219.9467
```

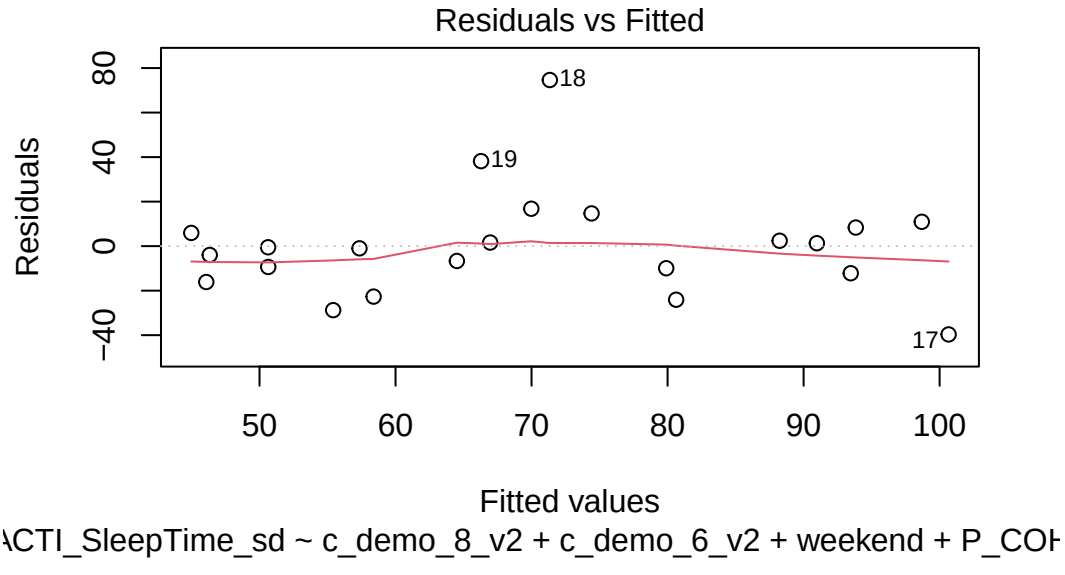
```r
################################
#Model 2: Family Factors
################################
mod2_dur_var <- lm(C_ACTI_SleepTime_sd ~ c_demo_8_v2 + c_demo_6_v2 + weekend + P_COHESION + C
summary(mod2_dur_var)
```

```
Call:
lm(formula = C_ACTI_SleepTime_sd ~ c_demo_8_v2 + c_demo_6_v2 +
    weekend + P_COHESION + C_MESA_FT + C_MESA_ES + C_CHAOS, data = weekly)

Residuals:
    Min      1Q  Median      3Q     Max
-39.665 -11.615  -0.750   7.749  74.636

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept)   174.253    109.518   1.591   0.1339
c_demo_8_v22  -11.076     14.379  -0.770   0.4539
c_demo_6_v2     5.173      6.506   0.795   0.4398
weekend       -21.392     20.147  -1.062   0.3063
P_COHESION    -14.160     13.543  -1.046   0.3135
C_MESA_FT      -5.378      3.058  -1.759   0.1005
C_MESA_ES      23.173     10.059   2.304   0.0371 *
C_CHAOS       -29.610     15.568  -1.902   0.0779 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 29.17 on 14 degrees of freedom
  (4 observations deleted due to missingness)
Multiple R-squared:  0.3685,    Adjusted R-squared:  0.05276
F-statistic: 1.167 on 7 and 14 DF,  p-value: 0.3799
```

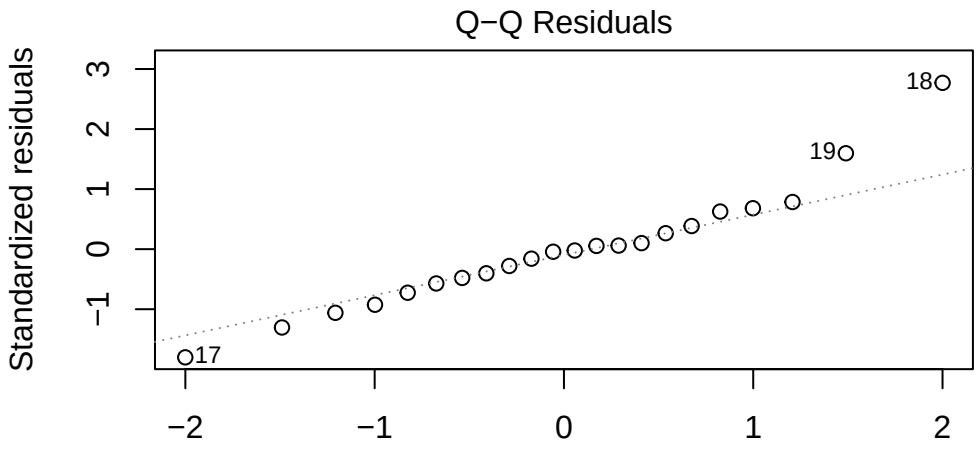
```r
ci <- confint(mod2_dur_var)
print(ci)
```

```
                 2.5 %     97.5 %
(Intercept)  -60.638830 409.145301
c_demo_8_v22 -41.917172  19.764182
c_demo_6_v2   -8.780178  19.126969
weekend      -64.603042  21.818488
P_COHESION   -43.207469  14.886874
C_MESA_FT    -11.936169   1.180993
C_MESA_ES      1.599275  44.747381
C_CHAOS      -63.000527   3.779916
```

```r
plot(mod2_dur_var, 1)
```




```r
plot(mod2_dur_var, 2)
```



ACTI_SleepTime_sd ~ c_demo_8_v2 + c_demo_6_v2 + weekend + P_COH

```
# log
mod2_dur_var_log <- lm(log(C_ACTI_SleepTime_sd) ~ c_demo_8_v2 + c_demo_6_v2 + weekend + P_COH
summary(mod2_dur_var_log)
```

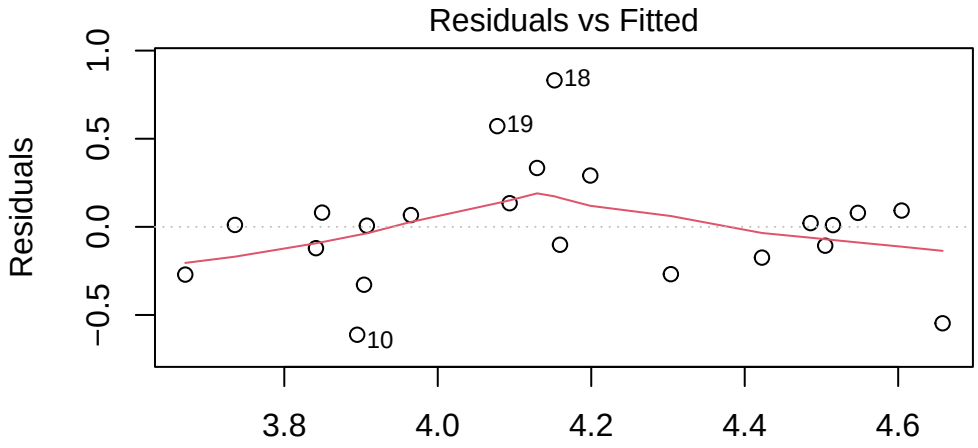
```
Call:
lm(formula = log(C_ACTI_SleepTime_sd) ~ c_demo_8_v2 + c_demo_6_v2 +
    weekend + P_COHESION + C_MESA_FT + C_MESA_ES + C_CHAOS, data = weekly)

Residuals:
     Min       1Q   Median       3Q      Max
-0.61207 -0.16106  0.01034  0.08964  0.83137

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept)   6.28420    1.50603   4.173 0.000939 ***
c_demo_8_v22 -0.21932    0.19774  -1.109 0.286063
c_demo_6_v2   0.06119    0.08946   0.684 0.505148
weekend      -0.34477    0.27705  -1.244 0.233770
P_COHESION   -0.28762    0.18624  -1.544 0.144800
C_MESA_FT    -0.09795    0.04205  -2.329 0.035324 *
C_MESA_ES     0.37470    0.13832   2.709 0.016960 *
```

```
C_CHAOS      -0.44337    0.21408  -2.071 0.057323 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.4011 on 14 degrees of freedom
  (4 observations deleted due to missingness)
Multiple R-squared:  0.4581,    Adjusted R-squared:  0.1872
F-statistic: 1.691 on 7 and 14 DF,  p-value: 0.1907
```

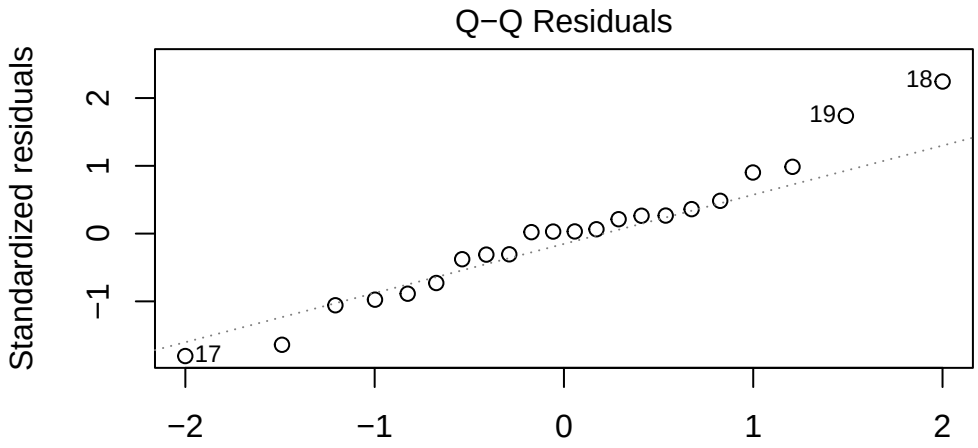
```r
ci <- confint(mod2_dur_var_log)
print(ci)
```

```
                  2.5 %       97.5 %
(Intercept)   3.05407580  9.514321529
c_demo_8_v22 -0.64342383  0.204788527
c_demo_6_v2  -0.13069006  0.253075631
weekend      -0.93898526  0.249442111
P_COHESION   -0.68706314  0.111822368
C_MESA_FT    -0.18814289 -0.007761974
C_MESA_ES     0.07802469  0.671376718
C_CHAOS      -0.90253277  0.015799806
```

```r
plot(mod2_dur_var_log, 1)
```



```
plot(mod2_dur_var_log, 2)
```




```
# compare
performance_aic(mod2_dur_var)
```

```
[1] 218.9068
```

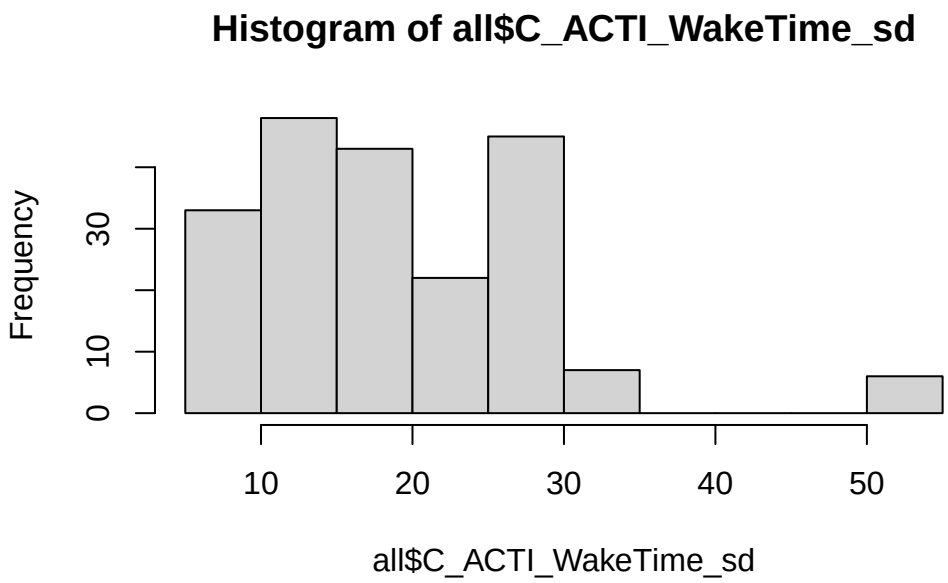
```
performance_aic(mod2_dur_var_log)
```

```
[1] 213.5388
```

```
# aic is close enough, could choose either model
# choose non transformed for simplicity
```

Offset Variability (C_ACTI_WakeTime_sd)

```
hist(all$C_ACTI_WakeTime_sd)
```




```
summary(all$C_ACTI_WakeTime_sd)
```

```
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
  6.154  12.581  17.277  19.293  25.446  52.751
```

```
################################
#Model 1: Neighborhood Factors
################################
mod1_off_var <- lm(C_ACTI_WakeTime_sd ~ c_demo_8_v2 + c_demo_6_v2 + weekend + geo_COI_3.0, da
summary(mod1_off_var)
```

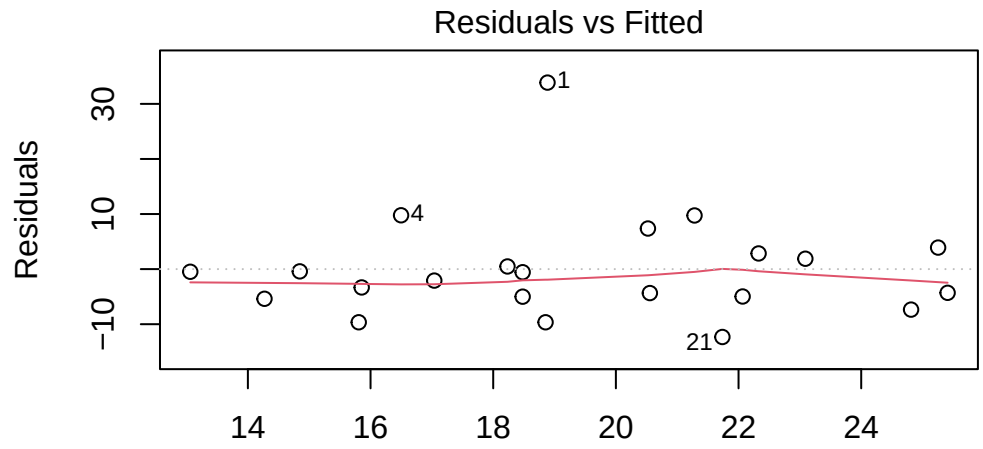
```
Call:
lm(formula = C_ACTI_WakeTime_sd ~ c_demo_8_v2 + c_demo_6_v2 +
    weekend + geo_COI_3.0, data = weekly)
```

```
Residuals:
    Min      1Q  Median      3Q     Max
-12.325  -4.996  -1.325   2.604  33.866

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept)  42.77100   20.42660   2.094   0.0516 .
c_demo_8_v22 -3.97671    5.22042  -0.762   0.4566
c_demo_6_v2  -2.19086    2.21642  -0.988   0.3368
weekend      -0.04793    5.93947  -0.008   0.9937
geo_COI_3.0  -0.70602    3.81887  -0.185   0.8555
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 10.69 on 17 degrees of freedom
  (4 observations deleted due to missingness)
Multiple R-squared:  0.1223,    Adjusted R-squared:  -0.0842
F-statistic: 0.5923 on 4 and 17 DF,  p-value: 0.6729
```

```r
ci <- confint(mod1_off_var)
print(ci)
```

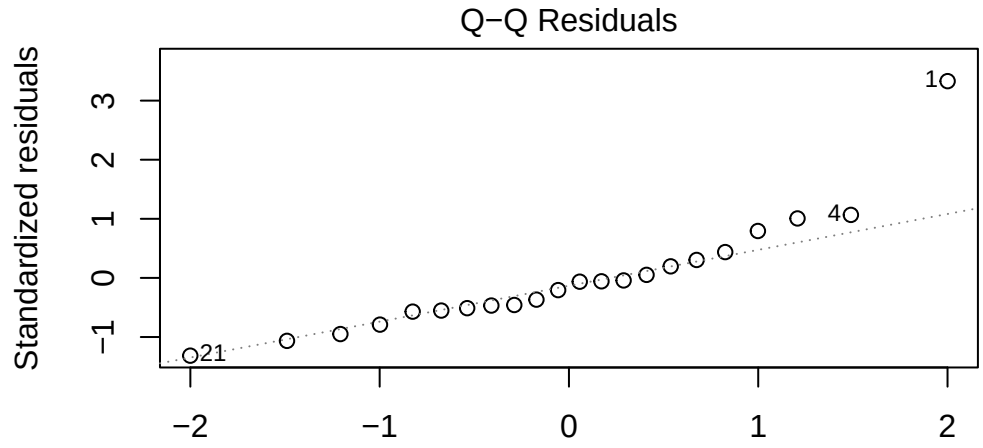
```
                  2.5 %    97.5 %
(Intercept)   -0.3253491 85.867358
c_demo_8_v22 -14.9908309  7.037401
c_demo_6_v2   -6.8671012  2.485387
weekend      -12.5791216 12.483268
geo_COI_3.0   -8.7631311  7.351091
```

```r
plot(mod1_off_var, 1)
```



:_ACTI_WakeTime_sd ~ c_demo_8_v2 + c_demo_6_v2 + weekend + geo_

```
plot(mod1_off_var, 2)
```



:_ACTI_WakeTime_sd ~ c_demo_8_v2 + c_demo_6_v2 + weekend + geo_

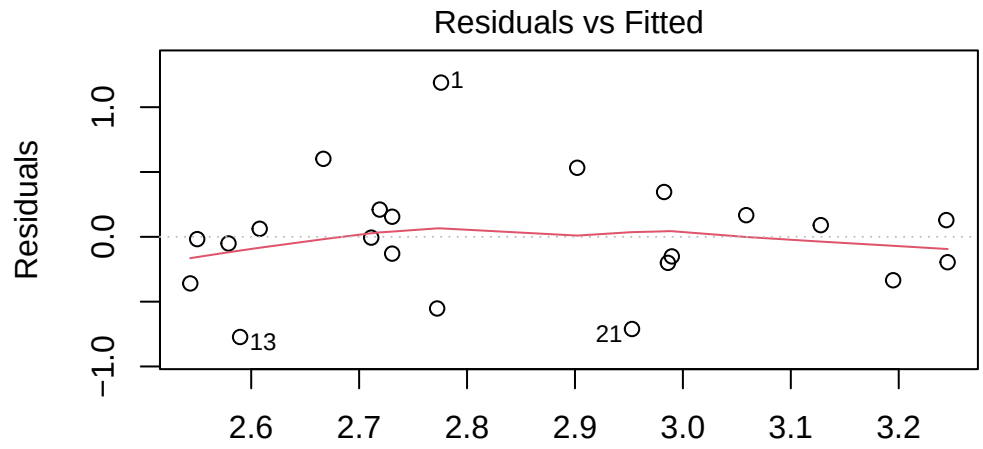
```r
# log
mod1_off_var_log <- lm(log(C_ACTI_WakeTime_sd) ~ c_demo_8_v2 + c_demo_6_v2 + weekend + geo_C
summary(mod1_off_var_log)
```

```
Call:
lm(formula = log(C_ACTI_WakeTime_sd) ~ c_demo_8_v2 + c_demo_6_v2 +
    weekend + geo_COI_3.0, data = weekly)

Residuals:
     Min       1Q   Median       3Q      Max
-0.77267 -0.19960 -0.01199  0.16402  1.18971

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept)   4.05233    0.93545   4.332 0.000453 ***
c_demo_8_v22 -0.32651    0.23907  -1.366 0.189826
c_demo_6_v2  -0.10318    0.10150  -1.016 0.323643
weekend       0.01074    0.27200   0.039 0.968957
geo_COI_3.0  -0.07889    0.17489  -0.451 0.657628
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.4897 on 17 degrees of freedom
  (4 observations deleted due to missingness)
Multiple R-squared:  0.2146,    Adjusted R-squared:  0.02983
F-statistic: 1.161 on 4 and 17 DF,  p-value: 0.3623
```

```r
ci <- confint(mod1_off_var_log)
print(ci)
```

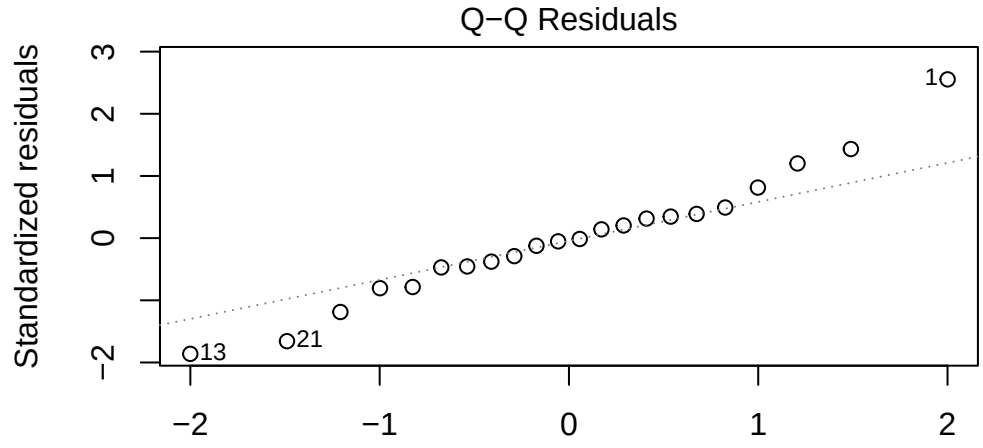
```
                 2.5 %    97.5 %
(Intercept)   2.0786984 6.0259687
c_demo_8_v22 -0.8309079 0.1778943
c_demo_6_v2  -0.3173301 0.1109753
weekend      -0.5631347 0.5846193
geo_COI_3.0  -0.4478723 0.2900926
```

```r
plot(mod1_off_var_log, 1)
```



|(C_ACTI_WakeTime_sd) ~ c_demo_8_v2 + c_demo_6_v2 + weekend + g

```
plot(mod1_off_var_log, 2)
```



|(C_ACTI_WakeTime_sd) ~ c_demo_8_v2 + c_demo_6_v2 + weekend + g

```r
# compare
performance_aic(mod1_off_var)
```

```
[1] 173.0192
```

```r
performance_aic(mod1_off_var_log)
```

```
[1] 162.6635
```

```r
# log slightly better but close

##################################
#Model 2: Family Factors
##################################
mod2_off_var <- lm(C_ACTI_WakeTime_sd ~ c_demo_8_v2 + c_demo_6_v2 + weekend + P_COHESION + C_
summary(mod2_off_var)
```

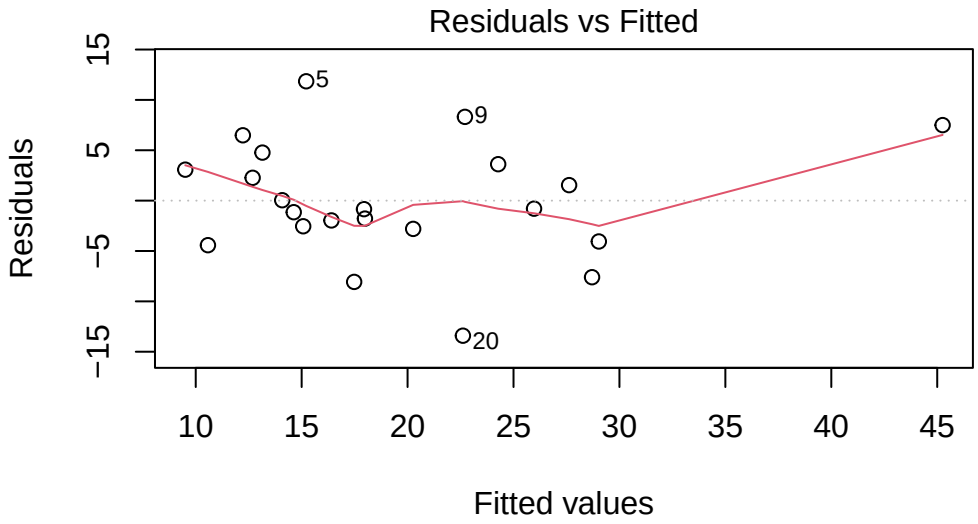
```
Call:
lm(formula = C_ACTI_WakeTime_sd ~ c_demo_8_v2 + c_demo_6_v2 +
    weekend + P_COHESION + C_MESA_FT + C_MESA_ES + C_CHAOS, data = weekly)

Residuals:
     Min       1Q   Median       3Q      Max
-13.4082  -2.7399  -0.8231   3.4801  11.8473

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept)   76.2372    26.9863   2.825 0.013498 *
c_demo_8_v22  -6.9736     3.5432  -1.968 0.069180 .
c_demo_6_v2   -1.5771     1.6031  -0.984 0.341909
weekend      -10.9615     4.9644  -2.208 0.044428 *
P_COHESION    -2.6123     3.3372  -0.783 0.446790
C_MESA_FT     -0.5576     0.7535  -0.740 0.471531
C_MESA_ES     11.3900     2.4786   4.595 0.000416 ***
C_CHAOS      -11.9724     3.8361  -3.121 0.007513 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 7.188 on 14 degrees of freedom
```

```
  (4 observations deleted due to missingness)
Multiple R-squared:  0.6622,    Adjusted R-squared:  0.4933
F-statistic:  3.92 on 7 and 14 DF,  p-value: 0.01422
```

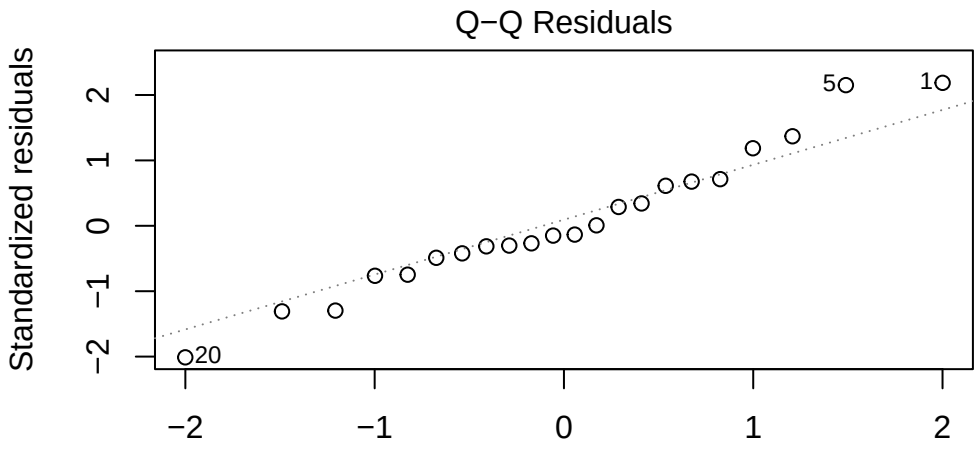
```r
ci <- confint(mod2_off_var)
print(ci)
```

```
                 2.5 %      97.5 %
(Intercept)   18.357410 134.1170602
c_demo_8_v22 -14.573069   0.6258520
c_demo_6_v2   -5.015439   1.8611699
weekend      -21.609032  -0.3138767
P_COHESION    -9.769831   4.5452144
C_MESA_FT     -2.173690   1.0585143
C_MESA_ES      6.073945  16.7060832
C_CHAOS      -20.200093  -3.7447037
```

```r
plot(mod2_off_var, 1)
```




```r
plot(mod2_off_var, 2)
```



ACTI_WakeTime_sd ~ c_demo_8_v2 + c_demo_6_v2 + weekend + P_COH

```
# log
mod2_off_var_log <- lm(log(C_ACTI_WakeTime_sd) ~ c_demo_8_v2 + c_demo_6_v2 + weekend + P_COH
summary(mod2_off_var_log)
```

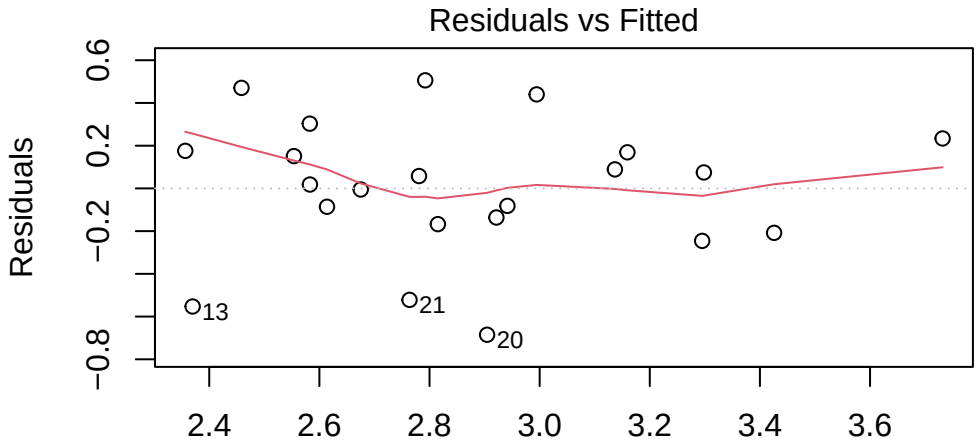
```
Call:
lm(formula = log(C_ACTI_WakeTime_sd) ~ c_demo_8_v2 + c_demo_6_v2 +
    weekend + P_COHESION + C_MESA_FT + C_MESA_ES + C_CHAOS, data = weekly)

Residuals:
     Min       1Q   Median       3Q      Max
-0.68499 -0.15953  0.03802  0.17407  0.50593

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept)   5.31989    1.46395   3.634  0.00271 **
c_demo_8_v22 -0.44386    0.19221  -2.309  0.03670 *
c_demo_6_v2  -0.07958    0.08696  -0.915  0.37561
weekend      -0.53952    0.26931  -2.003  0.06489 .
P_COHESION   -0.06937    0.18104  -0.383  0.70734
C_MESA_FT    -0.02540    0.04088  -0.621  0.54431
C_MESA_ES     0.43503    0.13446   3.235  0.00598 **
```

```
C_CHAOS      -0.49861    0.20810  -2.396  0.03111 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.3899 on 14 degrees of freedom
  (4 observations deleted due to missingness)
Multiple R-squared:  0.5569,    Adjusted R-squared:  0.3354
F-statistic: 2.514 on 7 and 14 DF,  p-value: 0.06737
```

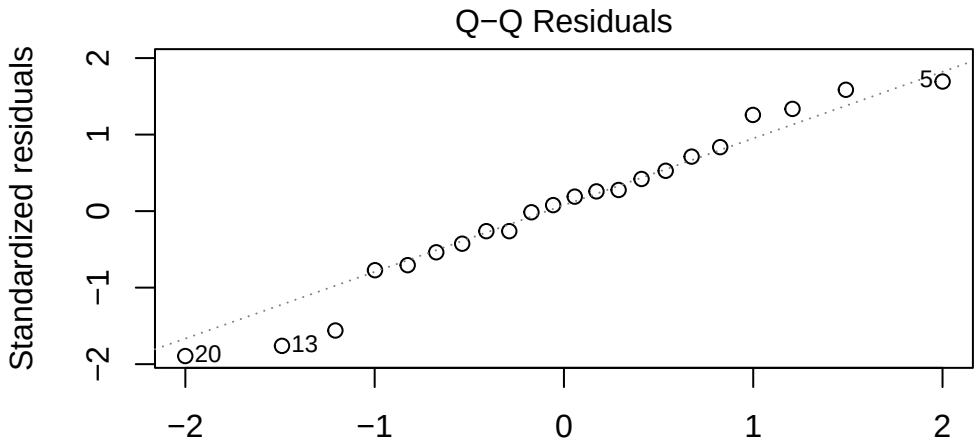
```r
ci <- confint(mod2_off_var_log)
print(ci)
```

```
                 2.5 %      97.5 %
(Intercept)   2.1800166  8.45975419
c_demo_8_v22 -0.8561161 -0.03160401
c_demo_6_v2  -0.2661060  0.10693677
weekend      -1.1171308  0.03809030
P_COHESION   -0.4576512  0.31891233
C_MESA_FT    -0.1130717  0.06226911
C_MESA_ES     0.1466437  0.72341669
C_CHAOS      -0.9449436 -0.05227048
```

```r
plot(mod2_off_var_log, 1)
```



```
plot(mod2_off_var_log, 2)
```




```
# compare
performance_aic(mod2_off_var)
```

```
[1] 157.2735
```

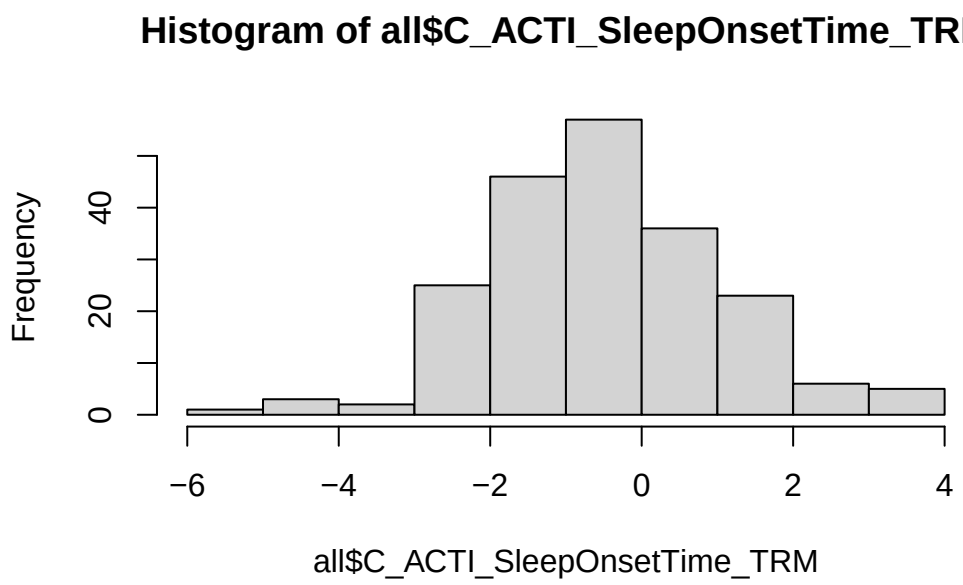
```
performance_aic(mod2_off_var_log)
```

```
[1] 155.3568
```

```
# pretty close
```

Onset Variability (C_ACTI_SleepOnsetTime_TRM)

```
hist(all$C_ACTI_SleepOnsetTime_TRM)
```




```
summary(all$C_ACTI_SleepOnsetTime_TRM)
```

```
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
-5.3700 -1.5700 -0.6000 -0.5149  0.4425  3.4500
```

```
################################
#Model 1: Neighborhood Factors
################################
mod1_on_var <- lm(C_ACTI_SleepOnsetTime_TRM ~ c_demo_8_v2 + c_demo_6_v2 + weekend + geo_COI_3
summary(mod1_on_var)
```

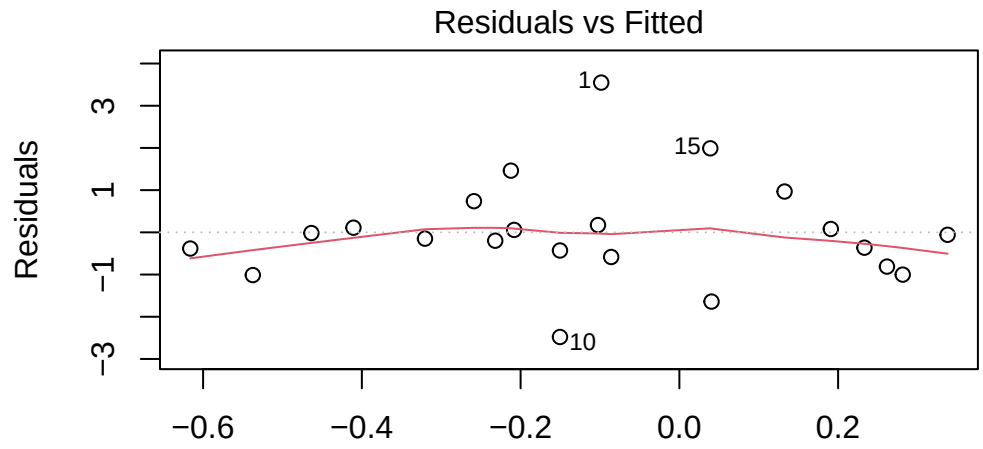
```
Call:
lm(formula = C_ACTI_SleepOnsetTime_TRM ~ c_demo_8_v2 + c_demo_6_v2 +
    weekend + geo_COI_3.0, data = weekly)
```

```
Residuals:
    Min      1Q  Median      3Q     Max
-2.4796 -0.5455 -0.1037  0.1570  3.5484

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept)   1.87694    2.64653   0.709    0.488
c_demo_8_v22 -0.10981    0.67637  -0.162    0.873
c_demo_6_v2  -0.20456    0.28717  -0.712    0.486
weekend       0.09008    0.76954   0.117    0.908
geo_COI_3.0  -0.09054    0.49478  -0.183    0.857

Residual standard error: 1.385 on 17 degrees of freedom
  (4 observations deleted due to missingness)
Multiple R-squared:  0.04572,   Adjusted R-squared:  -0.1788
F-statistic: 0.2036 on 4 and 17 DF,  p-value: 0.9329
```

```r
ci <- confint(mod1_on_var)
print(ci)
```

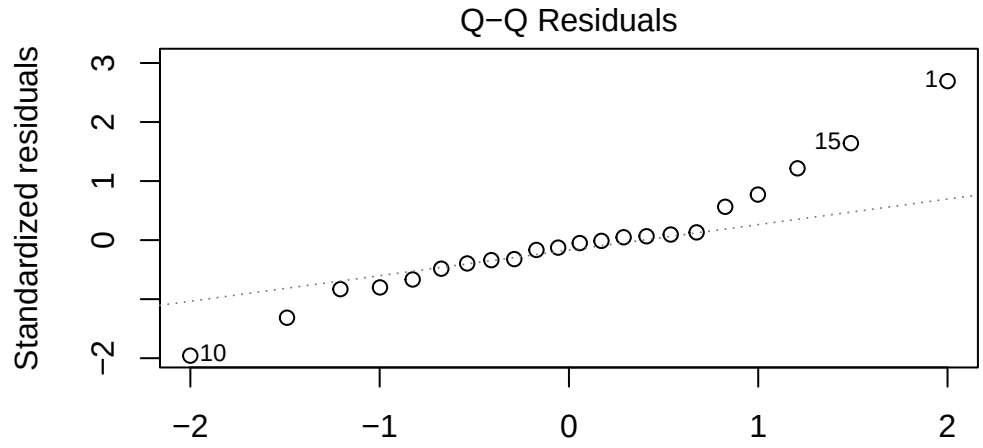
```
                 2.5 %    97.5 %
(Intercept)  -3.7067499 7.4606244
c_demo_8_v22 -1.5368347 1.3172062
c_demo_6_v2  -0.8104276 0.4013076
weekend      -1.5334960 1.7136590
geo_COI_3.0  -1.1344451 0.9533598
```

```r
plot(mod1_on_var, 1)
```



ACTI_SleepOnsetTime_TRM ~ c_demo_8_v2 + c_demo_6_v2 + weekend -

```
plot(mod1_on_var, 2)
```



ACTI_SleepOnsetTime_TRM ~ c_demo_8_v2 + c_demo_6_v2 + weekend -

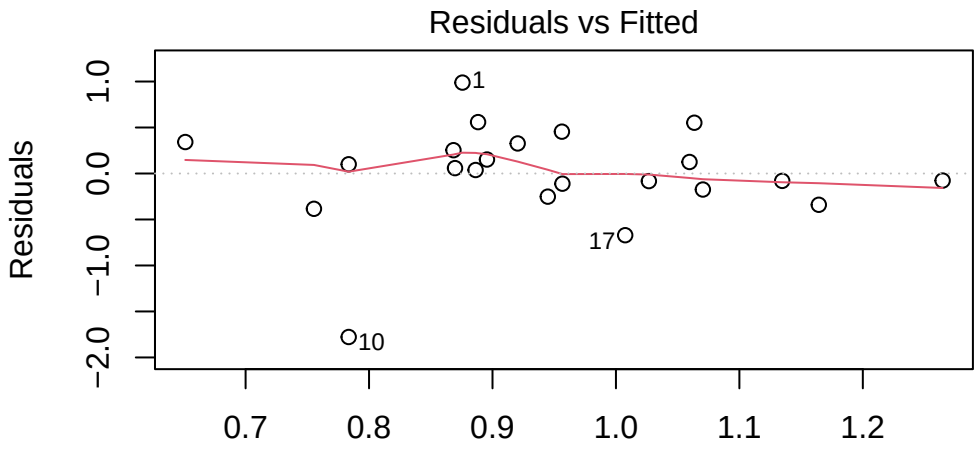
```r
# log
mod1_on_var_log <- lm(log(C_ACTI_SleepOnsetTime_TRM + 3) ~ c_demo_8_v2 + c_demo_6_v2 + weeke
summary(mod1_on_var_log)
```

```
Call:
lm(formula = log(C_ACTI_SleepOnsetTime_TRM + 3) ~ c_demo_8_v2 +
    c_demo_6_v2 + weekend + geo_COI_3.0, data = weekly)

Residuals:
     Min       1Q   Median       3Q      Max
-1.77775 -0.15845  0.04826  0.30829  0.98842

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept)   1.30254    1.14822   1.134    0.272
c_demo_8_v22 -0.08015    0.29345  -0.273    0.788
c_demo_6_v2  -0.03369    0.12459  -0.270    0.790
weekend       0.21851    0.33387   0.654    0.522
geo_COI_3.0  -0.16063    0.21467  -0.748    0.465

Residual standard error: 0.601 on 17 degrees of freedom
  (4 observations deleted due to missingness)
Multiple R-squared:  0.06693,   Adjusted R-squared:  -0.1526
F-statistic: 0.3049 on 4 and 17 DF,  p-value: 0.8707
```

```r
ci <- confint(mod1_on_var_log)
print(ci)
```

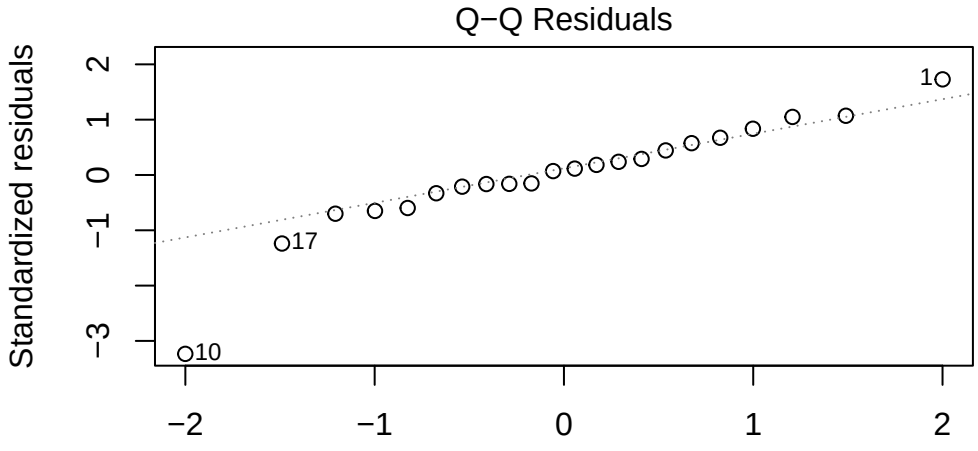
```
                 2.5 %    97.5 %
(Intercept)  -1.1199834 3.7250682
c_demo_8_v22 -0.6992699 0.5389778
c_demo_6_v2  -0.2965533 0.2291673
weekend      -0.4858909 0.9229125
geo_COI_3.0  -0.6135319 0.2922784
```

```r
plot(mod1_on_var_log, 1)
```



g(C_ACTI_SleepOnsetTime_TRM + 3) ~ c_demo_8_v2 + c_demo_6_v2 + \

```
plot(mod1_on_var_log, 2)
```



g(C_ACTI_SleepOnsetTime_TRM + 3) ~ c_demo_8_v2 + c_demo_6_v2 + \

```r
# compare
performance_aic(mod1_on_var)
```

```
[1] 83.1013
```

```r
performance_aic(mod1_on_var_log)
```

```
Warning: Could not compute corrected log-likelihood for models with transformed
  response. Log-likelihood value is probably inaccurate.
```

```
[1] 46.35961
```

```r
# log model is better


################################
#Model 2: Family Factors
################################
mod2_on_var <- lm(C_ACTI_SleepOnsetTime_TRM ~ c_demo_8_v2 + c_demo_6_v2 + weekend + P_COHESI
summary(mod2_on_var)
```

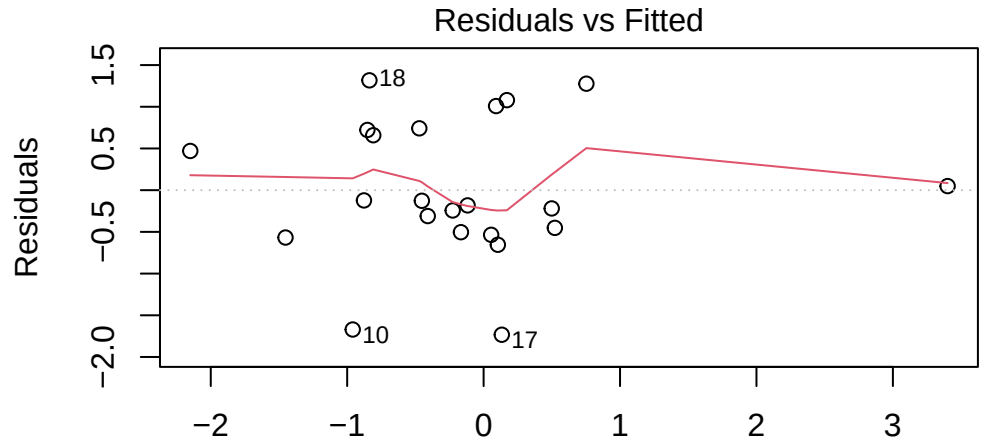
```
Call:
lm(formula = C_ACTI_SleepOnsetTime_TRM ~ c_demo_8_v2 + c_demo_6_v2 +
    weekend + P_COHESION + C_MESA_FT + C_MESA_ES + C_CHAOS, data = weekly)

Residuals:
    Min      1Q  Median      3Q     Max
-1.7333 -0.4909 -0.1548  0.7061  1.3170

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept)   5.39331    3.86466   1.396 0.184593
c_demo_8_v22 -0.13966    0.50742  -0.275 0.787161
c_demo_6_v2   0.04815    0.22958   0.210 0.836897
weekend      -0.68502    0.71094  -0.964 0.351626
P_COHESION   -0.58915    0.47791  -1.233 0.237964
C_MESA_FT    -0.03714    0.10791  -0.344 0.735800
C_MESA_ES     1.47507    0.35496   4.156 0.000971 ***
C_CHAOS      -1.64859    0.54937  -3.001 0.009535 **
```

```
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 1.029 on 14 degrees of freedom
  (4 observations deleted due to missingness)
Multiple R-squared:  0.6097,    Adjusted R-squared:  0.4145
F-statistic: 3.124 on 7 and 14 DF,  p-value: 0.03312
```

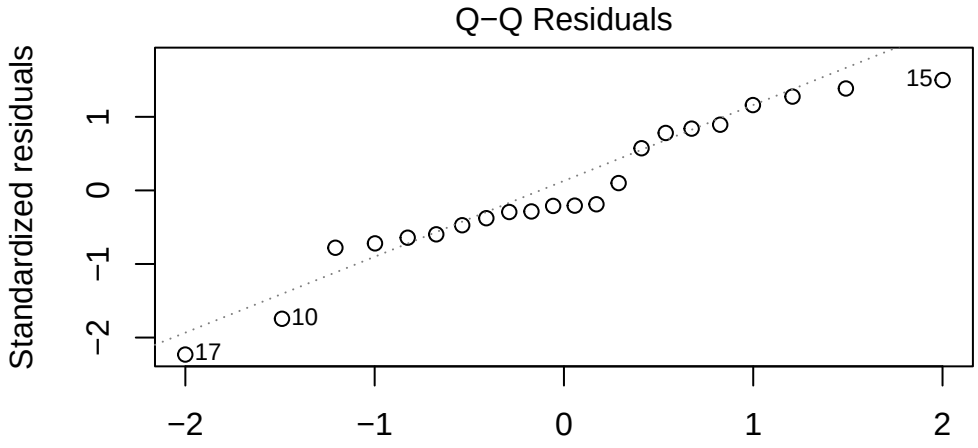
```r
ci <- confint(mod2_on_var)
print(ci)
```

```
                 2.5 %     97.5 %
(Intercept)  -2.8955545 13.6821772
c_demo_8_v22 -1.2279614  0.9486488
c_demo_6_v2  -0.4442433  0.5405434
weekend      -2.2098411  0.8397999
P_COHESION   -1.6141673  0.4358646
C_MESA_FT    -0.2685825  0.1942956
C_MESA_ES     0.7137663  2.2363757
C_CHAOS      -2.8268624 -0.4703157
```

```r
plot(mod2_on_var, 1)
```



```
plot(mod2_on_var, 2)
```



.CTI_SleepOnsetTime_TRM ~ c_demo_8_v2 + c_demo_6_v2 + weekend +

```
# log
mod2_on_var_log <- lm(log(C_ACTI_SleepOnsetTime_TRM + 3) ~ c_demo_8_v2 + c_demo_6_v2 + weeke
summary(mod2_on_var_log)
```

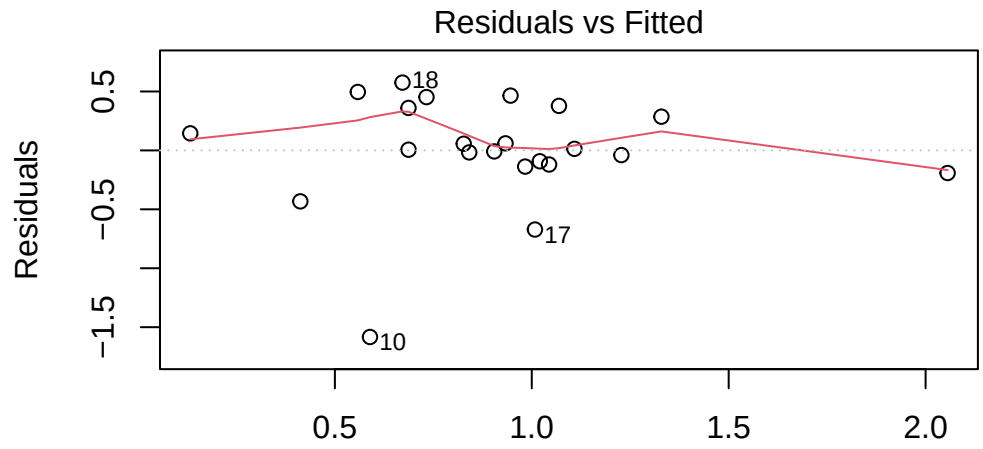
```
Call:
lm(formula = log(C_ACTI_SleepOnsetTime_TRM + 3) ~ c_demo_8_v2 +
    c_demo_6_v2 + weekend + P_COHESION + C_MESA_FT + C_MESA_ES +
    C_CHAOS, data = weekly)

Residuals:
    Min      1Q  Median      3Q     Max
-1.5834 -0.1128  0.0097  0.3419  0.5754

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept)   2.80621    2.15355   1.303   0.2136
c_demo_8_v22 -0.06692    0.28276  -0.237   0.8163
c_demo_6_v2   0.04806    0.12793   0.376   0.7128
weekend      -0.13739    0.39617  -0.347   0.7339
```

```
P_COHESION   -0.24366    0.26631  -0.915   0.3757
C_MESA_FT    -0.01720    0.06013  -0.286   0.7790
C_MESA_ES     0.50961    0.19780   2.576   0.0220 *
C_CHAOS      -0.60745    0.30613  -1.984   0.0672 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.5736 on 14 degrees of freedom
  (4 observations deleted due to missingness)
Multiple R-squared:  0.3925,    Adjusted R-squared:  0.08879
F-statistic: 1.292 on 7 and 14 DF,  p-value: 0.3225
```

```r
ci <- confint(mod2_on_var_log)
print(ci)
```

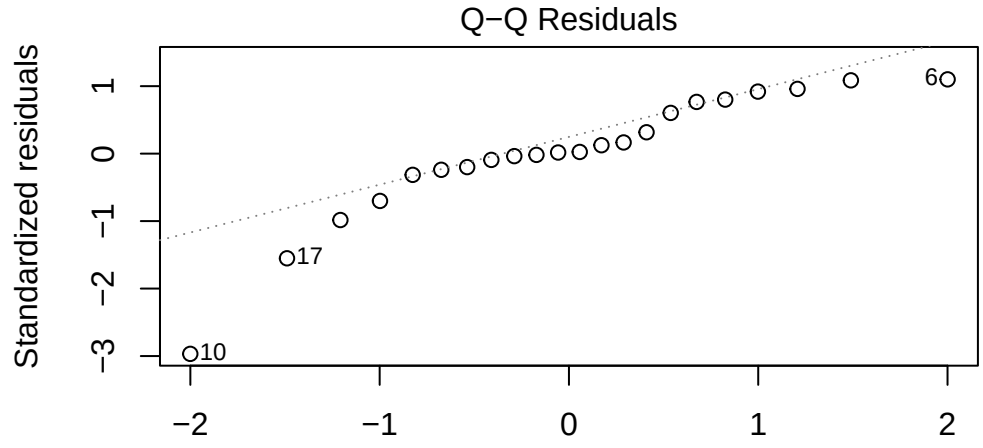
```
                   2.5 %     97.5 %
(Intercept)  -1.81270057 7.42512110
c_demo_8_v22 -0.67336662 0.53953375
c_demo_6_v2  -0.22632372 0.32244163
weekend      -0.98708956 0.71230093
P_COHESION   -0.81484367 0.32752184
C_MESA_FT    -0.14617082 0.11176468
C_MESA_ES     0.08537583 0.93383895
C_CHAOS      -1.26403877 0.04912994
```

```r
plot(mod2_on_var_log, 1)
```



g(C_ACTI_SleepOnsetTime_TRM + 3) ~ c_demo_8_v2 + c_demo_6_v2 + \

```
plot(mod2_on_var_log, 2)
```



g(C_ACTI_SleepOnsetTime_TRM + 3) ~ c_demo_8_v2 + c_demo_6_v2 + \

```
# compare
performance_aic(mod2_on_var)
```

```
[1] 71.76148
```

```
performance_aic(mod2_on_var_log)
```

```
Warning: Could not compute corrected log-likelihood for models with transformed
  response. Log-likelihood value is probably inaccurate.
```

```
[1] 46.03229
```

```
# log model is better
```