Doi: https://doi.org/10.1027/1015-5759/a000624

Supplement for: Bayesian Multivariate Mixed-Effects Location Scale Modeling of Longitudinal Relations among Affective Traits, States, and Physical Activity

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Library and Data

Load library and download data from osf repository

Subset the data for this example to reduce computation time: Select 30 individuals randomly

```
set.seed(6648)
subset_id <- sample(x = unique(dat$record_id ), 30)

## subset with given 30 individuals
dats <- dat[dat$record_id %in% subset_id, ]
```

Standard mixed effects location scale model

```
fit_melsm <- brm(bf(
    ## location
    P_A.std ~ 1 + day + P_A.lag + N_A.lag + steps.pm*steps.pmd + (1 + day +
steps.pmd | c | record_id),
    ## scale (the c  in |c| allows for correlation between location and
scale)
    sigma ~ 1 + P_A.lag + N_A.lag + steps.pm*steps.pmd + (1 + steps.pmd | c |
record_id)),
    data=dats, inits = 0,
    ## sample prior for Bayes factors
    cores = 4, sample_prior = T)
```

Print the estimates with information on credible intervals, Rhats and effective samplesize. The correlations among random effects for both location and scale are in "Group-Level Effects" and are denoted by `cor()`

```
summary(fit_melsm )

##  Family: gaussian
##   Links: mu = identity; sigma = log
## Formula: P_A.std ~ 1 + day + P_A.lag + N_A.lag + steps.pm * steps.pmd + (1
+ day + steps.pmd | c | record_id)
##          sigma ~ 1 + P_A.lag + N_A.lag + steps.pm * steps.pmd + (1 +
steps.pmd | c | record_id)
```

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```
##    Data: dats (Number of observations: 1851)
## Samples: 4 chains, each with iter = 2000; warmup = 1000; thin = 1;
##          total post-warmup samples = 4000
##
## Group-Level Effects:
## ~record_id (Number of levels: 30)
##                                   Estimate Est.Error l-95% CI u-95% CI
Rhat
## sd(Intercept)                         0.68      0.10     0.51     0.90
1.00
## sd(day)                               0.01      0.00     0.00     0.01
1.00
## sd(steps.pmd)                         0.13      0.03     0.09     0.19
1.00
## sd(sigma_Intercept)                   0.54      0.08     0.40     0.73
1.00
## sd(sigma_steps.pmd)                   0.12      0.05     0.03     0.22
1.00
## cor(Intercept,day)                   -0.29      0.18    -0.62     0.09
1.00
## cor(Intercept,steps.pmd)             -0.14      0.20    -0.52     0.27
1.00
## cor(day,steps.pmd)                   -0.38      0.23    -0.77     0.13
1.00
## cor(Intercept,sigma_Intercept)       -0.27      0.18    -0.60     0.09
1.00
## cor(day,sigma_Intercept)             -0.01      0.22    -0.45     0.43
1.00
## cor(steps.pmd,sigma_Intercept)        0.35      0.20    -0.08     0.69
1.00
## cor(Intercept,sigma_steps.pmd)       -0.35      0.24    -0.76     0.16
1.00
## cor(day,sigma_steps.pmd)              0.01      0.28    -0.53     0.55
1.00
## cor(steps.pmd,sigma_steps.pmd)       -0.08      0.29    -0.63     0.48
1.00
## cor(sigma_Intercept,sigma_steps.pmd)  0.24      0.27    -0.32     0.73
1.00
##                                   Bulk_ESS Tail_ESS
## sd(Intercept)                         1173     2088
## sd(day)                               1809     2264
## sd(steps.pmd)                         2567     2706
## sd(sigma_Intercept)                   2276     2828
## sd(sigma_steps.pmd)                    945     1272
## cor(Intercept,day)                    1793     2363
## cor(Intercept,steps.pmd)              2825     2611
## cor(day,steps.pmd)                    2109     2744
## cor(Intercept,sigma_Intercept)        2547     2616
## cor(day,sigma_Intercept)              1364     1949
## cor(steps.pmd,sigma_Intercept)        1243     2117
```

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```
## cor(Intercept,sigma_steps.pmd)           3553     2827
## cor(day,sigma_steps.pmd)                 3452     2519
## cor(steps.pmd,sigma_steps.pmd)           3765     3165
## cor(sigma_Intercept,sigma_steps.pmd)     3681     2932
##
## Population-Level Effects:
##                          Estimate Est.Error l-95% CI u-95% CI Rhat
Bulk_ESS
## Intercept                   -0.04      0.12    -0.29     0.19 1.00
923
## sigma_Intercept             -0.82      0.10    -1.03    -0.62 1.00
2052
## day                         -0.00      0.00    -0.00     0.00 1.00
1469
## P_A.lag                      0.33      0.02     0.29     0.38 1.00
5447
## N_A.lag                      0.05      0.02     0.01     0.09 1.00
7003
## steps.pm                     0.17      0.18    -0.18     0.54 1.00
1225
## steps.pmd                    0.15      0.03     0.09     0.22 1.00
2190
## steps.pm:steps.pmd          -0.00      0.05    -0.09     0.08 1.00
3070
## sigma_P_A.lag               -0.01      0.03    -0.07     0.05 1.00
7154
## sigma_N_A.lag               -0.00      0.03    -0.06     0.06 1.00
6636
## sigma_steps.pm              -0.04      0.16    -0.36     0.27 1.00
2065
## sigma_steps.pmd             -0.04      0.04    -0.11     0.03 1.00
2847
## sigma_steps.pm:steps.pmd    -0.01      0.05    -0.11     0.08 1.00
3460
##                          Tail_ESS
## Intercept                    1459
## sigma_Intercept              2713
## day                          2213
## P_A.lag                      2938
## N_A.lag                      3248
## steps.pm                     1949
## steps.pmd                    3064
## steps.pm:steps.pmd           2913
## sigma_P_A.lag                3300
## sigma_N_A.lag                3360
## sigma_steps.pm               2028
## sigma_steps.pmd              2261
## sigma_steps.pm:steps.pmd     3009
##
## Samples were drawn using sampling(NUTS). For each parameter, Bulk_ESS
```

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```
## and Tail_ESS are effective sample size measures, and Rhat is the potential
## scale reduction factor on split chains (at convergence, Rhat = 1).
```

Test hypothesis on correlation

BF_01 for null hypothesis

```
BF_01 <- hypothesis(fit_melsm, hypothesis =
"record_id__Intercept__sigma_steps.pmd = 0", class = "cor")
round( BF_01$hypothesis[1,7], 2)

## [1] 0.41
```

BF_10 for alternative hypothesis

Return the BF for the alternative hypothesis

```
round( 1/BF_01$hypothesis[1,7], 2)

## [1] 2.45
```

Multivariate mixed effects location scale model

Depending on computer, this can take from 1-several days for the full dataset

The multivariate outcome is defined by the use of `mvbind()` which binds both PA and NA vectors to a `brms` object matrix.

```
## Explicitly allow correlations among residuals of location and scale
## This avoids a warnnig
set_rescor(rescor = TRUE)

## [1] TRUE
## attr(,"class")
## [1] "setrescor"

fit_m_melsm <- brm(bf(
  # location
  mvbind(P_A.std, N_A.std) ~ 1 + day + P_A.lag + N_A.lag + steps.pm*steps.pmd
+ (1 + day + steps.pmd | c | record_id),
  # scale (the c  in |c| allows for correlation between location and scale)
  sigma ~ 1 + P_A.lag + N_A.lag + steps.pm*steps.pmd + (1 + steps.pmd | c |
record_id)),
  data=dats, inits = 0,
  # sample prior for Bayes factors
  cores = 4, sample_prior = T)
```

Print model summary:

```
summary(fit_m_melsm )

## Warning: There were 1 divergent transitions after warmup. Increasing
adapt_delta
```

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```
## above 0.8 may help. See http://mc-stan.org/misc/warnings.html#divergent-
## transitions-after-warmup

##  Family: MV(gaussian, gaussian)
##   Links: mu = identity; sigma = log
##          mu = identity; sigma = log
## Formula: P_A.std ~ 1 + day + P_A.lag + N_A.lag + steps.pm * steps.pmd + (1
+ day + steps.pmd | c | record_id)
##          sigma ~ 1 + P_A.lag + N_A.lag + steps.pm * steps.pmd + (1 +
steps.pmd | c | record_id)
##          N_A.std ~ 1 + day + P_A.lag + N_A.lag + steps.pm * steps.pmd + (1
+ day + steps.pmd | c | record_id)
##          sigma ~ 1 + P_A.lag + N_A.lag + steps.pm * steps.pmd + (1 +
steps.pmd | c | record_id)
##    Data: dats (Number of observations: 1851)
## Samples: 4 chains, each with iter = 2000; warmup = 1000; thin = 1;
##          total post-warmup samples = 4000
##
## Group-Level Effects:
## ~record_id (Number of levels: 30)
##                                               Estimate Est.Error l-95%
CI
## sd(PAstd_Intercept)                               0.68      0.10
0.51
## sd(PAstd_day)                                     0.01      0.00
0.00
## sd(PAstd_steps.pmd)                               0.14      0.03
0.09
## sd(sigma_PAstd_Intercept)                         0.53      0.08
0.40
## sd(sigma_PAstd_steps.pmd)                         0.14      0.04
0.07
## sd(NAstd_Intercept)                               0.44      0.07
0.32
## sd(NAstd_day)                                     0.00      0.00
0.00
## sd(NAstd_steps.pmd)                               0.03      0.01
0.01
## sd(sigma_NAstd_Intercept)                         0.56      0.08
0.44
## sd(sigma_NAstd_steps.pmd)                         0.19      0.05
0.10
## cor(PAstd_Intercept,PAstd_day)                   -0.33      0.16    -
0.61
## cor(PAstd_Intercept,PAstd_steps.pmd)             -0.12      0.18    -
0.47
## cor(PAstd_day,PAstd_steps.pmd)                   -0.27      0.21    -
0.63
## cor(PAstd_Intercept,sigma_PAstd_Intercept)       -0.19      0.17    -
0.50
```

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```
## cor(PAstd_day,sigma_PAstd_Intercept)                -0.06      0.19    -
0.42
## cor(PAstd_steps.pmd,sigma_PAstd_Intercept)           0.30      0.19    -
0.09
## cor(PAstd_Intercept,sigma_PAstd_steps.pmd)          -0.18      0.21    -
0.55
## cor(PAstd_day,sigma_PAstd_steps.pmd)                -0.07      0.22    -
0.49
## cor(PAstd_steps.pmd,sigma_PAstd_steps.pmd)          -0.07      0.23    -
0.50
## cor(sigma_PAstd_Intercept,sigma_PAstd_steps.pmd)     0.13      0.22    -
0.32
## cor(PAstd_Intercept,NAstd_Intercept)                -0.12      0.17    -
0.43
## cor(PAstd_day,NAstd_Intercept)                       0.33      0.17    -
0.01
## cor(PAstd_steps.pmd,NAstd_Intercept)                -0.09      0.19    -
0.46
## cor(sigma_PAstd_Intercept,NAstd_Intercept)           0.21      0.16    -
0.13
## cor(sigma_PAstd_steps.pmd,NAstd_Intercept)           0.26      0.20    -
0.13
## cor(PAstd_Intercept,NAstd_day)                      -0.26      0.19    -
0.61
## cor(PAstd_day,NAstd_day)                            -0.15      0.22    -
0.55
## cor(PAstd_steps.pmd,NAstd_day)                       0.23      0.22    -
0.23
## cor(sigma_PAstd_Intercept,NAstd_day)                -0.06      0.21    -
0.46
## cor(sigma_PAstd_steps.pmd,NAstd_day)                 0.16      0.24    -
0.32
## cor(NAstd_Intercept,NAstd_day)                      -0.20      0.20    -
0.58
## cor(PAstd_Intercept,NAstd_steps.pmd)                 0.29      0.24    -
0.21
## cor(PAstd_day,NAstd_steps.pmd)                       0.08      0.27    -
0.46
## cor(PAstd_steps.pmd,NAstd_steps.pmd)                -0.10      0.25    -
0.57
## cor(sigma_PAstd_Intercept,NAstd_steps.pmd)          -0.05      0.24    -
0.51
## cor(sigma_PAstd_steps.pmd,NAstd_steps.pmd)          -0.16      0.26    -
0.62
## cor(NAstd_Intercept,NAstd_steps.pmd)                -0.09      0.27    -
0.59
## cor(NAstd_day,NAstd_steps.pmd)                      -0.17      0.28    -
0.67
## cor(PAstd_Intercept,sigma_NAstd_Intercept)          -0.42      0.14    -
0.67
```

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```
## cor(PAstd_day,sigma_NAstd_Intercept)                  0.08      0.17    -
0.27
## cor(PAstd_steps.pmd,sigma_NAstd_Intercept)            0.08      0.18    -
0.27
## cor(sigma_PAstd_Intercept,sigma_NAstd_Intercept)      0.51      0.14
0.21
## cor(sigma_PAstd_steps.pmd,sigma_NAstd_Intercept)      0.47      0.18
0.08
## cor(NAstd_Intercept,sigma_NAstd_Intercept)            0.46      0.14
0.15
## cor(NAstd_day,sigma_NAstd_Intercept)                 -0.18      0.18    -
0.52
## cor(NAstd_steps.pmd,sigma_NAstd_Intercept)           -0.13      0.23    -
0.56
## cor(PAstd_Intercept,sigma_NAstd_steps.pmd)            0.05      0.19    -
0.32
## cor(PAstd_day,sigma_NAstd_steps.pmd)                  0.24      0.22    -
0.21
## cor(PAstd_steps.pmd,sigma_NAstd_steps.pmd)            0.08      0.22    -
0.36
## cor(sigma_PAstd_Intercept,sigma_NAstd_steps.pmd)      0.21      0.19    -
0.18
## cor(sigma_PAstd_steps.pmd,sigma_NAstd_steps.pmd)     -0.11      0.24    -
0.56
## cor(NAstd_Intercept,sigma_NAstd_steps.pmd)            0.20      0.19    -
0.19
## cor(NAstd_day,sigma_NAstd_steps.pmd)                 -0.07      0.24    -
0.54
## cor(NAstd_steps.pmd,sigma_NAstd_steps.pmd)            0.30      0.25    -
0.24
## cor(sigma_NAstd_Intercept,sigma_NAstd_steps.pmd)      0.11      0.19    -
0.27
##                                                  u-95% CI Rhat Bulk_ESS
## sd(PAstd_Intercept)                                  0.89 1.00     1042
## sd(PAstd_day)                                        0.01 1.00     1075
## sd(PAstd_steps.pmd)                                  0.20 1.00     1911
## sd(sigma_PAstd_Intercept)                            0.71 1.00     1529
## sd(sigma_PAstd_steps.pmd)                            0.24 1.00     1534
## sd(NAstd_Intercept)                                  0.60 1.00     1899
## sd(NAstd_day)                                        0.01 1.00     2082
## sd(NAstd_steps.pmd)                                  0.07 1.00     1526
## sd(sigma_NAstd_Intercept)                            0.73 1.00     2010
## sd(sigma_NAstd_steps.pmd)                            0.30 1.00     2148
## cor(PAstd_Intercept,PAstd_day)                       0.01 1.00     1279
## cor(PAstd_Intercept,PAstd_steps.pmd)                 0.24 1.00     2224
## cor(PAstd_day,PAstd_steps.pmd)                       0.17 1.00     1966
## cor(PAstd_Intercept,sigma_PAstd_Intercept)           0.16 1.00     1599
## cor(PAstd_day,sigma_PAstd_Intercept)                 0.31 1.00     1104
## cor(PAstd_steps.pmd,sigma_PAstd_Intercept)           0.63 1.00      938
## cor(PAstd_Intercept,sigma_PAstd_steps.pmd)           0.25 1.00     3360
```

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```
## cor(PAstd_day,sigma_PAstd_steps.pmd)                  0.35 1.00     3006
## cor(PAstd_steps.pmd,sigma_PAstd_steps.pmd)            0.38 1.00     3003
## cor(sigma_PAstd_Intercept,sigma_PAstd_steps.pmd)      0.55 1.00     3863
## cor(PAstd_Intercept,NAstd_Intercept)                  0.22 1.00     1956
## cor(PAstd_day,NAstd_Intercept)                        0.63 1.00     1851
## cor(PAstd_steps.pmd,NAstd_Intercept)                  0.28 1.00     1744
## cor(sigma_PAstd_Intercept,NAstd_Intercept)            0.50 1.00     2528
## cor(sigma_PAstd_steps.pmd,NAstd_Intercept)            0.62 1.00     1699
## cor(PAstd_Intercept,NAstd_day)                        0.12 1.00     2520
## cor(PAstd_day,NAstd_day)                              0.29 1.00     2585
## cor(PAstd_steps.pmd,NAstd_day)                        0.64 1.00     2282
## cor(sigma_PAstd_Intercept,NAstd_day)                  0.36 1.00     3181
## cor(sigma_PAstd_steps.pmd,NAstd_day)                  0.60 1.00     1787
## cor(NAstd_Intercept,NAstd_day)                        0.21 1.00     3997
## cor(PAstd_Intercept,NAstd_steps.pmd)                  0.71 1.00     4343
## cor(PAstd_day,NAstd_steps.pmd)                        0.58 1.00     5313
## cor(PAstd_steps.pmd,NAstd_steps.pmd)                  0.40 1.00     4480
## cor(sigma_PAstd_Intercept,NAstd_steps.pmd)            0.42 1.00     4716
## cor(sigma_PAstd_steps.pmd,NAstd_steps.pmd)            0.38 1.00     3881
## cor(NAstd_Intercept,NAstd_steps.pmd)                  0.47 1.00     3788
## cor(NAstd_day,NAstd_steps.pmd)                        0.39 1.00     3369
## cor(PAstd_Intercept,sigma_NAstd_Intercept)           -0.11 1.00     2448
## cor(PAstd_day,sigma_NAstd_Intercept)                  0.41 1.00     1577
## cor(PAstd_steps.pmd,sigma_NAstd_Intercept)            0.41 1.00     1997
## cor(sigma_PAstd_Intercept,sigma_NAstd_Intercept)      0.74 1.00     2580
## cor(sigma_PAstd_steps.pmd,sigma_NAstd_Intercept)      0.78 1.00     1729
## cor(NAstd_Intercept,sigma_NAstd_Intercept)            0.70 1.00     3412
## cor(NAstd_day,sigma_NAstd_Intercept)                  0.18 1.00     2708
## cor(NAstd_steps.pmd,sigma_NAstd_Intercept)            0.33 1.00     2527
## cor(PAstd_Intercept,sigma_NAstd_steps.pmd)            0.41 1.00     3512
## cor(PAstd_day,sigma_NAstd_steps.pmd)                  0.64 1.00     2581
## cor(PAstd_steps.pmd,sigma_NAstd_steps.pmd)            0.51 1.00     2819
## cor(sigma_PAstd_Intercept,sigma_NAstd_steps.pmd)      0.56 1.00     4572
## cor(sigma_PAstd_steps.pmd,sigma_NAstd_steps.pmd)      0.37 1.00     1859
## cor(NAstd_Intercept,sigma_NAstd_steps.pmd)            0.55 1.00     3817
## cor(NAstd_day,sigma_NAstd_steps.pmd)                  0.40 1.00     2380
## cor(NAstd_steps.pmd,sigma_NAstd_steps.pmd)            0.73 1.00     1926
## cor(sigma_NAstd_Intercept,sigma_NAstd_steps.pmd)      0.47 1.00     3765
##                                                  Tail_ESS
## sd(PAstd_Intercept)                                  1883
## sd(PAstd_day)                                        2259
## sd(PAstd_steps.pmd)                                  2719
## sd(sigma_PAstd_Intercept)                            2387
## sd(sigma_PAstd_steps.pmd)                            1917
## sd(NAstd_Intercept)                                  2486
## sd(NAstd_day)                                        2800
## sd(NAstd_steps.pmd)                                  1105
## sd(sigma_NAstd_Intercept)                            2877
## sd(sigma_NAstd_steps.pmd)                            2290
## cor(PAstd_Intercept,PAstd_day)                       2232
```

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```
## cor(PAstd_Intercept,PAstd_steps.pmd)                  2839
## cor(PAstd_day,PAstd_steps.pmd)                        2334
## cor(PAstd_Intercept,sigma_PAstd_Intercept)            2018
## cor(PAstd_day,sigma_PAstd_Intercept)                  1802
## cor(PAstd_steps.pmd,sigma_PAstd_Intercept)            1523
## cor(PAstd_Intercept,sigma_PAstd_steps.pmd)            2872
## cor(PAstd_day,sigma_PAstd_steps.pmd)                  2833
## cor(PAstd_steps.pmd,sigma_PAstd_steps.pmd)            2966
## cor(sigma_PAstd_Intercept,sigma_PAstd_steps.pmd)      3279
## cor(PAstd_Intercept,NAstd_Intercept)                  2465
## cor(PAstd_day,NAstd_Intercept)                        2761
## cor(PAstd_steps.pmd,NAstd_Intercept)                  2453
## cor(sigma_PAstd_Intercept,NAstd_Intercept)            2773
## cor(sigma_PAstd_steps.pmd,NAstd_Intercept)            2620
## cor(PAstd_Intercept,NAstd_day)                        2914
## cor(PAstd_day,NAstd_day)                              3205
## cor(PAstd_steps.pmd,NAstd_day)                        2985
## cor(sigma_PAstd_Intercept,NAstd_day)                  3446
## cor(sigma_PAstd_steps.pmd,NAstd_day)                  2617
## cor(NAstd_Intercept,NAstd_day)                        3164
## cor(PAstd_Intercept,NAstd_steps.pmd)                  3041
## cor(PAstd_day,NAstd_steps.pmd)                        2858
## cor(PAstd_steps.pmd,NAstd_steps.pmd)                  3714
## cor(sigma_PAstd_Intercept,NAstd_steps.pmd)            3395
## cor(sigma_PAstd_steps.pmd,NAstd_steps.pmd)            3110
## cor(NAstd_Intercept,NAstd_steps.pmd)                  3172
## cor(NAstd_day,NAstd_steps.pmd)                        3084
## cor(PAstd_Intercept,sigma_NAstd_Intercept)            2864
## cor(PAstd_day,sigma_NAstd_Intercept)                  2360
## cor(PAstd_steps.pmd,sigma_NAstd_Intercept)            2892
## cor(sigma_PAstd_Intercept,sigma_NAstd_Intercept)      2968
## cor(sigma_PAstd_steps.pmd,sigma_NAstd_Intercept)      3043
## cor(NAstd_Intercept,sigma_NAstd_Intercept)            3105
## cor(NAstd_day,sigma_NAstd_Intercept)                  3075
## cor(NAstd_steps.pmd,sigma_NAstd_Intercept)            3036
## cor(PAstd_Intercept,sigma_NAstd_steps.pmd)            2964
## cor(PAstd_day,sigma_NAstd_steps.pmd)                  3378
## cor(PAstd_steps.pmd,sigma_NAstd_steps.pmd)            3270
## cor(sigma_PAstd_Intercept,sigma_NAstd_steps.pmd)      3601
## cor(sigma_PAstd_steps.pmd,sigma_NAstd_steps.pmd)      2751
## cor(NAstd_Intercept,sigma_NAstd_steps.pmd)            3398
## cor(NAstd_day,sigma_NAstd_steps.pmd)                  3074
## cor(NAstd_steps.pmd,sigma_NAstd_steps.pmd)            3075
## cor(sigma_NAstd_Intercept,sigma_NAstd_steps.pmd)      3303
##
## Population-Level Effects:
##                              Estimate Est.Error l-95% CI u-95% CI Rhat
## PAstd_Intercept                 -0.04      0.13    -0.29     0.21 1.01
## sigma_PAstd_Intercept           -0.81      0.10    -1.02    -0.61 1.00
## NAstd_Intercept                 -0.05      0.09    -0.23     0.13 1.00
```

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```
## sigma_NAstd_Intercept              -0.88      0.11    -1.09    -0.67 1.00
## PAstd_day                          -0.00      0.00    -0.00     0.00 1.00
## PAstd_P_A.lag                       0.33      0.02     0.28     0.38 1.00
## PAstd_N_A.lag                       0.06      0.02     0.02     0.09 1.00
## PAstd_steps.pm                      0.13      0.18    -0.22     0.49 1.01
## PAstd_steps.pmd                     0.15      0.03     0.09     0.22 1.00
## PAstd_steps.pm:steps.pmd            0.00      0.05    -0.09     0.10 1.00
## sigma_PAstd_P_A.lag                -0.02      0.03    -0.08     0.05 1.00
## sigma_PAstd_N_A.lag                -0.01      0.03    -0.07     0.04 1.00
## sigma_PAstd_steps.pm               -0.06      0.15    -0.35     0.24 1.00
## sigma_PAstd_steps.pmd              -0.04      0.04    -0.12     0.03 1.00
## sigma_PAstd_steps.pm:steps.pmd     -0.01      0.05    -0.12     0.10 1.00
## NAstd_day                          -0.00      0.00    -0.00     0.00 1.00
## NAstd_P_A.lag                       0.01      0.02    -0.02     0.04 1.00
## NAstd_N_A.lag                       0.32      0.03     0.27     0.37 1.00
## NAstd_steps.pm                     -0.05      0.12    -0.29     0.20 1.00
## NAstd_steps.pmd                    -0.03      0.02    -0.06     0.00 1.00
## NAstd_steps.pm:steps.pmd            0.00      0.02    -0.04     0.05 1.00
## sigma_NAstd_P_A.lag                 0.08      0.03     0.02     0.14 1.00
## sigma_NAstd_N_A.lag                 0.21      0.03     0.16     0.27 1.00
## sigma_NAstd_steps.pm               -0.11      0.16    -0.42     0.20 1.00
## sigma_NAstd_steps.pmd              -0.06      0.05    -0.15     0.03 1.00
## sigma_NAstd_steps.pm:steps.pmd     -0.04      0.07    -0.17     0.09 1.00
##                                 Bulk_ESS Tail_ESS
## PAstd_Intercept                      500     1006
## sigma_PAstd_Intercept               1275     1842
## NAstd_Intercept                     1759     2244
## sigma_NAstd_Intercept               1170     2084
## PAstd_day                           1033     2000
## PAstd_P_A.lag                       5013     3109
## PAstd_N_A.lag                       5468     3298
## PAstd_steps.pm                       566     1156
## PAstd_steps.pmd                     1653     2354
## PAstd_steps.pm:steps.pmd            1796     2137
## sigma_PAstd_P_A.lag                 5510     2975
## sigma_PAstd_N_A.lag                 4443     2935
## sigma_PAstd_steps.pm                1187     1998
## sigma_PAstd_steps.pmd               2400     2414
## sigma_PAstd_steps.pm:steps.pmd      2693     2587
## NAstd_day                           2468     3063
## NAstd_P_A.lag                       6316     2572
## NAstd_N_A.lag                       5984     2523
## NAstd_steps.pm                      1830     2272
## NAstd_steps.pmd                     2526     2253
## NAstd_steps.pm:steps.pmd            2634     2875
## sigma_NAstd_P_A.lag                 6942     3013
## sigma_NAstd_N_A.lag                 6758     3223
## sigma_NAstd_steps.pm                1293     1980
## sigma_NAstd_steps.pmd               3168     3091
## sigma_NAstd_steps.pm:steps.pmd      2901     3012
```

Doi: https://doi.org/10.1027/1015-5759/a000624

```
##
## Residual Correlations:
##                     Estimate Est.Error l-95% CI u-95% CI Rhat Bulk_ESS
Tail_ESS
## rescor(PAstd,NAstd)     0.03      0.02    -0.02     0.07 1.00     7364
2963
##
## Samples were drawn using sampling(NUTS). For each parameter, Bulk_ESS
## and Tail_ESS are effective sample size measures, and Rhat is the potential
## scale reduction factor on split chains (at convergence, Rhat = 1).
```