cca_paper_example

7/6/2020

Load packages and Data set

```
## Loading required package: Matrix
```

```
## Loading 'metafor' package (version 2.1-0). For an overview
## and introduction to the package please type: help(metafor).
```

```
## Loading required package: OpenMx
```

```
## To take full advantage of multiple cores, use:
##   mxOption(key='Number of Threads', value=parallel::detectCores()) #now
##   Sys.setenv(OMP_NUM_THREADS=parallel::detectCores()) #before library(OpenMx)
```

```
##
## Attaching package: 'OpenMx'
```

```
## The following objects are masked from 'package:Matrix':
##
##     %&%, expm
```

```
## "SLSQP" is set as the default optimizer in OpenMx.
```

```
## mxOption(NULL, "Gradient algorithm") is set at "central".
```

```
## mxOption(NULL, "Optimality tolerance") is set at "6.3e-14".
```

```
## mxOption(NULL, "Gradient iterations") is set at "2".
```

Subset of the data

```
#Subset of variables needed for the analyses:
data_adt_cca<- data_adt[c("studyid", "es_g","se_g","g1hrsperweek","g1txdays")]

#Visualize missingness
source("../code/wrappers.R")
```

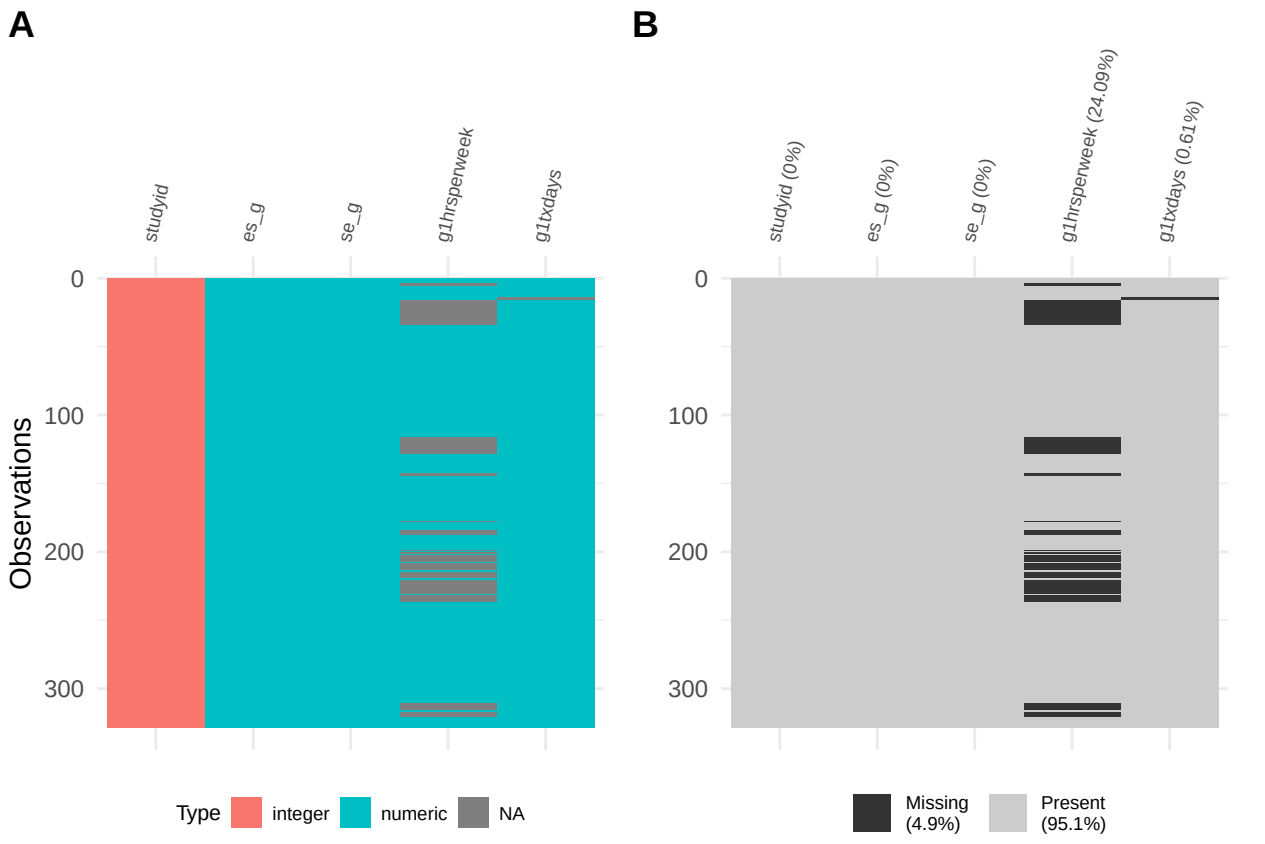
```
## -- Attaching packages ---------------------------------------------------------------------------
```

```
## v tibble  2.1.1     v purrr   0.3.3
## v tidyr   1.1.0     v dplyr   0.8.3
## v readr   1.3.1     v stringr 1.4.0
## v tibble  2.1.1     v forcats 0.4.0
```

```
## -- Conflicts ------------------------------------------------------------------------------------
## x tidyr::expand() masks Matrix::expand()
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()
## x tidyr::pack()   masks Matrix::pack()
## x purrr::rerun()  masks metaSEM::rerun()
## x tidyr::unpack() masks Matrix::unpack()
```

```
##
## ************************************************************
## Note: As of version 1.0.0, cowplot does not change the
##   default ggplot2 theme anymore. To recover the previous
##   behavior, execute:
##   theme_set(theme_cowplot())
## ************************************************************
##
## Attaching package: 'gridExtra'
## The following object is masked from 'package:dplyr':
##
##     combine
```

```
gg_summary_covariate_miss(data_adt_cca)
```




```
data.frame(k.NA=colSums(is.na(data_adt_cca)))
```

```
##              k.NA
## studyid         0
## es_g            0
## se_g            0
## g1hrsperweek   79
## g1txdays        2
```

```
table(rowSums(is.na(data_adt_cca)))
```

```
##
##   0   1
## 247  81
```

```
#Percentage missing by variable
miss_var_summary(data_adt_cca)
```

```
## # A tibble: 5 x 3
##   variable     n_miss pct_miss
##   <chr>         <int>    <dbl>
## 1 g1hrsperweek     79   24.1
## 2 g1txdays          2    0.610
## 3 studyid           0    0
## 4 es_g              0    0
## 5 se_g              0    0
```

```
#Percentage missing by Effect Size case
miss_case_summary(data_adt_cca)
```

```
## # A tibble: 328 x 3
##     case n_miss pct_miss
##    <int>  <int>    <dbl>
##  1     5      1       20
##  2     6      1       20
##  3    15      1       20
##  4    16      1       20
##  5    17      1       20
##  6    18      1       20
##  7    19      1       20
##  8    20      1       20
##  9    21      1       20
## 10    22      1       20
## # ... with 318 more rows
```

Complete case analysis - Dependent ES

While effect sizes and sampling variances are not missing for this dataset, there are a number of moderator (covariates) variables that are. A total of 328 ES available in the data.

```
##delete NA
data_adt_na<- na.omit(data_adt_cca)

#Meta-regression
#random-effects model

#Using rma.mv uncentered group-mean
rma_mv_cca<- rma.mv(es_g, se_g^2, mods= ~ 1 + g1hrsperweek + g1txdays,
                                  random= ~ 1|studyid,
                                  data= data_adt_na,
                                   method="REML")
rma_mv_cca
```

```
##
## Multivariate Meta-Analysis Model (k = 247; method: REML)
##
## Variance Components:
##
```

```
##             estim    sqrt  nlvls  fixed   factor
## sigma^2    0.0825  0.2872     37     no  studyid
##
## Test for Residual Heterogeneity:
## QE(df = 244) = 435.8172, p-val < .0001
##
## Test of Moderators (coefficients 2:3):
## QM(df = 2) = 4.2647, p-val = 0.1186
##
## Model Results:
##
##               estimate      se     zval    pval    ci.lb   ci.ub
## intrcpt         0.2034  0.1310   1.5528  0.1205  -0.0533  0.4602
## g1hrsperweek    0.0755  0.0383   1.9719  0.0486   0.0005  0.1506  *
## g1txdays       -0.0009  0.0011  -0.8341  0.4042  -0.0032  0.0013
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
#Using rma.mv group-mean  centered
g1hrsperweek.w<- group.center(data_adt_na$g1hrsperweek, grp=data_adt_na$studyid)

rma_mv_cca_2<- rma.mv(es_g, se_g^2, mods= ~ 1 + g1hrsperweek.w + g1txdays,
                                random= ~ 1|studyid,
                                data= data_adt_na,
                                 method="REML")
rma_mv_cca_2
```

```
##
## Multivariate Meta-Analysis Model (k = 247; method: REML)
##
## Variance Components:
##
##             estim    sqrt  nlvls  fixed   factor
## sigma^2    0.0889  0.2981     37     no  studyid
##
## Test for Residual Heterogeneity:
## QE(df = 244) = 447.6719, p-val < .0001
##
## Test of Moderators (coefficients 2:3):
## QM(df = 2) = 1.0216, p-val = 0.6000
##
## Model Results:
##
##                 estimate      se     zval    pval    ci.lb   ci.ub
## intrcpt           0.3050  0.1240   2.4601  0.0139   0.0620  0.5481  *
## g1hrsperweek.w    0.1273  0.1543   0.8248  0.4095  -0.1751  0.4297
## g1txdays         -0.0007  0.0012  -0.5841  0.5592  -0.0030  0.0016
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Only k=247 ES were included in the analysis.Thus, aproximetly 25% of the ES were excluded from the analysis. illustrating the loss of data that can occur when conducting a complete case analysis.

Shifting units analysis - Dependent ES

```
#Covariate 1: g1hrsperweek
##delete NA
data_subset<- data_adt_cca[, 1:4]
data_adt_na<- na.omit(data_subset)

#Meta-regression
#random-effects model
#Using rma.mv
rma_shu_cov1<- rma.mv(es_g, se_g^2, mods= ~ 1 +  g1hrsperweek,
                                  random= ~ 1|studyid,
                                 data= data_adt_na,
                                 method="REML")
rma_shu_cov1
```

```
##
## Multivariate Meta-Analysis Model (k = 249; method: REML)
##
## Variance Components:
##
##             estim    sqrt  nlvls  fixed   factor
## sigma^2    0.0863  0.2937     38     no  studyid
##
## Test for Residual Heterogeneity:
## QE(df = 247) = 460.4483, p-val < .0001
##
## Test of Moderators (coefficient 2):
## QM(df = 1) = 8.1039, p-val = 0.0044
##
## Model Results:
##
##               estimate      se    zval    pval    ci.lb   ci.ub
## intrcpt         0.0847  0.0808  1.0478  0.2947  -0.0737  0.2431
## g1hrsperweek    0.0972  0.0341  2.8467  0.0044   0.0303  0.1641  **
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
#Using rma.mv group-mean  centered
g1hrsperweek.w<- group.center(data_adt_na$g1hrsperweek, grp=data_adt_na$studyid)

rma_shu_cov1<- rma.mv(es_g, se_g^2, mods= ~ 1 +  g1hrsperweek.w,
                                  random= ~ 1|studyid,
                                 data= data_adt_na,
                                 method="REML")
rma_shu_cov1
```

```
##
## Multivariate Meta-Analysis Model (k = 249; method: REML)
##
## Variance Components:
##
##             estim    sqrt  nlvls  fixed   factor
## sigma^2    0.0986  0.3141     38     no  studyid
```

```
##
## Test for Residual Heterogeneity:
## QE(df = 247) = 467.1476, p-val < .0001
##
## Test of Moderators (coefficient 2):
## QM(df = 1) = 0.6805, p-val = 0.4094
##
## Model Results:
##
##                 estimate      se    zval    pval    ci.lb   ci.ub
## intrcpt           0.2583  0.0570  4.5297  <.0001   0.1466  0.3701  ***
## g1hrsperweek.w    0.1273  0.1543  0.8249  0.4094  -0.1751  0.4297
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```r
#Covariate 2: g1txdays
##delete NA
data_subset<- data_adt_cca[,c(1:3, 5)]
data_adt_na<- na.omit(data_subset)

#Meta-regression
#random-effects model
#Using rma.mv
rma_shu_cov2<- rma.mv(es_g, se_g^2, mods= ~ 1 +  g1txdays,
                                  random= ~ 1|studyid,
                                 data= data_adt_na,
                                 method="REML")
rma_shu_cov2
```

```
##
## Multivariate Meta-Analysis Model (k = 326; method: REML)
##
## Variance Components:
##
##             estim    sqrt  nlvls  fixed   factor
## sigma^2    0.0799  0.2828     45     no  studyid
##
## Test for Residual Heterogeneity:
## QE(df = 324) = 570.2498, p-val < .0001
##
## Test of Moderators (coefficient 2):
## QM(df = 1) = 0.0247, p-val = 0.8752
##
## Model Results:
##
##           estimate      se     zval    pval    ci.lb   ci.ub
## intrcpt     0.2081  0.0635   3.2771  0.0010   0.0836  0.3326  **
## g1txdays   -0.0001  0.0004  -0.1571  0.8752  -0.0009  0.0007
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```