**Supplemental Materials**

**Mplus code for obtaining person-specific iSD**

DATA:

FILE = C\data.txt;

VARIABLE:

NAMES = id day pain;

USEVARIABLES = pain day;

CLUSTER = id;

WITHIN = day;

MISSING = ALL(-999);

ANALYSIS:

TYPE = TWOLEVEL RANDOM;

ESTIMATOR = BAYES;

PROC = 2;

BITER = (5000);

THIN = 10;

MODEL:

%WITHIN%

slp | pain ON day; ! person-specific linear slope of time

logVarP | pain; ! person-specific log(iSD^2)

%BETWEEN%

pain WITH slp logVarP;

slp WITH logVarP;

OUTPUT:

TECH1 TECH8;

SAVEDATA:

FILE = C\fscores\_iSD2.txt;

SAVE = FSCORES(50,10);

! In the saved file, LOGVARP Median is used as the estimated person-specific log(iSD^2).

PLOT:

TYPE = PLOT3;

FACTORS = ALL;

**Mplus code for obtaining person-specific AR(1)**

DATA:

FILE = C\data.txt;

VARIABLE:

NAMES = id day pain;

USEVARIABLES = pain time;

CLUSTER = id;

WITHIN = time;

MISSING = ALL(-999);

LAGGED = pain(1);

TINTERVAL = day(1);

DEFINE:

time = day;

ANALYSIS:

TYPE = TWOLEVEL RANDOM;

ESTIMATOR = BAYES;

PROC = 2;

BITER = (5000);

THIN = 10;

MODEL:

%WITHIN%

ar | pain ON pain&1; ! person-specific AR(1)

slp | pain ON time; ! person-specific linear slope of time

logVarP | pain; ! person-specific innovation variance

%BETWEEN%

pain WITH slp ar logVarP;

slp WITH ar logVarP;

ar WITH logVarP;

OUTPUT:

TECH1 TECH8;

SAVEDATA:

FILE = C:\fscores\_AR.txt;

SAVE = FSCORES(50,10);

! In the saved file, AR Median is used as the estimated person-specific AR(1).

PLOT:

TYPE = PLOT3;

FACTORS = ALL;

**R code for computing individual mean, MSSD, and PAC**

Below we provide a step-by-step guide to run the R codes for calculating individual mean, MSSD, and PAC. Although it appears complex, all that is needed is to follow three simple steps: (1) run the codes outlined in Step 1 below; (2) set the working directory under which your file exists (Step 2), (3) insert required variable information in the “varim( )” function that we created and run the function (Step 3). After this process, varim ( ) will create a file that includes the individual mean, MSSD, and PAC with your person ID number. You can then import the data that was produced by varim( ) using your preferred statistical software (e.g., SPSS, SAS, etc.).

**# STEP 1. Open R and execute the following code (Please copy and paste) #**

#############################################

##### Execute the following code first #####

#############################################

**# Install required packages**

install.packages("foreign")

install.packages("psych")

**# Required packages**

library(foreign)

library(psych)

**# varim function: Read data file, calculate mean and variability measures including MSSD and PAC and save them as a data file**

varim <- function(filename,idv,tv,xv,ac,tint){

 **# Read data file**

 if (grepl(".dat",filename,fixed=T)){

 mydata0 <- read.table(filename,sep="\t",fileEncoding="UTF-8-BOM")

 filetype <- 1

 } else if (grepl(".csv",filename,fixed=T)){

 mydata0 <- read.table(filename,sep=",", fileEncoding="UTF-8-BOM")

 filetype <- 2

 } else if (grepl(".sav",filename,fixed=T)){

 mydata0 <- read.spss(filename,to.data.frame=T,use.missings=T,use.value.labels=F)

 filetype <- 3

 } else if (grepl(".xpt",filename,fixed=T)){

 mydata0 <- read.xport(filename)

 filetype <- 4

 } else {

 stop("unrecognized file type")

 }

 **# Select id, time, x variables only.**

 mydata = data.frame(id=mydata0[,idv],time=mydata0[,tv],x=mydata0[,xv])

 **# Calculate variability measures**

 mydata.v <- round(vm(data0=mydata,idv="id",xv="x",tv="time",tint=tint,ac=ac),4)

 **# Save the variability measures data**

 now <- Sys.time()

 if (filetype==1){

 filename.r <- paste("varim\_",format(now, "%m%d%Y\_%H%M%S"),".dat")

 write.table(x=mydata.v,file=filename.r,row.names=F,col.names=T,sep="\t")

 } else if (filetype==2){

 filename.r <- paste("varim\_",format(now, "%m%d%Y\_%H%M%S"),".csv")

 write.table(x=mydata.v,file=filename.r,row.names=F,col.names=T,sep=",")

 } else if (filetype==3){

 filename.data <- paste("varim\_",format(now, "%m%d%Y\_%H%M%S"),".txt")

 filename.code <- paste("varim\_",format(now, "%m%d%Y\_%H%M%S"),".sps")

 write.foreign(df=mydata.v,datafile=filename.data,codefile=filename.code,package="SPSS")

 } else if (filetype==4){

 filename.data <- paste("varim\_",format(now, "%m%d%Y\_%H%M%S"),".txt")

 filename.code <- paste("varim\_",format(now, "%m%d%Y\_%H%M%S"),".sas")

 write.foreign(df=mydata.v,datafile=filename.data,codefile=filename.code,package="SAS")

 }

}

# vm function: Calculate variability measures and return a data frame

vm <- function(data0,idv,xv,tv,tint,ac){

 data <- data0

 id <- data[,idv]

 x <- data[,xv]

 t <- data[,tv]

 unique.id <- unique(id)

 mydata <- c()

 for(j in 1:length(unique.id)){

 t.j <- t[id==unique.id[j]]

 x.j <- x[id==unique.id[j]]

 t.new <- seq(min(t.j),max(t.j),by=tint)

 x.new <- rep(NA,times=length(t.new))

 id.new <- rep(unique.id[j],times=length(t.new))

 index <- which((t.new %in% t.j))

 x.new[index] <- x.j

 data.new <- data.frame(id=id.new,t=t.new,x=x.new)

 mydata <- rbind(mydata,data.new)

 }

 **# Calculate variability measures for each person**

 MEAN <- tapply(X=mydata$x,INDEX=mydata$id,function(x) mean(x,na.rm=T))

 MSSD <- tapply(X=mydata$x,INDEX=mydata$id,function(x) mean(diff(x,lag=1)^2,na.rm=T))

 PAC <- tapply(X=mydata$x,INDEX=mydata$id,function(x) mean(abs(diff(x,lag=1))>ac,na.rm=T))

 # Create data frame

 id <- as.numeric(rownames(MEAN))

 vm <- data.frame(id,MEAN,MSSD,PAC)

 colnames(vm) <- c("ID","MEAN","MSSD","PAC")

 return(vm)

}

###############

##### End #####

###############

**# STEP 2. Set working directory in which your data file exists #**

setwd("C:\\work\\")

# For instance, setwd("C:\\Users\\CJ\\Desktop\\\Motivating Example\\”)

**# STEP 3. Insert all the required arguments in the “varim” function and execute the code. #**

varim(filename="data.csv",idv=1,tv=2,xv=3,ac=20,tint=1)

# For instance, for a spss data file:

# varim(filename="data.spss",idv="id",tv="day",xv="pain",ac=20,tint=1)

**#### More detailed information on varim ( ) function ####**

# varim() is an R function that reads a data file, calculates the mean, MSSD and PAC for a variable for each person in the data file, and save the obtained mean and variability measures as a data file.

**# You need to execute the code in step 1 before you use varim().**

**# You need to provide the following arguments when using varim().**

# **filename**: Specify your data file name. Currently varim() can deal with comma-separated files (.csv), tab-delimited files (.dat), SPSS data files (.sav), and SAS .xpt files (.xpt).

# For .csv and .dat files, no variable names should be included in the data file.

# **idv**: Specify your person ID variable.

# **tv**: Specify your time variable (e.g., weeks, days, moments).

# **xv**: Specify the variable for which the intra-individual variability measures are calculated (e.g., pain intensity).

# **ac**: Specify the cut-off value of xv that indicates an acute change. If the change between two consecutive observations is greater than ac, it is considered an acute change. In our example, we used 20 out of 100 numerical pain ratings as acute change.

# **tint**: Specify the time interval (i.e., the difference between two adjacent time points). For instance, if the difference between adjacent time points is one day, specify tinterval=1.

# For SAS .xpt files, all variable names (idv,tv,xv) should be in capital letters.

# Data files should be organized in a long format (observations at each time point for each person should be entered in a row).

# Currently varim() can deal with data collected at equally-spaced time points only.

# For .csv and .dat files the mean and variability measures will be saved as a file in the same data format.

# For SPSS and SAS .xpt data files an output data file (.txt) and a syntax file to read the output data file will be created.

# The output file name will be **varim\_YYYYMMDD**(year, month, day)**\_HHMMSS** (hour, minutes, second).