A Comparison of Imputation Strategies for Ordinal Missing Data on Likert Scale

Variables

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Supplementary Material

Appendix A

R code for the normal data model and logistic regression model approaches for the empirical example.

```
##### Multiple Imputation using Amelia/mice
##   install.packages("Amelia")
##   install.packages("mice")
##   install.packages("psych")
##   install.packages("lavaan")
library(Amelia)
library(mice)

## impMeth==1 observed continuous (Amelia)
## impMeth==2 naive rounding (Amelia)
## impMeth==3 multinomial logistic (mice)
## impMeth==4 proportional odds (mice)

datMiss <- read.table("qoc_for_R.dat", header=T)
impMeth <- 1
nImp <- 50

if (impMeth==1){
```

```

##impute
imp <- amelia(datMiss, m=nImp, p2s=0, empri =.01*nrow(datMiss))
##extract imputed data
datImpd <- list()
for (i in 1:nImp){
  datImpd[[i]] <- imp$imputations[[i]]
}

} else if (impMeth==2){
  ##impute
  imp <- amelia(datMiss, m=nImp, p2s=0, empri =.01*nrow(datMiss))
  ##extract imputed data
  b1 <- seq(1.5, (7-0.5), 1)
  b2 <- seq(1.5, (5-0.5), 1)
  datImpd <- list()
  for (i in 1:nImp){
    datImpd[[i]] <- imp$imputations[[i]]
    for (j in 2:9) {
      datImpd[[i]][,j] <- cut(datImpd[[i]][,j], breaks=c((min(datImpd[[i]][,j])-
999), b1, (max(datImpd[[i]][,j])+999)),
      include.lowest = TRUE, labels=FALSE)
    }
    for (j in 10:20)
      datImpd[[i]][,j] <- cut(datImpd[[i]][,j], breaks=c((min(datImpd[[i]][,j])-
999), b2, (max(datImpd[[i]][,j])+999)),
      include.lowest = TRUE, labels=FALSE)
  }

} else if (impMeth==3){
  ##impute
  datMiss[,1:20] <- lapply(datMiss[,1:20] , as.factor)
  imp <- mice(datMiss, meth=c("logreg", rep("polyreg",19)), m=nImp ,print=FALSE)
  ##extract imputed data
  imputations <- complete(imp, "long")
  datImpd <- list()
  for (i in 1:nImp){
    datImpd[[i]] <- imputations[imputations$.imp==i, -1:-2]
    nnd1 <- lapply(datImpd[[i]], as.character)
    nnd2 <- lapply(nnd1, as.numeric)
    datImpd[[i]] <- do.call("cbind", nnd2)
  }

} else if (impMeth==4){
  ##impute
  datMiss[,1:20] <- lapply(datMiss[,1:20] , as.ordered)
  imp <- mice(datMiss, meth=c("logreg", rep("polr",19)), m=nImp ,print=FALSE)

```

```

##extract imputed data
imputations <- complete(imp, "long")
datImpd <- list()
for (i in 1:nImp){
  datImpd[[i]] <- imputations[imputations$.imp==i, -1:-2]
  nnd1 <- lapply(datImpd[[i]], as.character)
  nnd2 <- lapply(nnd1, as.numeric)
  datImpd[[i]] <- do.call("cbind", nnd2)
}
}

for (m in 1:nImp){
write.table(datImpd[[m]], file=paste0("impMeth",impMeth,"_", m, ".dat"), row.names=F,
col.names=F)
}

```

Appendix B

Mplus code for the latent variable approach for the empirical example.

```

TITLE: multiple imputation
DATA: FILE IS qoc_for_mplus.dat;
VARIABLE: NAMES = gender a1-a8 b1-b11;
USEVARIABLES = gender a1-a8 b1-b11;

MISSING = ALL (-999);

DATA IMPUTATION:

IMPUTE = gender (c) a1-a8 (c) b1-b11 (c);

NDATASETS = 50;

SAVE = impMethMplus_*.dat;

ANALYSIS: TYPE = BASIC;

```