Longitudinal Analysis

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```
p<-read.csv("project11.csv",stringsAsFactors = FALSE,strip.white = TRUE,sep = ",")
p2<-read.csv("project11.csv",stringsAsFactors = FALSE,strip.white = TRUE,
             sep = ",",na.strings = "")
nrow(p)
```

```
## [1] 2671
```

- "Rarely or Never" = 0
- "Less than once a week" = 1
- "Once or twice a week" = 2
- "Everyday or almost everyday" = 3

```
#deleting rows which are missing in all the 8 items for all the 3 time
row_to_keep <- rep(TRUE, 2671)
for(i in 1:2671){
row_to_keep[i]<-ifelse(is.na(p2$T1_EATHEAL[i]) & is.na(p2$T1_ART[i])
                       & is.na(p2$T1_YOGA[i]) & is.na(p2$T1_RELAXA[i])
                       & is.na(p2$T1_DANCING[i]) & is.na(p2$T1_MUSIC[i])
                       &is.na(p2$T1_EXER[i]) & is.na(p2$T1_BREA[i])
                       & is.na(p2$T2_EATHEAL[i]) & is.na(p2$T2_ART[i])
                       & is.na(p2$T2_YOGA[i]) & is.na(p2$T2_RELAXA[i])
                       & is.na(p2$T2_DANCING[i]) & is.na(p2$T2_MUSIC[i])
                       &is.na(p2$T2_EXER[i]) & is.na(p2$T2_BREA[i])
                       & is.na(p2$T3_EATHEAL[i]) & is.na(p2$T3_ART[i])
                       & is.na(p2$T3_YOGA[i]) & is.na(p2$T3_RELAXA[i])
                       & is.na(p2$T3_DANCING[i]) & is.na(p2$T3_MUSIC[i])
                       &is.na(p2$T3_EXER[i]) & is.na(p2$T3_BREA[i]),FALSE, TRUE)
}
p<-p[row_to_keep,]
nrow(p)
```

```
## [1] 2463
```

208 observations missing in all 8 items for each time is deleted

```
cpy<-p
```

- meanscore1 corresponds to - (mean of available values in the 8items)*8 if there is no dk response, otherwise dk if there is dk in any of the 8 items.
- ms1binary corresponds to - a binary response indicating whether the meanscore1 is "don't know" or "know".
- meanscore2 corresponds to - (mean of available values in the 8items)*8 after taking "dk" as missing.
- meanscore3 corresponds to - (mean of available values in the 8items)*8 after taking "dk" as 0.

- meanscore4 corresponds to - (mean of available values in the 8items)*8 after taking "dk" as 1.5.
- meanscore5 corresponds to - (mean of available values in the 8items)*8 after taking "dk" as 3.

```
S1<-subset(p,select=c(T1_EATHEAL:T1_BREA))
for(i in names(S1)){
  p[[i]]<-ifelse(p[[i]]=="",NA,p[[i]])
  p[[i]]<-factor(p[[i]],levels= c("Rarely or Never",
                                  "Less than once a week",
                                  "Once or twice a week","Everyday or almost everyday",
                                  "Don't know"))
  j<-paste(i,"I",sep = "_")
  p[[j]]<-as.numeric(p[[i]])-1
}

S2<-subset(p,select=c(T2_EATHEAL:T2_BREA))
for(i in names(S2)){
  p[[i]]<-ifelse(p[[i]]=="",NA,p[[i]])
  p[[i]]<-factor(p[[i]],levels= c("Rarely or Never",
                                  "Less than once a week",
                                  "Once or twice a week","Everyday or almost everyday",
                                  "Don't know"))
  j<-paste(i,"I",sep = "_")
  p[[j]]<-as.numeric(p[[i]])-1
}

S3<-subset(p,select=c(T3_EATHEAL:T3_BREA))
for(i in names(S3)){
  p[[i]]<-ifelse(p[[i]]=="",NA,p[[i]])
  p[[i]]<-factor(p[[i]],levels=  c("Rarely or Never",
                                   "Less than once a week",
                                   "Once or twice a week","Everyday or almost everyday",
                                   "Don't know"))
  j<-paste(i,"I",sep = "_")
  p[[j]]<-as.numeric(p[[i]])-1
}
```

```
#1st outcome - taking meanscore as "Don't know" if
#any of the 8 item is Don't know and defining binary variable
#for the meanscore (ms1binary)

#T1
p$T1_meanscore1<-rep(0,2463)

for (i in 1:2463){
if(cpy$T1_EATHEAL[i]=="Don't know"|cpy$T1_ART[i]=="Don't know"|
   cpy$T1_YOGA[i]=="Don't know"| cpy$T1_RELAXA[i]=="Don't know"|
   cpy$T1_DANCING[i]=="Don't know"|cpy$T1_MUSIC[i]=="Don't know"|
   cpy$T1_EXER[i]=="Don't know"|cpy$T1_BREA[i]=="Don't know")

  {p$T1_meanscore1[i]<-"Don't know" }

else{
            p$T1_meanscore1[i] = round(mean(c(p$T1_EATHEAL_I[i],p$T1_ART_I[i],
```

```
            p$T1_YOGA_I[i],p$T1_RELAXA_I[i],p$T1_DANCING_I[i],
            p$T1_MUSIC_I[i],p$T1_EXER_I[i],p$T1_BREA_I[i]),
            na.rm=TRUE)*8,3)}
}

p$T1_ms1binary<-rep(0,2463)

for(i in 1:2463){
  p$T1_ms1binary<-ifelse(p$T1_meanscore1=="Don't know",0,1)
  p$T1_ms1binary<-ifelse(p$T1_meanscore1=="NaN",NA,p$T1_ms1binary)
}

#T2
p$T2_meanscore1<-rep(0,2463)

for (i in 1:2463){
if(cpy$T2_EATHEAL[i]=="Don't know"|cpy$T2_ART[i]=="Don't know"|
   cpy$T2_YOGA[i]=="Don't know"| cpy$T2_RELAXA[i]=="Don't know"|
   cpy$T2_DANCING[i]=="Don't know"|cpy$T2_MUSIC[i]=="Don't know"|
   cpy$T2_EXER[i]=="Don't know"|cpy$T2_BREA[i]=="Don't know")

  {p$T2_meanscore1[i]<-"Don't know" }

else{
            p$T2_meanscore1[i] = round(mean(c(p$T2_EATHEAL_I[i],p$T2_ART_I[i],
            p$T2_YOGA_I[i],p$T2_RELAXA_I[i],p$T2_DANCING_I[i],
            p$T2_MUSIC_I[i],p$T2_EXER_I[i],p$T2_BREA_I[i]),
            na.rm=TRUE)*8,3)}
}

p$T2_ms1binary<-rep(0,2463)

for(i in 1:2463){
  p$T2_ms1binary<-ifelse(p$T2_meanscore1=="Don't know",0,1)
  p$T2_ms1binary<-ifelse(p$T2_meanscore1=="NaN",NA,p$T2_ms1binary)
}

#T3

p$T3_meanscore1<-rep(0,2463)

for (i in 1:2463){
if(cpy$T3_EATHEAL[i]=="Don't know"|cpy$T3_ART[i]=="Don't know"|
   cpy$T3_YOGA[i]=="Don't know"| cpy$T3_RELAXA[i]=="Don't know"|
   cpy$T3_DANCING[i]=="Don't know"|cpy$T3_MUSIC[i]=="Don't know"|
   cpy$T3_EXER[i]=="Don't know"|cpy$T3_BREA[i]=="Don't know")

  {p$T3_meanscore1[i]<-"Don't know" }

else{
            p$T3_meanscore1[i] = round(mean(c(p$T3_EATHEAL_I[i],p$T3_ART_I[i],
            p$T3_YOGA_I[i],p$T3_RELAXA_I[i],p$T3_DANCING_I[i],
            p$T3_MUSIC_I[i],p$T3_EXER_I[i],p$T3_BREA_I[i]),
```

```
            na.rm=TRUE)*8,3)}
}

p$T3_ms1binary<-rep(0,2463)

for(i in 1:2463){
  p$T3_ms1binary<-ifelse(p$T3_meanscore1=="Don't know",0,1)
  p$T3_ms1binary<-ifelse(p$T3_meanscore1=="NaN",NA,p$T3_ms1binary)
}
```

```
#2nd outcome taking don't know as missing

#T1

    for(j in names(S1)){
      k<-paste(j,"I",sep="_")
    p[[k]]<-ifelse(cpy[[j]]=="Don't know",NA,p[[k]])
                }

p$T1_meanscore2<-rep(0,2463)


for(i in 1:2463){
  p$T1_meanscore2[i]<-round(mean(c(p$T1_EATHEAL_I[i],p$T1_ART_I[i],
            p$T1_YOGA_I[i],p$T1_RELAXA_I[i],p$T1_DANCING_I[i],
            p$T1_MUSIC_I[i],p$T1_EXER_I[i],p$T1_BREA_I[i]),
            na.rm=TRUE)*8,3)
}

#T2

for(j in names(S2)){
  k<-paste(j,"I",sep = "_")
  p[[k]]<-ifelse(cpy[[j]]=="Don't know",NA,p[[k]])
}

p$T2_meanscore2<-rep(0,2463)


for(i in 1:2463){
  p$T2_meanscore2[i]<-round(mean(c(p$T2_EATHEAL_I[i],p$T2_ART_I[i],
            p$T2_YOGA_I[i],p$T2_RELAXA_I[i],p$T2_DANCING_I[i],
            p$T2_MUSIC_I[i],p$T2_EXER_I[i],p$T2_BREA_I[i]),
            na.rm=TRUE)*8,3)
}

#T3

for(j in names(S3)){
  k<-paste(j,"I",sep = "_")
  p[[k]]<-ifelse(cpy[[j]]=="Don't know",NA,p[[k]])
}
```

```
p$T3_meanscore2<-rep(0,2463)


for(i in 1:2463){
  p$T3_meanscore2[i]<-round(mean(c(p$T3_EATHEAL_I[i],p$T3_ART_I[i],
            p$T3_YOGA_I[i],p$T3_RELAXA_I[i],p$T3_DANCING_I[i],
            p$T3_MUSIC_I[i],p$T3_EXER_I[i],p$T3_BREA_I[i]),
            na.rm=TRUE)*8,3)
}
```

```
#3rd outcome taking don't know as 0

#T1

 for(j in names(S1)){
   k<-paste(j,"I",sep = "_")
    p[[k]]<-ifelse(p[[j]]=="Don't know",0,p[[k]])
  }


p$T1_meanscore3<-rep(0,2463)

for(i in 1:2463){
  p$T1_meanscore3[i]<-round(mean(c(p$T1_EATHEAL_I[i],p$T1_ART_I[i],
            p$T1_YOGA_I[i],p$T1_RELAXA_I[i],p$T1_DANCING_I[i],
            p$T1_MUSIC_I[i],p$T1_EXER_I[i],p$T1_BREA_I[i]),
            na.rm=TRUE)*8,3)
}

#T2

for(j in names(S2)){
  k<-paste(j,"I",sep = "_")
  p[[k]]<-ifelse(p[[j]]=="Don't know",0,p[[k]])
}

p$T2_meanscore3<-rep(0,2463)


for(i in 1:2463){
  p$T2_meanscore3[i]<-round(mean(c(p$T2_EATHEAL_I[i],p$T2_ART_I[i],
            p$T2_YOGA_I[i],p$T2_RELAXA_I[i],p$T2_DANCING_I[i],
            p$T2_MUSIC_I[i],p$T2_EXER_I[i],p$T2_BREA_I[i]),
            na.rm=TRUE)*8,3)
}

#T3

for(j in names(S3)){
  k<-paste(j,"I",sep = "_")
  p[[k]]<-ifelse(p[[j]]=="Don't know",0,p[[k]])
}
```

```
p$T3_meanscore3<-rep(0,2463)


for(i in 1:2463){
  p$T3_meanscore3[i]<-round(mean(c(p$T3_EATHEAL_I[i],p$T3_ART_I[i],
            p$T3_YOGA_I[i],p$T3_RELAXA_I[i],p$T3_DANCING_I[i],
            p$T3_MUSIC_I[i],p$T3_EXER_I[i],p$T3_BREA_I[i]),
            na.rm=TRUE)*8,3)
}
```

```
#4th outcome taking Don't know as 1.5


#T1

 for(j in names(S1)){
   k<-paste(j,"I",sep = "_")
    p[[k]]<-ifelse(cpy[[j]]=="Don't know",1.5,p[[k]])
  }


p$T1_meanscore4<-rep(0,2463)

for(i in 1:2463){
  p$T1_meanscore4[i]<-round(mean(c(p$T1_EATHEAL_I[i],p$T1_ART_I[i],
            p$T1_YOGA_I[i],p$T1_RELAXA_I[i],p$T1_DANCING_I[i],
            p$T1_MUSIC_I[i],p$T1_EXER_I[i],p$T1_BREA_I[i]),
            na.rm=TRUE)*8,3)
}

#T2

for(j in names(S2)){
  k<-paste(j,"I",sep = "_")
  p[[k]]<-ifelse(cpy[[j]]=="Don't know",1.5,p[[k]])
}

p$T2_meanscore4<-rep(0,2463)


for(i in 1:2463){
  p$T2_meanscore4[i]<-round(mean(c(p$T2_EATHEAL_I[i],p$T2_ART_I[i],
            p$T2_YOGA_I[i],p$T2_RELAXA_I[i],p$T2_DANCING_I[i],
            p$T2_MUSIC_I[i],p$T2_EXER_I[i],p$T2_BREA_I[i]),
            na.rm=TRUE)*8,3)
}

#T3

for(j in names(S3)){
  k<-paste(j,"I",sep = "_")
  p[[k]]<-ifelse(cpy[[j]]=="Don't know",1.5,p[[k]])
```

```
}

p$T3_meanscore4<-rep(0,2463)


for(i in 1:2463){
  p$T3_meanscore4[i]<-round(mean(c(p$T3_EATHEAL_I[i],p$T3_ART_I[i],
            p$T3_YOGA_I[i],p$T3_RELAXA_I[i],p$T3_DANCING_I[i],
            p$T3_MUSIC_I[i],p$T3_EXER_I[i],p$T3_BREA_I[i]),
            na.rm=TRUE)*8,3)
}
```

```
#5th outcome taking Don't know as 3

#T1

 for(j in names(S1)){
   k<-paste(j,"I",sep = "_")
    p[[k]]<-ifelse(cpy[[j]]=="Don't know",3,p[[k]])
  }


p$T1_meanscore5<-rep(0,2463)

for(i in 1:2463){
  p$T1_meanscore5[i]<-round(mean(c(p$T1_EATHEAL_I[i],p$T1_ART_I[i],
            p$T1_YOGA_I[i],p$T1_RELAXA_I[i],p$T1_DANCING_I[i],
            p$T1_MUSIC_I[i],p$T1_EXER_I[i],p$T1_BREA_I[i]),
            na.rm=TRUE)*8,3)
}

#T2

for(j in names(S2)){
  k<-paste(j,"I",sep = "_")
  p[[k]]<-ifelse(cpy[[j]]=="Don't know",3,p[[k]])
}

p$T2_meanscore5<-rep(0,2463)


for(i in 1:2463){
  p$T2_meanscore5[i]<-round(mean(c(p$T2_EATHEAL_I[i],p$T2_ART_I[i],
            p$T2_YOGA_I[i],p$T2_RELAXA_I[i],p$T2_DANCING_I[i],
            p$T2_MUSIC_I[i],p$T2_EXER_I[i],p$T2_BREA_I[i]),
            na.rm=TRUE)*8,3)
}

#T3

for(j in names(S3)){
  k<-paste(j,"I",sep = "_")
```

```
  p[[k]]<-ifelse(cpy[[j]]=="Don't know",3,p[[k]])
}

p$T3_meanscore5<-rep(0,2463)


for(i in 1:2463){
  p$T3_meanscore5[i]<-round(mean(c(p$T3_EATHEAL_I[i],p$T3_ART_I[i],
            p$T3_YOGA_I[i],p$T3_RELAXA_I[i],p$T3_DANCING_I[i],
            p$T3_MUSIC_I[i],p$T3_EXER_I[i],p$T3_BREA_I[i]),
            na.rm=TRUE)*8,3)
}
```

CONVERTING TO LONG FORMAT

```
library(reshape2)
library(tidyverse)
```

```
## -- Attaching packages ---------------------------------------------------------------------------
## v ggplot2 2.2.1     v purrr   0.2.5
## v tibble  1.4.2     v dplyr   0.7.5
## v tidyr   0.8.1     v stringr 1.3.1
## v readr   1.1.1     v forcats 0.3.0
## -- Conflicts ------------------------------------------------------------------------------------
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()
```

```
project11<-p
eatheal<-subset(project11,select=c(STIDnum:RCT_GROUP,T1_EATHEAL,
                                   T2_EATHEAL,T3_EATHEAL,Female,Grade))
names(eatheal)[5]<-c("T1")
names(eatheal)[6]<-c("T2")
names(eatheal)[7]<-c("T3")
eatheal<-melt(eatheal,id.vars=c("STIDnum","Teach_num","School_Recode",
                                "RCT_GROUP","Female","Grade") ,
              measure.vars=c("T1","T2","T3"),variable.name="Time",
              value.name = "EATHEAL")

art<-subset(project11,select=c(STIDnum:RCT_GROUP,T1_ART,
                               T2_ART,T3_ART,Female,Grade))
names(art)[5]<-c("T1")
names(art)[6]<-c("T2")
names(art)[7]<-c("T3")
art<-melt(art,id.vars =c("STIDnum","Teach_num","School_Recode",
                         "RCT_GROUP","Female","Grade") ,
          measure.vars=c("T1","T2","T3"),variable.name="Time",
          value.name = "ART")

yoga<-subset(project11,select=c(STIDnum:RCT_GROUP,T1_YOGA,
                                T2_YOGA,T3_YOGA,Female,Grade))
names(yoga)[5]<-c("T1")
names(yoga)[6]<-c("T2")
```

```
names(yoga)[7]<-c("T3")
yoga<-melt(yoga,id.vars =c("STIDnum","Teach_num","School_Recode",
                           "RCT_GROUP","Female","Grade") ,
           measure.vars=c("T1","T2","T3"),variable.name="Time",
           value.name = "YOGA")

relaxa<-subset(project11,select=c(STIDnum:RCT_GROUP,T1_RELAXA,
                                  T2_RELAXA,T3_RELAXA,Female,Grade))
names(relaxa)[5]<-c("T1")
names(relaxa)[6]<-c("T2")
names(relaxa)[7]<-c("T3")
relaxa<-melt(relaxa,id.vars =c("STIDnum","Teach_num","School_Recode",
                               "RCT_GROUP","Female","Grade") ,
             measure.vars=c("T1","T2","T3"),variable.name="Time",
             value.name = "RELAXA")

dancing<-subset(project11,select=c(STIDnum:RCT_GROUP,T1_DANCING,
                                   T2_DANCING,T3_DANCING,Female,Grade))
names(dancing)[5]<-c("T1")
names(dancing)[6]<-c("T2")
names(dancing)[7]<-c("T3")
dancing<-melt(dancing,id.vars =c("STIDnum","Teach_num","School_Recode",
                                 "RCT_GROUP","Female","Grade") ,
              measure.vars=c("T1","T2","T3"),variable.name="Time",
              value.name = "DANCING")

music<-subset(project11,select=c(STIDnum:RCT_GROUP,T1_MUSIC,
                                 T2_MUSIC,T3_MUSIC,Female,Grade))
names(music)[5]<-c("T1")
names(music)[6]<-c("T2")
names(music)[7]<-c("T3")
music<-melt(music,id.vars =c("STIDnum","Teach_num","School_Recode",
                             "RCT_GROUP","Female","Grade") ,
            measure.vars=c("T1","T2","T3"),variable.name="Time",
            value.name = "MUSIC")


exer<-subset(project11,select=c(STIDnum:RCT_GROUP,T1_EXER,
                                T2_EXER,T3_EXER,Female,Grade))
names(exer)[5]<-c("T1")
names(exer)[6]<-c("T2")
names(exer)[7]<-c("T3")
exer<-melt(exer,id.vars =c("STIDnum","Teach_num","School_Recode",
                           "RCT_GROUP","Female","Grade") ,
           measure.vars=c("T1","T2","T3"),variable.name="Time",
           value.name = "EXER")


brea<-subset(project11,select=c(STIDnum:RCT_GROUP,T1_BREA,
                                T2_BREA,T3_BREA,Female,Grade))
names(brea)[5]<-c("T1")
names(brea)[6]<-c("T2")
names(brea)[7]<-c("T3")
```

```
brea<-melt(brea,id.vars =c("STIDnum","Teach_num","School_Recode",
                           "RCT_GROUP","Female","Grade") ,
           measure.vars=c("T1","T2","T3"),variable.name="Time",
           value.name = "BREA")


otdif<-subset(project11,select=c(STIDnum:RCT_GROUP,T1_otdif,
                                 T2_otdif,T3_otdif,Female,Grade))
names(otdif)[5]<-c("T1")
names(otdif)[6]<-c("T2")
names(otdif)[7]<-c("T3")
otdif<-melt(otdif,id.vars =c("STIDnum","Teach_num","School_Recode",
                             "RCT_GROUP","Female","Grade") ,
            measure.vars=c("T1","T2","T3"),variable.name="Time",
            value.name = "otdif")


pros<-subset(project11,select=c(STIDnum:RCT_GROUP,T1_pros,
                                T2_pros,T3_pros,Female,Grade))
names(pros)[5]<-c("T1")
names(pros)[6]<-c("T2")
names(pros)[7]<-c("T3")
pros<-melt(pros,id.vars =c("STIDnum","Teach_num","School_Recode",
                           "RCT_GROUP","Female","Grade") ,
           measure.vars=c("T1","T2","T3"),variable.name="Time",
           value.name = "pros")


otdif_T<-subset(project11,select=c(STIDnum:RCT_GROUP,T1_otdif_T,
                                   T2_otdif_T,T3_otdif_T,Female,Grade))
names(otdif_T)[5]<-c("T1")
names(otdif_T)[6]<-c("T2")
names(otdif_T)[7]<-c("T3")
otdif_T<-melt(otdif_T,id.vars =c("STIDnum","Teach_num","School_Recode",
                                 "RCT_GROUP","Female","Grade") ,
              measure.vars=c("T1","T2","T3"),variable.name="Time",
              value.name = "otdif_T")


pros_T<-subset(project11,select=c(STIDnum:RCT_GROUP,T1_pros_T,T2_pros_T,
                                  T3_pros_T,Female,Grade))
names(pros_T)[5]<-c("T1")
names(pros_T)[6]<-c("T2")
names(pros_T)[7]<-c("T3")
pros_T<-melt(pros_T,id.vars =c("STIDnum","Teach_num","School_Recode",
                               "RCT_GROUP","Female","Grade") ,
             measure.vars=c("T1","T2","T3"),variable.name="Time",
             value.name = "pros_T")

meanscore1<-subset(project11,select=c(STIDnum:RCT_GROUP,T1_meanscore1,T2_meanscore1,
                                      T3_meanscore1,Female,Grade))
names(meanscore1)[5]<-c("T1")
names(meanscore1)[6]<-c("T2")
```

```
names(meanscore1)[7]<-c("T3")
meanscore1<-melt(meanscore1,id.vars =c("STIDnum","Teach_num","School_Recode",
                                       "RCT_GROUP","Female","Grade") ,
                 measure.vars=c("T1","T2","T3"),variable.name="Time",
                 value.name = "meanscore1")

msbinary<-subset(project11,select = c(STIDnum:RCT_GROUP,T1_ms1binary,
                                       T2_ms1binary,T3_ms1binary,Female,Grade))
names(msbinary)[5]<-c("T1")
names(msbinary)[6]<-c("T2")
names(msbinary)[7]<-c("T3")
msbinary<-melt(msbinary,id.vars =c("STIDnum","Teach_num","School_Recode",
                                   "RCT_GROUP","Female","Grade") ,
               measure.vars=c("T1","T2","T3"),variable.name="Time",
               value.name = "ms1binary")

meanscore2<-subset(project11,select=c(STIDnum:RCT_GROUP,T1_meanscore2,
                                       T2_meanscore2,T3_meanscore2,Female,Grade))
names(meanscore2)[5]<-c("T1")
names(meanscore2)[6]<-c("T2")
names(meanscore2)[7]<-c("T3")
meanscore2<-melt(meanscore2,id.vars =c("STIDnum","Teach_num","School_Recode",
                                       "RCT_GROUP","Female","Grade") ,
                 measure.vars=c("T1","T2","T3"),variable.name="Time",
                 value.name = "meanscore2")

meanscore3<-subset(project11,select=c(STIDnum:RCT_GROUP,T1_meanscore3,
                                       T2_meanscore3,T3_meanscore3,Female,Grade))
names(meanscore3)[5]<-c("T1")
names(meanscore3)[6]<-c("T2")
names(meanscore3)[7]<-c("T3")
meanscore3<-melt(meanscore3,id.vars =c("STIDnum","Teach_num","School_Recode",
                                       "RCT_GROUP","Female","Grade") ,
                 measure.vars=c("T1","T2","T3"),variable.name="Time",
                 value.name = "meanscore3")

meanscore4<-subset(project11,select=c(STIDnum:RCT_GROUP,T1_meanscore4,
                                       T2_meanscore4,T3_meanscore4,Female,Grade))
names(meanscore4)[5]<-c("T1")
names(meanscore4)[6]<-c("T2")
names(meanscore4)[7]<-c("T3")
meanscore4<-melt(meanscore4,id.vars =c("STIDnum","Teach_num","School_Recode",
                                       "RCT_GROUP","Female","Grade") ,
                 measure.vars=c("T1","T2","T3"),variable.name="Time",
                 value.name = "meanscore4")

meanscore5<-subset(project11,select=c(STIDnum:RCT_GROUP,T1_meanscore5,
                                       T2_meanscore5,T3_meanscore5,Female,Grade))
names(meanscore5)[5]<-c("T1")
names(meanscore5)[6]<-c("T2")
names(meanscore5)[7]<-c("T3")
meanscore5<-melt(meanscore5,id.vars =c("STIDnum","Teach_num","School_Recode",
                                       "RCT_GROUP","Female","Grade") ,
```

```
                measure.vars=c("T1","T2","T3"),variable.name="Time",
                value.name = "meanscore5")


longdata<-data.frame(eatheal$STIDnum,eatheal$Teach_num,
                     eatheal$School_Recode,eatheal$RCT_GROUP,eatheal$Female,
                     eatheal$Grade,eatheal$Time,eatheal$EATHEAL,
                     art$ART,yoga$YOGA,relaxa$RELAXA,dancing$DANCING,
                     music$MUSIC,exer$EXER,brea$BREA,
                     meanscore1$meanscore1,msbinary$ms1binary,meanscore2$meanscore2,
                     meanscore3$meanscore3,meanscore4$meanscore4,
                     meanscore5$meanscore5,otdif$otdif,pros$pros,
                     otdif_T$otdif_T,pros_T$pros_T)
names(longdata)<-c("STIDnum","Teach_num","School_Recode",
                   "RCT_GROUP","Female",
                   "Grade","Time","EATHEAL","ART",
                   "YOGA","RELAXA","DANCING","MUSIC",
                   "EXER","BREA","meanscore1","ms1binary",
                   "meanscore2","meanscore3","meanscore4",
                   "meanscore5","otdif","pros","otdif_T","pros_T")
glimpse(longdata)
```

```
## Observations: 7,389
## Variables: 25
## $ STIDnum       <int> 1001, 1002, 1003, 1004, 1005, 1006, 1007, 1008, ...
## $ Teach_num     <int> 11104110, 11104110, 11104110, 11104110, 11104110...
## $ School_Recode <int> 1104, 1104, 1104, 1104, 1104, 1104, 1104, 1104, ...
## $ RCT_GROUP     <fct> CASE, CASE, CASE, CASE, CASE, CASE, CASE, CASE, ...
## $ Female        <int> 1, 0, 1, 1, 0, 0, 1, 1, 1, 1, 0, 1, 0, 1, 0, 0, ...
## $ Grade         <int> 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, ...
## $ Time          <fct> T1, T1, T1, T1, T1, T1, T1, T1, T1, T1, T1, T1, ...
## $ EATHEAL       <fct> Rarely or Never, Everyday or almost everyday, Ev...
## $ ART           <fct> Everyday or almost everyday, Everyday or almost ...
## $ YOGA          <fct> Once or twice a week, Everyday or almost everyda...
## $ RELAXA        <fct> Less than once a week, NA, Don't know, Rarely or...
## $ DANCING       <fct> Rarely or Never, Don't know, Once or twice a wee...
## $ MUSIC         <fct> Everyday or almost everyday, Everyday or almost ...
## $ EXER          <fct> Everyday or almost everyday, Everyday or almost ...
## $ BREA          <fct> Rarely or Never, Everyday or almost everyday, On...
## $ meanscore1    <fct> 12, Don't know, Don't know, 10, 5, 5, Don't know...
## $ ms1binary     <dbl> 1, 0, 0, 1, 1, 1, 0, NA, 1, 1, 1, 1, 0, 1, 0, 1,...
## $ meanscore2    <dbl> 12.000, 24.000, 19.200, 10.000, 5.000, 5.000, 10...
## $ meanscore3    <dbl> 12.000, 20.571, 13.714, 10.000, 5.000, 5.000, 9....
## $ meanscore4    <dbl> 12.000, 22.286, 17.143, 10.000, 5.000, 5.000, 10...
## $ meanscore5    <dbl> 12.000, 24.000, 20.571, 10.000, 5.000, 5.000, 12...
## $ otdif         <dbl> 20.50, 26.75, 23.00, 10.00, 13.00, 11.00, 14.00,...
## $ pros          <dbl> 9.0, 3.0, 6.0, 7.0, 5.0, 7.0, 6.0, 9.0, 7.0, 6.0...
## $ otdif_T       <dbl> 12, 18, 16, 0, 6, 11, 8, 3, 4, 2, 11, 1, 2, 4, 7...
## $ pros_T        <dbl> 9, 5, 8, 10, 7, 10, 3, 10, 8, 8, 6, 9, 9, 10, 9,...
```

defining dummy variables for cohort and time

```
longdata$case<-ifelse(longdata$RCT_GROUP=="CASE",1,0)
longdata$case<-as.factor(longdata$case)
longdata$T1<-ifelse(longdata$Time=="T1",1,0)
longdata$T2<-ifelse(longdata$Time=="T2",1,0)
longdata$T3<-ifelse(longdata$Time=="T3",1,0)
```

NULL MULTILEVEL MODEL (TO CHECK BETWEEN INDIVIDUAL EFFECTS) FOR BINARY OUTCOME

```
library(lme4)
```

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

```
##
## Attaching package: 'Matrix'
```

```
## The following object is masked from 'package:tidyr':
##
##     expand
```

```
fitm<-glmer(ms1binary~(1|STIDnum),data=longdata,
            family = binomial("logit"))
summary(fitm)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: binomial  ( logit )
## Formula: ms1binary ~ (1 | STIDnum)
##    Data: longdata
##
##      AIC      BIC   logLik deviance df.resid
##   4644.3   4657.4  -2320.1   4640.3     5135
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -2.0467  0.3136  0.3288  0.3477  0.7077
##
## Random effects:
##  Groups  Name        Variance Std.Dev.
##  STIDnum (Intercept) 1.284    1.133
## Number of obs: 5137, groups:  STIDnum, 2463
##
## Fixed effects:
##             Estimate Std. Error z value Pr(>|z|)
## (Intercept)  1.97416    0.07546   26.16   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

NULL SINGLE LEVEL MODEL (WITHOUT RANDOM EFFECTS)

```
fits<-glm(ms1binary~1,data=longdata,
          family = binomial(link = "logit"))
summary(fits)
```

```
##
## Call:
## glm(formula = ms1binary ~ 1, family = binomial(link = "logit"),
##     data = longdata)
##
## Deviance Residuals:
##     Min       1Q   Median       3Q      Max
## -1.8760   0.6146   0.6146   0.6146   0.6146
##
## Coefficients:
##             Estimate Std. Error z value Pr(>|z|)
## (Intercept)  1.57092    0.03696    42.5   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for binomial family taken to be 1)
##
##     Null deviance: 4717.6  on 5136  degrees of freedom
## Residual deviance: 4717.6  on 5136  degrees of freedom
##   (2252 observations deleted due to missingness)
## AIC: 4719.6
##
## Number of Fisher Scoring iterations: 3
```

LIKELIHOOD RATIO TEST TO CHECK WHETHER THERE IS RANDOM EFFECT DUE TO INDIVIDUALS

```
anova(fitm,fits)
```

```
## Data: longdata
## Models:
## fits: ms1binary ~ 1
## fitm: ms1binary ~ (1 | STIDnum)
##      Df    AIC    BIC  logLik deviance  Chisq Chi Df Pr(>Chisq)
## fits  1 4719.6 4726.1 -2358.8   4717.6
## fitm  2 4644.3 4657.4 -2320.2   4640.3 77.284      1  < 2.2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

the p value is significant, which implies that there is a strong evidence that betweeen individual variance is non-zero

ADDING LEVEL 1 EXPLANATORY VARIABLES

```
fitm1<-glmer(ms1binary~case*Time+(1|STIDnum),
             data=longdata,family = binomial("logit"))
summary(fitm1)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: binomial  ( logit )
## Formula: ms1binary ~ case * Time + (1 | STIDnum)
##    Data: longdata
##
```

```
##      AIC      BIC   logLik deviance df.resid
##   4636.1   4681.9  -2311.1   4622.1     5130
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -2.3720  0.2843  0.3238  0.3578  0.7908
##
## Random effects:
##  Groups  Name        Variance Std.Dev.
##  STIDnum (Intercept) 1.302    1.141
## Number of obs: 5137, groups:  STIDnum, 2463
##
## Fixed effects:
##               Estimate Std. Error z value Pr(>|z|)
## (Intercept)   1.791776   0.118843  15.077  < 2e-16 ***
## case1         0.003817   0.140477   0.027 0.978323
## TimeT2        0.260826   0.131920   1.977 0.048024 *
## TimeT3        0.504327   0.150061   3.361 0.000777 ***
## case1:TimeT2  0.044192   0.192486   0.230 0.818415
## case1:TimeT3 -0.405526   0.212157  -1.911 0.055947 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##             (Intr) case1  TimeT2 TimeT3 c1:TT2
## case1       -0.665
## TimeT2      -0.621  0.543
## TimeT3      -0.531  0.475  0.514
## case1:TimT2  0.443 -0.640 -0.684 -0.350
## case1:TimT3  0.384 -0.578 -0.363 -0.706  0.433
```

```
fitm1.1<-glmer(ms1binary~Time+(1|STIDnum),
               data = longdata,family = binomial("logit"))
summary(fitm1.1)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: binomial  ( logit )
## Formula: ms1binary ~ Time + (1 | STIDnum)
##    Data: longdata
##
##      AIC      BIC   logLik deviance df.resid
##   4635.8   4662.0  -2313.9   4627.8     5133
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -2.1942  0.2908  0.3114  0.3570  0.7808
##
## Random effects:
##  Groups  Name        Variance Std.Dev.
##  STIDnum (Intercept) 1.304    1.142
## Number of obs: 5137, groups:  STIDnum, 2463
##
```

```
## Fixed effects:
##             Estimate Std. Error z value Pr(>|z|)
## (Intercept)  1.79742    0.08892  20.215  < 2e-16 ***
## TimeT2       0.27321    0.09451   2.891  0.00384 **
## TimeT3       0.32758    0.10543   3.107  0.00189 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##        (Intr) TimeT2
## TimeT2 -0.469
## TimeT3 -0.410  0.441
```

```
fitm1.2<-glmer(ms1binary~case+(1|STIDnum),
               data=longdata,family = binomial("logit"))
summary(fitm1.2)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: binomial  ( logit )
## Formula: ms1binary ~ case + (1 | STIDnum)
##    Data: longdata
##
##      AIC      BIC   logLik deviance df.resid
##   4644.4   4664.0  -2319.2   4638.4     5134
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -2.0870  0.3070  0.3227  0.3390  0.7202
##
## Random effects:
##  Groups  Name        Variance Std.Dev.
##  STIDnum (Intercept) 1.276    1.129
## Number of obs: 5137, groups:  STIDnum, 2463
##
## Fixed effects:
##             Estimate Std. Error z value Pr(>|z|)
## (Intercept)  2.03256    0.08794  23.114   <2e-16 ***
## case1       -0.13187    0.09546  -1.381    0.167
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##       (Intr)
## case1 -0.516
```

```
anova(fitm1.1,fitm1)
```

```
## Data: longdata
## Models:
## fitm1.1: ms1binary ~ Time + (1 | STIDnum)
## fitm1: ms1binary ~ case * Time + (1 | STIDnum)
```

```
##         Df    AIC    BIC  logLik deviance  Chisq Chi Df Pr(>Chisq)
## fitm1.1  4 4635.8 4662.0 -2313.9   4627.8
## fitm1    7 4636.1 4681.9 -2311.1   4622.1 5.6895      3     0.1277
```

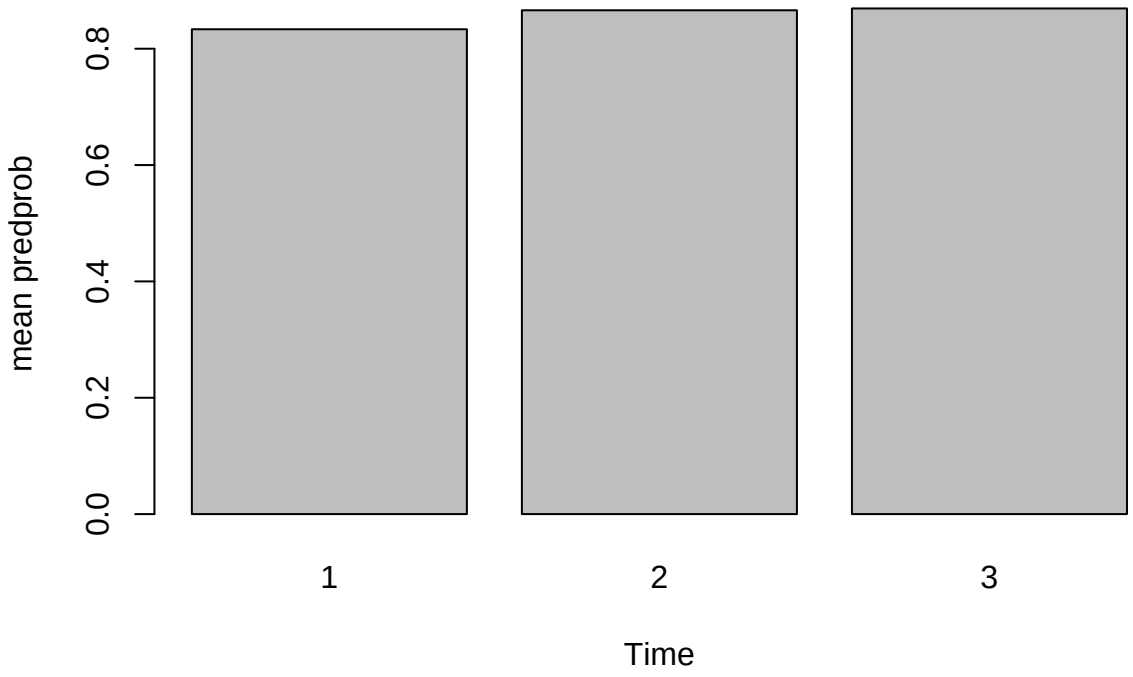
the effect of case is not significantly different across Time

Inference - cohort is not significant, but time is significant (TimeT2 with 0.003 and TimeT3 with 0.001) in predicting whether a student will answer "don't know" in anyone of the 8 items with log-odds of responding without "dk" increasing by a factor of 0.27 from T1 to T2 and by a factor of 0.32 from T1 to T3

```
predprob<-fitted(fitm1.1)
```

```
datapred<-(data.frame(cbind(predprob = predprob,
                            Time=longdata$Time[!is.na(longdata$ms1binary)])))
colnames(datapred)[1]<-"predprob"
```

```
mean.table<-tapply(datapred$predprob,datapred$Time,mean)
barplot(mean.table,ylab = "mean predprob",xlab = "Time")
```




```
data.frame(cbind("time" = c("T1","T2","T3"),
                 "mean of predicted probability" = as.vector(mean.table)))
```

```
##   time mean.of.predicted.probability
## 1   T1             0.833467373397667
## 2   T2              0.86603969526983
## 3   T3             0.869237483699879
```

the mean predicted probability for answering, increases from T1 to T2 and from T1 to T3.

CONTINUOUS OUTCOMES (meanscore2, meanscore3, meanscore4, meanscore5)

meanscore2 corresponds to the mean of the available responses after taking "dk" as NA

```
library(nlme)
```

```
##
## Attaching package: 'nlme'
## The following object is masked from 'package:lme4':
##
##     lmList
## The following object is masked from 'package:dplyr':
##
##     collapse
```

```
fitm2<-lme(meanscore2~case*Time,random = ~1|STIDnum,
           data = longdata,na.action = na.omit,method = c("ML"))
summary(fitm2)
```

```
## Linear mixed-effects model fit by maximum likelihood
##  Data: longdata
##        AIC      BIC    logLik
##   30741.47 30793.78 -15362.73
##
## Random effects:
##  Formula: ~1 | STIDnum
##         (Intercept) Residual
## StdDev:    4.037581 3.632156
##
## Fixed effects: meanscore2 ~ case * Time
##                  Value Std.Error   DF  t-value p-value
## (Intercept)  12.109206 0.1784729 2648 67.84898  0.0000
## case1         0.268333 0.2438695 2459  1.10031  0.2713
## TimeT2        0.012720 0.1794675 2648  0.07088  0.9435
## TimeT3        0.056297 0.1978404 2648  0.28456  0.7760
## case1:TimeT2  0.065628 0.2585752 2648  0.25381  0.7997
## case1:TimeT3 -0.674448 0.2862186 2648 -2.35641  0.0185
##  Correlation:
##              (Intr) case1  TimeT2 TimeT3 c1:TT2
## case1        -0.732
## TimeT2       -0.624  0.457
## TimeT3       -0.560  0.410  0.570
## case1:TimeT2  0.433 -0.528 -0.694 -0.396
## case1:TimeT3  0.387 -0.469 -0.394 -0.691  0.477
##
## Standardized Within-Group Residuals:
##         Min          Q1         Med          Q3         Max
```

```
## -4.17253594 -0.50760040 -0.03413559  0.48614360  3.74464893
##
## Number of Observations: 5113
## Number of Groups: 2461
```

```
fitm2.1<-lme(meanscore2~Time,random = ~1|STIDnum,
             data = longdata,na.action = na.omit,method = c("ML"))
summary(fitm2.1)
```

```
## Linear mixed-effects model fit by maximum likelihood
##  Data: longdata
##        AIC      BIC    logLik
##   30743.91 30776.61 -15366.96
##
## Random effects:
##  Formula: ~1 | STIDnum
##         (Intercept) Residual
## StdDev:     4.03816 3.636402
##
## Fixed effects: meanscore2 ~ Time
##                 Value Std.Error   DF   t-value p-value
## (Intercept) 12.258568 0.1211160 2650 101.21342  0.0000
## TimeT2      -0.002575 0.1276531 2650  -0.02018  0.9839
## TimeT3      -0.252123 0.1415607 2650  -1.78102  0.0750
##  Correlation:
##        (Intr) TimeT2
## TimeT2 -0.537
## TimeT3 -0.475  0.488
##
## Standardized Within-Group Residuals:
##         Min          Q1         Med          Q3         Max
## -4.19939901 -0.51528241 -0.03184054  0.48309214  3.79278046
##
## Number of Observations: 5113
## Number of Groups: 2461
```

```
fitm2.2<-lme(meanscore2~case,random = ~1|STIDnum,data = longdata,
             na.action = na.omit,method = c("ML"))
summary(fitm2.2)
```

```
## Linear mixed-effects model fit by maximum likelihood
##  Data: longdata
##        AIC      BIC    logLik
##   30745.47 30771.62 -15368.73
##
## Random effects:
##  Formula: ~1 | STIDnum
##         (Intercept) Residual
## StdDev:    4.035598 3.639454
##
## Fixed effects: meanscore2 ~ case
##                 Value Std.Error   DF  t-value p-value
```

```
## (Intercept) 12.130226 0.1321776 2652 91.77215  0.0000
## case1        0.147735 0.1963631 2459  0.75236  0.4519
##  Correlation:
##       (Intr)
## case1 -0.673
##
## Standardized Within-Group Residuals:
##         Min          Q1         Med          Q3         Max
## -4.16948466 -0.51201513 -0.03425569  0.48423207  3.74588810
##
## Number of Observations: 5113
## Number of Groups: 2461
```

```
anova(fitm2,fitm2.1)
```

```
##         Model df      AIC      BIC    logLik   Test  L.Ratio p-value
## fitm2       1  8 30741.47 30793.78 -15362.73
## fitm2.1     2  5 30743.92 30776.61 -15366.96 1 vs 2 8.447585  0.0376
```

The effect of case vary significantly across Time to predict meanscore2

Inference -Time and cohort are not individually significant in predicting meanscore2,but the interaction of TimeT3 with case is significant predictor(0.01), and meanscore2 decreases by 0.67 from T1 to T3 for case

meanscore3 corresponds to mean of the available responses after taking "dk" as 0

```
fitm3<-lme(meanscore3~case*Time,random = ~1|STIDnum,
           na.action = na.omit,data = longdata,method = c("ML"))
summary(fitm3)
```

```
## Linear mixed-effects model fit by maximum likelihood
##  Data: longdata
##        AIC      BIC    logLik
##   30624.82 30677.17 -15304.41
##
## Random effects:
##  Formula: ~1 | STIDnum
##         (Intercept) Residual
## StdDev:     3.90986 3.555352
##
## Fixed effects: meanscore3 ~ case * Time
##                  Value Std.Error   DF  t-value p-value
## (Intercept)  11.597200 0.1737704 2670 66.73864  0.0000
## case1         0.235147 0.2373193 2461  0.99085  0.3219
## TimeT2        0.016602 0.1751350 2670  0.09480  0.9245
## TimeT3       -0.078254 0.1928527 2670 -0.40577  0.6849
## case1:TimeT2  0.048700 0.2524904 2670  0.19288  0.8471
## case1:TimeT3 -0.644217 0.2788228 2670 -2.31049  0.0209
##  Correlation:
##              (Intr) case1  TimeT2 TimeT3 c1:TT2
## case1        -0.732
## TimeT2       -0.627  0.459
## TimeT3       -0.563  0.412  0.572
```

```
## case1:TimeT2  0.435 -0.530 -0.694 -0.397
## case1:TimeT3  0.389 -0.472 -0.395 -0.692  0.478
##
## Standardized Within-Group Residuals:
##         Min          Q1         Med          Q3         Max
## -3.56522751 -0.50779196 -0.01768381  0.50819849  3.63764472
##
## Number of Observations: 5137
## Number of Groups: 2463
```

```
fitm3.1<-lme(meanscore3~Time,random = ~1|STIDnum,
             na.action = na.omit,data = longdata,method = c("ML"))
summary(fitm3.1)
```

```
## Linear mixed-effects model fit by maximum likelihood
##  Data: longdata
##       AIC      BIC   logLik
##   30626.6 30659.32 -15308.3
##
## Random effects:
##  Formula: ~1 | STIDnum
##         (Intercept) Residual
## StdDev:    3.910726 3.558989
##
## Fixed effects: meanscore3 ~ Time
##                 Value Std.Error   DF  t-value p-value
## (Intercept) 11.729760 0.1178527 2672 99.52900  0.0000
## TimeT2      -0.002735 0.1245940 2672 -0.02195  0.9825
## TimeT3      -0.372247 0.1378973 2672 -2.69945  0.0070
##  Correlation:
##        (Intr) TimeT2
## TimeT2 -0.540
## TimeT3 -0.478  0.489
##
## Standardized Within-Group Residuals:
##         Min          Q1         Med          Q3         Max
## -3.59253489 -0.50843397 -0.02067797  0.50866167  3.68543360
##
## Number of Observations: 5137
## Number of Groups: 2463
```

```
fitm3.2<-lme(meanscore3~case,random = ~1|STIDnum,
             na.action = na.omit,data = longdata,method = c("ML"))
summary(fitm3.2)
```

```
## Linear mixed-effects model fit by maximum likelihood
##  Data: longdata
##        AIC      BIC    logLik
##   30633.67 30659.85 -15312.84
##
## Random effects:
##  Formula: ~1 | STIDnum
```

```
##         (Intercept) Residual
## StdDev:    3.907146 3.565299
##
## Fixed effects: meanscore3 ~ case
##                Value Std.Error   DF  t-value p-value
## (Intercept) 11.58311 0.1282427 2674 90.32178   0.000
## case1        0.12351 0.1905848 2461  0.64806   0.517
##  Correlation:
##       (Intr)
## case1 -0.673
##
## Standardized Within-Group Residuals:
##         Min          Q1         Med          Q3         Max
## -3.64062598 -0.51106802 -0.01533368  0.51288640  3.61072535
##
## Number of Observations: 5137
## Number of Groups: 2463
```

```
anova(fitm3,fitm3.1)
```

```
##         Model df      AIC      BIC    logLik   Test  L.Ratio p-value
## fitm3       1  8 30624.82 30677.17 -15304.41
## fitm3.1     2  5 30626.60 30659.32 -15308.30 1 vs 2 7.781281  0.0508
```

The effect of case varies weakly(0.05) across Time to predict meanscore3

Inference - Time T3 is significant (0.007) in predicting meanscore3 where, meanscore3 decreases by 0.37 from T1 to T3, the interaction of TimeT3 with case is significant predictor(0.02) and meanscore3 decreases by 0.64 from T1 to T3 for case, case is not individually significant

meascore4 corresponds to the (mean of the available response)*8 after taking "dk" as 1.5

```
library(lme4)
fitm4<-lme(meanscore4~Time*case,random = ~1|STIDnum,
           data = longdata,na.action = na.omit)
fitml4<-lmer(meanscore4~Time*case+(1|STIDnum),
             data = longdata,REML = FALSE)
summary(fitm4)
```

```
## Linear mixed-effects model fit by REML
##  Data: longdata
##        AIC      BIC   logLik
##   30188.79 30241.13 -15086.4
##
## Random effects:
##  Formula: ~1 | STIDnum
##         (Intercept) Residual
## StdDev:    3.912403 3.330967
##
## Fixed effects: meanscore4 ~ Time * case
##                   Value Std.Error   DF  t-value p-value
## (Intercept)  12.080364 0.1673750 2670 72.17545  0.0000
## TimeT2        0.005818 0.1646246 2670  0.03534  0.9718
## TimeT3       -0.048563 0.1813256 2670 -0.26782  0.7889
## case1         0.257325 0.2294033 2461  1.12172  0.2621
```

```
## TimeT2:case1 -0.020300 0.2372780 2670 -0.08555  0.9318
## TimeT3:case1 -0.596231 0.2620514 2670 -2.27524  0.0230
##  Correlation:
##              (Intr) TimeT2 TimeT3 case1  TmT2:1
## TimeT2       -0.613
## TimeT3       -0.550  0.573
## case1        -0.730  0.447  0.401
## TimeT2:case1  0.425 -0.694 -0.397 -0.515
## TimeT3:case1  0.380 -0.396 -0.692 -0.459  0.479
##
## Standardized Within-Group Residuals:
##         Min          Q1         Med          Q3         Max
## -3.79406792 -0.51164373 -0.03206246  0.49451022  3.72989279
##
## Number of Observations: 5137
## Number of Groups: 2463
```

```
fitm4.1<-lme(meanscore4~Time,random=~1|STIDnum,
             data = longdata,na.action = na.omit,method = c("ML"))
fitml4.1<-lmer(meanscore4~Time+(1|STIDnum),
               data = longdata,REML = FALSE)
summary(fitm4.1)
```

```
## Linear mixed-effects model fit by maximum likelihood
##  Data: longdata
##        AIC      BIC    logLik
##   30178.07 30210.79 -15084.04
##
## Random effects:
##  Formula: ~1 | STIDnum
##         (Intercept) Residual
## StdDev:    3.911251 3.331879
##
## Fixed effects: meanscore4 ~ Time
##                 Value Std.Error   DF   t-value p-value
## (Intercept) 12.225156 0.1139374 2672 107.29709  0.0000
## TimeT2      -0.042481 0.1171265 2672  -0.36269  0.7169
## TimeT3      -0.325756 0.1296304 2672  -2.51296  0.0120
##  Correlation:
##        (Intr) TimeT2
## TimeT2 -0.525
## TimeT3 -0.464  0.491
##
## Standardized Within-Group Residuals:
##         Min          Q1         Med          Q3         Max
## -3.82761124 -0.51538523 -0.02841712  0.49768634  3.77735070
##
## Number of Observations: 5137
## Number of Groups: 2463
```

```
fitm4.2<-lme(meanscore4~case,random=~1|STIDnum,
             data = longdata,na.action = na.omit,method = c("ML"))
```

```
fitml4.2<-lmer(meanscore4~case+(1|STIDnum),
               data = longdata,REML = FALSE)
summary(fitm4.2)
```

```
## Linear mixed-effects model fit by maximum likelihood
##  Data: longdata
##        AIC      BIC    logLik
##   30182.85 30209.03 -15087.43
##
## Random effects:
##  Formula: ~1 | STIDnum
##         (Intercept) Residual
## StdDev:    3.908012 3.336675
##
## Fixed effects: meanscore4 ~ case
##                 Value Std.Error   DF  t-value p-value
## (Intercept) 12.069638 0.1258674 2674 95.89171  0.0000
## case1        0.135306 0.1870449 2461  0.72339  0.4695
##  Correlation:
##       (Intr)
## case1 -0.673
##
## Standardized Within-Group Residuals:
##         Min          Q1         Med          Q3         Max
## -3.78299759 -0.51424218 -0.02589682  0.49664324  3.71287052
##
## Number of Observations: 5137
## Number of Groups: 2463
```

```
anova(fitml4,fitml4.1)
```

```
## Data: longdata
## Models:
## fitml4.1: meanscore4 ~ Time + (1 | STIDnum)
## fitml4: meanscore4 ~ Time * case + (1 | STIDnum)
##          Df   AIC   BIC logLik deviance  Chisq Chi Df Pr(>Chisq)
## fitml4.1  5 30178 30211 -15084    30168
## fitml4    8 30177 30230 -15081    30161 6.8097      3    0.07822 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

The effect of case does not significantly differ across time to predict meanscore4

Inference - Time T3 is significant(0.01) in predicting meanscore4 where, meanscore4 decreases by 0.32 from T1 to T3, case is not a significant predictor

meanscore5 corresponds to the (mean of the available responses)*8 after taking "dk" as 3

```
fitm5<-lme(meanscore5~Time*case, random = ~1|STIDnum,
           data = longdata,na.action = na.omit)
fitml5<-lmer(meanscore5~Time*case+(1|STIDnum),
             data = longdata,REML = FALSE)
summary(fitm5)
```

```
## Linear mixed-effects model fit by REML
```

```
##  Data: longdata
##        AIC      BIC    logLik
##   30860.33 30912.67 -15422.16
##
## Random effects:
##  Formula: ~1 | STIDnum
##         (Intercept) Residual
## StdDev:    3.970992 3.648607
##
## Fixed effects: meanscore5 ~ Time * case
##                  Value Std.Error   DF  t-value p-value
## (Intercept)  12.549671 0.1774596 2670 70.71848  0.0000
## TimeT2        0.007854 0.1795124 2670  0.04375  0.9651
## TimeT3       -0.006298 0.1976641 2670 -0.03186  0.9746
## case1         0.293929 0.2422256 2461  1.21345  0.2251
## TimeT2:case1 -0.095438 0.2588117 2670 -0.36875  0.7123
## TimeT3:case1 -0.557122 0.2857974 2670 -1.94936  0.0514
##  Correlation:
##              (Intr) TimeT2 TimeT3 case1  TmT2:1
## TimeT2       -0.629
## TimeT3       -0.565  0.572
## case1        -0.733  0.461  0.414
## TimeT2:case1  0.436 -0.694 -0.396 -0.532
## TimeT3:case1  0.391 -0.395 -0.692 -0.475  0.478
##
## Standardized Within-Group Residuals:
##         Min          Q1         Med          Q3         Max
## -4.17745056 -0.51313632 -0.04623257  0.49081540  3.70919597
##
## Number of Observations: 5137
## Number of Groups: 2463
```

```
fitm5.1<-lme(meanscore5~Time, random = ~1|STIDnum,
             data = longdata,na.action = na.omit)
fitml5.1<-lmer(meanscore5~Time+(1|STIDnum),
               data = longdata,REML = FALSE)
summary(fitm5.1)
```

```
## Linear mixed-effects model fit by REML
##  Data: longdata
##        AIC      BIC    logLik
##   30855.72 30888.44 -15422.86
##
## Random effects:
##  Formula: ~1 | STIDnum
##         (Intercept) Residual
## StdDev:    3.970504  3.64968
##
## Fixed effects: meanscore5 ~ Time
##                 Value Std.Error   DF   t-value p-value
## (Intercept) 12.714744 0.1202548 2672 105.73173  0.0000
## TimeT2      -0.074650 0.1276512 2672  -0.58480  0.5587
## TimeT3      -0.272497 0.1412805 2672  -1.92877  0.0539
```

```
##  Correlation:
##        (Intr) TimeT2
## TimeT2 -0.542
## TimeT3 -0.480  0.489
##
## Standardized Within-Group Residuals:
##         Min          Q1         Med          Q3         Max
## -4.21087625 -0.51404557 -0.04836512  0.49457873  3.74615088
##
## Number of Observations: 5137
## Number of Groups: 2463
```

```
fitm5.2<-lme(meanscore5~case, random = ~1|STIDnum,
             data = longdata,na.action = na.omit)
fitml5.2<-lmer(meanscore5~case+(1|STIDnum),
               data = longdata,REML = FALSE)
summary(fitm5.2)
```

```
## Linear mixed-effects model fit by REML
##  Data: longdata
##       AIC      BIC   logLik
##   30853.8 30879.98 -15422.9
##
## Random effects:
##  Formula: ~1 | STIDnum
##         (Intercept) Residual
## StdDev:    3.968888 3.651607
##
## Fixed effects: meanscore5 ~ case
##                 Value Std.Error   DF  t-value p-value
## (Intercept) 12.551432 0.1305649 2674 96.13172  0.0000
## case1        0.152963 0.1940371 2461  0.78832  0.4306
##  Correlation:
##       (Intr)
## case1 -0.673
##
## Standardized Within-Group Residuals:
##         Min          Q1         Med          Q3         Max
## -4.17379692 -0.51117291 -0.04490824  0.49432425  3.70386861
##
## Number of Observations: 5137
## Number of Groups: 2463
```

```
anova(fitml5,fitml5.1)
```

```
## Data: longdata
## Models:
## fitml5.1: meanscore5 ~ Time + (1 | STIDnum)
## fitml5: meanscore5 ~ Time * case + (1 | STIDnum)
##          Df   AIC   BIC logLik deviance  Chisq Chi Df Pr(>Chisq)
## fitml5.1  5 30848 30881 -15419    30838
## fitml5    8 30850 30902 -15417    30834 4.6141      3     0.2023
```

the effect of case do not significantly differ across time for predicting meanscore5 

Inference - TimeT3 is weakly significant predictor(0.05) of meanscore5, meanscore5 will decrease by a value of 0.27 from T1 to T3, case is not a significant predictor

CONCLUSION

- The log-odds of NOT responsding with "dk" increases from T1 to T2 and from T1 to T3.
- The meanscore after taking "dk" as missing,0,1.5 and 3 generally decreases from T1 to T3 especially for case, with significant p values for most of these meanscores.