#######################################################################################  
# Chapter 3 Data Analyses  
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# Last edited: 2019-11-27  
#######################################################################################  
  
  
#Data management---------------------------------------------  
if (!require("pacman")) install.packages("pacman")

## Loading required package: pacman

## Warning: package 'pacman' was built under R version 3.5.3

pacman::p\_load(readxl, psych, pastecs, Hmisc,lme4, car, lsmeans,lmerTest, ggplot2, emmeans, dplyr)  
setwd("C:/Users/rfalck/Desktop/UBC-PhD/Thesis Material/Thesis defense materials/Theis Data and Analyses")#Directory where you put the spreadsheet  
PAcog <- read\_excel("Chapter 3 Data.xlsx", sheet= "Averages")  
  
data1 <- PAcog[-c(8,40,42,105,122,136),]  
data2 <- data1[ which(data1$`ADAS-Cog Plus` < 1.29),]  
  
library(plyr)

## -------------------------------------------------------------------------

## You have loaded plyr after dplyr - this is likely to cause problems.  
## If you need functions from both plyr and dplyr, please load plyr first, then dplyr:  
## library(plyr); library(dplyr)

## -------------------------------------------------------------------------

##   
## Attaching package: 'plyr'

## The following objects are masked from 'package:dplyr':  
##   
## arrange, count, desc, failwith, id, mutate, rename, summarise,  
## summarize

## The following objects are masked from 'package:Hmisc':  
##   
## is.discrete, summarize

Final <- data2[c(1,5,6,8,9,11:14,21,23,36:37,38,43,45,51,63)]  
  
Final$EDU<-NA  
Final$EDU[Final$Education==5]<-"University"  
Final$EDU[Final$Education==4]<-"Some College"  
Final$EDU[Final$Education==3]<-"Trade School"  
Final$EDU[Final$Education<3]<-"High School or less"  
  
Final$MCI[Final$MCI==1]<-"MCI"  
Final$MCI[Final$MCI==0]<-"Healthy"  
  
Final$`Retired?`[Final$`Retired?`==1]<-"Retired"  
Final$`Retired?`[Final$`Retired?`==0]<-"Working"  
  
Final$Smoking<-NA  
Final$Smoking[Final$`Current Smoker`==1]<-"Smoker"  
Final$Smoking[Final$`Current Smoker`==0 & Final$`Past Smoker`==1]<-"Past Smoker"  
Final$Smoking[Final$`Current Smoker`==0 & Final$`Past Smoker`==0]<-"Non-Smoker"  
  
Final$lnMVPAbouts<- log(Final$`Avg 10+ Min Bouts of MVPA`+1)  
Final$Age.c<- scale(Final$Age, center = TRUE, scale= FALSE)  
Final$MVPA.c<-scale(Final$`%MVPA Time`, center = TRUE, scale = FALSE)  
Final$MVPAbouts.c<-scale(Final$lnMVPAbouts, center = TRUE, scale = FALSE)  
Final$SB.c<-scale(Final$`%SB Time`, center = TRUE, scale = FALSE)  
Final$SBbouts.c<-scale(Final$`Avg 30+ Min Bouts of SB`, center = TRUE, scale = FALSE)  
  
#Descriptive Statistics----------------------------------  
  
stat.desc(Final$Age)

## nbr.val nbr.null nbr.na min max   
## 1.500000e+02 0.000000e+00 0.000000e+00 5.300000e+01 1.010000e+02   
## range sum median mean SE.mean   
## 4.800000e+01 1.066600e+04 7.250000e+01 7.110667e+01 5.892510e-01   
## CI.mean.0.95 var std.dev coef.var   
## 1.164368e+00 5.208251e+01 7.216821e+00 1.014929e-01

describeBy(Final$Age, group = Final$MCI)

##   
## Descriptive statistics by group   
## group: Healthy  
## vars n mean sd median trimmed mad min max range skew kurtosis  
## X1 1 69 69.42 6.36 69 69.6 5.93 55 81 26 -0.21 -0.56  
## se  
## X1 0.77  
## --------------------------------------------------------   
## group: MCI  
## vars n mean sd median trimmed mad min max range skew kurtosis  
## X1 1 81 72.54 7.62 74 72.85 5.93 53 101 48 -0.01 1.49  
## se  
## X1 0.85

t.test(Final$Age~Final$MCI)

##   
## Welch Two Sample t-test  
##   
## data: Final$Age by Final$MCI  
## t = -2.7353, df = 147.95, p-value = 0.006995  
## alternative hypothesis: true difference in means is not equal to 0  
## 95 percent confidence interval:  
## -5.3790858 -0.8667542  
## sample estimates:  
## mean in group Healthy mean in group MCI   
## 69.42029 72.54321

Sextable<-table(Final$Sex, Final$MCI)  
chisq.test(Sextable)

##   
## Pearson's Chi-squared test with Yates' continuity correction  
##   
## data: Sextable  
## X-squared = 4.4514, df = 1, p-value = 0.03487

EdUtable<-table(Final$EDU, Final$MCI)  
chisq.test(EdUtable)

##   
## Pearson's Chi-squared test  
##   
## data: EdUtable  
## X-squared = 3.4596, df = 3, p-value = 0.326

Retiredtable<-table(Final$`Retired?`, Final$MCI)  
chisq.test(Retiredtable)

##   
## Pearson's Chi-squared test with Yates' continuity correction  
##   
## data: Retiredtable  
## X-squared = 0.003001, df = 1, p-value = 0.9563

Smokingtable<-table(Final$Smoking, Final$MCI)  
chisq.test(Smokingtable)

## Warning in chisq.test(Smokingtable): Chi-squared approximation may be  
## incorrect

##   
## Pearson's Chi-squared test  
##   
## data: Smokingtable  
## X-squared = 0.26246, df = 2, p-value = 0.877

stat.desc(Final$`%MVPA Time`)

## nbr.val nbr.null nbr.na min max   
## 150.0000000 0.0000000 0.0000000 0.2096788 38.6085018   
## range sum median mean SE.mean   
## 38.3988231 1536.9004004 8.4701425 10.2460027 0.5312692   
## CI.mean.0.95 var std.dev coef.var   
## 1.0497950 42.3370469 6.5066925 0.6350469

describeBy(Final$`%MVPA Time`, group= Final$MCI)

##   
## Descriptive statistics by group   
## group: Healthy  
## vars n mean sd median trimmed mad min max range skew kurtosis  
## X1 1 69 12.07 7.19 11.17 11.2 6.37 0.21 38.61 38.4 1.28 2.1  
## se  
## X1 0.86  
## --------------------------------------------------------   
## group: MCI  
## vars n mean sd median trimmed mad min max range skew kurtosis  
## X1 1 81 8.69 5.45 7.02 8.15 5.39 0.58 29.2 28.62 1.04 1.14  
## se  
## X1 0.61

MVPA.lm<-lm(`%MVPA Time`~Age+Sex+MCI,data=Final)  
anova(MVPA.lm)

## Analysis of Variance Table  
##   
## Response: %MVPA Time  
## Df Sum Sq Mean Sq F value Pr(>F)   
## Age 1 760.2 760.19 21.2822 8.599e-06 \*\*\*  
## Sex 1 161.3 161.27 4.5149 0.03528 \*   
## MCI 1 171.7 171.68 4.8064 0.02994 \*   
## Residuals 146 5215.1 35.72   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

stat.desc(Final$lnMVPAbouts)

## nbr.val nbr.null nbr.na min max   
## 150.00000000 15.00000000 0.00000000 0.00000000 2.29486305   
## range sum median mean SE.mean   
## 2.29486305 77.89245665 0.43078292 0.51928304 0.03566166   
## CI.mean.0.95 var std.dev coef.var   
## 0.07046791 0.19076308 0.43676433 0.84109106

describeBy(Final$lnMVPAbouts, group= Final$MCI)

##   
## Descriptive statistics by group   
## group: Healthy  
## vars n mean sd median trimmed mad min max range skew kurtosis se  
## X1 1 69 0.65 0.48 0.57 0.61 0.52 0 2.29 2.29 0.94 0.89 0.06  
## --------------------------------------------------------   
## group: MCI  
## vars n mean sd median trimmed mad min max range skew kurtosis se  
## X1 1 81 0.4 0.36 0.33 0.37 0.37 0 1.61 1.61 0.88 0.28 0.04

MVPAbouts.lm<-lm(lnMVPAbouts~Age+Sex+MCI,data=Final)  
anova(MVPAbouts.lm)

## Analysis of Variance Table  
##   
## Response: lnMVPAbouts  
## Df Sum Sq Mean Sq F value Pr(>F)   
## Age 1 3.6032 3.6032 22.3611 5.273e-06 \*\*\*  
## Sex 1 0.0147 0.0147 0.0913 0.762926   
## MCI 1 1.2799 1.2799 7.9431 0.005497 \*\*   
## Residuals 146 23.5259 0.1611   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

stat.desc(Final$`%SB Time`)

## nbr.val nbr.null nbr.na min max   
## 150.0000000 0.0000000 0.0000000 21.4615507 91.6631720   
## range sum median mean SE.mean   
## 70.2016213 8943.4334676 60.5730038 59.6228898 0.9797453   
## CI.mean.0.95 var std.dev coef.var   
## 1.9359897 143.9851354 11.9993806 0.2012546

describeBy(Final$`%SB Time`, group= Final$MCI)

##   
## Descriptive statistics by group   
## group: Healthy  
## vars n mean sd median trimmed mad min max range skew  
## X1 1 69 57.24 12.38 56.8 57.84 11.43 21.46 91.66 70.2 -0.29  
## kurtosis se  
## X1 0.43 1.49  
## --------------------------------------------------------   
## group: MCI  
## vars n mean sd median trimmed mad min max range skew  
## X1 1 81 61.65 11.35 62.87 61.9 10.03 30.58 90.44 59.86 -0.24  
## kurtosis se  
## X1 0.12 1.26

SB.lm<-lm(`%SB Time`~Age+Sex+MCI,data=Final)  
anova(SB.lm)

## Analysis of Variance Table  
##   
## Response: %SB Time  
## Df Sum Sq Mean Sq F value Pr(>F)   
## Age 1 856.9 856.93 6.4676 0.012027 \*   
## Sex 1 989.7 989.67 7.4694 0.007051 \*\*  
## MCI 1 262.6 262.64 1.9822 0.161282   
## Residuals 146 19344.5 132.50   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

stat.desc(Final$`Avg 30+ Min Bouts of SB`)

## nbr.val nbr.null nbr.na min max   
## 150.00000000 0.00000000 0.00000000 0.07692308 10.30769231   
## range sum median mean SE.mean   
## 10.23076923 557.49358974 3.57692308 3.71662393 0.14926893   
## CI.mean.0.95 var std.dev coef.var   
## 0.29495738 3.34218221 1.82816362 0.49188824

describeBy(Final$`Avg 30+ Min Bouts of SB`, group= Final$MCI)

##   
## Descriptive statistics by group   
## group: Healthy  
## vars n mean sd median trimmed mad min max range skew kurtosis  
## X1 1 69 3.3 1.73 3 3.22 2.05 0.25 7.31 7.06 0.34 -0.72  
## se  
## X1 0.21  
## --------------------------------------------------------   
## group: MCI  
## vars n mean sd median trimmed mad min max range skew kurtosis  
## X1 1 81 4.07 1.85 3.85 3.96 1.71 0.08 10.31 10.23 0.64 0.67  
## se  
## X1 0.21

SBbouts.lm<-lm(`Avg 30+ Min Bouts of SB`~Age+Sex+MCI,data=Final)  
anova(SBbouts.lm)

## Analysis of Variance Table  
##   
## Response: Avg 30+ Min Bouts of SB  
## Df Sum Sq Mean Sq F value Pr(>F)   
## Age 1 7.96 7.9642 2.5396 0.11319   
## Sex 1 19.50 19.4955 6.2166 0.01377 \*  
## MCI 1 12.67 12.6658 4.0388 0.04631 \*  
## Residuals 146 457.86 3.1360   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

stat.desc(Final$`ADAS-Cog Plus`)

## nbr.val nbr.null nbr.na min max   
## 150.00000000 0.00000000 0.00000000 -2.32940000 0.95386000   
## range sum median mean SE.mean   
## 3.28326000 -118.96092000 -0.85578500 -0.79307280 0.05316973   
## CI.mean.0.95 var std.dev coef.var   
## 0.10506409 0.42405303 0.65119354 -0.82110185

describeBy(Final$`ADAS-Cog Plus`, group= Final$MCI)

##   
## Descriptive statistics by group   
## group: Healthy  
## vars n mean sd median trimmed mad min max range skew kurtosis  
## X1 1 69 -1.11 0.57 -1.13 -1.13 0.48 -2.33 0.1 2.43 0.25 -0.39  
## se  
## X1 0.07  
## --------------------------------------------------------   
## group: MCI  
## vars n mean sd median trimmed mad min max range skew kurtosis  
## X1 1 81 -0.52 0.59 -0.59 -0.53 0.65 -1.72 0.95 2.67 0.15 -0.68  
## se  
## X1 0.07

ADASCog.lm<-lm(`ADAS-Cog Plus`~Age+Sex+MCI,data=Final)  
anova(ADASCog.lm)

## Analysis of Variance Table  
##   
## Response: ADAS-Cog Plus  
## Df Sum Sq Mean Sq F value Pr(>F)   
## Age 1 8.463 8.4627 29.709 2.086e-07 \*\*\*  
## Sex 1 5.950 5.9497 20.887 1.030e-05 \*\*\*  
## MCI 1 7.183 7.1827 25.215 1.474e-06 \*\*\*  
## Residuals 146 41.589 0.2849   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

stat.desc(Final$MoCA)

## nbr.val nbr.null nbr.na min max   
## 150.0000000 0.0000000 0.0000000 14.0000000 30.0000000   
## range sum median mean SE.mean   
## 16.0000000 3726.0000000 25.0000000 24.8400000 0.2260605   
## CI.mean.0.95 var std.dev coef.var   
## 0.4466986 7.6655034 2.7686645 0.1114599

describeBy(Final$MoCA, group= Final$MCI)

##   
## Descriptive statistics by group   
## group: Healthy  
## vars n mean sd median trimmed mad min max range skew kurtosis se  
## X1 1 69 27.19 1.1 27 27.11 1.48 26 30 4 0.48 -0.89 0.13  
## --------------------------------------------------------   
## group: MCI  
## vars n mean sd median trimmed mad min max range skew kurtosis  
## X1 1 81 22.84 2.11 23 23.12 1.48 14 25 11 -1.38 2.73  
## se  
## X1 0.23

MoCA.lm<-lm(MoCA~Age+Sex+MCI,data=Final)  
anova(MoCA.lm)

## Analysis of Variance Table  
##   
## Response: MoCA  
## Df Sum Sq Mean Sq F value Pr(>F)   
## Age 1 37.92 37.92 12.6650 0.0005031 \*\*\*  
## Sex 1 21.14 21.14 7.0615 0.0087531 \*\*   
## MCI 1 646.01 646.01 215.7843 < 2.2e-16 \*\*\*  
## Residuals 146 437.09 2.99   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

stat.desc(Final$MMSE)

## nbr.val nbr.null nbr.na min max   
## 1.500000e+02 0.000000e+00 0.000000e+00 2.500000e+01 3.000000e+01   
## range sum median mean SE.mean   
## 5.000000e+00 4.337000e+03 2.900000e+01 2.891333e+01 8.718140e-02   
## CI.mean.0.95 var std.dev coef.var   
## 1.722716e-01 1.140089e+00 1.067750e+00 3.692932e-02

describeBy(Final$MMSE, group= Final$MCI)

##   
## Descriptive statistics by group   
## group: Healthy  
## vars n mean sd median trimmed mad min max range skew kurtosis  
## X1 1 69 29.22 0.87 29 29.33 1.48 27 30 3 -0.95 0.15  
## se  
## X1 0.11  
## --------------------------------------------------------   
## group: MCI  
## vars n mean sd median trimmed mad min max range skew kurtosis  
## X1 1 81 28.65 1.15 29 28.75 1.48 25 30 5 -0.71 0.02  
## se  
## X1 0.13

MMSE.lm<-lm(MMSE~Age+Sex+MCI,data=Final)  
anova(MMSE.lm)

## Analysis of Variance Table  
##   
## Response: MMSE  
## Df Sum Sq Mean Sq F value Pr(>F)   
## Age 1 4.250 4.2503 4.0277 0.046605 \*   
## Sex 1 3.793 3.7930 3.5943 0.059953 .   
## MCI 1 7.761 7.7614 7.3549 0.007491 \*\*  
## Residuals 146 154.069 1.0553   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

#Linear regression analyses---------------------------  
PAcog.lm<-lm(`ADAS-Cog Plus`~`%MVPA Time`+Age.c+Sex+EDU,Final)  
PAcog.lm2<-lm(`ADAS-Cog Plus`~Age.c+Sex+EDU,Final)  
summary(PAcog.lm)

##   
## Call:  
## lm(formula = `ADAS-Cog Plus` ~ `%MVPA Time` + Age.c + Sex + EDU,   
## data = Final)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -1.31364 -0.37893 0.00507 0.37049 1.36744   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) -0.413154 0.134271 -3.077 0.002506 \*\*   
## `%MVPA Time` -0.017067 0.007462 -2.287 0.023650 \*   
## Age.c 0.022191 0.006769 3.278 0.001312 \*\*   
## Sex 0.388577 0.097989 3.966 0.000115 \*\*\*  
## EDUSome College -0.346305 0.156253 -2.216 0.028250 \*   
## EDUTrade School -0.297059 0.171700 -1.730 0.085769 .   
## EDUUniversity -0.447964 0.120205 -3.727 0.000279 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.5472 on 143 degrees of freedom  
## Multiple R-squared: 0.3224, Adjusted R-squared: 0.2939   
## F-statistic: 11.34 on 6 and 143 DF, p-value: 2.418e-10

summary(PAcog.lm2)

##   
## Call:  
## lm(formula = `ADAS-Cog Plus` ~ Age.c + Sex + EDU, data = Final)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -1.53056 -0.34476 0.05015 0.34925 1.33714   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) -0.591992 0.110748 -5.345 3.46e-07 \*\*\*  
## Age.c 0.027094 0.006515 4.159 5.47e-05 \*\*\*  
## Sex 0.426353 0.097996 4.351 2.56e-05 \*\*\*  
## EDUSome College -0.358568 0.158439 -2.263 0.025123 \*   
## EDUTrade School -0.302672 0.174187 -1.738 0.084415 .   
## EDUUniversity -0.458597 0.121867 -3.763 0.000244 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.5552 on 144 degrees of freedom  
## Multiple R-squared: 0.2976, Adjusted R-squared: 0.2732   
## F-statistic: 12.2 on 5 and 144 DF, p-value: 7.241e-10

PAboutscog.lm<-lm(`ADAS-Cog Plus`~lnMVPAbouts+Age.c+Sex+EDU,Final)  
PAboutscog.lm2<-lm(`ADAS-Cog Plus`~Age.c+Sex+EDU,Final)  
summary(PAcog.lm)

##   
## Call:  
## lm(formula = `ADAS-Cog Plus` ~ `%MVPA Time` + Age.c + Sex + EDU,   
## data = Final)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -1.31364 -0.37893 0.00507 0.37049 1.36744   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) -0.413154 0.134271 -3.077 0.002506 \*\*   
## `%MVPA Time` -0.017067 0.007462 -2.287 0.023650 \*   
## Age.c 0.022191 0.006769 3.278 0.001312 \*\*   
## Sex 0.388577 0.097989 3.966 0.000115 \*\*\*  
## EDUSome College -0.346305 0.156253 -2.216 0.028250 \*   
## EDUTrade School -0.297059 0.171700 -1.730 0.085769 .   
## EDUUniversity -0.447964 0.120205 -3.727 0.000279 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.5472 on 143 degrees of freedom  
## Multiple R-squared: 0.3224, Adjusted R-squared: 0.2939   
## F-statistic: 11.34 on 6 and 143 DF, p-value: 2.418e-10

summary(PAcog.lm2)

##   
## Call:  
## lm(formula = `ADAS-Cog Plus` ~ Age.c + Sex + EDU, data = Final)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -1.53056 -0.34476 0.05015 0.34925 1.33714   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) -0.591992 0.110748 -5.345 3.46e-07 \*\*\*  
## Age.c 0.027094 0.006515 4.159 5.47e-05 \*\*\*  
## Sex 0.426353 0.097996 4.351 2.56e-05 \*\*\*  
## EDUSome College -0.358568 0.158439 -2.263 0.025123 \*   
## EDUTrade School -0.302672 0.174187 -1.738 0.084415 .   
## EDUUniversity -0.458597 0.121867 -3.763 0.000244 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.5552 on 144 degrees of freedom  
## Multiple R-squared: 0.2976, Adjusted R-squared: 0.2732   
## F-statistic: 12.2 on 5 and 144 DF, p-value: 7.241e-10

SBcog.lm<-lm(`ADAS-Cog Plus`~`%SB Time`+Age.c+Sex+EDU,Final)  
SBcog.lm2<-lm(`ADAS-Cog Plus`~Age.c+Sex+EDU,Final)  
summary(SBcog.lm)

##   
## Call:  
## lm(formula = `ADAS-Cog Plus` ~ `%SB Time` + Age.c + Sex + EDU,   
## data = Final)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -1.4489 -0.3791 0.0486 0.3572 1.3409   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) -0.984046 0.256971 -3.829 0.000192 \*\*\*  
## `%SB Time` 0.006690 0.003962 1.688 0.093531 .   
## Age.c 0.025450 0.006546 3.888 0.000154 \*\*\*  
## Sex 0.390755 0.099629 3.922 0.000136 \*\*\*  
## EDUSome College -0.334600 0.158069 -2.117 0.036009 \*   
## EDUTrade School -0.298648 0.173095 -1.725 0.086626 .   
## EDUUniversity -0.457569 0.121093 -3.779 0.000231 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.5516 on 143 degrees of freedom  
## Multiple R-squared: 0.3113, Adjusted R-squared: 0.2824   
## F-statistic: 10.77 on 6 and 143 DF, p-value: 7.198e-10

summary(SBcog.lm2)

##   
## Call:  
## lm(formula = `ADAS-Cog Plus` ~ Age.c + Sex + EDU, data = Final)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -1.53056 -0.34476 0.05015 0.34925 1.33714   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) -0.591992 0.110748 -5.345 3.46e-07 \*\*\*  
## Age.c 0.027094 0.006515 4.159 5.47e-05 \*\*\*  
## Sex 0.426353 0.097996 4.351 2.56e-05 \*\*\*  
## EDUSome College -0.358568 0.158439 -2.263 0.025123 \*   
## EDUTrade School -0.302672 0.174187 -1.738 0.084415 .   
## EDUUniversity -0.458597 0.121867 -3.763 0.000244 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.5552 on 144 degrees of freedom  
## Multiple R-squared: 0.2976, Adjusted R-squared: 0.2732   
## F-statistic: 12.2 on 5 and 144 DF, p-value: 7.241e-10

SBboutscog.lm<-lm(`ADAS-Cog Plus`~`Avg 30+ Min Bouts of SB`+Age.c+Sex+EDU,Final)  
SBboutscog.lm2<-lm(`ADAS-Cog Plus`~Age.c+Sex+EDU,Final)  
summary(SBboutscog.lm)

##   
## Call:  
## lm(formula = `ADAS-Cog Plus` ~ `Avg 30+ Min Bouts of SB` + Age.c +   
## Sex + EDU, data = Final)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -1.44025 -0.37298 0.00832 0.34104 1.29830   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) -0.810862 0.140328 -5.778 4.54e-08 \*\*\*  
## `Avg 30+ Min Bouts of SB` 0.062632 0.025349 2.471 0.014655 \*   
## Age.c 0.025882 0.006421 4.031 9.00e-05 \*\*\*  
## Sex 0.380222 0.098097 3.876 0.000161 \*\*\*  
## EDUSome College -0.327306 0.156216 -2.095 0.037915 \*   
## EDUTrade School -0.321498 0.171349 -1.876 0.062655 .   
## EDUUniversity -0.461954 0.119771 -3.857 0.000173 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.5456 on 143 degrees of freedom  
## Multiple R-squared: 0.3263, Adjusted R-squared: 0.2981   
## F-statistic: 11.55 on 6 and 143 DF, p-value: 1.626e-10

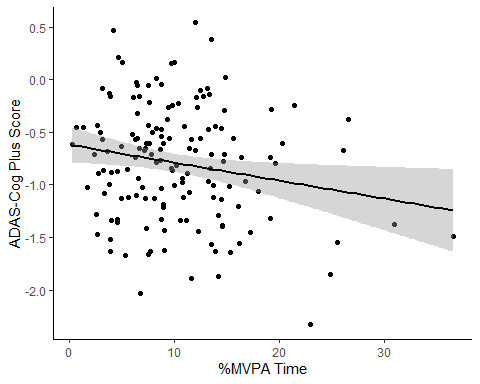
summary(SBboutscog.lm2)

##   
## Call:  
## lm(formula = `ADAS-Cog Plus` ~ Age.c + Sex + EDU, data = Final)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -1.53056 -0.34476 0.05015 0.34925 1.33714   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) -0.591992 0.110748 -5.345 3.46e-07 \*\*\*  
## Age.c 0.027094 0.006515 4.159 5.47e-05 \*\*\*  
## Sex 0.426353 0.097996 4.351 2.56e-05 \*\*\*  
## EDUSome College -0.358568 0.158439 -2.263 0.025123 \*   
## EDUTrade School -0.302672 0.174187 -1.738 0.084415 .   
## EDUUniversity -0.458597 0.121867 -3.763 0.000244 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.5552 on 144 degrees of freedom  
## Multiple R-squared: 0.2976, Adjusted R-squared: 0.2732   
## F-statistic: 12.2 on 5 and 144 DF, p-value: 7.241e-10

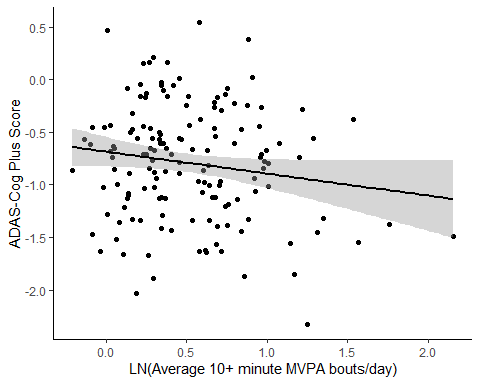
#Graphs (Figure 1)-----------------------------  
mean(Final$`%MVPA Time`)

## [1] 10.246

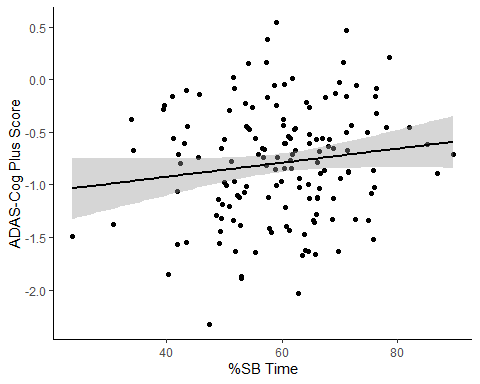
#%PA and Cognition  
MVPAresid<-residuals(lm(`%MVPA Time`~Age.c+Sex+EDU,Final))  
ADASCogresid<-residuals(lm(`ADAS-Cog Plus`~Age.c+Sex+EDU,Final))  
MVPA.adas.graph<-as.data.frame(cbind(MVPAresid,ADASCogresid))  
MVPA.adas.graph$MVPAresid<-MVPA.adas.graph$MVPAresid + mean(Final$`%MVPA Time`)  
MVPA.adas.graph$ADASCogresid<-MVPA.adas.graph$ADASCogresid + mean(Final$`ADAS-Cog Plus`)  
ggplot(data = MVPA.adas.graph, aes(x = MVPA.adas.graph$MVPAresid, y = MVPA.adas.graph$ADASCogresid)) +   
 labs(x="%MVPA Time", y="ADAS-Cog Plus Score") +geom\_point(color='black') + geom\_smooth(method= 'lm', se = TRUE, color= 'black') +  
 theme\_bw() + theme(panel.border = element\_blank(), panel.grid.major = element\_blank(),  
 panel.grid.minor = element\_blank(), axis.line = element\_line(colour = "black"))



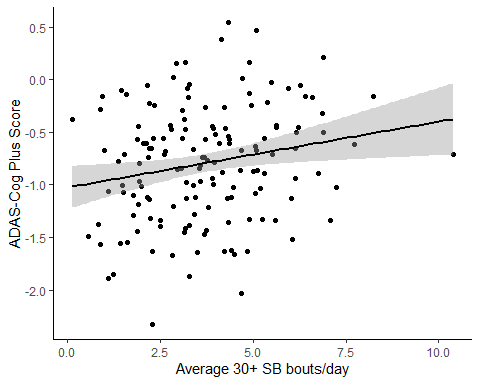
#PA Bouts and Cognition  
MVPAboutsresid<-residuals(lm(lnMVPAbouts~Age.c+Sex+EDU,Final))  
MVPAbouts.adas.graph<-as.data.frame(cbind(MVPAboutsresid,ADASCogresid))  
MVPAbouts.adas.graph$MVPAboutsresid<-MVPAbouts.adas.graph$MVPAboutsresid + mean(Final$lnMVPAbouts)  
MVPAbouts.adas.graph$ADASCogresid<-MVPAbouts.adas.graph$ADASCogresid + mean(Final$`ADAS-Cog Plus`)  
ggplot(data = MVPAbouts.adas.graph, aes(x = MVPAbouts.adas.graph$MVPAboutsresid, y = MVPAbouts.adas.graph$ADASCogresid)) +   
 labs(x="LN(Average 10+ minute MVPA bouts/day)", y="ADAS-Cog Plus Score") +geom\_point(color='black') + geom\_smooth(method= 'lm', se = TRUE, color= 'black') +  
 theme\_bw() + theme(panel.border = element\_blank(), panel.grid.major = element\_blank(),  
 panel.grid.minor = element\_blank(), axis.line = element\_line(colour = "black"))



#%SB and Cognition  
SBresid<-residuals(lm(`%SB Time`~Age.c+Sex+EDU,Final))  
SB.adas.graph<-as.data.frame(cbind(SBresid,ADASCogresid))  
SB.adas.graph$SBresid<-SB.adas.graph$SBresid + mean(Final$`%SB Time`)  
SB.adas.graph$ADASCogresid<-SB.adas.graph$ADASCogresid + mean(Final$`ADAS-Cog Plus`)  
ggplot(data = SB.adas.graph, aes(x = SB.adas.graph$SBresid, y = SB.adas.graph$ADASCogresid)) +   
 labs(x="%SB Time", y="ADAS-Cog Plus Score") +geom\_point(color='black') + geom\_smooth(method= 'lm', se = TRUE, color= 'black') +  
 theme\_bw() + theme(panel.border = element\_blank(), panel.grid.major = element\_blank(),  
 panel.grid.minor = element\_blank(), axis.line = element\_line(colour = "black"))



#SB Bouts and Cognition  
SBboutsresid<-residuals(lm(`Avg 30+ Min Bouts of SB`~Age+Sex+EDU,Final))  
SBbouts.adas.graph<-as.data.frame(cbind(SBboutsresid,ADASCogresid))  
SBbouts.adas.graph$SBboutsresid<-SBbouts.adas.graph$SBboutsresid + mean(Final$`Avg 30+ Min Bouts of SB`)  
SBbouts.adas.graph$ADASCogresid<-SBbouts.adas.graph$ADASCogresid + mean(Final$`ADAS-Cog Plus`)  
ggplot(data = SBbouts.adas.graph, aes(x = SBbouts.adas.graph$SBboutsresid, y = SBbouts.adas.graph$ADASCogresid)) +   
 labs(x="Average 30+ SB bouts/day", y="ADAS-Cog Plus Score") +geom\_point(color='black') + geom\_smooth(method= 'lm', se = TRUE, color= 'black') +  
 theme\_bw() + theme(panel.border = element\_blank(), panel.grid.major = element\_blank(),  
 panel.grid.minor = element\_blank(), axis.line = element\_line(colour = "black"))



#SEPERATED BY MCI STATUS-------------------------------------  
#Seperate data sets by MCI status  
MCI<-subset(Final, MCI=="MCI")  
Healthy<-subset(Final, MCI=="Healthy")  
  
#MCI  
PAcog.lm<-lm(`ADAS-Cog Plus`~`%MVPA Time`+Age+Sex+EDU,MCI)  
PAcog.lm2<-lm(`ADAS-Cog Plus`~Age+Sex+EDU,MCI)  
summary(PAcog.lm)

##   
## Call:  
## lm(formula = `ADAS-Cog Plus` ~ `%MVPA Time` + Age + Sex + EDU,   
## data = MCI)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -1.23982 -0.31761 0.00347 0.33998 1.18793   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) -2.0435839 0.6550227 -3.120 0.002579 \*\*   
## `%MVPA Time` -0.0002361 0.0112180 -0.021 0.983267   
## Age 0.0228752 0.0082451 2.774 0.006997 \*\*   
## Sex 0.4428776 0.1168694 3.790 0.000305 \*\*\*  
## EDUSome College -0.3613655 0.1875603 -1.927 0.057862 .   
## EDUTrade School -0.2333196 0.1961841 -1.189 0.238128   
## EDUUniversity -0.4614708 0.1481085 -3.116 0.002611 \*\*   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.5055 on 74 degrees of freedom  
## Multiple R-squared: 0.3276, Adjusted R-squared: 0.2731   
## F-statistic: 6.01 on 6 and 74 DF, p-value: 3.704e-05

summary(PAcog.lm2)

##   
## Call:  
## lm(formula = `ADAS-Cog Plus` ~ Age + Sex + EDU, data = MCI)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -1.24022 -0.31873 0.00433 0.34133 1.18743   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) -2.05009 0.57370 -3.573 0.000620 \*\*\*  
## Age 0.02293 0.00773 2.967 0.004035 \*\*   
## Sex 0.44308 0.11568 3.830 0.000264 \*\*\*  
## EDUSome College -0.36121 0.18616 -1.940 0.056104 .   
## EDUTrade School -0.23304 0.19442 -1.199 0.234451   
## EDUUniversity -0.46118 0.14647 -3.149 0.002355 \*\*   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.5022 on 75 degrees of freedom  
## Multiple R-squared: 0.3276, Adjusted R-squared: 0.2828   
## F-statistic: 7.309 on 5 and 75 DF, p-value: 1.263e-05

PAboutscog.lm<-lm(`ADAS-Cog Plus`~lnMVPAbouts+Age+Sex+EDU,MCI)  
PAboutscog.lm2<-lm(`ADAS-Cog Plus`~Age+Sex+EDU,MCI)  
summary(PAcog.lm)

##   
## Call:  
## lm(formula = `ADAS-Cog Plus` ~ `%MVPA Time` + Age + Sex + EDU,   
## data = MCI)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -1.23982 -0.31761 0.00347 0.33998 1.18793   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) -2.0435839 0.6550227 -3.120 0.002579 \*\*   
## `%MVPA Time` -0.0002361 0.0112180 -0.021 0.983267   
## Age 0.0228752 0.0082451 2.774 0.006997 \*\*   
## Sex 0.4428776 0.1168694 3.790 0.000305 \*\*\*  
## EDUSome College -0.3613655 0.1875603 -1.927 0.057862 .   
## EDUTrade School -0.2333196 0.1961841 -1.189 0.238128   
## EDUUniversity -0.4614708 0.1481085 -3.116 0.002611 \*\*   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.5055 on 74 degrees of freedom  
## Multiple R-squared: 0.3276, Adjusted R-squared: 0.2731   
## F-statistic: 6.01 on 6 and 74 DF, p-value: 3.704e-05

summary(PAcog.lm2)

##   
## Call:  
## lm(formula = `ADAS-Cog Plus` ~ Age + Sex + EDU, data = MCI)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -1.24022 -0.31873 0.00433 0.34133 1.18743   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) -2.05009 0.57370 -3.573 0.000620 \*\*\*  
## Age 0.02293 0.00773 2.967 0.004035 \*\*   
## Sex 0.44308 0.11568 3.830 0.000264 \*\*\*  
## EDUSome College -0.36121 0.18616 -1.940 0.056104 .   
## EDUTrade School -0.23304 0.19442 -1.199 0.234451   
## EDUUniversity -0.46118 0.14647 -3.149 0.002355 \*\*   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.5022 on 75 degrees of freedom  
## Multiple R-squared: 0.3276, Adjusted R-squared: 0.2828   
## F-statistic: 7.309 on 5 and 75 DF, p-value: 1.263e-05

SBcog.lm<-lm(`ADAS-Cog Plus`~`%SB Time`+Age+Sex+EDU,MCI)  
SBcog.lm2<-lm(`ADAS-Cog Plus`~Age+Sex+EDU,MCI)  
summary(SBcog.lm)

##   
## Call:  
## lm(formula = `ADAS-Cog Plus` ~ `%SB Time` + Age + Sex + EDU,   
## data = MCI)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -1.23811 -0.31777 0.00193 0.34412 1.18758   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) -2.062892 0.612770 -3.367 0.001210 \*\*   
## `%SB Time` 0.000322 0.005149 0.063 0.950300   
## Age 0.022849 0.007896 2.894 0.004996 \*\*   
## Sex 0.442467 0.116874 3.786 0.000309 \*\*\*  
## EDUSome College -0.361619 0.187526 -1.928 0.057646 .   
## EDUTrade School -0.234011 0.196344 -1.192 0.237130   
## EDUUniversity -0.462273 0.148487 -3.113 0.002631 \*\*   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.5055 on 74 degrees of freedom  
## Multiple R-squared: 0.3277, Adjusted R-squared: 0.2732   
## F-statistic: 6.011 on 6 and 74 DF, p-value: 3.698e-05

summary(SBcog.lm2)

##   
## Call:  
## lm(formula = `ADAS-Cog Plus` ~ Age + Sex + EDU, data = MCI)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -1.24022 -0.31873 0.00433 0.34133 1.18743   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) -2.05009 0.57370 -3.573 0.000620 \*\*\*  
## Age 0.02293 0.00773 2.967 0.004035 \*\*   
## Sex 0.44308 0.11568 3.830 0.000264 \*\*\*  
## EDUSome College -0.36121 0.18616 -1.940 0.056104 .   
## EDUTrade School -0.23304 0.19442 -1.199 0.234451   
## EDUUniversity -0.46118 0.14647 -3.149 0.002355 \*\*   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.5022 on 75 degrees of freedom  
## Multiple R-squared: 0.3276, Adjusted R-squared: 0.2828   
## F-statistic: 7.309 on 5 and 75 DF, p-value: 1.263e-05

SBboutscog.lm<-lm(`ADAS-Cog Plus`~`Avg 30+ Min Bouts of SB`+Age+Sex+EDU,MCI)  
SBboutscog.lm2<-lm(`ADAS-Cog Plus`~Age+Sex+EDU,MCI)  
summary(SBboutscog.lm)

##   
## Call:  
## lm(formula = `ADAS-Cog Plus` ~ `Avg 30+ Min Bouts of SB` + Age +   
## Sex + EDU, data = MCI)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -1.14884 -0.36707 0.02101 0.35780 1.16752   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) -2.112150 0.575548 -3.670 0.000455 \*\*\*  
## `Avg 30+ Min Bouts of SB` 0.034448 0.031054 1.109 0.270906   
## Age 0.022074 0.007756 2.846 0.005726 \*\*   
## Sex 0.436148 0.115673 3.771 0.000325 \*\*\*  
## EDUSome College -0.365620 0.185921 -1.967 0.052987 .   
## EDUTrade School -0.263022 0.195999 -1.342 0.183713   
## EDUUniversity -0.478497 0.147076 -3.253 0.001720 \*\*   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.5014 on 74 degrees of freedom  
## Multiple R-squared: 0.3386, Adjusted R-squared: 0.285   
## F-statistic: 6.315 on 6 and 74 DF, p-value: 2.139e-05

summary(SBboutscog.lm2)

##   
## Call:  
## lm(formula = `ADAS-Cog Plus` ~ Age + Sex + EDU, data = MCI)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -1.24022 -0.31873 0.00433 0.34133 1.18743   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) -2.05009 0.57370 -3.573 0.000620 \*\*\*  
## Age 0.02293 0.00773 2.967 0.004035 \*\*   
## Sex 0.44308 0.11568 3.830 0.000264 \*\*\*  
## EDUSome College -0.36121 0.18616 -1.940 0.056104 .   
## EDUTrade School -0.23304 0.19442 -1.199 0.234451   
## EDUUniversity -0.46118 0.14647 -3.149 0.002355 \*\*   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.5022 on 75 degrees of freedom  
## Multiple R-squared: 0.3276, Adjusted R-squared: 0.2828   
## F-statistic: 7.309 on 5 and 75 DF, p-value: 1.263e-05

#Healthy  
PAcog.lm<-lm(`ADAS-Cog Plus`~`%MVPA Time`+Age+Sex+EDU,Healthy)  
PAcog.lm2<-lm(`ADAS-Cog Plus`~Age+Sex+EDU,Healthy)  
summary(PAcog.lm)

##   
## Call:  
## lm(formula = `ADAS-Cog Plus` ~ `%MVPA Time` + Age + Sex + EDU,   
## data = Healthy)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -1.02866 -0.29321 0.02795 0.35368 1.18746   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) -1.517654 0.811634 -1.870 0.0662 .  
## `%MVPA Time` -0.020224 0.009417 -2.147 0.0357 \*  
## Age 0.013223 0.010589 1.249 0.2165   
## Sex 0.140467 0.152208 0.923 0.3597   
## EDUSome College -0.349786 0.237279 -1.474 0.1455   
## EDUTrade School -0.558960 0.286720 -1.949 0.0558 .  
## EDUUniversity -0.335006 0.182458 -1.836 0.0711 .  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.5192 on 62 degrees of freedom  
## Multiple R-squared: 0.2447, Adjusted R-squared: 0.1716   
## F-statistic: 3.348 on 6 and 62 DF, p-value: 0.006382

summary(PAcog.lm2)

##   
## Call:  
## lm(formula = `ADAS-Cog Plus` ~ Age + Sex + EDU, data = Healthy)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -1.28851 -0.32872 0.00897 0.34142 1.33755   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) -2.05504 0.79392 -2.588 0.0120 \*  
## Age 0.01793 0.01065 1.683 0.0973 .  
## Sex 0.20667 0.15327 1.348 0.1823   
## EDUSome College -0.42280 0.24147 -1.751 0.0848 .  
## EDUTrade School -0.62789 0.29297 -2.143 0.0360 \*  
## EDUUniversity -0.38840 0.18586 -2.090 0.0407 \*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.5339 on 63 degrees of freedom  
## Multiple R-squared: 0.1885, Adjusted R-squared: 0.1241   
## F-statistic: 2.927 on 5 and 63 DF, p-value: 0.0194

PAboutscog.lm<-lm(`ADAS-Cog Plus`~lnMVPAbouts+Age+Sex+EDU,Healthy)  
PAboutscog.lm2<-lm(`ADAS-Cog Plus`~Age+Sex+EDU,Healthy)  
summary(PAcog.lm)

##   
## Call:  
## lm(formula = `ADAS-Cog Plus` ~ `%MVPA Time` + Age + Sex + EDU,   
## data = Healthy)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -1.02866 -0.29321 0.02795 0.35368 1.18746   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) -1.517654 0.811634 -1.870 0.0662 .  
## `%MVPA Time` -0.020224 0.009417 -2.147 0.0357 \*  
## Age 0.013223 0.010589 1.249 0.2165   
## Sex 0.140467 0.152208 0.923 0.3597   
## EDUSome College -0.349786 0.237279 -1.474 0.1455   
## EDUTrade School -0.558960 0.286720 -1.949 0.0558 .  
## EDUUniversity -0.335006 0.182458 -1.836 0.0711 .  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.5192 on 62 degrees of freedom  
## Multiple R-squared: 0.2447, Adjusted R-squared: 0.1716   
## F-statistic: 3.348 on 6 and 62 DF, p-value: 0.006382

summary(PAcog.lm2)

##   
## Call:  
## lm(formula = `ADAS-Cog Plus` ~ Age + Sex + EDU, data = Healthy)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -1.28851 -0.32872 0.00897 0.34142 1.33755   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) -2.05504 0.79392 -2.588 0.0120 \*  
## Age 0.01793 0.01065 1.683 0.0973 .  
## Sex 0.20667 0.15327 1.348 0.1823   
## EDUSome College -0.42280 0.24147 -1.751 0.0848 .  
## EDUTrade School -0.62789 0.29297 -2.143 0.0360 \*  
## EDUUniversity -0.38840 0.18586 -2.090 0.0407 \*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.5339 on 63 degrees of freedom  
## Multiple R-squared: 0.1885, Adjusted R-squared: 0.1241   
## F-statistic: 2.927 on 5 and 63 DF, p-value: 0.0194

SBcog.lm<-lm(`ADAS-Cog Plus`~`%SB Time`+Age+Sex+EDU,Healthy)  
SBcog.lm2<-lm(`ADAS-Cog Plus`~Age+Sex+EDU,Healthy)  
summary(SBcog.lm)

##   
## Call:  
## lm(formula = `ADAS-Cog Plus` ~ `%SB Time` + Age + Sex + EDU,   
## data = Healthy)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -1.14995 -0.27112 0.00319 0.32578 1.19277   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) -2.678120 0.847741 -3.159 0.00245 \*\*  
## `%SB Time` 0.010684 0.005741 1.861 0.06747 .   
## Age 0.017584 0.010451 1.682 0.09752 .   
## Sex 0.104647 0.160035 0.654 0.51560   
## EDUSome College -0.290105 0.247377 -1.173 0.24539   
## EDUTrade School -0.543650 0.290947 -1.869 0.06641 .   
## EDUUniversity -0.333980 0.184663 -1.809 0.07536 .   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.5237 on 62 degrees of freedom  
## Multiple R-squared: 0.2314, Adjusted R-squared: 0.1571   
## F-statistic: 3.112 on 6 and 62 DF, p-value: 0.009927

summary(SBcog.lm2)

##   
## Call:  
## lm(formula = `ADAS-Cog Plus` ~ Age + Sex + EDU, data = Healthy)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -1.28851 -0.32872 0.00897 0.34142 1.33755   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) -2.05504 0.79392 -2.588 0.0120 \*  
## Age 0.01793 0.01065 1.683 0.0973 .  
## Sex 0.20667 0.15327 1.348 0.1823   
## EDUSome College -0.42280 0.24147 -1.751 0.0848 .  
## EDUTrade School -0.62789 0.29297 -2.143 0.0360 \*  
## EDUUniversity -0.38840 0.18586 -2.090 0.0407 \*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.5339 on 63 degrees of freedom  
## Multiple R-squared: 0.1885, Adjusted R-squared: 0.1241   
## F-statistic: 2.927 on 5 and 63 DF, p-value: 0.0194

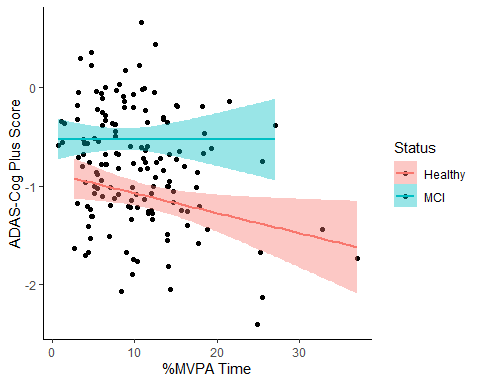
SBboutscog.lm<-lm(`ADAS-Cog Plus`~`Avg 30+ Min Bouts of SB`+Age+Sex+EDU,Healthy)  
SBboutscog.lm2<-lm(`ADAS-Cog Plus`~Age+Sex+EDU,Healthy)  
summary(SBboutscog.lm)

##   
## Call:  
## lm(formula = `ADAS-Cog Plus` ~ `Avg 30+ Min Bouts of SB` + Age +   
## Sex + EDU, data = Healthy)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -1.2003 -0.2929 0.0314 0.3474 1.2248   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) -2.41379 0.81457 -2.963 0.00431 \*\*  
## `Avg 30+ Min Bouts of SB` 0.06659 0.04111 1.620 0.11035   
## Age 0.01957 0.01057 1.852 0.06875 .   
## Sex 0.11856 0.16081 0.737 0.46371   
## EDUSome College -0.30809 0.24871 -1.239 0.22010   
## EDUTrade School -0.56110 0.29219 -1.920 0.05942 .   
## EDUUniversity -0.34948 0.18508 -1.888 0.06367 .   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.5271 on 62 degrees of freedom  
## Multiple R-squared: 0.2215, Adjusted R-squared: 0.1461   
## F-statistic: 2.939 on 6 and 62 DF, p-value: 0.01373

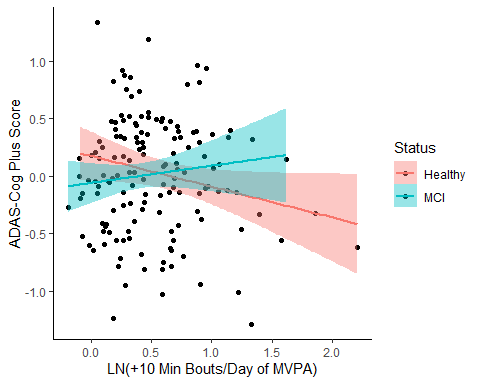
summary(SBboutscog.lm2)

##   
## Call:  
## lm(formula = `ADAS-Cog Plus` ~ Age + Sex + EDU, data = Healthy)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -1.28851 -0.32872 0.00897 0.34142 1.33755   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) -2.05504 0.79392 -2.588 0.0120 \*  
## Age 0.01793 0.01065 1.683 0.0973 .  
## Sex 0.20667 0.15327 1.348 0.1823   
## EDUSome College -0.42280 0.24147 -1.751 0.0848 .  
## EDUTrade School -0.62789 0.29297 -2.143 0.0360 \*  
## EDUUniversity -0.38840 0.18586 -2.090 0.0407 \*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.5339 on 63 degrees of freedom  
## Multiple R-squared: 0.1885, Adjusted R-squared: 0.1241   
## F-statistic: 2.927 on 5 and 63 DF, p-value: 0.0194

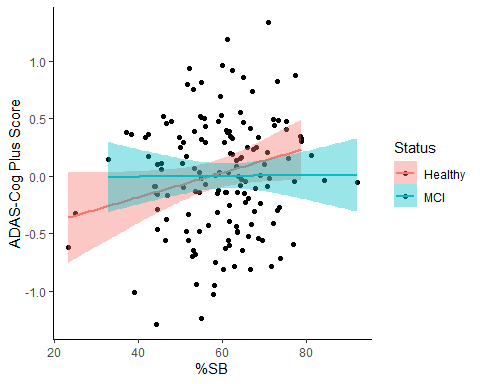
#Graphs for Linear regressions by MCI status (Figure 2)------------------------  
  
#%PA and Cognition  
MVPAresidHealthy<-residuals(lm(`%MVPA Time`~Age+Sex+EDU,Healthy))  
ADASCogresidHealthy<-residuals(lm(`ADAS-Cog Plus`~Age+Sex+EDU,Healthy))  
  
  
MVPAresidMCI<-residuals(lm(`%MVPA Time`~Age+Sex+EDU,MCI))  
ADASCogresidMCI<-residuals(lm(`ADAS-Cog Plus`~Age+Sex+EDU,MCI))  
  
  
MVPA.adas.graph.healthy<-as.data.frame(cbind(MVPAresidHealthy,ADASCogresidHealthy))  
names(MVPA.adas.graph.healthy)<-c("MVPA","ADASCog")  
MVPA.adas.graph.healthy$ADASCog<-MVPA.adas.graph.healthy$ADASCog + mean(Healthy$`ADAS-Cog Plus`)  
MVPA.adas.graph.healthy$MVPA<-MVPA.adas.graph.healthy$MVPA + mean(Healthy$`%MVPA Time`)  
MVPA.adas.graph.healthy$Status<-"Healthy"  
  
  
MVPA.adas.graph.MCI<-as.data.frame(cbind(MVPAresidMCI,ADASCogresidMCI))  
names(MVPA.adas.graph.MCI)<-c("MVPA","ADASCog")  
MVPA.adas.graph.MCI$ADASCog<-MVPA.adas.graph.MCI$ADASCog + mean(MCI$`ADAS-Cog Plus`)  
MVPA.adas.graph.MCI$MVPA<-MVPA.adas.graph.MCI$MVPA + mean(MCI$`%MVPA Time`)  
MVPA.adas.graph.MCI$Status<-"MCI"  
  
  
MVPA.adas.graph.full<-rbind(MVPA.adas.graph.MCI,MVPA.adas.graph.healthy)  
  
ggplot(data = MVPA.adas.graph.full, aes(x = MVPA, y = ADASCog, color= Status, fill= Status)) +   
 labs(x="%MVPA Time", y="ADAS-Cog Plus Score") +geom\_point(color='black') + geom\_smooth(method= 'lm') +  
 theme\_bw() + theme(panel.border = element\_blank(), panel.grid.major = element\_blank(),  
 panel.grid.minor = element\_blank(), axis.line = element\_line(colour = "black"))



#PA Bouts and Cognition  
MVPAboutsresidHealthy<-residuals(lm(lnMVPAbouts~Age+Sex+EDU,Healthy))  
MVPAboutsresidMCI<-residuals(lm(lnMVPAbouts~Age+Sex+EDU,MCI))  
  
MVPAbouts.adas.graph.healthy<-as.data.frame(cbind(MVPAboutsresidHealthy,ADASCogresidHealthy))  
names(MVPAbouts.adas.graph.healthy)<-c("MVPAbouts","ADASCog")  
MVPAbouts.adas.graph.healthy$MVPAbouts<-MVPAbouts.adas.graph.healthy$MVPAbouts + mean(Healthy$lnMVPAbouts)  
MVPAbouts.adas.graph.healthy$Status<-"Healthy"  
  
MVPAbouts.adas.graph.MCI<-as.data.frame(cbind(MVPAboutsresidMCI,ADASCogresidMCI))  
names(MVPAbouts.adas.graph.MCI)<-c("MVPAbouts","ADASCog")  
MVPAbouts.adas.graph.MCI$MVPAbouts<-MVPAbouts.adas.graph.MCI$MVPAbouts + mean(MCI$lnMVPAbouts)  
MVPAbouts.adas.graph.MCI$Status<-"MCI"  
  
  
MVPAbouts.adas.graph.full<-rbind(MVPAbouts.adas.graph.MCI,MVPAbouts.adas.graph.healthy)  
  
ggplot(data = MVPAbouts.adas.graph.full, aes(x = MVPAbouts, y = ADASCog, color= Status, fill= Status)) +   
 labs(x="LN(+10 Min Bouts/Day of MVPA)", y="ADAS-Cog Plus Score") +geom\_point(color='black') + geom\_smooth(method= 'lm') +  
 theme\_bw() + theme(panel.border = element\_blank(), panel.grid.major = element\_blank(),  
 panel.grid.minor = element\_blank(), axis.line = element\_line(colour = "black"))



#%SB and Cognition  
SBresidHealthy<-residuals(lm(`%SB Time`~Age+Sex+EDU,Healthy))  
SBresidMCI<-residuals(lm(`%SB Time`~Age+Sex+EDU,MCI))  
  
SB.adas.graph.healthy<-as.data.frame(cbind(SBresidHealthy,ADASCogresidHealthy))  
names(SB.adas.graph.healthy)<-c("SB","ADASCog")  
SB.adas.graph.healthy$SB<-SB.adas.graph.healthy$SB + mean(Healthy$`%SB Time`)  
SB.adas.graph.healthy$Status<-"Healthy"  
  
SB.adas.graph.MCI<-as.data.frame(cbind(SBresidMCI,ADASCogresidMCI))  
names(SB.adas.graph.MCI)<-c("SB","ADASCog")  
SB.adas.graph.MCI$SB<-SB.adas.graph.MCI$SB + mean(MCI$`%SB Time`)  
SB.adas.graph.MCI$Status<-"MCI"  
  
SB.adas.graph.full<-rbind(SB.adas.graph.MCI,SB.adas.graph.healthy)  
  
ggplot(data = SB.adas.graph.full, aes(x = SB, y = ADASCog, color= Status, fill= Status)) +   
 labs(x="%SB", y="ADAS-Cog Plus Score") +geom\_point(color='black') + geom\_smooth(method= 'lm') +  
 theme\_bw() + theme(panel.border = element\_blank(), panel.grid.major = element\_blank(),  
 panel.grid.minor = element\_blank(), axis.line = element\_line(colour = "black"))



#SB Bouts and Cognition  
SBboutsresidHealthy<-residuals(lm(`Avg 30+ Min Bouts of SB`~Age+Sex+EDU,Healthy))  
SBboutsresidMCI<-residuals(lm(`Avg 30+ Min Bouts of SB`~Age+Sex+EDU,MCI))  
  
SBbouts.adas.graph.healthy<-as.data.frame(cbind(SBboutsresidHealthy,ADASCogresidHealthy))  
names(SBbouts.adas.graph.healthy)<-c("SBbouts","ADASCog")  
SBbouts.adas.graph.healthy$SBbouts<-SBbouts.adas.graph.healthy$SB + mean(Healthy$`Avg 30+ Min Bouts of SB`)  
SBbouts.adas.graph.healthy$Status<-"Healthy"  
  
SBbouts.adas.graph.MCI<-as.data.frame(cbind(SBboutsresidMCI,ADASCogresidMCI))  
names(SBbouts.adas.graph.MCI)<-c("SBbouts","ADASCog")  
SBbouts.adas.graph.MCI$SBbouts<-SBbouts.adas.graph.MCI$SB + mean(MCI$`Avg 30+ Min Bouts of SB`)  
SBbouts.adas.graph.MCI$Status<-"MCI"  
  
SBbouts.adas.graph.full<-rbind(SBbouts.adas.graph.MCI,SBbouts.adas.graph.healthy)  
  
  
ggplot(data = SBbouts.adas.graph.full, aes(x = SBbouts, y = ADASCog, color= Status, fill= Status)) +   
 labs(x="Average 30+ SB bouts/day", y="ADAS-Cog Plus Score") +geom\_point(color='black') + geom\_smooth(method= 'lm') +  
 theme\_bw() + theme(panel.border = element\_blank(), panel.grid.major = element\_blank(),  
 panel.grid.minor = element\_blank(), axis.line = element\_line(colour = "black"))

