```r
## > INTERNATIONAL JOURNAL FOR EQUITY IN HEALTH
## > SPECIAL ISSUE: "A panorama for health inequalities in Brazil: National
Health Survey, 2013"
## > TITLE: "Educational inequalities in hypertension: complex patterns in
intersections with gender and race in Brazil"
## > AUTHORS: Ronaldo Fernandes Santos Alves; Eduardo Faerstein
## > DATA ANALYST: Ronaldo Fernandes Santos Alves
## > INSTITUTION: Department of Epidemiology, Institute of Social Medicine, State
University of Rio de Janeiro, RJ, Brazil.


## > LIBRARY

library(foreign) # read.dta
library(survey)  # load survey package (analyzes complex design surveys)


## > SET WORKING DIRECTORY

setwd( "C:/Prosaude/Replicações alunos/Ronaldo" )


## > OPEN DATABASE

dados = read.dta ("2013_PNS_data.dta")
dados = dados [complete.cases (dados$w00407), ] # exclude 800 NA-blood pressure


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

## > CREATE VARIABLES

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

# > AGE

dados$age_cat2 <- factor( 1 + findInterval( as.numeric( dados$c008 ) ,
                  c( 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80 ) ) ,
                  labels = c( "18-24", "25-29", "30-34", "35-39", "40-44",
                              "45-49", "50-54", "55-59", "60-64", "65-69",
                              "70-74", "75-79", "80 or older" ) )


# > RACE

dados$raca2 <- as.factor(ifelse(dados$c009=="1", "Branca",
                        ifelse(dados$c009=="2", "Preta",
                        ifelse(dados$c009=="3", "Outra",
                        ifelse(dados$c009=="4", "Parda",
                        ifelse(dados$c009=="5", "Outra",
                        ifelse(dados$c009=="9", "Outra", NA)))))))


# > EDUCATION ATTAINMENT

dados$educ_i <- factor(ifelse(dados$educ=="Supc", 1,
                       ifelse(dados$educ=="MedcSupi", 2,
                       ifelse(dados$educ=="FundcMedi", 3,
                       ifelse(dados$educ=="SinstFundi", 4, NA)))))


# > NUMERIC SCORE BY GENDER (calculos no final do script)
# > Exposure (education)
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```r
dados$escore_gi <- as.numeric(
                   ifelse(dados$educ=="Supc" & dados$c006=="masculino", 0.0570,
                   ifelse(dados$educ=="MedcSupi" & dados$c006=="masculino",
                   0.2753,
                   ifelse(dados$educ=="FundcMedi" & dados$c006=="masculino",
                   0.5190,
                   ifelse(dados$educ=="SinstFundi" & dados$c006=="masculino",
                   0.8008,
                   ifelse(dados$educ=="Supc" & dados$c006=="feminino", 0.0694,
                   ifelse(dados$educ=="MedcSupi" & dados$c006=="feminino",
                   0.3041,
                   ifelse(dados$educ=="FundcMedi" & dados$c006=="feminino",
                   0.5423,
                   ifelse(dados$educ=="SinstFundi" & dados$c006=="feminino",
                   0.8077,
                          NA)))))))))

# > NUMERIC SCORE BY GENDER AND RACE (calculos no final do script)
# > Exposure (education)

dados$escore_ri <- as.numeric(
  ifelse(dados$educ=="Supc" & dados$c006=="masculino" & dados$c009=="1", 0.0844,
    ifelse(dados$educ=="MedcSupi" & dados$c006=="masculino"& dados$c009=="1",
  0.3423,
  ifelse(dados$educ=="FundcMedi" & dados$c006=="masculino"& dados$c009=="1",
  0.5924,
  ifelse(dados$educ=="SinstFundi" & dados$c006=="masculino"& dados$c009=="1",
  0.8345,
  ifelse(dados$educ=="Supc" & dados$c006=="feminino" & dados$c009=="1", 0.0980,
  ifelse(dados$educ=="MedcSupi" & dados$c006=="feminino"& dados$c009=="1",
  0.3703,
  ifelse(dados$educ=="FundcMedi" & dados$c006=="feminino"& dados$c009=="1",
  0.6099,
  ifelse(dados$educ=="SinstFundi" & dados$c006=="feminino"& dados$c009=="1",
  0.8376,
  ifelse(dados$educ=="Supc" & dados$c006=="masculino" & dados$c009=="2", 0.0266,
    ifelse(dados$educ=="MedcSupi" & dados$c006=="masculino"& dados$c009=="2",
  0.1955,
  ifelse(dados$educ=="FundcMedi" & dados$c006=="masculino"& dados$c009=="2",
  0.4389,
  ifelse(dados$educ=="SinstFundi" & dados$c006=="masculino"& dados$c009=="2",
  0.7700,
  ifelse(dados$educ=="Supc" & dados$c006=="feminino" & dados$c009=="2", 0.0405,
  ifelse(dados$educ=="MedcSupi" & dados$c006=="feminino"& dados$c009=="2",
  0.2353,
  ifelse(dados$educ=="FundcMedi" & dados$c006=="feminino"& dados$c009=="2",
  0.4711,
  ifelse(dados$educ=="SinstFundi" & dados$c006=="feminino"& dados$c009=="2",
  0.7763,
  ifelse(dados$educ=="Supc" & dados$c006=="masculino" & dados$c009=="4", 0.0323,
    ifelse(dados$educ=="MedcSupi" & dados$c006=="masculino"& dados$c009=="4",
  0.2154,
  ifelse(dados$educ=="FundcMedi" & dados$c006=="masculino"& dados$c009=="4",
  0.4523,
  ifelse(dados$educ=="SinstFundi" & dados$c006=="masculino"& dados$c009=="4",
  0.7692,
  ifelse(dados$educ=="Supc" & dados$c006=="feminino" & dados$c009=="4", 0.0422,
  ifelse(dados$educ=="MedcSupi" & dados$c006=="feminino"& dados$c009=="4",
  0.2411,
  ifelse(dados$educ=="FundcMedi" & dados$c006=="feminino"& dados$c009=="4",
  0.4777,
  ifelse(dados$educ=="SinstFundi" & dados$c006=="feminino"& dados$c009=="4",
  0.7788,
  NA)))))))))))))))))))))))))))))))
```

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

## >> SPECIFY A COMPLEX SURVEY DESIGN

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

banco = svydesign(id = ~upa_pns, strata = ~v0024, data = dados, weights =
~v00291_x, nest = TRUE)


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

## > OUTCOME: HYPERTENSION (has1)

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

banco = transform (banco, has1 = as.numeric(
                   w00407 >= 140 | w00408 >= 90 | q006 == "1"))


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

## > RESULTS

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

## > TABLE 1

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

# > tamanho populacional

table(dados$c006)
table(dados$age_cat2)
table(dados$raca2)
table(dados$educ)

##

round(svymean(~c006, banco), 3)
round(confint(svymean(~c006, banco)), 3)

##

round(svymean(~age_cat2, banco), 3)
round(confint(svymean(~age_cat2, banco)), 3)

##

round(svymean(~raca2, banco), 3)
round(confint(svymean(~raca2, banco)), 3)

##

round(svymean(~educ, banco), 3)
round(confint(svymean(~educ, banco)), 3)

# > prevalência não ajustada

round(svymean(~has1, banco), 3)
round(confint(svymean(~has1, banco)), 3)
```

```r
svyby(~has1, ~c006, banco, svymean, vartype = c("ci"))
svyby(~has1, ~age_cat2, banco, svymean, vartype = c("ci"))
svyby(~has1, ~raca2, banco, svymean, vartype = c("ci"))
svyby(~has1, ~educ, banco, svymean, vartype = c("ci"))


########################################
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## > RESULTS

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

## > TABLE 2

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# > tamanho populacional

svyby(~educ_i, ~c006, banco, svymean)
svyby(~educ_i, ~raca2+c006, banco, svymean)

# > prevalência não ajustada

svyby(~has1, ~educ+c006, banco, svymean, vartype = c("ci"))
svyby(~has1, ~raca2+c006, banco, svymean, vartype = c("ci"))
svyby(~has1, ~educ+c006+raca2, banco, svymean, vartype = c("ci"))

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

## > TABLE 2

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# > AGE-ADJUSTED PREVALENCES

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## FUNCTION ("predictive marginal means")

# - Referências
#
https://www.r-bloggers.com/statistically-significant-trends-with-multiple-years-of-complex-survey-data/
# https://gist.github.com/tslumley/2e74cd0ac12a671d2724
# https://rdrr.io/rforge/survey/man/svypredmeans.html
# http://www.asdfree.com/2015/11/statistically-significant-trends-with.html

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

svypredmeans<-function(adjustmodel, groupfactor){

  design<-eval(bquote(update(adjustmodel$survey.design,
  .groupfactor=.(groupfactor[[2]]))))
  groups<-unique(model.frame(design)$.groupfactor)
  groups<-groups[!is.na(groups)]
  model<-update(adjustmodel, .~.+.groupfactor,design=design)
  w<-weights(design,"sampling")

  fits<-matrix(nrow=NROW(design),ncol=length(groups))
  dg_deta<-matrix(nrow=length(coef(model)),ncol=length(groups))
  for(i in 1:length(groups)){
    mf<-model.frame(design)
```

```
    mf$.groupfactor<-groups[i]
    mu<-predict(model,newdata=mf,type="response",se.fit=FALSE)
    eta<-predict(model,newdata=mf,type="link",se.fit=FALSE)
    fits[,i]<-coef(mu)

    mm<-model.matrix(terms(model),mf)
    dg_deta[,i]<-t(colSums(w*model$family$mu.eta(eta)*mm))/sum(w)
  }
  colnames(fits)<-as.character(groups)
  cond<-svymean(fits,design)
  addvar<-t(dg_deta)%*%vcov(model)%*%dg_deta
  vv<-addvar+attr(cond,"var")
  attr(vv,"parts")<-list(addvar,attr(cond,"var"))
  attr(cond,"var")<-vv
  cond
}

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

## MARGINAL MODELLING (total PNS population = STANDARD)

marginals <-
  svyglm(
    formula = I( has1 == 1 ) ~ age_cat2,
    design = banco ,
    family = quasibinomial (link = "logit")
  )
round(exp(cbind(coef(marginals), confint(marginals))), 2)

# > GENDER

x <- svypredmeans(marginals, ~factor(c006))
round(x * 100, 1)
round(confint(x) * 100, 1)

# RACA

x1 <- svypredmeans(marginals, ~factor(raca2))
round(x1 * 100, 1)
round(confint(x1) * 100, 1)

# GENDER * RACE

y <- svypredmeans(marginals, ~interaction(c006, raca2))
round(y * 100, 1)
round(confint(y) * 100, 1)

# GENDER * EDUCATION

y1 <- svypredmeans(marginals, ~interaction(c006, educ))
round(y1 * 100, 1)
round(confint(y1) * 100, 1)

# GENDER * RACE * EDUCATION

z <- svypredmeans(marginals, ~interaction(c006, raca2, educ))
round(z * 100, 1)
round(confint(z) * 100, 1)

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## > TABLE 2
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# > ODDS RATIOS (OR)

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# > OR - gender

logitmodel0_m <- svyglm (has1 ~ educ_i, design = subset(banco,
c006=="masculino"), family = quasibinomial(link = "logit"))
logitmodel1_m <- svyglm (has1 ~ educ_i + as.numeric(c008), design = subset(banco,
c006=="masculino"), family = quasibinomial(link = "logit"))
round(exp(cbind(coef(logitmodel0_m), confint(logitmodel0_m))),1)
round(exp(cbind(coef(logitmodel1_m), confint(logitmodel1_m))),1)

logitmodel0_f <- svyglm (has1 ~ educ_i, design = subset(banco, c006
=="feminino"), family = quasibinomial(link = "logit"))
logitmodel1_f <- svyglm (has1 ~ educ_i + as.numeric(c008), design = subset(banco,
c006 == "feminino"), family = quasibinomial(link = "logit"))
round(exp(cbind(coef(logitmodel0_f), confint(logitmodel0_f))), 1)
round(exp(cbind(coef(logitmodel1_f), confint(logitmodel1_f))), 1)

# > OR - gender  *race

# white men

logitmodel2_mb0 <- svyglm (has1 ~ educ_i, design = subset(banco,
c006=="masculino" & raca2=="Branca"), family=quasibinomial(link = "logit"))
#white men
logitmodel2_mb <- svyglm (has1 ~ educ_i + as.numeric(c008), design =
subset(banco, c006=="masculino" & raca2=="Branca"), family=quasibinomial(link =
"logit")) #white men
round(exp(cbind(coef(logitmodel2_mb0), confint(logitmodel2_mb0))), 1)
round(exp(cbind(coef(logitmodel2_mb), confint(logitmodel2_mb))), 1)

# brown men

logitmodel2_mpa0 <- svyglm (has1 ~ educ_i, design=subset(banco, c006=="masculino"
& raca2=="Parda"), family=quasibinomial(link = "logit")) #brown men
logitmodel2_mpa <- svyglm (has1 ~ educ_i + as.numeric(c008), design=subset(banco,
c006=="masculino" & raca2=="Parda"), family=quasibinomial(link = "logit")) #brown
men
round(exp(cbind(coef(logitmodel2_mpa0), confint(logitmodel2_mpa0))), 1)
round(exp(cbind(coef(logitmodel2_mpa), confint(logitmodel2_mpa))), 1)

# black men

logitmodel2_mpe0 <- svyglm (has1 ~ educ_i, design=subset(banco, c006=="masculino"
& raca2=="Preta"), family=quasibinomial(link = "logit")) #black men
logitmodel2_mpe <- svyglm (has1 ~ educ_i + as.numeric(c008), design=subset(banco,
c006=="masculino" & raca2=="Preta"), family=quasibinomial(link = "logit")) #black
men
round(exp(cbind(coef(logitmodel2_mpe0), confint(logitmodel2_mpe0))), 1)
round(exp(cbind(coef(logitmodel2_mpe), confint(logitmodel2_mpe))), 1)

# white women

logitmodel2_fb0 <- svyglm (has1 ~ educ_i, design=subset(banco, c006=="feminino" &
raca2=="Branca"), family=quasibinomial(link = "logit")) #white women
logitmodel2_fb <- svyglm (has1 ~ educ_i + as.numeric(c008), design=subset(banco,
c006=="feminino" & raca2=="Branca"), family=quasibinomial(link = "logit")) #white
women
round(exp(cbind(coef(logitmodel2_fb0), confint(logitmodel2_fb0))), 1)
round(exp(cbind(coef(logitmodel2_fb), confint(logitmodel2_fb))), 1)
```

```r
# brown women

logitmodel2_fpa0 <- svyglm (has1 ~ educ_i, design=subset(banco, c006=="feminino"
& raca2=="Parda"), family=quasibinomial(link = "logit")) #brown women
logitmodel2_fpa <- svyglm (has1 ~ educ_i + as.numeric(c008), design=subset(banco,
c006=="feminino" & raca2=="Parda"), family=quasibinomial(link = "logit")) #brown
women
round(exp(cbind(coef(logitmodel2_fpa0), confint(logitmodel2_fpa0))), 1)
round(exp(cbind(coef(logitmodel2_fpa), confint(logitmodel2_fpa))), 1)

# black women

logitmodel2_fpe0 <- svyglm (has1 ~ educ_i, design=subset(banco, c006 =="feminino"
& raca2=="Preta"), family=quasibinomial(link = "logit")) #black women
logitmodel2_fpe <- svyglm (has1 ~ educ_i + as.numeric(c008), design =
subset(banco, c006 =="feminino" & raca2=="Preta"), family=quasibinomial(link =
"logit")) #black women
round(exp(cbind(coef(logitmodel2_fpe0), confint(logitmodel2_fpe0))), 1)
round(exp(cbind(coef(logitmodel2_fpe), confint(logitmodel2_fpe))), 1)

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

## > TABLE 2

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# > RELATIVE INDEX OF INEQUALITY (RII) - gender

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rii_m0 <- svyglm(has1 ~ escore_gi, design = subset(banco, c006 == "masculino"),
family=quasibinomial(link = "logit"))
rii_m <- svyglm(has1 ~ escore_gi + as.numeric(c008), design = subset(banco, c006
== "masculino"), family=quasibinomial(link = "logit"))
round(exp(cbind(coef(rii_m0), confint(rii_m0))),1)
round(exp(cbind(coef(rii_m), confint(rii_m))),1)

rii_f0 <- svyglm(has1 ~ escore_gi, design=subset(banco, c006 == "feminino"),
family=quasibinomial(link = "logit"))
rii_f <- svyglm(has1 ~ escore_gi + as.numeric(c008), design = subset(banco, c006
== "feminino"), family=quasibinomial(link = "logit"))
round(exp(cbind(coef(rii_f0), confint(rii_f0))), 1)
round(exp(cbind(coef(rii_f), confint(rii_f))), 1)

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# > SLOPE INDEX OF INEQUALITY (SII) - gender

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sii_m0 <- svyglm(has1 ~ escore_gi, design = subset(banco, c006 == "masculino"),
family=quasi(link = "identity"))
sii_m <- svyglm(has1 ~ escore_gi + as.numeric(c008), design = subset(banco,
c006=="masculino"), family=quasi(link = "identity"))
#summary(sii_m0)
#summary(sii_m)
round(coef(sii_m0)*100, 1)
round(confint(sii_m0)*100, 1)
round(coef(sii_m)*100, 1)
round(confint(sii_m)*100, 1)
```

```
sii_f0 <- svyglm(has1 ~ escore_gi, design = subset(banco, c006 == "feminino"),
family = quasi(link = "identity"))
sii_f <- svyglm(has1 ~ escore_gi + as.numeric(c008), design = subset(banco, c006
== "feminino"), family = quasi(link = "identity"))
#summary(sii_f0)
#summary(sii_f)
round(coef(sii_f0)*100, 1)
round(confint(sii_f0)*100, 1)
round(coef(sii_f)*100, 1)
round(confint(sii_f)*100, 1)

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# > RELATIVE INDEX OF INEQUALITY (RII) - gender*race

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

# white men

rii_mb0 <- svyglm(has1 ~ escore_ri, design=subset(banco, c006=="masculino" &
raca2 == "Branca"), family=quasibinomial(link = "logit"))
rii_mb <- svyglm(has1 ~ escore_ri + as.numeric(c008), design = subset(banco, c006
== "masculino" & raca2 == "Branca"), family=quasibinomial(link = "logit"))
round(exp(cbind(coef(rii_mb0), confint(rii_mb0))),1) #white men (unadjusted)
round(exp(cbind(coef(rii_mb), confint(rii_mb))),1) #white men

# brown men

rii_mpa0 <- svyglm(has1 ~ escore_ri, design=subset(banco, c006=="masculino" &
raca2=="Parda"), family=quasibinomial(link = "logit"))
rii_mpa <- svyglm(has1 ~ escore_ri + as.numeric(c008), design=subset(banco,
c006=="masculino" & raca2=="Parda"), family=quasibinomial(link = "logit"))
round(exp(cbind(coef(rii_mpa0), confint(rii_mpa0))), 1) #brown men (unadjusted)
round(exp(cbind(coef(rii_mpa), confint(rii_mpa))), 1) #brown men

# black men

rii_mpe0 <- svyglm(has1 ~ escore_ri, design=subset(banco, c006=="masculino" &
raca2=="Preta"), family=quasibinomial(link = "logit"))
rii_mpe <- svyglm(has1 ~ escore_ri + as.numeric(c008), design=subset(banco,
c006=="masculino" & raca2=="Preta"), family=quasibinomial(link = "logit"))
round(exp(cbind(coef(rii_mpe0), confint(rii_mpe0))), 1) #black men (unadjusted)
round(exp(cbind(coef(rii_mpe), confint(rii_mpe))), 1) #black men

# white women

rii_fb0 <- svyglm(has1 ~ escore_ri, design=subset(banco, c006=="feminino" &
raca2=="Branca"), family=quasibinomial(link = "logit"))
rii_fb <- svyglm(has1 ~ escore_ri + as.numeric(c008), design=subset(banco,
c006=="feminino" & raca2=="Branca"), family=quasibinomial(link = "logit"))
round(exp(cbind(coef(rii_fb0), confint(rii_fb0))), 1) #white women (unadjusted)
round(exp(cbind(coef(rii_fb), confint(rii_fb))), 1) #white women

# brown women

rii_fpa0 <- svyglm(has1 ~ escore_ri, design=subset(banco, c006=="feminino" &
raca2=="Parda"), family=quasibinomial(link = "logit"))
rii_fpa <- svyglm(has1 ~ escore_ri + as.numeric(c008), design=subset(banco,
c006=="feminino" & raca2=="Parda"), family=quasibinomial(link = "logit"))
round(exp(cbind(coef(rii_fpa0), confint(rii_fpa0))), 1) #brown women (unadjusted)
round(exp(cbind(coef(rii_fpa), confint(rii_fpa))), 1) #brown women

# black women
```

```
rii_fpe0 <- svyglm(has1 ~ escore_ri, design=subset(banco, c006=="feminino" &
raca2=="Preta"), family=quasibinomial(link = "logit"))
rii_fpe <- svyglm(has1 ~ escore_ri + as.numeric(c008), design=subset(banco,
c006=="feminino" & raca2=="Preta"), family=quasibinomial(link = "logit"))
round(exp(cbind(coef(rii_fpe0), confint(rii_fpe0))), 1) #black women (unadjusted)
round(exp(cbind(coef(rii_fpe), confint(rii_fpe))), 1) #black women

########################################
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# > SLOPE INDEX OF INEQUALITY (SII) - gender*race

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

# white men

sii_mb0 <- svyglm(has1 ~ escore_ri, design=subset(banco, c006=="masculino" &
raca2=="Branca"), family=quasi(link = "identity"))
sii_mb <- svyglm(has1 ~ escore_ri + as.numeric(c008), design=subset(banco,
c006=="masculino" & raca2=="Branca"), family=quasi(link = "identity"))
#summary(sii_mb0)
#summary(sii_mb)
round(coef(sii_mb0) * 100, 1)
round(confint(sii_mb0) * 100, 1)
round(coef(sii_mb) * 100, 1)
round(confint(sii_mb) * 100, 1)

# brown men

sii_mpa0 <- svyglm(has1 ~ escore_ri, design=subset(banco, c006=="masculino" &
raca2=="Parda"), family=quasi(link = "identity"))
sii_mpa <- svyglm(has1 ~ escore_ri + as.numeric(c008), design=subset(banco,
c006=="masculino" & raca2=="Parda"), family=quasi(link = "identity"))
#summary(sii_mpa0)
#summary(sii_mpa)
round(coef(sii_mpa0) * 100, 1)
round(confint(sii_mpa0) * 100, 1)
round(coef(sii_mpa) * 100, 1)
round(confint(sii_mpa) * 100, 1)

# black men

sii_mpe0 <- svyglm(has1 ~ escore_ri, design=subset(banco, c006=="masculino" &
raca2=="Preta"), family=quasi(link = "identity"))
sii_mpe <- svyglm(has1 ~ escore_ri + as.numeric(c008), design=subset(banco,
c006=="masculino" & raca2=="Preta"), family=quasi(link = "identity"))
#summary(sii_mpe0)
#summary(sii_mpe)
round(coef(sii_mpe0) * 100, 1)
round(confint(sii_mpe0) * 100, 1)
round(coef(sii_mpe) * 100, 1)
round(confint(sii_mpe) * 100, 1)

# white women

sii_fb0 <- svyglm(has1 ~ escore_ri, design=subset(banco, c006=="feminino" &
raca2=="Branca"), family=quasi(link = "identity"))
sii_fb <- svyglm(has1 ~ escore_ri + as.numeric(c008), design=subset(banco,
c006=="feminino" & raca2=="Branca"), family=quasi(link = "identity"))
#summary(sii_fb0)
#summary(sii_fb)
round(coef(sii_fb0) * 100, 1)
round(confint(sii_fb0) * 100, 1)
```

```r
round(coef(sii_fb) * 100, 1)
round(confint(sii_fb) * 100, 1)

# brown women

sii_fpa0 <- svyglm(has1 ~ escore_ri, design=subset(banco, c006=="feminino" &
raca2=="Parda"), family=quasi(link = "identity"))
sii_fpa <- svyglm(has1 ~ escore_ri + as.numeric(c008), design=subset(banco,
c006=="feminino" & raca2=="Parda"), family=quasi(link = "identity"))
#summary(sii_fpa0)
#summary(sii_fpa)
round(coef(sii_fpa0) * 100, 1)
round(confint(sii_fpa0) * 100, 1)
round(coef(sii_fpa) * 100, 1)
round(confint(sii_fpa) * 100, 1)

# black women

sii_fpe0 <- svyglm(has1 ~ escore_ri, design=subset(banco, c006=="feminino" &
raca2=="Preta"), family=quasi(link = "identity"))
sii_fpe <- svyglm(has1 ~ escore_ri + as.numeric(c008), design=subset(banco,
c006=="feminino" & raca2=="Preta"), family=quasi(link = "identity"))
#summary(sii_fpe0)
#summary(sii_fpe)
round(coef(sii_fpe0) * 100, 1)
round(confint(sii_fpe0) * 100, 1)
round(coef(sii_fpe) * 100, 1)
round(confint(sii_fpe) * 100, 1)

########################################
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# >> GRAPH (Figures 1)

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plot.new()
layout(matrix(c(1,2,3,4), 2, 2, byrow = TRUE), respect=F)

# > All Men

#svyby(~educ_i, ~c006, banco, svymean)

par(mar = c(5, 4, 4, 8) + 0.3)
barplot(c(33.2, 34.7, 33.5, 33.9), # age-adjusted % hypertension
        c(0.1140733, 0.3223560, 0.1651937, 0.3983771), #prop educ_i
        space=0, ylim=c(0,80), col=c("White"), border="black",axes = F,
        xlab="numeric score",
        sub="cumulative relative frequency of the educational subgroups")
axis(4)
mtext("Prevalence", side = 4, line = 2.5, cex = 0.9)

x1 <- c(0.0570, 0.2753, 0.5190, 0.8008) #score_m
y1 <- c(33.2, 34.7, 33.5, 33.9) #prevalence
points(x1, y1)
segments(0.0570,0,0.0570,33.2,lty=2)
segments(0.2753,0,0.2753,34.7,lty=2)
segments(0.5190,0,0.5190,33.5,lty=2)
segments(0.8008,0,0.8008,33.9,lty=2)

par(new=T)
plot(c(0,0), c(-2,-6), type="n", xlab="", xlim=c(0,1), main = NULL, ylab="log
(RII)", xaxt="n", frame.plot=F)
```

```
abline(coef=c(-3.26051, 0.07710), lty=1, col="black") #summary(rii_m)
axis(1, at=c(0,1), labels=c("0 (Highest Education)","1 (Lowest Education)"))
text(0.62,-2.2,labels="Prevalence = 34.0% (95%CI 33.0 to 35.0)")
text(0.69,-2.5,labels="SII = 2.2% (95%CI -1.3 to 5.7)")
text(0.7,-2.8,labels="RII = 1.1 (95%CI 0.9 to 1.3)")
mtext("1a) All men", side = 3, adj=0, font.main = 1, line = 1, outer = F)

# > White Men

#svyby(~educ_i, ~c006, subset(banco, raca2 == "Branca"), svymean)

par(mar = c(5, 4, 4, 8) + 0.3)
barplot(c(32.1, 35.1, 31.1, 35.3), # age-adjusted % hypertension
        c(0.1688375, 0.3469587, 0.1531411, 0.3310628), #prop educ_i
        space=0, ylim=c(0,80), col="White", border="black",axes = F,
        xlab="numeric score",
        sub="cumulative relative frequency of the educational subgroups")
axis(4)
mtext("Prevalence", side = 4, line = 2.5, cex = 0.9)

x2 <- c(0.0844, 0.3423, 0.5924, 0.8345) #score_mb
y2 <- c(32.1, 35.1, 31.1, 35.3) #prevalence
points(x2, y2)
segments(0.0844,0,0.0844,32.1,lty=2)
segments(0.3423,0,0.3423,35.1,lty=2)
segments(0.5924,0,0.5924,31.1,lty=2)
segments(0.8345,0,0.8345,35.3,lty=2)

par(new=T)
plot(c(0,0), c(-2,-6), type="n", xlab="", xlim=c(0,1), main=NULL, ylab="log
(RII)", xaxt="n", frame.plot=F)
abline(coef=c(-3.277084, 0.191566), lty=4, col="black") #summary(rii_mb)
axis(1, at=c(0,1), labels=c("0 (Highest Education)","1 (Lowest Education)"))
text(0.62,-2.2,labels="Prevalence = 34.0% (95%CI 32.6 to 35.5)")
text(0.69,-2.5,labels="SII = 4.7% (95%CI -0.4 to 9.8)")
text(0.7,-2.8,labels="RII = 1.2 (95%CI 0.9 to 1.6)")
mtext("1b) White men", side = 3, adj=0, font.main = 1, line = 1, outer = F)

# > Brown Men

#svyby(~educ_i, ~c006, subset(banco, raca2 == "Parda"), svymean)

par(mar = c(5, 4, 4, 8) + 0.3)
barplot(c(34.6, 34.0, 35.0, 31.9), # age-adjusted % hypertension
        c(0.06463000, 0.3015907, 0.1720974, 0.4616819), #prop educ_i
        space=0, ylim=c(0,80), col="White", border="black",axes = F,
        xlab="numeric score",
        sub="cumulative relative frequency of the educational subgroups")
axis(4)
mtext("Prevalence", side = 4, line = 2.5, cex = 0.9)

x3 <- c(0.0323, 0.2154, 0.4523, 0.7692) #score_mpa
y3 <- c(34.6, 34.0, 35.0, 31.9) #prevalence
points(x3, y3)
segments(0.0323,0,0.0323,34.6,lty=2)
segments(0.2154,0,0.2154,34.0,lty=2)
segments(0.4523,0,0.4523,35.0,lty=2)
segments(0.7692,0,0.7692,31.9,lty=2)

par(new=T)
plot(c(0,0), c(-2,-6), type="n", xlab="", xlim=c(0,1), main=NULL, ylab="log
(RII)", xaxt="n", frame.plot=F)
abline(coef=c(-3.221295,-0.055054), lty=4, col="black") #summary(rii_mpa)
axis(1, at=c(0,1), labels=c("0 (Highest Education)","1 (Lowest Education)"))
```

```
text(0.62,-2.2,labels="Prevalence = 33.2% (95%CI 31.7 to 34.7)")
text(0.7,-2.5,labels="SII = -0.3% (95%CI -5.3 to 4.7)")
text(0.7,-2.8,labels="RII = 0.9 (95%CI 0.7 to 1.3)")
mtext("1c) Brown men", side = 3, adj=0, font.main = 1, line = 1, outer = F)

# > Black Men

#svyby(~educ_i, ~c006, subset(banco, raca2 == "Preta"), svymean)

par(mar = c(5, 4, 4, 8) + 0.3)
barplot(c(33.5, 36.0, 37.7, 37.6), # age-adjusted % hypertension
        c(0.05321320, 0.2846225, 0.2021691, 0.4599953), #prop educ_i
        space=0, ylim=c(0,80), col="White", border="black",axes = F,
        xlab="numeric score",
        sub="cumulative relative frequency of the educational subgroups")
axis(4)
mtext("Prevalence", side = 4, line = 2.5, cex = 0.9)

x4 <- c(0.0266, 0.1955, 0.4389, 0.7700) #score_mpe
y4 <- c(33.5, 36.0, 37.7, 37.6) #prevalence
points(x4, y4)
segments(0.0266,0,0.0266,33.5,lty=2)
segments(0.1955,0,0.1955,36.0,lty=2)
segments(0.4389,0,0.4389,37.7,lty=2)
segments(0.7700,0,0.7700,37.6,lty=2)

par(new=T)
plot(c(0,0), c(-2,-6), type="n", xlab="", xlim=c(0,1), main=NULL, ylab="log
(RII)", xaxt="n", frame.plot=F)
abline(coef=c(-3.256882, 0.303018), lty=4, col="black") #summary(rii_mpe)
axis(1, at=c(0,1), labels=c("0 (Highest Education)","1 (Lowest Education)"))
text(0.62,-2.2,labels="Prevalence = 37.0% (95%CI 33.9 to 40.2)")
text(0.7,-2.5,labels="SII = 6.8% (95%CI -5.0 to 18.6)")
text(0.7,-2.8,labels="RII = 1.4 (95%CI 0.7 to 2.5)")
mtext("1d) Black men", side = 3, adj=0, font.main = 1, line = 1, outer = F)

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# >> GRAPH (Figures 2)

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# > All Women

plot.new()

layout(matrix(c(1,2,3,4), 2, 2, byrow = TRUE),respect=F)

#svyby(~educ_i, ~c006, banco, svymean)

par(mar = c(5, 4, 4, 8) + 0.3)
barplot(c(22.9, 27.3, 31.5, 35.3),
        c(0.1388534, 0.3305116, 0.1459514, 0.3846836), #freq relativa educ_i
        space=0, ylim=c(0,80), col="White", border="black", axes = F,
        xlab="numeric score",
        sub="cumulative relative frequency of the educational subgroups")
axis(4)
mtext("Prevalence", side = 4, line = 2.5, cex = 0.9)

x5 <- c(0.0694, 0.3041, 0.5423, 0.8077) #score_f
y5 <- c(22.9, 27.3, 31.5, 35.3) #prevalence
points(x5, y5)
```

```
segments(0.0694,0,0.0694,22.9,lty=2)
segments(0.3041,0,0.3041,27.3,lty=2)
segments(0.5423,0,0.5423,31.5,lty=2)
segments(0.8077,0,0.8077,35.3,lty=2)

par(new=T)
plot(c(0,0), c(-2,-6), type="n", xlab="", xlim=c(0,1), main=NULL, ylab="log
(RII)", xaxt="n", frame.plot=F)
abline(coef=c(-4.431761,0.865499), lty=1, col="black") #summary(rii_f)
axis(1, at=c(0,1), labels=c("0 (Highest Education)","1 (Lowest Education)"),
outer=F)
text(0.62,-2.2,labels="Prevalence = 30.8% (95%CI 30.0 to 31.7)")
text(0.7,-2.5,labels="SII = 16.3% (95%CI 13.3 to 19.3)")
text(0.7,-2.8,labels="RII = 2.4 (95%CI 2.0 to 2.8)")
mtext("2a) All women", side = 3, adj=0, font.main = 1, line = 1, outer = F)

# > White Women

#svyby(~educ_i, ~c006, subset(banco, raca2 == "Branca"), svymean)

par(mar = c(5, 4, 4, 8) + 0.3)
barplot(c(22.7, 26.8, 30.5, 35.3),
        c(0.1960693, 0.3485568, 0.1305736, 0.3248003), #freq relativa educ_i
        space=0, ylim=c(0,80), col="White", border="black", axes = F,
        xlab="numeric score",
        sub="cumulative relative frequency of the educational subgroups")
axis(4)
mtext("Prevalence", side = 4, line = 2.5, cex = 0.9)

x6 <- c(0.0980, 0.3703, 0.6099, 0.8376) #score_fb
y6 <- c(22.7, 26.8, 30.5, 35.3) #prevalence
points(x6, y6)
segments(0.0980,0,0.0980,22.7,lty=2)
segments(0.3703,0,0.3703,26.8,lty=2)
segments(0.6099,0,0.6099,30.5,lty=2)
segments(0.8376,0,0.8376,35.3,lty=2)

par(new=T)
plot(c(0,0), c(-2,-6), type="n", xlab="", xlim=c(0,1), main=NULL, ylab="log
(RII)", xaxt="n", frame.plot=F)
abline(coef=c(-4.502200, 0.932470), lty=4, col="black") #summary(rii_fb)
axis(1, at=c(0,1), labels=c("0 (Highest Education)","1 (Lowest Education)"))
text(0.62,-2.2,labels="Prevalence = 29.5% (95%CI 28.4 to 30.7)")
text(0.7,-2.5,labels="SII = 18.1% (95%CI 13.5 to 22.8)")
text(0.7,-2.8,labels="RII = 2.5 (95%CI 2.0 to 3.3)")
mtext("2b) White women", side = 3, adj=0, font.main = 1, line = 1, outer = F)

# > Brown Women

#svyby(~educ_i, ~c006, subset(banco, raca2 == "Parda"), svymean)

par(mar = c(5, 4, 4, 8) + 0.3)
barplot(c(21.9, 27.4, 31.9, 35.3),
        c(0.08443106, 0.3133667, 0.1597387, 0.4424636), #freq relativa educ_i
        space=0, ylim=c(0,80), col="White", border="black", axes = F,
        xlab="numeric score",
        sub="cumulative relative frequency of the educational subgroups")
axis(4)
mtext("Prevalence", side = 4, line = 2.5, cex = 0.9)

x7 <- c(0.0422, 0.2411, 0.4777, 0.7788) #score_fpa
y7 <- c(21.9, 27.4, 31.9, 35.3) #prevalence
points(x7, y7)
segments(0.0422,0,0.0422,21.9,lty=2)
```

```
segments(0.2411,0,0.2411,27.4,lty=2)
segments(0.4777,0,0.4777,31.9,lty=2)
segments(0.7788,0,0.7788,35.3,lty=2)

par(new=T)
plot(c(0,0), c(-2,-6), type="n", xlab="", xlim=c(0,1), main=NULL, ylab="log
(RII)", xaxt="n", frame.plot=F)
abline(coef=c(-4.445430, 0.820453), lty=4, col="black") #summary(rii_fpa)
axis(1, at=c(0,1), labels=c("0 (Highest Education)","1 (Lowest Education)"))
text(0.62,-2.2,labels="Prevalence = 31.8% (95%CI 30.6 to 32.9)")
text(0.7,-2.5,labels="SII = 14.5% (95%CI 10.2 to 18.8)")
text(0.7,-2.8,labels="RII = 2.3 (95%CI 1.8 to 2.9)")
mtext("2c) Brown women", side = 3, adj=0, font.main = 1, line = 1, outer = F)

# > Black Women

#svyby(~educ_i, ~c006, subset(banco, raca2 == "Parda"), svymean)

par(mar = c(5, 4, 4, 8) + 0.3)
barplot(c(32.8, 32.6, 36.1, 35.6),
        c(0.08443106, 0.3133667, 0.1597387, 0.4424636), #freq relativa educ_i
        space=0, ylim=c(0,80), col="White", border="black", axes = F,
        xlab="numeric score",
        sub="cumulative relative frequency of the educational subgroups")
axis(4)
mtext("Prevalence", side = 4, line = 2.5, cex = 0.9)

x8 <- c(0.0405, 0.2353, 0.4711, 0.7763) #score_fpe
y8 <- c(32.8, 32.6, 36.1, 35.6) #prevalence
points(x8, y8)
segments(0.0405,0,0.0405,32.8,lty=2)
segments(0.2353,0,0.2353,32.6,lty=2)
segments(0.4711,0,0.4711,36.1,lty=2)
segments(0.7763,0,0.7763,35.6,lty=2)

par(new=T)
plot(c(0,0), c(-2,-6), type="n", xlab="", xlim=c(0,1), main=NULL, ylab="log
(RII)", xaxt="n", frame.plot=F)
abline(coef=c(-3.929183, 0.004430), lty=4, col="black") #summary(rii_fpe)
axis(1, at=c(0,1), labels=c("0 (Highest Education)","1 (Lowest Education)"))
text(0.62,-2.2,labels="Prevalence = 34.5% (95%CI 32.1 to 37.0)")
text(0.7,-2.5,labels="SII = 1.5% (95%CI -9.2 to 12.2)")
text(0.7,-2.8,labels="RII = 1.0 (95%CI 0.6 to 1.8)")
mtext("2d) Black women", side = 3, adj=0, font.main = 1, line = 1, outer = F)


########################################
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## > CÁLCULO DO ESCORE NUMÉRICO

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

# > NUMERIC SCORE - variável independente do RII/SII
# > Exposure (education)

########################################
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# > EDUCATION * GENDER

score0 <- data.frame(svyby(~c006, ~educ_i, banco, svytotal))
score0
```

```
score1m <- (score0[1,2]/2)/sum(score0[,2])
score2m <- (score0[1,2] + (score0[2,2]/2))/sum(score0[,2])
score3m <- (score0[1,2] + score0[2,2] + (score0[3,2]/2))/sum(score0[,2])
score4m <- (score0[1,2] + score0[2,2] + score0[3,2] +
(score0[4,2]/2))/sum(score0[,2])
score_m <- round(c(score1m, score2m, score3m, score4m), 4)
score_m

score1f <- (score0[1,3]/2)/sum(score0[,3])
score2f <- (score0[1,3] + (score0[2,3]/2))/sum(score0[,3])
score3f <- (score0[1,3] + score0[2,3] + (score0[3,3]/2))/sum(score0[,3])
score4f <- (score0[1,3] + score0[2,3] + score0[3,3] +
(score0[4,3]/2))/sum(score0[,3])
score_f <- round(c(score1f, score2f, score3f, score4f), 4)
score_f

# > EDUCATION * GENDER * RACE

score1 <- data.frame(svyby(~c006, ~educ_i, subset(banco, raca=="Branca"),
svytotal))
score1

score1mb <- (score1[1,2]/2)/sum(score1[,2])
score2mb <- (score1[1,2] + (score1[2,2]/2))/sum(score1[,2])
score3mb <- (score1[1,2] + score1[2,2] + (score1[3,2]/2))/sum(score1[,2])
score4mb <- (score1[1,2] + score1[2,2] + score1[3,2] +
(score1[4,2]/2))/sum(score1[,2])
score_mb <- round(c(score1mb, score2mb, score3mb, score4mb), 4)
score_mb

score1fb <- (score1[1,3]/2)/sum(score1[,3])
score2fb <- (score1[1,3] + (score1[2,3]/2))/sum(score1[,3])
score3fb <- (score1[1,3] + score1[2,3] + (score1[3,3]/2))/sum(score1[,3])
score4fb <- (score1[1,3] + score1[2,3] + score1[3,3] +
(score1[4,3]/2))/sum(score1[,3])
score_fb <- round(c(score1fb, score2fb, score3fb, score4fb), 4)
score_fb

score2 <- data.frame(svyby(~c006, ~educ_i, subset(banco, raca=="Preta"),
svytotal))
score2

score1mpe <- (score2[1,2]/2)/sum(score2[,2])
score2mpe <- (score2[1,2] + (score2[2,2]/2))/sum(score2[,2])
score3mpe <- (score2[1,2] + score2[2,2] + (score2[3,2]/2))/sum(score2[,2])
score4mpe <- (score2[1,2] + score2[2,2] + score2[3,2] +
(score2[4,2]/2))/sum(score2[,2])
score_mpe <- round(c(score1mpe, score2mpe, score3mpe, score4mpe), 4)
score_mpe

score1fpe <- (score2[1,3]/2)/sum(score2[,3])
score2fpe <- (score2[1,3] + (score2[2,3]/2))/sum(score2[,3])
score3fpe <- (score2[1,3] + score2[2,3] + (score2[3,3]/2))/sum(score2[,3])
score4fpe <- (score2[1,3] + score2[2,3] + score2[3,3] +
(score2[4,3]/2))/sum(score2[,3])
score_fpe <- round(c(score1fpe, score2fpe, score3fpe, score4fpe), 4)
score_fpe

score4 <- data.frame(svyby(~c006, ~educ_i, subset(banco, raca=="Parda"),
svytotal))
score4

score1mpa <- (score4[1,2]/2)/sum(score4[,2])
score2mpa <- (score4[1,2] + (score4[2,2]/2))/sum(score4[,2])
```

```
score3mpa <- (score4[1,2] + score4[2,2] + (score4[3,2]/2))/sum(score4[,2])
score4mpa <- (score4[1,2] + score4[2,2] + score4[3,2] +
(score4[4,2]/2))/sum(score4[,2])
score_mpa <- round(c(score1mpa, score2mpa, score3mpa, score4mpa), 4)
score_mpa

score1fpa <- (score4[1,3]/2)/sum(score4[,3])
score2fpa <- (score4[1,3] + (score4[2,3]/2))/sum(score4[,3])
score3fpa <- (score4[1,3] + score4[2,3] + (score4[3,3]/2))/sum(score4[,3])
score4fpa <- (score4[1,3] + score4[2,3] + score4[3,3] +
(score4[4,3]/2))/sum(score4[,3])
score_fpa <- round(c(score1fpa, score2fpa, score3fpa, score4fpa), 4)
score_fpa

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rm(list = ls() )
q()
```