UKBiobank Colorectal Cancer Analysis

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R Markdown

```r
#For our analysis, select: 1. european; 2. age by category; 3. see the complete dataset (no NA) number;
dat0=pheno.clean.final[which(pheno.clean.final$race=="White"),]
table(dat0$colorectal_cancer)
```

```
##
##      0      1
## 377373   4033
```

```r
dat0$agegroups<-cut(dat0$age, breaks=c( 40, 45,50,55,60,65,70,75), right = FALSE)
dat0=dat0[-which(dat0$colorectal_cancer==1 & dat0$colorectal_cancer_incident!=1),] #exclude non-inciden

dat0$prs_scaled=scale(dat0$PRS_colorectal,center = T,scale = T)
fit <- glm(colorectal_cancer~prs_scaled+PC1+PC2+PC3+PC4+PC5+PC6+PC7+PC8+PC9+PC10, data=dat0,family = bi
summary(fit)
```

```
##
## Call:
## glm(formula = colorectal_cancer ~ prs_scaled + PC1 + PC2 + PC3 +
##     PC4 + PC5 + PC6 + PC7 + PC8 + PC9 + PC10, family = binomial(),
##     data = dat0, model = FALSE, x = FALSE, y = FALSE)
##
## Deviance Residuals:
##     Min       1Q   Median       3Q      Max
## -0.3164  -0.1242  -0.1061  -0.0922   3.5321
##
## Coefficients:
##               Estimate Std. Error z value Pr(>|z|)
## (Intercept) -5.2860486  0.0819907 -64.471  < 2e-16 ***
## prs_scaled   0.4101889  0.0204574  20.051  < 2e-16 ***
## PC1         -0.0134804  0.0079532  -1.695 0.090082 .
## PC2         -0.0063994  0.0080499  -0.795 0.426629
## PC3          0.0118942  0.0099428   1.196 0.231593
## PC4          0.0030475  0.0045931   0.663 0.507011
## PC5          0.0116118  0.0027331   4.249 2.15e-05 ***
## PC6          0.0006845  0.0073662   0.093 0.925959
## PC7          0.0047842  0.0054692   0.875 0.381704
## PC8         -0.0228026  0.0063326  -3.601 0.000317 ***
```

```
## PC9          -0.0039339   0.0043521   -0.904 0.366045
## PC10         -0.0078056   0.0087750   -0.890 0.373718
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for binomial family taken to be 1)
##
##      Null deviance: 28788  on 379742  degrees of freedom
## Residual deviance: 28339  on 379731  degrees of freedom
## AIC: 28363
##
## Number of Fisher Scoring iterations: 8
```

```r
exp( 0.4101952)
```

```
## [1] 1.507112
```

```r
dat0$alcohol=NA
dat0$alcohol[which(dat0$AlcoholFreq=="Never" | dat0$AlcoholFreq== "Special occasions only")]=0
dat0$alcohol[which(dat0$AlcoholFreq=="Daily or almost daily" | dat0$AlcoholFreq== "Three or four times a
                    dat0$AlcoholFreq== "Once or twice a week" | dat0$AlcoholFreq=="One to three times a

#let's make NA to be 0 for the sum up
dat0$beef[which(dat0$beef<0)]=0
dat0$pork[which(dat0$pork<0)]=0
dat0$lamb[which(dat0$lamb<0)]=0

dat0$redmeat.numeric=dat0$beef+dat0$pork+dat0$lamb

dat0$cooked_veg[which(dat0$cooked_veg=="-10")]=0
dat0$raw_veg[which(dat0$raw_veg=="-10")]=0
dat0$raw_veg[which(dat0$raw_veg<0)]=NA
dat0$cooked_veg[which(dat0$cooked_veg<0)]=NA

dat0$veg.numeric=dat0$cooked_veg+dat0$raw_veg

dat0$process_meat[which(dat0$process_meat<0)]=NA

dat0$birth.x=as.numeric(as.character(dat0$birth.x))
dat0$birth.y=as.numeric(as.character(dat0$birth.y))


dat0$smoke.status[which(dat0$smoke.status<0)]=NA
#Add social economic and birth location/assessment center location
dat_test=dat0[,c("IID","PRS_colorectal","sex","age","height","waist","smoke.status","activity",
                 "colorectal_cancer","colorectal_cancer_incident","redmeat.numeric","veg.num
                 "assessment_center","agegroups", "birth.y","birth.x",
                 "alcohol","PC1","PC2","PC3","PC4","PC5","PC6","PC7","PC8","PC9","PC10")]

dat_test=dat_test[complete.cases(dat_test),]
table(dat_test$colorectal_cancer)
```

```
##
```

```
##      0      1
## 282429   1743
```

```
table(dat_test$colorectal_cancer_incident)
```

```
##
##      0      1
## 282429   1743
```

```
dim(dat_test) #[1] 284169      28
```

```
## [1] 284172      28
```

```
dat_test$prs_scaled=as.vector(scale(dat_test$PRS_colorectal,center = T,scale = T))
dat_test$age.scale=as.vector(scale(dat_test$age,center = T,scale=T))
dat_test$height.scale=as.vector(scale(dat_test$height,center=T,scale = T))
dat_test$waist.scale=as.vector(scale(dat_test$waist,center=T,scale = T))
dat_test$birth.y.scale=as.vector(scale(dat_test$birth.y,center=T,scale = T))
dat_test$birth.x.scale=as.vector(scale(dat_test$birth.x,center=T,scale = T))
dat_test$veg.numeric.scale=as.vector(scale(dat_test$veg.numeric,center=T,scale = T))
dat_test$process_meat.scale=as.vector(scale(dat_test$process_meat,center=T,scale = T))
dat_test$redmeat.numeric.scale=as.vector(scale(dat_test$redmeat.numeric,center=T,scale = T))
table(dat_test$assessment_center) #note that 10003 is too small, we set 11001 as the reference group
```

```
##
## 10003 11001 11002 11003 11004 11005 11006 11007 11008 11009 11010 11011 11012
##     4  7886  8470 10620 11303 10351 10971 18282 16615 21052 25872 25990  5802
## 11013 11014 11016 11017 11018 11020 11021 11022 11023
## 20047 17843 18834 12272 13376 13338 13567  1288   389
```

```
#dat_test$assessment_center=factor(dat_test$assessment_center)
#dat_test$assessment_center=relevel(dat_test$assessment_center,ref = "11001")
fit <- glm(colorectal_cancer~prs_scaled+PC1+PC2+PC3+PC4+PC5+PC6+PC7+PC8+PC9+PC10+factor(activity)+agegr
summary(fit)
```

```
##
## Call:
## glm(formula = colorectal_cancer ~ prs_scaled + PC1 + PC2 + PC3 +
##     PC4 + PC5 + PC6 + PC7 + PC8 + PC9 + PC10 + factor(activity) +
##     agegroups + sex + alcohol + height.scale + relevel(factor(dat_test$assessment_center),
##     ref = "11001") + waist.scale + factor(smoke.status) + redmeat.numeric.scale +
##     process_meat.scale + veg.numeric.scale + birth.x.scale +
##     birth.y.scale + prs_scaled:birth.x.scale + prs_scaled:birth.y.scale +
##     prs_scaled:factor(activity) + prs_scaled:agegroups + prs_scaled:sex +
##     prs_scaled:alcohol + prs_scaled:height.scale + prs_scaled:waist.scale +
##     prs_scaled:veg.numeric.scale + prs_scaled:redmeat.numeric.scale +
##     prs_scaled:factor(smoke.status) + prs_scaled:process_meat.scale,
##     family = binomial(), data = dat_test, model = FALSE, x = FALSE,
##     y = FALSE)
##
## Deviance Residuals:
```

```
##      Min      1Q   Median       3Q      Max
## -0.4718  -0.1291  -0.0979  -0.0696   3.9891
##
## Coefficients:
##                                                                          Estimate
## (Intercept)                                                             -7.101399
## prs_scaled                                                               0.655239
## PC1                                                                     -0.024151
## PC2                                                                      0.013532
## PC3                                                                      0.007292
## PC4                                                                     -0.003510
## PC5                                                                      0.009853
## PC6                                                                      0.002921
## PC7                                                                      0.003657
## PC8                                                                     -0.026568
## PC9                                                                     -0.006859
## PC10                                                                    -0.013153
## factor(activity)1                                                        0.023742
## factor(activity)2                                                        0.017799
## agegroups[45,50)                                                         0.709890
## agegroups[50,55)                                                         1.383273
## agegroups[55,60)                                                         1.650811
## agegroups[60,65)                                                         1.895994
## agegroups[65,70)                                                         2.148956
## agegroups[70,75)                                                         2.398049
## sexMale                                                                  0.227228
## alcohol                                                                 -0.015469
## height.scale                                                             0.056854
## relevel(factor(dat_test$assessment_center), ref = "11001")10003         -6.431823
## relevel(factor(dat_test$assessment_center), ref = "11001")11002         -0.038508
## relevel(factor(dat_test$assessment_center), ref = "11001")11003         -0.260607
## relevel(factor(dat_test$assessment_center), ref = "11001")11004         -0.295590
## relevel(factor(dat_test$assessment_center), ref = "11001")11005         -0.171025
## relevel(factor(dat_test$assessment_center), ref = "11001")11006         -0.259218
## relevel(factor(dat_test$assessment_center), ref = "11001")11007         -0.168623
## relevel(factor(dat_test$assessment_center), ref = "11001")11008         -0.233069
## relevel(factor(dat_test$assessment_center), ref = "11001")11009         -0.273151
## relevel(factor(dat_test$assessment_center), ref = "11001")11010         -0.292404
## relevel(factor(dat_test$assessment_center), ref = "11001")11011         -0.240929
## relevel(factor(dat_test$assessment_center), ref = "11001")11012         -0.208486
## relevel(factor(dat_test$assessment_center), ref = "11001")11013         -0.347291
## relevel(factor(dat_test$assessment_center), ref = "11001")11014         -0.349974
## relevel(factor(dat_test$assessment_center), ref = "11001")11016         -0.318156
## relevel(factor(dat_test$assessment_center), ref = "11001")11017         -0.443371
## relevel(factor(dat_test$assessment_center), ref = "11001")11018         -0.359613
## relevel(factor(dat_test$assessment_center), ref = "11001")11020         -0.449314
## relevel(factor(dat_test$assessment_center), ref = "11001")11021         -0.687207
## relevel(factor(dat_test$assessment_center), ref = "11001")11022         -0.953463
## relevel(factor(dat_test$assessment_center), ref = "11001")11023         -1.338564
## waist.scale                                                              0.129664
## factor(smoke.status)1                                                    0.173482
## factor(smoke.status)2                                                   -0.084341
## redmeat.numeric.scale                                                    0.073132
## process_meat.scale                                                       0.066610
```

```
## veg.numeric.scale                                                   0.005826
## birth.x.scale                                                      -0.056858
## birth.y.scale                                                       0.004340
## prs_scaled:birth.x.scale                                            0.005865
## prs_scaled:birth.y.scale                                            0.024590
## prs_scaled:factor(activity)1                                       -0.117096
## prs_scaled:factor(activity)2                                       -0.073661
## prs_scaled:agegroups[45,50)                                        -0.095915
## prs_scaled:agegroups[50,55)                                        -0.108503
## prs_scaled:agegroups[55,60)                                        -0.035762
## prs_scaled:agegroups[60,65)                                        -0.133928
## prs_scaled:agegroups[65,70)                                        -0.159267
## prs_scaled:agegroups[70,75)                                        -0.800574
## prs_scaled:sexMale                                                  0.018454
## prs_scaled:alcohol                                                 -0.056909
## prs_scaled:height.scale                                             0.017142
## prs_scaled:waist.scale                                             -0.019931
## prs_scaled:veg.numeric.scale                                       -0.011235
## prs_scaled:redmeat.numeric.scale                                   -0.008710
## prs_scaled:factor(smoke.status)1                                    0.021224
## prs_scaled:factor(smoke.status)2                                    0.063039
## prs_scaled:process_meat.scale                                      -0.030052
##                                                                    Std. Error
## (Intercept)                                                         0.282510
## prs_scaled                                                          0.185517
## PC1                                                                 0.011810
## PC2                                                                 0.013633
## PC3                                                                 0.014603
## PC4                                                                 0.007020
## PC5                                                                 0.004138
## PC6                                                                 0.013928
## PC7                                                                 0.009036
## PC8                                                                 0.010570
## PC9                                                                 0.005874
## PC10                                                                0.011748
## factor(activity)1                                                   0.073977
## factor(activity)2                                                   0.075635
## agegroups[45,50)                                                    0.227717
## agegroups[50,55)                                                    0.209969
## agegroups[55,60)                                                    0.205157
## agegroups[60,65)                                                    0.201298
## agegroups[65,70)                                                    0.202005
## agegroups[70,75)                                                    0.330289
## sexMale                                                             0.082133
## alcohol                                                             0.074986
## height.scale                                                        0.038566
## relevel(factor(dat_test$assessment_center), ref = "11001")10003    98.388597
## relevel(factor(dat_test$assessment_center), ref = "11001")11002     0.184021
## relevel(factor(dat_test$assessment_center), ref = "11001")11003     0.184971
## relevel(factor(dat_test$assessment_center), ref = "11001")11004     0.185246
## relevel(factor(dat_test$assessment_center), ref = "11001")11005     0.182502
## relevel(factor(dat_test$assessment_center), ref = "11001")11006     0.177249
## relevel(factor(dat_test$assessment_center), ref = "11001")11007     0.162411
## relevel(factor(dat_test$assessment_center), ref = "11001")11008     0.161748
```

```
## relevel(factor(dat_test$assessment_center), ref = "11001")11009    0.160575
## relevel(factor(dat_test$assessment_center), ref = "11001")11010    0.154377
## relevel(factor(dat_test$assessment_center), ref = "11001")11011    0.155995
## relevel(factor(dat_test$assessment_center), ref = "11001")11012    0.221011
## relevel(factor(dat_test$assessment_center), ref = "11001")11013    0.162058
## relevel(factor(dat_test$assessment_center), ref = "11001")11014    0.164782
## relevel(factor(dat_test$assessment_center), ref = "11001")11016    0.158828
## relevel(factor(dat_test$assessment_center), ref = "11001")11017    0.183390
## relevel(factor(dat_test$assessment_center), ref = "11001")11018    0.178403
## relevel(factor(dat_test$assessment_center), ref = "11001")11020    0.182685
## relevel(factor(dat_test$assessment_center), ref = "11001")11021    0.187201
## relevel(factor(dat_test$assessment_center), ref = "11001")11022    0.472268
## relevel(factor(dat_test$assessment_center), ref = "11001")11023    1.011719
## waist.scale                                                        0.030524
## factor(smoke.status)1                                              0.055744
## factor(smoke.status)2                                              0.100561
## redmeat.numeric.scale                                              0.028190
## process_meat.scale                                                 0.029215
## veg.numeric.scale                                                  0.026081
## birth.x.scale                                                      0.028572
## birth.y.scale                                                      0.034810
## prs_scaled:birth.x.scale                                           0.022996
## prs_scaled:birth.y.scale                                           0.023222
## prs_scaled:factor(activity)1                                       0.065899
## prs_scaled:factor(activity)2                                       0.066910
## prs_scaled:agegroups[45,50)                                        0.198006
## prs_scaled:agegroups[50,55)                                        0.181515
## prs_scaled:agegroups[55,60)                                        0.176573
## prs_scaled:agegroups[60,65)                                        0.173597
## prs_scaled:agegroups[65,70)                                        0.174258
## prs_scaled:agegroups[70,75)                                        0.294442
## prs_scaled:sexMale                                                 0.074247
## prs_scaled:alcohol                                                 0.066819
## prs_scaled:height.scale                                            0.034799
## prs_scaled:waist.scale                                             0.027616
## prs_scaled:veg.numeric.scale                                       0.024105
## prs_scaled:redmeat.numeric.scale                                   0.025640
## prs_scaled:factor(smoke.status)1                                   0.050630
## prs_scaled:factor(smoke.status)2                                   0.089542
## prs_scaled:process_meat.scale                                      0.026427
##                                                                    z value
## (Intercept)                                                        -25.137
## prs_scaled                                                           3.532
## PC1                                                                 -2.045
## PC2                                                                  0.993
## PC3                                                                  0.499
## PC4                                                                 -0.500
## PC5                                                                  2.381
## PC6                                                                  0.210
## PC7                                                                  0.405
## PC8                                                                 -2.514
## PC9                                                                 -1.168
## PC10                                                                -1.120
## factor(activity)1                                                    0.321
```

```
## factor(activity)2                                                    0.235
## agegroups[45,50)                                                     3.117
## agegroups[50,55)                                                     6.588
## agegroups[55,60)                                                     8.047
## agegroups[60,65)                                                     9.419
## agegroups[65,70)                                                    10.638
## agegroups[70,75)                                                     7.260
## sexMale                                                              2.767
## alcohol                                                             -0.206
## height.scale                                                         1.474
## relevel(factor(dat_test$assessment_center), ref = "11001")10003     -0.065
## relevel(factor(dat_test$assessment_center), ref = "11001")11002     -0.209
## relevel(factor(dat_test$assessment_center), ref = "11001")11003     -1.409
## relevel(factor(dat_test$assessment_center), ref = "11001")11004     -1.596
## relevel(factor(dat_test$assessment_center), ref = "11001")11005     -0.937
## relevel(factor(dat_test$assessment_center), ref = "11001")11006     -1.462
## relevel(factor(dat_test$assessment_center), ref = "11001")11007     -1.038
## relevel(factor(dat_test$assessment_center), ref = "11001")11008     -1.441
## relevel(factor(dat_test$assessment_center), ref = "11001")11009     -1.701
## relevel(factor(dat_test$assessment_center), ref = "11001")11010     -1.894
## relevel(factor(dat_test$assessment_center), ref = "11001")11011     -1.544
## relevel(factor(dat_test$assessment_center), ref = "11001")11012     -0.943
## relevel(factor(dat_test$assessment_center), ref = "11001")11013     -2.143
## relevel(factor(dat_test$assessment_center), ref = "11001")11014     -2.124
## relevel(factor(dat_test$assessment_center), ref = "11001")11016     -2.003
## relevel(factor(dat_test$assessment_center), ref = "11001")11017     -2.418
## relevel(factor(dat_test$assessment_center), ref = "11001")11018     -2.016
## relevel(factor(dat_test$assessment_center), ref = "11001")11020     -2.459
## relevel(factor(dat_test$assessment_center), ref = "11001")11021     -3.671
## relevel(factor(dat_test$assessment_center), ref = "11001")11022     -2.019
## relevel(factor(dat_test$assessment_center), ref = "11001")11023     -1.323
## waist.scale                                                          4.248
## factor(smoke.status)1                                                3.112
## factor(smoke.status)2                                               -0.839
## redmeat.numeric.scale                                                2.594
## process_meat.scale                                                   2.280
## veg.numeric.scale                                                    0.223
## birth.x.scale                                                       -1.990
## birth.y.scale                                                        0.125
## prs_scaled:birth.x.scale                                             0.255
## prs_scaled:birth.y.scale                                             1.059
## prs_scaled:factor(activity)1                                        -1.777
## prs_scaled:factor(activity)2                                        -1.101
## prs_scaled:agegroups[45,50)                                         -0.484
## prs_scaled:agegroups[50,55)                                         -0.598
## prs_scaled:agegroups[55,60)                                         -0.203
## prs_scaled:agegroups[60,65)                                         -0.771
## prs_scaled:agegroups[65,70)                                         -0.914
## prs_scaled:agegroups[70,75)                                         -2.719
## prs_scaled:sexMale                                                   0.249
## prs_scaled:alcohol                                                  -0.852
## prs_scaled:height.scale                                              0.493
## prs_scaled:waist.scale                                              -0.722
## prs_scaled:veg.numeric.scale                                        -0.466
```

```
## prs_scaled:redmeat.numeric.scale                                         -0.340
## prs_scaled:factor(smoke.status)1                                          0.419
## prs_scaled:factor(smoke.status)2                                          0.704
## prs_scaled:process_meat.scale                                            -1.137
##                                                                          Pr(>|z|)
## (Intercept)                                                              < 2e-16 ***
## prs_scaled                                                               0.000412 ***
## PC1                                                                      0.040847 *
## PC2                                                                      0.320899
## PC3                                                                      0.617517
## PC4                                                                      0.617127
## PC5                                                                      0.017269 *
## PC6                                                                      0.833909
## PC7                                                                      0.685715
## PC8                                                                      0.011953 *
## PC9                                                                      0.242883
## PC10                                                                     0.262860
## factor(activity)1                                                        0.748254
## factor(activity)2                                                        0.813953
## agegroups[45,50)                                                         0.001824 **
## agegroups[50,55)                                                         4.46e-11 ***
## agegroups[55,60)                                                         8.51e-16 ***
## agegroups[60,65)                                                         < 2e-16 ***
## agegroups[65,70)                                                         < 2e-16 ***
## agegroups[70,75)                                                         3.86e-13 ***
## sexMale                                                                  0.005664 **
## alcohol                                                                  0.836560
## height.scale                                                             0.140431
## relevel(factor(dat_test$assessment_center), ref = "11001")10003 0.947878
## relevel(factor(dat_test$assessment_center), ref = "11001")11002 0.834248
## relevel(factor(dat_test$assessment_center), ref = "11001")11003 0.158863
## relevel(factor(dat_test$assessment_center), ref = "11001")11004 0.110563
## relevel(factor(dat_test$assessment_center), ref = "11001")11005 0.348700
## relevel(factor(dat_test$assessment_center), ref = "11001")11006 0.143617
## relevel(factor(dat_test$assessment_center), ref = "11001")11007 0.299155
## relevel(factor(dat_test$assessment_center), ref = "11001")11008 0.149603
## relevel(factor(dat_test$assessment_center), ref = "11001")11009 0.088929 .
## relevel(factor(dat_test$assessment_center), ref = "11001")11010 0.058213 .
## relevel(factor(dat_test$assessment_center), ref = "11001")11011 0.122474
## relevel(factor(dat_test$assessment_center), ref = "11001")11012 0.345514
## relevel(factor(dat_test$assessment_center), ref = "11001")11013 0.032112 *
## relevel(factor(dat_test$assessment_center), ref = "11001")11014 0.033682 *
## relevel(factor(dat_test$assessment_center), ref = "11001")11016 0.045162 *
## relevel(factor(dat_test$assessment_center), ref = "11001")11017 0.015622 *
## relevel(factor(dat_test$assessment_center), ref = "11001")11018 0.043828 *
## relevel(factor(dat_test$assessment_center), ref = "11001")11020 0.013913 *
## relevel(factor(dat_test$assessment_center), ref = "11001")11021 0.000242 ***
## relevel(factor(dat_test$assessment_center), ref = "11001")11022 0.043497 *
## relevel(factor(dat_test$assessment_center), ref = "11001")11023 0.185815
## waist.scale                                                              2.16e-05 ***
## factor(smoke.status)1                                                    0.001858 **
## factor(smoke.status)2                                                    0.401633
## redmeat.numeric.scale                                                    0.009480 **
## process_meat.scale                                                       0.022606 *
```

```
## veg.numeric.scale                              0.823244
## birth.x.scale                                  0.046597 *
## birth.y.scale                                  0.900771
## prs_scaled:birth.x.scale                       0.798686
## prs_scaled:birth.y.scale                       0.289651
## prs_scaled:factor(activity)1                   0.075587 .
## prs_scaled:factor(activity)2                   0.270941
## prs_scaled:agegroups[45,50)                    0.628097
## prs_scaled:agegroups[50,55)                    0.549995
## prs_scaled:agegroups[55,60)                    0.839499
## prs_scaled:agegroups[60,65)                    0.440416
## prs_scaled:agegroups[65,70)                    0.360731
## prs_scaled:agegroups[70,75)                    0.006549 **
## prs_scaled:sexMale                             0.803711
## prs_scaled:alcohol                             0.394380
## prs_scaled:height.scale                        0.622294
## prs_scaled:waist.scale                         0.470468
## prs_scaled:veg.numeric.scale                   0.641150
## prs_scaled:redmeat.numeric.scale              0.734070
## prs_scaled:factor(smoke.status)1               0.675066
## prs_scaled:factor(smoke.status)2               0.481425
## prs_scaled:process_meat.scale                  0.255469
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for binomial family taken to be 1)
##
##     Null deviance: 21233  on 284171  degrees of freedom
## Residual deviance: 20188  on 284101  degrees of freedom
## AIC: 20330
##
## Number of Fisher Scoring iterations: 10
```

```
#Now let's select the control samples for the case/control study
table(dat_test$colorectal_cancer)
```

```
##
##      0      1
## 282429   1743
```

```
control=dat_test[which(dat_test$colorectal_cancer==0),]
set.seed(10252022)
#set.seed(11022022)
control=control[sample(1:dim(control)[1],size=1743,replace = F),]
dat_test_casecontrol=rbind(control,dat_test[which(dat_test$colorectal_cancer==1),])
table(dat_test_casecontrol$colorectal_cancer)
```

```
##
##    0    1
## 1743 1743
```

```r
dat_test_casecontrol$prs_scaled=as.vector(scale(dat_test_casecontrol$PRS_colorectal,center = T,scale = T
dat_test_casecontrol$age.scale=as.vector(scale(dat_test_casecontrol$age,center = T,scale=T))
dat_test_casecontrol$height.scale=as.vector(scale(dat_test_casecontrol$height,center=T,scale = T))
dat_test_casecontrol$waist.scale=as.vector(scale(dat_test_casecontrol$waist,center=T,scale = T))
dat_test_casecontrol$birth.y.scale=as.vector(scale(dat_test_casecontrol$birth.y,center=T,scale = T))
dat_test_casecontrol$birth.x.scale=as.vector(scale(dat_test_casecontrol$birth.x,center=T,scale = T))
dat_test_casecontrol$veg.numeric.scale=as.vector(scale(dat_test_casecontrol$veg.numeric,center=T,scale =
dat_test_casecontrol$process_meat.scale=as.vector(scale(dat_test_casecontrol$process_meat,center=T,scale
dat_test_casecontrol$redmeat.numeric.scale=as.vector(scale(dat_test_casecontrol$redmeat.numeric,center=T

fit_normal<-prs_e_function_gr(data=dat_test_casecontrol,
                              formula = colorectal_cancer~prs_scaled+PC1+PC2+PC3+PC4+PC5+PC6
                              formula_prs = prs_scaled ~ PC1+PC2+PC3+PC4+PC5+PC6+PC7+PC8+PC9
                              numDeriv = F,
                              facVar="assessment_center")
```

```
## After removing missing values, the number of observations is 3486
## initial  value 7079.971407
## iter  50 value 7058.783575
## final  value 7057.612449
## converged
```

```r
fit_cc_glm <- glm(colorectal_cancer~prs_scaled+PC1+PC2+PC3+PC4+PC5+PC6+PC7+PC8+PC9+PC10+factor(activity)

#print results
fit_normal$res_normal
```

```
##                          Estimate    Std.Error      Z.value
## (Intercept)           -1.8624592303 0.372146401 -5.004641256
## prs_scaled             0.7494519119 0.196056025  3.822641575
## PC1                   -0.0328349339 0.017714973 -1.853513054
## PC2                   -0.0025914285 0.020716835 -0.125088053
## PC3                    0.0023456304 0.022389950  0.104762642
## PC4                   -0.0081625534 0.010991280 -0.742639031
## PC5                    0.0121852278 0.006360451  1.915780523
## PC6                    0.0044850555 0.021470378  0.208895042
## PC7                   -0.0054891427 0.012909426 -0.425204230
## PC8                   -0.0358245037 0.015510612 -2.309677020
## PC9                   -0.0180150297 0.009044649 -1.991788670
## PC10                  -0.0129227671 0.017843378 -0.724233213
## factor(activity)1     -0.0764839442 0.103639558 -0.737980225
## factor(activity)2     -0.0667222143 0.105673711 -0.631398422
## agegroups[45,50)       0.6465500883 0.237398203  2.723483500
## agegroups[50,55)       1.2740540143 0.220569487  5.776202467
## agegroups[55,60)       1.7144391654 0.216458437  7.920408127
## agegroups[60,65)       1.9273764498 0.211578467  9.109511372
## agegroups[65,70)       2.2121974290 0.214557067 10.310531662
## agegroups[70,75)       2.2321323853 0.508886132  4.386310113
## sexMale                0.2004358175 0.115802577  1.730840730
## alcohol                0.0167083502 0.102961531  0.162277600
## height.scale           0.0384969521 0.054420669  0.707395789
## assessment_center11002 -0.1686919280 0.291866288 -0.577976747
## assessment_center11003 -0.3582593073 0.287849082 -1.244608128
```

```
## assessment_center11004            -0.1219663054 0.292953815 -0.416332880
## assessment_center11005            -0.0004021919 0.290539906 -0.001384291
## assessment_center11006            -0.2419307211 0.280712875 -0.861844049
## assessment_center11007            -0.1746538535 0.260269362 -0.671050377
## assessment_center11008            -0.3179623068 0.256398561 -1.240109559
## assessment_center11009            -0.3171081063 0.252479815 -1.255974092
## assessment_center11010            -0.3835740938 0.244467200 -1.569020687
## assessment_center11011            -0.2148826657 0.250534289 -0.857697630
## assessment_center11012            -0.3182985756 0.333113613 -0.955525573
## assessment_center11013            -0.3609548944 0.256604149 -1.406660396
## assessment_center11014            -0.2974060282 0.260774925 -1.140470191
## assessment_center11016            -0.5095579379 0.250514758 -2.034043587
## assessment_center11017            -0.2572761827 0.287347733 -0.895347878
## assessment_center11018            -0.3339763493 0.278990198 -1.197089904
## assessment_center11020            -0.5180131591 0.281790322 -1.838292941
## assessment_center11021            -0.7375506705 0.280730200 -2.627258020
## assessment_center11022            -1.0696518474 0.659346845 -1.622290083
## assessment_center11023            -1.4376261721 1.463113595 -0.982580011
## waist.scale                        0.1170583807 0.044041991  2.657881231
## factor(smoke.status)1              0.1680032918 0.078872353  2.130065678
## factor(smoke.status)2             -0.0870663714 0.133616490 -0.651613969
## redmeat.numeric.scale              0.0572790745 0.039495405  1.450271870
## process_meat.scale                 0.1019869442 0.040878919  2.494854221
## veg.numeric.scale                 -0.0115146116 0.037069724 -0.310620375
## birth.x.scale                     -0.0385289512 0.042340161 -0.909985939
## birth.y.scale                     -0.0047980723 0.052045005 -0.092190832
## prs_scaled:birth.x.scale          -0.0039143295 0.035829409 -0.109249068
## prs_scaled:birth.y.scale           0.0305684431 0.036986733  0.826470482
## prs_scaled:factor(activity)1      -0.1321675541 0.068734664 -1.922866073
## prs_scaled:factor(activity)2      -0.0840250729 0.070035955 -1.199741952
## prs_scaled:agegroups[45,50)       -0.1268838784 0.205333087 -0.617941708
## prs_scaled:agegroups[50,55)       -0.1234983412 0.188409370 -0.655478766
## prs_scaled:agegroups[55,60)       -0.0519407917 0.183019229 -0.283799642
## prs_scaled:agegroups[60,65)       -0.1724790531 0.179985960 -0.958291711
## prs_scaled:agegroups[65,70)       -0.1918974806 0.180517864 -1.063038728
## prs_scaled:agegroups[70,75)       -0.9689031226 0.314308519 -3.082649891
## prs_scaled:sexMale                 0.0086383467 0.078271013  0.110364571
## prs_scaled:alcohol                -0.0710648216 0.070469673 -1.008445463
## prs_scaled:height.scale            0.0176433534 0.036039787  0.489552104
## prs_scaled:waist.scale            -0.0119408331 0.029409240 -0.406023180
## prs_scaled:veg.numeric.scale      -0.0143603947 0.025599873 -0.560955696
## prs_scaled:redmeat.numeric.scale  -0.0140805779 0.026564866 -0.530045122
## prs_scaled:factor(smoke.status)1   0.0189597650 0.052979183  0.357871981
## prs_scaled:factor(smoke.status)2   0.0651317037 0.093276271  0.698266592
## prs_scaled:process_meat.scale     -0.0328308507 0.027466171 -1.195319525
## eta_X.Intercept.                  -0.1201589913 0.085503044 -1.405318290
## eta_PC1                            0.0065416887 0.007198291  0.908783590
## eta_PC2                           -0.0060058771 0.008740841 -0.687105217
## eta_PC3                            0.0016542777 0.009759041  0.169512324
## eta_PC4                            0.0001886295 0.004844563  0.038936323
## eta_PC5                           -0.0019827462 0.002727663 -0.726902998
## eta_PC6                           -0.0002292867 0.009622912 -0.023827161
## eta_PC7                            0.0095141354 0.005493888  1.731767346
## eta_PC8                           -0.0004760320 0.006774566 -0.070267518
```

```
## eta_PC9                            -0.0011852478 0.003846085 -0.308169956
## eta_PC10                            0.0049047785 0.007766306  0.631545848
## eta_birth.x.scale                  -0.0056059954 0.024847847 -0.225612922
## eta_birth.y.scale                   0.0195512376 0.026080744  0.749642626
## sigma_stratadata[, facVar]11001     0.9824778839 0.060636419 16.202768771
## sigma_stratadata[, facVar]11002     0.9443578708 0.055867199 16.903619506
## sigma_stratadata[, facVar]11003     1.0057258040 0.054926018 18.310553746
## sigma_stratadata[, facVar]11004     0.9794200032 0.052675825 18.593349247
## sigma_stratadata[, facVar]11005     0.9537129785 0.052615789 18.125984408
## sigma_stratadata[, facVar]11006     0.9070368536 0.051031199 17.774163062
## sigma_stratadata[, facVar]11007     0.9843861926 0.042022081 23.425451091
## sigma_stratadata[, facVar]11008     0.9580022583 0.041689405 22.979513757
## sigma_stratadata[, facVar]11009     0.9637053159 0.038063748 25.318192648
## sigma_stratadata[, facVar]11010     0.9873322180 0.035731109 27.632285649
## sigma_stratadata[, facVar]11011     0.9643073100 0.035793949 26.940511671
## sigma_stratadata[, facVar]11012     0.9965794024 0.075173284 13.257095432
## sigma_stratadata[, facVar]11013     1.0300137708 0.043467484 23.696190016
## sigma_stratadata[, facVar]11014     0.8927168012 0.040410188 22.091379415
## sigma_stratadata[, facVar]11016     0.9789042156 0.039860426 24.558297956
## sigma_stratadata[, facVar]11017     0.8727957140 0.050802546 17.180156804
## sigma_stratadata[, facVar]11018     0.9639861527 0.051032064 18.889813277
## sigma_stratadata[, facVar]11020     1.0242921321 0.055896763 18.324712725
## sigma_stratadata[, facVar]11021     1.0251153058 0.056234973 18.229142010
## sigma_stratadata[, facVar]11022     0.8472679240 0.170236628  4.977001334
## sigma_stratadata[, facVar]11023     1.3340849771 0.565234336  2.360233434
##                                          Pvalue
## (Intercept)                          5.596616e-07
## prs_scaled                           1.320296e-04
## PC1                                  6.380886e-02
## PC2                                  9.004538e-01
## PC3                                  9.165642e-01
## PC4                                  4.577003e-01
## PC5                                  5.539304e-02
## PC6                                  8.345302e-01
## PC7                                  6.706878e-01
## PC8                                  2.090604e-02
## PC9                                  4.639425e-02
## PC10                                 4.689226e-01
## factor(activity)1                    4.605265e-01
## factor(activity)2                    5.277800e-01
## agegroups[45,50)                     6.459744e-03
## agegroups[50,55)                     7.640543e-09
## agegroups[55,60)                     2.367322e-15
## agegroups[60,65)                     8.275383e-20
## agegroups[65,70)                     6.315099e-25
## agegroups[70,75)                     1.152897e-05
## sexMale                              8.348018e-02
## alcohol                              8.710873e-01
## height.scale                         4.793206e-01
## assessment_center11002               5.632798e-01
## assessment_center11003               2.132758e-01
## assessment_center11004               6.771664e-01
## assessment_center11005               9.988955e-01
## assessment_center11006               3.887733e-01
```

```
## assessment_center11007            5.021884e-01
## assessment_center11008            2.149349e-01
## assessment_center11009            2.091254e-01
## assessment_center11010            1.166431e-01
## assessment_center11011            3.910594e-01
## assessment_center11012            3.393120e-01
## assessment_center11013            1.595281e-01
## assessment_center11014            2.540905e-01
## assessment_center11016            4.194720e-02
## assessment_center11017            3.706012e-01
## assessment_center11018            2.312715e-01
## assessment_center11020            6.601925e-02
## assessment_center11021            8.607604e-03
## assessment_center11022            1.047413e-01
## assessment_center11023            3.258142e-01
## waist.scale                       7.863360e-03
## factor(smoke.status)1             3.316619e-02
## factor(smoke.status)2             5.146502e-01
## redmeat.numeric.scale             1.469827e-01
## process_meat.scale                1.260089e-02
## veg.numeric.scale                 7.560892e-01
## birth.x.scale                     3.628299e-01
## birth.y.scale                     9.265464e-01
## prs_scaled:birth.x.scale          9.130049e-01
## prs_scaled:birth.y.scale          4.085373e-01
## prs_scaled:factor(activity)1      5.449687e-02
## prs_scaled:factor(activity)2      2.302396e-01
## prs_scaled:agegroups[45,50)       5.366138e-01
## prs_scaled:agegroups[50,55)       5.121596e-01
## prs_scaled:agegroups[55,60)       7.765639e-01
## prs_scaled:agegroups[60,65)       3.379157e-01
## prs_scaled:agegroups[65,70)       2.877644e-01
## prs_scaled:agegroups[70,75)       2.051664e-03
## prs_scaled:sexMale                9.121202e-01
## prs_scaled:alcohol                3.132407e-01
## prs_scaled:height.scale           6.244509e-01
## prs_scaled:waist.scale            6.847256e-01
## prs_scaled:veg.numeric.scale      5.748277e-01
## prs_scaled:redmeat.numeric.scale  5.960806e-01
## prs_scaled:factor(smoke.status)1  7.204391e-01
## prs_scaled:factor(smoke.status)2  4.850105e-01
## prs_scaled:process_meat.scale     2.319622e-01
## eta_X.Intercept.                  1.599267e-01
## eta_PC1                           3.634644e-01
## eta_PC2                           4.920164e-01
## eta_PC3                           8.653937e-01
## eta_PC4                           9.689412e-01
## eta_PC5                           4.672854e-01
## eta_PC6                           9.809905e-01
## eta_PC7                           8.331499e-02
## eta_PC8                           9.439807e-01
## eta_PC9                           7.579530e-01
## eta_PC10                          5.276837e-01
## eta_birth.x.scale                 8.215025e-01
```

```
## eta_birth.y.scale                        4.534700e-01
## sigma_stratadata[, facVar]11001    4.820683e-59
## sigma_stratadata[, facVar]11002    4.231180e-64
## sigma_stratadata[, facVar]11003    6.817297e-75
## sigma_stratadata[, facVar]11004    3.637392e-77
## sigma_stratadata[, facVar]11005    1.987540e-73
## sigma_stratadata[, facVar]11006    1.120575e-70
## sigma_stratadata[, facVar]11007   2.352523e-121
## sigma_stratadata[, facVar]11008   7.471907e-117
## sigma_stratadata[, facVar]11009   2.014135e-141
## sigma_stratadata[, facVar]11010   4.556747e-168
## sigma_stratadata[, facVar]11011   7.368652e-160
## sigma_stratadata[, facVar]11012    4.104889e-40
## sigma_stratadata[, facVar]11013   3.947025e-124
## sigma_stratadata[, facVar]11014   3.825351e-108
## sigma_stratadata[, facVar]11016   3.526570e-133
## sigma_stratadata[, facVar]11017    3.738992e-66
## sigma_stratadata[, facVar]11018    1.383342e-79
## sigma_stratadata[, facVar]11020    5.255818e-75
## sigma_stratadata[, facVar]11021    3.030379e-74
## sigma_stratadata[, facVar]11022    6.457688e-07
## sigma_stratadata[, facVar]11023    1.826344e-02
```

```
summary(fit_cc_glm)
```

```
##
## Call:
## glm(formula = colorectal_cancer ~ prs_scaled + PC1 + PC2 + PC3 +
##     PC4 + PC5 + PC6 + PC7 + PC8 + PC9 + PC10 + factor(activity) +
##     agegroups + sex + alcohol + height.scale + assessment_center +
##     waist.scale + factor(smoke.status) + redmeat.numeric.scale +
##     process_meat.scale + veg.numeric.scale + birth.x.scale +
##     birth.y.scale + prs_scaled:birth.x.scale + prs_scaled:birth.y.scale +
##     prs_scaled:factor(activity) + prs_scaled:agegroups + prs_scaled:sex +
##     prs_scaled:alcohol + prs_scaled:height.scale + prs_scaled:waist.scale +
##     prs_scaled:veg.numeric.scale + prs_scaled:redmeat.numeric.scale +
##     prs_scaled:factor(smoke.status) + prs_scaled:process_meat.scale,
##     family = binomial(), data = dat_test_casecontrol, model = FALSE,
##     x = FALSE, y = FALSE)
##
## Deviance Residuals:
##     Min      1Q  Median      3Q     Max
## -2.318  -1.052   0.511   1.014   2.429
##
## Coefficients:
##                                 Estimate Std. Error z value Pr(>|z|)
## (Intercept)                    -1.863871   0.373154  -4.995 5.89e-07 ***
## prs_scaled                      0.499497   0.238532   2.094  0.03626 *
## PC1                            -0.031221   0.017375  -1.797  0.07235 .
## PC2                            -0.001645   0.020718  -0.079  0.93672
## PC3                             0.001455   0.022458   0.065  0.94835
## PC4                            -0.007664   0.011006  -0.696  0.48620
## PC5                             0.012662   0.006421   1.972  0.04861 *
## PC6                             0.003961   0.021718   0.182  0.85527
```

```
## PC7                            -0.007049  0.013208  -0.534  0.59355
## PC8                            -0.036849  0.015732  -2.342  0.01917 *
## PC9                            -0.017327  0.009147  -1.894  0.05821 .
## PC10                           -0.010266  0.018004  -0.570  0.56853
## factor(activity)1              -0.069999  0.105282  -0.665  0.50613
## factor(activity)2              -0.044384  0.107349  -0.413  0.67927
## agegroups[45,50)                0.677336  0.238974   2.834  0.00459 **
## agegroups[50,55)                1.262668  0.221802   5.693 1.25e-08 ***
## agegroups[55,60)                1.721197  0.217963   7.897 2.86e-15 ***
## agegroups[60,65)                1.946960  0.213114   9.136  < 2e-16 ***
## agegroups[65,70)                2.228565  0.216040  10.315  < 2e-16 ***
## agegroups[70,75)                2.227709  0.526871   4.228 2.36e-05 ***
## sexMale                         0.218233  0.118283   1.845  0.06504 .
## alcohol                         0.022692  0.104569   0.217  0.82820
## height.scale                    0.034745  0.055813   0.623  0.53360
## assessment_center11002         -0.189062  0.298327  -0.634  0.52625
## assessment_center11003         -0.329364  0.293504  -1.122  0.26179
## assessment_center11004         -0.155371  0.301725  -0.515  0.60659
## assessment_center11005          0.004084  0.298811   0.014  0.98910
## assessment_center11006         -0.234589  0.287361  -0.816  0.41430
## assessment_center11007         -0.162683  0.265678  -0.612  0.54032
## assessment_center11008         -0.360973  0.261192  -1.382  0.16697
## assessment_center11009         -0.327795  0.258923  -1.266  0.20552
## assessment_center11010         -0.411078  0.249548  -1.647  0.09950 .
## assessment_center11011         -0.227754  0.255604  -0.891  0.37291
## assessment_center11012         -0.312083  0.340233  -0.917  0.35901
## assessment_center11013         -0.411595  0.262348  -1.569  0.11667
## assessment_center11014         -0.335384  0.266277  -1.260  0.20784
## assessment_center11016         -0.583197  0.255896  -2.279  0.02266 *
## assessment_center11017         -0.257912  0.293121  -0.880  0.37892
## assessment_center11018         -0.376571  0.285428  -1.319  0.18706
## assessment_center11020         -0.600235  0.288220  -2.083  0.03729 *
## assessment_center11021         -0.713118  0.287651  -2.479  0.01317 *
## assessment_center11022         -0.932136  0.674587  -1.382  0.16704
## assessment_center11023         -1.889872  1.476241  -1.280  0.20048
## waist.scale                     0.122917  0.044748   2.747  0.00602 **
## factor(smoke.status)1           0.179899  0.080391   2.238  0.02523 *
## factor(smoke.status)2          -0.098684  0.135728  -0.727  0.46718
## redmeat.numeric.scale           0.065471  0.040199   1.629  0.10338
## process_meat.scale              0.099055  0.041569   2.383  0.01718 *
## veg.numeric.scale              -0.014606  0.037740  -0.387  0.69875
## birth.x.scale                  -0.036320  0.042846  -0.848  0.39662
## birth.y.scale                  -0.005420  0.052999  -0.102  0.91855
## prs_scaled:birth.x.scale        0.019313  0.038553   0.501  0.61641
## prs_scaled:birth.y.scale        0.036272  0.039235   0.924  0.35524
## prs_scaled:factor(activity)1   -0.091153  0.108538  -0.840  0.40101
## prs_scaled:factor(activity)2   -0.011432  0.111961  -0.102  0.91867
## prs_scaled:agegroups[45,50)    -0.016787  0.241636  -0.069  0.94461
## prs_scaled:agegroups[50,55)    -0.175490  0.223036  -0.787  0.43139
## prs_scaled:agegroups[55,60)     0.062828  0.220620   0.285  0.77581
## prs_scaled:agegroups[60,65)    -0.129553  0.212461  -0.610  0.54201
## prs_scaled:agegroups[65,70)    -0.113264  0.216266  -0.524  0.60047
## prs_scaled:agegroups[70,75)    -0.874803  0.506897  -1.726  0.08438 .
## prs_scaled:sexMale              0.128997  0.125349   1.029  0.30343
```

```
## prs_scaled:alcohol                  -0.001814   0.106803  -0.017  0.98645
## prs_scaled:height.scale             -0.040993   0.059002  -0.695  0.48720
## prs_scaled:waist.scale              -0.015674   0.046448  -0.337  0.73578
## prs_scaled:veg.numeric.scale        -0.019426   0.037445  -0.519  0.60390
## prs_scaled:redmeat.numeric.scale     0.024491   0.042442   0.577  0.56391
## prs_scaled:factor(smoke.status)1     0.124121   0.085627   1.450  0.14718
## prs_scaled:factor(smoke.status)2     0.121209   0.137469   0.882  0.37793
## prs_scaled:process_meat.scale       -0.044091   0.043437  -1.015  0.31008
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for binomial family taken to be 1)
##
##      Null deviance: 4832.6  on 3485   degrees of freedom
## Residual deviance: 4253.3  on 3416   degrees of freedom
## AIC: 4393.3
##
## Number of Fisher Scoring iterations: 4
```

Case-only method

```
summary.caseonly=function (parms, sd, sided = 2)
{
  if (sided != 1)
    sided <- 2
  cols <- c("Estimate", "Std.Error", "Z.value", "Pvalue")
  n <- length(parms)
  ret <- matrix(data = NA, nrow = n, ncol = 4)
  pnames <- c("prs",paste0("prs:",names(parms)[-1]))
  rownames(ret) <- pnames
  colnames(ret) <- cols
  ret[, 1] <- parms
  if (is.null(pnames))
    pnames <- 1:n
  cov <- sd
  ret[, 2] <- cov
  ret[, 3] <- parms/cov
  ret[, 4] <- sided * pnorm(abs(ret[, 3]), lower.tail = FALSE)
  ret
}
dat_caseonly=dat_test_casecontrol[which(dat_test_casecontrol$colorectal_cancer==1),]
fit_caseonly <- lm(prs_scaled~PC1+PC2+PC3+PC4+PC5+PC6+PC7+PC8+PC9+PC10+factor(activity)+agegroups+sex+al
beta_int=fit_caseonly$coefficients[-1]/(sd(fit_caseonly$residuals))^2
sd_int=summary(fit_caseonly)$coef[-1,2]/(sd(fit_caseonly$residuals))^2
mean_prs=mean(dat_test$prs_scaled)
beta_prs=(fit_caseonly$coefficients[1]-mean_prs)/(sd(fit_caseonly$residuals))^2
sd_prs= sqrt(( (summary(fit_caseonly)$coef[1,2])^2 +(sd(fit_caseonly$residuals))^2/dim(dat_test)[1]) /
res_caseonly=summary.caseonly(parms = c(beta_prs,beta_int),sd=c(sd_prs,sd_int))
print(res_caseonly)
```

```
##                          Estimate   Std.Error    Z.value      Pvalue
## prs                  5.827184e-01 0.284327199  2.04946427 0.040416738
```

```
## prs:PC1                       -4.138740e-04 0.013928493 -0.02971420 0.976294986
## prs:PC2                       -1.084352e-02 0.015645398 -0.69308061 0.488258965
## prs:PC3                        9.942647e-03 0.015962695  0.62286768 0.533371481
## prs:PC4                       -1.728694e-03 0.007570297 -0.22835216 0.819372480
## prs:PC5                        1.655533e-03 0.004485775  0.36906280 0.712080913
## prs:PC6                        1.338895e-03 0.015327354  0.08735331 0.930390677
## prs:PC7                        9.665850e-03 0.009585812  1.00834967 0.313286626
## prs:PC8                        7.401666e-05 0.011339744  0.00652719 0.994792093
## prs:PC9                       -5.193578e-03 0.005982193 -0.86817300 0.385299633
## prs:PC10                       5.718053e-03 0.012443497  0.45952142 0.645859774
## prs:factor(activity)1         -1.361187e-01 0.070945011 -1.91865041 0.055028591
## prs:factor(activity)2         -8.637115e-02 0.073004923 -1.18308670 0.236774788
## prs:agegroups[45,50)          -1.104074e-01 0.212560037 -0.51941757 0.603469579
## prs:agegroups[50,55)          -1.104802e-01 0.195033043 -0.56646892 0.571075054
## prs:agegroups[55,60)          -5.270008e-02 0.190052069 -0.27729283 0.781555265
## prs:agegroups[60,65)          -1.796503e-01 0.186657671 -0.96245867 0.335819256
## prs:agegroups[65,70)          -1.871272e-01 0.187352497 -0.99879728 0.317892903
## prs:agegroups[70,75)          -1.028864e+00 0.322094902 -3.19428764 0.001401764
## prs:sexMale                    2.047746e-03 0.082894540  0.02470303 0.980291841
## prs:alcohol                   -9.183786e-02 0.073045747 -1.25726497 0.208657702
## prs:height.scale               2.249915e-02 0.038453041  0.58510725 0.558475606
## prs:assessment_center11002    -9.751612e-03 0.196582064 -0.04960581 0.960436520
## prs:assessment_center11003    -2.862691e-01 0.195658613 -1.46310515 0.143438609
## prs:assessment_center11004     5.769232e-02 0.191975672  0.30051891 0.763781375
## prs:assessment_center11005    -5.696873e-03 0.191467975 -0.02975366 0.976263518
## prs:assessment_center11006    -1.887606e-01 0.187322530 -1.00767698 0.313609558
## prs:assessment_center11007    -6.237638e-02 0.173380904 -0.35976500 0.719022876
## prs:assessment_center11008     7.616300e-02 0.170262194  0.44732773 0.654638452
## prs:assessment_center11009     4.951012e-02 0.168042389  0.29462875 0.768277494
## prs:assessment_center11010     5.378413e-02 0.163033002  0.32989718 0.741477654
## prs:assessment_center11011    -8.087335e-02 0.166989485 -0.48430204 0.628171527
## prs:assessment_center11012    -4.101707e-02 0.232775657 -0.17620857 0.860130084
## prs:assessment_center11013     1.556109e-01 0.171923282  0.90511846 0.365402635
## prs:assessment_center11014    -1.880283e-02 0.174286809 -0.10788443 0.914087370
## prs:assessment_center11016     8.111268e-02 0.167391108  0.48456980 0.627981542
## prs:assessment_center11017    -1.421893e-01 0.193431363 -0.73508899 0.462285298
## prs:assessment_center11018     8.689313e-02 0.189931785  0.45749653 0.647314199
## prs:assessment_center11020     1.562422e-01 0.194013487  0.80531607 0.420637311
## prs:assessment_center11021    -1.243123e-01 0.197577143 -0.62918355 0.529228894
## prs:assessment_center11022    -5.704380e-01 0.494862660 -1.15271979 0.249025416
## prs:assessment_center11023     1.518699e+00 1.068121091  1.42184170 0.155072210
## prs:waist.scale               -1.423286e-02 0.030962494 -0.45968063 0.645745475
## prs:factor(smoke.status)1      2.310899e-02 0.055229472  0.41841767 0.675641768
## prs:factor(smoke.status)2      9.970760e-02 0.096695707  1.03114812 0.302471364
## prs:redmeat.numeric.scale     -1.423033e-02 0.027508188 -0.51731267 0.604937908
## prs:process_meat.scale        -3.017425e-02 0.028076845 -1.07470220 0.282508080
## prs:veg.numeric.scale         -1.356384e-02 0.027089596 -0.50070298 0.616580177
## prs:birth.x.scale             -2.236925e-02 0.029285715 -0.76382799 0.444969756
## prs:birth.y.scale              2.313971e-02 0.035927116  0.64407370 0.519527644
```