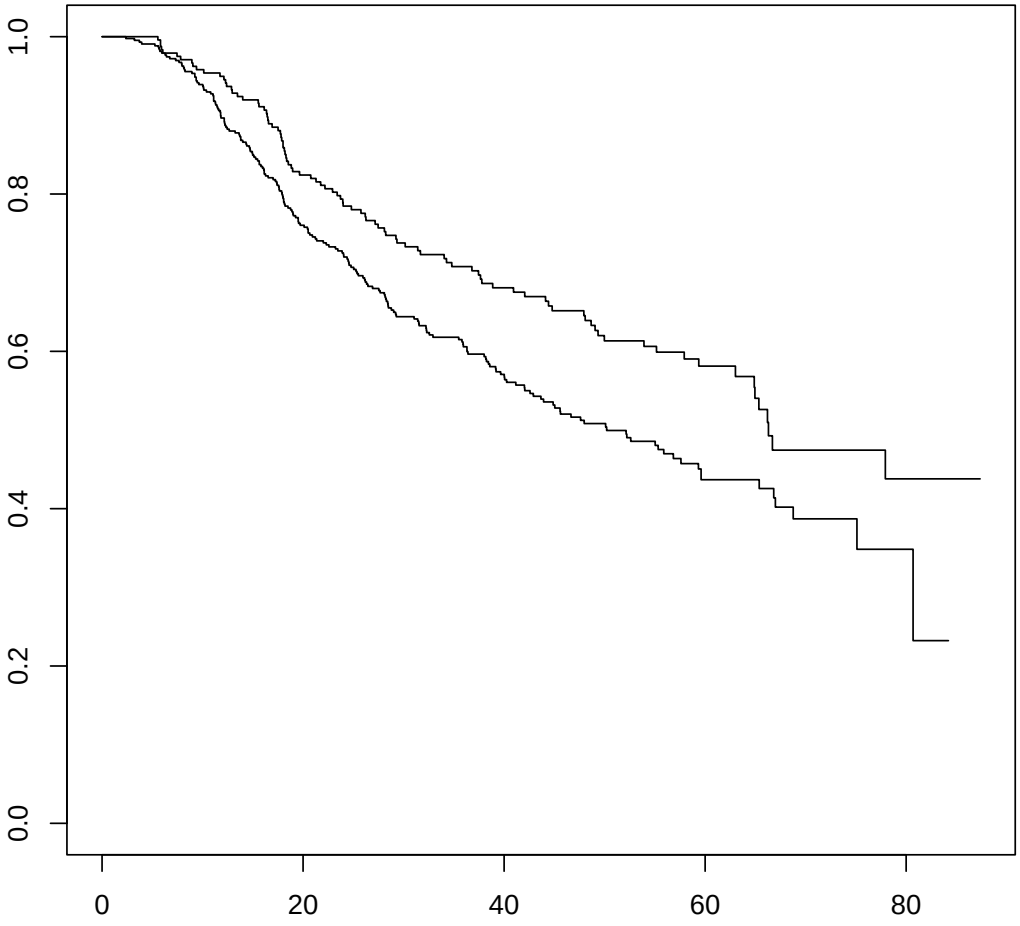
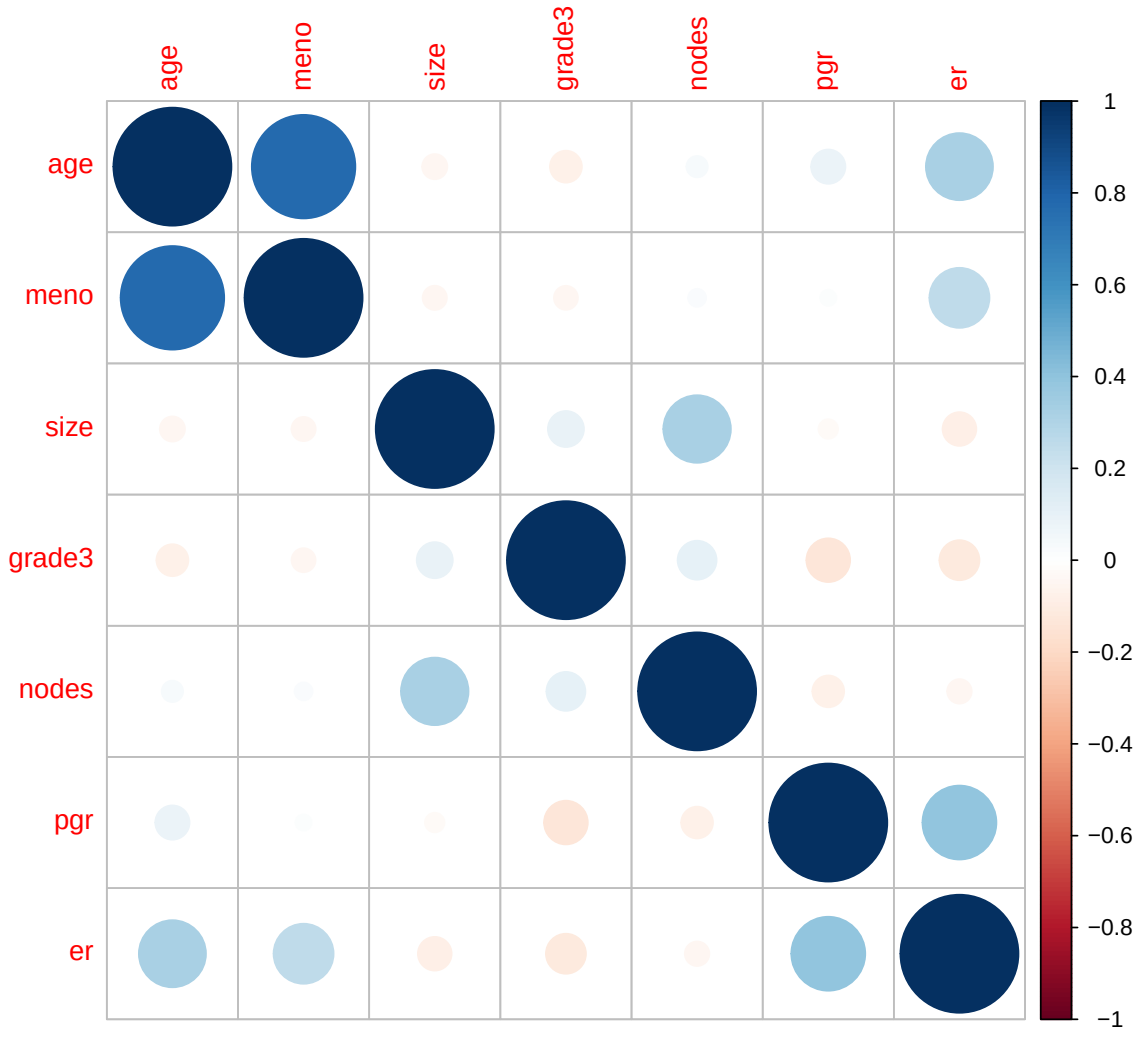
```
rm(list = ls())

# Local github
codepath <- c("/media/larryleon/My Projects/GitHub/Forest-Search/R/")
source(paste0(codepath, "source_forestsearch_v0.R"))
source_fs_functions(file_loc = codepath)

library(kableExtra)
library(knitr)
library(ggplot2)
library(gridExtra)
library(cubature)
library(aVirtualTwins)
library(randomForest)
library(survival)
library(survminer)
library(grf)
library(policytree)
library(data.table)
library(plyr)
library(dplyr)
library(glmnet)
library(corrplot)

library(table1)
library(cli)  # for colors in cat
```

```
t.start.all <- proc.time()[3]

df.analysis <- gbsg
df.analysis <- within(df.analysis, {
    id <- as.numeric(c(1:nrow(df.analysis)))
    # time to months
    time_months <- rfstime/30.4375
    grade3 <- ifelse(grade == "3", 1, 0)
})

confounders.name <- c("age", "meno", "size", "grade3", "nodes", "pgr", "er")

outcome.name <- c("time_months")
event.name <- c("status")
id.name <- c("id")
treat.name <- c("hormon")

plot(survfit(Surv(time_months, status) ~ hormon, data = df.analysis))
```




```
Zm <- cor(as.matrix(df.analysis[, c(confounders.name)]))
corrplot(Zm)
```

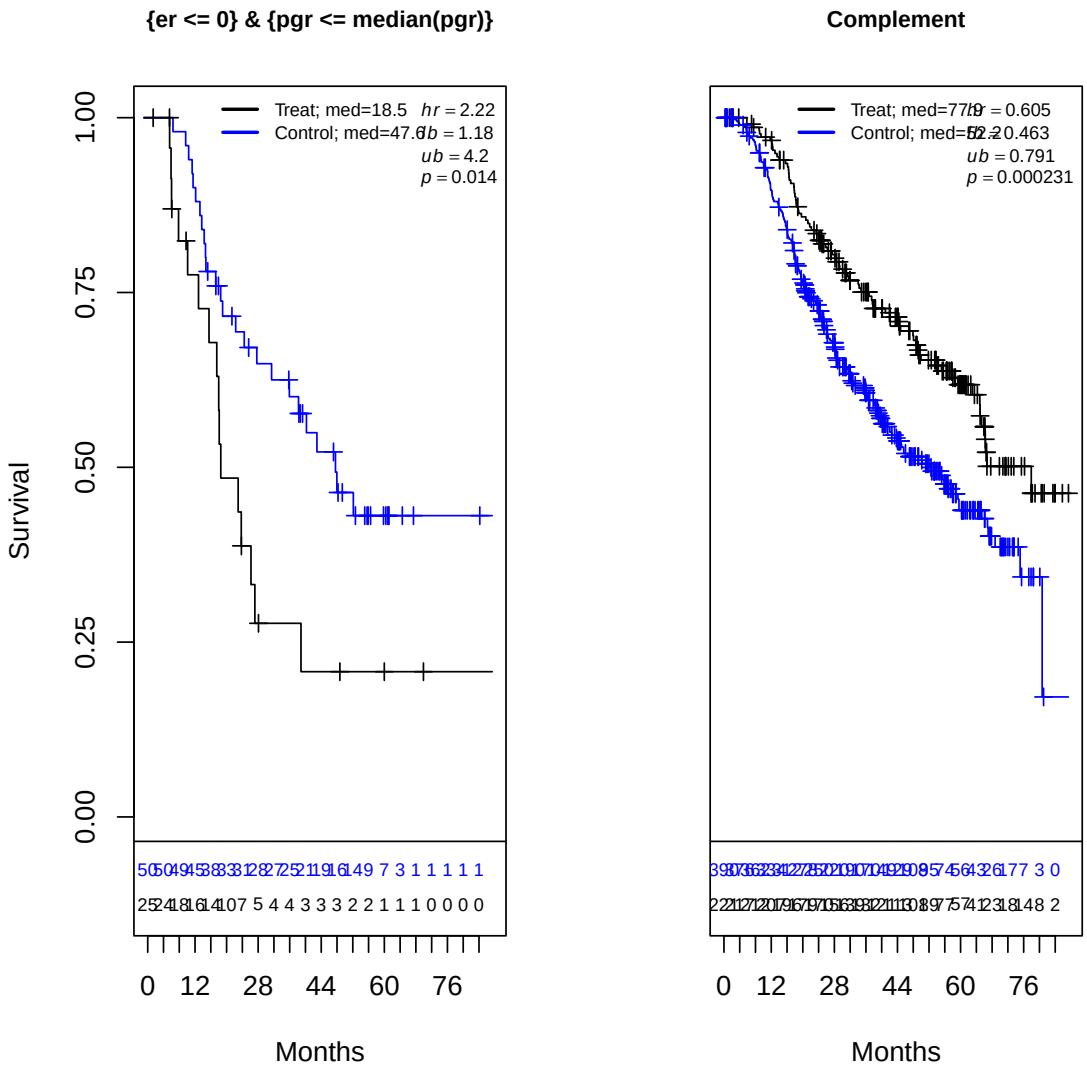



```
# suppressWarnings(table1 (~ age + wtkg + karnof + cd40 + cd80 + hemo + homo +
# drugs + race + gender + oprior + symptom | treat, data=df.analysis))


hr.threshold <- 1.25  # Inititial candidates
hr.consistency <- 1  # Candidates for many splits
pconsistency.threshold <- 0.9

stop.threshold <- 0.99

# NOTE: Allows for Age intervals since GRF cuts at 2 age levels
maxk <- 3

nmin.fs <- 60

pstop_futile <- 0.5

# Limit timing for forestsearch
```

```
max.minutes <- 3
m1.threshold <- Inf  # Turning this off (Default)
# pconsistency.threshold<-0.70 # Minimum threshold (will choose max among
# subgroups satisfying)

fs.splits <- 400  # How many times to split for consistency

# vi is % factor is selected in cross-validation --> higher more important
vi.grf.min <- 0.2
# Null, turns off grf screening

d.min <- 10  # Min number of events for both arms (d0.min=d1.min=d.min)
# default=5

use_lasso <- TRUE
use_grf <- TRUE
use_grf_only <- FALSE

# Now run with stop.threshold
fs.est <- forestsearch(df.analysis = df.analysis, Allconfounders.name = confounders.name,
    details = TRUE, use_lasso = use_lasso, use_grf = use_grf, use_grf_only = use_grf_only,
    dmin.grf = 12, frac.tau = 1, maxk = maxk, max_n_confounders = 11, sg_focus = "hr",
    stop.threshold = stop.threshold, grf_depth = 2, outcome.name = outcome.name,
    treat.name = treat.name, event.name = event.name, id.name = id.name, n.min = nmin.fs,
    hr.threshold = hr.threshold, hr.consistency = hr.consistency, fs.splits = fs.splits,
    d0.min = d.min, d1.min = d.min, pstop_futile = pstop_futile, pconsistency.threshold = pconsisten
    max.minutes = max.minutes, by.risk = 4, plot.sg = TRUE, vi.grf.min = vi.grf.min)
## tau, maxdepth= 77.93018 2
##    leaf.node control.mean control.size control.se treated.mean treated.size
## 1          2     5.698218    82.000000   6.409425    -5.698218    82.000000
## 2          3    -8.273804   604.000000   2.134322     8.273804   604.000000
## 11         4   -19.921490   112.000000   5.374664    19.921490   112.000000
## 21         5     8.189949   177.000000   3.777446    -8.189949   177.000000
## 4          7   -11.509826   356.000000   2.718385    11.509826   356.000000
##    treated.se      diff Nsg depth
## 1    6.409425  11.39644  82     1
## 2    2.134322 -16.54761 604     1
## 11   5.374664 -39.84298 112     2
## 21   3.777446  16.37990 177     2
## 4    2.718385 -23.01965 356     2
##    leaf.node control.mean control.size control.se treated.mean treated.size
## 21         5     8.189949   177.000000   3.777446    -8.189949   177.000000
##    treated.se    diff Nsg depth
## 21   3.777446 16.3799 177     2
## Subgroup found
## [1] "age <= 50" "age <= 43" "er <= 0"
## [1] "age <= 43"
## # of continuous/categorical characteristics 5 2
## Continuous characteristics: age size nodes pgr er
## Categorical characteristics: meno grade3
## CV lambda = 0.01843119
## 7 x 1 sparse Matrix of class "dgCMatrix"
##                  s0
## age     .
## meno    .
```

```
## size    0.005433435
## grade3  0.178139021
## nodes   0.049670523
## pgr    -0.001812895
## er      .
## Cox-LASSO selected: size grade3 nodes pgr
## Cox-LASSO not selected: age meno er
## Median cuts after Lasso: size nodes pgr
## Categorical after Lasso: grade3
## Factors per GRF: age <= 50 age <= 43 er <= 0
## Medians prior to removing if also in GRF: size nodes pgr
## Factors after removing any duplicates also in GRF: size nodes pgr
## ***Factors per lasso after omitting GRF dups***=grade3
## ***Factors per lasso after omitting GRF dups***=size <= median(size)
## ***Factors per lasso after omitting GRF dups***=nodes <= median(nodes)
## ***Factors per lasso after omitting GRF dups***=pgr <= median(pgr)
## Initial GRF cuts included age <= 50 age <= 43 er <= 0
## Factors included per GRF (not in lasso) age <= 50 age <= 43 er <= 0
## # of candidate subgroup factors= 7
## [1] "size <= median(size)"   "nodes <= median(nodes)" "pgr <= median(pgr)"
## [4] "age <= 50"              "age <= 43"              "er <= 0"
## [7] "grade3"
## LMAX= 7
## Confounders per grf screening q6 q1 q7 q4 q2 q3 q5
##   FSconfounders.name     vi.cs
## 6                 q6 0.1931314
## 1                 q1 0.1653027
## 7                 q7 0.1500610
## 4                 q4 0.1394943
## 2                 q2 0.1347695
## 3                 q3 0.1240801
## 5                 q5 0.0931610
## Number of unique levels (L) and possible subgroups= 14 16383
## # of subgroups based on # variables > k.max and excluded (per million) 0.015914
## k.max= 3
## Events criteria for control,exp= 10 10
## # of subgroups with events less than criteria: control, experimental 164 270
## # of subgroups with sample size less than criteria 246
## # of subgroups meeting all criteria = 178
## # of subgroups fitted (Cox model estimable) = 178
## *Subgroup Searching Minutes=* 0.00905
## Number of subgroups meeting HR threshold 14
## # of candidate subgroups (meeting HR criteria) =  14
## Subgroups (1st 10) meeting overall screening thresholds (HR, m1) sorted by HRs= Inf
##     K   n  E d1    m1    m0   HR L(HR) U(HR) q6.0 q6.1 q1.0 q1.1 q7.0 q7.1 q4.0
##  1: 3  80 37 12 16.49    NA 2.51  1.25  5.01    0    0    0    0    0    0    0
##  2: 3  62 35 14 18.53 47.61 2.41  1.21  4.82    0    1    0    0    0    0    0
##  3: 2  75 41 16 18.53 47.61 2.22  1.18  4.20    0    1    0    0    0    0    0
##  4: 2  68 38 14 18.53 47.61 2.16  1.11  4.22    0    1    0    0    0    0    0
##  5: 1  82 45 16 22.93 43.66 1.95  1.05  3.61    0    1    0    0    0    0    0
##  6: 3  84 43 12 27.17 44.88 1.59  0.81  3.10    0    0    0    0    1    0    0
##  7: 3 150 41 15 66.20    NA 1.55  0.82  2.94    1    0    0    0    0    0    0
##  8: 2 177 55 18 66.20    NA 1.53  0.87  2.69    0    0    0    0    0    0    0
##  9: 3  76 39 16 32.41 52.14 1.42  0.75  2.70    0    0    0    0    0    0    0
## 10: 2 142 72 18 27.17 39.66 1.40  0.82  2.39    0    0    0    0    0    0    0
```

```
##     q4.1 q2.0 q2.1 q3.0 q3.1 q5.0 q5.1
##  1:    1    0    0    0    1    1    0
##  2:    0    0    0    0    1    1    0
##  3:    0    0    0    0    1    0    0
##  4:    0    0    0    0    0    1    0
##  5:    0    0    0    0    0    0    0
##  6:    1    0    0    0    1    0    0
##  7:    1    0    0    0    0    1    0
##  8:    1    0    0    0    0    1    0
##  9:    1    1    0    0    0    1    0
## 10:    1    0    0    0    1    0    0
## Consistency 0.975
## # of splits= 400
## Model, % Consistency Met= {age <= 50} {pgr <= median(pgr)} !{age <= 43} 0.975
## Consistency 0.985
## # of splits= 400
## Model, % Consistency Met= {er <= 0} {pgr <= median(pgr)} !{age <= 43} 0.985
## Consistency 0.9925
## # of splits= 400
## Model, % Consistency Met= {er <= 0} {pgr <= median(pgr)} 0.9925
## Number of subgroups meeting consistency criteria=
##     Pcons  N g m K         M.1                  M.2          M.3
## 1: 0.9925 75 6 3 2   {er <= 0} {pgr <= median(pgr)}
## 2: 0.9850 62 7 2 3   {er <= 0} {pgr <= median(pgr)} !{age <= 43}
## 3: 0.9750 80 8 1 3 {age <= 50} {pgr <= median(pgr)} !{age <= 43}
```




```
## [1] "{er <= 0}"            "{pgr <= median(pgr)}"
## % consistency criteria met= 0.9925
## SG focus= hr
## Subgroup Consistency Minutes= 0.06856667
## Subgroup found (FS)
## Minutes overall= 0.0964
```

```
file_out <- c("output/gbsg_results_b=1000_v0a.Rdata")

library(doParallel)
registerDoParallel(parallel::detectCores(logical = FALSE))

cox.formula.boot <- as.formula(paste("Surv(time_months,status)~hormon"))
max.minutes <- 3

# Suggest running 20, first ... to get timing estimate

NB <- 1000
```

```r
df_boot_analysis <- fs.est$df.est

fitH <- get_Cox_sg(df_sg = subset(df_boot_analysis, treat.recommend == 0), cox.formula = cox.formula

H_obs <- fitH$est_obs  # log(hr) scale
seH_obs <- fitH$se_obs
# Hc observed estimates
fitHc <- get_Cox_sg(df_sg = subset(df_boot_analysis, treat.recommend == 1), cox.formula = cox.formul
Hc_obs <- fitHc$est_obs
seHc_obs <- fitHc$se_obs
rm("fitH", "fitHc")

Ystar_mat <- bootYstar({
    ystar <- get_Ystar(boot)
}, boots = NB, seed = 8316951, counter = "boot", export = fun_arg_list_boot)
# Check dimension
if (dim(Ystar_mat)[1] != NB | dim(Ystar_mat)[2] != nrow(df_boot_analysis)) stop("Dimension of Ystar_

# Check 1st 10 bootstraps
ansB <- NULL
for (bb in 1:10) {
    boot <- bb
    ans <- fsboot_forparallel(boot)
    cat_line("***Bootstrap done, B***=", c(boot), col = "blue")
    print(ans)
    ansB <- rbind(ansB, c(bb, ans))
}
```

```
## tau, maxdepth= 66.69405 2
##    leaf.node control.mean control.size control.se treated.mean treated.size
## 1          2     5.188109    85.000000   4.845534    -5.188109    85.000000
## 2          3    -6.692222   601.000000   1.655657     6.692222   601.000000
## 11         4   -16.214534    84.000000   4.989337    16.214534    84.000000
## 21         5     7.998578   133.000000   3.475361    -7.998578   133.000000
## 4          7    -8.991534   412.000000   1.924000     8.991534   412.000000
##    treated.se      diff Nsg depth
## 1    4.845534  10.37622  85     1
## 2    1.655657 -13.38444 601     1
## 11   4.989337 -32.42907  84     2
## 21   3.475361  15.99716 133     2
## 4    1.924000 -17.98307 412     2
##    leaf.node control.mean control.size control.se treated.mean treated.size
## 21         5     7.998578   133.000000   3.475361    -7.998578   133.000000
##    treated.se     diff Nsg depth
## 21   3.475361 15.99716 133     2
## Subgroup found
## [1] "age <= 48" "age <= 42" "er <= 0"
## [1] "age <= 42"
## # of continuous/categorical characteristics 5 2
## Continuous characteristics: age size nodes pgr er
## Categorical characteristics: meno grade3
## CV lambda = 0.01144389
## 7 x 1 sparse Matrix of class "dgCMatrix"
##                    s0
## age    -0.0067445197
```

```
## meno   -0.0334900698
## size    0.0050479396
## grade3  0.3004935560
## nodes   0.0431947483
## pgr    -0.0008205332
## er     -0.0001016426
## Cox-LASSO selected: age meno size grade3 nodes pgr er
## Cox-LASSO not selected:
## Median cuts after Lasso: age size nodes pgr er
## Categorical after Lasso: meno grade3
## Factors per GRF: age <= 48 age <= 42 er <= 0
## Medians prior to removing if also in GRF: age size nodes pgr er
## ***cMed_flag***=age
## ***cMed_flag***=age
## ***cMed_flag***=er
## ***to_exclude***=TRUE
## ***to_exclude***=FALSE
## ***to_exclude***=FALSE
## ***to_exclude***=FALSE
## ***to_exclude***=TRUE
## ***conf.cont_medians***=size
## ***conf.cont_medians***=nodes
## ***conf.cont_medians***=pgr
## Factors after removing any duplicates also in GRF: size nodes pgr
## ***Factors per lasso after omitting GRF dups***=meno
## ***Factors per lasso after omitting GRF dups***=grade3
## ***Factors per lasso after omitting GRF dups***=size <= median(size)
## ***Factors per lasso after omitting GRF dups***=nodes <= median(nodes)
## ***Factors per lasso after omitting GRF dups***=pgr <= median(pgr)
## Initial GRF cuts included age <= 48 age <= 42 er <= 0
## Factors included per GRF (not in lasso) age <= 48 age <= 42 er <= 0
## # of candidate subgroup factors= 8
## [1] "size <= median(size)"   "nodes <= median(nodes)" "pgr <= median(pgr)"
## [4] "age <= 48"              "age <= 42"              "er <= 0"
## [7] "meno"                   "grade3"
## LMAX= 7
## Confounders per grf screening q8 q6 q2 q3 q4 q1 q7
##   FSconfounders.name      vi.cs
## 8                 q8 0.24823961
## 6                 q6 0.21932881
## 2                 q2 0.12182119
## 3                 q3 0.11540089
## 4                 q4 0.11348862
## 1                 q1 0.11333843
## 7                 q7 0.05908588
## Number of unique levels (L) and possible subgroups= 14 16383
## # of subgroups based on # variables > k.max and excluded (per million) 0.015914
## k.max= 3
## Events criteria for control,exp= 10 10
## # of subgroups with events less than criteria: control, experimental 148 287
## # of subgroups with sample size less than criteria 228
## # of subgroups meeting all criteria = 167
## # of subgroups fitted (Cox model estimable) = 167
## *Subgroup Searching Minutes=* 0.01095
## Number of subgroups meeting HR threshold 4
```

```
## # of candidate subgroups (meeting HR criteria) =  4
## Subgroups (1st 10) meeting overall screening thresholds (HR, m1) sorted by HRs= Inf
##      K  n  E d1    m1    m0   HR L(HR) U(HR) q8.0 q8.1 q6.0 q6.1 q2.0 q2.1 q3.0
##  1:  2 75 47 19 18.53 40.25 2.26  1.24  4.09    0    0    0    1    0    0    0
##  2:  1 85 55 19 18.53 40.25 1.84  1.05  3.24    0    0    0    1    0    0    0
##  3:  3 61 37 13 18.00 31.05 1.83  0.93  3.62    0    1    0    0    0    0    0
##  4:  2 90 48 13 23.72 38.24 1.44  0.76  2.73    0    1    0    0    0    0    0
##  5: NA NA NA NA    NA    NA   NA    NA    NA   NA   NA   NA   NA   NA   NA   NA
##  6: NA NA NA NA    NA    NA   NA    NA    NA   NA   NA   NA   NA   NA   NA   NA
##  7: NA NA NA NA    NA    NA   NA    NA    NA   NA   NA   NA   NA   NA   NA   NA
##  8: NA NA NA NA    NA    NA   NA    NA    NA   NA   NA   NA   NA   NA   NA   NA
##  9: NA NA NA NA    NA    NA   NA    NA    NA   NA   NA   NA   NA   NA   NA   NA
## 10: NA NA NA NA    NA    NA   NA    NA    NA   NA   NA   NA   NA   NA   NA   NA
##     q3.1 q4.0 q4.1 q1.0 q1.1 q7.0 q7.1
##  1:    1    0    0    0    0    0    0
##  2:    0    0    0    0    0    0    0
##  3:    0    1    0    1    0    0    0
##  4:    0    0    0    1    0    0    0
##  5:   NA   NA   NA   NA   NA   NA   NA
##  6:   NA   NA   NA   NA   NA   NA   NA
##  7:   NA   NA   NA   NA   NA   NA   NA
##  8:   NA   NA   NA   NA   NA   NA   NA
##  9:   NA   NA   NA   NA   NA   NA   NA
## 10:   NA   NA   NA   NA   NA   NA   NA
## Consistency 0.9925
## # of splits= 400
## Model, % Consistency Met= {er <= 0} {pgr <= median(pgr)} 0.9925
## SG focus= hr
## Subgroup Consistency Minutes= 0.02151667
## Subgroup found (FS)
## Minutes overall= 0.04331667
## ***Bootstrap done, B***=1
##    H_biasadj_1 H_biasadj_2 Hc_biasadj_1 Hc_biasadj_2 tmins_search max_sg_est
## 1:    0.700942   0.6849777   -0.4357494   -0.3229908   0.01091667   2.257594
## tau, maxdepth= 66.69405 2
##   leaf.node control.mean control.size control.se treated.mean treated.size
## 1         2    11.355910    87.000000   4.306807   -11.355910    87.000000
## 2         3    -6.735298   599.000000   1.605803     6.735298   599.000000
## 3         4    12.168174    84.000000   4.409105   -12.168174    84.000000
## 4         5    -9.961720   294.000000   2.411649     9.961720   294.000000
## 5         6    10.058065    70.000000   4.176711   -10.058065    70.000000
## 6         7    -7.747583   238.000000   2.370839     7.747583   238.000000
##   treated.se      diff Nsg depth
## 1   4.306807  22.71182  87     1
## 2   1.605803 -13.47060 599     1
## 3   4.409105  24.33635  84     2
## 4   2.411649 -19.92344 294     2
## 5   4.176711  20.11613  70     2
## 6   2.370839 -15.49517 238     2
##   leaf.node control.mean control.size control.se treated.mean treated.size
## 3         4    12.168174    84.000000   4.409105   -12.168174    84.000000
##   treated.se     diff Nsg depth
## 3   4.409105 24.33635  84     2
## Subgroup found
## [1] "pgr <= 43" "er <= 0"   "pgr <= 74"
```

```
## [1] "er <= 0"
## # of continuous/categorical characteristics 5 2
## Continuous characteristics: age size nodes pgr er
## Categorical characteristics: meno grade3
## CV lambda = 0.009164127
## 7 x 1 sparse Matrix of class "dgCMatrix"
##                   s0
## age     .
## meno    0.0655875411
## size    0.0105561880
## grade3  0.3796314845
## nodes   0.0421993621
## pgr    -0.0017537694
## er     -0.0001772295
## Cox-LASSO selected: meno size grade3 nodes pgr er
## Cox-LASSO not selected: age
## Median cuts after Lasso: size nodes pgr er
## Categorical after Lasso: meno grade3
## Factors per GRF: pgr <= 43 er <= 0 pgr <= 74
## Medians prior to removing if also in GRF: size nodes pgr er
## ***cMed_flag***=pgr
## ***cMed_flag***=er
## ***cMed_flag***=pgr
## ***to_exclude***=FALSE
## ***to_exclude***=FALSE
## ***to_exclude***=TRUE
## ***to_exclude***=TRUE
## ***conf.cont_medians***=size
## ***conf.cont_medians***=nodes
## Factors after removing any duplicates also in GRF: size nodes
## ***Factors per lasso after omitting GRF dups***=meno
## ***Factors per lasso after omitting GRF dups***=grade3
## ***Factors per lasso after omitting GRF dups***=size <= median(size)
## ***Factors per lasso after omitting GRF dups***=nodes <= median(nodes)
## Initial GRF cuts included pgr <= 43 er <= 0 pgr <= 74
## Factors included per GRF (not in lasso) pgr <= 43 er <= 0 pgr <= 74
## # of candidate subgroup factors= 7
## [1] "size <= median(size)"   "nodes <= median(nodes)" "pgr <= 43"
## [4] "er <= 0"                "pgr <= 74"              "meno"
## [7] "grade3"
## LMAX= 7
## Confounders per grf screening q4 q7 q2 q1 q3 q6 q5
##   FSconfounders.name      vi.cs
## 4                 q4 0.40460324
## 7                 q7 0.15888880
## 2                 q2 0.09889540
## 1                 q1 0.09737508
## 3                 q3 0.08252573
## 6                 q6 0.07979085
## 5                 q5 0.07792090
## Number of unique levels (L) and possible subgroups= 14 16383
## # of subgroups based on # variables > k.max and excluded (per million) 0.015914
## k.max= 3
## Events criteria for control,exp= 10 10
## # of subgroups with events less than criteria: control, experimental 164 248
```

```
## # of subgroups with sample size less than criteria 216
## # of subgroups meeting all criteria = 184
## # of subgroups fitted (Cox model estimable) = 184
## *Subgroup Searching Minutes=* 0.008733333
## Number of subgroups meeting HR threshold 16
## # of candidate subgroups (meeting HR criteria) =  16
## Subgroups (1st 10) meeting overall screening thresholds (HR, m1) sorted by HRs= Inf
##     K   n  E d1    m1    m0   HR L(HR) U(HR) q4.0 q4.1 q7.0 q7.1 q2.0 q2.1 q1.0
##  1: 1  87 57 24 12.88 47.61 3.39  1.97  5.83    0    1    0    0    0    0    0
##  2: 2  70 24 12 59.37 65.38 2.41  1.07  5.44    0    0    0    0    0    0    0
##  3: 3  70 24 12 59.37 65.38 2.41  1.07  5.44    1    0    0    0    0    0    0
##  4: 2  62 31 10 18.00 43.93 2.00  0.93  4.29    0    0    0    1    0    0    0
##  5: 2 144 82 23 17.81 39.20 1.60  0.99  2.60    0    0    0    1    0    0    0
##  6: 3  85 64 20 12.88 17.58 1.57  0.92  2.67    0    0    0    1    1    0    0
##  7: 2 154 85 24 18.00 39.20 1.47  0.91  2.36    0    0    0    1    0    0    0
##  8: 3  91 66 20 12.88 18.76 1.42  0.84  2.41    0    0    0    1    1    0    0
##  9: 3  73 46 10 17.51 27.66 1.41  0.67  2.96    0    0    0    0    0    0    1
## 10: 2 107 76 23 12.88 20.50 1.38  0.83  2.27    0    0    0    1    1    0    0
##     q1.1 q3.0 q3.1 q6.0 q6.1 q5.0 q5.1
##  1:    0    0    0    0    0    0    0
##  2:    0    1    0    0    0    0    1
##  3:    0    1    0    0    0    0    1
##  4:    1    0    0    0    0    0    0
##  5:    0    0    1    0    0    0    0
##  6:    0    0    1    0    0    0    0
##  7:    0    0    0    0    0    0    1
##  8:    0    0    0    0    0    0    1
##  9:    0    0    1    1    0    0    0
## 10:    0    0    0    0    0    0    0
## Consistency 1
## # of splits= 400
## Model, % Consistency Met= {er <= 0} 1
## SG focus= hr
## Subgroup Consistency Minutes= 0.02151667
## Subgroup found (FS)
## Minutes overall= 0.03965
## ***Bootstrap done, B***=2
##    H_biasadj_1 H_biasadj_2 Hc_biasadj_1 Hc_biasadj_2 tmins_search max_sg_est
## 1:   0.6681079   0.1177458   -0.3611736   -0.2824913       0.0087   3.385423
## tau, maxdepth= 66.69405 2
##    leaf.node control.mean control.size control.se treated.mean treated.size
## 1          2    13.599979    78.000000   4.540939   -13.599979    78.000000
## 2          3    -8.051902   608.000000   1.601027     8.051902   608.000000
## 11         4   -14.420029   122.000000   3.745840    14.420029   122.000000
## 21         5     9.000873   155.000000   3.142448    -9.000873   155.000000
## 4          7   -10.957677   370.000000   1.950020    10.957677   370.000000
##    treated.se      diff Nsg depth
## 1    4.540939  27.19996  78     1
## 2    1.601027 -16.10380 608     1
## 11   3.745840 -28.84006 122     2
## 21   3.142448  18.00175 155     2
## 4    1.950020 -21.91535 370     2
##   leaf.node control.mean control.size control.se treated.mean treated.size
## 1         2    13.599979    78.000000   4.540939   -13.599979    78.000000
##   treated.se     diff Nsg depth
```

```
## 1   4.540939 27.19996  78     1
## Subgroup found
## [1] "er <= 0"
## [1] "er <= 0"
## # of continuous/categorical characteristics 5 2
## Continuous characteristics: age size nodes pgr er
## Categorical characteristics: meno grade3
## CV lambda = 0.01765235
## 7 x 1 sparse Matrix of class "dgCMatrix"
##                   s0
## age    -0.0003698075
## meno    .
## size    0.0050380318
## grade3  0.1759831893
## nodes   0.0524226554
## pgr    -0.0012033411
## er      .
## Cox-LASSO selected: age size grade3 nodes pgr
## Cox-LASSO not selected: meno er
## Median cuts after Lasso: age size nodes pgr
## Categorical after Lasso: grade3
## Factors per GRF: er <= 0
## Medians prior to removing if also in GRF: age size nodes pgr
## Factors after removing any duplicates also in GRF: age size nodes pgr
## ***Factors per lasso after omitting GRF dups***=grade3
## ***Factors per lasso after omitting GRF dups***=age <= median(age)
## ***Factors per lasso after omitting GRF dups***=size <= median(size)
## ***Factors per lasso after omitting GRF dups***=nodes <= median(nodes)
## ***Factors per lasso after omitting GRF dups***=pgr <= median(pgr)
## Initial GRF cuts included er <= 0
## Factors included per GRF (not in lasso) er <= 0
## # of candidate subgroup factors= 6
## [1] "age <= median(age)"     "size <= median(size)"   "nodes <= median(nodes)"
## [4] "pgr <= median(pgr)"     "er <= 0"                "grade3"
## LMAX= 6
## Confounders per grf screening q3 q4 q6 q5 q1 q2
##   FSconfounders.name     vi.cs
## 3                 q3 0.2048646
## 4                 q4 0.1945507
## 6                 q6 0.1866930
## 5                 q5 0.1816801
## 1                 q1 0.1191562
## 2                 q2 0.1130554
## Number of unique levels (L) and possible subgroups= 12 4095
## # of subgroups based on # variables > k.max and excluded (per million) 0.003797
## k.max= 3
## Events criteria for control,exp= 10 10
## # of subgroups with events less than criteria: control, experimental 112 156
## # of subgroups with sample size less than criteria 138
## # of subgroups meeting all criteria = 136
## # of subgroups fitted (Cox model estimable) = 136
## *Subgroup Searching Minutes=* 0.00585
## Number of subgroups meeting HR threshold 12
## # of candidate subgroups (meeting HR criteria) =  12
## Subgroups (1st 10) meeting overall screening thresholds (HR, m1) sorted by HRs= Inf
```

```
##     K   n  E d1    m1    m0   HR L(HR) U(HR) q3.0 q3.1 q4.0 q4.1 q6.0 q6.1 q5.0
##  1: 2  72 35 15 18.53    NA 3.88  1.94  7.76    0    0    0    1    0    0    0
##  2: 1  78 38 15 18.53    NA 3.04  1.56  5.92    0    0    0    0    0    0    0
##  3: 3  78 45 13 18.00 38.24 1.85  0.97  3.54    0    0    0    1    0    1    0
##  4: 3  97 72 29 18.00 24.38 1.62  1.01  2.60    1    0    0    1    0    0    0
##  5: 3  64 43 17 17.46 28.22 1.44  0.77  2.70    1    0    0    0    0    1    0
##  6: 3  92 63 32 23.72 28.42 1.44  0.87  2.37    1    0    0    0    0    0    0
##  7: 3  80 47 10 27.70 36.40 1.41  0.70  2.84    0    0    0    1    0    0    0
##  8: 3  97 44 12 34.27 44.88 1.40  0.72  2.72    0    0    0    1    0    0    0
##  9: 2 177 91 22 28.22 39.16 1.39  0.86  2.25    0    0    0    1    0    0    0
## 10: 3  87 62 17 16.43 20.50 1.37  0.78  2.41    1    0    0    1    0    0    0
##     q5.1 q1.0 q1.1 q2.0 q2.1
##  1:    1    0    0    0    0
##  2:    1    0    0    0    0
##  3:    0    0    0    1    0
##  4:    0    0    0    1    0
##  5:    0    0    0    1    0
##  6:    0    1    0    1    0
##  7:    0    0    1    1    0
##  8:    0    0    1    0    1
##  9:    0    0    1    0    0
## 10:    0    0    1    0    0
## Consistency 1
## # of splits= 400
## Model, % Consistency Met= {pgr <= median(pgr)} {er <= 0} 1
## SG focus= hr
## Subgroup Consistency Minutes= 0.0212
## Subgroup found (FS)
## Minutes overall= 0.03643333
## ***Bootstrap done, B***=3
##    H_biasadj_1 H_biasadj_2 Hc_biasadj_1 Hc_biasadj_2 tmins_search max_sg_est
## 1:   0.4462737  -0.1104955    -0.368787   -0.2569119       0.0058   3.877166
## tau, maxdepth= 75.10472 2
##   leaf.node control.mean control.size control.se treated.mean treated.size
## 1         2    -9.044924   660.000000   1.834078     9.044924   660.000000
## 2         4   -22.426090   102.000000   4.532073    22.426090   102.000000
## 3         5    12.170876   113.000000   3.802054   -12.170876   113.000000
## 4         6     6.350012    75.000000   5.676159    -6.350012    75.000000
## 5         7   -12.853668   396.000000   2.351096    12.853668   396.000000
##   treated.se      diff Nsg depth
## 1   1.834078 -18.08985 660     1
## 2   4.532073 -44.85218 102     2
## 3   3.802054  24.34175 113     2
## 4   5.676159  12.70002  75     2
## 5   2.351096 -25.70734 396     2
##   leaf.node control.mean control.size control.se treated.mean treated.size
## 3         5    12.170876   113.000000   3.802054   -12.170876   113.000000
##   treated.se     diff Nsg depth
## 3   3.802054 24.34175 113     2
## Subgroup found
## [1] "age <= 47" "age <= 43" "er <= 0"
## [1] "age <= 43"
## # of continuous/categorical characteristics 5 2
## Continuous characteristics: age size nodes pgr er
## Categorical characteristics: meno grade3
```

```
## CV lambda = 0.02203198
## 7 x 1 sparse Matrix of class "dgCMatrix"
##                 s0
## age     .
## meno    0.009736886
## size    .
## grade3  0.276082230
## nodes   0.051834823
## pgr    -0.001316396
## er      .
## Cox-LASSO selected: meno grade3 nodes pgr
## Cox-LASSO not selected: age size er
## Median cuts after Lasso: nodes pgr
## Categorical after Lasso: meno grade3
## Factors per GRF: age <= 47 age <= 43 er <= 0
## Medians prior to removing if also in GRF: nodes pgr
## Factors after removing any duplicates also in GRF: nodes pgr
## ***Factors per lasso after omitting GRF dups***=meno
## ***Factors per lasso after omitting GRF dups***=grade3
## ***Factors per lasso after omitting GRF dups***=nodes <= median(nodes)
## ***Factors per lasso after omitting GRF dups***=pgr <= median(pgr)
## Initial GRF cuts included age <= 47 age <= 43 er <= 0
## Factors included per GRF (not in lasso) age <= 47 age <= 43 er <= 0
## # of candidate subgroup factors= 7
## [1] "nodes <= median(nodes)" "pgr <= median(pgr)"     "age <= 47"
## [4] "age <= 43"              "er <= 0"                "meno"
## [7] "grade3"
## LMAX= 7
## Confounders per grf screening q7 q5 q1 q2 q6 q3 q4
##   FSconfounders.name      vi.cs
## 7                 q7 0.32940684
## 5                 q5 0.24197554
## 1                 q1 0.15598301
## 2                 q2 0.09636494
## 6                 q6 0.07942378
## 3                 q3 0.05017508
## 4                 q4 0.04667081
## Number of unique levels (L) and possible subgroups= 14 16383
## # of subgroups based on # variables > k.max and excluded (per million) 0.015914
## k.max= 3
## Events criteria for control,exp= 10 10
## # of subgroups with events less than criteria: control, experimental 169 288
## # of subgroups with sample size less than criteria 253
## # of subgroups meeting all criteria = 148
## # of subgroups fitted (Cox model estimable) = 148
## *Subgroup Searching Minutes=* 0.007966667
## Number of subgroups meeting HR threshold 24
## # of candidate subgroups (meeting HR criteria) =  24
## Subgroups (1st 10) meeting overall screening thresholds (HR, m1) sorted by HRs= Inf
##     K   n  E d1    m1    m0   HR L(HR) U(HR) q7.0 q7.1 q5.0 q5.1 q1.0 q1.1 q2.0
##  1: 3  93 22 11 64.95    NA 4.04  1.74  9.40    0    0    0    0    0    0    0
##  2: 3  79 41 16 18.14 52.14 3.33  1.73  6.39    0    0    0    1    0    0    0
##  3: 2 113 25 12 64.95    NA 3.07  1.40  6.76    0    0    0    0    0    0    0
##  4: 3  67 37 13 18.14 47.97 2.84  1.42  5.68    0    0    0    1    0    0    0
##  5: 2  94 53 16 18.14 40.25 2.79  1.52  5.10    0    0    0    1    0    0    0
```

```
##  6: 2  89 46 16 18.53 47.97 2.45  1.33  4.52    0    0    0    1    0    0    0
##  7: 1 104 58 16 18.53 38.57 2.09  1.17  3.74    0    0    0    1    0    0    0
##  8: 2  75 40 13 18.14 43.66 2.07  1.07  4.03    0    0    0    1    0    0    0
##  9: 3  64 32 10 16.71 66.83 1.79  0.85  3.79    0    1    1    0    0    0    0
## 10: 3  61 36 10 13.67 38.24 1.78  0.86  3.71    0    1    0    0    0    0    0
##     q2.1 q6.0 q6.1 q3.0 q3.1 q4.0 q4.1
##  1:    0    1    0    0    1    1    0
##  2:    1    0    0    0    0    1    0
##  3:    0    0    0    0    1    1    0
##  4:    1    0    0    1    0    0    0
##  5:    1    0    0    0    0    0    0
##  6:    0    0    0    0    0    1    0
##  7:    0    0    0    0    0    0    0
##  8:    0    0    0    1    0    0    0
##  9:    0    1    0    0    0    0    0
## 10:    0    1    0    0    1    0    0
## Consistency 0.9875
## # of splits= 400
## Model, % Consistency Met= !{meno} {age <= 47} !{age <= 43} 0.9875
## Consistency 1
## # of splits= 400
## Model, % Consistency Met= {er <= 0} {pgr <= median(pgr)} !{age <= 43} 1
## SG focus= hr
## Subgroup Consistency Minutes= 0.0427
## Subgroup found (FS)
## Minutes overall= 0.06058333
## ***Bootstrap done, B***=4
##    H_biasadj_1 H_biasadj_2 Hc_biasadj_1 Hc_biasadj_2 tmins_search max_sg_est
## 1:   0.7611633   0.5985762   -0.4533966    -0.256304  0.007966667   4.041984
## tau, maxdepth= 66.69405 2
##   leaf.node control.mean control.size control.se treated.mean treated.size
## 1         2    -8.201299   506.000000   1.923748     8.201299   506.000000
## 2         3     3.137727   180.000000   2.579216    -3.137727   180.000000
## 3         4   -11.231654   131.000000   3.819340    11.231654   131.000000
## 4         5     9.829112   128.000000   3.597026    -9.829112   128.000000
## 5         6   -14.563108   280.000000   2.449286    14.563108   280.000000
## 6         7     4.801527   147.000000   2.869781    -4.801527   147.000000
##   treated.se       diff Nsg depth
## 1   1.923748 -16.402597 506     1
## 2   2.579216   6.275454 180     1
## 3   3.819340 -22.463308 131     2
## 4   3.597026  19.658224 128     2
## 5   2.449286 -29.126217 280     2
## 6   2.869781   9.603053 147     2
##   leaf.node control.mean control.size control.se treated.mean treated.size
## 4         5     9.829112   128.000000   3.597026    -9.829112   128.000000
##   treated.se     diff Nsg depth
## 4   3.597026 19.65822 128     2
## Subgroup found
## [1] "age <= 48" "age <= 44" "er <= 101"
## [1] "age <= 44"
## # of continuous/categorical characteristics 5 2
## Continuous characteristics: age size nodes pgr er
## Categorical characteristics: meno grade3
## CV lambda = 0.01499184
```

```
## 7 x 1 sparse Matrix of class "dgCMatrix"
##                   s0
## age    -0.0014966338
## meno    .
## size    0.0026819002
## grade3  .
## nodes   0.0685438158
## pgr    -0.0015853423
## er     -0.0007426255
## Cox-LASSO selected: age size nodes pgr er
## Cox-LASSO not selected: meno grade3
## Median cuts after Lasso: age size nodes pgr er
## Categorical after Lasso:
## Factors per GRF: age <= 48 age <= 44 er <= 101
## Medians prior to removing if also in GRF: age size nodes pgr er
## ***cMed_flag***=age
## ***cMed_flag***=age
## ***cMed_flag***=er
## ***to_exclude***=TRUE
## ***to_exclude***=FALSE
## ***to_exclude***=FALSE
## ***to_exclude***=FALSE
## ***to_exclude***=TRUE
## ***conf.cont_medians***=size
## ***conf.cont_medians***=nodes
## ***conf.cont_medians***=pgr
## Factors after removing any duplicates also in GRF: size nodes pgr
## ***Factors per lasso after omitting GRF dups***=size <= median(size)
## ***Factors per lasso after omitting GRF dups***=nodes <= median(nodes)
## ***Factors per lasso after omitting GRF dups***=pgr <= median(pgr)
## Initial GRF cuts included age <= 48 age <= 44 er <= 101
## Factors included per GRF (not in lasso) age <= 48 age <= 44 er <= 101
## # of candidate subgroup factors= 6
## [1] "size <= median(size)"   "nodes <= median(nodes)" "pgr <= median(pgr)"
## [4] "age <= 48"              "age <= 44"              "er <= 101"
## LMAX= 5
## Confounders per grf screening q6 q1 q4 q3 q2
##   FSconfounders.name     vi.cs
## 6                 q6 0.3127067
## 1                 q1 0.2439341
## 4                 q4 0.1771667
## 3                 q3 0.1242483
## 2                 q2 0.1174634
## Number of unique levels (L) and possible subgroups= 10 1023
## # of subgroups based on # variables > k.max and excluded (per million) 0.000848
## k.max= 3
## Events criteria for control,exp= 10 10
## # of subgroups with events less than criteria: control, experimental 63 87
## # of subgroups with sample size less than criteria 68
## # of subgroups meeting all criteria = 84
## # of subgroups fitted (Cox model estimable) = 84
## *Subgroup Searching Minutes=* 0.003533333
## Number of subgroups meeting HR threshold 11
## # of candidate subgroups (meeting HR criteria) =  11
## Subgroups (1st 10) meeting overall screening thresholds (HR, m1) sorted by HRs= Inf
```

```
##     K   n   E d1    m1    m0   HR L(HR) U(HR) q6.0 q6.1 q1.0 q1.1 q4.0 q4.1
##  1: 3  66  36 10 11.73 39.66 3.30  1.57  6.93    0    0    1    0    0    1
##  2: 2  80  26 15 55.16    NA 2.12  0.97  4.63    1    0    1    0    0    0
##  3: 3  64  44 14  9.76 18.30 2.08  1.09  3.97    0    0    0    0    0    1
##  4: 3 120  62 19 17.51 42.58 1.96  1.14  3.38    0    1    0    0    0    1
##  5: 2 128  66 19 17.51 42.58 1.96  1.15  3.35    0    0    0    0    0    1
##  6: 3 117  59 14 27.17 68.76 1.62  0.88  2.96    0    1    1    0    0    1
##  7: 3  63  20 10 55.16    NA 1.59  0.66  3.83    1    0    1    0    0    0
##  8: 2 147  50 24    NA 66.99 1.36  0.78  2.36    1    0    0    0    1    0
##  9: 2 219 102 23 47.93 68.76 1.33  0.83  2.12    0    1    0    0    0    1
## 10: 3  96  61 16 17.74 28.45 1.29  0.72  2.28    0    1    0    0    0    1
##     q3.0 q3.1 q2.0 q2.1
##  1:    0    1    0    0
##  2:    0    0    0    0
##  3:    0    1    1    0
##  4:    0    1    0    0
##  5:    0    1    0    0
##  6:    0    0    0    0
##  7:    1    0    0    0
##  8:    0    0    0    0
##  9:    0    0    0    0
## 10:    0    0    1    0
## Consistency 0.9949875
## # of splits= 400
## Model, % Consistency Met= !{size <= median(size)} {age <= 48} {pgr <= median(pgr)} 0.994987468671
## SG focus= hr
## Subgroup Consistency Minutes= 0.02148333
## Subgroup found (FS)
## Minutes overall= 0.034
## ***Bootstrap done, B***=5
##    H_biasadj_1 H_biasadj_2 Hc_biasadj_1 Hc_biasadj_2 tmins_search max_sg_est
## 1:   0.2987703   0.4655117   -0.4281458   -0.4833695       0.0035   3.296798
## tau, maxdepth= 75.10472 2
##   leaf.node control.mean control.size control.se treated.mean treated.size
## 1         2    -9.004349   543.000000   1.970610     9.004349   543.000000
## 2         3     3.519685   143.000000   4.016152    -3.519685   143.000000
## 3         4   -11.220478   254.000000   2.998119    11.220478   254.000000
## 4         5     5.642840   100.000000   4.278444    -5.642840   100.000000
## 5         6   -11.509218   265.000000   2.746475    11.509218   265.000000
## 6         7    14.173336    67.000000   5.744199   -14.173336    67.000000
##   treated.se      diff Nsg depth
## 1   1.970610 -18.00870 543     1
## 2   4.016152   7.03937 143     1
## 3   2.998119 -22.44096 254     2
## 4   4.278444  11.28568 100     2
## 5   2.746475 -23.01844 265     2
## 6   5.744199  28.34667  67     2
##   leaf.node control.mean control.size control.se treated.mean treated.size
## 6         7    14.173336    67.000000   5.744199   -14.173336    67.000000
##   treated.se     diff Nsg depth
## 6   5.744199 28.34667  67     2
## Subgroup found
## [1] "age <= 53"  "er <= 44"   "size <= 36"
## [1] "size <= 36"
## # of continuous/categorical characteristics 5 2
```

```
## Continuous characteristics: age size nodes pgr er
## Categorical characteristics: meno grade3
## CV lambda = 0.01673217
## 7 x 1 sparse Matrix of class "dgCMatrix"
##                 s0
## age     .
## meno    0.041853121
## size    0.008292060
## grade3  0.323439843
## nodes   0.040103619
## pgr    -0.002528803
## er      .
## Cox-LASSO selected: meno size grade3 nodes pgr
## Cox-LASSO not selected: age er
## Median cuts after Lasso: size nodes pgr
## Categorical after Lasso: meno grade3
## Factors per GRF: age <= 53 er <= 44 size <= 36
## Medians prior to removing if also in GRF: size nodes pgr
## ***cMed_flag***=size
## ***to_exclude***=TRUE
## ***to_exclude***=FALSE
## ***to_exclude***=FALSE
## ***conf.cont_medians***=nodes
## ***conf.cont_medians***=pgr
## Factors after removing any duplicates also in GRF: nodes pgr
## ***Factors per lasso after omitting GRF dups***=meno
## ***Factors per lasso after omitting GRF dups***=grade3
## ***Factors per lasso after omitting GRF dups***=nodes <= median(nodes)
## ***Factors per lasso after omitting GRF dups***=pgr <= median(pgr)
## Initial GRF cuts included age <= 53 er <= 44 size <= 36
## Factors included per GRF (not in lasso) age <= 53 er <= 44 size <= 36
## # of candidate subgroup factors= 7
## [1] "nodes <= median(nodes)" "pgr <= median(pgr)"     "age <= 53"
## [4] "er <= 44"               "size <= 36"             "meno"
## [7] "grade3"
## LMAX= 7
## Confounders per grf screening q5 q7 q1 q4 q3 q2 q6
##   FSconfounders.name      vi.cs
## 5                 q5 0.33550687
## 7                 q7 0.14473257
## 1                 q1 0.14380982
## 4                 q4 0.11692239
## 3                 q3 0.10767578
## 2                 q2 0.09568279
## 6                 q6 0.05566979
## Number of unique levels (L) and possible subgroups= 14 16383
## # of subgroups based on # variables > k.max and excluded (per million) 0.015914
## k.max= 3
## Events criteria for control,exp= 10 10
## # of subgroups with events less than criteria: control, experimental 167 243
## # of subgroups with sample size less than criteria 219
## # of subgroups meeting all criteria = 192
## # of subgroups fitted (Cox model estimable) = 192
## *Subgroup Searching Minutes=* 0.009533333
## Number of subgroups meeting HR threshold 13
```

```
## # of candidate subgroups (meeting HR criteria) =  13
## Subgroups (1st 10) meeting overall screening thresholds (HR, m1) sorted by HRs= Inf
##     K   n  E d1    m1    m0   HR L(HR) U(HR) q5.0 q5.1 q7.0 q7.1 q1.0 q1.1 q4.0
##  1: 2  67 33 18 21.75 47.61 2.22  1.11  4.44    1    0    0    0    0    0    0
##  2: 3 115 71 17 16.36 31.41 1.75  1.01  3.03    0    0    0    1    0    0    0
##  3: 3  68 41 11 20.76 35.94 1.74  0.86  3.49    0    0    0    1    0    0    0
##  4: 2  95 38 22 44.78    NA 1.53  0.80  2.92    1    0    1    0    0    0    0
##  5: 3  70 46 15 12.88 20.50 1.47  0.79  2.73    0    0    0    1    1    0    0
##  6: 3  61 32 18 29.34 39.66 1.43  0.70  2.92    1    0    1    0    1    0    0
##  7: 2  86 43 18 29.37    NA 1.36  0.74  2.50    1    0    0    0    0    0    0
##  8: 3  78 36 21 59.37 59.33 1.36  0.70  2.64    0    0    0    0    1    0    0
##  9: 2  98 55 23 21.75 28.45 1.35  0.78  2.32    1    0    0    0    1    0    0
## 10: 1 143 65 28 31.41    NA 1.34  0.82  2.19    1    0    0    0    0    0    0
##     q4.1 q3.0 q3.1 q2.0 q2.1 q6.0 q6.1
##  1:    0    1    0    0    0    0    0
##  2:    1    0    0    0    1    0    0
##  3:    1    0    0    0    0    0    1
##  4:    0    0    0    0    0    0    0
##  5:    1    0    0    0    0    0    0
##  6:    0    0    0    0    0    0    0
##  7:    1    0    0    0    0    0    0
##  8:    0    0    0    1    0    0    1
##  9:    0    0    0    0    0    0    0
## 10:    0    0    0    0    0    0    0
## Consistency 0.9725
## # of splits= 400
## Model, % Consistency Met= !{size <= 36} !{age <= 53} 0.9725
## Consistency 0.95
## # of splits= 400
## Model, % Consistency Met= {grade3} {er <= 44} {pgr <= median(pgr)} 0.95
## Consistency 0.835
## Consistency 0.77
## Consistency 0.79
## Consistency 0.6925
## Consistency 0.6525
## Consistency 0.6225
## Consistency 0.715
## Consistency 0.715
## Consistency 0.615
## Consistency 0.53
## Consistency 0.5575
## SG focus= hr
## Subgroup Consistency Minutes= 0.2848333
## Subgroup found (FS)
## Minutes overall= 0.3008833
## ***Bootstrap done, B***=6
##    H_biasadj_1 H_biasadj_2 Hc_biasadj_1 Hc_biasadj_2 tmins_search max_sg_est
## 1:   0.2749672   0.4869534   -0.4851591   -0.5160849       0.0095   2.222482
## tau, maxdepth= 68.76386 2
##   leaf.node control.mean control.size control.se treated.mean treated.size
## 1         2    -6.794352   594.000000   1.708990     6.794352   594.000000
## 2         3     8.388327    92.000000   4.483674    -8.388327    92.000000
## 3         4   -10.782268   126.000000   3.865454    10.782268   126.000000
## 4         5    10.598959   168.000000   3.103245   -10.598959   168.000000
## 5         6   -13.474525   319.000000   2.199612    13.474525   319.000000
```

```
## 6         7     8.386231    73.000000   5.125491    -8.386231    73.000000
##   treated.se      diff Nsg depth
## 1   1.708990 -13.58870 594     1
## 2   4.483674  16.77665  92     1
## 3   3.865454 -21.56454 126     2
## 4   3.103245  21.19792 168     2
## 5   2.199612 -26.94905 319     2
## 6   5.125491  16.77246  73     2
##   leaf.node control.mean control.size control.se treated.mean treated.size
## 4         5    10.598959   168.000000   3.103245   -10.598959   168.000000
##   treated.se     diff Nsg depth
## 4   3.103245 21.19792 168     2
## Subgroup found
## [1] "age <= 50"  "age <= 43"  "size <= 36"
## [1] "age <= 43"
## # of continuous/categorical characteristics 5 2
## Continuous characteristics: age size nodes pgr er
## Categorical characteristics: meno grade3
## CV lambda = 0.02006424
## 7 x 1 sparse Matrix of class "dgCMatrix"
##                 s0
## age     .
## meno    0.155530395
## size    0.004009881
## grade3  .
## nodes   0.050334712
## pgr    -0.001934956
## er      .
## Cox-LASSO selected: meno size nodes pgr
## Cox-LASSO not selected: age grade3 er
## Median cuts after Lasso: size nodes pgr
## Categorical after Lasso: meno
## Factors per GRF: age <= 50 age <= 43 size <= 36
## Medians prior to removing if also in GRF: size nodes pgr
## ***cMed_flag***=size
## ***to_exclude***=TRUE
## ***to_exclude***=FALSE
## ***to_exclude***=FALSE
## ***conf.cont_medians***=nodes
## ***conf.cont_medians***=pgr
## Factors after removing any duplicates also in GRF: nodes pgr
## ***Factors per lasso after omitting GRF dups***=meno
## ***Factors per lasso after omitting GRF dups***=nodes <= median(nodes)
## ***Factors per lasso after omitting GRF dups***=pgr <= median(pgr)
## Initial GRF cuts included age <= 50 age <= 43 size <= 36
## Factors included per GRF (not in lasso) age <= 50 age <= 43 size <= 36
## # of candidate subgroup factors= 6
## [1] "nodes <= median(nodes)" "pgr <= median(pgr)"     "age <= 50"
## [4] "age <= 43"              "size <= 36"             "meno"
## LMAX= 6
## Confounders per grf screening q3 q5 q1 q2 q4 q6
##   FSconfounders.name      vi.cs
## 3                 q3 0.34373668
## 5                 q5 0.23846945
## 1                 q1 0.17924039
```

```
## 2                q2 0.14397947
## 4                q4 0.05345684
## 6                q6 0.04111717
## Number of unique levels (L) and possible subgroups= 12 4095
## # of subgroups based on # variables > k.max and excluded (per million) 0.003797
## k.max= 3
## Events criteria for control,exp= 10 10
## # of subgroups with events less than criteria: control, experimental 119 169
## # of subgroups with sample size less than criteria 150
## # of subgroups meeting all criteria = 107
## # of subgroups fitted (Cox model estimable) = 107
## *Subgroup Searching Minutes=* 0.005666667
## Number of subgroups meeting HR threshold 27
## # of candidate subgroups (meeting HR criteria) =  27
## Subgroups (1st 10) meeting overall screening thresholds (HR, m1) sorted by HRs= Inf
##     K   n  E d1    m1    m0   HR L(HR) U(HR) q3.0 q3.1 q5.0 q5.1 q1.0 q1.1 q2.0
##  1: 3  85 37 17 16.43    NA 5.62  2.87 11.01    0    1    0    0    0    0    0
##  2: 3  70 27 10 16.43    NA 5.48  2.42 12.40    0    0    0    0    0    0    0
##  3: 3  70 36 22 17.74    NA 3.17  1.62  6.23    0    1    0    0    1    0    0
##  4: 3  73 41 27 21.52    NA 3.16  1.63  6.11    0    0    1    0    1    0    0
##  5: 2 168 57 27 24.80    NA 2.88  1.71  4.85    0    1    0    0    0    0    0
##  6: 3 135 39 15 24.80    NA 2.70  1.41  5.19    0    1    0    0    0    0    0
##  7: 3 130 44 19 37.65    NA 2.42  1.33  4.39    0    1    0    1    0    0    0
##  8: 2 155 74 21 16.49 66.83 2.20  1.32  3.69    0    1    0    0    0    0    0
##  9: 2 111 51 29 30.37    NA 2.19  1.26  3.82    0    0    1    0    0    0    0
## 10: 3 122 55 14 17.74 66.83 2.11  1.14  3.91    0    1    0    1    0    0    0
##     q2.1 q4.0 q4.1 q6.0 q6.1
##  1:    1    1    0    0    0
##  2:    1    1    0    1    0
##  3:    0    1    0    0    0
##  4:    0    1    0    0    0
##  5:    0    1    0    0    0
##  6:    0    1    0    1    0
##  7:    0    1    0    0    0
##  8:    1    0    0    0    0
##  9:    0    1    0    0    0
## 10:    1    0    0    0    0
## Consistency 1
## # of splits= 400
## Model, % Consistency Met= {age <= 50} {pgr <= median(pgr)} !{age <= 43} 1
## SG focus= hr
## Subgroup Consistency Minutes= 0.02165
## Subgroup found (FS)
## Minutes overall= 0.03348333
## ***Bootstrap done, B***=7
##    H_biasadj_1 H_biasadj_2 Hc_biasadj_1 Hc_biasadj_2 tmins_search max_sg_est
## 1:    0.230653   0.3890683   -0.3487204   -0.4735544  0.005633333     5.6219
## tau, maxdepth= 75.10472 2
##   leaf.node control.mean control.size control.se treated.mean treated.size
## 1         2     8.897110    80.000000   5.460171    -8.897110    80.000000
## 2         3    -7.075530   606.000000   1.823131     7.075530   606.000000
## 3         4   -19.209861    90.000000   4.805198    19.209861    90.000000
## 4         5     8.717088   167.000000   3.438575    -8.717088   167.000000
## 5         6    14.051673    66.000000   5.800078   -14.051673    66.000000
## 6         7   -11.653661   363.000000   2.272171    11.653661   363.000000
```

```
##   treated.se      diff Nsg depth
## 1   5.460171  17.79422  80     1
## 2   1.823131 -14.15106 606     1
## 3   4.805198 -38.41972  90     2
## 4   3.438575  17.43418 167     2
## 5   5.800078  28.10335  66     2
## 6   2.272171 -23.30732 363     2
##   leaf.node control.mean control.size control.se treated.mean treated.size
## 5         6    14.051673    66.000000   5.800078   -14.051673    66.000000
##   treated.se     diff Nsg depth
## 5   5.800078 28.10335  66     2
## Subgroup found
## [1] "age <= 50" "age <= 43" "er <= 3"
## [1] "er <= 3"
## # of continuous/categorical characteristics 5 2
## Continuous characteristics: age size nodes pgr er
## Categorical characteristics: meno grade3
## CV lambda = 0.03936338
## 7 x 1 sparse Matrix of class "dgCMatrix"
##                   s0
## age     .
## meno    .
## size    0.0102478421
## grade3  .
## nodes   0.0518139829
## pgr    -0.0006167849
## er      .
## Cox-LASSO selected: size nodes pgr
## Cox-LASSO not selected: age meno grade3 er
## Median cuts after Lasso: size nodes pgr
## Categorical after Lasso:
## Factors per GRF: age <= 50 age <= 43 er <= 3
## Medians prior to removing if also in GRF: size nodes pgr
## Factors after removing any duplicates also in GRF: size nodes pgr
## ***Factors per lasso after omitting GRF dups***=size <= median(size)
## ***Factors per lasso after omitting GRF dups***=nodes <= median(nodes)
## ***Factors per lasso after omitting GRF dups***=pgr <= median(pgr)
## Initial GRF cuts included age <= 50 age <= 43 er <= 3
## Factors included per GRF (not in lasso) age <= 50 age <= 43 er <= 3
## # of candidate subgroup factors= 6
## [1] "size <= median(size)"   "nodes <= median(nodes)" "pgr <= median(pgr)"
## [4] "age <= 50"              "age <= 43"              "er <= 3"
## LMAX= 6
## Confounders per grf screening q6 q4 q1 q2 q3 q5
##   FSconfounders.name     vi.cs
## 6                 q6 0.3517081
## 4                 q4 0.1696282
## 1                 q1 0.1421386
## 2                 q2 0.1199226
## 3                 q3 0.1147136
## 5                 q5 0.1018889
## Number of unique levels (L) and possible subgroups= 12 4095
## # of subgroups based on # variables > k.max and excluded (per million) 0.003797
## k.max= 3
## Events criteria for control,exp= 10 10
```

```
## # of subgroups with events less than criteria: control, experimental 105 164
## # of subgroups with sample size less than criteria 150
## # of subgroups meeting all criteria = 113
## # of subgroups fitted (Cox model estimable) = 113
## *Subgroup Searching Minutes=* 0.005683333
## Number of subgroups meeting HR threshold 19
## # of candidate subgroups (meeting HR criteria) =  19
## Subgroups (1st 10) meeting overall screening thresholds (HR, m1) sorted by HRs= Inf
##     K   n  E d1    m1    m0   HR L(HR) U(HR) q6.0 q6.1 q4.0 q4.1 q1.0 q1.1 q2.0
##  1: 3  62 44 26 12.88 24.38 2.41  1.31  4.42    0    1    0    0    0    0    1
##  2: 3  93 54 29 16.36 42.91 2.25  1.31  3.85    0    1    0    0    0    0    0
##  3: 2  66 33 20 20.73 56.84 2.08  1.03  4.19    0    1    1    0    0    0    0
##  4: 3  91 25 11    NA 66.99 2.07  0.94  4.57    0    0    0    1    0    1    0
##  5: 3  73 35 16 17.74    NA 2.03  1.04  3.96    0    0    0    1    0    0    0
##  6: 2 167 54 23 64.95    NA 1.95  1.14  3.35    0    0    0    1    0    0    0
##  7: 2  74 52 26 12.88 21.36 1.95  1.12  3.37    0    1    0    0    0    0    1
##  8: 3 133 33 14    NA    NA 1.94  0.97  3.88    1    0    0    1    0    0    0
##  9: 3  76 29 12 37.65    NA 1.82  0.87  3.83    0    0    0    1    1    0    0
## 10: 2 100 54 29 18.53 45.57 1.72  1.01  2.94    0    1    0    0    0    0    0
##     q2.1 q3.0 q3.1 q5.0 q5.1
##  1:    0    0    0    1    0
##  2:    0    0    1    1    0
##  3:    0    0    0    0    0
##  4:    0    0    0    1    0
##  5:    0    0    1    1    0
##  6:    0    0    0    1    0
##  7:    0    0    0    0    0
##  8:    0    0    0    1    0
##  9:    0    0    0    1    0
## 10:    0    0    0    1    0
## Consistency 0.995
## # of splits= 400
## Model, % Consistency Met= {er <= 3} !{nodes <= median(nodes)} !{age <= 43} 0.995
## SG focus= hr
## Subgroup Consistency Minutes= 0.02135
## Subgroup found (FS)
## Minutes overall= 0.03365
## ***Bootstrap done, B***=8
##    H_biasadj_1 H_biasadj_2 Hc_biasadj_1 Hc_biasadj_2 tmins_search max_sg_est
## 1:   0.4762657   0.1236468   -0.2638629   -0.2251739  0.005683333   2.407159
## tau, maxdepth= 75.10472 2
##   leaf.node control.mean control.size control.se treated.mean treated.size
## 1         2     6.820985    82.000000   5.262939    -6.820985    82.000000
## 2         3    -5.489502   604.000000   1.811470     5.489502   604.000000
## 3         4     6.820985    82.000000   5.262939    -6.820985    82.000000
## 4         5    -9.515197   315.000000   2.558821     9.515197   315.000000
## 5         6     9.749882   129.000000   3.803021    -9.749882   129.000000
## 6         7    -9.850669   160.000000   3.261377     9.850669   160.000000
##   treated.se      diff Nsg depth
## 1   5.262939  13.64197  82     1
## 2   1.811470 -10.97900 604     1
## 3   5.262939  13.64197  82     2
## 4   2.558821 -19.03039 315     2
## 5   3.803021  19.49976 129     2
## 6   3.261377 -19.70134 160     2
```

```
##   leaf.node control.mean control.size control.se treated.mean treated.size
## 5         6     9.749882   129.000000   3.803021    -9.749882   129.000000
##   treated.se     diff Nsg depth
## 5   3.803021 19.49976 129     2
## Subgroup found
## [1] "er <= 49"  "er <= 0"   "pgr <= 80"
## [1] "pgr <= 80"
## # of continuous/categorical characteristics 5 2
## Continuous characteristics: age size nodes pgr er
## Categorical characteristics: meno grade3
## CV lambda = 0.009035554
## 7 x 1 sparse Matrix of class "dgCMatrix"
##                    s0
## age    -0.0009486819
## meno    .
## size    0.0090564154
## grade3  0.2221186352
## nodes   0.0373909670
## pgr    -0.0023773376
## er     -0.0002635831
## Cox-LASSO selected: age size grade3 nodes pgr er
## Cox-LASSO not selected: meno
## Median cuts after Lasso: age size nodes pgr er
## Categorical after Lasso: grade3
## Factors per GRF: er <= 49 er <= 0 pgr <= 80
## Medians prior to removing if also in GRF: age size nodes pgr er
## ***cMed_flag***=er
## ***cMed_flag***=er
## ***cMed_flag***=pgr
## ***to_exclude***=FALSE
## ***to_exclude***=FALSE
## ***to_exclude***=FALSE
## ***to_exclude***=TRUE
## ***to_exclude***=TRUE
## ***conf.cont_medians***=age
## ***conf.cont_medians***=size
## ***conf.cont_medians***=nodes
## Factors after removing any duplicates also in GRF: age size nodes
## ***Factors per lasso after omitting GRF dups***=grade3
## ***Factors per lasso after omitting GRF dups***=age <= median(age)
## ***Factors per lasso after omitting GRF dups***=size <= median(size)
## ***Factors per lasso after omitting GRF dups***=nodes <= median(nodes)
## Initial GRF cuts included er <= 49 er <= 0 pgr <= 80
## Factors included per GRF (not in lasso) er <= 49 er <= 0 pgr <= 80
## # of candidate subgroup factors= 7
## [1] "age <= median(age)"     "size <= median(size)"   "nodes <= median(nodes)"
## [4] "er <= 49"               "er <= 0"                "pgr <= 80"
## [7] "grade3"
## LMAX= 7
## Confounders per grf screening q5 q6 q4 q2 q3 q1 q7
##   FSconfounders.name      vi.cs
## 5                 q5 0.19259817
## 6                 q6 0.18963213
## 4                 q4 0.17126809
## 2                 q2 0.13796966
```

```
## 3                 q3 0.13348107
## 1                 q1 0.09689287
## 7                 q7 0.07815800
## Number of unique levels (L) and possible subgroups= 14 16383
## # of subgroups based on # variables > k.max and excluded (per million) 0.015914
## k.max= 3
## Events criteria for control,exp= 10 10
## # of subgroups with events less than criteria: control, experimental 155 243
## # of subgroups with sample size less than criteria 197
## # of subgroups meeting all criteria = 196
## # of subgroups fitted (Cox model estimable) = 196
## *Subgroup Searching Minutes=* 0.01256667
## Number of subgroups meeting HR threshold 32
## # of candidate subgroups (meeting HR criteria) =  32
## Subgroups (1st 10) meeting overall screening thresholds (HR, m1) sorted by HRs= Inf
##     K   n  E d1    m1    m0   HR L(HR) U(HR) q5.0 q5.1 q6.0 q6.1 q4.0 q4.1 q2.0
##  1: 3  76 34 22 47.93    NA 3.28  1.62  6.65    0    0    0    1    1    0    0
##  2: 3 103 58 40 30.16    NA 2.93  1.67  5.12    0    0    0    1    1    0    0
##  3: 3 105 32 10 47.93    NA 2.86  1.34  6.07    0    0    0    1    0    0    0
##  4: 3  68 36 25 49.35    NA 2.37  1.16  4.84    0    0    0    1    1    0    0
##  5: 3  61 35 16 28.22 50.10 2.28  1.16  4.47    0    0    0    1    1    0    1
##  6: 3 113 48 23 18.30    NA 2.21  1.25  3.91    0    0    0    1    0    0    0
##  7: 1  82 48 19 22.93 40.25 2.10  1.17  3.75    0    1    0    0    0    0    0
##  8: 2 129 71 41 34.79    NA 2.08  1.30  3.33    0    0    0    1    1    0    0
##  9: 3 129 71 41 34.79    NA 2.08  1.30  3.33    1    0    0    1    1    0    0
## 10: 3  83 52 32 30.16 50.10 1.99  1.13  3.49    0    0    0    1    1    0    0
##     q2.1 q3.0 q3.1 q1.0 q1.1 q7.0 q7.1
##  1:    0    0    1    0    0    0    0
##  2:    0    0    0    0    0    1    0
##  3:    0    0    1    0    1    0    0
##  4:    1    0    0    0    0    0    0
##  5:    0    0    0    0    0    0    0
##  6:    1    0    0    0    1    0    0
##  7:    0    0    0    0    0    0    0
##  8:    0    0    0    0    0    0    0
##  9:    0    0    0    0    0    0    0
## 10:    0    0    0    1    0    0    0
## Consistency 1
## # of splits= 400
## Model, % Consistency Met= {pgr <= 80} !{er <= 49} {nodes <= median(nodes)} 1
## SG focus= hr
## Subgroup Consistency Minutes= 0.02146667
## Subgroup found (FS)
## Minutes overall= 0.04355
## ***Bootstrap done, B***=9
##    H_biasadj_1 H_biasadj_2 Hc_biasadj_1 Hc_biasadj_2 tmins_search max_sg_est
## 1:   0.2108472   0.1905532   -0.6174811   -0.9079267   0.01253333   3.284921
## tau, maxdepth= 77.93018 2
##    leaf.node control.mean control.size control.se treated.mean treated.size
## 1          2    -7.835404   592.000000   1.991329     7.835404   592.000000
## 2          3     5.466376    94.000000   5.595669    -5.466376    94.000000
## 11         4   -25.394637    88.000000   5.497696    25.394637    88.000000
## 3          6    10.129600   156.000000   3.827421   -10.129600   156.000000
## 4          7    -8.983529   431.000000   2.280911     8.983529   431.000000
##    treated.se      diff Nsg depth
```

```
## 1    1.991329 -15.67081 592     1
## 2    5.595669  10.93275  94     1
## 11   5.497696 -50.78927  88     2
## 3    3.827421  20.25920 156     2
## 4    2.280911 -17.96706 431     2
##   leaf.node control.mean control.size control.se treated.mean treated.size
## 3         6    10.129600   156.000000   3.827421   -10.129600   156.000000
##   treated.se    diff Nsg depth
## 3   3.827421 20.2592 156     2
## Subgroup found
## [1] "age <= 42"  "size <= 40" "age <= 48"
## [1] "age <= 48"
## # of continuous/categorical characteristics 5 2
## Continuous characteristics: age size nodes pgr er
## Categorical characteristics: meno grade3
## CV lambda = 0.003651612
## 7 x 1 sparse Matrix of class "dgCMatrix"
##                   s0
## age    -0.0284297067
## meno    0.3320838001
## size    0.0058941277
## grade3  0.0830456319
## nodes   0.0663269703
## pgr    -0.0026267022
## er      0.0006369094
## Cox-LASSO selected: age meno size grade3 nodes pgr er
## Cox-LASSO not selected:
## Median cuts after Lasso: age size nodes pgr er
## Categorical after Lasso: meno grade3
## Factors per GRF: age <= 42 size <= 40 age <= 48
## Medians prior to removing if also in GRF: age size nodes pgr er
## ***cMed_flag***=age
## ***cMed_flag***=size
## ***cMed_flag***=age
## ***to_exclude***=TRUE
## ***to_exclude***=TRUE
## ***to_exclude***=FALSE
## ***to_exclude***=FALSE
## ***to_exclude***=FALSE
## ***conf.cont_medians***=nodes
## ***conf.cont_medians***=pgr
## ***conf.cont_medians***=er
## Factors after removing any duplicates also in GRF: nodes pgr er
## ***Factors per lasso after omitting GRF dups***=meno
## ***Factors per lasso after omitting GRF dups***=grade3
## ***Factors per lasso after omitting GRF dups***=nodes <= median(nodes)
## ***Factors per lasso after omitting GRF dups***=pgr <= median(pgr)
## ***Factors per lasso after omitting GRF dups***=er <= median(er)
## Initial GRF cuts included age <= 42 size <= 40 age <= 48
## Factors included per GRF (not in lasso) age <= 42 size <= 40 age <= 48
## # of candidate subgroup factors= 8
## [1] "nodes <= median(nodes)" "pgr <= median(pgr)"     "er <= median(er)"
## [4] "age <= 42"              "size <= 40"             "age <= 48"
## [7] "meno"                   "grade3"
## LMAX= 8
```

```
## Confounders per grf screening q8 q1 q2 q5 q3 q6 q7 q4
##   FSconfounders.name      vi.cs
## 8                 q8 0.22417497
## 1                 q1 0.17373353
## 2                 q2 0.14888770
## 5                 q5 0.13268615
## 3                 q3 0.11571098
## 6                 q6 0.08551550
## 7                 q7 0.08246532
## 4                 q4 0.03682585
## Number of unique levels (L) and possible subgroups= 16 65535
## # of subgroups based on # variables > k.max and excluded (per million) 0.064839
## k.max= 3
## Events criteria for control,exp= 10 10
## # of subgroups with events less than criteria: control, experimental 250 418
## # of subgroups with sample size less than criteria 362
## # of subgroups meeting all criteria = 225
## # of subgroups fitted (Cox model estimable) = 225
## *Subgroup Searching Minutes=* 0.01533333
## Number of subgroups meeting HR threshold 30
## # of candidate subgroups (meeting HR criteria) =  30
## Subgroups (1st 10) meeting overall screening thresholds (HR, m1) sorted by HRs= Inf
##     K   n  E d1    m1    m0   HR L(HR) U(HR) q8.0 q8.1 q1.0 q1.1 q2.0 q2.1 q5.0
##  1: 3  80 31 11 16.43    NA 5.12  2.38 11.05    0    0    0    0    0    1    0
##  2: 3  93 38 12 17.74    NA 2.26  1.13  4.56    0    0    0    0    0    1    0
##  3: 2 156 49 14 37.65    NA 2.14  1.14  4.00    0    0    0    0    0    0    0
##  4: 3 143 47 12 64.95    NA 2.03  1.04  3.94    0    0    0    0    0    0    0
##  5: 2 135 68 17 17.51 44.88 1.90  1.08  3.33    0    0    0    0    0    1    0
##  6: 3  85 37 13 37.65    NA 1.90  0.96  3.75    0    0    0    0    0    0    0
##  7: 3  87 46 13 17.51 44.88 1.84  0.96  3.54    1    0    0    0    0    1    0
##  8: 3  94 45 14 20.76 40.25 1.78  0.94  3.35    0    1    0    0    0    1    0
##  9: 3 127 41 11 64.95    NA 1.77  0.88  3.56    1    0    0    0    0    0    0
## 10: 2 111 44 16 34.79    NA 1.75  0.95  3.24    0    1    0    0    0    0    0
##     q5.1 q3.0 q3.1 q6.0 q6.1 q7.0 q7.1 q4.0 q4.1
##  1:    0    0    0    0    1    0    0    1    0
##  2:    0    0    0    0    0    1    0    1    0
##  3:    0    0    0    0    1    0    0    1    0
##  4:    0    0    0    0    1    1    0    1    0
##  5:    0    0    0    0    1    0    0    0    0
##  6:    0    0    1    0    1    0    0    1    0
##  7:    0    0    0    0    1    0    0    0    0
##  8:    0    0    1    0    0    0    0    0    0
##  9:    0    0    0    0    1    0    0    1    0
## 10:    0    0    0    0    0    0    0    1    0
## Consistency 1
## # of splits= 400
## Model, % Consistency Met= {pgr <= median(pgr)} {age <= 48} !{age <= 42} 1
## SG focus= hr
## Subgroup Consistency Minutes= 0.02155
## Subgroup found (FS)
## Minutes overall= 0.04363333
## ***Bootstrap done, B***=10
##    H_biasadj_1 H_biasadj_2 Hc_biasadj_1 Hc_biasadj_2 tmins_search max_sg_est
## 1:   0.4234103   0.6127372   -0.4304541   -0.4547211   0.01533333   5.123865
print(ansB)
```

```
##          H_biasadj_1 H_biasadj_2 Hc_biasadj_1 Hc_biasadj_2 tmins_search
##  [1,] 1  0.700942    0.6849777   -0.4357494   -0.3229908   0.01091667
##  [2,] 2  0.6681079   0.1177458   -0.3611736   -0.2824913   0.0087
##  [3,] 3  0.4462737   -0.1104955  -0.368787    -0.2569119   0.0058
##  [4,] 4  0.7611633   0.5985762   -0.4533966   -0.256304    0.007966667
##  [5,] 5  0.2987703   0.4655117   -0.4281458   -0.4833695   0.0035
##  [6,] 6  0.2749672   0.4869534   -0.4851591   -0.5160849   0.0095
##  [7,] 7  0.230653    0.3890683   -0.3487204   -0.4735544   0.005633333
##  [8,] 8  0.4762657   0.1236468   -0.2638629   -0.2251739   0.005683333
##  [9,] 9  0.2108472   0.1905532   -0.6174811   -0.9079267   0.01253333
## [10,] 10 0.4234103   0.6127372   -0.4304541   -0.4547211   0.01533333
##       max_sg_est
##  [1,] 2.257594
##  [2,] 3.385423
##  [3,] 3.877166
##  [4,] 4.041984
##  [5,] 3.296798
##  [6,] 2.222482
##  [7,] 5.6219
##  [8,] 2.407159
##  [9,] 3.284921
## [10,] 5.123865
```

```
tB.start <- proc.time()[3]
# Bootstraps
resB <- bootPar({
    ans <- fsboot_forparallel(boot)
}, boots = NB, seed = 8316951, counter = "boot", export = fun_arg_list_boot)
tB.now <- proc.time()[3]
tB.min <- (tB.now - tB.start)/60

doParallel::stopImplicitCluster()

cat("Minutes for Boots", c(NB, tB.min), "\n")
```

```
## Minutes for Boots 1000 3.420917
```

```
cat("Projection per 1000", c(tB.min * (1000/NB)), "\n")
```

```
## Projection per 1000 3.420917
```

```
cat("Propn bootstrap subgroups found =", c(sum(!is.na(resB$H_biasadj_1))/NB), "\n")
```

```
## Propn bootstrap subgroups found = 0.906
```

```
# How many timmed out
cat("Number timmed out=", c(sum(is.na(resB$H_biasadj_1) & resB$tmins_search > max.minutes)),
    "\n")
```

```
## Number timmed out= 0
```

```
H_estimates <- get_dfRes(Hobs = H_obs, seHobs = seH_obs, H1_adj = resB$H_biasadj_2,
    ystar = Ystar_mat, cov_method = "standard", cov_trim = 0, est.scale = "hr")
Hc_estimates <- get_dfRes(Hobs = Hc_obs, seHobs = seHc_obs, H1_adj = resB$Hc_biasadj_2,
    ystar = Ystar_mat, cov_method = "standard", cov_trim = 0, est.scale = "hr")

print(H_estimates)
```

```
##          H0      sdH0 H0_lower H0_upper       H1      sdH1  H1_lower H1_upper
## 1: 2.221839 0.7216747 1.175531 4.199437 1.559683 0.5419412 0.7893517 3.081785
```

```r
print(Hc_estimates)
```

```
##           H0       sdH0  H0_lower  H0_upper        H1      sdH1  H1_lower
## 1: 0.6053876 0.08250687 0.4634738 0.7907547 0.6318803 0.1110367 0.4477732
##     H1_upper
## 1: 0.8916853
```

```r
bootit <- list(H_estimates = H_estimates, Hc_estimates = Hc_estimates)

tall.min <- (tB.now - t.start.all)/60

cat("Overall minutes for analysis", c(tall.min), "\n")
```

```
## Overall minutes for analysis 4.20855
```

```r
if (!is.null(file_out)) save(df.analysis, fs.est, bootit, tall.min, resB, cox.formula.boot,
    file = file_out)
```

```
## H un-adjusted estimates-----:   2.22 (95% CI=1.18,4.2)
## H bias-corrected estimates--:   1.56 (95% CI=0.79,3.08)
## H^c un-adjusted estimates---:   0.61 (95% CI=0.46,0.79)
## H^c bias-corrected estimates:   0.63 (95% CI=0.45,0.89)
```