```r
library(flexsurv)

## Loading required package:  survival
## Loading required package:  splines

library(boot)

##
## Attaching package:  'boot'
##
## The following object is masked from 'package:survival':
##
##     aml

library(randomForestSRC)

## Loading required package:  parallel
##
##  randomForestSRC 1.5.5
##
##  Type rfsrc.news() to see new features, changes, and bug fixes.
##

library(timeROC)

## Loading required package:  pec
## Loading required package:  mvtnorm
## Loading required package:  timereg

library(risksetROC)

## Loading required package:  MASS

library(ggplot2)

## Loading required package:  methods

library(RColorBrewer)
```

```r
pal = brewer.pal(4, "Dark2")
names(pal) = c("gg", "km0", "mskcc.post", "mskcc.pre")
```

1 Preparation

Construct a *preoperative* function based on the Brennan nomogram. The preoperative nature will mean that most prognostic components will need to be marginalized out.

So the preoperative MSKCC score would be:

$$S = 1.4 + 6.1 + 0.8 + 18.2 + 18.9 + 15 + 9 + 15 * Back.pain + 3 * Weight.Loss + -2/15 * Age + 12 + 3\left[Sex = M\right] + 51\left[Hea \tag{1}$$

```r
fit.mskcc = list(
        inputs = list(
        History.Diagnosis.AgeAt = list(
                margins = data.frame(value = 65, fraction = 1),
```

Variable	Preoperative?	Available?	Marginals
Age	Yes	Yes	Linear. 90 =>0, 30 =>8. Therefore $f(x) = -2/15(x - 90) = -2/15x +$
Sex	Yes	Yes	Male risk delta 3
Portal Vein	NO		14.4% YES, risk delta 10, marginal 1.4
Splenectomy	NO		9.9% YES, risk delta 62, marginal 6.1
Margin of resection	NO		20.7% POS, risk delta 4, marginal 0.8
Head.vs.Other	Yes	Yes	Head risk delta 51
Differentiation	NO		14.2% Well, risk delta 0, marginal 0
			56.4% Mod, risk delta 14, marginal 7.9
			29.5% Poor, risk delta 35, marginal 10.3. Overall marginal 18.2
Posterior.margin	NO		86.0% POS, risk delta 22, marginal 18.9
Numb.pos.nodes	NO		Mean 2.1, approx marginal 15
Numb.neg.nodes	NO		Mean 16.9, approx marginal 9
Back.pain	Yes	NO	13.7% YES, risk delta 15, marginal 2.0
T.stage	Yes	Yes	
Weight Loss	Yes	NO	53.7% YES, risk delta 3, marginal 1.6
Max.path.axis	Yes	Yes	

```
                scorefunc = function(x) { x = x; -2/15*pmin(pmax(x, 0), 90) + 12 }),
        Patient.Sex = list(
                margins = data.frame(value = c("M", "F"), fraction = c(0.501, 1-0.501)),
                scorefunc = function(x) { 3*I(x == "M") }),
        Portal.Vein = list(
                margins = data.frame(value = c(TRUE, FALSE), fraction = c(0.144, 1-0.144)),
                scorefunc = function(x) { 10*I(x == TRUE) }),
        Splenectomy = list(
                margins = data.frame(value = c(TRUE, FALSE), fraction = c(0.099, 1-0.099)),
                scorefunc = function(x) { 62*I(x == TRUE) }),
        Treat.MarginPositive = list(
                margins = data.frame(value = c(TRUE, FALSE), fraction = c(0.207, 1-0.207)),
                scorefunc = function(x) { 4*I(x == TRUE) }),
        Path.LocationBody = list(
                margins = data.frame(value = c(FALSE, TRUE), fraction = c(0.894, 1-0.894)),
                scorefunc = function(x) { 51*I(x == TRUE) }),
        Path.Differentiation = list(
                margins = data.frame(value = c("1", "2", "3", "4"), fraction = c(0.142, 0.564, 1-0.142-(
                scorefunc = function(x) { 14*I(x == "2") + 35*I(x == "3") + 35*I(x == "4") }),
        Posterior.Margin = list(
                margins = data.frame(value = c(TRUE, FALSE), fraction = c(0.86, 1-0.86)),
                scorefunc = function(x) { 22*I(x == TRUE) }),
        Path.LN.Involved = list(
                margins = data.frame(value = 2.1, fraction = 1),
                scorefunc = function(x) {
                        x = pmin(40, pmax(x, 0))
                        fitfun = splinefun(c(0, 1, 2, 3, 4, 10, 15, 20, 25, 30, 35, 40), c(0, 14.56, 24.
                        fitfun(x)
                }),
        Path.LN.Negative = list(
                margins = data.frame(value = 16.9, fraction = 1),
                scorefunc = function(x) { (pmin(pmax(x, 0), 90)-90)*-11/90 }),
        Back.pain = list(
                margins = data.frame(value = c(TRUE, FALSE), fraction = c(0.137, 1-0.137)),
                scorefunc = function(x) { 15*I(x == TRUE) }),
```

```
        Stage.pT.Simplified = list(
                margins = data.frame(value = c("T1", "T2", "T34"), fraction = c(0.037, 0.119, 1-0.037-0.
                scorefunc = function(x) { 36*I(x == "T1") + 11*I(x == "T34") }),
                # The following matches the original Brennan nomogram, but was not used as there are too
                # tumours in either the NSWPCN *or* the MSKCC cohorts -- how the T4 coefficient was ever
                # I'll never know.  The T34 coefficient of 11 was arrived at as (0.828*10+(1-0.037-0.119
                # being a frequency-weighted average of the T3 and T4 coefficients.
                # margins = data.frame(value = c("T1", "T2", "T3", "T4"), fraction = c(0.037, 0.119, 0.8
                # scorefunc = function(x) { 36*I(x == "T1") + 10*I(x == "T3") + 63*I(x == "T4") }),
        Weight.loss = list(
                margins = data.frame(value = c(TRUE, FALSE), fraction = c(0.537, 1-0.537)),
                scorefunc = function(x) { 3*I(x == TRUE) }),
        Path.Size = list(
                margins = data.frame(),
                scorefunc = function(x) {
                        x = pmin(16, pmax(x, 0))
                        fitfun = splinefun(c(0, 1, 2, 3, 4, 6, 8, 10, 12, 14, 16), c(0, 29.74, 59.48, 86
                        fitfun(x)
                }) ),
        outputs = list(
                DSS12mo = function(s) {
                        x = pmax(50, pmin(350, s))
                        fitfun = splinefun(c(79.0323, 115.02, 165.524, 197.278, 221.774, 242.339, 261.08
                        y = fitfun(x)
                        pmax(0, pmin(1, y))
                },
                DSS24mo = function(s) {
                        x = pmax(50, pmin(350, s))
                        fitfun = splinefun(c(71.1694, 97.7823, 129.536, 153.73, 174.294, 193.347, 211.79
                        y = fitfun(x)
                        pmax(0, pmin(1, y))
                },
                DSS36mo = function(s) {
                        x = pmax(50, pmin(350, s))
                        fitfun = splinefun(c(69.3548, 101.109, 125.302, 145.867, 164.919, 183.367, 202.7
                        y = fitfun(x)
                        pmax(0, pmin(1, y))
                })
        )

applyNomogram = function(nomogram, data)
{
        scores = rowSums(sapply(names(nomogram$inputs), function(input) {
                if (input %in% colnames(data)) {
                        return(nomogram$inputs[[input]]$scorefunc(data[,input]))
                }
                warning(sprintf("Marginalizing missing variable: %s", input))
                margin_score = sum(nomogram$inputs[[input]]$scorefunc(nomogram$inputs[[input]]$margins$v
                return(rep(margin_score, nrow(data)))
        }))

        outputs = sapply(nomogram$outputs, function(f) f(scores))
        cbind(Score = scores, outputs)
```

```
}
```

2 Model and data loading

Trained models:

```
temp = readRDS("05_final_model.rds")
fit.gg = temp$gg
fit.km0 = temp$km0
data.nswpcn = temp$data.train
```

```
data.glasgow = readRDS("06_Glasgow.rds")
data.glasgow = data.glasgow[data.glasgow$Path.Type %in% c("Pancreatic Adenocarcinoma", "Pancreatic adeno
data.glasgow$Path.LN.Negative = data.glasgow$Path.LN.Inspected - data.glasgow$Path.LN.Involved
data.glasgow$History.Diagnosis.AgeAt = data.glasgow$History.Diagnosis.AgeAt.Cent + 68
data.glasgow$Path.Size = data.glasgow$Path.Size.Cent + 30
data.glasgow$SexM = data.glasgow$Patient.Sex == "M"
data.glasgow$AgeCent = data.glasgow$History.Diagnosis.AgeAt.Cent
data.glasgow$SizeCent = data.glasgow$Path.Size.Cent
data.glasgow$A2 = data.glasgow$Molec.S100A2.DCThresh
data.glasgow$A4 = data.glasgow$Molec.S100A4.DCThresh
data.glasgow$LocBody = data.glasgow$Path.Location != "HOP"
data.glasgow$Time = data.glasgow$History.Death.EventTimeDays
data.glasgow$DSD = data.glasgow$History.DSDeath.Event
```

```
data.apgi = readRDS("06_APGI.rds")
```

```
data.dresden = readRDS("06_Dresden.rds")

data.dresden$History.Diagnosis.AgeAt = data.dresden$History.Surgery.AgeAtYears
data.dresden$History.Diagnosis.AgeAt.Cent = data.dresden$History.Diagnosis.AgeAt - 68
data.dresden$Path.Size = data.dresden$Path.TumourSizeMm
data.dresden$Path.Size.Cent = data.dresden$Path.Size - 30
data.dresden$Stage.pT.Simplified = c("T1" = "T1", "T2" = "T2", "T3" = "T34", "T4" = "T34")[data.dresden$
data.dresden$Patient.Sex = data.dresden$Patient.Gender
data.dresden$SexM = data.dresden$Patient.Sex == "M"
data.dresden$AgeCent = data.dresden$History.Diagnosis.AgeAt.Cent
data.dresden$SizeCent = data.dresden$Path.Size.Cent
data.dresden$A2 = data.dresden$Molec.S100A2.DCThresh
data.dresden$A4 = data.dresden$Molec.S100A4.DCThresh
data.dresden$Path.LocationBody = data.dresden$Path.TumourLocation != "Head"
data.dresden$LocBody = data.dresden$Path.LocationBody
data.dresden$Time = data.dresden$History.Death.EventTimeDays
data.dresden$DSD = data.dresden$History.DSDeath.Event
data.dresden$Treat.MarginPositive = data.dresden$Treat.Surgery.ExcisionStatus != "R0"
data.dresden$Path.Differentiation = data.dresden$Path.Grade

temp.sel = data.dresden$Staging.pM != "M1" & !is.na(data.dresden$Staging.pM) & !is.na(data.dresden$A2) &
data.dresden = data.dresden[temp.sel,]
```

```
summary(data.nswpcn)

##    Patient.ID   Patient.Sex Cohort.ICGC     History.PreviousMalignancy
##  Min.   :   4   F:120       Mode :logical   Mode :logical
##  1st Qu.: 305   M:120       FALSE:240       FALSE:219
##  Median : 621               NA's :0         TRUE :21
##  Mean   : 618                               NA's :0
##  3rd Qu.:1030
##  Max.   :1453
##
##  History.FdrWithPancCancer History.FdrWithAnyCancer History.Diagnosis.Date
##  Mode :logical             Mode :logical            Min.   :1994-03-09
##  FALSE:230                 FALSE:202                1st Qu.:1998-06-26
##  TRUE :8                   TRUE :38                 Median :2001-05-24
##  NA's :2                   NA's :0                  Mean   :2000-12-19
##                                                     3rd Qu.:2003-06-16
##                                                     Max.   :2006-08-14
##
##  History.Diagnosis.AgeAt History.AlcoholLevel History.Smoking.Status
##  Min.   :28.0            0:151                Never  :140
##  1st Qu.:62.0            1: 45                Ceased : 48
##  Median :69.0            2: 22                Current: 52
##  Mean   :67.5            3: 22
##  3rd Qu.:75.0
##  Max.   :87.0
##
##  History.Smoking.PackYears History.Comorbid.Diabetes
##  Min.   : 2.0              Mode :logical
##  1st Qu.:20.0              FALSE:181
##  Median :25.0              TRUE :59
##  Mean   :31.9              NA's :0
##  3rd Qu.:50.0
##  Max.   :80.0
##  NA's   :185
##  History.Comorbid.ChronicPancreatitis History.Recurrence.Event
##  Mode :logical                        Min.   :0.000
##  FALSE:229                            1st Qu.:1.000
##  TRUE :11                             Median :1.000
##  NA's :0                              Mean   :0.971
##                                       3rd Qu.:1.000
##                                       Max.   :1.000
##
##  History.Recurrence.Date History.DSDeath.Event History.Death.Date
##  Min.   :1994-07-21      Min.   :0.000         Min.   :1995-01-12
##  1st Qu.:1999-09-16      1st Qu.:1.000         1st Qu.:1999-11-30
##  Median :2002-06-03      Median :1.000         Median :2002-11-21
##  Mean   :2002-03-05      Mean   :0.963         Mean   :2002-08-01
##  3rd Qu.:2005-01-08      3rd Qu.:1.000         3rd Qu.:2005-04-21
##  Max.   :2009-01-29      Max.   :1.000         Max.   :2011-10-03
##  NA's   :79
##  History.Followup.Date History.Death.EventTimeDays Treat.Resected
##  Min.   :2009-10-24    Min.   :  26                Mode:logical
##  1st Qu.:2009-10-24    1st Qu.: 274                TRUE:240
##  Median :2009-10-24    Median : 476                NA's:0
```

```
##  Mean   :2010-01-06    Mean   : 592
##  3rd Qu.:2010-02-12    3rd Qu.: 771
##  Max.   :2010-06-03    Max.   :2701
##  NA's   :237
##  Treat.ProcedureWhipple Treat.MarginPositive Treat.Chemo.Any
##  Mode :logical          Mode :logical        Mode :logical
##  FALSE:44               FALSE:137            FALSE:97
##  TRUE :196              TRUE :103            TRUE :117
##  NA's :0                NA's :0              NA's :26
##
##
##
##  Treat.Chemo.Adjuvant Treat.Chemo.Adjuvant.GE3Cycles
##  Mode :logical        Mode :logical
##  FALSE:169            FALSE:197
##  TRUE :71             TRUE :43
##  NA's :0              NA's :0
##
##
##
##  Treat.Chemo.Palliative Treat.Chemo.PalliativeDC Treat.Chemo.GEM
##  Mode :logical          Mode :logical            Mode :logical
##  FALSE:1                FALSE:170                FALSE:151
##  TRUE :65               TRUE :70                 TRUE :88
##  NA's :174              NA's :0                  NA's :1
##
##
##
##  Treat.Radio     Path.LocationBody   Path.Size    Path.Bilirubin.Preop
##  Mode :logical   Mode :logical     Min.   : 8.0   Min.   : 0.06
##  FALSE:197       FALSE:196         1st Qu.:25.0   1st Qu.: 0.69
##  TRUE :43        TRUE :44          Median :30.0   Median : 3.63
##  NA's :0         NA's :0           Mean   :33.6   Mean   : 7.31
##                                    3rd Qu.:40.0   3rd Qu.:10.72
##                                    Max.   :90.0   Max.   :45.03
##                                                   NA's   :96
##  Path.Ca199.Preop Path.Bilirubin.Postop Path.Ca199.Postop
##  Min.   :     1   Min.   : 0.12         Min.   :    1
##  1st Qu.:    73   1st Qu.: 0.47         1st Qu.:   17
##  Median :   218   Median : 0.70         Median :   77
##  Mean   :  2803   Mean   : 1.95         Mean   : 1571
##  3rd Qu.:   842   3rd Qu.: 1.30         3rd Qu.:  278
##  Max.   :101075   Max.   :25.38         Max.   :31760
##  NA's   :162      NA's   :100           NA's   :137
##         Path.Subtype Path.Differentiation Path.LN.Involved
##  Adenosquamous: 18   1: 16                Min.   : 0.00
##  Large Cell   :  0   2:157                1st Qu.: 0.00
##  Mucinous     :  5   3: 67                Median : 1.00
##  NotSpecified : 38   4:  0                Mean   : 1.76
##  Papillary    :  2                        3rd Qu.: 2.00
##  Tubular      :177                        Max.   :12.00
##                                           NA's   :3
##  Path.LN.Inspected Path.Invasion.Vascular Path.Invasion.Perineural
##  Min.   : 0.00     Mode :logical          Mode :logical
```

```
##  1st Qu.: 5.00     FALSE:128              FALSE:58
##  Median : 8.00     TRUE :112              TRUE :182
##  Mean   : 9.68     NA's :0                NA's :0
##  3rd Qu.:13.00
##  Max.   :52.00
##  NA's   :20
##  Stage.pT  Stage.pN   Stage.pM   Molec.BNIP3.NucInt Molec.BNIP3.CytoInt
##  Tis:  0   N0  : 80   M0  :177   0   :  6           0   :  1
##  T1 : 18   N1  :156   M1  :  8   1   :200           1   :125
##  T2 : 32   NA's:  4   NA's: 55   2   : 21           2   : 74
##  T3 :190                         3   :  2           3   : 29
##  T4 :  0                         NA's: 11           NA's: 11
##
##
##  Molec.CCND1.CytoLo Molec.CCND1.CytoHi Molec.CCND1.MembLo
##  0   :152           0   :71            0   :96
##  1   : 34           1   :87            1   :68
##  2   :  4           2   :32            2   :18
##  3   :  1           3   : 1            3   : 9
##  NA's: 49           NA's:49            NA's:49
##
##
##  Molec.CCND1.MembHi Molec.Grb7.Int Molec.Grb7.Percent Molec.HCNT3PlusHENT1
##  0   :29            0   :49        Min.   :  0.0      Mode :logical
##  1   :86            1   :90        1st Qu.:  3.0      FALSE:93
##  2   :45            2   :42        Median : 18.0      TRUE :94
##  3   :31            3   : 7        Mean   : 31.6      NA's :53
##  NA's:49            NA's:52        3rd Qu.: 58.5
##                                    Max.   :100.0
##                                    NA's   :52
##  Molec.HENT1.Percent Molec.HENT1.Int Molec.HER2      Molec.HOXB2.Percent
##  Min.   :  0.0       0   : 17        Mode :logical   Min.   :  0.0
##  1st Qu.: 11.2       1   :114        FALSE:36        1st Qu.: 35.0
##  Median : 42.5       2   : 51        TRUE :10        Median : 70.0
##  Mean   : 44.4       3   : 12        NA's :194       Mean   : 59.6
##  3rd Qu.: 75.0       NA's: 46                        3rd Qu.: 85.0
##  Max.   :100.0                                       Max.   :100.0
##  NA's   :46                                          NA's   :42
##  Molec.HOXB2.Int Molec.RON.Int Molec.S100A2.Int Molec.S100A2.Percent
##  0   : 14        0   : 19      0:87             Min.   :  0.0
##  1   :137        1   :110      1:59             1st Qu.:  0.0
##  2   : 33        2   : 59      2:56             Median : 10.0
##  3   : 14        3   : 10      3:38             Mean   : 28.1
##  NA's: 42        NA's: 42                       3rd Qu.: 60.0
##                                                 Max.   :100.0
##
##  Molec.S100A2.StromaScore Molec.S100A4.CytoInt Molec.S100A4.CytoPercent
##  Mode :logical            0:70                 Min.   :  0.0
##  FALSE:175                1:89                 1st Qu.:  0.0
##  TRUE :22                 2:40                 Median : 10.0
##  NA's :43                 3:41                 Mean   : 34.8
##                                                3rd Qu.: 75.0
##                                                Max.   :100.0
##
```

```
##  Molec.S100A4.NucInt Molec.S100A4.NucPercent Stage.Overall
##  0:78                Min.   :  0.0           IIB    :117
##  1:66                1st Qu.:  0.0           IIA    : 41
##  2:62                Median :  5.0           IB     : 12
##  3:34                Mean   : 26.4           IV     :  8
##                      3rd Qu.: 60.0           IA     :  7
##                      Max.   :100.0           (Other):  0
##                                              NA's   : 55
##  History.Death.Event Molec.S100A4.DCThresh Molec.S100A2.DCThresh
##  Min.   :0.000       Mode :logical         Mode :logical
##  1st Qu.:1.000       FALSE:60              FALSE:203
##  Median :1.000       TRUE :180             TRUE :37
##  Mean   :0.996       NA's :0               NA's :0
##  3rd Qu.:1.000
##  Max.   :1.000
##
##  Stage.pT.Simplified Path.Ca199.Preop.Cent Path.Ca199.Postop.Cent
##  T1 : 18             Min.   :-5.38         Min.   :-3.97
##  T2 : 32             1st Qu.:-1.09         1st Qu.:-1.14
##  T34:190             Median : 0.00         Median : 0.37
##                      Mean   : 0.09         Mean   : 0.62
##                      3rd Qu.: 1.36         3rd Qu.: 1.66
##                      Max.   : 6.14         Max.   : 6.40
##                      NA's   :162           NA's   :137
##  History.Diagnosis.AgeAt.Cent History.Smoking.PackYears.Cent
##  Min.   :-40.00               Min.   :-28.00
##  1st Qu.: -6.00               1st Qu.:-10.00
##  Median :  1.00               Median : -5.00
##  Mean   : -0.51               Mean   :  1.89
##  3rd Qu.:  7.00               3rd Qu.: 20.00
##  Max.   : 19.00               Max.   : 50.00
##                               NA's   :185
##  Path.Size.Cent   Path.Bilirubin.Preop.Cent Path.Bilirubin.Postop.Cent
##  Min.   :-22.00   Min.   :-3.39             Min.   :-0.53
##  1st Qu.: -5.00   1st Qu.:-2.76             1st Qu.:-0.18
##  Median :  0.00   Median : 0.18             Median : 0.06
##  Mean   :  3.56   Mean   : 3.86             Mean   : 1.30
##  3rd Qu.: 10.00   3rd Qu.: 7.27             3rd Qu.: 0.66
##  Max.   : 60.00   Max.   :41.58             Max.   :24.74
##                   NA's   :96                NA's   :100
##  History.Diagnosis.Date.Cent Path.LN.InvolvedFraction Path.LN.Negative
##  Min.   :-2867               Min.   :0.000            Min.   : 0.00
##  1st Qu.:-1297               1st Qu.:0.000            1st Qu.: 4.00
##  Median : -234               Median :0.143            Median : 7.00
##  Mean   : -389               Mean   :0.217            Mean   : 7.85
##  3rd Qu.:  519               3rd Qu.:0.333            3rd Qu.:11.00
##  Max.   : 1674               Max.   :1.000            Max.   :45.00
##                              NA's   :21               NA's   :20
##     SexM           Ca199          DiagYearCent         Time
##  Mode :logical   Mode :logical   Min.   :-7.849   Min.   :  26
##  FALSE:120       FALSE:26        1st Qu.:-3.551   1st Qu.: 274
##  TRUE :120       TRUE :52        Median :-0.639   Median : 474
##  NA's :0         NA's :162       Mean   :-1.065   Mean   : 589
##                                  3rd Qu.: 1.422   3rd Qu.: 764
```

```
##                                  Max.   : 4.583   Max.   :2701
##
##      DSD             AgeCent        LocBody          SizeCent
##  Mode :logical   Min.   :-40.00   Mode :logical   Min.   :-22.00
##  FALSE:9         1st Qu.: -6.00   FALSE:196       1st Qu.: -5.00
##  TRUE :231       Median :  1.00   TRUE :44        Median :  0.00
##  NA's :0         Mean   : -0.51   NA's :0         Mean   :  3.56
##                  3rd Qu.:  7.00                   3rd Qu.: 10.00
##                  Max.   : 19.00                   Max.   : 60.00
##
##      A2              A4             SizePlus
##  Mode :logical   Mode :logical   Min.   : 0.00
##  FALSE:203       FALSE:60        1st Qu.: 0.00
##  TRUE :37        TRUE :180       Median : 0.00
##  NA's :0         NA's :0         Mean   : 7.35
##                                  3rd Qu.:10.00
##                                  Max.   :60.00
##
```

```r
summary(data.glasgow)
```

```
##   Patient.ID        Patient.Sex History.Diagnosis.AgeAt Treat.Procedure
##  Length:189         F: 89       Min.   :37.5            Length:189
##  Class :character   M:100       1st Qu.:57.8            Class :character
##  Mode  :character               Median :64.0            Mode  :character
##                                 Mean   :62.6
##                                 3rd Qu.:69.4
##                                 Max.   :86.0
##
##  Path.Location
##  Length:189
##  Class :character
##  Mode  :character
##
##
##
##
##                                                          Path.Type
##  Pancreatic Adenocarcinoma                                    :156
##  Pancreatic adenocarcinoma                                    : 32
##  Pancreatic Adenocarcinom                                     :  1
##  Pancreatic adenocarcinoma arising form IPMN                  :  0
##  Pancreatic adenocarcinoma arising from mucnous cystic neoplsm:  0
##  Pancreatic Adenocarcinoma arising IPMN                       :  0
##  (Other)                                                      :  0
##  Path.Differentiation Path.Grade Stage.pT  Stage.pN
##  1: 12                Low :128   Tis:  0   N0: 33
##  2:117                High: 61   T1 :  1   N1:156
##  3: 60                           T2 : 13
##  4:  0                           T3 :171
##                                  T4 :  4
##
##
##  Path.Invasion.Perineural Path.Invasion.Vascular Path.LN.Inspected
```

```
##  Mode :logical            Mode :logical          Min.   : 1.0
##  FALSE:13                 FALSE:96               1st Qu.:13.0
##  TRUE :176                TRUE :93               Median :20.0
##  NA's :0                  NA's :0                Mean   :20.2
##                                                  3rd Qu.:27.0
##                                                  Max.   :53.0
##
##  Path.LN.InvolvedFraction Treat.MarginPositive Treat.VeinResection
##  Min.   :0.00             Mode :logical        Mode :logical
##  1st Qu.:0.05             FALSE:51             FALSE:158
##  Median :0.14             TRUE :138            TRUE :31
##  Mean   :0.20             NA's :0              NA's :0
##  3rd Qu.:0.27
##  Max.   :1.00
##
##    Path.Size    History.Death.EventTimeDays History.Death.Cause
##  Min.   : 5.0   Min.   :   8                0:  9
##  1st Qu.:25.0   1st Qu.: 233                1:161
##  Median :30.0   Median : 501                2: 19
##  Mean   :32.7   Mean   : 673
##  3rd Qu.:40.0   3rd Qu.: 915
##  Max.   :65.0   Max.   :3531
##
##  Treat.Chemo.Adjuvant Treat.Chemo.Neoadjuvant Molec.S100A2.DCThresh
##  Mode :logical        Mode :logical           Mode :logical
##  FALSE:110            FALSE:188               FALSE:127
##  TRUE :79             TRUE :1                 TRUE :62
##  NA's :0              NA's :0                 NA's :0
##
##
##
##  Molec.S100A4.DCThresh Treat.ProcedureWhipple Path.LocationBody
##  Mode :logical         Mode:logical           Mode :logical
##  FALSE:55              TRUE:189               FALSE:189
##  TRUE :134             NA's:0                 NA's :0
##  NA's :0
##
##
##
##  History.DSDeath.Event History.ACDeath.Event Path.LN.Involved
##  Mode :logical         Mode :logical         Min.   : 0.00
##  FALSE:28              FALSE:9               1st Qu.: 1.00
##  TRUE :161             TRUE :180             Median : 2.00
##  NA's :0               NA's :0               Mean   : 3.57
##                                              3rd Qu.: 5.00
##                                              Max.   :32.00
##
##  History.Diagnosis.AgeAt.Cent Path.Size.Cent   Stage.pT.Simplified
##  Min.   :-30.55               Min.   :-25.00   T1 :  1
##  1st Qu.:-10.19               1st Qu.: -5.00   T2 : 13
##  Median : -4.00               Median :  0.00   T34:175
##  Mean   : -5.37               Mean   :  2.72
##  3rd Qu.:  1.43               3rd Qu.: 10.00
##  Max.   : 18.00               Max.   : 35.00
```

```
##
##  Path.LN.Negative    SexM            AgeCent          SizeCent
##  Min.   : 0.0     Mode :logical   Min.   :-30.55   Min.   :-25.00
##  1st Qu.:10.0     FALSE:89        1st Qu.:-10.19   1st Qu.: -5.00
##  Median :16.0     TRUE :100       Median : -4.00   Median :  0.00
##  Mean   :16.6     NA's :0         Mean   : -5.37   Mean   :  2.72
##  3rd Qu.:23.0                     3rd Qu.:  1.43   3rd Qu.: 10.00
##  Max.   :47.0                     Max.   : 18.00   Max.   : 35.00
##
##      A2              A4            LocBody             Time
##  Mode :logical   Mode :logical   Mode :logical   Min.   :   8
##  FALSE:127       FALSE:55        FALSE:189       1st Qu.: 233
##  TRUE :62        TRUE :134       NA's :0         Median : 501
##  NA's :0         NA's :0                         Mean   : 673
##                                                  3rd Qu.: 915
##                                                  Max.   :3531
##
##     DSD
##  Mode :logical
##  FALSE:28
##  TRUE :161
##  NA's :0
##
##
##
```

```
summary(data.apgi)
```

```
##   Patient.ID        Patient.Gender                      Patient.Ethnicity
##  Length:75          Female:34      Asian                         : 7
##  Class :character   Male  :41      Asian, White/Caucasian        : 0
##  Mode  :character                  Black/African                 : 1
##                                    Black/African, White/Caucasian: 0
##                                    White/Caucasian               :67
##
##
##                   Patient.Country History.LastFollowup.Date
##  Australia               :75     Min.   :2008-04-14
##  Italy                   : 0     1st Qu.:2011-02-03
##  New Zealand             : 0     Median :2012-05-09
##  Puerto Rico             : 0     Mean   :2012-06-02
##  United Kingdom          : 0     3rd Qu.:2013-11-06
##  United States of America: 0     Max.   :2014-09-08
##
##  History.Smoking.PackYears History.Diagnosis.Date
##  Min.   :  0.75            Min.   :2004-12-30
##  1st Qu.: 12.00            1st Qu.:2009-11-28
##  Median : 27.50            Median :2010-05-28
##  Mean   : 30.98            Mean   :2010-06-08
##  3rd Qu.: 44.06            3rd Qu.:2010-11-29
##  Max.   :123.75            Max.   :2012-02-17
##  NA's   :43
##  History.Diagnosis.AgeAtYears History.Surgery.Date
##  Min.   :47.0                 Min.   :2004-12-30
```

```
##  1st Qu.:60.5                 1st Qu.:2009-12-05
##  Median :67.0                 Median :2010-06-01
##  Mean   :66.8                 Mean   :2010-06-16
##  3rd Qu.:74.0                 3rd Qu.:2011-01-19
##  Max.   :84.0                 Max.   :2012-02-17
##
##                                                                   Treat.Surgery.Procedure
##  Classic Whipple                                                                 :55
##  Classic Whipple, Exploratory laparotomy                                         : 3
##  PPPD                                                                            : 3
##  Splenectomy, Subtotal Panc/L sided Panc or distal Panc                          : 3
##  Subtotal Panc/L sided Panc or distal Panc                                       : 3
##  Cholecystectomy, Cholecystojejunostomy/Hepaticojejunostomy, Classic Whipple: 1
##  (Other)                                                                         : 7
##  Treat.Surgery.ExcisionStatus Treat.Surgery.Margin.Pancreatic
##  R0:51                        <2 mm   : 2
##  R1:20                        Clear   :65
##  R2: 4                        Involved: 2
##                               NA's    : 6
##
##
##
##  Treat.Surgery.MarginSizeMm.Pancreatic Treat.Surgery.Margin.Periunc
##  Min.   : 0.00                         <2 mm   :16
##  1st Qu.: 5.00                         Clear   :36
##  Median :10.00                         Involved:11
##  Mean   : 9.94                         NA's    :12
##  3rd Qu.:10.00
##  Max.   :40.00
##  NA's   :15
##  Treat.Surgery.MarginSizeMm.Periunc Treat.Surgery.Margin.PVGroove
##  Min.   : 0.00                      <2 mm   :18
##  1st Qu.: 1.00                      Clear   :37
##  Median : 2.20                      Involved:10
##  Mean   : 6.92                      NA's    :10
##  3rd Qu.:10.00
##  Max.   :40.00
##  NA's   :24
##  Treat.Surgery.MarginSizeMm.PVGroove Treat.Surgery.Margin.Retrop
##  Min.   : 0.0                         <2 mm   :19
##  1st Qu.: 1.0                         Clear   :46
##  Median : 2.0                         Involved: 5
##  Mean   : 3.8                         NA's    : 5
##  3rd Qu.: 4.0
##  Max.   :25.0
##  NA's   :24
##  Treat.Surgery.MarginSizeMm.Retrop Treat.Surgery.Margin.CBD
##  Min.   : 0.10                     <2 mm   : 0
##  1st Qu.: 1.00                     Clear   :58
##  Median : 3.00                     Involved: 0
##  Mean   : 5.29                     NA's    :17
##  3rd Qu.: 8.00
##  Max.   :25.00
##  NA's   :14
```

```
##  Treat.Surgery.MarginSizeMm.CBD Treat.Surgery.Margin.Duodenal
##  Min.   : 3.0                   Clear   :40
##  1st Qu.:11.5                   Involved: 0
##  Median :20.0                   NA's    :35
##  Mean   :21.9
##  3rd Qu.:30.0
##  Max.   :50.0
##  NA's   :31
##  Treat.Surgery.MarginSizeMm.Duodenal Treat.Surgery.Margin.Gastric
##  Min.   : 20.0                       Clear:39
##  1st Qu.: 47.5                       NA's :36
##  Median : 75.0
##  Mean   : 75.0
##  3rd Qu.:102.5
##  Max.   :130.0
##  NA's   :73
##  Treat.Surgery.MarginSizeMm.Gastric Treat.Surgery.Margin.Comments
##  Min.   : 20                        Length:75
##  1st Qu.: 40                        Class :character
##  Median : 60                        Mode  :character
##  Mean   : 60
##  3rd Qu.: 80
##  Max.   :100
##  NA's   :73
##                          Path.HistoType
##  Pancreatic Ductal Adenocarcinoma:75
##  Acinar Cell Carcinoma           : 0
##  Ampullary Adenocarcinoma        : 0
##  Carcinoid Tumour                : 0
##  Cholangiocarcinoma              : 0
##  Clear Cell Carcinoma            : 0
##  (Other)                         : 0
##                     Path.HistoType.Subtype Path.Grade
##  Gastric                        : 0         1: 3
##  Intestinal                     : 0         2:47
##  Mixed                          : 0         3:23
##  Not otherwise Specified (NOS):10           4: 2
##  Pancreatobiliary               :10
##  Squamous                       : 0
##  NA's                           :55
##       Path.TumourLocation Path.TumourSizeMm Path.Invasion.PN
##  Head           :55       Min.   :15.0      Absent : 9
##  Head (Uncinate): 9       1st Qu.:28.0      Present:66
##  Body           : 7       Median :35.0
##  Tail           : 3       Mean   :36.9
##  Ampulla        : 1       3rd Qu.:43.0
##                 : 0       Max.   :90.0
##  (Other)        : 0
##  Path.Invasion.VS Path.Nodes.Regional.Total Path.Nodes.Regional.Involved
##  Absent :22       Min.   : 2.0              Min.   : 0.00
##  Present:51       1st Qu.:13.0              1st Qu.: 1.00
##  NA's   : 2       Median :16.0              Median : 3.00
##                   Mean   :18.6              Mean   : 3.03
##                   3rd Qu.:23.5              3rd Qu.: 4.00
```

```
##                   Max.   :46.0              Max.   :13.00
##
##  Path.Nodes.SepRec.Total Path.Nodes.SepRec.Involved
##  Min.   : 2.0            Min.   : 0.00
##  1st Qu.:13.0            1st Qu.: 1.00
##  Median :16.0            Median : 3.00
##  Mean   :18.6            Mean   : 3.03
##  3rd Qu.:23.5            3rd Qu.: 4.00
##  Max.   :46.0            Max.   :13.00
##
##                                    Staging.Version Staging.pM Staging.pN
##  pTNM AJCC 6th Ed 2002                     :12     M0  : 2    N0:16
##  pTNM AJCC 7th Ed 2010                     :63     M1  : 4    N1:59
##  pTNM AJCC 7th Ed 2010 (Ampulla)           : 0     NA's:69
##  pTNM AJCC 7th Ed 2010 (Cholangiocarcinoma): 0
##  pTNM AJCC 7th Ed 2010 (Neuroendocrine)    : 0
##
##
##  Staging.pT Staging.Stage    History.Recurrence History.Recurrence.Date
##  Tis: 0     IA : 1        Not observed:15       Min.   :2007-12-31
##  T1 : 1     IB : 1        Suspected   : 2       1st Qu.:2010-10-25
##  T2 : 3     IIA:13        Confirmed   :56       Median :2011-04-11
##  T3 :70     IIB:55        NA's        : 2       Mean   :2011-06-29
##  T4 : 1     III: 1                              3rd Qu.:2012-02-28
##             IV : 4                              Max.   :2014-08-27
##                                                 NA's   :17
##  History.Recurrence.Site.Stomach History.Recurrence.Site.Peritoneum
##  Mode :logical                   Mode :logical
##  FALSE:75                        FALSE:67
##  NA's :0                         TRUE :8
##                                  NA's :0
##
##
##
##  History.Recurrence.Site.PancRemnant History.Recurrence.Site.PancBed
##  Mode :logical                       Mode :logical
##  FALSE:70                            FALSE:64
##  TRUE :5                             TRUE :11
##  NA's :0                             NA's :0
##
##
##
##  History.Recurrence.Site.Other History.Recurrence.Site.Omentum
##  Mode :logical                 Mode :logical
##  FALSE:69                      FALSE:74
##  TRUE :6                       TRUE :1
##  NA's :0                       NA's :0
##
##
##
##  History.Recurrence.Site.Mesentery History.Recurrence.Site.LymphNodes
##  Mode :logical                     Mode :logical
##  FALSE:74                          FALSE:61
##  TRUE :1                           TRUE :14
```

```
##  NA's :0                          NA's :0
##
##
##
##  History.Recurrence.Site.Lung History.Recurrence.Site.Liver
##  Mode :logical                Mode :logical
##  FALSE:60                     FALSE:51
##  TRUE :15                     TRUE :24
##  NA's :0                      NA's :0
##
##
##
##  History.Recurrence.Site.Brain History.Recurrence.Site.Bone
##  Mode :logical                 Mode :logical
##  FALSE:73                      FALSE:71
##  TRUE :2                       TRUE :4
##  NA's :0                       NA's :0
##
##
##
##                      History.Status History.Death.Date
##  Alive - With Disease       : 7     Min.   :2008-05-13
##  Alive - Without Disease    :13     1st Qu.:2010-12-20
##  Deceased - Of Disease      :51     Median :2011-12-28
##  Deceased - Of Other Cause  : 4     Mean   :2011-11-08
##  Deceased - Of Unknown Cause: 0     3rd Qu.:2012-09-08
##                                     Max.   :2014-01-26
##                                     NA's   :20
##                        History.Death.Cause Surv.Event.Death
##  Cancer Death (Pancreatic)       :51       Min.   :0.000
##  Died of Treatment Complication  : 2       1st Qu.:0.000
##  Cancer Death (Other) - Lung ca  : 1       Median :1.000
##  Other (please specify) - Suicide: 1       Mean   :0.733
##  Other (please specify)          : 0       3rd Qu.:1.000
##  (Other)                         : 0       Max.   :1.000
##  NA's                            :20
##  Surv.EventTimeFromDiag.Death Surv.EventTimeFromSurg.Death
##  Min.   :  56                 Min.   :  62
##  1st Qu.: 386                 1st Qu.: 362
##  Median : 653                 Median : 655
##  Mean   : 753                 Mean   : 745
##  3rd Qu.:1007                 3rd Qu.:1010
##  Max.   :2848                 Max.   :2848
##
##  Surv.EventTimeFromRec.Death Surv.Event.DSDeath
##  Min.   :   3.0              Min.   :0.00
##  1st Qu.:  65.8              1st Qu.:0.00
##  Median : 202.0              Median :1.00
##  Mean   : 287.4              Mean   :0.68
##  3rd Qu.: 371.2              3rd Qu.:1.00
##  Max.   :1333.0              Max.   :1.00
##  NA's   :17
##  Surv.EventTimeFromDiag.DSDeath Surv.EventTimeFromSurg.DSDeath
##  Min.   :  31                   Min.   :  37
```

```
##  1st Qu.: 386                   1st Qu.: 362
##  Median : 653                   Median : 655
##  Mean   : 752                   Mean   : 743
##  3rd Qu.:1007                   3rd Qu.:1010
##  Max.   :2848                   Max.   :2848
##
##  Surv.EventTimeFromRec.DSDeath Surv.Event.Recurrence
##  Min.   :   3.0               Min.   :0.000
##  1st Qu.:  65.8               1st Qu.:1.000
##  Median : 202.0               Median :1.000
##  Mean   : 287.1               Mean   :0.767
##  3rd Qu.: 371.2               3rd Qu.:1.000
##  Max.   :1333.0               Max.   :1.000
##  NA's   :17                   NA's   :2
##  Surv.EventTimeFromDiag.Recurrence Surv.EventTimeFromSurg.Recurrence
##  Min.   :  31                      Min.   : -15
##  1st Qu.: 241                      1st Qu.: 231
##  Median : 388                      Median : 377
##  Mean   : 540                      Mean   : 532
##  3rd Qu.: 698                      3rd Qu.: 705
##  Max.   :1954                      Max.   :1954
##  NA's   :2                         NA's   :2
##      A2              A4          Path.LN.Inspected Path.LN.Involved
##  Mode :logical   Mode :logical   Min.   : 2.0      Min.   : 0.00
##  FALSE:64        FALSE:26        1st Qu.:13.0      1st Qu.: 1.00
##  TRUE :11        TRUE :49        Median :16.0      Median : 3.00
##  NA's :0         NA's :0         Mean   :18.6      Mean   : 3.03
##                                  3rd Qu.:23.5      3rd Qu.: 4.00
##                                  Max.   :46.0      Max.   :13.00
##
##  Path.LN.Negative History.Diagnosis.AgeAt History.Diagnosis.AgeAt.Cent
##  Min.   : 2.0     Min.   :47.0            Min.   :-21.00
##  1st Qu.: 9.0     1st Qu.:60.5            1st Qu.: -7.50
##  Median :13.0     Median :67.0            Median : -1.00
##  Mean   :15.6     Mean   :66.8            Mean   : -1.15
##  3rd Qu.:21.0     3rd Qu.:74.0            3rd Qu.:  6.00
##  Max.   :44.0     Max.   :84.0            Max.   : 16.00
##
##    Path.Size    Path.Size.Cent   Patient.Sex    SexM
##  Min.   :15.0   Min.   :-15.00   Female:34   Mode :logical
##  1st Qu.:28.0   1st Qu.: -2.00   Male  :41   FALSE:34
##  Median :35.0   Median :  5.00               TRUE :41
##  Mean   :36.9   Mean   :  6.89               NA's :0
##  3rd Qu.:43.0   3rd Qu.: 13.00
##  Max.   :90.0   Max.   : 60.00
##
##  Treat.MarginPositive    AgeCent          SizeCent      Stage.pT
##  Mode :logical        Min.   :-21.00   Min.   :-15.00   Tis: 0
##  FALSE:51             1st Qu.: -7.50   1st Qu.: -2.00   T1 : 1
##  TRUE :24             Median : -1.00   Median :  5.00   T2 : 3
##  NA's :0              Mean   : -1.15   Mean   :  6.89   T3 :70
##                       3rd Qu.:  6.00   3rd Qu.: 13.00   T4 : 1
##                       Max.   : 16.00   Max.   : 60.00
##
```

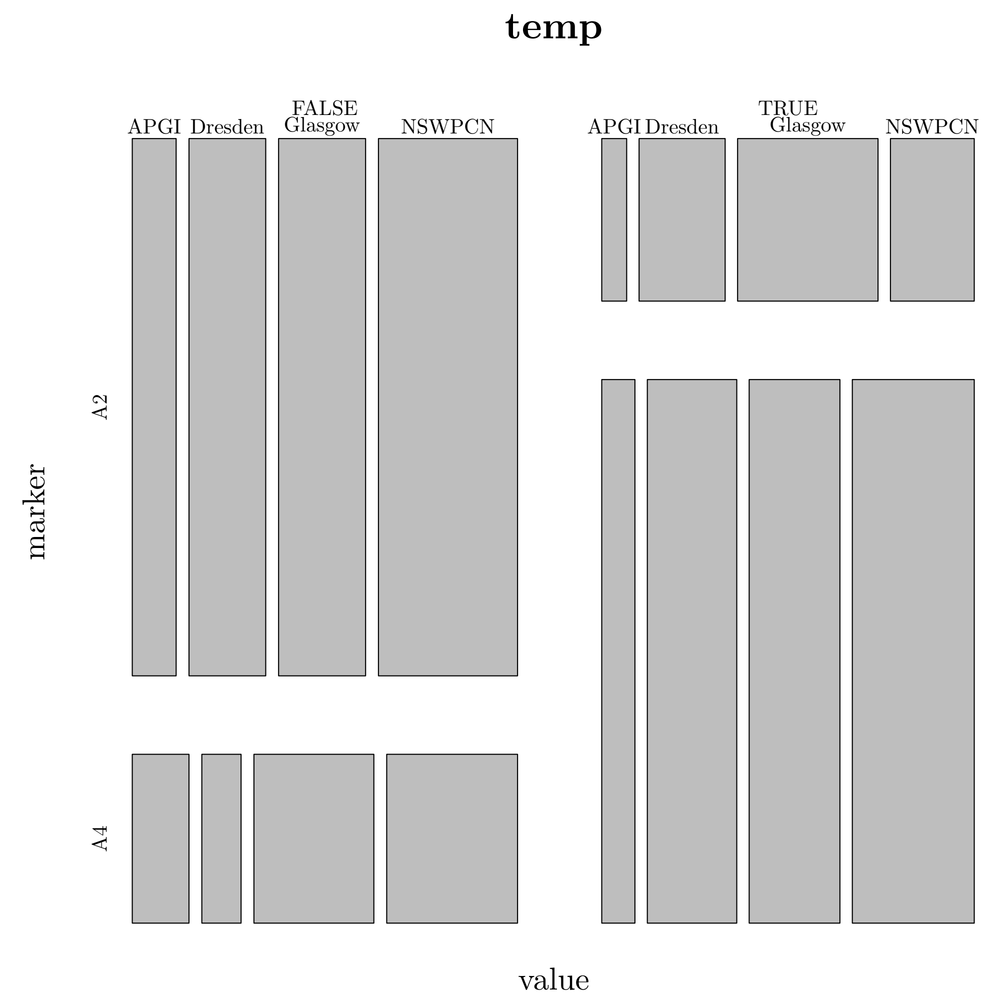
```
##  Stage.pT.Simplified Path.LocationBody Path.Differentiation
##  Length:75           Mode :logical     1: 3
##  Class :character    FALSE:64          2:47
##  Mode  :character    TRUE :11          3:23
##                      NA's :0           4: 2
##
##
##
##   LocBody             Time           DSD
##  Mode :logical   Min.   :  37   Min.   :0.00
##  FALSE:64        1st Qu.: 362   1st Qu.:0.00
##  TRUE :11        Median : 655   Median :1.00
##  NA's :0         Mean   : 743   Mean   :0.68
##                  3rd Qu.:1010   3rd Qu.:1.00
##                  Max.   :2848   Max.   :1.00
##
```

```r
summary(data.dresden)
```

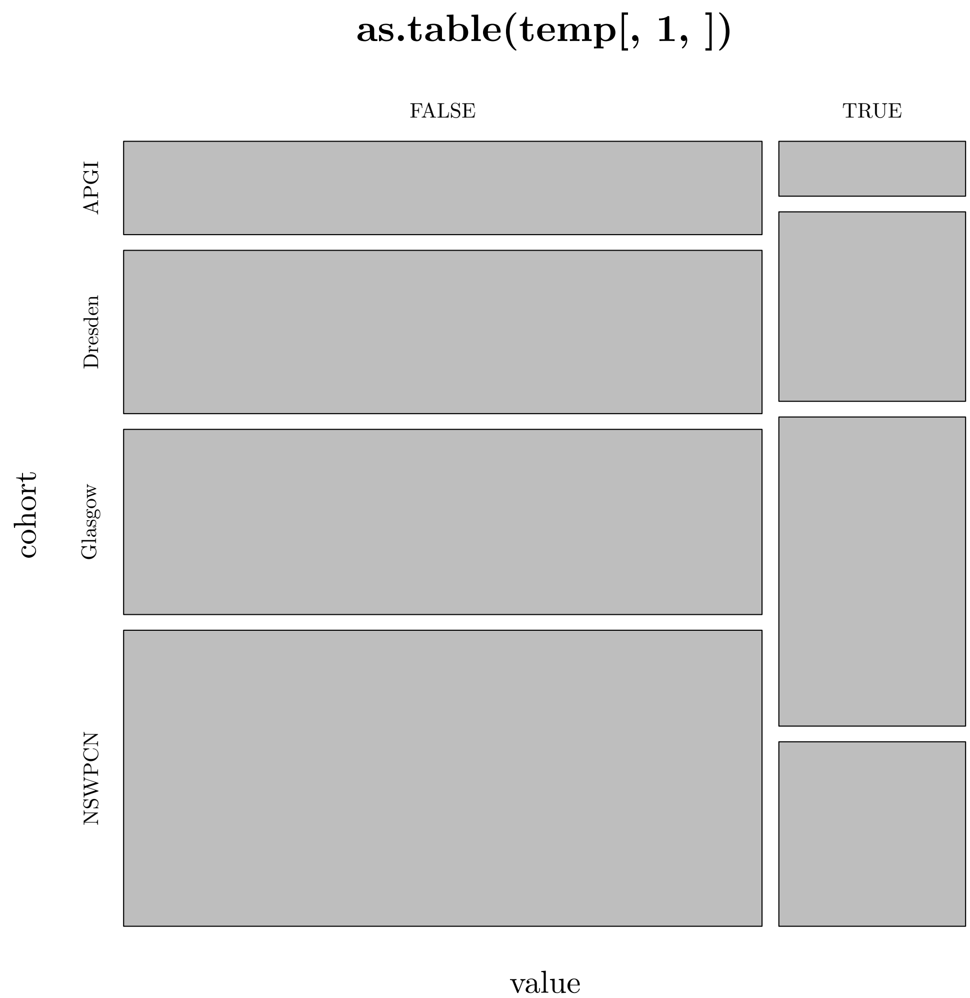
```
##      Dresden.SSID Patient.Gender History.Surgery.AgeAtYears
##  3_105_PaCa:  1   F:68           Min.   :40.0
##  3_112_PaCa:  1   M:82           1st Qu.:59.0
##  3_11_PaCa :  1                  Median :68.0
##  3_131_PaCa:  1                  Mean   :65.6
##  3_13_PaCa :  1                  3rd Qu.:73.0
##  3_196_PaCa:  1                  Max.   :84.0
##  (Other)   :144
##  History.Death.EventTimeDays History.Death.Event History.DSDeath.Event
##  Min.   :  10                Mode :logical       Mode :logical
##  1st Qu.: 311                FALSE:22            FALSE:38
##  Median : 514                TRUE :128           TRUE :112
##  Mean   : 715                NA's :0             NA's :0
##  3rd Qu.: 915
##  Max.   :4190
##
##  History.Death.Cause Treat.Surgery.ExcisionStatus Path.Grade Staging.pT
##  other: 16           R0:98                        1: 3       T2:  9
##  PaCa :112           R1:42                        2:75       T3:141
##  NA's : 22           R2:10                        3:71
##                                                   4: 1
##
##
##
##  Staging.pN Staging.pM Path.Invasion.VS Path.Invasion.PN
##  N0: 47     M0:150     Mode :logical    Mode :logical
##  N1:101     M1:  0     FALSE:64         FALSE:53
##  N2:  2                TRUE :36         TRUE :95
##                        NA's :50         NA's :2
##
##
##
##  Path.TumourLocation Path.TumourSizeMm Molec.S100A2.DCThresh
##  Head:139            Min.   :15.0      Mode :logical
##  Tail: 11            1st Qu.:25.0      FALSE:112
```

```
##                       Median :34.5      TRUE :38
##                       Mean   :34.2      NA's :0
##                       3rd Qu.:40.0
##                       Max.   :85.0
##
##  Molec.S100A4.DCThresh History.Diagnosis.AgeAt
##  Mode :logical         Min.   :40.0
##  FALSE:18              1st Qu.:59.0
##  TRUE :132             Median :68.0
##  NA's :0               Mean   :65.6
##                        3rd Qu.:73.0
##                        Max.   :84.0
##
##  History.Diagnosis.AgeAt.Cent   Path.Size    Path.Size.Cent
##  Min.   :-28.00               Min.   :15.0   Min.   :-15.00
##  1st Qu.: -9.00               1st Qu.:25.0   1st Qu.: -5.00
##  Median :  0.00               Median :34.5   Median :  4.50
##  Mean   : -2.39               Mean   :34.2   Mean   :  4.17
##  3rd Qu.:  5.00               3rd Qu.:40.0   3rd Qu.: 10.00
##  Max.   : 16.00               Max.   :85.0   Max.   : 55.00
##
##  Stage.pT.Simplified Patient.Sex    SexM            AgeCent
##  Length:150          F:68        Mode :logical   Min.   :-28.00
##  Class :character    M:82        FALSE:68        1st Qu.: -9.00
##  Mode  :character                TRUE :82        Median :  0.00
##                                  NA's :0         Mean   : -2.39
##                                                  3rd Qu.:  5.00
##                                                  Max.   : 16.00
##
##     SizeCent          A2              A4          Path.LocationBody
##  Min.   :-15.00   Mode :logical   Mode :logical   Mode :logical
##  1st Qu.: -5.00   FALSE:112       FALSE:18        FALSE:139
##  Median :  4.50   TRUE :38        TRUE :132       TRUE :11
##  Mean   :  4.17   NA's :0         NA's :0         NA's :0
##  3rd Qu.: 10.00
##  Max.   : 55.00
##
##   LocBody             Time         DSD          Treat.MarginPositive
##  Mode :logical   Min.   :  10   Mode :logical   Mode :logical
##  FALSE:139       1st Qu.: 311   FALSE:38        FALSE:98
##  TRUE :11        Median : 514   TRUE :112       TRUE :52
##  NA's :0         Mean   : 715   NA's :0         NA's :0
##                  3rd Qu.: 915
##                  Max.   :4190
##
##  Path.Differentiation
##  1: 3
##  2:75
##  3:71
##  4: 1
##
##
##
```

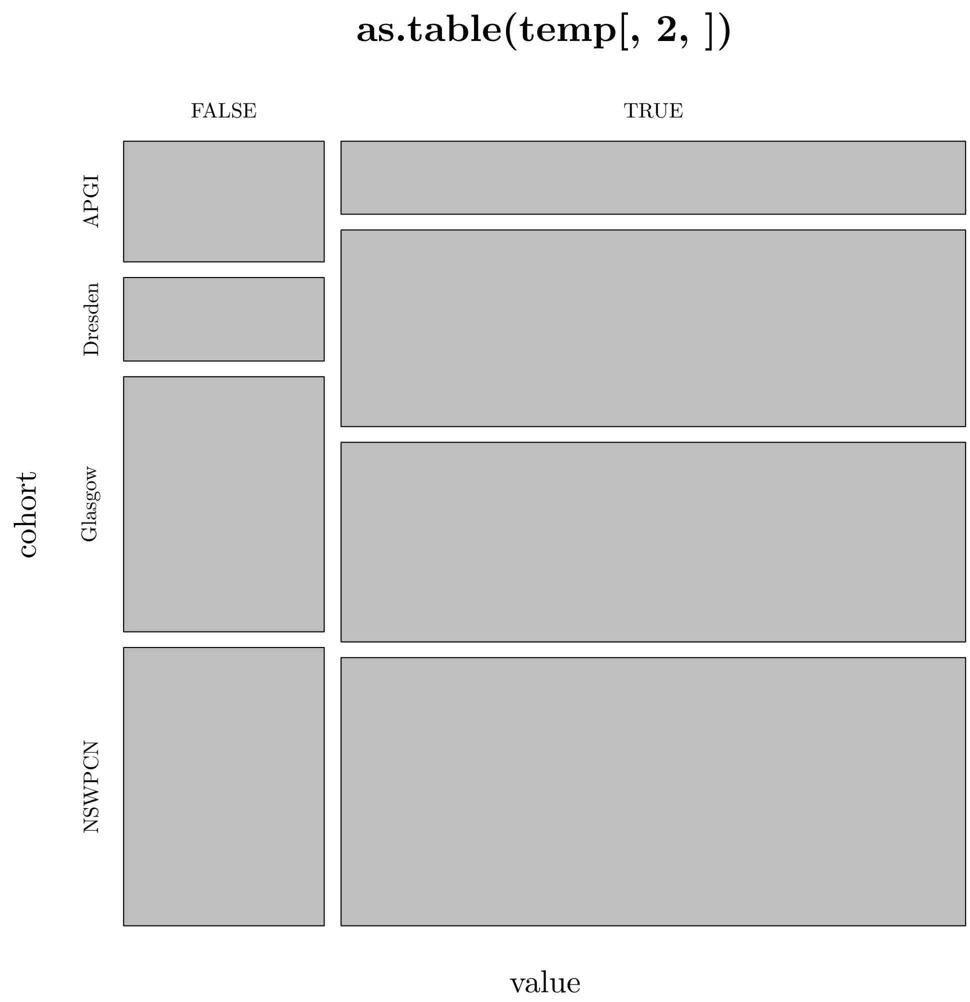
```
temp = table(value = c(data.nswpcn$A2, data.glasgow$A2, data.apgi$A2, data.dresden$A2, data.nswpcn$A4, c
temp

## , , cohort = APGI
##
##        marker
## value    A2  A4
##   FALSE  64  26
##   TRUE   11  49
##
## , , cohort = Dresden
##
##        marker
## value    A2  A4
##   FALSE 112  18
##   TRUE   38 132
##
## , , cohort = Glasgow
##
##        marker
## value    A2  A4
##   FALSE 127  55
##   TRUE   62 134
##
## , , cohort = NSWPCN
##
##        marker
## value    A2  A4
##   FALSE 203  60
##   TRUE   37 180

plot(temp)
```



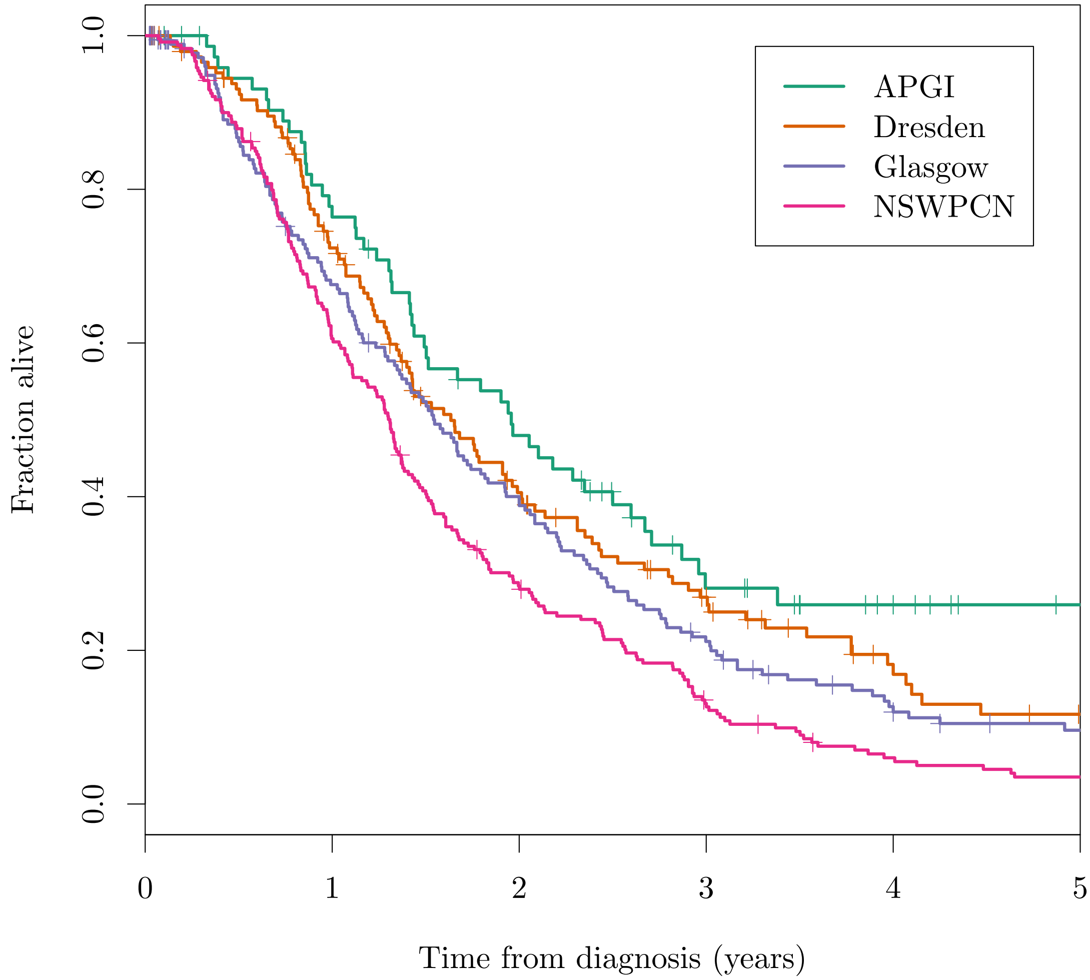

```
plot(as.table(temp[,1,]))
```




```
plot(as.table(temp[,2,]))
```




```
temp.time = c(data.nswpcn$Time, data.glasgow$Time, data.apgi$Time, data.dresden$Time) / 365.25
temp.dsd = c(data.nswpcn$DSD, data.glasgow$DSD, data.apgi$DSD, data.dresden$DSD)
temp.cohort = factor(rep(c("NSWPCN", "Glasgow", "APGI", "Dresden"), c(nrow(data.nswpcn), nrow(data.glasg
temp.survfit = survfit(Surv(temp.time, temp.dsd) ~ temp.cohort)
plot(temp.survfit, col = pal[1:4], xlim = c(0, 5), lwd = 3, main = "", xlab = "Time from diagnosis (year
legend("topright", legend = c("APGI", "Dresden", "Glasgow", "NSWPCN"), col = pal[1:4], inset = 0.05, lwd
```




```
survdiff(Surv(temp.time, temp.dsd) ~ temp.cohort)

## Call:
## survdiff(formula = Surv(temp.time, temp.dsd) ~ temp.cohort)
##
##                        N Observed Expected (O-E)^2/E (O-E)^2/V
## temp.cohort=APGI     75       51     74.7     7.495    8.7035
## temp.cohort=Dresden 150      112    137.3     4.661    6.2829
## temp.cohort=Glasgow 189      161    163.2     0.031    0.0443
## temp.cohort=NSWPCN  240      231    179.8    14.581   21.8988
##
##  Chisq= 27.1  on 3 degrees of freedom, p= 5.68e-06

temp.vars = c("Time", "DSD", "SexM", "AgeCent", "SizeCent", "Stage.pT.Simplified", "LocBody", "Treat.Mar
temp.all = as.data.frame(rbind(
        cbind(data.nswpcn[,temp.vars], cohort = "NSWPCN"),
        cbind(data.glasgow[,temp.vars], cohort = "Glasgow"),
        cbind(data.apgi[,temp.vars], cohort = "APGI"),
        cbind(data.dresden[,temp.vars], cohort = "Dresden")))
table(temp.all$SexM, temp.all$cohort)

##
##           NSWPCN Glasgow APGI Dresden
```

```
##   FALSE    120      89   34      68
##   TRUE     120     100   41      82
```

```
temp.allfit = coxph(Surv(Time, DSD) ~ LocBody + cohort*(SexM + AgeCent + SizeCent + Treat.MarginPositive
temp.allfit2 = coxph(Surv(Time, DSD) ~ LocBody + SexM + AgeCent + SizeCent + Treat.MarginPositive + I(Pa
summary(temp.allfit)
```

```
## Call:
## coxph(formula = Surv(Time, DSD) ~ LocBody + cohort * (SexM +
##     AgeCent + SizeCent + Treat.MarginPositive + I(Path.Differentiation %in%
##     c("3", "4")) + A2 + A4), data = temp.all)
##
##   n= 654, number of events= 555
##
##                                                          coef
## LocBodyTRUE                                          2.83e-01
## cohortGlasgow                                       -8.22e-01
## cohortAPGI                                          -1.08e+00
## cohortDresden                                       -6.85e-01
## SexMTRUE                                            -9.81e-02
## AgeCent                                             -3.10e-03
## SizeCent                                             8.51e-03
## Treat.MarginPositiveTRUE                             4.91e-01
## I(Path.Differentiation %in% c("3", "4"))TRUE         1.35e-01
## A2TRUE                                               6.88e-01
## A4TRUE                                               5.70e-01
## cohortGlasgow:SexMTRUE                               2.53e-01
## cohortAPGI:SexMTRUE                                  5.60e-01
## cohortDresden:SexMTRUE                               3.91e-01
## cohortGlasgow:AgeCent                               -2.27e-02
## cohortAPGI:AgeCent                                   2.78e-02
## cohortDresden:AgeCent                                1.83e-02
## cohortGlasgow:SizeCent                               2.44e-02
## cohortAPGI:SizeCent                                  8.54e-05
## cohortDresden:SizeCent                              -4.15e-04
## cohortGlasgow:Treat.MarginPositiveTRUE               1.61e-01
## cohortAPGI:Treat.MarginPositiveTRUE                  8.27e-01
## cohortDresden:Treat.MarginPositiveTRUE               7.85e-02
## cohortGlasgow:I(Path.Differentiation %in% c("3", "4"))TRUE  1.74e-01
## cohortAPGI:I(Path.Differentiation %in% c("3", "4"))TRUE     2.71e-01
## cohortDresden:I(Path.Differentiation %in% c("3", "4"))TRUE  3.62e-01
## cohortGlasgow:A2TRUE                                 5.56e-02
## cohortAPGI:A2TRUE                                   -1.99e-01
## cohortDresden:A2TRUE                                -4.45e-01
## cohortGlasgow:A4TRUE                                -2.69e-01
## cohortAPGI:A4TRUE                                   -2.65e-01
## cohortDresden:A4TRUE                                -3.09e-01
##                                                     exp(coef)
## LocBodyTRUE                                          1.33e+00
## cohortGlasgow                                        4.40e-01
## cohortAPGI                                           3.41e-01
## cohortDresden                                        5.04e-01
## SexMTRUE                                             9.07e-01
## AgeCent                                              9.97e-01
```

```
## SizeCent                                                    1.01e+00
## Treat.MarginPositiveTRUE                                    1.63e+00
## I(Path.Differentiation %in% c("3", "4"))TRUE                1.14e+00
## A2TRUE                                                      1.99e+00
## A4TRUE                                                      1.77e+00
## cohortGlasgow:SexMTRUE                                      1.29e+00
## cohortAPGI:SexMTRUE                                         1.75e+00
## cohortDresden:SexMTRUE                                      1.48e+00
## cohortGlasgow:AgeCent                                       9.78e-01
## cohortAPGI:AgeCent                                          1.03e+00
## cohortDresden:AgeCent                                       1.02e+00
## cohortGlasgow:SizeCent                                      1.02e+00
## cohortAPGI:SizeCent                                         1.00e+00
## cohortDresden:SizeCent                                      1.00e+00
## cohortGlasgow:Treat.MarginPositiveTRUE                      1.17e+00
## cohortAPGI:Treat.MarginPositiveTRUE                         2.29e+00
## cohortDresden:Treat.MarginPositiveTRUE                      1.08e+00
## cohortGlasgow:I(Path.Differentiation %in% c("3", "4"))TRUE  1.19e+00
## cohortAPGI:I(Path.Differentiation %in% c("3", "4"))TRUE     1.31e+00
## cohortDresden:I(Path.Differentiation %in% c("3", "4"))TRUE  1.44e+00
## cohortGlasgow:A2TRUE                                        1.06e+00
## cohortAPGI:A2TRUE                                           8.19e-01
## cohortDresden:A2TRUE                                        6.41e-01
## cohortGlasgow:A4TRUE                                        7.64e-01
## cohortAPGI:A4TRUE                                           7.67e-01
## cohortDresden:A4TRUE                                        7.34e-01
##                                                             se(coef)     z
## LocBodyTRUE                                                 1.64e-01  1.73
## cohortGlasgow                                               2.87e-01 -2.86
## cohortAPGI                                                  3.59e-01 -2.99
## cohortDresden                                               3.91e-01 -1.75
## SexMTRUE                                                    1.33e-01 -0.74
## AgeCent                                                     7.30e-03 -0.42
## SizeCent                                                    5.13e-03  1.66
## Treat.MarginPositiveTRUE                                    1.41e-01  3.48
## I(Path.Differentiation %in% c("3", "4"))TRUE                1.61e-01  0.84
## A2TRUE                                                      2.03e-01  3.40
## A4TRUE                                                      1.59e-01  3.59
## cohortGlasgow:SexMTRUE                                      2.13e-01  1.18
## cohortAPGI:SexMTRUE                                         3.41e-01  1.64
## cohortDresden:SexMTRUE                                      2.38e-01  1.64
## cohortGlasgow:AgeCent                                       1.12e-02 -2.03
## cohortAPGI:AgeCent                                          1.94e-02  1.43
## cohortDresden:AgeCent                                       1.32e-02  1.38
## cohortGlasgow:SizeCent                                      9.38e-03  2.60
## cohortAPGI:SizeCent                                         1.01e-02  0.01
## cohortDresden:SizeCent                                      1.07e-02 -0.04
## cohortGlasgow:Treat.MarginPositiveTRUE                      2.38e-01  0.68
## cohortAPGI:Treat.MarginPositiveTRUE                         3.38e-01  2.45
## cohortDresden:Treat.MarginPositiveTRUE                      2.53e-01  0.31
## cohortGlasgow:I(Path.Differentiation %in% c("3", "4"))TRUE  2.38e-01  0.73
## cohortAPGI:I(Path.Differentiation %in% c("3", "4"))TRUE     3.41e-01  0.79
## cohortDresden:I(Path.Differentiation %in% c("3", "4"))TRUE  2.65e-01  1.36
## cohortGlasgow:A2TRUE                                        2.71e-01  0.21
```

```
## cohortAPGI:A2TRUE                                          4.36e-01 -0.46
## cohortDresden:A2TRUE                                       3.07e-01 -1.45
## cohortGlasgow:A4TRUE                                       2.42e-01 -1.11
## cohortAPGI:A4TRUE                                          3.73e-01 -0.71
## cohortDresden:A4TRUE                                       3.64e-01 -0.85
##                                                           Pr(>|z|)
## LocBodyTRUE                                                0.08445
## cohortGlasgow                                              0.00422
## cohortAPGI                                                 0.00275
## cohortDresden                                              0.08017
## SexMTRUE                                                   0.46098
## AgeCent                                                    0.67098
## SizeCent                                                   0.09729
## Treat.MarginPositiveTRUE                                   0.00050
## I(Path.Differentiation %in% c("3", "4"))TRUE               0.40055
## A2TRUE                                                     0.00069
## A4TRUE                                                     0.00034
## cohortGlasgow:SexMTRUE                                     0.23670
## cohortAPGI:SexMTRUE                                        0.10066
## cohortDresden:SexMTRUE                                     0.10095
## cohortGlasgow:AgeCent                                      0.04235
## cohortAPGI:AgeCent                                         0.15134
## cohortDresden:AgeCent                                      0.16648
## cohortGlasgow:SizeCent                                     0.00928
## cohortAPGI:SizeCent                                        0.99325
## cohortDresden:SizeCent                                     0.96910
## cohortGlasgow:Treat.MarginPositiveTRUE                     0.49879
## cohortAPGI:Treat.MarginPositiveTRUE                        0.01431
## cohortDresden:Treat.MarginPositiveTRUE                     0.75612
## cohortGlasgow:I(Path.Differentiation %in% c("3", "4"))TRUE  0.46494
## cohortAPGI:I(Path.Differentiation %in% c("3", "4"))TRUE     0.42668
## cohortDresden:I(Path.Differentiation %in% c("3", "4"))TRUE  0.17251
## cohortGlasgow:A2TRUE                                       0.83723
## cohortAPGI:A2TRUE                                          0.64777
## cohortDresden:A2TRUE                                       0.14658
## cohortGlasgow:A4TRUE                                       0.26585
## cohortAPGI:A4TRUE                                          0.47722
## cohortDresden:A4TRUE                                       0.39663
##
##                                                           exp(coef)
## LocBodyTRUE                                                   1.327
## cohortGlasgow                                                 0.440
## cohortAPGI                                                    0.341
## cohortDresden                                                 0.504
## SexMTRUE                                                      0.907
## AgeCent                                                       0.997
## SizeCent                                                      1.009
## Treat.MarginPositiveTRUE                                      1.633
## I(Path.Differentiation %in% c("3", "4"))TRUE                  1.145
## A2TRUE                                                        1.989
## A4TRUE                                                        1.768
## cohortGlasgow:SexMTRUE                                        1.287
## cohortAPGI:SexMTRUE                                           1.751
## cohortDresden:SexMTRUE                                        1.478
```

```
## cohortGlasgow:AgeCent                                            0.978
## cohortAPGI:AgeCent                                               1.028
## cohortDresden:AgeCent                                            1.018
## cohortGlasgow:SizeCent                                           1.025
## cohortAPGI:SizeCent                                              1.000
## cohortDresden:SizeCent                                           1.000
## cohortGlasgow:Treat.MarginPositiveTRUE                           1.175
## cohortAPGI:Treat.MarginPositiveTRUE                              2.287
## cohortDresden:Treat.MarginPositiveTRUE                           1.082
## cohortGlasgow:I(Path.Differentiation %in% c("3", "4"))TRUE     1.190
## cohortAPGI:I(Path.Differentiation %in% c("3", "4"))TRUE        1.311
## cohortDresden:I(Path.Differentiation %in% c("3", "4"))TRUE     1.436
## cohortGlasgow:A2TRUE                                             1.057
## cohortAPGI:A2TRUE                                                0.819
## cohortDresden:A2TRUE                                             0.641
## cohortGlasgow:A4TRUE                                             0.764
## cohortAPGI:A4TRUE                                                0.767
## cohortDresden:A4TRUE                                             0.734
##                                                               exp(-coef)
## LocBodyTRUE                                                       0.754
## cohortGlasgow                                                     2.275
## cohortAPGI                                                        2.933
## cohortDresden                                                     1.983
## SexMTRUE                                                          1.103
## AgeCent                                                           1.003
## SizeCent                                                          0.992
## Treat.MarginPositiveTRUE                                          0.612
## I(Path.Differentiation %in% c("3", "4"))TRUE                      0.874
## A2TRUE                                                            0.503
## A4TRUE                                                            0.566
## cohortGlasgow:SexMTRUE                                            0.777
## cohortAPGI:SexMTRUE                                               0.571
## cohortDresden:SexMTRUE                                            0.676
## cohortGlasgow:AgeCent                                             1.023
## cohortAPGI:AgeCent                                                0.973
## cohortDresden:AgeCent                                             0.982
## cohortGlasgow:SizeCent                                            0.976
## cohortAPGI:SizeCent                                               1.000
## cohortDresden:SizeCent                                            1.000
## cohortGlasgow:Treat.MarginPositiveTRUE                            0.851
## cohortAPGI:Treat.MarginPositiveTRUE                               0.437
## cohortDresden:Treat.MarginPositiveTRUE                            0.924
## cohortGlasgow:I(Path.Differentiation %in% c("3", "4"))TRUE      0.840
## cohortAPGI:I(Path.Differentiation %in% c("3", "4"))TRUE         0.763
## cohortDresden:I(Path.Differentiation %in% c("3", "4"))TRUE      0.696
## cohortGlasgow:A2TRUE                                              0.946
## cohortAPGI:A2TRUE                                                 1.220
## cohortDresden:A2TRUE                                              1.560
## cohortGlasgow:A4TRUE                                              1.309
## cohortAPGI:A4TRUE                                                 1.303
## cohortDresden:A4TRUE                                              1.362
##                                                               lower .95
## LocBodyTRUE                                                      0.962
## cohortGlasgow                                                    0.250
```

```
## cohortAPGI                                                     0.169
## cohortDresden                                                  0.234
## SexMTRUE                                                       0.698
## AgeCent                                                        0.983
## SizeCent                                                       0.998
## Treat.MarginPositiveTRUE                                       1.239
## I(Path.Differentiation %in% c("3", "4"))TRUE                   0.835
## A2TRUE                                                         1.337
## A4TRUE                                                         1.295
## cohortGlasgow:SexMTRUE                                         0.847
## cohortAPGI:SexMTRUE                                            0.897
## cohortDresden:SexMTRUE                                         0.927
## cohortGlasgow:AgeCent                                          0.956
## cohortAPGI:AgeCent                                             0.990
## cohortDresden:AgeCent                                          0.992
## cohortGlasgow:SizeCent                                         1.006
## cohortAPGI:SizeCent                                            0.980
## cohortDresden:SizeCent                                         0.979
## cohortGlasgow:Treat.MarginPositiveTRUE                         0.737
## cohortAPGI:Treat.MarginPositiveTRUE                            1.180
## cohortDresden:Treat.MarginPositiveTRUE                         0.659
## cohortGlasgow:I(Path.Differentiation %in% c("3", "4"))TRUE     0.746
## cohortAPGI:I(Path.Differentiation %in% c("3", "4"))TRUE        0.672
## cohortDresden:I(Path.Differentiation %in% c("3", "4"))TRUE     0.854
## cohortGlasgow:A2TRUE                                           0.622
## cohortAPGI:A2TRUE                                              0.349
## cohortDresden:A2TRUE                                           0.351
## cohortGlasgow:A4TRUE                                           0.476
## cohortAPGI:A4TRUE                                              0.370
## cohortDresden:A4TRUE                                           0.359
##                                                            upper .95
## LocBodyTRUE                                                    1.830
## cohortGlasgow                                                  0.772
## cohortAPGI                                                     0.689
## cohortDresden                                                  1.086
## SexMTRUE                                                       1.177
## AgeCent                                                        1.011
## SizeCent                                                       1.019
## Treat.MarginPositiveTRUE                                       2.153
## I(Path.Differentiation %in% c("3", "4"))TRUE                   1.568
## A2TRUE                                                         2.958
## A4TRUE                                                         2.414
## cohortGlasgow:SexMTRUE                                         1.956
## cohortAPGI:SexMTRUE                                            3.419
## cohortDresden:SexMTRUE                                         2.359
## cohortGlasgow:AgeCent                                          0.999
## cohortAPGI:AgeCent                                             1.068
## cohortDresden:AgeCent                                          1.045
## cohortGlasgow:SizeCent                                         1.044
## cohortAPGI:SizeCent                                            1.020
## cohortDresden:SizeCent                                         1.021
## cohortGlasgow:Treat.MarginPositiveTRUE                         1.872
## cohortAPGI:Treat.MarginPositiveTRUE                            4.433
## cohortDresden:Treat.MarginPositiveTRUE                         1.776
```

```
## cohortGlasgow:I(Path.Differentiation %in% c("3", "4"))TRUE     1.897
## cohortAPGI:I(Path.Differentiation %in% c("3", "4"))TRUE        2.558
## cohortDresden:I(Path.Differentiation %in% c("3", "4"))TRUE     2.416
## cohortGlasgow:A2TRUE                                           1.798
## cohortAPGI:A2TRUE                                              1.925
## cohortDresden:A2TRUE                                           1.169
## cohortGlasgow:A4TRUE                                           1.227
## cohortAPGI:A4TRUE                                              1.593
## cohortDresden:A4TRUE                                           1.500
##
## Concordance= 0.681  (se = 0.014 )
## Rsquare= 0.274   (max possible= 1 )
## Likelihood ratio test= 209  on 32 df,   p=0
## Wald test            = 202  on 32 df,   p=0
## Score (logrank) test = 218  on 32 df,   p=0
```

```
anova(temp.allfit)
```

```
## Analysis of Deviance Table
##  Cox model: response is Surv(Time, DSD)
## Terms added sequentially (first to last)
##
##                                                   loglik Chisq Df Pr(>|Chi|)
## NULL                                               -3089
## LocBody                                            -3082 14.72  1    0.00013
## cohort                                             -3069 26.55  3    7.3e-06
## SexM                                               -3068  1.22  1    0.27016
## AgeCent                                            -3068  0.15  1    0.70036
## SizeCent                                           -3054 27.65  1    1.5e-07
## Treat.MarginPositive                               -3037 33.69  1    6.5e-09
## I(Path.Differentiation %in% c("3", "4"))           -3026 22.66  1    1.9e-06
## A2                                                 -3011 29.43  1    5.8e-08
## A4                                                 -3003 17.05  1    3.6e-05
## cohort:SexM                                        -3000  5.32  3    0.14956
## cohort:AgeCent                                     -2994 12.21  3    0.00671
## cohort:SizeCent                                    -2990  7.07  3    0.06978
## cohort:Treat.MarginPositive                        -2987  5.63  3    0.13114
## cohort:I(Path.Differentiation %in% c("3", "4"))  -2987  1.06  3    0.78686
## cohort:A2                                          -2985  3.33  3    0.34326
## cohort:A4                                          -2984  1.67  3    0.64338
```

```
anova(temp.allfit, temp.allfit2)
```

```
## Analysis of Deviance Table
##  Cox model: response is  Surv(Time, DSD)
##  Model 1: ~ LocBody + cohort * (SexM + AgeCent + SizeCent + Treat.MarginPositive + I(Path.Differentia
##  Model 2: ~ LocBody + SexM + AgeCent + SizeCent + Treat.MarginPositive + I(Path.Differentiation %in%
##   loglik Chisq Df P(>|Chi|)
## 1  -2984
## 2  -3025  81.3 24   3.8e-08
```

```
cox.zph(temp.allfit)
```

```
##                                                                      rho
## LocBodyTRUE                                                      0.03809
```

```
## cohortGlasgow                                                    0.06697
## cohortAPGI                                                       0.01437
## cohortDresden                                                   -0.01345
## SexMTRUE                                                         0.11035
## AgeCent                                                         -0.07038
## SizeCent                                                        -0.05970
## Treat.MarginPositiveTRUE                                        -0.05022
## I(Path.Differentiation %in% c("3", "4"))TRUE                    -0.00879
## A2TRUE                                                           0.02464
## A4TRUE                                                          -0.06118
## cohortGlasgow:SexMTRUE                                          -0.07548
## cohortAPGI:SexMTRUE                                             -0.10355
## cohortDresden:SexMTRUE                                          -0.05615
## cohortGlasgow:AgeCent                                            0.03511
## cohortAPGI:AgeCent                                              -0.06395
## cohortDresden:AgeCent                                            0.00267
## cohortGlasgow:SizeCent                                          -0.01654
## cohortAPGI:SizeCent                                              0.02391
## cohortDresden:SizeCent                                          -0.00991
## cohortGlasgow:Treat.MarginPositiveTRUE                           0.00379
## cohortAPGI:Treat.MarginPositiveTRUE                              0.06396
## cohortDresden:Treat.MarginPositiveTRUE                           0.01213
## cohortGlasgow:I(Path.Differentiation %in% c("3", "4"))TRUE -0.04754
## cohortAPGI:I(Path.Differentiation %in% c("3", "4"))TRUE    -0.00593
## cohortDresden:I(Path.Differentiation %in% c("3", "4"))TRUE  0.06682
## cohortGlasgow:A2TRUE                                            -0.04746
## cohortAPGI:A2TRUE                                                0.06970
## cohortDresden:A2TRUE                                            -0.02126
## cohortGlasgow:A4TRUE                                            -0.02756
## cohortAPGI:A4TRUE                                                0.01480
## cohortDresden:A4TRUE                                            -0.01282
## GLOBAL                                                                NA
##                                                                    chisq
## LocBodyTRUE                                                      0.90616
## cohortGlasgow                                                    2.56256
## cohortAPGI                                                       0.10117
## cohortDresden                                                    0.12785
## SexMTRUE                                                         6.70881
## AgeCent                                                          3.28661
## SizeCent                                                         2.35545
## Treat.MarginPositiveTRUE                                         1.50171
## I(Path.Differentiation %in% c("3", "4"))TRUE                     0.04807
## A2TRUE                                                           0.38624
## A4TRUE                                                           2.05228
## cohortGlasgow:SexMTRUE                                           3.23367
## cohortAPGI:SexMTRUE                                              6.67723
## cohortDresden:SexMTRUE                                           1.91757
## cohortGlasgow:AgeCent                                            0.71607
## cohortAPGI:AgeCent                                               2.76090
## cohortDresden:AgeCent                                            0.00445
## cohortGlasgow:SizeCent                                           0.18172
## cohortAPGI:SizeCent                                              0.35473
## cohortDresden:SizeCent                                           0.07646
## cohortGlasgow:Treat.MarginPositiveTRUE                           0.00837
```

```
## cohortAPGI:Treat.MarginPositiveTRUE                               2.63651
## cohortDresden:Treat.MarginPositiveTRUE                            0.09593
## cohortGlasgow:I(Path.Differentiation %in% c("3", "4"))TRUE  1.29374
## cohortAPGI:I(Path.Differentiation %in% c("3", "4"))TRUE     0.02202
## cohortDresden:I(Path.Differentiation %in% c("3", "4"))TRUE  2.94642
## cohortGlasgow:A2TRUE                                              1.29339
## cohortAPGI:A2TRUE                                                 2.82302
## cohortDresden:A2TRUE                                              0.28947
## cohortGlasgow:A4TRUE                                              0.40662
## cohortAPGI:A4TRUE                                                 0.13340
## cohortDresden:A4TRUE                                              0.10976
## GLOBAL                                                           58.78746
##                                                                        p
## LocBodyTRUE                                                     0.34114
## cohortGlasgow                                                   0.10942
## cohortAPGI                                                      0.75043
## cohortDresden                                                   0.72067
## SexMTRUE                                                        0.00959
## AgeCent                                                         0.06985
## SizeCent                                                        0.12485
## Treat.MarginPositiveTRUE                                        0.22041
## I(Path.Differentiation %in% c("3", "4"))TRUE                    0.82645
## A2TRUE                                                          0.53428
## A4TRUE                                                          0.15198
## cohortGlasgow:SexMTRUE                                          0.07214
## cohortAPGI:SexMTRUE                                             0.00977
## cohortDresden:SexMTRUE                                          0.16613
## cohortGlasgow:AgeCent                                           0.39744
## cohortAPGI:AgeCent                                              0.09659
## cohortDresden:AgeCent                                           0.94683
## cohortGlasgow:SizeCent                                          0.66990
## cohortAPGI:SizeCent                                             0.55145
## cohortDresden:SizeCent                                          0.78216
## cohortGlasgow:Treat.MarginPositiveTRUE                          0.92710
## cohortAPGI:Treat.MarginPositiveTRUE                             0.10443
## cohortDresden:Treat.MarginPositiveTRUE                          0.75677
## cohortGlasgow:I(Path.Differentiation %in% c("3", "4"))TRUE 0.25536
## cohortAPGI:I(Path.Differentiation %in% c("3", "4"))TRUE    0.88203
## cohortDresden:I(Path.Differentiation %in% c("3", "4"))TRUE 0.08607
## cohortGlasgow:A2TRUE                                            0.25542
## cohortAPGI:A2TRUE                                               0.09292
## cohortDresden:A2TRUE                                            0.59056
## cohortGlasgow:A4TRUE                                            0.52369
## cohortAPGI:A4TRUE                                               0.71493
## cohortDresden:A4TRUE                                            0.74042
## GLOBAL                                                          0.00267
```

```
temp = cox.zph(temp.allfit)$table
sort(p.adjust(temp[grepl("^cohort", rownames(temp)), "p"], "holm"))
```

```
##                                              cohortAPGI:SexMTRUE
##                                                           0.2344
##                                                    cohortGlasgow
##                                                           1.0000
```

```
##                                                cohortAPGI
##                                                    1.0000
##                                             cohortDresden
##                                                    1.0000
##                                      cohortGlasgow:SexMTRUE
##                                                    1.0000
##                                      cohortDresden:SexMTRUE
##                                                    1.0000
##                                      cohortGlasgow:AgeCent
##                                                    1.0000
##                                         cohortAPGI:AgeCent
##                                                    1.0000
##                                      cohortDresden:AgeCent
##                                                    1.0000
##                                     cohortGlasgow:SizeCent
##                                                    1.0000
##                                        cohortAPGI:SizeCent
##                                                    1.0000
##                                     cohortDresden:SizeCent
##                                                    1.0000
##                     cohortGlasgow:Treat.MarginPositiveTRUE
##                                                    1.0000
##                        cohortAPGI:Treat.MarginPositiveTRUE
##                                                    1.0000
##                     cohortDresden:Treat.MarginPositiveTRUE
##                                                    1.0000
## cohortGlasgow:I(Path.Differentiation %in% c("3", "4"))TRUE
##                                                    1.0000
##    cohortAPGI:I(Path.Differentiation %in% c("3", "4"))TRUE
##                                                    1.0000
## cohortDresden:I(Path.Differentiation %in% c("3", "4"))TRUE
##                                                    1.0000
##                                       cohortGlasgow:A2TRUE
##                                                    1.0000
##                                          cohortAPGI:A2TRUE
##                                                    1.0000
##                                       cohortDresden:A2TRUE
##                                                    1.0000
##                                       cohortGlasgow:A4TRUE
##                                                    1.0000
##                                          cohortAPGI:A4TRUE
##                                                    1.0000
##                                       cohortDresden:A4TRUE
##                                                    1.0000

#plot(cox.zph(temp.allfit))
```

3 Score calculation

```
temp = applyNomogram(fit.mskcc, data.glasgow)
```

```
## Warning in FUN(c("History.Diagnosis.AgeAt", "Patient.Sex", "Portal.Vein", :  Marginalizing
missing variable:  Portal.Vein
## Warning in FUN(c("History.Diagnosis.AgeAt", "Patient.Sex", "Portal.Vein", :  Marginalizing
missing variable:  Splenectomy
## Warning in FUN(c("History.Diagnosis.AgeAt", "Patient.Sex", "Portal.Vein", :  Marginalizing
missing variable:  Posterior.Margin
## Warning in FUN(c("History.Diagnosis.AgeAt", "Patient.Sex", "Portal.Vein", :  Marginalizing
missing variable:  Back.pain
## Warning in FUN(c("History.Diagnosis.AgeAt", "Patient.Sex", "Portal.Vein", :  Marginalizing
missing variable:  Weight.loss
```

```
mskcc_post.linpred.glasgow = temp[,1]
mskcc_post.12mo.glasgow = temp[,2]
mskcc_post.24mo.glasgow = temp[,3]
mskcc_post.36mo.glasgow = temp[,4]
temp = applyNomogram(fit.mskcc, data.glasgow[,c("History.Diagnosis.AgeAt", "Patient.Sex", "Path.Locatior
```

```
## Warning in FUN(c("History.Diagnosis.AgeAt", "Patient.Sex", "Portal.Vein", :  Marginalizing
missing variable:  Portal.Vein
## Warning in FUN(c("History.Diagnosis.AgeAt", "Patient.Sex", "Portal.Vein", :  Marginalizing
missing variable:  Splenectomy
## Warning in FUN(c("History.Diagnosis.AgeAt", "Patient.Sex", "Portal.Vein", :  Marginalizing
missing variable:  Treat.MarginPositive
## Warning in FUN(c("History.Diagnosis.AgeAt", "Patient.Sex", "Portal.Vein", :  Marginalizing
missing variable:  Path.Differentiation
## Warning in FUN(c("History.Diagnosis.AgeAt", "Patient.Sex", "Portal.Vein", :  Marginalizing
missing variable:  Posterior.Margin
## Warning in FUN(c("History.Diagnosis.AgeAt", "Patient.Sex", "Portal.Vein", :  Marginalizing
missing variable:  Path.LN.Involved
## Warning in FUN(c("History.Diagnosis.AgeAt", "Patient.Sex", "Portal.Vein", :  Marginalizing
missing variable:  Path.LN.Negative
## Warning in FUN(c("History.Diagnosis.AgeAt", "Patient.Sex", "Portal.Vein", :  Marginalizing
missing variable:  Back.pain
## Warning in FUN(c("History.Diagnosis.AgeAt", "Patient.Sex", "Portal.Vein", :  Marginalizing
missing variable:  Weight.loss
```

```
mskcc_pre.linpred.glasgow = temp[,1]
mskcc_pre.12mo.glasgow = temp[,2]
mskcc_pre.24mo.glasgow = temp[,3]
mskcc_pre.36mo.glasgow = temp[,4]
```

```
temp = applyNomogram(fit.mskcc, data.apgi)
```

```
## Warning in FUN(c("History.Diagnosis.AgeAt", "Patient.Sex", "Portal.Vein", :  Marginalizing
missing variable:  Portal.Vein
## Warning in FUN(c("History.Diagnosis.AgeAt", "Patient.Sex", "Portal.Vein", :  Marginalizing
missing variable:  Splenectomy
## Warning in FUN(c("History.Diagnosis.AgeAt", "Patient.Sex", "Portal.Vein", :  Marginalizing
missing variable:  Posterior.Margin
## Warning in FUN(c("History.Diagnosis.AgeAt", "Patient.Sex", "Portal.Vein", :  Marginalizing
missing variable:  Back.pain
## Warning in FUN(c("History.Diagnosis.AgeAt", "Patient.Sex", "Portal.Vein", :  Marginalizing
missing variable:  Weight.loss
```

```
mskcc_post.linpred.apgi = temp[,1]
```

```
mskcc_post.12mo.apgi = temp[,2]
mskcc_post.24mo.apgi = temp[,3]
mskcc_post.36mo.apgi = temp[,4]
temp = applyNomogram(fit.mskcc, data.apgi[,c("History.Diagnosis.AgeAt", "Patient.Sex", "Path.LocationBoc

## Warning in FUN(c("History.Diagnosis.AgeAt", "Patient.Sex", "Portal.Vein", : Marginalizing
missing variable: Portal.Vein
## Warning in FUN(c("History.Diagnosis.AgeAt", "Patient.Sex", "Portal.Vein", : Marginalizing
missing variable: Splenectomy
## Warning in FUN(c("History.Diagnosis.AgeAt", "Patient.Sex", "Portal.Vein", : Marginalizing
missing variable: Treat.MarginPositive
## Warning in FUN(c("History.Diagnosis.AgeAt", "Patient.Sex", "Portal.Vein", : Marginalizing
missing variable: Path.Differentiation
## Warning in FUN(c("History.Diagnosis.AgeAt", "Patient.Sex", "Portal.Vein", : Marginalizing
missing variable: Posterior.Margin
## Warning in FUN(c("History.Diagnosis.AgeAt", "Patient.Sex", "Portal.Vein", : Marginalizing
missing variable: Path.LN.Involved
## Warning in FUN(c("History.Diagnosis.AgeAt", "Patient.Sex", "Portal.Vein", : Marginalizing
missing variable: Path.LN.Negative
## Warning in FUN(c("History.Diagnosis.AgeAt", "Patient.Sex", "Portal.Vein", : Marginalizing
missing variable: Back.pain
## Warning in FUN(c("History.Diagnosis.AgeAt", "Patient.Sex", "Portal.Vein", : Marginalizing
missing variable: Weight.loss

mskcc_pre.linpred.apgi = temp[,1]
mskcc_pre.12mo.apgi = temp[,2]
mskcc_pre.24mo.apgi = temp[,3]
mskcc_pre.36mo.apgi = temp[,4]
```

```
temp = applyNomogram(fit.mskcc, data.dresden)

## Warning in FUN(c("History.Diagnosis.AgeAt", "Patient.Sex", "Portal.Vein", : Marginalizing
missing variable: Portal.Vein
## Warning in FUN(c("History.Diagnosis.AgeAt", "Patient.Sex", "Portal.Vein", : Marginalizing
missing variable: Splenectomy
## Warning in FUN(c("History.Diagnosis.AgeAt", "Patient.Sex", "Portal.Vein", : Marginalizing
missing variable: Posterior.Margin
## Warning in FUN(c("History.Diagnosis.AgeAt", "Patient.Sex", "Portal.Vein", : Marginalizing
missing variable: Path.LN.Involved
## Warning in FUN(c("History.Diagnosis.AgeAt", "Patient.Sex", "Portal.Vein", : Marginalizing
missing variable: Path.LN.Negative
## Warning in FUN(c("History.Diagnosis.AgeAt", "Patient.Sex", "Portal.Vein", : Marginalizing
missing variable: Back.pain
## Warning in FUN(c("History.Diagnosis.AgeAt", "Patient.Sex", "Portal.Vein", : Marginalizing
missing variable: Weight.loss

mskcc_post.linpred.dresden = temp[,1]
mskcc_post.12mo.dresden = temp[,2]
mskcc_post.24mo.dresden = temp[,3]
mskcc_post.36mo.dresden = temp[,4]
temp = applyNomogram(fit.mskcc, data.dresden[,c("History.Diagnosis.AgeAt", "Patient.Sex", "Path.Locatior

## Warning in FUN(c("History.Diagnosis.AgeAt", "Patient.Sex", "Portal.Vein", : Marginalizing
missing variable: Portal.Vein
```

```
## Warning in FUN(c("History.Diagnosis.AgeAt", "Patient.Sex", "Portal.Vein", :  Marginalizing
missing variable:  Splenectomy
## Warning in FUN(c("History.Diagnosis.AgeAt", "Patient.Sex", "Portal.Vein", :  Marginalizing
missing variable:  Treat.MarginPositive
## Warning in FUN(c("History.Diagnosis.AgeAt", "Patient.Sex", "Portal.Vein", :  Marginalizing
missing variable:  Path.Differentiation
## Warning in FUN(c("History.Diagnosis.AgeAt", "Patient.Sex", "Portal.Vein", :  Marginalizing
missing variable:  Posterior.Margin
## Warning in FUN(c("History.Diagnosis.AgeAt", "Patient.Sex", "Portal.Vein", :  Marginalizing
missing variable:  Path.LN.Involved
## Warning in FUN(c("History.Diagnosis.AgeAt", "Patient.Sex", "Portal.Vein", :  Marginalizing
missing variable:  Path.LN.Negative
## Warning in FUN(c("History.Diagnosis.AgeAt", "Patient.Sex", "Portal.Vein", :  Marginalizing
missing variable:  Back.pain
## Warning in FUN(c("History.Diagnosis.AgeAt", "Patient.Sex", "Portal.Vein", :  Marginalizing
missing variable:  Weight.loss

mskcc_pre.linpred.dresden = temp[,1]
mskcc_pre.12mo.dresden = temp[,2]
mskcc_pre.24mo.dresden = temp[,3]
mskcc_pre.36mo.dresden = temp[,4]
```

Get approximate linear predictors from the GG model, by just calculating the location term.

```
val.prob.times = seq(0, max(c(data.glasgow$Time, data.apgi$Time)), 1)
```

```
gg.path.glasgow = summary(fit.gg, newdata = data.glasgow, ci = FALSE)
temp.coefs = coef(fit.gg)
gg.linpred.glasgow = sapply(1:length(temp.coefs), function(coef_i) {
        # if (names(temp.coefs)[coef_i] == "SexMTRUE") {
 #        rep(0, nrow(data.val))
        # } else
        if (names(temp.coefs)[coef_i] %in% colnames(data.glasgow)) {
                temp.coefs[coef_i] * data.glasgow[,names(temp.coefs)[coef_i]]
        } else if (gsub("TRUE$", "", names(temp.coefs)[coef_i]) %in% colnames(data.glasgow)) {
                temp.coefs[coef_i] * data.glasgow[,gsub("TRUE$", "", names(temp.coefs)[coef_i])]
        } else {
                rep(0, nrow(data.glasgow))
        } })
gg.linpred.glasgow = -rowSums(gg.linpred.glasgow)       # Negate to bring into concordance with the dire
temp = summary(fit.gg, newdata = data.glasgow, ci = FALSE)
gg.prob.glasgow = sapply(temp, function(x) approx(x[,1], x[,2], xout = val.prob.times, yleft = 1, yright
colnames(gg.prob.glasgow) = rownames(data.glasgow)
```

```
gg.path.apgi = summary(fit.gg, newdata = data.apgi, ci = FALSE)
temp.coefs = coef(fit.gg)
gg.linpred.apgi = sapply(1:length(temp.coefs), function(coef_i) {
        # if (names(temp.coefs)[coef_i] == "SexMTRUE") {
 #        rep(0, nrow(data.val))
        # } else
        if (names(temp.coefs)[coef_i] %in% colnames(data.apgi)) {
                temp.coefs[coef_i] * data.apgi[,names(temp.coefs)[coef_i]]
```

```
        } else if (gsub("TRUE$", "", names(temp.coefs)[coef_i]) %in% colnames(data.apgi)) {
                temp.coefs[coef_i] * data.apgi[,gsub("TRUE$", "", names(temp.coefs)[coef_i])]
        } else {
                rep(0, nrow(data.apgi))
        } })
gg.linpred.apgi = -rowSums(gg.linpred.apgi)     # Negate to bring into concordance with the direction of
temp = summary(fit.gg, newdata = data.apgi, ci = FALSE)
gg.prob.apgi = sapply(temp, function(x) approx(x[,1], x[,2], xout = val.prob.times, yleft = 1, yright =
colnames(gg.prob.apgi) = rownames(data.apgi)
```

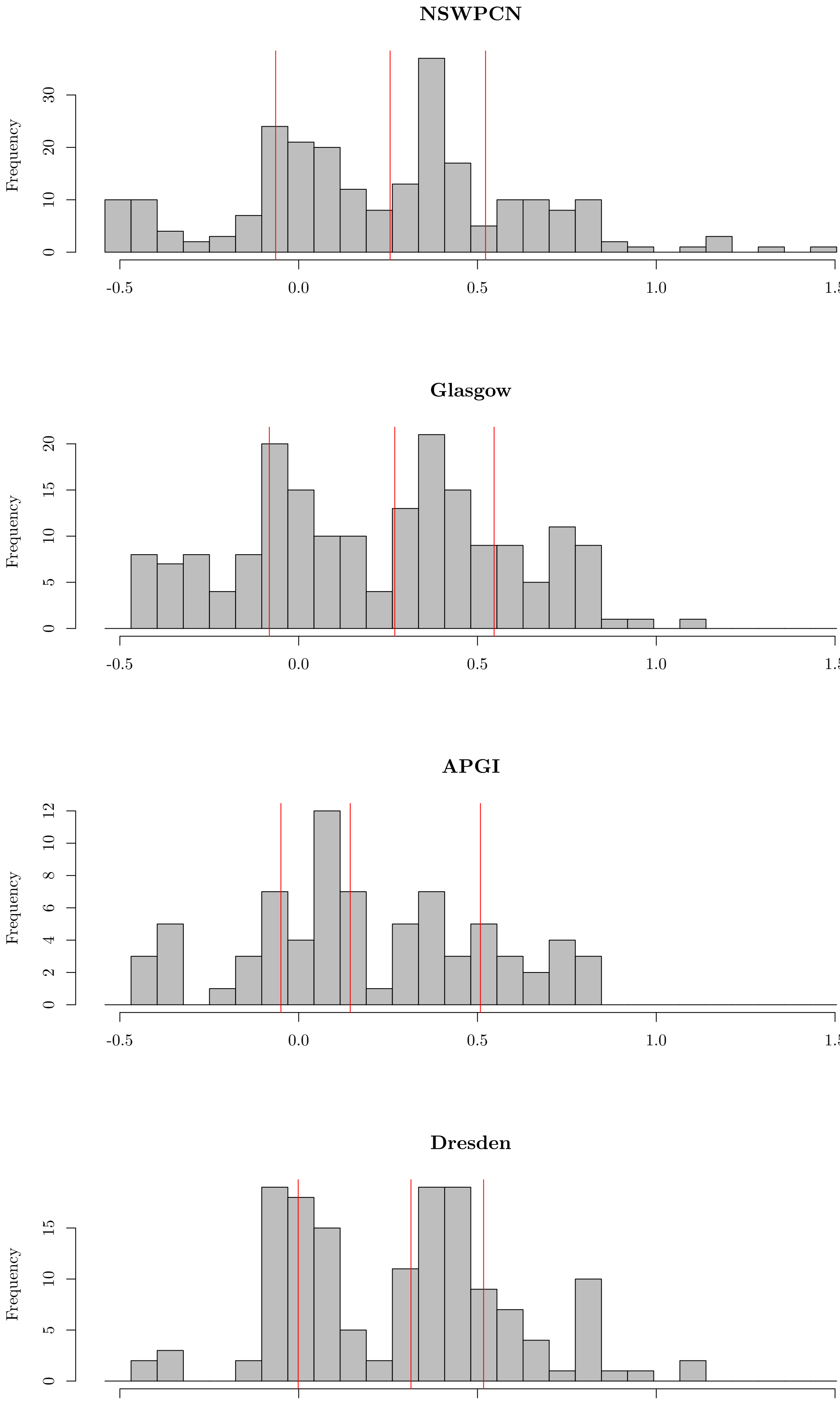
```
gg.path.dresden = summary(fit.gg, newdata = data.dresden, ci = FALSE)
temp.coefs = coef(fit.gg)
gg.linpred.dresden = sapply(1:length(temp.coefs), function(coef_i) {
        # if (names(temp.coefs)[coef_i] == "SexMTRUE") {
 #        rep(0, nrow(data.val))
        # } else
        if (names(temp.coefs)[coef_i] %in% colnames(data.dresden)) {
                temp.coefs[coef_i] * data.dresden[,names(temp.coefs)[coef_i]]
        } else if (gsub("TRUE$", "", names(temp.coefs)[coef_i]) %in% colnames(data.dresden)) {
                temp.coefs[coef_i] * data.dresden[,gsub("TRUE$", "", names(temp.coefs)[coef_i])]
        } else {
                rep(0, nrow(data.dresden))
        } })
gg.linpred.dresden = -rowSums(gg.linpred.dresden)       # Negate to bring into concordance with the dire
temp = summary(fit.gg, newdata = data.dresden, ci = FALSE)
gg.prob.dresden = sapply(temp, function(x) approx(x[,1], x[,2], xout = val.prob.times, yleft = 1, yright
colnames(gg.prob.dresden) = rownames(data.dresden)
```

```
gg.linpred.nswpcn = sapply(1:length(temp.coefs), function(coef_i) {
        # if (names(temp.coefs)[coef_i] == "SexMTRUE") {
 #        rep(0, nrow(data.val))
        # } else
        if (names(temp.coefs)[coef_i] %in% colnames(data.glasgow)) {
                temp.coefs[coef_i] * data.nswpcn[,names(temp.coefs)[coef_i]]
        } else if (gsub("TRUE$", "", names(temp.coefs)[coef_i]) %in% colnames(data.nswpcn)) {
                temp.coefs[coef_i] * data.nswpcn[,gsub("TRUE$", "", names(temp.coefs)[coef_i])]
        } else {
                rep(0, nrow(data.nswpcn))
        } })
gg.linpred.nswpcn = -rowSums(gg.linpred.nswpcn)         # Negate to bring into concordance with the dire
temp = summary(fit.gg, newdata = data.nswpcn, ci = FALSE)
gg.prob.nswpcn = sapply(temp, function(x) approx(x[,1], x[,2], xout = val.prob.times, yleft = 1, yright
colnames(gg.prob.nswpcn) = rownames(data.nswpcn)
```

4 Validation

4.1 Altman diagnostic 1: score histograms

```
par(mfrow = c(4, 1))
temp.breaks = seq(min(c(gg.linpred.nswpcn, gg.linpred.glasgow, gg.linpred.apgi, gg.linpred.dresden)), ma
hist(gg.linpred.nswpcn, main = "NSWPCN", xlim = range(c(gg.linpred.nswpcn, gg.linpred.glasgow, gg.linpre
abline(v = quantile(gg.linpred.nswpcn, probs = c(0.2, 0.5, 0.8)), col = "red")
hist(gg.linpred.glasgow, main = "Glasgow", xlim = range(c(gg.linpred.nswpcn, gg.linpred.glasgow, gg.linp
abline(v = quantile(gg.linpred.glasgow, probs = c(0.2, 0.5, 0.8)), col = "red")
hist(gg.linpred.apgi, main = "APGI", xlim = range(c(gg.linpred.nswpcn, gg.linpred.glasgow, gg.linpred.ap
abline(v = quantile(gg.linpred.apgi, probs = c(0.2, 0.5, 0.8)), col = "red")
hist(gg.linpred.dresden, main = "Dresden", xlim = range(c(gg.linpred.nswpcn, gg.linpred.glasgow, gg.linp
abline(v = quantile(gg.linpred.dresden, probs = c(0.2, 0.5, 0.8)), col = "red")
```


NSWPCN
Frequency
0
10
20
30
-0.5
0.0
0.5
1.0
1.5
Glasgow
Frequency
0
5
10
15
20
-0.5
0.0
0.5
1.0
1.5
APGI
Frequency
0
2
4
6
8
10
12
-0.5
0.0
0.5
1.0
1.5
Dresden
Frequency
0
5
10
15
-0.5
0.0
0.5
1.0
1.5

```r
par(mfrow = c(1, 1))
```

4.2 Altman method 1 (D,F)

```r
summary(coxph(Surv(Time, DSD) ~ mskcc_post.linpred.glasgow, data.glasgow))

## Call:
## coxph(formula = Surv(Time, DSD) ~ mskcc_post.linpred.glasgow,
##     data = data.glasgow)
##
##   n= 189, number of events= 161
##
##                               coef exp(coef) se(coef)    z Pr(>|z|)
## mskcc_post.linpred.glasgow 0.01682   1.01696  0.00428 3.93  8.4e-05
##
##                            exp(coef) exp(-coef) lower .95 upper .95
## mskcc_post.linpred.glasgow      1.02      0.983      1.01      1.03
##
## Concordance= 0.584  (se = 0.026 )
## Rsquare= 0.081   (max possible= 0.999 )
## Likelihood ratio test= 15.9  on 1 df,   p=6.79e-05
## Wald test            = 15.5  on 1 df,   p=8.43e-05
## Score (logrank) test = 15.7  on 1 df,   p=7.56e-05

summary(coxph(Surv(Time, DSD) ~ mskcc_pre.linpred.glasgow, data.glasgow))

## Call:
## coxph(formula = Surv(Time, DSD) ~ mskcc_pre.linpred.glasgow,
##     data = data.glasgow)
##
##   n= 189, number of events= 161
##
##                             coef exp(coef) se(coef)    z Pr(>|z|)
## mskcc_pre.linpred.glasgow 0.0118    1.0118   0.0105 1.12     0.26
##
##                           exp(coef) exp(-coef) lower .95 upper .95
## mskcc_pre.linpred.glasgow      1.01      0.988     0.991      1.03
##
## Concordance= 0.585  (se = 0.026 )
## Rsquare= 0.006   (max possible= 0.999 )
## Likelihood ratio test= 1.15  on 1 df,   p=0.284
## Wald test            = 1.25  on 1 df,   p=0.263
## Score (logrank) test = 1.25  on 1 df,   p=0.264

summary(coxph(Surv(Time, DSD) ~ mskcc_post.linpred.apgi, data.apgi))

## Call:
## coxph(formula = Surv(Time, DSD) ~ mskcc_post.linpred.apgi, data = data.apgi)
##
##   n= 75, number of events= 51
##
##                            coef exp(coef) se(coef)   z Pr(>|z|)
## mskcc_post.linpred.apgi 0.01626   1.01639  0.00452 3.6  0.00032
```

```
##
##                           exp(coef) exp(-coef) lower .95 upper .95
## mskcc_post.linpred.apgi      1.02      0.984      1.01      1.03
##
## Concordance= 0.701  (se = 0.044 )
## Rsquare= 0.14   (max possible= 0.993 )
## Likelihood ratio test= 11.3  on 1 df,   p=0.000754
## Wald test            = 12.9  on 1 df,   p=0.000319
## Score (logrank) test = 13.3  on 1 df,   p=0.000268
```

```
summary(coxph(Surv(Time, DSD) ~ mskcc_pre.linpred.apgi, data.apgi))
```

```
## Call:
## coxph(formula = Surv(Time, DSD) ~ mskcc_pre.linpred.apgi, data = data.apgi)
##
##   n= 75, number of events= 51
##
##                             coef exp(coef) se(coef)    z Pr(>|z|)
## mskcc_pre.linpred.apgi 0.00329   1.00330  0.00673 0.49     0.62
##
##                          exp(coef) exp(-coef) lower .95 upper .95
## mskcc_pre.linpred.apgi         1      0.997      0.99      1.02
##
## Concordance= 0.475  (se = 0.044 )
## Rsquare= 0.003   (max possible= 0.993 )
## Likelihood ratio test= 0.23  on 1 df,   p=0.634
## Wald test            = 0.24  on 1 df,   p=0.625
## Score (logrank) test = 0.24  on 1 df,   p=0.624
```

```
summary(coxph(Surv(Time, DSD) ~ mskcc_post.linpred.dresden, data.dresden))
```

```
## Call:
## coxph(formula = Surv(Time, DSD) ~ mskcc_post.linpred.dresden,
##     data = data.dresden)
##
##   n= 150, number of events= 112
##
##                                 coef exp(coef) se(coef)    z Pr(>|z|)
## mskcc_post.linpred.dresden 0.00792   1.00795  0.00363 2.18    0.029
##
##                              exp(coef) exp(-coef) lower .95 upper .95
## mskcc_post.linpred.dresden      1.01      0.992         1      1.02
##
## Concordance= 0.597  (se = 0.031 )
## Rsquare= 0.028   (max possible= 0.998 )
## Likelihood ratio test= 4.2  on 1 df,   p=0.0404
## Wald test            = 4.76  on 1 df,   p=0.0291
## Score (logrank) test = 4.81  on 1 df,   p=0.0282
```

```
summary(coxph(Surv(Time, DSD) ~ mskcc_pre.linpred.dresden, data.dresden))
```

```
## Call:
## coxph(formula = Surv(Time, DSD) ~ mskcc_pre.linpred.dresden,
##     data = data.dresden)
##
```

```
##   n= 150, number of events= 112
##
##                                coef exp(coef) se(coef)    z Pr(>|z|)
## mskcc_pre.linpred.dresden 0.00336   1.00337  0.00485 0.69     0.49
##
##                             exp(coef) exp(-coef) lower .95 upper .95
## mskcc_pre.linpred.dresden         1      0.997     0.994      1.01
##
## Concordance= 0.518  (se = 0.031 )
## Rsquare= 0.003   (max possible= 0.998 )
## Likelihood ratio test= 0.45  on 1 df,   p=0.502
## Wald test            = 0.48  on 1 df,   p=0.488
## Score (logrank) test = 0.48  on 1 df,   p=0.488
```

```
summary(coxph(Surv(Time, DSD) ~ gg.linpred.glasgow, data.glasgow))
```

```
## Call:
## coxph(formula = Surv(Time, DSD) ~ gg.linpred.glasgow, data = data.glasgow)
##
##   n= 189, number of events= 161
##
##                       coef exp(coef) se(coef)    z Pr(>|z|)
## gg.linpred.glasgow 0.805     2.236    0.239 3.37  0.00075
##
##                     exp(coef) exp(-coef) lower .95 upper .95
## gg.linpred.glasgow      2.24      0.447       1.4      3.57
##
## Concordance= 0.607  (se = 0.026 )
## Rsquare= 0.059   (max possible= 0.999 )
## Likelihood ratio test= 11.4  on 1 df,   p=0.000725
## Wald test            = 11.3  on 1 df,   p=0.000754
## Score (logrank) test = 11.5  on 1 df,   p=0.000705
```

```
summary(coxph(Surv(Time, DSD) ~ gg.linpred.apgi, data.apgi))
```

```
## Call:
## coxph(formula = Surv(Time, DSD) ~ gg.linpred.apgi, data = data.apgi)
##
##   n= 75, number of events= 51
##
##                    coef exp(coef) se(coef)    z Pr(>|z|)
## gg.linpred.apgi 0.894     2.444    0.427 2.09    0.036
##
##                  exp(coef) exp(-coef) lower .95 upper .95
## gg.linpred.apgi      2.44      0.409      1.06      5.64
##
## Concordance= 0.579  (se = 0.044 )
## Rsquare= 0.057   (max possible= 0.993 )
## Likelihood ratio test= 4.42  on 1 df,   p=0.0355
## Wald test            = 4.39  on 1 df,   p=0.0362
## Score (logrank) test = 4.43  on 1 df,   p=0.0352
```

```
summary(coxph(Surv(Time, DSD) ~ gg.linpred.dresden, data.dresden))
```

```
## Call:
```

```
## coxph(formula = Surv(Time, DSD) ~ gg.linpred.dresden, data = data.dresden)
##
##   n= 150, number of events= 112
##
##                      coef exp(coef) se(coef)    z Pr(>|z|)
## gg.linpred.dresden 0.527     1.694    0.312 1.69    0.091
##
##                    exp(coef) exp(-coef) lower .95 upper .95
## gg.linpred.dresden      1.69       0.59     0.919      3.12
##
## Concordance= 0.545  (se = 0.031 )
## Rsquare= 0.019   (max possible= 0.998 )
## Likelihood ratio test= 2.82  on 1 df,   p=0.0928
## Wald test            = 2.85  on 1 df,   p=0.0913
## Score (logrank) test = 2.86  on 1 df,   p=0.0911

anova(coxph(Surv(Time, DSD) ~ offset(gg.linpred.glasgow) + gg.linpred.glasgow, data.glasgow))

## Analysis of Deviance Table
##  Cox model: response is Surv(Time, DSD)
## Terms added sequentially (first to last)
##
##                    loglik Chisq Df Pr(>|Chi|)
## NULL                 -678
## gg.linpred.glasgow   -678  0.66  1       0.41

anova(coxph(Surv(Time, DSD) ~ offset(gg.linpred.apgi) + gg.linpred.apgi, data.apgi))

## Analysis of Deviance Table
##  Cox model: response is Surv(Time, DSD)
## Terms added sequentially (first to last)
##
##                 loglik Chisq Df Pr(>|Chi|)
## NULL              -185
## gg.linpred.apgi   -185  0.06  1        0.8

anova(coxph(Surv(Time, DSD) ~ offset(gg.linpred.dresden) + gg.linpred.dresden, data.dresden))

## Analysis of Deviance Table
##  Cox model: response is Surv(Time, DSD)
## Terms added sequentially (first to last)
##
##                    loglik Chisq Df Pr(>|Chi|)
## NULL                 -466
## gg.linpred.dresden   -465  2.31  1       0.13
```

Booyah.

4.3 Altman method 2 (F)

```
summary(coxph(Surv(Time, DSD) ~ offset(mskcc_pre.linpred.glasgow) + AgeCent + SexM + SizeCent + A2 + A4,

## Warning in fitter(X, Y, strats, offset, init, control, weights = weights, :  Ran out of
iterations and did not converge
```

```
## Error in fitter(X, Y, strats, offset, init, control, weights = weights, :  NA/NaN/Inf in
foreign function call (arg 6)
```

```r
summary(coxph(Surv(Time, DSD) ~ offset(mskcc_post.linpred.glasgow) + AgeCent + SexM + SizeCent + A2 + A4
```

```
## Call:
## coxph(formula = Surv(Time, DSD) ~ offset(mskcc_post.linpred.glasgow) +
##     AgeCent + SexM + SizeCent + A2 + A4, data = data.glasgow)
##
##   n= 189, number of events= 161
##
##                coef exp(coef)  se(coef)      z Pr(>|z|)
## AgeCent    0.22744   1.25538   0.00862  26.39  < 2e-16
## SexMTRUE  -4.18282   0.01526   0.29544 -14.16  < 2e-16
## SizeCent   0.07140   1.07401   0.01910   3.74  0.00019
## A2TRUE    -2.96537   0.05154   0.41042  -7.23    5e-13
## A4TRUE     5.40464 222.43685   0.28361  19.06  < 2e-16
##
##          exp(coef) exp(-coef) lower .95 upper .95
## AgeCent     1.2554     0.7966  1.23e+00    1.2768
## SexMTRUE    0.0153    65.5506  8.55e-03    0.0272
## SizeCent    1.0740     0.9311  1.03e+00    1.1150
## A2TRUE      0.0515    19.4019  2.31e-02    0.1152
## A4TRUE    222.4369     0.0045  1.28e+02  387.8075
##
## Concordance= 0.588  (se = 0.026 )
## Rsquare= 0.982   (max possible= 1 )
## Likelihood ratio test= 757  on 5 df,   p=0
## Wald test            = 1654  on 5 df,   p=0
## Score (logrank) test = 1745  on 5 df,   p=0
```

```r
summary(coxph(Surv(Time, DSD) ~ offset(gg.linpred.glasgow) + AgeCent + SexM + SizeCent + A2 + A4, data.g
```

```
## Call:
## coxph(formula = Surv(Time, DSD) ~ offset(gg.linpred.glasgow) +
##     AgeCent + SexM + SizeCent + A2 + A4, data = data.glasgow)
##
##   n= 189, number of events= 161
##
##              coef exp(coef) se(coef)     z Pr(>|z|)
## AgeCent  -0.03105   0.96943  0.00872 -3.56  0.00037
## SexMTRUE  0.63117   1.87981  0.16671  3.79  0.00015
## SizeCent  0.02245   1.02270  0.00767  2.93  0.00343
## A2TRUE    0.33327   1.39553  0.17564  1.90  0.05776
## A4TRUE   -0.05074   0.95052  0.18482 -0.27  0.78367
##
##          exp(coef) exp(-coef) lower .95 upper .95
## AgeCent      0.969      1.032     0.953     0.986
## SexMTRUE     1.880      0.532     1.356     2.606
## SizeCent     1.023      0.978     1.007     1.038
## A2TRUE       1.396      0.717     0.989     1.969
## A4TRUE       0.951      1.052     0.662     1.365
##
## Concordance= 0.676  (se = 0.026 )
## Rsquare= 0.184   (max possible= 0.999 )
```

```
## Likelihood ratio test= 38.4  on 5 df,   p=3.19e-07
## Wald test            = 39  on 5 df,   p=2.4e-07
## Score (logrank) test = 40.5  on 5 df,   p=1.19e-07
```

```
summary(coxph(Surv(Time, DSD) ~ offset(mskcc_pre.linpred.apgi) + AgeCent + SexM + SizeCent + A2 + A4, da
```

```
## Warning in fitter(X, Y, strats, offset, init, control, weights = weights, :  Ran out of
iterations and did not converge
## Error in fitter(X, Y, strats, offset, init, control, weights = weights, :  NA/NaN/Inf in
foreign function call (arg 6)
```

```
summary(coxph(Surv(Time, DSD) ~ offset(mskcc_post.linpred.apgi) + AgeCent + SexM + SizeCent + A2 + A4, d
```

```
## Warning in fitter(X, Y, strats, offset, init, control, weights = weights, :  Ran out of
iterations and did not converge
## Error in fitter(X, Y, strats, offset, init, control, weights = weights, :  NA/NaN/Inf in
foreign function call (arg 6)
```

```
summary(coxph(Surv(Time, DSD) ~ offset(gg.linpred.apgi) + AgeCent + SexM + SizeCent + A2 + A4, data.apgi
```

```
## Call:
## coxph(formula = Surv(Time, DSD) ~ offset(gg.linpred.apgi) + AgeCent +
##     SexM + SizeCent + A2 + A4, data = data.apgi)
##
##   n= 75, number of events= 51
##
##             coef exp(coef) se(coef)    z Pr(>|z|)
## AgeCent  0.02404   1.02433  0.01798 1.34   0.1812
## SexMTRUE 0.99912   2.71590  0.31918 3.13   0.0017
## SizeCent 0.01343   1.01352  0.00828 1.62   0.1050
## A2TRUE   0.22816   1.25628  0.39709 0.57   0.5656
## A4TRUE   0.17023   1.18558  0.33812 0.50   0.6146
##
##          exp(coef) exp(-coef) lower .95 upper .95
## AgeCent       1.02      0.976     0.989      1.06
## SexMTRUE      2.72      0.368     1.453      5.08
## SizeCent      1.01      0.987     0.997      1.03
## A2TRUE        1.26      0.796     0.577      2.74
## A4TRUE        1.19      0.843     0.611      2.30
##
## Concordance= 0.684  (se = 0.044 )
## Rsquare= 0.189   (max possible= 0.993 )
## Likelihood ratio test= 15.7  on 5 df,   p=0.00775
## Wald test            = 14.8  on 5 df,   p=0.0113
## Score (logrank) test = 15.6  on 5 df,   p=0.00816
```

```
summary(coxph(Surv(Time, DSD) ~ offset(mskcc_pre.linpred.dresden) + AgeCent + SexM + SizeCent + A2 + A4,
```

```
## Warning in fitter(X, Y, strats, offset, init, control, weights = weights, :  Ran out of
iterations and did not converge
```

```
## Call:
## coxph(formula = Surv(Time, DSD) ~ offset(mskcc_pre.linpred.dresden) +
##     AgeCent + SexM + SizeCent + A2 + A4, data = data.dresden)
##
##   n= 150, number of events= 112
```

```
##
##                coef exp(coef)  se(coef)     z Pr(>|z|)
## AgeCent   1.07e+00  2.90e+00  1.40e+00  0.76    0.446
## SexMTRUE -9.61e+00  6.72e-05  7.27e+00 -1.32    0.186
## SizeCent -7.39e-02  9.29e-01  3.99e-01 -0.19    0.853
## A2TRUE    9.40e-01  2.56e+00  1.18e+01  0.08    0.936
## A4TRUE    2.69e+01  4.83e+11  1.38e+01  1.95    0.052
##
##          exp(coef) exp(-coef) lower .95 upper .95
## AgeCent   2.90e+00   3.45e-01  1.87e-01  4.51e+01
## SexMTRUE  6.72e-05   1.49e+04  4.38e-11  1.03e+02
## SizeCent  9.29e-01   1.08e+00  4.25e-01  2.03e+00
## A2TRUE    2.56e+00   3.91e-01  2.42e-10  2.71e+10
## A4TRUE    4.83e+11   2.07e-12  8.14e-01  2.86e+23
##
## Concordance= 0.551  (se = 0.031 )
## Rsquare= 1   (max possible= 1 )
## Likelihood ratio test= 6039  on 5 df,   p=0
## Wald test            = 29003  on 5 df,   p=0
## Score (logrank) test = 38248  on 5 df,   p=0
```

```
summary(coxph(Surv(Time, DSD) ~ offset(mskcc_post.linpred.dresden) + AgeCent + SexM + SizeCent + A2 + A4
```

```
## Warning in fitter(X, Y, strats, offset, init, control, weights = weights, :  Ran out of
iterations and did not converge
## Error in fitter(X, Y, strats, offset, init, control, weights = weights, :  NA/NaN/Inf in
foreign function call (arg 6)
```

```
summary(coxph(Surv(Time, DSD) ~ offset(gg.linpred.dresden) + AgeCent + SexM + SizeCent + A2 + A4, data.d
```

```
## Call:
## coxph(formula = Surv(Time, DSD) ~ offset(gg.linpred.dresden) +
##     AgeCent + SexM + SizeCent + A2 + A4, data = data.dresden)
##
##   n= 150, number of events= 112
##
##              coef exp(coef) se(coef)     z Pr(>|z|)
## AgeCent   0.01589   1.01601  0.01103  1.44    0.150
## SexMTRUE  0.46624   1.59399  0.19189  2.43    0.015
## SizeCent  0.00808   1.00812  0.00918  0.88    0.378
## A2TRUE   -0.08110   0.92210  0.21938 -0.37    0.712
## A4TRUE    0.08918   1.09328  0.32044  0.28    0.781
##
##          exp(coef) exp(-coef) lower .95 upper .95
## AgeCent      1.016      0.984     0.994      1.04
## SexMTRUE     1.594      0.627     1.094      2.32
## SizeCent     1.008      0.992     0.990      1.03
## A2TRUE       0.922      1.084     0.600      1.42
## A4TRUE       1.093      0.915     0.583      2.05
##
## Concordance= 0.595  (se = 0.031 )
## Rsquare= 0.053   (max possible= 0.998 )
## Likelihood ratio test= 8.1  on 5 df,   p=0.151
## Wald test            = 8  on 5 df,   p=0.156
## Score (logrank) test = 8.1  on 5 df,   p=0.151
```

Still strong evidence of misspecification or poor fit. However, the above calibration slope was not significantly different from 1. Hmm. This doesn't necessarily sink the method, but will need checking as we go along.

4.4 Altman method 3 (D)

```
library(Hmisc)
rcorr.cens(gg.linpred.glasgow, Surv(data.glasgow$Time, data.glasgow$DSD))

##        C Index            Dxy           S.D.              n        missing
##      3.928e-01     -2.145e-01      4.883e-02      1.890e+02      0.000e+00
##     uncensored Relevant Pairs     Concordant      Uncertain
##      1.610e+02      2.891e+04      1.135e+04      6.608e+03

rcorr.cens(mskcc_pre.linpred.glasgow, Surv(data.glasgow$Time, data.glasgow$DSD))

##        C Index            Dxy           S.D.              n        missing
##         0.4150        -0.1699         0.0514       189.0000         0.0000
##     uncensored Relevant Pairs     Concordant      Uncertain
##       161.0000     28906.0000     11997.0000      6608.0000

rcorrp.cens(gg.linpred.glasgow, mskcc_pre.linpred.glasgow, Surv(data.glasgow$Time, data.glasgow$DSD))

##                Dxy               S.D. x1 more concordant
##          1.272e-01          5.245e-02          5.636e-01
## x2 more concordant                  n            missing
##          4.364e-01          1.890e+02          0.000e+00
##         uncensored     Relevant Pairs          Uncertain
##          1.610e+02          2.891e+04          6.608e+03
##               C X1               C X2             Dxy X1
##          3.928e-01          4.150e-01         -2.145e-01
##             Dxy X2
##         -1.699e-01

rcorr.cens(gg.linpred.apgi, Surv(data.apgi$Time, data.apgi$DSD))

##        C Index            Dxy           S.D.              n        missing
##        0.42092       -0.15815        0.08359       75.00000        0.00000
##     uncensored Relevant Pairs     Concordant      Uncertain
##       51.00000     4464.00000     1879.00000     1086.00000

rcorr.cens(mskcc_pre.linpred.apgi, Surv(data.apgi$Time, data.apgi$DSD))

##        C Index            Dxy           S.D.              n        missing
##      5.251e-01      5.018e-02      8.872e-02      7.500e+01      0.000e+00
##     uncensored Relevant Pairs     Concordant      Uncertain
##      5.100e+01      4.464e+03      2.344e+03      1.086e+03

rcorrp.cens(gg.linpred.apgi, mskcc_pre.linpred.apgi, Surv(data.apgi$Time, data.apgi$DSD))

##                Dxy               S.D. x1 more concordant
##           -0.06855            0.08827            0.46550
## x2 more concordant                  n            missing
##            0.53405           75.00000            0.00000
##         uncensored     Relevant Pairs          Uncertain
##           51.00000         4464.00000         1086.00000
```

```
##              C X1              C X2            Dxy X1
##           0.42092           0.52509          -0.15815
##            Dxy X2
##           0.05018
```

```r
rcorr.cens(gg.linpred.dresden, Surv(data.dresden$Time, data.dresden$DSD))
```

```
##       C Index            Dxy           S.D.              n        missing
##     4.553e-01     -8.942e-02      5.994e-02      1.500e+02      0.000e+00
##    uncensored Relevant Pairs     Concordant      Uncertain
##     1.120e+02      1.745e+04      7.943e+03      4.890e+03
```

```r
rcorr.cens(mskcc_pre.linpred.dresden, Surv(data.dresden$Time, data.dresden$DSD))
```

```
##       C Index            Dxy           S.D.              n        missing
##     4.823e-01     -3.542e-02      5.516e-02      1.500e+02      0.000e+00
##    uncensored Relevant Pairs     Concordant      Uncertain
##     1.120e+02      1.745e+04      8.414e+03      4.890e+03
```

```r
rcorrp.cens(gg.linpred.dresden, mskcc_pre.linpred.dresden, Surv(data.dresden$Time, data.dresden$DSD))
```

```
##               Dxy              S.D. x1 more concordant
##         1.765e-02         5.548e-02          5.087e-01
## x2 more concordant                 n            missing
##         4.910e-01         1.500e+02          0.000e+00
##        uncensored    Relevant Pairs          Uncertain
##         1.120e+02         1.745e+04          4.890e+03
##              C X1              C X2             Dxy X1
##         4.553e-01         4.823e-01         -8.942e-02
##            Dxy X2
##        -3.542e-02
```

```r
library(survcomp)
concordance.index(gg.linpred.glasgow, data.glasgow$Time, data.glasgow$DSD, method = "noether")
```

```
## $c.index
## [1] 0.6086
##
## $se
## [1] 0.02411
##
## $lower
## [1] 0.5613
##
## $upper
## [1] 0.6558
##
## $p.value
## [1] 6.667e-06
##
## $n
## [1] 189
##
## $data
## $data$x
```

```
##    [1]  0.80162  0.34886  0.09981  0.01110 -0.04435  0.18851 -0.28454
##    [8] -0.03326  0.62420 -0.04435  0.38434  0.51708  0.93468  0.04435
##   [15] -0.41760  0.38434 -0.28454  0.27789  0.42870  0.56144  0.33967
##   [22] -0.04435  0.14416  0.04435  0.54402  0.25096  0.65046  0.14416
##   [29] -0.13306  0.05545  0.01110 -0.08871 -0.03326 -0.09535 -0.15147
##   [36] -0.28454  0.29563  0.42838  0.51708  0.25096  0.09981 -0.28454
##   [43] -0.24018  0.56176  0.80162 -0.32002  0.71291  0.33967  0.01110
##   [50]  0.18851 -0.11532 -0.41760  0.47305  0.13306  0.70404  0.47273
##   [57] -0.37324  0.71291  0.80162  0.04435  0.28676  0.56144  1.06774
##   [64] -0.13306  0.71291  0.84597  0.71291  0.38434  0.18851  0.38434
##   [71]  0.29563 -0.05987  0.47273  0.00000  0.32157 -0.28454  0.36660
##   [78]  0.19516  0.42838  0.42838  0.42870  0.02884 -0.02439  0.60611
##   [85] -0.41760  0.71291  0.03771 -0.42647  0.56176 -0.37324  0.32857
##   [92]  0.73952  0.42838  0.04435 -0.03326  0.01110  0.65014 -0.37324
##   [99]  0.51740  0.38434  0.51740  0.00000 -0.03548  0.04435 -0.01774
##  [106] -0.04435  0.42838  0.47305  0.71291 -0.46195  0.26870 -0.07761
##  [113]  0.38402 -0.41760  0.75726  0.01110 -0.42647 -0.03326  0.71291
##  [120]  0.47273 -0.20470  0.47273  0.47305  0.00000  0.65969 -0.03326
##  [127]  0.33999 -0.12196 -0.13306  0.38402  0.31306 -0.42647  0.29563
##  [134]  0.27789 -0.05987  0.66856  0.54370  0.51708  0.01110  0.55034
##  [141]  0.38402  0.36660 -0.12196  0.80162 -0.19583  0.33112 -0.03326
##  [148]  0.89033  0.80162  0.14416 -0.04435  0.01110 -0.12196  0.84597
##  [155]  0.35518  0.33999  0.22145  0.62420 -0.37324  0.60579 -0.32889
##  [162]  0.18851  0.14416  0.75726 -0.37324 -0.21067  0.60579  0.29563
##  [169]  0.27722  0.33967  0.78388  0.42838  0.84597 -0.08871  0.52595
##  [176] -0.31115  0.38434  0.05545  0.33999  0.66856  0.05545  0.18851
##  [183] -0.32889 -0.28454 -0.07761 -0.04435  0.33999  0.38434  0.01997
##
## $data$surv.time
##    [1]  233.456  266.937   40.482  216.106 2611.537  410.906  473.912
##    [8]  610.881 1380.949 1443.651  959.694  147.013   10.044  915.256
##   [15]  161.319 2884.562  136.056 3530.750  450.475  143.969   17.349
##   [22] 1104.881  267.850  655.319   38.656  283.069 1018.743  812.681
##   [29] 1452.782 1420.518 1342.294  900.950  308.332  336.943 1116.143
##   [36] 1016.613  423.994  741.762 1921.519  597.488    8.218   25.263
##   [43]  803.550  350.031  394.774  299.201  148.231 1094.837   25.263
##   [50]  312.593  436.169  751.806  492.174   11.262  416.994  809.637
##   [57]  806.594  142.143  621.838  316.550 2749.419  136.056   49.613
##   [64]  379.556  210.932  256.588  253.544  705.237 1254.938  510.437
##   [71]  890.906  116.576  178.668  519.568   14.306  702.193  148.231
##   [78]  560.050  113.532    9.131  152.188 1102.751  375.294  343.944
##   [85]  353.075 2830.688  185.669 1310.943 1491.438  576.182  663.538
##   [92]  408.776  548.788  781.331  467.824  636.144   76.094  468.738
##   [99]    9.131  501.306  248.674  837.944 2221.938 2556.750 2587.188
##  [106]  286.113  542.701  534.787  396.601  856.207  139.099   29.524
##  [113]  629.143 1205.325  868.382  395.688 1046.137   43.526  862.294
##  [120]  235.282  177.451  118.706  553.049  903.081  563.094  404.819
##  [127]  565.224  203.018  190.843  398.731  413.037  786.201  497.044
##  [134]  942.649  883.601  257.806  344.857  191.756   45.656  730.500
##  [141]  103.487 1004.438 1461.000  974.000  118.706 1156.625  703.106
##  [148]  233.151  581.356 1552.312 1156.625 1795.812 2343.688  175.624
##  [155] 1649.712 1978.438  487.000  602.663 1552.312   24.350  608.750
##  [162]  319.594   76.094  730.500 1217.500 1461.000   91.312   30.438
```

```
## [169]  182.625  517.438  213.062  760.938  243.500  943.562  152.188
## [176] 1126.188  760.938 1068.356 1129.231  243.500  273.938  362.206
## [183] 1007.481  669.625 1187.062  273.938  608.750 1065.312  426.125
##
## $data$surv.event
##   [1]  TRUE  TRUE FALSE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE
##  [12]  TRUE FALSE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE FALSE  TRUE
##  [23]  TRUE  TRUE FALSE  TRUE  TRUE  TRUE  TRUE  TRUE FALSE  TRUE  TRUE
##  [34]  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE FALSE FALSE  TRUE  TRUE
##  [45]  TRUE  TRUE  TRUE  TRUE FALSE  TRUE FALSE  TRUE  TRUE FALSE  TRUE
##  [56]  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE
##  [67]  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE FALSE  TRUE  TRUE
##  [78]  TRUE  TRUE FALSE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE
##  [89]  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE FALSE
## [100]  TRUE  TRUE  TRUE FALSE FALSE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE
## [111]  TRUE FALSE  TRUE  TRUE  TRUE  TRUE  TRUE FALSE  TRUE  TRUE  TRUE
## [122]  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE
## [133]  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE FALSE  TRUE  TRUE  TRUE  TRUE
## [144]  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE
## [155] FALSE  TRUE  TRUE  TRUE FALSE  TRUE  TRUE  TRUE FALSE  TRUE FALSE
## [166] FALSE  TRUE FALSE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE
## [177]  TRUE  TRUE FALSE  TRUE  TRUE  TRUE  TRUE  TRUE FALSE FALSE  TRUE
## [188] FALSE  TRUE
##
##
## $comppairs
## [1] 28512
```

```
concordance.index(mskcc_pre.linpred.glasgow, data.glasgow$Time, data.glasgow$DSD, method = "noether")
```

```
## $c.index
## [1] 0.5851
##
## $se
## [1] 0.0251
##
## $lower
## [1] 0.5359
##
## $upper
## [1] 0.6343
##
## $p.value
## [1] 0.0006962
##
## $n
## [1] 189
##
## $data
## $data$x
##   [1] 158.0 160.9 161.6 161.9 158.5 162.1 164.5 164.5 161.4 146.8 159.6
##  [12] 161.4 161.0 149.4 164.7 158.2 161.7 159.0 157.7 162.4 160.8 158.5
##  [23] 162.6 159.0 159.1 164.5 146.2 160.7 152.3 160.5 149.3 158.7 161.3
##  [34] 187.6 162.4 163.1 158.1 151.0 161.3 165.4 160.2 150.4 162.0 161.1
```

```
##  [45] 159.0 162.9 159.4 161.3 161.6 162.4 158.6 162.4 161.2 159.1 160.5
##  [56] 160.6 162.1 158.5 160.9 160.4 147.4 162.1 159.1 165.0 159.7 158.4
##  [67] 160.3 158.1 162.0 158.0 161.2 162.6 163.6 161.4 161.5 163.2 158.5
##  [78] 149.9 160.7 161.3 161.0 154.0 161.3 162.4 162.8 158.5 161.3 160.7
##  [89] 157.5 161.7 158.7 162.1 161.1 157.4 162.2 161.5 161.0 162.8 159.9
## [100] 159.7 160.1 158.2 157.7 158.3 159.5 161.6 161.3 158.5 159.7 162.0
## [111] 162.4 162.8 162.8 161.0 159.6 162.7 161.5 161.0 148.1 161.8 161.3
## [122] 165.6 159.7 158.8 159.2 160.8 161.3 164.6 165.1 163.6 161.8 162.2
## [133] 159.5 161.3 163.0 161.4 161.9 160.9 160.4 159.4 161.7 159.6 166.0
## [144] 157.8 161.9 159.4 163.0 159.8 160.1 160.2 161.3 161.1 166.1 158.7
## [155] 160.3 149.3 162.2 163.8 164.3 162.6 161.9 159.1 163.9 147.1 161.5
## [166] 201.9 162.7 157.7 161.5 161.4 158.7 162.9 158.0 162.0 163.3 163.5
## [177] 158.1 164.6 158.5 159.6 161.7 164.7 162.1 162.3 162.6 160.0 158.7
## [188] 158.5 160.7
##
## $data$surv.time
##   [1]  233.456  266.937   40.482  216.106 2611.537  410.906  473.912
##   [8]  610.881 1380.949 1443.651  959.694  147.013   10.044  915.256
##  [15]  161.319 2884.562  136.056 3530.750  450.475  143.969   17.349
##  [22] 1104.881  267.850  655.319   38.656  283.069 1018.743  812.681
##  [29] 1452.782 1420.518 1342.294  900.950  308.332  336.943 1116.143
##  [36] 1016.613  423.994  741.762 1921.519  597.488    8.218   25.263
##  [43]  803.550  350.031  394.774  299.201  148.231 1094.837   25.263
##  [50]  312.593  436.169  751.806  492.174   11.262  416.994  809.637
##  [57]  806.594  142.143  621.838  316.550 2749.419  136.056   49.613
##  [64]  379.556  210.932  256.588  253.544  705.237 1254.938  510.437
##  [71]  890.906  116.576  178.668  519.568   14.306  702.193  148.231
##  [78]  560.050  113.532    9.131  152.188 1102.751  375.294  343.944
##  [85]  353.075 2830.688  185.669 1310.943 1491.438  576.182  663.538
##  [92]  408.776  548.788  781.331  467.824  636.144   76.094  468.738
##  [99]    9.131  501.306  248.674  837.944 2221.938 2556.750 2587.188
## [106]  286.113  542.701  534.787  396.601  856.207  139.099   29.524
## [113]  629.143 1205.325  868.382  395.688 1046.137   43.526  862.294
## [120]  235.282  177.451  118.706  553.049  903.081  563.094  404.819
## [127]  565.224  203.018  190.843  398.731  413.037  786.201  497.044
## [134]  942.649  883.601  257.806  344.857  191.756   45.656  730.500
## [141]  103.487 1004.438 1461.000  974.000  118.706 1156.625  703.106
## [148]  233.151  581.356 1552.312 1156.625 1795.812 2343.688  175.624
## [155] 1649.712 1978.438  487.000  602.663 1552.312   24.350  608.750
## [162]  319.594   76.094  730.500 1217.500 1461.000   91.312   30.438
## [169]  182.625  517.438  213.062  760.938  243.500  943.562  152.188
## [176] 1126.188  760.938 1068.356 1129.231  243.500  273.938  362.206
## [183] 1007.481  669.625 1187.062  273.938  608.750 1065.312  426.125
##
## $data$surv.event
##   [1]  TRUE  TRUE FALSE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE
##  [12]  TRUE FALSE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE FALSE  TRUE
##  [23]  TRUE  TRUE FALSE  TRUE  TRUE  TRUE  TRUE  TRUE FALSE  TRUE  TRUE
##  [34]  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE FALSE FALSE  TRUE  TRUE
##  [45]  TRUE  TRUE  TRUE  TRUE FALSE  TRUE FALSE  TRUE  TRUE FALSE  TRUE
##  [56]  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE
##  [67]  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE FALSE  TRUE  TRUE
##  [78]  TRUE  TRUE FALSE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE
```

```
##  [89]  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE FALSE
## [100]  TRUE  TRUE  TRUE FALSE FALSE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE
## [111]  TRUE FALSE  TRUE  TRUE  TRUE  TRUE  TRUE FALSE  TRUE  TRUE  TRUE
## [122]  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE
## [133]  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE FALSE  TRUE  TRUE  TRUE  TRUE
## [144]  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE
## [155] FALSE  TRUE  TRUE  TRUE FALSE  TRUE  TRUE  TRUE FALSE  TRUE FALSE
## [166] FALSE  TRUE FALSE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE
## [177]  TRUE  TRUE FALSE  TRUE  TRUE  TRUE  TRUE  TRUE FALSE FALSE  TRUE
## [188] FALSE  TRUE
##
##
## $comppairs
## [1] 28884
```

```
concordance.index(gg.linpred.apgi, data.apgi$Time, data.apgi$DSD, method = "noether")
```

```
## $c.index
## [1] 0.5798
##
## $se
## [1] 0.03978
##
## $lower
## [1] 0.5019
##
## $upper
## [1] 0.6578
##
## $p.value
## [1] 0.04476
##
## $n
## [1] 75
##
## $data
## $data$x
##  [1]  0.188513  0.384341  0.428695  0.081914  0.115320  0.046581  0.505986
##  [8]  0.757265  0.543345  0.073193  0.384341  0.314781  0.775007  0.295633
## [15]  0.055451 -0.195828  0.099805  0.384341  0.314781  0.295633  0.757265
## [22]  0.046581  0.106449  0.357729 -0.382114  0.159674  0.608188  0.046581
## [29]  0.011098  0.437246  0.011098  0.099805  0.643351 -0.006644  0.133062
## [36] -0.122785 -0.044354 -0.444210 -0.390985 -0.104223  0.177416  0.046581
## [43]  0.126418  0.561437  0.144159  0.295633  0.099805  0.517403 -0.461951
## [50] -0.077610  0.739172 -0.044354  0.232867  0.569807  0.758320 -0.461951
## [57]  0.428695  0.339987 -0.328890  0.000000 -0.033256 -0.328890  0.492197
## [64]  0.845973  0.801619  0.517403  0.170772 -0.088708 -0.070966 -0.113914
## [71] -0.382114  0.339317  0.676608  0.366280 -0.044354
##
## $data$surv.time
##  [1]  525 2848 1779 1279   37  436 1048  476  135  315  452  346  858  549
## [15] 1235  715  949  269  410  516  359  750 1081  835  768  989   71 1574
## [29]  209  313  312 1504  553  718 1588  237 1268  518 1533 1430  610 1461
## [43]  106  325  142 1171  365  281 1278  611  976 1407  427 1094  655  913
```

```
## [57]   796   480   162 1176   852   521   482   695   412 1030   305   869   892   241
## [71]   911   120   950   545   709
##
## $data$surv.event
##  [1] 1 1 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0 0 1 1 1 0 1 1 0
## [36] 1 0 1 0 0 1 0 0 1 1 0 1 1 0 0 1 0 1 1 1 1 1 1 1 0 0 1 1 1 1 0 1 0 0 1
## [71] 0 1 0 1 1
##
##
## $comppairs
## [1] 4422
```

```
concordance.index(mskcc_pre.linpred.apgi, data.apgi$Time, data.apgi$DSD, method = "noether")
```

```
## $c.index
## [1] 0.4745
##
## $se
## [1] 0.04286
##
## $lower
## [1] 0.3904
##
## $upper
## [1] 0.5585
##
## $p.value
## [1] 0.5511
##
## $n
## [1] 75
##
## $data
## $data$x
##  [1] 159.7 157.3 159.9 240.6 157.7 160.3 159.6 157.5 156.8 158.9 145.4
## [12] 210.1 157.1 159.2 160.0 159.6 161.1 158.4 210.1 160.3 157.1 158.5
## [23] 159.5 158.8 160.8 158.5 208.2 148.1 160.0 158.7 157.3 157.7 209.5
## [34] 160.7 158.0 209.0 158.9 156.5 157.2 157.5 157.9 158.1 157.2 159.3
## [45] 157.2 159.5 159.1 159.7 158.5 161.3 149.1 158.3 158.8 208.2 210.6
## [56] 158.3 158.3 158.9 157.1 159.3 159.1 160.3 209.1 157.5 156.5 159.3
## [67] 158.8 160.7 160.7 209.0 159.3 158.7 209.0 157.3 158.0
##
## $data$surv.time
##  [1]   525 2848 1779 1279    37   436 1048   476   135   315   452   346   858   549
## [15]  1235   715   949   269   410   516   359   750 1081   835   768   989    71 1574
## [29]   209   313   312 1504   553   718 1588   237 1268   518 1533 1430   610 1461
## [43]   106   325   142 1171   365   281 1278   611   976 1407   427 1094   655   913
## [57]   796   480   162 1176   852   521   482   695   412 1030   305   869   892   241
## [71]   911   120   950   545   709
##
## $data$surv.event
##  [1] 1 1 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0 0 1 1 1 0 1 1 0
## [36] 1 0 1 0 0 1 0 0 1 1 0 1 1 0 0 1 0 1 1 1 1 1 1 1 0 0 1 1 1 1 0 1 0 0 1
## [71] 0 1 0 1 1
```

```
##
##
## $comppairs
## [1] 4384

concordance.index(gg.linpred.dresden, data.dresden$Time, data.dresden$DSD, method = "noether")

## $c.index
## [1] 0.5457
##
## $se
## [1] 0.0297
##
## $lower
## [1] 0.4874
##
## $upper
## [1] 0.6039
##
## $p.value
## [1] 0.1243
##
## $n
## [1] 150
##
## $data
## $data$x
##   [1] -0.088708  0.099805 -0.461951  0.517083  0.473049  0.428695  0.499342
##   [8]  0.011098 -0.328890  0.845973  0.295633  0.295314  0.384341  0.099805
##  [15]  0.011098  0.580905  0.295633  0.286763  0.339987 -0.033256  0.705447
##  [22]  0.000000  0.561437 -0.417598  0.303364  0.384341  0.428695 -0.033256
##  [29]  0.525134  0.144159 -0.033256  0.845973  0.490791  0.339987  0.384341
##  [36]  0.472729  0.845973 -0.133062 -0.088708  0.055451  0.055451  0.554963
##  [43]  0.677428  0.428695  0.099805 -0.077610 -0.077610 -0.050998  0.801619
##  [50] -0.033256  0.517403  0.863714  0.250960  0.321575  0.055451  0.384341
##  [57]  0.428375  0.845973  0.668557 -0.059869  0.082064  0.055451  0.384341
##  [64]  0.650816  0.144159  0.188513  0.314781  0.517403  0.144159  0.011098
##  [71]  0.428695  0.384021  0.845973 -0.121964  0.011098  0.561757  0.295633
##  [78] -0.033256  0.019968  1.087210 -0.006644  0.339667  0.819360  0.561437
##  [85]  0.055451  0.295314  0.517403  0.384341  0.401763  0.428375  0.428695
##  [92] -0.033256  1.105303  0.934681  0.490471  0.055451  0.339987  0.419504
##  [99]  0.073193 -0.033256  0.339987  0.357729 -0.346631 -0.033256  0.472729
## [106]  0.002227 -0.097579  0.011098 -0.328890  0.402083  0.195157 -0.033256
## [113]  0.499661  0.473049  0.428375  0.473049  0.446437  0.099805  0.561437
## [120] -0.006644  0.776733  0.000000  0.339987  0.473049  0.794474  0.159674
## [127] -0.006644  0.011098  0.055451  0.775007 -0.006644  0.473049  0.339987
## [134]  0.437566  0.392892  0.011098  0.384341  0.019968 -0.077610  0.055451
## [141]  0.650145  0.313375  0.561757  0.011098 -0.035483  0.295314 -0.035483
## [148]  0.099805  0.473049  0.019148
##
## $data$surv.time
##   [1]  475  319  478  292  266 4190  511 1211 1379  844  737  338  583 1379
##  [15] 3691  496  360 1173  379  391  522 1486   27  891  356  123 2906  500
##  [29] 1450  747  357   10 2017 1256 1517  152 1061  317  698  435  987  975
```

```
##  [43]  604  859  427 1632 4059  521  526  471  309  305  559  110  844  389
##  [57]  349 1098 2353  169  420 1292  648 1022  219  392  540  717  319 1461
##  [71]  643  293  283   55  781  322  605  981 1920  375  704  886  735   13
##  [85] 1823  178  802 1096  453   69  288  707  522  254  727  153  652 1177
##  [99]  348  445  442  239  218  419  392  524  154  614 1727 1422  478  516
## [113]  184  330  303  502 1383  491  100 1101  138   17  538  278  761 1497
## [127]   49  698  641   71 1109  597 1204  304 1030  873  467  188   18  338
## [141]  279  308  448  268  923 1087  376 1084  252  745
##
## $data$surv.event
##   [1]  TRUE  TRUE  TRUE FALSE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE
##  [12]  TRUE  TRUE  TRUE FALSE  TRUE  TRUE  TRUE  TRUE FALSE  TRUE  TRUE
##  [23] FALSE  TRUE  TRUE  TRUE FALSE  TRUE  TRUE FALSE  TRUE FALSE  TRUE
##  [34] FALSE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE FALSE  TRUE  TRUE  TRUE
##  [45]  TRUE  TRUE FALSE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE
##  [56]  TRUE FALSE  TRUE FALSE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE
##  [67]  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE
##  [78] FALSE FALSE  TRUE  TRUE  TRUE  TRUE FALSE FALSE  TRUE FALSE FALSE
##  [89]  TRUE  TRUE  TRUE FALSE  TRUE  TRUE  TRUE FALSE  TRUE FALSE  TRUE
## [100]  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE FALSE FALSE  TRUE FALSE FALSE
## [111] FALSE  TRUE  TRUE  TRUE  TRUE FALSE FALSE  TRUE  TRUE  TRUE  TRUE
## [122] FALSE FALSE FALSE  TRUE  TRUE  TRUE  TRUE  TRUE FALSE FALSE  TRUE
## [133] FALSE  TRUE  TRUE  TRUE  TRUE  TRUE FALSE  TRUE  TRUE  TRUE  TRUE
## [144]  TRUE  TRUE FALSE FALSE  TRUE  TRUE FALSE
##
##
## $comppairs
## [1] 17106
```

```
concordance.index(mskcc_pre.linpred.dresden, data.dresden$Time, data.dresden$DSD, method = "noether")
```

```
## $c.index
## [1] 0.518
##
## $se
## [1] 0.02694
##
## $lower
## [1] 0.4652
##
## $upper
## [1] 0.5708
##
## $p.value
## [1] 0.5043
##
## $n
## [1] 150
##
## $data
## $data$x
##   [1] 147.5 152.0 150.8 188.4 148.2 147.3 153.6 154.3 150.3 148.5 146.6
##  [12] 150.5 147.9 149.7 151.7 203.0 146.7 147.9 146.3 149.1 201.5 147.8
##  [23] 149.6 153.5 202.2 150.9 148.7 150.9 239.0 153.5 150.4 147.9 149.0
```

```
##  [34] 146.5 149.3 149.5 146.9 188.0 148.9 152.9 149.3 198.5 147.5 147.7
##  [45] 152.3 150.7 152.1 187.5 147.9 150.3 148.2 147.7 154.9 150.1 150.1
##  [56] 147.9 150.3 149.3 149.3 151.1 150.7 150.7 149.4 148.9 149.3 152.8
##  [67] 201.7 151.1 150.1 151.9 148.1 152.4 147.5 153.3 152.9 147.4 147.5
##  [78] 150.3 150.3 199.9 153.3 185.3 146.9 150.9 151.5 151.5 146.7 147.1
##  [89] 150.5 150.0 147.0 149.1 200.7 182.9 151.2 150.3 146.7 150.3 151.7
## [100] 151.7 146.2 146.3 151.3 150.0 149.7 150.3 146.5 150.4 150.9 147.3
## [111] 182.7 153.1 148.9 147.5 150.1 146.3 146.7 150.3 149.7 149.2 197.6
## [122] 148.2 149.9 146.7 201.2 147.4 148.4 149.5 150.5 145.9 154.3 146.7
## [133] 147.5 146.7 151.2 149.5 147.3 149.9 149.2 150.8 152.1 146.9 147.3
## [144] 149.7 146.3 151.3 147.3 152.4 185.3 237.7
##
## $data$surv.time
##   [1]  475  319  478  292  266 4190  511 1211 1379  844  737  338  583 1379
##  [15] 3691  496  360 1173  379  391  522 1486   27  891  356  123 2906  500
##  [29] 1450  747  357   10 2017 1256 1517  152 1061  317  698  435  987  975
##  [43]  604  859  427 1632 4059  521  526  471  309  305  559  110  844  389
##  [57]  349 1098 2353  169  420 1292  648 1022  219  392  540  717  319 1461
##  [71]  643  293  283   55  781  322  605  981 1920  375  704  886  735   13
##  [85] 1823  178  802 1096  453   69  288  707  522  254  727  153  652 1177
##  [99]  348  445  442  239  218  419  392  524  154  614 1727 1422  478  516
## [113]  184  330  303  502 1383  491  100 1101  138   17  538  278  761 1497
## [127]   49  698  641   71 1109  597 1204  304 1030  873  467  188   18  338
## [141]  279  308  448  268  923 1087  376 1084  252  745
##
## $data$surv.event
##   [1]  TRUE  TRUE  TRUE FALSE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE
##  [12]  TRUE  TRUE  TRUE FALSE  TRUE  TRUE  TRUE  TRUE FALSE  TRUE  TRUE
##  [23] FALSE  TRUE  TRUE  TRUE FALSE  TRUE  TRUE FALSE  TRUE FALSE  TRUE
##  [34] FALSE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE FALSE  TRUE  TRUE  TRUE
##  [45]  TRUE  TRUE FALSE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE
##  [56]  TRUE FALSE  TRUE FALSE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE
##  [67]  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE
##  [78] FALSE FALSE  TRUE  TRUE  TRUE  TRUE FALSE FALSE  TRUE FALSE FALSE
##  [89]  TRUE  TRUE  TRUE FALSE  TRUE  TRUE  TRUE FALSE  TRUE FALSE  TRUE
## [100]  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE FALSE FALSE  TRUE FALSE FALSE
## [111] FALSE  TRUE  TRUE  TRUE  TRUE FALSE FALSE  TRUE  TRUE  TRUE  TRUE
## [122] FALSE FALSE FALSE  TRUE  TRUE  TRUE  TRUE  TRUE FALSE FALSE  TRUE
## [133] FALSE  TRUE  TRUE  TRUE  TRUE  TRUE FALSE  TRUE  TRUE  TRUE  TRUE
## [144]  TRUE  TRUE FALSE FALSE  TRUE  TRUE FALSE
##
##
## $comppairs
## [1] 17236
```

```
cindex.comp(concordance.index(gg.linpred.glasgow, data.glasgow$Time, data.glasgow$DSD, method = "noether
```

```
## $p.value
## [1] 0.283
##
## $cindex1
## [1] 0.6086
##
## $cindex2
## [1] 0.5851
```

```
cindex.comp(concordance.index(gg.linpred.apgi, data.apgi$Time, data.apgi$DSD, method = "noether"), conco
```

```
## $p.value
## [1] 0.04175
##
## $cindex1
## [1] 0.5798
##
## $cindex2
## [1] 0.4745
```

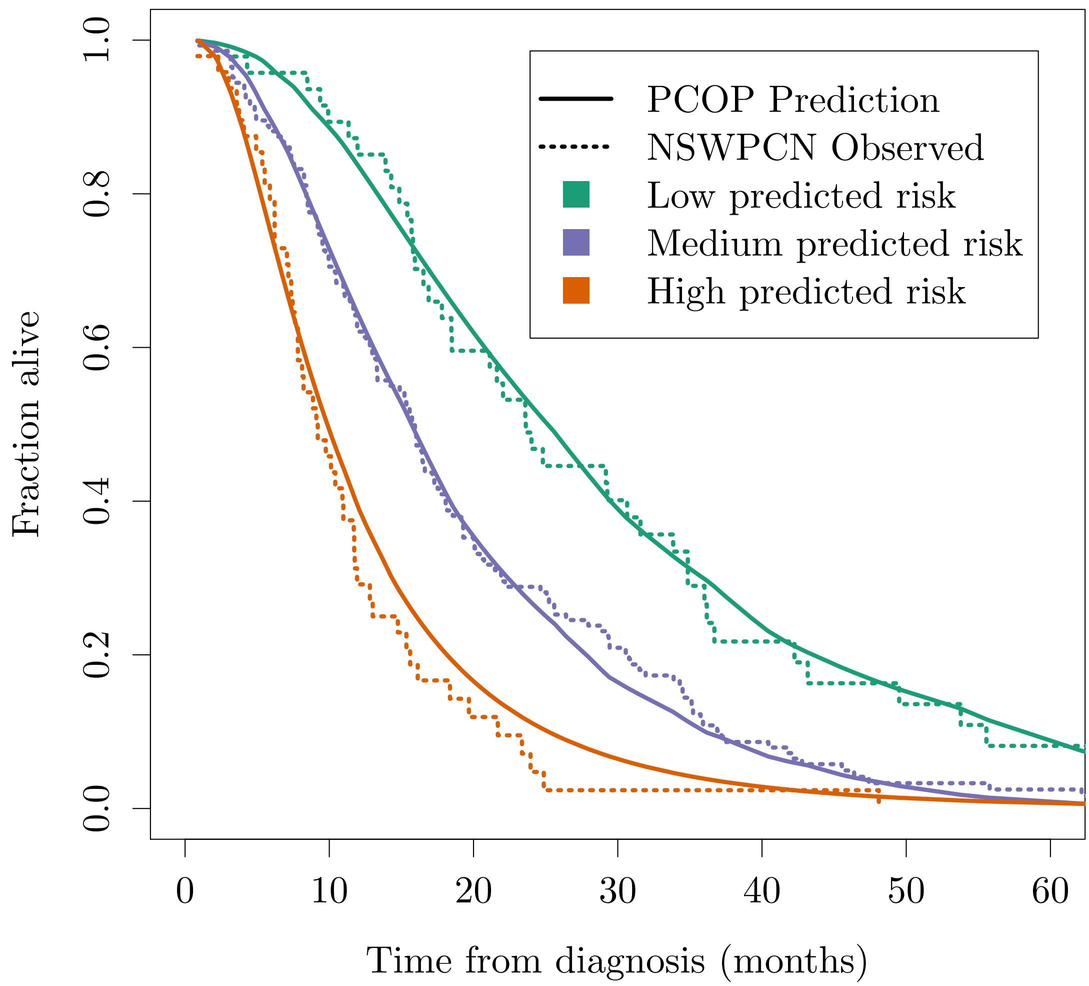
```
cindex.comp(concordance.index(gg.linpred.dresden, data.dresden$Time, data.dresden$DSD, method = "noether
```

```
## $p.value
## [1] 0.2626
##
## $cindex1
## [1] 0.5457
##
## $cindex2
## [1] 0.518
```

4.5 Altman method 4 (D,C)

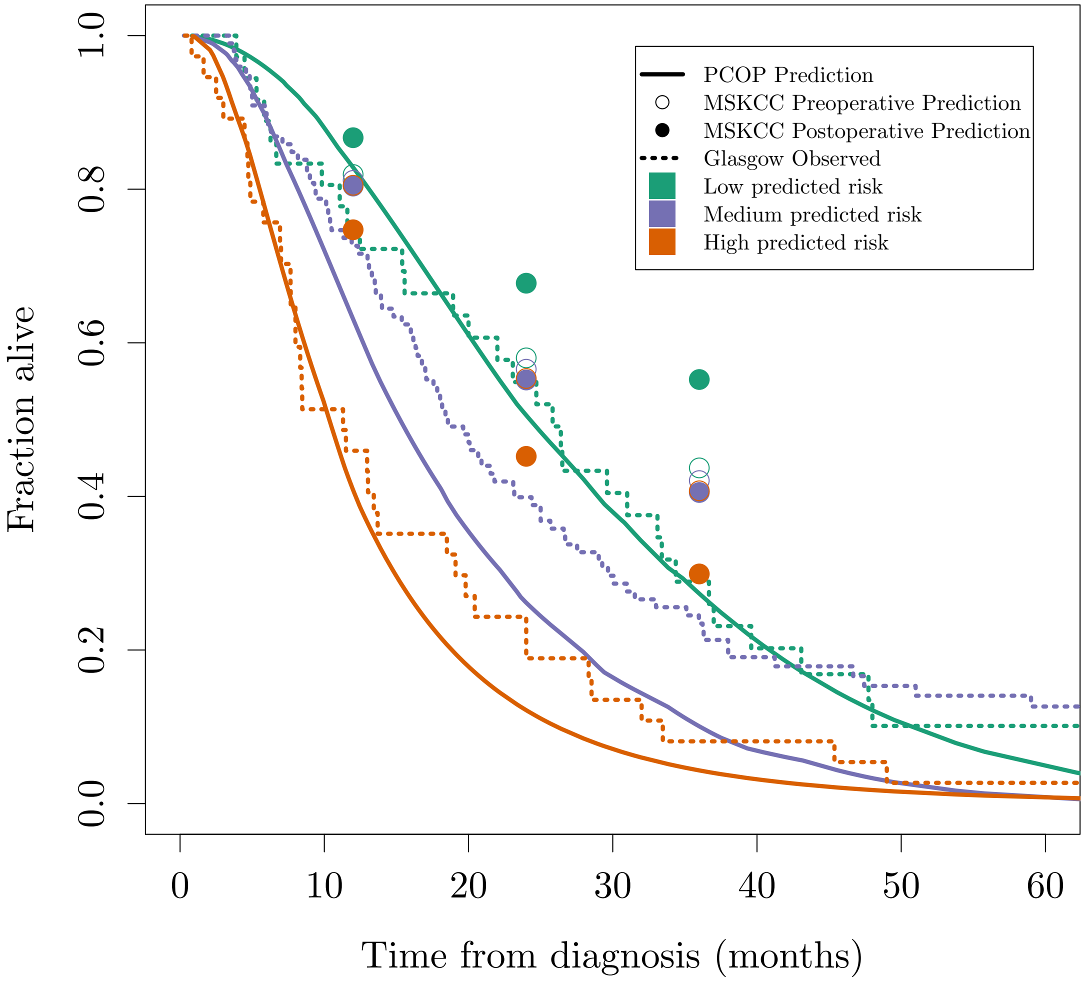
```
group_quantiles = c(0, 0.2, 0.8, 1)
gg.groups.nswpcn = cut(gg.linpred.nswpcn, quantile(gg.linpred.nswpcn, group_quantiles), labels = FALSE)
temp.alpha = 0.1
```

```
temp.km = survfit(Surv(data.nswpcn$Time, data.nswpcn$DSD) ~ gg.groups.nswpcn, conf.int = 1-temp.alpha)
temp.km = data.frame(surv = temp.km$surv, group = rep(gsub(".*=", "", names(temp.km$strata)), temp.km$st
temp.pred = summary(fit.gg, newdata = data.nswpcn, ci = FALSE)
temp.pred.times = temp.pred[[1]][,1]
temp.pred.ests = sapply(temp.pred, function(x) x[,2])
temp.pred.ests = tapply(1:ncol(temp.pred.ests), gg.groups.nswpcn, function(is) apply(temp.pred.ests[,is]
temp.pred.lower = sapply(temp.pred.ests, function(x) x[1,])
temp.pred.meds = sapply(temp.pred.ests, function(x) x[2,])
temp.pred.upper = sapply(temp.pred.ests, function(x) x[3,])
temp.pred = data.frame(surv = as.vector(temp.pred.meds), group = rep(colnames(temp.pred.meds), each = nr
temp.data = rbind(temp.km, temp.pred)
temp.data$time = temp.data$time / 365.25 * 12

plot(0 ~ 0, type = "n", xlim = c(0, 5*12), ylim = c(0, 1), xlab = "Time from diagnosis (months)", ylab =
temp.pal = brewer.pal(length(unique(gg.groups.nswpcn)), "Dark2")[c(1, 3, 2)]
names(temp.pal) = sort(unique(gg.groups.nswpcn))
for (temp.i in factor(sort(unique(gg.groups.nswpcn))))
{
        lines(surv ~ time, temp.data[as.character(temp.data$group) == as.character(temp.i) & temp.data$e
        lines(surv ~ time, temp.data[as.character(temp.data$group) == as.character(temp.i) & temp.data$e
}
legend("topright", inset = 0.05, legend = c("PCOP Prediction", "NSWPCN Observed", "Low predicted risk",
```

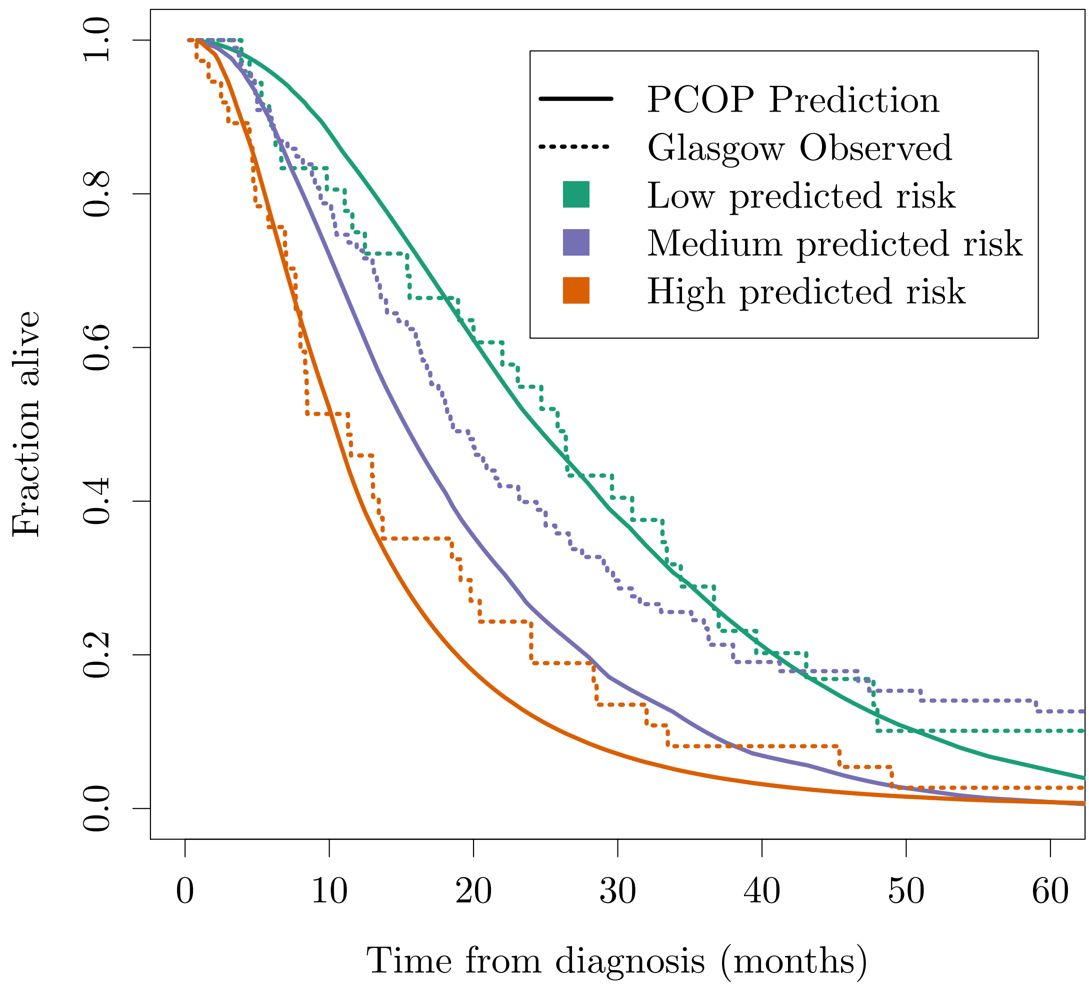



```
summary(coxph(Surv(data.nswpcn$Time, data.nswpcn$DSD) ~ factor(gg.groups.nswpcn)))

## Call:
## coxph(formula = Surv(data.nswpcn$Time, data.nswpcn$DSD) ~ factor(gg.groups.nswpcn))
##
##   n= 239, number of events= 230
##    (1 observation deleted due to missingness)
##
##                             coef exp(coef) se(coef)    z Pr(>|z|)
## factor(gg.groups.nswpcn)2 0.532     1.703    0.176 3.03   0.0025
## factor(gg.groups.nswpcn)3 1.328     3.775    0.219 6.06  1.3e-09
##
##                           exp(coef) exp(-coef) lower .95 upper .95
## factor(gg.groups.nswpcn)2      1.70      0.587      1.21       2.4
## factor(gg.groups.nswpcn)3      3.78      0.265      2.46       5.8
##
## Concordance= 0.618  (se = 0.019 )
## Rsquare= 0.138   (max possible= 1 )
## Likelihood ratio test= 35.5  on 2 df,   p=1.96e-08
## Wald test            = 37.9  on 2 df,   p=6.01e-09
## Score (logrank) test = 40.7  on 2 df,   p=1.46e-09
```

```
mskcc_pre.groups.glasgow = cut(mskcc_pre.linpred.glasgow, quantile(mskcc_pre.linpred.glasgow, group_quan
mskcc_post.groups.glasgow = cut(mskcc_post.linpred.glasgow, quantile(mskcc_post.linpred.glasgow, group_q
gg.groups.glasgow = cut(gg.linpred.glasgow, quantile(gg.linpred.glasgow, group_quantiles), labels = FALS

temp.km = survfit(Surv(data.glasgow$Time, data.glasgow$DSD) ~ gg.groups.glasgow, conf.int = 1-temp.alpha
temp.km = data.frame(surv = temp.km$surv, group = rep(gsub(".*=", "", names(temp.km$strata)), temp.km$st
temp.pred = summary(fit.gg, newdata = data.glasgow, ci = FALSE)
temp.pred.times = temp.pred[[1]][,1]
temp.pred.ests = sapply(temp.pred, function(x) x[,2])
temp.pred.ests = tapply(1:ncol(temp.pred.ests), gg.groups.glasgow, function(is) apply(temp.pred.ests[,is
temp.pred.lower = sapply(temp.pred.ests, function(x) x[1,])
temp.pred.meds = sapply(temp.pred.ests, function(x) x[2,])
temp.pred.upper = sapply(temp.pred.ests, function(x) x[3,])
temp.pred = data.frame(surv = as.vector(temp.pred.meds), group = rep(colnames(temp.pred.meds), each = nr
temp.data = rbind(temp.km, temp.pred)
temp.data$time = temp.data$time / 365.25 * 12
temp.predpre.12mo = simplify2array(tapply(mskcc_pre.12mo.glasgow, mskcc_pre.groups.glasgow, quantile, pr
temp.predpre.24mo = simplify2array(tapply(mskcc_pre.24mo.glasgow, mskcc_pre.groups.glasgow, quantile, pr
temp.predpre.36mo = simplify2array(tapply(mskcc_pre.36mo.glasgow, mskcc_pre.groups.glasgow, quantile, pr
temp.predpost.12mo = simplify2array(tapply(mskcc_post.12mo.glasgow, mskcc_post.groups.glasgow, quantile,
temp.predpost.24mo = simplify2array(tapply(mskcc_post.24mo.glasgow, mskcc_post.groups.glasgow, quantile,
temp.predpost.36mo = simplify2array(tapply(mskcc_post.36mo.glasgow, mskcc_post.groups.glasgow, quantile,
temp.data2 = data.frame(
        surv = c(temp.predpre.12mo[2,], temp.predpre.24mo[2,], temp.predpre.36mo[2,], temp.predpost.12mo
        group = factor(rep(sort(unique(mskcc_pre.groups.glasgow)), 6)),
        time = rep(c(12, 24, 36), each = 3),
        upper = c(temp.predpre.12mo[3,], temp.predpre.24mo[3,], temp.predpre.36mo[3,], temp.predpost.12m
        lower = c(temp.predpre.12mo[1,], temp.predpre.24mo[1,], temp.predpre.36mo[1,], temp.predpost.12m
        est = rep(c("MSKCC Preoperative", "MSKCC Postoperative"), each = 9))

plot(0 ~ 0, type = "n", xlim = c(0, 5*12), ylim = c(0, 1), xlab = "Time from diagnosis (months)", ylab =
temp.pal = brewer.pal(length(unique(gg.groups.glasgow)), "Dark2")[c(1, 3, 2)]
names(temp.pal) = sort(unique(gg.groups.glasgow))
for (temp.i in factor(sort(unique(gg.groups.glasgow))))
{
        lines(surv ~ time, temp.data[as.character(temp.data$group) == as.character(temp.i) & temp.data$e
        lines(surv ~ time, temp.data[as.character(temp.data$group) == as.character(temp.i) & temp.data$e
        points(surv ~ time, temp.data2[as.character(temp.data2$group) == as.character(temp.i) & temp.dat
        points(surv ~ time, temp.data2[as.character(temp.data2$group) == as.character(temp.i) & temp.dat
}
legend("topright", inset = 0.05, legend = c("PCOP Prediction", "MSKCC Preoperative Prediction", "MSKCC P
```




```
plot(0 ~ 0, type = "n", xlim = c(0, 5*12), ylim = c(0, 1), xlab = "Time from diagnosis (months)", ylab =
temp.pal = brewer.pal(length(unique(gg.groups.glasgow)), "Dark2")[c(1, 3, 2)]
names(temp.pal) = sort(unique(gg.groups.glasgow))
for (temp.i in factor(sort(unique(gg.groups.glasgow))))
{
        lines(surv ~ time, temp.data[as.character(temp.data$group) == as.character(temp.i) & temp.data$e
        lines(surv ~ time, temp.data[as.character(temp.data$group) == as.character(temp.i) & temp.data$e
}
legend("topright", inset = 0.05, legend = c("PCOP Prediction", "Glasgow Observed", "Low predicted risk",
```




```
summary(coxph(Surv(data.glasgow$Time, data.glasgow$DSD) ~ factor(gg.groups.glasgow)))

## Call:
## coxph(formula = Surv(data.glasgow$Time, data.glasgow$DSD) ~ factor(gg.groups.glasgow))
##
##   n= 188, number of events= 160
##    (1 observation deleted due to missingness)
##
##                               coef exp(coef) se(coef)    z Pr(>|z|)
## factor(gg.groups.glasgow)2 0.0794    1.0826   0.2074 0.38   0.7019
## factor(gg.groups.glasgow)3 0.6662    1.9468   0.2438 2.73   0.0063
##
##                             exp(coef) exp(-coef) lower .95 upper .95
## factor(gg.groups.glasgow)2      1.08      0.924     0.721      1.63
## factor(gg.groups.glasgow)3      1.95      0.514     1.207      3.14
##
## Concordance= 0.577  (se = 0.023 )
## Rsquare= 0.049   (max possible= 0.999 )
## Likelihood ratio test= 9.37  on 2 df,   p=0.00923
## Wald test            = 10.4  on 2 df,   p=0.00543
## Score (logrank) test = 10.8  on 2 df,   p=0.00463

summary(coxph(Surv(data.glasgow$Time, data.glasgow$DSD) ~ factor(mskcc_pre.groups.glasgow)))
```

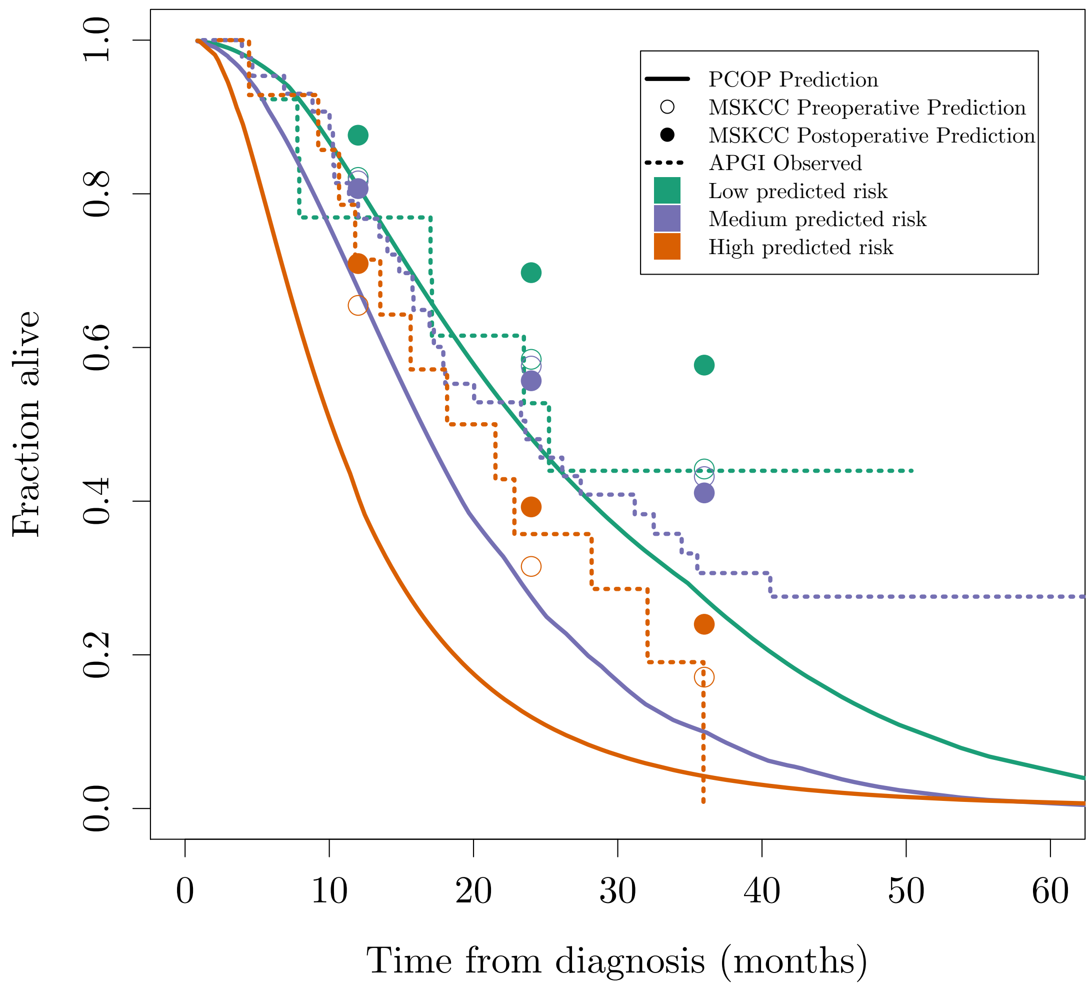
```
## Call:
## coxph(formula = Surv(data.glasgow$Time, data.glasgow$DSD) ~ factor(mskcc_pre.groups.glasgow))
##
##   n= 188, number of events= 160
##    (1 observation deleted due to missingness)
##
##                                    coef exp(coef) se(coef)    z Pr(>|z|)
## factor(mskcc_pre.groups.glasgow)2 0.764     2.147    0.217 3.52  0.00043
## factor(mskcc_pre.groups.glasgow)3 0.762     2.143    0.260 2.93  0.00338
##
##                                   exp(coef) exp(-coef) lower .95 upper .95
## factor(mskcc_pre.groups.glasgow)2      2.15      0.466      1.40      3.28
## factor(mskcc_pre.groups.glasgow)3      2.14      0.467      1.29      3.57
##
## Concordance= 0.563  (se = 0.023 )
## Rsquare= 0.077   (max possible= 0.999 )
## Likelihood ratio test= 15.1  on 2 df,   p=0.000535
## Wald test            = 13.1  on 2 df,   p=0.00144
## Score (logrank) test = 13.6  on 2 df,   p=0.00109
```

```
summary(coxph(Surv(data.glasgow$Time, data.glasgow$DSD) ~ factor(mskcc_post.groups.glasgow)))
```

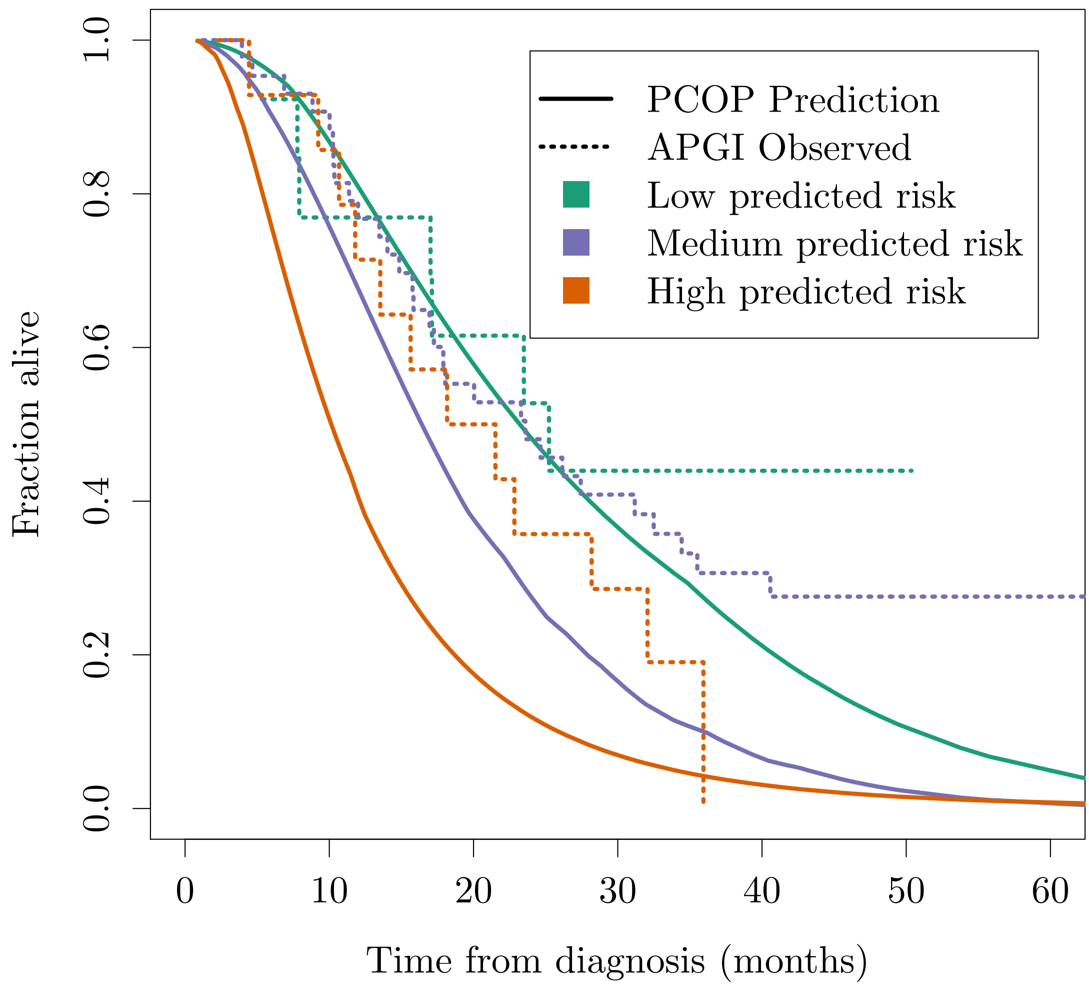
```
## Call:
## coxph(formula = Surv(data.glasgow$Time, data.glasgow$DSD) ~ factor(mskcc_post.groups.glasgow))
##
##   n= 188, number of events= 160
##    (1 observation deleted due to missingness)
##
##                                     coef exp(coef) se(coef)   z Pr(>|z|)
## factor(mskcc_post.groups.glasgow)2 0.631     1.879    0.218 2.9  0.00378
## factor(mskcc_post.groups.glasgow)3 0.990     2.691    0.261 3.8  0.00015
##
##                                    exp(coef) exp(-coef) lower .95
## factor(mskcc_post.groups.glasgow)2      1.88      0.532      1.23
## factor(mskcc_post.groups.glasgow)3      2.69      0.372      1.61
##                                    upper .95
## factor(mskcc_post.groups.glasgow)2      2.88
## factor(mskcc_post.groups.glasgow)3      4.49
##
## Concordance= 0.579  (se = 0.023 )
## Rsquare= 0.081   (max possible= 0.999 )
## Likelihood ratio test= 15.8  on 2 df,   p=0.000372
## Wald test            = 14.7  on 2 df,   p=0.00066
## Score (logrank) test = 15.3  on 2 df,   p=0.000484
```

```
mskcc_pre.groups.apgi = cut(mskcc_pre.linpred.apgi, quantile(mskcc_pre.linpred.apgi, group_quantiles), l
mskcc_post.groups.apgi = cut(mskcc_post.linpred.apgi, quantile(mskcc_post.linpred.apgi, group_quantiles)
gg.groups.apgi = cut(gg.linpred.apgi, quantile(gg.linpred.apgi, group_quantiles), labels = FALSE)

temp.km = survfit(Surv(data.apgi$Time, data.apgi$DSD) ~ gg.groups.apgi, conf.int = 1-temp.alpha)
temp.km = data.frame(surv = temp.km$surv, group = rep(gsub(".*=", "", names(temp.km$strata)), temp.km$st
temp.pred = summary(fit.gg, newdata = data.apgi, ci = FALSE)
temp.pred.times = temp.pred[[1]][,1]
```

```
temp.pred.ests = sapply(temp.pred, function(x) x[,2])
temp.pred.ests = tapply(1:ncol(temp.pred.ests), gg.groups.apgi, function(is) apply(temp.pred.ests[,is],
temp.pred.lower = sapply(temp.pred.ests, function(x) x[1,])
temp.pred.meds = sapply(temp.pred.ests, function(x) x[2,])
temp.pred.upper = sapply(temp.pred.ests, function(x) x[3,])
temp.pred = data.frame(surv = as.vector(temp.pred.meds), group = rep(colnames(temp.pred.meds), each = nr
temp.data = rbind(temp.km, temp.pred)
temp.data$time = temp.data$time / 365.25 * 12
temp.predpre.12mo = simplify2array(tapply(mskcc_pre.12mo.apgi, mskcc_pre.groups.apgi, quantile, probs =
temp.predpre.24mo = simplify2array(tapply(mskcc_pre.24mo.apgi, mskcc_pre.groups.apgi, quantile, probs =
temp.predpre.36mo = simplify2array(tapply(mskcc_pre.36mo.apgi, mskcc_pre.groups.apgi, quantile, probs =
temp.predpost.12mo = simplify2array(tapply(mskcc_post.12mo.apgi, mskcc_post.groups.apgi, quantile, probs
temp.predpost.24mo = simplify2array(tapply(mskcc_post.24mo.apgi, mskcc_post.groups.apgi, quantile, probs
temp.predpost.36mo = simplify2array(tapply(mskcc_post.36mo.apgi, mskcc_post.groups.apgi, quantile, probs
temp.data2 = data.frame(
        surv = c(temp.predpre.12mo[2,], temp.predpre.24mo[2,], temp.predpre.36mo[2,], temp.predpost.12mo
        group = factor(rep(sort(unique(mskcc_pre.groups.apgi)), 6)),
        time = rep(c(12, 24, 36), each = 3),
        upper = c(temp.predpre.12mo[3,], temp.predpre.24mo[3,], temp.predpre.36mo[3,], temp.predpost.12m
        lower = c(temp.predpre.12mo[1,], temp.predpre.24mo[1,], temp.predpre.36mo[1,], temp.predpost.12m
        est = rep(c("MSKCC Preoperative", "MSKCC Postoperative"), each = 9))

plot(0 ~ 0, type = "n", xlim = c(0, 5*12), ylim = c(0, 1), xlab = "Time from diagnosis (months)", ylab =
temp.pal = brewer.pal(length(unique(gg.groups.apgi)), "Dark2")[c(1, 3, 2)]
names(temp.pal) = sort(unique(gg.groups.apgi))
for (temp.i in factor(sort(unique(gg.groups.apgi))))
{
        lines(surv ~ time, temp.data[as.character(temp.data$group) == as.character(temp.i) & temp.data$e
        lines(surv ~ time, temp.data[as.character(temp.data$group) == as.character(temp.i) & temp.data$e
        points(surv ~ time, temp.data2[as.character(temp.data2$group) == as.character(temp.i) & temp.dat
        points(surv ~ time, temp.data2[as.character(temp.data2$group) == as.character(temp.i) & temp.dat
}
legend("topright", inset = 0.05, legend = c("PCOP Prediction", "MSKCC Preoperative Prediction", "MSKCC P
```




```
plot(0 ~ 0, type = "n", xlim = c(0, 5*12), ylim = c(0, 1), xlab = "Time from diagnosis (months)", ylab =
temp.pal = brewer.pal(length(unique(gg.groups.apgi)), "Dark2")[c(1, 3, 2)]
names(temp.pal) = sort(unique(gg.groups.apgi))
for (temp.i in factor(sort(unique(gg.groups.apgi))))
{
        lines(surv ~ time, temp.data[as.character(temp.data$group) == as.character(temp.i) & temp.data$e
        lines(surv ~ time, temp.data[as.character(temp.data$group) == as.character(temp.i) & temp.data$e
}
legend("topright", inset = 0.05, legend = c("PCOP Prediction", "APGI Observed", "Low predicted risk", "M
```




```
summary(coxph(Surv(data.apgi$Time, data.apgi$DSD) ~ factor(gg.groups.apgi)))

## Call:
## coxph(formula = Surv(data.apgi$Time, data.apgi$DSD) ~ factor(gg.groups.apgi))
##
##   n= 73, number of events= 50
##    (2 observations deleted due to missingness)
##
##                           coef exp(coef) se(coef)    z Pr(>|z|)
## factor(gg.groups.apgi)2 0.182     1.199    0.421 0.43     0.67
## factor(gg.groups.apgi)3 0.584     1.793    0.477 1.22     0.22
##
##                         exp(coef) exp(-coef) lower .95 upper .95
## factor(gg.groups.apgi)2      1.20      0.834     0.525      2.74
## factor(gg.groups.apgi)3      1.79      0.558     0.704      4.56
##
## Concordance= 0.533  (se = 0.039 )
## Rsquare= 0.024   (max possible= 0.993 )
## Likelihood ratio test= 1.79  on 2 df,   p=0.409
## Wald test            = 1.89  on 2 df,   p=0.389
## Score (logrank) test = 1.92  on 2 df,   p=0.383

summary(coxph(Surv(data.apgi$Time, data.apgi$DSD) ~ factor(mskcc_pre.groups.apgi)))
```

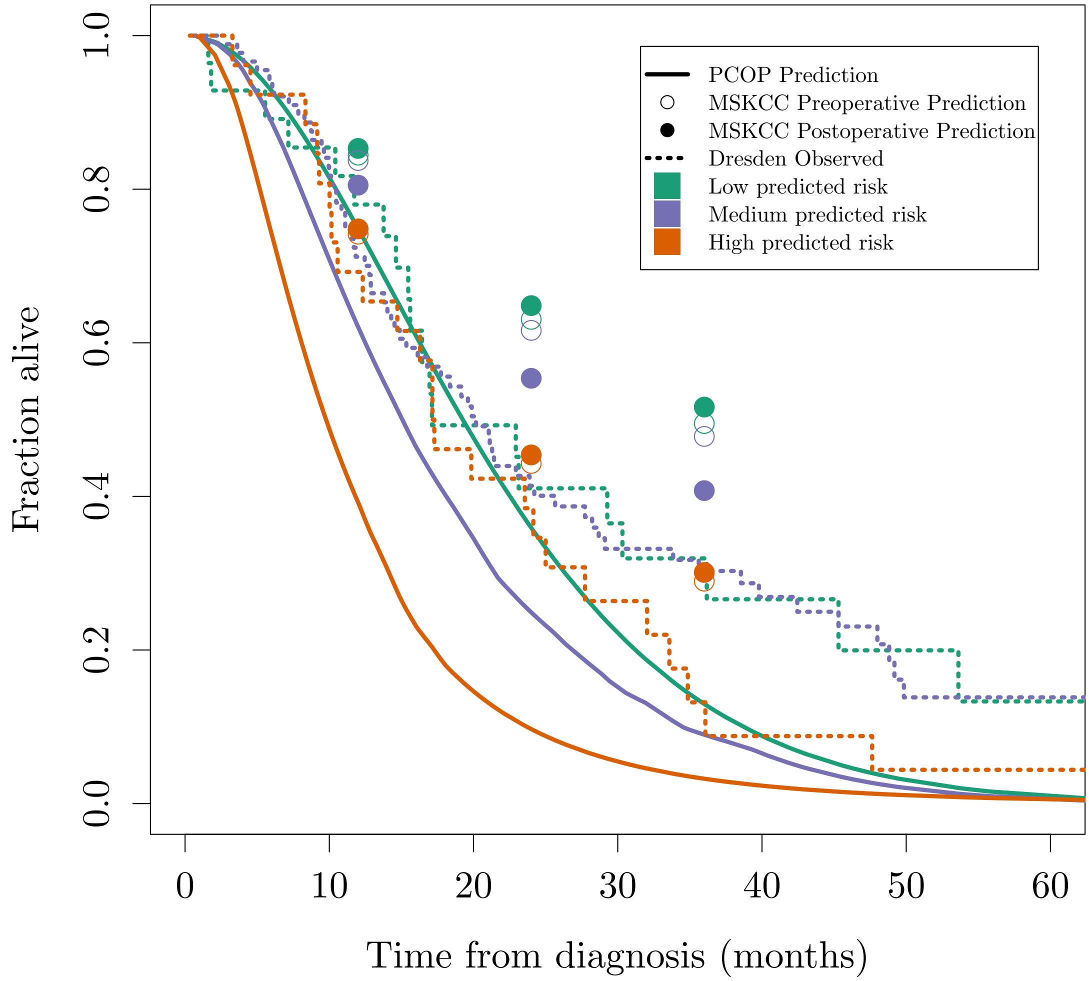
```
## Call:
## coxph(formula = Surv(data.apgi$Time, data.apgi$DSD) ~ factor(mskcc_pre.groups.apgi))
##
##   n= 74, number of events= 50
##    (1 observation deleted due to missingness)
##
##                                    coef exp(coef) se(coef)     z Pr(>|z|)
## factor(mskcc_pre.groups.apgi)2 -0.412     0.662    0.367 -1.12     0.26
## factor(mskcc_pre.groups.apgi)3 -0.058     0.944    0.449 -0.13     0.90
##
##                                  exp(coef) exp(-coef) lower .95 upper .95
## factor(mskcc_pre.groups.apgi)2     0.662       1.51     0.322      1.36
## factor(mskcc_pre.groups.apgi)3     0.944       1.06     0.392      2.27
##
## Concordance= 0.559  (se = 0.037 )
## Rsquare= 0.023   (max possible= 0.993 )
## Likelihood ratio test= 1.7  on 2 df,   p=0.428
## Wald test            = 1.75  on 2 df,   p=0.417
## Score (logrank) test = 1.77  on 2 df,   p=0.412
```

```
summary(coxph(Surv(data.apgi$Time, data.apgi$DSD) ~ factor(mskcc_post.groups.apgi)))
```

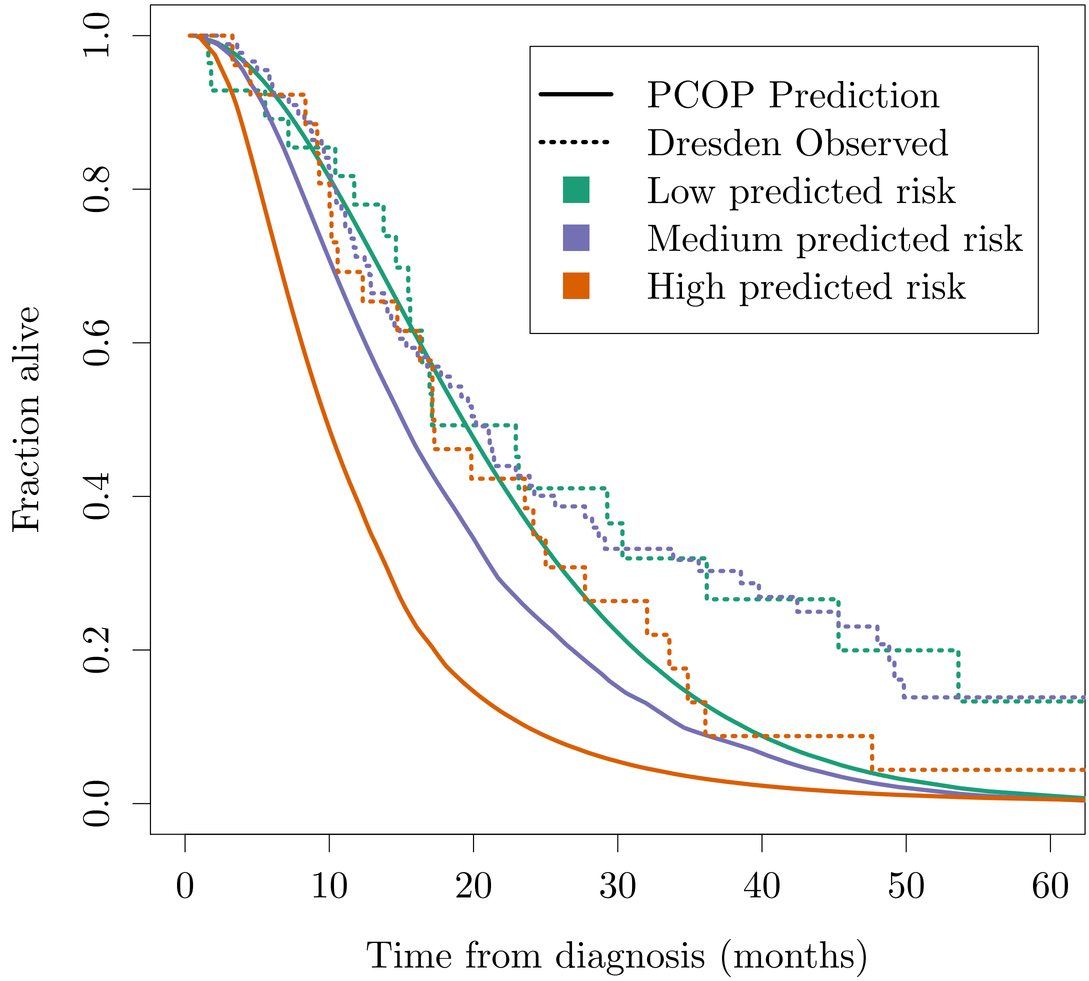
```
## Call:
## coxph(formula = Surv(data.apgi$Time, data.apgi$DSD) ~ factor(mskcc_post.groups.apgi))
##
##   n= 74, number of events= 51
##    (1 observation deleted due to missingness)
##
##                                    coef exp(coef) se(coef)    z Pr(>|z|)
## factor(mskcc_post.groups.apgi)2 1.526     4.598    0.531 2.87   0.0041
## factor(mskcc_post.groups.apgi)3 1.812     6.125    0.576 3.15   0.0016
##
##                                   exp(coef) exp(-coef) lower .95 upper .95
## factor(mskcc_post.groups.apgi)2      4.60      0.217      1.62      13.0
## factor(mskcc_post.groups.apgi)3      6.12      0.163      1.98      18.9
##
## Concordance= 0.624  (se = 0.04 )
## Rsquare= 0.184   (max possible= 0.993 )
## Likelihood ratio test= 15.1  on 2 df,   p=0.000539
## Wald test            = 10.1  on 2 df,   p=0.00628
## Score (logrank) test = 12.3  on 2 df,   p=0.00208
```

```
mskcc_pre.groups.dresden = cut(mskcc_pre.linpred.dresden, quantile(mskcc_pre.linpred.dresden, group_quan
mskcc_post.groups.dresden = cut(mskcc_post.linpred.dresden, quantile(mskcc_post.linpred.dresden, group_q
gg.groups.dresden = cut(gg.linpred.dresden, quantile(gg.linpred.dresden, group_quantiles), labels = FALS

temp.km = survfit(Surv(data.dresden$Time, data.dresden$DSD) ~ gg.groups.dresden, conf.int = 1-temp.alpha
temp.km = data.frame(surv = temp.km$surv, group = rep(gsub(".*=", "", names(temp.km$strata)), temp.km$st
temp.pred = summary(fit.gg, newdata = data.dresden, ci = FALSE)
temp.pred.times = temp.pred[[1]][,1]
temp.pred.ests = sapply(temp.pred, function(x) x[,2])
temp.pred.ests = tapply(1:ncol(temp.pred.ests), gg.groups.dresden, function(is) apply(temp.pred.ests[,is
temp.pred.lower = sapply(temp.pred.ests, function(x) x[1,])
```

```
temp.pred.meds = sapply(temp.pred.ests, function(x) x[2,])
temp.pred.upper = sapply(temp.pred.ests, function(x) x[3,])
temp.pred = data.frame(surv = as.vector(temp.pred.meds), group = rep(colnames(temp.pred.meds), each = nr
temp.data = rbind(temp.km, temp.pred)
temp.data$time = temp.data$time / 365.25 * 12
temp.predpre.12mo = simplify2array(tapply(mskcc_pre.12mo.dresden, mskcc_pre.groups.dresden, quantile, pr
temp.predpre.24mo = simplify2array(tapply(mskcc_pre.24mo.dresden, mskcc_pre.groups.dresden, quantile, pr
temp.predpre.36mo = simplify2array(tapply(mskcc_pre.36mo.dresden, mskcc_pre.groups.dresden, quantile, pr
temp.predpost.12mo = simplify2array(tapply(mskcc_post.12mo.dresden, mskcc_post.groups.dresden, quantile,
temp.predpost.24mo = simplify2array(tapply(mskcc_post.24mo.dresden, mskcc_post.groups.dresden, quantile,
temp.predpost.36mo = simplify2array(tapply(mskcc_post.36mo.dresden, mskcc_post.groups.dresden, quantile,
temp.data2 = data.frame(
        surv = c(temp.predpre.12mo[2,], temp.predpre.24mo[2,], temp.predpre.36mo[2,], temp.predpost.12mo
        group = factor(rep(sort(unique(mskcc_pre.groups.dresden)), 6)),
        time = rep(c(12, 24, 36), each = 3),
        upper = c(temp.predpre.12mo[3,], temp.predpre.24mo[3,], temp.predpre.36mo[3,], temp.predpost.12m
        lower = c(temp.predpre.12mo[1,], temp.predpre.24mo[1,], temp.predpre.36mo[1,], temp.predpost.12m
        est = rep(c("MSKCC Preoperative", "MSKCC Postoperative"), each = 9))

plot(0 ~ 0, type = "n", xlim = c(0, 5*12), ylim = c(0, 1), xlab = "Time from diagnosis (months)", ylab =
temp.pal = brewer.pal(length(unique(gg.groups.dresden)), "Dark2")[c(1, 3, 2)]
names(temp.pal) = sort(unique(gg.groups.dresden))
for (temp.i in factor(sort(unique(gg.groups.dresden))))
{
        lines(surv ~ time, temp.data[as.character(temp.data$group) == as.character(temp.i) & temp.data$e
        lines(surv ~ time, temp.data[as.character(temp.data$group) == as.character(temp.i) & temp.data$e
        points(surv ~ time, temp.data2[as.character(temp.data2$group) == as.character(temp.i) & temp.dat
        points(surv ~ time, temp.data2[as.character(temp.data2$group) == as.character(temp.i) & temp.dat
}
legend("topright", inset = 0.05, legend = c("PCOP Prediction", "MSKCC Preoperative Prediction", "MSKCC F
```




```
plot(0 ~ 0, type = "n", xlim = c(0, 5*12), ylim = c(0, 1), xlab = "Time from diagnosis (months)", ylab =
temp.pal = brewer.pal(length(unique(gg.groups.dresden)), "Dark2")[c(1, 3, 2)]
names(temp.pal) = sort(unique(gg.groups.dresden))
for (temp.i in factor(sort(unique(gg.groups.dresden))))
{
        lines(surv ~ time, temp.data[as.character(temp.data$group) == as.character(temp.i) & temp.data$e
        lines(surv ~ time, temp.data[as.character(temp.data$group) == as.character(temp.i) & temp.data$e
}
legend("topright", inset = 0.05, legend = c("PCOP Prediction", "Dresden Observed", "Low predicted risk",
```




```
summary(coxph(Surv(data.dresden$Time, data.dresden$DSD) ~ factor(gg.groups.dresden)))

## Call:
## coxph(formula = Surv(data.dresden$Time, data.dresden$DSD) ~ factor(gg.groups.dresden))
##
##   n= 149, number of events= 111
##    (1 observation deleted due to missingness)
##
##                                coef exp(coef) se(coef)    z Pr(>|z|)
## factor(gg.groups.dresden)2 0.0305    1.0310   0.2555 0.12     0.90
## factor(gg.groups.dresden)3 0.3364    1.4000   0.3038 1.11     0.27
##
##                              exp(coef) exp(-coef) lower .95 upper .95
## factor(gg.groups.dresden)2      1.03      0.970     0.625      1.70
## factor(gg.groups.dresden)3      1.40      0.714     0.772      2.54
##
## Concordance= 0.52  (se = 0.027 )
## Rsquare= 0.012   (max possible= 0.998 )
## Likelihood ratio test= 1.73  on 2 df,   p=0.421
## Wald test            = 1.84  on 2 df,   p=0.399
## Score (logrank) test = 1.85  on 2 df,   p=0.397

summary(coxph(Surv(data.dresden$Time, data.dresden$DSD) ~ factor(mskcc_pre.groups.dresden)))
```

```
## Call:
## coxph(formula = Surv(data.dresden$Time, data.dresden$DSD) ~ factor(mskcc_pre.groups.dresden))
##
##   n= 149, number of events= 112
##    (1 observation deleted due to missingness)
##
##                                     coef exp(coef) se(coef)    z Pr(>|z|)
## factor(mskcc_pre.groups.dresden)2 0.0797    1.0830   0.2483 0.32     0.75
## factor(mskcc_pre.groups.dresden)3 0.3448    1.4117   0.2938 1.17     0.24
##
##                                   exp(coef) exp(-coef) lower .95 upper .95
## factor(mskcc_pre.groups.dresden)2      1.08      0.923     0.666      1.76
## factor(mskcc_pre.groups.dresden)3      1.41      0.708     0.794      2.51
##
## Concordance= 0.517  (se = 0.028 )
## Rsquare= 0.01   (max possible= 0.998 )
## Likelihood ratio test= 1.57  on 2 df,   p=0.456
## Wald test            = 1.64  on 2 df,   p=0.441
## Score (logrank) test = 1.65  on 2 df,   p=0.438
```

```
summary(coxph(Surv(data.dresden$Time, data.dresden$DSD) ~ factor(mskcc_post.groups.dresden)))
```

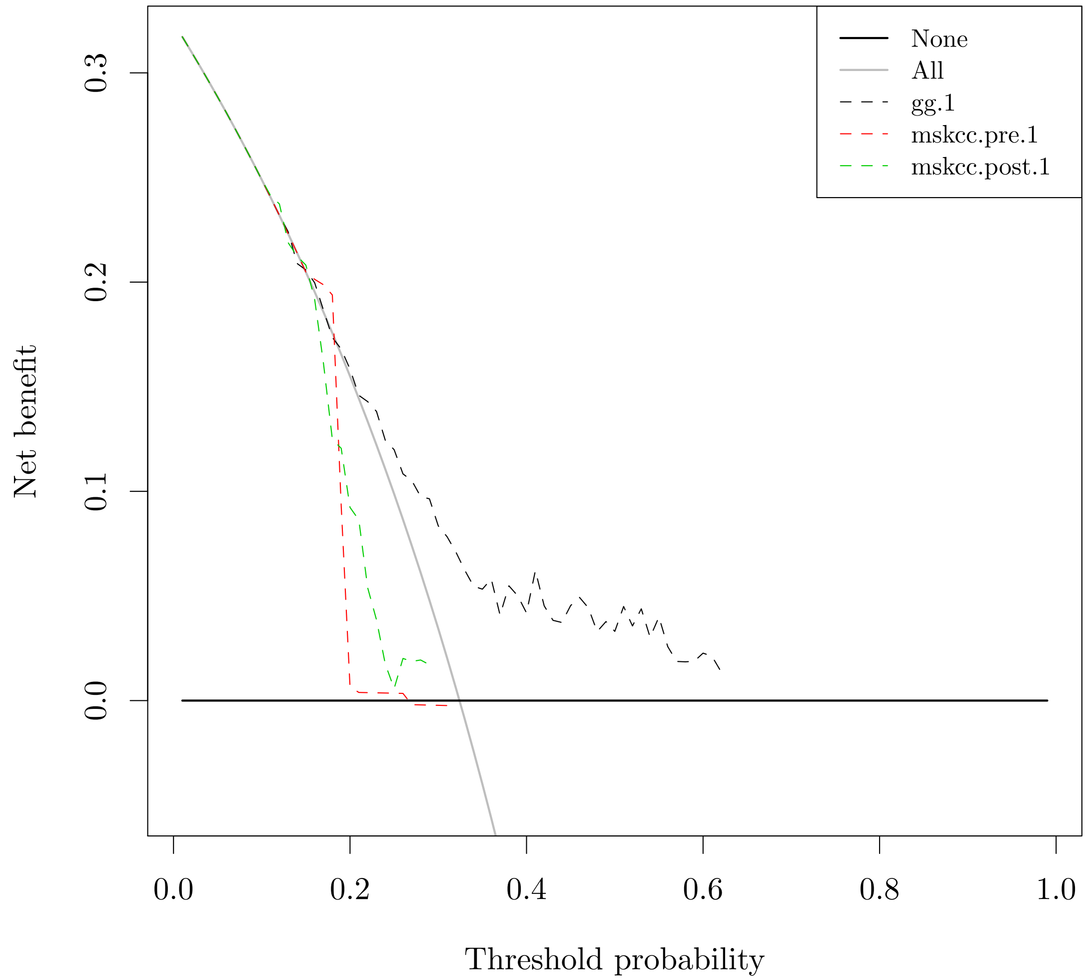
```
## Call:
## coxph(formula = Surv(data.dresden$Time, data.dresden$DSD) ~ factor(mskcc_post.groups.dresden))
##
##   n= 149, number of events= 111
##    (1 observation deleted due to missingness)
##
##                                     coef exp(coef) se(coef)    z Pr(>|z|)
## factor(mskcc_post.groups.dresden)2 0.431     1.539    0.284 1.51   0.1298
## factor(mskcc_post.groups.dresden)3 1.019     2.771    0.334 3.05   0.0023
##
##                                    exp(coef) exp(-coef) lower .95
## factor(mskcc_post.groups.dresden)2      1.54      0.650     0.881
## factor(mskcc_post.groups.dresden)3      2.77      0.361     1.439
##                                    upper .95
## factor(mskcc_post.groups.dresden)2      2.69
## factor(mskcc_post.groups.dresden)3      5.34
##
## Concordance= 0.569  (se = 0.027 )
## Rsquare= 0.063   (max possible= 0.998 )
## Likelihood ratio test= 9.73  on 2 df,   p=0.00772
## Wald test            = 10.1  on 2 df,   p=0.00648
## Score (logrank) test = 10.5  on 2 df,   p=0.0052
```

Decision curve analysis.

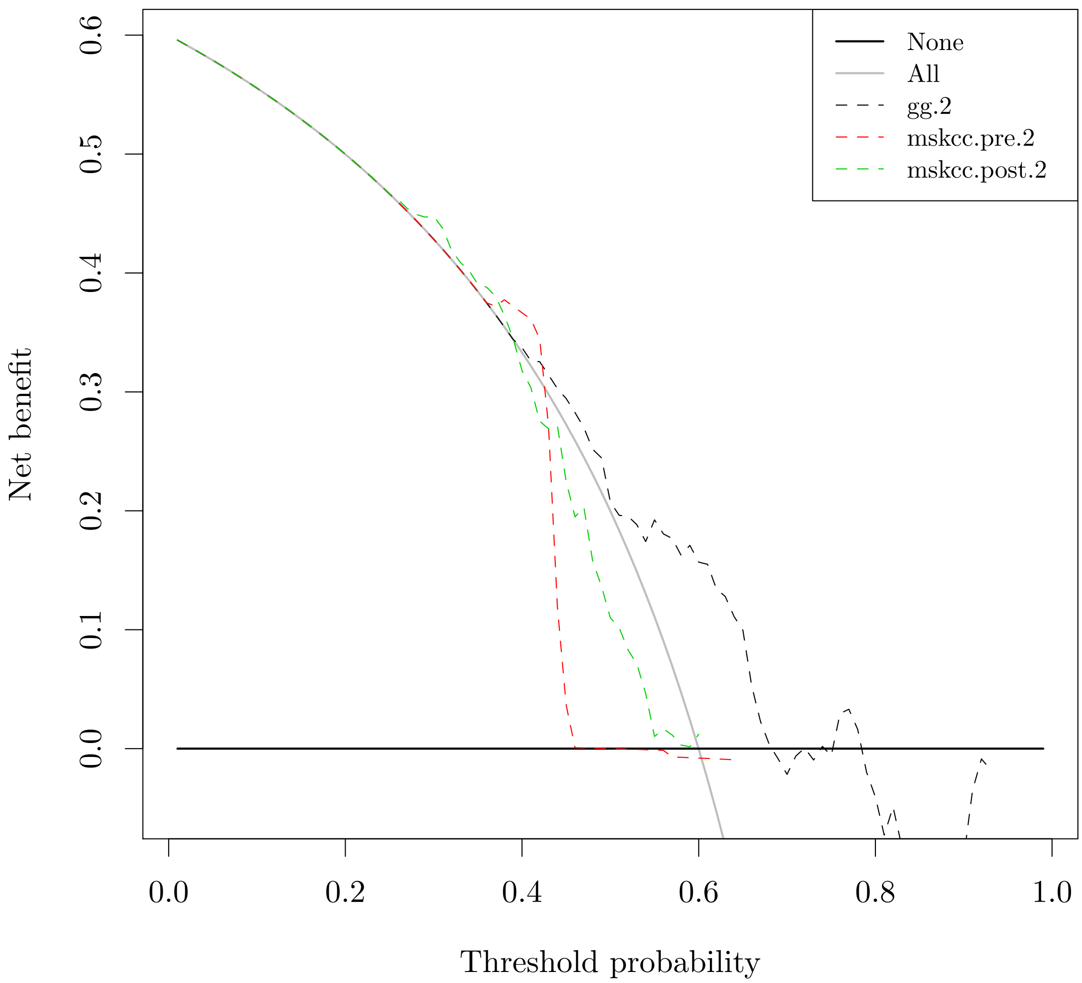
```
source("stdca.R")
temp.data = data.frame(Time = data.glasgow$Time, DSD = data.glasgow$DSD*1,
    gg.1 = 1-gg.prob.glasgow[val.prob.times == 365,], gg.2 = 1-gg.prob.glasgow[val.prob.times == 365*2,]
    mskcc.pre.1 = 1-mskcc_pre.12mo.glasgow, mskcc.pre.2 = 1-mskcc_pre.24mo.glasgow, mskcc.pre.3 = 1-mskc
    mskcc.post.1 = 1-mskcc_post.12mo.glasgow, mskcc.post.2 = 1-mskcc_post.24mo.glasgow, mskcc.post.3 = 1
invisible(stdca(data = temp.data, outcome = "DSD", ttoutcome = "Time", predictors = c("gg.1", "mskcc.pre
```

```
## [1] "gg.1: No observations with risk greater than 63% that have followup through the timepoint select
```

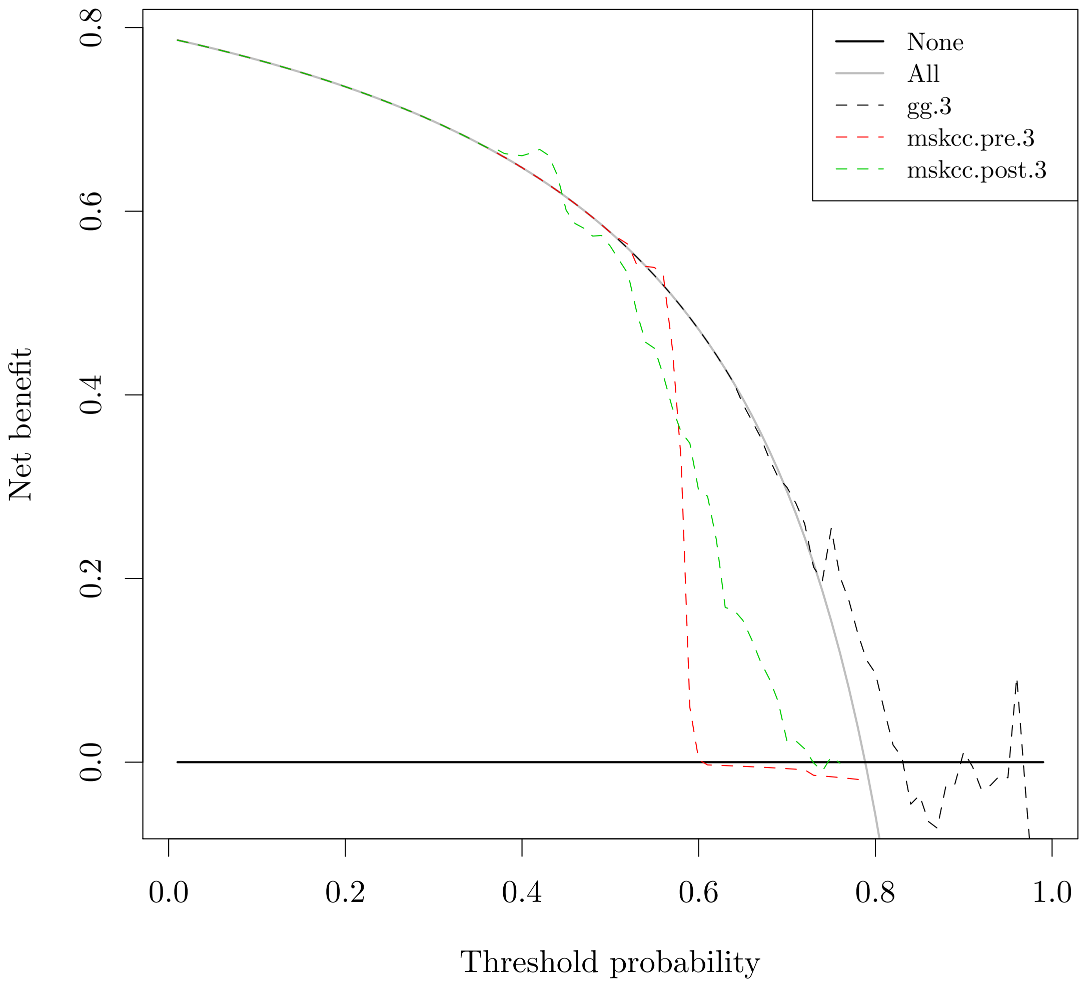
```
## [2] "mskcc.pre.1: No observations with risk greater than 32%, and therefore net benefit not calculabl
## [3] "mskcc.post.1: No observations with risk greater than 30% that have followup through the timepoin
```



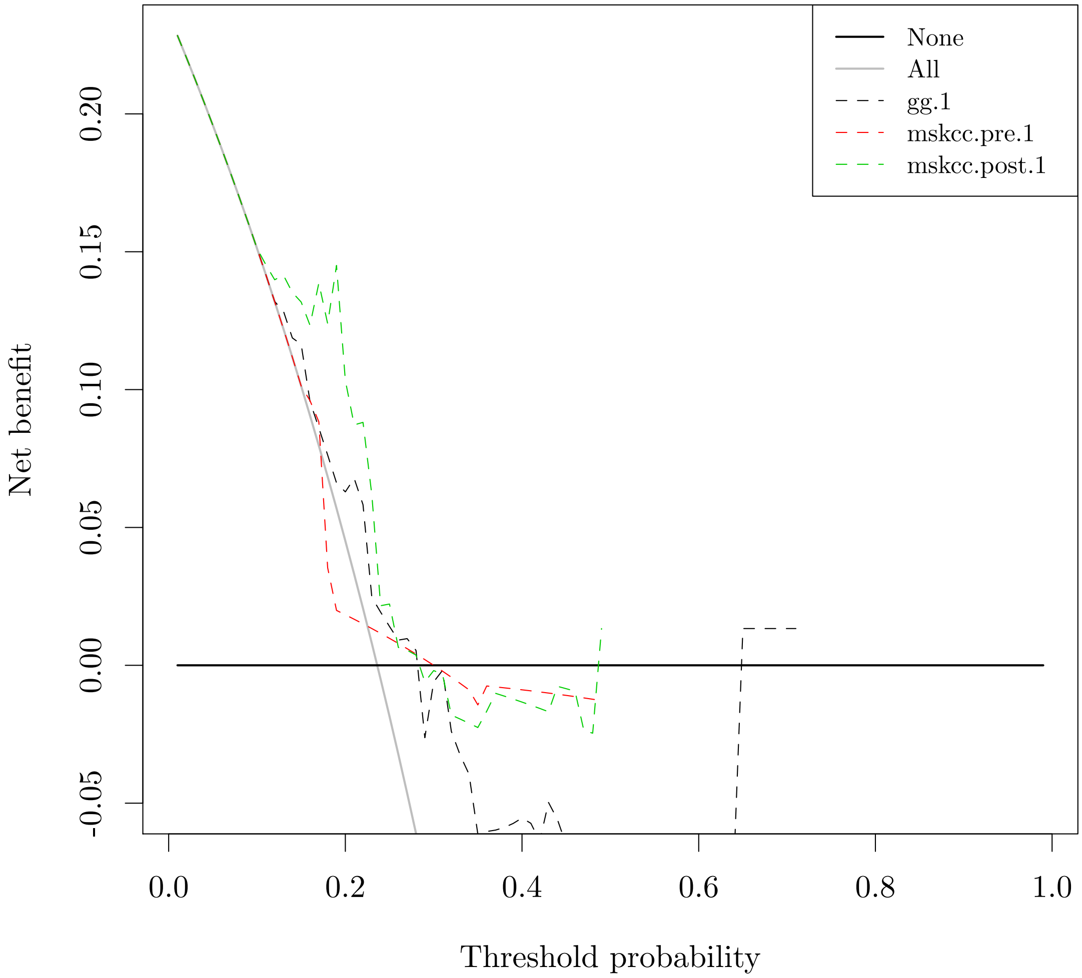

```
invisible(stdca(data = temp.data, outcome = "DSD", ttoutcome = "Time", predictors = c("gg.2", "mskcc.pre

## [1] "gg.2: No observations with risk greater than 94% that have followup through the timepoint select
## [2] "mskcc.pre.2: No observations with risk greater than 65%, and therefore net benefit not calculabl
## [3] "mskcc.post.2: No observations with risk greater than 61% that have followup through the timepoin
```



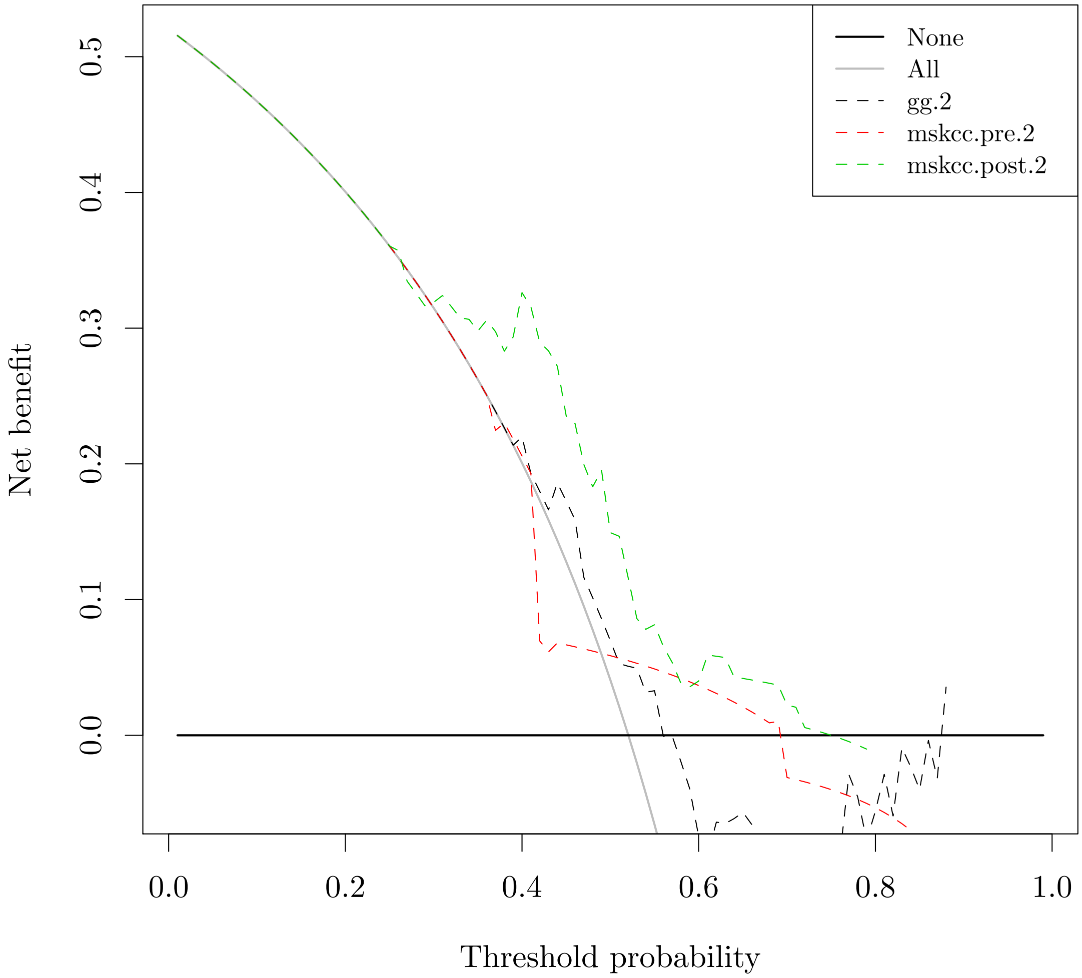

```
invisible(stdca(data = temp.data, outcome = "DSD", ttoutcome = "Time", predictors = c("gg.3", "mskcc.pre

## [1] "mskcc.pre.3: No observations with risk greater than 80%, and therefore net benefit not calculabl
## [2] "mskcc.post.3: No observations with risk greater than 77% that have followup through the timepoin
```



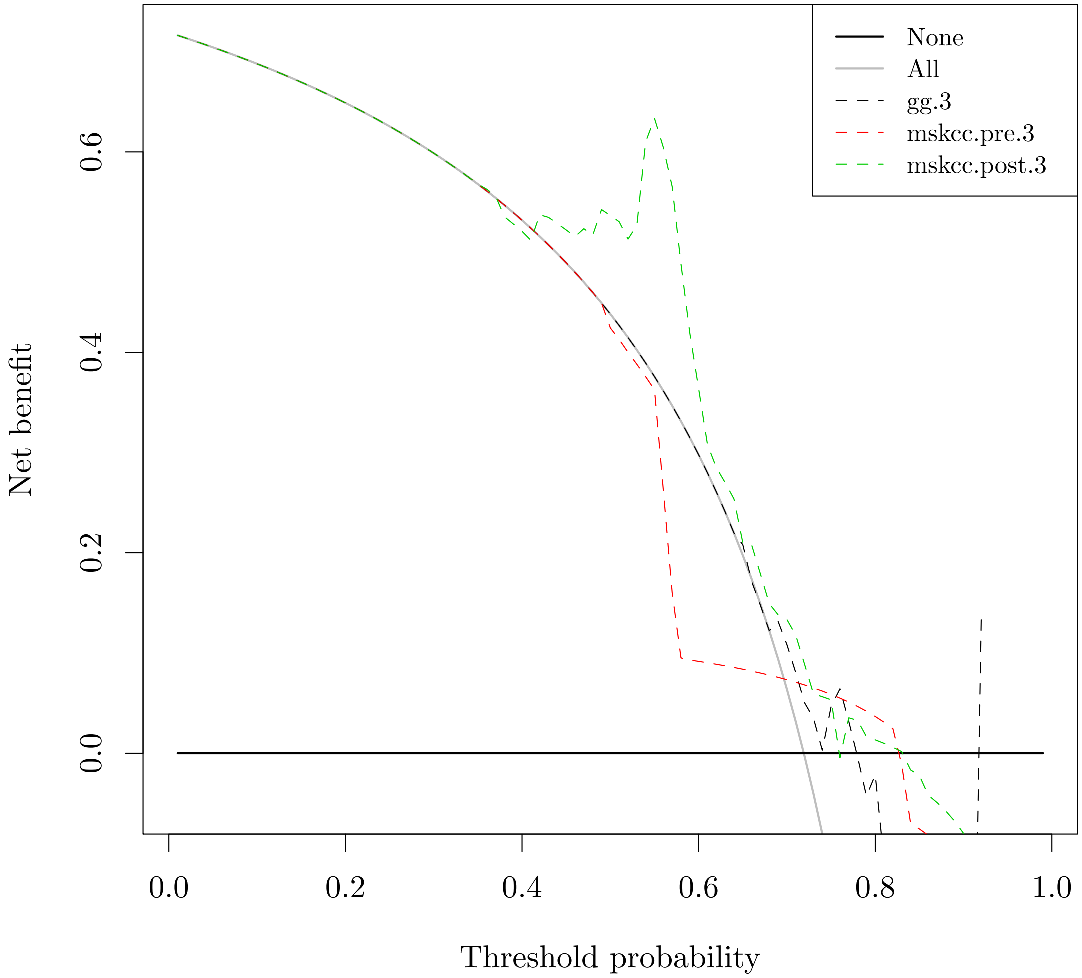

```
temp.data = data.frame(Time = data.apgi$Time, DSD = data.apgi$DSD*1,
    gg.1 = 1-gg.prob.apgi[val.prob.times == 365,], gg.2 = 1-gg.prob.apgi[val.prob.times == 365*2,], gg.3
    mskcc.pre.1 = 1-mskcc_pre.12mo.apgi, mskcc.pre.2 = 1-mskcc_pre.24mo.apgi, mskcc.pre.3 = 1-mskcc_pre.
    mskcc.post.1 = 1-mskcc_post.12mo.apgi, mskcc.post.2 = 1-mskcc_post.24mo.apgi, mskcc.post.3 = 1-mskcc
invisible(stdca(data = temp.data, outcome = "DSD", ttoutcome = "Time", predictors = c("gg.1", "mskcc.pre

## [1] "gg.1: No observations with risk greater than 72%, and therefore net benefit not calculable in th
## [2] "mskcc.pre.1: No observations with risk greater than 50%, and therefore net benefit not calculabl
## [3] "mskcc.post.1: No observations with risk greater than 50%, and therefore net benefit not calculab
```



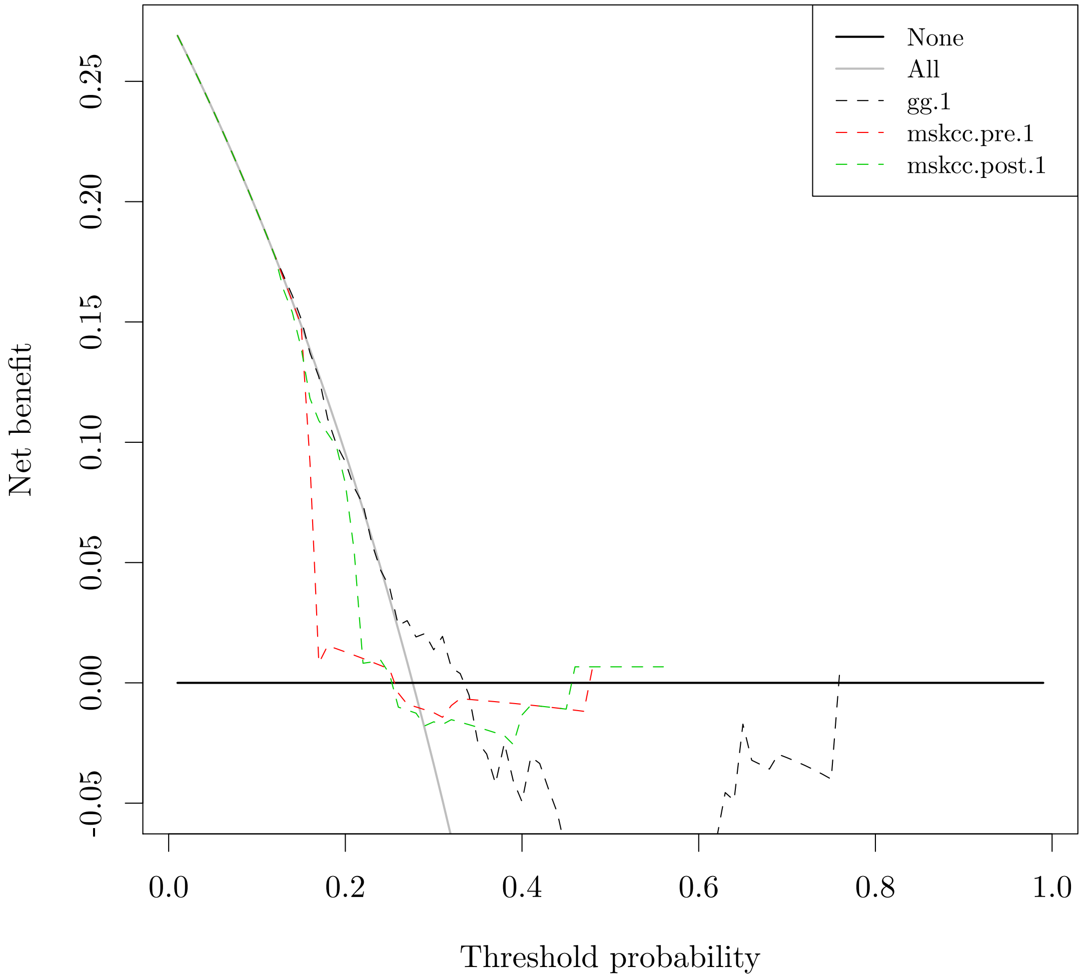

```
invisible(stdca(data = temp.data, outcome = "DSD", ttoutcome = "Time", predictors = c("gg.2", "mskcc.pre

## [1] "gg.2: No observations with risk greater than 89% that have followup through the timepoint select
## [2] "mskcc.pre.2: No observations with risk greater than 85%, and therefore net benefit not calculabl
## [3] "mskcc.post.2: No observations with risk greater than 80% that have followup through the timepoin
```



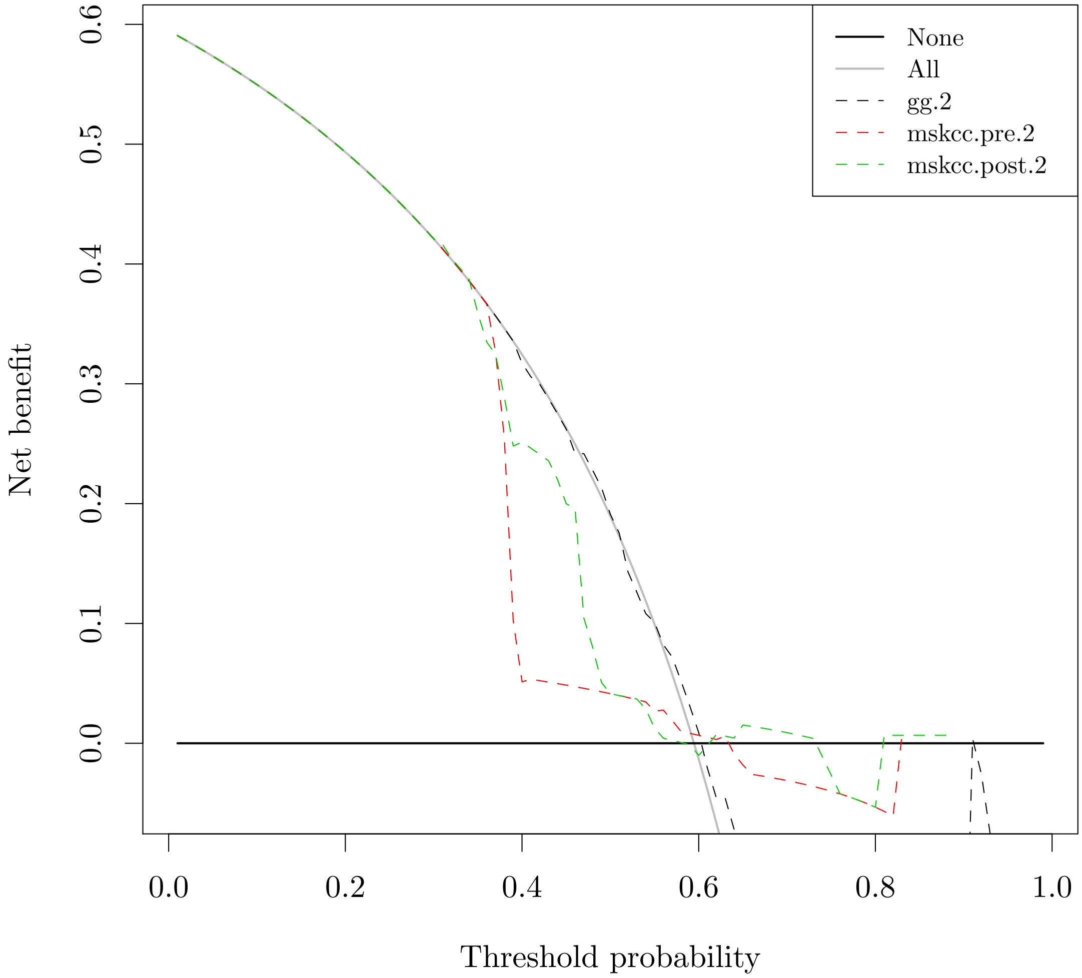

```
invisible(stdca(data = temp.data, outcome = "DSD", ttoutcome = "Time", predictors = c("gg.3", "mskcc.pre

## [1] "gg.3: No observations with risk greater than 93% that have followup through the timepoint select
## [2] "mskcc.pre.3: No observations with risk greater than 95%, and therefore net benefit not calculabl
## [3] "mskcc.post.3: No observations with risk greater than 92% that have followup through the timepoin
```



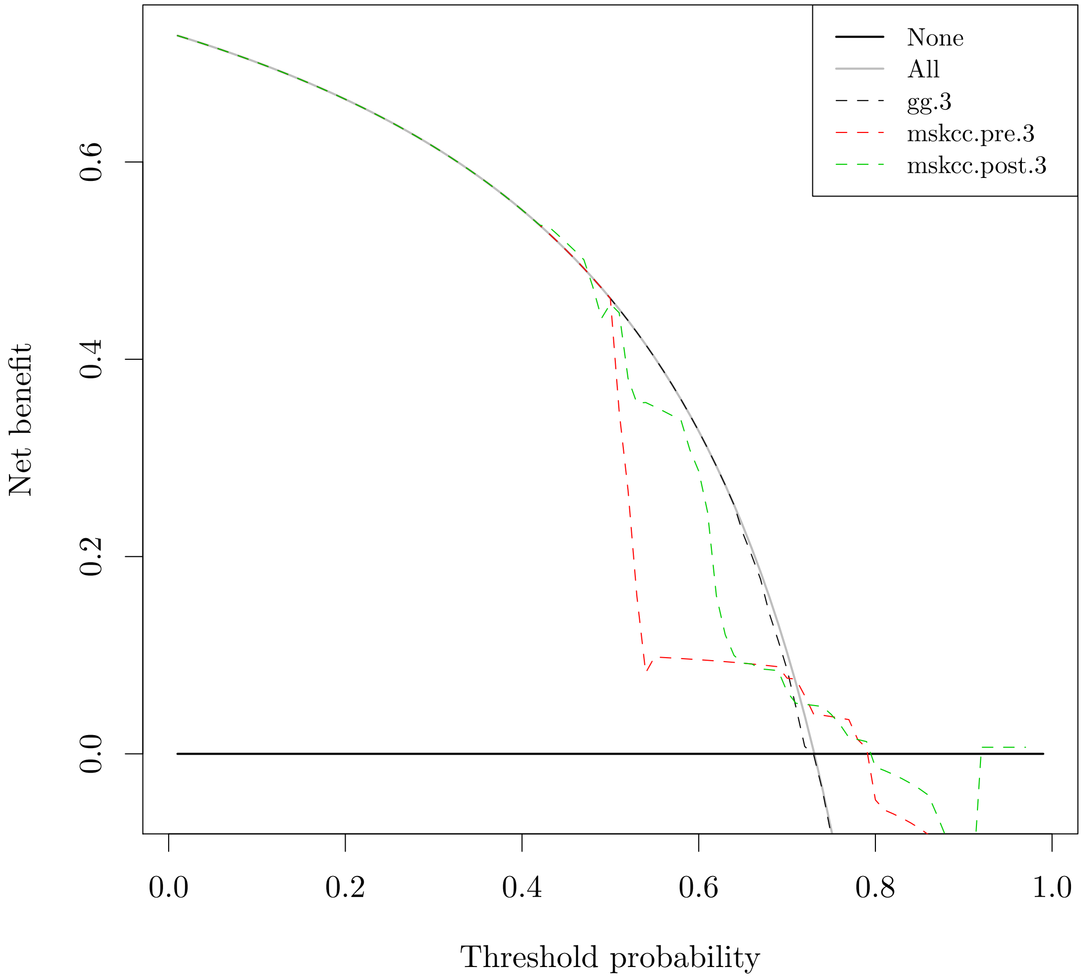

```
temp.data = data.frame(Time = data.dresden$Time, DSD = data.dresden$DSD*1,
    gg.1 = 1-gg.prob.dresden[val.prob.times == 365,], gg.2 = 1-gg.prob.dresden[val.prob.times == 365*2,]
    mskcc.pre.1 = 1-mskcc_pre.12mo.dresden, mskcc.pre.2 = 1-mskcc_pre.24mo.dresden, mskcc.pre.3 = 1-mskc
    mskcc.post.1 = 1-mskcc_post.12mo.dresden, mskcc.post.2 = 1-mskcc_post.24mo.dresden, mskcc.post.3 = 1
invisible(stdca(data = temp.data, outcome = "DSD", ttoutcome = "Time", predictors = c("gg.1", "mskcc.pre

## [1] "gg.1: No observations with risk greater than 77%, and therefore net benefit not calculable in th
## [2] "mskcc.pre.1: No observations with risk greater than 49%, and therefore net benefit not calculabl
## [3] "mskcc.post.1: No observations with risk greater than 57%, and therefore net benefit not calculab
```




```
invisible(stdca(data = temp.data, outcome = "DSD", ttoutcome = "Time", predictors = c("gg.2", "mskcc.pre

## [1] "gg.2: No observations with risk greater than 94% that have followup through the timepoint select
## [2] "mskcc.pre.2: No observations with risk greater than 84%, and therefore net benefit not calculabl
## [3] "mskcc.post.2: No observations with risk greater than 90%, and therefore net benefit not calculab
```




```
invisible(stdca(data = temp.data, outcome = "DSD", ttoutcome = "Time", predictors = c("gg.3", "mskcc.pre

## [1] "mskcc.pre.3: No observations with risk greater than 94%, and therefore net benefit not calculabl
## [2] "mskcc.post.3: No observations with risk greater than 98%, and therefore net benefit not calculab
```



4.6 Brier score

```
calcIBS = function(surv, pred, pred_times, max_time, min_time = 0)
{
        stopifnot(nrow(surv) == nrow(pred) && length(pred_times) == ncol(pred))

        n = nrow(surv)
        marg_survfit = survfit(surv ~ 1)
        marg_censfit = survfit(Surv(surv[,1], !surv[,2]) ~ 1)
        marg_surv_func = approxfun(marg_survfit$time, marg_survfit$surv, method = "constant", yleft = 1,
        marg_cens_func = approxfun(marg_censfit$time, marg_censfit$surv, method = "constant", yleft = 1,

        pred_funcs = apply(pred, 1, function(pat_preds) approxfun(pred_times, pat_preds, yleft = 1, yrig

        indiv_patient_bsc = function(pat_i, tstars)
        {
                observed_time = surv[pat_i, 1]
                observed_event = surv[pat_i, 2]
                pred_func = pred_funcs[[pat_i]]
                category = 1*(observed_time <= tstars & observed_event) + 2*(observed_time > tstars) + 3
                bsc = rep(NA, length(tstars))
                bsc[category == 1] = pred_func(tstars[category == 1])^2 / marg_cens_func(observed_time)
```

```
                bsc[category == 2] = (1 - pred_func(tstars[category == 2]))^2 / marg_cens_func(tstars[ca
                bsc[category == 3] = 0
                bsc
        }

        bsc_func = function(tstars) { rowMeans(sapply(1:n, function(pat_i) indiv_patient_bsc(pat_i, tsta

        weight_func = function(tstars) { (1 - marg_surv_func(tstars)) / (1 - marg_surv_func(max_time)) }

        # Be slack and do trapezoidal int. with a fine grid.  It should be possible
        # to calulate the int. exactly but I cbfed.
        int_grid = seq(min_time, max_time, length.out = 1e3)
        bsc_vals = bsc_func(int_grid)
        weight_vals = weight_func(int_grid)
        int_vals = bsc_vals * weight_vals
        ibsc = (2*sum(int_vals) - int_vals[1] - int_vals[length(int_vals)]) * (diff(range(int_grid))) /

        return(list(bsc = bsc_vals, weights = weight_vals, eval_times = int_grid, ibsc = ibsc))
}

calcBSsingle = function(surv, pred, pred_time)
{
        n = nrow(surv)
        obs_time = surv[,1]
        obs_event = surv[,2]
        marg_censfit = survfit(Surv(obs_time, !obs_event) ~ 1)
        marg_cens_func = approxfun(marg_censfit$time, marg_censfit$surv, method = "constant", yleft = 1,

        brier_val = rep(NA, n)
        cat = 1*I(obs_time <= pred_time & obs_event) + 2*I(obs_time > pred_time) + 3*I(obs_time <= pred_
        brier_val[cat == 1] = (pred[cat == 1])^2 / marg_cens_func(obs_time[cat == 1])
        brier_val[cat == 2] = (1-pred[cat == 2])^2 / marg_cens_func(pred_time)
        brier_val[cat == 3] = 0

        mean(brier_val)
}
```

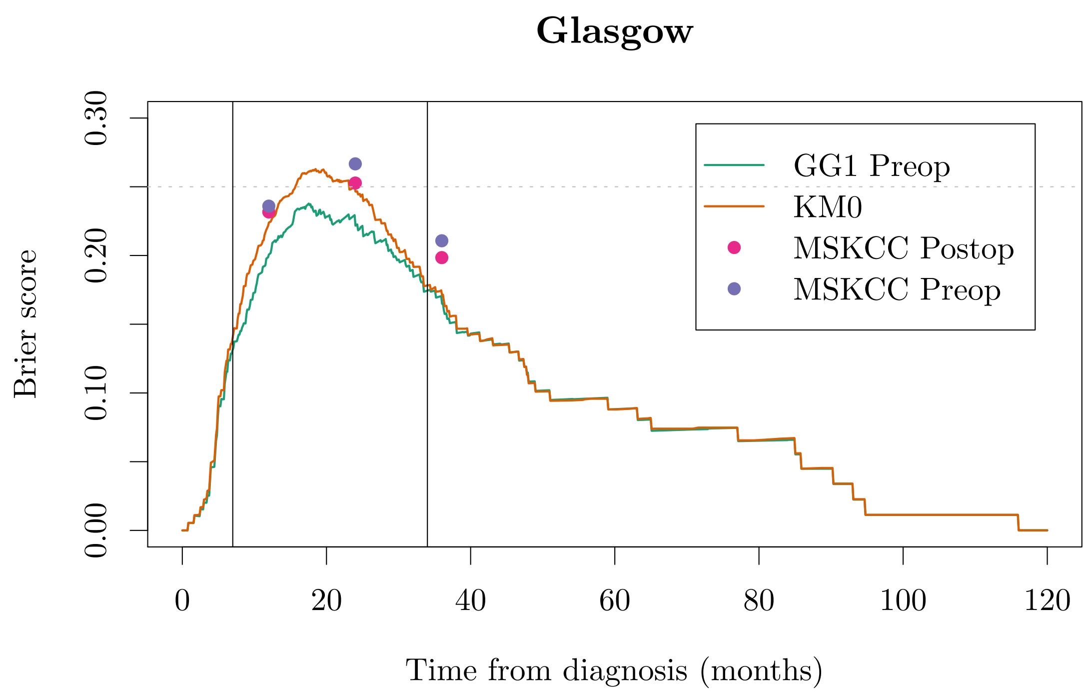
```
mskcc_post.12mo.glasgow.brier = calcBSsingle(Surv(data.glasgow$Time, data.glasgow$DSD), mskcc_post.12mo.
mskcc_post.24mo.glasgow.brier = calcBSsingle(Surv(data.glasgow$Time, data.glasgow$DSD), mskcc_post.24mo.
mskcc_post.36mo.glasgow.brier = calcBSsingle(Surv(data.glasgow$Time, data.glasgow$DSD), mskcc_post.36mo.
mskcc_pre.12mo.glasgow.brier = calcBSsingle(Surv(data.glasgow$Time, data.glasgow$DSD), mskcc_pre.12mo.gl
mskcc_pre.24mo.glasgow.brier = calcBSsingle(Surv(data.glasgow$Time, data.glasgow$DSD), mskcc_pre.24mo.gl
mskcc_pre.36mo.glasgow.brier = calcBSsingle(Surv(data.glasgow$Time, data.glasgow$DSD), mskcc_pre.36mo.gl
gg.path.glasgow.brier = calcIBS(Surv(data.glasgow$Time, data.glasgow$DSD), t(sapply(gg.path.glasgow, fun
km0.path.glasgow.brier = calcIBS(Surv(data.glasgow$Time, data.glasgow$DSD), matrix(fit.km0$surv, nrow =
```

```
mskcc_post.12mo.apgi.brier = calcBSsingle(Surv(data.apgi$Time, data.apgi$DSD), mskcc_post.12mo.apgi, 12/
mskcc_post.24mo.apgi.brier = calcBSsingle(Surv(data.apgi$Time, data.apgi$DSD), mskcc_post.24mo.apgi, 24/
mskcc_post.36mo.apgi.brier = calcBSsingle(Surv(data.apgi$Time, data.apgi$DSD), mskcc_post.36mo.apgi, 36/
mskcc_pre.12mo.apgi.brier = calcBSsingle(Surv(data.apgi$Time, data.apgi$DSD), mskcc_pre.12mo.apgi, 12/12
mskcc_pre.24mo.apgi.brier = calcBSsingle(Surv(data.apgi$Time, data.apgi$DSD), mskcc_pre.24mo.apgi, 24/12
mskcc_pre.36mo.apgi.brier = calcBSsingle(Surv(data.apgi$Time, data.apgi$DSD), mskcc_pre.36mo.apgi, 36/12
```

```
gg.path.apgi.brier = calcIBS(Surv(data.apgi$Time, data.apgi$DSD), t(sapply(gg.path.apgi, function(x) x[
km0.path.apgi.brier = calcIBS(Surv(data.apgi$Time, data.apgi$DSD), matrix(fit.km0$surv, nrow = nrow(data
```

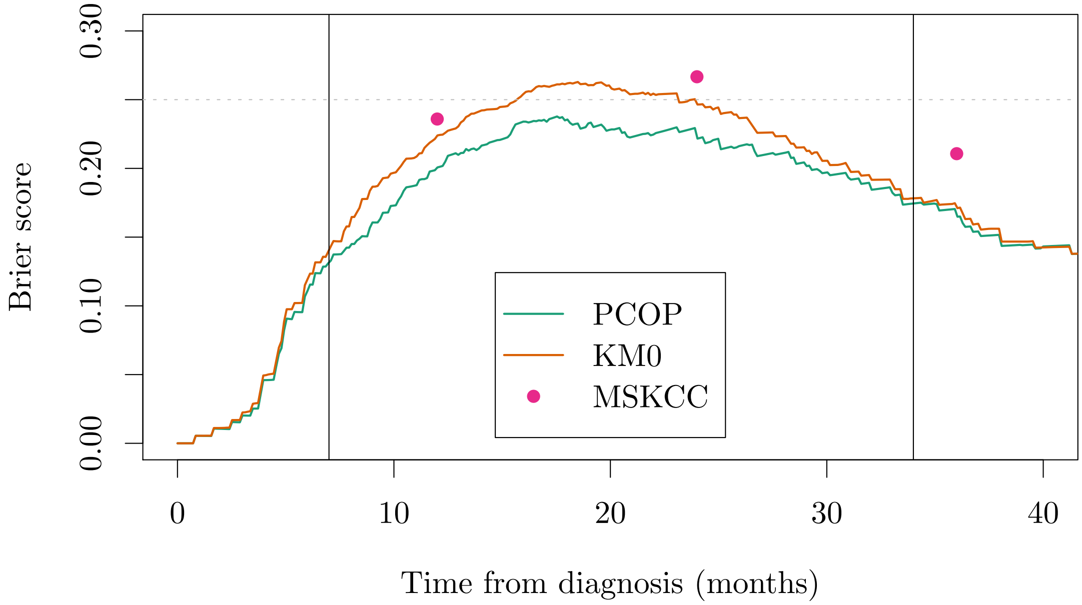
```
mskcc_post.12mo.dresden.brier = calcBSsingle(Surv(data.dresden$Time, data.dresden$DSD), mskcc_post.12mo.
mskcc_post.24mo.dresden.brier = calcBSsingle(Surv(data.dresden$Time, data.dresden$DSD), mskcc_post.24mo.
mskcc_post.36mo.dresden.brier = calcBSsingle(Surv(data.dresden$Time, data.dresden$DSD), mskcc_post.36mo.
mskcc_pre.12mo.dresden.brier = calcBSsingle(Surv(data.dresden$Time, data.dresden$DSD), mskcc_pre.12mo.dr
mskcc_pre.24mo.dresden.brier = calcBSsingle(Surv(data.dresden$Time, data.dresden$DSD), mskcc_pre.24mo.dr
mskcc_pre.36mo.dresden.brier = calcBSsingle(Surv(data.dresden$Time, data.dresden$DSD), mskcc_pre.36mo.dr
gg.path.dresden.brier = calcIBS(Surv(data.dresden$Time, data.dresden$DSD), t(sapply(gg.path.dresden, fun
km0.path.dresden.brier = calcIBS(Surv(data.dresden$Time, data.dresden$DSD), matrix(fit.km0$surv, nrow =
```

```
plot(gg.path.glasgow.brier$eval_times/365.25*12, gg.path.glasgow.brier$bsc, col = pal["gg"], type = "l",
lines(gg.path.glasgow.brier$eval_times/365.25*12, km0.path.glasgow.brier$bsc, col = pal["km0"], lwd = 2)
points(c(12, 24, 36), c(mskcc_post.12mo.glasgow.brier, mskcc_post.24mo.glasgow.brier, mskcc_post.36mo.gl
points(c(12, 24, 36), c(mskcc_pre.12mo.glasgow.brier, mskcc_pre.24mo.glasgow.brier, mskcc_pre.36mo.glasg
abline(h = 0.25, col = "grey", lty = "dotted")
abline(v = c(7, 34))
legend("topright",
        legend = c(     "GG1 Preop",    "KM0",          "MSKCC Postop",         "MSKCC Preop"),
        pch = c(        NA,                     NA,             16,                             16),
        col = c(        pal["gg"],              pal["km0"], pal["mskcc.pre"],   pal["mskcc.post"]),
        lty = c(        "solid",                "solid",        NA,                             NA),
        inset = 0.05, lwd = 2)
```

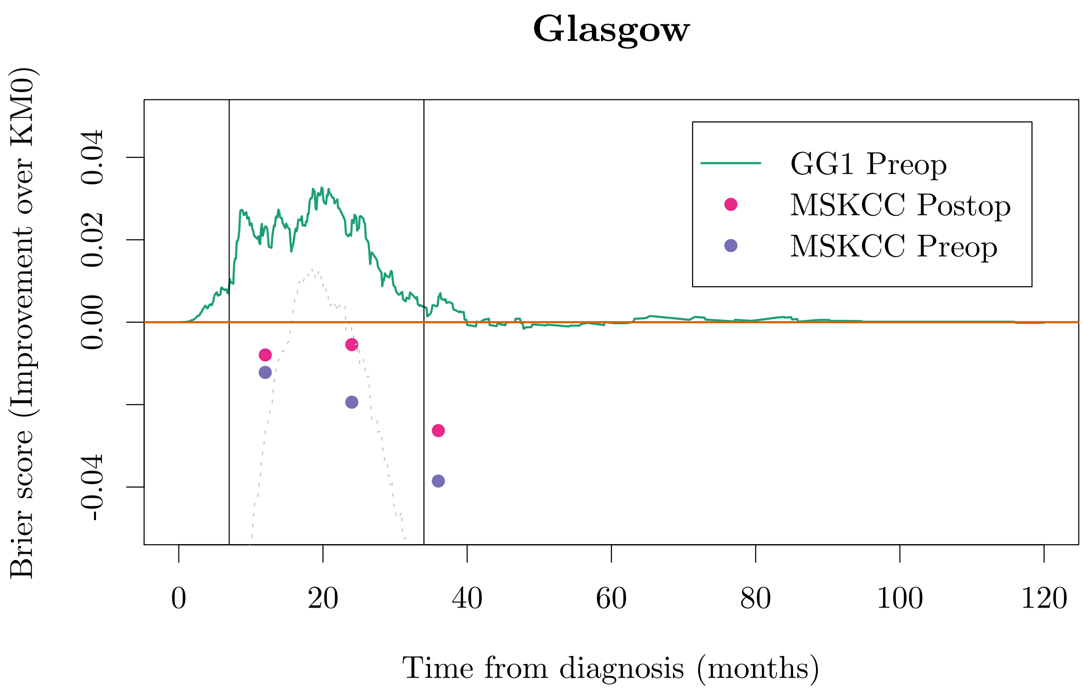



```
plot(gg.path.glasgow.brier$eval_times/365.25*12, gg.path.glasgow.brier$bsc, col = pal["gg"], type = "l",
lines(gg.path.glasgow.brier$eval_times/365.25*12, km0.path.glasgow.brier$bsc, col = pal["km0"], lwd = 2)
points(c(12, 24, 36), c(mskcc_pre.12mo.glasgow.brier, mskcc_pre.24mo.glasgow.brier, mskcc_pre.36mo.glasg
abline(h = 0.25, col = "grey", lty = "dotted")
abline(v = c(7, 34))
```

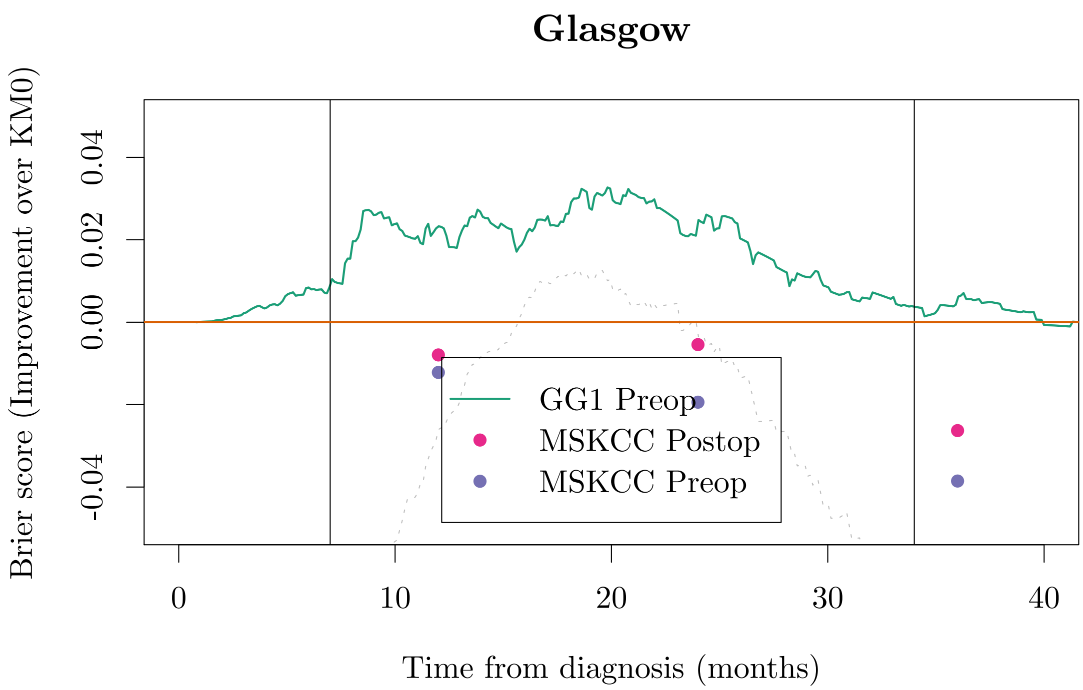
```
legend("bottom",
       legend = c(     "PCOP",                       "KM0",            "MSKCC"),
       pch = c(        NA,                           NA,               16),
       col = c(        pal["gg"],                    pal["km0"], pal["mskcc.pre"]),
       lty = c(        "solid",                      "solid",          NA),
       inset = 0.05, lwd = 2)
```



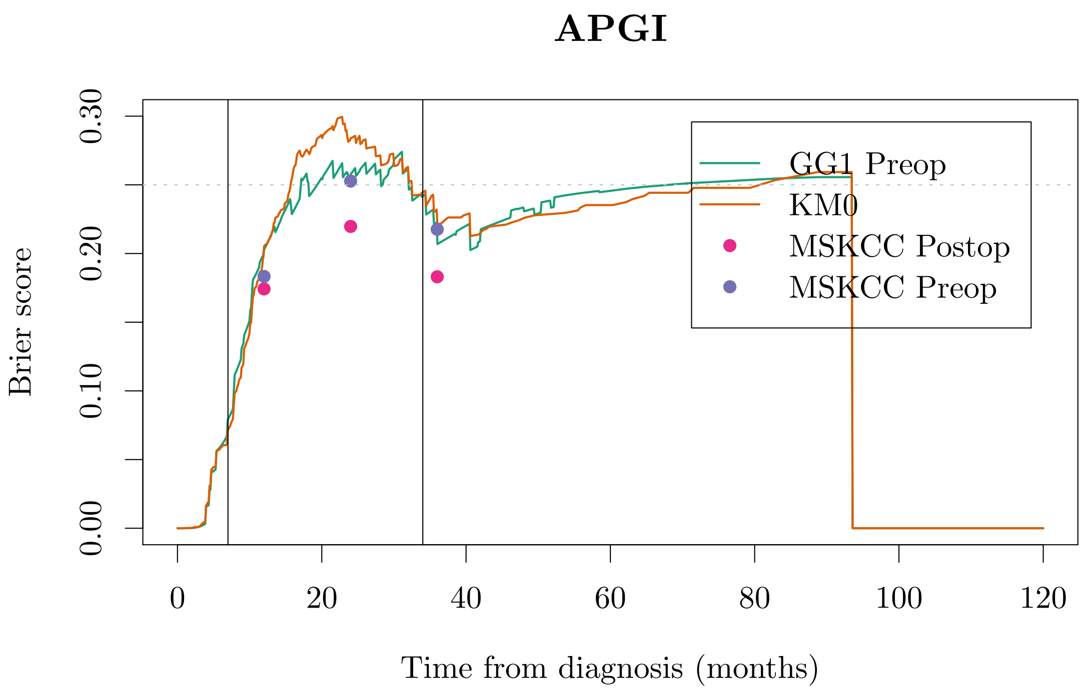

```
plot(gg.path.glasgow.brier$eval_times/365.25*12, km0.path.glasgow.brier$bsc - gg.path.glasgow.brier$bsc,
points(c(12, 24, 36), approx(km0.path.glasgow.brier$eval_times/365.25*12, km0.path.glasgow.brier$bsc, c(
points(c(12, 24, 36), approx(km0.path.glasgow.brier$eval_times/365.25*12, km0.path.glasgow.brier$bsc, c(
lines(gg.path.glasgow.brier$eval_times/365.25*12, km0.path.glasgow.brier$bsc - 0.25, col = "grey", lty =
abline(v = c(7, 34))
abline(h = 0, col = pal["km0"], lwd = 2)
legend("topright",
       legend = c(     "GG1 Preop",    "MSKCC Postop",         "MSKCC Preop"),
       pch = c(        NA,                           16,                           16),
       col = c(        pal["gg"],                    pal["mskcc.pre"],       pal["mskcc.post"]),
       lty = c(        "solid",                      NA,                           NA),
       inset = 0.05, lwd = 2)
```



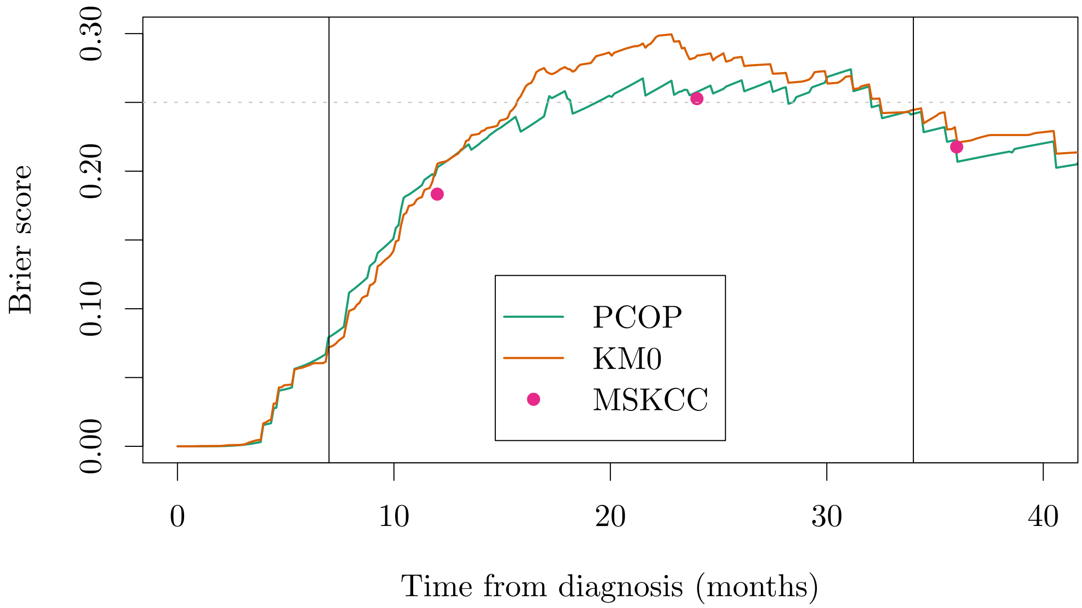

```
plot(gg.path.glasgow.brier$eval_times/365.25*12, km0.path.glasgow.brier$bsc - gg.path.glasgow.brier$bsc,
points(c(12, 24, 36), approx(km0.path.glasgow.brier$eval_times/365.25*12, km0.path.glasgow.brier$bsc, c(
points(c(12, 24, 36), approx(km0.path.glasgow.brier$eval_times/365.25*12, km0.path.glasgow.brier$bsc, c(
lines(gg.path.glasgow.brier$eval_times/365.25*12, km0.path.glasgow.brier$bsc - 0.25, col = "grey", lty =
abline(v = c(7, 34))
abline(h = 0, col = pal["km0"], lwd = 2)
legend("bottom",
        legend = c(     "GG1 Preop",    "MSKCC Postop",         "MSKCC Preop"),
        pch = c(        NA,                     16,                             16),
        col = c(        pal["gg"],              pal["mskcc.pre"],       pal["mskcc.post"]),
        lty = c(        "solid",                NA,                             NA),
        inset = 0.05, lwd = 2)
```



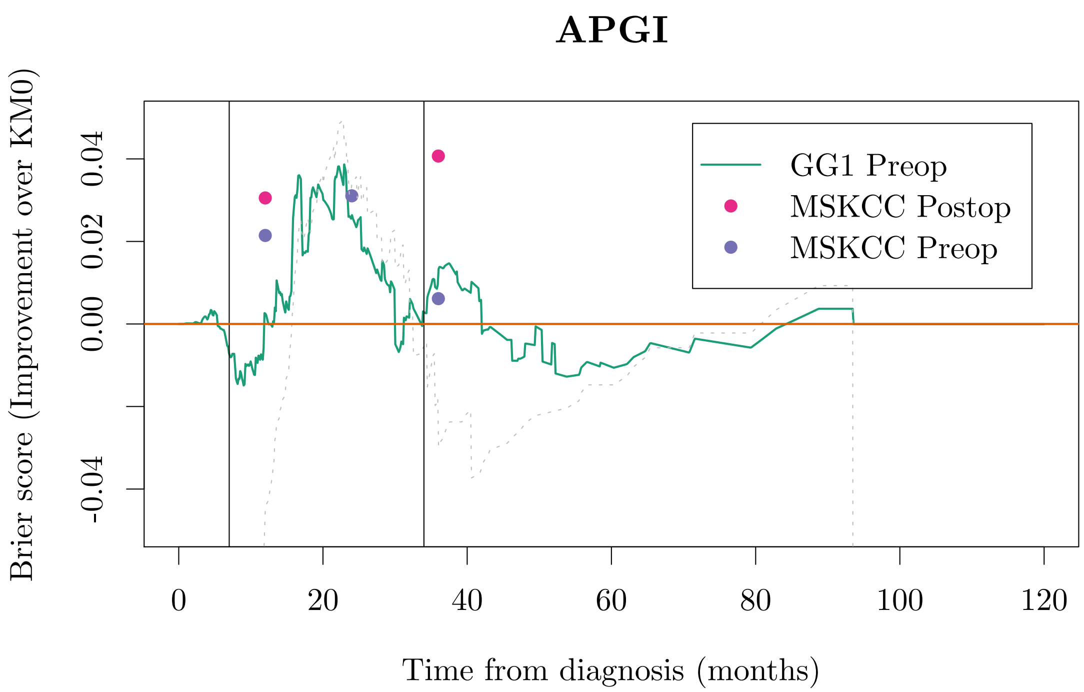

```r
plot(gg.path.apgi.brier$eval_times/365.25*12, gg.path.apgi.brier$bsc, col = pal["gg"], type = "l", ylim
lines(gg.path.apgi.brier$eval_times/365.25*12, km0.path.apgi.brier$bsc, col = pal["km0"], lwd = 2)
points(c(12, 24, 36), c(mskcc_post.12mo.apgi.brier, mskcc_post.24mo.apgi.brier, mskcc_post.36mo.apgi.bri
points(c(12, 24, 36), c(mskcc_pre.12mo.apgi.brier, mskcc_pre.24mo.apgi.brier, mskcc_pre.36mo.apgi.brier)
abline(h = 0.25, col = "grey", lty = "dotted")
abline(v = c(7, 34))
legend("topright",
        legend = c(     "GG1 Preop",    "KM0",          "MSKCC Postop",         "MSKCC Preop"),
        pch = c(        NA,                         NA,              16,                                16),
        col = c(        pal["gg"],                  pal["km0"], pal["mskcc.pre"],   pal["mskcc.post"]),
        lty = c(        "solid",                    "solid",        NA,                                NA),
        inset = 0.05, lwd = 2)
```



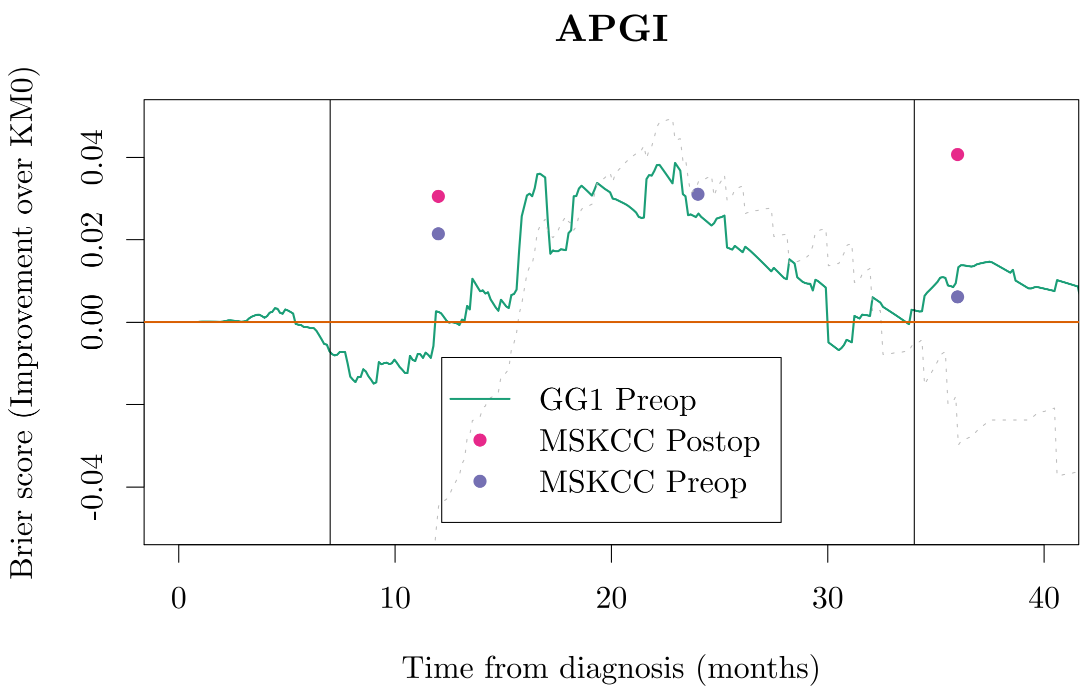

```r
plot(gg.path.apgi.brier$eval_times/365.25*12, gg.path.apgi.brier$bsc, col = pal["gg"], type = "l", ylim
lines(gg.path.apgi.brier$eval_times/365.25*12, km0.path.apgi.brier$bsc, col = pal["km0"], lwd = 2)
points(c(12, 24, 36), c(mskcc_pre.12mo.apgi.brier, mskcc_pre.24mo.apgi.brier, mskcc_pre.36mo.apgi.brier)
abline(h = 0.25, col = "grey", lty = "dotted")
abline(v = c(7, 34))
legend("bottom",
        legend = c(     "PCOP",                     "KM0",            "MSKCC"),
        pch = c(        NA,                         NA,               16),
        col = c(        pal["gg"],                  pal["km0"], pal["mskcc.pre"]),
        lty = c(        "solid",                    "solid",          NA),
        inset = 0.05, lwd = 2)
```



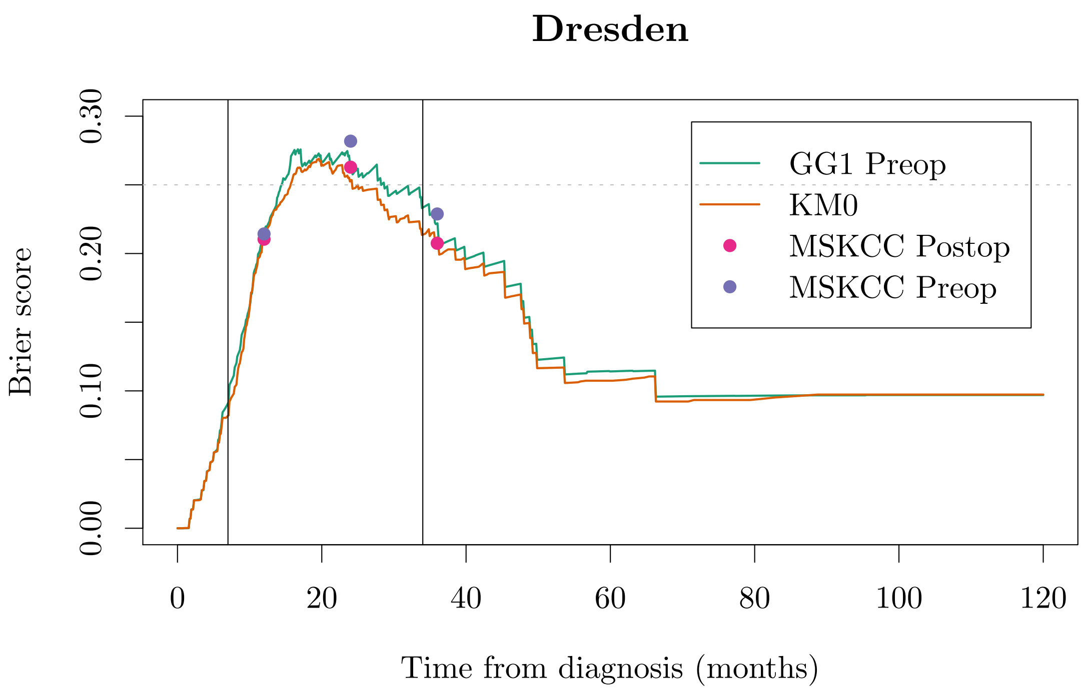
```
plot(gg.path.apgi.brier$eval_times/365.25*12, km0.path.apgi.brier$bsc - gg.path.apgi.brier$bsc, col = pa
points(c(12, 24, 36), approx(km0.path.apgi.brier$eval_times/365.25*12, km0.path.apgi.brier$bsc, c(12, 24
points(c(12, 24, 36), approx(km0.path.apgi.brier$eval_times/365.25*12, km0.path.apgi.brier$bsc, c(12, 24
lines(gg.path.apgi.brier$eval_times/365.25*12, km0.path.apgi.brier$bsc - 0.25, col = "grey", lty = "dott
abline(v = c(7, 34))
abline(h = 0, col = pal["km0"], lwd = 2)
legend("topright",
        legend = c(     "GG1 Preop",    "MSKCC Postop",         "MSKCC Preop"),
        pch = c(        NA,                     16,                             16),
        col = c(        pal["gg"],              pal["mskcc.pre"],       pal["mskcc.post"]),
        lty = c(        "solid",                NA,                             NA),
        inset = 0.05, lwd = 2)
```



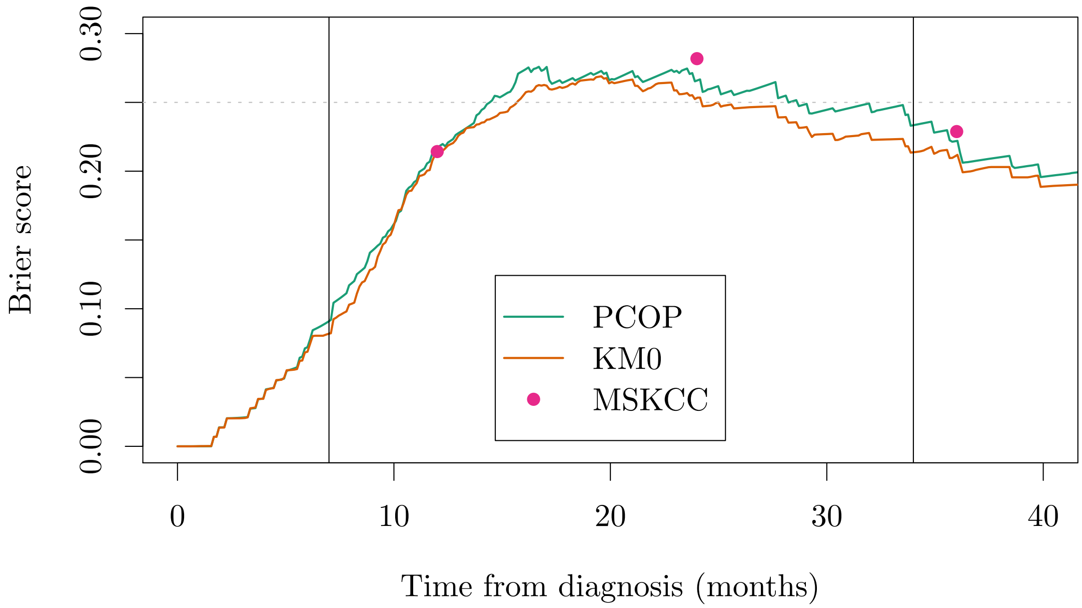

```
plot(gg.path.apgi.brier$eval_times/365.25*12, km0.path.apgi.brier$bsc - gg.path.apgi.brier$bsc, col = pa
points(c(12, 24, 36), approx(km0.path.apgi.brier$eval_times/365.25*12, km0.path.apgi.brier$bsc, c(12, 24
points(c(12, 24, 36), approx(km0.path.apgi.brier$eval_times/365.25*12, km0.path.apgi.brier$bsc, c(12, 24
lines(gg.path.apgi.brier$eval_times/365.25*12, km0.path.apgi.brier$bsc - 0.25, col = "grey", lty = "dott
abline(v = c(7, 34))
abline(h = 0, col = pal["km0"], lwd = 2)
legend("bottom",
        legend = c(     "GG1 Preop",    "MSKCC Postop",         "MSKCC Preop"),
        pch = c(        NA,                     16,                             16),
        col = c(        pal["gg"],              pal["mskcc.pre"],       pal["mskcc.post"]),
        lty = c(        "solid",                NA,                             NA),
        inset = 0.05, lwd = 2)
```



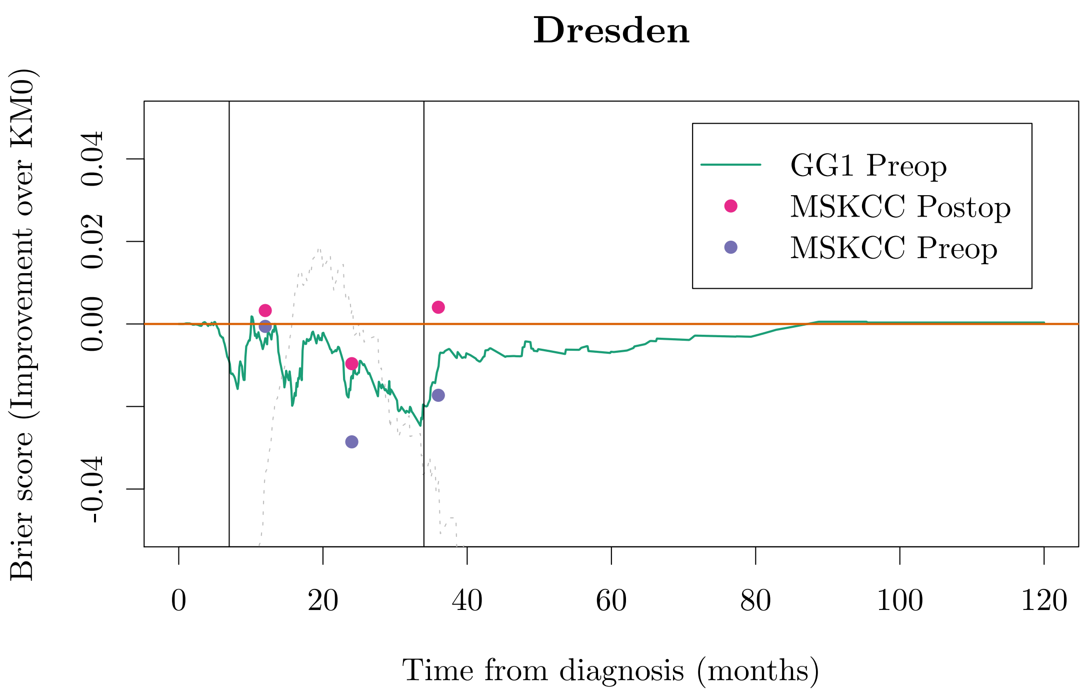

```
plot(gg.path.dresden.brier$eval_times/365.25*12, gg.path.dresden.brier$bsc, col = pal["gg"], type = "l",
lines(gg.path.dresden.brier$eval_times/365.25*12, km0.path.dresden.brier$bsc, col = pal["km0"], lwd = 2)
points(c(12, 24, 36), c(mskcc_post.12mo.dresden.brier, mskcc_post.24mo.dresden.brier, mskcc_post.36mo.dr
points(c(12, 24, 36), c(mskcc_pre.12mo.dresden.brier, mskcc_pre.24mo.dresden.brier, mskcc_pre.36mo.dresd
abline(h = 0.25, col = "grey", lty = "dotted")
abline(v = c(7, 34))
legend("topright",
        legend = c(     "GG1 Preop",    "KM0",          "MSKCC Postop",         "MSKCC Preop"),
        pch = c(        NA,                     NA,             16,                             16),
        col = c(        pal["gg"],              pal["km0"], pal["mskcc.pre"],   pal["mskcc.post"]),
        lty = c(        "solid",                "solid",        NA,                             NA),
        inset = 0.05, lwd = 2)
```



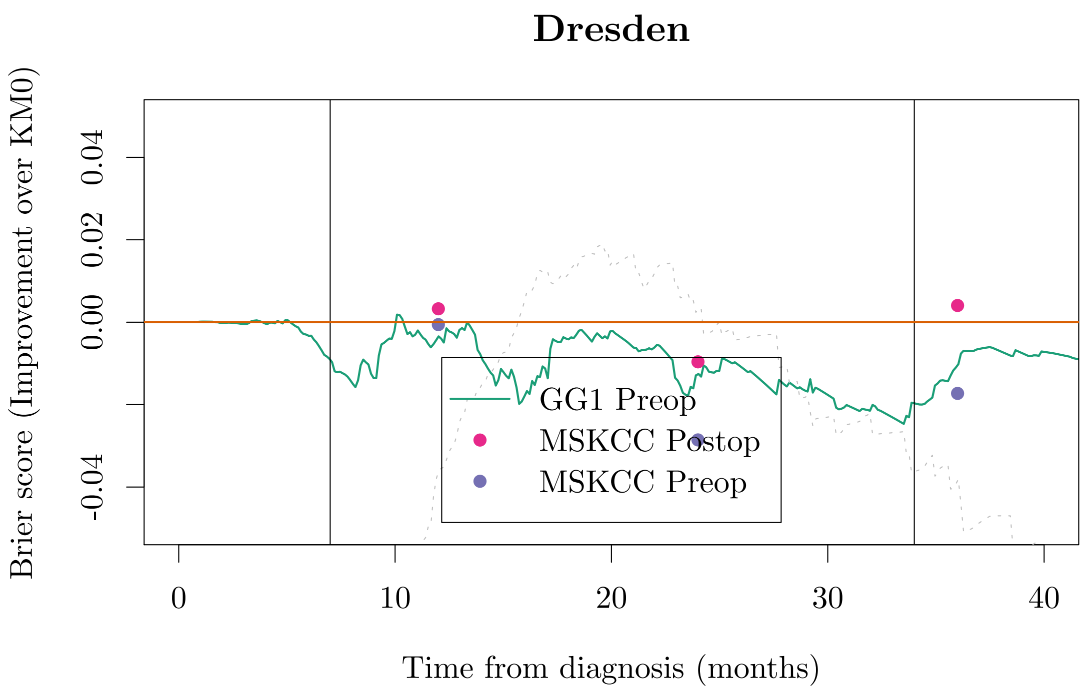

```
plot(gg.path.dresden.brier$eval_times/365.25*12, gg.path.dresden.brier$bsc, col = pal["gg"], type = "l",
lines(gg.path.dresden.brier$eval_times/365.25*12, km0.path.dresden.brier$bsc, col = pal["km0"], lwd = 2)
points(c(12, 24, 36), c(mskcc_pre.12mo.dresden.brier, mskcc_pre.24mo.dresden.brier, mskcc_pre.36mo.dresd
abline(h = 0.25, col = "grey", lty = "dotted")
abline(v = c(7, 34))
legend("bottom",
        legend = c(     "PCOP",                   "KM0",           "MSKCC"),
        pch = c(        NA,                       NA,              16),
        col = c(        pal["gg"],                pal["km0"], pal["mskcc.pre"]),
        lty = c(        "solid",                  "solid",         NA),
        inset = 0.05, lwd = 2)
```



```
plot(gg.path.dresden.brier$eval_times/365.25*12, km0.path.dresden.brier$bsc - gg.path.dresden.brier$bsc,
points(c(12, 24, 36), approx(km0.path.dresden.brier$eval_times/365.25*12, km0.path.dresden.brier$bsc, c(
points(c(12, 24, 36), approx(km0.path.dresden.brier$eval_times/365.25*12, km0.path.dresden.brier$bsc, c(
lines(gg.path.dresden.brier$eval_times/365.25*12, km0.path.dresden.brier$bsc - 0.25, col = "grey", lty =
abline(v = c(7, 34))
abline(h = 0, col = pal["km0"], lwd = 2)
legend("topright",
        legend = c(     "GG1 Preop",    "MSKCC Postop",         "MSKCC Preop"),
        pch = c(        NA,                     16,                             16),
        col = c(        pal["gg"],              pal["mskcc.pre"],       pal["mskcc.post"]),
        lty = c(        "solid",                NA,                             NA),
        inset = 0.05, lwd = 2)
```




```
plot(gg.path.dresden.brier$eval_times/365.25*12, km0.path.dresden.brier$bsc - gg.path.dresden.brier$bsc,
points(c(12, 24, 36), approx(km0.path.dresden.brier$eval_times/365.25*12, km0.path.dresden.brier$bsc, c(
points(c(12, 24, 36), approx(km0.path.dresden.brier$eval_times/365.25*12, km0.path.dresden.brier$bsc, c(
lines(gg.path.dresden.brier$eval_times/365.25*12, km0.path.dresden.brier$bsc - 0.25, col = "grey", lty =
abline(v = c(7, 34))
abline(h = 0, col = pal["km0"], lwd = 2)
legend("bottom",
        legend = c(     "GG1 Preop",    "MSKCC Postop",         "MSKCC Preop"),
        pch = c(        NA,                     16,                             16),
        col = c(        pal["gg"],              pal["mskcc.pre"],       pal["mskcc.post"]),
        lty = c(        "solid",                NA,                             NA),
        inset = 0.05, lwd = 2)
```




```
probs_bs_boot_func_glasgow = function(d, i) {
        bs.mskcc.postop.12 = calcBSsingle(Surv(d$Time[i], d$DSD[i]), mskcc_post.12mo.glasgow[i], 12/12*3
        bs.mskcc.postop.24 = calcBSsingle(Surv(d$Time[i], d$DSD[i]), mskcc_post.24mo.glasgow[i], 24/12*3
        bs.mskcc.postop.36 = calcBSsingle(Surv(d$Time[i], d$DSD[i]), mskcc_post.36mo.glasgow[i], 36/12*3
        bs.mskcc.preop.12 = calcBSsingle(Surv(d$Time[i], d$DSD[i]), mskcc_pre.12mo.glasgow[i], 12/12*365
        bs.mskcc.preop.24 = calcBSsingle(Surv(d$Time[i], d$DSD[i]), mskcc_pre.24mo.glasgow[i], 24/12*365
        bs.mskcc.preop.36 = calcBSsingle(Surv(d$Time[i], d$DSD[i]), mskcc_pre.36mo.glasgow[i], 36/12*365

        bs.gg.vals = t(sapply(gg.path.glasgow[i], function(path) approx(path[,1], path[,2], c(12, 24, 36
        rownames(bs.gg.vals) <- NULL
        bs.gg.12 = calcBSsingle(Surv(d$Time[i], d$DSD[i]), bs.gg.vals[,1], 12/12*365.25)
        bs.gg.24 = calcBSsingle(Surv(d$Time[i], d$DSD[i]), bs.gg.vals[,2], 24/12*365.25)
        bs.gg.36 = calcBSsingle(Surv(d$Time[i], d$DSD[i]), bs.gg.vals[,3], 36/12*365.25)

        bs.km0.vals = approx(fit.km0$time, fit.km0$surv, c(12, 24, 36)/12*365.25)$y
        bs.km0.12 = calcBSsingle(Surv(d$Time[i], d$DSD[i]), rep(bs.km0.vals[1], nrow(d[i,])), 12/12*365.
        bs.km0.24 = calcBSsingle(Surv(d$Time[i], d$DSD[i]), rep(bs.km0.vals[2], nrow(d[i,])), 24/12*365.
        bs.km0.36 = calcBSsingle(Surv(d$Time[i], d$DSD[i]), rep(bs.km0.vals[3], nrow(d[i,])), 36/12*365.

        result = c(
                bs.gg.12 - bs.km0.12,                   bs.mskcc.preop.12 - bs.km0.12,
                bs.gg.12 - bs.mskcc.preop.12,
                bs.gg.24 - bs.km0.24,                   bs.mskcc.preop.24 - bs.km0.24,
                bs.gg.24 - bs.mskcc.preop.24,
                bs.gg.36 - bs.km0.36,                   bs.mskcc.preop.36 - bs.km0.36,
                bs.gg.36 - bs.mskcc.preop.36)

        names(result) <- NULL
        result
}

set.seed(20150208)
```

```
deltaBrier.boot.glasgow = boot(data.glasgow, probs_bs_boot_func_glasgow, R = 500)
deltaBrier.boot.glasgow.cis = t(sapply(1:ncol(deltaBrier.boot.glasgow$t), function(i) boot.ci(deltaBrier
colnames(deltaBrier.boot.glasgow.cis) = c("level", "lowindex", "highindex", "lci", "uci")
rownames(deltaBrier.boot.glasgow.cis) = c(
        "12:gg-km0", "12:pre-km0", "12:gg-pre",
        "24:gg-km0", "24:pre-km0", "24:gg-pre",
        "36:gg-km0", "36:pre-km0", "36:gg-pre")
deltaBrier.boot.glasgow

##
## ORDINARY NONPARAMETRIC BOOTSTRAP
##
##
## Call:
## boot(data = data.glasgow, statistic = probs_bs_boot_func_glasgow,
##     R = 500)
##
##
## Bootstrap Statistics :
##      original     bias    std. error
## t1* -0.023252 -5.591e-04    0.011020
## t2*  0.012000  5.097e-04    0.014791
## t3* -0.035252 -1.069e-03    0.018703
## t4* -0.024707 -1.173e-03    0.011163
## t5*  0.020378  1.780e-04    0.020822
## t6* -0.045085 -1.351e-03    0.022651
## t7* -0.006137 -3.073e-04    0.006092
## t8*  0.039775 -9.123e-06    0.018277
## t9* -0.045912 -2.982e-04    0.018448

deltaBrier.boot.glasgow.cis

##            level lowindex highindex        lci        uci
## 12:gg-km0   0.95    19.36     493.3 -0.0438016  0.0001641
## 12:pre-km0  0.95    10.07     485.4 -0.0179132  0.0401415
## 12:gg-pre   0.95     9.88     485.4 -0.0753277 -0.0035136
## 24:gg-km0   0.95    17.35     492.2 -0.0471870 -0.0023731
## 24:pre-km0  0.95    11.87     487.8 -0.0189747  0.0617515
## 24:gg-pre   0.95    19.24     493.3 -0.0845755  0.0024417
## 36:gg-km0   0.95    15.48     490.9 -0.0174246  0.0056702
## 36:pre-km0  0.95     7.75     482.0  0.0002576  0.0703455
## 36:gg-pre   0.95    17.88     492.7 -0.0791661 -0.0078058
```

```
probs_bs_boot_func_apgi = function(d, i) {
        bs.mskcc.postop.12 = calcBSsingle(Surv(d$Time[i], d$DSD[i]), mskcc_post.12mo.apgi[i], 12/12*365.
        bs.mskcc.postop.24 = calcBSsingle(Surv(d$Time[i], d$DSD[i]), mskcc_post.24mo.apgi[i], 24/12*365.
        bs.mskcc.postop.36 = calcBSsingle(Surv(d$Time[i], d$DSD[i]), mskcc_post.36mo.apgi[i], 36/12*365.
        bs.mskcc.preop.12 = calcBSsingle(Surv(d$Time[i], d$DSD[i]), mskcc_pre.12mo.apgi[i], 12/12*365.25
        bs.mskcc.preop.24 = calcBSsingle(Surv(d$Time[i], d$DSD[i]), mskcc_pre.24mo.apgi[i], 24/12*365.25
        bs.mskcc.preop.36 = calcBSsingle(Surv(d$Time[i], d$DSD[i]), mskcc_pre.36mo.apgi[i], 36/12*365.25

        bs.gg.vals = t(sapply(gg.path.apgi[i], function(path) approx(path[,1], path[,2], c(12, 24, 36)/1
        rownames(bs.gg.vals) <- NULL
```

```
        bs.gg.12 = calcBSsingle(Surv(d$Time[i], d$DSD[i]), bs.gg.vals[,1], 12/12*365.25)
        bs.gg.24 = calcBSsingle(Surv(d$Time[i], d$DSD[i]), bs.gg.vals[,2], 24/12*365.25)
        bs.gg.36 = calcBSsingle(Surv(d$Time[i], d$DSD[i]), bs.gg.vals[,3], 36/12*365.25)

        bs.km0.vals = approx(fit.km0$time, fit.km0$surv, c(12, 24, 36)/12*365.25)$y
        bs.km0.12 = calcBSsingle(Surv(d$Time[i], d$DSD[i]), rep(bs.km0.vals[1], nrow(d[i,])), 12/12*365.
        bs.km0.24 = calcBSsingle(Surv(d$Time[i], d$DSD[i]), rep(bs.km0.vals[2], nrow(d[i,])), 24/12*365.
        bs.km0.36 = calcBSsingle(Surv(d$Time[i], d$DSD[i]), rep(bs.km0.vals[3], nrow(d[i,])), 36/12*365.

        result = c(
                bs.gg.12 - bs.km0.12,                   bs.mskcc.preop.12 - bs.km0.12,
                bs.gg.12 - bs.mskcc.preop.12,
                bs.gg.24 - bs.km0.24,                   bs.mskcc.preop.24 - bs.km0.24,
                bs.gg.24 - bs.mskcc.preop.24,
                bs.gg.36 - bs.km0.36,                   bs.mskcc.preop.36 - bs.km0.36,
                bs.gg.36 - bs.mskcc.preop.36)

        names(result) <- NULL
        result
}

set.seed(20150208)
deltaBrier.boot.apgi = boot(data.apgi, probs_bs_boot_func_apgi, R = 500)
deltaBrier.boot.apgi.cis = t(sapply(1:ncol(deltaBrier.boot.apgi$t), function(i) boot.ci(deltaBrier.boot.
colnames(deltaBrier.boot.apgi.cis) = c("level", "lowindex", "highindex", "lci", "uci")
rownames(deltaBrier.boot.apgi.cis) = c(
        "12:gg-km0", "12:pre-km0", "12:gg-pre",
        "24:gg-km0", "24:pre-km0", "24:gg-pre",
        "36:gg-km0", "36:pre-km0", "36:gg-pre")
deltaBrier.boot.apgi

##
## ORDINARY NONPARAMETRIC BOOTSTRAP
##
##
## Call:
## boot(data = data.apgi, statistic = probs_bs_boot_func_apgi, R = 500)
##
##
## Bootstrap Statistics :
##      original      bias    std. error
## t1* -0.002467 -9.427e-04     0.01533
## t2* -0.021902 -9.299e-04     0.01871
## t3*  0.019435 -1.284e-05     0.02357
## t4* -0.026163  1.455e-04     0.01626
## t5* -0.031015 -2.957e-03     0.03088
## t6*  0.004852  3.102e-03     0.03210
## t7* -0.013158  5.419e-04     0.01076
## t8* -0.002300 -1.978e-03     0.03104
## t9* -0.010858  2.520e-03     0.03157

deltaBrier.boot.apgi.cis

##            level lowindex highindex      lci      uci
## 12:gg-km0   0.95    19.66     493.6 -0.03018 0.028926
```

```
## 12:pre-km0  0.95    19.61     493.7 -0.05458 0.021352
## 12:gg-pre   0.95     9.26     484.6 -0.03157 0.063344
## 24:gg-km0   0.95    11.80     487.7 -0.05845 0.005853
## 24:pre-km0  0.95    24.25     495.0 -0.08215 0.036547
## 24:gg-pre   0.95     9.20     484.1 -0.05843 0.066835
## 36:gg-km0   0.95     7.17     481.3 -0.03799 0.005808
## 36:pre-km0  0.95    13.87     489.6 -0.06168 0.053566
## 36:gg-pre   0.95    14.34     490.2 -0.06126 0.052894
```

```
probs_bs_boot_func_dresden = function(d, i) {
        bs.mskcc.postop.12 = calcBSsingle(Surv(d$Time[i], d$DSD[i]), mskcc_post.12mo.dresden[i], 12/12*3
        bs.mskcc.postop.24 = calcBSsingle(Surv(d$Time[i], d$DSD[i]), mskcc_post.24mo.dresden[i], 24/12*3
        bs.mskcc.postop.36 = calcBSsingle(Surv(d$Time[i], d$DSD[i]), mskcc_post.36mo.dresden[i], 36/12*3
        bs.mskcc.preop.12 = calcBSsingle(Surv(d$Time[i], d$DSD[i]), mskcc_pre.12mo.dresden[i], 12/12*365
        bs.mskcc.preop.24 = calcBSsingle(Surv(d$Time[i], d$DSD[i]), mskcc_pre.24mo.dresden[i], 24/12*365
        bs.mskcc.preop.36 = calcBSsingle(Surv(d$Time[i], d$DSD[i]), mskcc_pre.36mo.dresden[i], 36/12*365

        bs.gg.vals = t(sapply(gg.path.dresden[i], function(path) approx(path[,1], path[,2], c(12, 24, 36
        rownames(bs.gg.vals) <- NULL
        bs.gg.12 = calcBSsingle(Surv(d$Time[i], d$DSD[i]), bs.gg.vals[,1], 12/12*365.25)
        bs.gg.24 = calcBSsingle(Surv(d$Time[i], d$DSD[i]), bs.gg.vals[,2], 24/12*365.25)
        bs.gg.36 = calcBSsingle(Surv(d$Time[i], d$DSD[i]), bs.gg.vals[,3], 36/12*365.25)

        bs.km0.vals = approx(fit.km0$time, fit.km0$surv, c(12, 24, 36)/12*365.25)$y
        bs.km0.12 = calcBSsingle(Surv(d$Time[i], d$DSD[i]), rep(bs.km0.vals[1], nrow(d[i,])), 12/12*365.
        bs.km0.24 = calcBSsingle(Surv(d$Time[i], d$DSD[i]), rep(bs.km0.vals[2], nrow(d[i,])), 24/12*365.
        bs.km0.36 = calcBSsingle(Surv(d$Time[i], d$DSD[i]), rep(bs.km0.vals[3], nrow(d[i,])), 36/12*365.

        result = c(
                bs.gg.12 - bs.km0.12,                   bs.mskcc.preop.12 - bs.km0.12,
                bs.gg.12 - bs.mskcc.preop.12,
                bs.gg.24 - bs.km0.24,                   bs.mskcc.preop.24 - bs.km0.24,
                bs.gg.24 - bs.mskcc.preop.24,
                bs.gg.36 - bs.km0.36,                   bs.mskcc.preop.36 - bs.km0.36,
                bs.gg.36 - bs.mskcc.preop.36)

        names(result) <- NULL
        result
}

set.seed(20150208)
deltaBrier.boot.dresden = boot(data.dresden, probs_bs_boot_func_dresden, R = 500)
deltaBrier.boot.dresden.cis = t(sapply(1:ncol(deltaBrier.boot.dresden$t), function(i) boot.ci(deltaBrier
colnames(deltaBrier.boot.dresden.cis) = c("level", "lowindex", "highindex", "lci", "uci")
rownames(deltaBrier.boot.dresden.cis) = c(
        "12:gg-km0", "12:pre-km0", "12:gg-pre",
        "24:gg-km0", "24:pre-km0", "24:gg-pre",
        "36:gg-km0", "36:pre-km0", "36:gg-pre")
deltaBrier.boot.dresden

##
## ORDINARY NONPARAMETRIC BOOTSTRAP
##
```

```
##
## Call:
## boot(data = data.dresden, statistic = probs_bs_boot_func_dresden,
##     R = 500)
##
##
## Bootstrap Statistics :
##        original     bias    std. error
## t1*  0.0034421  9.367e-04    0.011108
## t2*  0.0004868  6.525e-05    0.016340
## t3*  0.0029552  8.714e-04    0.020299
## t4*  0.0126527  4.762e-04    0.010369
## t5*  0.0285863 -1.651e-04    0.026848
## t6* -0.0159336  6.414e-04    0.031273
## t7*  0.0103725  3.284e-04    0.006289
## t8*  0.0172025 -6.142e-04    0.025904
## t9* -0.0068300  9.426e-04    0.028929
```

```
deltaBrier.boot.dresden.cis
```

```
##            level lowindex highindex       lci     uci
## 12:gg-km0   0.95     8.37     482.4 -0.020654 0.02330
## 12:pre-km0  0.95    13.25     489.2 -0.028488 0.03549
## 12:gg-pre   0.95     6.20     478.0 -0.042748 0.03807
## 24:gg-km0   0.95    13.87     489.8 -0.007239 0.03688
## 24:pre-km0  0.95    10.10     485.6 -0.029593 0.07763
## 24:gg-pre   0.95    14.01     489.9 -0.075056 0.05172
## 36:gg-km0   0.95     9.38     484.3 -0.001999 0.02198
## 36:pre-km0  0.95    11.04     486.9 -0.037358 0.06442
## 36:gg-pre   0.95    10.83     486.4 -0.063253 0.05389
```

```
temp.time = gsub(":.*", "", rownames(deltaBrier.boot.glasgow.cis))
temp.methodpos = gsub(".*:", "", gsub("-.*", "", rownames(deltaBrier.boot.glasgow.cis)))
temp.methodneg = gsub(".*-", "", rownames(deltaBrier.boot.glasgow.cis))
temp.methods = sort(unique(c(temp.methodpos, temp.methodneg)))
tapply(1:length(temp.time), temp.time, function(is) {
        res = matrix(0, nrow = length(temp.methods), ncol = length(temp.methods))
        rownames(res) = temp.methods
        colnames(res) = temp.methods
        # Make res signed.  0 => NS.  +1 => row is better than col (BS_row - BS_col < 0).  -1 => row is
        res[cbind(temp.methodpos[is], temp.methodneg[is])] = (sign(deltaBrier.boot.glasgow.cis[is, "uci'
        res[cbind(temp.methodneg[is], temp.methodpos[is])] = (sign(deltaBrier.boot.glasgow.cis[is, "uci'
        res
})
```

```
## $`12`
##     gg km0 pre
## gg   0   0   1
## km0  0   0   0
## pre -1   0   0
##
## $`24`
##     gg km0 pre
## gg   0   1   0
```

```
## km0 -1   0   0
## pre  0   0   0
##
## $`36`
##     gg km0 pre
## gg   0   0   1
## km0  0   0   1
## pre -1  -1   0
```

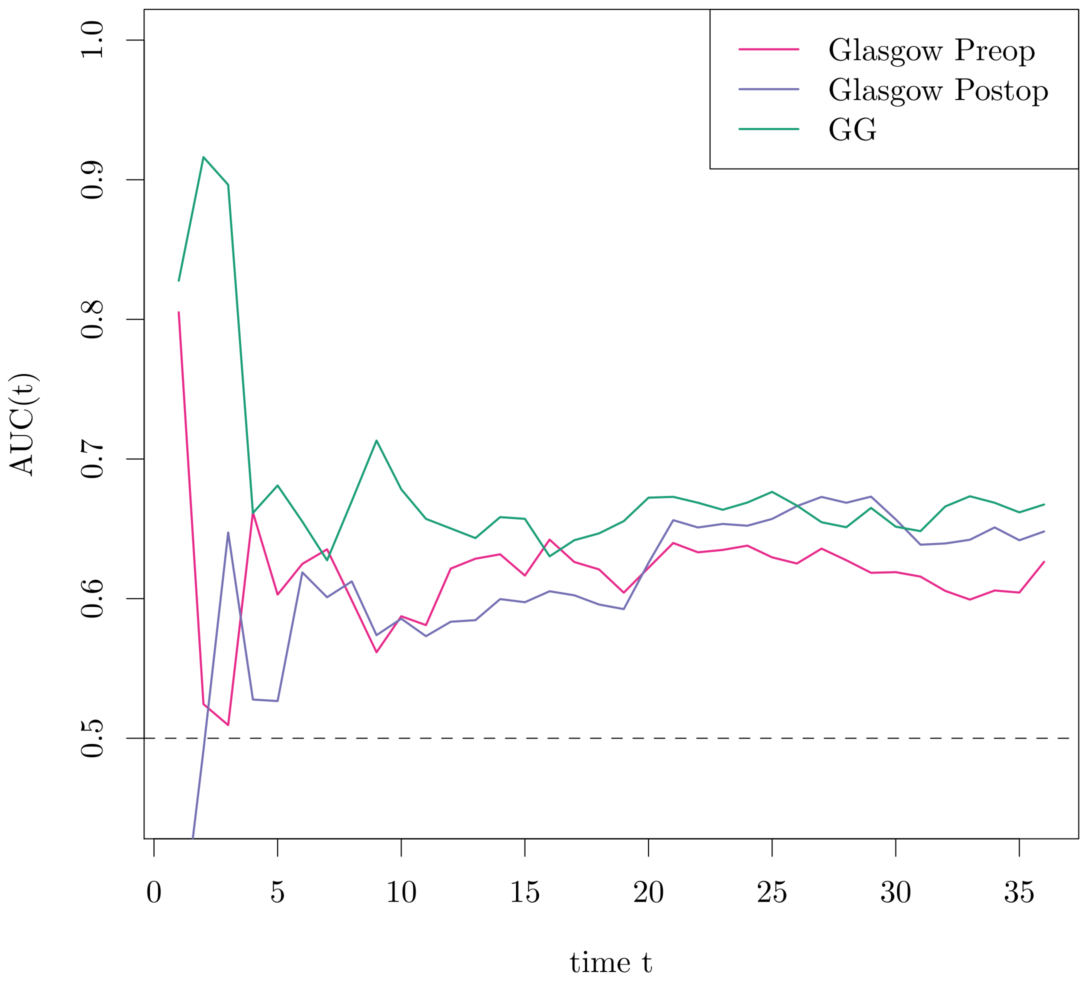
```
temp.time = gsub(":.*", "", rownames(deltaBrier.boot.apgi.cis))
temp.methodpos = gsub(".*:", "", gsub("-.*", "", rownames(deltaBrier.boot.apgi.cis)))
temp.methodneg = gsub(".*-", "", rownames(deltaBrier.boot.apgi.cis))
temp.methods = sort(unique(c(temp.methodpos, temp.methodneg)))
tapply(1:length(temp.time), temp.time, function(is) {
        res = matrix(0, nrow = length(temp.methods), ncol = length(temp.methods))
        rownames(res) = temp.methods
        colnames(res) = temp.methods
        # Make res signed.  0 => NS.  +1 => row is better than col (BS_row - BS_col < 0).  -1 => row is
        res[cbind(temp.methodpos[is], temp.methodneg[is])] = (sign(deltaBrier.boot.apgi.cis[is, "uci"])
        res[cbind(temp.methodneg[is], temp.methodpos[is])] = (sign(deltaBrier.boot.apgi.cis[is, "uci"])
        res
})

## $`12`
##     gg km0 pre
## gg   0   0   0
## km0  0   0   0
## pre  0   0   0
##
## $`24`
##     gg km0 pre
## gg   0   0   0
## km0  0   0   0
## pre  0   0   0
##
## $`36`
##     gg km0 pre
## gg   0   0   0
## km0  0   0   0
## pre  0   0   0
```

```
temp.time = gsub(":.*", "", rownames(deltaBrier.boot.dresden.cis))
temp.methodpos = gsub(".*:", "", gsub("-.*", "", rownames(deltaBrier.boot.dresden.cis)))
temp.methodneg = gsub(".*-", "", rownames(deltaBrier.boot.dresden.cis))
temp.methods = sort(unique(c(temp.methodpos, temp.methodneg)))
tapply(1:length(temp.time), temp.time, function(is) {
        res = matrix(0, nrow = length(temp.methods), ncol = length(temp.methods))
        rownames(res) = temp.methods
        colnames(res) = temp.methods
        # Make res signed.  0 => NS.  +1 => row is better than col (BS_row - BS_col < 0).  -1 => row is
        res[cbind(temp.methodpos[is], temp.methodneg[is])] = (sign(deltaBrier.boot.dresden.cis[is, "uci'
        res[cbind(temp.methodneg[is], temp.methodpos[is])] = (sign(deltaBrier.boot.dresden.cis[is, "uci'
```

```
        res
})

## $`12`
##     gg km0 pre
## gg   0   0   0
## km0  0   0   0
## pre  0   0   0
##
## $`24`
##     gg km0 pre
## gg   0   0   0
## km0  0   0   0
## pre  0   0   0
##
## $`36`
##     gg km0 pre
## gg   0   0   0
## km0  0   0   0
## pre  0   0   0
```

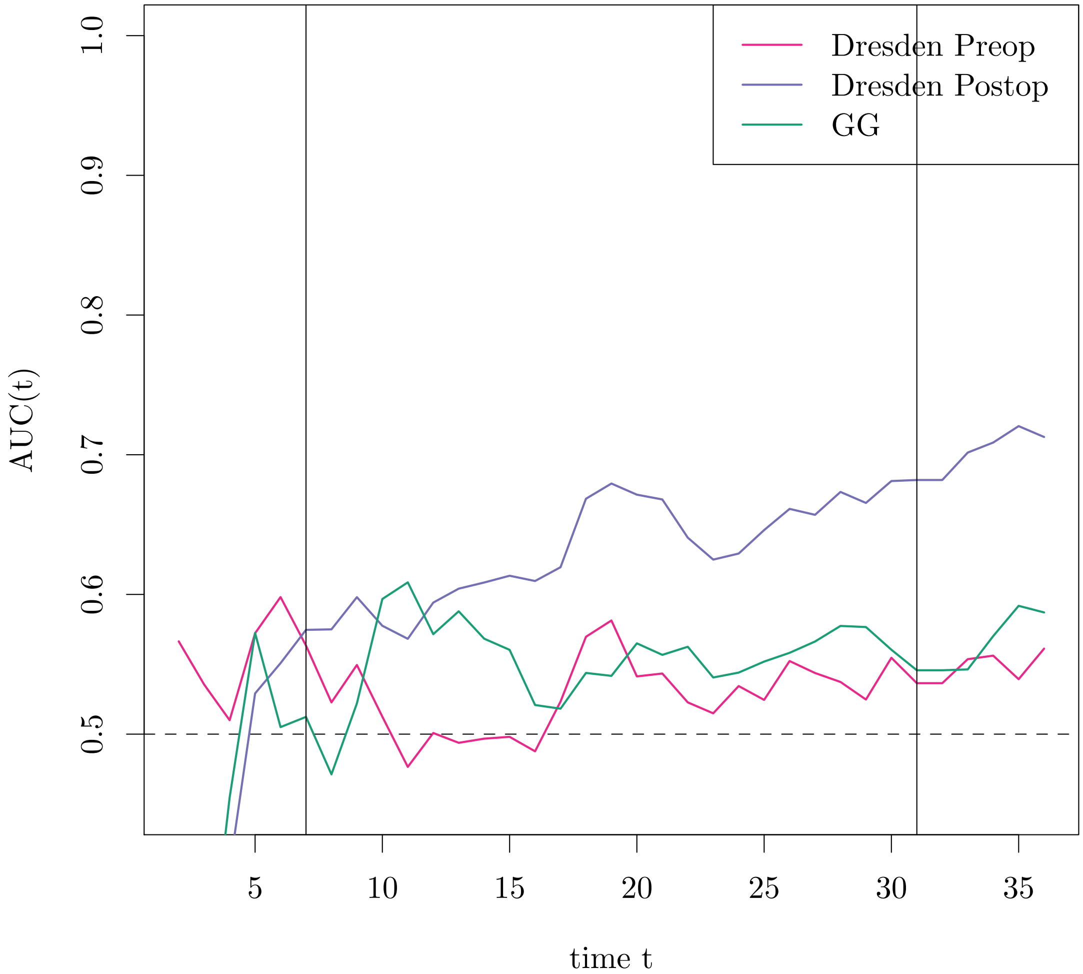
Cumulative-dynamic:

```
mskcc_pre.cdroc.glasgow = timeROC(data.glasgow$Time/365.25*12, data.glasgow$DSD, mskcc_pre.linpred.glasg
mskcc_post.cdroc.glasgow = timeROC(data.glasgow$Time/365.25*12, data.glasgow$DSD, mskcc_post.linpred.gla
gg.cdroc.glasgow = timeROC(data.glasgow$Time/365.25*12, data.glasgow$DSD, gg.linpred.glasgow, cause = 1,
plotAUCcurve(mskcc_pre.cdroc.glasgow, conf.int = FALSE, add = FALSE, col = pal["mskcc.pre"])
plotAUCcurve(mskcc_post.cdroc.glasgow, conf.int = FALSE, add = TRUE, col = pal["mskcc.post"])
plotAUCcurve(gg.cdroc.glasgow, conf.int = FALSE, add = TRUE, col = pal["gg"])
legend("topright", legend = c("Glasgow Preop", "Glasgow Postop", "GG"), col = c(pal["mskcc.pre"], pal["m
```




```
mskcc_pre.cdroc.apgi = timeROC(data.apgi$Time/365.25*12, data.apgi$DSD, mskcc_pre.linpred.apgi, cause =
mskcc_post.cdroc.apgi = timeROC(data.apgi$Time/365.25*12, data.apgi$DSD, mskcc_post.linpred.apgi, cause
gg.cdroc.apgi = timeROC(data.apgi$Time/365.25*12, data.apgi$DSD, gg.linpred.apgi, cause = 1, times = seq
plotAUCcurve(mskcc_pre.cdroc.apgi, conf.int = FALSE, add = FALSE, col = pal["mskcc.pre"])
plotAUCcurve(mskcc_post.cdroc.apgi, conf.int = FALSE, add = TRUE, col = pal["mskcc.post"])
plotAUCcurve(gg.cdroc.apgi, conf.int = FALSE, add = TRUE, col = pal["gg"])
legend("topright", legend = c("APGI Preop", "APGI Postop", "GG"), col = c(pal["mskcc.pre"], pal["mskcc.p
abline(v = c(7, 31))
```


```
mskcc_pre.cdroc.dresden = timeROC(data.dresden$Time/365.25*12, data.dresden$DSD, mskcc_pre.linpred.dresd
mskcc_post.cdroc.dresden = timeROC(data.dresden$Time/365.25*12, data.dresden$DSD, mskcc_post.linpred.dre
gg.cdroc.dresden = timeROC(data.dresden$Time/365.25*12, data.dresden$DSD, gg.linpred.dresden, cause = 1,
plotAUCcurve(mskcc_pre.cdroc.dresden, conf.int = FALSE, add = FALSE, col = pal["mskcc.pre"])
plotAUCcurve(mskcc_post.cdroc.dresden, conf.int = FALSE, add = TRUE, col = pal["mskcc.post"])
plotAUCcurve(gg.cdroc.dresden, conf.int = FALSE, add = TRUE, col = pal["gg"])
legend("topright", legend = c("Dresden Preop", "Dresden Postop", "GG"), col = c(pal["mskcc.pre"], pal["m
abline(v = c(7, 31))
```



Incident-dynamic:

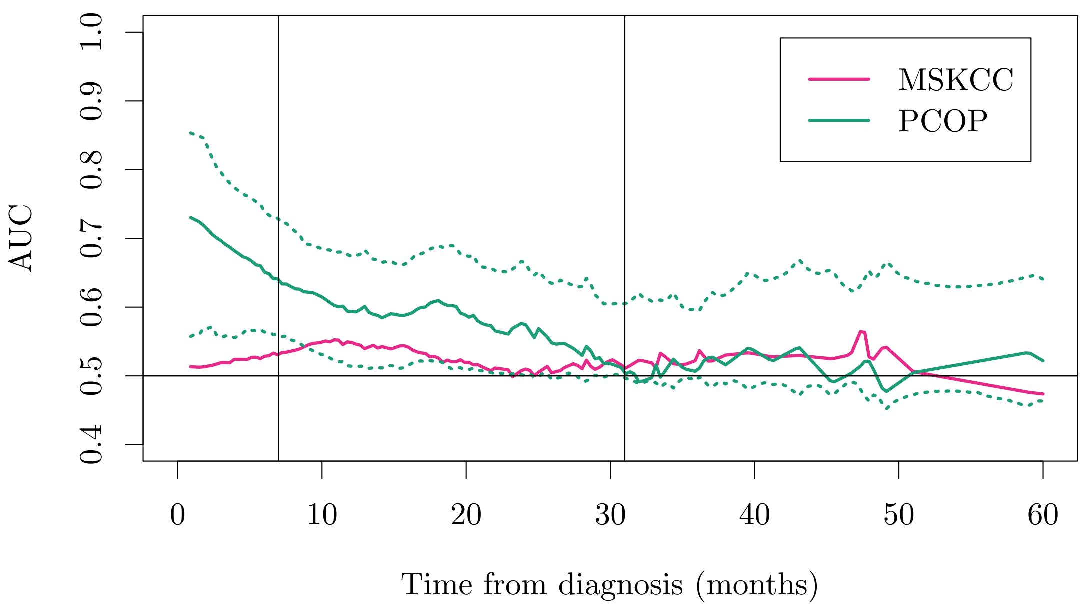
```
risksetROC.boot = function(time, event, marker, tmin = 0, tmax, B = 2000, ...)
{
        data = data.frame(time = time, event = event, marker = marker)
        eval_times = seq(tmin, tmax, length.out = 200)

        boot_obj = boot(data, function(data, indices) {
                data_draw = data[indices,]
                rsAUC = risksetAUC(Stime = data_draw$time, status = data_draw$event, marker = data_draw$
                AUC_at_eval_times = approx(rsAUC$utimes, rsAUC$AUC, eval_times)$y
                AUC_at_eval_times
        }, R = B)

        res = list(boot = boot_obj, eval_times = eval_times)
        class(res) = "rrROC_boot"
        return(res)
}
```

```
plot.rrROC_boot = function(obj, add = FALSE, ci = FALSE, ci_conf = 0.95, ci_type = c("perc", "norm", "ba
{
        ci_type = match.arg(ci_type)
        boot_ci = t(sapply(1:length(obj$boot$t0), function(i) {
```

```
                ci = try(boot.ci(obj$boot, index = c(i, i), type = ci_type, conf = ci_conf))
                if (class(ci) == "try-error") {
                        if (ci_type == "norm")  { return(c(NA, NA, NA)) } else { return(c(NA, NA, NA, NA
                }
                return(ci[[c("bca" = "bca", "norm" = "normal", "basic" = "basic", "stud" = "student", "p
        }))
        if (ci_type == "norm")  { colnames(boot_ci) = c("level", "lci", "uci") } else { colnames(boot_ci
        summ = as.data.frame(cbind(time = obj$eval_times, mean = obj$boot$t0, boot_ci))

        if (!add) {
                plot(mean ~ time, summ, ylim = c(0.4, 1), type = "l", ...)
        } else {
                lines(mean ~ time, summ, ...)
        }
        if (ci) {
                lines(lci ~ time, summ, lty = "dotted", ...)
                lines(uci ~ time, summ, lty = "dotted", ...)
        }
        abline(h = 0.5)
}
```

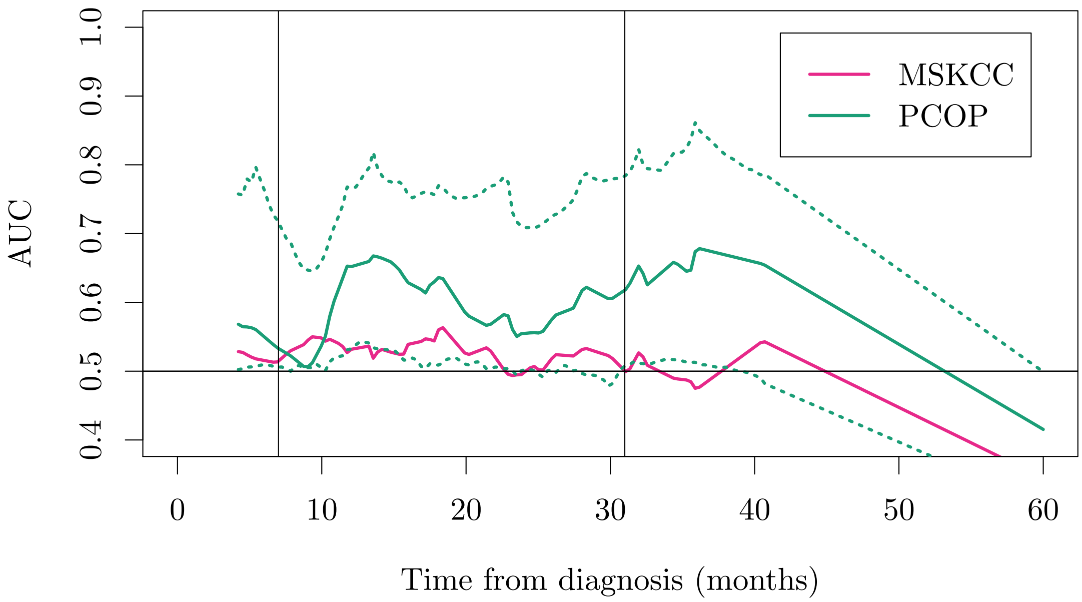
```
set.seed(20150216)
rrROC_boot.mskcc_pre.glasgow = risksetROC.boot(time = data.glasgow$Time/365.25*12, event = data.glasgow$
rrROC_boot.mskcc_post.glasgow = risksetROC.boot(time = data.glasgow$Time/365.25*12, event = data.glasgow
rrROC_boot.gg.glasgow = risksetROC.boot(time = data.glasgow$Time/365.25*12, event = data.glasgow$DSD, ma
```

```
plot(rrROC_boot.mskcc_pre.glasgow, col = pal["mskcc.pre"], xlab = "Time from diagnosis (months)", ylab =
plot(rrROC_boot.gg.glasgow, col = pal["gg"], add = TRUE, ci = TRUE, lwd = 3)
legend("topright", legend = c("MSKCC", "PCOP"), col = c(pal["mskcc.pre"], pal["gg"]), lty = "solid", lwd
abline(v = c(7, 31))
```



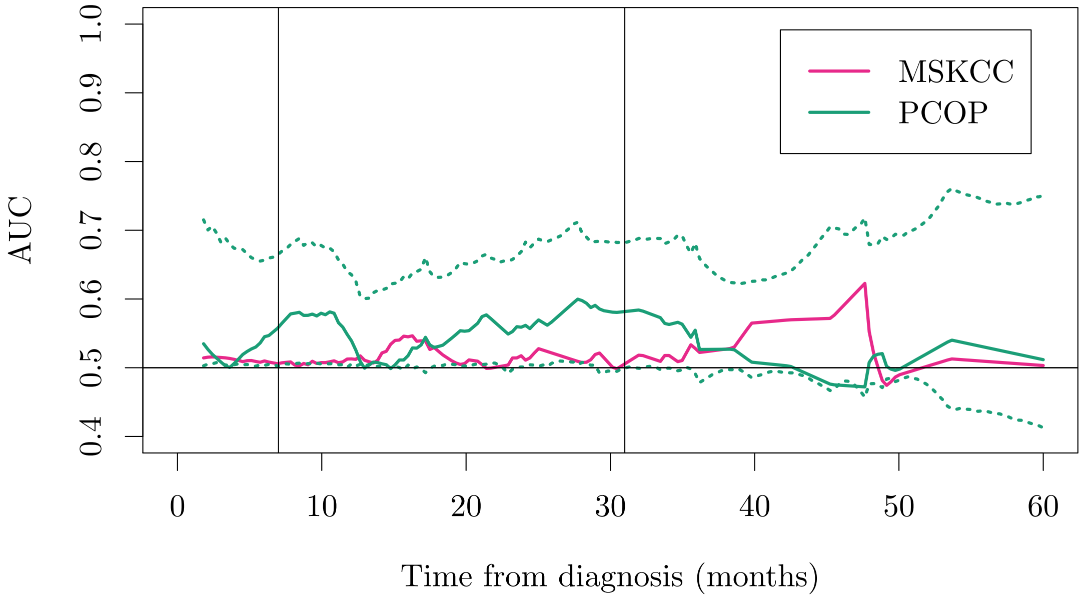
```
set.seed(20150216)
rrROC_boot.mskcc_pre.apgi = risksetROC.boot(time = data.apgi$Time/365.25*12, event = data.apgi$DSD, mark
rrROC_boot.mskcc_post.apgi = risksetROC.boot(time = data.apgi$Time/365.25*12, event = data.apgi$DSD, mar
rrROC_boot.gg.apgi = risksetROC.boot(time = data.apgi$Time/365.25*12, event = data.apgi$DSD, marker = gg
```

```
plot(rrROC_boot.mskcc_pre.apgi, col = pal["mskcc.pre"], xlab = "Time from diagnosis (months)", ylab = "A
plot(rrROC_boot.gg.apgi, col = pal["gg"], add = TRUE, ci = TRUE, lwd = 3)
legend("topright", legend = c("MSKCC", "PCOP"), col = c(pal["mskcc.pre"], pal["gg"]), lty = "solid", lwd
abline(v = c(7, 31))
```




```
set.seed(20150216)
rrROC_boot.mskcc_pre.dresden = risksetROC.boot(time = data.dresden$Time/365.25*12, event = data.dresden$
rrROC_boot.mskcc_post.dresden = risksetROC.boot(time = data.dresden$Time/365.25*12, event = data.dresden
rrROC_boot.gg.dresden = risksetROC.boot(time = data.dresden$Time/365.25*12, event = data.dresden$DSD, ma
```

```
plot(rrROC_boot.mskcc_pre.dresden, col = pal["mskcc.pre"], xlab = "Time from diagnosis (months)", ylab =
plot(rrROC_boot.gg.dresden, col = pal["gg"], add = TRUE, ci = TRUE, lwd = 3)
legend("topright", legend = c("MSKCC", "PCOP"), col = c(pal["mskcc.pre"], pal["gg"]), lty = "solid", lwd
abline(v = c(7, 31))
```


AUC
0.4
0.5
0.6
0.7
0.8
0.9
1.0
MSKCC
PCOP
0
10
20
30
40
50
60
Time from diagnosis (months)