Lung Cancer

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1 Detailed Survival analyis of the Survival lung data.

1.0.1 Libraries

```
library(survival)
library(FRESA.CAD)
```

```
## Loading required package: Rcpp
## Loading required package: stringr
## Loading required package: miscTools
## Loading required package: Hmisc
##
## Attaching package: 'Hmisc'
## The following objects are masked from 'package:base':
##
##     format.pval, units
## Loading required package: pROC
## Type 'citation("pROC")' for a citation.
##
## Attaching package: 'pROC'
## The following objects are masked from 'package:stats':
##
##     cov, smooth, var
```

```
op <- par(no.readonly = TRUE)
pander::panderOptions('digits', 3)
pander::panderOptions('keep.trailing.zeros',TRUE)
```

1.0.2 Libraries

```
data(lung)
```

```
## Warning in data(lung): data set 'lung' not found
```

```
lung$inst <- NULL
lung$status <- lung$status - 1
lung <- lung[complete.cases(lung),]

pander::pander(table(lung$status))
```

0	1
47	121

```
pander::pander(summary(lung$time))
```

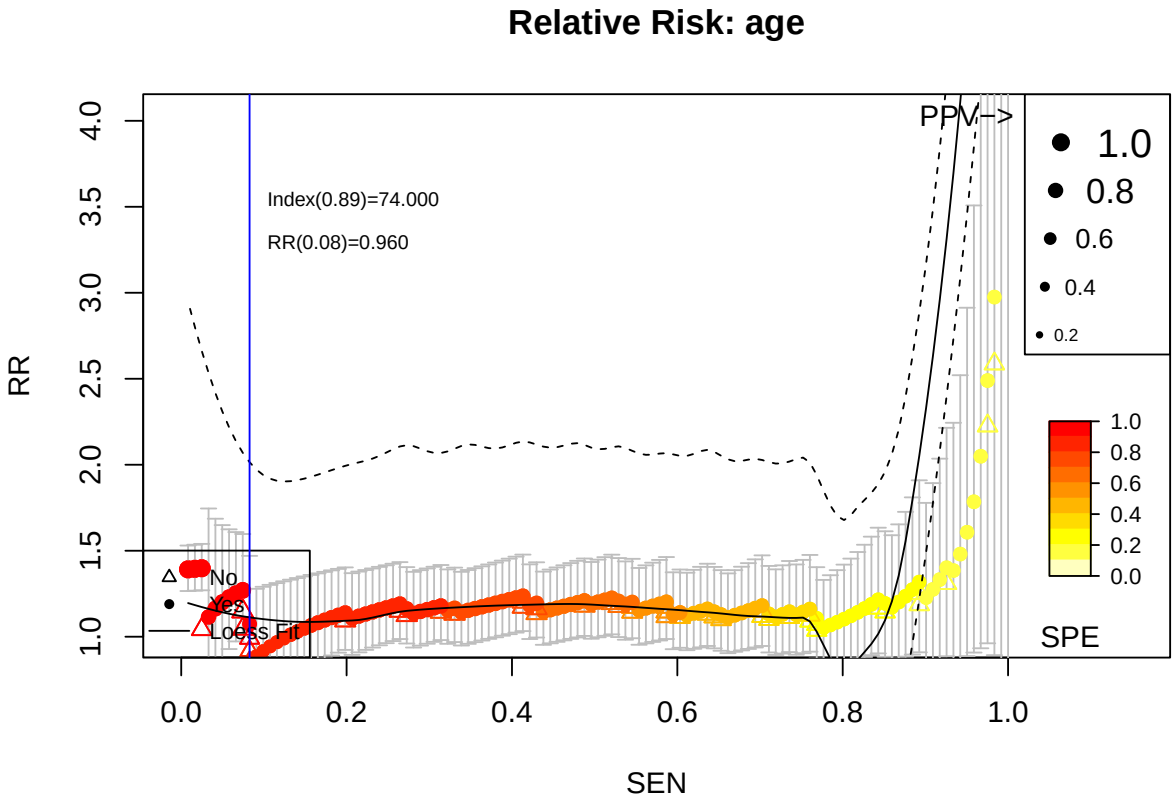
Min.	1st Qu.	Median	Mean	3rd Qu.	Max.
5	175	268	310	416	1022

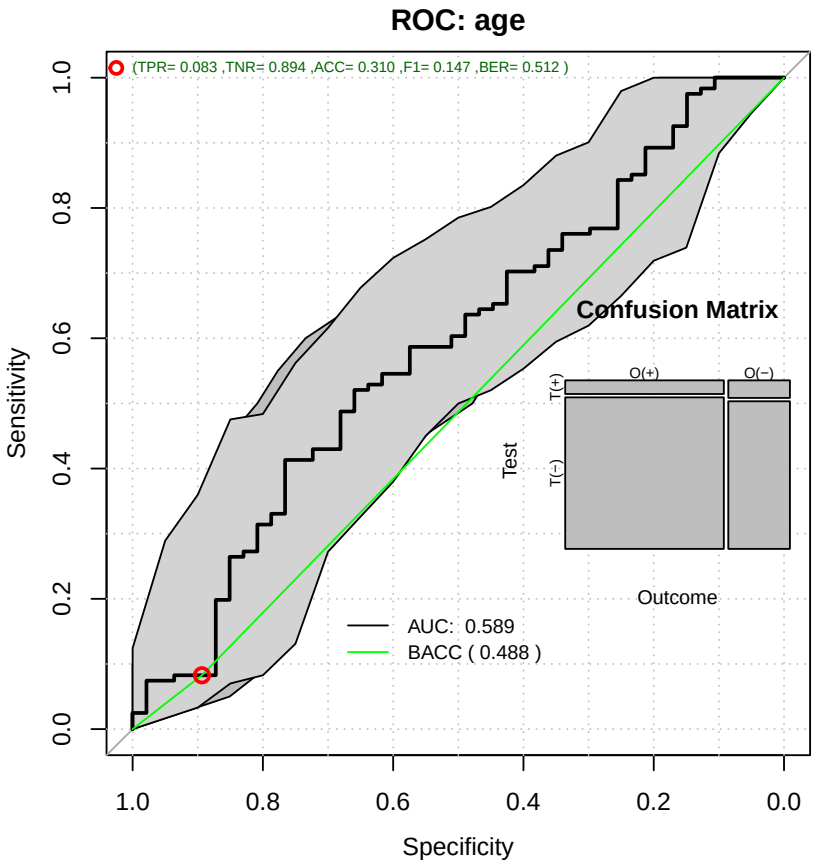
1.1 Exploring Raw Features with RRPlot

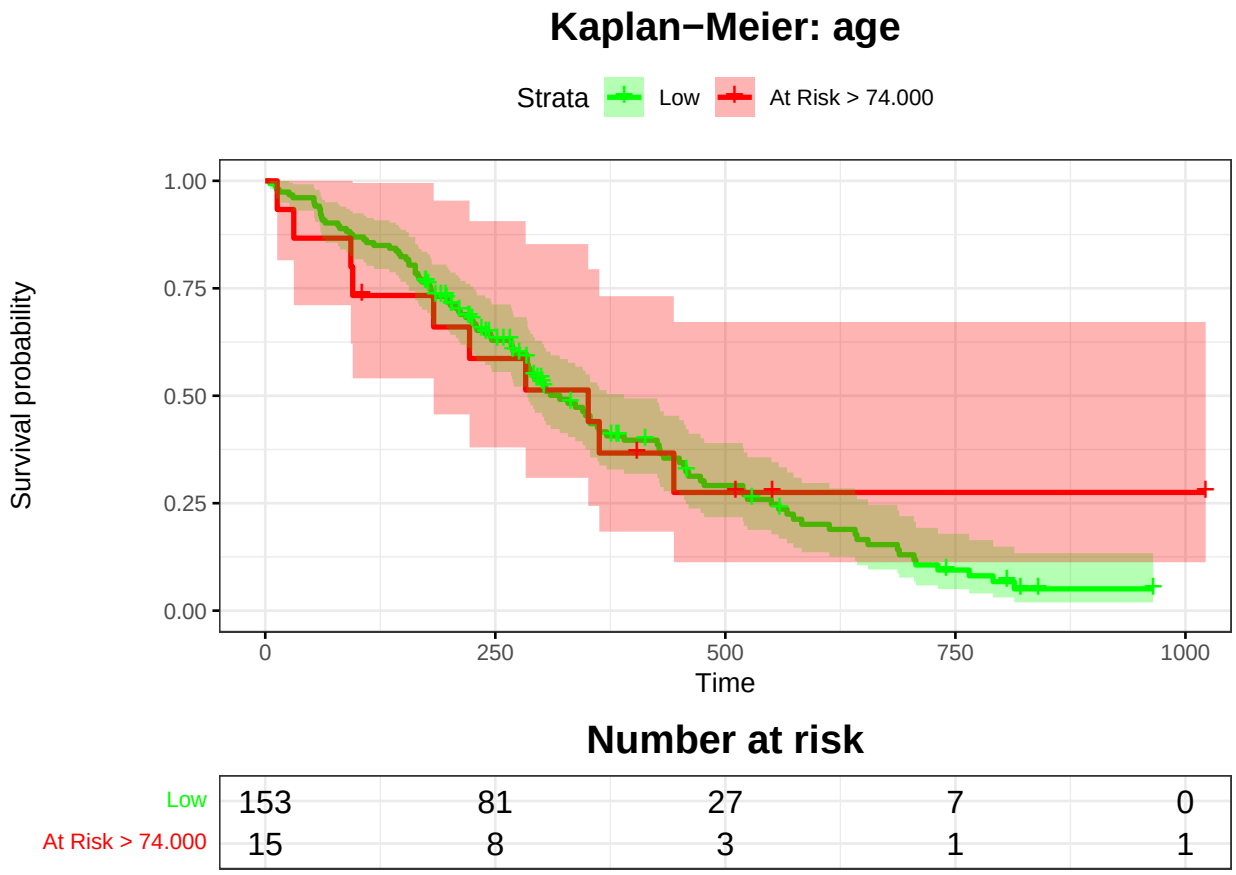
```
convar <- colnames(lung)[lapply(apply(lung,2,unique),length) > 10]
convar <- convar[convar != "time"]
topvar <- univariate_BinEnsemble(lung[,c("status",convar)],"status")
pander::pander(topvar)
```

age	wt.loss
0.106	0.106

```
topv <- min(5,length(topvar))
topFive <- names(topvar)[1:topv]
RRanalysis <- list();
idx <- 1
for (topf in topFive)
{
  RRanalysis[[idx]] <- RRPlot(cbind(lung$status,lung[,topf]),
                              atProb=c(0.90),
                  timetoEvent=lung$time,
                  title=topf,
#                  plotRR=FALSE
                  )
  idx <- idx + 1
}
```

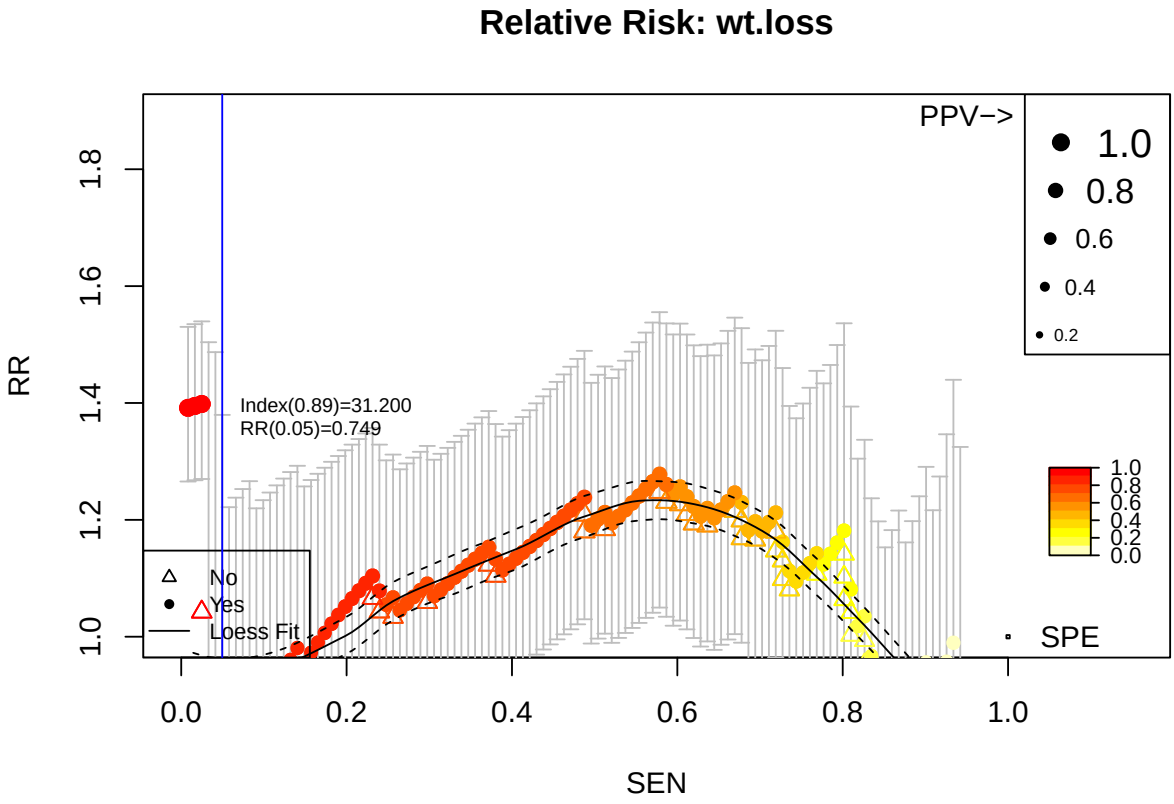

Relative Risk: age
PPV–>
1.0
0.8
0.6
0.4
0.2
Index(0.89)=74.000
RR(0.08)=0.960
1.0
0.8
0.6
0.4
0.2
0.0
SPE
No
Yes
Loess Fit
RR
SEN
1.0
1.5
2.0
2.5
3.0
3.5
4.0
0.0
0.2
0.4
0.6
0.8
1.0

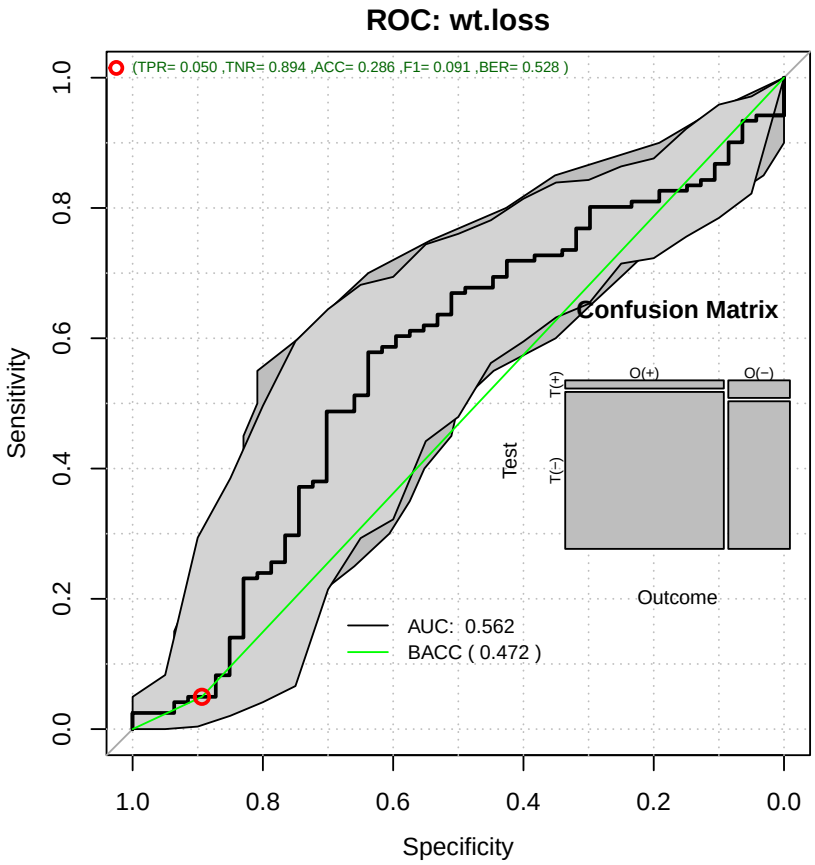

ROC: age
(TPR= 0.083 ,TNR= 0.894 ,ACC= 0.310 ,F1= 0.147 ,BER= 0.512)
Sensitivity
1.0
0.8
0.6
0.4
0.2
0.0
Specificity
1.0
0.8
0.6
0.4
0.2
0.0
Confusion Matrix
O(+)
O(−)
T(+)
T(−)
Test
Outcome
AUC: 0.589
BACC (0.488)

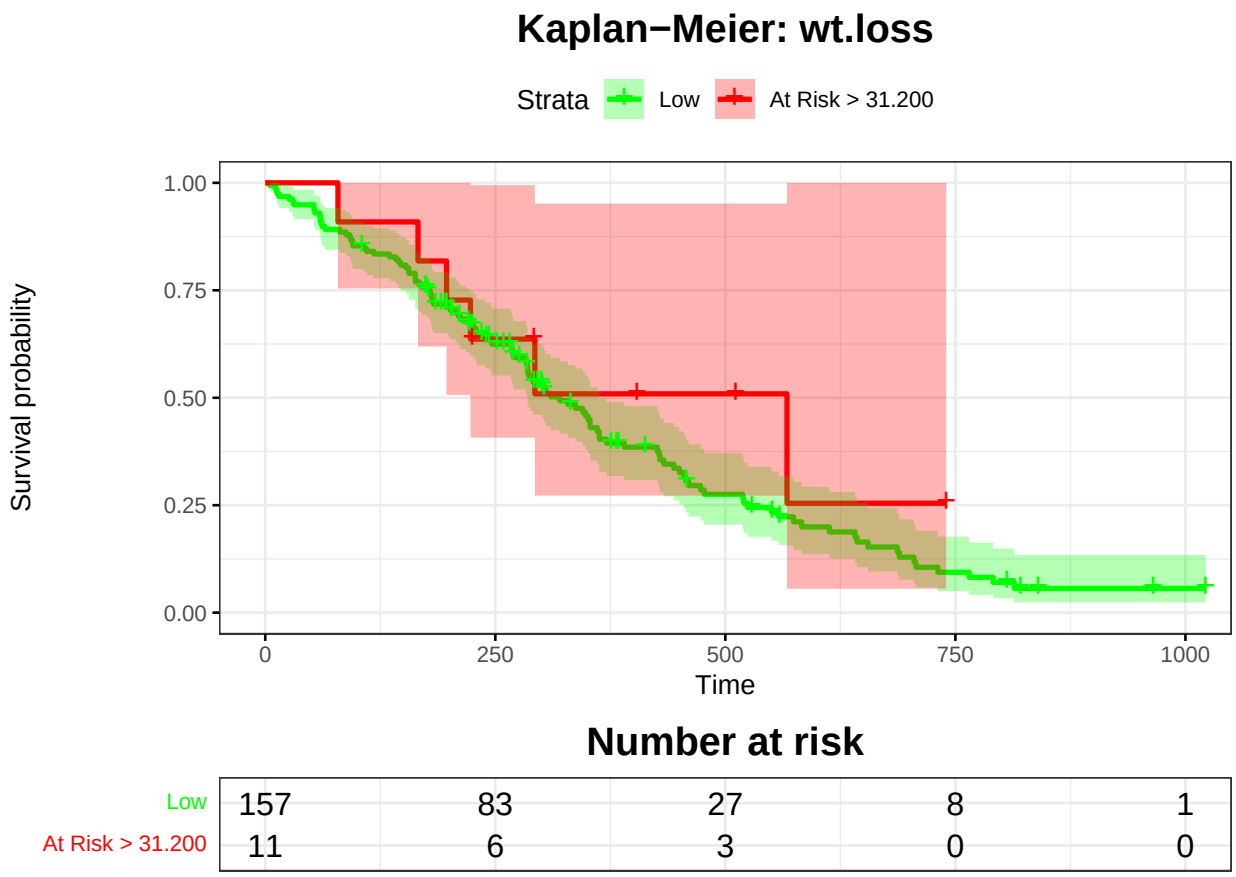


Number at risk

Low	153	81	27	7	0
At Risk > 74.000	15	8	3	1	1


Relative Risk: wt.loss
PPV–>
1.0
0.8
0.6
0.4
0.2
RR
1.8
1.6
1.4
1.2
1.0
Index(0.89)=31.200
RR(0.05)=0.749
1.0
0.8
0.6
0.4
0.2
0.0
No
Yes
Loess Fit
SPE
0.0
0.2
0.4
0.6
0.8
1.0
SEN


ROC: wt.loss
(TPR= 0.050 ,TNR= 0.894 ,ACC= 0.286 ,F1= 0.091 ,BER= 0.528)
Sensitivity
Specificity
1.0
0.8
0.6
0.4
0.2
0.0
Confusion Matrix
O(+)
O(−)
T(+)
T(−)
Test
Outcome
AUC: 0.562
BACC (0.472)




```
names(RRanalysis) <- topFive
```

1.2 Reporting the Metrics

```
ROCAUC <- NULL
CstatCI <- NULL
RRatios <- NULL
LogRangp <- NULL
Sensitivity <- NULL
Specificity <- NULL

for (topf in topFive)
{
  CstatCI <- rbind(CstatCI,RRanalysis[[topf]]$c.index$cstatCI)
  RRatios <- rbind(RRatios,RRanalysis[[topf]]$RR_atP)
  LogRangp <- rbind(LogRangp,RRanalysis[[topf]]$surdif$pvalue)
  Sensitivity <- rbind(Sensitivity,RRanalysis[[topf]]$ROCAnalysis$sensitivity)
  Specificity <- rbind(Specificity,RRanalysis[[topf]]$ROCAnalysis$specificity)
  ROCAUC <- rbind(ROCAUC,RRanalysis[[topf]]$ROCAnalysis$aucs)
}
rownames(CstatCI) <- topFive
rownames(RRatios) <- topFive
rownames(LogRangp) <- topFive
rownames(Sensitivity) <- topFive
rownames(Specificity) <- topFive
```

```
rownames(ROCAUC) <- topFive

pander::pander(ROCAUC)
```

	est	lower	upper
age	0.589	0.491	0.687
wt.loss	0.562	0.463	0.661

```
pander::pander(CstatCI)
```

	mean.C Index	median	lower	upper
age	0.558	0.558	0.500	0.619
wt.loss	0.515	0.516	0.456	0.574

```
pander::pander(RRatios)
```

	est	lower	upper
age	0.960	0.675	1.37
wt.loss	0.749	0.435	1.29

```
pander::pander(LogRangp)
```

age	0.818
wt.loss	0.358

```
pander::pander(Sensitivity)
```

	est	lower	upper
age	0.0826	0.0403	0.147
wt.loss	0.0496	0.0184	0.105

```
pander::pander(Specificity)
```

	est	lower	upper
age	0.894	0.769	0.965
wt.loss	0.894	0.769	0.965

```
meanMatrix <- cbind(ROCAUC[,1],CstatCI[,1],Sensitivity[,1],Specificity[,1],RRatios[,1])
colnames(meanMatrix) <- c("ROCAUC","C-Stat","Sen","Spe","RR")
pander::pander(meanMatrix)
```

	ROCAUC	C-Stat	Sen	Spe	RR
age	0.589	0.558	0.0826	0.894	0.960

	ROCAUC	C-Stat	Sen	Spe	RR
wt.loss	0.562	0.515	0.0496	0.894	0.749

1.3 Modeling

```
ml <- BSWiMS.model(Surv(time,status)~1,data=lung,NumberofRepeats = 10)
```

[++++++++++++++++++++++++++++++]..

```
sm <- summary(ml)
pander::pander(sm$coefficients)
```

Table 11: Table continues below

	Estimate	lower	HR	upper	u.Accuracy	r.Accuracy
ph.ecog	4.32e-01	1.194	1.541	1.988	0.679	0.649
sex	-4.59e-01	0.456	0.632	0.876	0.649	0.679
pat.karno	-1.77e-03	0.997	0.998	1.000	0.506	0.720
ph.karno	-4.06e-07	1.000	1.000	1.000	0.577	0.720
age	4.57e-08	1.000	1.000	1.000	0.565	0.720

Table 12: Table continues below

	full.Accuracy	u.AUC	r.AUC	full.AUC	IDI	NRI
ph.ecog	0.601	0.601	0.620	0.600	0.0449	0.405
sex	0.601	0.620	0.601	0.600	0.0285	0.478
pat.karno	0.506	0.585	0.500	0.585	0.0292	0.342
ph.karno	0.577	0.570	0.500	0.570	0.0143	0.280
age	0.565	0.549	0.500	0.549	0.0162	0.195

	z.IDI	z.NRI	Delta.AUC	Frequency
ph.ecog	3.33	2.48	-0.02005	1.0
sex	2.76	2.85	-0.00167	1.0
pat.karno	2.44	2.24	0.08546	1.0
ph.karno	2.22	1.64	0.06998	0.7
age	1.97	1.14	0.04871	0.1

1.4 Cox Model Performance

Here we evaluate the model using the RRPlot() function.

1.4.1 The evaluation of the raw Cox model with RRPlot()

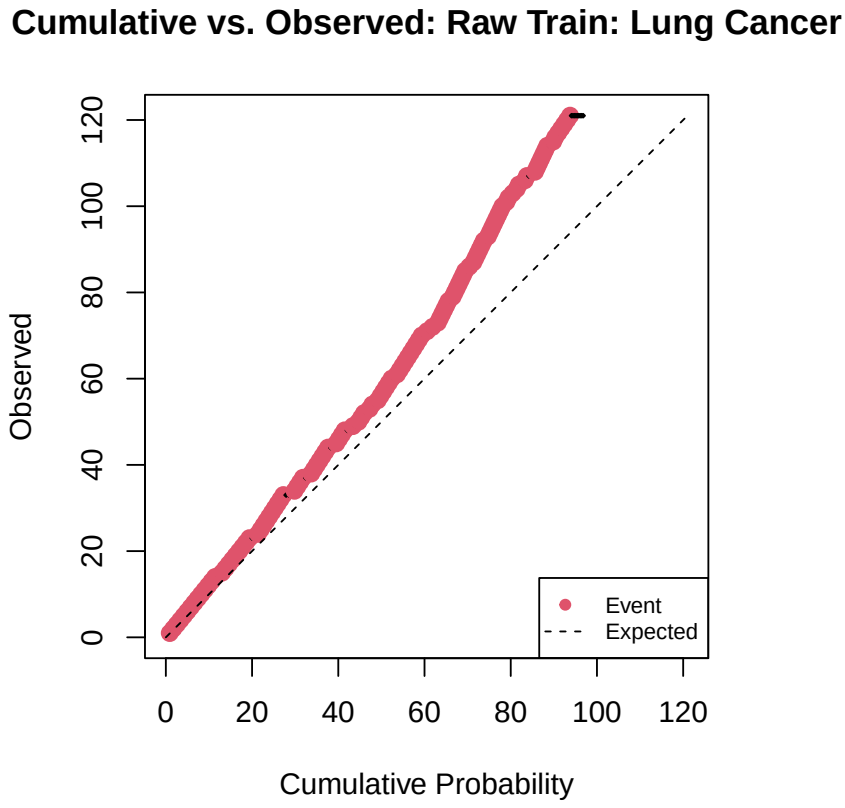
Here we will use the predicted event probability assuming a baseline hazard for events withing 5 years

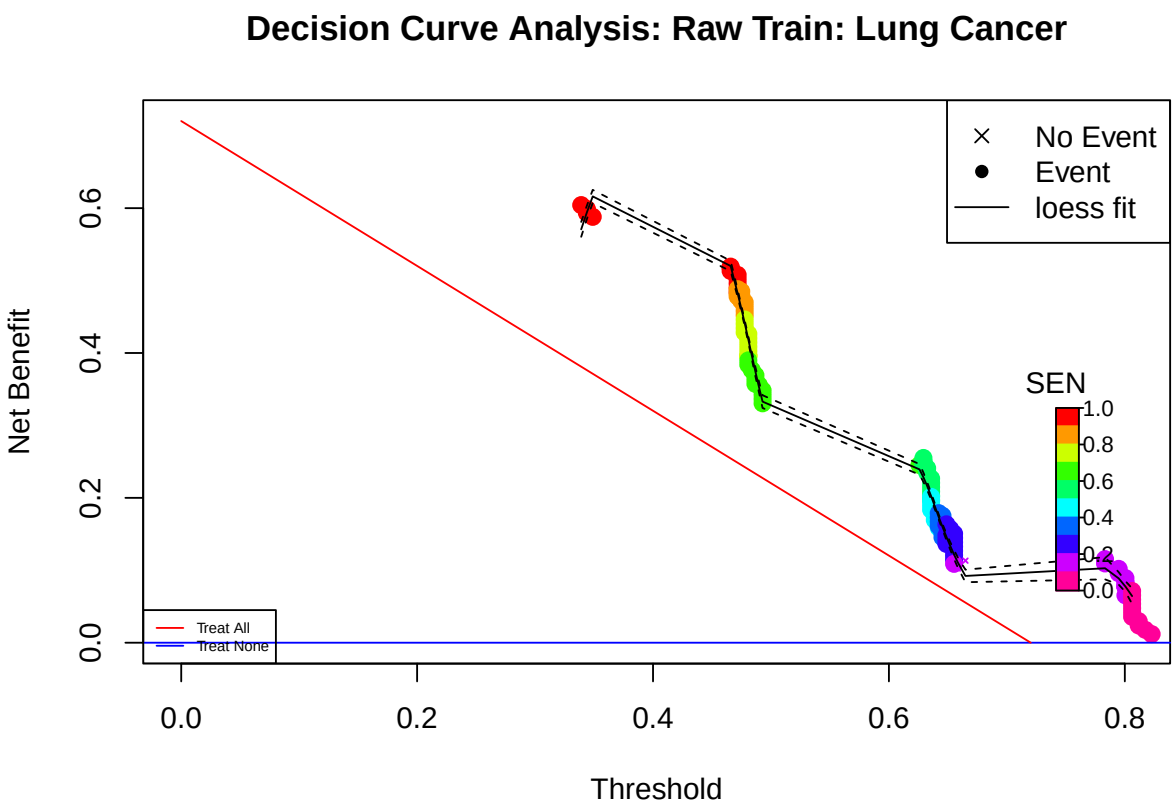
```
timeinterval <- 2*mean(subset(lung,status==1)$time)

h0 <- sum(lung$status & lung$time <= timeinterval)
h0 <- h0/sum((lung$time > timeinterval) | (lung$status==1))
pander::pander(t(c(h0=h0,timeinterval=timeinterval)),caption="Initial Parameters")
```

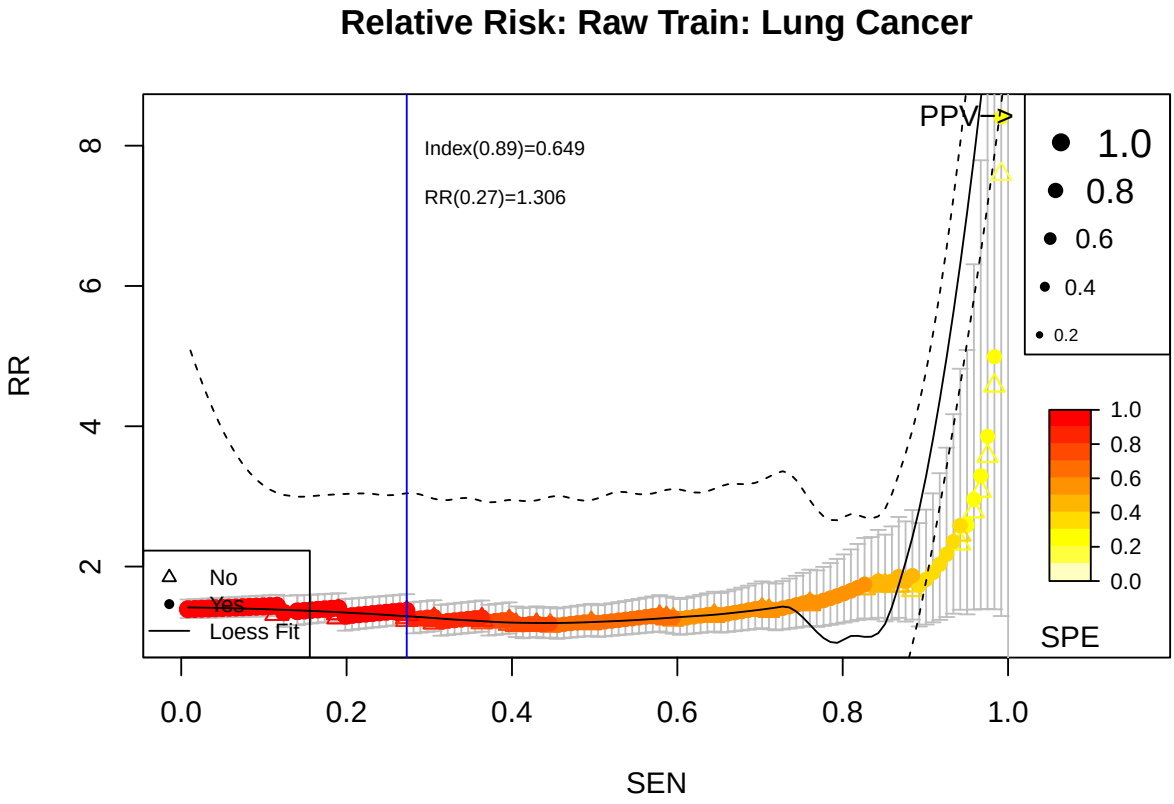
Table 14: Initial Parameters

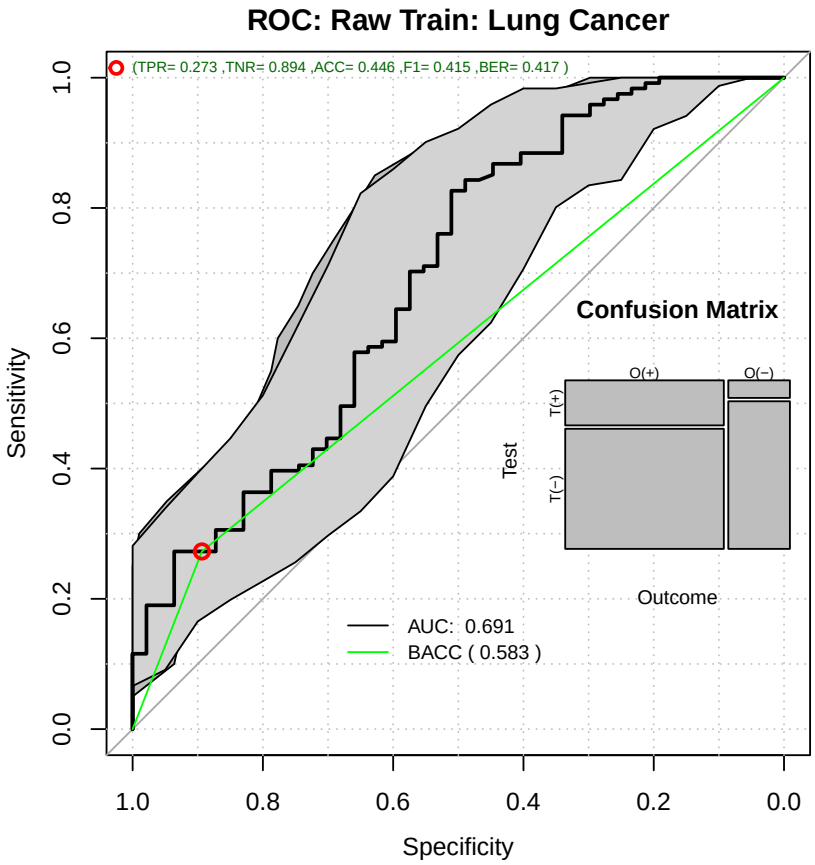
h0	timeinterval
0.85	578

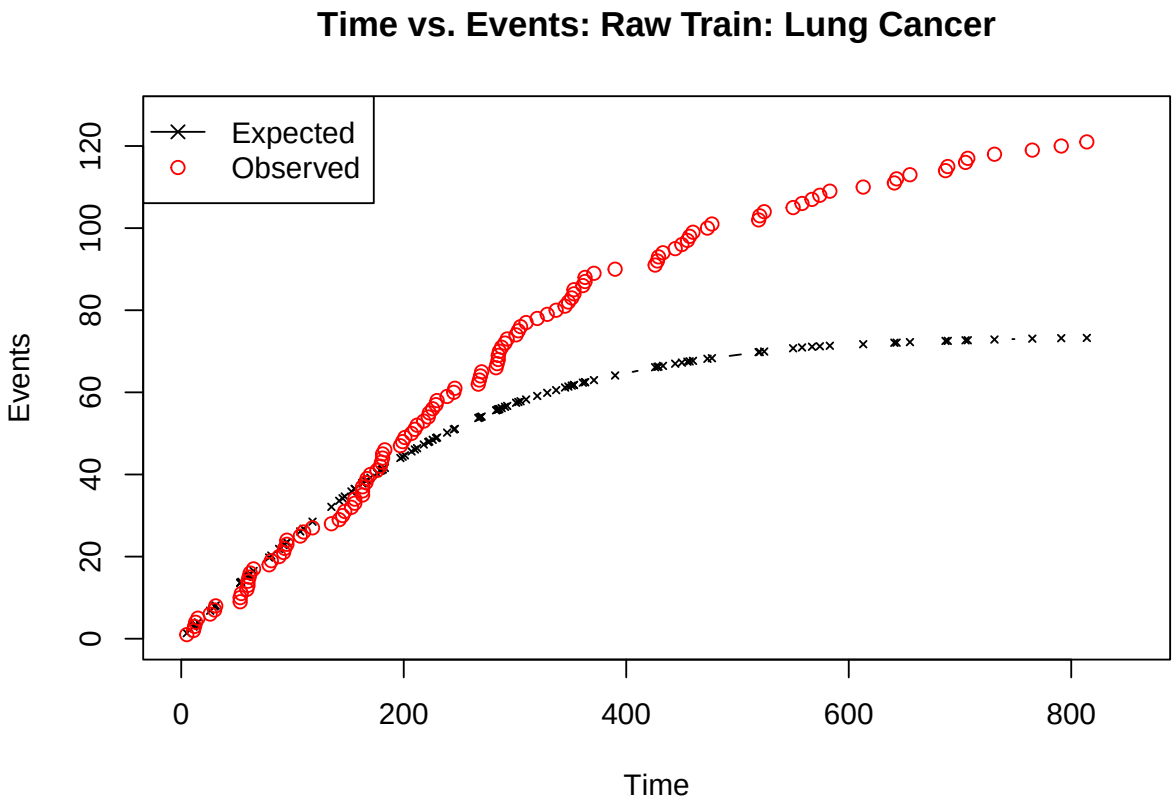
```
index <- predict(ml,lung)

rdata <- cbind(lung$status,ppoisGzero(index,h0))

rrAnalysisTrain <- RRPlot(rdata,atProb=c(0.90),
                      timetoEvent=lung$time,
                      title="Raw Train: Lung Cancer",
                      ysurvlim=c(0.00,1.0),
                      riskTimeInterval=timeinterval)
```

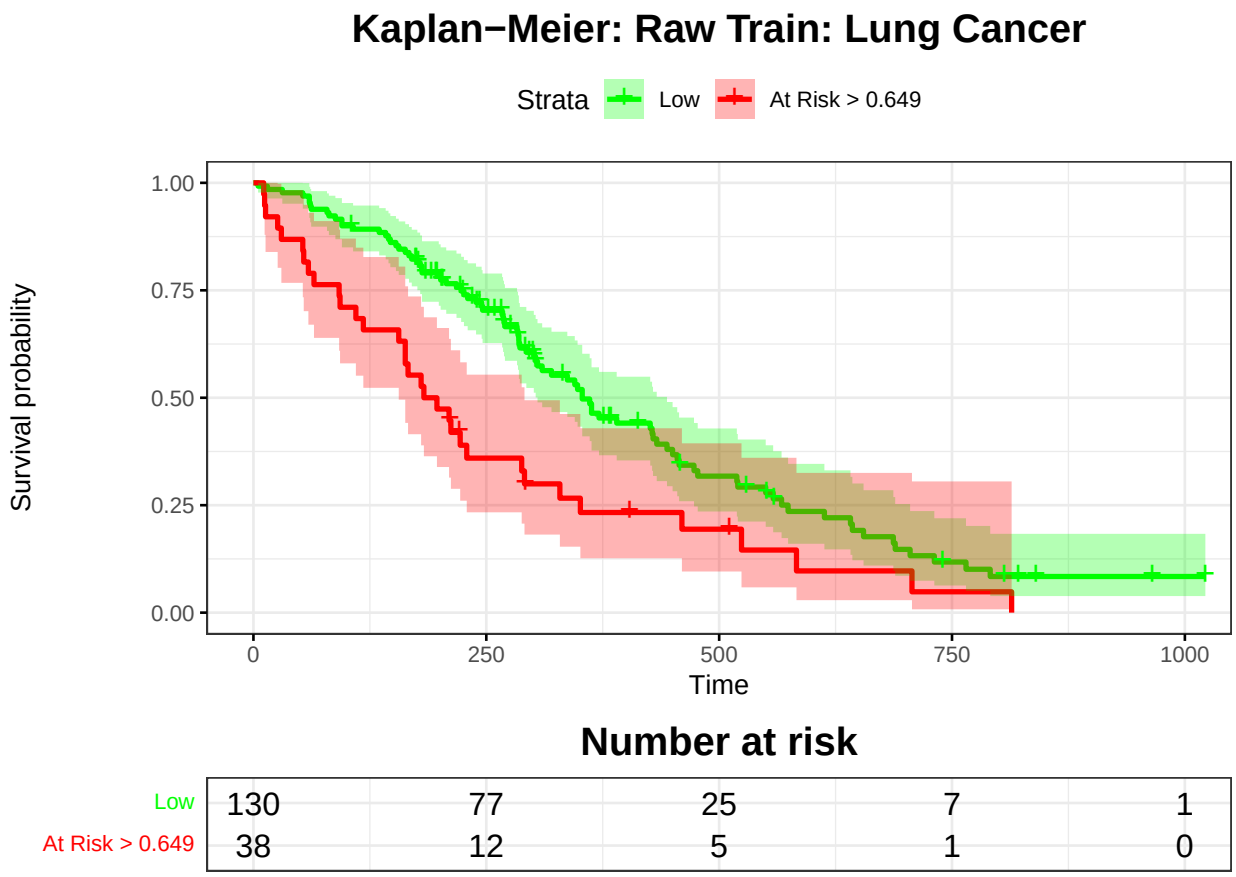



Decision Curve Analysis: Raw Train: Lung Cancer
No Event
Event
loess fit
SEN
1.0
0.8
0.6
0.4
0.2
0.0
Treat All
Treat None
Net Benefit
0.0
0.2
0.4
0.6
0.0
0.2
0.4
0.6
0.8
Threshold


Relative Risk: Raw Train: Lung Cancer
Index(0.89)=0.649
RR(0.27)=1.306
PPV
1.0
0.8
0.6
0.4
0.2
SPE
No
Yes
Loess Fit
RR
SEN
2
4
6
8
0.0
0.2
0.4
0.6
0.8
1.0


ROC: Raw Train: Lung Cancer
(TPR= 0.273 ,TNR= 0.894 ,ACC= 0.446 ,F1= 0.415 ,BER= 0.417)
Sensitivity
1.0
0.8
0.6
0.4
0.2
0.0
Specificity
1.0
0.8
0.6
0.4
0.2
0.0
Confusion Matrix
O(+)
O(−)
T(+)
T(−)
Test
Outcome
AUC: 0.691
BACC (0.583)


Time vs. Events: Raw Train: Lung Cancer
Expected
Observed
Events
0
20
40
60
80
100
120
0
200
400
600
800
Time



As we can see the Observed probability as well as the Time vs. Events are not calibrated.

1.4.2 Uncalibrated Performance Report

```
pander::pander(t(rrAnalysisTrain$keyPoints),caption="Threshold values")
```

Table 15: Threshold values

	@:0.9	@MAX_BACC	@MAX_RR	@SPE100	p(0.5)
Thr	0.649	0.478	0.339	0.339	0.493
RR	1.240	1.742	68.491	68.491	1.270
SEN	0.273	0.826	1.000	1.000	0.612
SPE	0.872	0.511	0.191	0.191	0.596
BACC	0.573	0.669	0.596	0.596	0.604

```
pander::pander(t(rrAnalysisTrain$OERatio$estimate),caption="O/E Ratio")
```

Table 16: O/E Ratio

O/E	Low	Upper	p.value
1.65	1.37	1.97	3.16e-07

```
pander::pander(t(rrAnalysisTrain$OE95ci),caption="O/E Mean")
```

Table 17: O/E Mean

mean	50%	2.5%	97.5%
1.23	1.23	1.18	1.27

```
pander::pander(t(rrAnalysisTrain$OAcum95ci),caption="O/Acum Mean")
```

Table 18: O/Acum Mean

mean	50%	2.5%	97.5%
1.2	1.2	1.19	1.21

```
pander::pander(rrAnalysisTrain$c.index$cstatCI,caption="C. Index")
```

mean.C Index	median	lower	upper
0.651	0.65	0.585	0.709

```
pander::pander(t(rrAnalysisTrain$ROCAnalysis$aucs),caption="ROC AUC")
```

Table 20: ROC AUC

est	lower	upper
0.691	0.598	0.784

```
pander::pander((rrAnalysisTrain$ROCAnalysis$sensitivity),caption="Sensitivity")
```

Table 21: Sensitivity

est	lower	upper
0.273	0.196	0.361

```
pander::pander((rrAnalysisTrain$ROCAnalysis$specificity),caption="Specificity")
```

Table 22: Specificity

est	lower	upper
0.894	0.769	0.965

```
pander::pander(t(rrAnalysisTrain$thr_atP),caption="Probability Thresholds")
```

Table 23: Probability Thresholds

90%
0.649

```
pander::pander(t(rrAnalysisTrain$RR_atP),caption="Risk Ratio")
```

Table 24: Risk Ratio

est	lower	upper
1.31	1.11	1.54

```
pander::pander(rrAnalysisTrain$surdif,caption="Logrank test")
```

Table 25: Logrank test Chisq = 10.879375 on 1 degrees of freedom, p = 0.000972

	N	Observed	Expected	(O-E)^2/E	(O-E)^2/V
class=0	130	88	101.3	1.76	10.9
class=1	38	33	19.7	9.05	10.9

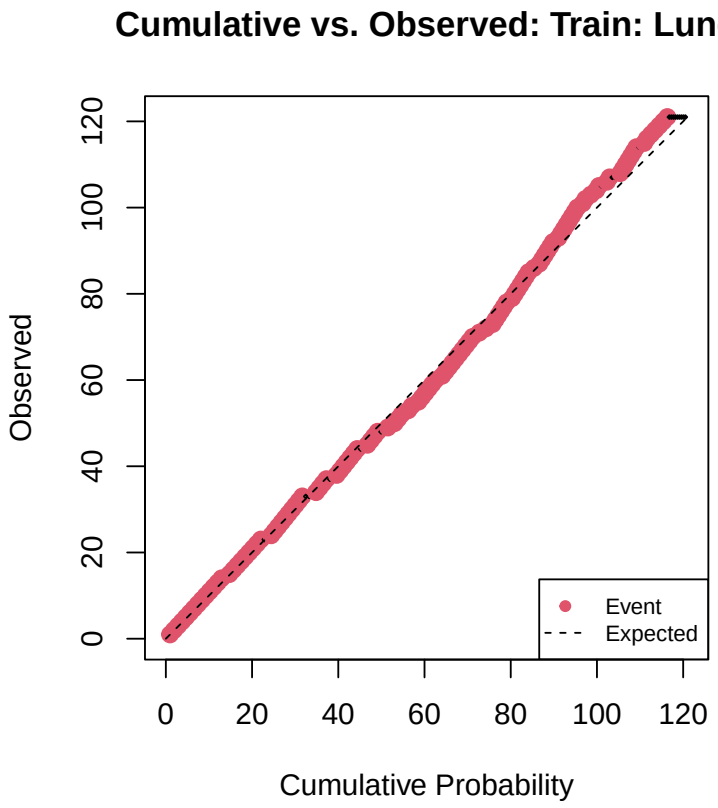
1.4.3 Cox Calibration

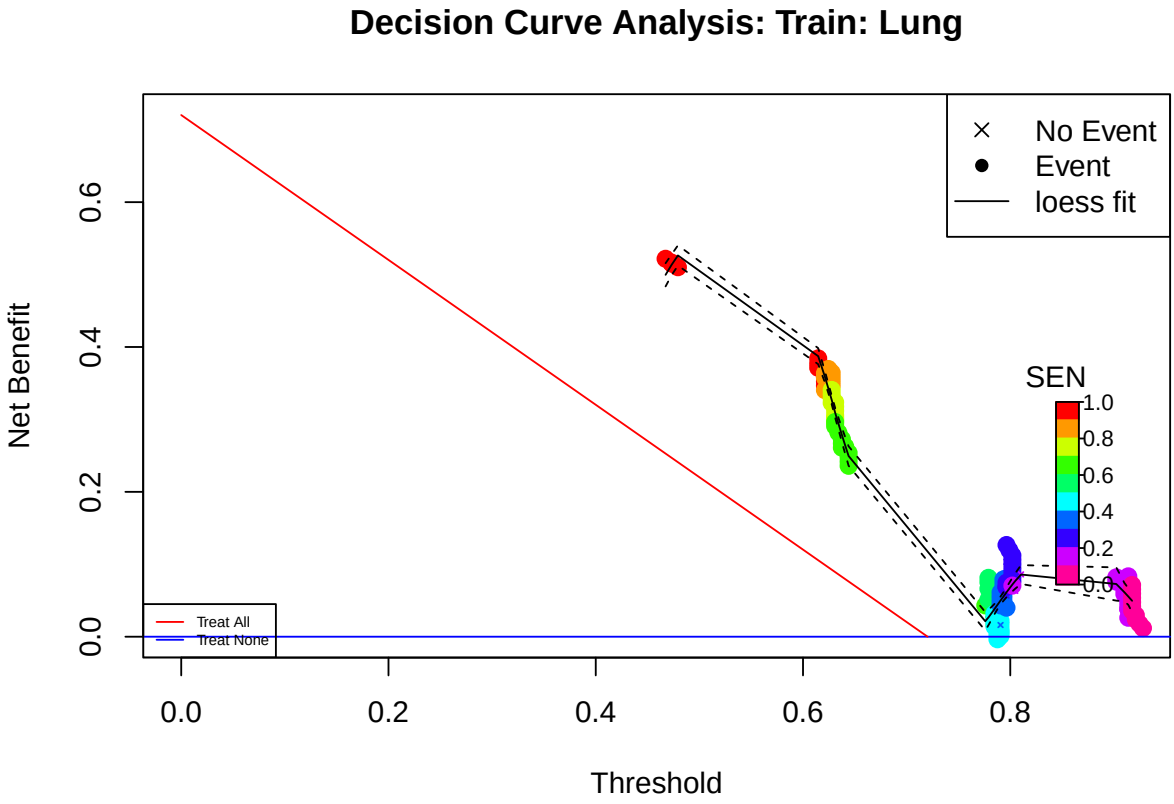
```
op <- par(no.readonly = TRUE)


calprob <- CoxRiskCalibration(ml,lung,"status","time")

pander::pander(c(h0=calprob$h0,
                 Gain=calprob$hazardGain,
                 DeltaTime=calprob$timeInterval),
               caption="Cox Calibration Parameters")
```

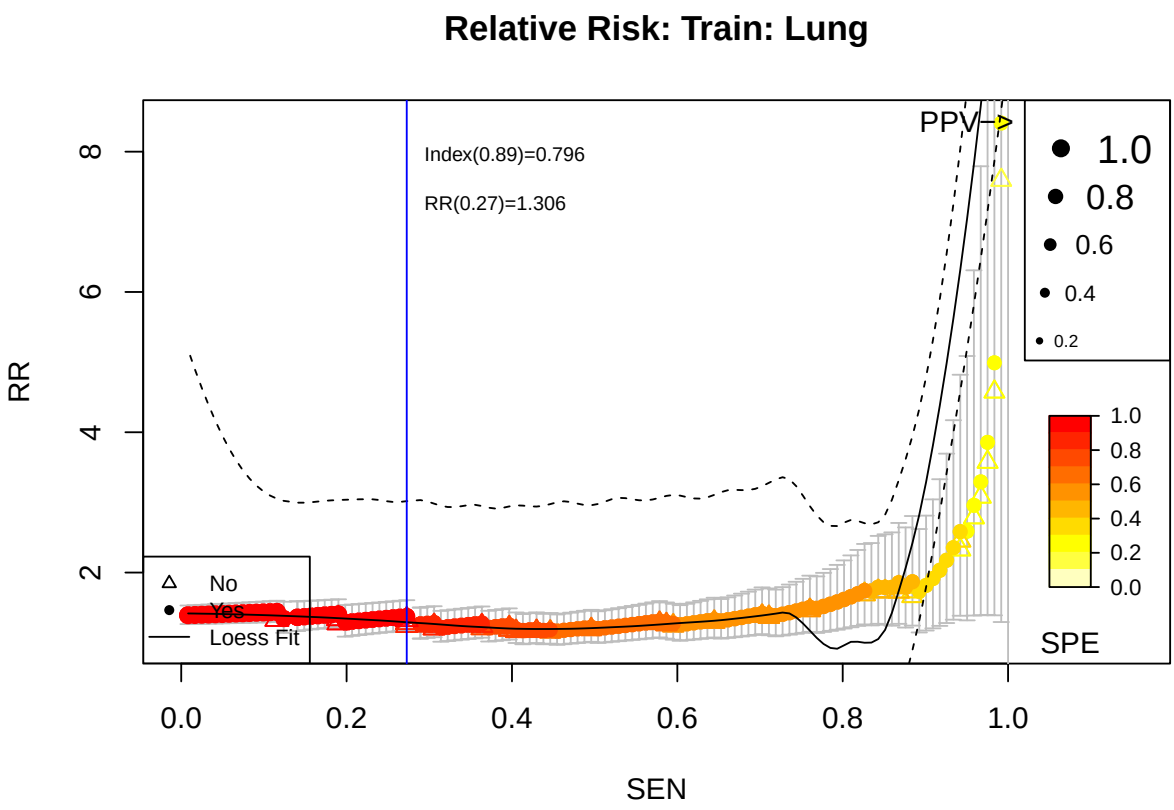
h0	Gain	DeltaTime
1.29	1.52	749

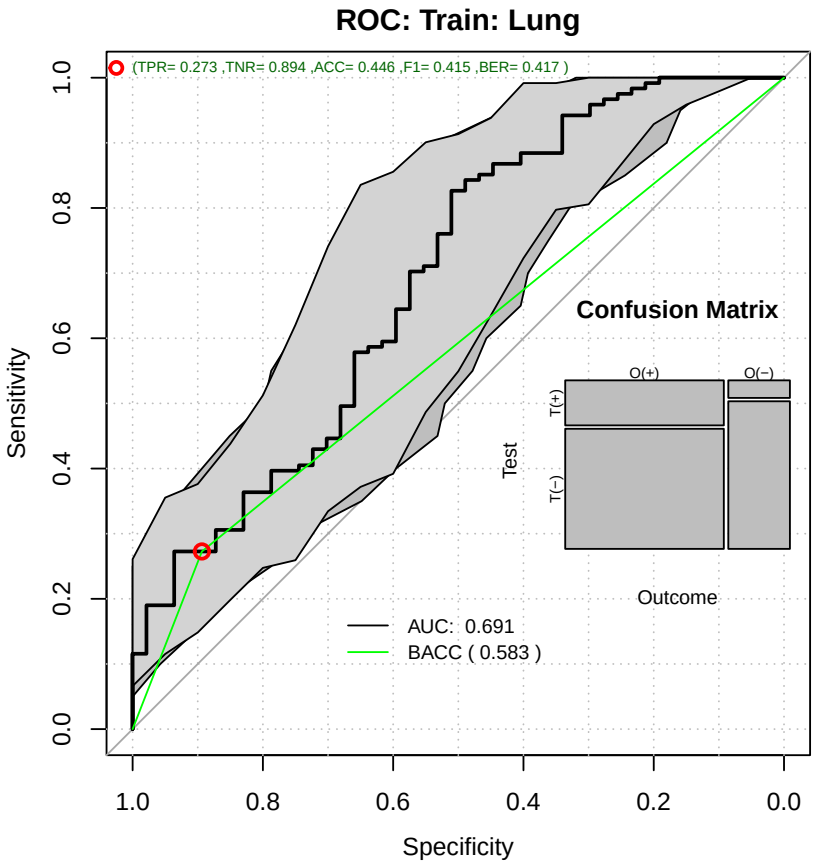
1.4.4 The RRplot() of the calibrated model

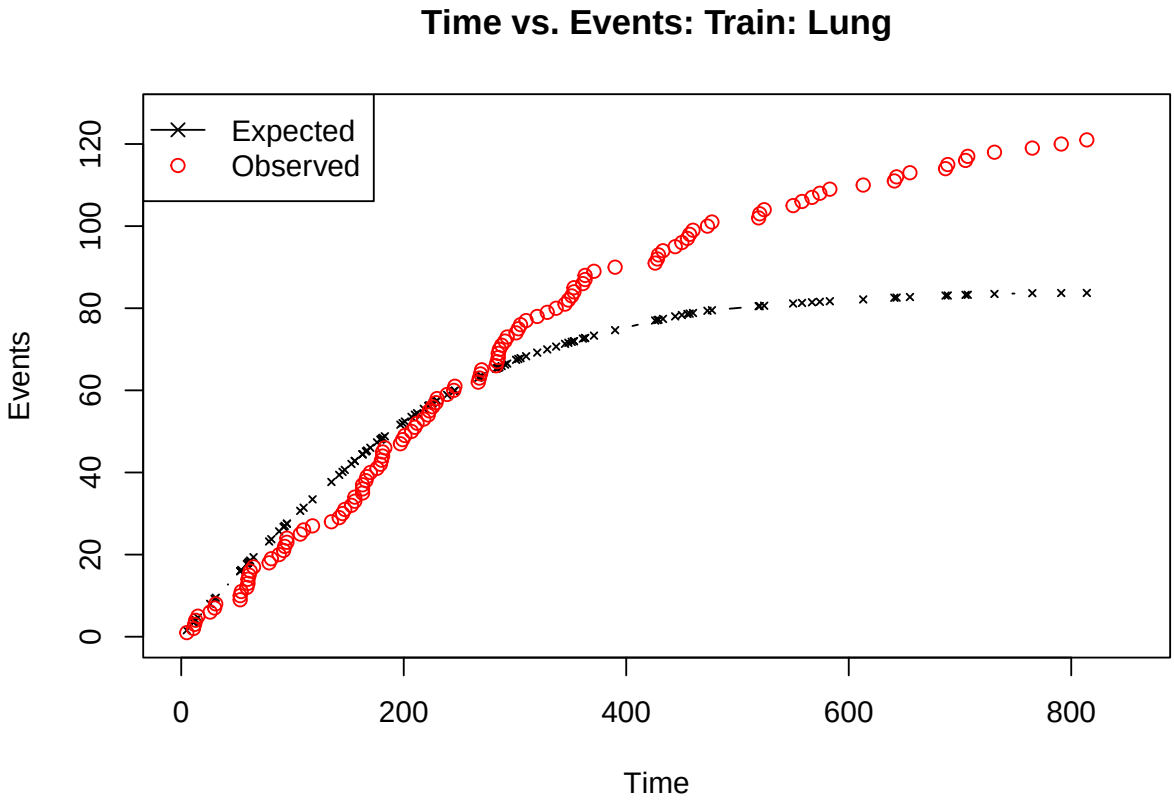
```
h0 <- calprob$h0
timeinterval <- calprob$timeInterval;

rdata <- cbind(lung$status,calprob$prob)


rrAnalysisTrain <- RRPlot(rdata,atProb=c(0.90),
                      timetoEvent=lung$time,
                      title="Train: Lung",
                      ysurvlim=c(0.00,1.0),
                      riskTimeInterval=timeinterval)
```

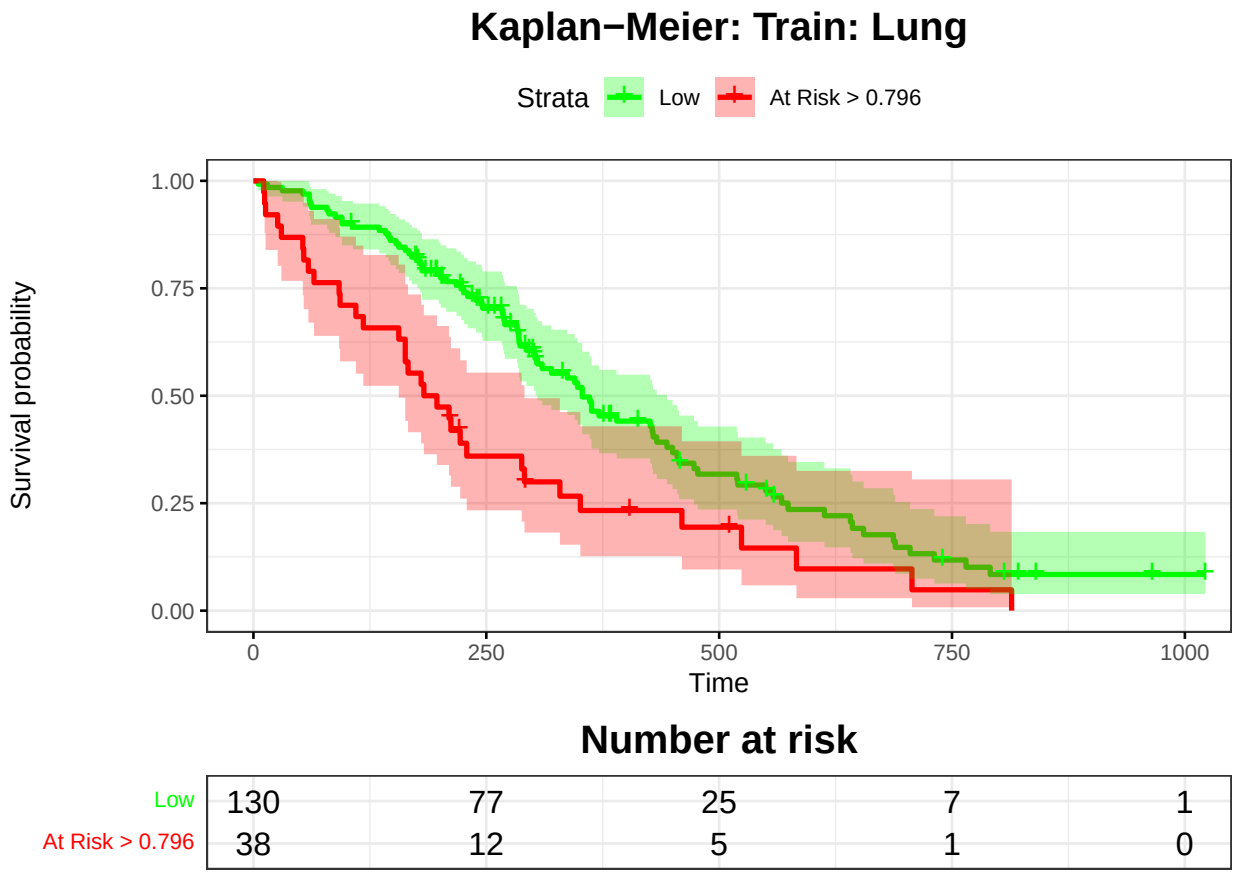

Cumulative vs. Observed: Train: Lung
Observed
0
20
40
60
80
100
120
Event
Expected
0
20
40
60
80
100
120
Cumulative Probability


Decision Curve Analysis: Train: Lung
No Event
Event
loess fit
SEN
1.0
0.8
0.6
0.4
0.2
0.0
Treat All
Treat None
Net Benefit
0.0
0.2
0.4
0.6
0.0
0.2
0.4
0.6
0.8
Threshold


Relative Risk: Train: Lung
Index(0.89)=0.796
RR(0.27)=1.306
PPV
1.0
0.8
0.6
0.4
0.2
SPE
No
Yes
Loess Fit
RR
SEN
2
4
6
8
0.0
0.2
0.4
0.6
0.8
1.0


ROC: Train: Lung
(TPR= 0.273 ,TNR= 0.894 ,ACC= 0.446 ,F1= 0.415 ,BER= 0.417)
Sensitivity
1.0
0.8
0.6
0.4
0.2
0.0
Specificity
1.0
0.8
0.6
0.4
0.2
0.0
Confusion Matrix
O(+)
O(−)
T(+)
T(−)
Test
Outcome
AUC: 0.691
BACC (0.583)


Time vs. Events: Train: Lung
Expected
Observed
Events
0
20
40
60
80
100
120
0
200
400
600
800
Time



1.4.5 Calibrated Train Performance

```
pander::pander(t(rrAnalysisTrain$keyPoints),caption="Threshold values")
```

Table 27: Threshold values

	@:0.9	@MAX_BACC	@MAX_RR	@SPE100	p(0.5)
Thr	0.796	0.628	0.467	0.467	0.479
RR	1.240	1.742	68.491	68.491	2.784
SEN	0.273	0.826	1.000	1.000	0.959
SPE	0.872	0.511	0.191	0.191	0.277
BACC	0.573	0.669	0.596	0.596	0.618

```
pander::pander(t(rrAnalysisTrain$OERatio$estimate),caption="O/E Ratio")
```

Table 28: O/E Ratio

O/E	Low	Upper	p.value
1.45	1.2	1.73	0.000124

```
pander::pander(t(rrAnalysisTrain$OE95ci),caption="O/E Mean")
```

Table 29: O/E Mean

mean	50%	2.5%	97.5%
1.06	1.06	1.02	1.1

```
pander::pander(t(rrAnalysisTrain$OAcum95ci),caption="O/Acum Mean")
```

Table 30: O/Acum Mean

mean	50%	2.5%	97.5%
1	1	0.996	1.01

```
pander::pander(rrAnalysisTrain$c.index$cstatCI,caption="C. Index")
```

mean.C Index	median	lower	upper
0.651	0.649	0.585	0.712

```
pander::pander(t(rrAnalysisTrain$ROCAnalysis$aucs),caption="ROC AUC")
```

Table 32: ROC AUC

est	lower	upper
0.691	0.598	0.784

```
pander::pander((rrAnalysisTrain$ROCAnalysis$sensitivity),caption="Sensitivity")
```

Table 33: Sensitivity

est	lower	upper
0.273	0.196	0.361

```
pander::pander((rrAnalysisTrain$ROCAnalysis$specificity),caption="Specificity")
```

Table 34: Specificity

est	lower	upper
0.894	0.769	0.965

```
pander::pander(t(rrAnalysisTrain$thr_atP),caption="Probability Thresholds")
```

Table 35: Probability Thresholds

90%
0.796

```
pander::pander(t(rrAnalysisTrain$RR_atP),caption="Risk Ratio")
```

Table 36: Risk Ratio

est	lower	upper
1.31	1.11	1.54

```
pander::pander(rrAnalysisTrain$surdif,caption="Logrank test")
```

Table 37: Logrank test Chisq = 10.879375 on 1 degrees of freedom, p = 0.000972

	N	Observed	Expected	(O-E)^2/E	(O-E)^2/V
class=0	130	88	101.3	1.76	10.9
class=1	38	33	19.7	9.05	10.9

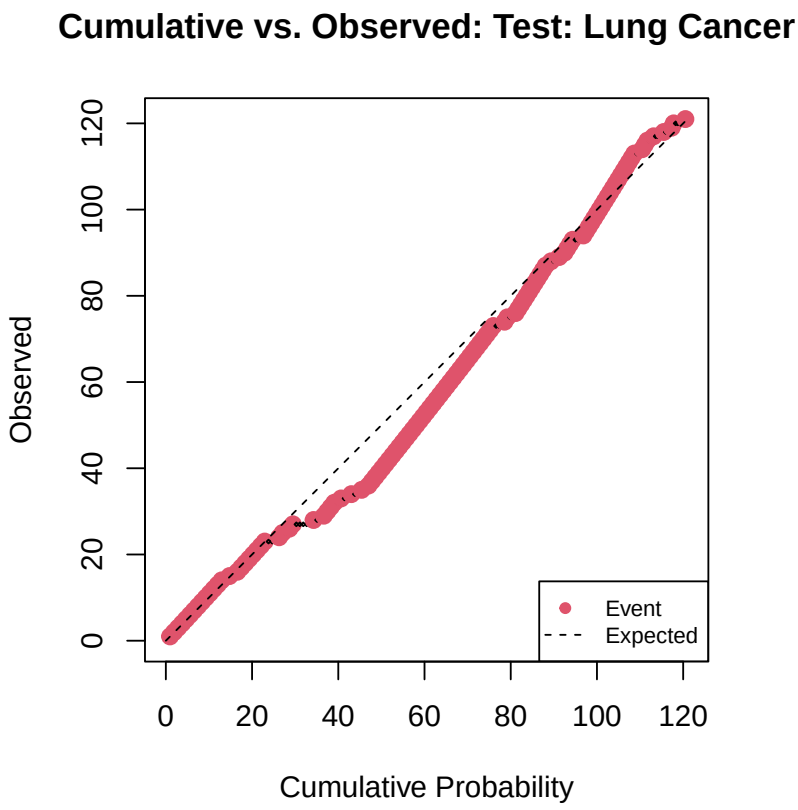
1.5 Cross-Validation

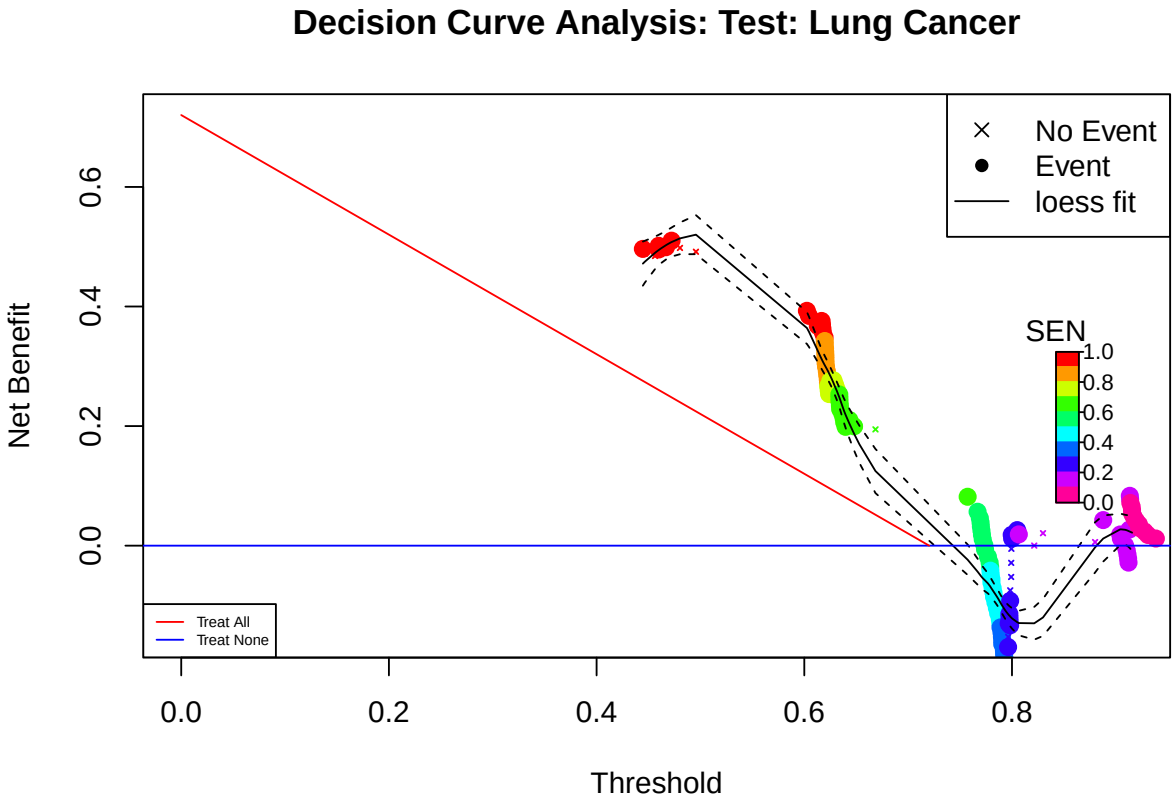
```
rcv <- randomCV(theData=lung,
                theOutcome = Surv(time,status)~1,
                fittingFunction=BSWiMS.model,
                trainFraction = 0.95,
                repetitions=200,
                classSamplingType = "Pro"
        )
```

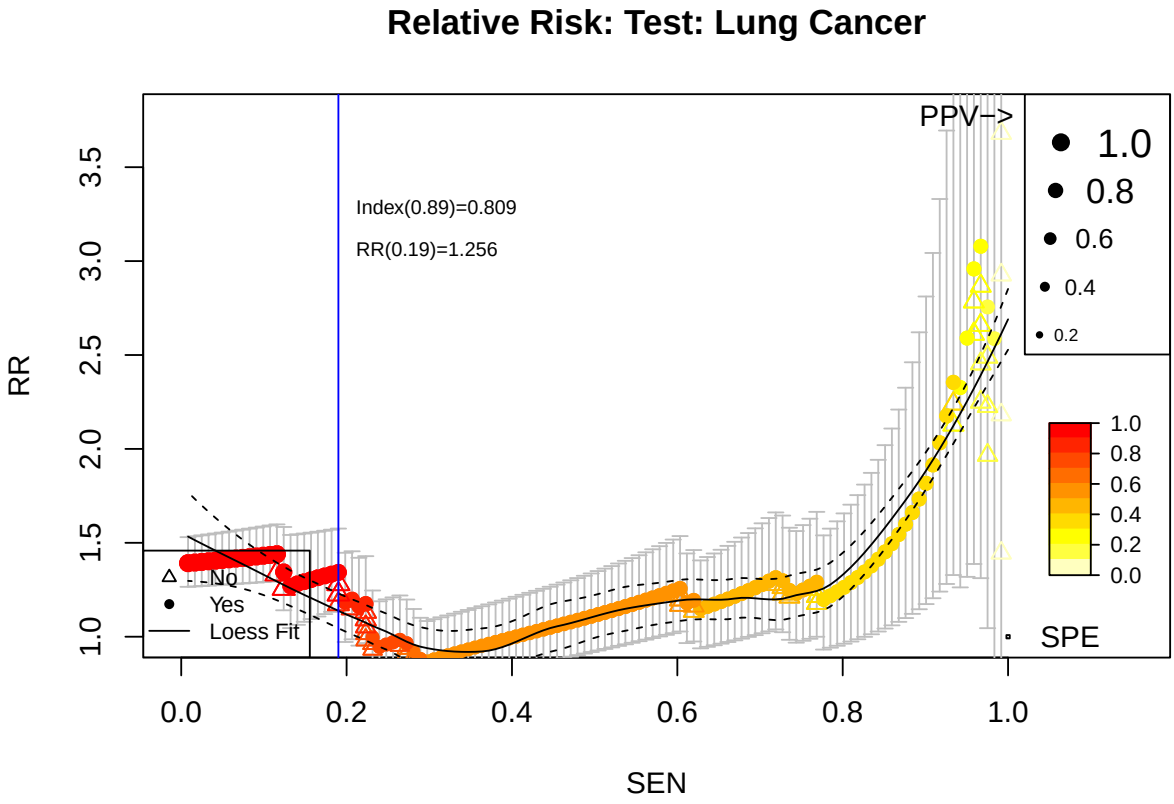
.[++].[+++].[+++].[+++].[+++].[++].[++++].[++].[+++].[+++]10 Tested: 71 Avg. Selected: 3.8 Min Tests: 1 Max Tests: 3 Mean Tests: 1.408451 . MAD: 0.4851003 .[+++].[+++].[++-].[+++].[+++].[++].[+++].[++].[++++].[+++]20 Tested: 111 Avg. Selected: 3.8 Min Tests: 1 Max Tests: 5 Mean Tests: 1.801802 . MAD: 0.484259 .[++].[++].[++].[++].[++-].[+++].[++].[++].[+++].[+++]30 Tested: 135 Avg. Selected: 3.633333 Min Tests: 1 Max Tests: 7 Mean Tests: 2.222222 . MAD: 0.481389 .[+-].[+-].[++].[++++].[++].[++].[++].[++].[+++].[+++]40 Tested: 150 Avg. Selected: 3.5 Min Tests: 1 Max Tests: 7 Mean Tests: 2.666667 . MAD: 0.4782527 .[+++].[++++].[++++].[++++].[+++].[++++].[++].[+++].[+++].[+++] Tested: 157 Avg. Selected: 3.66 Min Tests: 1 Max Tests: 8 Mean Tests: 3.184713 . MAD: 0.4795391 .[+++].[++].[+++].[+++].[++].[+++].[+++].[+++].[+++].[+]60 Tested: 164 Avg. Selected: 3.65 Min Tests: 1 Max Tests: 10 Mean Tests: 3.658537 . MAD: 0.4776671 .[+++].[++-].[++].[++].[++-].[+++].[+++].[+++].[++].[+++]70 Tested: 166 Avg. Selected: 3.628571 Min Tests: 1 Max Tests: 13 Mean Tests: 4.216867 . MAD: 0.4758085 .[+++].[+++].[++].[+++].[+++].[+++].[+++].[++].[++].[++]80 Tested: 167 Avg. Selected: 3.625 Min Tests: 1 Max Tests: 13 Mean Tests: 4.790419 . MAD: 0.4761656 .[+++].[+++].[+++].[+++].[+++].[++++].[+++].[+++].[++].[+]90 Tested: 167 Avg. Selected: 3.644444 Min Tests: 1 Max Tests: 15 Mean Tests: 5.389222 . MAD: 0.4758431 .[+++].[++++].[+++].[++-].[++].[++-].[+++].[+++].[+++].[+]100 Tested: 167 Avg. Selected: 3.64 Min Tests: 1 Max Tests: 15 Mean Tests: 5.988024 . MAD: 0.4761757 .[+++].[++].[++].[++].[++].[+++].[+++].[+].[++++].[++]110 Tested: 167 Avg. Selected: 3.618182 Min Tests: 1 Max Tests: 15 Mean Tests: 6.586826 . MAD: 0.4757842 .[+++].[+++].[++++].[+++].[++-].[++-].[++].[+++].[+++].[+++]120 Tested:

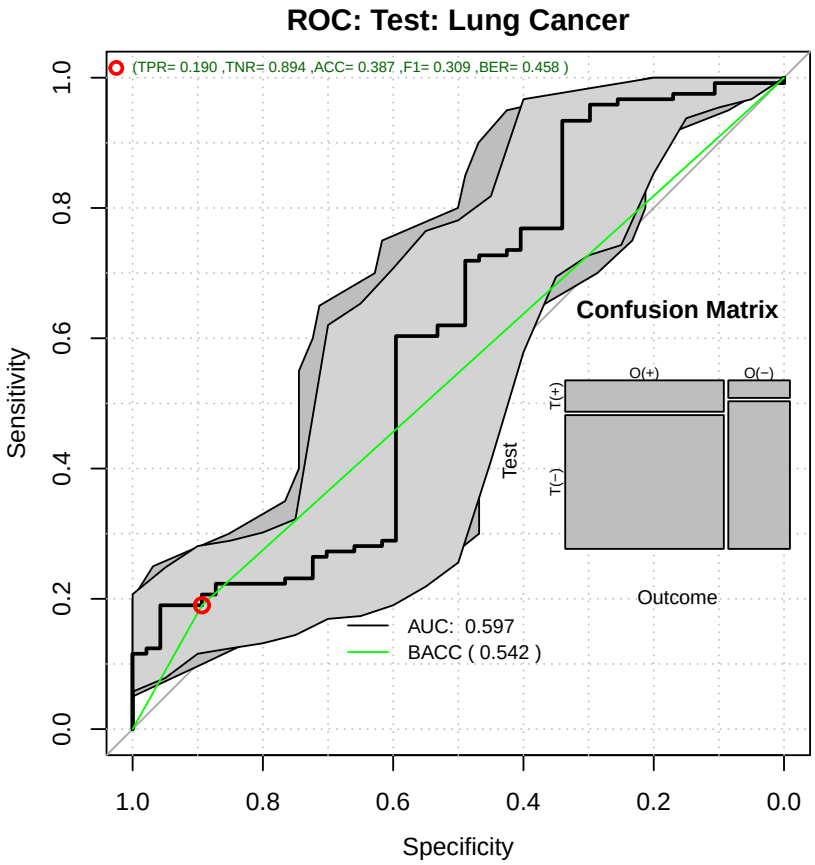
168 Avg. Selected: 3.633333 Min Tests: 1 Max Tests: 16 Mean Tests: 7.142857 . MAD: 0.47593 .[+++].[+++].[+++].[++].[+++].[++].[++].[+++].[+++].[+++]130 Tested: 168 Avg. Selected: 3.638462 Min Tests: 1 Max Tests: 16 Mean Tests: 7.738095 . MAD: 0.4761118 .[+++].[+++].[++].[++].[+++].[++].[+].[+++].[++].[+++]140 Tested: 168 Avg. Selected: 3.621429 Min Tests: 1 Max Tests: 17 Mean Tests: 8.333333 . MAD: 0.4758875 .[+++].[++].[+++].[++++].[+++].[++-].[+++].[+++].[+++].[+++]150 Tested: 168 Avg. Selected: 3.64 Min Tests: 2 Max Tests: 18 Mean Tests: 8.928571 . MAD: 0.4758612 .[++].[+++].[+++].[++].[+++].[++].[+++].[+++].[+++].[+++]160 Tested: 168 Avg. Selected: 3.64375 Min Tests: 2 Max Tests: 19 Mean Tests: 9.52381 . MAD: 0.4758268 .[+++].[+++].[+++].[+++].[+++].[+++].[+++].[+++].[+++].[+++-]170 Tested: 168 Avg. Selected: 3.658824 Min Tests: 2 Max Tests: 19 Mean Tests: 10.11905 . MAD: 0.4762053 .[+].[+++].[++].[+].[++].[+++].[++++].[+++].[+++].[+++]180 Tested: 168 Avg. Selected: 3.65 Min Tests: 3 Max Tests: 20 Mean Tests: 10.71429 . MAD: 0.4760382 .[++++].[+++].[+++].[+++].[+++].[+++].[+++].[+++].[+].[+++ Tested: 168 Avg. Selected: 3.663158 Min Tests: 3 Max Tests: 21 Mean Tests: 11.30952 . MAD: 0.4758161 .[+].[+++].[++].[++].[+++].[+-].[++].[+++].[++].[++++]200 Tested: 168 Avg. Selected: 3.645 Min Tests: 3 Max Tests: 22 Mean Tests: 11.90476 . MAD: 0.4758556

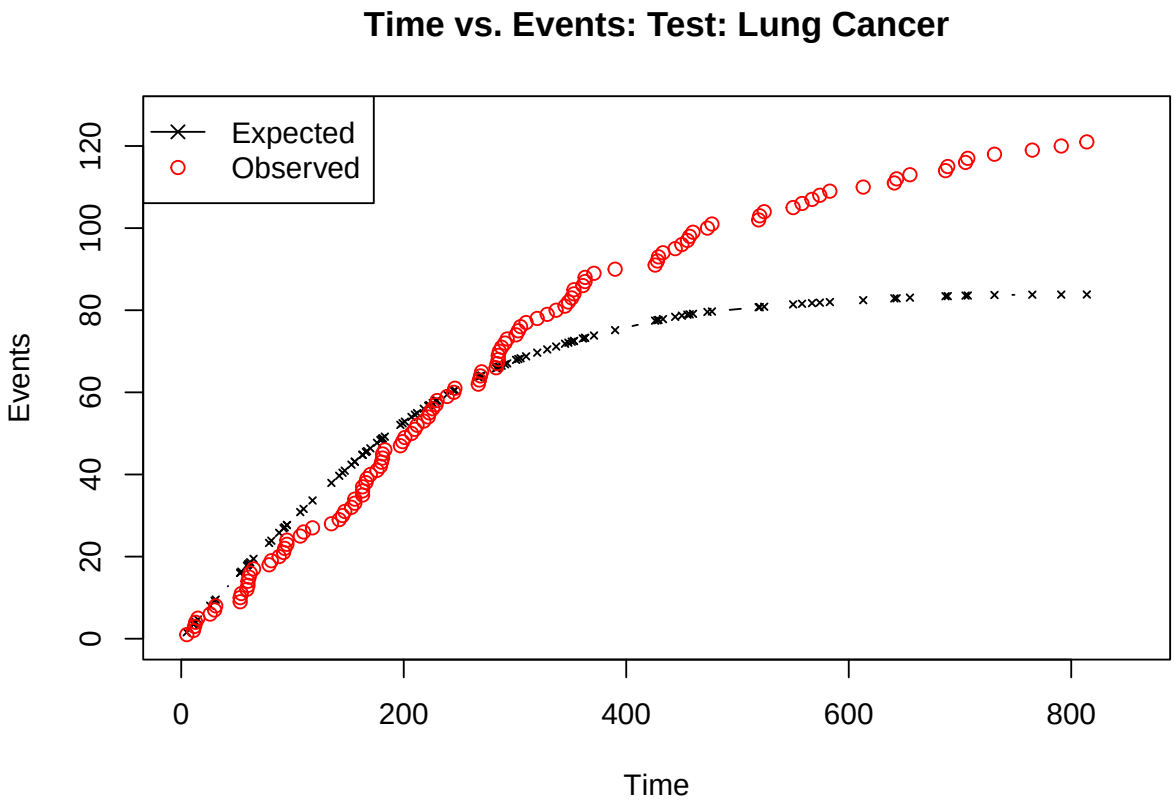
```
stp <- rcv$survTestPredictions
stp <- stp[!is.na(stp[,4]),]

bbx <- boxplot(unlist(stp[,1])~rownames(stp),plot=FALSE)
times <- bbx$stats[3,]
status <- boxplot(unlist(stp[,2])~rownames(stp),plot=FALSE)$stats[3,]
prob <- ppoisGzero(boxplot(unlist(stp[,4])~rownames(stp),plot=FALSE)$stats[3,],h0)

rdatacv <- cbind(status,prob)
rownames(rdatacv) <- bbx$names
names(times) <- bbx$names

rrAnalysisTest <- RRPlot(rdatacv,atProb=c(0.90),
                      timetoEvent=times,
                      title="Test: Lung Cancer",
                      ysurvlim=c(0.00,1.0),
                      riskTimeInterval=timeinterval)
```

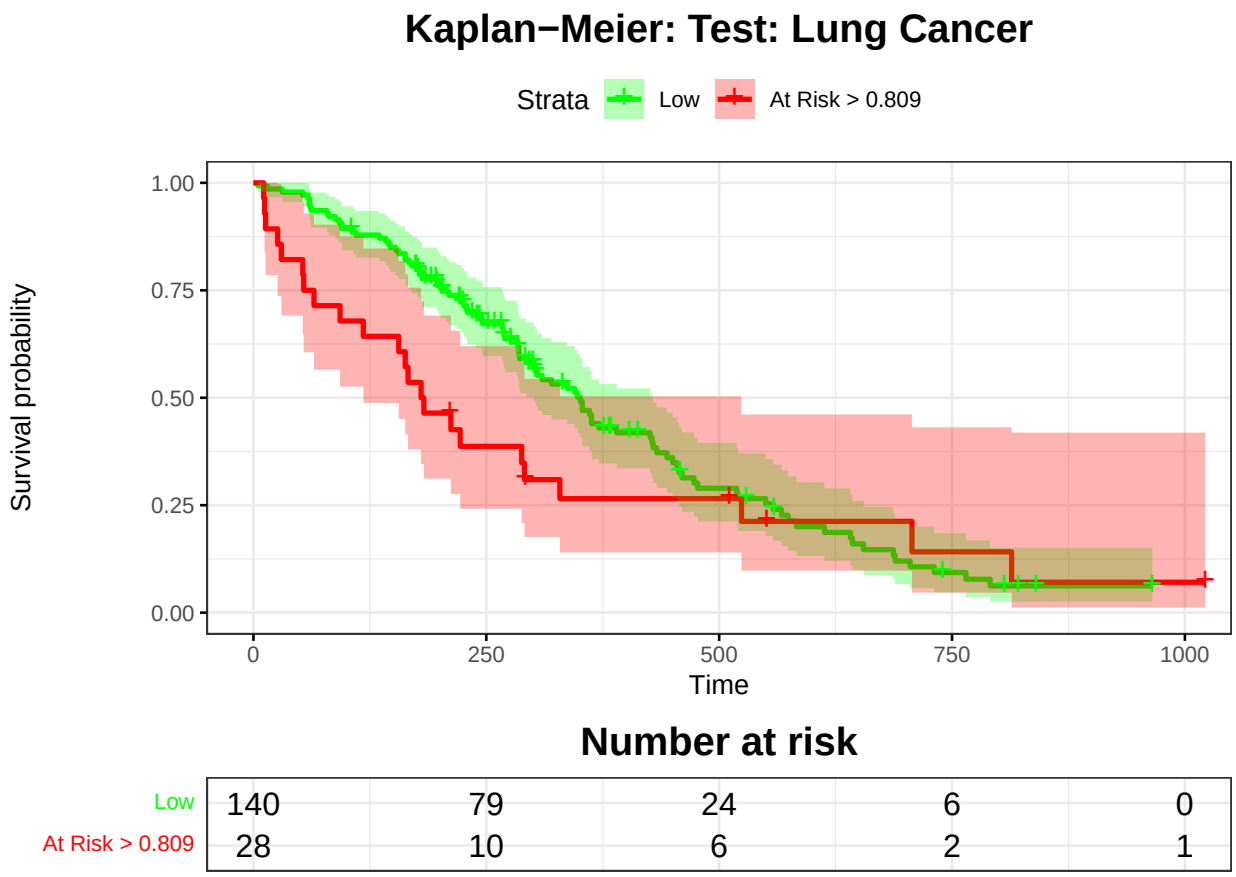

Cumulative vs. Observed: Test: Lung Cancer
Observed
0
20
40
60
80
100
120
Event
Expected
0
20
40
60
80
100
120
Cumulative Probability


Decision Curve Analysis: Test: Lung Cancer
No Event
Event
loess fit
SEN
1.0
0.8
0.6
0.4
0.2
0.0
Treat All
Treat None
Net Benefit
0.0
0.2
0.4
0.6
0.0
0.2
0.4
0.6
0.8
Threshold


Relative Risk: Test: Lung Cancer
PPV–>
1.0
0.8
0.6
0.4
0.2
Index(0.89)=0.809
RR(0.19)=1.256
No
Yes
Loess Fit
SPE
RR
SEN
1.0
1.5
2.0
2.5
3.0
3.5
0.0
0.2
0.4
0.6
0.8
1.0


ROC: Test: Lung Cancer
(TPR= 0.190 ,TNR= 0.894 ,ACC= 0.387 ,F1= 0.309 ,BER= 0.458)
Sensitivity
Specificity
1.0
0.8
0.6
0.4
0.2
0.0
Confusion Matrix
O(+)
O(−)
T(+)
T(−)
Test
Outcome
AUC: 0.597
BACC (0.542)


Time vs. Events: Test: Lung Cancer
Expected
Observed
Events
0
20
40
60
80
100
120
0
200
400
600
800
Time



1.5.1 Cross-Validation Test Performance

```
pander::pander(t(rrAnalysisTest$keyPoints),caption="Threshold values")
```

Table 38: Threshold values

	@:0.9	@MAX_BACC	@MAX_RR	@SPE100	p(0.5)
Thr	0.807	0.617	0.460	0.445	0.496
RR	1.186	2.354	4.444	1.000	2.784
SEN	0.198	0.934	0.992	1.000	0.959
SPE	0.894	0.340	0.106	0.000	0.277
BACC	0.546	0.637	0.549	0.500	0.618

```
pander::pander(t(rrAnalysisTest$OERatio$estimate),caption="O/E Ratio")
```

Table 39: O/E Ratio

O/E	Low	Upper	p.value
1.44	1.2	1.72	0.000126

```
pander::pander(t(rrAnalysisTest$OE95ci),caption="O/E Mean")
```

Table 40: O/E Mean

mean	50%	2.5%	97.5%
1.05	1.05	1.01	1.09

```
pander::pander(t(rrAnalysisTest$OAcum95ci),caption="O/Acum Mean")
```

Table 41: O/Acum Mean

mean	50%	2.5%	97.5%
0.936	0.935	0.922	0.948

```
pander::pander(rrAnalysisTest$c.index$cstatCI,caption="C. Index")
```

mean.C Index	median	lower	upper
0.581	0.579	0.511	0.645

```
pander::pander(t(rrAnalysisTest$ROCAnalysis$aucs),caption="ROC AUC")
```

Table 43: ROC AUC

est	lower	upper
0.597	0.493	0.701

```
pander::pander((rrAnalysisTest$ROCAnalysis$sensitivity),caption="Sensitivity")
```

Table 44: Sensitivity

est	lower	upper
0.19	0.124	0.271

```
pander::pander((rrAnalysisTest$ROCAnalysis$specificity),caption="Specificity")
```

Table 45: Specificity

est	lower	upper
0.894	0.769	0.965

```
pander::pander(t(rrAnalysisTest$thr_atP),caption="Probability Thresholds")
```

Table 46: Probability Thresholds

90%
0.809

```
pander::pander(t(rrAnalysisTest$RR_atP),caption="Risk Ratio")
```

Table 47: Risk Ratio

est	lower	upper
1.26	1.05	1.51

```
pander::pander(rrAnalysisTest$surdif,caption="Logrank test")
```

Table 48: Logrank test Chisq = 2.346444 on 1 degrees of freedom, p = 0.125569

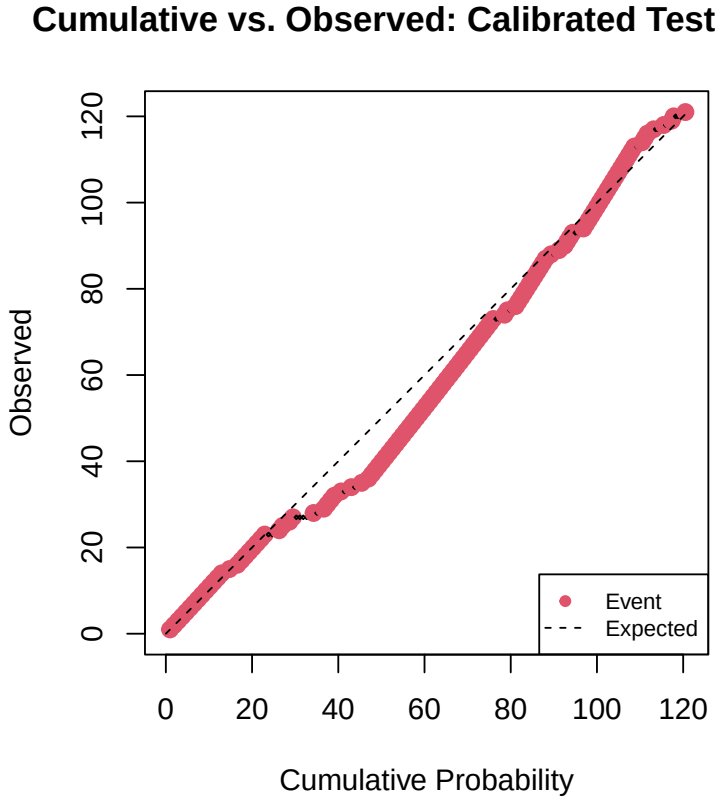
	N	Observed	Expected	(O-E)^2/E	(O-E)^2/V
class=0	140	98	103.8	0.328	2.35
class=1	28	23	17.2	1.981	2.35

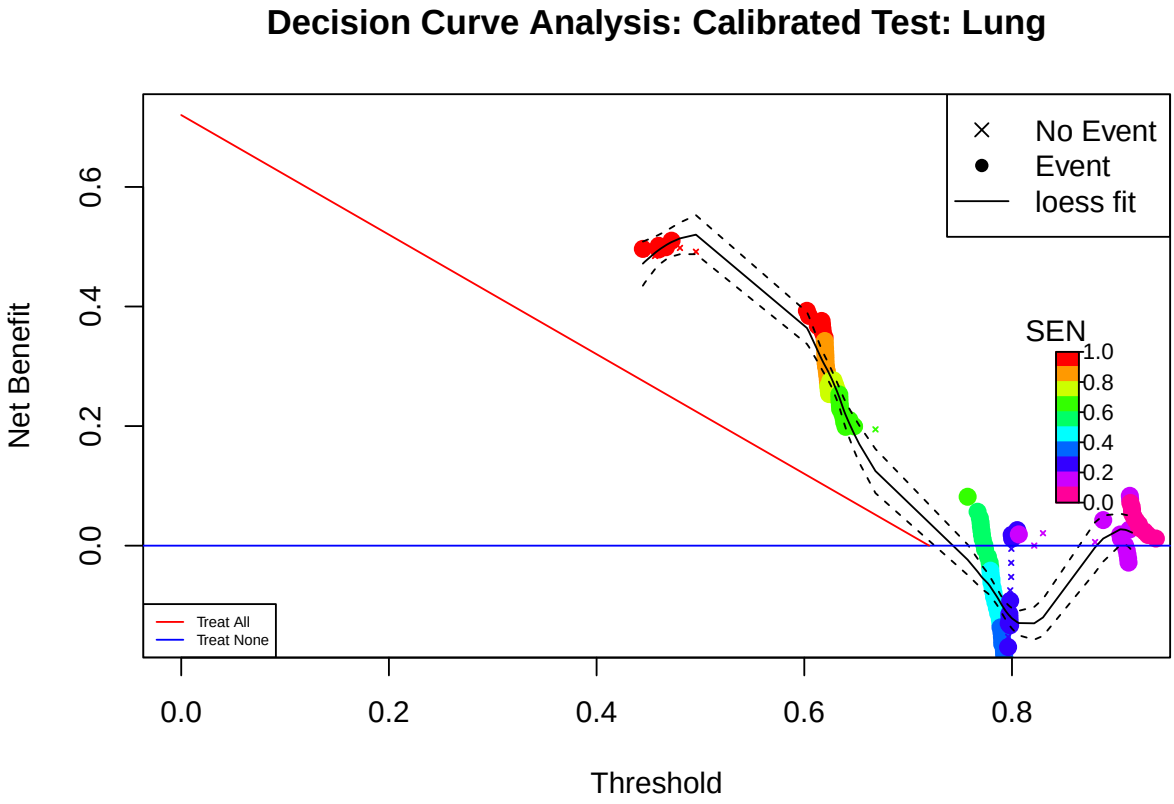
1.5.2 Calibrating the test results

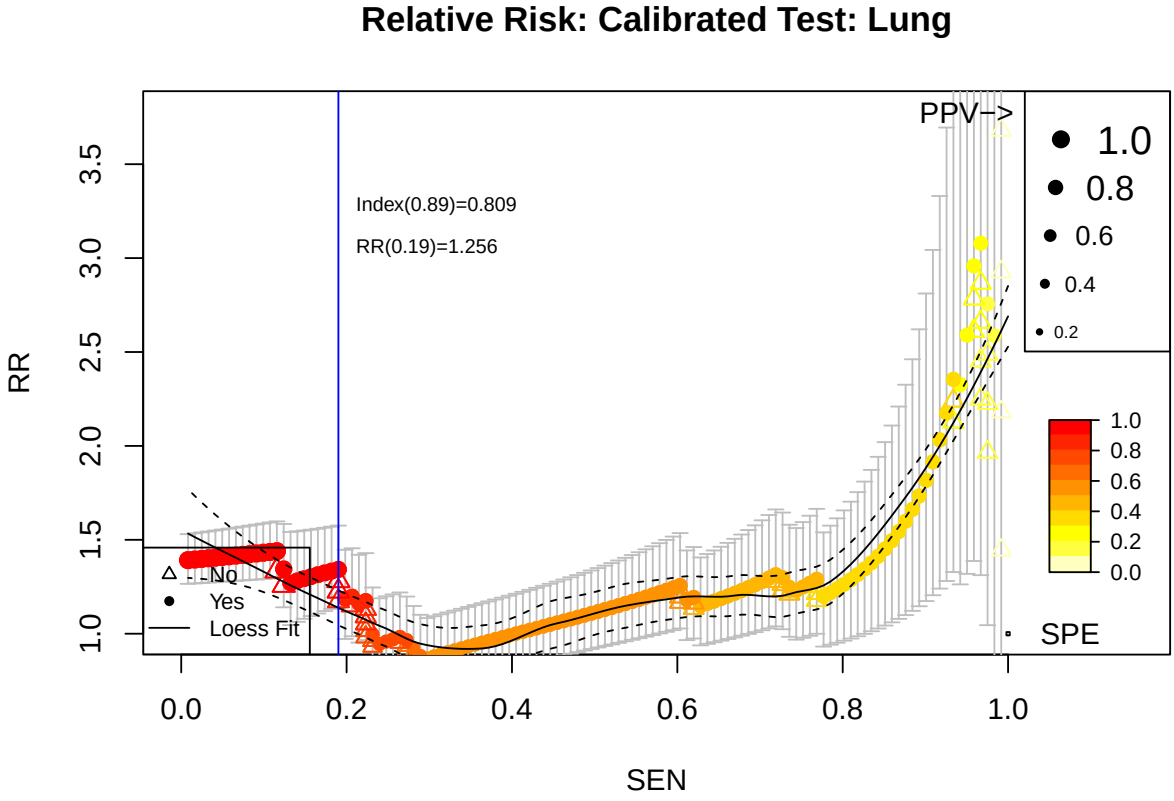
```
rdatacv <- cbind(status,prob,times)
calprob <- CalibrationProbPoissonRisk(rdatacv)

pander::pander(c(h0=calprob$h0,
                 Gain=calprob$hazardGain,
                 DeltaTime=calprob$timeInterval),
               caption="Cox Calibration Parameters")
```

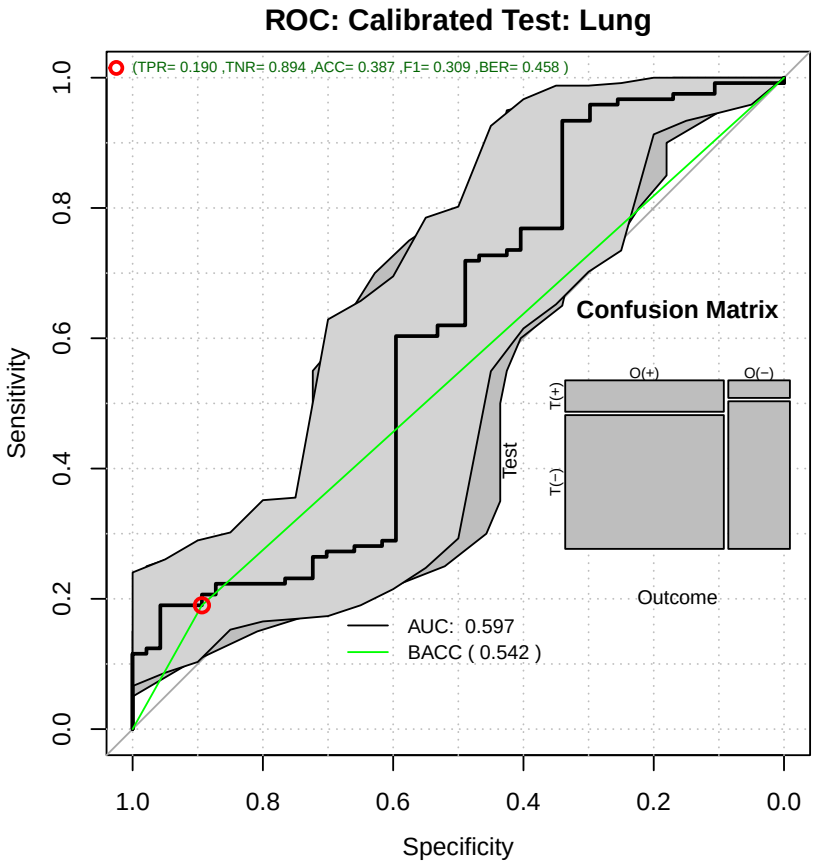
h0	Gain	DeltaTime
0.85	1	755

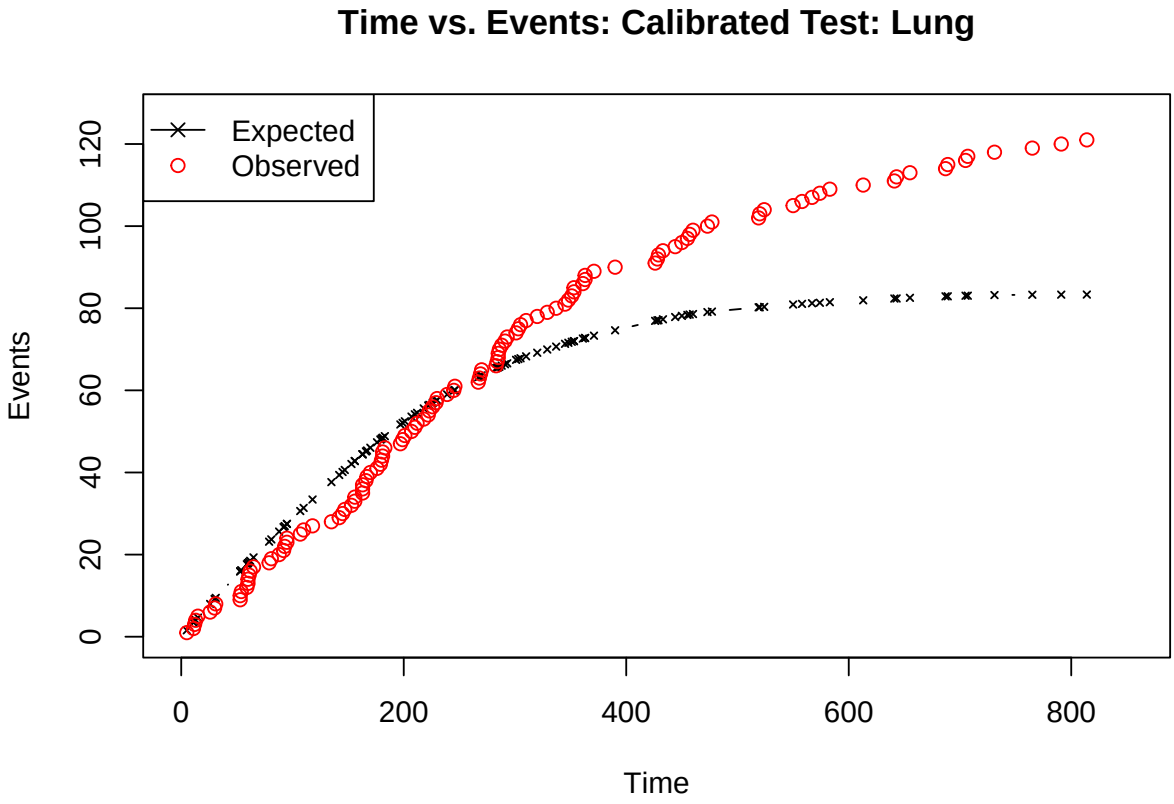
```
timeinterval <- calprob$timeInterval;

rdata <- cbind(status,calprob$prob)


rrAnalysisTest <- RRPlot(rdata,atProb=c(0.90),
                      timetoEvent=times,
                      title="Calibrated Test: Lung",
                      ysurvlim=c(0.00,1.0),
                      riskTimeInterval=timeinterval)
```

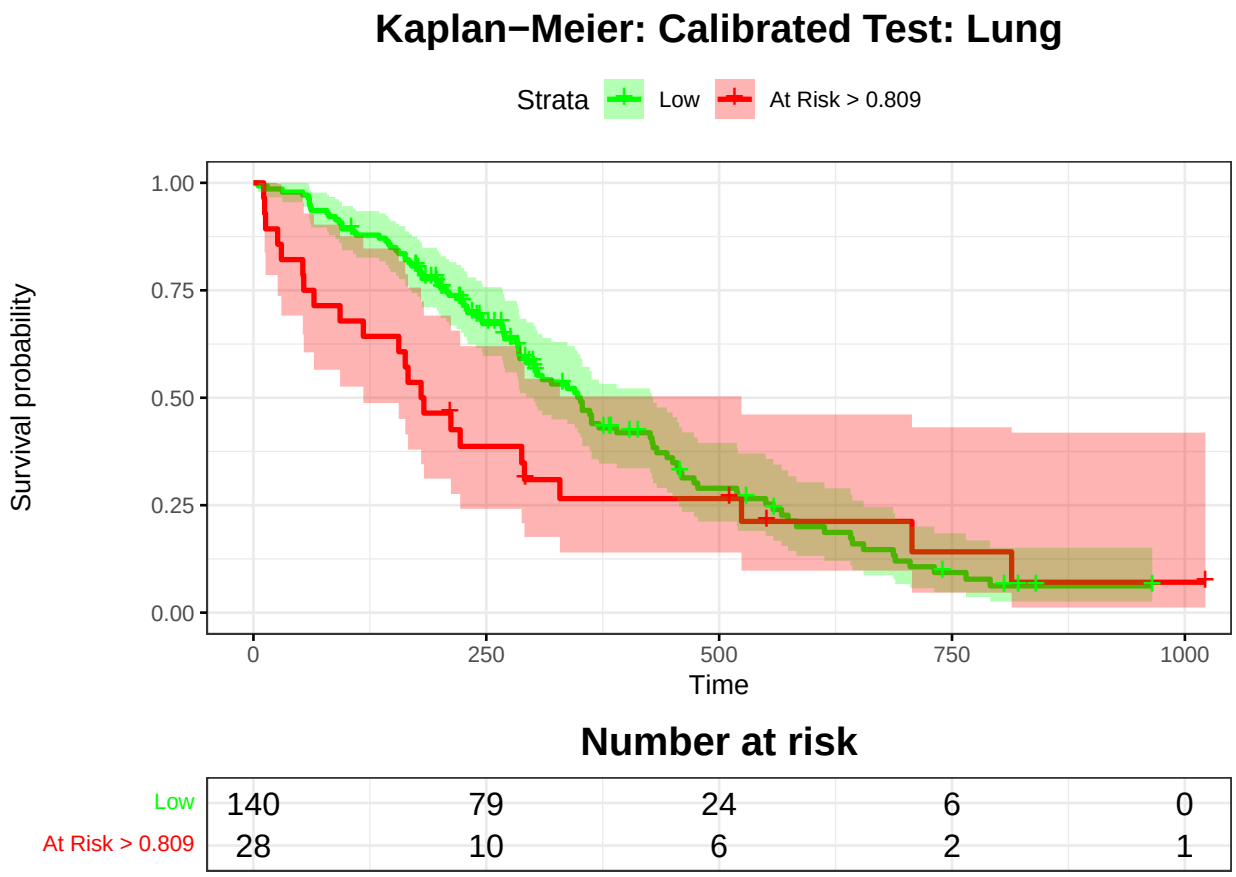

Cumulative vs. Observed: Calibrated Test: Lung
Observed
0
20
40
60
80
100
120
Cumulative Probability
Event
Expected


Decision Curve Analysis: Calibrated Test: Lung
No Event
Event
loess fit
SEN
1.0
0.8
0.6
0.4
0.2
0.0
Treat All
Treat None
Net Benefit
0.0
0.2
0.4
0.6
0.0
0.2
0.4
0.6
0.8
Threshold


Relative Risk: Calibrated Test: Lung
PPV–>
1.0
0.8
0.6
0.4
0.2
Index(0.89)=0.809
RR(0.19)=1.256
No
Yes
Loess Fit
SPE
RR
SEN
1.0
1.5
2.0
2.5
3.0
3.5
0.0
0.2
0.4
0.6
0.8
1.0


ROC: Calibrated Test: Lung
(TPR= 0.190 ,TNR= 0.894 ,ACC= 0.387 ,F1= 0.309 ,BER= 0.458)
Sensitivity
Specificity
1.0
0.8
0.6
0.4
0.2
0.0
Confusion Matrix
O(+)
O(−)
T(+)
T(−)
Test
Outcome
AUC: 0.597
BACC (0.542)


Time vs. Events: Calibrated Test: Lung
Expected
Observed
Events
0
20
40
60
80
100
120
0
200
400
600
800
Time



1.5.3 Calibrated Test Performance

```
pander::pander(t(rrAnalysisTest$keyPoints),caption="Threshold values")
```

Table 50: Threshold values

	@:0.9	@MAX_BACC	@MAX_RR	@SPE100	p(0.5)
Thr	0.807	0.617	0.460	0.445	0.496
RR	1.186	2.354	4.444	1.000	2.784
SEN	0.198	0.934	0.992	1.000	0.959
SPE	0.894	0.340	0.106	0.000	0.277
BACC	0.546	0.637	0.549	0.500	0.618

```
pander::pander(t(rrAnalysisTest$OERatio$estimate),caption="O/E Ratio")
```

Table 51: O/E Ratio

O/E	Low	Upper	p.value
1.45	1.2	1.74	9.64e-05

```
pander::pander(t(rrAnalysisTest$OE95ci),caption="O/E Mean")
```

Table 52: O/E Mean

mean	50%	2.5%	97.5%
1.06	1.06	1.02	1.09

```
pander::pander(t(rrAnalysisTest$OAcum95ci),caption="O/Acum Mean")
```

Table 53: O/Acum Mean

mean	50%	2.5%	97.5%
0.936	0.935	0.922	0.948

```
pander::pander(rrAnalysisTest$c.index$cstatCI,caption="C. Index")
```

mean.C Index	median	lower	upper
0.581	0.58	0.514	0.645

```
pander::pander(t(rrAnalysisTest$ROCAnalysis$aucs),caption="ROC AUC")
```

Table 55: ROC AUC

est	lower	upper
0.597	0.493	0.701

```
pander::pander((rrAnalysisTest$ROCAnalysis$sensitivity),caption="Sensitivity")
```

Table 56: Sensitivity

est	lower	upper
0.19	0.124	0.271

```
pander::pander((rrAnalysisTest$ROCAnalysis$specificity),caption="Specificity")
```

Table 57: Specificity

est	lower	upper
0.894	0.769	0.965

```
pander::pander(t(rrAnalysisTest$thr_atP),caption="Probability Thresholds")
```

Table 58: Probability Thresholds

90%
0.809

```
pander::pander(t(rrAnalysisTest$RR_atP),caption="Risk Ratio")
```

Table 59: Risk Ratio

est	lower	upper
1.26	1.05	1.51

```
pander::pander(rrAnalysisTest$surdif,caption="Logrank test")
```

Table 60: Logrank test Chisq = 2.346444 on 1 degrees of freedom, p = 0.125569

	N	Observed	Expected	(O-E)^2/E	(O-E)^2/V
class=0	140	98	103.8	0.328	2.35
class=1	28	23	17.2	1.981	2.35