# Breast Cancer: Wisconsin

Jose Tamez

2023-04-26

## Contents



```
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
```

```
source("~/GitHub/FRESA.CAD/R/RRPlot.R")
source("~/GitHub/FRESA.CAD/R/PoissonEventRiskCalibration.R")
op <- par(no.readonly = TRUE)
pander::panderOptions('digits', 3)
pander::panderOptions('table.split.table', 400)
pander::panderOptions('keep.trailing.zeros',TRUE)
layout(matrix(1:1, nrow=1))
```

```
dataBreast <- read.csv("~/GitHub/RISKPLOTS/DATA/wpbc.data", header=FALSE)
table(dataBreast$V2)
```

```
##
##   N   R
## 151  47
```

```
rownames(dataBreast) <- dataBreast$V1
dataBreast$V1 <- NULL
dataBreast$status <- 1*(dataBreast$V2=="R")
dataBreast$V2 <- NULL
dataBreast$time <- dataBreast$V3
dataBreast$V3 <- NULL
dataBreast <- sapply(dataBreast,as.numeric)
```

```
## Warning in lapply(X = X, FUN = FUN, ...): NAs introduced by coercion
```

```
dataBreast <- as.data.frame(dataBreast[complete.cases(dataBreast),])
table(dataBreast$status)
```

```
##
##   0   1
## 148  46
```

## 0.1 Modeling

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

[++++++]

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

| | Estimate | lower | HR | upper | u.Accuracy | a.Accuracy | full.Accuracy | u.AUC | a.AUC | full.AUC | IDI | NRI | z.IDI | z.NRI | Delta.AUC | Frequency |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **V24** | 4.69e-02 | 1.01 | 1.05 | 1.08 | 0.598 | 0.237 | 0.598 | 0.609 | 0.5 | 0.609 | 0.0619 | 0.437 | 2.87 | 2.67 | 0.1091 | 1 |
| **V26** | 4.72e-03 | 1.00 | 1.00 | 1.01 | 0.593 | 0.237 | 0.593 | 0.598 | 0.5 | 0.598 | 0.0626 | 0.393 | 2.77 | 2.38 | 0.0983 | 1 |
| **V27** | 2.42e-04 | 1.00 | 1.00 | 1.00 | 0.608 | 0.237 | 0.608 | 0.608 | 0.5 | 0.608 | 0.0563 | 0.434 | 2.76 | 2.63 | 0.1084 | 1 |
| **V34** | 1.19e-02 | 1.00 | 1.01 | 1.02 | 0.634 | 0.237 | 0.634 | 0.618 | 0.5 | 0.618 | 0.0320 | 0.471 | 2.42 | 2.85 | 0.1178 | 1 |
| **V7** | 6.05e-08 | 1.00 | 1.00 | 1.00 | 0.588 | 0.237 | 0.588 | 0.595 | 0.5 | 0.595 | 0.0487 | 0.380 | 2.30 | 2.30 | 0.0949 | 1 |
| **V35** | 5.06e-06 | 1.00 | 1.00 | 1.00 | 0.727 | 0.237 | 0.727 | 0.641 | 0.5 | 0.641 | 0.0289 | 0.565 | 2.28 | 3.50 | 0.1412 | 1 |

## 0.2 Cox Model Performance

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

### 0.2.1 The evaluation of the raw Cox model with RRPlot()

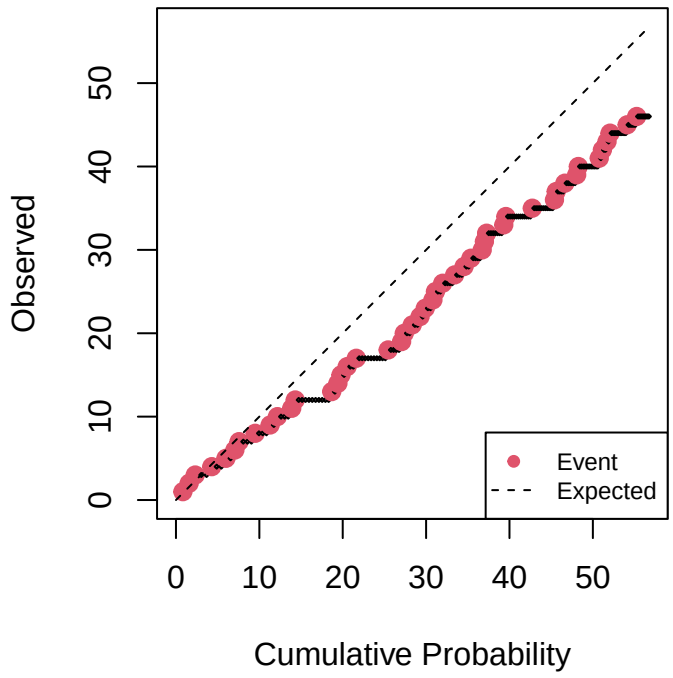
Here we will use the predicted event probability assuming a baseline hazard for events withing 5 years

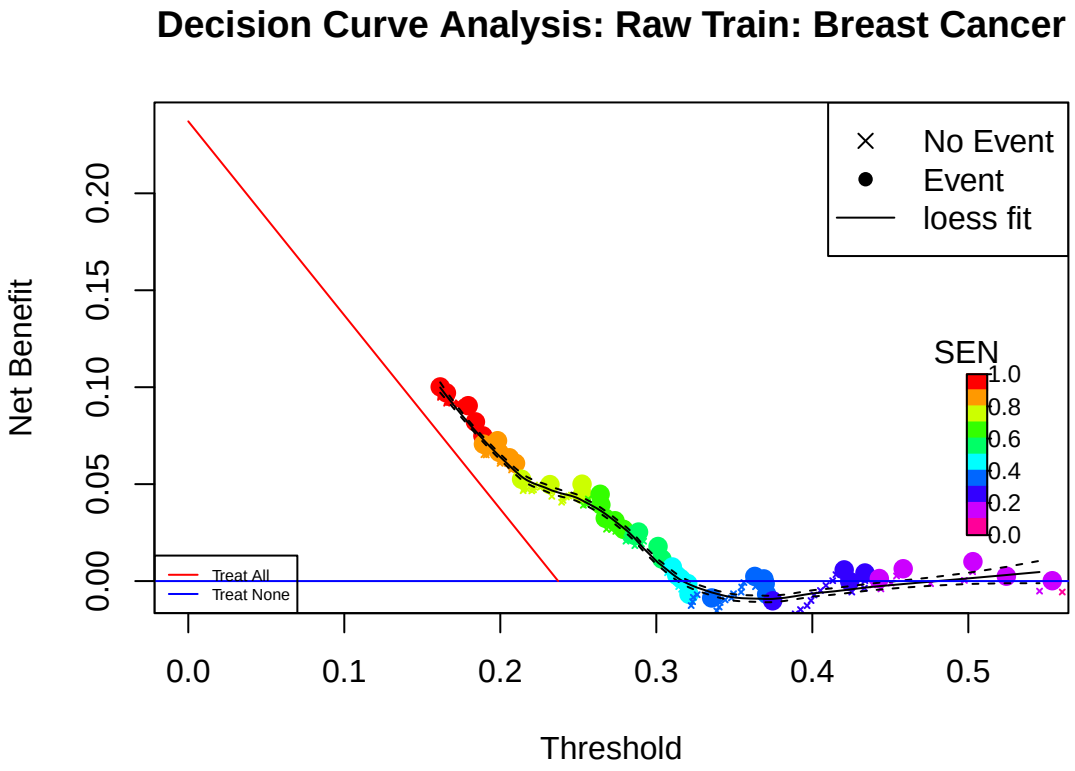
```
index <- predict(ml,dataBreast)
timeinterval <- 2*mean(subset(dataBreast,status==1)$time)

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

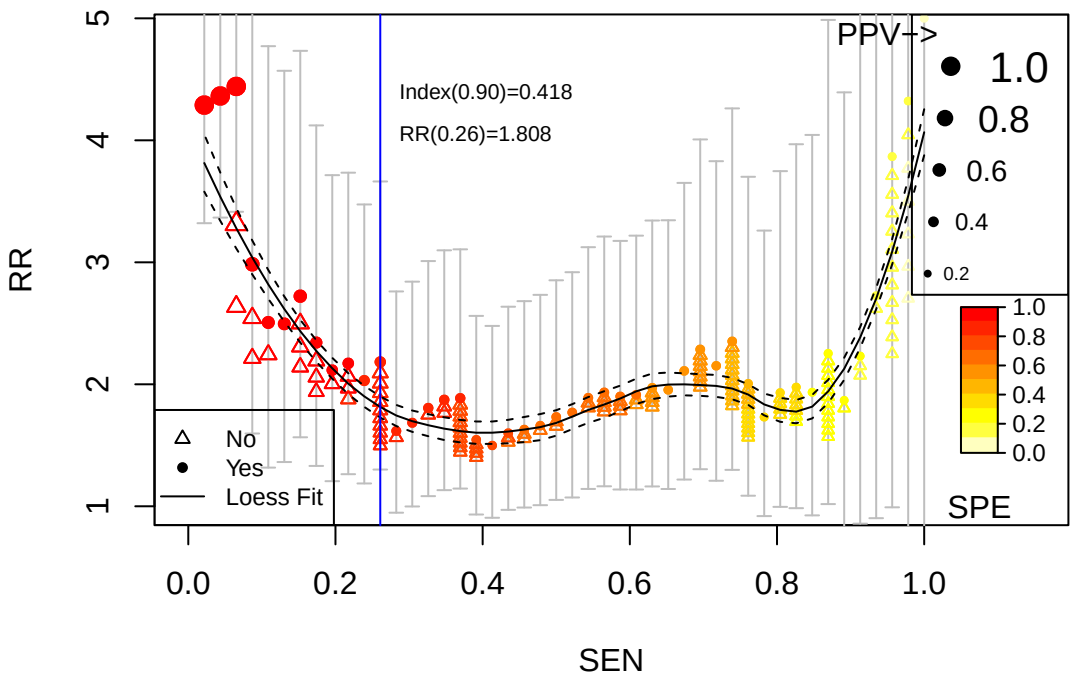
Table 2: Initial Parameters

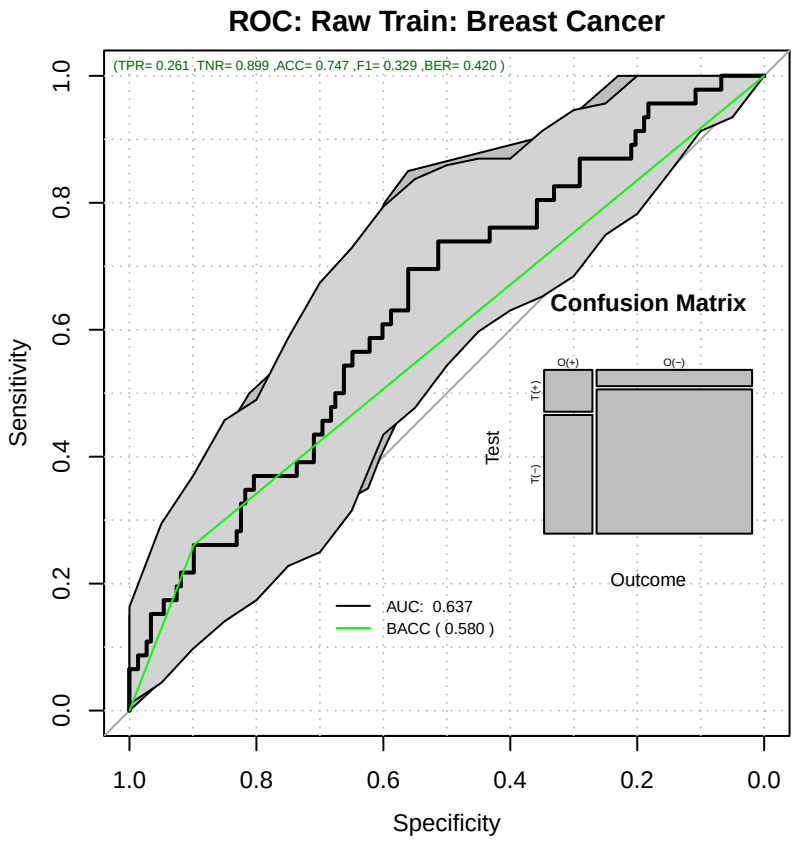
| h0 | timeinterval |
|---|---|
| 0.323 | 51.1 |

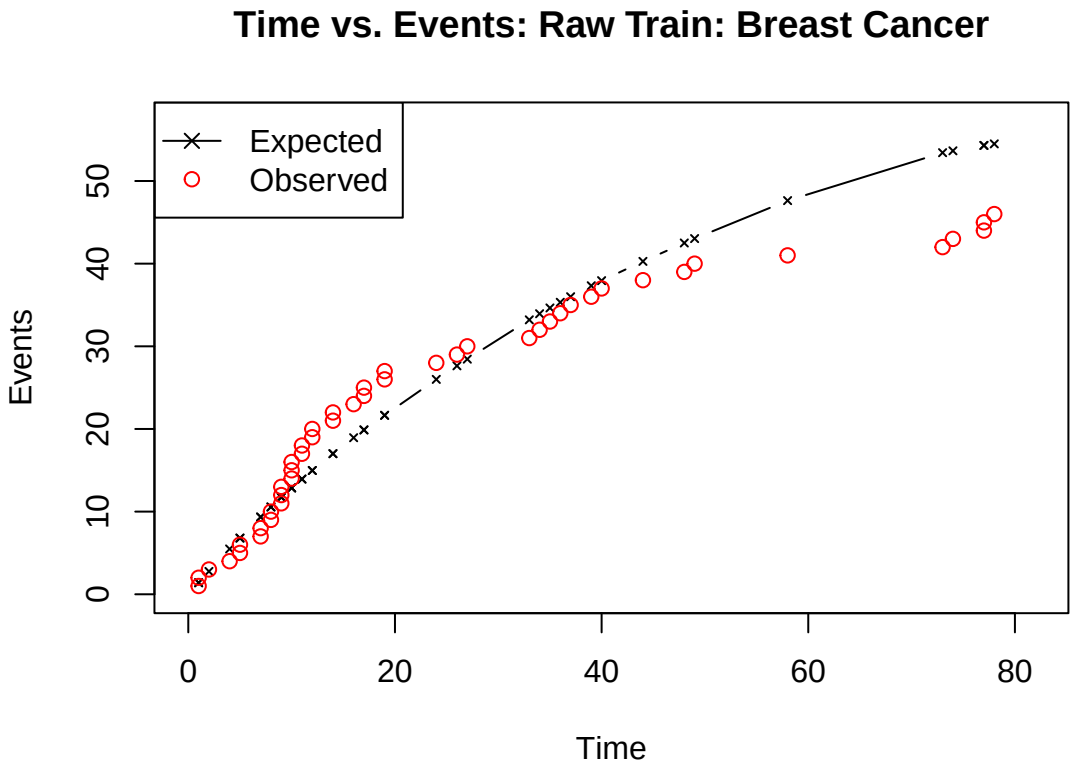
```
rdata <- cbind(dataBreast$status,ppoisGzero(index,h0))
rownames(rdata) <- rownames(dataBreast)

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

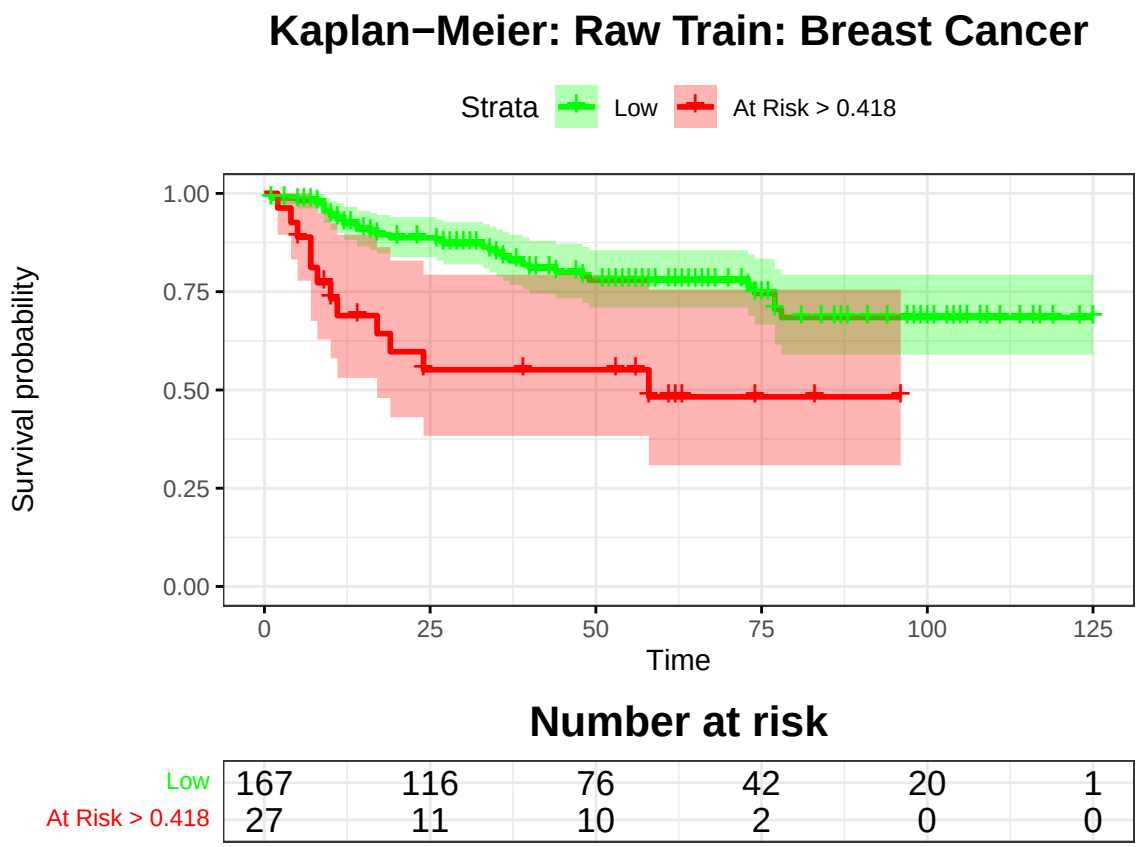



Decision Curve Analysis: Raw Train: Breast Cancer
No Event
Event
loess fit
SEN
1.0
0.8
0.6
0.4
0.2
0.0
Treat All
Treat None
Net Benefit
0.00
0.05
0.10
0.15
0.20
0.0
0.1
0.2
0.3
0.4
0.5
Threshold


Relative Risk: Raw Train: Breast Cancer
RR
SEN
PPV–>
SPE
Index(0.90)=0.418
RR(0.26)=1.808
No
Yes
Loess Fit
1.0
0.8
0.6
0.4
0.2
0.0


ROC: Raw Train: Breast Cancer
(TPR= 0.261 ,TNR= 0.899 ,ACC= 0.747 ,F1= 0.329 ,BER= 0.420 )
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: 0.637
BACC ( 0.580 )


Time vs. Events: Raw Train: Breast Cancer
Expected
Observed
Events
0
10
20
30
40
50
0
20
40
60
80
Time




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

### 0.2.2 Uncalibrated Performance Report

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

Table 3: O/E Ratio

| est | lower | upper |
|---|---|---|
| 0.844 | 0.618 | 1.13 |

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

Table 4: O/E Ratio

| mean | 50% | 2.5% | 97.5% |
|---|---|---|---|
| 1.02 | 1.02 | 0.967 | 1.07 |

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

Table 5: O/Acum Ratio

| mean | 50% | 2.5% | 97.5% |
|---|---|---|---|
| 0.797 | 0.797 | 0.789 | 0.806 |

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

| mean.C Index | median | lower | upper |
|---|---|---|---|
| 0.68 | 0.681 | 0.599 | 0.759 |

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

Table 7: ROC AUC

| est | lower | upper |
|---|---|---|
| 0.637 | 0.546 | 0.728 |

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

Table 8: Sensitivity

| est | lower | upper |
|---|---|---|
| 0.261 | 0.143 | 0.411 |

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

Table 9: Specificity

| est | lower | upper |
|---|---|---|
| 0.899 | 0.838 | 0.942 |

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

Table 10: Probability Thresholds

| 90% |
|---|
| 0.418 |

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

Table 11: Risk Ratio

| est | lower | upper |
|---|---|---|
| 1.81 | 1.06 | 3.09 |

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

Table 12: Logrank test Chisq = 11.608565 on 1 degrees of freedom, p = 0.000656

| | N | Observed | Expected | (O-E)^2/E | (O-E)^2/V |
|---|---|---|---|---|---|
| **class=0** | 167 | 34 | 41.1 | 1.23 | 11.6 |
| **class=1** | 27 | 12 | 4.9 | 10.27 | 11.6 |