CODE ▾

CovidSurg Analysis

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1 Introduction

This is a report that summarizes the main results from the research, including plots and tables. It is set so as to mimic the analysis pipeline undergone in the paper *****, where slurm was used and so no reproducibility could be performed. For more information please go to:

https://globalsurg.org/covidsurg/#Anchor-URL-link

and check our shiny webb app to use our model for COVID-19 patients undergoing surgery.

https://inflam.shinyapps.io/CovidSugRiskApp/#Anchor-URL-link

2 Set-up and libraries

HIDE

```
#install.packages("flextable")
library(flextable)
library(knitr)
#install.packages("cowplot")
library(ggplot2)
library(grid)
library(cowplot)
library(dplyr)
#install.packages("webshot")
#install.packages("magick")
library(webshot)
library(magick)
library(officer)
library(gridExtra)
library(magrittr)
library(tibble)
#library(gtsummary);
library(gt);
library(forcats);
library(compareGroups)
library(tidyverse)


# load all targets from drake and extras

loadd(MatrixCorr)
loadd(data2)
loadd(PlotsNames)
loadd(Logitplot)
loadd(TopModels)
loadd(AUCPlots)
loadd(CalibrationPlots)
loadd(hh)
load("ExternalParams.RData")
```

3 Data exploration

3.1 General information coding

HIDE

```
dataA <- readd(data1)

dataPercent <- dataA %>%
  filter(age != "17-19 years")


Info <- data.frame(table(dataPercent$redcap_data_access_group)) %>%
  separate(Var1, into = c("Country","City","Hospital"),sep = "_")

dim(Info) #Hospitals
dim(table(Info$Country)) #Countries

#filter(Info, Country == "es")
table(dataPercent$sex, useNA = "ifany")
table(dataPercent$agegroup, useNA = "ifany")
table(dataPercent$time, useNA = "ifany")
table(dataPercent$urgency4, useNA = "ifany")
table(dataPercent$indication,  useNA = "ifany")
table(dataPercent$spec2, useNA = "ifany")
table(dataPercent$mortality, useNA = "ifany")
```

3.2 Preprocessing and table 1

HIDE

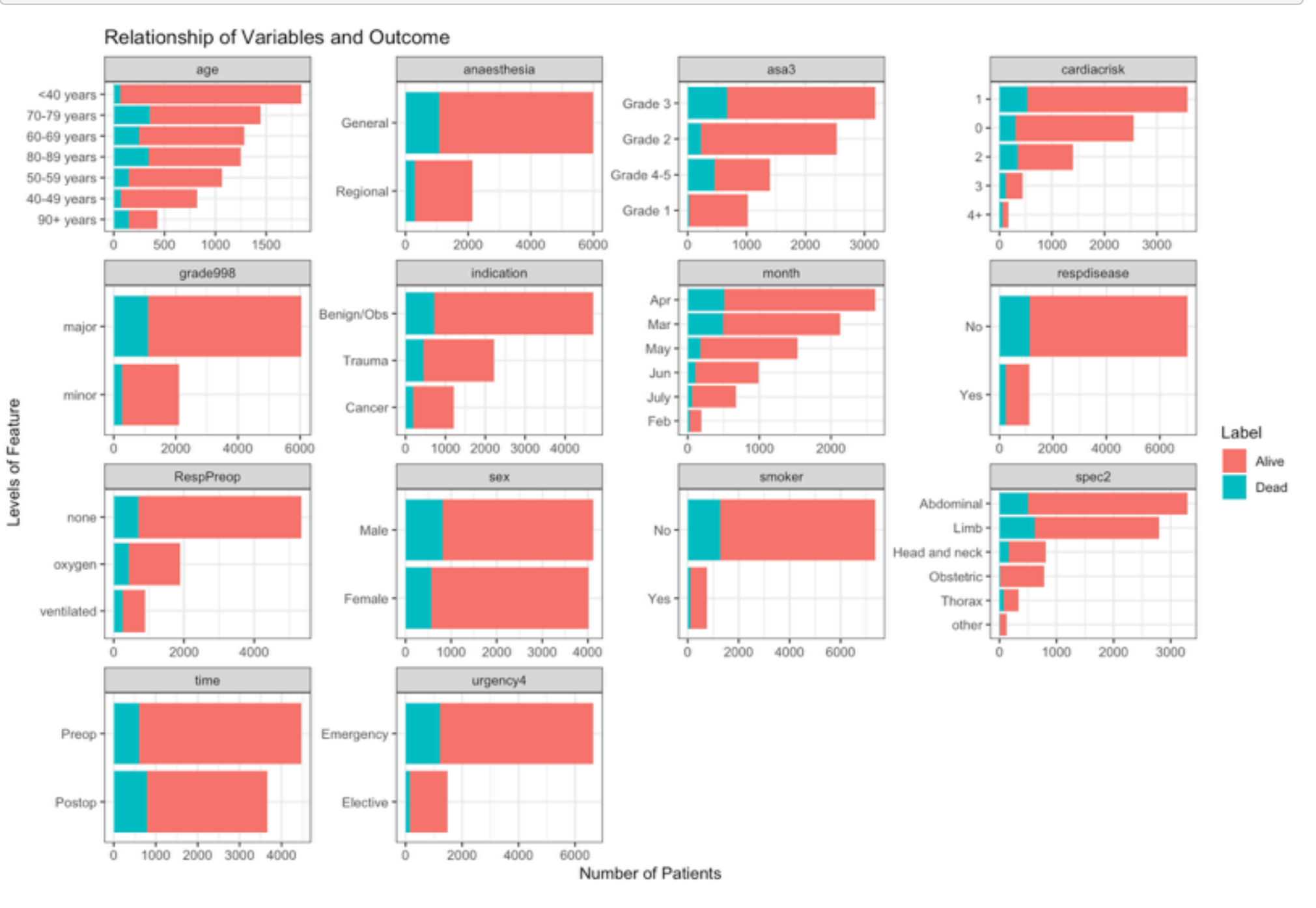
```
head(p)
```

```
##
## --------Summary descriptives table ---------
##
## ________________________________________________________________
________________________________________________________________
##
                                                All
Derivation                                   Validation
##                  ______________________________________
______________________
##                              Alive           Dead          OR          p.overall  N     Alive
Dead         p.overall
##                              N=7030          N=1462                                     N=5498
N=1279           N=1532
## ---------------------------------------------------------------------
---------------------------------------------------------------------
## Age:                                                                  <0.001   8492
<0.001                                      <0.001
##     <40 years          1842 (26.2%)     74 (5.06%)          Ref.                     1124 (20.4%
)    45 (3.52%)              718 (46.9%)        29 (15.8%)
##     40-49 years        778 (11.1%)      77 (5.27%)    2.46 [1.75;3.48]               563 (10.2%
)    62 (4.85%)              215 (14.0%)        15 (8.20%)
##     50-59 years        967 (13.8%)     155 (10.6%)    3.99 [2.97;5.39]               756 (13.8%
)    120 (9.38%)             211 (13.8%)        35 (19.1%)
##     60-69 years        1091 (15.5%)    257 (17.6%)    5.86 [4.46;7.78]               921 (16.8%
)    221 (17.3%)             170 (11.1%)        36 (19.7%)
##     70-79 years        1135 (16.1%)    378 (25.9%)    8.29 [6.37;10.9]               1025 (18.6%
)    342 (26.7%)             110 (7.18%)        36 (19.7%)
##     80-89 years        927 (13.2%)     362 (24.8%)    9.71 [7.44;12.8]               832 (15.1%
)    337 (26.3%)              95 (6.20%)        25 (13.7%)
##     90+ years          290 (4.13%)     159 (10.9%)    13.6 [9.99;18.7]               277 (5.04%
)    152 (11.9%)              13 (0.85%)         7 (3.83%)
## Sex:                                                                  <0.001   8489
<0.001                                       0.028
##     Female             3558 (50.6%)    603 (41.3%)         Ref.                      2794 (50.8%
)    528 (41.3%)             764 (49.9%)        75 (41.0%)
##     Male               3471 (49.4%)    857 (58.7%)    1.46 [1.30;1.64]               2703 (49.2%
)    749 (58.7%)             768 (50.1%)       108 (59.0%)
## C-reactive protein 31.0 [6.00;98.0] 52.0 [13.0;140] 1.00 [1.00;1.00]  <0.001   5481  33.0 [7.00;1
02] 49.0 [12.0;137]  <0.001     20.0 [5.00;71.2] 94.5 [24.0;162]  <0.001
## ---------------------------------------------------------------------
---------------------------------------------------------------------
```

3.3 General distribution of categorical variables

HIDE

```
Plot1a((data2)[[1]]) + theme_bw()
```

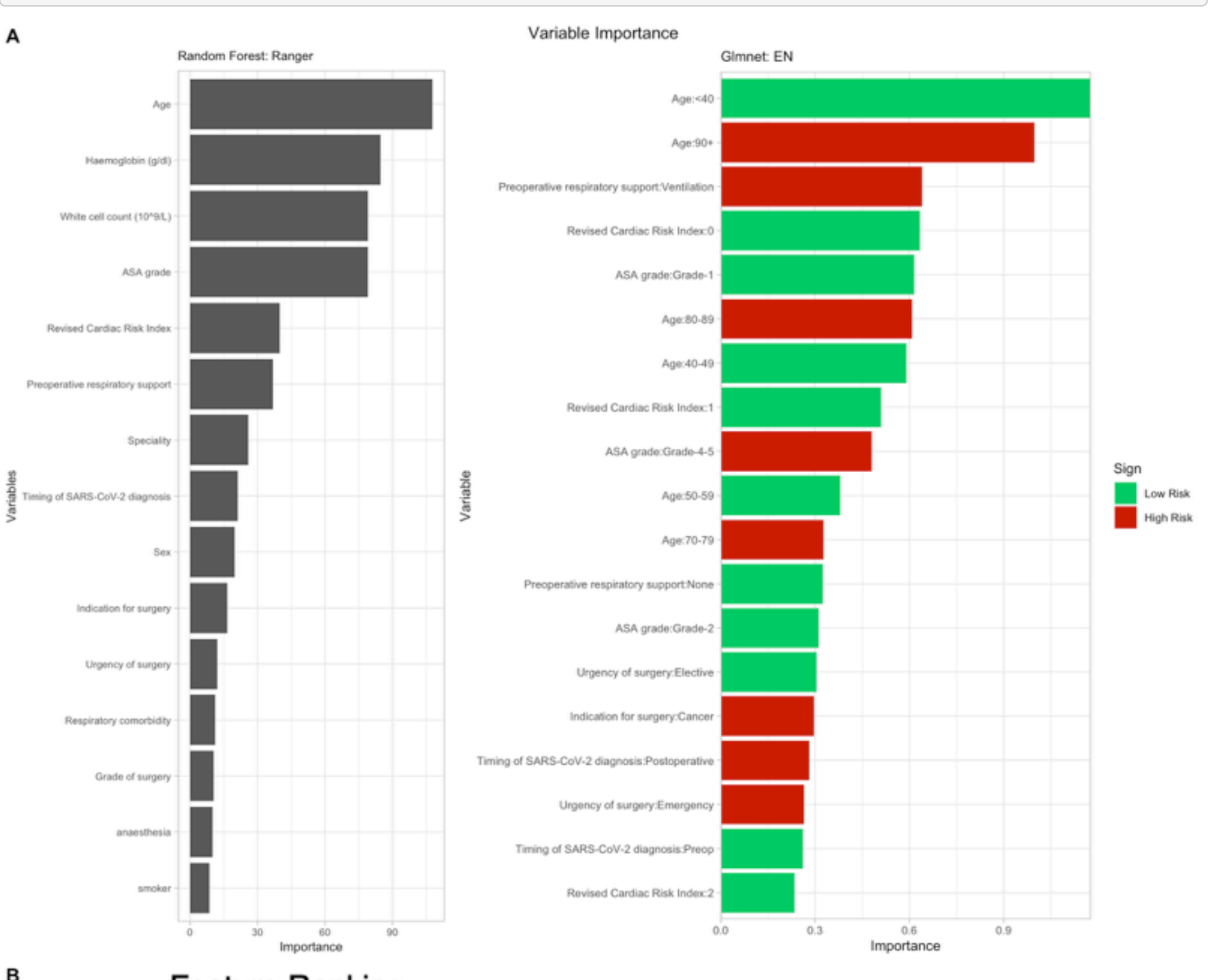


4 Feature Selection

HIDE

```
cowplot::plot_grid(Plot1, gg2, nrow = 2, ncol = 1, rel_heights = c(4, 2), labels = c('A', 'B'))
```

A



B

Feature Ranking

Variable Name	Top rank in model	Freq of appearance
age	1-LASSOEN	8
cardiacrisk	4-LASSOEN	3
asa3	4-RF	3
RespPreop	3-LASSOEN	2
spec2	7-RF	2
hb	2-RF	1
wcc	3-RF	1

Figure 2: Feature Selection A. Importance ranking RF and EN. B. Top ranking features

5 Model building

HIDE

```
cowplot::plot_grid(All, NULL, Logitplot, ncol = 1, nrow = 3, rel_heights = c(1.2,0.05, 2), rel_width
s  = c(2, 1) )
```

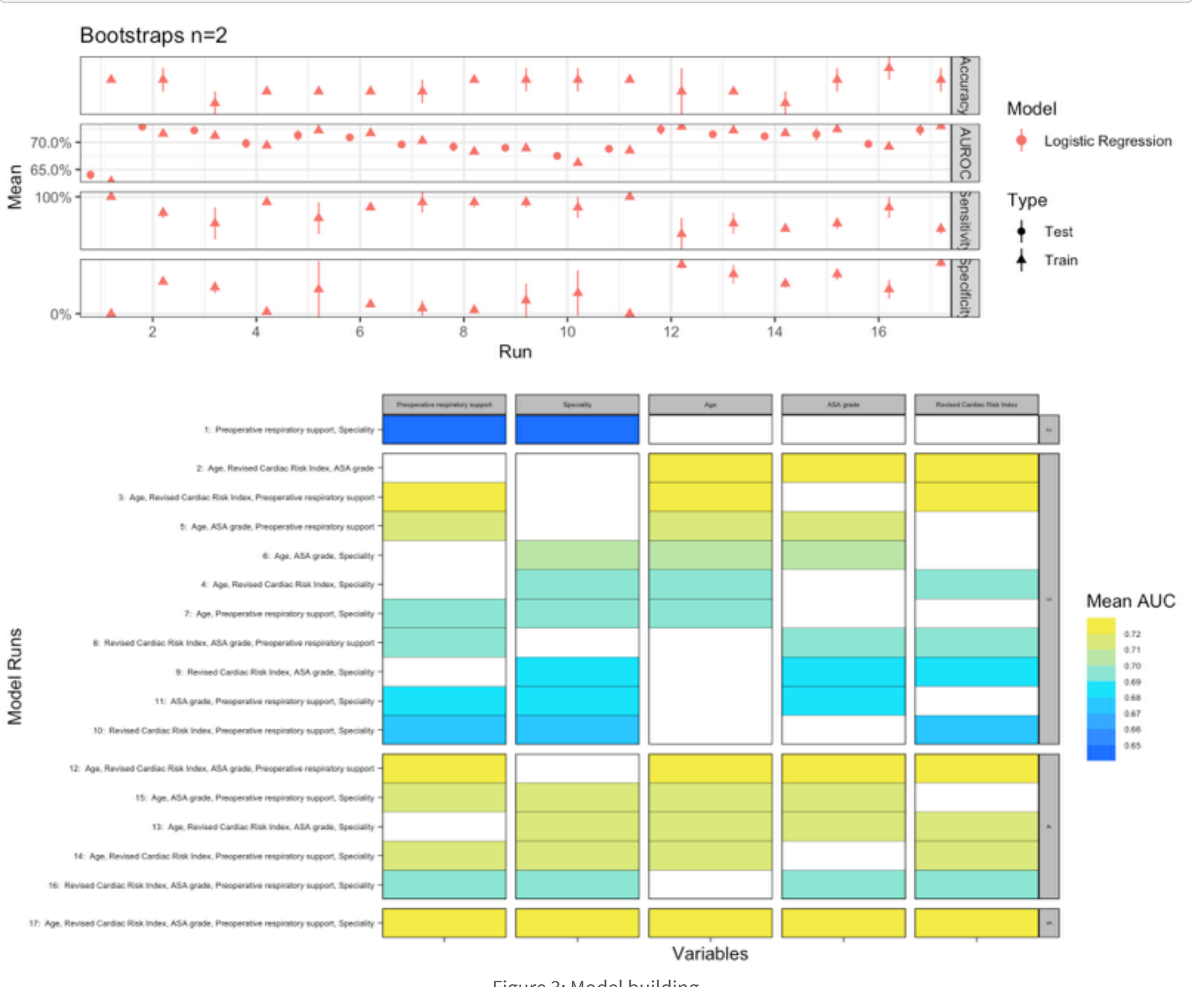


Figure 3: Model building

5.1 Model results tables

HIDE

```
library(readr)

read_csv("Top20Models.csv") %>%
            select(-X1) %>%
kable(., digits = 2, format.args = list(scientific = FALSE))
```

Model	Run	Mean	sd	Metrics	Names	NumVars
logit	2	0.73	0.00	AUROC	Age, Revised Cardiac Risk Index, ASA grade	3
logit	12	0.72	0.01	AUROC	Age, Revised Cardiac Risk Index, ASA grade, Preoperative respiratory support	4
logit	17	0.72	0.01	AUROC	Age, Revised Cardiac Risk Index, ASA grade, Preoperative respiratory support, Speciality	5
logit	3	0.72	0.00	AUROC	Age, Revised Cardiac Risk Index, Preoperative respiratory support	3
logit	13	0.72	0.00	AUROC	Age, Revised Cardiac Risk Index, ASA grade, Speciality	4
logit	15	0.72	0.01	AUROC	Age, ASA grade, Preoperative respiratory support, Speciality	4
logit	5	0.71	0.00	AUROC	Age, ASA grade, Preoperative respiratory support	3
logit	14	0.71	0.01	AUROC	Age, Revised Cardiac Risk Index, Preoperative respiratory support, Speciality	4
logit	6	0.71	0.00	AUROC	Age, ASA grade, Speciality	3
logit	4	0.70	0.01	AUROC	Age, Revised Cardiac Risk Index, Speciality	3
logit	16	0.70	0.01	AUROC	Revised Cardiac Risk Index, ASA grade, Preoperative respiratory support, Speciality	4
logit	7	0.70	0.00	AUROC	Age, Preoperative respiratory support, Speciality	3
logit	8	0.69	0.01	AUROC	Revised Cardiac Risk Index, ASA grade, Preoperative respiratory support	3
logit	9	0.69	0.00	AUROC	Revised Cardiac Risk Index, ASA grade, Speciality	3
logit	11	0.69	0.00	AUROC	ASA grade, Preoperative respiratory support, Speciality	3
logit	10	0.68	0.00	AUROC	Revised Cardiac Risk Index, Preoperative respiratory support, Speciality	3
logit	1	0.64	0.01	AUROC	Preoperative respiratory support, Speciality	2

5.2 AUCPlots

HIDE

```
plot(AUCPlots[[3]])
```

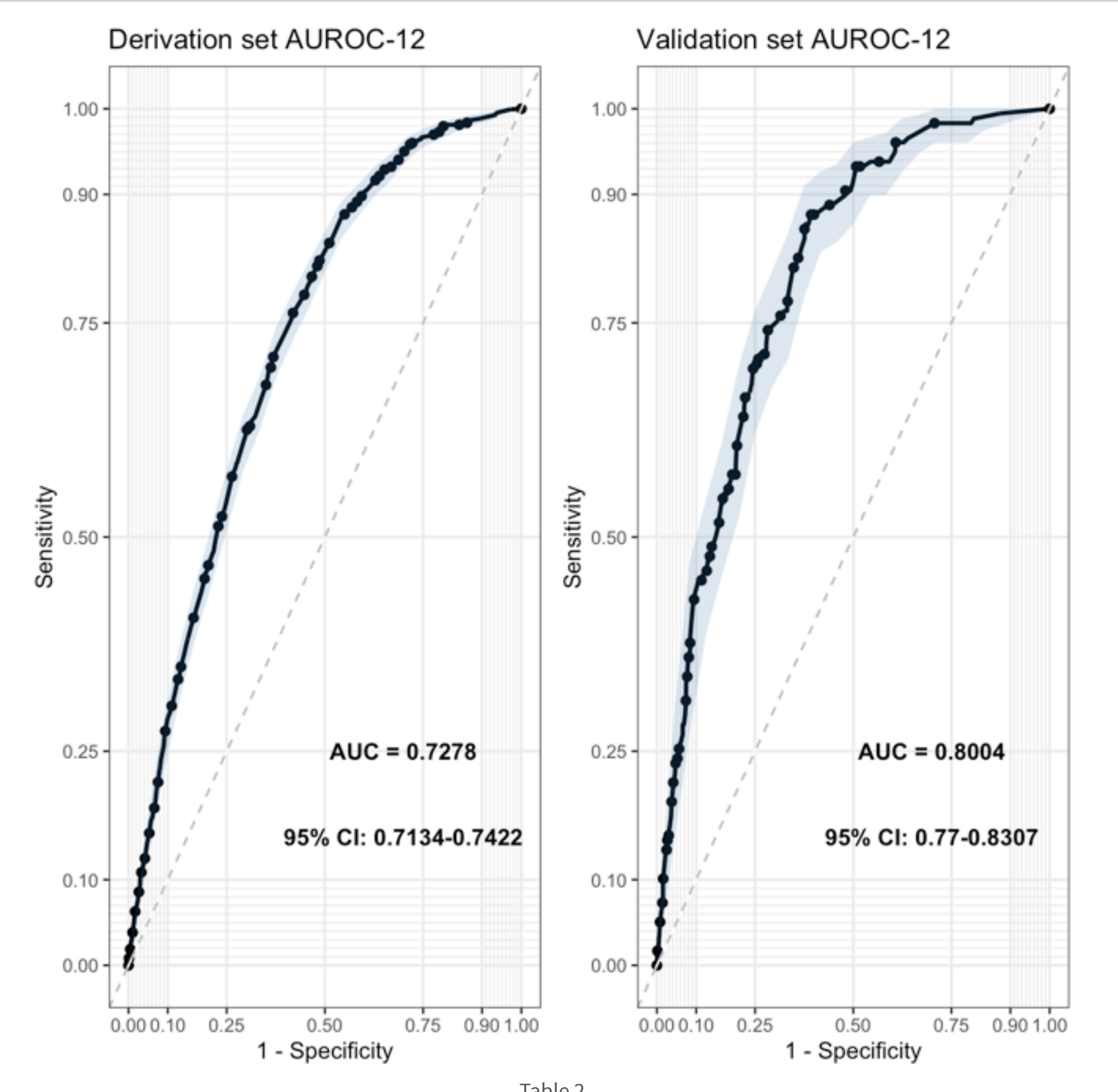
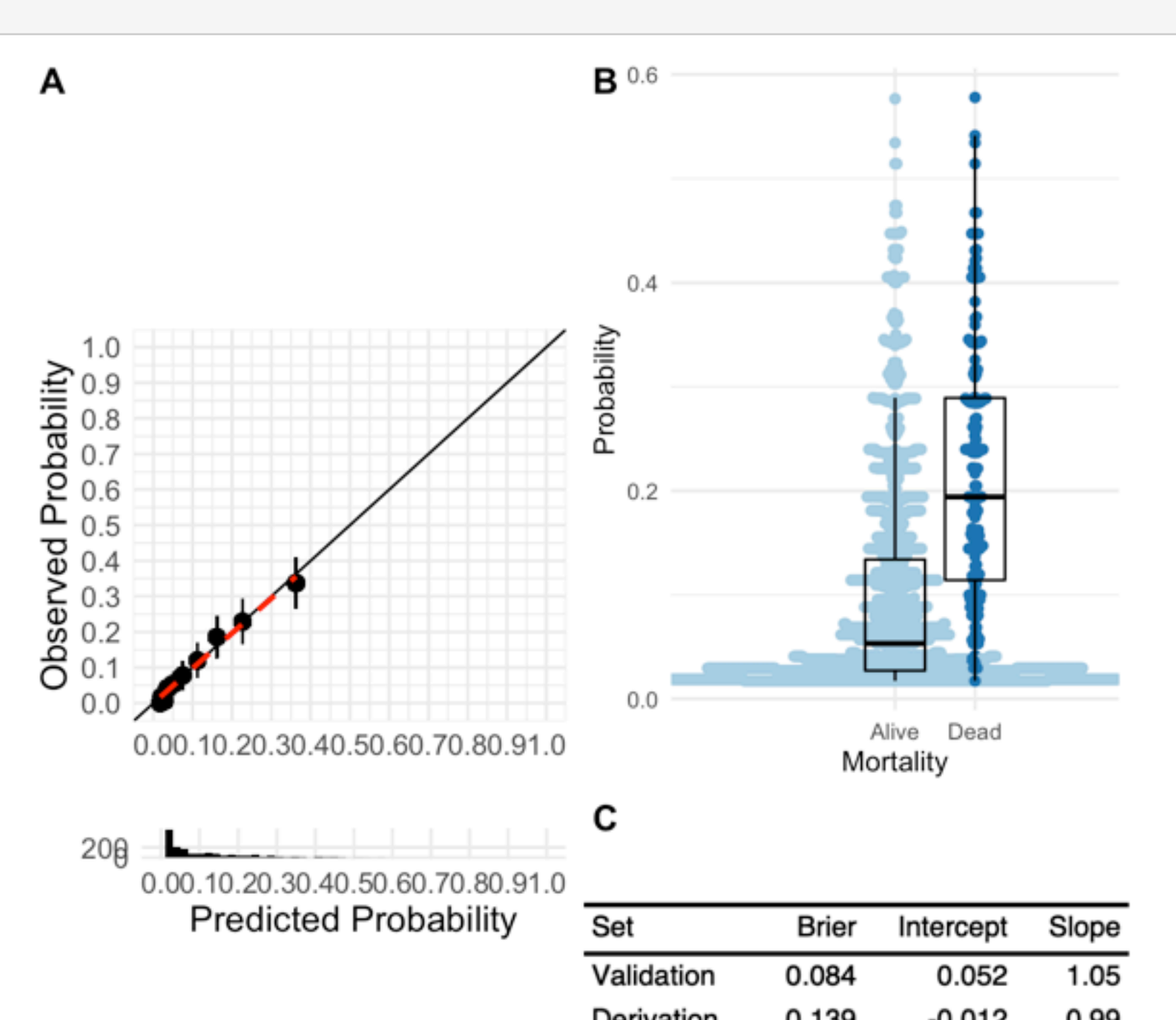


Table 2

5.3 Calibration

HIDE

```
plot_grid(
 g, bottom,
   ncol = 2, align = "h", labels = c('A', '')
)
```



C

Set	Brier	Intercept	Slope
Validation	0.084	0.052	1.05
Derivation	0.139	-0.012	0.99

Figure 5: Calibration

6 Case fatality and probability outcome

HIDE

```
ColoursMort
```

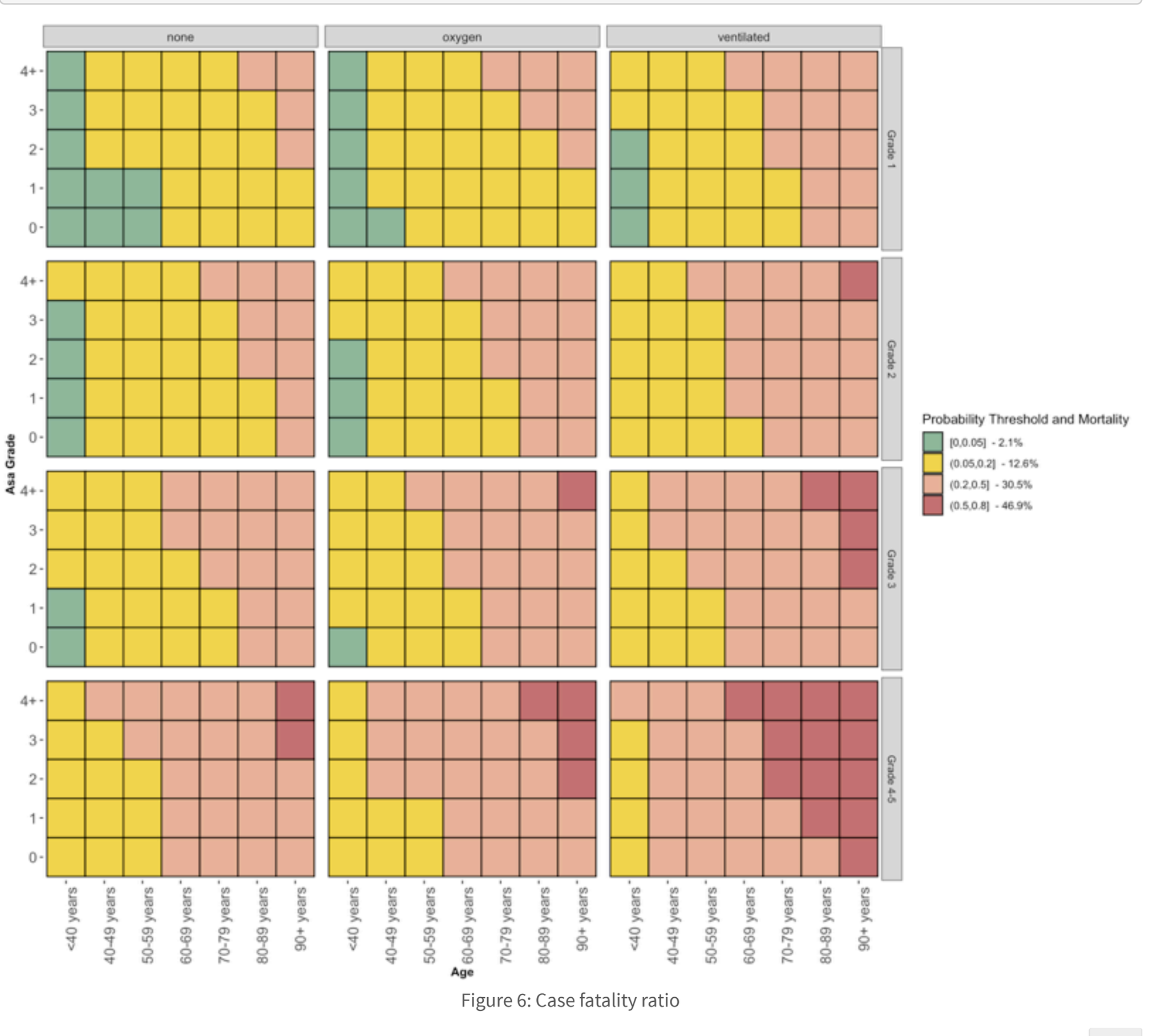


Figure 6: Case fatality ratio

HIDE

```
qqVal %>%
  kable(., digits = 2, format.args = list(scientific = FALSE))
```

Cutoff Risk	No of patients (%)	TP	TN	FP	FN	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	Mortality (%)
<=0.05	741 (44.42)	166	729	761	12	93.26	48.93	17.91	98.38	1.62
<=0.2	1372 (82.25)	87	1281	209	91	48.88	85.97	29.39	93.37	6.63
<=0.5	1660 (99.52)	4	1486	4	174	2.25	99.73	50.00	89.52	10.48
>=0.05	927 (55.58)	166	729	761	12	93.26	48.93	17.91	98.38	17.91
>=0.2	296 (17.75)	87	1281	209	91	48.88	85.97	29.39	93.37	29.39
>=0.5	8 (0.48)	4	1486	4	174	2.25	99.73	50.00	89.52	50.00

HIDE

```
qqDerv %>%
  kable(., digits = 2, format.args = list(scientific = FALSE))
```

Cutoff Risk	No of patients (%)	TP	TN	FP	FN	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	Mortality (%)
<=0.05	1079 (16.67)	1198	1052	4197	27	97.80	20.04	22.21	97.50	2.50
<=0.2	3680 (56.84)	869	3324	1925	356	70.94	63.33	31.10	90.33	9.67
<=0.5	6401 (98.87)	34	5210	39	1191	2.78	99.26	46.58	81.39	18.61
>=0.05	5395 (83.33)	1198	1052	4197	27	97.80	20.04	22.21	97.50	22.21
>=0.2	2794 (43.16)	869	3324	1925	356	70.94	63.33	31.10	90.33	31.10
>=0.5	73 (1.13)	34	5210	39	1191	2.78	99.26	46.58	81.39	46.58