```
1
2  ************************************************************************
3  *                                                                      *
4
5  *                          MESA - ELSA HR risk score                   *
6
7  *.                                                                     *
8  ************************************************************************
9
10 ********************** DESCRIPTIVE ANALYSIS ********************
11
12 * * * Table 1 * * *
13
14 * * * Flowchart * * *
15
16 sum S_FRCIC
17
18 sum hf_45plus
19
20 sum hf_45plus_noMI
21
22 sum hf_final
23
24 * * * Table 2 - sensitivity analysis * * *
25
26 proportion A_CVH_HB_SNA_CAT_MR if !missing(idadea)
27
28 Descriptive
29
30 *** General sample ***
31
32 tab age_ELSA_HFrisk1
33
34 tab sexo
35
36 tab race_recode
37
38 tab educ_group
39
40 tab smoke_ELSA_HFrisk1
41
42 tab bmi2_ELSA_HFrisk1
43
44 tab sbp_ELSA_HFrisk1
45
46 tab hr_ELSA_HFrisk1
47
48 tab A_DM_3
```

```
49
50 tab S_FRCIC
51
52 *** Clean sample ***
53
54 tab age_ELSA_HFrisk1  if !missing(hf_final)
55 csgof age_ELSA_HFrisk1 , expperc(61.43 28.03 10.51 0.03)
56
57 tab sexo if !missing(hf_final)
58 csgof sexo, expperc(45.59 54.21)
59
60 tab race_recode if !missing(hf_final)
61 csgof race_recode, expperc(52.21 16.06 28.16 3.56)
62
63 tab educ_group if !missing(hf_final)
64 csgof educ_group, expperc(14.12 42.58 17.84 18.50 6.96)
65
66 tab smoke_ELSA_HFrisk1 if !missing(hf_final)
67 csgof smoke_ELSA_HFrisk1, expperc(56.90 30.01 13.09)
68
69 tab bmi2_ELSA_HFrisk1 if !missing(hf_final)
70 csgof bmi2_ELSA_HFrisk1, expperc(36.86 40.25 22.88)
71
72 tab sbp_ELSA_HFrisk1 if !missing(hf_final)
73 csgof sbp_ELSA_HFrisk1, expperc(51.67 35.08 10.23 3.03)
74
75 tab hr_ELSA_HFrisk1 if !missing(hf_final)
76 csgof hr_ELSA_HFrisk1, expperc(15.31 34.88 33.25 12.99 3.58)
77
78 tab A_DM_3 if !missing(hf_final)
79 csgof A_DM_3, expperc(83.91 16.09)
80
81 tab S_FRCIC if !missing(hf_final)
82 csgof S_FRCIC, expperc(99.66 0.34)
83
84
85 ****** Cohort baseline - wave 1 ********
86
87 sum interval_months
88 sum interval_years
89 mean interval_years
90
91
92 ********************** INFERENTIAL ANALYSIS ******************
93
94 * * * Figure 2 - ELSA nomogram * * *
95
96 *** ELSA ****
```

```
logistic hf_final age_ELSA_HFrisk1 sex2_ELSA_HFrisk smoke_ELSA_HFrisk1
 bmi2_ELSA_HFrisk1 sbp_ELSA_HFrisk1 hr_ELSA_HFrisk1 diab_ELSA_HFrisk1

logistic hf_final i.diab_ELSA_HFrisk1 hr_ELSA_HFrisk1 sbp_ELSA_HFrisk1
 i.bmi2_ELSA_HFrisk1 i.smoke_ELSA_HFrisk1 i.sex2_ELSA_HFrisk i.
age_ELSA_HFrisk1
nomolog

logistic hf_final i.diab_ELSA_HFrisk1 hr_ELSA_HFrisk1 sbp_ELSA_HFrisk1
 bmi2_ELSA_HFrisk1 smoke_ELSA_HFrisk1 sex2_ELSA_HFrisk
age_ELSA_HFrisk1
nomolog

* * * Figure 3 - Risk scores accuracy - MESA and ELSA  * * *

****************** Discriminant assessement********************

******* MESA HF -> ELSA (observed vs predicted) *************

*** wave 1 ***
logistic hf_final HF0risk1
estat ic
predict drI01, dev
predict preditoI01

**Predicted vs Observed (Cutoff point was set in AUC >=0.70)**
roctab hf_final  preditoI01
roctab hf_final  preditoI01, graph
roctab hf_final  preditoI01, detail



********** ELSA HF -> ELSA (observed vs predicted)
********************

*** wave 1 ***
logistic hf_final  age_ELSA_HFrisk1 sex_ELSA_HFrisk smoke_ELSA_HFrisk1
 bmi2_ELSA_HFrisk1 sbp_ELSA_HFrisk1 hr_ELSA_HFrisk1 diab_ELSA_HFrisk1
estat ic
predict drE1, dev
predict preditoE1

**Predicted vs Observed (Cutoff point was set in AUC >=0.70)**
roctab hf_final  preditoE1
roctab hf_final  preditoE1, graph
roctab hf_final  preditoE1, detail

```

```
136
137 ************************** Calibration
    assessement**********************
138
139 ****** Calibration assessement - calibration general line*******
140 logit hf_final  age_ELSA_HFrisk1 sex_ELSA_HFrisk smoke_ELSA_HFrisk1
    bmi2_ELSA_HFrisk1 sbp_ELSA_HFrisk1 hr_ELSA_HFrisk1 diab_ELSA_HFrisk1
141 * Predicted Probabilities
142 predict phat, pr
143
144 * Grønnesby–Borgan Test- This is a modified Hosmer-Lemeshow test for
    survival data, but for logistic models, you can use:
145 * P/O ratio = 1 → perfect calibration
146 * >1 → overestimation
147 * <1 → underestimation
148 * Grønnesby–Borgan (estat gof) → large χ² and p<0.05 = poor fit
149 estat gof, group(10)
150
151 * Group by deciles or categories
152 xtile risk_decile = phat, n(10)
153
154 * Get Observed vs Predicted Risk by Decile
155 collapse (mean) phat hf_final, by(risk_decile)
156
157 ** Assess calibration graphically *****
158 twoway (line hf_final risk_decile) (line phat risk_decile), ///
159     legend(label(1 "Observed") label(2 "Predicted")) ///
160     ytitle("Heart Failure Risk") xtitle("Risk Decile") title(
    "Calibration Plot")
161
162     * You can generate the P/O ratio for each decile like this:
163 gen po_ratio = phat / hf_final
164 sum po_ratio
165
166
167 ****** Calibration assessement - bar chart (observed vs predicted)
    *******
168
169 * Create quartile variable based on preditoE1
170 xtile quartile = preditoE1, nq(4)
171
172 * Collapse and save each series
173 // ----- hf_final (Observed) -----
174 preserve
175 collapse (mean) hf_final, by(quartile)
176 gen type = "Observed"
177 rename hf_final value
178 tempfile obs
```

```
save `obs', replace
restore

* ----- preditoE1 -----
preserve
collapse (mean) preditoE1, by(quartile)
gen type = "Predicted_E1"
rename preditoE1 value
tempfile predE1
save `predE1', replace
restore

* ----- preditoI01 -----
preserve
collapse (mean) preditoI01, by(quartile)
gen type = "Predicted_I01"
rename preditoI01 value
tempfile predI01
save `predI01', replace
restore

* Append into one long-format dataset
use `obs', clear
append using `predE1'
append using `predI01'

* Set graph colors by bar number (Observed=1, E1=2, I01=3)
graph bar value, over(type, gap(5)) over(quartile, label(angle(0))) ///
    bar(1, color(navy)) bar(2, color(blue)) bar(3, color(red)) ///
    blabel(bar, format(%4.2f)) ///
    legend(label(1 "Observed (Azul)") label(2 "Predicted E1 (Blue)") label(3 "Predicted I01 (Red)")) ///
    title("Observed vs Predicted HF Risk by Quartile") ///
    ytitle("Heart Failure Risk")



****** Calibration assessement -  P/O ratio *******

* Group by deciles or categories
xtile risk_decile = phat, n(10)


* You can generate the P/O ratio for each decile like this:
gen po_ratio = phat / hf_final
sum po_ratio

```

```
*Generate quartiles of predicted HF risk (preditoE1)
xtile quartile = preditoE1, nq(4)

*Collapse to get mean predicted and observed risk per quartile
collapse (mean) preditoE1 hf_final, by(quartile)
rename preditoE1 predicted
rename hf_final observed

*Calculate P/O ratio
gen po_ratio = predicted / observed
replace po_ratio = . if observed == 0  // prevent division by zero

* Bar chart of P/O ratio by quartile
graph bar po_ratio, over(quartile, label(angle(0))) ///
    ytitle("Predicted-to-Observed (P/O) Ratio") ///
    title("P/O Ratio by Quartiles of Predicted HF Risk (preditoE1)")
///
    bar(1, color(dknavy)) blabel(bar, format(%4.2f))
```