

## Practical session 7: RISK PREDICTION

Advanced Statistics for Records Research

### Research question

In this session, we will explore the dataset of 2000 participants we met in the lecture, and fit a risk prediction model for death within 5 years, based on some simple patient characteristics.

### Objectives

By the end of this practical, you should be able to:

1. Fit a logistic model to create risk predictions.
2. Assess model discrimination by calculating the Area Under the Curve.
3. Assess model calibration by graphing observed and predicted risks.

### Dataset and analysis

For this practical we will use a (simulated) dataset called “Prediction-data.dta”. This contains data for 2,000 patients, with information on six variables.

Variable	Description
id	Unique patient ID
age	Age (years)
sbp	Systolic Blood Pressure
bmi	Body Mass Index kg/m <sup>2</sup>
sex	Female=0, Male=1
dead	Alive=0, Dead=1

### Preparatory steps

1. Copy the dataset “Prediction-data.dta” to your own folder.
2. Open a do-file. Start by changing the working directory using the `cd` command
3. Open the dataset “Prediction-data.dta”.

### Data exploration

4. Have a look at the data. How many participants die? What proportion are female? What ages are these participants?

### Randomly split data into training and validation parts

5. Create a variable  $S = 0/1$  that separates the data into two equal halves:

```
. gen rvar = runiform()  
. sort rvar  
. gen S = 0  
. replace S =1 if _n>1000
```

### Fit model in training data and predict risks

6. For the  $S=0$  dataset, estimate the model using logistic regression. Include all measured variables as predictors.
7. Predict the risk of death for all individuals (i.e. those with  $S=0$  and those with  $S=1$ ).

```
. predict m2pr
```

### Validation

8. Draw an ROC curve in the  $S=0$  dataset.

```
. roctab dead m2pr if S==0, graph specificity
```

What is the AUC? Interpret this number. Now repeat for the  $S=1$  dataset. Are the two ROC curves very different?

9. Create a Hosmer-Lemeshow goodness of fit table for the  $S=0$  and the  $S=1$  datasets.

```
. estat gof if S==0, group(10) table
```

10. Draw a bar graph comparing the predicted and observed risks in the  $S=0$  data.

```
. egen m2prg0 = cut(m2pr) if S==0, group(10)  
. graph bar (sum) m2pr (sum) dead, over(m2prg0)
```

Repeat for the  $S=1$  dataset.

11. If you have time, see if you can write a short do-file to repeatedly split the data, calculate the AUC from the  $S=0$  and  $S=1$  datasets and store the results.