Presentation

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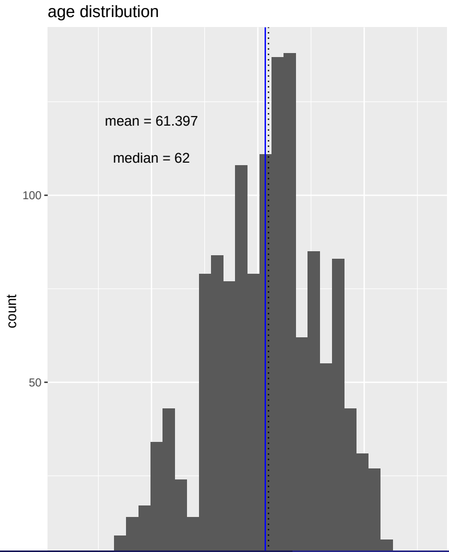
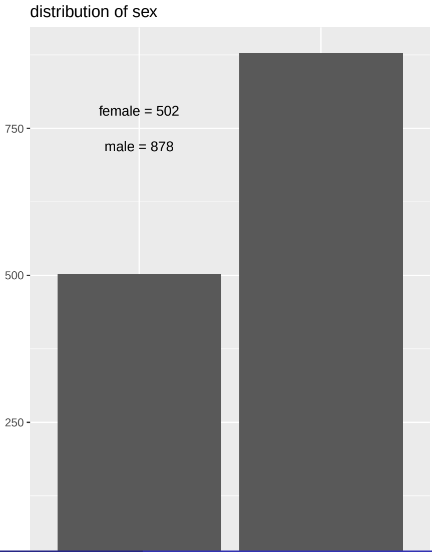
Introduction

Introduction text here

Descriptive statistics

- Demographic information





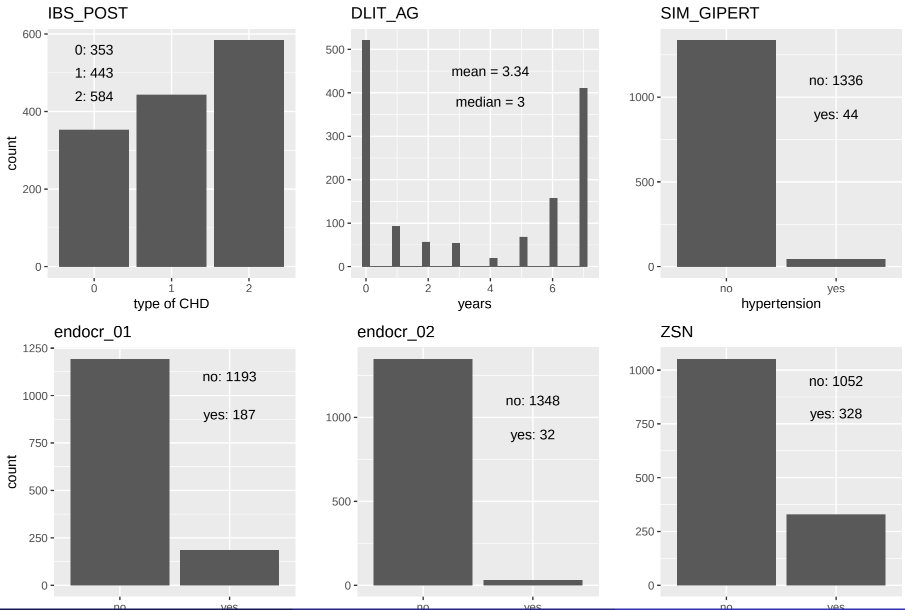
Descriptive statistics

- Patient physiological attributes
- IBS_POST: coronary heart disease in recen weeks before admission to hospital
  - 0: there was no CHD
  - 1: extertional angina pectoris
  - 2: unstable angina pectoris
- DLIT_AG: duration of arterial hypertension
  - 0: there was no arterial hypertension
  - 1: one year
  - 2: two years
  - 3: three years
  - 4: four years
  - 5: five years
  - 6: 6-10 years
  - 7: more than 10 years

Descriptive statistics

- SIM_GIPERT: systematic hypertension; 0 - no, 1 - yes
- endocr_01: diabetes mellitus in the anamnesis; 0 - no, 1 - yes
- endocr_02: obesity in the anamnesis; 0 - no, 1 - yes
- ZSN: chronic heart failure; 0 - no, 1 - yes

Descriptive statistics



Ariane: Analysis of Sex and Chronic Heart Failure: Overview

Question: Is there an association between sex and chronic heart failure?

```
        Chronic Heart Failure
Sex       No Yes
  Female 353 149
  Male   699 179
```

Analysis of Sex and Chronic Heart Failure: Tests

Pearson χ^2 Test of Independence:

```
X-squared
 14.71773
```

```
p-value = 0.00012
```

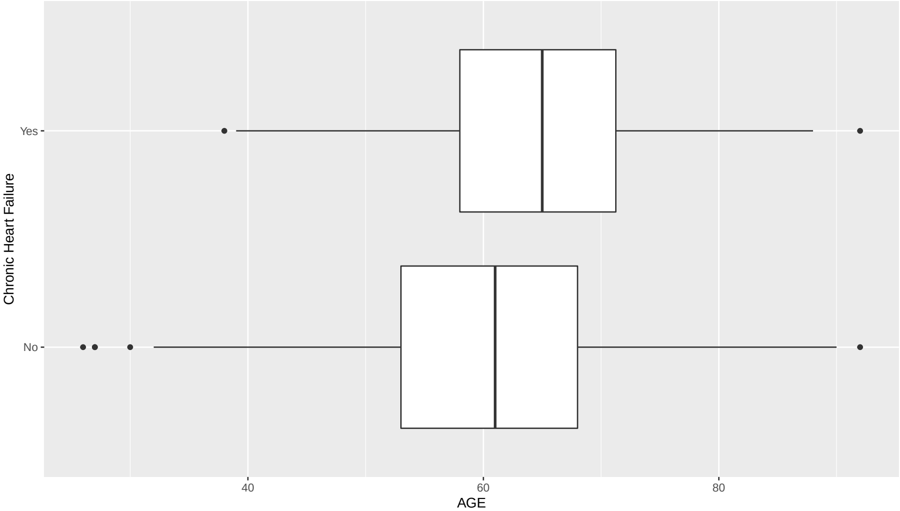
Likelihood Ratio Test of Independence:

```
       G
14.93905
```

```
p-value = 0.00011
```

Analysis of Age(Continuous) and Chronic Heart Failure: Overview

Question: Is there an association between age and chronic heart failure?



Analysis of Age(Continuous) and Chronic Heart Failure: Summary Statistics

	Chronic Heart Failure	
	No	Yes
Min.	26	38
1st Qu.	53	58
Median	61	65
Mean	60.42586	64.51220
3rd Qu.	68.00	71.25
Max	92	92

Analysis of Age(Continuous) and Chronic Heart Failure: Test

Analysis was done using a two sided Wilcoxon Rank Sum Test to test if there is a difference in Chronic Heart Failure outcome across age.

```
       W
136546.5

p-value = 1e-08
```

Analysis of Age(Categorical) and Chronic Heart Failure: Overview

Question: Is there an association between age(decade) and chronic heart failure?

	Chronic Heart Failure	
Age	No	Yes
20s	3	0
30s	44	2
40s	114	24
50s	294	67
60s	365	126
70s	197	86
80s	32	22
90s	3	1

Analysis of Age(Categorical) and Chronic Heart Failure: Test

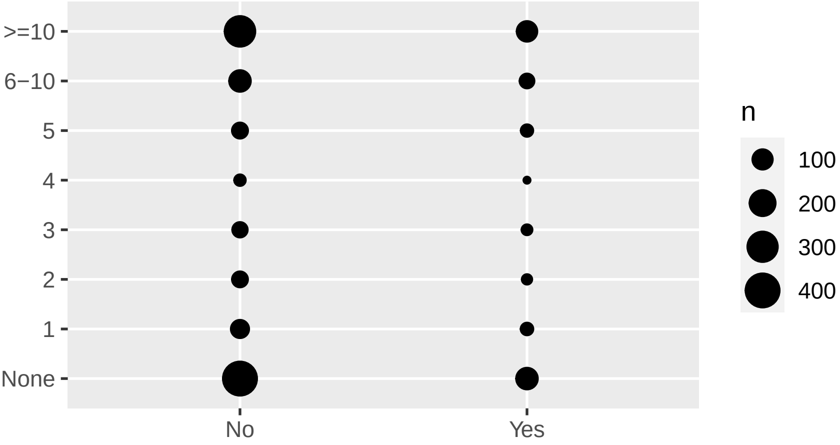
Pearson χ^2 Test of Independence:

```
X-squared
 35.41942

p-value = 1e-05
```

Likelihood Ratio Test of Independence:

```
       G
38.86163

p-value = 2.08e-06
```

Alona: Examining the relationship between Duration of Arterial Hypertension and CHF



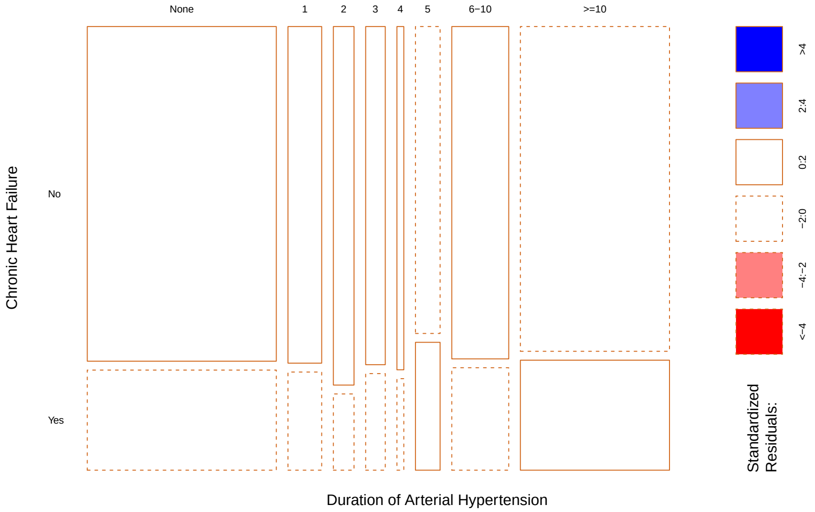
- The two classes of CHF have similar count distributions across the levels of duration of arterial hypertension.
- We will further test the hypothesis that there is an association between the two variables

Inference for contigency table.

Table 1: Duration of Arterial Hypertension by Chronic Heart Failure

	No	Yes
None	401	120
1	72	21
2	47	10
3	42	12
4	15	4
5	48	20
6-10	120	37
>=10	307	104

Examining the Standerdized residuals.



For Ix2 tables, testing for a linear trend in either response category, we use the Cochran-Armitage trend test.

```
##
##  Cochran-Armitage test for trend
##
## data:  dlitag
## Z = -0.99455, dim = 8, p-value = 0.32
## alternative hypothesis: two.sided
```

Issues to consider: Ordinal variable with unequal intervals so trend test on the original classification provides information about the direction but ignores the unequal spacing in the last two categories.

Logistic Regression model

x - Duration of Arterial Hypertension.

Table 2: Parameter Estimates for Logit link

	Estimate	Std. Error	z value	Pr(>|z|)
(Intercept)	-1.2283412	0.0915051	-13.4237468	0.0000000
x	0.0138949	0.0143812	0.9661872	0.3339505

Table 3: Parameter Estiamtes for Identity link

	Estimate	Std. Error	z value	Pr(>|z|)
(Intercept)	0.2264438	0.0160982	14.0664047	0.0000000
x	0.0025212	0.0026207	0.9620338	0.3360326

Goodness of fit tests for the fitted models

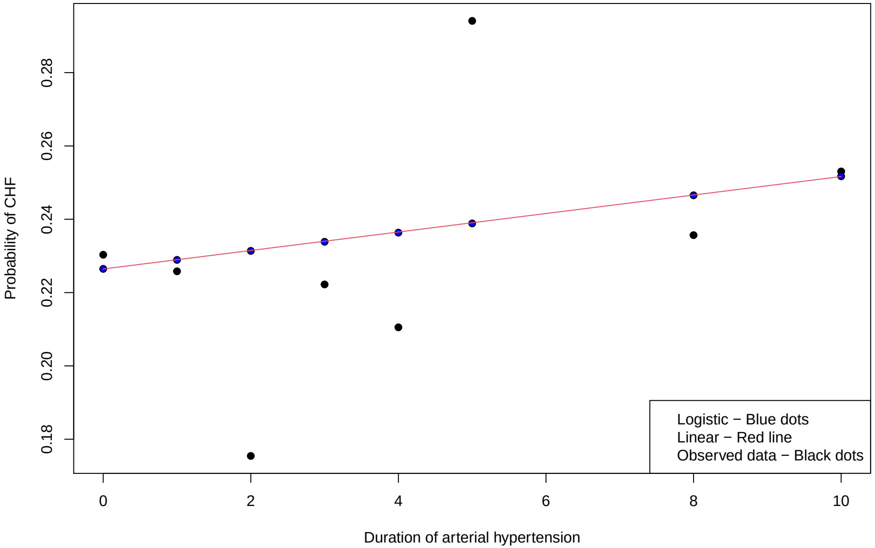
For the logit model:

- $G^2 = 2.4236058$
- df $= 6$
- p-value $= 0.8769175$

For the linear model:

- $G^2 = 2.4249567$
- df $= 6$
- p-value $= 0.8767699$

Predicted probabilities for the fitted models and the observed data.



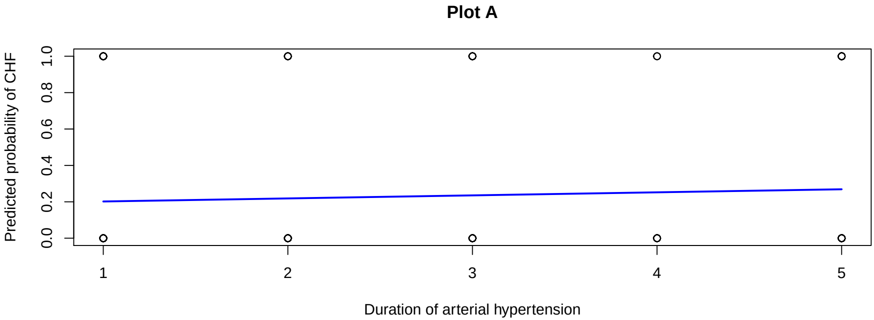
Sub-analsis

We tested the Linear model for the subset: Duration of arterial hypertension $\in [1 - 5]$

Table 4: Parameter Estiamtes for subset analysis

	Estimate	Std. Error	z value	$Pr(>\|z\|)$
(Intercept)	0.1850895	0.0483670	3.826774	0.0001298
DLIT_AG_N	0.0167632	0.0161478	1.038107	0.2992204

Predicted probabilities



The p-value for the goodness of fit went down sharply (0.16) but still didn't reach significance level to reject the null of no-fit.

Conclusions

- There is no significant association between CHF and the duration of arterial hypertension.
- By itself, duration of arterial hypertension is not predictive of CHF.

Minsu

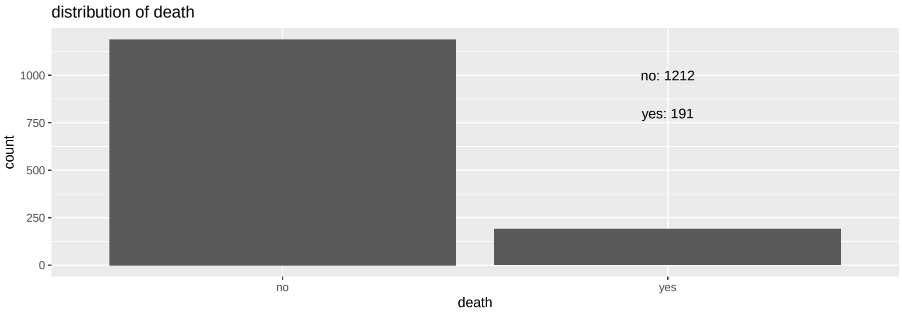
Minsu

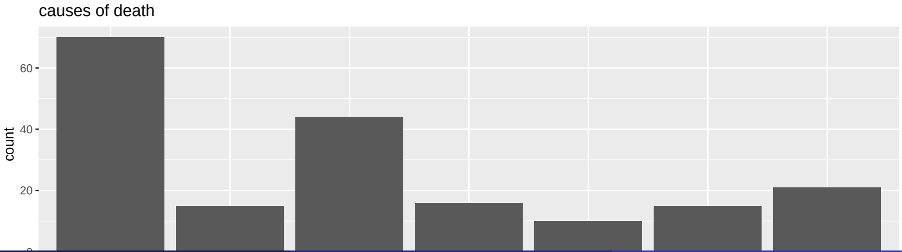
Jadey

Secondary analysis - modeling the relationship between death outcome and selected variables

- The dataset includes one variable indicating the causes of lethal outcome for the patients
  - LET_IS: causes of lethal outcome
    - 0: survive
    - 1: cardiogenic edema
    - 2: pulmonary edema
    - 3: myocardial rupture
    - 4: progress of congestive heart failure
    - 5: thromboembolism
    - 6: asystole
    - 7: ventricular fibrillation
- Build a logistic regression model to predict death of the patients by turning LET_IS to a binary variable “death”
- Build model with multimonial response to investigate the cause of death

Secondary analysis - modeling the relationship between death outcome and selected variables





Secondary analysis

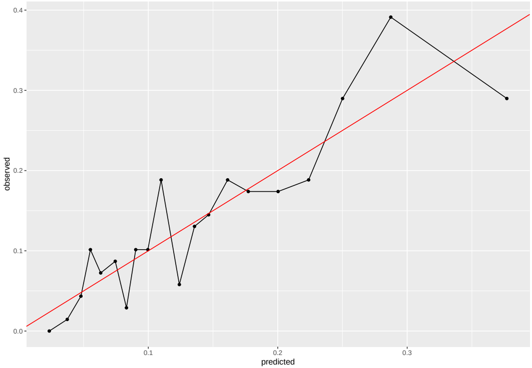
- Full model contains continuous variables AGE, DLIT_AG, categorical variables SEX, IBS_POST, SIM_GIPERT, endocr_01, endocr_02, and the interaction terms between AGE and all the other variables.
- Used stepwise step() to select the best model.
- The best model selected:

$$log \frac{\pi_i}{1-\pi_i} = -6.018 + 0.058 \times AGE + 0.073 \times I(IBS = 1) + 0.696 \times I(IBS = 2) + 0.726 \times I(SIM = 1) + 0.476 \times I(endocr01 = 1) + 1.081 \times I(endocr02 = 1)$$

- All selected predictors increase the probability of death.
  - exp(beta_age) = 1.06
  - OR(IBS_POST = 1 vs. IBS_POST = 0) = 1.08 ($p = 0.77 > 0.5$)
  - OR(IBS_POST = 2 vs. IBS_POST = 0) = 2.01
  - OR(hypertension vs. non hypertension) = 2.07 ($p = 0.065 > 0.5$)
  - OR(diabetes vs. non diabetes) = 1.61
  - OR(obese vs. not obese) = 2.95

Secondary analysis

- Goodness of fit check with Hosmer-Lemeshow test by grouping the observations into 20 groups. The test statistic is 0.4291, indicating an adequate fit of the model to the dataset.
- Plotted the predicted value against the observed value of the 20 groups. Overall the dots follow the diagonal.



Secondary analysis

- Fit baseline category logit model on cause of death. Used predictors selected in the previous analysis.
  $log\frac{\pi_j(x)}{\pi_J(x)} = \beta_{0j} + \beta_{1j} \times AGE + \beta_{2j} \times I(IBS = 1) + \beta_{3j} \times I(IBS = 2) + \beta_{4j} \times I(SIM = 1) + \beta_{5j} \times I(endocr01 = 1) + \beta_{6j} \times I(endocr02 = 1), j = 1, ..., 6$

where J = cardiogenic shock, j = 1 pulmonary edema, 2 myocardial rupture, 3 progress of congestive heart failure, 4 thromboembolism, 5 asystole, 6 ventricular fibrillation

```
multi.mod <- multinom(LET_IS ~ AGE + as.factor(IBS_POST) + as.
```

```
## # weights:  56 (42 variable)
## initial  value 371.668838
## iter  10 value 312.126386
## iter  20 value 300.807784
## iter  30 value 300.010607
## iter  40 value 299.933289
## iter  50 value 299.931699
```

Secondary analysis

```
##   intercept         AGE IBS_POST = 1 IBS_POST = 2 SIM_GIPEF
## 2 -5.208477  0.05003237    0.4172287   -0.2605801  -14.8802
## 3 -2.662446  0.04515371   -0.8725386   -1.3250667   -0.0125
## 4 -3.189649  0.02970654   -0.3969242   -0.7216065    0.0040
## 5  1.046965 -0.03766681   -0.2262002   -1.5074724  -16.1651
## 6 -2.551705  0.03088585   -2.0391936   -1.3081214  -16.8835
## 7  2.872844 -0.05676433   -0.5333366   -0.2875964    0.2570
##   endocr_02 = 1
## 2   -14.0286129
## 3     0.6681173
## 4   -15.2277093
## 5   -16.3110403
## 6     0.7648381
## 7   -15.7083009
```

Secondary analysis

Estimated $exp(\beta_{ij})$:

```
##      intercept       AGE IBS_POST = 1 IBS_POST = 2 SIM_GIPI
## 2  0.005469998 1.0513051    1.5177496    0.7706045   3.4482
## 3  0.069777345 1.0461887    0.4178893    0.2657852   9.8748
## 4  0.041186340 1.0301522    0.6723850    0.4859709   1.0040
## 5  2.848990047 0.9630338    0.7975584    0.2214691   9.5399
## 6  0.077948656 1.0313678    0.1301336    0.2703274   4.6510
## 7 17.687253718 0.9448167    0.5866443    0.7500642   1.2930
##   endocr_02 = 1
## 2  8.080734e-07
## 3  1.950562e+00
## 4  2.436071e-07
## 5  8.245276e-08
## 6  2.148646e+00
## 7  1.506509e-07
```