

A group of researchers wanted to predict the death from ventilator associated pneumonia in patients admitted to an intensive care unit. The authors measures the blood concentration of proANP on day 0 (D0) and day 4 (D4) after diagnosed ventilator associated pneumonia. They also recorded the age and gender of the patients. They used this data to predict non-survivors. In the study-group 71 patients were enrolled of which 26 died.

- 1) (20 %) The authors constructed a logistic regression model to predict non-survivors in the patient group.
 - a. Which parameter is the best single predictor for survival?
 - b. Why is to odds ratio calculated from the logistic regression not exactly the same as the one you calculated by the χ^2 -test?
 - c. Will it be enough to measure the level of proANP at day 0 in order to predict death by this model? (why? / why not?)
 - d. Calculate the regression coefficients for the logistic regression model.
 - e. What is the probability that a 39 year old male patient in the study will die, if his proANP concentration is 600 pmol/L and 550 pmol/L at day 0 and 4, respectively. Assume that the regression constant, β_0 , is -13.0.

Parameter	odds ratio (95 % CI)	P
Age	1.00 (0.96 - 1.04)	0.89
Gender, female	1.80 (0.62 - 5.26)	0.28
ln(proANP) D0	2.35 (1.05 - 5.26)	0.04
ln(proANP) D4	3.76 (1.39 - 10.18)	0.01

Table 1. The odds ratios for non-survivors based on a logistic regression model. PLEASE NOTE that proANP concentrations are logarithmic transformed.

!!!!SPOILER Suggestions for solutions SPOILER!!!!

- 1) The authors constructed a logistic regression model to predict non-survivors in the patient group.

a. Which parameter is the best single predictor for survival?

The level of proANP at day 4 has the highest odds ratio and is therefore the best predicting factor.

b. Why is the odds ratio calculated from the logistic regression different from you calculated by the χ^2 -test?

The two tests differ because the logistic regression takes more factors into consideration. However, in this case the conclusion is the same for the univariate χ^2 -test and the multivariate logistic regression.

c. Will it be enough to measure the level of proANP at day 0 in order to predict death by this model? (why? / why not?)

No. There is a significant impact from measurement of proANP at day 0 and day 4. Both measurements add to the model significantly. The interaction terms were not reported. They may have provided more information.

d. Calculate the regression coefficients for the logistic regression model.

The regression coefficients can be calculated by taking the logarithm to the odds ratios:

Parameter	β
Age	0
Gender, female	0.59
ln(proANP) D0	0.85
ln(proANP) D4	1.32

e. What is the probability that a 39 year old male patient in the study will die, if his proANP concentration is 600 pmol/L and 550 pmol/L at day 0 and 4, respectively. Assume that the regression constant, β_0 , is -13.0.

$$z = 39 \cdot 0 + 0 \cdot 0.59 + \ln(600) \cdot 0.85 + \ln(550) \cdot 1.32 - 13.8 = 0.766$$

$$p = 1 / (1 + \exp(-z)) = 0.68$$

Parameter	odds ratio (95 % CI)	P
Age	1.00 (0.96 - 1.04)	0.89
Gender, female	1.80 (0.62 - 5.26)	0.28
ln(proANP) D0	2.35 (1.05 - 5.26)	0.04
ln(proANP) D4	3.76 (1.39 - 10.18)	0.01

Tabel 2.