Chapter 37
Logistic Regression with a Continuous Predictor (55 Patients)

1 General Purpose

Logistic regression with a binary predictor and binary outcome variable can predict the effect of a better treatment on a better outcome (see previous chapter). If your predictor is continuous, like age, it can predict the odds of responding (= ratio of responders/non responders per subgroup, e.g., per year).

2 Schematic Overview of Type of Data File

Outcome binary	predictor continuous
•	•
•	•
•	•
•	•
•	•
•	•
•	•

T.J. Cleophas, A.H. Zwinderman, *SPSS for Starters and 2nd Levelers*,
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3 Primary Scientific Question

In clinical research the outcome is often responding yes or no. If your predictor is continuous like age, body weight, health score etc, then logistic regression calculates whether the predictors have a significant effect on the odds of responding, and, in addition, it calculates the odds values to be interpreted as chance of responding for each year of age, kg of body weight and score level of health score.

4 Data Example

The example of Chap. 35 is used once more. In 55 hospitalized patients the risk of falling out of bed was assessed. The question to be answered was: is age an independent predictor of the odds or rather logodds to be interpreted as chance of "falloutofbed". The first 10 patients of the 55 patient file is underneath.

Fall out of bed	Year of age
1,00	60,00
1,00	86,00
1,00	67,00
1,00	75,00
1,00	56,00
1,00	46,00
1,00	98,00
1,00	66,00
1,00	54,00
1,00	86,00

fall out of bed 1 = yes, 0 = no

The data file is in extras.springer.com, and is entitled "chapter35unpairedbinary". We will start by opening the data in SPSS.

5 Logistic Regression with a Continuous Predictor

For analysis the statistical model Binary Logistic Regression in the module Regression is required.

Command:

Analyze....Regression....Binary Logistic Regression....Dependent: falloutofbed.... Covariate: age....click OK.

Variables in the equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a]	age	,106	,027	15,363	1	,000	1,112
	Constant	−6,442	1,718	14,068	1	,000	,002

[a]Variable(s) entered on step 1: age

The correct conclusion is, that age is, indeed, a very significant predictor of the chance of falling out of bed, with a p-value of < 0.0001.

6 Using the Logistic Equation for Making Predictions

The logistic model makes use of the underneath equation (ln = natural logarithm).

$$\ln \text{ods} = \text{a} + \text{bx}$$

By replacing the values a and b with the respective intercept and regression coefficient, we can calculate the odds ("risk") of falling out of bed for each age class.

$$\ln \text{odds} = -6,442 + ,106\text{*age}$$

This would mean that for a patient 40 years old

$$\begin{aligned} \ln \text{odds} &= -6,442 + ,106\text{*}40 \\ &= -2,202 \\ \text{odds} &= 0,11. \end{aligned}$$

However, for somebody aged 60 it would mean

$$\begin{aligned} \text{In odds} &= -6,442 + ,106\text{*}60 \\ &= 0,92. \end{aligned}$$

7 Conclusion

Logistic regression with a binary predictor and binary outcome variable can predict the effect of a better treatment on a better outcome. If your predictor is, however, continuous, like age, then the odds of responding can be predicted for multiple subgroups (odds = ratio of responders / non responders per subgroup of, e.g., 1 year).

8 Note

More background, theoretical, and mathematical information about logistic regression is given in Statistics applied to clinical studies 5th edition, Chaps. 17 and 65, Springer Heidelberg Germany, 2012, from the same authors.