Chapter 43
Rate Analysis of Medical Data Better than Risk Analysis (52 Patients)

General Purpose

For the assessment of medical treatments clinical event analysis with logistic regression is often performed. Treatment modalities are used as predictor and the odds of the event as outcome. However, instead of the odds of event, counted rates of events can be computed and statistically tested. This may produce better sensitivity of testing, because their standard errors are smaller.

Specific Scientific Question

Does rate analysis of medical events provide better sensitivity of testing than traditional risk analysis.

Example

We will use an example also used in the Chap. 10 of SPSS for starters part two, pp 43–48, Poisson regression, Springer Heidelberg Germany, 2012, from the same authors. In a parallel-group study of 52 patients the presence of torsade de pointes was measured during two treatment modalities.

treatment modality	Presence torsade de pointes
,00	1,00
,00	1,00
,00	1,00
,00	1,00
,00	1,00
,00	1,00
,00	1,00
,00	1,00
,00	1,00
,00	1,00

The first 10 patients are above. The entire data file is in extras.springer.com, and is entitled "rates". SPSS statistical software will be used for analysis. First, we will perform a traditional binary logistic regression with torsade de pointes as outcome and treatment modality as predictor.

Command:

Analyze….Regression….Binary Logistic….Dependent: torsade….. Covariates: treatment….OK.

Variables in the Equation							
		B	S.E.	Wald	df	Sid.	Exp(B)
Step 1[a]	VAR00001	1,224	,626	3,819	1	,051	3,400
	Constant	-,125	,354	,125	1	,724	,882

[a]Variable(s) entered on step 1: VAR00001

The above table shows that the treatment modality does not significantly predict the presence of torsades de pointes. The numbers of torsades in one group is not significantly different from the other group.

A rate analysis is performed subsequently.

Command:

Generalized Linear Models ….mark Custom….Distribution: Poisson ….Link Function: Log….Response: Dependent Variable: torsade…. Predictors: Main Effect: treatment…..Estimation: mark Robust Tests….OK.

Example   263

Parameter estimates

| Parameter | B | Std. Error | 95 % Wald confidence interval | | Hypothesis test | | |
			Lower	Upper	Wald Chi- Square	df	Sig.
(Intercept)	-,288	,1291	-,541	-,035	4,966	1	,026
[VAR00001=,00]	-,470	,2282	-.917	-,023	4,241	1	,039
[VAR00001 = 1,00]	0[a]						
(Scale)	1[b]						

Dependent Variable: torsade
Model: (Intercept), VAR00001
[a]Set to zero because this parameter is redundant
[b]Fixed at the displayed value

The predictor treatment modality is now statistically significant at p = 0.039. And so, using the Poisson distribution in Generalized Linear Models, we found that treatment one performed significantly better in predicting numbers of torsades de pointe than did treatment zero at 0.039. We will check with a 3-dimensional graph of the data if this result is in agreement with the data as observed.

Command:

Graphs….Legacy Dialog….3-D Bar: X-Axis mark: Groups of Cases, Z-Axis mark: Groups of Cases…Define 3-D Bar: X Category Axis: treatment, Z Category Axis: torsade….OK.
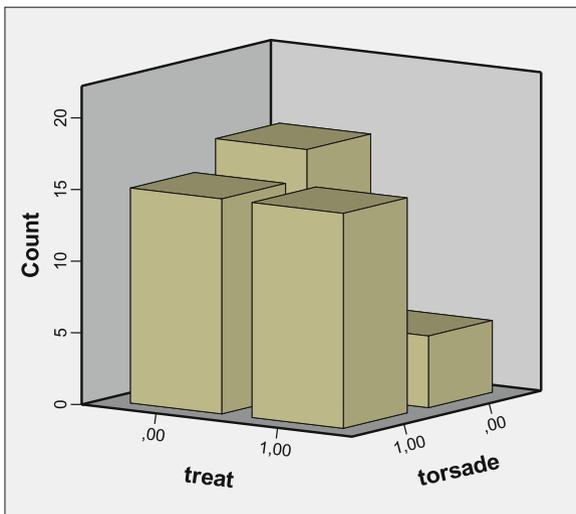
    The above graph shows that in the 0-treatment (placebo) group the number of patients with torsades de pointe is virtually equal to that of the patients without. However, in the 1-treatment group it is smaller. The treatment seems to be efficacious.

Conclusion

Rate analysis using Poisson regression is different from logistic regression, because it uses a log transformed dependent variable. For the analysis of rates Poisson regression is very sensitive and, thus, better than standard logistic regression.

Note

More background, theoretical and mathematical information of rate analysis is given in Chap. 10 of SPSS for starters part two, pp 43–48, Poisson regression, Springer Heidelberg Germany, 2012, from the same authors.