PERFORMING Multiple Logistic Regression with SigmaPlot 15

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Data source: Logistic Regression Data in statistics samples.jnb

In general the data contains one depending variable, which contains the values 0 and 1. Zero, 0, for not having the occurrence, and one, 1, for having the occurrence.

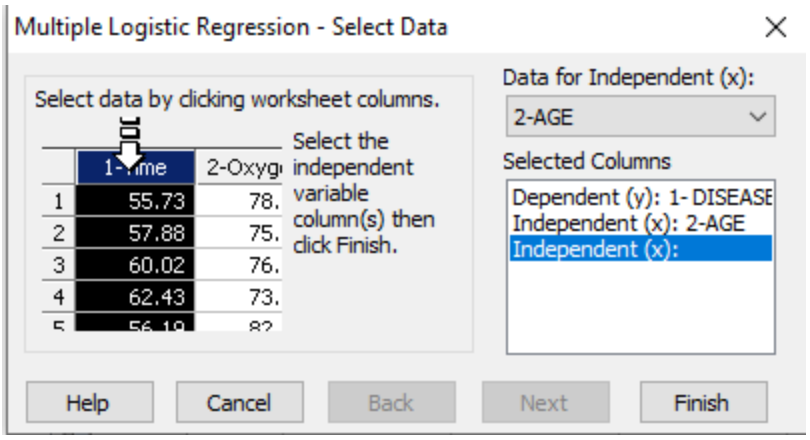
1. Load a datafile

A datafile looks like :

Data 1

	1-DISEAS	2-AGE
1	0,0000	20,0000
2	0,0000	23,0000
3	0,0000	24,0000
4	0,0000	25,0000
5	1,0000	25,0000
6	0,0000	26,0000
7	0,0000	26,0000
8	0,0000	28,0000
9	0,0000	28,0000
10	0,0000	29,0000
11	0,0000	30,0000
12	0,0000	30,0000
13	0,0000	30,0000
14	0,0000	30,0000
15	0,0000	30,0000
16	1,0000	30,0000
17	0,0000	32,0000
18	0,0000	32,0000
19	0,0000	33,0000
20	0,0000	33,0000

1. Perform the analyses : depending is disease (values of 0 and 1), independing is AGE



2. Inspect the report

The report shows :

Logit P = -5,309 + (0,111 * AGE)

N = 100
Estimation Criterion: Maximum likelihood
Dependent Variable: DISEASE
Positive response (1): 1
Reference response (0): 0
Number of unique independent variable combinations: 43

Pearson Chi-square Statistic: 101,943 (P = 0,346)
Likelihood Ratio Test Statistic: 29,310 (P = <0,001)
-2*Log(Likelihood) = 107,353
Hosmer-Lemeshow Statistic: 1,160 (P = 0,997)

Threshold probability for positive classification: 0,500
Classification Table:

	Predicted Reference	**Predicted Positive**	**Totals**
Actual Reference Responses	45	12	57
Actual Positive Responses	14	29	43
Totals	59	41	100

Details of the Logistic Regression Equation

Ind. Variable	Coefficient	Standard Error	Wald Statistic	P value	VIF
Constant	-5,309	1,134	21,935	<0,001	
AGE	0,111	0,0241	21,254	<0,001	1,000

Ind. Variable	Odds Ratio	5% Conf. Lower	95% Conf. Upper
Constant	0,00494	0,000536	0,0456
AGE	1,117	1,066	1,171

3. We are only interested in the following part of the report:

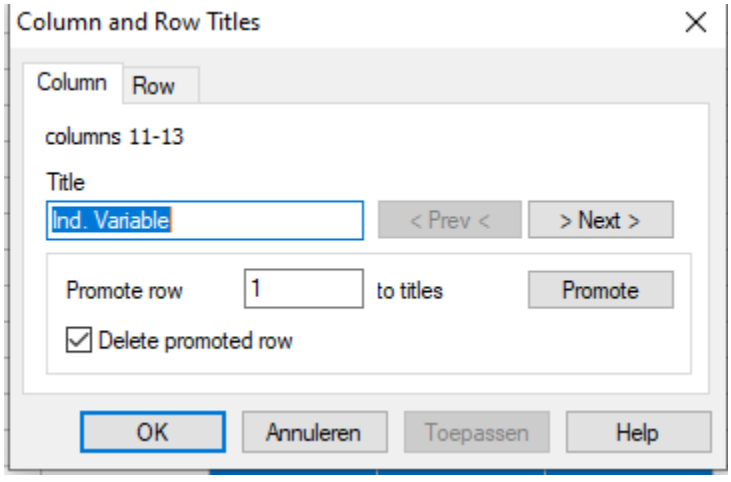
In order to generate the graphs, and the CI of the model, we use both the model Coefficient and the corresponding Standard Error

Variable	Coefficient	Standard Error
Constant	**-5,309**	**1,134**
AGE	**0,111**	**0,0241**

4. We copy this in the data sheet :

8	9-Log of Odds	10	11	12	13	
56,4706	3,0890		Variable	Coefficient	Standard Error	
46,6386	2,7560		Constant	-5,3090	1,1340	
43,7575	2,6450		AGE	0,1110	0,0241	
41,0545	2,5340					
41,0545	2,5340					

5. We select the cells in Column 11-13, select these, and use from Worksheet -> Titles “Promote” first row to titles.



The result is :

11-Ind. Variable	12-Coefficient	13-Standard Erro
Constant	-5,3090	1,1340
AGE	0,1110	0,0241

6. Now make use of the logistic regression function :

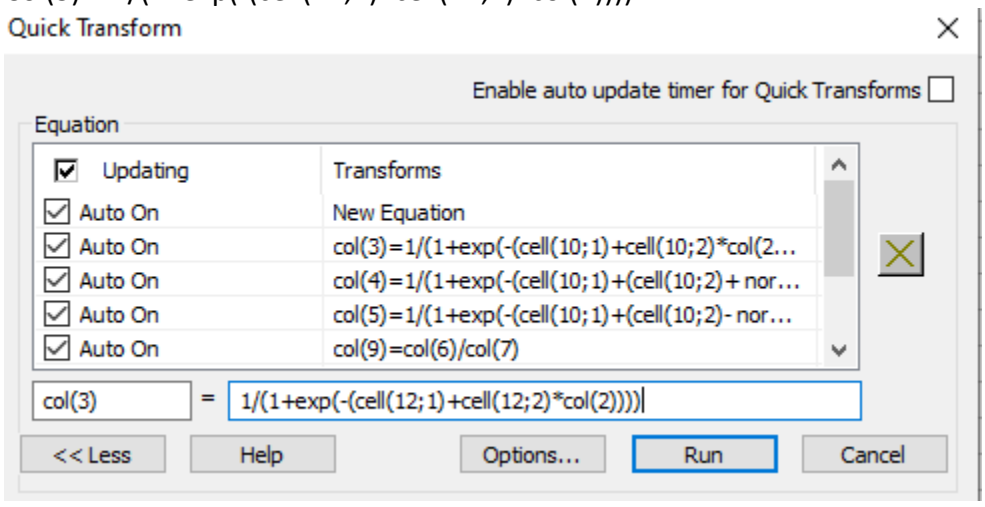
   Using the *logistic model*, the probability of a binary event is

$$\Pr(Y = 1|X) = \frac{\exp(\beta_0 + \beta_1 X)}{1 + \exp(\beta_0 + \beta_1 X)} = \frac{1}{1 + \exp(-\beta_0 - \beta_1 X)}$$

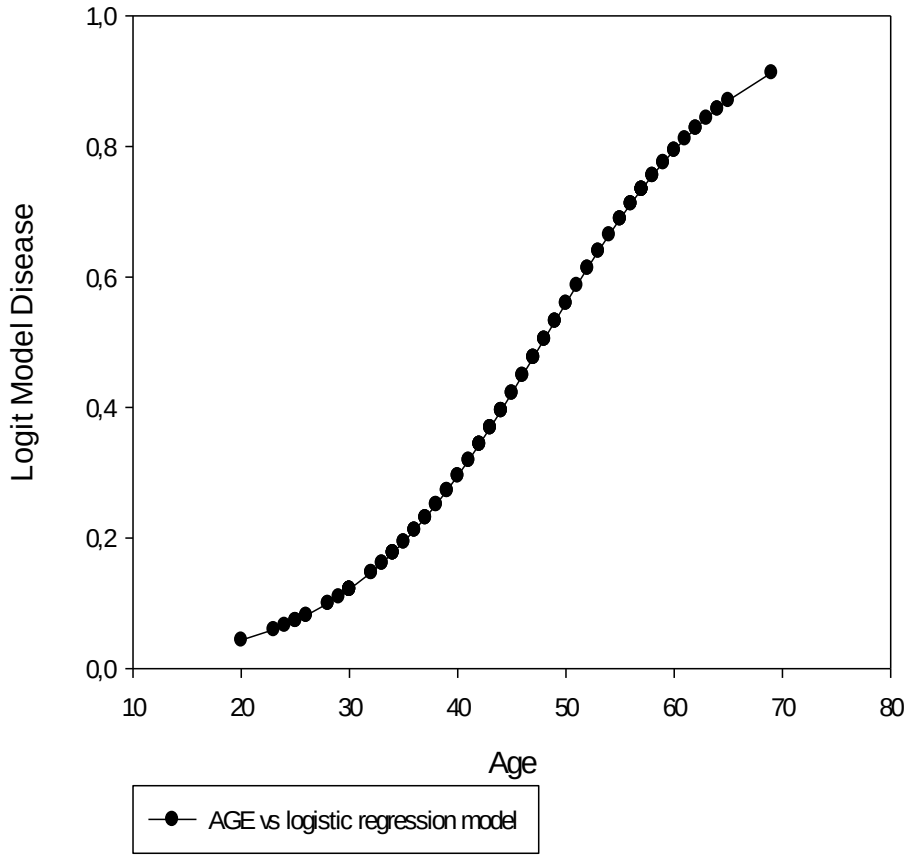
   Here we use the following commands in

   Col(1)= Disease
   Col(2) = AGE

   Col(3) = 1/(1+exp(-(cell(12;1)+cell(12;2)*col(2))))



7. This will result in one line, with an S-curve. This uses only the Coefficients b0=-5,30 and b1=0,11



8. We are able to create a confidence interval graph by using the formula:

A (1 - α)% two-sided confidence interval for β_1 is

$$\hat{\beta}_1 \pm z_{1-\frac{\alpha}{2}} s_{\hat{\beta}_1}$$

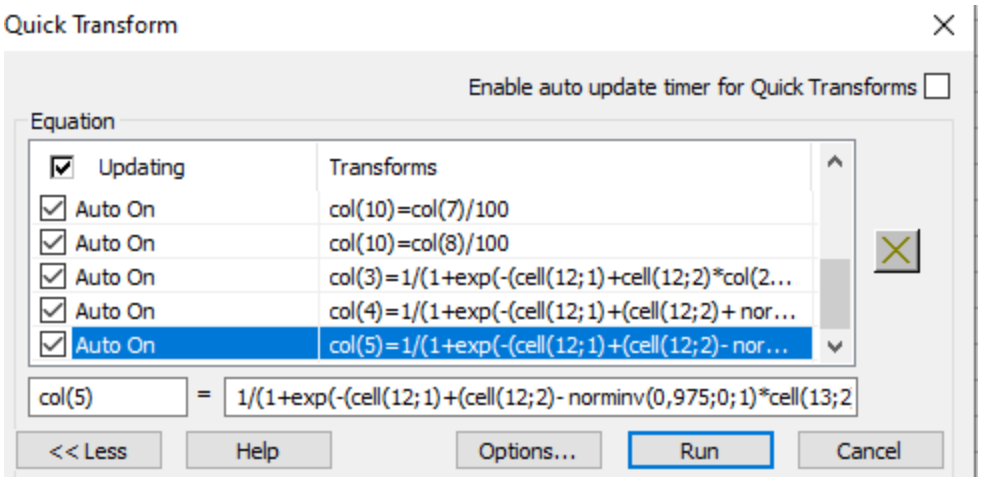
We use the following formulas :

For “higher 95% CI”

Col(4) = 1/(1+exp(-(cell(12;1)+(cell(12;2)+ norminv(0,975;0;1)*cell(12;2))*col(2))))

And for “Lower 95% CI”

Col(5) = 1/(1+exp(-(cell(12;1)+(cell(12;2) - norminv(0,975;0;1)*cell(12;2))*col(2))))



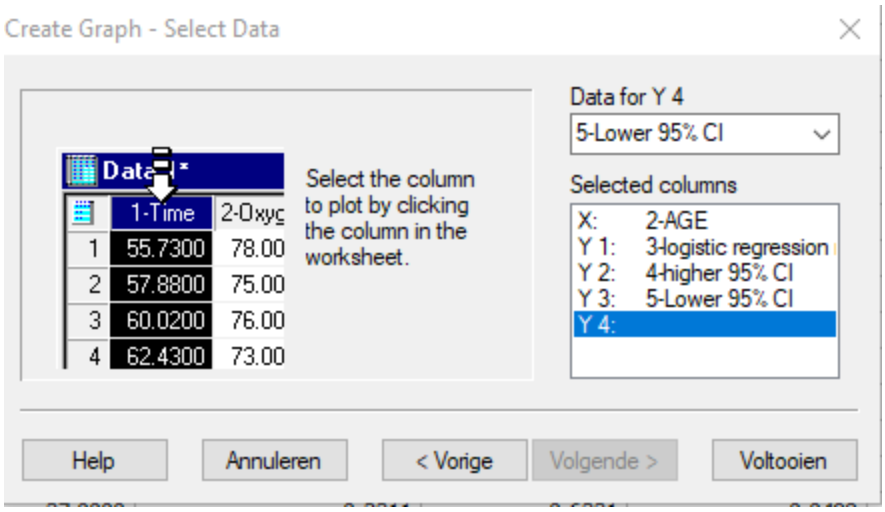
9. We place this in the data file, after we have given the correct column labels :

Data 1*

	.- DISEASI	2-AGE	3-logistic regression model	4-higher 95% CI	5-Lower 95% CI
1	0,0000	20,0000	0,0436	0,1049	0,0174
2	0,0000	23,0000	0,0597	0,1585	0,0210
3	0,0000	24,0000	0,0663	0,1807	0,0223
4	0,0000	25,0000	0,0735	0,2054	0,0238
5	1,0000	25,0000	0,0735	0,2054	0,0238
6	0,0000	26,0000	0,0814	0,2324	0,0253
7	0,0000	26,0000	0,0814	0,2324	0,0253
8	0,0000	28,0000	0,0997	0,2935	0,0286
9	0,0000	28,0000	0,0997	0,2935	0,0286
10	0,0000	29,0000	0,1101	0,3274	0,0305

Let’s plot the data:

We use the option “Multiple Line Graphs”, and “One X many Y”.



Graph of Logistic regression Disease by Age