Chi square - test, Odds Ratio

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Comparative analysis of drug A and drug B

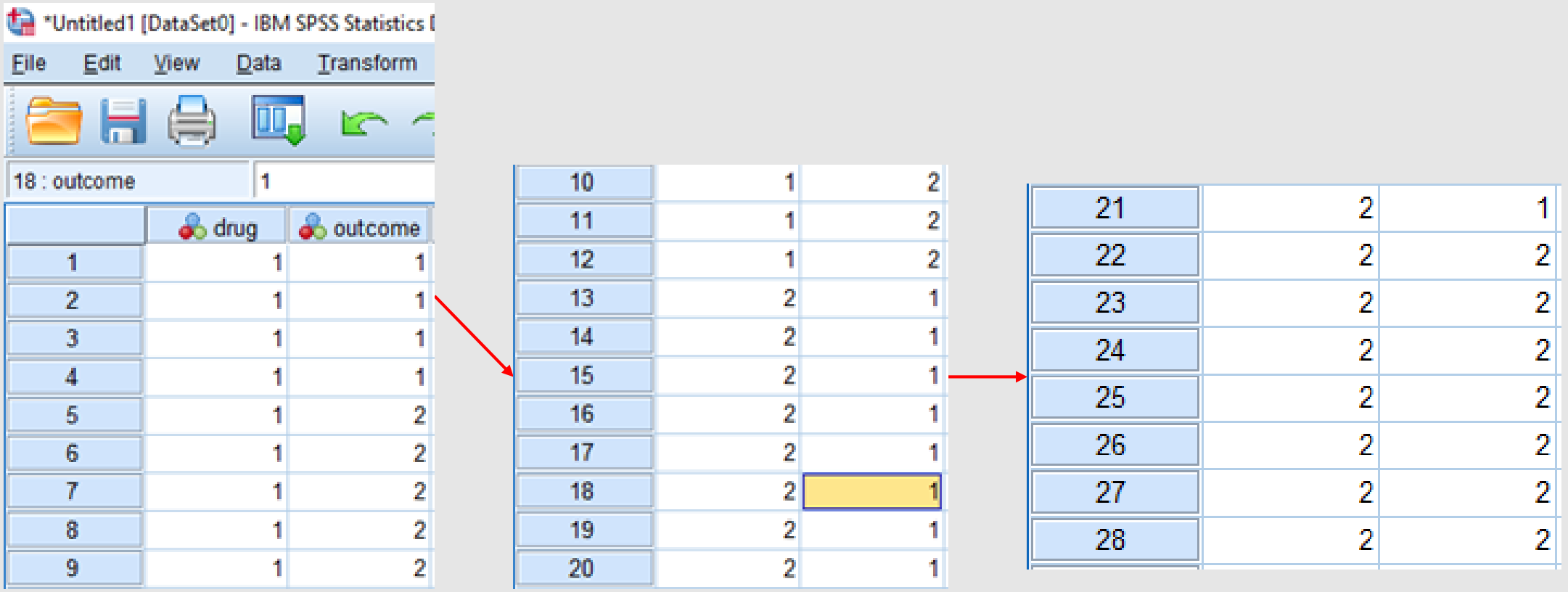
Suppose in a study, 28 people were given either drug A or drug B. Of the 12 people who received drug A, 4 were cured, and of the 16 people who received drug B, 9 were cured. We want to test whether there is a difference between the two drugs and if there is a relationship between the drug and the therapeutic effect.

The data is presented in the form of a 2x2 matrix.

	Therapeutic effect	
Drug	Cured=1	Not cured=2
A=1	4	8
B=2	9	7

Entering data and defining variables

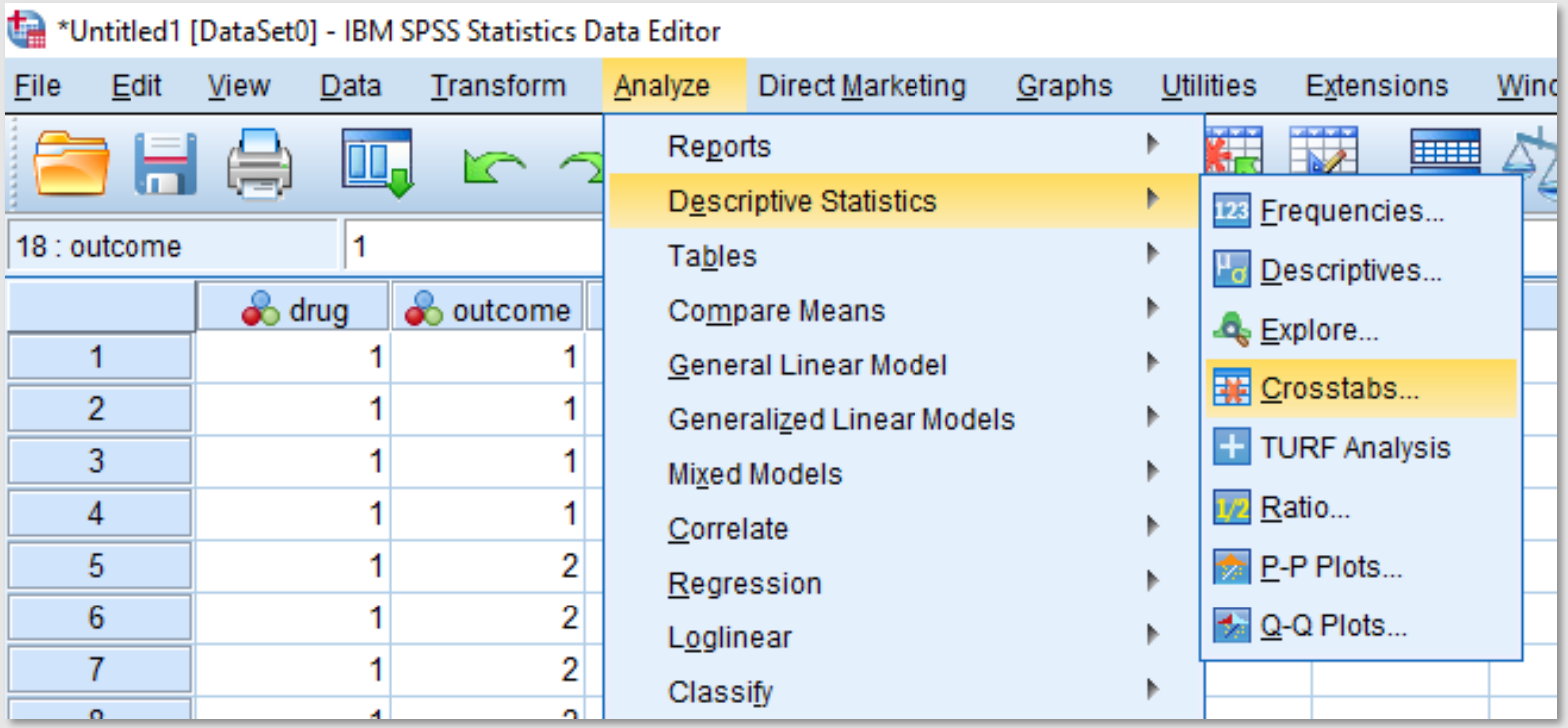
Enter the data in the **Data View** and define the variables in the **Variable View**



	drug	outcome
1	1	1
2	1	1
3	1	1
4	1	1
5	1	2
6	1	2
7	1	2
8	1	2
9	1	2
10	1	2
11	1	2
12	1	2
13	2	1
14	2	1
15	2	1
16	2	1
17	2	1
18	2	1
19	2	1
20	2	1
21	2	1
22	2	2
23	2	2
24	2	2
25	2	2
26	2	2
27	2	2
28	2	2

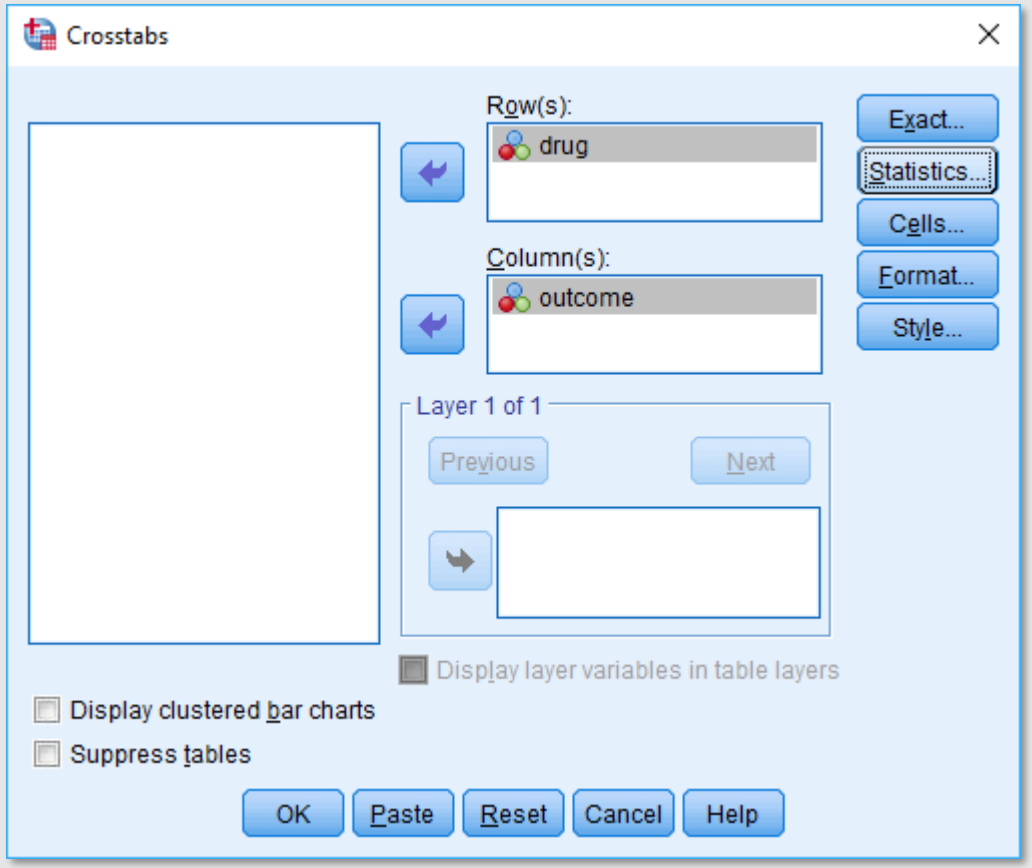
Running the chi-square test

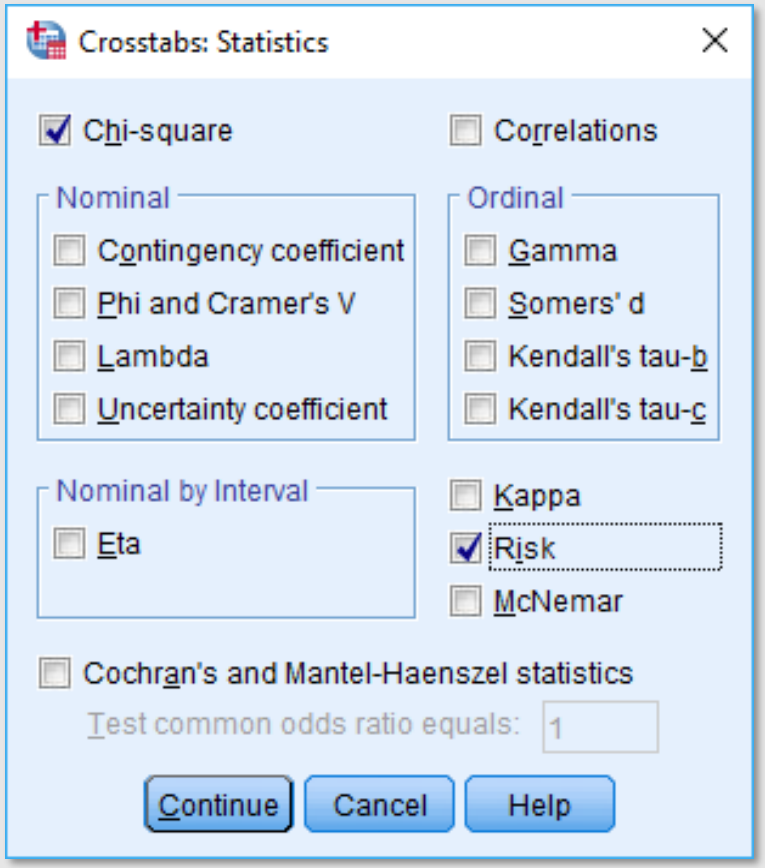
- To test the relationship between the **two categorical variables** or compare the percentages of patients treated by the two drugs, we will apply the **chi-square test**.
- Choose **Analyze -> Descriptive Statistics -> Crosstabs** from the menu.



Running the chi-square test

Drag the variable **drug** from the left box into the **Row(s):** box, and the variable **outcome** from the left box into the **Column(s):** box. Then, choose **Statistics**, select **Chi-square** and **Risk**, and press **Continue**, and **OK**.





Results and interpretation

In the **Chi-Square Tests** table, the **Pearson Chi-Square** value is **1.448**, which is not statistically significant (p>0.05), indicating that there is no relationship between the drug and treatment outcome. Alternatively, the percentages of patients treated by the two drugs do not differ.

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	1.448[a]	1	.229		
Continuity Correction[b]	.673	1	.412		
Likelihood Ratio	1.467	1	.226		
Fisher's Exact Test				.276	.207
Linear-by-Linear Association	1.396	1	.237		
N of Valid Cases	28				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 5.57.

b. Computed only for a 2x2 table

Results and interpretation

- In the **Risk Estimate table**, the **Odds Ratio** for drug (A/B) is 0.389.
  - This means that patients treated with drug A have 0.389 times the odds of being cured compared to patients treated with drug B.
  - It also means that drug A is associated with lower odds of treatment success compared to drug B.
  - In other words, patients on drug A are **less likely** to be cured than those on drug B. Specifically, the odds of being cured with drug A are about 61.1% lower than with drug B.
- The **95% confidence interval** for the **Odds Ratio** is 0.082 to 1.840. Since this interval **does include 1**, it suggests that the odds ratio is non statistically significant. The interval indicates that, with 95% confidence, the true odds ratio for drug A compared to drug B is between 0.082 and 1.840.
- For **easier interpretation**, we can calculate the **inverse** of the odds ratio (1/0.389≈2.571). This inverse value represents the odds of the comparison in the reverse direction (i.e., the odds of being cured with drug B compared to drug A). Thus, drug B has approximately 2.57 times the odds of success compared to drug A.
- This means that the 95% confidence interval for the odds ratio in the reverse direction ranges from approximately 0.543 (1/1.840≈0.543) to 12.20 (1/0.082≈12.20). Thus, drug B has between 0.543 and 12.20 times the odds of success compared to drug A.

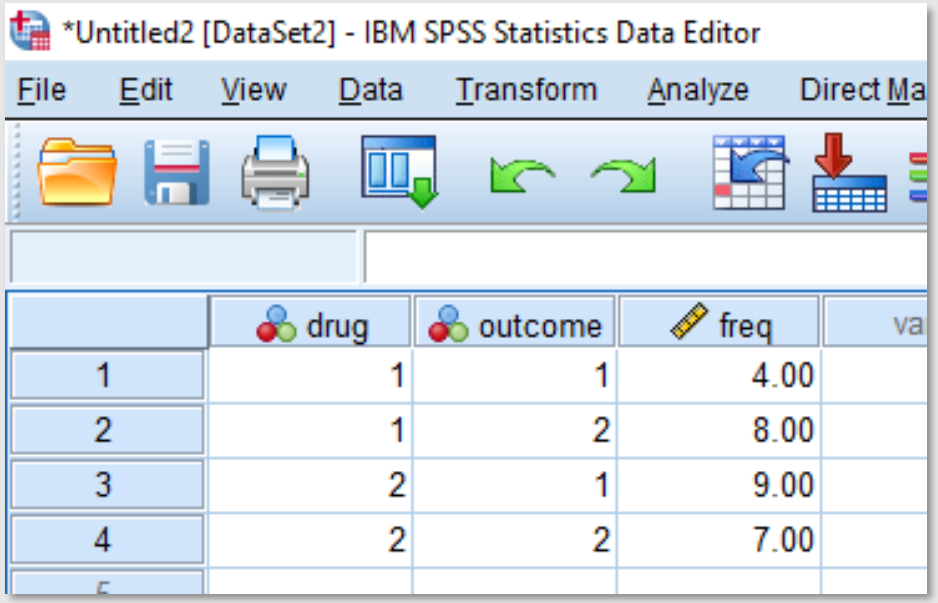
Risk Estimate

	Value	95% Confidence Interval	
		Lower	Upper
Odds Ratio for drug (A / B)	.389	.082	1.840
For cohort outcome = Cured	.593	.239	1.471
For cohort outcome = Not Cured	1.524	.768	3.022
N of Valid Cases	28		

Chi-Square - test, OR with the use of weight cases

Entering data and defining variables

Enter the data in the **Data View** and define the variables in the **Variable View** as shown below



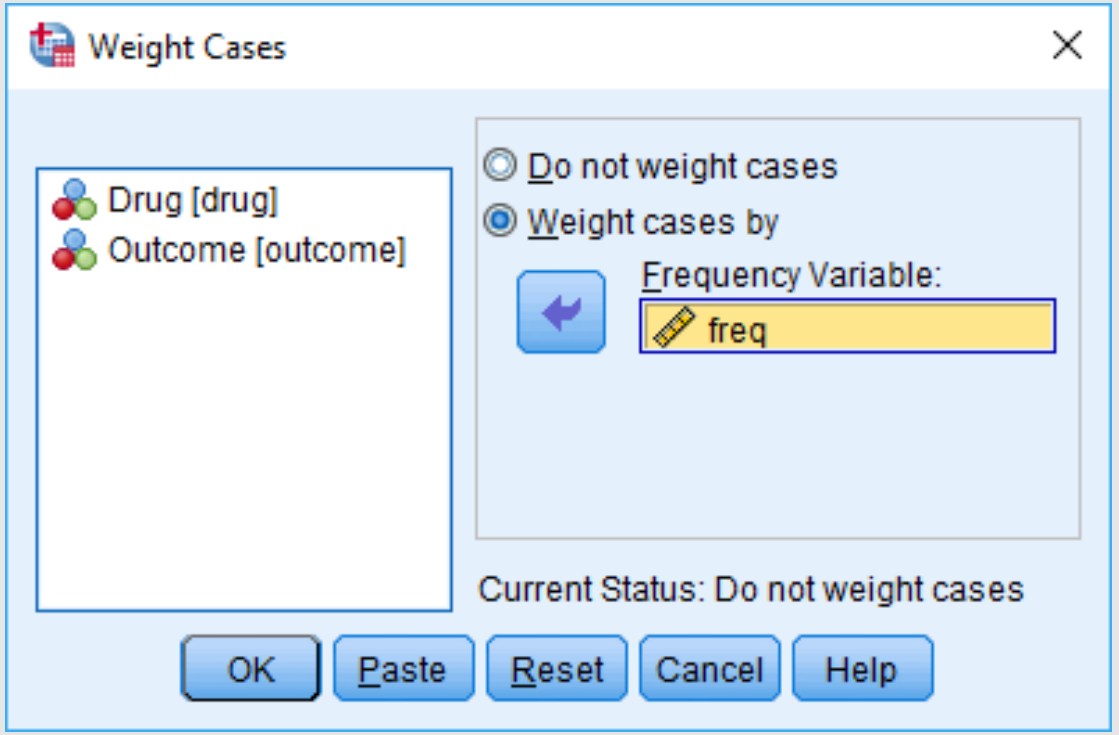
	drug	outcome	freq	va
1	1	1	4.00	
2	1	2	8.00	
3	2	1	9.00	
4	2	2	7.00	

	Outcome	
Drug	Cured=1	Not cured=2
A=1	4	8
B=2	9	7

Name	Type	Width	Decimals	Label	Values	Missing	Columns	Align	Measure
drug	Numeric	1	0	Drug	None	None	8	Right	Nominal
outcome	Numeric	1	0	Outcome	None	None	8	Right	Nominal
freq	Numeric	8	2		None	None	8	Right	Scale

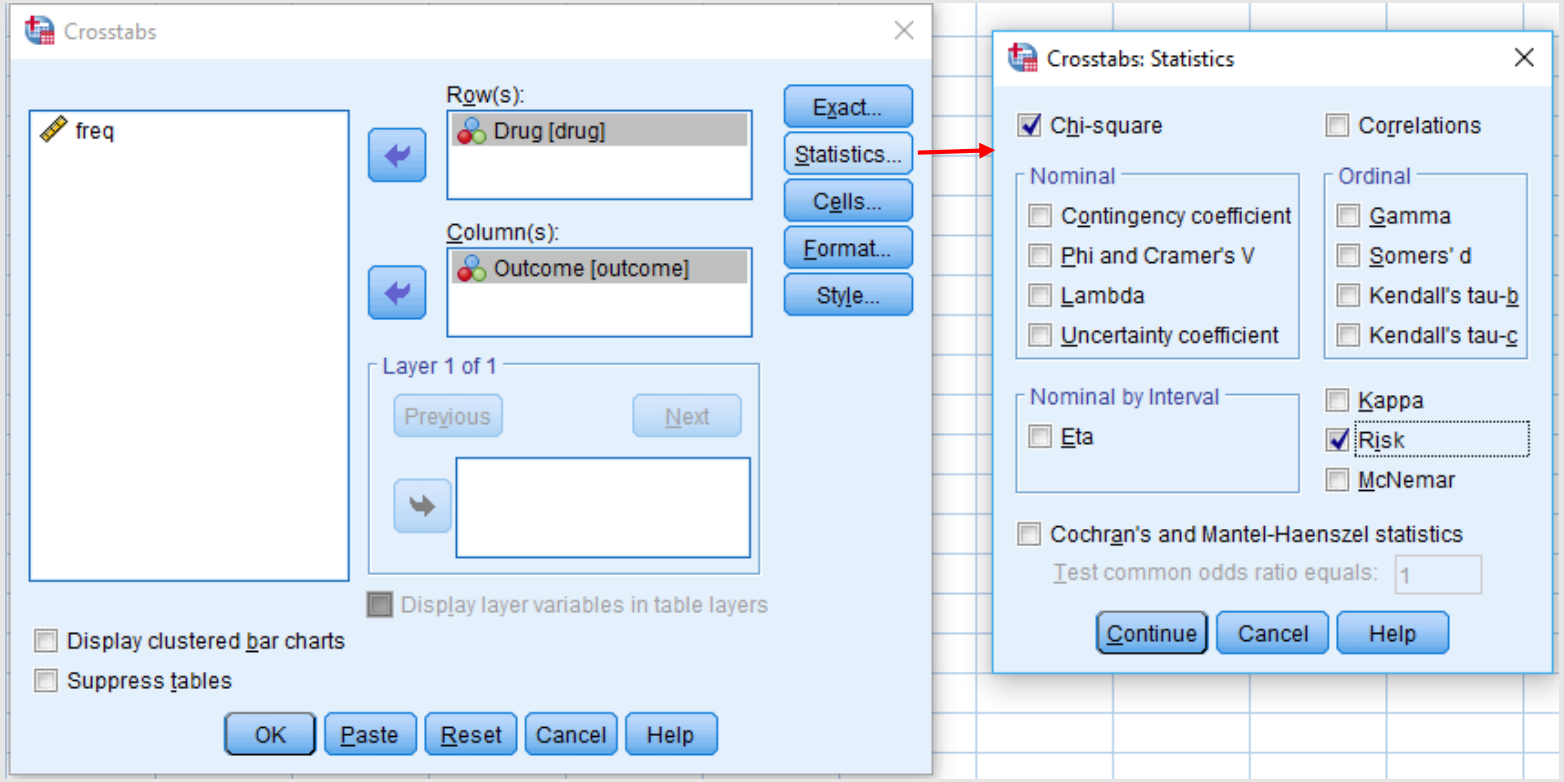
Weight Cases

From the menu, select **Data -> Weight Cases**. In the window that appears, choose **Weight cases by**, and drag the variable freq into the **Frequency Variable:** field. Then, click **OK**.



Chi-Square test, OR

- Choose **Analyze -> Descriptive Statistics -> Crosstabs** from the menu.
- Drag the variable **drug** from the left box into the **Row(s):** box, and the variable **outcome** from the left box into the **Column(s):** box. Then, choose **Statistics**, select **Chi-square** and **Risk**, and press **Continue**, and **OK**.



Results

Chi-Square Tests

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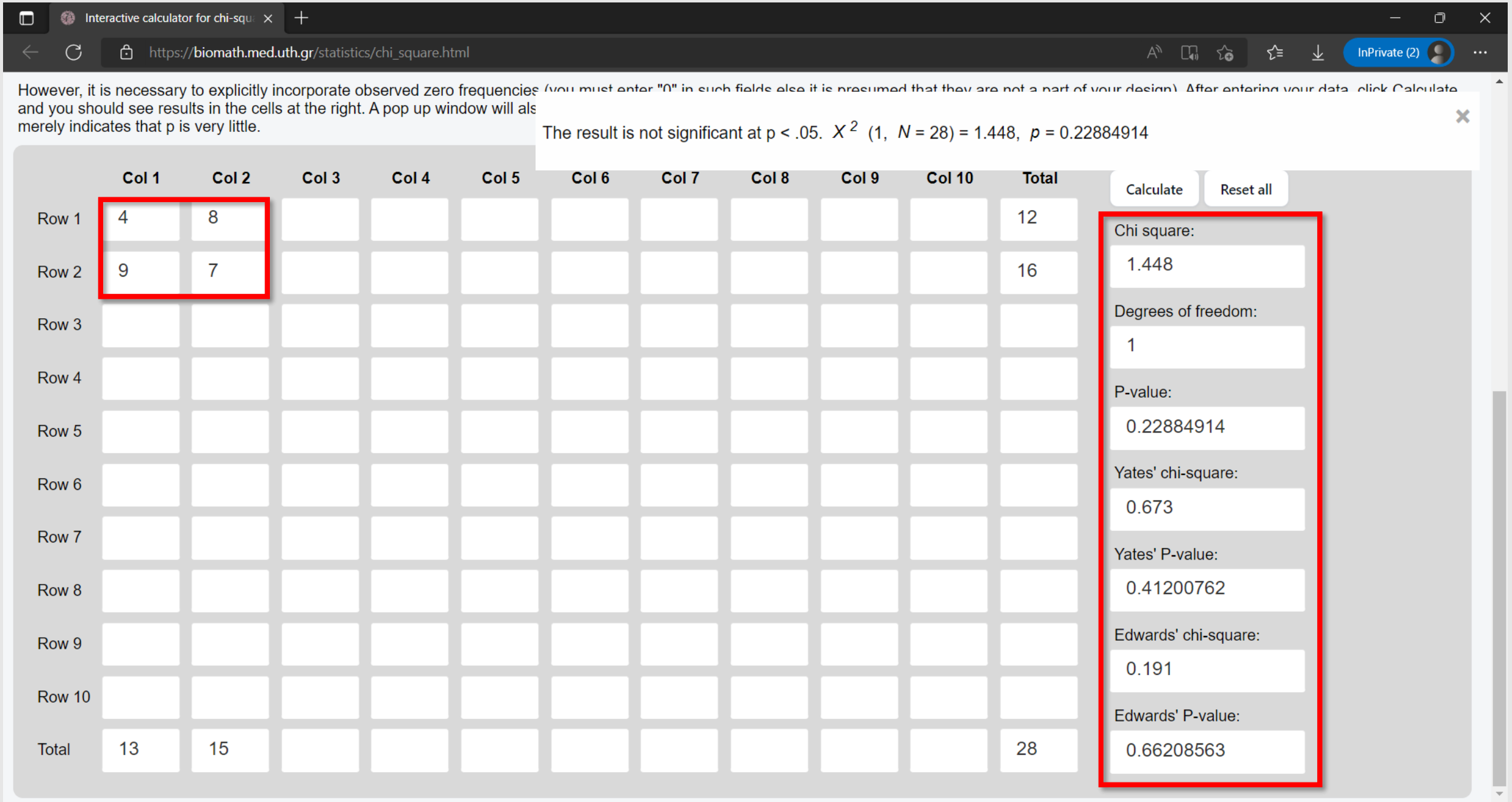
Interactive Calculator for chi square tests of independence

(https://biomath.med.uth.gr/statistics/chi_square.html)



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