

How to conduct a Fisher's exact test in Cytel Studio

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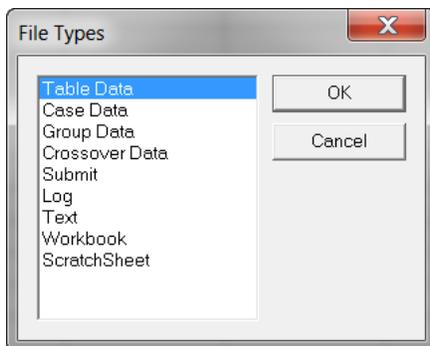
The objective of this write-up is to illustrate the procedure of running a Fisher's exact test as a supplement to a conventional Pearson's Chi-square test. For the conceptual framework of exact tests, please consult:

Yu, C. H. (2003). Resampling methods: Concepts, applications, and justification. *Practical Assessment Research and Evaluation*, 8(19). Retrieved from <http://pareonline.net/getvn.asp?v=8&n=19>

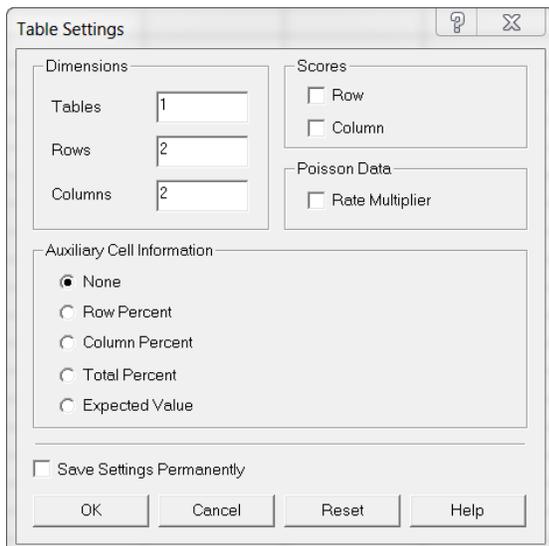
Yu, C. H. (2007). Resampling: A conceptual and procedural introduction. In Jason Osborne (Ed.), *Best practices in quantitative methods* (pp. 283-298). Thousand Oaks, CA: Sage Publications.

Steps

In Cytel Studio, choose **New** from the pull down menu **File**. Next, select **Table Data** and then click **OK**.



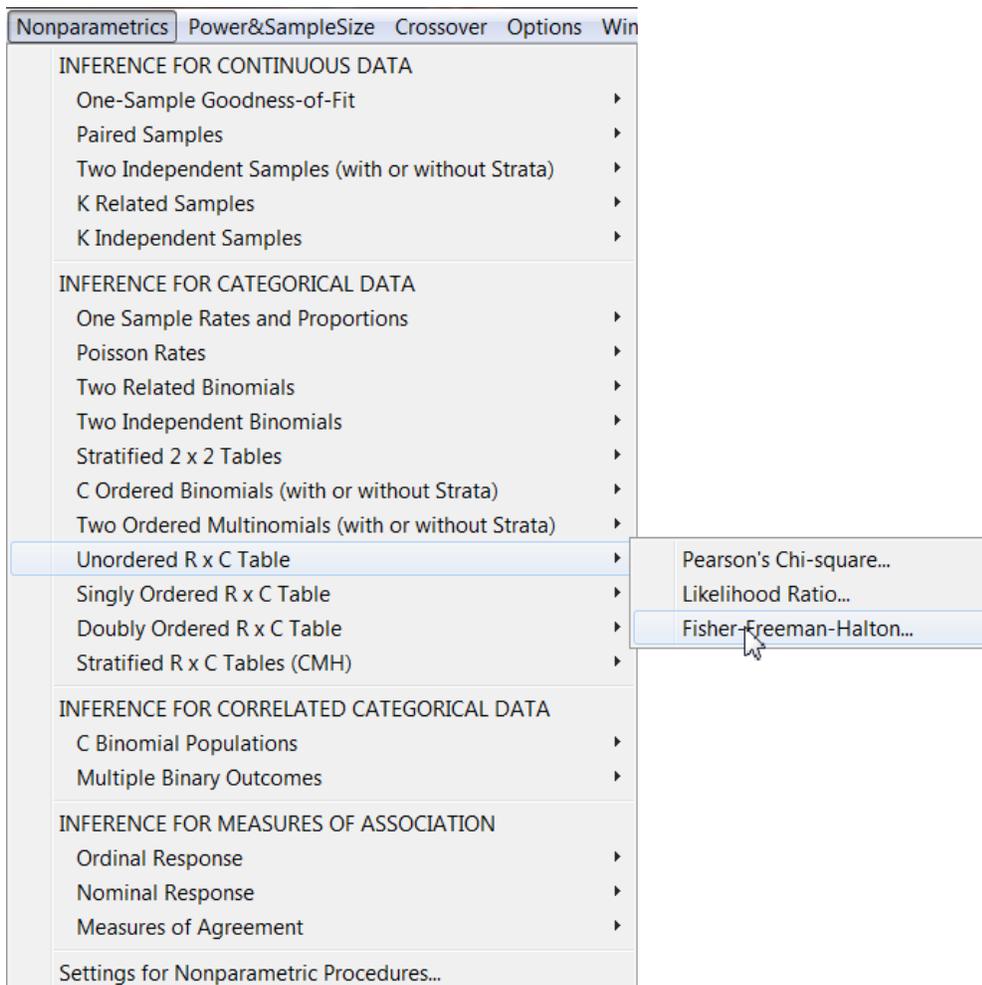
In this example, we will use two categorical variables, and each variable has two categories. Thus, we will use a 2-column X 2-row table.



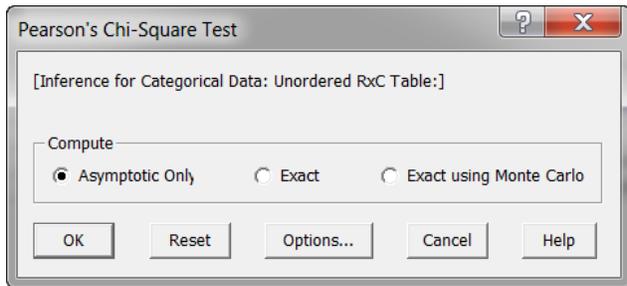
In this hypothetical data set, there are 48 male students and 42 female students. Some of them are majoring in science while some are majoring in art. We want to know whether gender makes a difference in choosing a major. It could be not the otherwise. Choosing an art major cannot make me a girl. In this step, we can simply enter the labels and the data as follows:

Table1	Male	Female	Total
Art	12	18	30
Science	36	24	60
Total	48	42	90

Next, from the pull down menu **Nonparametrics**, scroll down to **Unordered R X C Table**. Three options will pop up. Although the goal is to perform a Fisher's exact test, you can run a **Pearson's Chi-square test** first to obtain the Chi-square value.



Another window will prompt you to choose an inference method. You can select any one of the options. With such a small sample size, Cytel Studio will yield both asymptotic and exact p values by default.



The Chi-square test shows you the p values, the **Pearson Chi-square statistics** and the **Chi-square with Yates CC**.

Pearson Chi-Square Test

```
chisqr ( method = monte, time_limit = none , use_impsamp = no );
```

Data File:

Number of Rows: 2

Number of Columns: 2

Summary of the Test Statistic:

Y	Minimum	Maximum	Mean	Std. Dev
12	0	30	16	2.244

Pearson Chi-Square Statistic 3.214

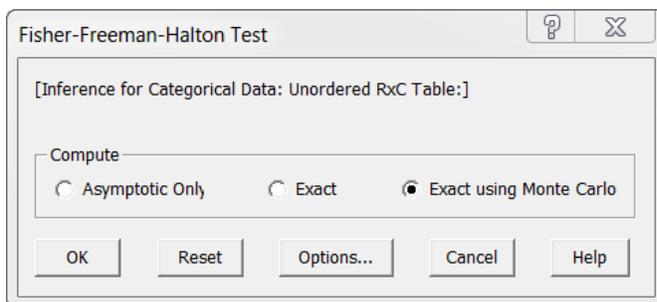
Chi-Square Statistic with Yates CC 2.461

Inference:

Type	Statistic	DF	Tail	P-Value		
				1-Sided	2-Sided	Point Prob.
Asymptotic	3.214	1	.GE.	0.0365	0.073	
Exact	3.214		.GE.		0.116	0.07319
Exact	12		.LE.	0.05828		0.03661

Elapsed time: 0:0:0.01

Next, run a **Fisher's exact test**. Again, you have three options. With a small data set, you can select the **Exact** option, which will use all possible permutations. However, when you have a large data set, it could be very computing-intensive and time-consuming. It is better to choose **Exact using Monte Carlo** by default. In this option, a subset of all possible permutations will be simulated.



In this example, you can see that the statistics of the Fisher's exact test is slightly different from that of the Pearson's Chi-square test. Using a two-sided test, both test concur that there is no gender effect in major selection.

Fisher's Exact Test

`fisher_exact (method = monte, time_limit = none , use_impsamp = no);`

Data File:

Number of Rows: 2

Number of Columns: 2

Summary of the Test Statistic:

Y	Minimum	Maximum	Mean	Std. Dev	Observed
12	0	30	16	2.244	3.172

Inference:

Hypergeometric Prob. of the table: 0.03661

Type	Statistic	DF	Tail	P-Value		
				1-Sided	2-Sided	Point Prob.
Asymptotic	3.172	1	.GE.	0.03745	0.0749	
Exact	3.172		.GE.		0.116	0.03661
Exact	12		.LE.	0.05828		0.03661

Elapsed time: 0:0:0.01