How to Perform Statistical Testing for Rates and Proportions

This technical assistance document was created by HSAG to assist health plans with statistical testing required for conducting performance improvement projects (PIPs). Selected steps from the PIP Submission Form and screen shots from Graphpad.com are provided to illustrate the proper techniques required to perform statistical testing and correctly document the results. The website provided in this document is recommended; however, not required. HSAG is not responsible for maintaining Graphpad.com and is not responsible for the accuracy of the website calculations.

The Web site, GraphPad (https://www.graphpad.com/quickcalcs/contingency1/), can be used to perform statistical testing. The site provides three different statistical tests: Pearson's Chi-square test, Yates' Chi-square (correction for continuity) test, and Fisher's exact test.

The Chi-square with Yates continuity correction and the Fisher's exact test are used with numerators and denominators less than 30. The difference between the two tests is the Fisher's exact test provides the exact *p* value probability while the Chi-square with the Yates continuity correction is an approximate *p* value. HSAG recommends health plans use the Fisher's exact test when working with small numerators and denominators because the *p* value is the exact probability.

If health plans have large numerators and denominators that do not allow calculation of the Fisher's exact test from Graphpad.com, HSAG recommends the use of the Yates' or Pearson Chi-square test. Either test provides approximately the same *p* value when the numerators and denominators are too large to calculate the Fisher's exact test.

Statistical Testing using Graphpad.com

When learning how to use Graphpad.com, use the example **Step 7: Indicator Results** table on page 2 from the PIP Submission Form. The example statistical testing is between a baseline rate of 72.3 percent and a Remeasurement 1 rate of 77.5 percent.

Step 7: Indicator Results. Enter the results of the indicator(s) in the table below. For HEDIS-based/CMS Core Set PIPs, the data reported in the PIP Submission Form should match the validated **performance measure rate(s)**. Enter results for each indicator by completing the table below. *P* values should be reported to four decimal places (i.e., 0.1234). Additional remeasurement period rows can be added, if necessary.

Indicator 1 Title: [Enter title of indicator]

Measurement Period	Indicator Measurement	Numerator	Denominator	Percentage	Mandated Goal or Target, if applicable	Statistical Test Used, Statistical Significance, and *p* Value
1/1/2020—12/31/2020	**Baseline**	402	556	72.3%	N/A for baseline	N/A for baseline
1/1/2021 —12/31/2021	**Remeasurement 1**	455	587	77.5%	87.3% Remeasurement 1 goal represents a statistically significant increase from the Baseline	*Fisher's exact test, statistically significant increase from Baseline to Remeasurement 1, p value=0.0475*

GraphPad Instructions

1. Open the GraphPad Web site by holding the control ("Ctrl") key and clicking the link on page 1.
2. Enter the information provided in the table below. See **Figure 1** and **Figure 2** below for data entry on page 4 and page 5, respectively.

Field Name	Required Data Entry
Group 1	Replace **Group 1** with **Baseline.**
Group 2	Replace **Group 2** with **R1 (Remeasurement 1).**
Outcome 1	Replace **Outcome 1** with **Had Service**.
Outcome 2	Replace **Outcome 2** with **No Service**.

First blank field to the right of **Baseline** (under **Had Service**)	Type the baseline numerator from the Step 7 table on page 2. (The baseline numerator is **402** on page 2.)
Second blank field to the right of **Baseline** (under **No Service**)	From the Step 7 table on page 2, subtract the baseline numerator from the baseline denominator, and enter the result. (In the example table on page 2, 556 – 402 = 154. The example result is 154.)
First blank field to the right of **R1** (under **Had Service**)	Type the Remeasurement 1 numerator from the Step 7 table on page 2. (The Remeasurement 1 numerator is **455** on page 2.)
Second blank field to the right of **R1** (under **No Service**)	From the Step 7 table on page 2, subtract the Remeasurement 1 numerator from the Remeasurement 1 denominator, and enter the result. (In the example table on page 2, 587 - 455 = 132. The example result is 132.)

3. Leave the "**Fisher's exact test (recommend)**" selected and the "**Two-Tailed (recommended)**" selected. Only change the statistical test to "**Chi-square with Yates' correction**" or "**Chi-square without Yates' correction**" if the Fisher's exact test won't calculate due to large numbers (see page 1 for further explanation). Always leave the "**Two-tailed (recommended)**" selected as there is no reason to change this.
4. Click the orange "**Calculate**" button.
5. The Web page will refresh and contain the statistical testing results. See **Figure 3** below on page 6.
6. **Note:** Health plans can copy the Web page by pressing the Print Screen key on your keyboard then pasting the screenshot in the PIP documentation and submit it to support statistical findings. All *p* values should be reported to four digits beyond the decimal point (i.e., 0.1234).

Figure 1

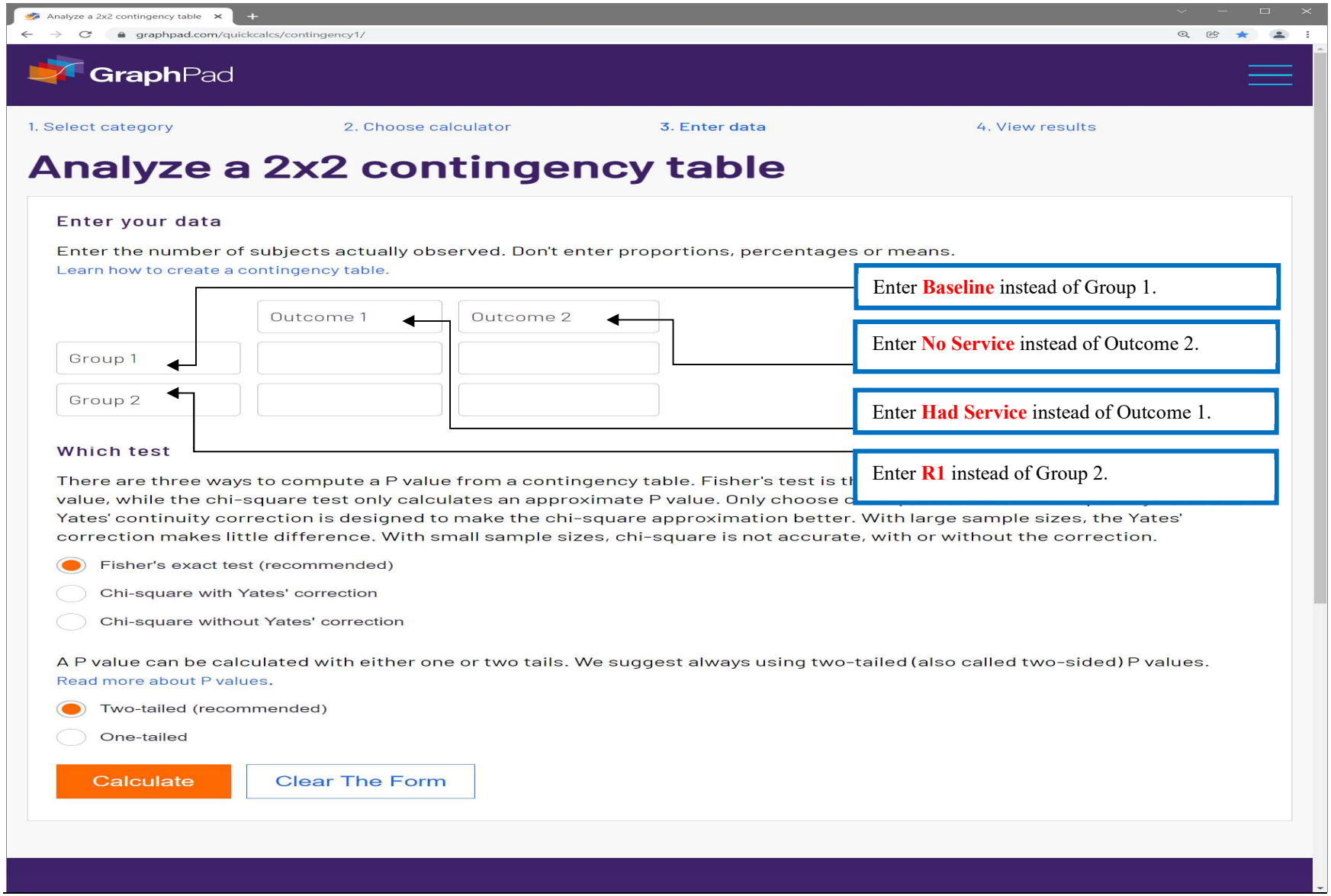

Analyze a 2x2 contingency table
graphpad.com/quickcalcs/contingency1/
GraphPad
1. Select category
2. Choose calculator
3. Enter data
4. View results
Analyze a 2x2 contingency table
Enter your data
Enter the number of subjects actually observed. Don't enter proportions, percentages or means.
Learn how to create a contingency table.
Outcome 1
Outcome 2
Group 1
Group 2
Enter Baseline instead of Group 1.
Enter No Service instead of Outcome 2.
Enter Had Service instead of Outcome 1.
Enter R1 instead of Group 2.
Which test
There are three ways to compute a P value from a contingency table. Fisher's test is th
value, while the chi-square test only calculates an approximate P value. Only choose c
Yates' continuity correction is designed to make the chi-square approximation better. With large sample sizes, the Yates'
correction makes little difference. With small sample sizes, chi-square is not accurate, with or without the correction.
Fisher's exact test (recommended)
Chi-square with Yates' correction
Chi-square without Yates' correction
A P value can be calculated with either one or two tails. We suggest always using two-tailed (also called two-sided) P values.
Read more about P values.
Two-tailed (recommended)
One-tailed
Calculate
Clear The Form

Figure 2

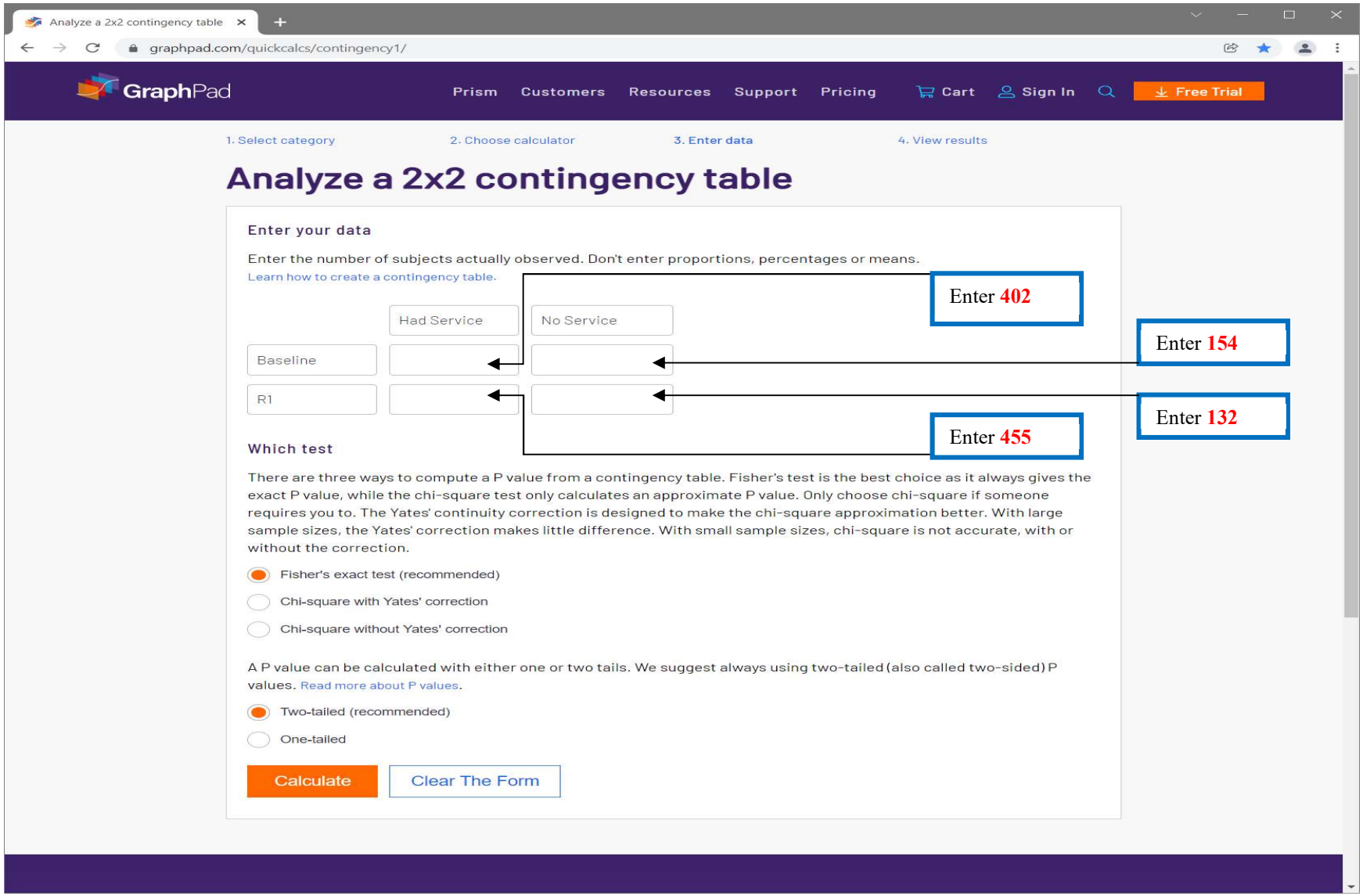
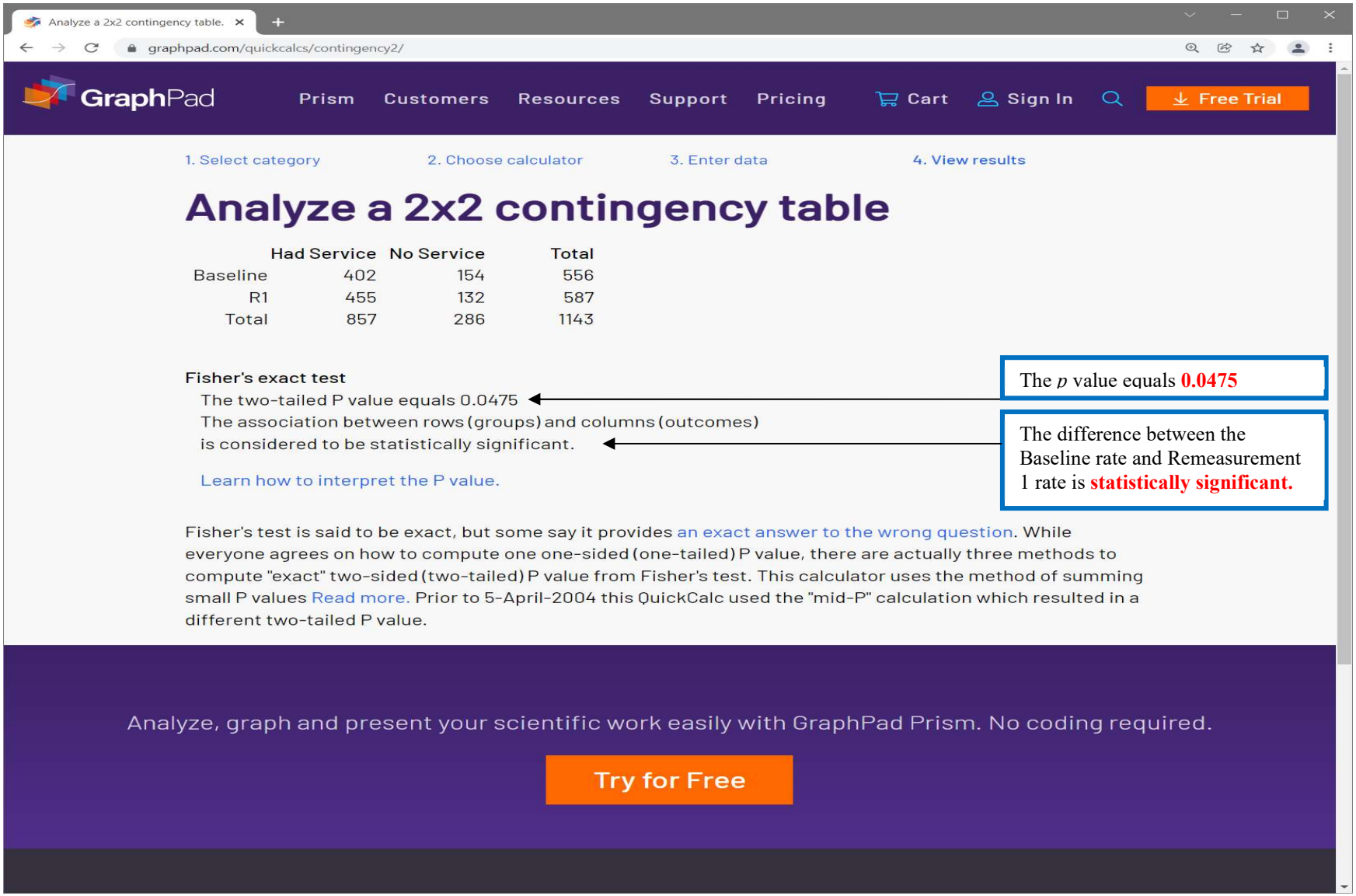

Analyze a 2x2 contingency table
graphpad.com/quickcalcs/contingency1/
GraphPad
Prism
Customers
Resources
Support
Pricing
Cart
Sign In
Free Trial
1. Select category
2. Choose calculator
3. Enter data
4. View results
Analyze a 2x2 contingency table
Enter your data
Enter the number of subjects actually observed. Don't enter proportions, percentages or means.
Learn how to create a contingency table.
Had Service
No Service
Baseline
R1
Enter 402
Enter 154
Enter 132
Enter 455
Which test
There are three ways to compute a P value from a contingency table. Fisher's test is the best choice as it always gives the exact P value, while the chi-square test only calculates an approximate P value. Only choose chi-square if someone requires you to. The Yates' continuity correction is designed to make the chi-square approximation better. With large sample sizes, the Yates' correction makes little difference. With small sample sizes, chi-square is not accurate, with or without the correction.
Fisher's exact test (recommended)
Chi-square with Yates' correction
Chi-square without Yates' correction
A P value can be calculated with either one or two tails. We suggest always using two-tailed (also called two-sided) P values. Read more about P values.
Two-tailed (recommended)
One-tailed
Calculate
Clear The Form

Figure 3


Analyze a 2x2 contingency table.
graphpad.com/quickcalcs/contingency2/
GraphPad
Prism
Customers
Resources
Support
Pricing
Cart
Sign In
Free Trial
1. Select category
2. Choose calculator
3. Enter data
4. View results
Analyze a 2x2 contingency table
Had Service
No Service
Total
Baseline 402 154 556
R1 455 132 587
Total 857 286 1143
Fisher's exact test
The two-tailed P value equals 0.0475
The association between rows (groups) and columns (outcomes) is considered to be statistically significant.
Learn how to interpret the P value.
The p value equals 0.0475
The difference between the Baseline rate and Remeasurement 1 rate is statistically significant.
Fisher's test is said to be exact, but some say it provides an exact answer to the wrong question. While everyone agrees on how to compute one one-sided (one-tailed) P value, there are actually three methods to compute "exact" two-sided (two-tailed) P value from Fisher's test. This calculator uses the method of summing small P values Read more. Prior to 5-April-2004 this QuickCalc used the "mid-P" calculation which resulted in a different two-tailed P value.
Analyze, graph and present your scientific work easily with GraphPad Prism. No coding required.
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