


An Introduction to OpenEpi Version 3.0.1

by

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The screenshot shows a web browser window displaying the OpenEpi website. The address bar shows the URL openepi.com/v37/Menu/OE_Menu.htm. The page features a teal header with the OpenEpi logo and the text "Open Source Epidemiologic Statistics for Public Health". Below the header, it states "Now in English, French, Spanish, Italian, and Portuguese" and "Version 3.01 Updated 2013/04/06 Try it in a Smartphone browser!". The main content area includes a photograph of a building with a large archway and text describing the software's capabilities and licensing. A sidebar on the left lists various statistical tools available on the site.

OpenEpi Open Source Epidemiologic Statistics for Public Health

Now in English, French, Spanish, Italian, and Portuguese

Version 3.01 Updated 2013/04/06 *Try it in a Smartphone browser!*

OpenEpi provides statistics for counts and measurements in descriptive and analytic studies, stratified analysis with exact confidence limits, matched pair and person-time analysis, sample size and power calculations, random numbers, sensitivity, specificity and other evaluation statistics, R x C tables, chi-square for dose-response, and links to other useful sites.

OpenEpi is free and **open source** software for epidemiologic statistics. It can be run from a web server or downloaded and run without a web connection. A server is not required. The programs are written in JavaScript and HTML, and should be compatible with recent Linux, Mac, and PC browsers, regardless of operating system. (If you are seeing this, your browser settings are allowing JavaScript.) The programs can be run in the browsers of many iPhone and Android cellphones.

Test results are provided for each module so that you can judge reliability, although it is always a good idea to check important results with software from more than one source. Links to hundreds of Internet calculators are provided.

The programs have an open source license and can be downloaded, distributed, or translated. Some of the components from other sources have licensing statements in the source code files. Licenses referred to are available in full text at OpenSource.org/licenses. OpenEpi development was supported in part by a grant from the Bill and Melinda Gates Foundation to Emory University,

Rollins School of Public Health.

A toolkit for creating new modules and for translation is included. Please let us know if you would like to collaborate in this way. Suggestions, comments, and expressions of interest in contributing to this effort should be sent by email to: andy.dean@gmail.com, cdckms@sph.emory.edu, and msoe@cdc.gov

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Introduction

OpenEpi (www.OpenEpi) is a free, web-based, open source, operating system-independent series of programs for use in epidemiology, biostatistics, public health, and medicine, providing a number of epidemiologic and statistical tools for summary data.(1-13) OpenEpi was developed in JavaScript and hypertext markup language (HTML) and can be run in browsers supporting these languages, such as Microsoft Explorer, Mozilla Firefox, Safari, Chrome, and Opera, on a number of operating systems, such as Microsoft Windows, Macintosh, Linux, and on an iPhone. The program can be run from the OpenEpi website or downloaded and run without a web connection. The source code and documentation is downloadable and freely available. Reviews of OpenEpi can be found in the following references.(14-17) OpenEpi has had over 8 million hits since its inception in 2003, with over 1.8 million hits in 2011 alone, from 188 countries.

The OpenEpi developers have had extensive experience in the development and testing of Epi Info, a program developed by the Centers for Disease Control and Prevention (CDC) and widely used around the world for data entry and analysis. OpenEpi was developed to perform analyses found in the DOS version of Epi Info modules StatCalc and EpiTable, to improve upon the types of analyses provided by these modules, and to provide a number of tools and calculations not currently available in Epi Info. It is the first step toward an entirely web-based set of epidemiologic software tools. OpenEpi can be thought of as an important companion to Epi Info and to other programs such as SAS, PSPP, SPSS, Stata, SYSTAT, Minitab, Epidata, and R. For a comparison of the types of cross-tabulations performed by OpenEpi, Epi Info, SAS, and SPSS, see Appendix 1. Epi Info version 3.5.3 and later versions includes a link to OpenEpi. Another functionally similar Windows-based program is Winpepi (information available at Wikipedia). Both OpenEpi and Epi Info were developed with the goal of providing tools for low and moderate resource areas of the world. The initial development of OpenEpi was supported by a grant from the Bill and Melinda Gates Foundation to Emory University.(18-19)

The types of calculations currently performed by OpenEpi include:

- Various confidence intervals for proportions, rates, standardized mortality ratio, mean, median, percentiles
- 2x2 crude and stratified tables for count and rate data
- Matched case-control analysis
- Test for trend with count data
- Independent t-test and one-way ANOVA
- Diagnostic and screening test analyses with receiver operating characteristic (ROC) curves
- Sample size for proportions, cross-sectional surveys, unmatched case-control, cohort, randomized controlled trials, and comparison of two means
- Power calculations for proportions (unmatched case-control, cross-sectional, cohort, randomized controlled trials) and for the comparison of two means
- Random number generator

For epidemiologists and other health researchers, OpenEpi performs a number of calculations based on tables not found in most epidemiologic and statistical packages. For example, for a single 2x2 table, in addition to the results presented in other programs, OpenEpi provides estimates for:

- Etiologic or prevented fraction in the population and in exposed with confidence intervals, based on risk, odds, or rate data
- The cross-product and MLE odds ratio estimate
- Mid-p exact p-values and confidence limits for the odds ratio
- Calculations of rate ratios and rate differences with confidence intervals and statistical tests.

Figure 1. OpenEpi Menu with a short description

Menu item	Description
Home	The main OpenEpi page
Info and Help	
Language/Options/Settings	Optional settings such as language, table orientation, etc.
Calculator	A calculator, similar to a hand-held scientific calculator
Counts	The following modules are for analysis of count data
Std.Mort.Ratio	SMR - Standardized mortality (or morbidity) ratio, no. observed / no. expected
Proportion	Various confidence intervals for a proportion
Two by Two Table	2 x 2 tables and stratified 2 x 2 tables with p-values and estimates
Dose-Response	R x 2 tables and stratified R x 2 tables for more than 2 exposure levels
R by C Table	General R x C table (usually for more than 2 rows/2 columns), chi-square p-value
Matched Case Control	Pair-matched case-control analysis; p-values and the odds ratio
Screening	Screening/diagnostic results such as sensitivity, specificity, ROC
Person Time	The following modules are for the analysis of person-time data
1 Rate	Various confidence intervals for a single rate
Compare 2 Rates	2 x 2 tables and stratified tables with person-time data, p-values and estimates
Continuous Variables	The following modules are for the analysis of continuous or ordinal data
Mean CI	Provides a confidence interval for a mean
Median/%ile CI	Provides observations for a percentile and its confidence limits
t test	Calculates independent <i>t</i> test assuming equal & unequal variance
ANOVA	Calculates ANOVA table and confidence limits around each group mean
Sample Size	Sample size calculations for various study designs
Proportion	Absolute precision approach to sample size for a proportion
Unmatched CC	Sample size calculation for an unmatched case-control study
Cohort/RCT	Sample size calculation for a cross-sectional, cohort, or clinical trial study
Mean Difference	Sample size for the difference between two means
Power	Power calculations for various study designs
Unmatched CC	Power calculations for an unmatched case-control study
Cohort	Power calculations for a cohort study
Clinical Trial	Power calculations for a randomized clinical trial
X-Sectional	Power calculations for a cross-sectional study
Mean Difference	Power calculations for the difference between two means
Random numbers	Random number generator
Download OpenEpi	

For stratified 2x2 tables with count data, OpenEpi provides:

- Mantel-Haenszel (MH) and precision-based estimates of the risk ratio and odds ratio
- Precision-based adjusted risk difference
- Tests for interaction for the risk ratio, odds ratio, and risk difference
- Four different confidence limit methods for the odds ratio.

Similar to Epi Info, in a stratified analysis, both crude and adjusted estimates are provided so that the assessment of confounding can be made. With rate data, OpenEpi provides adjusted rate ratio's and rate

differences, and tests for interaction. Finally, with count data, OpenEpi also performs a test for trend, for both crude data and stratified data.

In addition to being used to analyze data by health researchers, OpenEpi has been used as a training tool for teaching epidemiology to students at: Emory University, University of Michigan, Morehouse College, Columbia University, University of Wisconsin, San Jose State University, University of Medicine and Dentistry of New Jersey, and elsewhere. This includes campus-based and distance learning courses. Because OpenEpi is easy to use, requires no programming experience, and can be run on the internet, students can use the program and focus on the interpretation of results.

Version 2.2 of OpenEpi was released Nov 11 2007 with the improvement of being able to run in English, French, Spanish, or Italian. In progress are translations into Portuguese and Chinese.

Comments and suggestions for improvements are welcomed and the developers respond to user queries. The developers encourage others to develop modules that could be added to OpenEpi and provide a developer's tool at the website. Planned future developments include improvements to existing modules, development of new modules, and add the ability to cut and paste data and/or read data files.

We encourage those in public health to use OpenEpi and to share their experiences with the developers. Comments and suggestions for improvements are welcome and we respond to user queries. We encourage others to develop modules that could be added to OpenEpi and we provide a developer's tool at the website. The developers are currently seeking funding to improve the existing modules, develop new modules, translate into other languages, and add the ability to cut and paste data and/or read data files.

Should you use OpenEpi results in a report or publication, we suggest you use the following reference:

Dean AG, Sullivan KM, Soe MM. OpenEpi Version 3.0.1: Open Source Epidemiologic Statistics for Public Health. Updated Apr 6, 2013, www.OpenEpi.com, accessed (date).

Please be sure to use the correct "updated" date which is on the main OpenEpi screen near the center bottom of the screen; the date of Apr 6, 2013 was the most recent version at the time of this writing. Also list the date in which OpenEpi was accessed for your analyses.

Finally, we would like to note that OpenEpi may not always operate as expected because of different operating systems, different browsers, and different levels of computer security. Most of our testing of OpenEpi is under the Windows environment using Microsoft Explorer and Mozilla Firefox. If you run into unexpected problems, please let us know and provide: the operating system and version number; browser name and version number; type of computer/PDA/phone used; antivirus and popup blocker software installed on computer; whether you have administrative rights on the computer; and exact details of the problem with a screen shot and the steps taken prior to the error.

Considerations and Issues in Using OpenEpi

Below are some issues in using OpenEpi which are reviewed next:

- Running OpenEpi on the Web vs. Downloading
- Options and Settings
- Copying and Pasting results
- Using OpenEpi on PDA's and cell phones

Running OpenEpi on the Web vs. Downloading

The easiest way to use OpenEpi is to open a browser on a computer linked to the internet and go to www.OpenEpi.com. You may consider downloading OpenEpi to your computer for the following reasons:

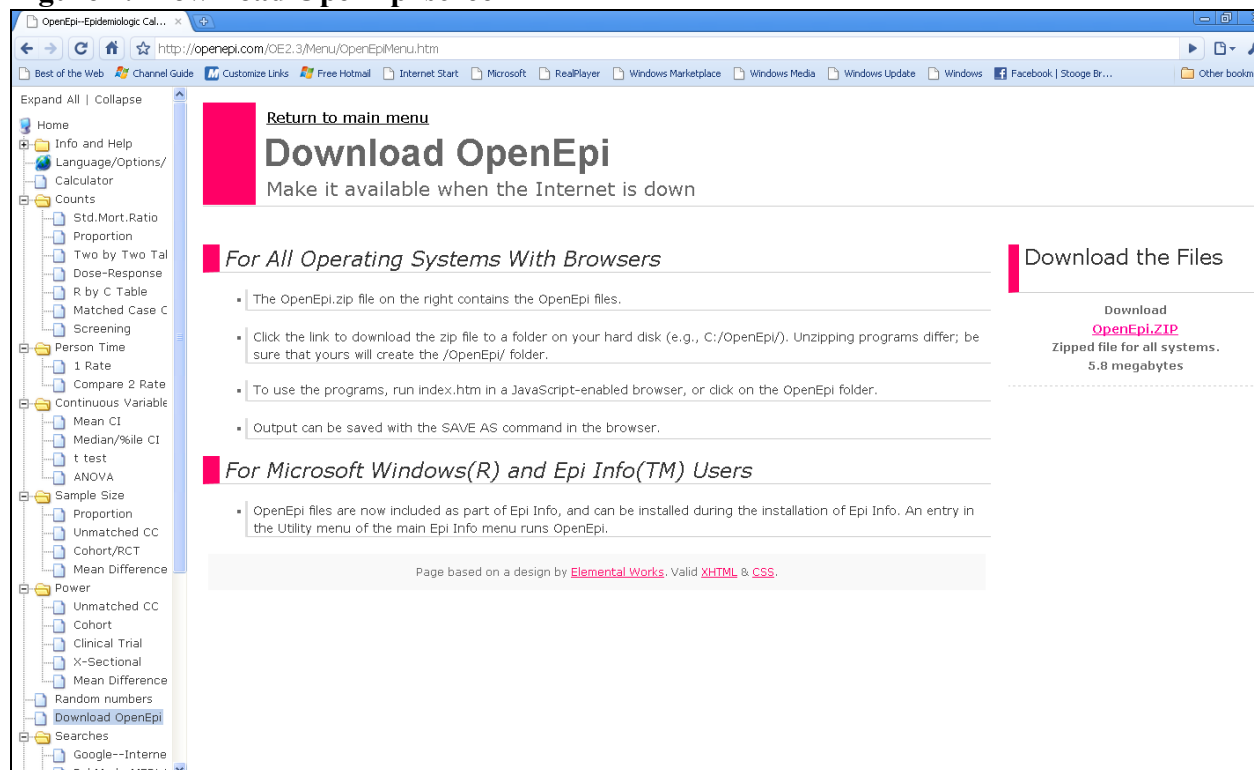
- Your access to the internet is limited, intermittent, or slow
- To have OpenEpi available when offline, such as for portable computers while traveling
- You want to review the source code and modify it for your own use
- Occasionally the server on which OpenEpi resides may not work for short periods of time

For those who travel, you might want to install OpenEpi on your portable computer or PDA so that you can use it without requiring an internet connection. For those living in areas with infrequent or slow internet access, you might consider installing OpenEpi on your computer. You can copy OpenEpi to a USB memory stick or a CD ROM.

Another reason to download OpenEpi is that some users might be JavaScript programmers and interested in reviewing the source code and perhaps modifying the code. We encourage JavaScript programmers to send suggestions and/or updated code to the OpenEpi developers for recommended improvements or for new types of calculations.

To download OpenEpi, click on **Download OpenEpi** in the left command window and the information is present as shown in Figure 2. Download a “.zip” file to your computer and use a program to “unzip” the files to your computer, an option that works under most operating systems.

Figure 2. Download OpenEpi screen



Using the mouse, left click on **OpenEpi.ZIP** (see Figure 2). For most users a dialog box may appear asking if you want to *save* or *open* the .zip file. You can either save the .zip file to your computer and then open the .zip file using a .zip utility program or, if you have a zip utility program on your computer, open the .zip file. Additional information on zip files can be found at [en.wikipedia.org/wiki/ZIP_\(file_format\)](http://en.wikipedia.org/wiki/ZIP_(file_format)). When the .zip file is “unzipped” or “uncompressed”, you will need to specify where to place the files. Frequently the files are saved on the “C:”

drive in a folder called “OpenEpi”, however you can save the files into whichever drive and folder you prefer. To start OpenEpi, open the folder where the OpenEpi files were uncompressed, and click on the file “Index.htm”.

Options and Settings

There are a number of options and settings that can be selected in OpenEpi. To see these, click on the “Options/Setting” option in the menu on the left side of the screen and the OpenEpi Settings screen will be presented (Figure 3). The options/settings are:

- Language
- Settings for 2 x 2 Input Table (“table orientation”)
- Confidence level for confidence intervals
- Provide the following in the output:
 - Do Not Highlight “significant” p-values
 - Show column percents
 - Show row percents
 - Show input datatables
 - Show stratum results

Language: As of this writing, the languages supported by OpenEpi are English, French, Italian, and Spanish. As languages are added, they will be added to the **Select Language** pull down menu as shown in Figure 3. If you switch languages, you will most likely need to use the “refresh” button on the browser to change the language on the current screen.

Figure 3. OpenEpi Settings screen

Layout - Settings for a 2 x 2 Input Table: This option allows the user to specify whether disease forms the columns and exposure the rows, or vice versa. It also allows the user to specify the order of those with the event, i.e. “(+)”, or without the event, i.e. “(-)”. Different textbooks and different software programs may have different ways in which a 2 x 2 table is presented. The “Epi Info; Schlesselman; Lilienfeld; Friis” automatic layout is as follows:

Exposed	Disease		Total
	(+)	(-)	
(+)	a	b	a+b
(-)	c	d	c+d
Total	a+c	b+d	a+b+c+d

From this table orientation, the odds ratio (OR), risk ratio (RR), and risk difference (RD) in the above table can be calculated as:

$$OR = (a*d) / (b*c) \quad RR = [a/(a+b)] / [c/(c+d)] \quad RD = [a/(a+b)] - [c/(c+d)]$$

The previous table layout is also the expected format in SAS and SPSS for “Column 1 Risk” calculations. It is up to the user to make sure the table orientation is correct for the data so that the odds ratio, risk ratio, and other epidemiologic parameter estimates are calculated correctly. The “Kleinbaum; Breslow/Day” automatic layout is as follows, with disease forming the rows and exposure the columns:

Disease	Exposed		Total
	(+)	(-)	
(+)	a	b	a+b
(-)	c	d	c+d
Total	a+c	b+d	a+b+c+d

There are eight possible ways to orient a 2 x 2 table (see Table 1). For a given definition of disease and exposure, only one of these tables will provide the correct risk ratio and risk different estimates. For the odds ratio there are two possibilities: the correct odds ratio and the inverse of the odds ratio (1/OR).

Here is the suggested way to use this option. First, click on **Language/Options/Settings** in the left menu screen, adjust the table orientation to your preference, then go to the **Two by Two Table** menu option and the input table orientation should be as just set in the options/settings. Note that OpenEpi writes a cookie to the computer (if allowed) to remember the options/settings so they will not change unless the user changes these settings. Also note that when the table orientation is changed when data are in an input table, data in the input table will be erased. Another place where the options/settings can be changed is from the input window of some of the OpenEpi modules. An example is presented in Figure 4 for the Two by Two Table, just below the **Clear** button where it says “Settings”. Also note that the output in the Results window will be in the same layout as the input table as specified in the Options/Settings.

Figure 4. Example of how to go to the Settings/Options screen from Two by Two Table data input module

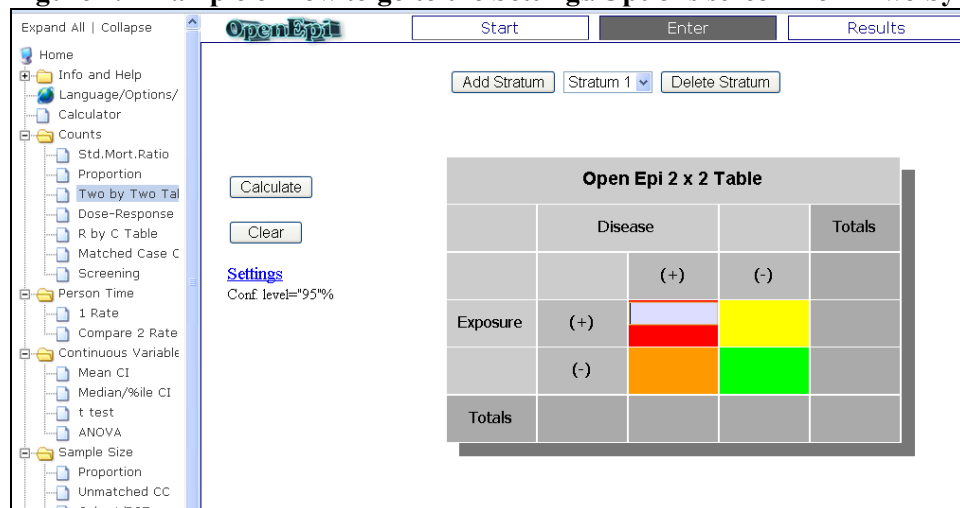


Table 1. Eight possible ways to arrange a 2x2 table on Disease and Exposure status

Disease Status in *Columns*, Exposure Status in *Rows*

1. Correct – Epi Info, SAS (col 1 risk), SPSS (col 1 risk)

	Disease		Total
	(+)	(-)	
Exposed			
(+)	27	13	40
(-)	19	16	35
Total	46	29	75

OR = 1.75 RR = 1.24

2. Disease Columns Switched

	Disease		Total
	(-)	(+)	
Exposed			
(+)	13	27	40
(-)	16	19	35
Total	29	46	75

“OR” = 0.57 “RR” = 0.71

3. Exposure Rows Switched

	Disease		Total
	(+)	(-)	
Exposed			
(-)	19	16	35
(+)	27	13	40
Total	46	29	75

“OR” = 0.57 “RR” = 0.80

4. Both Disease & Exposure Switched

	Disease		Total
	(-)	(+)	
Exposed			
(-)	16	19	35
(+)	13	27	40
Total	29	46	75

“OR” = 1.75 “RR” = 1.41

Disease Status in *Rows*, Exposure Status in *Columns* (which is incorrect in Epi Info, SAS, and SPSS)

5. (+) in First Column/Row

	Exposed		Total
	(+)	(-)	
Disease			
(+)	27	19	46
(-)	13	16	29
Total	40	35	75

“OR” = 1.75 “RR” = 1.31

6. Exposure Columns Switched

	Exposed		Total
	(-)	(+)	
Disease			
(+)	19	27	46
(-)	16	13	29
Total	35	40	75

“OR” = 0.57 “RR” = 0.75

7. Disease Rows Switched

	Exposed		Total
	(+)	(-)	
Disease			
(-)	13	16	29
(+)	27	19	46
Total	40	35	75

“OR” = 0.57 “RR” = 0.80

8. Both Disease & Exposure Switched

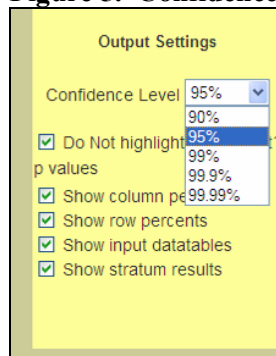
	Exposed		Total
	(-)	(+)	
Disease			
(-)	16	13	29
(+)	19	27	46
Total	35	40	75

“OR” = 1.75 “RR” = 1.34

(+)=“Yes” or present; (-)=“No” or absent

Confidence level for confidence intervals: Ninety five percent confidence intervals are the default, but users can select from a list of other confidence levels (See Figure 5). In some of the data input modules the confidence level is presented (see Figure 4 below the **Clear** button and Settings as an example). The output in the Results screen will also specify the confidence level.

Figure 5. Confidence level options in the Options/Settings screen



Do Not highlight “significant” p-values: If this box is checked, all p-values and confidence intervals are presented in a black font. If this box is *not* checked, p-values <0.05 and confidence intervals that do not capture the null value are presented in a blue font – all others will be in a black font. There will also be the following message in the output:

P-values < 0.05 and confidence limits excluding null values (0,1, or [n]) are highlighted.

Show column percents, row percents, input tables, stratum results: This option applies to the Two x Two Tables and Compare Two Rates modules. At this time it appears that the Show input datatables and Show stratum results are always on, that is, the data tables and stratum results are also presented in the results. For Show column percents and Show row percents, the cell counts and percentages are shown. The cell counts are represented in bold numbers in the larger font in the table below.

		Unstratified (Crude) Values		
		'Disease'		
		(+)	(-)	
'Exposure'	(+) 294	205	89	294
		69.7%	30.3%	100%
		61.4%	50.9%	
	(-) 215	129	86	215
		60%	40%	100%
		38.6%	49.1%	
		334	175	509
		65.6%	34.4%	100%
	100%	100%		

The marginal counts - row, column, and total, are represented in bold numbers in the larger font in the table below:

		Unstratified (Crude) Values		
		'Disease'		
		(+)	(-)	
'Exposure'	(+) 294	205	89	100%
		69.7%	30.3%	
		61.4%	50.9%	
	(-) 215	129	86	100%
		60%	40%	
		38.6%	49.1%	
		334	175	509
		65.6%	34.4%	100%
	100%	100%		

The row percents are represented in bold numbers in the larger font in the table below:

		Unstratified (Crude) Values		
		'Disease'		
		(+)	(-)	
'Exposure'	(+)	205	89	294
		69.7%	30.3%	100%
		61.4%	50.9%	
	(-)	129	86	215
		60%	40%	100%
		38.6%	49.1%	
		334	175	509
		65.6%	34.4%	100%
		100%	100%	

The column percents are represented in bold numbers in the larger font in the table below:

Unstratified (Crude) Values				
		'Disease'		
		(+)	(-)	
'Exposure'	(+)	205	89	294
		69.7%	30.3%	100%
		61.4%	50.9%	
	(-)	129	86	215
		60%	40%	100%
		38.6%	49.1%	
		334	175	509
		65.6%	34.4%	100%
		100%	100%	

If stratified data are entered, the results by stratum are presented as well as a “crude” table which combines the stratified tables into one table as shown on the next page:

2 x 2 Table Statistics					
Values for Stratum 1					
		'Disease'			
		(+)	(-)		
'Exposure'	(+) <div></div>	66	28	94	
		70.2%	29.8%	100%	
		64.7%	46.7%		
	(-) <div></div>	36	32	68	
		52.9%	47.1%	100%	
		35.3%	53.3%		
			102	60	162
			63%	37%	100%
			100%	100%	
Values for Stratum 2					
		'Disease'			
		(+)	(-)		
'Exposure'	(+) <div></div>	139	61	200	
		69.5%	30.5%	100%	
		59.9%	53%		
	(-) <div></div>	93	54	147	
		63.3%	36.7%	100%	
		40.1%	47%		
			232	115	347
			66.9%	33.1%	100%
			100%	100%	

		Unstratified (Crude) Values			
		'Disease'			
		(+)	(-)		
'Exposure'	(+) <div></div>	205	89	294	
		69.7%	30.3%	100%	
		61.4%	50.9%		
	(-) <div></div>	129	86	215	
		60%	40%	100%	
		38.6%	49.1%		
			334	175	509
			65.6%	34.4%	100%
		100%	100%		

Copying and Pasting results

OpenEpi presents the results in their own window in HTML. You may want to copy information in the results window to a word processor, such as Word, or print the results. Printing is relatively easy, just use the print function of the browser. To copy and paste data, in Windows, you “block” or “select” the data, that is, move the mouse to the top of the results that you want to copy, hold the left button and move the mouse to the bottom of the output you wish to copy. Next to copy the data, you can press the control key (“Ctrl”) and the “c” key (“c”) simultaneously, e.g., Ctrl+C. This will copy the data to the clipboard. (Note: an alternative method is after you have selected the data, from the Internet Explorer (or other browser) menu, click on **Edit** and then **Copy**, or right click in the highlighted area and a small menu should appear and click on **Copy**.) Next, open the word processor, place the cursor where you want to paste the data, and press Ctrl+V (or, alternatively, from the word processing menu **Edit** and then **Paste**). Once in the word processor you can change font sizes and make other modifications to the results.

For those who have installed OpenEpi onto their computer using OpenEpi.MSI (and are therefore using Windows), one of the icons labeled “OpenEpi SAVE”. By clicking on this icon to run OpenEpi all of the output will automatically be saved into the folder ...OpenEpi\RESULTS.

Using OpenEpi on PDA's and cell phones

OpenEpi works on some PDA's and cell phones, although OpenEpi was not developed with small screens in mind. We have been able to use OpenEpi on an iPhone, iPad, iPod, Nook, and other smaller devices. Whether OpenEpi will work on a PDA or cell phone depends on the extent to which the browser can run JavaScript. Open the browser and go the www.OpenEpi.com and determine whether you can see both the menu and the main screen. Some browsers seem to have problems showing both the menu and main screen. If you have problems at this point, it is possible to avoid the OpenEpi menu system and to go directly to each module. The link for each module is presented in Figure 6. Also there some similar modules and other programs available at www.sph.emory.edu/~cdckms.

Figure 6. Direct website link to OpenEpi modules

Menu item	Direct website link to module
Home	
Info and Help	
Calculator	www.openepi.com/Calculator/calculator.htm
Counts	
Std.Mort.Ratio	www.openepi.com/SMR/SMR.htm
Proportion	www.openepi.com/Proportion/Proportion.htm
Two by Two Table	www.openepi.com/TwobyTwo/TwobyTwo.htm
Dose-Response	www.openepi.com/DoseResponse/DoseResponse.htm
R by C Table	www.openepi.com/RbyC/RbyC.htm
Matched Case Control	www.openepi.com/MatchCC/MatchCC.htm
Screening	www.openepi.com/DiagnosticTest/DiagnosticTest.htm
Person Time	
1 Rate	www.openepi.com/PersonTime1/PersonTime1.htm
Compare 2 Rates	www.openepi.com/PersonTime2/PersonTime2.htm
Continuous Variables	
Mean CI	www.openepi.com/Mean/CIMean.htm
Median/%ile CI	www.openepi.com/Median/CIMedian.htm
t test	www.openepi.com/Mean/t_testMean.htm
ANOVA	www.openepi.com/Mean/ANOVA.htm
Sample Size	
Proportion	www.openepi.com/SampleSize/SSPropor.htm
Unmatched CC	www.openepi.com/SampleSize/SSCC.htm
Cohort/RCT	www.openepi.com/SampleSize/SSCohort.htm
Mean Difference	www.openepi.com/SampleSize/SSMean.htm
Power	
Unmatched CC	www.openepi.com/Power/PowerCC.htm
Cohort	www.openepi.com/Power/PowerCohort.htm
Clinical Trial	www.openepi.com/Power/PowerRCT.htm
X-Sectional	www.openepi.com/Power/PowerCross.htm
Mean Difference	www.openepi.com/Power/PowerMean.htm
Random numbers	www.openepi.com/Random/Random.htm
Options/Settings	www.openepi.com/Etable/Settings.htm

An Introduction to the structure of OpenEpi modules

Each of OpenEpi's modules has a "tabbed" interface, i.e., there are a series of tabs with the names of the tabs as follows (see Figure 7):

- Start
- Enter
- Results
- Examples
- Help

A brief overview of the tabbed screens is provided in Figures 7-10.

Figure 7. Example of a "Start" page (Two by Two Table)

Every module has a "Start" page that provides an overview of what types of analyses the module performs.

To begin data entry, you can press the red "Enter New Data" button **or** click on the "Enter" Tab.

Two documents are provided::

1. Types of analyses performed - "Documentation"
2. Comparison of OpenEpi results with other programs - "Testing"

OpenEpi
Open Source Software for Public Health

Start Enter Documentation Testing Help

Enter New Data

Add Stratum | Stratum 1 | Delete Stratum

OpenEpi 2 x 2 Table

		Exposure		Totals
		(+)	(-)	
Disease	(+)	94	95	102
	(-)	28	60	60
Totals		94	88	162

Author(s)
Statistics
 Kevin M. Sullivan, Emory University
 and Andrew G. Dean, EpiInformatics.com
 based on code from John C. Pezullo
 Exact and maximum likelihood statistics adapted from
 a Pascal program by David Martin. Thanks to Ray
 Simons for advice and testing.
Interface
 Andrew G. Dean and Roger Mir

Load Demo Data

Two by two tables are used to evaluate the association between a possible risk factor ("Exposure") and an outcome ("Disease"). Counts summarizing the occurrence of the four possible combinations of events in the study population are entered into the appropriate cells. The table can be rotated or flipped so that either rows or columns represent Exposure, and the column headings (+) and (-) can be in either order to match common textbooks of epidemiology. A single table or multiple strata can be entered.

Statistics produced include the Fisher and mid-p exact tests, chi squares, odds ratio, maximum likelihood odds ratio estimate, risk-prevalence ratio (relative risk), risk difference, and etiologic fractions with confidence limits produced by several methods, with stratified analysis.

Select, copy, and paste results to other programs or download OpenEpi to local disk and run OpenEpiSave.HTA to save automatically.

Some modules have a "Load Demo Data" button which will automatically provide cell values as an example.

Figure 8. Example of an “Enter” page (Two by Two Table)

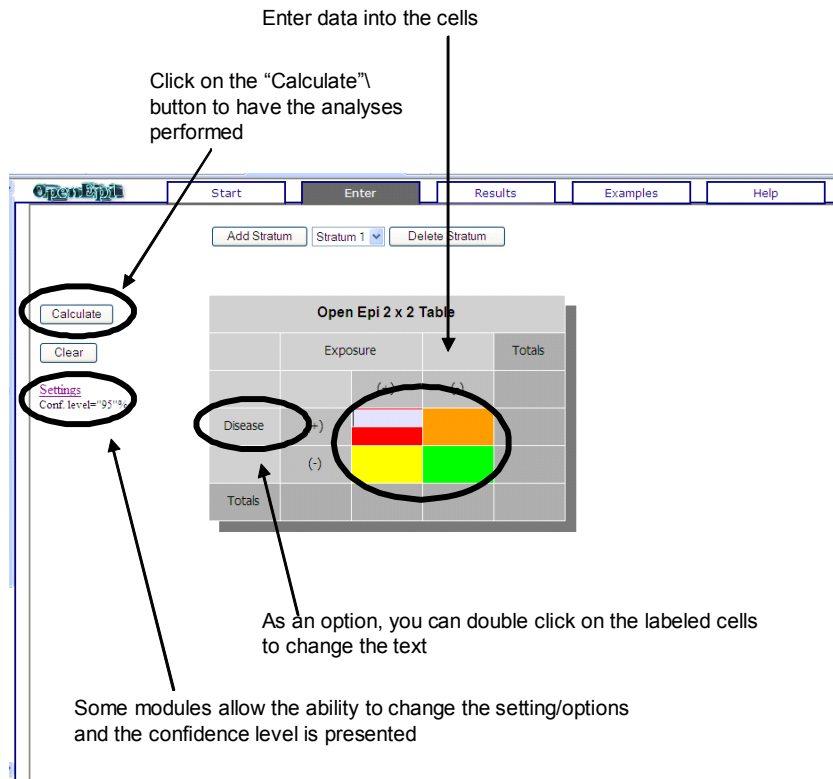


Figure 9. Example of a “Results” page (Two by Two Table)

Results are presented in their own tabbed window. Information on copying and printing results are presented in this document.

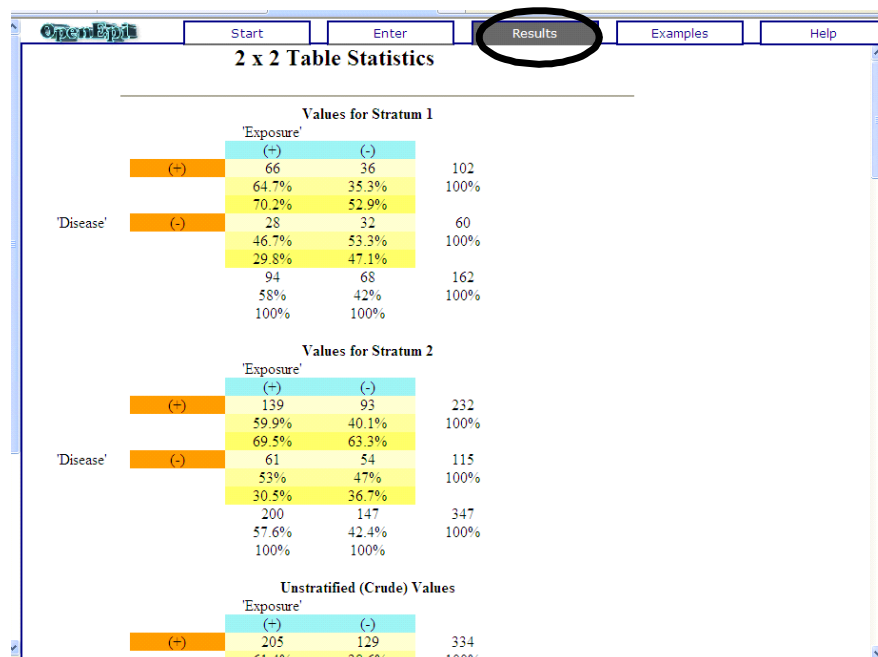
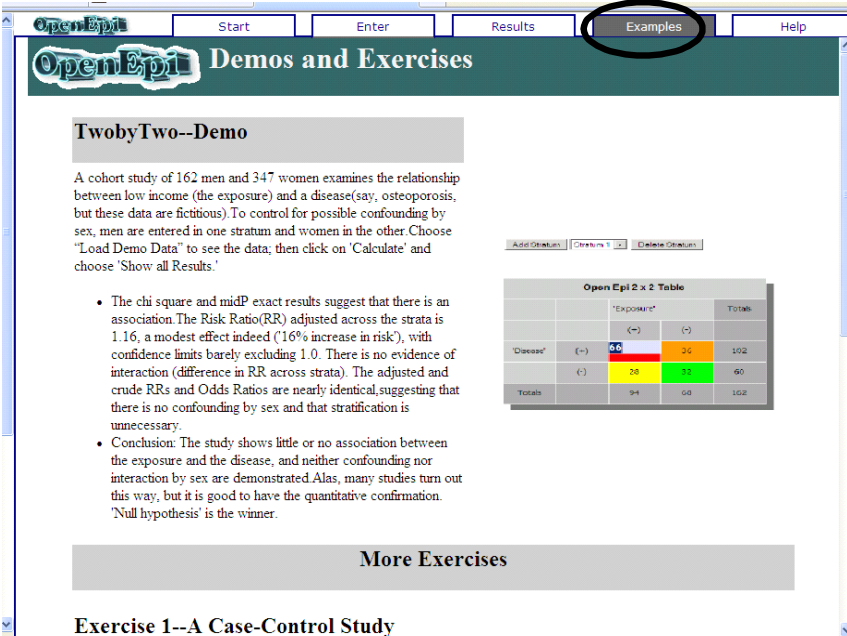


Figure 10. Example of an “Example” page (Two by Two Table)

Some modules provide examples and exercises for use with the module.



The screenshot shows the OpenEpi web application interface. At the top, there is a navigation bar with buttons for 'Start', 'Enter', 'Results', 'Examples', and 'Help'. The 'Examples' button is circled in red, and an arrow points to it from the text above. Below the navigation bar, the page title is 'OpenEpi Demos and Exercises'. The main content area is titled 'TwobyTwo--Demo'. It contains a paragraph describing a cohort study of 162 men and 347 women examining the relationship between low income (the exposure) and a disease (say, osteoporosis). Below the text, there is a 2x2 table titled 'Open Epi 2 x 2 Table'. The table has columns for 'Disease' and 'Exposure', and rows for 'Disease' and 'Totals'. The cells contain numerical values: 36, 24, 60, and 102. Below the table, there is a section titled 'More Exercises' and a link to 'Exercise 1--A Case-Control Study'.

TwobyTwo--Demo

A cohort study of 162 men and 347 women examines the relationship between low income (the exposure) and a disease (say, osteoporosis, but these data are fictitious). To control for possible confounding by sex, men are entered in one stratum and women in the other. Choose "Load Demo Data" to see the data; then click on 'Calculate' and choose 'Show all Results.'

• The chi square and midP exact results suggest that there is an association. The Risk Ratio (RR) adjusted across the strata is 1.16, a modest effect indeed ('16% increase in risk'), with confidence limits barely excluding 1.0. There is no evidence of interaction (difference in RR across strata). The adjusted and crude RRs and Odds Ratios are nearly identical, suggesting that there is no confounding by sex and that stratification is unnecessary.

• Conclusion: The study shows little or no association between the exposure and the disease, and neither confounding nor interaction by sex are demonstrated. Alas, many studies turn out this way, but it is good to have the quantitative confirmation. 'Null hypothesis' is the winner.

More Exercises

Exercise 1--A Case-Control Study

		"Exposure"		Totals
		(+)	(-)	
"Disease"	(+)	36	24	60
	(-)	36	24	60
Totals		72	48	120

Calculator

A calculator with higher math functions. For epidemiologists, it is somewhat better than the simple calculator that comes with Microsoft Windows. Some details on the use of the calculator are provided below.

Algebraic functions

e Mathematical constant 2.718281828459045

Pi Mathematical constant 3.141592653589793

+/- Change the sign of the number in the display from + to – or vice versa

exp e to the power of the number in the display

Example, “1” in the display, press “exp” (i.e., e^1) and the result is 2.718281828459045
Example, “2” in the display, press “exp” (i.e., e^2) and the result is 7.38905609893065

log Logarithm of base 10 (\log_{10})

Example, “10” in the display, press “log” (i.e., $\log_{10}10$) and the result is 1
Example, “100” in the display, press “log” (i.e., $\log_{10}100$) and the result is 2

ln Natural logarithm, logarithm of base e ($\log_{2.718281828459045}$)

Example, “1” in the display, press “ln” (i.e., $\ln 1$) and the result is 2.718281828459045
Example, “2.718281828459045” in the display, press “ln” (i.e., $\ln 2.71\dots$) and the result is 1

sqrt Square root ($\sqrt{}$) of the number in the display

Example, “4” in the display, press “sqrt” and the result is 2
Example, “9” in the display, press “sqrt” and the result is 3

^ Take the number in the display to the power of another number

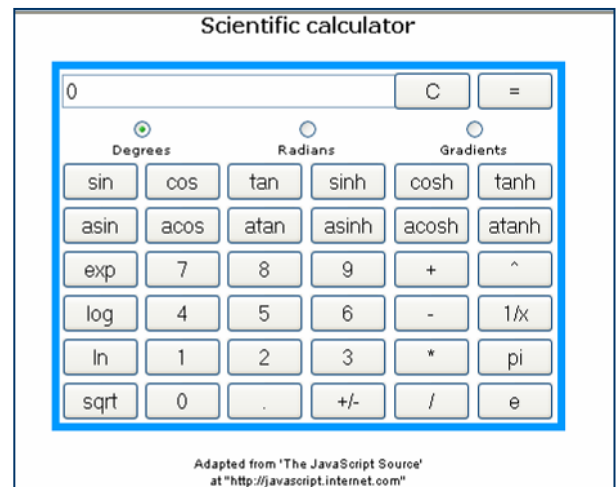
Example, “10” is in the display, press “^” and enter “2” (i.e., 10^2) and the result is 100
Example, “4” is in the display, press “^” and enter “0.5” (i.e., $4^{1/2}$) and the result is 2

1/x Inverse of the number in the display

Example, “10” is in the display, press “1/x” (i.e., $1/10$) and the result is 0.1
Example, “0.5” is in the display, press “1/x” (i.e., $1/0.5$) and the result is 2

Trigonometric functions

- Function
 - sin sine
 - cos cosine
 - tan tangent
- Inverse function
 - asin arcsine
 - acos arccosine
 - atan arctangent
- Hyperbolic trigonometric functions
 - cosh
 - tanh



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Appendix 1. Comparison of OpenEpi, Epi Info, SAS, and SPSS on some statistical output

Confidence intervals for a proportion and rate

Table A1.1 Comparison of Epi Info, OpenEpi, SAS, and SPSS for a single proportion or rate

	Epi Info 3.5.4	Epi Info 7.1.4	OpenEpi 3.01	SAS 9.3	SPSS 17.0
Confidence Interval Methods					
Proportion					
Mid-p exact	-	-	Y	-	-
Fisher's exact (Clopper-Pearson)	Y	Y	Y	Y	-
Wald (Norm Approx)	-	-	Y	Y	Y
Modified Wald (Agresti-Coull)	-	-	Y	Y	-
Score (Wilson)	Y	-	Y	Y	-
Score with cc (quadratic)	-	-	Y	-	-
Rate					
Mid-p exact	-	-	Y	-	-
Fisher's exact	-	-	Y	-	-
Normal Approx	-	-	Y	Y	Y
Byar poisson	-	-	Y	-	-
Rothman/Greenland	-	-	Y	-	-

Notes: Norm Approx = normal approximation; cc = continuity correction; Epi Info will provide the Fisher exact confidence limits with "small" numbers and Score method for large numbers; In SPSS, for a proportion, with a variable coded as 1/0, use the Explore command and request options under statistics for a confidence interval. SAS and SPSS can calculate a confidence interval for a rate using the ratio command approach.

Single 2x2 Table Statistics and Parameter Estimates

Comparison of Epi Info, OpenEpi, SAS, and SPSS for single 2x2 table, count data

	Epi Info 3.5.4	Epi Info 7.1.4	OpenEpi 3.01	SAS 9.3	SPSS 17.0
Statistical Tests					
χ^2 Pearson, uncorrected	2 sided	2 sided	1 & 2 sided	2 sided	2 sided
χ^2 Yates, corrected	2 sided	2 sided	1 & 2 sided	2 sided	2 sided
χ^2 Mantel-Haenszel	2 sided	2 sided	1 & 2 sided	2 sided	2 sided
χ^2 Likelihood Ratio	-		-	2 sided	2 sided
Fisher exact	1 sided	1 & 2 sided	1 & 2 sided	1 & 2 sided	1 & 2 sided
Mid-p exact	1 sided	1 sided	1 & 2 sided	-	-
Risk-based point est/CIs					
Risk ratio					
Approximate	Y	Y	Y	Y	Y
Exact	-	-	-	Y	-
Risk difference					
Approximate	Y	Y	Y	Y	-
Exact	-	-	-	Y	-
EFp	-	-	Y	-	-
EFe	-	-	Y	-	-
PFp	-	-	Y	-	-
PFe	-	-	Y	-	-
Odds-based point est/CIs					
OR cross-product	Y	Y	Y	Y	Y
OR MLE	Y	Y	Y	-	-
CI for OR					
Taylor	Y	Y	Y	Y	Y
Fisher	Y	Y	Y	Y	Y
Mid-P	Y	Y	Y	-	-
EFp	-	-	Y	-	-
EFe	-	-	Y	-	-
PFp	-	-	Y	-	-
PFe	-	-	Y	-	-

Uncorr=uncorrected; MH=Mantel-Haenszel; LR=likelihood ratio; CI=confidence interval; MLE=maximum likelihood estimate;

EFp=Etiologic Fraction in the population; EFe=Etiologic Fraction in the exposed; PFp=preventive fraction in the population; PFe=Prevented Fraction in the exposed

Comparison of Epi Info, OpenEpi, SAS, and SPSS for a single 2x2 table, person-time data

	Epi Info 3.5.4	Epi Info 7.1.4	OpenEpi 3.01	SAS 9.3	SPSS 17.0
Statistical Tests					
Z approach (same as χ^2)	-	-	1 & 2 sided	-	-
Fisher exact	-	-	1 & 2 sided	-	-
Mid-p exact	-	-	1 & 2 sided	-	-
Point est/CIs					
Rate ratio	-	-	Y	-	-
Rate difference	-	-	Y	-	-
EFp	-	-	Y	-	-
EFe	-	-	Y	-	-
PFp	-	-	Y	-	-
PFe	-	-	Y	-	-

EFp=Etiologic Fraction in the population; EFe=Etiologic Fraction in the exposed; PFp=preventive fraction in the population; PFe=Prevented Fraction in the exposed

Stratified 2x2 Table Statistics and Parameter Estimates

Comparison of Epi Info, OpenEpi, SAS, and SPSS for stratified 2x2 tables, count data

	Epi Info 3.5.4	Epi Info 7.1.4	OpenEpi 3.01	SAS 9.3	SPSS 17.0
Statistical Tests					
Statistics for crude table	-	-	Y	-	-
Statistics for adjusted results					
χ^2 MH uncorrected	2 sided	2 sided	1 & 2 sided	2 sided	2 sided
χ^2 MH corrected	2 sided	2 sided	-	-	-
Fisher exact	1 sided	-	1 & 2 sided	1 & 2 sided	-
Mid-p exact	1 sided	-	1 & 2 sided	-	-
Test for interaction					
OR					
Breslow-Day	-	-	-	Y	-
WoOLF	Y	Y	Y	-	Y
Exact (Zelen)	-	-	-	Y	-
RR (WoOLF)	Y	Y	Y	-	-
RD (WoOLF)	-	-	Y	-	-
Risk-based point est/CIs					
Risk ratios					
Crude Risk ratio	Y	Y	Y	-	-
Adj. Risk ratio MH	Y	Y	Y	Y	-
Adj. Risk ratio precision (Logit)	-		Y	Y	-
Risk differences					
Crude Risk difference	-	-	Y	-	-
Adj. Risk difference prec	-	-	Y	-	-
Adj. Risk difference MH	-	-	-	-	-
Odds-based point est/CIs					
Crude OR					
OR cross-product	Y	Y	Y	-	-
OR MLE	Y	Y	Y	-	-
Adjusted OR					
Adj OR MH	Y	Y	Y	Y	Y
Adj OR precision	-	-	Y	Y	-
Adj OR MLE	Y	Y	Y	-	-
CI for adjusted OR					
Taylor	-		Y	-	-
RGB	Y	Y	Y	Y	Y
Fisher	Y	Y	Y	Y	-
Mid-P	Y	-	Y	-	-

Note that Epi Info, SAS, and SPSS can estimate the OR MLE using logistic regression, and SAS can estimate an adjusted risk ratio and risk difference using PROC GENMOD

Comparison of Epi Info, OpenEpi, SAS, and SPSS for stratified 2x2 tables, person-time data

	Epi Info 3.5.4	Epi Info 7.1.4	OpenEpi 2.3.1	SAS 9.3	SPSS 17.0
Statistical Tests					
Statistics for crude table	-	-	Y	-	-
Statistics for adjusted results					
Z approach	-	-	1 & 2 sided	-	-
Fisher exact	-	-	1 & 2 sided	-	-
Mid-p exact	-	-	1 & 2 sided	-	-
Test for interaction (Woolf)					
Rate ratio	-	-	Y	-	-
Rate difference	-	-	Y	-	-
Rate-based point est/CIs					
Rate ratios					
Crude Rate ratio	-	-	Y	-	-
Adj. Rate ratio MH	-	-	Y	-	-
Adj. Rate ratio precision	-	-	Y	-	-
Rate differences					
Crude Rate difference	-	-	Y	-	-
Adj. Risk difference prec	-	-	Y	-	-
Adj. Risk difference MH	-	-	-	-	-

Another approach to analyzing person-time data is through survival analysis which Epi Info, SAS, and SPSS can perform