

# Using the Statistics Calculator

## Description

The statistics calculator allows you to conduct statistical tests to determine whether there is a statistically significant difference between two measures. The statistics calculator can be accessed from the left navigation bar by selecting Analysis>Statistics Calculator.

## Options

There are four options available on this calculator, each described below.

### 1. Compare Two Proportions

Select this option when comparing proportions such as SSI rates and device utilization ratios. Run the appropriate analyses to find each proportion, and take note of the proportion's numerator and the denominator data. For example, suppose you wish to compare the January urinary catheter device utilization ratio in the orthopedic ward to the February ratio in the same location. In this example, you would need to run two CAUTI rate tables, one for each year.

- In January, you find that there were 300 catheter days and 500 patient days, giving a device utilization ratio of 0.60.
- In February, you find that there were 250 catheter days and 550 patient days, giving a device utilization ratio of 0.45.
- Are these two ratios significantly different from each other?

### Compare Two Proportions

When comparing two proportions (e.g. SSI Rates, Device Utilization ratios etc.), the hypothesis is that the rates are not different from each other. To perform a statistical test and calculate a p-value, enter the number of events as the numerator and the number of trials as the denominator (e.g. procedures, patient days) for two data sources. Press calculate.

	Data Source #1	Data Source #2
<b>Group Labels:</b>	January	February
<b>Numerator (Number of Events):</b>	300	250
<b>Denominator (Number of Trials):</b>	500	550

**Title:**

- Enter a group label for each proportion you wish to compare. In this example, we used 'January' and 'February' as the group labels.
- Enter the numerator data (# of catheter days) for each month; 300 for January and 250 for February.
- Enter the denominator data (# of patient days) for each month; 500 for January and 550 for February.
- You may create a title for the comparison.
- Click 'Calculate' on the bottom of the screen.

## Output/Results and Interpretation

The statistics calculator will calculate the proportions and a proportion p-value. If this p-value is less than 0.05 (a convenient cut point), then there is a significant difference (higher or lower) between the two proportions.

National Healthcare Safety Network

Urinary Catheter Utilization Ratio Comparison

As of: January 13, 2014 at 1:27 PM

	January	February
<b>Numerator</b>	300	250
<b>Denominator</b>	500	550
<b>Proportion</b>	60.000%	45.455%
<b>Proportion p-value</b>	0.0086	

In this example, the proportion p-value is 0.0086, indicating that the February urinary catheter device utilization ratio is significantly different (lower) from the January ratio.

**Note:** The proportions are displayed as a percent; divide these percents by 100 to get the true ratio.

## 2. Compare Single SIR to 1

This option will allow you to compare a standardized infection ratio (SIR) to 1. Because an SIR is calculated as the number of infections observed divided by the number of infections expected (predicted), comparing this ratio to 1 will allow you to see whether the number of infections observed is statistically significantly different from the number of infections expected.

NOTE: This comparison is made using NHSN aggregate data from the referenced published report when running the SIR output options within NHSN Analysis. Therefore, this option is recommended for those SIRs that are calculated using aggregate data from a source other than NHSN (e.g., state aggregate).

For example, you would like to test whether the number of ventilator-associated pneumonias (VAPs) in your MICU for the 4<sup>th</sup> quarter of 2011 is different from what would be expected based on the NHSN aggregate data.

- Your facility observed 4 VAPs in Q4 of 2011, and the expected infection count was 2.874.

### Compare Single SIR to 1

When comparing a standardized infection ratio, the hypothesis is that the SIR is not different from one. To perform a hypothesis test and calculate a p-value, enter the number of observed events and the number of expected events. The SIR will be displayed automatically. Press calculate.

**Data Source #1**

**Group Labels:**

**Number observed:**

**Number expected:**

**Standardized Infection Ratio:**

**Title:**

- Enter a group label for the data; in this example, we used 'Q4 2011' as the group label.
- Enter the number of observed infections (4).
- Enter the number of expected infections (2.874).
- The Standardized Infection Ratio will automatically be calculated and displayed.
- Create a title for your output (optional).
- Click 'Calculate' on the bottom of the screen.

## Output/Results and Interpretation

National Healthcare Safety Network

VAP SIR in MICU, Q4 2011

As of: January 13, 2014 at 1:30 PM

Q4 2011 Number Observed	Q4 2011 Number Expected	SIR	SIR p-value	SIR95CI
4	2.874	1.392	0.4886	0.442, 3.357

The statistics calculator will calculate the SIR and its p-value; if the p-value is less than 0.05, then the SIR is significantly different from 1 (and the number of observed infections is significantly different from the number expected). In this case, the SIR p-value is 0.4886, and the SIR is not statistically different from 1.

The output also includes a 95% confidence interval (SIR95CI). This gives the range of values for the SIR. If the confidence interval includes the value of 1 (as it does in our example), then the SIR is not significantly different from 1. Note: In almost all cases, the p-value and the 95% confidence interval should lead you to draw the same conclusion regarding the significance of the SIR.

### 3. Compare Two Standardized Infection Ratios

This option will allow you to compare two SIRs to each other. You must first run SIR tables from NHSN Analysis and take note of the numerator (# of observed infections) and the denominator (# of expected infections) for both SIRs.

For example, you are interested to know whether your surgical site infection (SSI) SIR in 2011 is significantly different from the SSI SIR in 2010.

- In 2010, your facility observed 3 SSIs. Based on NHSN aggregate data, the number expected was 5.523.
- In 2011, your facility observed 4 SSIs, and 4.407 infections were expected.

#### Compare Two Standardized Infection Ratios

When comparing two standardized infection ratios, the hypothesis is that the two ratios are not different from each other. To perform a hypothesis test and calculate a p-value, enter the number of observed events and the number of expected events. The standardized infection ratio (SIR) for each data source will be displayed automatically. Press calculate.

	Data Source #1	Data Source #2
<b>Group Labels:</b>	<input type="text" value="2010"/>	<input type="text" value="2011"/>
<b>Number observed:</b>	<input type="text" value="3"/>	<input type="text" value="4"/>
<b>Number expected:</b>	<input type="text" value="5.523"/>	<input type="text" value="4.407"/>
<b>Standardized Infection Ratio:</b>	<input type="text" value="0.543"/>	<input type="text" value="0.908"/>

**Title:**

- Enter a group label for each SIR data; in this example, we used '2010' and '2011' as the group labels.
- Enter the number of observed infections in each year.
- Enter the number of expected infections in each year.
- The Standardized Infection Ratio will automatically be calculated and displayed.
- Create a title for your output (optional).
- Click 'Calculate' on the bottom of the screen.

### Output/Results and Interpretation

National Healthcare Safety Network

Annual SIR Comparison, 2010-2011

As of: January 13, 2014 at 1:34 PM

	2010	2011
<b>Observed</b>	<b>3</b>	<b>4</b>
<b>Expected</b>	<b>5.523</b>	<b>4.407</b>
<b>SIR</b>	<b>0.543</b>	<b>0.908</b>

<b>Relative change in SIR (data column 2 / data column 1):</b> $0.908/0.543=1.672$
<b>Two-tailed p-value:</b> 0.5236
<b>95% Conf. Interval:</b> 0.345, 8.957
<b>Percent change:</b> $1.672*100 = 167.2$

The output will include the "Relative Change" in the SIR, comparing the second SIR to the first. In this example, the relative change is 1.672, which can be interpreted as: the SSI SIR increased by 167.2% in 2011.

The statistics calculator will also provide a p-value and a 95% confidence interval; if the p-value is less than 0.05, then the SIR in data column 2 is statistically significantly different from the SIR in column 1. In this case, the p-value is 0.5236 and the 2011 SIR is not statistically different from the SIR in 2010.

The confidence interval gives the range of values for the relative change. If the confidence interval includes the value of 1 (as it does in our example), then the SIRs are not significantly different. Note: In almost all cases, the p-value and the 95% confidence interval should lead you to draw the same conclusion regarding the significance of the relative change.

## 4. Compare Two Incidence Density Rates

Using this option will allow you to compare two incidence density rates (e.g., CLABSI or CAUTI rates) from different time periods or groups. The following example will compare CLABSI rates from two surgical ICUs.

We have recently added a Multiplier variable to this comparison screen to allow you to view rates as they are normally displayed in NHSN. Remember: CLABSI, CAUTI, and MRSA bacteremia incidence rates are defined (in NHSN) as the number of infections **per 1000 device or patient days**; hence, the Multiplier for these infection types would be 1000. The bottom of this statistics calculator page shows three additional examples.

### Compare Two Incidence Density Rates

[HELP](#)

When comparing two incidence density rates (i.e. person-time), the hypothesis is that the rates are no different from each other. To perform a statistical test and calculate a p-value, enter the number of events as the numerator, the number of person-time units (i.e. exposure) as the denominator, and choose the multiplier you wish for the rate calculation. Press calculate. (See examples below)

	Data Source #1	Data Source #2
Group Labels:	SICU 2nd Floor	SICU 3rd Floor
Numerator(Number of events):	2	1
Denominator(Number of person-time units):	1054	1036
Multiplier:	1000	

Title:

- Enter a group label for each incidence density rate; in this example, we used 'SICU 2<sup>nd</sup> Floor' and 'SICU 3<sup>rd</sup> Floor' as the group labels.
- Enter the number of observed CLABSIs for each SICU.
- Enter the total number of central line days for each SICU.
- Select the Multiplier based on the infection type.
- Create a title for your output (optional).
- Click 'Calculate' on the bottom of the screen.

**Example 1**  
To compare 2 C.difficile LabID incidence rates:

- Enter the # of CDI HO Incident LabID events
- Enter the # of patient days
- Choose the desired multiplier(i.e., 10,000)
- Press calculate
- Output will provide the CDI HO Incident LabID Event rates per 10,000 patient days and the p-value to indicate the level of statistical significance

**Example 2**  
To compare 2 Dialysis Event bloodstream infection rates:

- Enter the # of Dialysis Event positive blood cultures
- Enter the # of patient months
- Choose the desired multiplier(i.e., 100)
- Press calculate
- Output will provide the DE positive blood culture rates per 100 patient months and the p-value to indicate the level of statistical significance

**Example 3**  
To compare 2 central-line associated bloodstream infection rates:

- Enter the number of CLABSIs
- Enter the # of central line days
- Choose the desired multiplier (i.e., 1000)
- Press calculate
- Output will provide the CLABSI rates per central line and the p-value to indicate level of statistical significance

## Output/Results and Interpretation

National Healthcare Safety Network

CLABSI Rates from 2nd and 3rd Floor SICUs

As of: January 13, 2014 at 1:47 PM

	SICU 2nd Floor	SICU 3rd Floor
<b>Numerator</b>	<b>2</b>	<b>1</b>
<b>Denominator</b>	<b>1054</b>	<b>1036</b>
<b>Incidence Density Rate</b>	<b>1.898</b>	<b>0.965</b>
<b>IDR p-value</b>	<b>0.6347</b>	

- The output will include incidence density rates; in this example, the CLABSI rate is shown for each SICU in the comparison.
- The IDR p-value is a comparison of the two rates; if the p-value is less than 0.05, then the two rates are significantly different from each other. In this case, the two SICU CLABSI rates are not significantly different from each other.