

# What is the Standardized Infection Ratio (SIR)?

The standardized infection ratio (SIR) is a summary value used to track healthcare-associated infections (HAIs) at a national, state, or local level. The SIR adjusts for several risk factors found to be significantly associated with differences in infection incidence. In HAI data analysis, the SIR compares the actual number of HAIs reported (observed by Infection Prevention Surveillance) with the baseline U.S. experience (predicted or expected).

$$\text{SIR} = \frac{\text{Observed HAIs}}{\text{Predicted or Expected HAIs}}$$

Aggregate data from the CDC's National Healthcare Safety Network (NHSN) is used to calculate the risk-adjusted number of HAIs predicted or expected.

## “It’s been a while since I studied statistics; explain it in plain language”

In simple terms, your data are compared to the average of a historical standard population, adjusted for risk.

SIR is not a rate. It is a “value” or “ratio,” comparing one number to another.

SIR will only be calculated if the expected number of HAIs is >1 because you can't have less than a whole person infected.

## “What does this value actually tell me?”

It's all about comparison to the number 1.



A SIR of **1.0** means the Observed number of infections is **equal** to the number of Expected infections.



A SIR **above 1.0** means that the infection rate is **higher** than expected for the standard population.

- The standard population comes from data reported by the hundreds of U.S. hospitals that use the NHSN system.
- The difference above 1.0 is the percentage by which the infection rate exceeds that of the standard population.



A SIR **below 1.0** means the infection rate is **lower** than that of the standard population. The difference below 1.0 is the percentage by which the infection rate is lower than that experienced by the standard population.

## “Should I just trust that this SIR represents our data?”

The SIR is only a point estimate and needs additional information to indicate if it is truly relevant (or “statistically significantly different from 1”), which is why the following are also calculated with each SIR output:

Variable	Definition	Interpretation of SIR
95 Percent Confidence Interval (CI)	A range of values in which the true SIR is thought to lie, with the calculated SIR being the most likely value	If this range of values <b>does not contain the value 1</b> , the SIR is considered “statistically significant”
SIR p-value	A statistical measure indicating if the observed number of infections is significantly different from what was expected	If the p-value is <b>less than 0.05</b> , the SIR is considered “statistically significant”

Also note, an alert will be generated if both summary data AND events are missing for any month in which a particular event type is specified in the monthly reporting plan. Until the alert is cleared, this month/location/event type will be excluded from rate and SIR calculations, which can lead to inaccuracy in the SIR.

## “OK, but how about a real-world example?”

Below is an example of an Overall CLABSI SIR table from NHSN, which shows reported central-line-associated bloodstream infections and related SIR values.

Org ID	Summary Year	Infection Count	Number Expected	Central Line Days	SIR	SIR p-value	95 Percent Confidence Interval
12345	2009	9	7.191	3786	1.25	0.2962	0.653, 2.184

From this table, you could infer the following:

- During 2009, there were **9** CLABSIs identified in this facility.
- Based on the NHSN baseline data, **7.191** CLABSIs were expected.
- This results in an SIR of **1.25** ( $9/7.191$ ), signifying that during this time period the facility identified 25 percent ( $(SIR-1 \times 100 = \%)$ ) more CLABSIs than expected.
- The p-value above 0.05 and 95 percent CI containing 1 indicate that the number of observed CLABSIs is not significantly higher than the number of expected CLABSIs.
- While the central line days are provided, this information should not be used for comparison of a simple CLABSI rate. Instead, the central line days are provided to inform you of the precision of the SIR.

## “What happens now that I understand our SIR?”

- Significantly low SIRs may demonstrate current prevention efforts are strong for that infection type. However, in some cases, current data collection processes may need to be evaluated for accuracy and completeness.
- Significantly high SIRs may indicate a need to strengthen prevention efforts for the given type of infection.
- The ultimate goal is zero HAIs, so ongoing monitoring and effort is required by the entire health team.

Additional resources for data analysis can be found at  
<http://www.cdc.gov/nhsn/PS-Analysis-resources/index.html>

<http://www.cdc.gov/nhsn/PS-Analysis-resources/PDF/SIRTablesDA.pdf>

