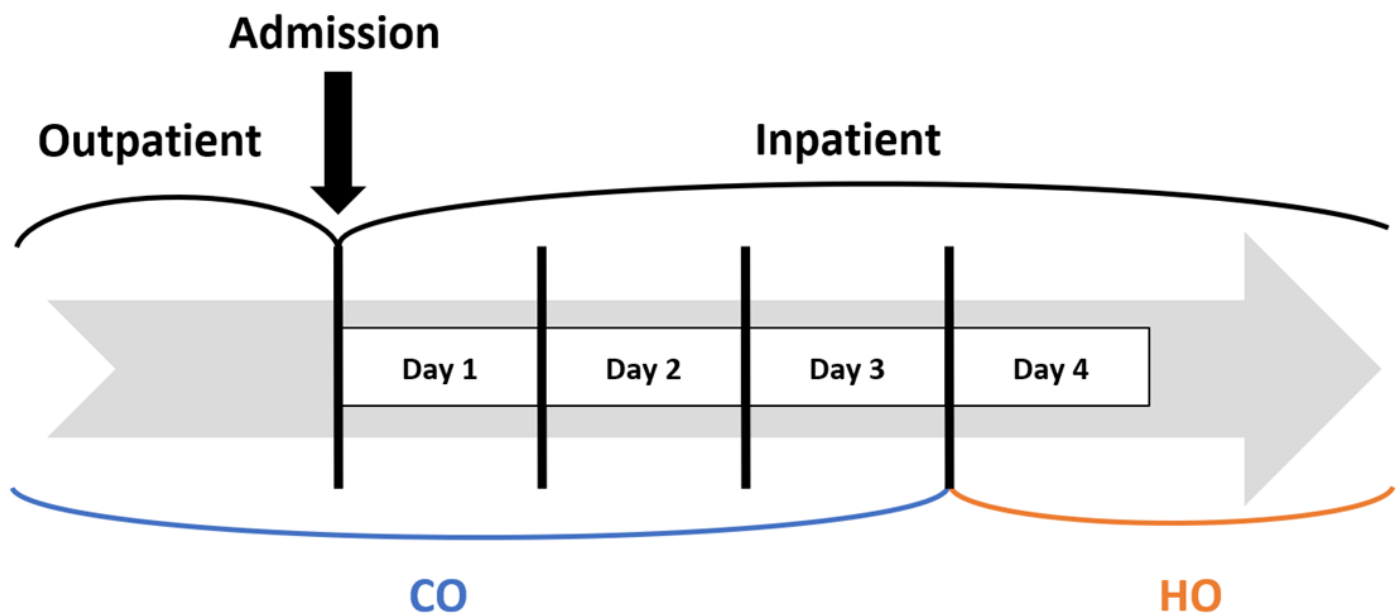


AR Option Pathogen-specific Standardized Infection Ratio (pSIR) Report

Description

The Antimicrobial Resistance (AR) Option Pathogen-specific Standardized Infection Ratio (pSIR) is a metric developed by CDC to enable facilities to compare their rates of hospital-onset culture-positive infections from a specific pathogen to a national benchmark. It compares the actual number of AR Events (pathogens isolated) to the number predicted, given the standard population (specifically, the 2019 NHSN baseline), adjusting for several risk factors that have been found to be statistically significantly associated with differences in infection incidence. This report includes a set of tables that display the pSIR by pathogen or pathogen group, regardless of susceptibility results, by specimen source (blood, lower respiratory tract, and urine). pSIRs are not available for the cerebrospinal fluid (CSF) specimen source. NHSN classifies AR Events as hospital-onset (HO) or community-onset (CO) based on the specimen collection date and date of admission (see screenshot below). Facility admission date is considered Day 1. If the specimen was collected in an outpatient location or in an inpatient location on Days 1, 2, or 3, the AR Event is classified as CO. If the specimen was collected in an inpatient location on Day 4 or after, the AR Event is classified as HO.



NHSN calculates the pSIR for each pathogen or pathogen group and specimen source using the following formula:

$$\text{pSIR} = \frac{\# \text{ Observed Infections of Specific Pathogens}}{\# \text{ Predicted Infections of Specific Pathogens}}$$

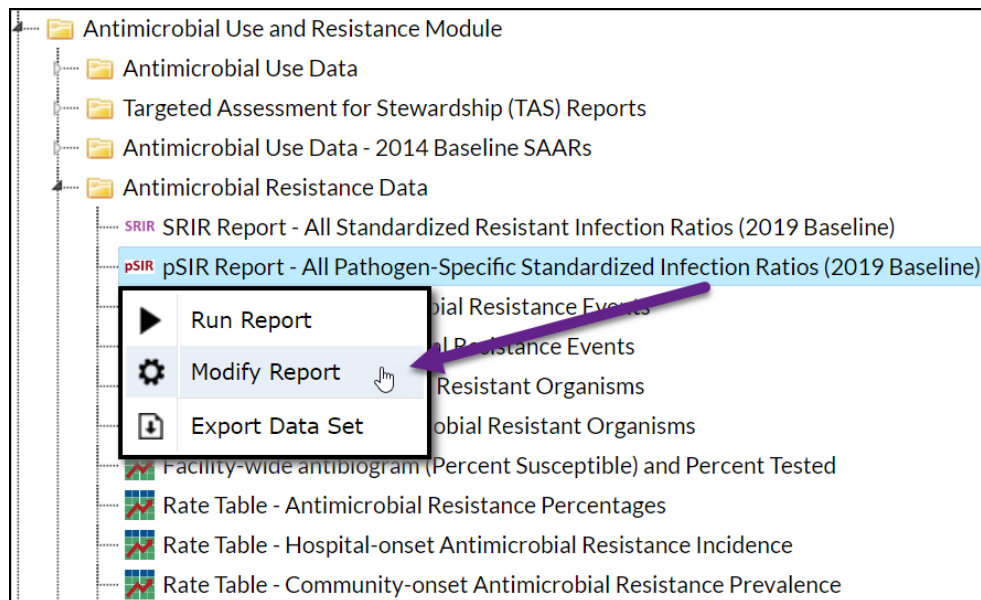
The default settings for the pSIR report produce a report by quarter, but users can make modifications to display the data by half-year, year, or cumulative time periods. Users do not have the option to run the report by month. The pSIR report can be generated for specimen collection dates 2019 and forward. The default option will include 12 tables, one for each combination of pathogen or pathogen group and specimen source, though users can modify the report to display only certain tables.



Example

Suppose you want to review the pSIR for hospital-onset *Staphylococcus aureus* in blood specimens for 2020-2022 by quarter for your facility.

After generating data sets, to run the report, click Analysis > Reports > Antimicrobial Use and Resistance Module > Antimicrobial Resistance Data. After selecting the report, “pSIR Report – All Pathogen-Specific Standardized Infection Ratios (2019 Baseline)” in this case, a pop-up box will appear that will allow you to “Run Report,” “Modify Report,” or “Export Data Set.” Select “Modify Report” to customize your report.



Modifying the Report

For a general, step-by-step explanation of the NHSN modification screen, please refer to this document: <https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/howtomodifyreport.pdf>.

When you choose to modify the report, the modification screen appears showing multiple tabs containing available modifications for the given report. The “Title/Format” tab allows you to update the report title and select the format in which you want the report displayed, such as HTML or PDF. To filter the data by time period, choose the “Time Period” tab at the top of the page. To display data for 2020-2022, select Summary~Yr with a beginning date of 2020 and an ending date of 2022.

Tip: For more descriptive variable labels on your report, check the box “Show descriptive variable names” that appears near the top of the modification window (recommended).

Modify "pSIR Report - All Pathogen-Specific Standardized Infection Ratios (2019 Baseline)"

Show descriptive variable names ([Print List](#)) Analysis Data Set: AR_All_pSIR_2019 Type: pSIR Last Generated: [September 5, 2023 4:27 PM](#)

Title/Format **Time Period** Filters Display Options

Time Period:

Date Variable	Beginning	Ending	
Summary~Yr	2020	2022	Clear Time Period

Enter Date variable/Time period at the time you click the Run button

[Run](#) [Save...](#) [Export...](#) [Close](#)

The "Filters" tab allows you to filter the data displayed in the report. For our example, we want to filter the report to show the pSIR for hospital-onset *Staphylococcus aureus* in blood specimens. Select pSIR Type as the variable and use the "equal" operator. Use the drop-down menu to select "Hospital-onset (HO) *Staphylococcus aureus* in blood specimens".

Modify "pSIR Report - All Pathogen-Specific Standardized Infection Ratios (2019 Baseline)"

Show descriptive variable names ([Print List](#)) Analysis Data Set: AR_All_pSIR_2019 Type: pSIR Last Generated: [September 5, 2023 4:27 PM](#)

Title/Format Time Period **Filters** Display Options

Additional Filters: [Show](#) [Clear](#)

AND OR [Add group](#)

AND OR [Add rule](#)

pSIR Type equal [Delete](#)

Hospital-onset (HO) *Staphylococcus aureus* in blood specimens

[Run](#) [Save...](#) [Export...](#) [Close](#)

The "Display Options" tab allows you to pick how you'd like the tables displayed in your final report. For this example, we'd like the tables to display by quarter, which is the default option. Make sure Summary~Yr/Qtr is selected as the "Group by" value.

Modify "pSIR Report - All Pathogen-Specific Standardized Infection Ratios (2019 Baseline)"

Show descriptive variable names ([Print List](#)) Analysis Data Set: AR_All_pSIR_2019 Type: pSIR Last Generated: [September 5, 2023 4:27 PM](#)

Title/Format Time Period Filters **Display Options**

pSIR Options:

Group by: Summary~Yr/Qtr

[Run](#) [Save...](#) [Export...](#) [Close](#)

Final Report

The example rate table shown below is the result of the modifications shown in this document. In this example, because we specified a single pSIR of interest, we will only see one table. The output below shows the pSIR for hospital-onset *Staphylococcus aureus* in blood specimens collected in 2020-2022 by quarter.

Note: This example uses fictitious data for illustrative purposes only.

National Healthcare Safety Network
pSIR Table - All Pathogen-Specific Standardized Infection Ratios (2019 Baseline)
 As of: September 5, 2023 at 8:30 PM
 Date Range: AR_ALL_P_SIR_2019 summaryYr 2020 to 2022
 If ((pSIR_Type = "HO_SA_Blood"))

1 Hospital-onset (HO) Staphylococcus aureus in blood specimens

Facility Org ID	Summary Yr/Qtr	pSIR Type	Hospital-Onset Isolates	Predicted Hospital-Onset Isolates	Patient days from AR Summary	pSIR	pSIR p-value	95% Confidence Interval
13860	2020Q1	HO_SA_Blood	29	0.774	7226	37.468	0.0000	25.568, 53.110
13860	2020Q3	HO_SA_Blood	0	2.058	19208	.	.	.
13860	2020Q4	HO_SA_Blood	0	0.388	3618	.	.	.
13860	2021Q2	HO_SA_Blood	0	0.504	4700	.	.	.
13860	2021Q3	HO_SA_Blood	0	1.403	13100	.	.	.
13860	2021Q4	HO_SA_Blood	1	0.809	7550	1.236	0.7491	0.062, 6.096
13860	2022Q1	HO_SA_Blood	0	0.236	2200	.	.	.
13860	2022Q2	HO_SA_Blood	4	0.271	2525	.	.	.
13860	2022Q3	HO_SA_Blood	0	0.252	2350	.	.	.
13860	2022Q4	HO_SA_Blood	0	0.723	6750	0.000	0.4853	., 4.143

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- Includes data from January 2019 forward.
- pSIR=0 indicates the facility reported at least one isolate from the specimen source of interest (for any HO organism) but the organism of interest was not isolated from any of those specimens.
- pSIR may be null when: a) no specimens were collected from the specimen source of interest, b) no HO isolates from the specimen source of interest were reported during the time period, or c) an HO organism of interest was reported for the specimen source but <0.3 events were predicted.

- The table heading specifies which pathogen or pathogen group and specimen source is being displayed in each table. In this example, the table includes the observed and predicted infections for hospital-onset *Staphylococcus aureus* in blood specimens.
- The second column in the table specifies the time period. In the modifications screen, we filtered the time period to only include data from 2020 through 2022, and we specified the report to group the data by quarter. Each row in the table represents one quarter starting with 2020Q1 and ending with 2022Q4. Quarters within the range specified that have no AR Option data do not appear in the table (2020Q2 and 2021Q1 in this example).
- The third column specifies the abbreviation for the pSIR model type being displayed; this should align with the table heading.
- Each table will include the number of hospital-onset AR Events isolated from the specified specimen source. In this example, as shown in the purple box, there was one hospital-onset *Staphylococcus aureus* isolate identified in blood specimens in 2021Q4.
- NHSN calculates predicted hospital-onset isolates by risk-adjusting for several risk factors found to be statistically significantly associated with differences in infection incidence among the pSIR referent population. The referent population comes from nationally aggregated AR data reported to NHSN during the baseline time period (2019). As shown in the purple box, NHSN calculated 0.809 predicted hospital-onset *Staphylococcus aureus* blood isolates for this facility in 2021Q4.
- The table includes the patient days reported for all facility inpatient locations (FacWideIN) to the AR Option since patient days is used in the calculation of the predicted hospital-onset isolates. Data from outpatient locations are not included in pSIR risk adjustment. In this example, patients contributed 7,550 patient days for all facility inpatient locations in 2021Q4.
- The pSIR is calculated by dividing observed hospital-onset isolates by predicted hospital-onset isolates. As shown in the purple box, the pSIR was calculated by dividing 1 by 0.809, which equals 1.236. The pSIR for hospital-onset

Staphylococcus aureus isolated from blood specimens in 2021Q4 is 1.236. A pSIR greater than 1.0 indicates that more infections were observed than predicted. A pSIR less than 1.0 indicates that fewer infections were observed than predicted. A pSIR value of 0 indicates a facility reported at least one HO isolate from the specimen source of interest during the time period, but the pathogen of interest was not isolated.

8. The pSIR p-value is a statistical measure that tells you if the observed infections are significantly different from predicted infections. A p-value less than 0.05 (an arbitrary and conveniently used cut point) indicates that the number of observed infections is statistically significantly different (higher or lower) than the number of predicted infections. In this example, a p-value of 0.7491 indicates that observed infections are not statistically significantly different than predicted infections.
9. The 95% Confidence Interval (CI) is a range of values in which we have a high degree of confidence that the true pSIR lies; however, the pSIR reported under the pSIR column is the most likely value. If the CI includes the value of 1, then the pSIR is not statistically significant (observed infections are not statistically significantly different from predicted infections, using the same convenient cut point). In this example, the 2021Q4 pSIR 95% CI does contain 1, so we can conclude that the 2021Q4 pSIR is not statistically significantly different than 1.

Important Note: Users should interpret p-values and 95% CI with caution, as statistical significance does not necessarily translate into clinical significance. For example, a rapid increase of infections compared to the facility's baseline or a cluster of events in a short period of time and patient care locations may already warrant investigation even if the pSIR is not statistically significantly higher than the national benchmark.

10. The pSIR footnotes are the same across all tables. The Enterobacterales and *Enterococcus* tables include an additional footnote about what pathogens are included in the pathogen group.
 - a. The report only includes data from January 2019 forward.
 - b. When the pSIR equals 0, this indicates the facility reported at least one isolate from the specimen source of interest (for any HO organism) but the organism of interest was not isolated from any of those specimens.
 - i. An example of pSIR=0 can be seen by the orange teardrop (A).
 - c. The pSIR will be null when no positive culture grew reportable AR organisms from the given specimen source during the time period, or an HO organism of interest was reported for the specimen source but <0.3 events were predicted (minimum precision criteria was not met).
 - i. Examples of a null pSIR can be seen by the orange teardrops (B) and (C).

Note: If denominator data (*i.e.*, patient days) are missing for a month (data not submitted), but AR Events were reported for that month, then the AR Events for that month will be excluded from the observed counts for the rollup (*i.e.*, quarter, half-year, year, cumulative). If denominator data (*i.e.*, patient days) are missing or reported as zero for all three months in a quarter, all six months in a half-year, all 12 months in a year, or all months (cumulative), but AR Events were reported for that time period, then the AR Events will be included in the counts, but both the denominator and pSIR will be suppressed/appear missing ('.').

Additional Resources

How to Export Data from NHSN: <http://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/exportdata.pdf>

AUR Module Protocol: <https://www.cdc.gov/nhsn/pdfs/pscmanual/11pscaurcurrent.pdf>

AUR Training: <https://www.cdc.gov/nhsn/training/patient-safety-component/aur.html>

NHSN Analysis Quick Reference Guides: <http://www.cdc.gov/nhsn/PS-Analysis-resources/reference-guides.html>