



Patient Safety Component

Embracing NHSN Analytics and the Power of Data for Action

Maggie Dudeck, MPH

Lead, NHSN Acute Care Analytics Team

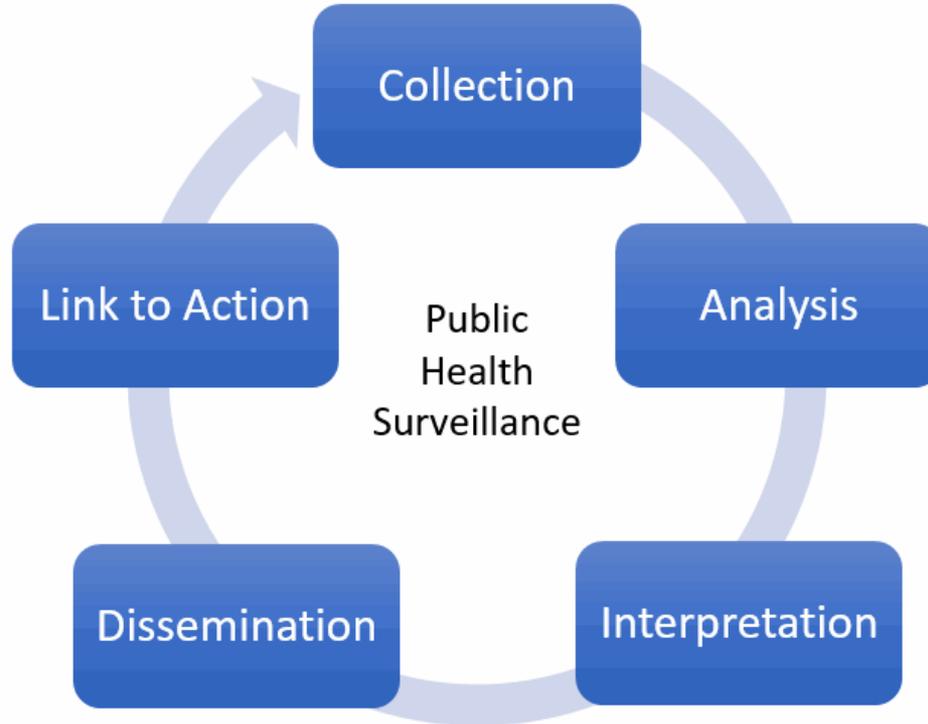
March 19, 2024

Objectives

By the end of this presentation, you will be able to:

- Identify use cases for different analytic output options.
- Discuss the importance of regular, ongoing analysis of surveillance data by using NHSN reports.
- Summarize the use of healthcare-associated infection (HAI) data for actionable results.

Public Health Surveillance: An Overview



D2-Dudeck-Embracing NHSN Analytics-Q1

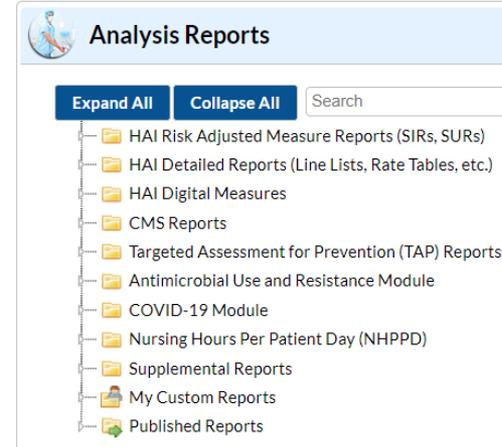
- Let's take a poll!

How familiar are you with using NHSN analytic reports?

- A. I don't use any NHSN reports...yet!
- B. I use them sporadically.
- C. I frequently use them as part of my core responsibilities
- D. I use them only to export data for use in other applications.

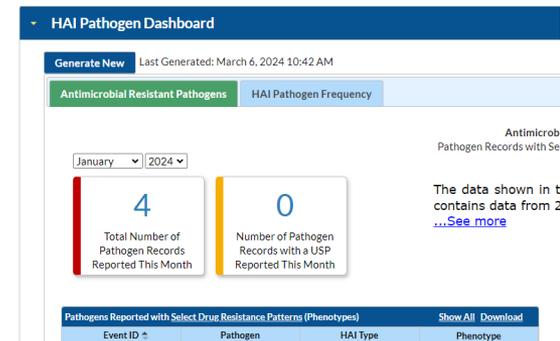
What data are available from NHSN reports?

- Anything reported **in** to NHSN can be obtained **out** of NHSN
 - Includes required and optional fields
 - Data available after generating datasets
- Additional metrics and statistics provided
 - Rates
 - Risk-adjusted measures
- Supplemental reports include survey line lists, all event line lists, procedure line lists, etc.
- Dashboards that turn data into actionable information (available via NHSN Home screen)



The screenshot shows the 'Analysis Reports' section of the NHSN interface. It features a search bar and two buttons: 'Expand All' and 'Collapse All'. Below these are several report categories, each with a folder icon and a dropdown arrow:

- HAI Risk Adjusted Measure Reports (SIRs, SURs)
- HAI Detailed Reports (Line Lists, Rate Tables, etc.)
- HAI Digital Measures
- CMS Reports
- Targeted Assessment for Prevention (TAP) Reports
- Antimicrobial Use and Resistance Module
- COVID-19 Module
- Nursing Hours Per Patient Day (NHPPD)
- Supplemental Reports
- My Custom Reports
- Published Reports



The screenshot shows the 'HAI Pathogen Dashboard' interface. It includes a 'Generate New' button and a timestamp 'Last Generated: March 6, 2024 10:42 AM'. There are two tabs: 'Antimicrobial Resistant Pathogens' (active) and 'HAI Pathogen Frequency'. The dashboard displays two key metrics for January 2024:

- Total Number of Pathogen Records Reported This Month: 4
- Number of Pathogen Records with a USP Reported This Month: 0

Below the metrics is a table header for 'Pathogens Reported with Select Drug Resistance Patterns (Phenotypes)'. The table has columns for 'Event ID', 'Pathogen', 'HAI Type', and 'Phenotype'. There are 'Show All' and 'Download' buttons at the bottom right.

Aligning Your Needs with the Right Report Type

If you need:

- All information entered for a record
- Timestamp of data entry/modification
- Event-level details
- Survey-level details

Then use:
Line Lists

Line List Example: CDI Events with Onset Determination

- Line lists can be valuable for:
 - Understanding which events are included in the rate and SIR numerators
 - Digging in to potential data quality issues – for example, are the admissions dates correct?
 - Providing supporting/supplemental information during Epi investigations

National Healthcare Safety Network Line Listing - All CDI LabID Events

As of: March 5, 2024 at 3:38 PM

Date Range: LABID_EVENTS specDateYr After and Including 2020
if (((spcOrgType = "CDIF"))

eventID	spcOrg Type	location	outpatient	onset	cdiAssay	admitDate	specimenDate	facToSpecDays	FWCDIF_facIncHOCCount	FWCDIF_admPrevCOCCount
40543236	CDIF	EDEPT	Y	CO	INCIDENT	.	01/15/2020	.	0	1
43685894	CDIF	23	N	HO	INCIDENT	05/01/2020	05/05/2020	5	1	0
41955828	CDIF	SICU-L	N	CO	INCIDENT	06/01/2020	06/02/2020	2	0	1
43685896	CDIF	MDWARD	N	HO	INCIDENT	05/01/2020	07/09/2020	70	1	0
44951787	CDIF	3 CENTRAL	N	CO	INCIDENT	01/11/2021	01/12/2021	2	0	1
45526631	CDIF	EDEPT	Y	CO-HCFA	INCIDENT	.	01/28/2021	.	0	0
45526777	CDIF	EDEPT	Y	CO	INCIDENT	.	02/01/2021	.	0	1
52060744	CDIF	OF ICU	N	HO	INCIDENT	11/12/2021	11/17/2021	6	1	0
50992212	CDIF	0910	N	HO	INCIDENT	01/23/2022	01/26/2022	4	0	0
60452805	CDIF	23	N	HO	INCIDENT	07/08/2022	07/13/2022	6	1	0
60452804	CDIF	3W	N	HO	INCIDENT	08/03/2022	08/09/2022	7	1	0
58542598	CDIF	GRANT 4	N	HO	INCIDENT	01/25/2023	02/02/2023	9	1	0
63181597	CDIF	NEURO ICU	N	HO	INCIDENT	12/29/2023	01/02/2024	5	1	0

Fictitious data used for illustrative purposes only.

Aligning Your Needs with the Right Report Type

If you need:

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- Event-level details
- Survey-level details

Then use:
Line Lists

If you need:

- Summarized counts
- Unadjusted rates/ratios
- Visualization of counts
- Visualization of unadjusted rates/ratios

Then use:
Frequency Tables
Rate Tables
Pie/Bar/Run
Charts

Frequency Table Example: Review Event Level Data – CLABSI by location type (ICU, Ward)

- Frequency Table – All CLAB Events
- Based on the output below:
 - The number of CLABSI increased in 2020, and decreased in following years
 - The proportion of CLABSI in Wards increased in 2020

Modify "Frequency Table - All CLAB Events"

Show descriptive variable names ([Print List](#)) Analysis Data Set: CLAB_Ev

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

Frequency Table Options:

Selected Variables to include in report:

Row	Column
Event~Year	Location Type

Frequency Table Options:

Table percent - Display cell frequency divided by table total

Missing - Include observations with missing values

Print the table in list form

Two-Way Table Options:

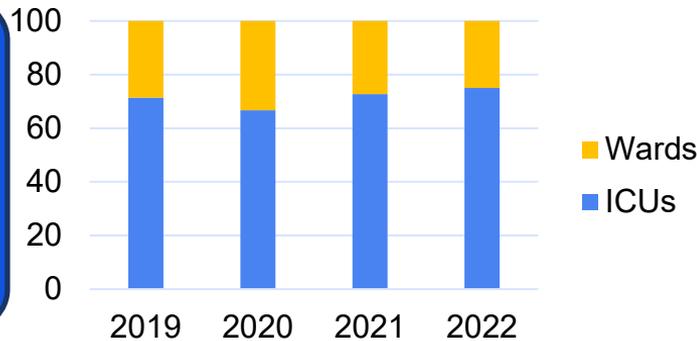
Row Percent - Display cell frequency divided by row total

Column Percent - Display cell frequency divided by column total

Expected - Expected cell frequencies

Chi-square - Test for independence

Table of evntDateYr by locationType			
evntDateYr(Event~Year)	locationType(Location Type)		
	ICU	Ward	Total
2019	5	2	7
2020	10	5	15
2021	8	3	11
2022	6	2	8
Total	29	12	41



Data can be exported for use in other software!

Rate Table Example:

CLABSI Data in ICU/Other Units

National Healthcare Safety Network

Rate Table for Central Line-Associated BSI Data for ICU-Other

As of: March 5, 2024 at 3:41 PM

Date Range: All BS2_CLAB_RATESICU

orgID=10000 loccdc=IN:ACUTE:CC:M

location	summaryYM	CLABCount	numCLDays	CLABRate	numPatDays	LineDU
MED ICU	2023M10	2	392	5.102	587	0.668
MED ICU	2023M11	2	361	2.770	528	0.684
MED ICU	2023M12	0	360	0.000	584	0.616

- Can make timely, monthly-level assessment of HAI incidence and exposure for each location
- Aids in internal trend assessment – where have we seen reductions? How has the device use changed over time? How is this location performing compared to itself over time?

Aligning Your Needs with the Right Report Type

If you need:

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- Survey-level details

Then use:
Line Lists

If you need:

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- Visualization of counts
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Then use:
Frequency Tables
Rate Tables
Pie/Bar/Run
Charts

If you need:

- Risk-adjusted measures
- Comparison to National benchmark
- Percentile ranking from HAI Progress Report
- Metric for excess infections

Then use:
SIRs
SURs
CAD/TAP

In a Nutshell: Standardized Infection Ratio (SIR)

$$SIR = \frac{\# \text{ observed HAIs}}{\# \text{ predicted HAIs}}$$

- The SIR takes into account the national data at the baseline year, and your hospital's experience when calculating the # predicted
- The SIR is a comparison to a National standard – in our case, the NHSN baseline.
- The SIR is risk-adjusted, using the data reported to NHSN
 - The SIR should be used when aggregating data from multiple locations, procedures, hospitals, etc.
- Your hospital is being compared to other hospitals with similar patient population, during the baseline year
 - P-value and 95% CI provided as statistical evidence with each SIR

SIR Example: CLABSI SIR

- How does your facility compare to the national?
 - SIR p-value and 95% Confidence Interval compare your hospital's SIR to a value of 1
 - Review the Percentile in the SIR reports – locates your facility's SIR in the National distribution from the most recent HAI progress report

National Healthcare Safety Network

SIR for Central Line-Associated BSI Data for Acute Care Hospitals (2015 baseline) - By OrgID

As of: June 14, 2023 at 8:15 AM

Date Range: All BS2_CLAB_RATESALL

Facility Org ID=10000 Type of Affiliation=M



Facility Org ID	CMS Certification Number	Summary Yr/Qtr	Events	Number Predicted	Central Line Days	SIR	SIR p-value	95% Confidence Interval	SIR Percentile
10000	000123	2020Q1	1	2.158	1854	0.463	0.4804	0.023, 2.285	23
10000	000123	2020Q2	0	0.035	34	.	.		.
10000	000123	2020Q3	2	1.371	445	1.458	0.5579	0.245, 4.818	76
10000	000123	2020Q4	0	0.023	20	.	.		.

Measuring Excess Infections using Cumulative Attributable Difference (CAD)

- CDC's Targeted Assessment for Prevention (TAP) Strategy uses the CAD as the first step
 - CAD measures excess infections – those that must be prevented to reach an HAI reduction goal¹
 - Incorporates predicted number of infections (that is, the SIR denominator)
 - Can be used even when predicted number is <1 .

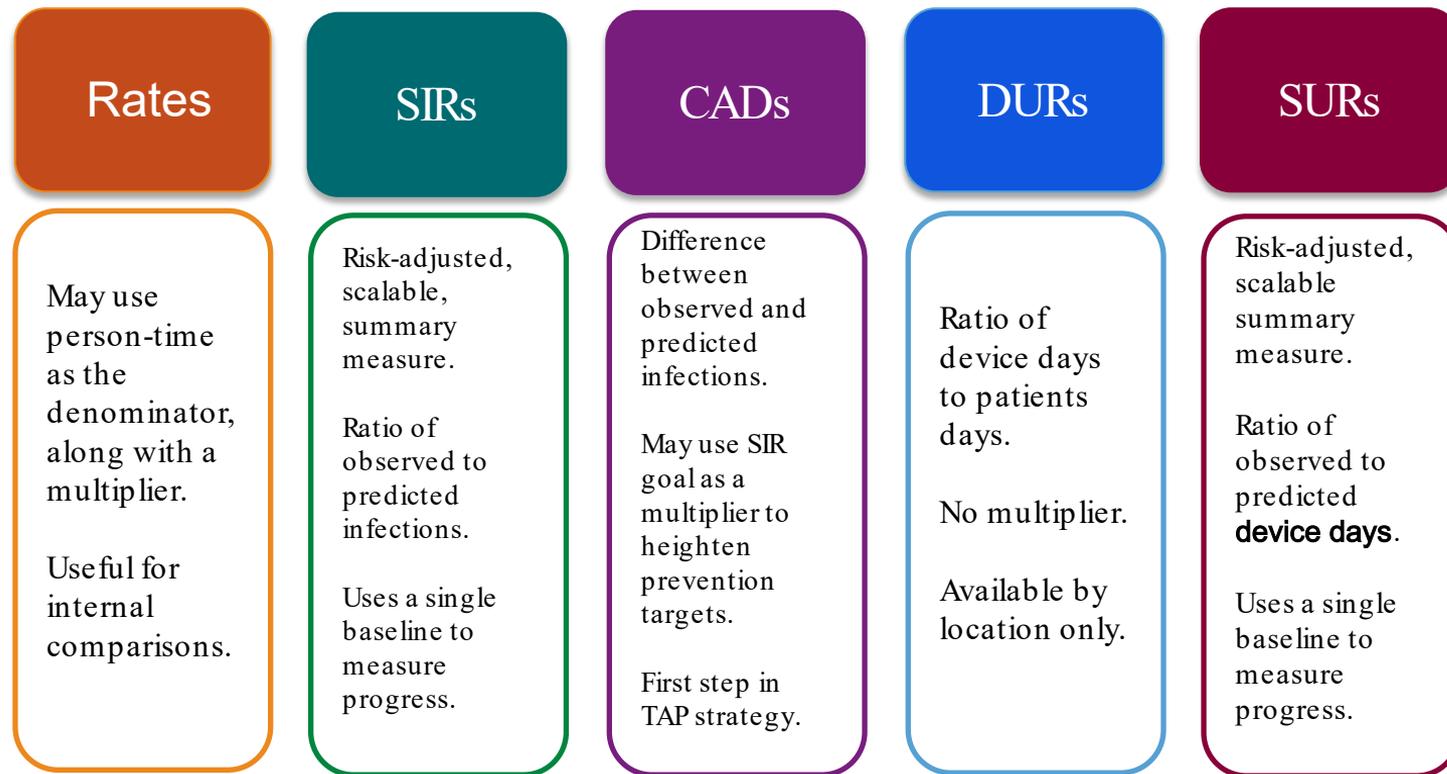
¹-Soe MM, Gould CV, Pollock D, Edwards J. Targeted Assessment for Prevention of Health-Associated Infections: A New Prioritization Metric. *Infection Control & Hospital Epidemiology* 2015;36(12):1379-1384. doi:10.1017/ice.2015.201

More information and training:

<https://www.cdc.gov/hai/prevent/tap.html>

<https://www.cdc.gov/nhsn/training/analysis/index.html>

Recap: Summarized Data Can Include



SIR: standardized infection ratio; CAD: cumulative attributable difference; TAP: Targeted Assessment for Prevention; DUR: device utilization ratio; SUR: standardized utilization ratio

D2-Dudeck-Embracing NHSN Analytics-Q2

Knowledge Check!

- You're interested in reviewing the central line days for each unit. Which report(s) can be used for this purpose?
 - A. CLABSI SIR report
 - B. Central line SUR report
 - C. CLABSI rate table(s)
 - D. Summary data line list
 - E. All of the above

Three Options to Review Changes in Central line Days

Fictitious data used for illustrative purposes only

- **Option 1: “SIR – Acute Care Hospital CLAB Data”**
 - Benefit: scalable - will include an aggregate for all locations, in addition to location-specific results

- **Option 2: “SUR – Acute Care Hospital Central Line Device Use”**
 - Benefit: scalable, risk-adjusted measurement of device utilization

- **Option 3: “Rate Table – CLAB Data for ICU-Other”**
 - Benefit: will include location-specific results for pinpointing changes
 - Downside: additional reports needed for NICU and Oncology locations

Example: Option 1

National Healthcare Safety Network
SIR for Central Line-Associated BSI Data for Acute Care Hospitals (2015 baseline) - By OrgID
 As of: June 14, 2023 at 8:15 AM
 Date Range: All BSI_CLAB_RATESALL

Facility Org ID=10000 Type of Affiliation=M

Facility Org ID	CMS Certification Number	Summary Yr/Qtr	Events	Number Predicted	Central Line Days	SIR	SIR p-value	95% Confidence Interval	SIR Percentile
10000	000123	2020Q1	1	2.158	1854	0.463	0.4804	0.023, 2.285	23
10000	000123	2020Q2	0	0.035	34
10000	000123	2020Q3	2	1.371	445	1.458	0.5579	0.245, 4.818	76
10000	000123	2020Q4	0	0.023	20

Example: Option 2

National Healthcare Safety Network
SUR for Central Line Device Use for Acute Care Hospitals (2015 baseline) - By OrgID
 As of: June 14, 2023 at 8:21 AM
 Date Range: All BSI_CLAB_RATESALL

Facility Org ID=10000 Type of Affiliation=M

Facility Org ID	CMS Certification Number	Summary Yr/Qtr	Central Line Days	Patient Days	Number Predicted Device Days	SUR	SUR p-value	95% Confidence Interval	SUR Percentile
10000	000123	2020Q1	1854	2234	1,190.162	1.558	0.0000	1.488, 1.630	89
10000	000123	2020Q2	34	203	91.029	0.374	0.0000	0.263, 0.516	9
10000	000123	2020Q3	445	1815	951.912	0.467	0.0000	0.426, 0.512	12
10000	000123	2020Q4	20	461	188.518	0.106	0.0000	0.067, 0.161	3

Example: Option 3

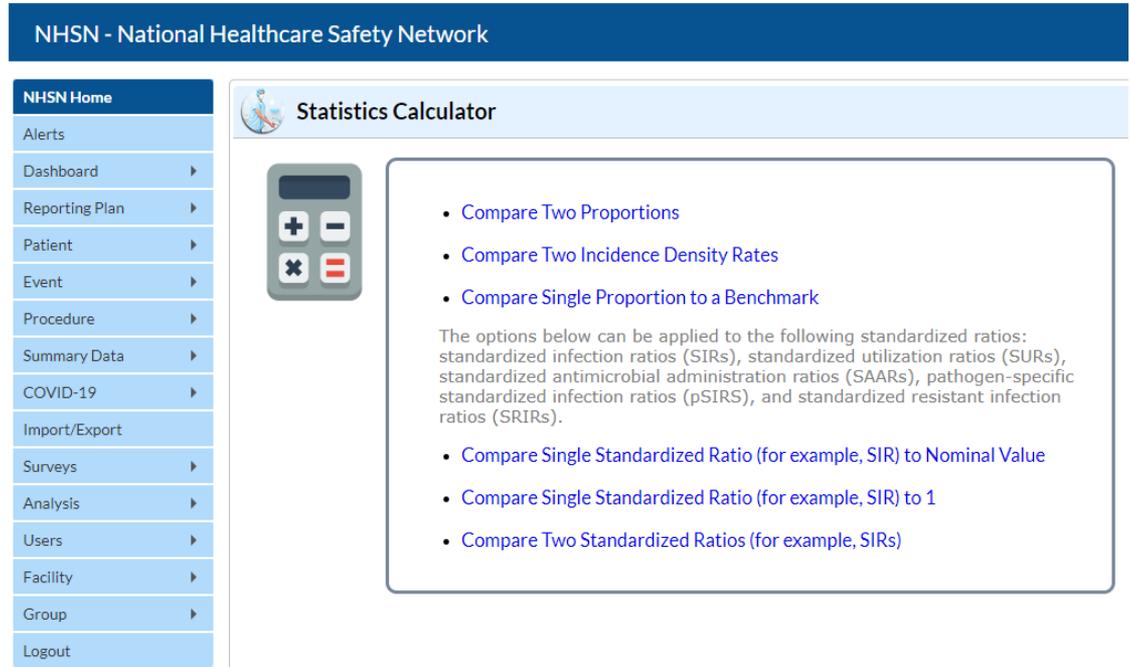
National Healthcare Safety Network
Rate Table for Central Line-Associated BSI Data for ICU-Other
 As of: June 14, 2023 at 8:24 AM
 Date Range: All BSI_CLAB_RATESICU

Facility Org ID=10000 CDC Location=IN:ACUTE:CC:M

Location	Summary Yr/Qtr	Months	CLA BSI Count	Central Line Days	CLA BSIRate	Patient Days	CL Util Ratio
12 WEST3	2021Q3	1	0	26	0.000	326	0.080

NHSN Statistics Calculator

- Available via Analysis > Statistics Calculator
- Options available for making internal comparisons, as well as comparing to a benchmark or goal, or a nominal SIR value.



The screenshot shows the NHSN - National Healthcare Safety Network interface. On the left is a navigation menu with the following items: NHSN Home, Alerts, Dashboard, Reporting Plan, Patient, Event, Procedure, Summary Data, COVID-19, Import/Export, Surveys, Analysis, Users, Facility, Group, and Logout. The main content area is titled 'Statistics Calculator' and features a calculator icon. Below the icon is a list of options: 'Compare Two Proportions', 'Compare Two Incidence Density Rates', and 'Compare Single Proportion to a Benchmark'. A text box explains that these options apply to standardized ratios: SIRs, SURs, SAARs, pSIRs, and SRIRs. Below this text is a second list of options: 'Compare Single Standardized Ratio (for example, SIR) to Nominal Value', 'Compare Single Standardized Ratio (for example, SIR) to 1', and 'Compare Two Standardized Ratios (for example, SIRs)'.

NHSN - National Healthcare Safety Network

NHSN Home

- Alerts
- Dashboard ▶
- Reporting Plan ▶
- Patient ▶
- Event ▶
- Procedure ▶
- Summary Data ▶
- COVID-19 ▶
- Import/Export
- Surveys ▶
- Analysis ▶
- Users ▶
- Facility ▶
- Group ▶
- Logout

Statistics Calculator

- Compare Two Proportions
- Compare Two Incidence Density Rates
- Compare Single Proportion to a Benchmark

The options below can be applied to the following standardized ratios: standardized infection ratios (SIRs), standardized utilization ratios (SURs), standardized antimicrobial administration ratios (SAARs), pathogen-specific standardized infection ratios (pSIRs), and standardized resistant infection ratios (SRIRs).

- Compare Single Standardized Ratio (for example, SIR) to Nominal Value
- Compare Single Standardized Ratio (for example, SIR) to 1
- Compare Two Standardized Ratios (for example, SIRs)

NHSN Statistics Calculator

- All options require input of values
 - Data cannot be *imported* into Statistics Calculator
- Each option provides information and guidance for use
- SAS Macros available online

 **Compare Two Standardized Ratios (for example, SIRs)**

When comparing two standardized ratios, the hypothesis is that the two ratios are not different from each other. To perform a hypothesis test and calculate a p-value, first select the type of ratio you wish to analyze. Then, enter the values for the appropriate number observed and number predicted. The standardized ratios for each data source will be displayed automatically. Click Calculate

Type of ratio:	<input type="text" value="SIR - standardized infection ratio"/>	
	Data Source #1	Data Source #2
Group Labels:	<input type="text"/>	<input type="text"/>
Number Observed Infections:	<input type="text"/>	<input type="text"/>
Number Predicted Infections:	<input type="text"/>	<input type="text"/>
Standardized Infection Ratio:	<input type="text"/>	
Title:	<input type="text"/>	

NHSN Statistics Calculator

- Why use the statistics calculator?
 - Useful to identify statistical differences between two points/observations
 - For example:
 - Has the CLABSI rate decreased in the ICU?
 - Has the urinary catheter use changed in each unit?
 - How does our facility's MRSA SIR compare to our goal SIR?
 - Obtain results using trusted statistical tests- All methods align with those used in NHSN reports (within the application, as well as for CDC NHSN reports)

Applying CDC's Methods to YOUR data!

Example: Facility-level CLABSI SIRs – 2019 thru 2022

Year	# CLABSI	CL days	# pred	SIR	Pval	95% CI
2019	7	11,550	12.39	0.565	0.1106	(0.247, 1.118)
2020	15	12,625	12.04	1.246	0.3901	(0.724, 2.009)
2021	11	12,120	12.53	0.878	0.6967	(0.462, 1.526)
2022	8	11,150	12.05	0.664	0.2391	(0.308, 1.261)

- CLABSI SIR values increased in 2020 and began to decrease
 - None of the SIRs were statistically significantly different compared to 2015
- How do the pandemic years compare to the pre-pandemic time period (2019)?

Example: Difference between 2019 and 2020

National Healthcare Safety Network 2019 vs 2020 CLABSI SIRs

As of: June 16, 2023 at 7:19 AM

	2019	2020
Observed Infection	7	15
Predicted Infection	12.39	12.04
SIR	0.565	1.246

Relative ratio of SIRs (data column 2 / data column 1): $1.246/0.565 = 2.205$ (220.5%)

Two-tailed p-value: 0.0810

95% Conf. Interval: 0.911, 5.783

Another way to look at the above results would be to consider relative change between the measures as shown in the table below

Percent change between SIRs ((data column 2/data column 1)-1)*100: $(1.246/0.565-1)*100 = 120.531$

Two-tailed p-value: 0.0810

95% Conf. Interval: -8.9, 478.3



120.5% change
95% CI (-8.9, 478.3)

- Use “Compare 2 Standardized Ratios” option in Statistics Calculator
 - Consistent with methods from Weiner-Lastinger L, et al to calculate **relative percent change**¹
- In this example, based on the 95% CI, the percent change between 2020 and 2019 is **not** statistically significant (i.e., not different).
- This option can also be used to compare SURs

¹ Weiner-Lastinger, L, Pattabiraman, V, Konnor, R, Patel, P, Wong, E, Xu, S, . . . Dudeck, M. (2022). The impact of coronavirus disease 2019 (COVID-19) on healthcare-associated infections in 2020: A summary of data reported to the National Healthcare Safety Network. Infection Control & Hospital Epidemiology, 43(1), 12-25. doi:10.1017/icc.2021.362

Areas of further exploration

- What if there's not enough data for an SIR?
 - Compare rates using the Statistics Calculator
 - Use TAP reports to identify locations with the most excess infections
 - Oftentimes (but not always) there are 0 observed HAIs
- Review timing of HAIs with seasonal respiratory admissions, healthcare worker shortages, and/or other changes impacting healthcare delivery
 - Allows assessment of system stress and impact on HAIs, at the local level
- Assess any changes in patient LOS, length of device use, other related outcomes.
- Are there changes in the pathogens associated with HAIs? Any changes in antimicrobial resistance?

Resources

- Statistics Calculator:

<https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/StatsCalc.pdf>

- Exporting Data:

<https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/exportdata.pdf>

- Data Quality:

<https://www.cdc.gov/nhsn/ps-analysis-resources/data-quality/index.html>

- Published NHSN Reports:

<https://www.cdc.gov/nhsn/datastat/index.html>

- National and State HAI Progress Report:

<https://www.cdc.gov/hai/data/portal/progress-report.html>

For any questions or concerns, contact the NHSN Helpdesk using

- **NHSN-ServiceNow** to submit questions to the NHSN Help Desk. The new portal can be accessed at <https://servicedesk.cdc.gov/nhsncsp>.
- Users will be authenticated using CDC's Secure Access Management Services (SAMS) the same way you access NHSN.
- If you do not have a SAMS login, or are unable to access ServiceNow, you can still email the NHSN Help Desk at nhsn@cdc.gov.

For more information please contact Centers for Disease Control and Prevention

1600 Clifton Road NE, Atlanta, GA 30333

Telephone, 1-800-CDC-INFO (232-4636)/TTY: 1-888-232-6348

E-mail: cdcinfo@cdc.gov Web: www.cdc.gov

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

