



# Analysis: Telling Your Hospital's Story with NHSN Data

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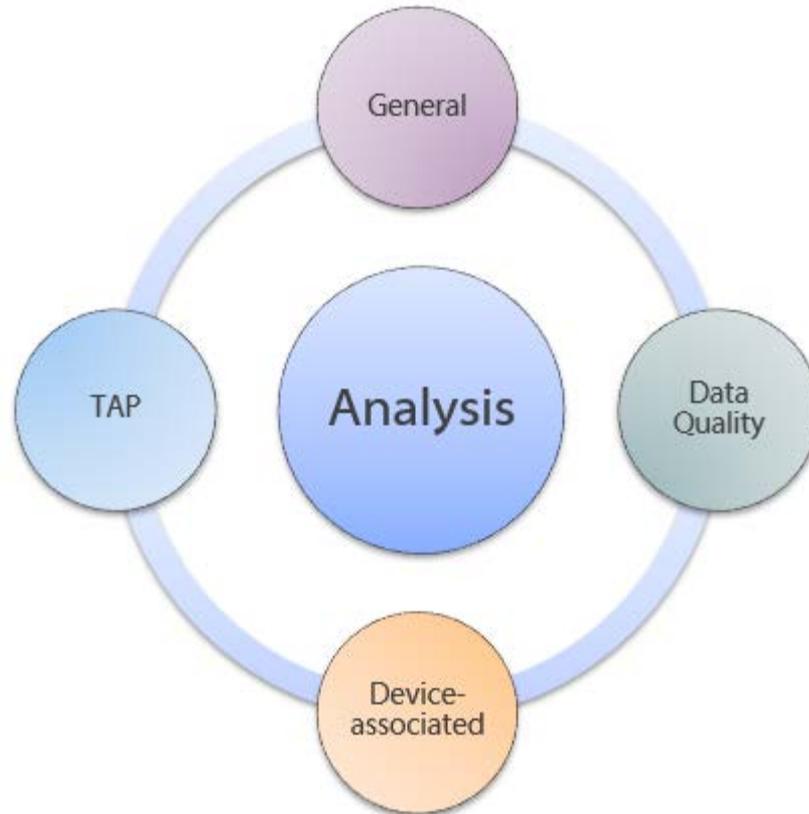
NHSN Annual Training

March 26, 2019

# Objectives

- Identify various HAI reports that can complement the SIRs
- Interpret SIRs, rates, and summarized event-level data
- Use the NHSN Statistics Calculator to make conclusions regarding a hospital's HAI experience and comparison to goals and/or itself over time

# What have we covered so far?





A word cloud featuring various medical and statistical terms. The most prominent words are 'SIR' and 'rates', both in large, dark brown, sans-serif font. Other words include 'SUR percentile', 'p-value', 'model', 'worse', 'significant', 'benchmark', 'risk-adjustment', 'DUR', 'better', '95CI', and 'different'. The words are arranged in a non-linear fashion, with some overlapping. The colors of the words range from dark brown to light green.

95CI  
different  
better  
DUR  
benchmark  
worse  
model  
significant  
SIR  
SUR  
percentile  
rates  
risk-adjustment  
p-value

## Building a story

- All of the following options can provide data that will complement the overall SIRs for each of the HAIs we're measuring
  - Location-specific SIRs and rates
  - Procedure- and surgeon-specific SSI SIRs
  - Event- and pathogen-level information
  - Quarterly SIRs
  - Statistics Calculator
  - Location-specific SURs and device-utilization ratios
  - TAP Reports and TAP Dashboard

**Event-level Data**

# Event-level Data: Time between Admission and Event

- Available for all HAIs and LabID events
  - For labID, use the variable **facToSpecDays** (*Days: Fac Admit to Spec Collect*)

Event Type=UTI

Facility Org ID	Event ID	Event Type	Location	Fac Admission Date	Event Date	Days: Admit to Event
10000	25985590	UTI	CMICU_N	03/02/2017	03/08/2017	7
10000	27752601	UTI	REHAB	03/16/2017	04/09/2017	25
10000	27752126	UTI	3 CENTRAL	03/29/2017	04/08/2017	11
10000	27750024	UTI	REHAB	04/01/2017	04/08/2017	8
10000	27750026	UTI	REHAB	04/01/2017	04/22/2017	22
10000	27752194	UTI	5 WEST	04/01/2017	04/15/2017	15
10000	27752208	UTI	3 CENTRAL	04/02/2017	04/22/2017	21
10000	27753015	UTI	REHAB	04/11/2017	04/27/2017	17
10000	27752262	UTI	3 CENTRAL	05/01/2017	05/06/2017	6
10000	27752377	UTI	3 CENTRAL	05/29/2017	06/03/2017	6
10000	27750747	UTI	REHAB	06/04/2017	06/17/2017	14
10000	27752460	UTI	3 CENTRAL	06/04/2017	06/17/2017	14
10000	27715204	UTI	ICUICU	06/12/2017	07/04/2017	23
10000	27752489	UTI	3 CENTRAL	06/20/2017	06/28/2017	9
10000	27777176	UTI	5WEST	06/21/2017	07/07/2017	17

**TIP:**  
Calculate the average # days from admission to event by exporting the line list into .xlsx or .csv

# Event-Level Data: SSI criteria and detection

Event ID	Procedure Code	Event Type	Specific Event	Event Date	Days: Procedure to Event	When Detected	Physician Diagnosis of this Event Type?	Pathogen Identified
17773116	HPRO	SSI	DIP	02/01/2015	21	RF		Y
22847103	HYST	SSI	IAB	04/09/2015	11	RO		Y
22847016	COLO	SSI	SIP	03/26/2015	17	RF		Y
22847105	COLO	SSI	DIP	06/27/2015	16	P		Y
22847079	HPRO	SSI	BONE	03/26/2015	25	RF		Y
20996240	HPRO	SSI	PJI	10/03/2015	2	RO		Y
21010090	HPRO	SSI	BONE	01/05/2016	5	A		Y
21321000	KPRO	SSI	BONE	01/05/2016	5	P		Y
21010092	HPRO	SSI	PJI	01/05/2016	5	RF		Y
23158005	COLO	SSI	DIP	01/28/2016	17	A		Y
23430132	COLO	SSI	DIP	03/25/2016	30	A		Y
				03/12/2016	5	P		N
				05/31/2016	21	RF		Y
				07/24/2016	2	RO		Y
				07/19/2016	1	A	Y	N
				02/11/2016	2	P		Y
				07/21/2016	3	A	Y	N
				02/01/2017	3	P		N
				01/10/2017	10	A		Y

*Did you know??*

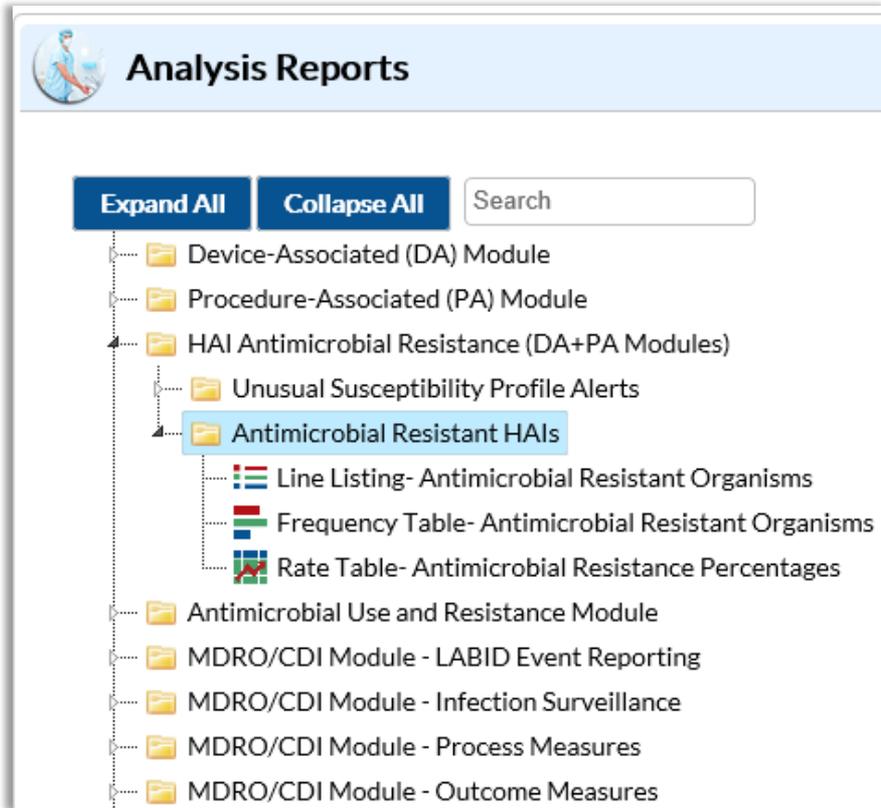
The SSI Line List can include all of the event and procedure-level data for each SSI reported.

# Event-level Data: Pathogens

- Consider a **Frequency Table** that will display pathogen counts for each HAI type
- This example is a frequency table in it's simplest form, exported as a .xls and modified
- Could run a frequency table of pathogens by location, location type, or specified time period (e.g., month, quarter)

Pathogen 1 Description	Frequency	Percent
Acinetobacter baumannii - ACBA	3	11.11%
Acholeplasma laidlawii - ACHOLAID	1	3.70%
Achromobacter - ACHSP	1	3.70%
Anaerobiospirillum succinoproducens - ANSU	1	3.70%
Bacillus patagoniensis - BPATA	1	3.70%
Enterobacter aerogenes - EA	2	7.41%
Enteropathogenic Escherichia coli - ECEP	1	3.70%
Enterococcus faecium - ENTFM	5	18.52%
Enterococcus faecalis - ENTFS	3	11.11%
Gram-negative bacillus - GNR	1	3.70%
Granulicatella adiacens - GRADJ	2	7.41%
Klebsiella pneumoniae - KP	4	14.81%
Raoultella ornithinolytica - RAOORN	1	3.70%
Staphylococcus chromogenes - STACHR	1	3.70%
TOTAL	27	100

# Event-level Data: HAI Antimicrobial Resistance



The screenshot displays a web interface for "Analysis Reports". At the top left is a circular icon of a person in a blue protective suit. Below the header are two buttons: "Expand All" and "Collapse All", followed by a search input field. A tree view of folders is shown below. The "HAI Antimicrobial Resistance (DA+PA Modules)" folder is expanded, revealing three sub-items: "Unusual Susceptibility Profile Alerts", "Antimicrobial Resistant HAIs" (which is highlighted in blue), and "Antimicrobial Use and Resistance Module". The "Antimicrobial Resistant HAIs" folder is further expanded to show three sub-items: "Line Listing- Antimicrobial Resistant Organisms", "Frequency Table- Antimicrobial Resistant Organisms", and "Rate Table- Antimicrobial Resistance Percentages". Other folders in the tree include "Device-Associated (DA) Module", "Procedure-Associated (PA) Module", "Antimicrobial Use and Resistance Module", and four "MDRO/CDI Module" folders for "LABID Event Reporting", "Infection Surveillance", "Process Measures", and "Outcome Measures".

- Reports for select phenotypes reported with DA and SSI events.
- Phenotype definitions are available at: [https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/phenotype\\_definitions.pdf](https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/phenotype_definitions.pdf)

# Event-level Data: HAI Antimicrobial Resistance

## National Healthcare Safety Network Line Listing- Antimicrobial Resistant Organisms MRSA\_HAI - Methicillin-resistant Staphylococcus aureus

As of: June 9, 2017 at 1:05 PM  
Date Range: All ANTIBIOGRAM\_HAI

Event ID	Gender	Fac Admission Date	Event Date	Event Type	Location	Pathogen Description
44759	M	01/13/2014	01/15/2014	UTI	1098REMDRO	Staphylococcus aureus - SA
47495	F	02/02/2015	02/06/2015	BSI	REHABIRF-1	Staphylococcus aureus - SA
54954	F	01/01/2015	01/05/2015	BSI	ICU-A	Staphylococcus aureus - SA

Criteria used to define each phenotype can be found on the Patient Safety Analysis Resources webpage.  
The data in this table include all applicable pathogens entered for an HAI, and are not limited to the first pathogen.  
Sorted by orgID eventDate  
Data contained in this report were last generated on June 7, 2017 at 10:46 AM.

## National Healthcare Safety Network Frequency Table- Antimicrobial Resistant Organisms As of: June 9, 2017 at 1:00 PM Date Range: All ANTIBIOGRAM\_HAI

Frequency Row Pct	Table of phenotype by eventType		
	eventType(Event Type)		
phenotype(Resistant Organism)	BSI	UTI	Total
CREall_HAI	8 72.73	3 27.27	11
MDR_Acine_HAI	2 40.00	3 60.00	5
MDR_PA_HAI	0 0.00	1 100.00	1
MRSA_HAI	2 66.67	1 33.33	3
VREfaecalis_HAI	2 100.00	0 0.00	2
carbNS_Acine_HAI	4 50.00	4 50.00	8
carbNS_PA_HAI	1 50.00	1 50.00	2
<b>Total</b>	<b>19</b>	<b>13</b>	<b>32</b>

Criteria used to define each phenotype can be found on the Patient Safety Analysis Resources webpage.  
The data in this table include all applicable pathogens entered for an HAI, and are not limited to the first pathogen.  
Data contained in this report were last generated on June 7, 2017 at 10:46 AM.

# Event-level Data: Interpreting a Frequency Table

Frequency	Table of location by onset				
Percent	location	onset			
Row Pct		CO	CO-HCFA	HO	Total
Col Pct					
	ICU	11	0	7	18
		15.28	0.00	9.72	25.00
		61.11	0.00	38.89	
		35.48	0.00	18.42	
	STEP	1	1	4	6
		1.39	1.39	5.56	1.39
		16.67	16.67	66.67	
		3.23	33.33	10.53	
	ED	8	0	0	8
		11.11	0.00	0.00	11.11
		100.00	0.00	0.00	
		25.81	0.00	0.00	
	WARD	11	2	27	40
		15.28	2.78	37.50	55.55
		27.50	5.00	67.50	
		35.48	66.67	71.05	
	Total	31	3	38	72
		43.06	4.17	52.78	100.00

- Based on the data in this table, please provide the following:
  - a. Percent of events in the Ward that are CO-HCFA: **5% (row %)**
  - b. Percent of HO events that were identified in the ICU: **18.42% (col %)**
  - c. Percent of all CDI events that are CO and identified in the WARD: **15.28% (total %)**
  - d. Percent of all events that are HO: **52.78%**

**Summarized Data**

# Summarized Data Can Include:

## Rates

May use person-time as the denominator, along with a multiplier.

Useful for internal comparisons.

## DURs

Ratio of device days to patients days.

No multiplier.

Available by location only.

## SIRs

Risk-adjusted, scalable, summary measure.

Ratio of observed to predicted infections.

Uses a single baseline to measure progress.

## CADs

Difference between observed and predicted infections.

May use SIR goal as a multiplier to heighten prevention targets.

First step in TAP strategy.

## SURs

Risk-adjusted, scalable summary measure.

Ratio of observed to predicted **device days**.

Uses a single baseline to measure progress.

## SAARs

Risk-adjusted, scalable summary measure.

Ratio of observed to predicted **days of antimicrobial therapy**.

Uses a single baseline.

# Making a Case for Device-associated (DA) Rates and DURs

- Can make monthly-level assessment of HAI incidence and exposure for each location
- Allows for 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?

Quarter	Location	# CAUTI	# UC Days	Rate	DUR
1	Med ICU	5	1,360	3.67	0.60
2	Med ICU	4	1,287	3.11	0.51
3	Med ICU	4	1,462	2.74	0.61
4	Med ICU	3	1,201	2.50	0.48

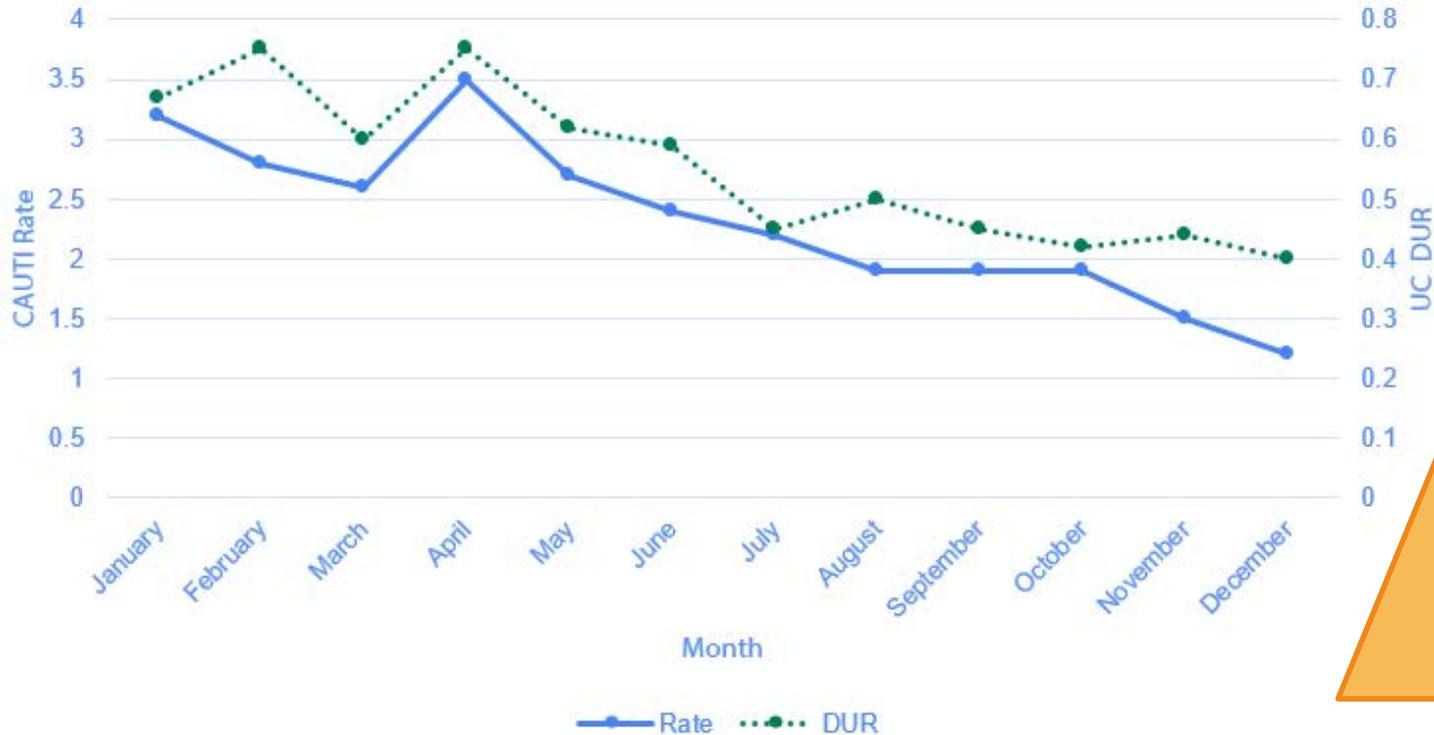
# Making a Case for DA Rates and DURs

- Can be calculated as long as the denominator is >0
  - BE CAREFUL! Lower device days or patient days = less precision

Location A	Location B
1 CLABSIs	10 CLABSIs
500 central line days	5,000 central line days
2.00 per 1,000 CL days	2.00 per 1,000 CL days

# Making a Case for Internal Use of DA Rates and DURs

SICU CAUTI Rates and DURs, January-December



**CAUTION!**  
This run chart does not represent statistical evidence of a trend.

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

## Standardized Infection Ratio (SIR)

- 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
- 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

**Knowledge Check #1: True or False: Your facility's KPRO SIR of 0 (95% CI: . , 2.149) is statistically significant.**

True

False

## Knowledge Check #1 RATIONALE

True or False: Your facility's KPRO SIR of 0 (95% CI: . , 2.149) is statistically significant.

- A. True
-  B. False

While the lower bound of the confidence interval is not calculated, it can be assumed to be zero. Therefore, the lower bound and upper bound are on opposite sides of the nominal value of 1.

## Quarterly CLABSI SIRs, Rates, and DURs

Location	Quarter	Events	CL Days	Pt days	# Pred	SIR	Rate	DUR
Med ICU	1	4	2250	3840	3.002	1.332	1.78	0.59
Med ICU	2	5	2280	4780	3.057	1.635	2.19	0.48
Med ICU	3	2	2560	4500	3.419	0.585	0.78	0.57
Med ICU	4	1	2270	3300	3.029	0.330	0.44	0.69
Surg ICU	1	3	2660	5220	5.058	0.593	1.13	0.51
Surg ICU	2	3	2600	3480	4.893	0.613	1.15	0.75
Surg ICU	3	4	2480	4610	4.873	0.821	1.61	0.54
Surg ICU	4	2	2360	4400	4.315	0.463	0.85	0.54
HemOnc	1	0	2060	3750	2.538	0.000	0.00	0.55
HemOnc	2	2	2450	3650	3.018	0.663	0.82	0.67
HemOnc	3	1	2370	3540	2.920	0.342	0.42	0.67
HemOnc	4	1	1880	2920	2.316	0.432	0.53	0.64

## Knowledge Check #2:

You are asked by the C-suite for a national rate to benchmark your hospital's DA rates, as has been provided in the past. Should you use pre-2015 NHSN reports to meet this request?

- A. Yes, in order to fulfill the requirement by the C-suite
- B. Yes, my hospital was not impacted by definition changes
- C. No, the data are not comparable
- D. No, the comparison is not in NHSN and can't be made elsewhere
- E. It depends...does my job depend on it?

## Knowledge Check #2 – Answer

★ C. No, the data are not comparable

- Various protocol and definition changes impact the applicability of previous National pooled means and SIR baselines to current data.
- **National 2015 Standardized Infection Ratios (SIRs) Calculated Using Historical Baselines**

<https://www.cdc.gov/hai/surveillance/data-reports/2015-SIR-report.html>

## Hospital DA Infections – Overall SIRs

HAI	# Events	# pt days	# device days	Rate	# pred	SIR	P-value	95% CI
CLABSI	28	47,990	28,220	0.96	42.438	0.660	0.0199	(0.447, 0.941)
CAUTI	36	47,990	21,450	1.678	34.158	1.054	0.7343	(0.749, 1.443)
Total VAE	16	17,320	2,230	7.175	15.061	1.062	0.7799	(0.629, 1.688)

*What's wrong with this picture???*

*Fictitious data used for illustrative purposes only.*

## Hospital DA Infections – Overall SIRs

HAI	# Events	# pt days	# device days	VAE	# pred	SIR	P-value	95% CI
CLABSI	28	47,990	28,220	1.6	42.438	0.660	0.0199	(0.447, 0.941)
CAUTI	36	47,990	21,450	1.78	34.158	1.054	0.7343	(0.749, 1.443)
Total VAE	16	17,320	2,230	1.5	15.061	1.062	0.7799	(0.629, 1.688)

Crude, unadjusted device-associated rates do not provide an accurate picture of what may be happening in your hospital. Rates can differ depending on patient population and patient care areas.

*Fictitious data used for illustrative purposes only.*

# A Tale of Two Sister Hospitals

- You are looking at an annual SIR for your hospital, alongside the sister hospital.
- Although the hospitals are similar, why are the SIRs and interpretations different?

Factor	Your Hospital	Your (Sister) Hospital
Bedsize	250	300
Medical SchoolAff	Nonteaching	Nonteaching
Number of ICU beds	40	50
CAUTISIR	1.37	1.42
Interpretation	Worsethan Nat'l	No different

# A Tale of Two Sister Hospitals

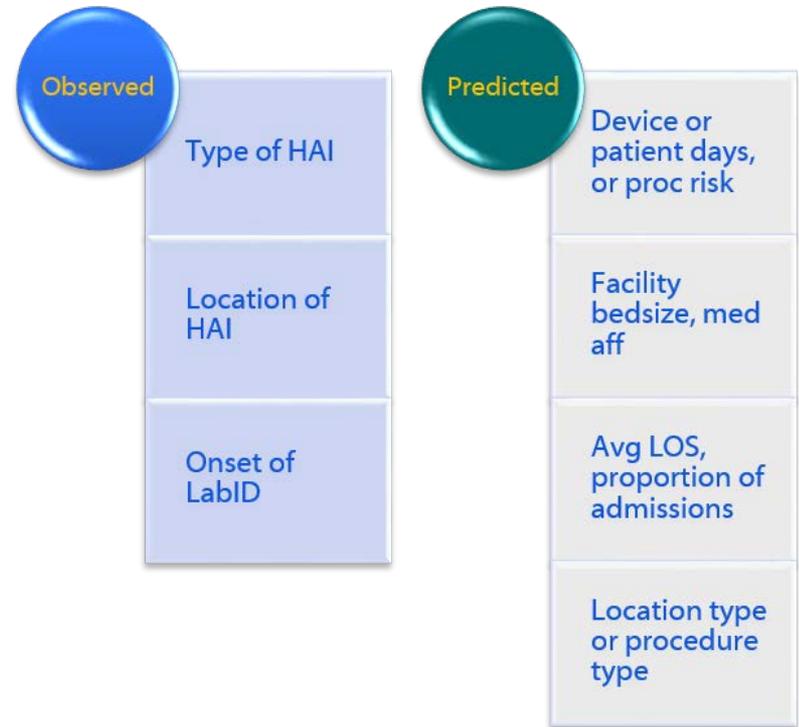
- Are these two hospitals *directly* comparable?
- Additional information is needed:
  - What types of units are reporting?
  - How many infections?
  - How many predicted?
  - How many device days?

Factor	Your Hospital	Your (Sister) Hospital
Bedsize	250	300
Medical School Aff	Nonteaching	Nonteaching
Number of ICU beds	40	50
CAUTI SIR	1.37	1.42
Interpretation	Worse than Nat'l	No different

# SIR: More than Just a Number

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

- Remember to look at SIR *in addition to*:
  - number predicted
  - number observed
  - patient and/or device days
  - Changes in facility demographics (reported on Annual Surveys)
  - CO prevalence rates (LabID)
  - Changes in reporting locations (DA)
  - Changes in procedures (SSI)



# Interpretation – Additional Elements to Consider

- Internal and External Validation
- Prevention initiatives
- Educational endeavors
- Change in facility demographics
  - Diff. patient population?
  - Closing of units?
  - New services?

## Let's talk about...Low Exposure

- Oftentimes, this is defined as # predicted  $<1$ 
  - Also low device and/or patient days
- What do you do when the SIR is not calculated due to low exposure?
  - Consider using rates, even without National rate for comparison
  - Review data over longer periods of time – may result in ability to calculate the SIR
- Oftentimes (but not always) there are 0 observed HAIs

## Low exposure...continued

- Units or procedures with  $<1$  predicted infection are still included in the overall SIR
  - Remember – the SIR is scalable
  - In the below example, the FUSN SSI, procedures, and # pred are included in the Overall SSI SIR for the facility.

<b>Procedure</b>	<b># SSI</b>	<b># procedures</b>	<b># pred</b>	<b>SIR</b>	<b>P-value</b>	<b>95% CI</b>
<i>Overall</i>	<i>14</i>	<i>601</i>	<i>17.890</i>	<i>0.783</i>	<i>0.3637</i>	<i>(0.445, 1.282)</i>
COLO	7	236	11.604	0.603	0.1653	(0.264, 1.193)
HYST	3	58	1.340	2.239	0.1994	(0.569, 6.093)
HPRO	3	94	2.592	1.157	0.7418	(0.294, 3.150)
KPRO	0	53	1.394	0.000	0.2481	(. , 2.149)
FUSN	1	160	0.960			

**A Step Further – Statistics Calculator**

# NHSN Statistics Calculator

- Options available for making internal comparisons, as well as comparing to a benchmark or goal, or a nominal SIR value.

**CDC** Centers for Disease Control and Prevention  
CDC 24/7: Saving Lives, Protecting People™

**NHSN**  
National Healthcare Safety Network

NHSN - National Healthcare Safety Network (apt-v-nhsn-test:8001)

MAGGIE  
DHQP MEMORIAL HOSPITAL

**NHSN Home**

- Alerts
- Dashboard
- Reporting Plan ▶
- Patient ▶
- Event ▶
- Procedure ▶
- Summary Data ▶

**Statistics Calculator**

- [Compare Two Proportions](#)
- [Compare Single SIR to 1](#)
- [Compare Two Standardized Infection Ratios](#)
- [Compare Two Incidence Density Rates](#)
- [Compare Single Proportion to a Benchmark](#)
- [Compare Single SIR to Nominal Value](#)

# NHSN Statistics Calculator

- Compare Two Standardized Infection Ratios:
  - Use SIR data from NHSN that are calculated using the same baseline!
  - Have to enter numerator (# observed) and denominator (# predicted)
  - Use for internal comparisons
- Compare Two Incidence Density Rates
  - Allows for comparison of two device-associated rates
  - Useful for internal comparison without the need for national pooled mean rates.

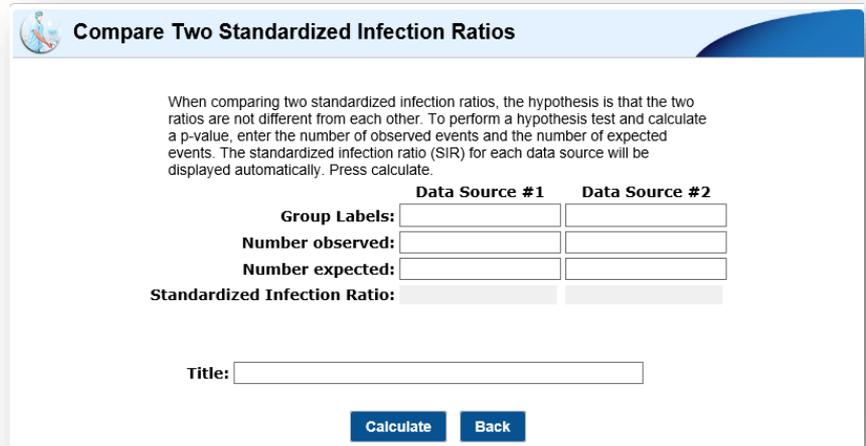
<https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/StatsCalc.pdf>

# NHSN Statistics Calculator

- Compare Single Proportion to a Benchmark
  - Produces a 95% CI around the proportion
  - Produces 1- and 2-tailed p-values comparing the proportion to a benchmark/goal
- Compare Single SIR to Nominal Value
  - Nominal value could represent a Goal

# NHSN Statistics Calculator

- All options require input of values
  - Data cannot be *imported* into Statistics Calculator
- Each option provides information and guidance for use
- All methods align with those used in NHSN reports (within the application, as well as for CDC NHSN reports)
- SAS Macros available online



**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.

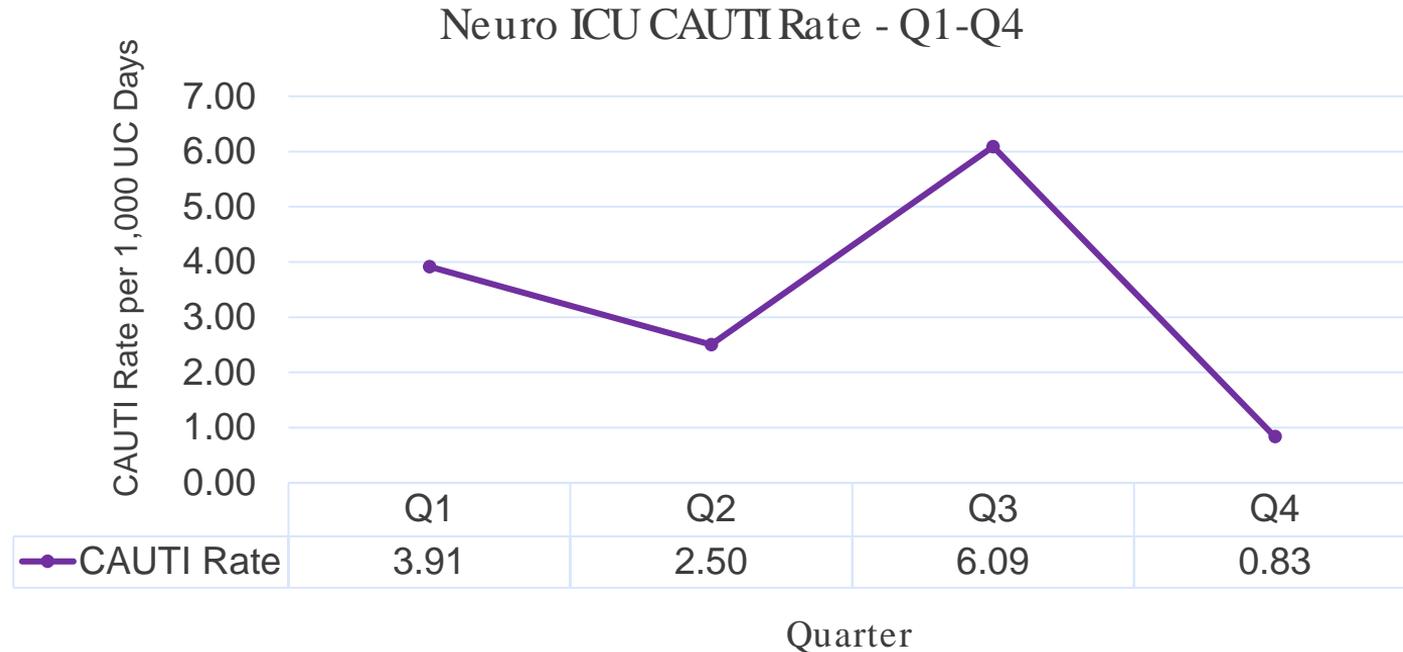
	Data Source #1	Data Source #2
<b>Group Labels:</b>	<input type="text"/>	<input type="text"/>
<b>Number observed:</b>	<input type="text"/>	<input type="text"/>
<b>Number expected:</b>	<input type="text"/>	<input type="text"/>
<b>Standardized Infection Ratio:</b>	<input type="text"/>	<input type="text"/>

Title:

<https://www.cdc.gov/nhsn/PS-Analysis-resources/index.html>

# Location-specific CAUTI Rates

- Your facility has been carefully reviewing the CAUTI rates in the Neurologic ICU. Below is the quarterly data for this unit.



# Compare Two Incidence Density Rates

- You want to determine if the CAUTI rate has significantly decreased in Q4.
- You decide to use the Statistics Calculator in NHSN.

	Data Source #1	Data Source #2
Group Labels:	<input type="text" value="Q1"/>	<input type="text" value="Q4"/>
Numerator(Number of events):	<input type="text" value="9"/>	<input type="text" value="2"/>
Denominator(Number of person-time units):	<input type="text" value="2300"/>	<input type="text" value="2400"/>
Multiplier:	<input type="text" value="1000"/>	
Title:	<input type="text" value="Neuro ICU CAUTI Rate Comparison"/>	

NOTE: This option can be used for internal comparison of location-stratified DA rates, or inpatient HO LabID rates (FACWIDEIN or by location, if known).

# Compare Two Incidence Density Rates - RESULTS

	Data Source #1	Data Source #2
Group Labels:	<input type="text" value="Q1"/>	<input type="text" value="Q4"/>
Numerator(Number of events):	<input type="text" value="9"/>	<input type="text" value="2"/>
Denominator(Number of person-time units):	<input type="text" value="2300"/>	<input type="text" value="2400"/>
Multiplier:	<input type="text" value="1000"/> ▾	
Title:	<input type="text" value="Neuro ICU CAUTI Rate Comparison"/>	
	<input type="button" value="Calculate"/>	<input type="button" value="Back"/>

## National Healthcare Safety Network Neuro ICU CAUTI Rate Comparison

As of: March 8, 2019 at 10:44 AM

	Q1	Q4
Numerator	9	2
Denominator	2300	2400
Incidence Density Rate	3.913	0.833
IDR p-value	0.0327	

## Knowledge Check #3:

Based on the p-value of 0.0327, can you conclude that the Neuro ICU significantly reduced its CAUTI rate during this year?

- A. Yes, the p-value is statistically significant
- B. No, the p-value is not statistically significant
- C. No, the comparison included only two quarters
- D. No, the data are not risk-adjusted

## Knowledge Check #3: RATIONALE

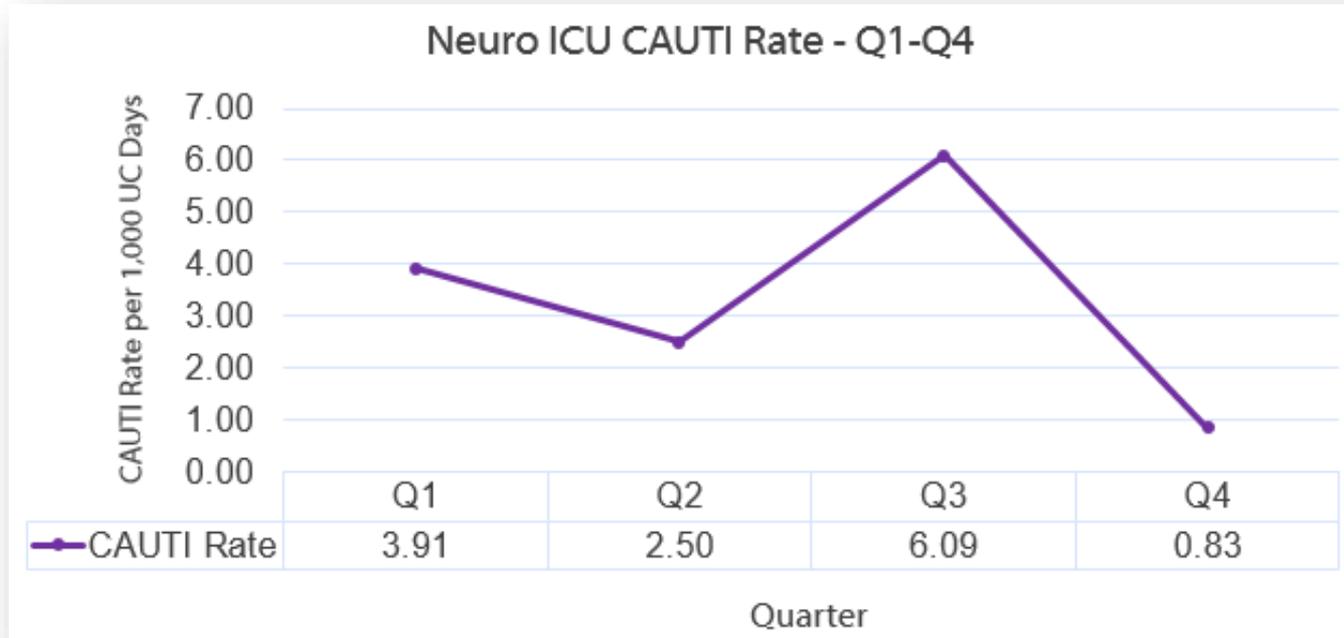


### C. No, the comparison included only two quarters

- The results of this analysis tell us that the CAUTI rate in Q4 is significantly different from the rate in Q1, as the test compares **two point estimates**. It does *not* tell us how the facility performed during the year as a whole.
- Therefore, our interpretation would instead be:
  - *The CAUTI rate in our Neuro ICU, Q4, is significantly different than the rate at the beginning of the year in Q1.*

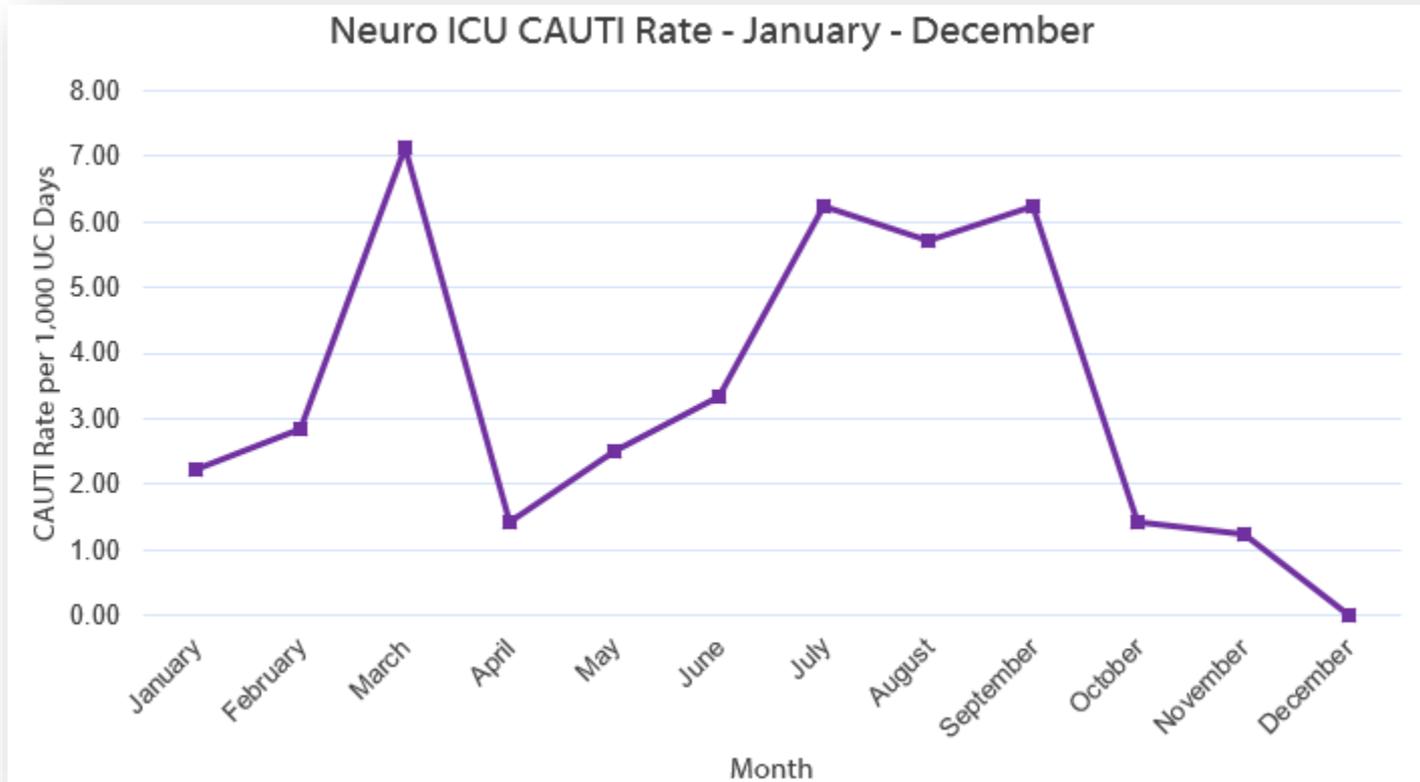
## Knowledge Check #3: RATIONALE (cont'd)

- Notice the rate increased in Q3, indicating that there was not a continuous decrease in CAUTI incidence throughout the year



## Knowledge Check #3: RATIONALE (cont'd)

- Looking at the data by month shows even greater variability.



# Comparison of Two SIRs

- Similar to comparison of two incidence density rates
- Can be used for SIRs, SURs, and SAARs
- Use for internal comparisons (e.g., Did my hospital's CDI SIR improve compared to the previous year?)

	Data Source #1	Data Source #2
<b>Group Labels:</b>	CDI 2016	CDI 2017
<b>Number observed:</b>	38	40
<b>Number expected:</b>	29.548	44.145
<b>Standardized Infection Ratio:</b>	1.286	0.906

**Title:** Annual CDI SIR Comparisons

## National Healthcare Safety Network Annual CDI SIR Comparisons

As of: March 8, 2019 at 3:01 PM

	CDI 2016	CDI 2017
Observed	38	40
Expected	29.548	44.145
SIR	1.286	0.906

Relative ratio of SIRs (data column 2 / data column 1):  $0.906/1.286 = 0.705$  (70.5%)

Two-tailed p-value: 0.1246

95% Conf. Interval: 0.451, 1.103

**Knowledge Check #4: You have been asked to provide comparison to a benchmark and you choose to use the Statistics Calculator to perform a comparison. TRUE or FALSE: You should use the "Compare 2 SIRs" option.**

True

False

# Knowledge Check #4 Answer and RATIONALE

- FALSE – the Compare 2 SIRs option is not appropriate for comparison to a benchmark or goal
- SIR Comparison to Nominal Value:
  - The National Median SIR, or other published value, should be used as a *guide* for determining a suitable goal for your hospital.
  - Your hospital’s SIR should not be directly compared to a national or state SIR

HAI and Patient Population	Standardized Infection Ratio Data					Percentile Distribution of Facility-specific SIRs <sup>8</sup>				
	Hospital-onset events <sup>5</sup>	Predicted Hospital-onset events <sup>6</sup>	SIR	95% CI for SIR		10%	25%	50%	75%	90%
Laboratory-identified <i>C. difficile</i> , facility-wide	95,530	103,780.133	0.921	0.915	0.926	0.262	0.568	0.851	1.144	1.466

## Knowledge Check #4 RATIONALE (cont'd)

- Why can't we compare 2 SIRs in this case?
  - Comparison of 2 SIRs assumes that the distribution of exposure between the facility and the national are proportional.
    - Is a single facility's exposure proportional to that of the entire U.S.?

Example:

$$\text{(hospital)} \frac{28}{42.438}$$

$$\text{(U.S.)} \frac{26,029}{26,183.537}$$

- Best to compare to a nominal value (e.g., SIR goal)

# SIR Comparison to Nominal Value

- How does this work\*?
  1. Select the nominal value. (e.g., HHS goal, median SIR, etc.)
  2. Multiply the # predicted by the nominal value.
  3. Calculate the new SIR (observed/new predicted)
  4. Obtain p-value.

*Example:* 0.85 is the chosen nominal value

$$\frac{40}{(44.145 * 0.85)} = \frac{40}{37.523} = 1.07$$

# SIR Comparison to Nominal Value

Data Source	
Group Label:	2017 CDI
Number Observed:	40
Number Expected:	44.145
Standardized Infection Ratio:	0.906
Nominal Value:	0.85
Title:	Comparison of 2017 CDI SIR to Goal

## National Healthcare Safety Network Comparison of 2017 CDI SIR to Goal

As of: March 8, 2019 at 3:44 PM

2017 CDI Number Observed	2017 CDI Number Expected	SIR	p-value as compared to 0.85
40	44.145	0.906	0.6705

- Based on these results, our hospital's CDI LabID SIR of 0.906 is not significantly different from our chosen goal of 0.85 (p=0.6705)

## In Summary:

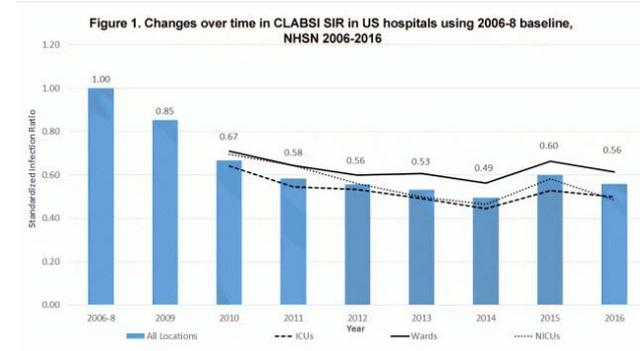
- Event-level reports are valuable sources of data to complement summary measures
- SIRs and rates can be used to measure local improvement
- The NHSN statistics calculator provides options to test for significant changes within a hospital, as well as difference to a chosen goal

# Resources

- CDC HAI Reports
- <https://www.cdc.gov/hai/surveillance/data-reports/index.html>

- *Healthcare-associated Infections in the United States, 2006-2016: A Story of Progress<sup>1</sup>*
- *2015 National and State Healthcare-associated Infections Data Report<sup>2</sup>*
- *National 2015 Standardized Infection Ratios (SIRs) Calculated Using Historical Baselines<sup>3</sup>*

1. <https://www.cdc.gov/hai/surveillance/data-reports/data-summary-assessing-progress.html>
2. <https://www.cdc.gov/hai/surveillance/data-reports/2015-HAI-data-report.html>
3. <https://www.cdc.gov/hai/surveillance/data-reports/2015-SIR-report.html>



**NATIONAL ACUTE CARE HOSPITALS**

Healthcare-associated infections (HAIs) are infections patients can get while receiving medical treatment in a healthcare facility. Working toward the elimination of HAIs is a CDC priority. The standardized infection ratio (SIR) is a summary statistic that can be used to track HAI prevention progress over time. SIRs are better than the infection data are reported to CDC's National Healthcare Safety Network (NHSN). SIR data for nearly all US hospitals are published on the Hospital Compare website. This report is based on SIR data, published in 2017 and uses the 2015 Baseline and risk-adjusted models.

**CLABSIS**

**CRITICAL CARE ASSOCIATED BLOODSTREAM INFECTIONS**

When a central line is placed in a large vein and not put in correctly or kept clean, it can become a way for germs to enter the body and cause deadly infections in the blood.

- Among the 2,328 hospitals with enough data to calculate an SIR:
  - 138 had an SIR significantly higher (worse) than 0.904, the value of the national SIR
  - 128 had an SIR significantly lower (better) than 0.904, the value of the national SIR

**CAUTIs**

**CATHETER ASSOCIATED URINARY TRACT INFECTIONS**

When a urinary catheter is not put in correctly, not kept clean, or left in a patient for too long, germs can travel through the catheter and infect the bladder and kidneys.

- Among the 2,567 hospitals with enough data to calculate an SIR:
  - 126 had an SIR significantly higher (worse) than 0.903, the value of the national SIR
  - 128 had an SIR significantly lower (better) than 0.903, the value of the national SIR

**VAEs**

**VENTILATOR ASSOCIATED EVENTS**

When a medical problem makes it hard or impossible for a patient to breathe on their own, they may be placed on a special breathing machine called a ventilator to save their life. This usually involves placing a tube in the patient's airway, and attaching the tube to the ventilator. Patients on ventilators are usually very sick, and they can develop problems related to their illness or related to being on a ventilator. This includes infections such as pneumonia or other problems such as fluid buildup in the lungs.

- Among the 1,373 hospitals with enough data to calculate an SIR:
  - 126 had an SIR significantly higher (worse) than 1.000, the value of the national SIR
  - 206 had an SIR significantly lower (better) than 1.000, the value of the national SIR

**SSIs**

**SURGICAL SITE INFECTIONS** (see page 44 for additional information)

When germs get into an incision or surgery site or wound, patients can get a surgical site infection. Sometimes these infections involve only the skin. Other SSIs can involve tissues under the skin, organs, or implanted material.

- Among the 614 hospitals with enough data to calculate an SIR:
  - 18 had an SIR significantly higher (worse) than 1.003, the value of the national SIR
  - 13 had an SIR significantly lower (better) than 1.003, the value of the national SIR

**SSI: Adhesional Hysterectomy**

- Among the 614 hospitals with enough data to calculate an SIR:
  - 18 had an SIR significantly higher (worse) than 1.003, the value of the national SIR
  - 13 had an SIR significantly lower (better) than 1.003, the value of the national SIR

**SSI: Colon Surgery**

- Among the 1,813 hospitals with enough data to calculate an SIR:
  - 98 had an SIR significantly higher (worse) than 0.904, the value of the national SIR
  - 49 had an SIR significantly lower (better) than 0.904, the value of the national SIR

**C. DIFFICILE EVENTS**

**LABORATORY-CONFIRMED CLOSTRIDIUM DIFFICILE C. DIFFICILE EVENTS**

When a person takes antibiotics, good bacteria that protect against infections are destroyed for several months. During this time, patients can get sick from Clostridium difficile (C. difficile) bacteria that cause potentially deadly diarrhea, which can be spread in healthcare settings.

- Among the 3,150 hospitals with enough data to calculate an SIR:
  - 126 had an SIR significantly higher (worse) than 0.903, the value of the national SIR
  - 128 had an SIR significantly lower (better) than 0.903, the value of the national SIR

**MRSA BACTEREMIA**

**LABORATORY-CONFIRMED METHICILLIN-RESISTANT STAPHYLOCOCCUS AUREUS (MRSA) BACTEREMIA**

MRSA is a type of staphylococcus bacteria. MRSA is bacteria usually spread by contaminated hands. In a healthcare setting, such as a hospital, MRSA can cause serious bloodstream events.

- Among the 1,476 hospitals with enough data to calculate an SIR:
  - 98 had an SIR significantly higher (worse) than 0.903, the value of the national SIR
  - 49 had an SIR significantly lower (better) than 0.903, the value of the national SIR

**CDC**

HAI REPORT IS BASED ON 2015 DATA, PUBLISHED IN 2017. WHO USED THE 2015 BASELINE AND RISK-ADJUSTED MODELS.

# Resources

- 2017 National and State HAI Progress Report:
  - <https://www.cdc.gov/hai/data/portal/progress-report.html>
- CDC Patient Safety Atlas:
  - <https://gis.cdc.gov/grasp/PSA/HAIreport.html>

## National Data for Acute Care Hospitals, Year 2017

Card View Table

### CLABSI

↓ -19%

LOWER COMPARED TO NATL. BASELINE



U.S. hospitals reported a significant decrease in CLABSIs between 2016 and 2017.

9%

Among the 2,337 hospitals in U.S. with enough data to calculate an SIR, 9% had an SIR significantly higher (worse) than 0.81, the value of the national SIR.

### CENTRAL LINE-ASSOCIATED BLOODSTREAM INFECTIONS

When a tube is placed in a large vein and not put in correctly or kept clean, it can become a way for germs to enter the body and cause deadly infections in the blood.

### CAUTI

↓ -12%

LOWER COMPARED TO NATL. BASELINE



U.S. hospitals reported a significant decrease in CAUTIs between 2016 and 2017.

11%

Among the 2,589 hospitals in U.S. with enough data to calculate an SIR, 11% had an SIR significantly higher (worse) than 0.88, the value of the national SIR.

### CATHETER-ASSOCIATED URINARY TRACT INFECTIONS

When a urinary catheter is not put in correctly, not kept clean, or left in a patient for too long, germs can travel through the catheter and infect the bladder and kidneys.

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



## 2017 National and State Healthcare-Associated Infections Progress Report

### EXECUTIVE SUMMARY

The Centers for Disease Control and Prevention (CDC) is committed to protecting patients and healthcare personnel from adverse healthcare events and promoting safety, quality, and value in healthcare delivery. Preventing healthcare-associated infections (HAIs) is a top priority for CDC and its partners in public health and healthcare. The 2017 [National and State Healthcare-Associated Infections \(HAI\) Progress Report](#) provides a summary of select HAIs across four healthcare settings; acute care hospitals (ACHs), critical access hospitals (CAHs), inpatient rehabilitation facilities (IRFs) and long-term acute care hospitals (LTACHs). Data from CAHs are provided in the detailed technical tables but not in the report itself. The designation of CAH is assigned by the Centers for Medicare and Medicaid Services (CMS) to hospitals that have 25 or fewer acute care inpatient beds and that maintain an annual average length of stay of 96 hours or less for acute care patients. IRFs include hospitals, or part of a hospital, that provide intensive rehabilitation services using an interdisciplinary team approach. LTACHs provide treatment for patients who are generally very sick and stay, on average, more than 25 days. To view HAI data from individual hospitals, LTACHs and IRFs, please see: CMS [Hospital Compare](#), [LTACH Compare](#), and [IRF Compare](#).

This report, along with the detailed technical tables, provides national- and state-level data about HAI incidence during 2017. The report is designed to be accessible to many audiences. Instead of national and state HAI reports being featured as individual factsheets for downloading from the CDC website, these reports will be made available for viewing, downloading, and printing from the [Patient Safety Atlas](#). For detailed methods, references, and definitions please refer to the Technical Appendix and Glossary within this report. For more information, please visit CDC's [Healthcare-Associated Infection Data Reports website](#).

# Resources

- NHSN Guide to the SIR

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

- NHSN Guide to the SUR

<https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/nhsn-sur-guide-508.pdf>

- Analysis Quick Reference Guides:

<https://www.cdc.gov/nhsn/ps-analysis-resources/reference-guides.html>

- MORE Analysis Training!

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

# Thank you!!

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For more information, contact CDC  
1-800-CDC-INFO (232-4636)  
TTY: 1-888-232-6348 [www.cdc.gov](http://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.

