Patient Safety Component Analysis:
Telling Your Hospital's Story with NHSN Data

Maggie Dudeck, MPH

Lead – NHSN Acute Care Analytics Team

NHSN Virtual Annual Training

March 23, 2022

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

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

Fictitious data used for illustrative purposes only.

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
				12/2016	5	P		N
				2016	21	RF		Y
				2016	2	RO		Y
				2016	1	A	Y	N
				2016	2	P		Y
				2016	3	A	Y	N
				2017	3	P		N
				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: COVID-19 Status

- Optional thru Dec 2021 HAIs, Required beginning with Jan 2022 HAIs

National Healthcare Safety Network
HAIs by Type and COVID Status
As of: March 4, 2022 at 8:13 AM
Date Range: EVENTS evntDateYr After and Including 2020

if (((eventType IN ("BSI", "SSI", "UTI", "VAE"))))

Frequency Row Pct	Table of eventType by COVID19		
	eventType(Event Type)	COVID19(COVID-19)	
		N	Y	Total
BSI	17 80.95	4 19.05	21
SSI	10 83.33	2 16.67	12
UTI	11 91.67	1 8.33	12
VAE	1 50.00	1 50.00	2
Total	39	8	47
Frequency Missing = 64			

National Healthcare Safety Network
Line Listing for All Central Line-Associated BSI Events
As of: March 4, 2022 at 9:02 AM
Date Range: CLAB_EVENTS evntDateYr After and Including 2020

if (((COVID19 = "Y")))

eventID	admitDate	eventDate	admToEvntDays	ageAtEvent	eventType	spcEvent	location	locCDC	COVID19
50231621	12/24/2021	01/08/2022	16	48	BSI	LCBI	MD WARD	IN:ACUTE:WARD:M	Y
42261730	06/30/2020	07/02/2020	3	65	BSI	LCBI	CARDCRIT	IN:ACUTE:CC:C	Y
42666422	08/04/2020	08/06/2020	3	65	BSI	LCBI	CARDCRIT	IN:ACUTE:CC:C	Y
50551439	.	01/06/2022	.	96	BSI	LCBI	CTICU	IN:ACUTE:CC:CT	Y

- Frequency table for Infection Events (left) can produce counts of events by type and COVID status
- Additional line lists (above) can provide event-level data by (or limited to) COVID status

Fictitious data used for illustrative purposes only.

Event-level Data: Pathogens

- Consider a **Frequency Table** that will display pathogen counts for each HAI type

- This example is a frequency table in its 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

- 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

Event-level Data: Interpreting a Frequency Table

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

- ■ 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 <u>and</u> identified in the WARD: **15.28% (total %)**
  d. Percent of all events that are HO: **52.78%**

Fictitious data used for illustrative purposes only.

Summarized Data

Summarized Data Can Include:

Rates	DURs	SIRs	CADs	SURs	SAARs
May use person-time as the denominator, along with a multiplier. Useful for internal comparisons.	Ratio of device days to patients days. No multiplier. Available by location only.	Risk-adjusted, scalable, summary measure. Ratio of observed to predicted infections. Uses a single baseline to measure progress.	Difference between observed and predicted infections. May use SIR goal as a multiplier to heighten prevention targets. First step in TAP strategy.	Risk-adjusted, scalable summary measure. Ratio of observed to predicted **device days**. Uses a single baseline to measure progress.	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

Fictitious data used for illustrative purposes only.

Making a Case for Internal Use of DA Rates and DURs

SICU CAUTI Rates and DURs, January-December
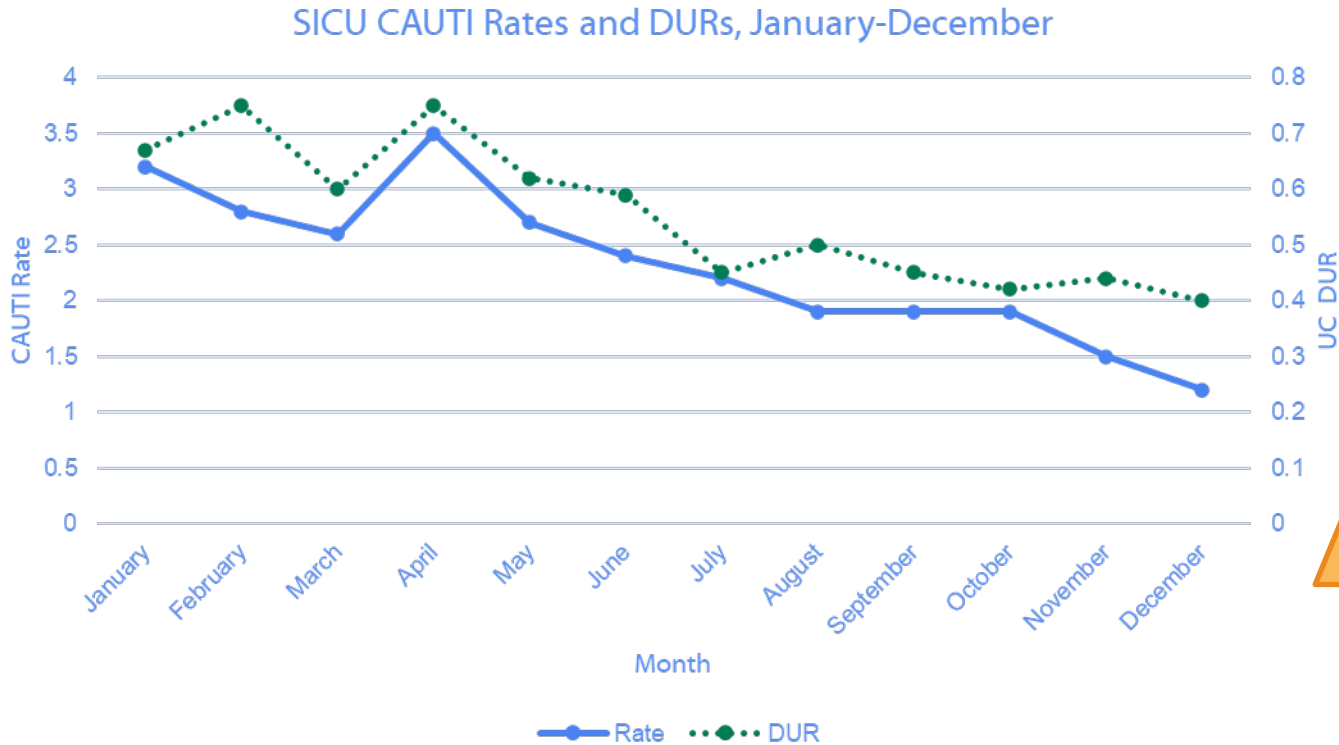
CAUTION!
This run chart does not represent statistical evidence of a trend.

Standardized Infection Ratio (SIR)

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

- The SIR takes into account the national data at the baseline year, <u>and</u> your hospital's experience when calculating the # predicted

- The SIR <u>is</u> a comparison to a National standard – in our case, the NHSN baseline.

- The SIR <u>is</u> risk-adjusted, using the data reported to NHSN
  - The SIR should be used when aggregating data from multiple locations, procedures, hospitals, etc.

- Your hospital <u>is</u> 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 SSI SIR of 0 (95% CI: . , 2.149) is statistically significant

- True
- False

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

A. True

B. False

While the lower bound of the confidence interval is <u>not</u> 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.

SIR: More than Just a Number

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

- 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)

Observed

| Type of HAI |
| Location of HAI |
| Onset of LabID |

Predicted

| Device or patient days, or proc risk |
| Facility bedsize, med aff |
| Avg LOS, proportion of admissions |
| Location type or procedure type |
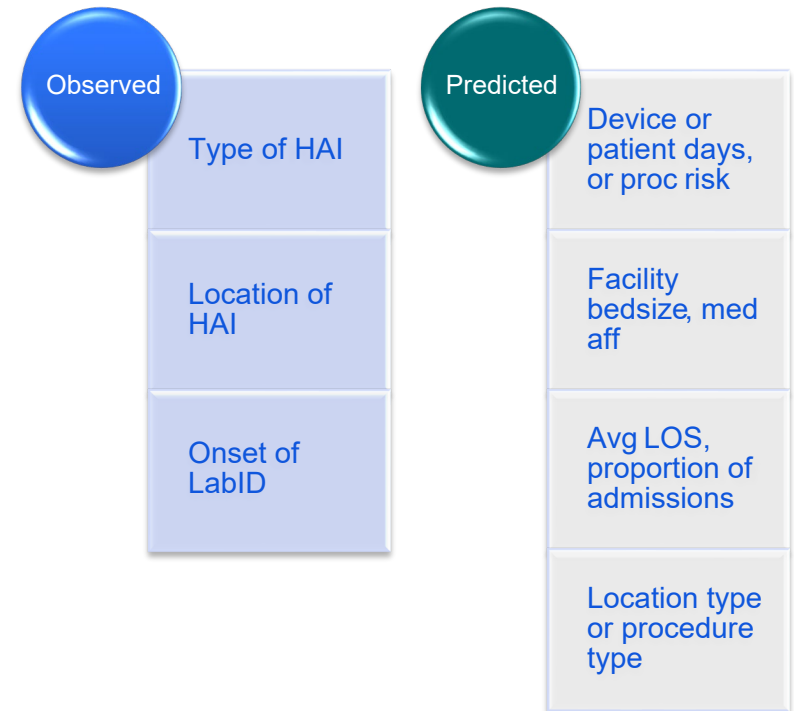
Interpretation – Additional Elements to Consider

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

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.

NHSN Statistics Calculator

- Compare Two Standardized Ratios (e.g., SIRs):
  - Use SIR data from NHSN that are calculated using the same baseline!
  - Have to enter numerator (# observed) and denominator (# predicted)
  - Use for <u>internal</u> comparisons
- Compare Two Incidence Density Rates
  - Allows for comparison of two device-associated rates
  - Useful for <u>internal</u> 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 Standardized Ratio (e.g., SIR) to Nominal Value
  - Nominal value could represent a Goal

https://www.cdc.gov/nhsn/pdfs/ps-analysisresources/StatsCalc.pdf

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 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

	Data Source #1	Data Source #2
Type of ratio:	SIR - standardized infection ratio	
Group Labels:		
Number Observed Infections:		
Number Predicted Infections:		
Standardized Infection Ratio:		
Title:		

Calculate **Back**

Example: 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.

Neuro ICU CAUTI Rate - Q1-Q4

	Q1	Q2	Q3	Q4
CAUTI Rate	3.91	2.50	6.09	0.83

Quarter
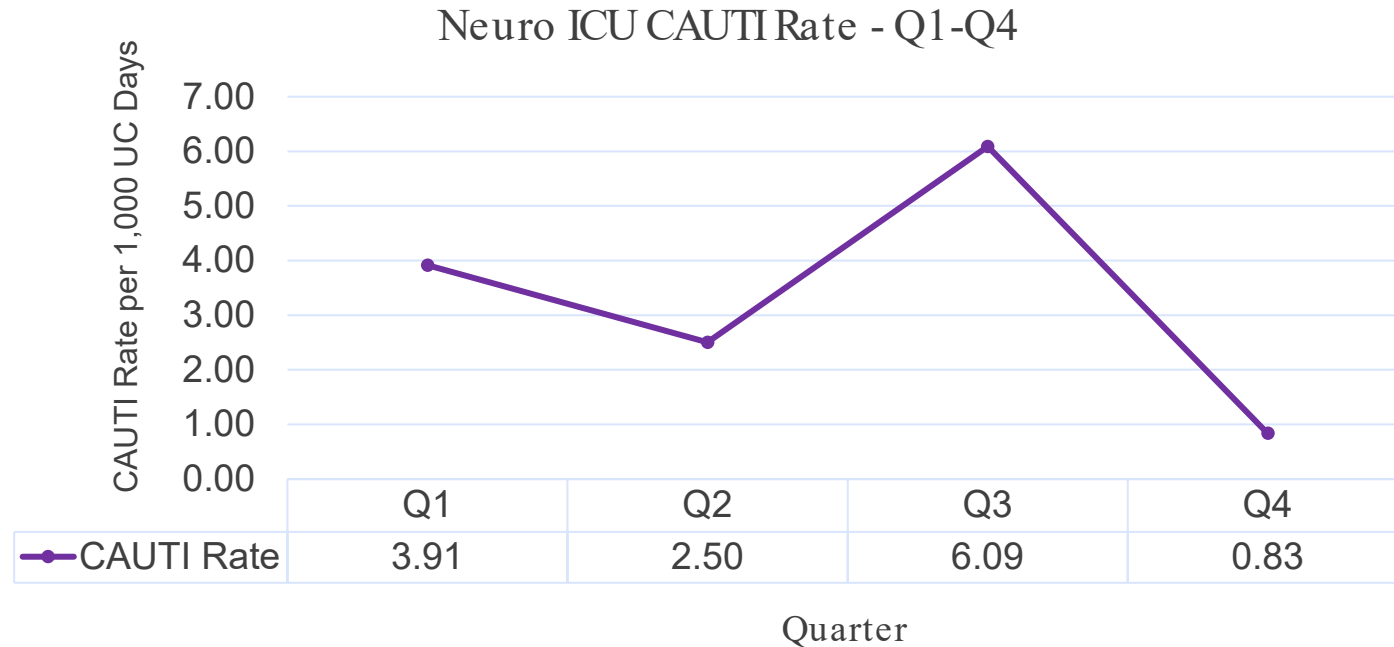
Example: Compare Two Incidence Density Rates

- 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:	Q1	Q4
Numerator(Number of events):	9	2
Denominator(Number of person-time units):	2300	2400
Multiplier:	1000	

Title: 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).

Example: Compare Two Incidence Density Rates - RESULTS

Knowledge Check #2: Based on the p-value of 0.0327, can you conclude that the Neuro ICU significantly reduced its CAUTI rate throughout the year?

- A. Yes, the p–value is statistically significant at the 0.05 level
- 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 #2: RATIONALE

- 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 #2: RATIONALE (cont'd)

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

Neuro ICU CAUTI Rate - Q1-Q4

	Q1	Q2	Q3	Q4
CAUTI Rate	3.91	2.50	6.09	0.83

CAUTI Rate per 1,000 UC Days

Quarter
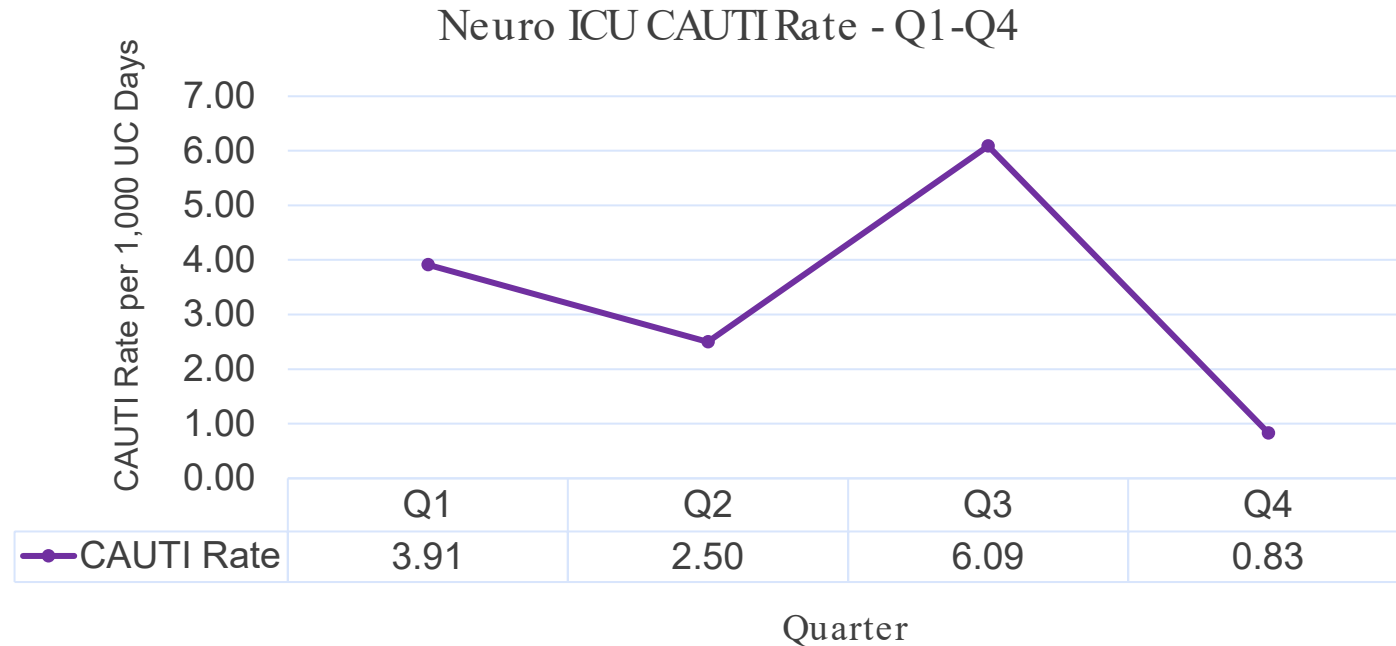
Knowledge Check #2: RATIONALE (cont'd)

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

Neuro ICU CAUTI Rate - January - December
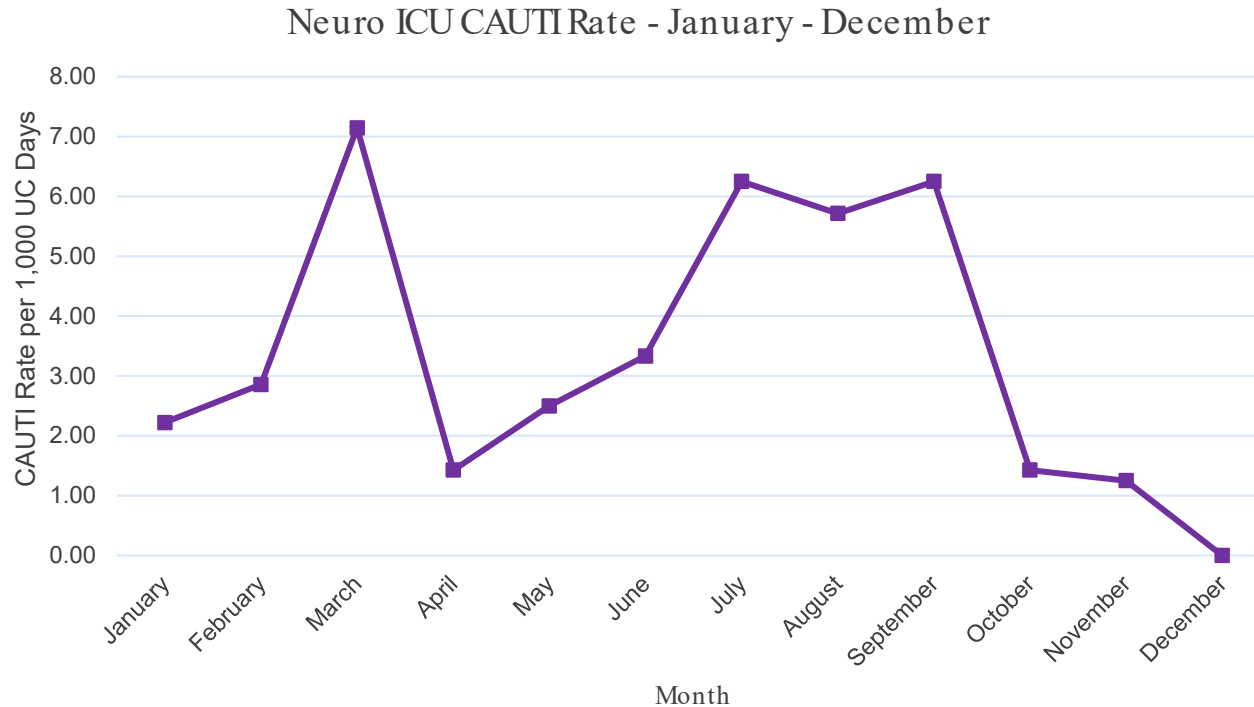
Example: Compare Two Standardized Ratios

- Similar to comparison of two incidence density rates

- Can be used for SIRs, SURs, and SAARs

- Use for <u>internal</u> comparisons (e.g., Did my hospital's CDI SIR improve compared to the previous year?)

	Data Source #1	Data Source #2
Group Labels:	CDI 2016	CDI 2017
Number observed:	38	40
Number expected:	29.548	44.145
Standardized Infection Ratio:	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 #3: You have been asked to provide a comparison of your facility's data to the National experience.
True or False: You should use the "Compare Two Standardized Ratios" option.

- True
- False

Knowledge Check #3 Answer and RATIONALE

- FALSE – the Compare Two Standardized Ratios 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 <u>not</u> be directly compared to a national or state SIR

HAI and Patient Population	Standardized Infection Ratio Data					Percentile Distribution of Facility-specific SIRs[8]					
	Hospital-onset events[5]	Predicted Hospital-onset events[6]	SIR	95% CI for SIR		10%	25%	50%	75%	90%	95%
Laboratory-identified *C. difficile*, facility-wide	40,562	78,365.082	0.518	0.513	0.523	0.000	0.229	0.438	0.692	0.980	1.220

Source: 2020 HAI Progress Report https://www.cdc.gov/hai/data/portal/progress-report.html

Knowledge Check #3 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:

  (hospital) $\dfrac{28}{42.438}$ (U.S.) $\dfrac{26{,}029}{26{,}183.537}$

- 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

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

Bringing it all together

Event Details, SIRs, and the Statistics Calculator

Case Study: Ventilator-associated Events During COVID-19 Pandemic

- Your hospital has been consistently performing VAE surveillance in three medical ICUs.

- You noticed an increase in VAE during the COVID-19 pandemic, particularly during surges in hospitalizations.

- You need to understand how the current experience compares to the pre-pandemic time period

  - What is the change in ventilator days?

  - What types of VAE (i.e., VAC, IVAC, PVAP) have been identified

  - What proportion of these events are identified in COVID-19 patients?

  - Is there a statistically significant difference in the SIR?

Case Study: Two Options to Review Changes in Ventilator Days

Fictitious data used for illustrative purposes only.

- **Option 1**: "SIR – Acute Care Hospitals VAE Data"

  – Benefit: will include an aggregate for all locations, in addition to location-specific results

- **Option 2**: "Rate Table (vent. Days) VAE Data for ICU-Other/SCA/ONC"

  – Benefit: will include location-specific results for pinpointing changes

Example: Option 1

National Healthcare Safety Network
SIR for Ventilator-Associated Event Data for Acute Care Hospitals (2015 Baseline) - By OrgID
As of: March 7, 2022 at 7:49 AM
Date Range: BS2_VAE_RATESICU_SCA summaryYr After and Including 2019
if (((locationType = "CC")))

vaeCategory=Total VAE Facility Org ID=10000 Type of Affiliation=' '

Facility Org ID	CMS Certification Number	Summary Yr/Qtr	Events	Number Predicted	Ventilator Days	SIR	SIR p-value	95% Confidence Interval	SIR Percentile	vaeCategory
10000	31C0001043	2019Q1	2	4.699	630	0.426	0.2042	0.071, 1.406	35	Total VAE
10000	31C0001043	2019Q2	0	1.335	179	0.000	0.2631	, 2.244	20	Total VAE
10000	31C0001043	2019Q4	0	0.067	9	.	.	.	.	Total VAE

Example: Option 2

National Healthcare Safety Network
Rate Table (Ventilator Days) for Ventilator-Associated Event Data for ICU-Other/SCA/ONC
Total VAE
As of: March 7, 2022 at 7:53 AM
Date Range: BS2_VAE_RATESICU_SCA summaryYr After and Including 2019
if (((locationType = "CC")))

Facility Org ID=10000 CMS Certification Number=31C0001043 CDC Location=IN:ACUTE:CC:C

Location	Summary Yr/Qtr	Months	VAE Count	Ventilator Days	VAE Rate	Patient Days	Vent Util Ratio	vaeCategory
CARDCRIT	2019Q1	2	0	7	0.000	145	0.048	Total VAE
CARDCRIT	2019Q4	2	0	9	0.000	89	0.101	Total VAE
CMICU_N	2019Q1	1	2	158	12.658	260	0.608	Total VAE
CMICU_N	2019Q2	1	0	100	0.000	1500	0.067	Total VAE
CARDCRIT	2020Q1	1	0	1	0.000	26	0.038	Total VAE
CARDCRIT	2020Q2	2	0	4	0.000	87	0.046	Total VAE

Case Study: Review Event Level Data – Specific VAE Type

- Frequency Table – All VAE
- Based on the output below:
  - The number of total VAE increased each year between 2019 and 2021
  - The proportion of VAE, defined as VAC, increased each year
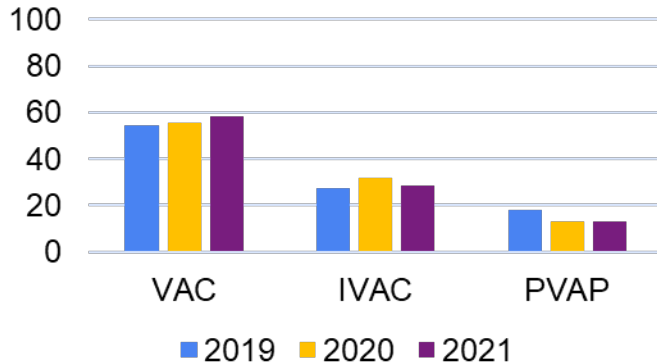
Fictitious data used for illustrative purposes only.

Modify "Frequency Table - All VAE"

☑ Show descriptive variable names (Print List)   Analysis Data Set: VA_Events   Type: Frequency Table   Last Generated: February 28, 2022 12:37 PM

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

Frequency Table Options:
Selected Variables to include in report:

| Row | Column | Page by |
| Event~Year | Specific Event | |

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 spcEvent				
evntDateYr(Event~Year)	**spcEvent(Specific Event)**			
Frequency Row Pct	**IVAC**	**PVAP**	**VAC**	**Total**
2019	9	6	18	33
	27.27	18.18	54.54	
2020	15	6	26	47
	31.91	12.77	55.32	
2021	17	8	35	60
	28.33	13.33	58.34	
Total	41	20	79	140

Case Study: Review VAE Event-Level Data – COVID-19 Status

- Frequency Table – All VAE

- Based on this output:

  - A total of 62 VAE occurred in COVID-19 patients

  - This proportion increased in 2021 compared to 2020

  - This result does *not* indicate risk of VAE among COVID-19 patients.

  - Instead, can be used as informative data point

Table of evntDateYr by spcEvent			
evntDateYr(Event~Year)	COVID19(Specific Event)		
Frequency Row Pct	N	Y	Total
2020	22 46.81	25 53.19	47
2021	23 38.33	37 61.67	60
Total	45	62	107

Fictitious data used for illustrative purposes only.

Case Study: Review VAE SIRs – 2019 thru 2021

Year	# VAE	Vent days	# pred	SIR	Pval	95% CI
2019	33	2,512	31.281	1.055	0.7393	(0.738, 1.464)
2020	47	3,574	36.821	1.276	0.1032	(0.949, 1.683)
2021	60	3,706	42.833	1.401	0.0128	(1.078, 1.791)

- VAE SIRs continued to increase in this example hospital
  - Only 2021 was statistically significant compared to 2015
- How do 2020 and 2021 compare to the pre-pandemic time period (2019)?

Fictitious data used for illustrative purposes only.

Case Study: Difference between 2019 and 2020

National Healthcare Safety Network
2019 vs 2020 Total VAE SIRs in MICUs
As of: March 7, 2022 at 3:06 PM

	2019 Total VAE	2020 Total VAE
Observed Infection	33	47
Predicted Infection	31.281	36.821
SIR	1.055	1.276

Relative ratio of SIRs (data column 2 / data column 1): 1.276/1.055 = 1.209 (120.9%)
Two-tailed p-value: 0.4043
95% Conf. Interval: 0.776, 1.903

$$\left(\frac{1.276}{1.055} - 1\right) \times 100 = (1.209 - 1) \times 100 = 20.9$$

20.9% different
95% CI (-22.4, 90.3)

- Use "Compare 2 Standardized Ratios" option in Statistics Calculator

- Apply 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).

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/ice.2021.362

In Summary:

- Event-level reports are valuable sources of data to complement summary measures

- SIRs and rates can be used to measure local improvement or increases

- The NHSN statistics calculator provides options to test for significant changes within a hospital, as well has difference to a chosen goal

Resources

- CDC NHSN Reports and Publications
  https://www.cdc.gov/nhsn/datastat/index.html

Resources

- 2020 National and State HAI Progress Report:
  - https://www.cdc.gov/hai/data/portal/progress-report.html
- CDC Antibiotic Resistance & Patient Safety Portal:
  - https://arpsp.cdc.gov/

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!!

nhsn@cdc.gov

BONUS SLIDES!!!

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.

Procedure	# SSI	# procedures	# pred	SIR	P-value	95% CI
Overall	*14*	*601*	*17.890*	*0.783*	*0.3637*	*(0.445, 1.282)*
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	--	--	--

Parameter Estimates

Table 3b. Abdominal Hysterectomy Procedures, Complex 30-Day Model

Parameter	Parameter Estimate
Intercept	*-5.1801*
Diabetes: Yes	0.3247
Diabetes: No	REFERENT
ASA score: 1, 2, 3, 4/5	0.4414
BMI: ≥ 30	0.1106
BMI: < 30	REFERENT
Age (Patient's age/10)	-0.1501
Oncology Hospital: Yes	0.5474
Oncology Hospital: No	REFERENT

- Each factor is given a positive or negative value, depending on the relationship of risk of HAI

- 'REFERENT' = the parameter value on which the remainder in the factor is based. (i.e., parameter estimate = 0)

NHSN SIR Guide: https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/nhsn-sir-guide.pdf

Intercept-only Models

- A few models developed with the 2015 baseline are intercept-only
- "Fancy" term for a model with no statistically significant risk factors (i.e., a regression model without predictors)
  - Think of this like a crude, unadjusted rate
- SIRs are still calculated when an intercept-only model is available