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

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NHSN Virtual Annual Training

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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*)

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

#### Table: Event Type=UTI

<table>
<thead>
<tr>
<th>Facility Org ID</th>
<th>Event ID</th>
<th>Event Type</th>
<th>Location</th>
<th>Fac Admission Date</th>
<th>Event Date</th>
<th>Days: Admit to Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>10000</td>
<td>25985590</td>
<td>UTI</td>
<td>CMICU_N</td>
<td>03/02/2017</td>
<td>03/08/2017</td>
<td>7</td>
</tr>
<tr>
<td>10000</td>
<td>27752601</td>
<td>UTI</td>
<td>REHAB</td>
<td>03/16/2017</td>
<td>04/09/2017</td>
<td>25</td>
</tr>
<tr>
<td>10000</td>
<td>27752126</td>
<td>UTI</td>
<td>3 CENTRAL</td>
<td>03/29/2017</td>
<td>04/08/2017</td>
<td>11</td>
</tr>
<tr>
<td>10000</td>
<td>27750024</td>
<td>UTI</td>
<td>REHAB</td>
<td>04/01/2017</td>
<td>04/08/2017</td>
<td>8</td>
</tr>
<tr>
<td>10000</td>
<td>27750026</td>
<td>UTI</td>
<td>REHAB</td>
<td>04/01/2017</td>
<td>04/22/2017</td>
<td>22</td>
</tr>
<tr>
<td>10000</td>
<td>27752194</td>
<td>UTI</td>
<td>5 WEST</td>
<td>04/01/2017</td>
<td>04/15/2017</td>
<td>15</td>
</tr>
<tr>
<td>10000</td>
<td>27752208</td>
<td>UTI</td>
<td>3 CENTRAL</td>
<td>04/02/2017</td>
<td>04/22/2017</td>
<td>21</td>
</tr>
<tr>
<td>10000</td>
<td>27753015</td>
<td>UTI</td>
<td>REHAB</td>
<td>04/11/2017</td>
<td>04/27/2017</td>
<td>17</td>
</tr>
<tr>
<td>10000</td>
<td>27752262</td>
<td>UTI</td>
<td>3 CENTRAL</td>
<td>05/01/2017</td>
<td>05/06/2017</td>
<td>6</td>
</tr>
<tr>
<td>10000</td>
<td>27752377</td>
<td>UTI</td>
<td>3 CENTRAL</td>
<td>05/29/2017</td>
<td>06/03/2017</td>
<td>6</td>
</tr>
<tr>
<td>10000</td>
<td>27756747</td>
<td>UTI</td>
<td>REHAB</td>
<td>06/04/2017</td>
<td>06/17/2017</td>
<td>14</td>
</tr>
<tr>
<td>10000</td>
<td>27752460</td>
<td>UTI</td>
<td>3 CENTRAL</td>
<td>06/04/2017</td>
<td>06/17/2017</td>
<td>14</td>
</tr>
<tr>
<td>10000</td>
<td>27715204</td>
<td>UTI</td>
<td>ICUICU</td>
<td>06/12/2017</td>
<td>07/04/2017</td>
<td>23</td>
</tr>
<tr>
<td>10000</td>
<td>27752489</td>
<td>UTI</td>
<td>3 CENTRAL</td>
<td>06/20/2017</td>
<td>06/28/2017</td>
<td>9</td>
</tr>
<tr>
<td>10000</td>
<td>27777176</td>
<td>UTI</td>
<td>5WEST</td>
<td>06/21/2017</td>
<td>07/07/2017</td>
<td>17</td>
</tr>
</tbody>
</table>
# Event-Level Data: SSI criteria and detection

<table>
<thead>
<tr>
<th>Event ID</th>
<th>Procedure Code</th>
<th>Event Type</th>
<th>Specific Event</th>
<th>Event Date</th>
<th>Days: Procedure to Event</th>
<th>When Detected</th>
<th>Physician Diagnosis of this Event Type?</th>
<th>Pathogen Identified</th>
</tr>
</thead>
<tbody>
<tr>
<td>17773116 HPRO</td>
<td>SSI</td>
<td>DIP</td>
<td></td>
<td>02/01/2015</td>
<td>21</td>
<td>RF</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>22847103 HYST</td>
<td>SSI</td>
<td>IAB</td>
<td></td>
<td>04/09/2015</td>
<td>11</td>
<td>RO</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>22847016 COLO</td>
<td>SSI</td>
<td>SIP</td>
<td></td>
<td>03/26/2015</td>
<td>17</td>
<td>RF</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>22847105 COLO</td>
<td>SSI</td>
<td>DIP</td>
<td></td>
<td>06/27/2015</td>
<td>16</td>
<td>P</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>22847079 HPRO</td>
<td>SSI</td>
<td>BONE</td>
<td></td>
<td>03/26/2015</td>
<td>25</td>
<td>RF</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>20996240 HPRO</td>
<td>SSI</td>
<td>PJI</td>
<td></td>
<td>10/03/2015</td>
<td>2</td>
<td>RO</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>21010090 HPRO</td>
<td>SSI</td>
<td>BONE</td>
<td></td>
<td>01/05/2016</td>
<td>5</td>
<td>A</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>21321000 KPRO</td>
<td>SSI</td>
<td>BONE</td>
<td></td>
<td>01/05/2016</td>
<td>5</td>
<td>P</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>21010092 HPRO</td>
<td>SSI</td>
<td>PJI</td>
<td></td>
<td>01/05/2016</td>
<td>5</td>
<td>RF</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>23158005 COLO</td>
<td>SSI</td>
<td>DIP</td>
<td></td>
<td>01/28/2016</td>
<td>17</td>
<td>A</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>23430132 COLO</td>
<td>SSI</td>
<td>DIP</td>
<td></td>
<td>03/25/2016</td>
<td>30</td>
<td>A</td>
<td>Y</td>
<td>Y</td>
</tr>
</tbody>
</table>

---

**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

- 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
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).

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

*Fictitious data used for illustrative purposes only.*
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
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%**

Fictitious data used for illustrative purposes only.
Summarized Data
Summarized Data Can Include:

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

<table>
<thead>
<tr>
<th>Quarter</th>
<th>Location</th>
<th># CAUTI</th>
<th># UC Days</th>
<th>Rate</th>
<th>DUR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Med ICU</td>
<td>5</td>
<td>1,360</td>
<td>3.67</td>
<td>0.60</td>
</tr>
<tr>
<td>2</td>
<td>Med ICU</td>
<td>4</td>
<td>1,287</td>
<td>3.11</td>
<td>0.51</td>
</tr>
<tr>
<td>3</td>
<td>Med ICU</td>
<td>4</td>
<td>1,462</td>
<td>2.74</td>
<td>0.61</td>
</tr>
<tr>
<td>4</td>
<td>Med ICU</td>
<td>3</td>
<td>1,201</td>
<td>2.50</td>
<td>0.48</td>
</tr>
</tbody>
</table>

Fictitious data used for illustrative purposes only.
Making a Case for Internal Use of DA Rates and DURs

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

\[
SIR = \frac{\text{# observed HAIs}}{\text{# predicted HAIs}}
\]
Knowledge Check #1:
True or False: Your facility’s SSI SIR of 0 (95% CI: 0.0, 2.149) is statistically significant

- True
- False
Knowledge Check #1 RATIONALE
True or False: Your facility’s SSI SIR of 0 (95% CI: 0, 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.
SIR: More than Just a Number

- 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)

\[
SIR = \frac{\text{# observed HAIs}}{\text{# predicted HAIs}}
\]
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.

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

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

- **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 **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](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

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
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.

<table>
<thead>
<tr>
<th>Quarter</th>
<th>CAUTI Rate per 1,000 UC Days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q1</td>
<td>3.91</td>
</tr>
<tr>
<td>Q2</td>
<td>2.50</td>
</tr>
<tr>
<td>Q3</td>
<td>6.09</td>
</tr>
<tr>
<td>Q4</td>
<td>0.83</td>
</tr>
</tbody>
</table>

Neuro ICU CAUTI Rate - Q1-Q4
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.

NOTE: This option can be used for internal comparison of location stratified DA rates, or inpatient HO Lab ID rates (FACWIDEIN or by location, if known).
Example: Compare Two Incidence Density Rates - RESULTS

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

National Healthcare Safety Network Neuro ICU CAUTI Rate Comparison
As of: March 8, 2019 at 10:44 AM

<table>
<thead>
<tr>
<th></th>
<th>Q1</th>
<th>Q4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Numerator</td>
<td>9</td>
<td>2</td>
</tr>
<tr>
<td>Denominator</td>
<td>2300</td>
<td>2400</td>
</tr>
<tr>
<td>Incidence Density Rate</td>
<td>3.913</td>
<td>0.833</td>
</tr>
<tr>
<td>IDR p-value</td>
<td>0.0327</td>
<td></td>
</tr>
</tbody>
</table>
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.
Knowledge Check #2: RATIONALE (cont’d)

- Looking at the data by month shows even greater variability.
Example: Compare Two Standardized Ratios

- 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?)

**National Healthcare Safety Network**

**Annual CDI SIR Comparisons**

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

<table>
<thead>
<tr>
<th>Data Source #1</th>
<th>Data Source #2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Group Labels:</strong></td>
<td>CDI 2016</td>
</tr>
<tr>
<td><strong>Number observed:</strong></td>
<td>38</td>
</tr>
<tr>
<td><strong>Number expected:</strong></td>
<td>29.548</td>
</tr>
<tr>
<td><strong>Standardized Infection Ratio:</strong></td>
<td>1.286</td>
</tr>
</tbody>
</table>

**Title:** Annual CDI SIR Comparisons

<table>
<thead>
<tr>
<th>CDI 2016</th>
<th>CDI 2017</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Observed:</strong></td>
<td>38</td>
</tr>
<tr>
<td><strong>Expected:</strong></td>
<td>29.548</td>
</tr>
<tr>
<td><strong>SIR:</strong></td>
<td>1.286</td>
</tr>
</tbody>
</table>

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 **not** be directly compared to a national or state SIR.

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:**

  \[
  \text{(hospital)} \quad \frac{28}{42.438} \quad \text{(U.S.)} \quad \frac{26,029}{26,183.537}
  \]

- 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

\[
\frac{40}{(44.145 \times 0.85)} = \frac{40}{37.523} = 1.07
\]

*SAS Macro available from: https://www.cdc.gov/nhsn/sas/p-value-of-sir-compared-to-nominal.sas
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

- **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

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Fictitious data used for illustrative purposes only.
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

<table>
<thead>
<tr>
<th>Table of evntDateYr by spcEvent</th>
</tr>
</thead>
<tbody>
<tr>
<td>evntDateYr(Event~Year)</td>
</tr>
<tr>
<td>-------------------------</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>2019</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>2020</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>2021</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

Fictitious data used for illustrative purposes only.
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

<table>
<thead>
<tr>
<th>evntDateYr(Event~Year)</th>
<th>COVID19(Specific Event)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
</tr>
<tr>
<td>2020</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>46.81</td>
</tr>
<tr>
<td>2021</td>
<td>23</td>
</tr>
<tr>
<td></td>
<td>38.33</td>
</tr>
<tr>
<td>Total</td>
<td>45</td>
</tr>
</tbody>
</table>

Fictitious data used for illustrative purposes only.
Case Study: Review VAE SIRs – 2019 thru 2021

- 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

- 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).

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 as differences to a chosen goal
Resources

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

Resources

- NHSN Guide to the SIR

- NHSN Guide to the SUR

- 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

For more information, contact CDC
1-800-CDC-INFO (232-4636)

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.
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.

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

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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Parameter Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>-5.1801</td>
</tr>
<tr>
<td>Diabetes: Yes</td>
<td>0.3247</td>
</tr>
<tr>
<td>Diabetes: No</td>
<td>REFERENT</td>
</tr>
<tr>
<td>ASA score: 1, 2, 3, 4/5</td>
<td>0.4414</td>
</tr>
<tr>
<td>BMI: ≥ 30</td>
<td>0.1106</td>
</tr>
<tr>
<td>BMI: &lt; 30</td>
<td>REFERENT</td>
</tr>
<tr>
<td>Age (Patient’s age/10)</td>
<td>-0.1501</td>
</tr>
<tr>
<td>Oncology Hospital: Yes</td>
<td>0.5474</td>
</tr>
<tr>
<td>Oncology Hospital: No</td>
<td>REFERENT</td>
</tr>
</tbody>
</table>

- 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)

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