2018 NHSN Training

Analyzing LabID Event Data in NHSN

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Goals

- Review options for LabID data analysis
  - MRSA bacteremia, \textit{C. difficile}, carbapenem-resistant Enterobacteriaceae (CRE)
- Demonstrate how to run and interpret rates & SIRs
- Describe risk adjustment used in the LabID SIR calculations
- Discuss techniques for ensuring SIR data quality
- Group exercises with your colleagues!

*CDI = \textit{C. difficile} LabID Event
*CO = community-onset
*HO = healthcare facility-onset
*CO-HCFA = community-onset, healthcare facility-associated
NHSN Reports for LabID Events
Analysis Tree

- MDRO/CDI Module – LabID Event Reporting
  - Sub-folders for each organism
Report Types

- **Line List:**
  - Review event-level details
  - Categorization of community-onset (CO) vs. healthcare facility-onset (HO)
    - See variable called “onset”
  - Categorization of incident vs. recurrent CDI
    - See variable called “cdiAssay”
  - Determine which MRSA/CDI events are counted in the SIR
  - Customize the line list
Report Types

- **Frequency Table:**
  - Counts of events meeting different criteria
    - Total # of CO, CO-HCFA, & HO events
    - Number of events identified in each unit

### National Healthcare Safety Network Frequency Table - All CDIF LabID Events

<table>
<thead>
<tr>
<th>specDateYr</th>
<th>CO</th>
<th>CO-HCFA</th>
<th>HO</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
<td>88</td>
<td>20</td>
<td>72</td>
<td>180</td>
</tr>
<tr>
<td></td>
<td>48.89</td>
<td>11.11</td>
<td>40.0</td>
<td></td>
</tr>
</tbody>
</table>
Report Types

- **Bar/Pie Chart:**
  - Visual depiction of counts of events
Report Types

Rate Table:

- “How often are LabID events occurring in my facility?”
- Monthly incidence and prevalence rates
- # events and patient days/admissions are shown
  - Good for data quality review!
- Most common: FacWideIN, ED, 24 hour observation units, and IRF units

### Inpatient CO Prevalence Rate

\[
\text{Inpatient CO prevalence rate} = \frac{\# \text{ CO events}}{\# \text{ admissions}} \times 100
\]
CRE among CLABSI, CAUTI, & SSI in the U.S., 2014

CDC’s Patient Safety Atlas: https://gis.cdc.gov/grasp/PSA/
CRE LabID Event Surveillance in NHSN

- CRE LabID surveillance requires surveillance of the three common CRE bacteria:
  - *E.coli*
  - *Enterobacter*
  - *Klebsiella*
- Surveillance can be performed for “FacWideIN”, or individual units
- Blood specimens only, or all specimen types
- Numerator: all positive CRE laboratory test results (per NHSN definitions)
- Denominator: For FacWideIN, *same* denominator record already completed for MRSA/CDI surveillance. No additional data entry needed.
Analyzing CRE Rates

- Monthly rates available for each species, or all 3 species combined

Let’s look at examples of FacWideIN CRE rates!

Remember: before analyzing data...
1. Clear all alerts from the home screen
2. Generate new analysis data sets (Analysis > Generate Data Sets)
3. If needed, be prepared to read footnotes beneath the report and/or use analysis help guides from the NHSN website

CRE Rates for December 2017

- Several rate tables will appear by default
  - prevalence, incidence, blood specimens, community-onset, healthcare-onset, etc.

1. CRE Admission Prevalence Rate = community-onset admission prevalence rate

<table>
<thead>
<tr>
<th>Summary Year/Month</th>
<th>Location</th>
<th>CRE_admPrevCount</th>
<th>Admissions</th>
<th>CRE Admission Prevalence Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017M12</td>
<td>FACWIDEIN</td>
<td>1</td>
<td>60</td>
<td>1.667</td>
</tr>
</tbody>
</table>

- Measure of community-onset CRE burden coming into the facility
- # CO events / # admissions (* 100) = 1.667
- In December 2017, this facility observed 1.7 CO CRE per 100 admissions
2. **CRE Prevalence Rate** = Overall prevalence rate
   - Includes HO and CO events in the numerator
   - Overall CRE burden in the facility

<table>
<thead>
<tr>
<th>Summary Year/Month</th>
<th>Location</th>
<th>CRE_labidCount</th>
<th>Admissions</th>
<th>CRE Prevalence Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017M12</td>
<td>FACWIDEIN</td>
<td>3</td>
<td>60</td>
<td>5.000</td>
</tr>
</tbody>
</table>

- Total # CRE events / # admissions \(\times 100\) = 5.0
- In December 2017, this facility observed 5 cases of CRE per 100 admissions
  - 5% of admissions had a positive CRE specimen
3. **CRE MDRO Incidence Density Rate** = rate of healthcare-onset CRE per 1,000 patient days

- # healthcare-onset CRE / # patient days \( \times 1,000 \) = 5.714
- This facility observed 5.7 healthcare-onset CRE per 1,000 patient days

- Additional rates are available in NHSN Rate Tables
  - Review NHSN Data Dictionary for definitions and algorithms

https://www.cdc.gov/nhsn/ps-analysis-resources/index.html
More about LabID Rates

- National LabID rates (benchmarks) are not available for any organism

**Why?**

- **MRSA bacteremia & CDI:** national benchmarks are available in the form of a standardized infection ratio (SIR)
  - SIR offers a better comparison to national data and takes into account significant predictors of infection
  - 2015 predicted rate calculator (national rates)
- **CRE, MDR-Acinetobacter, VRE, CephR-Klebsiella:**
  - Reporting based on state/local mandate, or voluntary reporting
  - CDC continues to evaluate the amount of these data entered into NHSN
  - National benchmarks may be available in the future, if/when sufficient data exist in the NHSN database
Track Your Own LabID Rates Over Time

- Use the NHSN Statistics Calculator
- Take note of your LabID rates for two time periods
  - P-value will tell you whether two rates are significantly different

Standardized Infection Ratio
What is the SIR?

- Calculated value that provides information about the number of HAIs reported in your facility
- Used by various organizations:
  - CMS: public reporting on Hospital Compare
  - State health department may publish SIRs
  - Corporation
  - Non-profit or research group
  - CDC: national and state-level SIRs
  - Your facility!
LabID Event SIRs: A Quick Review

- A summarized measure that compares your facility’s data to the national baseline.

\[
\text{SIR} = \frac{\text{# observed healthcare-onset LabID events}}{\text{# predicted healthcare-onset LabID events}}
\]

- **Observed events**: the number entered into NHSN *that meet SIR criteria*
- **Predicted events**: comes from the national 2015 baseline data
  - Calculated and risk adjusted specifically for your facility
- If SIR > 1.0, facility observed more events than predicted
- If SIR < 1.0, facility observed fewer events than predicted
LabID Event SIRs: A Quick Review

- P-values and 95% confidence intervals
- Review NHSN’s “Keys to Success” document
  - Fantastic resource for those who are new to the SIR or NHSN analysis
  - Available at:
LabID Event SIRs: A Quick Review

Keys to Success with NHSN Data

Let’s talk p-value.
As far as the SIR goes...

The p-value is a statistical measure that tells us whether the number of observed infections is statistically significantly different than the number of predicted infections (i.e., whether the SIR is significantly different from 1.0).

If the p-value ≤ 0.05, we can conclude that the number of observed infections is statistically significantly different than the number predicted.

If the p-value > 0.05, we conclude that the number of observed infections is not statistically significantly different than the number predicted.

Presenting - wait for it - the Standardized Infection Ratio (SIR)!

SIR = \frac{\text{Observed (O) HAIs}}{\text{Predicted (P) HAIs}}

If the SIR > 1.0, then more HAIs were observed than predicted, based on the 2015 national aggregate data.

And how about that 95% Confidence Interval (CI)?

The 95% CI is a statistical range of values for which we have a high degree of confidence that the true SIR lies within that range.

If the CI does not include 1, then the SIR is significantly different than 1.0 (i.e., the number of observed infections is significantly different than the number predicted).

Example: 95% CI = (0.85, 0.92)

If the CI includes the value of 1, then the SIR is not significantly different than 1.0 (i.e., the number of observed infections is not significantly different than the number predicted).

Example: 95% CI = (0.85, 1.24)

If the SIR is 0.000 (i.e., the infection count is 0 and the number of predicted infections is 1.0), the lower bound of the 95% CI will not be calculated.

The SIR will not be calculated if the number of
SIR Reports

- Different SIR reports in NHSN based on your facility type

- Different risk factors and calculations for the number of predicted events (SIR denominator) for each facility type
SIR Reports

- SIRs on 2015 baseline
- In and Off-plan data

- Preview of data submitted for CMS Quality Reporting
- SIRs on 2015 baseline
- In-plan data only

- SIRs for ACHs/CAHs only (2010-2011 baseline)
- In and Off-plan data
- Historic LabID rates submitted to CMS for IRFs & LTACs (through 2016)
LabID Event SIRs are Unique!

- LabID SIR calculations follow different rules compared to device-associated and SSI SIRs
  - Most LabID Event SIRs are not available on a monthly basis
  - LabID Events SIRs are not available for any specific unit*

- Important to understand these concepts before trying to run and interpret your LabID Event SIRs

*Exception: CMS-certified IRF units within a hospital
Basic Rules: LabID Event SIRs for Acute Care Hospitals

1. SIRs are only available for MRSA bacteremia and *C. difficile*

2. SIRs are only available for facility-wide inpatient (FacWideIN) surveillance
   - SIRs cannot be calculated for any individual unit*
   - If interested in unit-specific metrics: enter unit-specific denominators into NHSN & use rate tables

3. SIRs are accurate once all 3 months of data are entered for a quarter
   - SIRs are not available on a monthly basis
   - Risk adjustment calculations use your hospital’s quarterly data to calculate a *quarterly # of predicted events*

* Exception: CMS-certified IRF units within a hospital
REMEMBER!

- LabID Event SIRs should only be reviewed at the end of a quarter, once all 3 months of data are entered for that quarter.

**Why?**

- CDI SIRs are risk adjusted based on CDI test type (laboratory method)
  - CDI test type is entered on the denominator screen, 3rd month of the quarter.

- MRSA bacteremia and CDI SIRs for acute care hospitals are risk adjusted based on the quarterly community-onset prevalence rate
  - SIR is not accurate until all data have been entered for the quarter and the CO prevalence rate can be calculated for that quarter.
What does this mean?

- Wait until you have finished data entry for the quarter before running the MRSA and CDI SIRs (acute care hospitals)
  - This will ensure the SIRs you see in NHSN are complete and accurate

- Later in the presentation, we will discuss alternatives for reviewing LabID data before the quarter has finished
LabID Event SIR Tables from NHSN

Depending on your facility type and data, you may see the following tables in your MRSA/CDI SIR reports from NHSN:

- Table 1: Actual SIR calculation for your facility (or Group)
- Table 2: Risk adjustment factors used to calculate # predicted events
- Table 3: Outlier Prevalence Rate (if applicable)
- Table 4: Incomplete Months (if applicable)
### Table 1: National Healthcare Safety Network SIR for CDI FacwideIN for CMS Hospital IQR (2015 baseline)

As of: February 1, 2018 at 3:38 PM

<table>
<thead>
<tr>
<th>location</th>
<th>summaryYQ</th>
<th>months</th>
<th>CDIF_faclnchOCount</th>
<th>numPred</th>
<th>numpatdays</th>
<th>SIR</th>
<th>SIR_pval</th>
<th>sir95ci</th>
</tr>
</thead>
<tbody>
<tr>
<td>FACWIDEIN</td>
<td>2017Q1</td>
<td>3</td>
<td>1</td>
<td>1.069</td>
<td>1570</td>
<td>0.935</td>
<td>1.0000</td>
<td>0.047, 4.612</td>
</tr>
</tbody>
</table>

1. This report includes facility-wide inpatient data from acute care hospitals for 2015 and forward.
2. The SIR is only calculated if number predicted (numPred) is >= 1. Lower bound of 95% Confidence Interval only calculated when number of observed events > 0.
3. The # of predicted events is calculated based on national 2015 NHSN data. It is adjusted for inpatient community-onset CDI prevalence rate, ED/OBS reporting, CDI test type, medical school teaching status, facility type, # beds, and # ICU beds.
4. Events from rehabilitation wards and behavioral health/psych wards with a unique CCN are excluded. Information on how to determine which events are counted in the SIR can be found here: [http://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/mrsacdi_tips.pdf](http://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/mrsacdi_tips.pdf)
5. If any risk factor data are missing, the record is excluded from the SIR.

Source of aggregate data: 2015 NHSN CDI LabID Data

Data contained in this report were last generated on February 1, 2018 at 3:30 PM.
Example CDI SIR Report

- Months = 3
- SIR Numerator: # of incident, HO CDI events = 1
- SIR Denominator: # predicted = 1.069
- Total patient days for the quarter = 1,570
- SIR = 1 / 1.069 = 0.935
  - In 2017 Q1, we observed fewer infections than predicted
- 95% confidence interval includes the value of 1 (0.047 – 4.612)
  - # observed infections is not SIGNIFICANTLY different than # predicted
SIR Numerator:
# Observed LabID Events
Common Question from NHSN Users

Q: “I entered 5 CDI events for Q1, but only 1 event is included in the SIR numerator. Why is the SIR excluding some of my events?”

- Reminder: All LabID events that meet NHSN protocol must be reported
  - However, not all LabID events will be counted in the SIR numerator
  - Events that are not counted in the SIR numerator contribute to risk adjustment and algorithms for determining “duplicate” events
Which Events are Counted in the FacWideIN SIR Numerator?

- **C. difficile (CDI):**
  - Inpatient units only, *excluding* Rehab & Psych units with unique CCN
  - Specimens collected on Day 4 or later (healthcare facility-onset, HO)
  - Specimens classified by NHSN as “Incident”
    - > 56 days after the most recent positive CDI specimen for this patient
    - See variable on NHSN line list called “cdiAssay”

- **MRSA Bacteremia:**
  - Blood specimens from inpatient units, *excluding* Rehab & Psych units with unique CCN
  - Specimens collected on Day 4 or later after admission (healthcare facility-onset, HO)
  - No positive MRSA bacteremia in the previous 14 days in any location

* Read more about LabID SIR algorithms: [https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/mrsacdi_tips.pdf](https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/mrsacdi_tips.pdf)
FAQ from the NHSN Helpdesk

- **Q:** Our patient was positive for CDI on Day 1, and a second positive specimen was collected on Day 6. This second specimen is labeled as “HO” in NHSN! How do I change this?

- **A:** You cannot change the onset categorization applied by NHSN. Even though the event is correctly labeled as “HO”, it will not be counted in the SIR.

- **Not all HO events are counted in the SIR**
Which Events are Counted in the FacWideIN SIR Numerator?

- Run a MRSA/CDI LabID Event line list
- Review indicator variable on far right of the list:
  - `FWCDIF_facIncHOCount` (CDI) or `FWMRSA_bldIncCount` (MRSA)
  - 1 = counted in SIR numerator; 0 = not counted in SIR numerator

<table>
<thead>
<tr>
<th>patID</th>
<th>eventID</th>
<th>location</th>
<th>outpatient</th>
<th>onset</th>
<th>cdiAssay</th>
<th>admitDate</th>
<th>specimen Source</th>
<th>specimenDate</th>
<th>FWCDIF_facIncHOCount</th>
</tr>
</thead>
<tbody>
<tr>
<td>1212</td>
<td>63690</td>
<td>BURN</td>
<td>N</td>
<td>CO-HCFA</td>
<td>Incident</td>
<td>02/20/2017</td>
<td>STOOL</td>
<td>02/20/2017</td>
<td>0</td>
</tr>
<tr>
<td>1231</td>
<td>63691</td>
<td>ICU</td>
<td>N</td>
<td>CO-HCFA</td>
<td>Incident</td>
<td>02/19/2017</td>
<td>STOOL</td>
<td>02/19/2017</td>
<td>0</td>
</tr>
<tr>
<td>5221</td>
<td>63031</td>
<td>ICU</td>
<td>N</td>
<td>HO</td>
<td>Incident</td>
<td>12/15/2016</td>
<td>STOOL</td>
<td>01/01/2017</td>
<td>1</td>
</tr>
<tr>
<td>EO1</td>
<td>68242</td>
<td>MED</td>
<td>N</td>
<td>CO</td>
<td>Incident</td>
<td>01/04/2017</td>
<td>STOOL</td>
<td>01/05/2017</td>
<td>0</td>
</tr>
<tr>
<td>EO1</td>
<td>68243</td>
<td>ED</td>
<td>Y</td>
<td>CO</td>
<td>Recurrent</td>
<td></td>
<td>STOOL</td>
<td>02/01/2017</td>
<td>0</td>
</tr>
</tbody>
</table>
When Reviewing CDI Events, Ask Yourself These Questions:

- Did the event occur in an inpatient unit (non-IRF/IPF)?
- Is the event labeled “HO” (Day 4 or later, after admission)?
- Is the event labeled “Incident” (Day 57 or later, after prior event)?
A Note About CDI Assay...

- CdiAssay = “Recurrent” if a positive specimen was collected 2-8 weeks (15-56 days) earlier
- CdiAssay = “blank” if a positive specimen was collected < 2 weeks (1-14 days) earlier
  - Blank cdiAssay represents a duplicate event in a new location
- Both “blank” and “Recurrent” events are not counted in the SIR numerator
Hospitals With a CMS-Certified Rehab (IRF) Unit

- Hospitals with an IRF unit may have two separate SIRs submitted to CMS:
  1. FacWideIN SIR for the acute care hospital
  2. IRF Unit SIR

- The SIR for the IRF Unit uses different risk adjustment than acute care hospital’s FacWideIN SIR

- The SIR for the IRF Unit uses a different algorithm to determine which events are counted in the numerator
Which LabID Events are Counted in the SIR for IRF Units?

- **C. difficile (CDI):**
  - Specimens collected in CMS-certified Rehab unit
  - Specimens collected on Day 4 or later after being transferred to Rehab unit
  - No positive test in the previous 14 days in any Rehab unit within the facility

- **MRSA Bacteremia:**
  - Blood specimens from CMS-certified Rehab unit
  - Specimens collected on Day 4 or later after being transferred to Rehab unit
  - No positive test in the previous 14 days in any Rehab unit within the facility

- Run a LabID line list and review IRF unit indicator variables: `MRSA_IRFbldIncCount` or `CDIF_IRFIncCount`

More information about LabID SIR algorithms: [https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/mrsacdi_tips.pdf](https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/mrsacdi_tips.pdf)
SIR Denominator: # Predicted Events
### 2017 Q1 Example
#### SIR Denominator

How is this calculated?

<table>
<thead>
<tr>
<th>Location</th>
<th>Summary Yr/Qtr</th>
<th>Months</th>
<th>CFIF Facility Incident HO LabID Event Count</th>
<th>Number Predicted</th>
<th>Patient Days</th>
<th>SIR</th>
<th>SIR p-value</th>
<th>95% Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>FACWIDEIN</td>
<td>2017Q1</td>
<td>3</td>
<td></td>
<td>1.069</td>
<td>1570</td>
<td>0.935</td>
<td>1.0000</td>
<td>0.047, 4.612</td>
</tr>
</tbody>
</table>

- Negative binomial regression model calculates # predicted events
- Calculations may take into account:
  - NHSN annual survey
  - NHSN enrollment information
  - Information on LabID events and denominators
- Refer to the second table in the SIR Report
LabID Event SIR Report for CMS

Table 2:

<table>
<thead>
<tr>
<th>summaryYQ</th>
<th>CDL_COprevRate</th>
<th>cdiTestType</th>
<th>numICUBeds</th>
<th>facType</th>
<th>numBeds</th>
<th>CDIF_EDOBSIndicator</th>
<th>medType</th>
<th>numpatdays</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017Q1</td>
<td>0.000</td>
<td>NAAT</td>
<td>15</td>
<td>HOSP-GEN</td>
<td>50</td>
<td>0</td>
<td></td>
<td>1570</td>
</tr>
</tbody>
</table>

- Displays all values for your hospital that were used to calculate the # of predicted events
- Inaccurate data entry may lead to inaccurate # of predicted events
- Review this table whenever you run your SIR reports
Number of Predicted Events: CDI in Acute Care Hospitals

- Negative binomial regression model incorporates 7 different factors & total patient days

<table>
<thead>
<tr>
<th>7 Variables Used to Calculate Acute Care Hospital's # Predicted CDI Events</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Inpatient community-onset prevalence rate</td>
</tr>
<tr>
<td>2. CDI test type</td>
</tr>
<tr>
<td>3. Medical school affiliation <em>(from annual survey)</em></td>
</tr>
<tr>
<td>4. Number of ICU beds <em>(from annual survey)</em></td>
</tr>
<tr>
<td>5. Total number of inpatient beds <em>(from annual survey)</em></td>
</tr>
<tr>
<td>6. Facility type <em>(indicated during enrollment)</em></td>
</tr>
<tr>
<td>7. Reporting CDI from an ED or 24 hr observation unit</td>
</tr>
</tbody>
</table>

# 1. Inpatient community-onset prevalence rate
Inpatient Community-Onset (CO) Prevalence Rate

- \# Inpatient CO CDI events / \# Admissions * 100
- Prevalence rate includes data from inpatient locations only
- CO = LabID event collected on Day 1, 2, 3 of patient admission
  - Facility admit date: first date patient is transferred to inpatient unit
- CO-HCFAs are excluded
- Based on your facility’s prevalence rate for the ENTIRE QUARTER
  - Quarterly prevalence rate is used to predict \# of CDI events per quarter

\[
\text{cdif_admPrevCOCount / numAdms * 100}
\]
Review CO Prevalence Rate

- **Quarterly** rate available in Table 2 of the SIR Report (CDI_COprevRate)

- Review **monthly** prevalence rate data using *C. difficile* Rate Tables
  - Confirm accurate # of CO events and FacWideIN admissions each month
Outlier Prevalence Rate Exclusion: CDI SIR

- Outlier prevalence rate exclusion rule
- If facility’s inpatient CO prevalence rate is above pre-determined threshold, the # of predicted CDI events and SIR cannot be accurately calculated for that quarter
- Outlier threshold = **2.6 CO CDI events per 100 admissions**
- In this situation, data are still considered “complete” and submitted to CMS for Quality Reporting, given that all reporting requirements are met

More information:
Example: Outlier Prevalence Rate

- You will notice that **all** SIR data are missing for a quarter.
- Scroll down in the SIR report – look for supplementary tables.

### Table 3:

<table>
<thead>
<tr>
<th>Location</th>
<th>SummaryYQ</th>
<th>months</th>
<th>CDIF_facIncHOCount</th>
<th>numPred</th>
<th>numPatdays</th>
<th>SIR</th>
<th>SIR_pval</th>
<th>sir95ci</th>
</tr>
</thead>
<tbody>
<tr>
<td>FACWIDEIN</td>
<td>2017Q1</td>
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<td>1.069</td>
<td>1570</td>
<td>0.935</td>
<td>1.0000</td>
<td>0.047, 4.612</td>
</tr>
<tr>
<td>FACWIDEIN</td>
<td>2017Q2</td>
<td>3</td>
<td>3</td>
<td>0.241</td>
<td>702</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>FACWIDEIN</td>
<td>2017Q3</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
#2 – *C. difficile* Laboratory Test Type
CDI Test Type

- Entered on FacWideIN monthly denominator form: March, June, Sept, Dec

Drop-down menu provides common methods: *consult with lab if needed*

- EIA
- NAAT *(PCR)*
- GDH + EIA
- GDH + NAAT
- GDH + EIA + NAAT
- NAAT + EIA, if NAAT positive
- Cell cytotoxicity
- Toxigenic culture
- Other (specify)
CDI Test Type = Other

- Majority of hospitals should not select “Other”
- Use the pre-populated drop-down options if possible
- ***PCR = NAAT (nucleic acid amplification test)***

![Image of incorrect selection: Other with PCR]

- Will cause facility’s SIR to be inflated. Facility may be penalized unfairly!

![Image of correct selection: NAAT]

- Facility’s SIR will account for the sensitive PCR testing method and will be calculated appropriately.
Conclusion & Recap: CDI Test Type

- Entered into NHSN during data entry for the last month of the quarter
  - Therefore, all 3 months of data entry must be completed before CDI SIR is available

- Review CDI test type for accuracy!
  - Manual review of FacWideIN denominators
  - Use line lists from the Advanced folder: Summary Data or CDI Test Method History

- If using PCR, select **NAAT** as test type
Reviewing Data Before Quarter is Complete

- We encourage review of your HAI data before the quarter is complete
  - Data quality checks, internal validation, preparation for CMS deadlines, and measure impact of prevention activities

- What happens if you try to run the CDI SIR report in the middle of the quarter?

“Dear NHSN,
I entered January 2018 LabID data, but it is not appearing in my CDI SIR report. I confirmed that my January data entry is complete and accurate. NHSN must be broken!”
CDI SIR Report Before Quarter is Complete

- **Answer:** NHSN is working as designed. CDI test type has not been selected for this quarter yet, and therefore an SIR cannot be calculated. CDI test type is selected at the end of quarter 1, on the March denominator record.

- Several ways to review monthly LabID data:
  - Enter appropriate specifications on the modify screen of the SIR report
  - Review supplemental SIR tables in the report
  - Run monthly rate tables
Option 1: Adjust “Group by” to SummaryYM

- Will allow you to review the SIR numerator and total patient days for each month
- # predicted and SIR will not be calculated

Depending on your facility type, months from completed quarters will be shown
Option 2: Review Supplemental SIR Report Tables

- Keep the “Group by” option set to Summary
- **HINT!** Ensure that your time period includes at least one complete quarter
  
  - Ex: We want to view January 2018 data
  - Set beginning time period to **2017 Q4**

- When running CDI SIR report on an incomplete quarter, “Incomplete Months” table will appear at the bottom of the report
  - January is considered “Incomplete” until all of Q1 data are entered
Example: Incomplete Months

- SIR report will first show you the 2017 Q4 SIR (table 1)
- Scroll down to view supplemental tables

### Table 4:

<table>
<thead>
<tr>
<th>location</th>
<th>summaryYM</th>
<th>CDIF_labidCount</th>
<th>numPatDays</th>
<th>numAdms</th>
<th>cdiTestType</th>
<th>numBeds</th>
<th>medAff</th>
</tr>
</thead>
<tbody>
<tr>
<td>FACWIDEIN</td>
<td>2018M01</td>
<td>0</td>
<td>1450</td>
<td>1350</td>
<td></td>
<td>50</td>
<td>N</td>
</tr>
</tbody>
</table>
Option 3: Run Monthly Rate Tables

- Rate Tables will show you monthly data from *any* month
- Can view the # of events (SIR numerator), total patient days, and total admissions for each month
  - SIR numerators:
    - MRSA – MRSA_bldIncCount
    - CDI – CDIF_facIncHOCCount
Group Exercises
LabID Analysis Group Exercises

NHSN Annual Training: February 26, 2018

Tables 1 – 10: LabID Line Listing Conundrum Part 1 (Questions 1-4)

Tables 11 – 20: LabID Line Listing Conundrum Part 2 (Questions 5-8)

Tables 21 – 30: A Data Entry Error Gone Wild (Questions 9-14)
LabID Group Exercises

- Complete the questions assigned to your table
  - Your table may be called on to share your answers
- Complete more questions/scenarios as time allows
- Questions? Raise your hand!

**Tables 1 – 10:** LabID Line Listing Conundrum Part 1 (Questions 1-4)

**Tables 11 – 20:** LabID Line Listing Conundrum Part 2 (Questions 5-8)

**Tables 21 – 30:** A Data Entry Error Gone Wild (Questions 9-14)
Line Listing Conundrum Part 1

- # 1. Complete the column for “onset”
**Line Listing Conundrum Part 1 - Answer**

<table>
<thead>
<tr>
<th>Event ID</th>
<th>Location</th>
<th>Outpatient</th>
<th>Onset</th>
<th>cdiAssay</th>
<th>admitDate</th>
<th>specimenDate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1054</td>
<td>2 South</td>
<td>N</td>
<td>HO</td>
<td>Incident</td>
<td>1/5/2018</td>
<td>1/9/2018</td>
</tr>
<tr>
<td>1055</td>
<td>East Ward</td>
<td>N</td>
<td>CO</td>
<td>Incident</td>
<td>1/14/2018</td>
<td>1/15/2018</td>
</tr>
<tr>
<td>1056</td>
<td>Med ICU</td>
<td>N</td>
<td>HO</td>
<td>Incident</td>
<td>1/1/2018</td>
<td>1/4/2018</td>
</tr>
<tr>
<td>1057</td>
<td>Med ICU</td>
<td>N</td>
<td>HO</td>
<td>Recurrent</td>
<td>1/1/2018</td>
<td>1/28/2018</td>
</tr>
</tbody>
</table>

- **HO** = Day 4 or later
- **CO** = Day 1, 2, or 3
# 2. How many healthcare-onset (HO) CDI events did your hospital observe in January 2018?

# 3. How many CDI events from January will be counted in your hospital’s CDI SIR numerator?
Line Listing Conundrum Part 1 - Answer

We have **3** healthcare-onset (HO) CDI events in January

- **2** events will be counted in the SIR numerator
  - Patient A
  - First event from Patient C
# 4. Will the event from Patient B be incorporated into the SIR? Why or why not?
TRICKY!

- Event will not be counted in SIR numerator because onset = CO
- Event will be incorporated into SIR denominator via the inpatient CO prevalence rate
# 5. How many Incident CDI events were observed in February?
Line Listing Conundrum Part 2 - Answer

- **Answer: 3**

<table>
<thead>
<tr>
<th>Patient ID</th>
<th>Event ID</th>
<th>Location</th>
<th>Outpatient</th>
<th>Onset</th>
<th>cdiAssay</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q</td>
<td>1059</td>
<td>ED</td>
<td>Y</td>
<td>CO</td>
<td>Incident</td>
</tr>
<tr>
<td>R</td>
<td>1060</td>
<td>Med ICU</td>
<td>N</td>
<td>HO</td>
<td>Incident</td>
</tr>
<tr>
<td>X</td>
<td>1061</td>
<td>East Ward</td>
<td>N</td>
<td>CO-HCFA</td>
<td>Incident</td>
</tr>
<tr>
<td>X</td>
<td>1062</td>
<td>Med ICU</td>
<td>N</td>
<td>HO</td>
<td>.</td>
</tr>
</tbody>
</table>
# 6. Why is cdIAssay “missing” for patient X’s second event?
CdIAssay is set to “missing” on any event when the patient had a positive CDI specimen in the previous 14 days.

Patient X’s second event occurred on Feb 12th, however the patient had a prior positive event on Feb 9th (4 days apart).

Note: cdIAssay will display as “Recurrent” if the second event is 15-56 days after the prior event.
# 7. Will either event from patient X be counted in the SIR numerator? Explain why or why not.

Event #1061
Event #1062
Line Listing Conundrum Part 2 - Answer

- Event #1061: No, because the event is categorized as CO-HCFA. Only HO events are counted in the SIR numerator.

- Event #1062: No. Only ‘Incident’ CDI events are counted in the SIR numerator. This event is not labeled ‘Incident’.
8. Explain why event # 1062 is labeled as "healthcare-onset" (HO) even though this patient had a prior positive specimen?
Line Listing Conundrum Part 2 - Answer

- Events are labeled as “HO” if specimen collection date is on Day 4 or later after patient admission.
- Event 1062 occurs on Day 5, and is therefore labeled “HO”.
- The onset of each LabID event is assigned *regardless of prior events for a patient*. 
#9. Can you spot the data entry error for this patient?
A Data Entry Error Gone Wild- Answer

- Date of admission is incorrect, and should have been entered as 5/2/2017
- Date of admission is the date the patient is first housed in an inpatient unit
A Data Entry Error Gone Wild

- #10. Does the data entry error impact the categorization of onset?
A Data Entry Error Gone Wild- Answer

- Yes. The correct date of admission will cause this event to be CO.

- Currently, event is labeled as “HO”
  - Admit date = 5/1
  - Specimen date = 5/4
  - Specimen occurred on Day 4; HO

- After corrections:
  - Admit date = 5/2
  - Specimen date = 5/4
  - Specimen occurred on Day 3; CO
A Data Entry Error Gone Wild

- #11. Does the data entry error impact the cdiAssay assignment?
A Data Entry Error Gone Wild- Answer

- No
- CdiAssay is not based on admission date, and Mr. Wild had no prior positive CDI events
- CdiAssay will remain as Incident
A Data Entry Error Gone Wild

#12. After correcting the data entry error, will the value for “FWCDIF_facIncHOCount” change?
A Data Entry Error Gone Wild- Answer

- Yes. This indicator will change to “0”, signifying that the event will not be counted in the SIR numerator.
- After fixing the error, the event will become “CO”
- CO events are excluded from the SIR numerator

<table>
<thead>
<tr>
<th>Patient ID</th>
<th>Event ID</th>
<th>Location</th>
<th>Outpatient</th>
<th>Onset</th>
<th>cdiAssay</th>
<th>admitDate</th>
<th>specimenDate</th>
<th>FWCDIF_facIncHOCount</th>
</tr>
</thead>
</table>
A Data Entry Error Gone Wild

#13. Does this data entry error impact the CDI SIR numerator?
A Data Entry Error Gone Wild- Answer

- Yes
- The data entry error is causing an extra event to be counted in the SIR numerator
A Data Entry Error Gone Wild

- BONUS! After correcting the data entry error, would we expect the SIR denominator to change? Explain.
A Data Entry Error Gone Wild- Answer

- Yes!
- After fixing the error, the event will become “CO”
- Inpatient CO events are included in the CO prevalence rate used for risk adjustment
- A change in CO prevalence rate will lead to a change in the number of predicted events
Three Keys to Success!
Accurate LabID SIRs

1. Confirm 3 months of data for each quarter

2. Review number of events and FacWideIN patient days/admissions for accuracy

3. Be aware of risk factors used in the SIR calculation: review for accuracy!

**Calculate # Predicted CDI Events On Your Own**

*Table 1. Acute Care Hospitals*

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Parameter Estimate</th>
<th>Standard Error</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>-8.9463</td>
<td>0.0523</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Inpatient Community-Onset Prevalence Rate*</td>
<td>0.7339</td>
<td>0.0181</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>CDI Test Type*: EIA</td>
<td>-0.1579</td>
<td>0.0246</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>CDI Test Type*: NAAT</td>
<td>0.1307</td>
<td>0.0219</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>CDI Test Type*: OTHER</td>
<td>REFERENT</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Medical School Affiliation*: Major, graduate, or undergraduate teaching status</td>
<td>0.0331</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medical School Affiliation*: None</td>
<td>REFERENT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of ICU beds^1: &gt;43</td>
<td>0.7465</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of ICU beds^1: 20-42</td>
<td>0.7145</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of ICU beds^1: 10-19</td>
<td>0.6261</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of ICU beds^1: 5-9</td>
<td>0.4394</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of ICU beds^1: 0-4</td>
<td>REFERENT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Facility type: Cancer Hospital (HOSP-ONC)</td>
<td>1.2420</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Facility type: General Acute Care Hospital (HOSP-GEN)</td>
<td>0.3740</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Facility type: Other Hospital</td>
<td>REFERENT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Facility bed size^2</td>
<td>0.0003</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reporting from ED or 24-hour observation unit*: YES</td>
<td>0.1119</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reporting from ED or 24-hour observation unit*: NO</td>
<td>REFERENT</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**# predicted HO CDI = \( \text{Exp} \left[-8.9463 \right] \right) + 0.7339 \text{ (CO prevalence rate)} - 0.1579 \text{ (CDI test type = EIA)} + 0.1307 \text{ (CDI test type = NAAT)} + 0.7465 \text{ (ICU beds} \geq 43) + 0.7145 \text{ (ICU beds: 20 – 42)} + 0.6261 \text{ (ICU beds: 10-19)} + 0.4394 \text{ (ICU beds: 5-9)} + 1.2420 \text{ (Oncology hospital)} + 0.3740 \text{ (General hospital)} + 0.0003 \text{ (Total facility bed size)} + 0.1119 \text{ (Reporting from ED or 24 hr. Obs)} + 0.0331 \text{ (Teaching hospital)} \times \text{CDI patient days}**

Thank you!

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.
APPENDIX:
- Additional information on MRSA bacteremia SIRs
- LabID SIRs in non-acute care facilities
Differences in the MRSA Bacteremia Model
Acute Care Hospitals

- Variables in bold were not previously discussed
- Quarterly prevalence rates used in risk adjustment

<table>
<thead>
<tr>
<th>6 Variables Required for # Predicted MRSA events</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Inpatient community-onset prevalence rate - QUARTERLY</td>
</tr>
<tr>
<td>2. *Average length of stay</td>
</tr>
<tr>
<td>3. Medical school affiliation (<em>annual survey</em>)</td>
</tr>
<tr>
<td>4. Number of ICU beds (<em>annual survey</em>)</td>
</tr>
<tr>
<td>5. Facility type</td>
</tr>
<tr>
<td>6. *Outpatient community-onset prevalence rate - QUARTERLY</td>
</tr>
</tbody>
</table>
Number of Predicted Events: MRSA Bacteremia

- Quarterly inpatient and quarterly outpatient CO prevalence rates are used in the MRSA bacteremia SIR calculation.

- Therefore, MRSA bacteremia SIRs in acute care hospitals require that data from the entire quarter have been entered into NHSN.

- Accurate SIRs can only be calculated for a quarter time period, or longer.
Average Length of Stay

- Average # of days a patient stays in the facility
- Derived from the annual survey
- Total annual patient days / total annual admissions

6 Variables Used for # Predicted MRSA events

1. Inpatient community-onset prevalence rate
2. Average length of stay
3. Medical school affiliation
4. Number of ICU beds
5. Facility type
6. Outpatient community-onset prevalence rate

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Parameter Estimate</th>
<th>Standard Error</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Length of Stay**: ≥5.1 days</td>
<td>0.2787</td>
<td>0.0343</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Average Length of Stay**: 4.3-5.0 days</td>
<td>0.0955</td>
<td>0.0341</td>
<td>0.0050</td>
</tr>
<tr>
<td>Average Length of Stay**: 0-4.2 days</td>
<td>REFERENT</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
Outpatient Community-Onset Prevalence Rate

- Combines MRSA bacteremia data from any ED or 24 hour observation (obs) location in the facility

\[
\text{# unique CO MRSA bacteremia events} \times 100 \\
\text{in ED/24hr Obs} \\
\text{total # encounters for the quarter}
\]

- Calculated for entire quarter
- If no ED or 24 hr Observation location – that’s ok! Will still receive risk adjustment based on other variables in the model.
Other Healthcare Settings

- Acute Care Hospitals (Hospital IQR)
- Critical Access Hospitals (Hospital IQR)
- Inpatient Rehabilitation Facilities (IRFQR)
- Long Term Acute Care Hospitals (LTCHQR)
- PPS-Exempt Cancer Hospitals (PCHQR)
Critical Access Hospital (CAH): CDI SIR

- Available for facilities enrolled in NHSN as “HOSP-CAH”
- SIR numerator: incident, healthcare-facility onset events
- Risk adjustment used for # predicted events:
  - Inpatient Community-Onset Prevalence Rate
    - \# Inpatient CO CDI events / \# Admissions * 100
    - 2 categories for risk adjustment:
      - Prevalence Rate = 0
      - Prevalence Rate > 0
    - Based on your facility’s prevalence rate for the ENTIRE QUARTER
      - All 3 months of data entry for the quarter must be complete

*REMEMBER: Accurate CDI SIRs can only be calculated for an entire quarter, or longer.*
CAH: MRSA Bacteremia SIR

- Available for facilities enrolled in NHSN as “HOSP-CAH”
- # of predicted events uses “intercept-only model”
  - None of the investigated variables were statistically significantly associated with MRSA bacteremia in CAHs
  - # predicted events will be calculated using the overall (unadjusted) national MRSA bacteremia experience in CAHs
  - Monthly SIRs are available for CAHs

**Table 2. Critical Access Hospitals (CAHs)**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Parameter Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept*</td>
<td>-10.7795</td>
</tr>
</tbody>
</table>

Formula for manual calculation:

\[
\# \text{ predicted} = [\exp(-10.7795)] \times \text{patient days}
\]
Long Term Acute Care (LTAC): MRSA Bacteremia SIR

- Risk adjustment used in calculation of # predicted events:
  - Percent of annual admissions on a ventilator
    - Derived from the annual LTAC facility survey
    - (# annual admissions on vent / total annual admissions) x 100
  - Monthly MRSA bacteremia SIRs available for LTACs
LTAC: CDI SIR

- Risk adjustment for # predicted events:
  
  1. Inpatient Community-Onset Prevalence Rate (for the entire quarter)
  
  2. CDI test type
  
  3. Percent of admissions on a ventilator (annual survey)
  
  4. Percent of beds located in single occupancy rooms (annual survey)

**REMEMBER:** Accurate CDI SIRs can only be calculated for an entire quarter, or longer.
Inpatient Rehabilitation Facility (IRF): MRSA Bacteremia SIR

- SIR numerator:
  - Free-standing Rehab hospitals: # healthcare facility-onset LabID events
  - Rehab units within a hospital: # of location-incident LabID events
- # of predicted events uses “intercept-only model”
  - None of the investigated variables were statistically significantly associated with MRSA bacteremia in IRFs
  - # predicted events will be calculated using the overall (unadjusted) national MRSA bacteremia experience in IRFs
  - Monthly MRSA bacteremia SIRs available for IRFs

Formula for manual calculation:
# predicted = [exp (-10.8703)] * IRF patient days
IRF: CDI SIR

- Risk adjustment used in calculation of # predicted events:
  - CDI test type
  - Type of IRF (unit within a hospital vs. free-standing IRF)
    - Additional adjustment for free-standing IRFs with reported community-onset (CO) events
  - Percent of admissions with orthopedic conditions (annual survey)
  - Percent of admissions with stroke (annual survey)
  - Percent of admissions with traumatic and non-traumatic spinal cord dysfunction (annual survey)

REMEMBER: Accurate CDI SIRs can only be calculated for an entire quarter, or longer.