2019 Annual NHSN Training

Analyzing LabID Event Data in NHSN

Lindsey Lastinger, MPH
Karen Jones, PhD, MSPH
NHSN Methods and Analytics Team
Centers for Disease Control and Prevention

Disclaimer: The examples and screen shots used in this presentation represent fictitious data.

Goals For Today

- Introduce the analytic reports available for LabID event data
  - MRSA bacteremia, *C.difficile*, other organisms
- Discuss benchmarks: rates and SIRs
- Describe the risk adjustment used in the LabID SIRs for acute care hospitals
- Define *which* LabID events contribute to the SIR numerators
- Discuss techniques for ensuring accuracy and quality of data

Acronyms

*CDI = *C.difficile* LabID Event

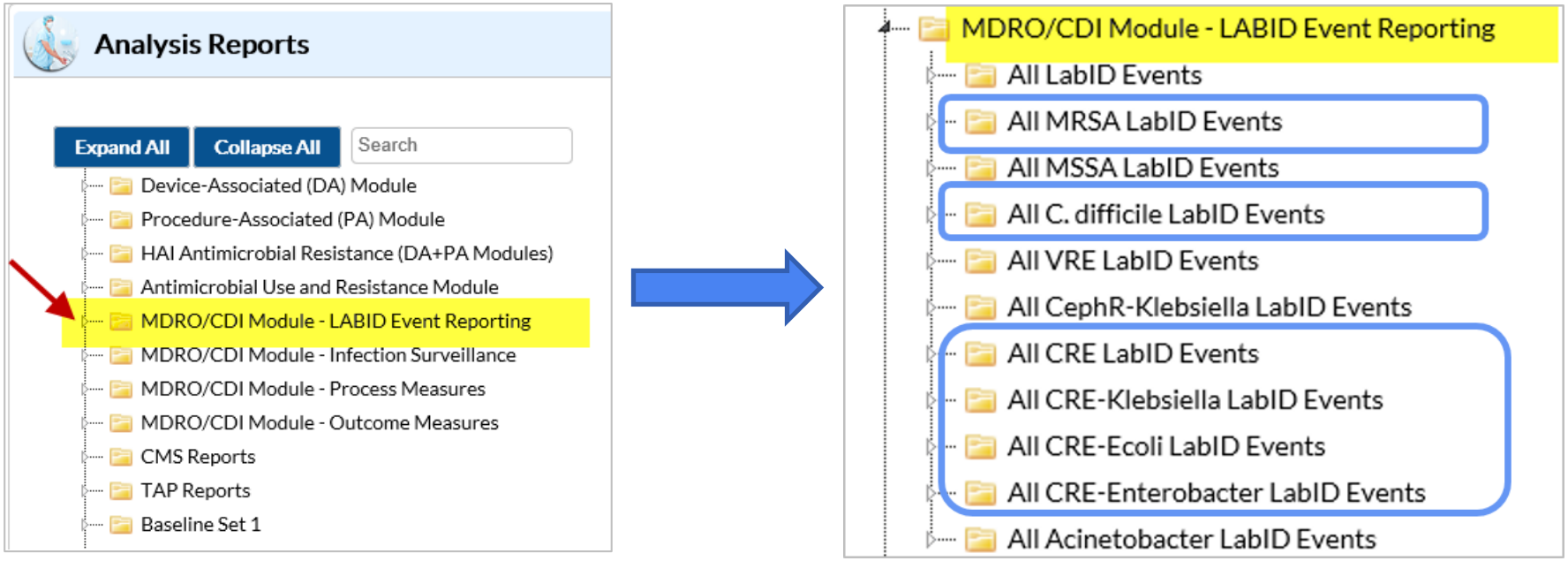
*CO = community-onset

*HO = healthcare facility-onset

*CO-HCFA = community-onset, healthcare facility-associated

LabID Analysis Reports in NHSN

Analysis Tree

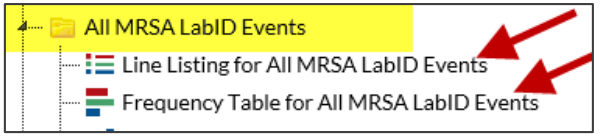


…The Other MDROs

Organism	# Facilities Reporting to NHSN
C. difficile	5,351
MRSA	5,232
CRE	725
VRE	666
Multidrug -resistant *Acinetobacter*	151
Extended-spectrum cephalosporin-resistant (CephR) *Klebsiella*	136
MSSA	72

2017 NHSN data

Line Lists & Frequency Tables



- Great starting place for analysis
  - Line List: event-level details
  - Frequency Table: counts of events
- Will contain all LabID events reported for the organism
- Review NHSN's categorizations for each event
  - Onset: CO, HO, or CO-HCFA
  - cdiAssay: Incident, Recurrent, or blank
- Determine which events are counted in the SIR
- Easy to customize

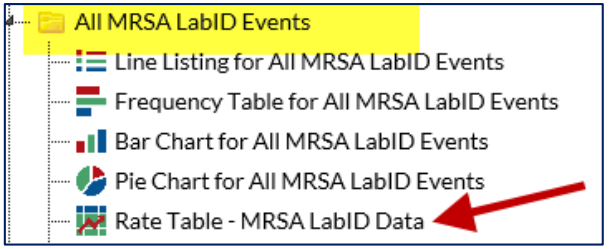
Table of location by onset

location	onset		
	CO	HO	Total
2N	1 100.00	0 0.00	1
2WEST	2 100.00	0 0.00	2
BURN	7 58.33	5 41.67	12
ED	6 100.00	0 0.00	6

patID	spcOrgType	location	onset	admitDate	specimenDate	FWMRSA_bldIncCount
020202CG	MRSA	2N	CO	10/30/2017	11/01/2017	0
030303	MRSA	ICU	HO	06/18/2017	06/22/2017	1
030303	MRSA	ICU	CO	07/01/2017	07/01/2017	0
0AUGT	MRSA	BURN	CO	08/04/2017	08/05/2017	0
1112	MRSA	ICU	HO	10/30/2018	11/25/2018	1
1112	MRSA	BURN	HO	10/30/2018	11/30/2018	0

Rate Tables

"How often are LabID events occurring in my facility?"



- NHSN provides healthcare-onset and community-onset rates
- Rates are available for locations listed separately on the monthly reporting plans (i.e., in which location-specific denominator records are entered)
  - Most common: FacWideIN, EDs, 24 hour observation units, and IRF units
  - Other units
- Useful for data quality review
  - Rate tables display the # of events, patient days, and admissions
  - Rates can be generated by month, quarter, half-year, or year

Healthcare-onset Incidence Rate

- Used to describe the amount of HO events identified in inpatient locations in the facility
  - Formula (CDI): # incident HO CDI events / # patient days * 10,000
  - Numerator of the incidence rate = numerator of the SIR (CDIF_facIncHOCount)

CDI Incidence - Inpatient Facility CDIF Healthcare Facility-Onset Incidence Rate

summaryYM	location	CDIF_facIncHOCount	numPatDays	CDIF_HOIncRate
2018M10	FACWIDEIN	1	1200	8.333
2018M11	FACWIDEIN	0	1384	0.000
2018M12	FACWIDEIN	1	1298	7.704

- October: (1 incident HO CDI event/1,200 patient days) * 10,000 = 8.333
- Interpretation: *Our facility saw 8.3 incident HO CDI events per 10,000 patient days*

Community-onset Prevalence Rate

- Inpatient CO prevalence rate[+]: # inpatient CO LabID events / # admissions * 100
- Outpatient CO prevalence rate: # outpatient CO LabID events / # encounters * 100

CDI Prevalence - Community-Onset Admission Prevalence Rate

summaryYM	location	CDIF_admPrevCOCount	numAdms	CDI_COprevRate
2018M10	FACWIDEIN	1	804	0.124
2018M11	FACWIDEIN	1	1107	0.090
2018M12	FACWIDEIN	0	908	0.000

- Interpretation:
  - In October, our facility identified 0.124 inpatient CO CDI events per 100 admissions
  - Or, stated another way: 1.24 inpatient CO CDI events **per 1,000 admissions**
    - Choice of multiplier

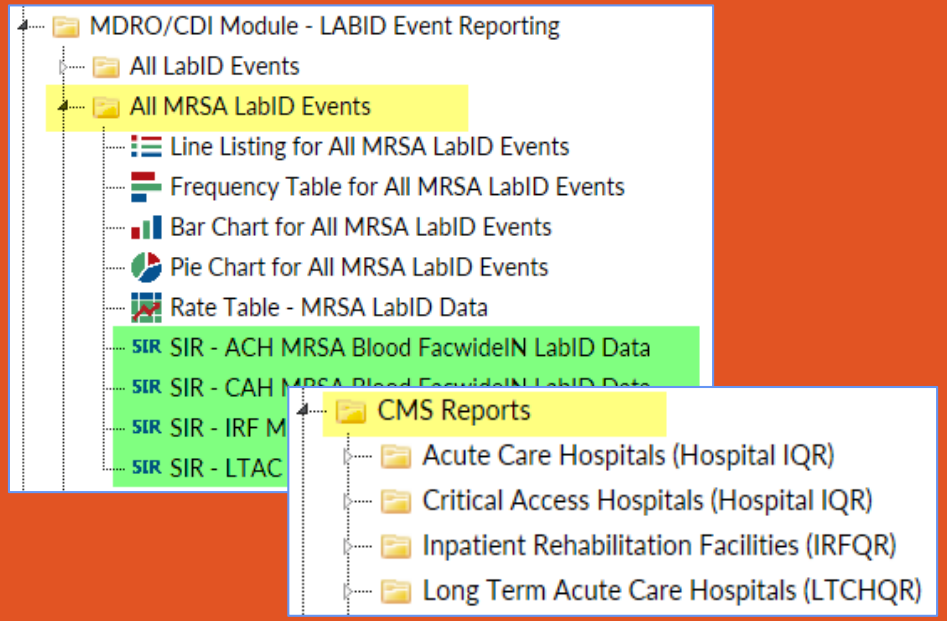
[+] Used in risk adjustment of the SIR

More about LabID Rates

- National LabID rates 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
- CRE, MDR-*Acinetobacter*, VRE, CephR-*Klebsiella*, MSSA:
  - 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 national data exist



Standardized Infection Ratio

LabID Event SIRs: A Quick Review

- "How does MRSA bacteremia (or CDI) in my facility compare to the nation?"

$$SIR = \frac{\#\ observed\ HO\ LabID\ Events}{\#\ predicted\ HO\ LabID\ Events}$$

- **# observed events**: HO events entered into NHSN *that meet the SIR criteria*
- **# predicted events**: based on the national 2015 baseline data
  - Calculated and risk adjusted specifically for your facility

Interpretation:

- If SIR > 1.0: more events observed than predicted
- If SIR < 1.0: fewer events observed than predicted
- Statistical significance: p-value and 95% confidence interval

Example MRSA SIR Report: 2018 Q3 and 2018 Q4

SIR for MRSA Blood FacwideIN LabID Data in Acute Care Hospital (2015 baseline)

location	summaryYQ	months	MRSA_bldIncCount	numPred	numpatdays	SIR	SIR_pval	sir95ci
FACWIDEIN	2018Q3	3	1	1.314	17089	0.761	0.8907	0.038, 3.754
FACWIDEIN	2018Q4	3	3	0.156	2627			

2018 Q3

- Months: **3**
- SIR numerator (MRSA_bldIncCount): **1**
- SIR denominator (numPred): **1.314**
- Total patient days for the quarter: **17,089**
- SIR: 1 / 1.314 = **0.761**

Interpretation (SIR < 1):

- In 2018 Q3, we observed fewer MRSA blood events than what was predicted by the national baseline

Example MRSA SIR Report: 2018 Q3 and 2018 Q4

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FACWIDEIN	2018Q4	3	3	0.156	2627	.	.	.

2018 Q3

- P-value and 95% confidence interval
  - P-value is > 0.05
  - The 95% confidence interval (CI) includes 1
    - (0.038 – 3.754)

Interpretation:

- SIR is not statistically significant
- # observed events is not significantly different than the number predicted
- # observed events is not significantly different than national baseline

Example MRSA SIR Report: 2018 Q3 and 2018 Q4

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2018 Q4

- Facility reported 3 months of data and 2,627 patient days
- Facility observed 3 healthcare-onset MRSA blood events
- Why are the columns for SIR, p-value, and 95% CI blank?

Knowledge Check!

SIR for MRSA Blood FacwideIN LabID Data in Acute Care Hospital (2015 baseline)

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FACWIDEIN	2018Q3	3	1	1.314	17089	0.761	0.8907	0.038, 3.754
FACWIDEIN	2018Q4	3	3	0.156	2627	.	.	

TRUE or FALSE?

The SIR and statistics are not calculated because the number of patient days for this quarter is below the pre-determined threshold.

Answer: FALSE

Rationale

- NHSN does not calculate SIRs and accompanying statistics when the number of predicted events is less than 1
  - Statistically imprecise SIRs, which typically have extreme values
- This rule is implemented regardless of the number of patient days

SIR for MRSA Blood FacwideIN LabID Data in Acute Care Hospital (2015 baseline)

location	summaryYQ	months	MRSA_bldIncCount	numPred	numpatdays	SIR	SIR_pval	sir95ci
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FACWIDEIN	2018Q4	3	3	0.156	2627	.	.	

- 2018 Q3 – our facility had 1.314 predicted events
- 2018 Q4 – our facility had 0.156 predicted events
- Drastic change between quarters could indicate a data quality issue
  - How would we investigate this?
  - Know what values are used in the calculation of # predicted events

SIR Denominator: # Predicted Events

Emphasis on MRSA Bacteremia

How is the Predicted # of MRSA Events Calculated?

- Negative binomial regression models were created using 2015 national data
  - MRSA: 6 different factors & total patient days
- Review data table beneath the SIR report
  - Inaccurate risk adjustment factors will lead to inaccurate # of predicted events
  - Review this table whenever you run your SIR reports

Risk Adjustment Factors for FacwideIN MRSA Bacteremia SIR

summaryYQ	MRSA_admPrevBldRate	MRSA_EDObsPrevRate	LOS	medType	facType	numICUBeds	numpatdays
2017Q1	0.265	0.000	10.3	M	HOSP-GEN	10	2120
2017Q2	0.062	0.071	10.3	M	HOSP-GEN	10	1500
2017Q3	12.5	0.000	10.3	M	HOSP-GEN	10	1089

Details on LabID SIR Risk Adjustment: https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/nhsn-sir-guide.pdf

Closer Look: MRSA Risk Factors for 2018 Q4

Risk Adjustment Factors f… FacwideIN MRSA Bacteremia SIR

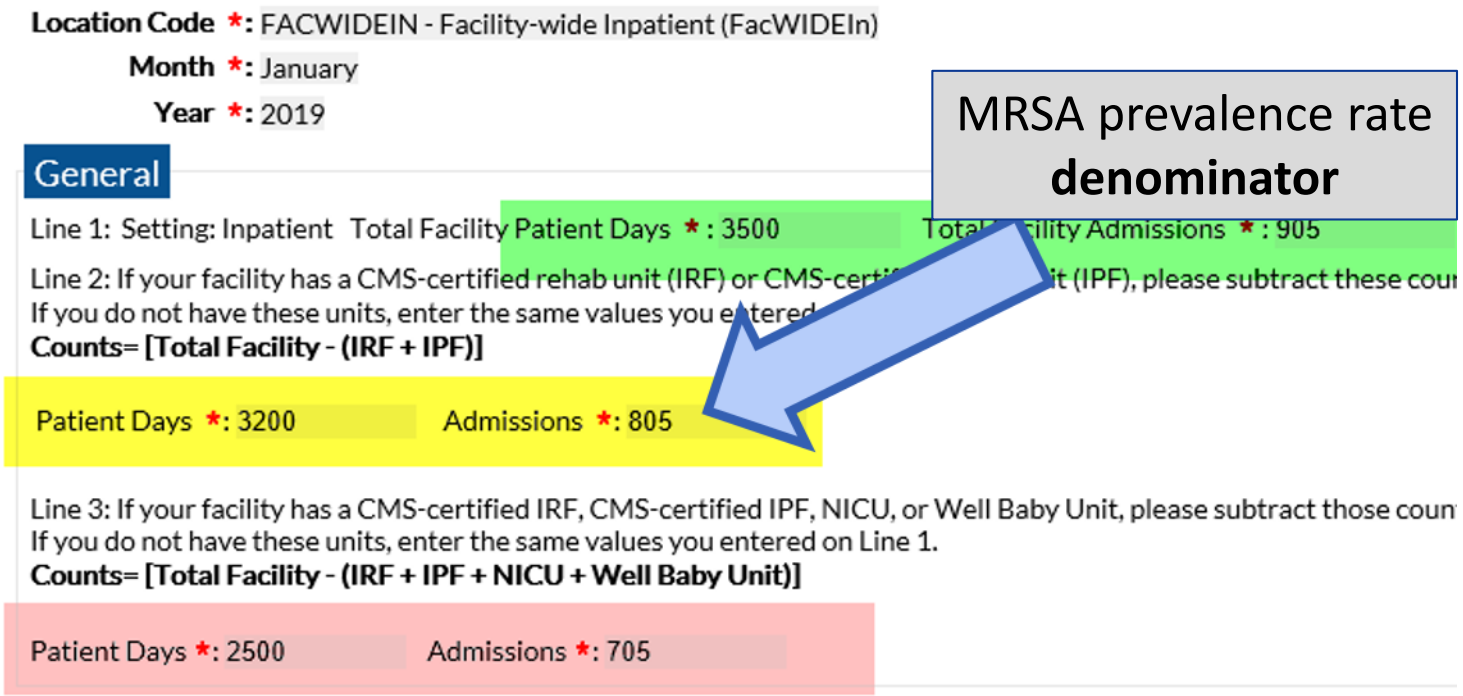
summaryYQ	MRSA_admPrevBldRate	MRSA_EDObsPrevRate	LOS	medType	facType	numICUBeds	numpatdays
2018Q4	0	0.022	90	M	HOSP-GEN	100	2627

- Inpatient MRSA blood community-onset prevalence rate

$$\frac{\#\,unique\ CO\ blood\ events}{total\ \#\,admissions\ (quarter)}\ x\ 100$$

- "Is this rate correct for my facility, for this quarter?"
  - Confirm CO events & admission counts were entered correctly

FacWideIN Denominator Form

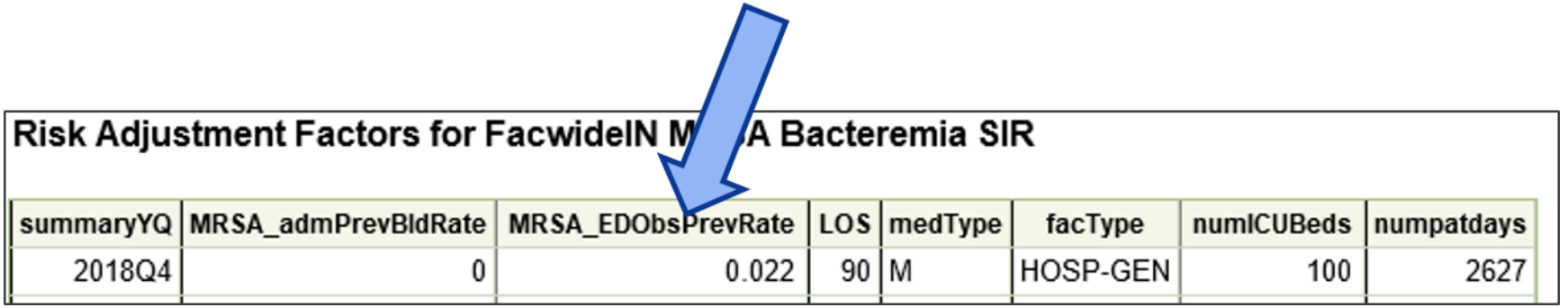


Inpatient Community-Onset (CO) Prevalence Rate

- Prevalence rate includes data from all inpatient locations
- CO: LabID specimen collected on Day 1, 2, or 3 of patient admission
  - Facility admission date: “Day 1”
  - 14 day de-duplication*
- Calculated for the **entire quarter**
  - Quarterly prevalence rate is used to predict quarterly # of MRSA events
- View this rate in MRSA Rate Tables
  - *MRSA_admPrevBldCount/numAdms * 100*

*Indicator variable on MRSA Line List: FWMRSA_admPrevBldCount

Outpatient MRSA CO Prevalence Rate



Risk Adjustment Factors for FacwideIN M A Bacteremia SIR

summaryYQ	MRSA_admPrevBldRate	MRSA_EDObsPrevRate	LOS	medType	facType	numICUBeds	numpatdays
2018Q4	0	0.022	90	M	HOSP-GEN	100	2627

$$\frac{\#\ unique\ CO\ blood\ events\ from\ EDs\ and\ 24\ hr\ Observation\ Units}{total\ \#\ outpatient\ encounters\ (quarter)}\ x\ 100$$

- Calculated for the **entire quarter,** and combines EDs & 24hr Obs
- Available in NHSN Rate Tables: *MRSA_EDOBSprevCount/numEncounters * 100*
- If no ED or 24 hr Observation Unit in your facility, you will still receive risk adjustment based on other variables in the model

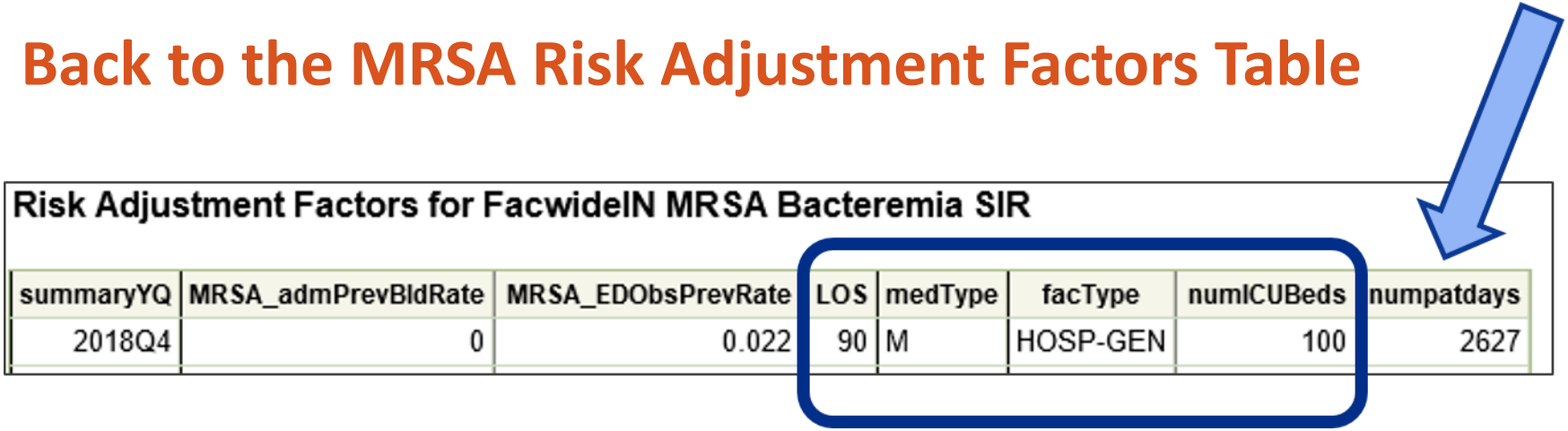
LabID Event SIRs are a Quarterly Measure

- 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?

- MRSA and CDI SIRs are risk adjusted based on quarterly community-onset prevalence rates
- CDI SIRs are risk adjusted based on CDI test type, which is collected once per quarter
- LabID event SIRs are not accurate until the quarterly risk adjustment calculations can be performed

Back to the MRSA Risk Adjustment Factors Table



Risk Adjustment Factors for FacwideIN MRSA Bacteremia SIR

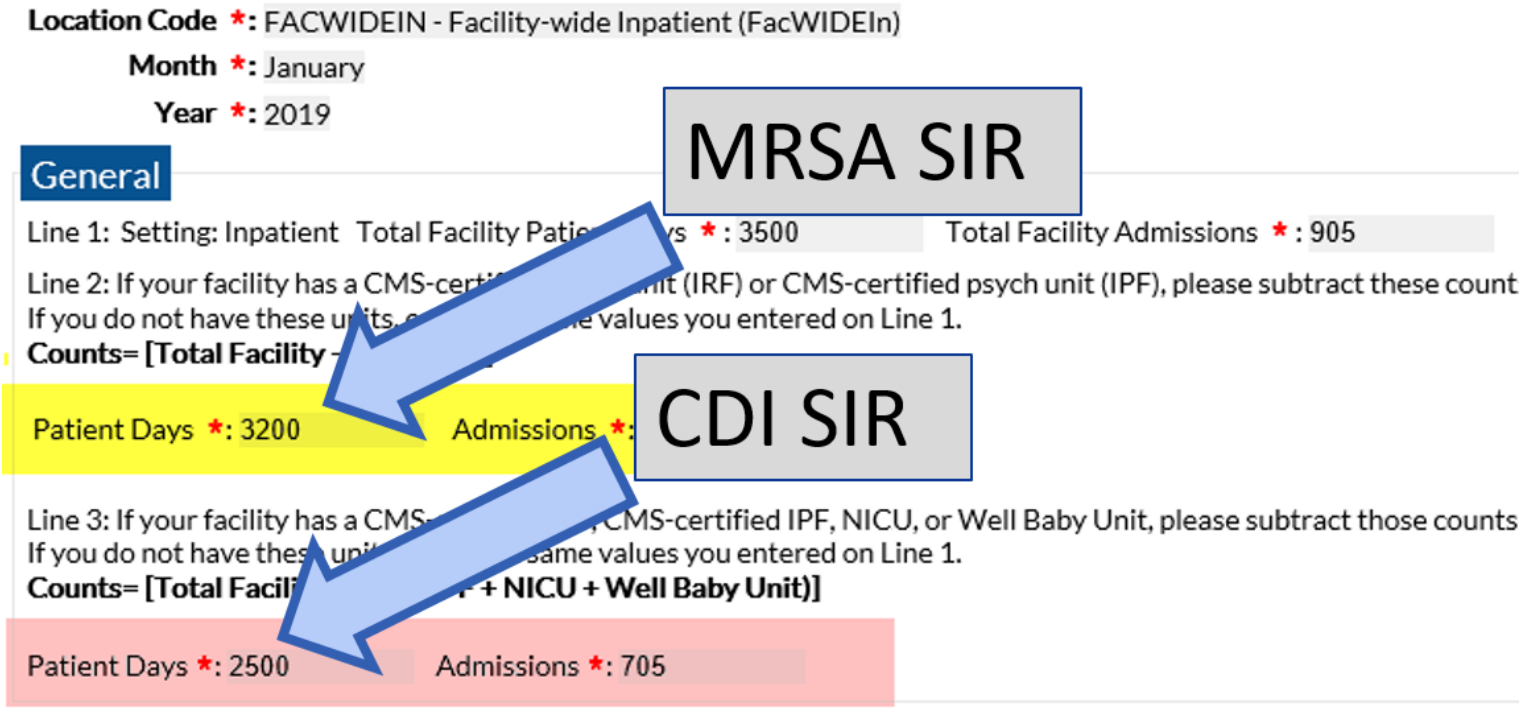
summaryYQ	MRSA_admPrevBldRate	MRSA_EDObsPrevRate	LOS	medType	facType	numICUBeds	numpatdays
2018Q4	0	0.022	90	M	HOSP-GEN	100	2627

Collected on annual facility survey and during NHSN enrollment:

- Average length of stay
- Medical school affiliation
- Facility type
- # of ICU beds

Patient days are collected on the FacWideIN denominator form and summed for the quarter

FacWideIN Denominator Form



Which of the following is true?

- A) SIRs are available for all organisms in the MDRO Module
- B) I can review my facility's MRSA SIRs for each month of a quarter
- C) If a facility adds their Medical ICU to their LabID monthly reporting plan, a LabID Event SIR will become available for that ICU
- D) The MRSA SIR is risk adjusted using the inpatient and outpatient CO prevalence rate

Answer: D

Rationale

- SIRs are available for all organisms in the MDRO Module
  - FALSE: SIRs are only available for MRSA and CDI
- I can review my facility's MRSA SIRs for each month of a quarter
  - FALSE: SIRs are only calculated on a quarterly-level due to requirements for risk adjustment
- If a facility adds their Medical ICU to their LabID monthly reporting plan, a LabID Event SIR will become available for that ICU
  - FALSE: SIRs are only available for FacWideIN and CMS-certified IRF units. Adding select ICUs to the monthly reporting plans would allow the facility to see rates for those ICUs.

CDI Test Type and Risk Adjustment

- The CDI SIR is risk adjusted, *each quarter*, based on your facility's CDI test type **category**

CDI Test Type Category	Parameter Estimate
NAAT category	0.1307
EIA category	-0.1579
Other category	Referent

- **NAAT category:** NAAT, or any testing algorithm in which "NAAT" is the final step
- **EIA category:** EIA, or any algorithm in which "EIA" is the final step
- **Other category:** cell cytotoxicity assay, toxigenic culture, or free-text entry

CDI Test Type and Risk Adjustment

CDI Test Type Category	Parameter Estimate
NAAT category	0.1307
EIA category	-0.1579
Other category	Referent

- 'Parameter estimate' describes the contribution of CDI test type to the # of predicted events
  - Referent = no contribution to predicted events
  - Positive number = more predicted events than referent category
  - Negative number = fewer predicted events than referent category
- Question from NHSN facility:
  - "My facility is thinking about changing our CDI test method from NAAT (Q1) to a two-step algorithm of NAAT + EIA (for Q2). How will this change impact our number of predicted events?"

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

CDI Test Type Category	Parameter Estimate
NAAT category	0.1307
EIA category	-0.1579
Other category	Referent

Answer

- Facility is moving from ‘NAAT’ to ‘NAAT + EIA’
  - CDI test type category will change from the NAAT category to the EIA category
  - EIA contributes to a lower # of predicted events, compared to the NAAT category
- However:
  - The # predicted CDI events is calculated using 8 different variables
  - For any given qtr, # of predicted events will change from the prior qtr based on changes to these variables (e.g., patient days, inpatient CO prevalence rate)
  - A change in CDI test type may lead to a change in the inpatient CO prevalence rate

Final Answer: The change in # of predicted events cannot be determined by assuming that CDI test type is the ONLY variable that changes between 2 quarters. However, assuming all other variables in the model do not change, this facility **may** see a decrease in the # predicted events.

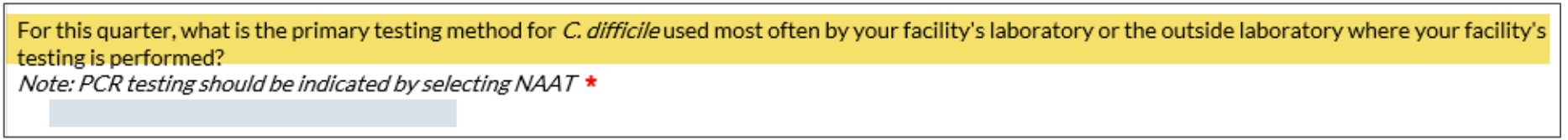
SIR Numerator
Observed LabID Events

Important LabID Analysis Variables

- CDI Test Type
- onset
- cdiAssay

CDI Test Type

- Entered on FacWideIN monthly denominator form: Mar, Jun, Sept, Dec


For this quarter, what is the primary testing method for *C. difficile* used most often by your facility's laboratory or the outside laboratory where your facility's testing is performed?
Note: PCR testing should be indicated by selecting NAAT *

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

EIA - Enzyme immunoassay (EIA) for toxin
Cyto - Cell cytotoxicity neutralization assay
NAAT - Nucleic acid amplification test (NAAT)
NAATEIA - NAAT plus EIA, if NAAT positive (2-step algorithm)
GDH - Glutamate dehydrogenase (GDH) antigen plus EIA for toxin
GDHNAAT - GDH plus NAAT
GDHEIA - GDH plus EIA for toxin, followed by NAAT for discrepant results
ToxiCul - Toxigenic culture
OTH - Other (specify)

Methods
vs.
Category

NAAT
EIA
Other

Risk adjustment

Onset

- Uses the location, facility admission date (if applicable), & specimen collection date. *Assigned within NHSN application*
- Community-onset (**CO**)
  - Outpatient event and NOT previous discharge in 4 weeks* OR
  - Inpatient event ≤ Day 3 of admission+
- Community-onset healthcare facility-associated (**CO-HCFA**) ***CDI only***
  - Outpatient or inpatient event and WITH previous discharge in 4 weeks*
- Healthcare facility-onset (**HO**): Inpatient event on Day 4+

*Has patient been discharged from your facility in the past 4 weeks?
+Where Day 1 is the date of inpatient admission

Onset, continued

- **CO** and **CO-HCFA** events are not included in SIR numerator
- **CO-HCFA** events are not counted in CO admission prevalence rate

Line Listing - MRSA BLDSPC

Pat id	Event id	Location	Outpatient	PatDischarge4wk	Onset	Admit Date	Specimen Date	FWMRSA_admPrevBldCount	FWMRSA_bldIncCount
303	66877	ICU	N	N	HO	11/18/2018	11/22/2018	0	1
303	66883	ICU	N	Y	CO	12/01/2018	12/01/2018	1	0
332	43019	3NS	N	N	HO	10/01/2018	10/09/2018	0	1

PatDischarge4wk: Has patient been discharged from your facility in the past 4 weeks?

cdiAssay

- Uses current and prior specimen collection dates
- Assigned within NHSN application
  - **Incident** if a positive specimen was collected > 56 days after most recent event or no previous event for patient
  - **Recurrent** if a positive specimen was collected 2–8 weeks (15–56 days) earlier
  - **Blank** / **“ ”** if a positive specimen was collected < 2 weeks (1–14 days) earlier
    - **“ ”** cdiAssay represents a duplicate event in a new location

cdiAssay, continued

- Both **Blank** and **Recurrent** events are not counted in SIR numerator

Line Listing - CDIF

Pat id	Event id	SpcOrg Type	Location	PatDischarge4wk	Onset	Admit Date	Specimen Date	cdiAssay	FWCDIF_adm PrevCOCount	FWCDIF_fac IncHOCount
142	63078	CDIF	3NS	N	CO	10/01/2018	10/01/2018	Incident	1	0
142	63079	CDIF	OBS	N	CO	.	11/25/2018	Recurrent	1	0
189	76261	CDIF	ED	Y	CO-HCFA	12/01/2018	12/01/2018	Incident	0	0
202	77604	CDIF	ICD	N	CO	11/11/2018	11/11/2018	Incident	1	0
202	77605	CDIF	MED	N	HO	11/11/2018	11/23/2018		0	0

Common Question from NHSN Users

SIR for MRSA blood FacWideIN

Location	Summary Yr/Qtr	Months	MRSA Blood Incident LabID Count	Number Predicted	Patient Days	SIR	SIR p-value	95% Confidence Interval
FACWIDEIN	2019Q1	3	4	3.319	50621	1.205	0.6647	0.383, 2.907

Q: "I entered 5 MRSA events for Q1, but only 4 events were 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
  - Events that are not counted in the SIR numerator contribute to risk adjustment and algorithms for determining "duplicate" events
  - However, not all LabID events will be counted in the SIR numerator

Which LabID Events are Counted in FacWideIN SIR Numerator?

- *C. difficile* (CDI):
  - Inpatient units only, *excluding* Rehab & Psych units with unique CCN
  - **HO** (specimens collected on Day 4 or later after admission)
  - **Incident** (> 56 days after the most recent positive CDI LabID event for this patient)
- MRSA Bacteremia:
  - Blood specimens from inpatient units, *excluding* Rehab & Psych units with unique CCN
  - **HO** (specimens collected on Day 4 or later after admission)
  - No positive MRSA bacteremia in the previous 14 days in any location

Included in General Resources

* Read more about LabID SIR numerator: https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/mrsacdi_tips.pdf

FAQ from the NHSN Helpdesk

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

- **A:** You cannot change the onset categorization applied by NHSN.

Knowledge Check

A patient was positive for MRSA on Day 1, and a second positive specimen was collected on Day 6 in a different unit. The second specimen was categorized as HO.

<u>True or False</u>: The 2nd specimen is counted in the MRSA SIR numerator

Knowledge Check: Answer

True or False: The 2nd specimen is counted in the MRSA SIR numerator.

Answer: False

The 2nd specimen is NOT counted in the MRSA SIR numerator.

- Correctly labeled HO
- Positive MRSA bacteremia in the previous 14 days in any location
- Not all HO events are counted in the SIR numerator

Review FacWideIN SIR Numerator

- Run a LabID Event line list for the organism of interest
- Review indicator variable
  - **FWCDIF_facIncHOCount** (CDI) or **FWMRSA_bldIncCount** (MRSA blood)
    - 1 = counted in SIR numerator
    - 0 = not counted in SIR numerator

Pat id	Event id	Location	Outpatient	PatDischarge4wk	Onset	Admit Date	Specimen Date	FWMRSA_admPrevBldCount	FWMRSA_bldIncCount
303	66877	ICU	N	N	HO	10/18/2018	10/22/2018	0	1
303	66883	ICU	N	Y	CO	11/01/2018	11/01/2018	1	0
332	43019	MED	N	N	HO	10/01/2018	10/09/2018	0	1
227	46274	2S	N	N	HO	12/01/2018	12/09/2018	0	1
227	46325	3S	N	N	HO	12/01/2018	12/20/2018	0	0

When Reviewing MRSA 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)?
- Was there a prior MRSA positive event in the previous 14 days in any location?

Pat id	Event id	Location	Outpatient	PatDischarge4wk	Onset	Admit Date	Specimen Date	FWMRSA_admPrevBldCount	FWMRSA_bldIncCount
303	66877	ICU	N	N	HO	10/18/2018	10/22/2018	0	1
303	66883	ICU	N	Y	CO	11/01/2018	11/01/2018	1	0
332	43019	MED	N	N	HO	10/01/2018	10/09/2018	0	1
227	46274	2S	N	N	HO	12/01/2018	12/09/2018	0	1
227	46325	3S	N	N	HO	12/01/2018	12/20/2018	0	0

Assume 66877 is first event for Patid 303

FYI

- Event 66883 is excluded because it is CO
- Event 46325 is excluded because it occurred on Day 12, after prior positive event

LabID Event Line List SIR Numerator Indicator Variables

Facility Type	MRSA SIR numerator Indicator	CDI SIR numerator Indicator
Acute Care Hospital	FWMRSA_bldIncCount	FWCDIF_facIncHOCount
CMS-certified Inpatient Rehabilitation (IRF) unit located within a hospital	MRSA_IRFbldIncCount	CDIF_IRFIncCount
Critical Access Hospital	FWMRSA_bldIncCount	FWCDIF_facIncHOCount
Long-term Acute Care Hospital	FWMRSA_bldIncCount	FWCDIF_facIncHOCount
Free-standing Inpatient Rehab Facility	FWMRSA_bldIncCount	FWCDIF_facIncHOCount

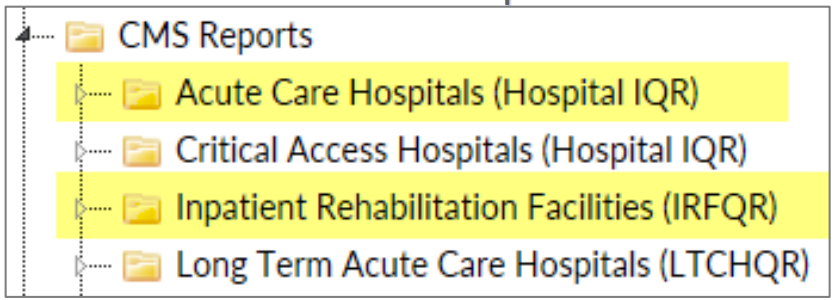
- 1 = counted in SIR numerator
- 0 = not counted in SIR numerator

FacWideIN and IRF SIR Differences

Hospitals With a CMS-Certified Rehab (IRF) Unit

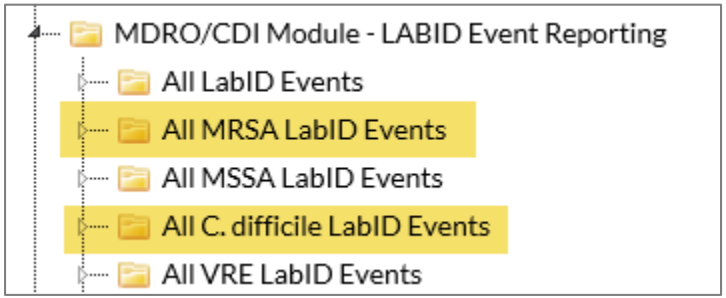
- Hospitals with an IRF unit may have two separate SIRs submitted to CMS
  - 1. FacWideIN SIR for the acute care hospital
  - 2. IRF Unit SIR
- **As of 2018 Q4, MRSA is no longer part of the CMS IRFQR program**

Review both reports



CMS reports

MRSA SIR still available here



non-CMS reports

Which LabID Events are Counted in the SIR numerator 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**

Knowledge Check

True or False: The algorithm for the SIR numerator is different for FacWideIN and IRF units.

Knowledge Check: Answer

True or False: The algorithm for the SIR numerator is different for FacWideIN and IRF units.

Answer: True

- Previous slides
  - Which LabID Events are Counted in FacWideIN SIR Numerator?
  - Which LabID Events are Counted in the SIR for IRF Units?
- Troubleshooting the MRSA Bacteremia and CDI LabID Event SIR, https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/mrsacdi_tips.pdf

Data Quality

CDI Test Type, FacWideIN denominator form, complete 3 months reporting

Important Note

- Regenerate datasets

CDI Test Type = Other

- Majority of hospitals should not select “Other”
- Use the pre-populated drop-down options when possible
- **Note: PCR testing should be indicated by selecting NAAT**
- Possible SIR impact

CDI Test Type = Other SIR Impact

CDI Test Type Category	Parameter Estimate
NAAT category	0.1307
EIA category	-0.1579
Other category	Referent

For this quarter, what is the primary testing method for *C. difficile* used most often by your facility's laboratory or the testing is performed?

Note: PCR testing should be indicated by selecting NAAT *

OTH - Other (specify) | Other (specify) *: PCR

Will cause facility's SIR to be inflated → SIR = 1.299

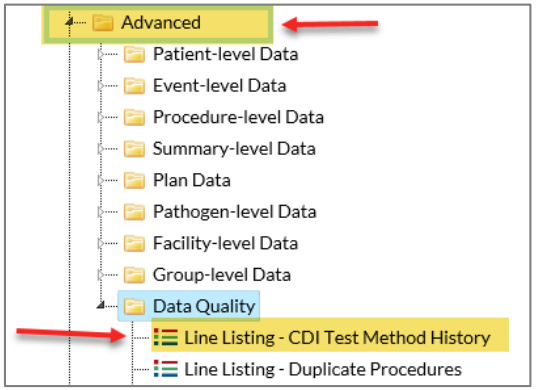
For this quarter, what is the primary testing method for *C. difficile* used most often by your facility's laboratory or the testing is performed?

Note: PCR testing should be indicated by selecting NAAT *

NAAT - Nucleic acid amplification test (NAAT)(e.g., PCR)

Facility's SIR will receive proper risk adjustment category, and calculate appropriately. → SIR = 1.140

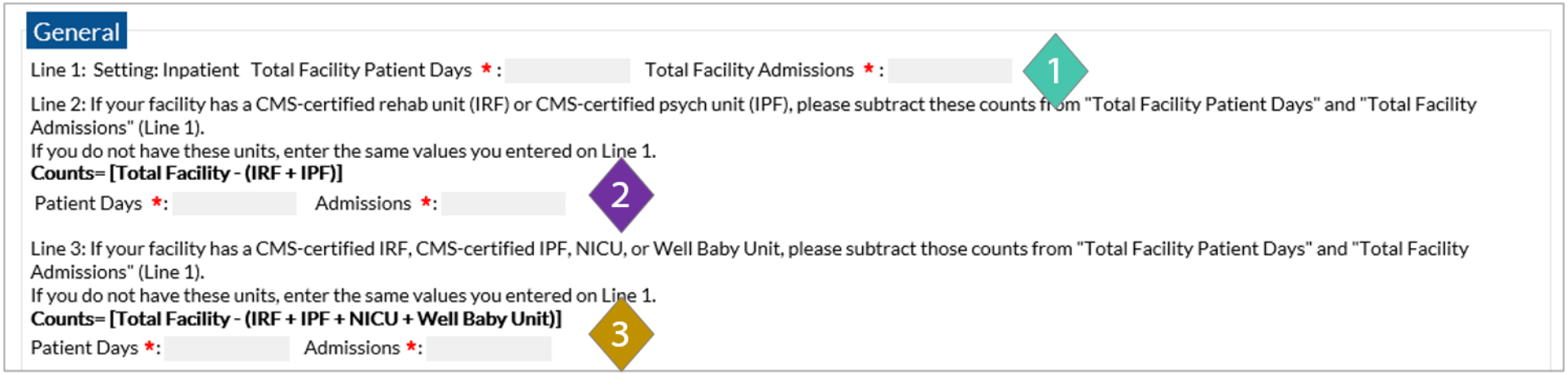
CDI Test Type Review



- Denominator forms (3rd month of the quarter: Mar, Jun, Sept, and Dec)
  - Soft alert
- Analysis > Reports > Advanced > Data Quality > CDI Test Method History

Year	Month	Source	cdiTestMeth	cdiTestMethOth	down grade
2018	.	Annual Hospital Survey	NAAT		
2018	3	MDRO/CDI FacWideIN Summary	NAAT		
2018	6	MDRO/CDI FacWideIN Summary	NAAT		
2018	9	MDRO/CDI FacWideIN Summary	GDHNAAT		
2018	12	MDRO/CDI FacWideIN Summary	EIA		Y

FacWideIN Denominator Form



- **Line 1:** Counts from all inpatient locations in the facility
- **Line 2:** Counts from all inpatient locations in the facility except CMS-certified Rehab and Psych units
- **Line 3:** Counts from all inpatient locations in the facility except CMS-certified Rehab and Psych units, NICUs, and well-baby units

Incorrect Data Entry

General

Line 1: Setting: Inpatient Total Facility Patient Days *: 550 Total Facility Admissions *: 240 (1)

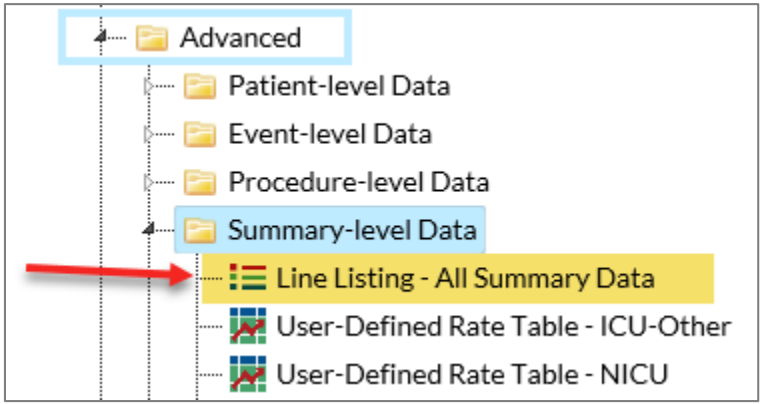
Line 2: If your facility has a CMS-certified rehab unit (IRF) or CMS-certified psych unit (IPF), please subtract these counts from "Total Facility Patient Days" and "Total Facility Admissions" (Line 1).
If you do not have these units, enter the same values you entered on Line 1.
Counts= [Total Facility - (IRF + IPF)]
Patient Days *: 3 Admissions *: 1 (2)

Line 3: If your facility has a CMS-certified IRF, CMS-certified IPF, NICU, or Well Baby Unit, please subtract those counts from "Total Facility Patient Days" and "Total Facility Admissions" (Line 1).
If you do not have these units, enter the same values you entered on Line 1.
Counts= [Total Facility - (IRF + IPF + NICU + Well Baby Unit)]
Patient Days *: 0 Admissions *: 0 (3)

- **Line 2** and **Line 3** refer to the total number of patient days & admissions based on <u>all patients</u> housed in inpatient locations (FacWideIN) in your facility, regardless of the patient's MDRO or *C. difficile* infection status

FacWideIN Data Quality Check

- Suspicious data entry: patient days or admissions on **Line 2** and/or **Line 3** < 25% of **Line 1**



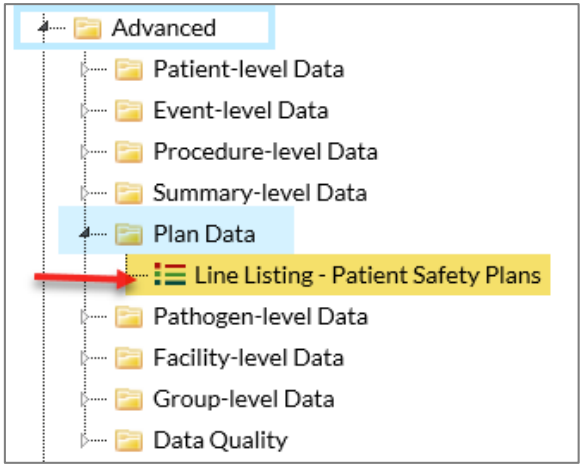
	FacWideIN denominator	Variable name
Line 1	Total facility patient days	numTotPayDays
	Total facility admissions	numTotAdm
Line 2	Patient days	numpatdays
	Admissions	numAdms
Line 3	Patient days	numCdifPatDays
	Admissions	numCdifAdm

Ensure Reporting for the Quarter is Complete

- Monthly reporting plan
- Review summary data
- Incomplete quarter review

3 months of reporting – MRPs

- Ensure FacWideIN, ED, & 24-hr observation units are included on monthly reporting plans for all 3 months
- Analysis folder: Advanced > Plan Data > Line Listing
  - Possible filters: mrsa_labID, mrsa_LabIDBld, cdif_labID

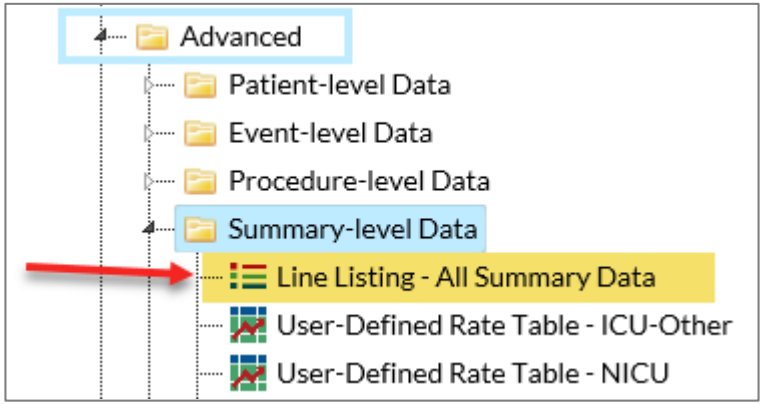


planYM	PSNoPlan	location	mrsa_labID	mrsa_labIDBld	cdif_labID
2018M10	N	ED	N	Y	Y
2018M10	N	FACWIDEIN	N	Y	Y
2018M11	N	ED	N	Y	Y
2018M11	N	FACWIDEIN	N	Y	Y
2018M12	N	ED	N	Y	Y
2018M12	N	FACWIDEIN	N	Y	Y

Note: Row shows unique location-month pair

3 months of reporting – Summary forms

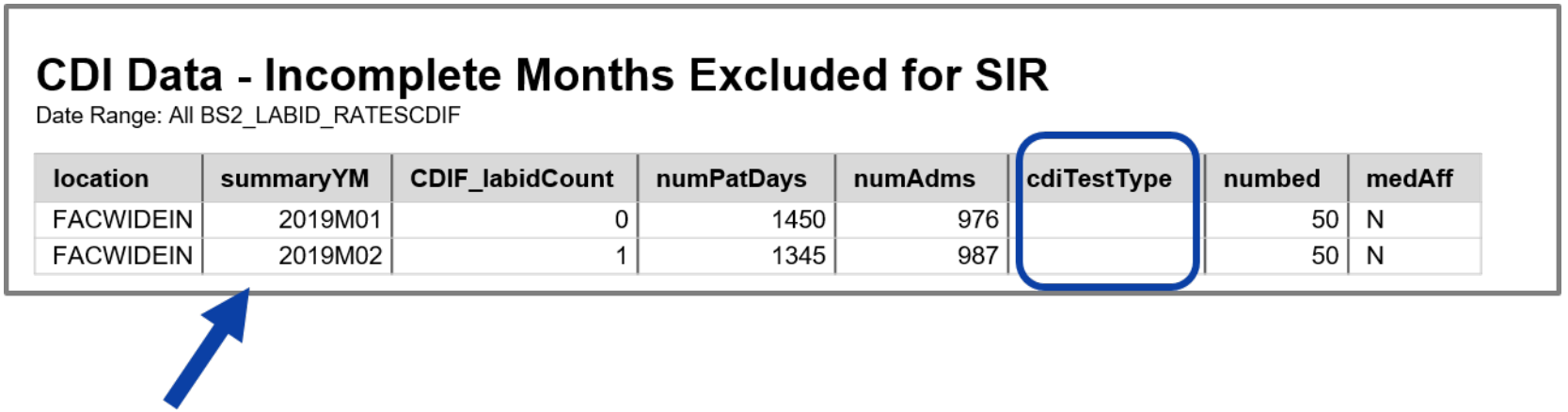
- Ensure FacWideIN, ED, & 24-hr observation units completed denominator forms for all 3 months
- Analysis folder: Advanced > Summary-level Data > Line Listing
  - Filter on SummaryType = MDRO
  - Review denominator values



summary YM	summary type	location	event type
2018M10	MDRO	ED	CDIF
2018M10	MDRO	FACWIDEIN	CDIF
2018M10	MDRO	ED	MRSA
2018M10	MDRO	FACWIDEIN	MRSA
2018M11	MDRO	ED	CDIF
2018M11	MDRO	FACWIDEIN	CDIF
2018M11	MDRO	ED	MRSA
2018M11	MDRO	FACWIDEIN	MRSA

Incomplete Months

- SIR report will first display the SIR table
- Scroll down to view supplemental table



CDI Data - Incomplete Months Excluded for SIR

Date Range: All BS2_LABID_RATESCDIF

location	summaryYM	CDIF_labidCount	numPatDays	numAdms	cdiTestType	numbed	medAff
FACWIDEIN	2019M01	0	1450	976		50	N
FACWIDEIN	2019M02	1	1345	987		50	N

Reviewing LabID Data Before Quarter is Complete

- Several ways to review monthly LabID data:
  - 1. SIR Reports: monthly counts of the SIR numerator and patient days
  - 2. Rate Tables: monthly HO and CO rates
  - 3. Frequency Table: # of events reported on each unit
  - 4. Summary Data Line List: patient days, admissions, CDI test type

- Refer to Appendix of this presentation for more details

location	summaryYM	CDIF_labidCount	numPred	numpatdays	SIR	SIR_pval	sir95ci
FACWIDEIN	2019M01	1	.	1450	.	.	.
FACWIDEIN	2019M02	0	.	1345	.	.	.
FACWIDEIN	2019M03	0	.	1402	.	.	.

Ex. of # 1

Conclusions

- LabID Rate tables are available on a monthly basis for all organisms in the MDRO Module
- LabID SIRs are available on a quarterly basis for MRSA & CDI, and are risk adjusted using several factors
- Not all events are included in the SIR numerator (MRSA/CDI Troubleshooting)
- Data quality
- Appendix (more topics!)

Thank you!

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

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

2019 NHSN Training
LabID Data Analysis in NHSN

APPENDIX:

- Reviewing data from incomplete quarters
- Additional information on CDI LabID SIRs in acute care hospitals
- LabID SIRs in other healthcare settings

Reviewing LabID Data Before Quarter is Complete

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 2019 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!"

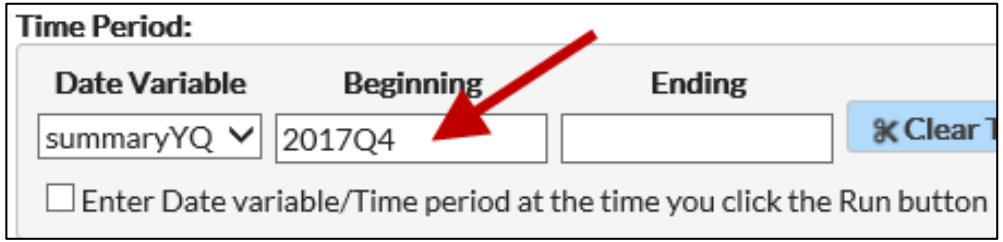
CDI SIR Report Before Quarter is Complete

- **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:
  - 1. Review supplemental SIR tables in the report (for incomplete quarters)
  - 2. Run monthly SIR report to view numerator and patient days
  - 3. Run monthly rate tables
  - 4. Review monthly numerator data (e.g., frequency tables)
  - 5. Review summary data line list

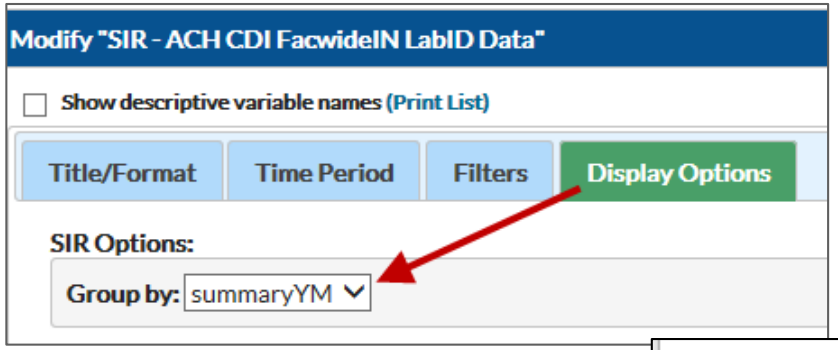
Option 1: Review Supplemental SIR Report Tables

- Keep the “Group by” option set to Summary**YQ**
- **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

Option 2: Adjust "Group by" to SummaryYM on the SIR Report



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

location	summaryYM	CDIF_facIncHOCount	numPred	numpatdays	SIR	SIR_pval	sir95ci
FACWIDEIN	2017M01	1	.	500	.	.	
FACWIDEIN	2017M02	0	.	450	.	.	
FACWIDEIN	2017M03	0	.	620	.	.	
FACWIDEIN	2017M04	1	.	234	.	.	
FACWIDEIN	2017M05	1	.	234	.	.	
FACWIDEIN	2017M06	1	.	234	.	.	

- Depending on your facility type, months from completed quarters will be shown

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_facIncHOCount**

Option 3: Run Monthly Rate Tables, continued

Rate Table for All MRSA LabID Events by Location
MDRO Bloodstream Infection - Inpatient MRSA BSI Admission Prevalence Rate

summaryYM	location	MRSA_admPrevBLDCount	numAdms	MRSA_PrevRate
2018M07	FACWIDEIN	1	1345	0.074
2018M08	FACWIDEIN	2	1233	0.162
2018M09	FACWIDEIN	1	1442	0.069
2018M10	FACWIDEIN	0	1301	0.000

- Review CO rate tables
- MRSA_admPrevBLDCount = MRSA blood admission prevalence rate

- Review HO rate tables
- MRSA_BSIIncDensRate = MRSA blood incidence density rate

Rate Table for All MRSA LabID Events by Location
MDRO Bloodstream Infection - Inpatient MRSA BSI Incidence Density Rate

summaryYM	location	MRSA_bldIncCount	numPatDays	MRSA_BSIIncDensRate
2018M07	FACWIDEIN	0	4304	0.000
2018M08	FACWIDEIN	1	3333	0.030
2018M09	FACWIDEIN	1	4290	0.023
2018M10	FACWIDEIN	0	6343	0.000

MRSA SIR numerator indicator

Options 4 and 5: Monthly Numerator Data and Summary Line List

- Review monthly numerator data (e.g., frequency table)

Table of specDateYM by onset				
	onset			
specDateYM	CO	CO-HCFA	HO	Total
2018M10	0 0.00	0 0.00	1 100.00	1
2018M11	0 0.00	0 0.00	2 100.00	2
2018M12	1 100.00	0 0.00	0 0.00	1

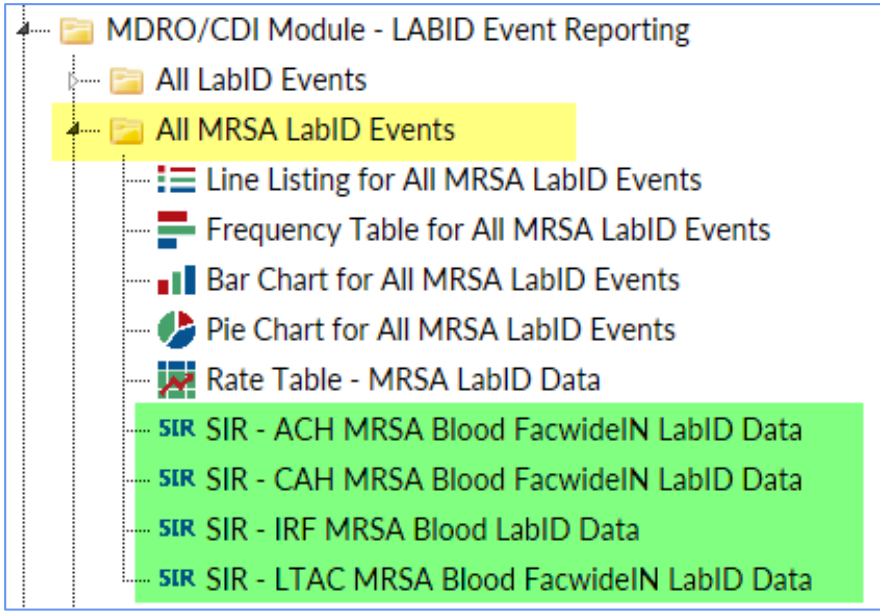
- Review monthly summary data line list

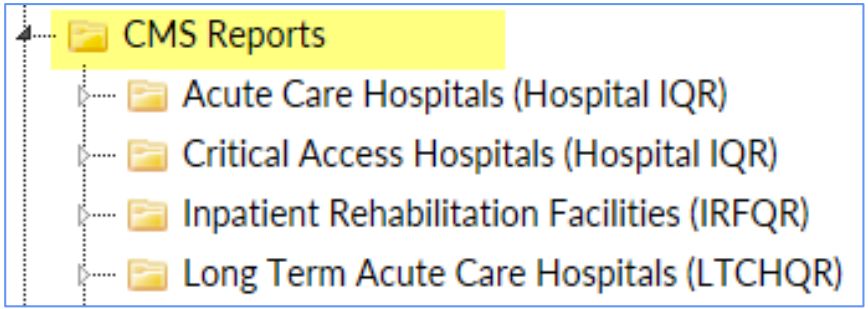
summaryYM	location	eventtype	numpatdays	cdiTestMeth	numAdms	numTotAdm	numTotPatDays	modifyDate	modifyUserID	createDate	createUserID	noEventsLabID
2018M12	FACWIDEIN	CDIF	500	NAAT	15	25	750	06FEB19:08:19	5929	29JAN19:13:43	22728	N
2018M12	FACWIDEIN	MRSA	500	NAAT	15	25	750	06FEB19:08:19	5929	29JAN19:13:43	22728	N

The Details: CDI LabID SIR Reports

LabID Event 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





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)

Number of Predicted Events: CDI in Acute Care Hospitals

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

7 Variables Used to Calculate Acute Care Hospital's # Predicted CDI Events
1. Inpatient community-onset prevalence rate
2. CDI test type
3. Medical school affiliation *(from annual survey)*
4. Number of ICU beds *(from annual survey)*
5. Total number of inpatient beds *(from annual survey)*
6. Facility type *(indicatedduring enrollment)*
7. Reporting CDI from an ED or 24 hr observation unit

Details on LabID SIR Risk Adjustment: https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/nhsn-sir-guide.pdf

Number of Predicted Events: CDI in Acute Care Hospitals

Table 2:

Risk Adjustment Factors for FacwideIN CDI SIR

As of: February 1, 2018 at 4:00 PM

summaryYQ	CDI_COprevRate	cdiTestType	numICUBeds	facType	numBeds	CDIF_EDOBSindicator	medType	numpatdays
2017Q1	0.000	NAAT	15	HOSP-GEN	50	0		1570

- 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

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, or 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

NHSN Variables: cdif_admPrevCOCount /numAdms * 100

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:

https://www.cdc.gov/nhsn/pdfs/cms/cms-ipps-cdi-sir.pdf

Example: Outlier Prevalence Rate

location	summaryYQ	months	CDIF_facIncHOCount	numPred	numpatdays	SIR	SIR_pval	sir95ci
FACWIDEIN	2017Q1	3	1	1.069	1570	0.935	1.0000	0.047, 4.612
FACWIDEIN	2017Q2	3	3	0.241	702	.	.	
FACWIDEIN	2017Q3	3	.	.	.	.	.	

- You will notice that all SIR data are missing for a quarter
- Scroll down in the SIR report – look for supplemental table

Table 3:

CDI Quarters with Outlier Prevalence Rate

As of: February 2, 2018 at 11:56 AM

Date Range: BS2_LABID_RATESCDIF summaryYQ 2017Q1 to 2017Q3

Location	Summary Yr/Qtr	CDIF CO Admission Prevalence LabID Count	Admissions	CDIF Facility CO Prevalence Rate
FACWIDEIN	2017Q3	3	1	300.000

CDI Specimens Collected in ED and Observation Units

- Used to determine which events are counted in the SIR numerator
- For example:
  - Patient has a positive CDI event in ED.
  - Patient is transferred to an inpatient unit. 10 days after admission, patient has a second positive CDI event.

✓ First CDI event in the ED will not be counted in the SIR

✓ Second CDI event occurred 10 days after admission

- Event will be labeled as “HO” on the CDI Line List
- Event will **NOT** be counted in the SIR (i.e., second event within 56 days)

Surveillance in ED/Observation Unit Impacts Risk Adjustment (# predicted)

- Indicator variable included in risk adjustment
- "For this quarter, is the facility reporting CDI LabID data from an ED or 24 hour observation location?" (Yes/No)
  - Baseline analysis found facilities with these locations had more HO CDI events compared to facilities without
- For data quality: If you have an ED/24 hr observation location, make sure it is mapped and included in LabID surveillance efforts
- If facility does not have an ED/24 hr observation location, will still receive risk adjustment from the other variables in the model

NHSN Location Mapping Definitions: https://www.cdc.gov/nhsn/pdfs/pscmanual/15locationsdescriptions_current.pdf

Other Healthcare Settings

CDI Event Line List SIR Indicator Variables

Facility Type	CDI SIR Indicator
Acute Care Hospital	FWCDIF_facIncHOCount
CMS-certified Inpatient Rehabilitation (IRF) unit located within a hospital	CDIF_IRFIncCount
Critical Access Hospital	FWCDIF_facIncHOCount
Long-term Acute Care Hospital	FWCDIF_facIncHOCount
Free-standing Inpatient Rehab Facility	FWCDIF_facIncHOCount

- Use these variables to determine which events on the line lists are counted in the SIR numerator
  - 1 = counted in SIR numerator
  - 0 = not counted in SIR numerator

MRSA Event Line List SIR Indicator Variables

Facility Type	MRSA SIR Indicator
Acute Care Hospital	FWMRSA_bldIncCount
CMS-certified Inpatient Rehabilitation (IRF) unit located within a hospital	MRSA_IRFbldIncCount
Critical Access Hospital	FWMRSA_bldIncCount
Long-term Acute Care Hospital	FWMRSA_bldIncCount
Free-standing Inpatient Rehab Facility	FWMRSA_bldIncCount

- Use these variables to determine which events on the line lists are counted in the SIR numerator
  - 1 = counted in SIR numerator
  - 0 = not counted in SIR numerator

Critical Access Hospital (CAH): CDI SIR

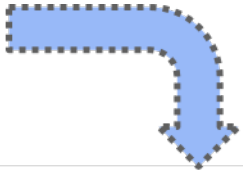
- Available for facilities enrolled in NHSN as “HOSP-CAH”
- SIR numerator: incident, healthcare-facility onset events
- Risk adjustment used for # predicted events:
  - Inpatient Community-Onset Prevalence Rate
    - # Inpatient CO CDI events / # Admissions * 100
    - 2 categories for risk adjustment:
      - 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)	
Parameter	**Parameter Estimate**
*Intercept**	*-10.7795*

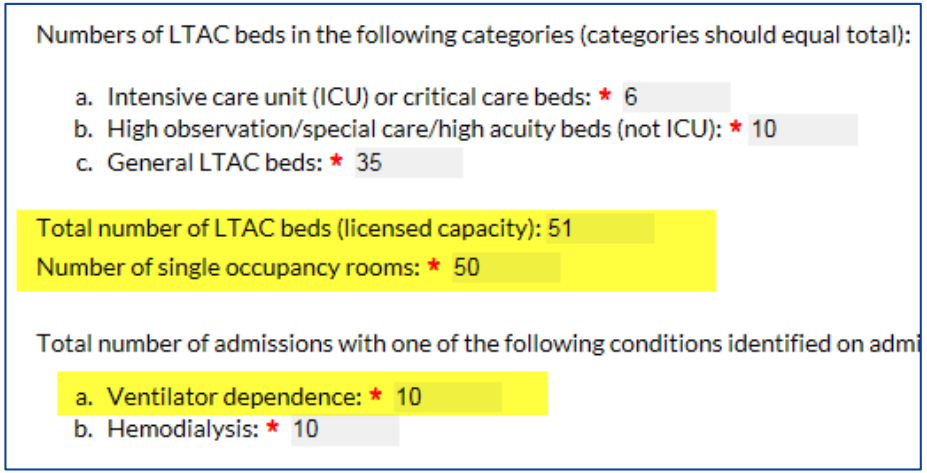


Formula for manual calculation:

predicted = [exp (-10.7795)] * patient days

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.

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 traumatic and non-traumatic spinal cord dysfunction (*annual survey)*
  - Percent of admissions with stroke (*annual survey)*

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