LabID Event Analysis and Reporting Refresher

Sunny Xu, MPH

NHSN Acute Care Analytics Team

March 2023

Objectives

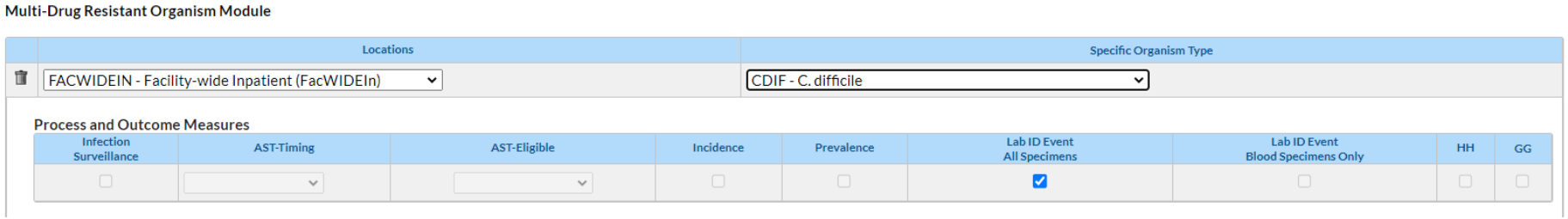
- At the end of the presentation, participants will be able to
  - Identify best practices before running analysis reports
  - Identify the LabID event analysis report options
  - Describe the risk adjustment factors used in the LabID SIRs (Acute Care Hospitals)
  - Define which LabID events contribute to the SIR numerators

Prior to Analysis

- ❑ MDRO/CDI organism selected on the monthly reporting plan(s)
- ❑ Alerts dashboard
- ❑ Generate data sets
- ❑ Consider report modifications

Monthly Reporting Plan (MRP)

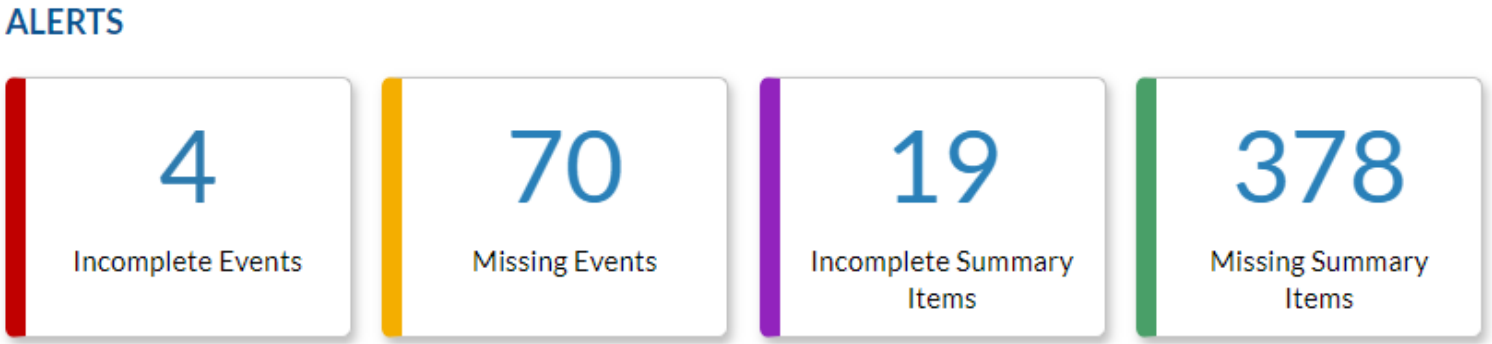
- Only in-plan data receives NHSN Alerts
- Complete quarterly data is needed to calculate certain LabID metrics
- Only in-plan data is included in CMS Reports



Read more about MRPs: https://www.cdc.gov/nhsn/pdfs/pscmanual/3psc_monthlyreportingplancurrent.pdf

Alerts

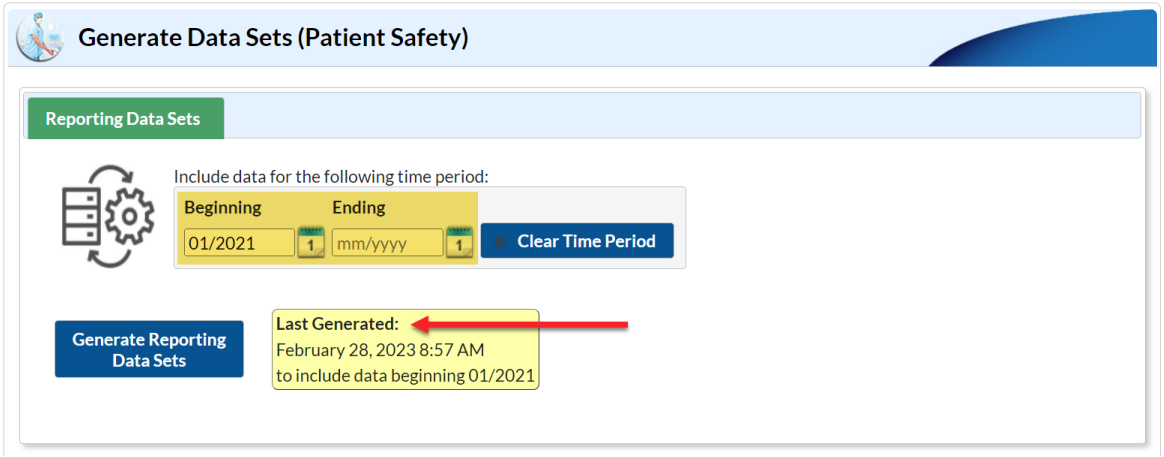
- Incomplete or Missing Events
- Incomplete or Missing Summary Items
- Confirm CDI Test Type



Read more about resolving alerts: https://www.cdc.gov/nhsn/pdfs/gen-support/nhsn-alerts.pdf

Generate Data Sets

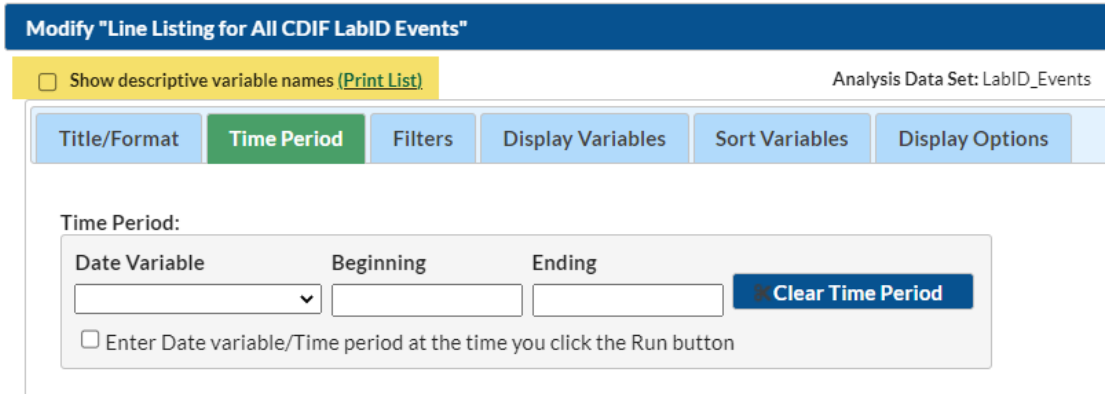
- Verify “Beginning” and “Ending” time period
- Verify “Last Generated” timestamp
- Note: The data set generation process will include *all LabID events* (necessary for accurate event categorizations)



Read more about data set generation: https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/generatedatasets-psc-508.pdf

Modify Screen

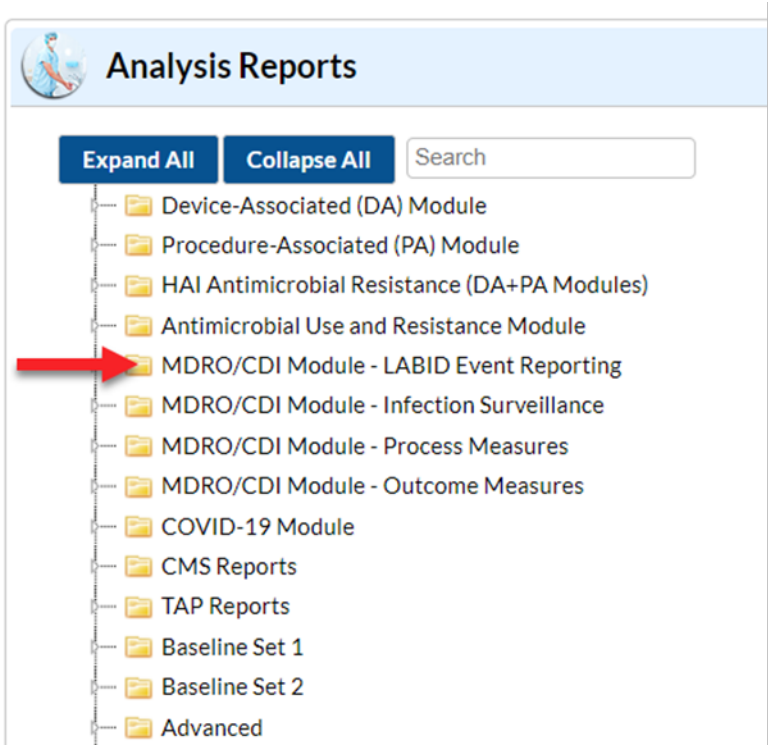
- Consider report modifications for
  - Time period
  - Filter by a certain variable
  - Display additional variables
  - Show descriptive variable names

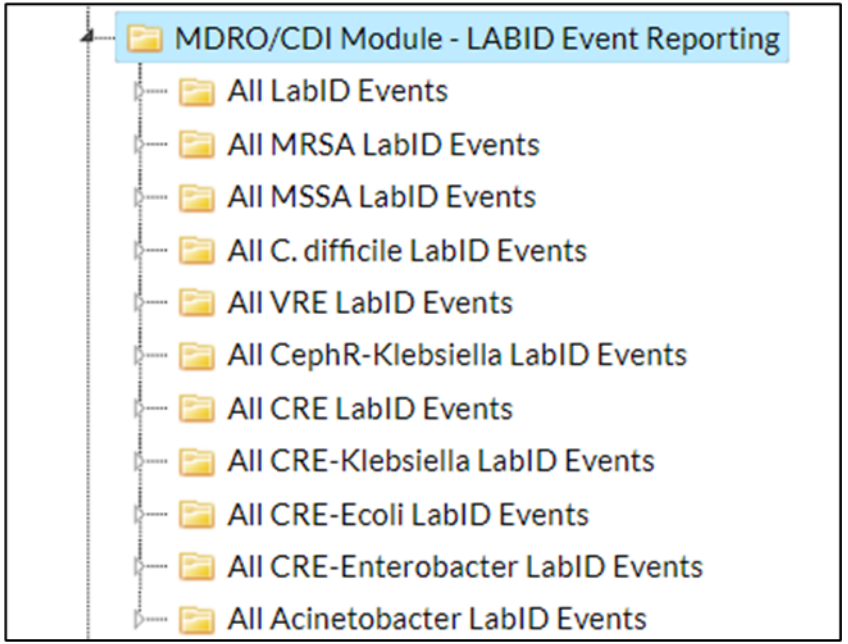


Read more about modifying reports: https://www.cdc.gov/nhsn/pdfs/analysis/how2view-create-modify-dates-in-nhsn.pdf

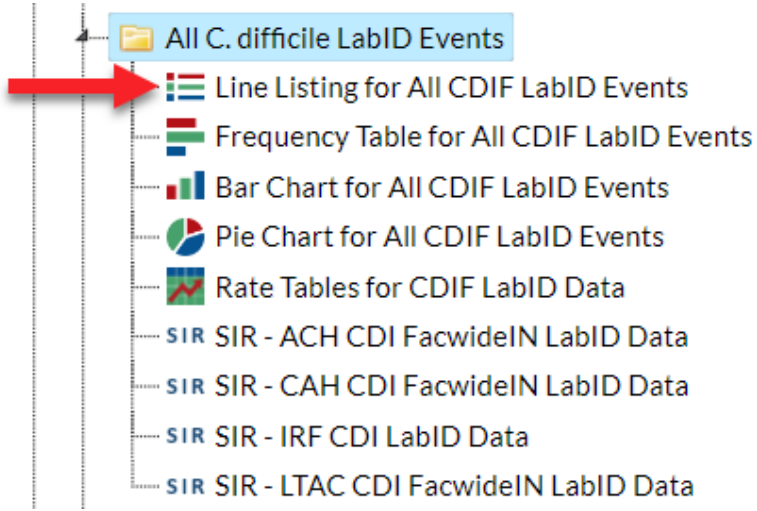
Analysis Reports

Analysis Folders



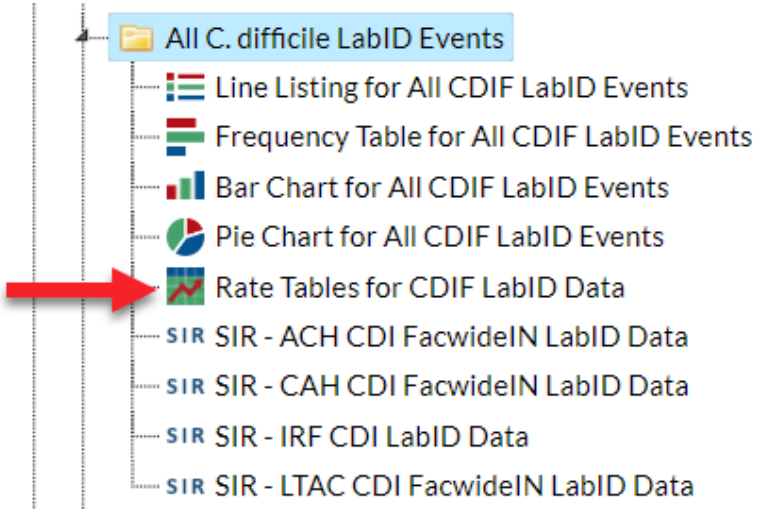


Line Listings



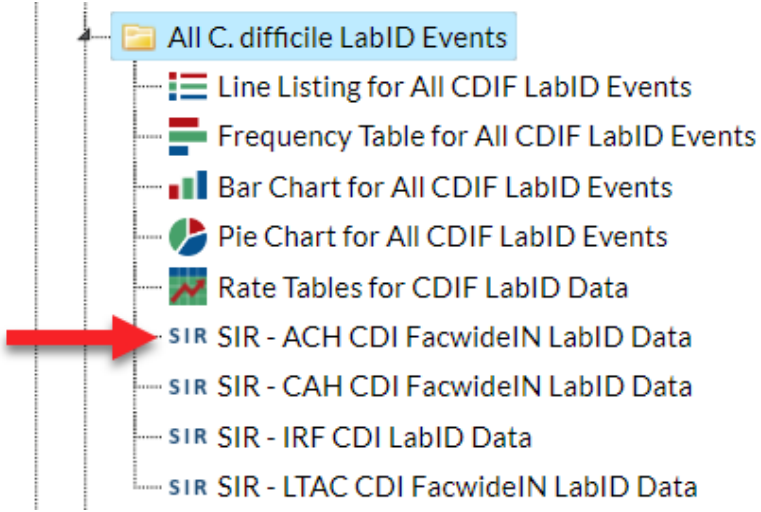
- Provides event level details
- Contains all LabID events reported for the organism
- Use to review NHSN event categorizations
- Identify which events are counted in the SIR
- Easy to modify and customize

Rate Tables

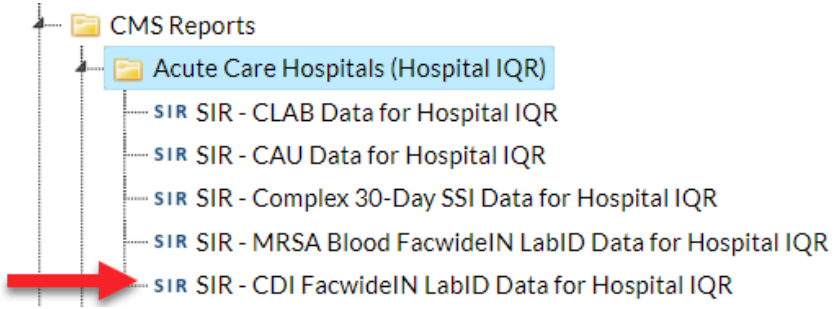


- Review healthcare-onset and community-onset rates
- Location-specific rates can be calculated if location-specific denominator records are entered
- Rates can be calculated by month, quarter, half-year, or year

SIR Reports (Non-CMS and CMS)



- SIR reports under **organism-specific folder** include all data
- SIR reports under **CMS Reports** folder only include in-plan data
  - Title of CMS SIR report indicates “for Hospital IQR”



Standardized Infection Ratio

CDI LabID Example

LabID Event SIRs

- "How does CDI (or MRSA bacteremia) 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

Example CDI SIR Report: 2022 Q1

SIR for CDI FacwideIN LabID in Acute Care Hospital (2015 baseline)

As of: February 28, 2023 at 7:14 PM

Date Range: BS2_LABID_RATESCDIF summaryYr After and Including 2015

orgID=10401 medType=M

orgID	ccn	location	summaryYQ	months	CDIF_facIncHOCount	numPred	numpatdays	SIR	SIR_pval	sir95ci	SIR_pctl
10401	999999	FACWIDEIN	2022Q1	3	1	1.227	1341	0.815	0.9460	0.041, 4.019	83

- Months: **3**
- SIR numerator (CDIF_facIncHOCount): **1**
- SIR denominator (numPred): **1.227**
- Total CDI patient days for the quarter (numpatdays): **1,341**
- SIR: 1 / 1.227 = **0.815**

Fictitious data used for illustrative purposes only.

Example CDI SIR Report: 2022 Q1

SIR for CDI FacwideIN LabID in Acute Care Hospital (2015 baseline)

As of: February 28, 2023 at 7:14 PM

Date Range: BS2_LABID_RATESCDIF summaryYr After and Including 2015

orgID=10401 medType=M

orgID	ccn	location	summaryYQ	months	CDIF_facIncHOCount	numPred	numpatdays	SIR	SIR_pval	sir95ci	SIR_pctl
10401	999999	FACWIDEIN	2022Q1	3	1	1.227	1341	0.815	0.9460	0.041, 4.019	83

- P-value is > 0.05
- The 95% confidence interval (CI) includes 1
    - (0.041 – 4.019)
- SIR is not statistically significant

Fictitious data used for illustrative purposes only.

What if numPred < 1?

- SIR, p-value, and 95% CI would be blank
- 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

SIR Denominator

CDI LabID Example (Acute Care Hospital)

How is the predicted # of CDI Events calculated?

- Negative binomial regression models were created using 2015 national data
  - CDI: 7 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 CDI SIR

As of: February 28, 2023 at 7:14 PM

Date Range: BS2_LABID_RATESCDIF summaryYr After and Including 2015

orgID=10401 medType=M

orgID	ccn	summaryYQ	CDI_COprevRate	cdiTestType	numICUBeds	facType	numBeds	CDIF_EDOBSindicator	medType	numpatdays
10401	999999	2022Q1	0.662	NAAT	75	HOSP-GEN	225	1	M	1341

Fictitious data used for illustrative purposes only.

CDI Risk Factors for 2022Q1

Risk Adjustment Factors for FacwideIN CDI SIR

As of: February 28, 2023 at 7:14 PM

Date Range: BS2_LABID_RATESCDIF summaryYr After and Including 2015

orgID=10401 medType=M

orgID	ccn	summaryYQ	CDI_COprevRate	cdiTestType	numICUBeds	facType	numBeds	CDIF_EDOBSindicator	medType	numpatdays
10401	999999	2022Q1	0.662	NAAT	75	HOSP-GEN	225	1	M	1341

- Inpatient community-onset prevalence rate (CDI_COprevRate)

$$\frac{\#\ inpatient\ CO\ CDI\ events}{total\ \#\ admissions\ (quarter)} x\ 100$$

Fictitious data used for illustrative purposes only.

CDI Risk Factors for 2022Q1

Risk Adjustment Factors for FacwideIN CDI SIR

As of: February 28, 2023 at 7:14 PM

Date Range: BS2_LABID_RATESCDIF summaryYr After and Including 2015

orgID=10401 medType=M

orgID	ccn	summaryYQ	CDI_COprevRate	cdiTestType	numICUBeds	facType	numBeds	CDIF_EDOBSindicator	medType	numpatdays
10401	999999	2022Q1	0.662	NAAT	75	HOSP-GEN	225	1	M	1341

Collected on annual facility survey and during NHSN enrollment:

- # of ICU beds (numICUBeds)
- Facility type (facType)
- Facility bed size (numBeds)
- Medical school affiliation (medType)

Fictitious data used for illustrative purposes only.

CDI Risk Factors for 2022Q1

Risk Adjustment Factors for FacwideIN CDI SIR

As of: February 28, 2023 at 7:14 PM

Date Range: BS2_LABID_RATESCDIF summaryYr After and Including 2015

orgID=10401 medType=M

orgID	ccn	summaryYQ	CDI_COprevRate	cdiTestType	numICUBeds	facType	numBeds	CDIF_EDOBSindicator	medType	numpatdays
10401	999999	2022Q1	0.662	NAAT	75	HOSP-GEN	225	1	M	1341

- ED/OBS indicator variable (CDIF_EDOBSindicator)
  - 1 = your facility has mapped ED or 24-hour Observation unit(s), included in your facility's monthly reporting plan for LabID events, and have appropriate outpatient LabID data reported

Fictitious data used for illustrative purposes only.

CDI Risk Factors for 2022Q1

Risk Adjustment Factors for FacwideIN CDI SIR

As of: February 28, 2023 at 7:14 PM

Date Range: BS2_LABID_RATESCDIF summaryYr After and Including 2015

orgID=10401 medType=M

orgID	ccn	summaryYQ	CDI_COprevRate	cdiTestType	numICUBeds	facType	numBeds	CDIF_EDOBSindicator	medType	numpatdays
10401	999999	2022Q1	0.662	NAAT	75	HOSP-GEN	225	1	M	1341

- Patient days are collected on the FacWideIN denominator form and summed for the quarter (numpatdays)
- CDI test type is collected on the FacWideIN denominator form on the 3rd month of the quarter (cdiTestType)

Fictitious data used for illustrative purposes only.

FacWideIN Denominator Form

Location Code *: FACWIDEIN - Facility-wide Inpatient (FacWIDEIn)
Month *: March
Year *: 2022

General

Line 1: Setting: Inpatient Total Facility Patient Days * : 500 Total Facility Admissions * : 200

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 *: 476 Admissions *: 189

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 *: 455 Admissions *: 163

CDI SIR patient days

CDI prevalence rate denominator

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 *
GDHEIA - GDH plus EIA for toxin, followed by NAAT for discrepant results

CDI Test Type

Fictitious data used for illustrative purposes only.

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

SIR Numerator

CDI LabID Example (Acute Care Hospital)

Which LabID Events are Counted in FacWideIN SIR Numerator?

- ***C. difficile* (CDI):**
  - Inpatient units only, *excluding* Rehab & Psych units with unique CCN
  - Healthcare Facility-Onset (HO)
  - Incident
- MRSA Bacteremia:
  - Blood specimens from inpatient units, *excluding* Rehab & Psych units with unique CCN
  - Healthcare Facility-Onset (HO)
  - No positive MRSA bacteremia event in the previous 14 days in any location

CDI Line Listing for 2022Q1

patID	eventID	spcOrgType	location	onset	cdiAssay	admitDate	locationAdmitDate	specimenDate	FWCDIF_facIncHOCount	FWCDIF_admPrevCOCount
2323	110902	CDIF	ICU	CO	INCIDENT	03/03/2022	03/03/2022	03/04/2022	0	1
3425	110903	CDIF	MED	CO	INCIDENT	03/07/2022	03/07/2022	03/08/2022	0	1
870	110900	CDIF	ICU	HO	INCIDENT	03/13/2022	03/13/2022	03/16/2022	1	0
8787	110901	CDIF	MED	CO	INCIDENT	03/30/2022	03/30/2022	03/30/2022	0	1

- onset
  - Categorized by NHSN
  - Based on
    - location of specimen collection
    - date admitted to facility
    - date of specimen collection
    - previous discharge

Fictitious data used for illustrative purposes only.

CDI Line Listing for 2022Q1

patID	eventID	spcOrgType	location	onset	cdiAssay	admitDate	locationAdmitDate	specimenDate	FWCDIF_facIncHOCount	FWCDIF_admPrevCOCount
2323	110902	CDIF	ICU	CO	INCIDENT	03/03/2022	03/03/2022	03/04/2022	0	1
3425	110903	CDIF	MED	CO	INCIDENT	03/07/2022	03/07/2022	03/08/2022	0	1
870	110900	CDIF	ICU	HO	INCIDENT	03/13/2022	03/13/2022	03/16/2022	1	0
8787	110901	CDIF	MED	CO	INCIDENT	03/30/2022	03/30/2022	03/30/2022	0	1

- onset
  - **Community-Onset (CO):** outpatient event and no previous discharge in 4 weeks OR inpatient event on HD1 [day of admission], HD2 or HD3
  - **Community-Onset Healthcare Facility-Associated (CO-HCFA):** outpatient or inpatient event and *with* previous discharge in 4 weeks
  - **Healthcare Facility-Onset (HO):** inpatient event on or after HD4

Fictitious data used for illustrative purposes only.

CDI Line Listing for 2022Q1

patID	eventID	spcOrgType	location	onset	cdiAssay	admitDate	locationAdmitDate	specimenDate	FWCDIF_facIncHOCount	FWCDIF_admPrevCOCount
2323	110902	CDIF	ICU	CO	INCIDENT	03/03/2022	03/03/2022	03/04/2022	0	1
3425	110903	CDIF	MED	CO	INCIDENT	03/07/2022	03/07/2022	03/08/2022	0	1
870	110900	CDIF	ICU	HO	INCIDENT	03/13/2022	03/13/2022	03/16/2022	1	0
8787	110901	CDIF	MED	CO	INCIDENT	03/30/2022	03/30/2022	03/30/2022	0	1

- cdiAssay
  - Assigned by NHSN
  - Based on event specimen collection dates (current and prior)

Fictitious data used for illustrative purposes only.

CDI Line Listing for 2022Q1

patID	eventID	spcOrgType	location	onset	cdiAssay	admitDate	locationAdmitDate	specimenDate	FWCDIF_facIncHOCount	FWCDIF_admPrevCOCount
2323	110902	CDIF	ICU	CO	INCIDENT	03/03/2022	03/03/2022	03/04/2022	0	1
3425	110903	CDIF	MED	CO	INCIDENT	03/07/2022	03/07/2022	03/08/2022	0	1
870	110900	CDIF	ICU	HO	INCIDENT	03/13/2022	03/13/2022	03/16/2022	1	0
8787	110901	CDIF	MED	CO	INCIDENT	03/30/2022	03/30/2022	03/30/2022	0	1

- cdiAssay
  - **Incident:** positive specimen obtained more than 56 days after the most recent CDI LabID Event for that patient
  - **Recurrent:** specimen obtained more than 14 days and less than or equal to 56 days after the most recent CDI LabID Event for that patient
  - **Blank:** collected less than or equal to 14 days after the most recent CDI LabID event for that patient

Fictitious data used for illustrative purposes only.

CDI Line Listing for 2022Q1

patID	eventID	spcOrgType	location	onset	cdiAssay	admitDate	locationAdmitDate	specimenDate	FWCDIF_facIncHOCount	FWCDIF_admPrevCOCount
2323	110902	CDIF	ICU	CO	INCIDENT	03/03/2022	03/03/2022	03/04/2022	0	1
3425	110903	CDIF	MED	CO	INCIDENT	03/07/2022	03/07/2022	03/08/2022	0	1
870	110900	CDIF	ICU	HO	INCIDENT	03/13/2022	03/13/2022	03/16/2022	1	0
8787	110901	CDIF	MED	CO	INCIDENT	03/30/2022	03/30/2022	03/30/2022	0	1

- Indicator variables
  - **FWCDIF_facIncHOCount**
    - 1 = event is counted in the numerator of the CDI SIR
  - **FWCDIF_admPrevCOCount**
    - 1 = event is counted in the numerator of the CDI inpatient CO prevalence rate

Fictitious data used for illustrative purposes only.

Additional Resources

- MRSA/CDI Troubleshooting guide: https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/mrsacdi_tips.pdf
- SIR guide: https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/nhsn-sir-guide.pdf
- CMS MRSA SIR report guide (ACH): https://www.cdc.gov/nhsn/pdfs/cms/cms-ipps-mrsa-sir.pdf
- CMS CDI SIR report guide (ACH): https://www.cdc.gov/nhsn/pdfs/cms/cms-ipps-cdi-sir.pdf

Thank You!

For any questions or concerns,
contact the NHSN Helpdesk at nhsn@cdc.gov

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.

Extra Slides: CDI Test Type

NAAT-level risk adjustment:

- NAAT (nucleic acid amplification test, including PCR)
- GDH plus NAAT (2-step algorithm)
- GDH plus EIA for toxin, followed by NAAT for discrepant results

EIA-level risk adjustment:

- Enzyme immunoassay (EIA) for toxin
- GDH antigen plus EIA for toxin (2-step algorithm)
- NAAT plus EIA, if NAAT positive*

OTHER- level risk adjustment:

- Cell cytotoxicity neutralization assay
- Toxigenic culture (CDI culture followed by detection of toxins)
- "Other"

Read more: https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/mrsacdi_tips.pdf

Extra Slides: ACH CDI model from SIR guide

Table 1. CDI in Acute Care Hospitals

Parameter	Parameter Estimate	Standard Error	P-value
Intercept	*-8.9463*	*0.0523*	*<0.0001*
Inpatient community-onset prevalence rate*	0.7339	0.0181	<0.0001
CDI test type⁺: EIA	-0.1579	0.0246	<0.0001
CDI test type⁺: NAAT	0.1307	0.0219	<0.0001
CDI test type⁺: OTHER	REFERENT	-	-
Medical school affiliation‡: Major, graduate, or undergraduate	0.0331	0.0111	0.0028
Medical school affiliation‡: Non-teaching	REFERENT	-	-
Number of ICU beds‡: ≥ 43	0.7465	0.0412	<0.0001
Number of ICU beds‡: 20- 42	0.7145	0.0395	<0.0001
Number of ICU beds‡: 10-19	0.6261	0.0396	<0.0001
Number of ICU beds‡: 5-9	0.4394	0.0420	<0.0001
Number of ICU beds‡: 0-4	REFERENT	-	-
Facility type: Oncology Hospital *(HOSP-ONC)*	1.2420	0.0765	<0.0001
Facility type: General Acute Care Hospital *(HOSP-GEN)*	0.3740	0.0342	<0.0001
Facility type: Other Specialty Hospital	REFERENT	-	-
Facility bed size‡	0.0003	0.0000	<0.0001
Reporting from ED or 24-hour observation unit^: YES	0.1119	0.0179	<0.0001
Reporting from ED or 24-hour observation unit^: NO	REFERENT	-	-

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