Introduction to the NHSN Adjusted Ranking Metric (ARM)

Kevin Kennedy, Statistics Team

Ruth Kallay, Acute Care Analytics Team

Presented on behalf of the NHSN Team, DHQP, NCEZID, CDC

June 24, 2025

What you need to know before we begin

- **This webinar is designed to deepen your understanding of the ARM rankings, helping you effectively interpret and apply these concepts in your healthcare facility**

- **Prerequisites:**
  - A working understanding of the Standard Infection Ratio (SIR), including its purpose and calculation

- **Resource to review:**
  - ARM | Analysis Resources | NHSN | CDC

Disclaimers and Disclosures

- **This presentation does not include Patient Health or Identifiable Information (PHI/PII) data**
  - Images of fictitious data and facility information are for illustrative purposes only and do not represent actual NHSN data

- **The ARM dashboard is only available to acute care hospitals (ACHs) in NHSN at this time**
  - Not available for NHSN Groups

- **The ARM rankings use the same 2022 baseline as the updated SIRs**

Objectives

At the end of this presentation, participants will be able to:

- Define what is the Adjusted-Ranking Metric (ARM), and how it compares to the Standard Infection Ratio (SIR)

- Locate and interpret rankings in the new ARM dashboard
    - Navigate to the ARM dashboard in the NHSN application and identify parts of the dashboard
    - Interpret ARM percentile rankings with examples
    - Understand why a facility may have "Numerator Only" or "No Data" instead of an ARM ranking

Plan for Today

1. Kevin will present the **adjusted ranking metric model**, discuss **statistical methods** for developing the ARM score and rankings, and will provide a **comparison with the SIR**

2. Ruth will then show how the **ARM rankings** will be presented in the dashboard in the NHSN application, how to **interpret your rankings**, and what **special scenarios** might exist

3. **Q&A** at the end for both presenters, although participants are encouraged to submit questions to the Q&A box throughout the presentation

Kevin Kennedy

Statistics Team, NHSN

SIR and ARM: What is it?

Standardized Infection Ratio (SIR)

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

SSIs reported to NHSN

Calculated by CDC

- When # of observed SSIs is greater than the # predicted, the SIR will be greater than 1

$$\frac{5\ observed\ SSIs}{3.2\ predicted\ SSIs} = SIR\ of\ \mathbf{1.6}$$

- If # observed SSIs is less than # predicted, the SIR will be less than 1
- P-values and 95% confidence intervals (CI) provide information about statistical significance
- Review the 2022 Baseline SIR Guide and the Statistics Calculator for more information
  - NHSN's Statistics Calculator
    - https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/statscalc.pdf
  - NHSN's Guide to the 2022 Baseline SIRs
    - https://www.cdc.gov/nhsn/2022rebaseline/analysis-resources.html

Adjusted Ranking Metric (ARM)

$$\text{ARM} = \frac{Reliability\ Adjusted\ Outcomes}{\#\ of\ Predicted\ Outcomes}$$

Calculated by CDC

Calculated by CDC

- **Similar interpretation of the ratio**
  - **ARM<1 means Fewer outcomes than predicted**
  - **ARM>1 means More outcomes than predicted**

- **The Numerator is now model derived instead of a "count", this allows for fractional (decimal) values in the numerator**

What is "Reliability" adjusted?

- Not all hospitals have the same exposure to an HAI. Some hospitals have large volumes others have small.

- In the below example, the 2nd hospital has 5 times the volume of the 1st. Hence, the 2nd hospital has a more "reliable" measure of HAI rate.

Hospital ID	Number of Procedures	Observed Number of SSI	Predicted Number of SSI
*****	82	0	1.007
*****	553	0	5.548

* Magnitude real, but numbers fictitious

- The ARM will account for this difference in exposure!

Does anyone else use Reliability adjusted measures?

- **Yes!**
- **CMS started reporting ARM-type measures in 2012 for their Hospital Readmission Reduction Program (HRRP)**
- **Recommended by the Committee of Presidents of Statistical Societies (COPSS)**
- **Other large hospital data registries also report ARM type measures**

Hospital Readmissions Reduction Program (HRRP)

The Hospital Readmissions Reduction Program (HRRP) is a Medicare value-based purchasing program that, for example, encourages hospitals to improve communication and care coordination to better engage patients and caregivers in discharge plans and, in turn, reduce avoidable readmissions. The program supports the national goal of improving health care for Americans by linking payment to the quality of hospital care.

Section 1886(q) of the Social Security Act sets forth the statutory requirements for HRRP, which required the Secretary of the U.S. Department of Health and Human Services to reduce payments to subsection (d) hospitals for excess readmissions beginning October 1, 2012 (that is, fiscal year [FY] 2013). In addition, the 21st Century Cures Act directs CMS to assess a hospital's performance relative to other hospitals with a similar proportion of beneficiaries who are dually eligible for Medicare and full Medicaid benefits beginning in FY 2019. The legislation requires estimated payments under the peer grouping methodology (that is, FY 2019 and onward) equal payments estimated under the non-peer grouping methodology (that is, FY 2013 to FY 2018) to maintain budget neutrality.

Prospective Payment Systems
- Home Health Agency (HHA) Center
- HIPPS Codes
- Provider Specific Data for Public Use in Text Format
- Provider Specific Data for Public Use in SAS Format
- Historical Provider Specific Data for Public Use File in CSV Format

https://www.cms.gov/medicare/payment/prospective-payment-systems/acute-inpatient-pps/hospital-readmissionsreduction-program-hrrp

SIR and ARM: How do they Compare?

Major Difference 1: ZERO's

- **The numerator in the SIR is a "count". Meaning ZERO is a plausible value. An observed count of zero will give a SIR=0 every time.**

- **The numerator in the ARM is "derived". Zero _CAN NOT_ be a value for Reliability-Adjusted outcomes, hence the ARM will never be ZERO.**

Histogram of SIR (CDI 2022)

Hospitals with Zero HAIs
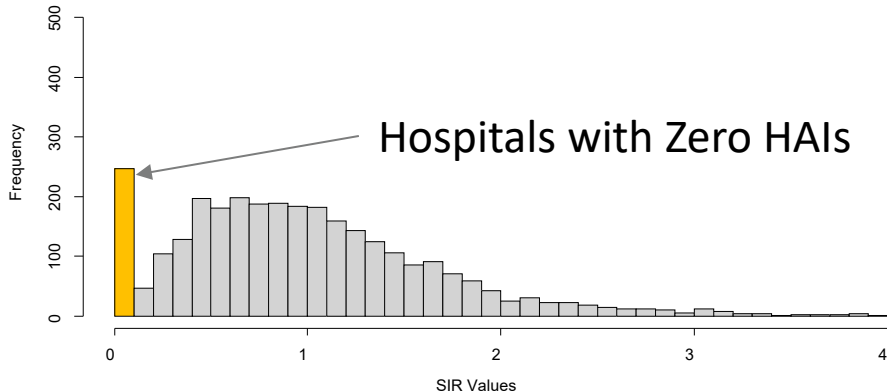
Histogram of ARM (CDI 2022)
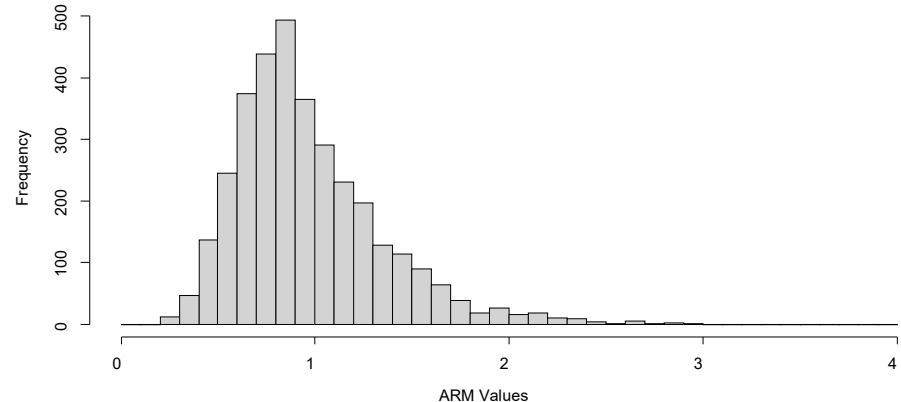
What happens to the many SIR=0's?

- **Many of the hospitals with zero HAIs (SIR=0) are low exposure hospitals**
- **The more <u>exposure</u> a hospital has the less it gets shrunk with the ARM (Low Exposure=High Shrinkage, High Exposure=Low Shrinkage)**

Hospital ID	Number of Patient Days (CDI)	Observed Number of CDI	Predicted Number	SIR	ARM
*****	7829	0	1.06	0	0.82
*****	69499	0	26.3	0	0.20

- **The 2nd hospital has 20x the exposure as the first, but they both have ZERO CDI events, and therefore both have a ZERO SIR**
- **The ARM "shrinks" the 1st substantially toward the middle but shrinks the 2nd more modestly**

Major Difference 2: Extreme Outliers

- **The SIR can also show extreme outliers, however the same principle of low exposure hospitals getting "shrunk" to the middle still applies (it works both ways!)**

Hospital ID	Number of Patient Days (CDI)	Observed Number of CDI	Predicted Number	SIR	ARM
*****	8711	4	1.12	3.58	1.66
*****	14741	19	4.8	3.99	2.92

Putting it all together

- **Below shows a scatter plot of ARM (y-axis) vs SIR (x-axis), it shows both the effect of the ZEROs and Large outliers**
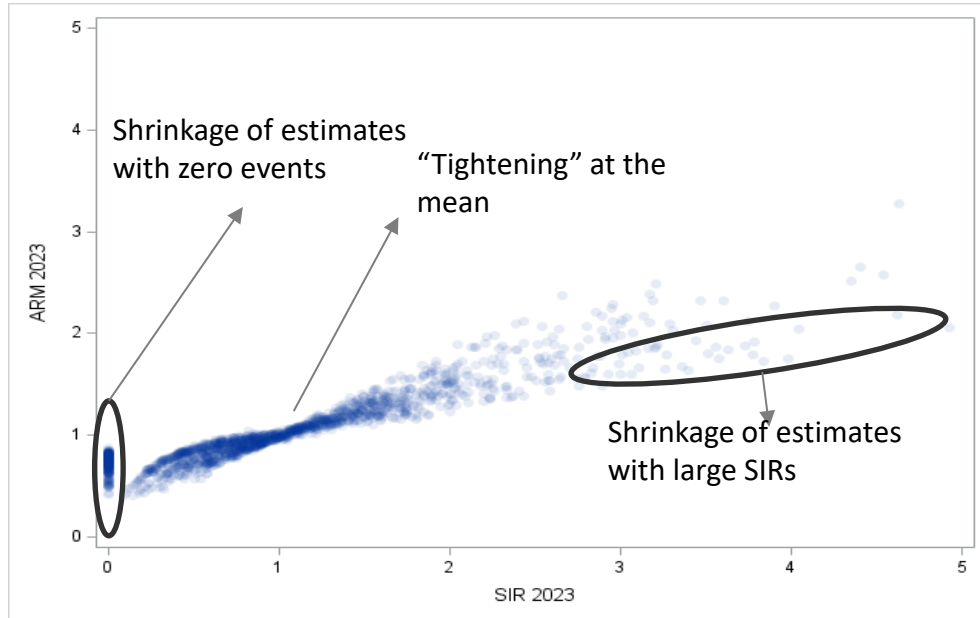
ARM and SIR: Pressing Questions

Pressing Questions

- **Do we need both measures?**
  - Yes! The SIR and ARM can and should co-exist in a complimentary way.
  - The SIR will still be the preferred metric for tracking HAIs over time. Also, the SIR supports the use of the Cumulative Attributable Difference (CAD) metric useful for prevention prioritization.
  - The ARM excels for ranking performance among facilities by adjusting for reliability (i.e., related to exposure volume).
- **Can a facility calculate their own ARM?**
  - No. Unlike the SIR (which can be calculated in the NHSN application or by using excel/calculator) there is no way for facility staff to calculate their ARM directly. This is why NHSN plans to continually publish these data in the ARM Dashboard within the web application as the full complement of all facility data are required for any given year at the time ARM values are to be produced.

Pressing Questions (cont'd)

- **What is the "ranking"?**
  - NHSN will be reporting the ranks based on facility-specific ARM values instead of the values themselves. The ranks will be from 1 (best rank) to 100 (worst rank).

- **Why am I getting an ARM ranking but not an SIR?**
  - The SIR and ARM have different criteria for being calculated and reported. The SIR requires at least 1 predicted event called the minimum precision criteria, whereas the ARM utilizes a minimum exposure threshold of 1 predicted event for every five years or 0.2. So, it is possible for NHSN to report an ARM ranking for a facility with no SIR reported.

Pressing Questions (cont'd, page 2)

- **What are some alternate terms for reliability adjustment?**
  - Reliability adjustment may be referred to as "shrinkage", "stabilized," or "smoothed" estimation
- **Are there other names for the ARM metric?**
  - The ARM metric was originally called the reliability adjusted SIR
  - It may be called a "Predicted to Expected" or "P/E" ratio
- **Will NHSN report an ARM rank or value by Sub-Unit within my facility?**
  - The quick answer is no. NHSN will report a single ARM rank for each HAI and year for each facility given the exposure threshold is met. The primary use for the ARM is to rank overall facility performance in a risk- and reliability-adjusted manner. Also, this will help avoid computational complexity and allow the SIR to remain the primary metric for sub-unit and intra-facility comparisons.

Ruth Kallay

Acute Care Analytics Team, NHSN

Navigating the ARM dashboard in NHSN

NHSN - National Healthcare Safety Network (ps1320-597bb655c8-v7rf8:80)

QCP9

NHSN Home

Alerts

Dashboard

Reporting Plan

Patient

Event

Procedure

Summary Data

Hospital Respiratory Data

Infectious Diseases of Public Health Concern

Import/Export

Surveys

Analysis

Users

Facility

Group

Tools

Cheat Sheets

Dynamic Forms

NHSN Patient Safety Component Home Page

▸ TAP Strategy Dashboard

▸ ARM Dashboard

▸ TAS Dashboard

▸ HAI Pathogen Dashboard

▸ Survey Data Quality Dashboard

▾ Action Items

COMPLETE THESE ITEMS

Survey Required	Mini-IRF Survey Required	Confer Rights	Facility Geolocation
2024	2024	Not Accepted	Confirm

ALERTS

▾ **ARM Dashboard**

Name: █████████████████████

Year: 2023 ▾

Data as of: May 16, 2024

| 77 CAUTI | 6 CLABSI | 37 COLO | 5 HYST | 74 CDI | 44 MRSA |

Print

Reliability-Adjusted Ranking

	Percentile
CAUTI	77
CLABSI	6
SSI-COLO	37
SSI-HYST	5
CDI LabID	74
MRSA LabID	44

Better — Percentile — Worse
(0 20 40 60 80 100)

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For more information, please visit the NHSN website: https://www.cdc.gov/nhsn/ps-analysis-resources/arm/index.html

Disclaimer: fictitious data for illustrative purposes only

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Print

Name: [redacted]

Year: 2023

Data as of: May 16, 2024

Choose year of data

77	6	37	5	74	44
CAUTI	CLABSI	COLO	HYST	CDI	MRSA

Reliability-Adjusted Ranking

Category	Value
CAUTI	77
CLABSI	6
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Better — Percentile — Worse

(x-axis: 0, 20, 40, 60, 80, 100)

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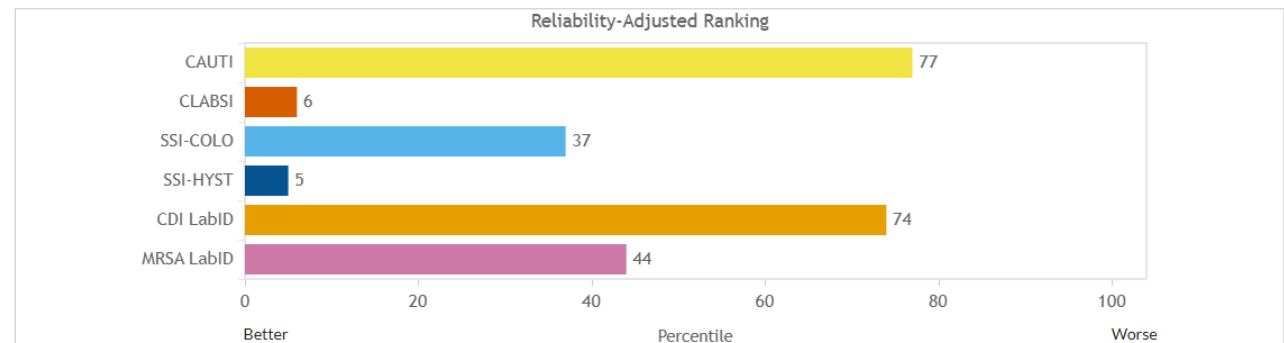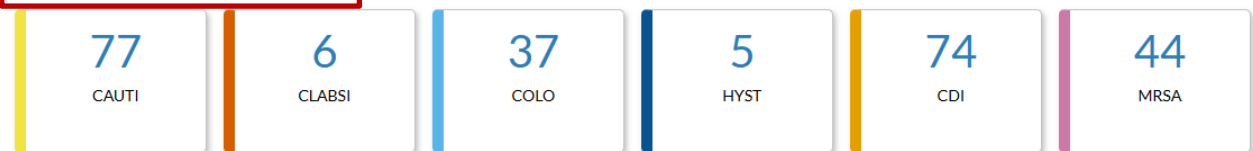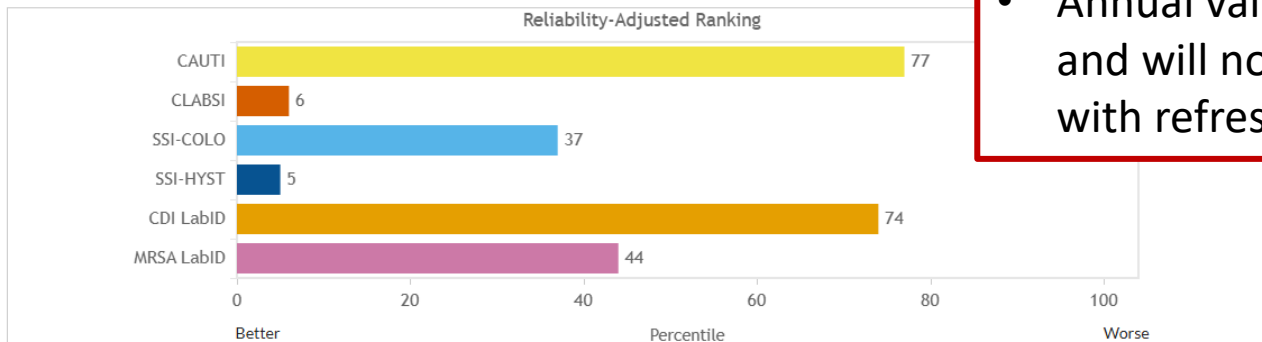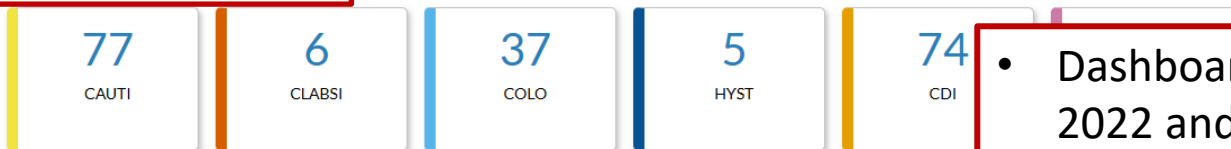*For more information, please visit the NHSN website:* https://www.cdc.gov/nhsn/ps-analysis-resources/arm/index.html

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ARM Dashboard

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Name: ▮▮▮▮▮▮
Year: 2023
Data as of: May 16, 2024

Choose year of data

77	6	37	5	74
CAUTI	CLABSI	COLO	HYST	CDI

- Dashboard includes 2022 and 2023 data

- 2024 data to be added later this year

- Annual values are static and will not be updated with refreshed data

Reliability-Adjusted Ranking

CAUTI	77
CLABSI	6
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0   20   40   60   80   100
Better   Percentile   Worse

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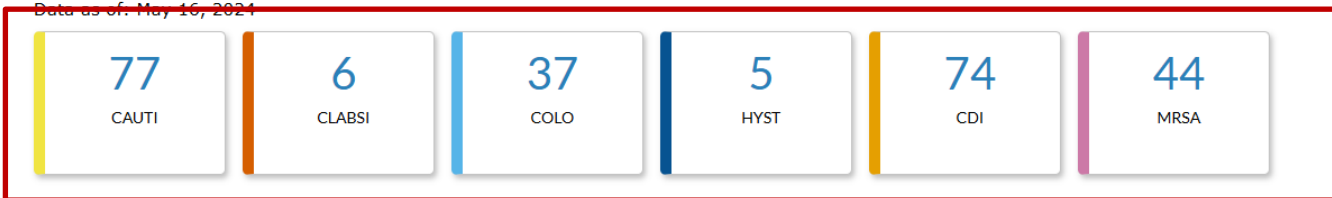For more information, please visit the NHSN website: https://www.cdc.gov/nhsn/ps-analysis-resources/arm/index.html

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ARM Dashboard

Name: [redacted]

Year: 2023

Data as of: May 16, 2024

77 CAUTI	**6** CLABSI	**37** COLO	**5** HYST	**74** CDI	**44** MRSA

ARM rankings for each HAI

Reliability-Adjusted Ranking

HAI	Percentile
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CLABSI	6
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0   20   40   60   80   100

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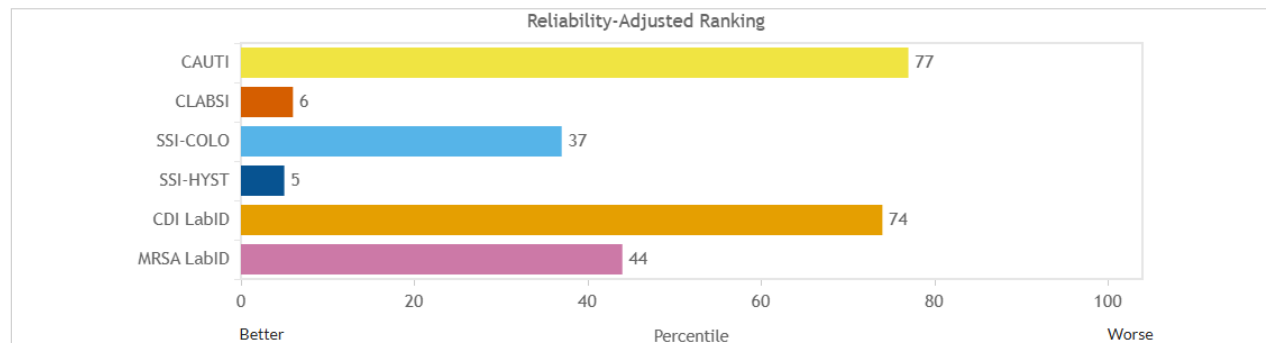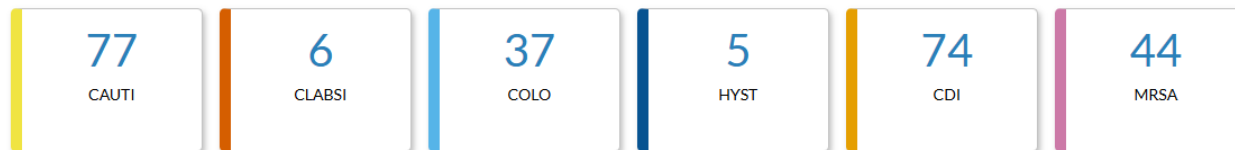
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ARM Dashboard

Print

Name: [redacted]

Year: 2023

Data as of: May 16, 2024

CAUTI	CLABSI	COLO	HYST	CDI	MRSA
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Reliability-Adjusted Ranking

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Better ⟷ Worse (Percentile axis: 0, 20, 40, 60, 80, 100)

Bar graph of ARM rankings

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Reliability-Adjusted Ranking

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0   20   40   60   80   100

Better   Percentile   Worse

Information about ARM rankings

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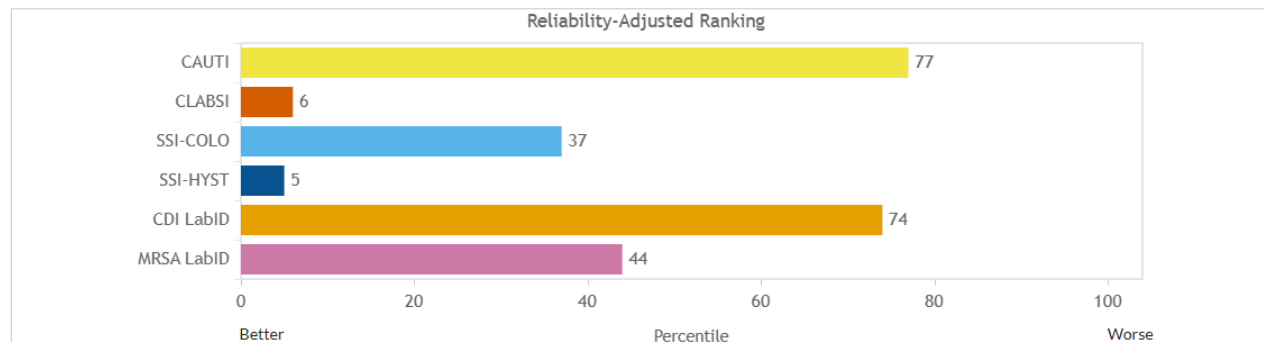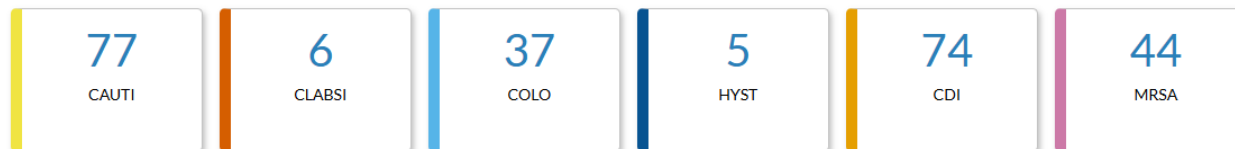
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Interpreting your ARM rankings

ARM Dashboard

Print

Name:

Year: 2023

Data as of: May 16, 2024

77 CAUTI	6 CLABSI	37 COLO	5 HYST	74 CDI	44 MRSA

Reliability-Adjusted Ranking

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Better — Percentile — Worse

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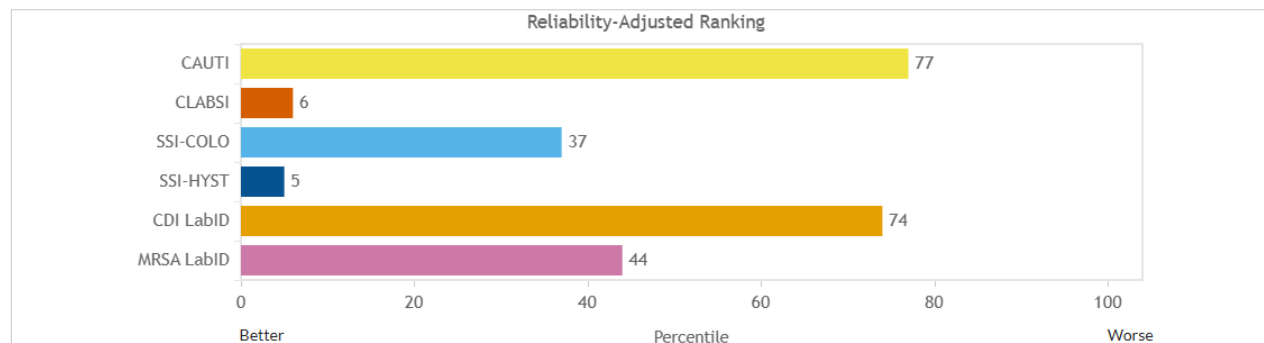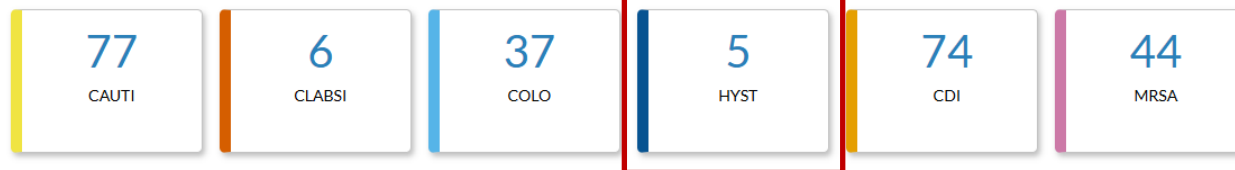*For more information, please visit the NHSN website: https://www.cdc.gov/nhsn/ps-analysis-resources/arm/index.html*

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ARM Dashboard

Name: ▓▓▓▓▓▓▓▓▓▓▓▓▓

Print

Year: 2023

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77	6	37	5	74	44
CAUTI	CLABSI	COLO	HYST	CDI	MRSA

Best ranking

Reliability-Adjusted Ranking

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0   20   40   60   80   100

Better   Percentile   Worse

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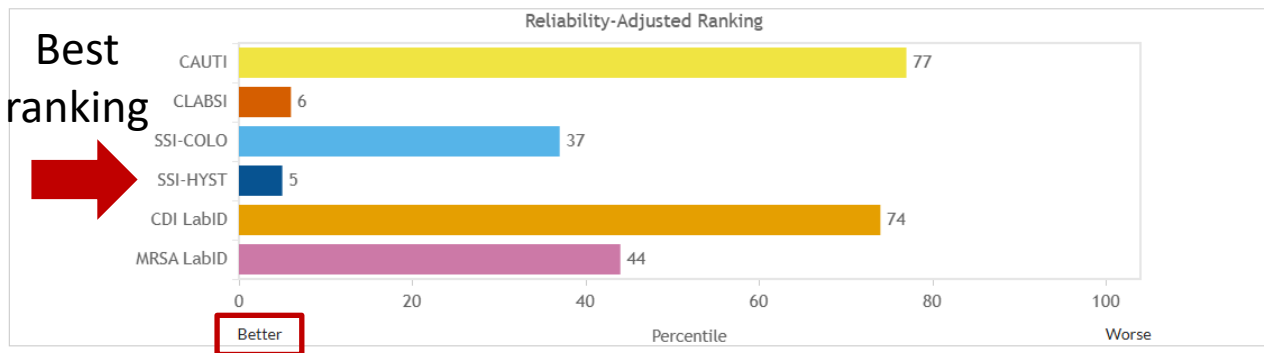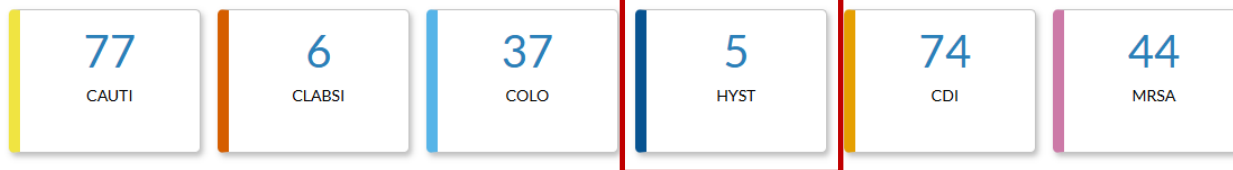
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ARM Dashboard

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Print

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This facility is performing better than 95% of other facilities with ARM rankings for SSI-HYST

Reliability-Adjusted Ranking

CAUTI

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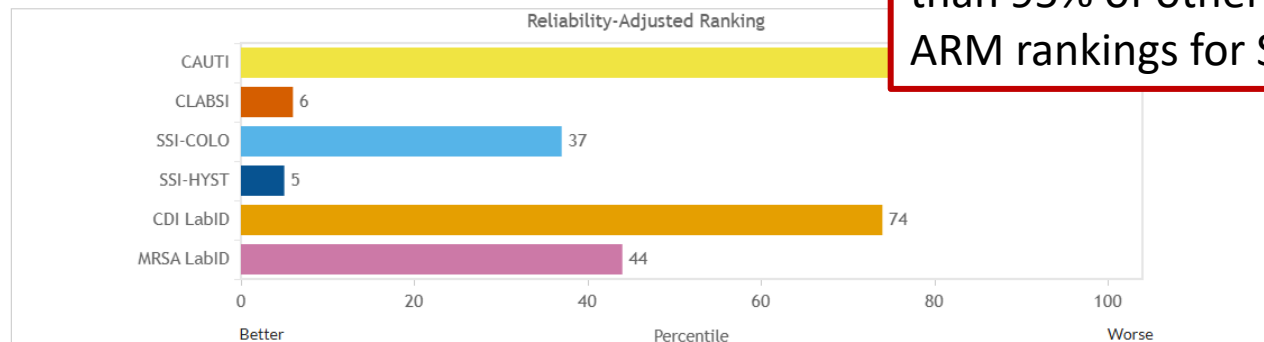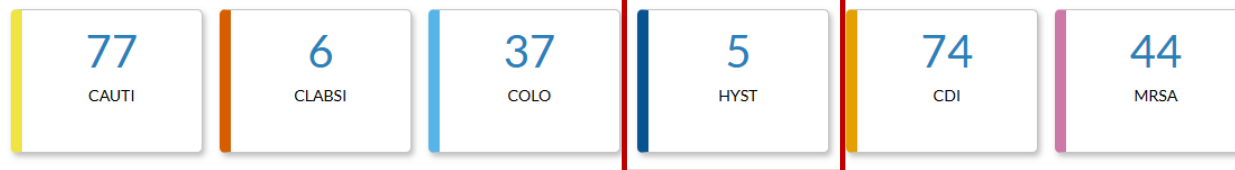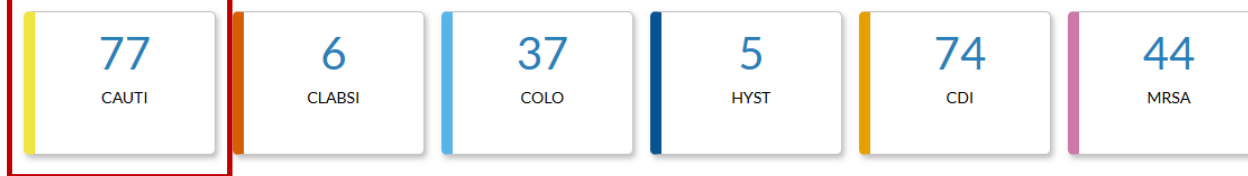
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ARM Dashboard

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77 CAUTI	**6** CLABSI	**37** COLO	**5** HYST	**74** CDI	**44** MRSA

Worst ranking ⬆

Reliability-Adjusted Ranking

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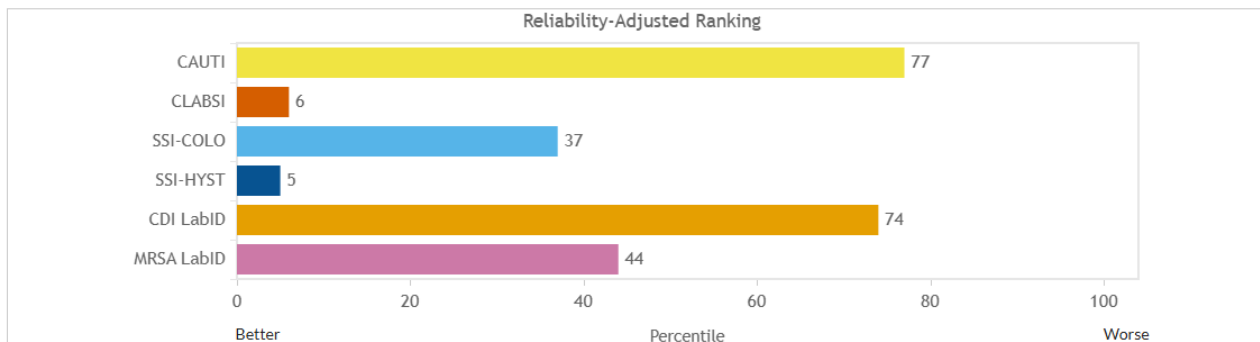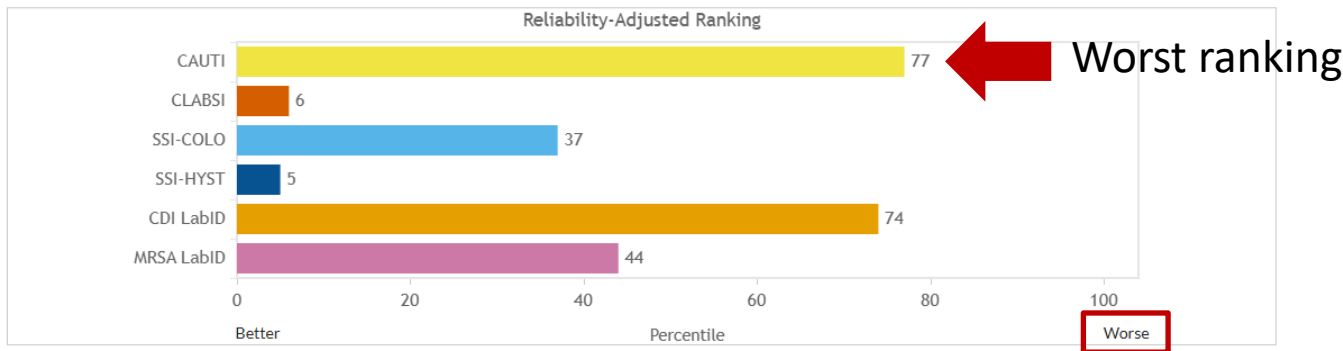
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Print

77	6	37	5
CAUTI	CLABSI	COLO	HYST

- Best ranking is 1
- Worst ranking is 100
- Comparative with other facilities nationally who report for that HAI event and receive ARM ranking

Reliability-Adjusted Ranking

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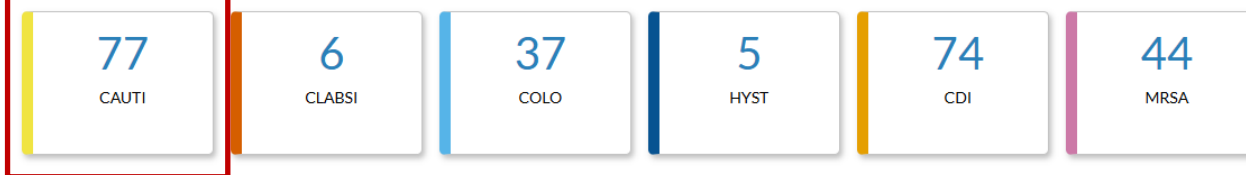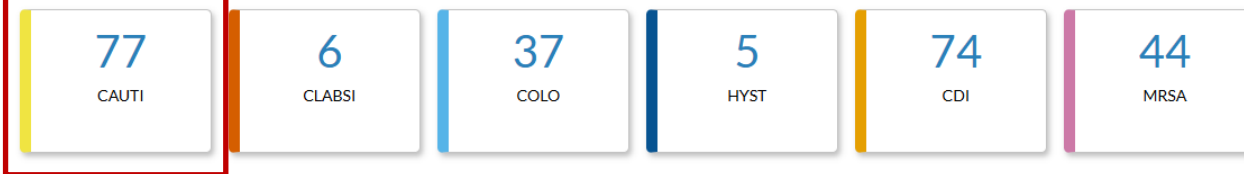
For more information, please visit the NHSN website: https://www.cdc.gov/nhsn/ps-analysis-resources/arm/index.html

Disclaimer: fictitious data for illustrative purposes only

Event
Procedure
Summary Data
Hospital Respiratory Data
Infectious Diseases of Public Health Concern
Import/Export
Surveys
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Cheat Sheets
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Logout

Special Scenarios in the ARM dashboard

Summary Data

Hospital Respiratory Data

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Data as of: May 16, 2024

2	14	7	25	31
CAUTI	CLABSI	COLO	CDI	MRSA

Reliability-Adjusted Ranking

HAI	Value
CAUTI	2
CLABSI	14
SSI-COLO	7
SSI-HYST	Numerator Only
CDI LabID	25
MRSA LabID	31

Better — Percentile — Worse

Numerator Only:
The following HAIs are predicted to occur less than once in a five-year time period for your hospital, suggesting that zero events are predicted to occur during a single year. In lieu of a reliability-adjusted ranking, the number of events is provided below.

HAI ⬍	Number of Events
SSI-HYST	0

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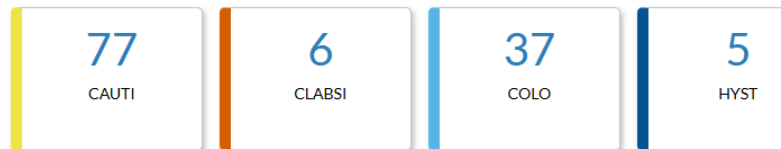*For more information, please visit the NHSN website:* https://www.cdc.gov/nhsn/ps-analysis-resources/arm/index.html

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Top cards:

2	14	7	25	31
CAUTI	CLABSI	COLO	CDI	MRSA

Reliability-Adjusted Ranking

HAI	Value
CAUTI	2
CLABSI	14
SSI-COLO	7
SSI-HYST	Numerator Only
CDI LabID	25
MRSA LabID	31

X-axis: Percentile — 0 (Better) to 100 (Worse)

Numerator Only:
The following HAIs are predicted to occur less than once in a five-year time period for your hospital, suggesting that zero events are predicted to occur during a single year. In lieu of a reliability-adjusted ranking, the number of events is provided below.

HAI ⬍	Number of Events
SSI-HYST	0

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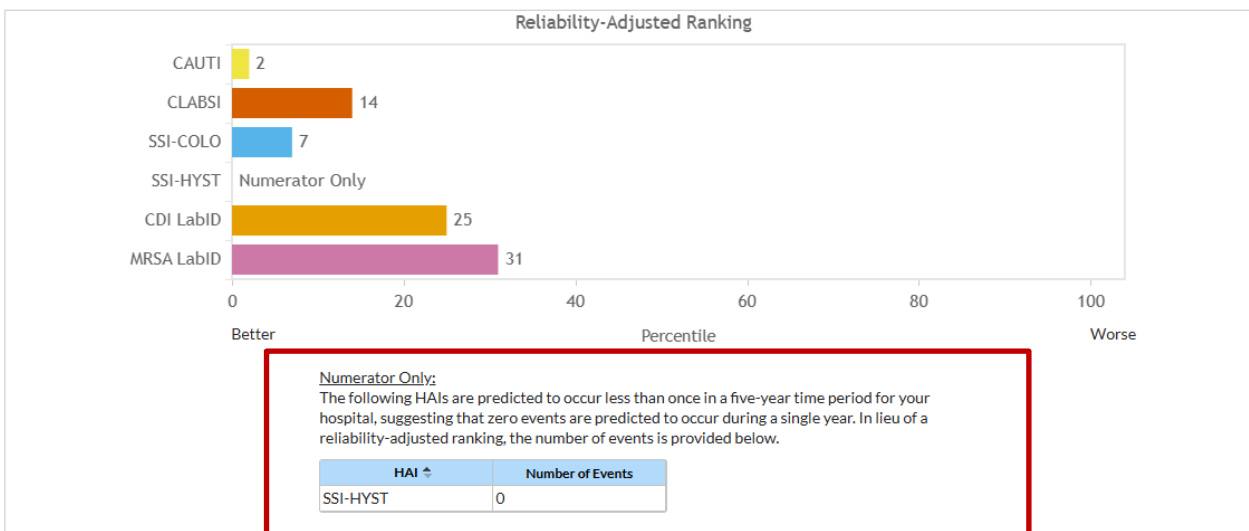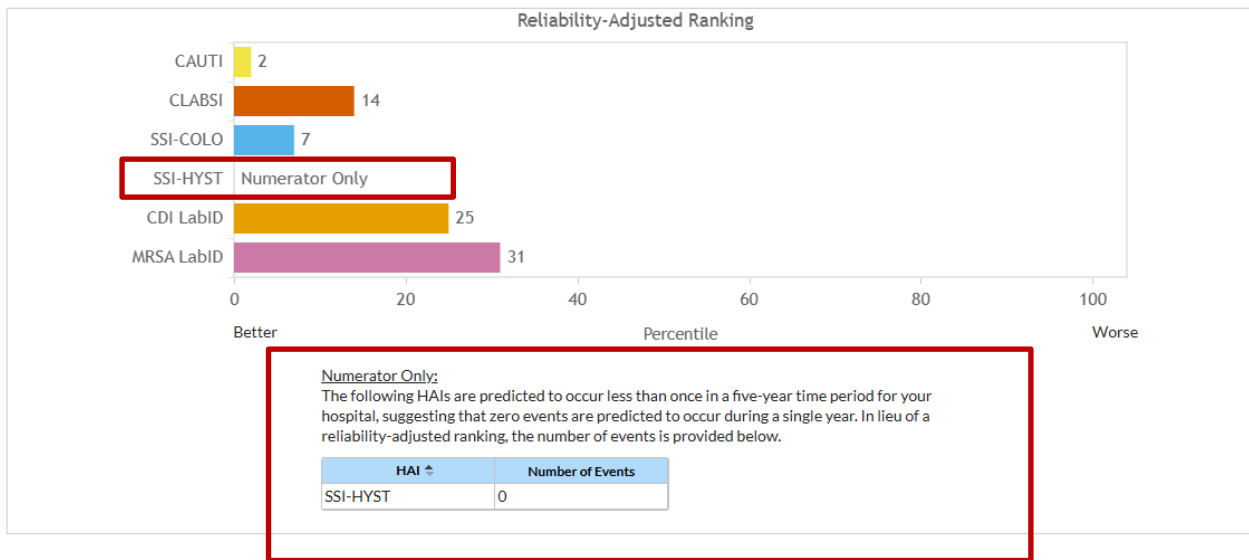
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Data as of: May 16, 2024

2	14	7	25	31
CAUTI	CLABSI	COLO		

Reliability-Adjusted Rank

CAUTI — 2
CLABSI — 14
SSI-COLO — 7
SSI-HYST — Numerator Only
CDI LabID — 25
MRSA LabID — 31

0   20   40   60   80   100

Better   Percentile   Worse

- Facilities that do not receive SIR for an event type may still receive ARM ranking

- **At least 1 predicted event in 5 years** to receive ARM ranking

- Only the total reported number of events will be provided for facilities with fewer predicted events

Numerator Only:
The following HAIs are predicted to occur less than once in a five-year time period for your hospital, suggesting that zero events are predicted to occur during a single year. In lieu of a reliability-adjusted ranking, the number of events is provided below.

HAI ⬍	Number of Events
SSI-HYST	0

About these data:

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NHSN Patient Safety Component Home Page

NHSN Home
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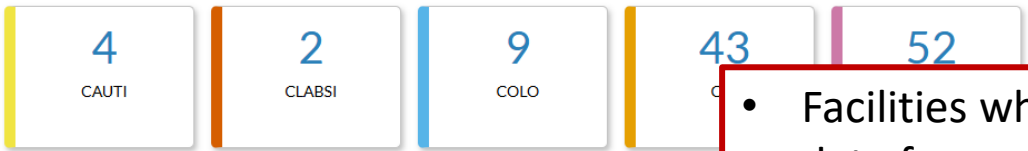- Cheat Sheets
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▸ **TAP Strategy Dashboard**

▾ **ARM Dashboard**

Print

Name: ▨▨▨▨▨

Year: 2022 ▾

Data as of: May 16, 2023

4	2	9	43	52
CAUTI	CLABSI	COLO		

- Facilities who did not report any HAI data for an event type in the selected year will see "No Data" for that HAI

- They will not receive an ARM ranking or number of events

Reliability-Adjusted Rank

CAUTI	4
CLABSI	2
SSI-COLO	9
SSI-HYST	No Data
CDI LabID	43
MRSA LabID	52

Better   Percentile   Worse

0   20   40   60   80   100
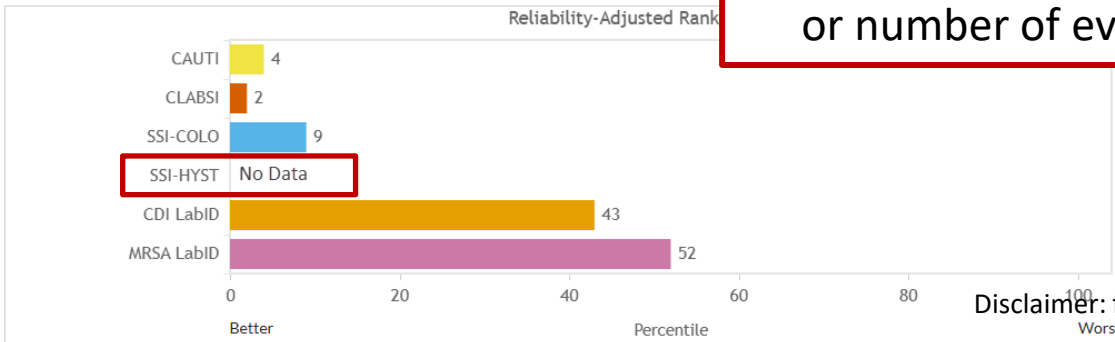
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How to use the ARM rankings

Which Measure to Use?

SIR
- Scalable summary measure
- Comparison vs. baseline
- Facility/state/nation **performance over time**

Progress

CAD
- Uses SIR denominator
- Measures # of excess infections as part of TAP strategy
- Useful for prioritizing prevention efforts

Prevention

ARM
- Similar to SIR but accounts for differences in exposure between facilities
- Some facilities without SIRs can receive ARMs
- **Preferable for ranking**

Ranking

Sneak peek: ARM Composite Measure

Sneak Peek: ARM Composite Measure

- Goal: Create 1 measure from 6 eligible ARMs
  (COLO, HYST, MRSA, CDI, CAUTI, CLABSI)

- Each facility will get one composite ranking showing how the facility compares on all HAIs

- Coming later this year!

19
Composite

Questions?

For NHSN questions or concerns related to the Annual Training

Post questions in the Annual Training Community

After June 10th, please submit questions to the NHSN Help Desk.

- Access new portal at **https://servicedesk.cdc.gov/nhsncsp**
- If you do not have a SAMS login, or are unable to access ServiceNow, you can still email the NHSN Help Desk 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.