CBE ID

1716

Title

Methicillin-resistant Staphylococcus Aureus (MRSA) Bacteremia LabID Event Standardized Infection Ratio (SIR)

Project

Management of Acute Events, Chronic Disease, Surgery, and Behavioral Health

Endorsement Status

Endorsed with Conditions

E&M Committee Rationale/Justification

When the measure comes back for maintenance in 3 years, the developer will have: Explored the possibility of using other all-payer data sources to expand the use of patient-level factors in the risk adjustment model and reduce reliance on facility-level factors.

Is Under Review

No

Next Maintenance Cycle

Spring 2029

Previous Endorsement Cycle

Fall 2025

Initial Endorsement

Wed, 12/12/2012 - 21:17

Steward

Centers for Disease Control and Prevention, National Healthcare Safety Network

1.0 New or Maintenance

Maintenance

1.1 Measure Structure

Single Measure

1.3 Electronic Clinical Quality Measure (eCQM)

No

1.6 Measure Description

Annual risk-adjusted standardized infection ratio (SIR) of methicillin-resistant staphylococcus

aureus (MRSA) bacteremia LabID Events among adults, children, and neonates hospitalized as inpatients at acute care and oncology hospitals. SIR is reported annually and is calculated by dividing the number of observed MRSA bacteremia LabID Events into the number of predicted MRSA bacteremia LabID Events.

1.6a Material Specification Change(s)

No

1.7 Measure Type

Outcome

1.8 Level of Analysis

Facility

1.9 Care Setting

Hospital: Acute Care Facility, Hospital: Inpatient, Other

1.9b Other Care Setting

Oncology hospitals

1.10 Measure Rationale

The use of this measure will promote Methicillin-resistant Staphylococcus aureus (MRSA) prevention activities that will lead to improved patient outcomes including reduction of MRSA infections, avoidable medical costs, and patient morbidity and mortality through reduced need for antimicrobials and reduced length of stay.

1.11 Measure Webpage

https://www.cdc.gov/nhsn/psc/cdiff/index.html

1.13 Data Dictionary

Not attached. I attest that all information will be provided where codes and/or value sets are needed (1.14a - 1.15c).

1.14 Numerator

Number of annually observed methicillin-resistant staphylococcus aureus (MRSA) bacteremia LabID Events in hospitalized inpatients.

1.14a Numerator Details

1. Determine the patients who have a positive lab finding from a blood culture for methicillin-resistant staphylococcus aureus (MRSA) Bacteremia LabID event and the date the Lab ID Event was identified.
    1. Includes *Staphylococcus aureus* cultured from a blood culture specimen that tests oxacillin-resistant, cefoxitin-resistant, or methicillin-resistant by standard susceptibility testing methods, or by a positive result from molecular testing for mecA and PBP2a; these methods may also include positive results of specimens tested by

any other FDA approved PCR test for MRSA.
    2. Active surveillance testing is excluded.
2. Determine if the patient is in an inpatient location.
3. Determine if the specimen was collected >3 days after the patient's admission to the hospital.
4. The patient did not have any prior positive MRSA blood specimen LabID events in the previous 14 days in any inpatient location (including IRF/IPF units), emergency department, or 24-hour observation location. Specimen collection date is considered Day 1.

1.15 Denominator

Number of annually predicted methicillin-resistant staphylococcus aureus (MRSA) bacteremia LabID Events in hospitalized inpatients.

1.15a Denominator Details

1. Calculate the monthly number of inpatient days by summing the daily count of patients occupying beds, per inpatient location in the facility.
2. Calculate the monthly number of inpatient admissions, per inpatient location.
3. The number of predicted events in NHSN is calculated based on the 2022 national hospital onset MRSA LabID event aggregate data and is adjusted for each facility using variables found to be significant predictors of MRSA incidence. The number of predicted MRSA LabID Bacteremia Events is calculated using a negative binomial regression model.
    1. The general formula for the negative binomial regression model is

$$\log(\lambda) = \alpha + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_i X_i \text{ , where:}$$

α = Intercept

β_i = Parameter estimate

X_i = Value of risk factor (categorical variables: 1 if present, 0 if not present)

i = Number of predictors

The tables below represent the variables found to be statistically significant predictors of MRSA bacteremia LabID events and are used in the negative binomial regression model to calculate the number of predicted healthcare facility-onset MRSA bacteremia LabID events in inpatient hospitals under the 2022 baseline data.

See 7.1 Supplemental Information Attachment Pages 1-2 for the MRSA bacteremia LabID event risk tables.

1.15b Denominator Exclusions

None

1.15c Denominator Exclusions Details

None

1.15d Age Group

Children (0-17 years), Adults (18-64 years), Older Adults (65 years and older)

1.16 Type of Score

Ratio

1.17 Measure Score Interpretation

Better performance = Lower score

1.18 Calculation of Measure Score

The National Healthcare Safety Network (NHSN) is a system for tracking healthcare-associated infections (HAIs) using data from US healthcare facilities. NHSN provides facility leaders, state health departments, and the nation with data needed to identify problem areas, measure progress of prevention efforts, and ultimately eliminate HAIs.

NHSN began tracking HAIs in around 300 hospitals and now serves over approximately 38,000 medical facilities. Current participants include acute care hospitals, long-term acute care hospitals, psychiatric hospitals, rehabilitation hospitals, outpatient dialysis centers, ambulatory surgery centers, and nursing homes, with hospitals (over 6,000) and dialysis facilities representing most of the facilities reporting data.

Establishing this system for tracking and preventing HAIs across the county required NHSN to understand key baseline data about facilities and healthcare. Information that allows NHSN to measure the incidence rates of HAIs represented in these baseline data includes:

- Facility demographics (like number of beds and medical school affiliation)
- Units within facilities (like the type of medical services or care provided on a unit)
- Surveillance data about infections (if, when, and where they occur)

The standardized infection ratio (SIR) is a summary metric used by healthcare facilities, CDC, and other public health organizations to track the incidence of HAIs over time. The SIR compares the number of HAIs reported (numerator) to the number that would be predicted (denominator), given the standard population (i.e., national baseline), adjusting for various facility and/or patient-level risk factors that have been found to be significantly associated with differences in HAI incidence. When interpreting the SIR, a value greater than 1.0 indicates that more HAIs were observed than predicted; conversely, an SIR less than 1.0 indicates that fewer HAIs were observed than predicted.

The MRSA Bacteremia LabID Event SIR compares the actual number of MRSA Bacteremia LabID Events reported to the number of MRSA Bacteremia LabID Events that would be predicted. The number of predicted infections is calculated using multivariable regression models generated from nationally aggregated data during a baseline period. These models are applied to a facility's denominator and risk factor data to generate a predicted number of infections. To enforce a minimum precision criterion, facility SIRs are only calculated when the number of predicted infections is at least 1.0. This rule was instituted to avoid the calculation and interpretation of statistically imprecise SIRs, which typically have extreme values.

SIR = Observed (O) HAIs/Predicted (P) HAIs

1.Total the number of annually observed (numerator) MRSA Bacteremia LabID Events across the facility.

2. Calculate the number of predicted (denominator) MRSA Bacteremia LabID Events for the facility.

The number of predicted infections is the estimated number of MRSA Bacteremia LabID Events for the facility considering several facility factors reported to NHSN. The model is based on aggregated national data reported to NHSN during a specific timeframe (i.e. baseline year 2022). The negative binomial generalized linear model is utilized for MRSA Bacteremia LabID Events. As a national surveillance HAI tracking system that US healthcare facilities must report data to, NHSN must characterize risk of infection in the most efficient way. To minimize the burden of data collection on facilities, NHSN risk models utilize patient location and facility characteristics that are already reported by all facilities. NHSN does not collect additional patient characteristics for inclusion in the risk model because this would create additional burden for facilities.

Negative binomial regression models are used to estimate incidence from a summarized population. The general negative binomial regression formula is:

log (λ) = α + □□1□□1 + □□2□□2 + ⋯ + □□i□□i , where:

α = Intercept

βi = Parameter estimate

Xi = Value of risk factor (categorical variables: 1 if present, 0 if not present)

i = Number of predictors

3. Divide the number of observed MRSA Bacteremia LabID Events by the number of predicted MRSA Bacteremia LabID Events to obtain the standardized infection ratio (SIR).

•If the SIR is greater than 1.0, then more HAIs were observed than predicted based on the 2022 national aggregate data.

• If the SIR is less than 1.0, then fewer HAIs were observed than predicted based on the 2022 national aggregate data.

• If the SIR equals 1.0, then the same number of HAIs were observed as predicted based on the 2022 national aggregate data.

The tables below represent the variables found to be statistically significant predictors of MRSA Bacteremia LabID Events and are used in the negative binomial regression model to calculate the number of predicted healthcare facility-onset MRSA Bacteremia LabID Events in hospital inpatients under the 2022 baseline data.

The negative binomial generalized linear models for acute care hospitals and critical access hospitals are listed below.

See 1.18a for details.

1.18a Attach measure score calculation diagram

1.18-Calculation-of-Measure-Score.pdf

1.19 Measure Stratification Details

The measure is not stratified.

1.20 Types of Data Sources

Electronic Health Records, Paper Patient Medical Records

1.21a Data Collection Tool URL(s)

http://example.com

1.25 Data Source Details

Data is submitted by facilities using the National Healthcare Safety Network (NHSN), web-based application (accessed securely via the Secure Access Management Service).

https://www.cdc.gov/nhsn/psc/cdiff/index.html
https://www.cdc.gov/nhsn/pdfs/pscmanual/12pscmdro_cdadcurrent.pdf

https://www.cdc.gov/nhsn/forms/57.128_LabIDEvent_BLANK.pdf
https://www.cdc.gov/nhsn/forms/57.127_MDROMonthlyReporting_BLANK.pdf
https://www.cdc.gov/nhsn/2022rebaseline/sir-guide.pdf

1.26 Minimum Sample Size

N/A

2.1 Attach Logic Model

2.1-Logic-Model.pdf

2.2 Evidence of Measure Importance

A collection of prevention efforts has been identified to reduce the incidence of methicillin-resistant staphylococcus aureus (MRSA) Bacteremia LabID events. These interventions include (i) Appropriate use of antibiotics (ii) Implementing surveillance strategies (iii) Implementing infection control precautions (iv) Use of contact precautions (v) Environmental cleaning.

Clinical practice guidelines for the management of multidrug-resistant organisms (MDROs), including MRSA, have been published. Adherence to the recommendations in the guidelines can result in decreased rates of MDRO transmission and infection. Decreasing rates of infection will result in a lower SIR, which indicates improving performance.

Reference: Siegel JD, Rhinehart E, Jackson M, Chiarello L; Healthcare Infection Control Practices Advisory Committee. Management of multidrug-resistant organisms in health care settings, 2006. Am J Infect Control. 2007 Dec;35(10 Suppl 2):S165-93.

The 2021 National and State Healthcare-Associated Infections Progress Report showed statistically significant increases in hospital-onset methicillin-resistant *Staphylococcus aureus* (MRSA) (14%) between 2020 and 2021 (Lastinger, L., et al., 2023). Multiple strategies—such as improving catheter insertion techniques, following contact precautions, monitoring hand hygiene, disinfecting caps for intravenous lines, and chlorhexidine baths—have been found to reduce the number of healthcare acquired infections (HAIs) in hospitals. Bathing patients with chlorhexidine gluconate (CHG) wipes has decreased rates of multiple HAIs, including MRSA. A recent study evaluated the use of intranasal mupirocin twice daily and CHG baths daily for 5 days preoperatively in cardiac surgery patients who were colonized with MRSA. These patients also received prophylactic vancomycin and cefazolin with contact isolation precautions. The study showed that preoperative screening for *S. aureus* and decolonization was associated with a decrease in postoperative colonization (odds ratio 0.73, 95% CI: 0.53 to 1.00, p=0.05) (Saraswat, et. al, 2017). As many of the prevention strategies that facilities implement are

nursing driven, given that the tasks are patient-care related another study found that American Nurses Credentialing Center Magnet designated hospitals, compared to non-Magnet hospitals, had a significant and positive coefficient (0.74, $P < 0.001$) and were associated with a lower MRSA bloodstream infections (Pakyz, A., et al., 2021). A multicenter, randomized, controlled trial where participants were randomly assigned to an education group or decolonization group. Those in the education group received and reviewed an educational binder about MRSA and how it is spread and recommendations for personal hygiene, laundry, and household cleaning (Huang, S., et al., 2019). The decolonization group received and reviewed the identical educational binder and underwent decolonization, which included 4% rinse-off chlorhexidine for daily showering, 0.12% chlorhexidine mouthwash twice daily, and 2% nasal mupirocin twice daily, for 5 days twice monthly for a period of 6 months after hospital discharge (Huang, S., et al., 2019). The study found that participants in the decolonization group who adhered fully to the regimen had 44% fewer MRSA infections than the education group (hazard ratio, 0.56; 95% CI, 0.36 to 0.86) and had 40% fewer infections from any cause (hazard ratio, 0.60; 95% CI, 0.46 to 0.78) (Huang, S., et al., 2019). Topical decolonization led to lower risks of infections and readmissions than hygiene education alone among patients after the transition from hospital to home and other care settings (Huang, S., et al., 2019).

- Huang SS, Singh R, McKinnell JA, Park S, Gombosev A, Eells SJ, Gillen DL, Kim D, Rashid S, Macias-Gil R, Bolaris MA, Tjoa T, Cao C, Hong SS, Lequieu J, Cui E, Chang J, He J, Evans K, Peterson E, Simpson G, Robinson P, Choi C, Bailey CC Jr, Leo JD, Amin A, Goldmann D, Jernigan JA, Platt R, Septimus E, Weinstein RA, Hayden MK, Miller LG; Project CLEAR Trial. Decolonization to Reduce Postdischarge Infection Risk among MRSA Carriers. N Engl J Med. 2019 Feb 14;380(7):638-650.
- Lastinger, L., Alvarez, C., Kofman, A., Konnor, R., Kuhar, D., Nkwata, A., . . . Dudeck, M. (2023). Continued increases in the incidence of healthcare-associated infection (HAI) during the second year of the coronavirus disease 2019 (COVID-19) pandemic. Infection Control & Hospital Epidemiology, 44(6), 997-1001.
- Pakyz AL, Wang H, Ozcan YA, Edmond MB, Vogus TJ. Leapfrog Hospital Safety Score, Magnet Designation, and Healthcare-Associated Infections in United States Hospitals. J Patient Saf. 2021 Sep 1;17(6):445-450.
- Saraswat MK, Magruder JT, Crawford TC, Gardner JM, Duquaine D, Sussman MS, Maragakis LL, Whitman GJ. Preoperative Staphylococcus Aureus Screening and Targeted Decolonization in Cardiac Surgery. Ann Thorac Surg. 2017 Oct;104(4):1349-1356.

Clinical Guideline: Siegel JD, Rhinehart E, Jackson M, Chiarello L; Healthcare Infection Control Practices Advisory Committee. Management of multidrug-resistant organisms in health care settings, 2006. Am J Infect Control. 2007 Dec;35(10 Suppl 2):S165-93.

Healthcare Infection Control Practices Advisory Committee (***HICPAC***) system for

categorizing recommendations in this guideline is as follows:

Category IA. Strongly recommended for implementation and strongly supported by well-designed experimental, clinical, or epidemiologic studies.

Category IB. Strongly recommended for implementation and supported by some experimental, clinical, or epidemiologic studies and a strong theoretical rationale; or an accepted practice (e.g., aseptic technique) supported by limited evidence.

Category IC. Required by state or federal regulations, rules, or standards.

Category II. Suggested for implementation and supported by suggestive clinical or epidemiologic studies or a theoretical rationale.

No Recommendation. Unresolved issue. Practices for which insufficient evidence or no consensus regarding efficacy exists.

Strength of Recommendations

Recommendation

Definition: A Recommendation means that CDC is confident that the benefits of the recommended approach clearly exceed the harms (or, in the case of a negative recommendation, that the harms clearly exceed the benefits). In general, Recommendations should be supported by high- to moderate-quality evidence. In some circumstances, however, Recommendations may be made based on lesser evidence or even expert opinion when high-quality evidence is impossible to obtain and the anticipated benefits strongly outweigh the harms or when then Recommendation is required by federal law.

Implied Obligation: A Recommendation implies that healthcare personnel/healthcare facilities "should" implement the recommended approach unless a clear and compelling rationale for an alternative approach is present.

Conditional Recommendation

Definition: A Conditional Recommendation means that CDC has determined that the benefits of the recommended approach are *likely* to exceed the harms (or, in the case of a negative recommendation, that the harms are likely to exceed the benefits). Conditional Recommendations may be supported by either low-, moderate- or high-quality evidence when:

- There is high-quality evidence, but the benefit/harm balance is not clearly tipped in one direction.
- The evidence is weak enough to cast doubt on whether the recommendation will

consistently lead to benefit.
- The likelihood of benefit for a specific patient population or clinical situation is extrapolated from relatively high-quality evidence demonstrating impact on other patient populations or in other clinical situations (e.g., evidence obtained during outbreaks used to support probable benefit during endemic periods).
- The impact of the specific intervention is difficult to disentangle from the impact of other simultaneously implemented interventions (e.g., studies evaluating "bundled" practices).
- There appears to be benefit based on available evidence, but the benefit/harm balance may change with further research.
- The benefit is most likely if the intervention is used as a supplemental measure in addition to basic practices.

Implied Obligation: A Conditional Recommendation implies that healthcare facilities/ personnel "could," or could "consider" implementing the recommended approach. The degree of appropriateness may vary depending on the benefit vs. harm balance for the specific setting.

No Recommendation

Definition: No Recommendation is made when there is both a lack of pertinent evidence and an unclear balance between benefits and harms.

Level of Confidence in the Effect Estimate

High: Highly confident that the true effect lies close to that of the estimated size and direction of the effect. For example, confidence in the evidence is rated as "High" when there are multiple studies with no major limitations, there are consistent findings, and the summary estimate has a narrow confidence interval.

Moderate: The true effect is likely to be close to the estimated size and direction of the effect, but there is a possibility that it is substantially different. For example, confidence in the evidence is rated as "Moderate" when there are only a few studies and some have limitations but not major flaws, there is some variation between study results, or the confidence interval of the summary estimate is wide.

Low: The true effect may be substantially different from the estimated size and direction of the effect. For example, confidence in the evidence is rated as "Low" when supporting studies have major flaws, there is important variation between study results, the confidence interval of the summary estimate is very wide, or there are no rigorous studies.

V.A.3. Judicious Use of Antimicrobial Agents

V.A.3.a. In hospitals and LTCFs, ensure that a multidisciplinary process is in place to review antimicrobial utilization, local susceptibility patterns 36 (antibiograms), and antimicrobial agents included in the formulary to foster appropriate antimicrobial use. IB

V.A.3.b. Implement systems (e.g., computerized physician order entry, comment in microbiology susceptibility report, notification from a clinical pharmacist or unit director) to prompt clinicians to use the appropriate antimicrobial agent and regimen for the given clinical situation. IB

V.A.3.b.i. Provide clinicians with antimicrobial susceptibility reports and analysis of current trends, updated at least annually, to guide antimicrobial prescribing practices. IB

V.A.3.b.ii. In settings that administer antimicrobial agents but have limited electronic communication system infrastructures to implement physician prompts (e.g., LTCFs, home care and infusion companies), implement a process for appropriate review of prescribed antimicrobials. Prepare and distribute reports to prescribers that summarize findings and provide suggestions for improving antimicrobial use. II

V.A.4. Surveillance

V.A.4.a.In microbiology laboratories, use standardized laboratory methods and follow published guidance for determining antimicrobial susceptibility of targeted (e.g., MRSA, VRE, MDR-ESBLs) and emerging (e.g., VRSA, MDR-Acinetobacter baumannii) MDROs. IB

V.A.4.b.In all healthcare organizations, establish systems to ensure that clinical microbiology laboratories (in-house and out-sourced) promptly notify infection control staff or a medical director/ designee when a novel resistance pattern for that facility is detected. IB

V.A.4.c. In hospitals and LTCFs, develop and implement laboratory protocols for storing isolates of selected MDROs for molecular typing when needed to confirm transmission or delineate the epidemiology of the MDRO within the healthcare setting. IB

V.A.4.d. Prepare facility-specific antimicrobial susceptibility reports as recommended by the Clinical and Laboratory Standards Institute (CLSI), monitor these reports for evidence of changing resistance patterns that may indicate the emergence or transmission of MDROs. IB/IC

V.A.4.d.i. In hospitals and LTCFs with special-care units (e.g., ventilator-dependent, ICU, or oncology units), develop and monitor unit-specific antimicrobial susceptibility reports. IB

V.A.4.d.ii. Establish a frequency for preparing summary reports based on volume of clinical isolates, with updates at least annually. II/IC

V.A.4.d.iii. In healthcare organizations that outsource microbiology laboratory services (e.g., ambulatory care, home care, LTCFs, smaller acute care hospitals), specify by contract that the

laboratory provide either facility-specific susceptibility data or local or regional aggregate susceptibility data in order to identify prevalent MDROs and trends in the geographic area served. II

V.A.4.e. Monitor trends in the incidence of target MDROs in the facility over time using appropriate statistical methods to determine whether MDRO rates are decreasing and whether additional interventions are needed. IA

V.A.4.e.i. Specify isolate origin (i.e., location and clinical service) in MDRO monitoring protocols in hospitals and other large multi-unit facilities with high-risk patients. IB

V.A.4.e.ii. Establish a baseline (e.g., incidence) for targeted MDRO isolates by reviewing results of clinical cultures; if more timely or localized information is needed, perform baseline point prevalence studies of colonization in high-risk units. When possible, distinguish colonization from infection in analysis of these data. IB

V.A.5. Infection Control Precautions to Prevent Transmission of MDROs

V.A.5.a. Follow Standard Precautions during all patient encounters in all settings in which healthcare is delivered. IB

V.A.5.b. Use masks according to Standard Precautions when performing splash-generating procedures (e.g., wound irrigation, oral suctioning, intubation) when caring for patients with open tracheostomies and the potential for projectile secretions and in circumstances where there is evidence of transmission from heavily colonized sources (e.g., burn wounds). Masks are not otherwise recommended for prevention of MDRO transmission from patients to healthcare personnel during routine care (e.g., upon room entry). IB

V.A.5.c. Use of Contact Precautions

V.A.5.C.I. IN ACUTE-CARE HOSPITALS

V.A.5.c.i. Implement Contact Precautions routinely for all patients infected with target MDROs and for patients that have been previously identified as being colonized with target MDROs (e.g., patients transferred from other units or facilities who are known to be colonized). IB

V.A.5.H. DISCONTINUATION OF CONTACT PRECAUTIONS

V.A.5.h.No recommendation can be made regarding when to discontinue Contact Precautions. (See Background for discussion of options.) Unresolved issue

V.A.5.I. PATIENT PLACEMENT IN HOSPITALS AND LTCFS

V.A.5.i.1. When single-patient rooms are available, assign priority for these rooms to patients with known or suspected MDRO colonization or infection. Give highest priority to those patients who have conditions that may facilitate transmission, e.g., uncontained secretions or excretions. IB

V.A.5.i.2. When single-patient rooms are not available, cohort patients with the same MDRO in the same room or patient-care area. IB

* V.A.5.i.3. When cohorting patients with the same MDRO is not possible, place MDRO patients in rooms with patients who are at low risk for acquisition of MDROs and associated adverse outcomes from infection and are likely to have short lengths of stay. II

V.A.6. Environmental Measures

V.A.6.a. Clean and disinfect surfaces and equipment that may be contaminated with pathogens, including those that are in close proximity to the patient (e.g., bed rails, over bed tables) and frequently-touched surfaces in the patient care environment (e.g., door knobs, surfaces in and surrounding toilets in patients' rooms) on a more frequent schedule compared to that for minimal touch surfaces (e.g., horizontal surfaces in waiting rooms). IB

V.A.6.b. Dedicate noncritical medical items to use on individual patients known to be infected or colonized with MDROs. IB

V.A.6.c. Prioritize room cleaning of patients on Contact Precautions. Focus on cleaning and disinfecting frequently touched surfaces (e.g., bedrails, bedside commodes, bathroom fixtures in the patient's room, doorknobs) and equipment in the immediate vicinity of the patient. IB

2.4 Performance Gap

A total of 1,907 Acute Care Hospitals qualified for the measure having at least 1 predicted event. The mean SIR across all hospitals was 0.77 with a range of 0-5.92. A total of 355 hospitals have an SIR=0 meaning they had zero MRSA events. The 10 decile groups represent 190 or 191 hopsitals. The range of mean performance across the 10 groups ranges from 0 to 2.176, indicating a wide range of performance across hospitals.

No Critical Access Hospitals qualified for the metric reporting as all had <1 predicted event.

Table 1. Performance Scores by Decile

Performance Gap

	Overall	Minimum	Decile_1	Decile_2	Decile_3	Decile_4	Decile_5	Decile_6	Decile_7	Decile_8	Decile_9	Decile_10	Maximum
Mean Performance Score	0.77	0.0	0.0	0.222	0.319	0.472	0.599	0.737	0.892	1.097	1.381	2.176	5.92
N of Entities	1907		190	191	191	190	191	191	190	191	191	191	
N of Persons / Encounters / Episodes	150508334		8112144	10378951	17437085	16675838	18633041	16523005	17872656	18403890	14985851	11485873	

2.4a Attach Performance Gap Results

2.4a-Performance-Gap-Results.pdf

2.6 Meaningfulness to Target Population

The Patient Safety Action Network is a coalition of individuals and organizations consisting of patients who have been medically harmed, their loved ones, and concerned patient safety advocates.

“Please accept these comments from the Patient Safety Action Network regarding the following HAI measures; we are commenting on all of them together:

- Catheter-Associated Urinary Tract Infections (CAUTI)
- Central Line Associated Blood Stream Infections (CLABSI
- 30-Day Post-Operative Colon Surgery (COLO) and Abdominal Hysterectomy (HYST) Surgical Site Infection (SSI)
- Methicillin-resistant *Staphylococcus aureus* (MRSA) Bacteremia LabID Event
- *Clostridioides difficile* (CDI) LabID Event
- Antimicrobial Use Measure

Fundamentally, each of these measures is important and essential to preventing infections. If we do not measure and publicly report these events in a continuous, standardized way, we cannot truly know or understand when actual progress is made.

There are several target populations for these measures. First, members of the public who may need to use the services of a local hospital at any given point without warning or who have an interest in seeing how their hospital compares to others on hospital acquired infections. The published HAI measures provide that public service. Second, patients being treated at a hospital who are infected might not benefit from the past published HAI measures, but they probably are interested in accountability. One of the first questions many ask is “will my infection be counted?” The next question typically is, “how can we prevent it from happening again to someone else?” To them, these measurements are very important.

The value and meaningfulness of these outcome measures lie in tracking reduction of patient harm over time using individual hospitals’ HAI measures. Progress means fewer infections at each point of measurement with a goal toward no infections. Unfortunately, these measures are rarely

presented on a continuum demonstrating whether each hospital has reduced this harm over the years. And they are no longer presented with the actual numbers of infections, which reflect actual infections reported and not an estimate.

We also believe the value of these measures is lowered because of the way they are reported to the public. It appears that the standardization using an SIR of 1.0 as the baseline has established that as the status quo, even though the baseline has been adjusted over time. We wonder how often hospitals accept SIRs of around 1.0 as acceptable. Further, the use of risk adjustment skews the real results in each of these measures, i.e., the patients who got infected. We would rather see a stratified presentation that compares similar hospitals together – without risk adjustments. We believe that would be more meaningful to the public.

Also, the terms used to present the data lead to confusion, such as predicted number of infections and better than/no different/worse than the national benchmark. Many hospitals' data is "not available," without context (the hospital failed to report, the hospital does not have enough cases to rate, etc).

Even with these limitations, the measures are important to retain because of their value to patients who expect to be free from preventable harm when hospitalized. You ask about the full meaning of these measures to patients, but that requires some understanding of what happens to them following a hospital acquired infection. These events affect each person in a different way. It can mean a round of antibiotics; a longer stay in the hospital or the need to seek further treatment; continued chronic conditions, including recurrences of the infection; significant medical debt; losing a job due to missing work as a consequence of an infection; losing one's home due to mounting medical bills and other debts; permanent disability; sepsis that is only survived after intense medical care; and death. This should clearly explain why all these measures are meaningful to patients.

Frankly, we need more infection measures so that all hospital acquired infections are accounted for, like what is done in California. It seems to us that every time federal agencies ask for feedback about these measures, the result is less information to the public."

Methicillin-resistant Staphylococcus aureus (MRSA) Standardized Infection Ratio serves as a broad, objective measure of healthcare-associated infection (HAI) burden within many patient care locations. HAI reduction has been a national priority set by U.S. Government going back to

2008 with the U.S. Health and Human Services (HHS) National Action Plan to Prevent Health Care-associated Infections: Roadmap to Elimination.[1] While there has been overall progress in reducing these specific HAIs, there is room for improvement in both the surveillance and prevention of MRSA.

Measuring MRSA has also been a priority for CMS as indicated by the use of the measure in three CMS Measure Programs, including Hospital-Acquired Condition Reduction Program (HACRP), Hospital Inpatient Quality Reporting Program (HIQR), The Prospective Payment System (PPS)-Exempt Cancer Hospital Quality Reporting (PCHQR) Program, Hospital Value-Based Purchasing Program.

1. U.S. Health and Human Services (HHS) National Action Plan to Prevent Health Care-associated Infections: Roadmap to Elimination. Accessed May 2, 2025 at https://www.hhs.gov/oidp/topics/health-care-associated-infections/hai-a...;

3.1 Contributions Towards Closing Care Gaps

This criteria is optional for the Fall 2025 cycle.

4.1a Data Structure and Availability

This is a maintenance measure, and the measure specifications have not changed. Facilities have not notified NHSN of any feasibility issues within the last year.

All required data elements are routinely generated, in structured fields, and used during care delivery. Facilities can choose to submit this data manually via a web form or via submission of CDA electronic files. NHSN has built-in business rules for mandatory data elements and does not allow for the submission of incomplete records.
Addressing NHSN data quality issues is integral to NHSN's ability to help facilities collect the data needed to identify areas needing prevention efforts, measure progress of prevention efforts, and push toward MRSA elimination. The NHSN team routinely reviews the data reported to NHSN and contacts facilities to resolve confirmed and suspected data quality flags. Data quality checks conducted to help confirm the accuracy of the data being reported include checking MRSA data, implementing business rules within the application, verifying alerts, and confirming that flags are triggered by incomplete data.

NHSN provides facilities with internal validation toolkits, which can be used to audit their internal data to identify any potential inaccuracies or problems. The internal validation toolkit also provides recommendations to facilities for implementing quality control processes to ensure data is accurate and complete.

Additionally, NHSN offers external validation toolkits, which can be used by state or local health

departments, or other auditors, to perform checks on the data that facilities submit to NHSN. External validation allows for the auditors to identify gaps in understanding of surveillance definitions or other errors and provide education to ensure data reported to NHSN follows the standardized specifications.

4.1b Implementation Costs and Burden

Per the Paperwork Reduction Act (PRA) of 1995, federal agencies cannot conduct or sponsor the collection of information unless the Office of Management and Budget (OMB) has reviewed and approved the proposed data collection. Federal agencies must submit a set of documents known as an Information Collection Request (ICR), to request OMB approval of an information collection. The ICR documents describe what information is needed; why it is needed; how it will be collected; and how much time, money, and effort it will cost the respondents to collect the information.

Multiple data collection forms are utilized to provide surveillance data on MRSA Bacteremia LabID Events. Below are the OMB-approved estimated total annual burden hours and annual cost for all facilities that complete this data collection.

See 7.1 Supplemental Information Attachment Page 3 for burden and cost details.

4.1c Confidentiality

While CDC can retrieve data by personal identifier, CDC does not, as a matter of practice or policy, retrieve data in this way. Specifically, the primary practice and policy of CDC regarding NHSN data is to retrieve data by the name of the hospital or another non-personal identifier, not an individual patient, for surveillance and public health purposes. Furthermore, patient identifiers are not necessary for NHSN to operate.

An Assurance of Confidentiality is granted for all data collected under NHSN. NHSN’s Assurance of Confidentiality, states the following:

“The voluntarily provided information obtained in this surveillance system that would permit identification of any individual or institution is collected with a guarantee that it will be held in strict confidence, will be used only for the purposes stated, and will not otherwise be disclosed or released without the consent of the individual, or the institution in accordance with Sections 304, 306 and 308(d) of the Public Health Service Act (42 USC 242b, 242k, and 242m(d)).”

4.3 Feasibility Informed Final Measure

This is a maintenance measure, and the measure specifications have not changed.

4.4 Proprietary Information

Not a proprietary measure and no proprietary components

5.1.1 Data Used for Testing

Reliability Testing: The dataset used for testing is the Center for Disease Control's (CDC) National Healthcare Safety Network (NHSN), which collects healthcare infection data from facilities throughout the United States. Data are from 1/1/2024 to 12/31/2024.

Risk Adjustment:
The dataset used for the risk adjustment model was derived from the 2022 Center for Disease Control's (CDC) National Healthcare Safety Network (NHSN), which includes healthcare infection data from facilities reported from 1/1/2022 to 12/31/2022 throughout the United States. The data includes in-plan MRSA bacteremia LabID data and risk factors derived from facility enrollment information and the annual facility survey.

Validity Testing: The dataset used for testing is the Center for Disease Control's (CDC) National Healthcare Safety Network (NHSN), which collects healthcare infection data from facilities throughout the United States. Data is from 1/1/2024 to 12/31/2024.

Validation Studies:

Date of data used in testing: December 1, 2021, until October 31, 2023

Prascius S, Wells A, Collier AM, Renard A, Hooper D, Stein T. Reduction of hospital-onset methicillin-resistant Staphylococcus aureus (MRSA) bacteremia with the use of twice daily alcohol-based nasal antiseptic in intensive care units. Am J Infect Control. 2025 Aug 19:S0196-6553(25)00504-8. doi: 10.1016/j.ajic.2025.08.006.

Date of data used in testing: January 1, 2013-December 31, 2013.

Pakyz AL, Wang H, Ozcan YA, Edmond MB, Vogus TJ. Leapfrog Hospital Safety Score, Magnet Designation, and Healthcare-Associated Infections in United States Hospitals. J Patient Saf. 2021 Sep 1;17(6):445-450.

5.1.1a Dates of Testing Data

Reliability Testing: The dataset used for testing is the Center for Disease Control's (CDC) National Healthcare Safety Network (NHSN), which collects healthcare infection data from facilities throughout the United States. Data are from 1/1/2024 to 12/31/2024.

Risk Adjustment:
The dataset used for the risk adjustment model was derived from the 2022 Center for Disease Control's (CDC) National Healthcare Safety Network (NHSN), which includes healthcare infection data from facilities reported from 1/1/2022 to 12/31/2022 throughout the United States. The data includes in-plan MRSA bacteremia LabID data and risk factors derived from facility enrollment information and the annual facility survey.

Validity Testing: The dataset used for testing is the Center for Disease Control's (CDC) National Healthcare Safety Network (NHSN), which collects healthcare infection data from facilities throughout the United States. Data is from 1/1/2024 to 12/31/2024.

Validation Studies:

Date of data used in testing: December 1, 2021, until October 31, 2023

Prascius S, Wells A, Collier AM, Renard A, Hooper D, Stein T. Reduction of hospital-onset methicillin-resistant Staphylococcus aureus (MRSA) bacteremia with the use of twice daily alcohol-based nasal antiseptic in intensive care units. Am J Infect Control. 2025 Aug 19:S0196-6553(25)00504-8. doi: 10.1016/j.ajic.2025.08.006.

Date of data used in testing: January 1, 2013-December 31, 2013.

Pakyz AL, Wang H, Ozcan YA, Edmond MB, Vogus TJ. Leapfrog Hospital Safety Score, Magnet Designation, and Healthcare-Associated Infections in United States Hospitals. J Patient Saf. 2021 Sep 1;17(6):445-450.

5.1.2 Differences in Data

Reliability Testing: The dataset used for testing is the 2024 Center for Disease Control's (CDC) National Healthcare Safety Network (NHSN) data, which collects healthcare infection data from facilities throughout the United States. Hospitals were excluded from the reporting if they had <1

predicted event.

Risk Adjustment:

The 2022 national aggregate data are reviewed for all potential data quality issues, including outlier values prior to performing the risk adjustment modeling of the SIR denominator for the MRSA bacteremia LabID model. Based on the surveillance protocol for MRSA, data were excluded from modeling consideration if it met the criteria: Inpatient rehabilitation locations and inpatient psychiatric locations that have their own Centers for Medicare and Medicaid Services (CMS) Certification Number (CCN) are excluded.

Validity Testing:

The dataset used for testing is the 2024 Center for Disease Control's (CDC) National Healthcare Safety Network (NHSN data, which collects healthcare infection data from facilities throughout the United States. Only facilities with both a MRSA and central line associated bloodstream infection (CLABSI) SIR, or a MRSA and *Clostridioidesdifficile* infection (CDI) LabID Event were included in the analysis (facilities with >=1 predicted event for both event types, respectively, were included).

Validation Studies:

MRSA SIR data was reported to NSHN from December 1, 2021, until October 31, 2023

Prascius S, Wells A, Collier AM, Renard A, Hooper D, Stein T. Reduction of hospital-onset methicillin-resistant Staphylococcus aureus (MRSA) bacteremia with the use of twice daily alcohol-based nasal antiseptic in intensive care units. Am J Infect Control. 2025 Aug 19:S0196-6553(25)00504-8. doi: 10.1016/j.ajic.2025.08.006.

MRSA SIR data was reported to NHSN January 1, 2013 to December 31, 2013.

Pakyz AL, Wang H, Ozcan YA, Edmond MB, Vogus TJ. Leapfrog Hospital Safety Score, Magnet Designation, and Healthcare-Associated Infections in United States Hospitals. J Patient Saf. 2021 Sep 1;17(6):445-450

5.1.3 Characteristics of Measured Entities

See 7.1 Supplemental Information Attachment Pages 4-6 for details.

5.1.4 Characteristics of Units of the Eligible Population

Reliability Testing:

The MRSA risk models used to calculate the predicted number of events were developed using patient care location- and facility-level factors. Since the data collection design did not allow for the capture of patient-level factors such as age or sex, these models are informed by surrogates of patient acuity (e.g., patient care location type, etc.).

Risk Adjustment:

The MRSA bacteremia LabID risk models used to calculate the predicted number of events were developed using facility-level factors and facility-wide inpatient data. The data collection design did not allow for the capture of patient-level factors, such as age or sex.

Validity Testing:

The MRSA risk models used to calculate the predicted number of events were developed using patient care location- and facility-level factors. Since the data collection design did not allow for the capture of patient-level factors such as age or sex, these models are informed by surrogates of patient acuity (e.g., patient care location type, etc.).

Validation Studies:

Prascius S, Wells A, Collier AM, Renard A, Hooper D, Stein T. Reduction of hospital-onset methicillin-resistant Staphylococcus aureus (MRSA) bacteremia with the use of twice daily alcohol-based nasal antiseptic in intensive care units. Am J Infect Control. 2025 Aug 19:S0196-6553(25)00504-8. doi: 10.1016/j.ajic.2025.08.006.

Patient who developed a MRSA LabID event.

Pakyz AL, Wang H, Ozcan YA, Edmond MB, Vogus TJ. Leapfrog Hospital Safety Score, Magnet Designation, and Healthcare-Associated Infections in United States Hospitals. J Patient Saf. 2021 Sep 1;17(6):445-450.

Patient who developed a MRSA LabID event.

5.2.1 Level(s) of Reliability Testing Conducted

Accountable entity level (i.e., measure score) (e.g., signal-to-noise analysis)

5.2.2 Method(s) of Reliability Testing

Signal-to-noise (SNR) reliability testing was performed to distinguish measure scores between facilities (Adams J.L. 2009). The annual standardized infection ratio (SIR) is defined as the sum of observed (O) events at the facility divided by the sum of predicted (P) events calculated from the risk-adjustment model. Signal-to-noise reliability testing denotes between-facility variance and within-facility variance (Adams J.L. 2009). The SNR for each facility SIR is calculated using both the between-facility and within-facility variance across eligible facilities with predicted number ≥1. The between-facility variance is simply the total variance of the SIR facility distribution. However, the within-facility variance of the SIR for each facility was then calculated as Var(O/P) where P is a constant, a nuisance factor with no random variation. The observed (O) was assumed to follow a Poisson distribution with a mean parameter lambda approximated by P. The result is Var(O/P) = Var(O)/P2 = P/P2 = 1/P. Signal to noise reliability scores can range from 0 to 1. A reliability of zero implies that all the variability in a measure is attributable to measurement error. A reliability of one implies that all the variability is attributable to real difference in performance.

References:

- Adams, J. L. (2009). *The reliability of provider profiling: a tutorial*. RAND.

5.2.3 Reliability Testing Results

We calculated the signal-to-noise reliability score for each facility that had at least one predicted MRSA event. Reliability testing was performed on data from 2024, for the Acute Care Hospitals. The mean reliability score was 0.58. There was not sufficient data in the CAH cohort for reliability analysis.

The percentage of facilities with an estimated reliability of >=0.6 was as follows 45% (856/1907).

5.2.3a Attach Additional Reliability Testing Results

5.2.3-Reliability-Testing-Results.pdf

5.2.4 Interpretation of Reliability Results

We calculated the signal-to-noise reliability score for each facility that had at least one predicted MRSA event. Reliability testing was performed on data from 2024, for the Acute Care Hospitals. The mean reliability score was 0.58. There was not sufficient data in the CAH cohort for reliability analysis. The median signal-to-noise reliability score demonstrates moderate reliability.

The percentage of facilities with an estimated reliability of >=0.6 was as follows 45% (856/1907). The decile distribution of reliability measurements can be located in section 5.2.3a above.

Signal-to-Noise reliability scores vary across facilities from zero to one, with a score of zero indicating that all variation is attributable to noise (variation across patients within facilities) and a score of one indicating that all variation is caused by real differences in performance across facilities.

Our interpretation of the results is based on the standards established by Landis and Koch (1977):
< 0 – Less than chance agreement
0 – 0.2 Slight agreement
0.21 – 0.39 Fair agreement
0.4 – 0.59 Moderate agreement
0.6 – 0.79 Substantial agreement
0.8 – 0.99 Almost Perfect agreement
1 Perfect agreement

Landis, J. R., & Koch, G. G. (1977). The measurement of observer agreement for categorical data. biometrics, 159-174.

Table 2. Accountable Entity Level Reliability Testing Results by Denominator, Target Population Size

Accountable Entity-Level Reliability Testing Results

	Overall	Minimum	Decile_1	Decile_2	Decile_3	Decile_4	Decile_5	Decile_6	Decile_7	Decile_8	Decile_9	Decile_10	Maximum
Reliability	0.58	0.308	0.335	0.389	0.446	0.496	0.548	0.601	0.653	0.712	0.781	0.875	0.947
Mean Performance Score	0.770		0.766	0.751	0.790	0.690	0.715	0.776	0.758	0.802	0.828	0.822	
N of Entities	1907		190	191	191	190	191	191	190	191	191	191	
N of Persons / Encounters / Episodes	150508334		5053570	6235125	7766428	9076812	10924702	12848588	14860455	18667779	24087685	40987190	

5.3.1 Level(s) of Validity Testing Conducted

Accountable entity level (i.e., measure score) (e.g., criterion validity)

5.3.2 Type of Accountable Entity Level Validity Testing Conducted

Empirical validity testing at the accountable entity-level (e.g., criterion validity, construct validity, known groups analysis)

5.3.3 Method(s) of Validity Testing

Validity Testing:

Spearman correlation coefficients were calculated to assess a hypothesized monotonic relationship in the positive direction between the annual MRSA and CDI and MRSA and CLABSI Standardized Infection Ratios (SIR). The annual SIR is defined as the sum of observed (O) events at the facility divided by the sum of predicted (P) events calculated from the risk-adjustment model. Each facility that reported both MRSA and CDI, or MRSA and CLABSI, data for 2024 with at least 1 predicted event for each HAI, respectively, was included. If a facility reported only one of the listed HAI events or did not have at least 1 predicted event for the paired HAIs, they were excluded from the analysis. Correlation coefficients range from -1 to +1, where a coefficient of -1 implies a perfect negative correlation, 0 implies no correlation, and +1 implies a perfect positive correlation. A significance threshold of 0.05 was used to test the result.

We hypothesized that there would be a positive correlation between MRSA and CDI SIRs as well as MRSA and CLABSI SIRs because there is overlap in the infection prevention practices preventing these types of infections (for example, hand hygiene, assessing catheter need and implementing protocols for removal, performing aseptic technique for insertion, performing surveillance in ICU and non-ICU locations, and use of care and maintenance bundles). Thus, we predicted that while the correlations would be positive, they would be weak correlations.

Validation Studies:

A 191-bed hospital within a Midwest health care system experienced an increase in hospital acquired Methicillin-resistant *Staphylococcus aureus* (MRSA) bacteremia. In response, the hospital sought a targeted intervention for MRSA prevention within the MICU and SICU using an alcohol based nasal antiseptic. In August 2021, Infection Prevention and Control (IPC) partnered with Nursing and the alcohol-based nasal antiseptic product vendor to implement the product in the 2 units. Nasal antiseptic was administered twice daily. Data collected from December 1, 2021, until October 31, 2023 were analyzed using SAS 9.4. To measure the outcome, IPC continued tracking incidence of hospital-onset MRSA (HO-MRSA) bacteremia using the NHSN definitions to generate a SIR using the 2015 baseline model. MRSA rates in 2021, 2022, and 2023 were calculated using total MRSA LabID cases for each year divided by inpatient days. Statistical significance was derived using a two-tailed z-test.

Prascius S, Wells A, Collier AM, Renard A, Hooper D, Stein T. Reduction of hospital-onset methicillin-resistant Staphylococcus aureus (MRSA) bacteremia with the use of twice daily alcohol-based nasal antiseptic in intensive care units. Am J Infect Control. 2025 Aug 19:S0196-6553(25)00504-8. doi: 10.1016/j.ajic.2025.08.006.

Empirical validity testing at the accountable entity level was performed by evaluating published studies from facilities that implemented MRSA prevention activities and hypothesized that these approaches would reduce their MRSA LabID event SIR.

The study focuses on organizational factors such as a hospital's safety infrastructure (indicated by Leapfrog Hospital Safety Score) or workplace quality (Magnet recognition) to determine whether Magnet and hospitals with better Leapfrog Hospital Safety Scores have fewer hospital associated infections. An ordered probit regression analyses tested associations between Safety Score, Magnet status, and standardized infection ratios (SIR), depicting whether a hospital had a methicillin-resistant Staphylococcus aureus (MRSA) bloodstream infection standardized infection ratio that was "better," "no different," or "worse" than a National Benchmark as per CDC NHSN. A total of 1,701 hospitals were included in the study.

Pakyz AL, Wang H, Ozcan YA, Edmond MB, Vogus TJ. Leapfrog Hospital Safety Score, Magnet Designation, and Healthcare-Associated Infections in United States Hospitals. J Patient Saf. 2021 Sep 1;17(6):445-450. doi: 10.1097/PTS.0000000000000378. PMID: 28452915.

5.3.4 Validity Testing Results

Validation Testing:

The acute care hospitals with both a MRSA SIR and a CDI SIR (n=1,906) had a weak but significant positive correlation (rho= 0.05165, p= 0.0241). The acute care hospitals with both a MRSA SIR and a CLABSI SIR (n= 1,869) also had a weak but significant positive correlation (rho= 0.22, p< .0001).

Validation Studies:

From 2021 to 2023, MRSA standardized infection ratios (SIR) declined with an SIR of 1.18 in 2021 to an SIR of 0.90 in 2023.

Prascius S, Wells A, Collier AM, Renard A, Hooper D, Stein T. Reduction of hospital-onset methicillin-resistant Staphylococcus aureus (MRSA) bacteremia with the use of twice daily alcohol-based nasal antiseptic in intensive care units. Am J Infect Control. 2025 Aug 19:S0196-6553(25)00504-8. doi: 10.1016/j.ajic.2025.08.006.

The study found that relative to non-Magnet hospitals, hospitals with a Magnet designation have a significant and positive relationship with MRSA bloodstream infections (0.74, $P < 0.001$) and are associated with fewer than expected MRSA infections.

Pakyz AL, Wang H, Ozcan YA, Edmond MB, Vogus TJ. Leapfrog Hospital Safety Score, Magnet Designation, and Healthcare-Associated Infections in United States Hospitals. J Patient Saf. 2021 Sep 1;17(6):445-450. doi: 10.1097/PTS.0000000000000378. PMID: 28452915.

5.3.4a Attach Additional Validity Testing Results

5.3.4a.docx

5.3.5 Interpretation of Validity Results

Validity Testing:

The significant positive correlations between MRSA and CDI SIR (rho= 0.06775, p= 0.0031) and MRSA and CLABSI SIR (rho= 0.18898, p< .0001) in acute care hospitals demonstrate that the SIRs are valid measures of healthcare quality, as they are all driven by clinically relevant patient care practices and evidence-based infection prevention strategies implemented by the healthcare facilities.

MRSA – CDI SIR: The CDI SIR and MRSA SIR are both laboratory-identified healthcare associated infection outcome measures. Implementation of infection prevention strategies, such as hand hygiene, have been shown to decrease the spread of *C.difficile* and MRSA. Environmental cleaning and disinfection, and appropriate use of contact/isolation precautions are also important prevention practices that can decrease the transmission of both pathogens.

However, other factors or prevention strategies may differ between the two pathogens. For example, facilities may focus antimicrobial stewardship resources to avoiding or limiting antibiotics associated with high CDI risk (such as fluoroqinolones). Alternatively, some facilities may choose to implement decolonization strategies aimed to reduce MRSA bloodstream infections. For these reasons, we hypothesized that there would be a weak positive correlation between the CDI SIR and MRSA SIR. We predicted only a weak correlation between the two measures because some facilities may choose to focus quality improvement on the prevention of a single HAI (CDI or MRSA) due to resource limitations or other factors.

MRSA – CLABSI SIR: The MRSA standardized infection ratio (SIR) and CLABSI SIR are both healthcare associated infection outcome measures. Implementation of infection prevention strategies, such as prevention bundles or checklists for infection prevention, have been shown to decrease these SIRs.

Some infection prevention strategies are employed to prevent both device-associated infections (CLABSI) as well as pathogen-specific infections (MRSA bacteremia). These include hand hygiene and line insertion and care practices (for both central and peripheral lines), antimicrobial stewardship, and CHG bathing plus intranasal mupiorocin for patients with a central line. Other infection prevention strategies may be targeted at just one of the HAIs, for example nasal

decolonization for all ICU patients (not just those with a central line) to decrease MRSA, or daily review of central lines to decrease CLABSI risk.

For these reasons, we hypothesized that there would be a weak positive correlation between the MRSA and CDI SIRs, as well as MRSA and CLABSI SIRs. We predicted only weak correlations between the paired measures because some facilities may choose to focus quality improvement on the prevention of a single HAI due to resource limitations or other factors.

Validation Studies:

From 2021 to 2023, MRSA standardized infection ratios (SIR) declined with an SIR of 1.18 in 2021 to an SIR of 0.90 in 2023. The total number of MRSA cases decreased from 2021 to 2022 with 4 cases and 1 case, respectively. This study supports the premise that the measure score represents an improvable quality measure.

Prascius S, Wells A, Collier AM, Renard A, Hooper D, Stein T. Reduction of hospital-onset methicillin-resistant Staphylococcus aureus (MRSA) bacteremia with the use of twice daily alcohol-based nasal antiseptic in intensive care units. Am J Infect Control. 2025 Aug 19:S0196-6553(25)00504-8. doi: 10.1016/j.ajic.2025.08.006.

The study found that relative to non-Magnet hospitals, hospitals with a Magnet designation have a significant and positive relationship with MRSA bloodstream infections (0.74, $P < 0.001$) and are associated with fewer than expected MRSA infections. Additionally, the study demonstrates that Magnet designated hospitals have decreased rates of reported MRSA infections. Thus, this study supports the hypothesis that the measure score correctly reflects the quality of care provided and adequately identifies differences in quality.

Pakyz AL, Wang H, Ozcan YA, Edmond MB, Vogus TJ. Leapfrog Hospital Safety Score, Magnet Designation, and Healthcare-Associated Infections in United States Hospitals. J Patient Saf. 2021 Sep 1;17(6):445-450. doi: 10.1097/PTS.0000000000000378. PMID: 28452915.

5.4.1 Methods Used to Address Risk Factors

Statistical risk adjustment model with risk factors

5.4.2 Conceptual Model Rationale

NHSN follows a highly rigorous process while developing risk adjustment models for its measures. The process begins with a thorough clinical and epidemiological review of all eligible potential risk factors that are currently collected in NHSN. The data available in NHSN are a combination of facility-level, unit-level, and limited patient-level risk factors. Those experts then recommend risk factors to be evaluated statistically. CDC obtains the risk factors considered for the model predicted events (i.e., denominator) by estimating the parameters or probability of risk occurrence. The final model is chosen by finding the optimal parameterizations of all covariates (i.e., risk factors) in linear regression procedures. In other words, risk factors are included in a model if they are determined to significantly impact healthcare associated infection (HAI) incidence. The model is then double-tested by a reverse process that removes non-significant factors. Each best model is fit-tested, calibrated, and validated using industry standard techniques.

References:

- NHSN's Guide to the 2022 Baseline Standardized Infection Ratios. Centers for Disease Control and Prevention website. https://www.cdc.gov/nhsn/2022rebaseline/sir-guide.pdf.
- Obtaining the Number of Predicted Events for the Standardized Infection Ratio (SIR)
- https://wwwdev.cdc.gov/nhsn/2022rebaseline/index.html

5.4.2a Attach Conceptual Model

5.4.2a-Conceptual-Model.pdf

5.4.3 Variable Distribution Across Measured Entities

See attachment under 5.4.3a below.

5.4.3a Attach Descriptive Statistics for Risk/Case-mix Variables

5.4.3-Variable-Distribution-Across-Measured-Entities.pdf

5.4.4 Risk/Case-Mix Adjustment Modeling and/or Stratification Results

Each potential risk factor was tested for association with the outcome using Wald, Likelihood Ratio, and Type III Chi-square tests at significant level for entry ≤ 0.25. This initial analysis was repeated by adding successive model parameters that assess model fit using AIC, BIC, and Deviance; where possible, we evaluated the model’s prediction using the pseudo-adjusted R-squared. Model diagnostics were used to assess potential multicollinearity by variance decomposition and the conditional index. Data points were assessed for high influence and leverage. Linearization and monotonicity were assessed using splines or other regularization methods. Each resulting model from this process was fit using backward elimination (or selection) to detect any possible associations not identified in the former forward stagewise selection process and to seek additional confirmation of any factor associations. Variables were retained in the final model if $p<0.05$ and confirmed by both forward stagewise and backward selection approaches. Next, the best model was validated via bootstrap sampling that relied on 1,000 replications selected randomly with replacement. If the confidence interval of the beta estimate

for a variable contained 0 using the 2.5 and 97.5 percentiles, that variable would be removed from the final model. For the acute-care hospital model, only 1 variable did not meet statistical significance: ED/Obs indicator, every other variable tested was retained in the final model. Finally, the model discrimination was computed with the pseudo-adjusted R-squared.

Similar strategies were used for the critical access hospital model; however, the total number of events from these hospitals was low during model derivation at 53 total events, with most hospitals having zero events. This required a much smaller risk model of degrees of freedom used. The optimal model under these restrictions retained 2 variables: any CO Prev rate in ED/OBS, any CO Prev rate in inpatient. Ultimately, the minimum precision criteria we require hospitals to have (>=1 predicted event) will result in no (zero) hospitals qualifying for measure reporting.

5.4.4a Attach Risk/Case-mix Adjustment Modeling and/or Stratification Specifications

5.4.4a-Risk-Case-mix-Adjustment-Modeling.pdf

5.4.5 Calibration and Discrimination

Discrimination of risk models were assessed using the Dispersion-based pseudo R-squared, and calibration was visually investigated by dividing the predicted number of events into deciles and plotting the observed number of events. Additionally, the Root Mean Square Error (RMSE) was calculated between observed and predicted events.

For the acute care hospital model, the dispersion-based pseudo r-square was 40.6%, while it was 4.8% for CAH. The RMSE for ACH was 0.99 and CAH 0.45.The decile calibration plots are attached under 5.4.5a.

5.4.5a Attach Calibration and Discrimination Testing Results

5.4.5-Calibration-and-Discrimination.pdf

5.4.6 Interpretation of Risk/Case-mix Factor Findings

The final risk adjustment models demonstrated that differences in facility-level factors were adequately accounted for. Variables were retained based on both statistical significance ($p < 0.05$) and validation through forward stagewise and backward elimination techniques. For the Acute Care model all but 1 variable that was sent forward for testing was retained in the final model. This is an indication of both, each variables independent association with MRSA events and the number of events we had to model. The Critical Access Hospitals are known to have a much smaller number of events which limit the final risk model. During derivation there were 53 total events in the CAH hospitals leading to 2 variables being retained in the final model with little degree of freedom room for additional covariates. The models were validated using bootstrap sampling, which helped identify and remove any variables with unstable beta estimates, ensuring

that the model-maintained generalizability. Overall, the modeling approach demonstrated that the retained risk factors sufficiently captured variation in patient case-mix across facility types. The use of model diagnostics such pseudo-R-squared confirmed good model fit and predictive utility. This indicates that outcome comparisons using the risk-adjusted results are fair and not confounded by underlying differences in population or facility. The retained variables meaningfully explain differences in outcome risk, and the exclusion of non-significant variables and variables that were limited in the model helps to avoid unnecessary model complexity.

See 7.1 Supplemental Information Attachment Pages 7-8 for risk adjustment models.

5.4.7 Final Approach to Address Risk Factors

Statistical risk adjustment model with risk factors

6.1.1 Current Status

In use

6.1.2 Current or Planned Use(s)

Public Reporting, Public Health/Disease Surveillance, Regulatory and Accreditation Programs, Quality Improvement with Benchmarking (external benchmarking to multiple organizations), Quality Improvement (Internal to the specific organization)

6.1.3 Program Details

Name of the program and sponsor
CDC NHSN
URL of the program
http://www.cdc.gov/nhsn/
Purpose of the program

NHSN HAI tracking system provides facilities, states, regions, and the nation with data needed to identify problem areas, measure progress of prevention efforts, and ultimately eliminate healthcare-associated infections.

Geographic area and percentage of accountable entities and patients included

US

Applicable level of analysis and care setting

Facility hospital

,
Name of the program and sponsor
CMS Care Compare
URL of the program
https://www.medicare.gov/care-compare/
Purpose of the program

This tool provides a single source search and compare experience, that helps the public choose a Medicare provider.

Geographic area and percentage of accountable entities and patients included

Over 4,000 Medicare-certified acute-care hospitals, long-term acute care hospitals and over 1,100 acute rehabilitation hospitals across the nation.

Applicable level of analysis and care setting

Facility, Inpatient/Hospital

,
Name of the program and sponsor
CMS Hospital-Acquired Condition Reduction Program (HACRP)
URL of the program
https://www.cms.gov/medicare/payment/prospective-payment-systems/acute-inpatien...
Purpose of the program

Encourages hospitals to improve patients' safety and reduce the number of conditions people experience from their time in a hospital. The Program encourages hospitals to improve patients' safety and implement best practices to reduce their rates of infections associated with health care.

Geographic area and percentage of accountable entities and patients included

General acute-care hospitals across the nation.

Applicable level of analysis and care setting

Facility, Inpatient/Hospital

,
Name of the program and sponsor
CMS Hospital Inpatient Quality Reporting Program (HIQR)
URL of the program
https://www.cms.gov/medicare/quality/initiatives/hospital-quality-initiative/in...
Purpose of the program

CMS collects quality data from hospitals paid under the Inpatient Prospective Payment System, with the goal of driving quality improvement through measurement and transparency by publicly displaying data to help consumers make more informed decisions about their health care.

Geographic area and percentage of accountable entities and patients included

Over 4,000 Medicare-certified acute-care hospitals across the nation.

Applicable level of analysis and care setting

Facility, Inpatient/Hospital

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Name of the program and sponsor
CMS The Prospective Payment System (PPS)-Exempt Cancer Hospital Quality Reporting (PCHQR) Program
URL of the program
https://qualitynet.cms.gov/pch/pchqr
Purpose of the program

Equips consumers with quality-of-care information to make more informed decisions about healthcare options. It is also intended to encourage hospitals and clinicians to improve the quality of inpatient care that is provided to Medicare beneficiaries.

Geographic area and percentage of accountable entities and patients included

Eleven cancer hospitals across the nation.

Applicable level of analysis and care setting

Facility, Inpatient/Hospital

,
Name of the program and sponsor
CMS Hospital Value-Based Purchasing Program
URL of the program
https://www.cms.gov/medicare/quality/value-based-programs/hospital-purchasing
Purpose of the program

The program adjusts payments to hospitals under the Inpatient Prospective Payment System (IPPS), based on the quality of care they deliver.

Geographic area and percentage of accountable entities and patients included

Over 3,000 hospitals across the country.

Applicable level of analysis and care setting

Facility, Inpatient/Hospital

6.2.1 Actions of Measured Entities to Improve Performance

To improve performance on this measure, facilities should review best practices and available guideline recommendations to determine which prevention strategies they can implement. The capability of a facility to implement MRSA LabID Event prevention strategies can vary. Success in reducing rates depends on factors such as available resources, leadership support, and staff

engagement.

Prevention strategies can include hand washing, performing routine surveillance, enhanced environmental cleaning, patient and healthcare personnel education, assessing for signs or symptoms of infection, and adherence to clinical guidelines. Conducting root cause analysis of increased prevalence of MRSA or outbreaks helps identify infection control weak points and guide targeted interventions.

The MRSA LabID Event Standardized Infection Ratio (SIR) is an important indicator of MRSA LabID Event prevention effort.

6.2.2 Feedback on Measure Performance

Facilities provide feedback that they are generating Standardized Infection Ratio (SIR) analysis reports, within CDC NHSN monthly, and that they use their SIR to determine if process improvement initiatives should be implemented to reduce MRSA events.

State health departments have advised that they report facilities SIRs publicly, which allows patients and families within the state to select high-quality facilities. State health departments also utilize the MRSA LabID Event Standardized Infection Ratio to target specific facilities with higher SIRs for additional support in initiating prevention activities.

Reporting facilities and state health departments provide feedback on measure performance and implementation through the CDC NHSN Helpdesk. Additionally, during live training such as ‘Ask the Experts’ webinars and educational sessions, an online survey is provided to attendees to share feedback on the measure.

There was no feedback given by users and there was no change to the measure or implementations strategy.

6.2.3 Consideration of Measure Feedback

CDC NHSN teams conduct an annual review of each measure protocol. For any measure revision recommendation received, NHSN follows a standard operational procedure designed to ensure thorough evaluation and implementation if appropriate. The process begins with a preliminary discussion and decision making by the NHSN Subject Matter Expert team. User inquiries are then assessed to understand the extent of the concern or improvement. The NHSN team then conducts a literature review to determine whether the recommendations align with current guidelines. If supporting evidence is identified, the NHSN team performs a collaborative

review of the findings, followed by input from branch leadership and clinicians. External experts are consulted on an ad hoc basis.

Since 2015, NHSN has released an annual 'Summary of Updates' that outlines changes to the Patient Safety Component protocol based on the review process. These modifications aim to enhance clarity and address feedback received from measured entities. It is important to note that the actual measures themselves are not changed every year.

There was no feedback given by users and there was no change to the measure or implementations strategy.

6.2.4 Progress on Improvement

See 7.1 Supplemental Information Attachment Pages 9-10

6.2.5 Unexpected Findings

Patient medical records and other sources of patient data must be reviewed to determine if the patient meets the necessary criteria for a MRSA LabID Event. It is possible that reviewers may fail to identify that a patient meets criteria thereby under-reporting MRSA LabID Events. Data collectors might also intentionally under-report MRSA LabID Events. Both actions would result in an SIR that is calculated to be lower than actual. Alternatively, patients may be identified as having a MRSA LabID Event, when in fact they do not meet MRSA LabID Event criteria and thereby calculate an SIR that is higher than actual. The NHSN reporting tool includes business logic to minimize misclassification of MRSA LabID Events and the CDC NHSN system generates SIRs automatically, reducing the possibility of manual error in SIR calculation.

7.1 Supplemental Attachment

See-7.1-Supplemental-Information-Attachment---MRSA-Bacteremia-LabID-Event-SIR.pdf

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The measure developer is different from the measure steward

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