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Hospital-Onset Methicillin-Resistant *Staphylococcus aureus* Prevention in Acute Care Hospitals

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Abstract

IMPORTANCE Methicillin-resistant *Staphylococcus aureus* (MRSA) infections are major contributors to morbidity and mortality among hospitalized patients. Despite evidence-based guidelines, opportunities remain to improve the implementation of MRSA infection prevention.

OBJECTIVE To determine whether an educational quality improvement program is associated with improved evidence-based practices and prevention of MRSA infections among hospitalized patients.

DESIGN, SETTING, AND PARTICIPANTS This quality improvement study evaluates the Agency for Healthcare Research and Quality's Safety Program for MRSA Prevention, which was conducted and evaluated in volunteer intensive care units (ICUs) and non-ICUs in US acute care hospitals from April 2022 through September 2023. Data analysis, which was conducted between October 2024 and January 2025, compared data from the project period to the previous 12 months of baseline data.

EXPOSURES The program provided 22 webinars and durable educational content and assisted units with implementing evidence-based MRSA infection prevention interventions. Webinars targeted nurses, infection preventionists, physicians, nursing assistants, and environmental services personnel. The major foci were chlorhexidine bathing, nasal MRSA decolonization, environmental disinfection, and interventions to prevent person-based MRSA transmission and device-related infections.

MAIN OUTCOMES AND MEASURES The primary outcome was the rate of laboratory-identified, MRSA hospital-onset bacteremia (HOB) events. Secondary outcomes included hospital-onset clinical cultures growing MRSA, all-cause HOB, and central line–associated bloodstream infections. The χ^2 test was used to compare binary outcomes.

RESULTS One hundred ninety-three hospital units completed the program (106 ICUs and 87 non-ICUs from 94 hospitals), including units from 31 (33%) academic medical centers, 42 (45%) non–academic medical centers teaching hospitals, and 21 (22%) nonteaching community or other hospitals. Between baseline and the end of the program, laboratory-identified MRSA HOB events decreased by −2.3 events per 10 000 patient-days (95% CI, −2.8 to −1.9 events per 10 000 patient-days; $P < .001$), or −65% (95% CI, −73% to −58%; $P < .001$). Clinical cultures growing MRSA from hospital day 4 or later decreased by −5.6 events per 10 000 patient-days (95% CI, −7.8 to −3.3 events per 10 000 patient-days; $P < .001$), or −39% (95% CI, −50% to −29%; $P < .001$). All-cause HOB decreased by −10.5 events per 10 000 patient-days (95% CI, −13.8 to −7.1 events per 10 000 patient-days; $P < .001$), or −37% (95% CI, −45% to −30%; $P < .001$). Central line–associated bloodstream

(continued)

Key Points

Question Is a focused educational quality improvement program associated with improved evidence-based practices and prevention of methicillin-resistant *Staphylococcus aureus* (MRSA) infections among hospitalized patients?

Findings In this quality improvement study that included 106 intensive care units (ICUs) and 87 non-ICUs from 94 hospitals, the intervention period was associated with a decrease in hospital-onset MRSA bacteremia laboratory-identified events of 2.3 events per 10 000 patient-days or 65%, a significant difference.

Meaning These findings suggest that publicly available MRSA prevention program toolkit materials may help ICUs and non-ICUs reduce MRSA infections among hospitalized patients.

+ Supplemental content

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Abstract (continued)

infections decreased by −3.5 events per 10 000 central-line days (95% CI, −5.5 to −1.5 events per 10 000 central-line days; *P* < .001), or −31% (95% CI, −45% to −17%; *P* < .001).

CONCLUSIONS AND RELEVANCE In this quality improvement study of MRSA prevention in ICU and non-ICU hospital settings, the program was associated with significantly reduced rates of laboratory-identified MRSA HOB events and other infections among participating hospital units. The program content is publicly available and may help ICUs and non-ICUs reduce MRSA infection among hospitalized patients.

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Introduction

Methicillin-resistant *Staphylococcus aureus* (MRSA) is a highly invasive and deadly multidrug-resistant organism that continues to be a serious threat in both the community and health care settings.[1-4] The Centers for Disease Control and Prevention estimated that there were more than 323 000 MRSA infections in hospitalized patients and more than 10 000 MRSA-related deaths in 2019.[4] The COVID-19 pandemic further exacerbated MRSA infections, diverting resources and hindering progress in preventing hospital-onset MRSA bloodstream infections.[4-6] Ongoing challenges posed by MRSA highlight the urgent need for effective infection prevention strategies to mitigate its impact on health care systems and patient outcomes.

With interest in preventing MRSA transmission and infections in US health care settings, the Agency for Healthcare Research and Quality (AHRQ) established the AHRQ Safety Program for MRSA Prevention in February 2020 through a partnership with Johns Hopkins University Armstrong Institute (Baltimore, Maryland) and NORC at the University of Chicago (Chicago, Illinois) to measurably decrease MRSA infections in intensive care units (ICUs) and non-ICUs, high-risk surgical services, and long-term care facilities. The AHRQ Safety Program for MRSA Prevention adapted the comprehensive unit-based safety program (CUSP) framework, which aims to improve patient safety through improvements in teamwork, communication, and the science of safety, together with evidence-based practices to reduce patient risk of MRSA infection.[7] We describe the structure, implementation, and outcomes of the safety program in ICUs and non-ICUs in US acute care hospitals.

Methods

The safety program was acknowledged and exempted from informed consent by the Johns Hopkins University School of Medicine Institutional Review Board. The program adhered to the Revised Standards for Quality Improvement Reporting Excellence (SQUIRE) reporting guidelines.[8]

Program Participants

Hospital ICUs and non-ICUs from across the US were eligible to participate in the program (eFigure 1 in Supplement 1). Recruitment involved working with national and local health care associations, quality improvement networks, public and private health systems, and federal partners, and through informational webinars led by the team's clinical subject matter experts. Participating units identified a point of contact and implementation lead, and all staff were encouraged to actively engage in the project. Continuing medical education credits for participating in educational webinars were provided for physicians and physician assistants, and continuing education units were provided for participating registered nurses, nurse practitioners, and infection preventionists.

Program Implementation

The safety program implementation began in April 2022 and concluded in September 2023. Throughout the 18-month implementation period, the program hosted 22 distinct educational webinars covering various topics related to MRSA prevention. Content included approaches to (1) strengthen the culture of safety and build capacity for unit-based quality improvement activities and (2) implement evidence-based infection prevention practices to interrupt MRSA transmission and prevent MRSA infection (eTable 1 in Supplement 1). Clinical subject matter experts in infectious diseases, health care epidemiology, and patient safety led the webinars. Each of the 22 webinars was delivered 2 to 3 times at different times of day, to facilitate attendance by participants in different time zones. Participants were encouraged to attend each of the 22 live seminar sessions or watch the recorded versions, which were posted on the project website.

All sessions were informed by the 4-part program framework developed for MRSA prevention (eFigure 2 in Supplement 1). The program also offered participating units implementation resources (eg, tools, forms, and templates) and optional, twice-monthly office hours led by program subject matter experts for implementation guidance and facilitated peer-to-peer sharing. The design and content of the safety program were developed through evidence review and collaboration with a 19-member infectious disease technical expert panel. The content was continuously accessible throughout the program.

Sites were paired with experienced quality improvement implementation advisors to facilitate program implementation and data collection activities. The program used the following strategies to maintain engagement with participating units: flexible webinar schedules and recordings available to those unable to attend live presentations, implementation support from clinical experts, quarterly benchmarking reports presenting individual unit data compared with the mean among participating units, a monthly program newsletter, and a help desk to answer questions from participating units.

Data Collection

Data were collected from participating hospitals and units to assess changes in infrastructure, implementation, and clinical outcomes (eTable 2 in Supplement 1). The infrastructure assessment (gap analysis) collected information regarding infection prevention program structure, resources, and infection control activities, specifically those related to MRSA prevention for each participating hospital and unit at baseline and at the end of the program (eFigure 3 in Supplement 1). The implementation assessment (team checkup tool) asked each participating unit to estimate the frequency of use of safety guidelines, tools, and resources at baseline and each implementation month (eFigure 4 in Supplement 1). Clinical outcomes for each participating unit were collected for a 12-month retrospective period before program implementation (April 2021 to March 2022) and for each month during the 18-month implementation period (April 2022 to September 2023). Units had the option of directly submitting select clinical outcomes data to the safety program through the secure data collection portal, or they could confer their National Healthcare Safety Network (NHSN) data rights to the safety program, in which case the safety program team extracted the relevant data for select outcomes. The primary clinical outcome was the rate of laboratory-identified MRSA hospital-onset bacteremia (HOB) events.[9]

The secondary outcomes collected were the rates of HOB more generally, defined as a positive blood culture growing any organism from any cause (including contaminants and repeat positive blood cultures) sent from the participating unit and taken on day 4 or later after hospital admission; MRSA-positive cultures from hospital day 4 or later; and central line–associated bloodstream infection (CLABSI) events (eTable 3 in Supplement 1). To ensure data quality throughout the safety program, we provided units with detailed data submission user guides and held instructional webinars at the start of the program that covered electronic data extraction, completion of the standardized data collection template, and uploading data. The safety program team provided technical assistance to units that had missing data or data that were clinically implausible (eg, the submitted number of central-line days was greater than the number of patient-days). In addition, the

safety program provided individualized quarterly benchmarking reports to each unit to enable them to assess their progress throughout the safety program compared with other ICUs or non-ICUs, as appropriate to the unit receiving the report.

Statistical Analysis

The final statistical data analyses were conducted between October 2024 and January 2025. We analyzed baseline to end-of-program changes in hospital infrastructure and team activities related to infection control collected from the gap analysis and team checkup tool, with comparisons made using the χ^2 test for binary outcomes. The participating clinical unit was the unit of analysis except for the hospital-level gap analysis, where the hospital was the unit of analysis.

We compared the mean monthly rates of each of the clinical outcomes, as well as the rates of CLABSI and HOB events by select causative organisms (eg, MRSA, methicillin-susceptible *S aureus*, *Escherichia coli, Candida* species, and *Klebsiella pneumoniae*), for the 12 months of the baseline period to the 18-month implementation period for our primary analysis. Stratified analyses were performed to investigate the program outcome variation by hospital and unit characteristics, including hospital size and type, unit size and type (within the ICU or non-ICU strata), and census region. We also compared rates of each of the clinical outcomes across the same quarter for each year of the study to account for potential seasonality and reported for our primary sensitivity analysis those changes identified between July to September 2021 (the second quarter of the baseline period) and July to September 2023 (the final quarter of the implementation period). In an additional sensitivity analysis, the quarterly changes in outcomes identified in this study were further compared with changes identified at the national level using data collected through NHSN. All clinical outcomes were analyzed as unit-month level rates using linear mixed-effects models, with clinical unit random effects to take clustering effect into account. A 2-sided significance level of $P < .05$ was considered statistically significant. Data were analyzed with Stata software version 18.5 (StataCorp).

Results

Program Participation

A total of 94 hospitals (106 ICUs and 87 non-ICUs) completed the safety program (**Table 1**). These hospitals included 31 academic medical centers (AMCs; 33%), 42 non-AMC teaching hospitals (45%), and 21 nonteaching community hospitals (22%). Most hospitals had 100 to 499 beds (70 hospitals [75%]), and 50% of the hospitals (47 hospitals) were from the South region.

A mean of 90 clinical staff from participating units attended each live webinar. By the conclusion of the implementation period in September 2023, the 10 most popular educational webinar recordings on the program website had over 2600 unique downloads (averaging 244 downloads per topic). From October 2021 to April 2024, the safety program help desk responded to 1252 inquiries related to the ICU and non-ICU cohort.

Changes in Infrastructure and Team Activities

Among participating units, we observed that the intervention period was associated with statistically significant increases in the percentage of units that reported performing nasal MRSA decolonization for all patients (ICUs increased from 35% [36 units] to 61% [49 units]; non-ICUs increased from 13% [11 units] to 35% [25 units]; $P < .001$ for both settings) and having a process in place for monitoring environmental cleaning (ICUs increased from 50% [51 units] to 75% [60 units]; $P < .001$; non-ICUs increased from 52% [44 units] to 76% [53 units]; $P = .003$). At the hospital level, the intervention period was associated with a significant increase in having surveillance in place to assess compliance with environmental cleaning (baseline, 79 of 92 hospitals [86%]; end line, 72 of 75 hospitals [96%]; $P = .03$).

The percentage of ICUs that estimated more than 75% of all patients received 5 days of MRSA intranasal decolonization treatment increased from 49% (18 of 37 ICUs) to 78% (35 of 45 ICUs;

P = .006), and the percentage of non-ICUs that estimated more than 75% of high-touch surfaces in the patient care rooms were adequately cleaned and disinfected both daily and terminal cleaning increased from 71% (40 of 56 non-ICUs) to 88% (51 of 58 non-ICUs; *P* = .03). Changes in other assessed items regarding unit and hospital infrastructures and implementing evidence-based practices are included in eTables 4 to 8 in Supplement 1.

Changes in Clinical Outcomes

Compared with the baseline period, the implementation period was associated with a −65% change (95% CI, −73% to −58%; *P* < .001) in the mean monthly rate of laboratory-identified MRSA HOB events among program participants, including −2.3 fewer events per 10 000 patient-days (95% CI, −2.8 to −1.9 events per 10 000 patient-days; *P* < .001) for combined ICU and non-ICU cohorts, −3.0 fewer events per 10 000 patient-days (95% CI, −3.7 to −2.3 events per 10 000 patient-days;

Table 1. Hospital and Unit Characteristics

Characteristics	Hospitals and units, No. (%)
Hospital characteristics (n = 94)	
Hospital type	
Academic medical centers	31 (33)
Non-academic medical center teaching hospitals	42 (45)
Nonteaching community hospitals	21 (22)
Hospital size, No. of beds	
<100	5 (5)
100-499	70 (75)
≥500	19 (20)
Geographic location	
Urban	46 (49)
Suburban	35 (37)
Rural	13 (14)
Census region	
Northeast	19 (20)
Midwest	16 (17)
South	47 (50)
West	12 (13)
No. of participating units, median (IQR)	2 (1-3)
ICU characteristics (n = 106)	
Unit type	
Medical ICUs	50 (47)
Medical and/or surgical ICUs	40 (38)
Surgical, trauma, or neurological ICUs	16 (15)
Unit size, No. of beds	
<15	40 (38)
15-24	47 (44)
≥25	19 (18)
Non-ICU characteristics (n = 87)	
Unit type	
Medical wards	11 (13)
Medical and/or surgical wards	38 (44)
Surgical and other wards	10 (12)
Stepdown and/or telemetry wards	28 (32)
Unit size, No. of beds	
<25	33 (38)
25-39	27 (31)
≥40	27 (31)

Abbreviation: ICU, intensive care unit.

P < .001) for ICUs, and −1.5 fewer events per 10 000 patient-days (95% CI, −2.1 to −1.0 events per 10 000 patient-days; *P* < .001) for non-ICUs. The implementation period was associated with significantly lower rates of all other measured clinical outcomes, including the HOB rate in both ICU and non-ICU settings (−10.5 events per 10 000 patient-days [95% CI, −13.8 to −7.1 events per 10 000 patient-days; *P* < .001]; percentage change, −37% [95% CI, −45% to −30%; *P* < .001]), rates of MRSA-positive cultures from hospital day 4 or later (−5.6 events per 10 000 patient-days [95% CI, −7.8 to −3.3 events per 10 000 patient-days; *P* < .001]; percentage change, −39% [95% CI, −50% to −29%; *P* < .001]), and CLABSI events in ICUs (−3.5 events per 10 000 central-line days [95% CI, −5.5 to −1.5 events per 10 000 central-line days; *P* < .001]; percentage change, −31% [95% CI, −45% to −17%; *P* < .001]) (**Table 2**).

Significantly lower rates of MRSA HOB were associated with the implementation quarters over the study years as well (**Figure**). Between July to September 2021 (baseline quarter) and July to September 2023 (end of implementation quarter), MRSA HOB rates decreased by −3.8 events per 10 000 patient-days (95% CI, −4.9 to −2.6 events per 10 000 patient-days; *P* < .001) in the combined cohort, −4.3 events per 10 000 patient-days (95% CI, −5.9 to −2.6 events per 10 000 patient-days; *P* < .001) in ICUs, and −3.2 events per 10 000 patient-days (95% CI, −4.6 to −1.7 events per 10 000 patient-days; *P* < .001) in non-ICUs. Results were similar for the other quarterly comparisons of MRSA HOB over the years of the study (**Table 3**).

For the change in HOB per 10 000 patient-days from the baseline period to the implementation period, over half of the reductions were attributed to MRSA, methicillin-susceptible *S aureus,* and coagulase-negative *Staphylococcus* species in both ICU and non-ICU settings (eTables 9-14 in Supplement 1). Stratified analyses did not find a clear pattern in outcome variation by select hospital and unit characteristics.

There was also a significant difference in the sensitivity analysis comparing the change in laboratory-identified MRSA HOB events per 10 000 patient-days reported through the safety program with national data collected through NHSN. From July to September 2021 (baseline) to July to September 2023 (end of implementation), the rate was 74% lower (95% CI, 60% to 88%), or 1.5 vs 5.7 events per 10 000 patient-days, in participating ICUs and 93% lower (95% CI, 86% to 100%),

Table 2. Change in Clinical Outcomes Between Baseline and Implementation Periods

Outcome	No. of units in analysis	Monthly rate, mean No. of events/ 10 000 patient-days		Change from baseline to implementation period	
		Baseline period	Implementation period	No. of events/10 000 patient-days, mean (95% CI)	Percentage change
Combined (ICUs and non-ICUs)					
Laboratory-identified MRSA HOB events	191	3.6	1.2	−2.3 (−2.8 to −1.9)[a]	−65
All-cause HOB events	151	27.9	17.5	−10.5 (−13.8 to −7.1)[a]	−37
MRSA-positive cultures from hospital day 4 or later	150	14.1	8.5	−5.6 (−7.8 to −3.3)[a]	−39
CLABSI events[b]	189	11.1	7.6	−3.5 (−5.5 to −1.5)[a]	−31
ICUs					
Laboratory-identified MRSA HOB events	105	4.6	1.6	−3.0 (−3.7 to −2.3)[a]	−66
All-cause HOB events	81	37.2	22.1	−15.0 (−20.5 to −9.7)[a]	−41
MRSA-positive cultures from hospital day 4 or later	80	19.1	11.4	−7.7 (−10.8 to −4.6)[a]	−40
CLABSI events[b]	104	13.6	8.0	−5.6 (−8.1 to −3.1)[a]	−41
Non-ICUs					
Laboratory-identified MRSA HOB events	86	2.3	0.8	−1.5 (−2.1 to −1.0)[a]	−65
All-cause HOB events	70	17.2	12.0	−5.2 (−8.3 to −2.1)[c]	−30
MRSA-positive cultures from hospital day 4 or later	70	8.5	5.3	−3.2 (−6.4 to 0.1)	−38
CLABSI events[b]	85	8.0	7.1	−0.9 (−4.1 to 2.2)	−11

Abbreviations: CLABSI, central line–associated bloodstream infection; HOB, hospital-onset bacteremia; ICU, intensive care unit; MRSA, methicillin-resistant *Staphylococcus aureus*.

[a] *P* < .001.

[b] CLABSI events are expressed as number per 10 000 central-line days.

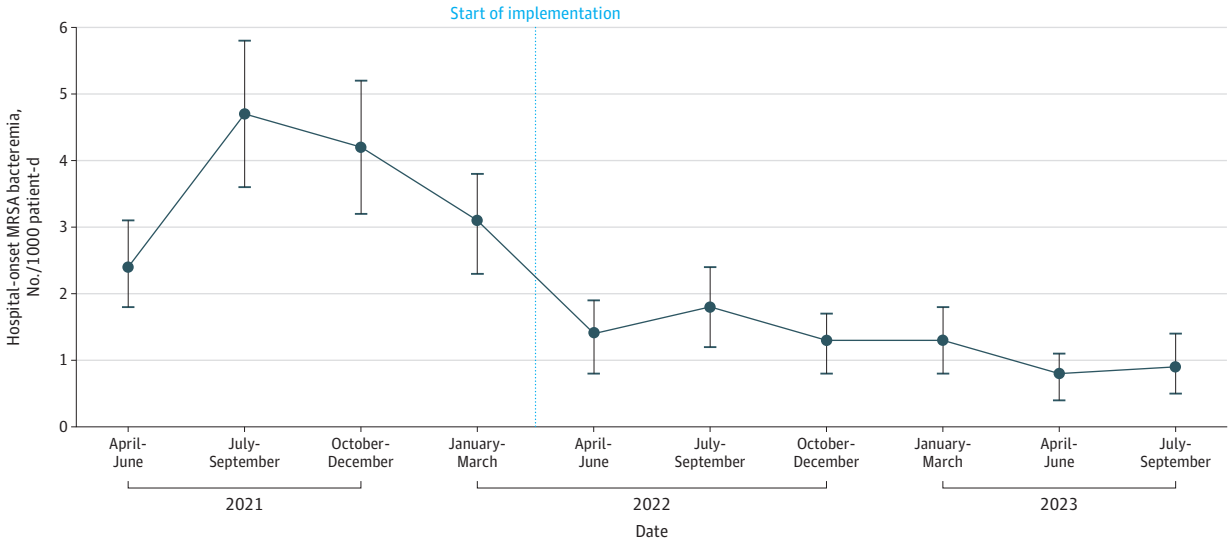
[c] *P* < .01.

or 0.2 vs 3.4 events per 10 000 patient-days, in participating non-ICUs; both were significantly different ($P < .001$) from the 36% rate decrease (from 1.2 to 0.7 events per 10 000 patient-days) observed among national acute care hospitals over the same period (eTables 15-17 in Supplement 1).

Discussion

In this quality improvement study, the AHRQ Safety Program for MRSA Prevention was associated with reduced MRSA HOB, all-cause HOB, clinical cultures growing MRSA, and CLABSI rates across an 18-month implementation project adopted by 106 ICUs and 87 non-ICUs. This program highlights the ongoing need for dissemination programs to promote adoption of MRSA prevention strategies well after the evidence base has been established.[10-12] The program was associated with a measurable improvement in the number of participating ICUs and non-ICUs that utilized MRSA prevention practices, including nasal decolonization, chlorhexidine bathing, and high-quality environmental cleaning of high-touch surfaces. This effort further demonstrates the success of the CUSP methods, emphasizing the importance of teamwork and communication in ensuring a culture of safety.

Figure. Line Graph of Hospital-Onset Methicillin-Resistant *Staphylococcus aureus* (MRSA) Bacteremia Events Over Time



Graph shows data for combined intensive care units (ICUs) and non-ICUs. Dots denote mean number of laboratory-identified MRSA hospital-onset bacteremia events per 10 000 patient-days. Error bars denote 95% CIs.

Table 3. Laboratory-Identified Hospital-Onset Methicillin-Resistant *Staphylococcus aureus* Bacteremia Across Quarters

Comparison quarters	No. of events/10 000 patient-days, mean (95% CI)		
	Combined ICU and non-ICU cohort	ICUs	Non-ICUs
April to June 2022 vs 2021	−1.1 (−1.9 to −0.2)[a]	−1.2 (−2.6 to 0.2)	−0.9 (−1.6 to −0.2)[b]
July to September 2022 vs 2021	−2.9 (−4.2 to −1.6)[c]	−3.6 (−5.5 to −1.7)[c]	−2.1 (−3.7 to −0.4)[a]
October to December 2022 vs 2021	−2.9 (−4.0 to −1.9)[c]	−4.4 (−6.0 to −2.8)[c]	−1.1 (−2.1 to −0.04)[a]
January to March 2023 vs 2022	−1.7 (−2.6 to −0.8)[c]	−2.1 (−3.5 to −0.6)[b]	−1.3 (−2.1 to −0.5)[b]
April to June 2023 vs 2022	−0.6 (−1.1 to −0.02)[a]	−1.0 (−1.9 to −0.03)[a]	−0.1 (−0.6 to 0.4)
July to September 2023 vs 2022	−0.9 (−1.6 to −0.2)[a]	−0.7 (−1.8 to 0.4)	−1.1 (−1.9 to −0.3)[b]
April to June 2023 vs 2021	−1.6 (−2.4 to −0.9)[c]	−2.1 (−3.4 to −0.9)[c]	−1.0 (−1.7 to −0.4)[b]
July to September 2023 vs 2021	−3.8 (−4.9 to −2.6)[c]	−4.3 (−5.9 to −2.6)[c]	−3.2 (−4.6 to −1.7)[c]

Abbreviation: ICU, intensive care unit.

[a] $P < .05$.

[b] $P < .01$.

[c] $P < .001$.

MRSA prevention in health care settings is multifaceted and complex. Effective strategies include both horizontal approaches that prevent transmission of infection with many types of organisms (eg, hand hygiene and environmental disinfection) and vertical approaches that specifically target *S aureus* (eg, nasal decolonization). The complexity of the multiple interventions further underscores the need and value of dissemination programs like the AHRQ Safety Program for MRSA Prevention whereby expert-driven presentations, protocols, and conversations can lower thresholds for adoption, troubleshoot common errors leading to ineffective adoption, and prioritize the menu of strategies to fit institutional needs. This program reinforced longstanding strategies, such as hand hygiene, environmental cleaning, and contact precautions, and facilitated the adoption of more recently proven strategies involving nasal decolonization and daily chlorhexidine skin antisepsis for patients in ICUs and patients with invasive devices in non-ICUs.[13-15]

The AHRQ Safety Program addressed the issue of nonadherence to guidelines by providing comprehensive information and tools for successful implementation of evidence-based MRSA prevention within the CUSP framework. MRSA prevention interventions were organized into 4 basic MRSA prevention strategies: decolonizing patients, decontaminating the environment, preventing person-based MRSA transmission, and preventing device-related infections. This MRSA prevention framework provided a structure for conceptualizing, implementing, and assessing process improvement. The 18-month program period was associated with significant increases in the reported use of nasal decolonization and implementation of environmental cleaning monitoring systems in the participating units.

Another strength of the program was its incorporation of adaptive behavioral safety interventions in addition to the technical ones. Using the CUSP framework, the project team supported participating units to strengthen their culture of safety and improve teamwork and communication. Case examples were used to illustrate the interactive and complementary nature of the technical and adaptive interventions. The educational content and case examples emphasized the importance of communication and provided specific examples and strategies. Individualized coaching and support from the implementation advisors and access to the program experts through office hours and a help desk tailored the content to individual unit's needs. The program's impact is seen in its association with a greater decrease in MRSA infections in the participating units compared with national data for the same period. Future investigation into the effectiveness of this approach will help elucidate which elements of the program are most effective and important. Longer-term studies would also be helpful to understand how best to achieve and sustain adherence to existing infection prevention guidelines and how best to disseminate and promote the adoption of new approaches.

Limitations

There were several limitations and program challenges. First, and most notably, the intervening COVID-19 pandemic limited recruitment and facility resources. The resulting smaller participant group affected our ability to assess rare events and perform subgroup analyses. Second, because this was a pragmatic implementation program with the primary goal of adoption of already proven strategies, the before-and-after evaluation may have been affected by volunteerism and secular trends. As we had data access only to participating units and could not obtain comparable unit-level measures from nonparticipating sites for the same period to establish a contemporaneous control group, we conducted sensitivity analyses to compare changes in our outcomes with the broader NHSN data, which supported reductions in hospital-acquired infections that were significantly greater than those seen across national acute care hospitals. Third, several clinical outcomes (eg, MRSA HOB) declined before the start of the official implementation. This may reflect increased awareness of and focus on MRSA prevention among participating units before the formal intervention period and/or may reflect the improved availability of resources and attention to infection prevention practices as the pandemic subsided. However, MRSA rates continued to decline throughout the implementation period, and, importantly, comparison with national NHSN data

suggested a greater improvement in MRSA HOB among participants than in US hospitals as a whole. Fourth, a potential limitation was the self-reported nature of the clinical outcomes. Although the program team could not verify that the clinical outcomes data submitted to the program matched the information in the hospitals' electronic health records, the team routinely searched for outlier data and worked with the submitting teams to verify that submitted data were correct or encouraged correction and resubmission, when appropriate. Fifth, the safety program implementation included substantial support—optional twice-monthly office hours and access to implementation advisors—to facilitate program adoption within each participating hospital and unit. Therefore, generalizability may be limited as similar results may not be achieved in settings that implement the program without comparable technical assistance and engagement supports. Despite these limitations, the program demonstrates that pairing a focused concentration on basic evidence-based practices with resources to support adaptive skills and a culture of safety can be associated with improved patient outcomes.

Conclusions

In this quality improvement study of MRSA prevention in acute hospital ICU and non-ICU units, the AHRQ Safety Program for MRSA Prevention was associated with a significant reduction in MRSA HOB, all-cause HOB, clinical cultures growing MRSA, and CLABSI. Participation in the program by ICU and non-ICU units was associated with significant improvements in their MRSA prevention practices, including the use of MRSA decolonization and active monitoring of the quality of environmental cleaning. Although COVID-19 complicated recruitment and implementation, the program was associated with reduced MRSA infections at a time when national MRSA infection rates recovered more slowly from pandemic-related increases.[4,16,17] The program equipped frontline clinicians with tools and resources to strengthen existing infection prevention initiatives and establish new ones. The AHRQ MRSA Prevention Toolkit is publicly available to provide the project materials and support MRSA prevention efforts in acute care hospitals.[18]

ARTICLE INFORMATION

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Data Sharing Statement: See Supplement 2.

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SUPPLEMENT 1.

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Data Sharing Statement