MRSA Prevention in Acute Care Settings

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Current MRSA burden
Updates to SHEA MRSA Compendium
Review Tricky Issues
  Contact precautions (Thorny Issue #1)
  Active surveillance (Thorny Issue #2)
  Decolonization (Thorny Issue #3)
Role of whole genome sequencing in infection control
MSSA
Unresolved Issues
Impact of COVID-19 on HAIs

Weiner-Lastinger, et al., ICHE 2022

MMWR, June 2018
CA-MRSA: Impact on Acute Care Settings

- USA300 MRSA has been shown to cause hospital-onset infections
- Genomic studies suggest that there is an intermixing of community and hospital MRSA transmission networks
- Are people already colonized with USA300 MRSA before admission to the hospital? Consider certain community exposures as risks.
- Prevention efforts may need to extend to the community for maximal benefit

Popovich, et al., JID 2017
Rhee, et al., ICHE 2015
Popovich, et al., CID 2020
SHEA/IDSA/APIC Practice Recommendation

SHEA/IDSA/APIC Practice Recommendation; Strategies to prevent methicillin-resistant Staphylococcus aureus transmission and infection in acute-care hospitals: 2022 Update

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A lot of recommendations in infection control are not based on strong data or randomized control trials.

Yet many of such measures are cornerstones of robust infection control programs in acute care settings.
Essential

- Formerly “Basic Practices”
- Recommended for all acute care hospitals
- Even though terminology used is “essential”, discussion is included for “opt-out” strategy for hospitals based on risk assessment

Additional

- Formerly “Special Approaches”
- Recommended for use in locations and/or populations within the hospital that have unacceptably high MRSA rates despite implementation of the basic MRSA transmission and infection prevention strategies
- A risk assessment can help guide hospitals
### Basic/Essential Recommendations that are Unchanged from 2014 Document

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Evidence Rating</th>
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<tr>
<td>MRSA Risk Assessment</td>
<td>LOW</td>
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<tr>
<td>MRSA Monitoring Program</td>
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<td>Hand Hygiene</td>
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<td>Environmental Cleaning</td>
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<td>Alert System for MRSA-colonized or MRSA-infected Patients</td>
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<td>Education</td>
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**Opt-out discussion included**
Essential: Conduct an MRSA risk assessment
(Quality of Evidence: LOW)

- Examine the opportunity for MRSA transmission, estimate the facility-specific MRSA burden and rates of MRSA transmission and infection
- This recommendation is referenced often to assist hospitals in choosing and implementing strategies
  - Findings should be used to develop the hospital’s surveillance, prevention, and control plan
  - Assist hospitals in determining if “Additional” strategies are needed
- Provides a baseline for subsequent assessments and other data comparisons
Reclassified antimicrobial stewardship from an Unresolved issue to an Essential practice

Several studies support effectiveness of antibiotic stewardship programs

No evidence of harm

Beneficial to other important outcomes
Forest plot of the incidence ratios for studies of the effect of antibiotic stewardship on the incidence of Methicillin-resistant Staphylococcus aureus

Thorny Issue #1: Contact Precautions

*CDC continues to recommend the use of contact precautions for MRSA colonized for infected patients (https://www.cdc.gov/mrsa/healthcare/inpatient.html)*
Use contact precautions for MRSA-colonized and MRSA-infected patients. Quality of evidence: MODERATE. A facility that chooses or has already chosen to modify the use of contact precautions for some or all of these patients should conduct a MRSA-specific risk assessment to evaluate the facility for transmission risks and to assess the effectiveness of other MRSA risk mitigation strategies (e.g., hand hygiene, cleaning and disinfection of the environment, single occupancy patient rooms) and should establish a process for monitoring, oversight, and risk assessment.
Results: Central line-associated bloodstream infections, catheter-associated urinary tract infections, mediastinal surgical site infection, and ventilator-associated pneumonia rate trended down at each institution. There were no statistically significant increases in these infections associated with discontinuing CP. Individual horizontal infection prevention strategies variably impacted HAI outcomes.

Conclusions: Stopping the routine use of CP for patients with contained body fluids who are colonized or infected with MRSA or VRE did not result in increased HAs. Bundled horizontal infection prevention strategies resulted in sustained HAI reductions.
Considerations for facilities that choose to discontinue contact precautions for MRSA

- If an ongoing MRSA outbreak or high or increasing MRSA infection rates, should consider NOT discontinuing contact precautions for MRSA-colonized or MRSA-infected patients.
- Hospitals should ensure excellent infection prevention/control practices and promote adherence with standard precautions.
  - Many studies demonstrating success with stopping contact precautions had several horizontal strategies in place.
- Hospitals should monitor key metrics and consider re-instituting contact precautions if rates increase.
Maintain Contact Precautions for Certain Patients?

- Based on a risk assessment hospitals might consider prioritizing certain high-risk populations to continue contact precautions
  - e.g., ICU, NICU, Burn, dialysis, immunocompromised or transplant, indwelling devices
- Active draining wounds, especially those unable to be contained in a bandage
Are Contact Precautions “Essential” for the Prevention of Healthcare-associated Methicillin-resistant Staphylococcus aureus? 

Brian J. Busch, Yezi Bai, Michael F. Bono, Matthew H. Smith, G. C. Caffey, and Steve J. Morgan

The recent updated advice from the National Institute of Allergy and Infectious Diseases, and the U.S. Centers for Disease Control and Prevention, on infection control practices recommending the use of controlled isolation (CIP) for healthcare-associated methicillin-resistant Staphylococcus aureus (MRSA) in acute care facilities for contact precautions (CP) in patients known to be infected or colonized with MRSA, is an “essential practice.” We argue that limited evidence on Staphylococcal infections associated with CP do not justify this recommendation. There are no controlled trials that support broad use of CP for MRSA prevention. Some hospitals that have documented CP for MRSA have found its impact on MRSA acquisition to be minimal. The benefits of CP versus CIP are uncertain, including the economic benefits of decreased patient stay and cost. We suggest that CIP be included among other “essential practices” to MRSA prevention that can be implemented in specific circumstances (e.g., outbreaks, regulatory measures, or specific healthcare settings).
“The relatively high rates of hand hygiene compliance across the 3 hospitals may limit the applicability of these findings to hospitals with low compliance.” Haessler, et al., AJIC 2020

“Good hand hygiene and low baseline HAI rates may be conditions permissive of safe removal of contact precautions.” Martin, et al., ICHE 2021

“We think discontinuation of CPs (as currently practiced) for MRSA and VRE can be safely accomplished, particularly in hospitals with a strong horizontal infection prevention strategy, including high levels of compliance with hand hygiene.” Marra, et al., (Diekema senior author) AJIC 2018

“Findings from our study suggest that contact precautions might be safely discontinued in a context of universal chlorhexidine bathing.” McKinnell, et al., Epidemiol Infect

“Discontinuing CP did not increase acquired MRSA and ESBL in our ICU with single rooms with dedicated equipment, strict application of hand hygiene, medical and paramedical leadership, and good antibiotic stewardship.” Renaudin, et al., ICHE 2017

“Relevant questions for future research include when and where CP may provide additional benefits over assiduous use of standard precautions, especially when hospitals are using horizontal control measures, such as chlorhexidine bathing, universal gloving, hand hygiene surveillance, and environmental cleaning.” Morgan, et al., ICHE 2015
My Response

- Yes! Would be ideal if all acute care settings in the US had excellent adherence with basic infection control practices to keep rates of MRSA transmission and infection in their hospitals low.
  - Historic hand hygiene compliance rates LOW
  - CHG bathing—not done universally and adherence could be relevant
- Studies documenting success of discontinuing contact precautions—are these hospitals representative of most acute care settings in the US?
  - Resources and staffing for infection control programs at various healthcare settings are variable and some hospitals might face different challenges than large academic centers
  - Need robust system in place for monitoring MRSA rates and implementing a response should rates increase (e.g., bring back contact precautions)
- Post-COVID HAI rates: Is now the time or rather do we work toward this goal?
Thorny Issue #2: Active Surveillance Testing
Current: Active Surveillance Testing

- Recommendation: Implement an MRSA AST program for select patient populations as part of a multifaceted strategy to control and prevent MRSA (Quality of Evidence: MODERATE)
- Recommendations now for Sub-Populations
  - ICU
  - Hospital-wide
  - Outbreak
  - Pre-operative
Active surveillance with contact precautions is inferior to universal decolonization for reduction of MRSA clinical isolates in adult ICUs (Quality of Evidence: HIGH)
**Decolonization should be strongly considered as part of a multimodal approach to control MRSA outbreaks (Quality of Evidence: MODERATE)**
*Multiple infection control interventions occurred to resolve outbreak, including:
- AST
- Decolonization
- Integrated genomic sequencing
Screen healthcare worker personnel for MRSA infection or colonization if they are epidemiologically linked to a cluster of MRSA infections (Quality of Evidence: LOW)

- HCP can become transiently or persistently colonized with MRSA, and be the source of hospital outbreaks
- Routine screening of HCP for MRSA is not currently recommended in the endemic setting
- Screen HCP for MRSA infection or colonization if they are epidemiologically linked to a cluster of MRSA infections
- Screening of HCP can be an important component of outbreak investigation if HCP have been epidemiologically linked to a clonal cluster of MRSA cases or if there is evidence of on-going transmission despite comprehensive implementation of basic MRSA control measures.
Other Ways to use AST Data

- State mandates for AST for MRSA
- Part of antibiotic stewardship to reduce vancomycin usage
- As part of a strategy to discontinue contact precautions
- Implementing post-discharge interventions
  - E.g., Decolonization to Reduce Post-discharge Infection Risk among MRSA Carriers

Parente, et al., CID 2018
Shenoy, et al., AJIC 2016
Ghosh, et al., 2014
Huang, et al., NEJM 2019
The Clinical Utility of Methicillin-Resistant Staphylococcus aureus (MRSA) Nasal Screening to Rule Out MRSA Pneumonia: A Diagnostic Meta-analysis With Antimicrobial Stewardship Implications

Hanna M. Winters, Thomas A. Beaver, christina r. lorenz, and Dennis T. Starnes

Diagnosis...
Thorny Issue #3: Decolonization
Current: Decolonization for MRSA

- Remains an “Additional Approach”
- 2 Recommendations with Quality of Evidence = HIGH
- 7 Recommendations with Quality of Evidence = MODERATE
Use universal decolonization (daily CHG bathing plus 5 days of nasal decolonization) for all patients in adult ICUs to reduce endemic MRSA clinical cultures.

Consider post-discharge decolonization of MRSA carriers to reduce post-discharge MRSA infection and readmission.

Huang, et al., NEJM 2013
Huang, et al. ICHE 2014
Climo, et al., NEJM 2013
Derde, et al., Lancet ID 2014
Considerations for Universal Decolonization Approach in Adult ICUs

- Hospitals may choose to use CHG-only decolonization strategy to target other pathogens or reduce bloodstream infections ("Horizontal" strategy)
  - If goal to reduce MRSA, then nasal decolonization may be needed
- Complications of decolonization therapy are rare and generally mild
  - Drug-related toxicities
  - Development of resistance (e.g., mupirocin)
  - Development of reduced susceptibility (e.g., CHG)
  - Discussed in Unresolved Issues section
Decolonization of MRSA Carriers at Hospital Discharge

- 30% fewer post-discharge MRSA infections in decolonization arm
- 17% fewer post-discharge all-cause infection in decolonization arm
- Number needed to treat to prevent MRSA infection: 30

Huang, et al., NEJM 2019
Current: Decolonization Recommendations
(Quality of Evidence: MODERATE)

- Pre-operative
- Surgical units
- Non-ICU patients with devices
- Neonatal ICUs
- Burn patients
- Hemodialysis patients
- Outbreaks
Provide CHG bathing plus nasal decolonization to known MRSA carriers outside the ICU with medical devices, specifically central lines, mid-line catheters, and lumbar drains, to reduce MRSA clinical cultures.

*10% of patients had devices but were responsible for 37% MRSA/VRE cultures and 56% of all-cause bloodstream infection

Huang, et al., Lancet 2019
Perform pre-operative nares screening with targeted use of CHG and nasal decolonization in MRSA carriers to reduce MRSA SSI in surgical procedures involving implantation of hardware (Quality of Evidence: MODERATE)

- Schweizer, et al. JAMA 2015
  - 20-hospital interventional cohort study of cardiac, hip, and knee surgeries, showed that AST, intranasal mupirocin + CHG bathing for S. aureus carriers for up to 5 days before surgery, and vancomycin prophylaxis if MRSA colonized reduced S. aureus surgical site infections

- S. aureus outcomes were not the target of the current compendium or its search strategy. However, several studies involving S. aureus as the outcome are mentioned.

Schweizer, et al., BMJ 2013
Schweizer, et al. JAMA 2015
Phillips, et al. ICHE 2014
SHEA/IDSA/APIC Practice Recommendation

Strategies to prevent surgical site infections in acute-care hospitals: 2022 Update


The authors wish to acknowledge the contributions of all members of the SHEA/IDSA Subcommittee on Infectious Diseases and Control and Infection Prevention and Control (IDSACIP), who have generously given their time and expertise to the development of this document. This work was supported by the Surveillance and Research Project (SARP) under the auspices of the CDC/IDSA/APHIS/APHIS.WV. The opinions expressed herein are those of the authors and do not necessarily reflect the position or policies of the CDC, IDSA, or APIC. The authors also wish to thank the many institutions and organizations that have contributed to the development of this document.

The authors have no relevant financial relationships to disclose.

The authors declare that they have no relevant financial relationships to disclose.
Neonatal ICUs should consider targeted or universal decolonization during times of above average MRSA infection rates or targeted decolonization for patients at high risk of MRSA infection (e.g. low birth weight, indwelling devices, or prior to high-risk surgeries).

- MRSA colonization is an important risk factor for subsequent infection in this population.
- Quasi-experimental studies have shown that decolonization can reduce MRSA infections during endemic and outbreak settings.
- Targeted and universal decolonization approaches have both been successfully used to reduce MRSA in this population.
- Parents can be an important reservoir for S. aureus and expose their neonates in the NICU.

Huang, et al., Ped Infect Dis 2015  Ristagno, et al., ICHE 2018
Milstone, et al., JAMA 2020 (TREAT PARENTS TRIAL)
Additional Issues to Consider for Current and Next Version of the Compendium
Universal MRSA decolonization
- What is the incremental benefit of mupirocin to daily CHG bathing in adult ICUs?
- What is the role of routine universal decolonization of NICU patients?
- How will this impact the skin microbiome?

Best approaches for MRSA decolonization outside the ICU?
- Other patient populations where decolonization may be beneficial

Mupirocin and chlorhexidine resistance
- Monitoring needed as these agents become more widely used
- Nasal iodophors

MRSA-colonized healthcare personnel
- What is the optimal management (e.g., decolonization, follow-up monitoring) of MRSA-colonized healthcare personnel that also minimizes work restrictions
Nasal Iodophor Antiseptic vs Nasal Mupirocin Antibiotic in the Setting of Chlorhexidine Bathing to Prevent Infections in Adult ICUs: A Randomized Clinical Trial

Key Points

**Question:** Does iodophor antiseptic work better than mupirocin for preventing hospital-acquired infections in adult ICUs in addition to daily chlorhexidine bathing?

**Hypothesis:** This multicenter, double-blinded, placebo-controlled trial of 20000 adult patients in 115 hospitals exposed to chlorhexidine significantly reduced the incidence of infections by 29.8% compared with daily chlorhexidine bathing alone.

**Meaning:** Nasal antiseptic treatment did not increase the risk of nasal resistance to antibiotics for the treatment of Gram-negative bacteria in adult ICUs. In addition, the results were consistent with data from being effective for nasal decontamination.
Noncompliance with Nasal Iodophors?

Identifying barriers to compliance with a universal inpatient protocol for Staphylococcus aureus nasal decolonization with povidone-iodine swabs or product swab, patient perceptions of brown nasal discoloration
Whole Genome Sequencing can help with Infection Prevention
*During a patient encounter, WGS showed how MRSA can be spread between the patient, healthcare worker, and the environment.*

*WGS detected possible intra and inter-ICU spread of MRSA.*

*WGS allowed us to identify persistent environmental contamination in patient rooms and healthcare worker contamination as possible sources of MRSA spread.*

Popovich, et al., CID, 2020
Detection of Nosocomial Outbreaks: Genomic Surveillance Takes the Lead

Whole-genome sequencing (WGS) has emerged as the gold standard method for microbial subtyping and as a powerful tool for nosocomial outbreak investigation. Advantages of WGS, compared to other molecular subtyping methods,
What About Methicillin Susceptible S. aureus?

Should future guidelines be focused on Staphylococcus aureus?
Bundled Interventions: Which Components are Essential?

- Are all elements of an infection control bundle essential?
- Are some components more important than others?
- Are we able to determine the relative roles of different components of an infection control bundle?
- This knowledge would help with determining which infection control strategies should be emphasized and labeled as essential,
  - Especially in settings where compliance might be challenging.
Conclusions

- MRSA epidemiology continues to evolve and changes in the community can impact rates of infections in acute care settings.
- Whole genome sequencing can be an important epidemiologic tool in infection control.
- Don’t underestimate MSSA!
- Despite “thorny” and “unresolved” issues with MRSA infection control, basic/foundational elements of infection prevention (e.g., hand hygiene) continue to be essential!!!