MRSA Prevention in Acute Care Settings

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Outline

- 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

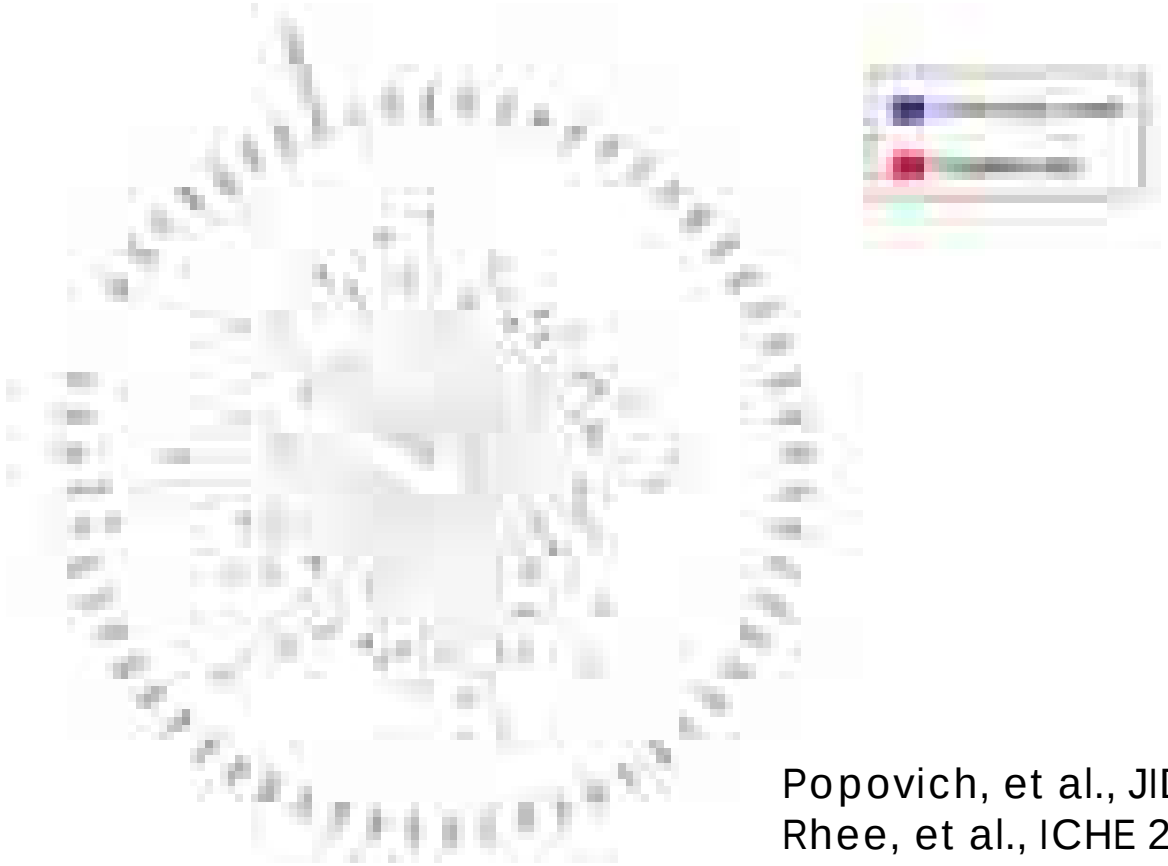
Weiner-Lastinger, et al., ICHE 2022

Invasive Methicillin-Resistant *Staphylococcus aureus* Infections Among Persons Who Inject Drugs — Six Sites, 2005–2016

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

Infection Control & Hospital Epidemiology 2022; 44: 1200–1220
Received 18 Nov 2021; Accepted

SHEA

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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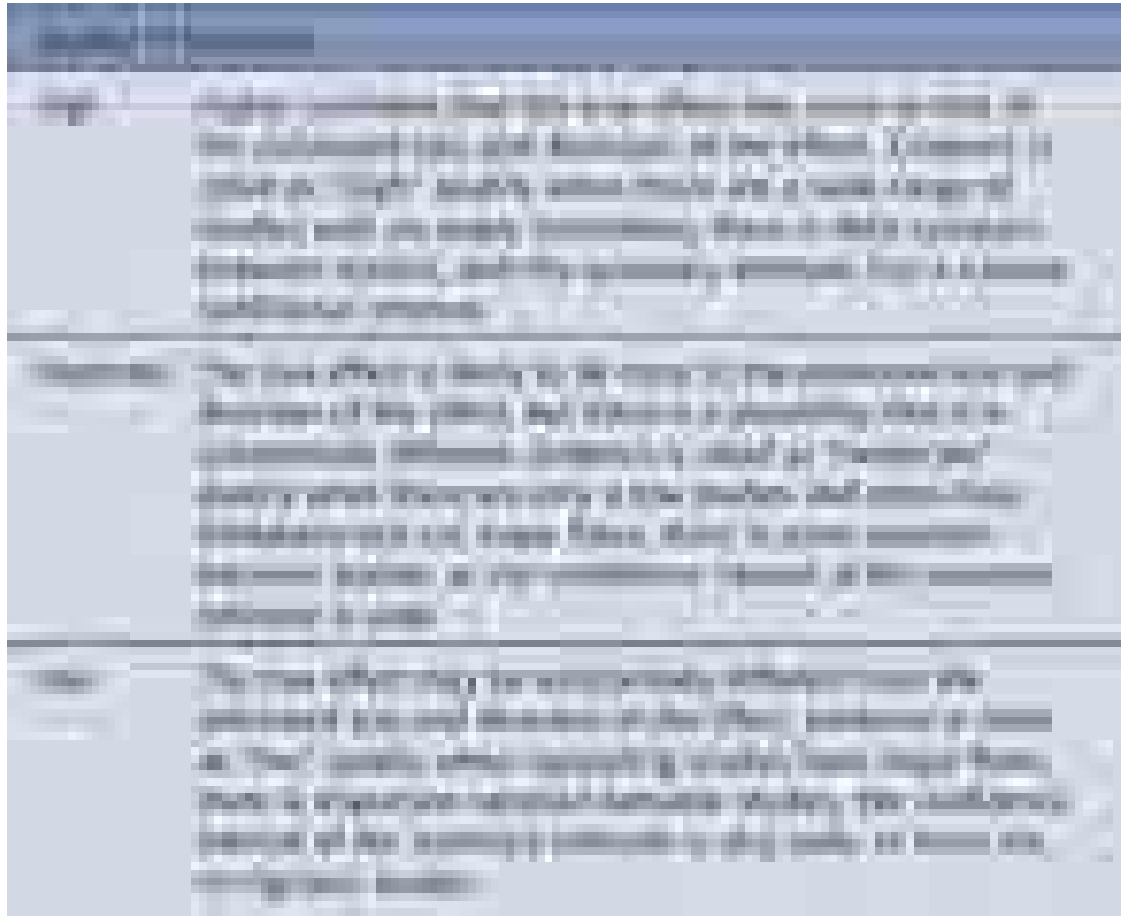
Infection Control Research Challenges

- 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

Recommendation	Evidence Rating
MRSA Risk Assessment	LOW
MRSA Monitoring Program	LOW
Hand Hygiene	MODERATE
Contact Precautions**	MODERATE
Environmental Cleaning	MODERATE
Alert System for MRSA-colonized or MRSA-infected Patients	LOW
Education	LOW

****Opt-out discussion included**

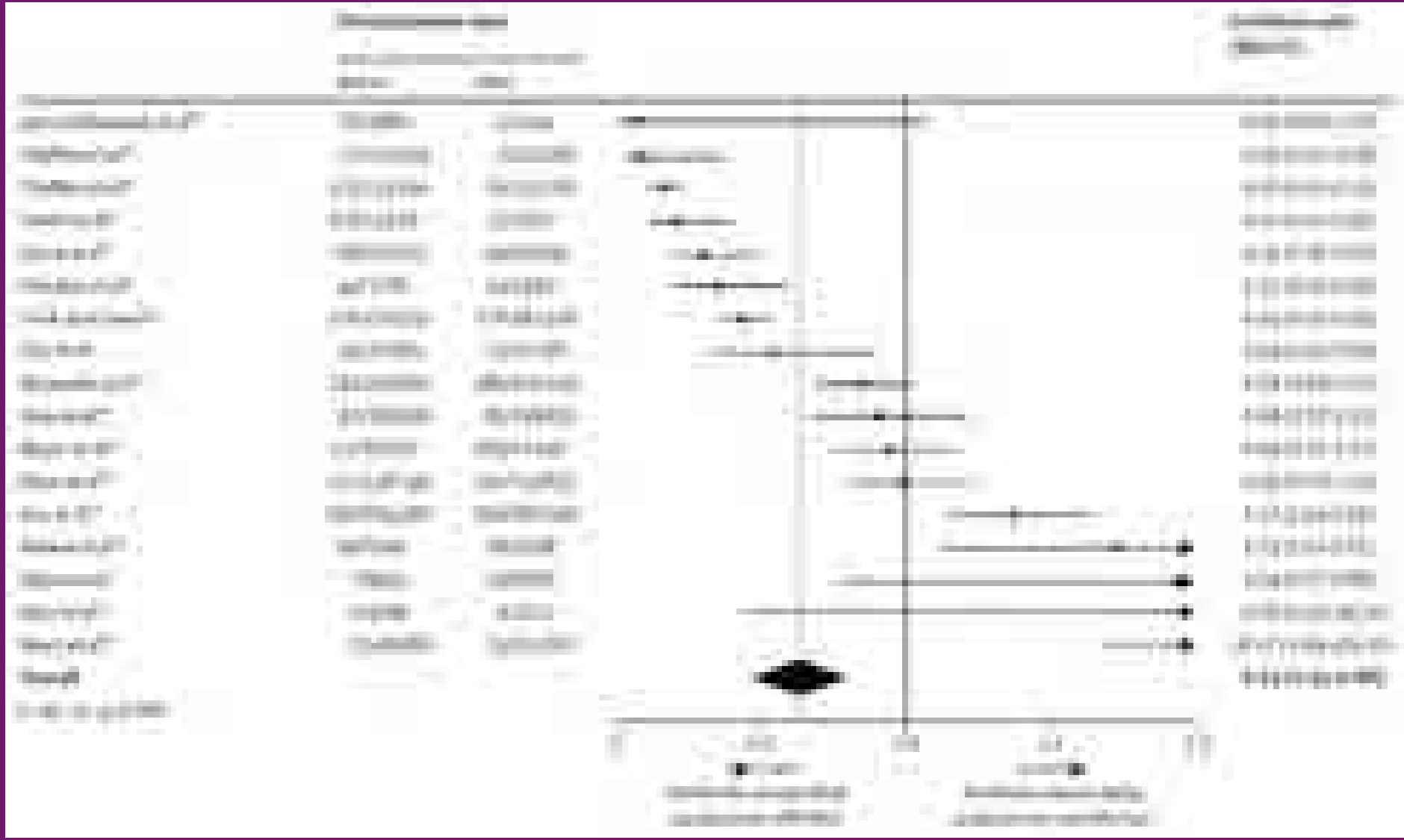
Essential: Conduct an MRSA risk assessment (Quality of Evidence: LOW)

- 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

Essential: Implement an Antimicrobial Stewardship Program (Quality of Evidence: Low)

- 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*



Baur, et al. Lancet ID, 2017

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)

Essential Recommendation (With Opt-Out Guidance)

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 (eg, hand hygiene, cleaning and disinfection of the environment, single occupancy patient rooms) and should establish a process for ongoing monitoring, oversight, and risk assessment.

American Journal of Infection Control

Stopping the routine use of contact precautions for management of MRSA and VRE at three academic medical centers: An interrupted time series study

Results: Central line-associated bloodstream infections, catheter-associated urinary tract infections, mediastinal surgical site infection, and ventilator-associated pneumonia rates 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 HAIs. Bundled horizontal infection prevention strategies resulted in sustained HAI reductions.

AJIC 2020

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

Clinical Infectious Diseases

VIEWPOINTS

Are Contact Precautions "Essential" for the Prevention of Healthcare-associated Methicillin-resistant *Staphylococcus aureus*?

[illegible]

[illegible]

"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 ESBLE 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)

the NEW ENGLAND JOURNAL of MEDICINE

Targeted versus Universal Decolonization to Prevent ICU Infection

CONCLUSIONS

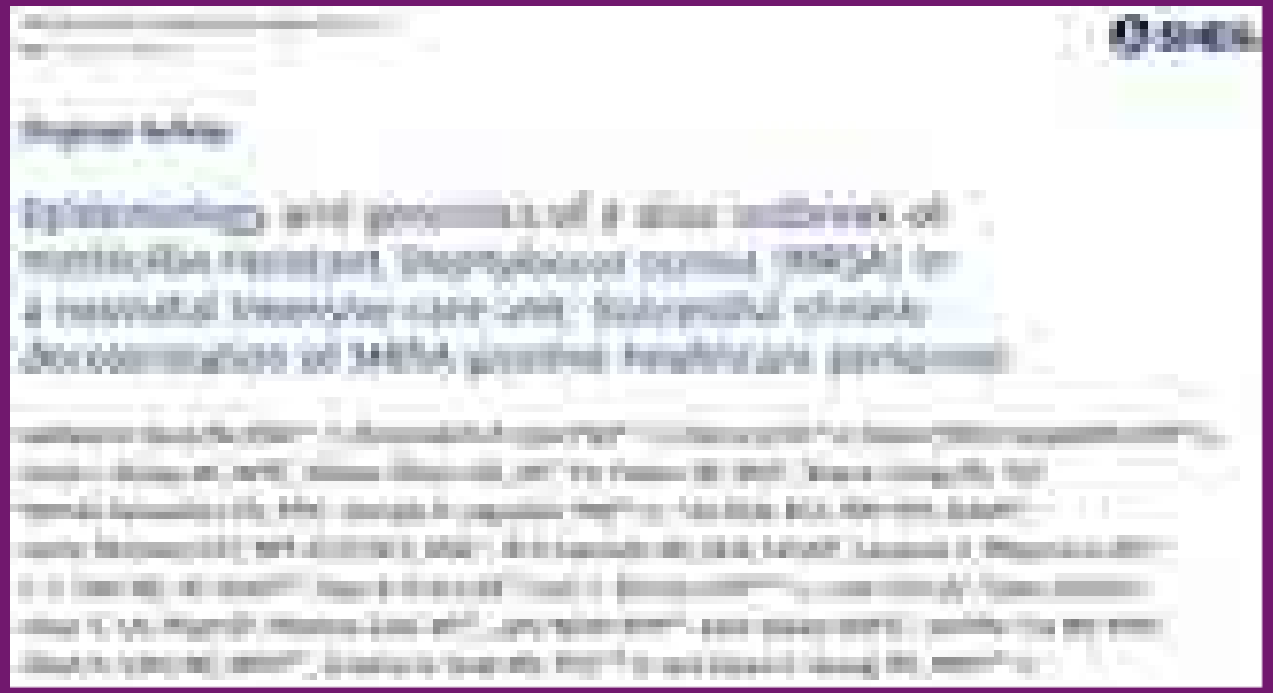
In routine ICU practice, universal decolonization was more effective than targeted decolonization or screening and isolation in reducing rates of MRSA clinical isolates and bloodstream infections from any pathogen. (Funded by the Agency for Healthcare Research and the Centers for Disease Control and Prevention; REDUCE MRSA ClinicalTrials.gov number, NCT00790660.)

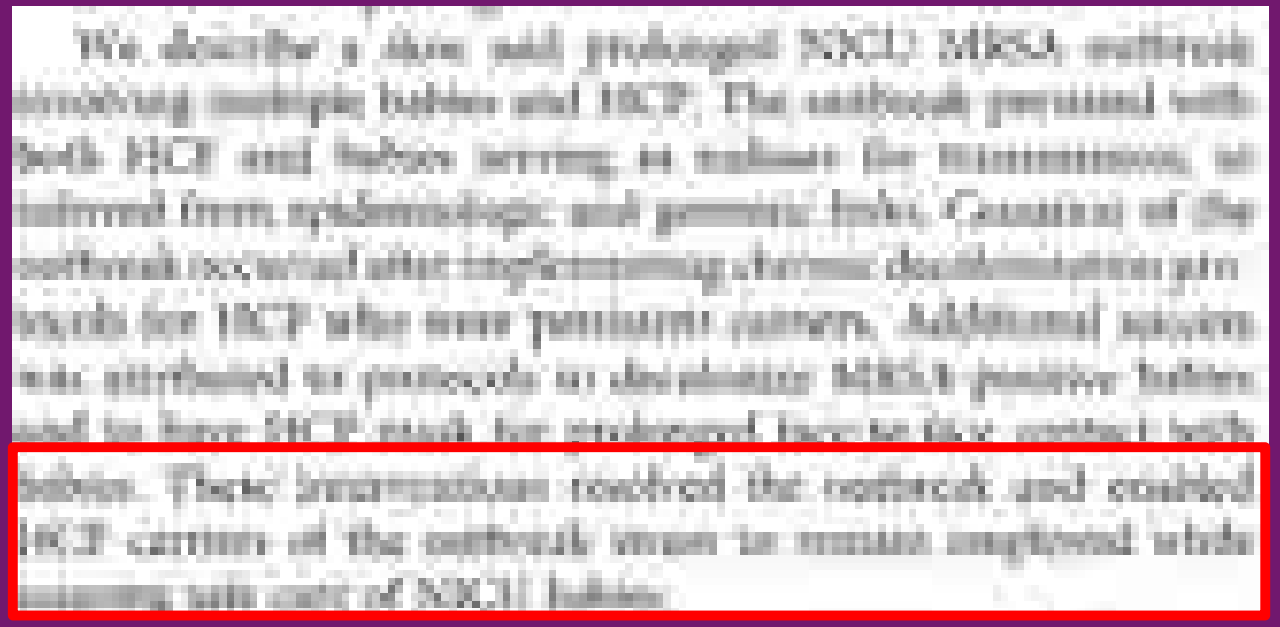
Controlling Outbreaks due to MRSA

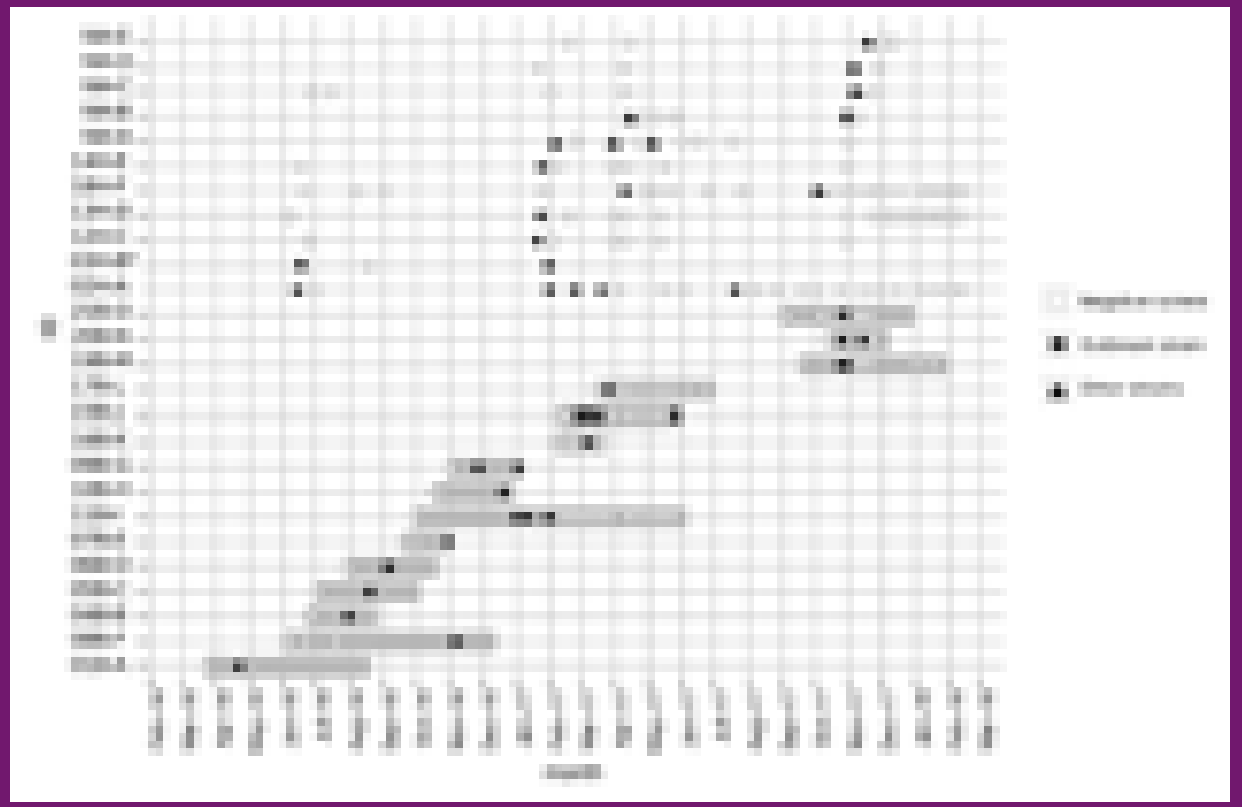
Active surveillance can be performed in the setting of a MRSA outbreak or evidence of ongoing transmission of MRSA within a unit as part of a multifaceted strategy to halt transmission. (Quality of evidence: MODERATE).

a. During outbreaks, serial (eg, weekly until outbreak is over) AST can provide important information about the scope of the outbreak, and AST helps identify new cases to enable communication and response (eg, contact precautions, decolonization).

**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 <u>not</u> 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 <u>clonal</u> 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

Clinical Infectious Diseases
MAJOR ARTICLE

The Clinical Utility of Methicillin-Resistant *Staphylococcus aureus* (MRSA) Nasal Screening to Rule Out MRSA Pneumonia: A Diagnostic Meta-analysis With Antimicrobial Stewardship Implications

[illegible]

[illegible]

2018

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

Current: Decolonization Recommendations (Quality of Evidence: HIGH)

- Use universal decolonization (daily CHG bathing plus 5 days of nasal decolonization) for all patients in adult ICUs to reduce endemic MRSA clinical cultures

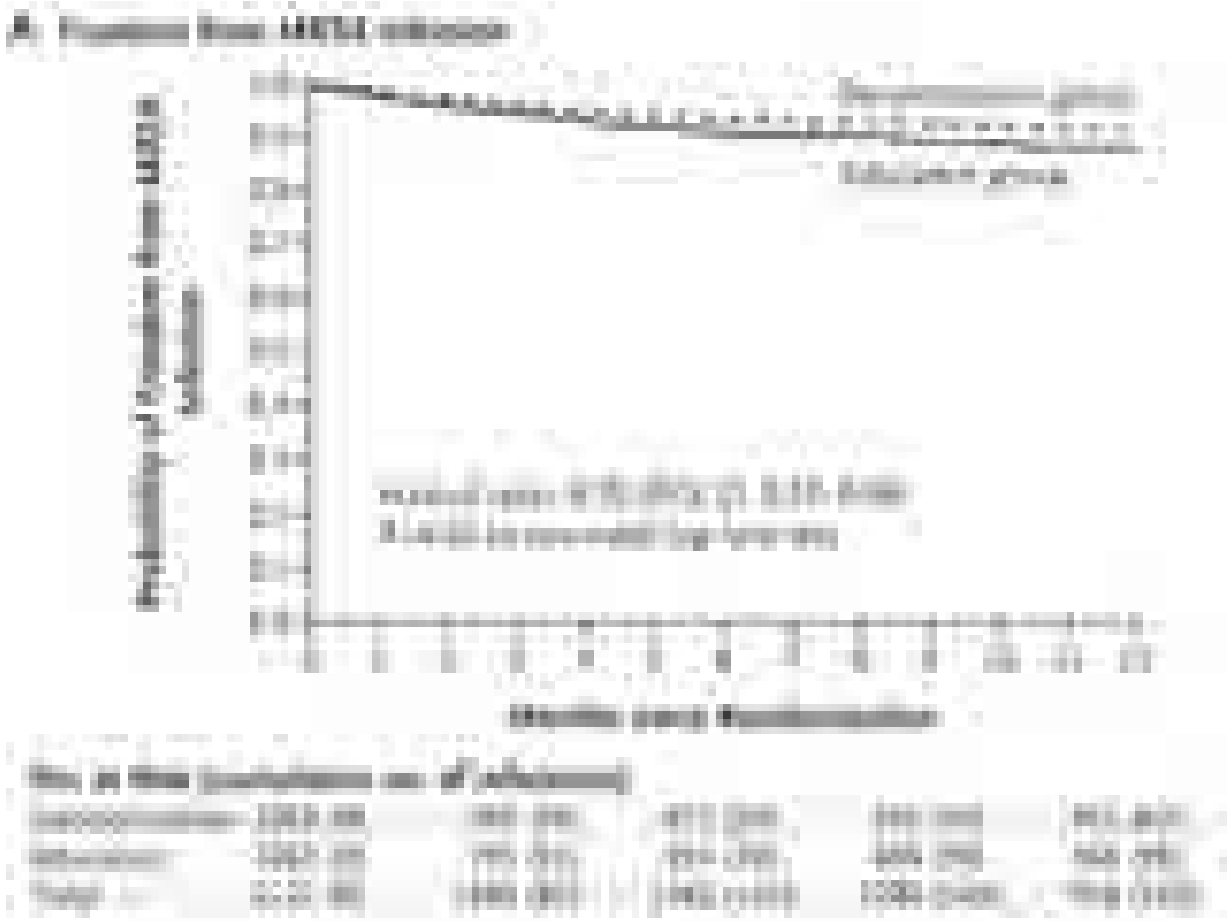
- Consider post-discharge decolonization of MRSA carriers to reduce post-discharge MRSA infection and readmission

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

	Routine care	Decolonisation	p value
Patients with medical devices	24/950	36/47	
MRSA or VRE clinical cultures	1·12 (1·00–1·37)	0·80 (0·69–0·93)	0·0034*
MRSA clinical cultures only	1·17 (0·99–1·39)	0·87 (0·76–1·02)	0·0126*
VRE clinical cultures only	1·26 (0·85–1·86)	0·58 (0·44–0·78)	0·0010*
All pathogen bloodstream infections	1·13 (0·96–1·33)	0·83 (0·70–0·94)	0·0032*

*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 <u>*S. aureus* surgical site infections</u>
- *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
Lee, et al. BMJ Open 2013

Infection Control & Hospital Epidemiology 2023; 44: 197–206
https://doi.org/10.1017/ice.2022.80

SHEA

SHEA/IDSA/APIC Practice Recommendation

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

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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

CDC Guidance, 2020
SHEA White Paper 2020
Huang, et al., Ped Infect Dis 2015
Milstone, et al., JAMA 2020 (TREAT PARENTS TRIAL)
Popoola, et al. J Perinatal 2014
Pierce, et al. JHI 2017
Ristagno, et al., ICHE 2018

Additional Issues to Consider for Current and Next Version of the Compendium

Current Document: Unresolved Issues

- 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

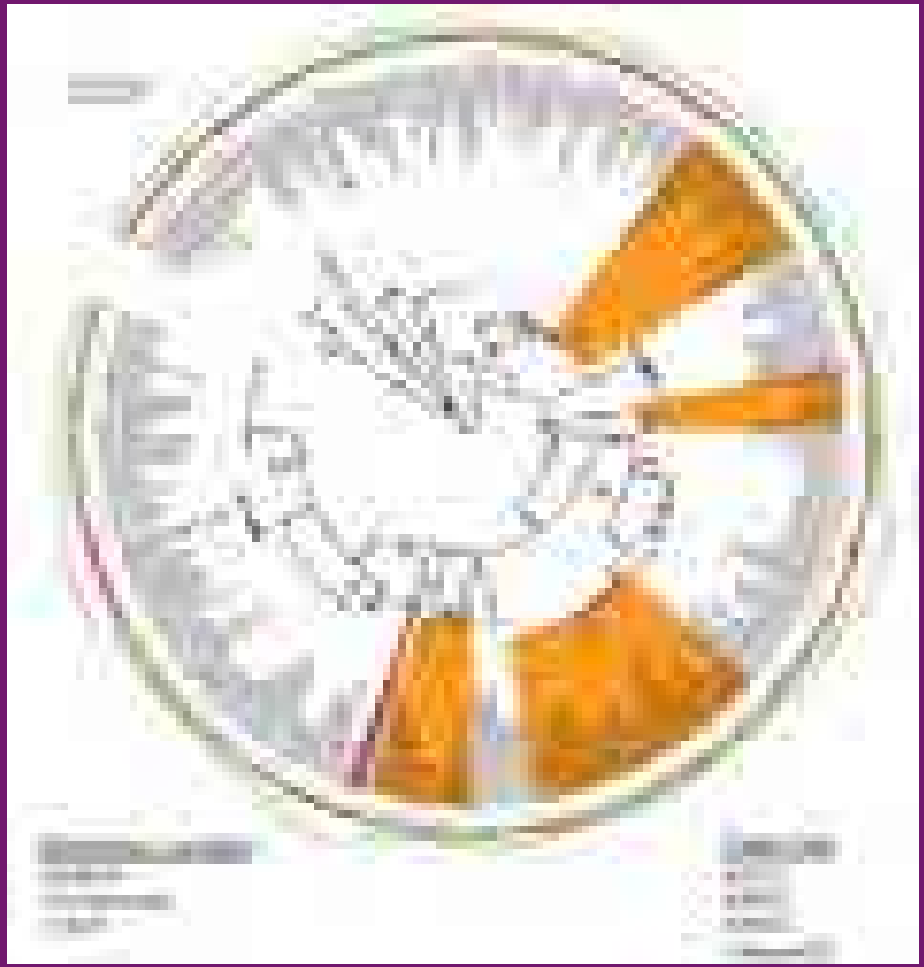
Key Points

October 2023

Noncompliance with Nasal Iodophors?

***Size 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

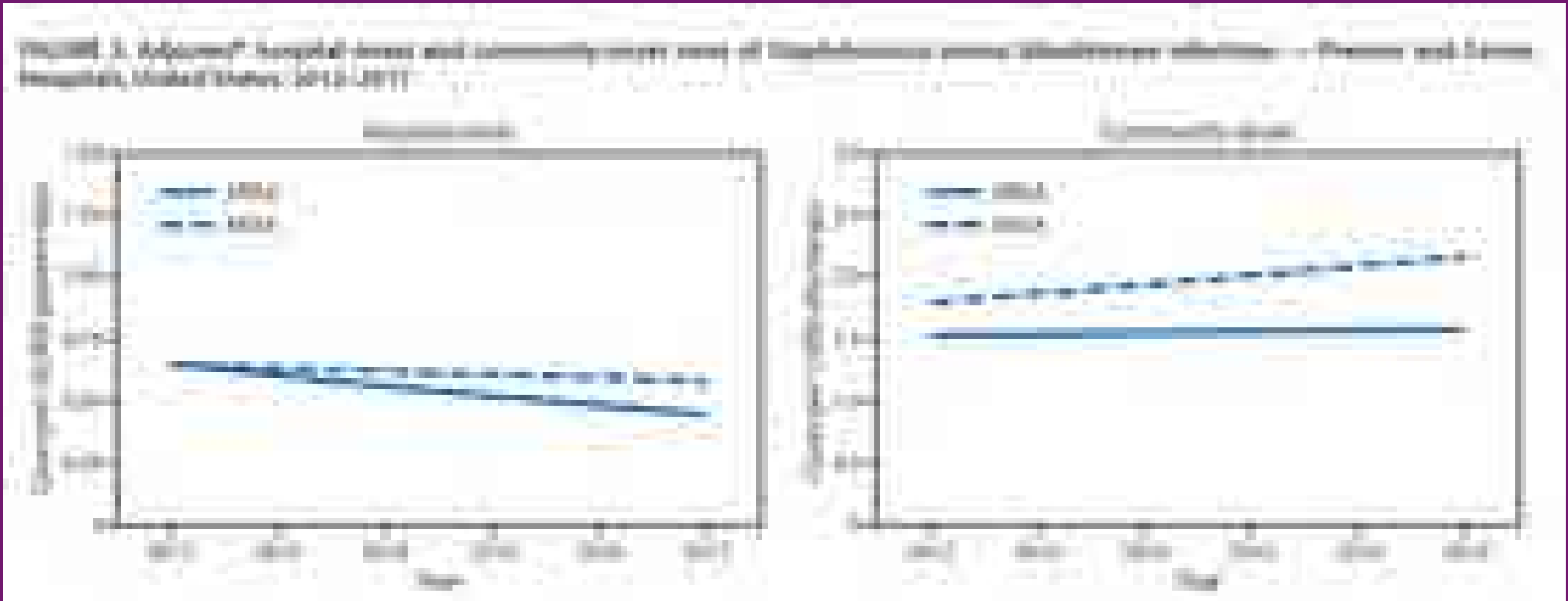
EDITORIAL COMMENTARY

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*?



March 2019, MMWR

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 label as essential
  - Especially in setting 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!!!