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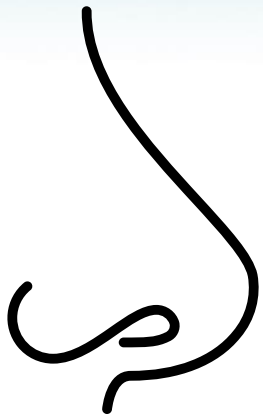
Does the Nose Know? The Value of MRSA Nares Swab in Skin & Soft Tissue Infections



A presentation for HealthTrust Members
May 8, 2024

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Learning Objectives

- Recall the current indications for the methicillin-resistant *Staphylococcus aureus* (MRSA) nasal polymerase chain reaction (PCR) test.
- Identify studies that have utilized the MRSA nasal PCR in skin and soft tissue infections (SSTI).
- Recognize the clinical utility for the MRSA nasal PCR in SSTI.

Abbreviations

Abbreviation	Definition
MRSA	Methicillin-resistant *Staphylococcus aureus*
PBP	Penicillin-binding protein
PCR	Polymerase chain reaction
SSTI	Skin and soft tissue infection
DFI	Diabetic foot infection
PNA	Pneumonia
CAP	Community-acquired pneumonia
HCAP	Health-care associated pneumonia
HAP	Hospital-acquired pneumonia
I&D	Incision and drainage
VAP	Ventilator-associated pneumonia
IE	Infective endocarditis
IDSA	Infectious Diseases Society of America
ATS	American Thoracic Society
IV	Intravenous
PPV	Positive predictive value
NPV	Negative predictive value

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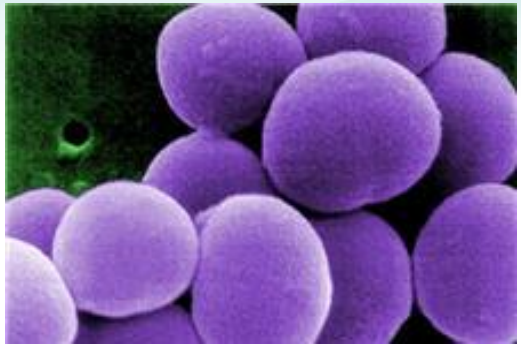
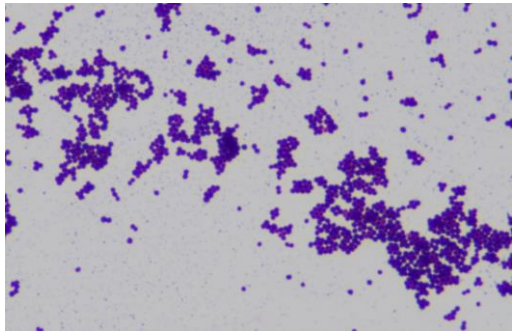
Staphylococcus aureus





Staphylococcus aureus is a gram-positive bacteria colonized in the:

- Nares
- Throat
- Axillae
- Rectum
- Groin

Sources:
Pharmacotherapy. 2018;38(12):1216-1228.
Methicillin-Resistant *Staphylococcus aureus*. StatPearls [Internet].

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MRSA

Resistance to beta-lactam antibiotics due to the presence of the mecA gene sequence

Sources:
Methicillin-Resistant *Staphylococcus aureus*. StatPearls [Internet].
Clin Infect Dis. 2004;39:776-782.
Virulence. 2021;12(1):547-569.
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MRSA

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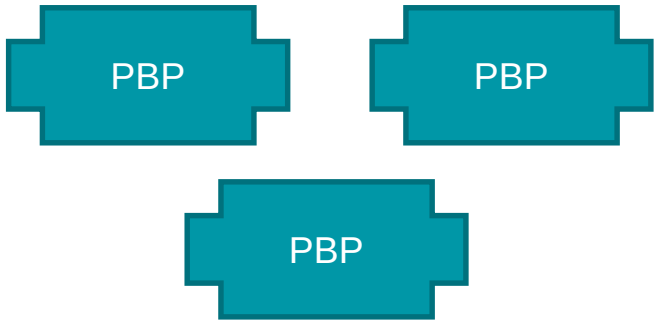

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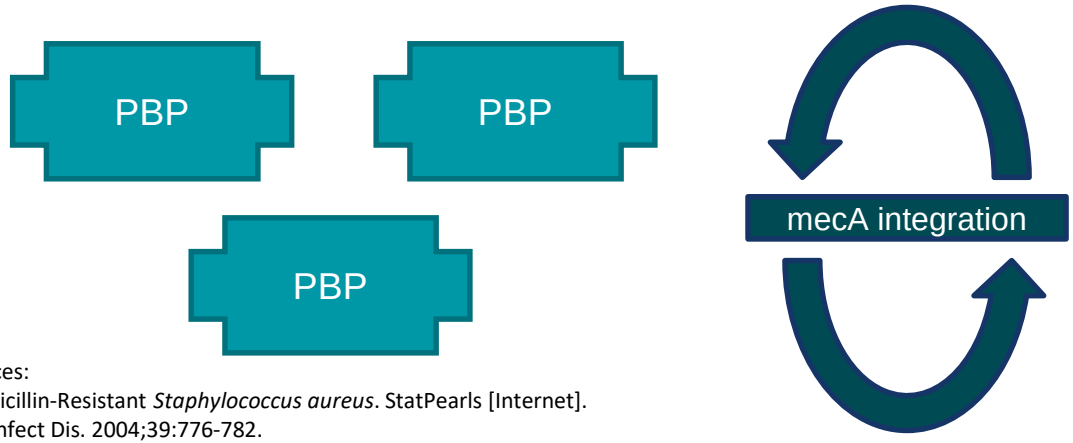

Sources:
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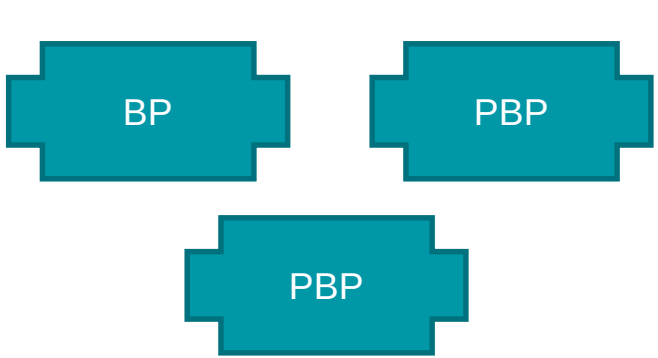

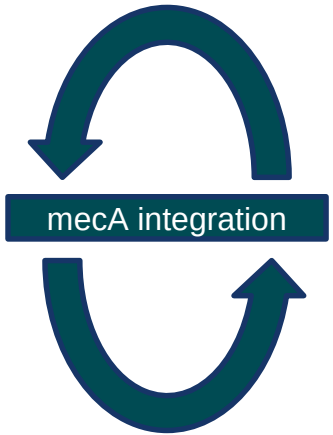

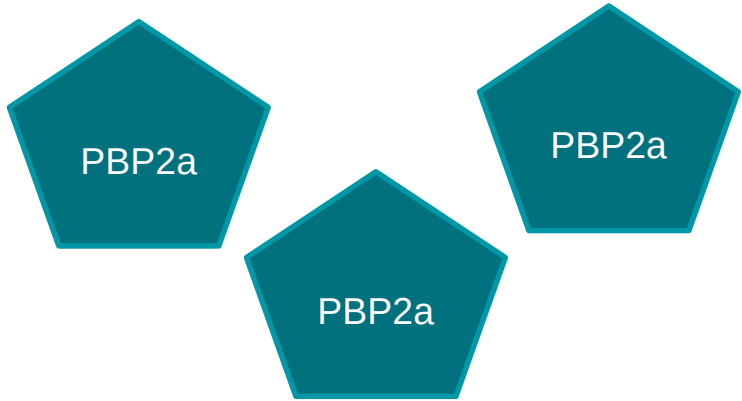

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Clin Infect Dis. 2004;39:776-782.
Virulence. 2021;12(1):547-569.
Annu Rev Biochem. 2015;84:577-601.

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MRSA Risk Factors

- Recent hospitalization
- Prolonged hospitalization
- Intensive care admission
- Invasive procedures
- Recent antibiotic use
- MRSA colonization
- Nursing home residents
- Hemodialysis
- Long-term central venous catheters and/or indwelling urinary catheter

Source:
Methicillin-Resistant *Staphylococcus aureus*. StatPearls [Internet].

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MRSA Infection Types

- SSTI
- Bone and joint infections
- PNA
- IE
- Bacteremia

Source:
Methicillin-Resistant *Staphylococcus aureus*. StatPearls [Internet].

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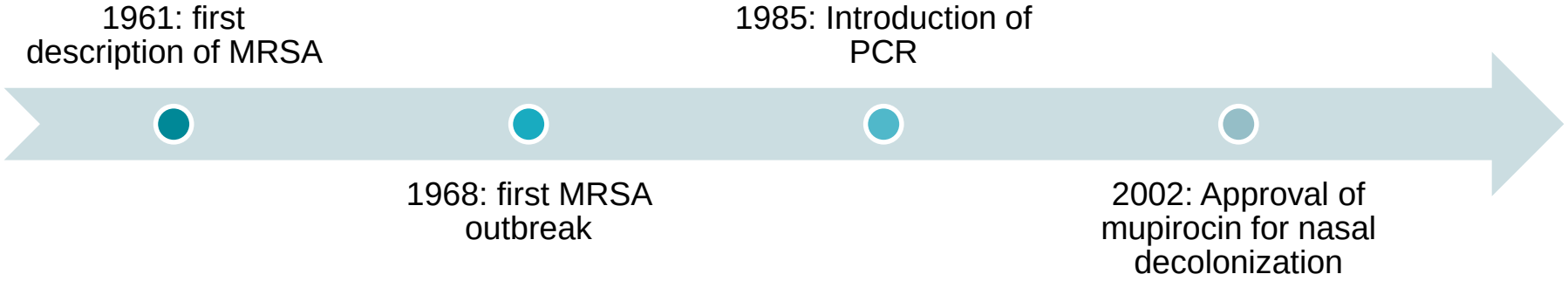
History of MRSA and Decolonization



Sources:
Methicillin-Resistant *Staphylococcus aureus*. StatPearls [Internet].
Polymerase Chain Reaction (PCR). StatPearls [Internet].

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Deoxyribonucleic Acid (DNA) PCR

Introduced in 1985

PCR: nucleic acid amplification technique used to denature and renature short segments of DNA or ribonucleic acid (RNA) sequences using DNA polymerase I enzyme

3 types

Conventional PCR	Real-time PCR	Transcriptase PCR

3 major phases

Denaturation	Hybridization/annealing	Elongation/amplification

Source:
Polymerase Chain Reaction (PCR). StatPearls [Internet].

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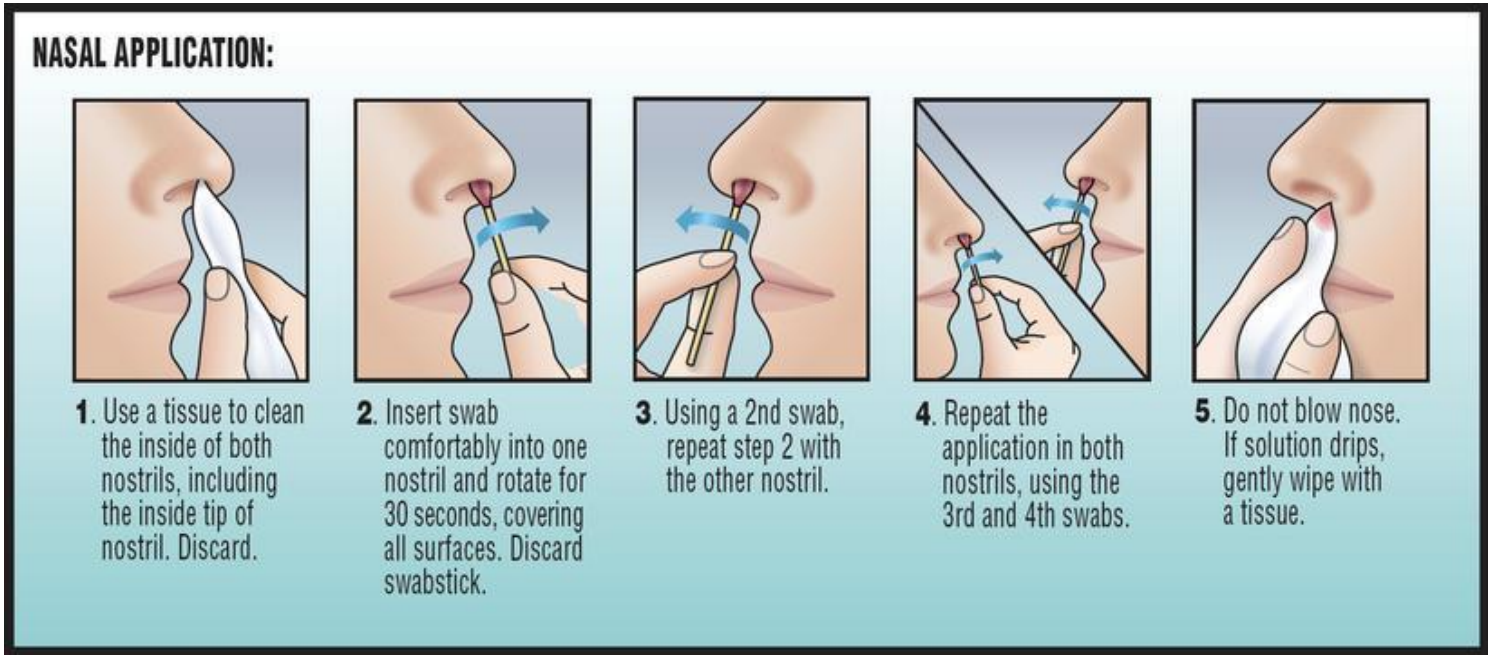
Testing for MRSA

- Positive nasal MRSA DNA PCR indicates presence of MRSA



Sources:
Methicillin-Resistant *Staphylococcus aureus*. StatPearls [Internet].
The Informed Patient - The Ultimate Battle Against MRSA. Wall Street Journal.

Assessing Validity of PCR Tests

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Sensitivity	• Ability of a test to yield a positive result for a subject that has that disease
Specificity	• Ability of a test to obtain normal range or detect a true negative result
PPV	• True positive
NPV	• True negative

Source:
Diagnostic Testing Accuracy: Sensitivity, Specificity, Predicative Values and Likelihood Ratios. StatPearls [Internet].

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Effect of Nasal Sanitizer on Colonization

Ghaddara, *et al*. 2020 → nonblinded, placebo-controlled randomized trial		
Purpose	**Methods**	**Results**
Group 1 (N = 21)		
Assess the efficacy of a one-time povidone-iodine nasal sanitizer	Included patients with positive MRSA nares culture that had not received systemic antibiotics or topical antibiotics/antiseptics within the past 7 days	Statistically significant reduction in the mean MRSA concentrations at 1 and 6 hours but not at 12 or 24 hours
Group 2 (N = 18)		
Determine if repeated dosing would enhance efficacy	Povidone-iodine applied every 12 hours for 5 days with nares cultures obtained at baseline, immediately prior to each treatment dose, and 2 days after the final dose	Povidone-iodine group had lower mean nasal MRSA concentrations during the treatment days, but not statistically significant
Authors' Conclusions • Single applications of povidone-iodine may be effective for short-term suppression of *S. aureus* • Factors leading to lack of sustained reduction: decreased povidone-iodine concentrations, embedded MRSA in the base of hair follicles or mucus, and reinoculation		

Source:
Am J of Infect Control. 2020;48:456-459.

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Effect of Nasal Sanitizer and Anti-MRSA Agents on MRSA Nasal PCR Validity

Chaudhry, *et al.* 2020 → retrospective, noninferiority, observational cohort study

Purpose	Methods	Results (Before vs. After PCR)
Determine whether mupirocin administration affects the reliability of MRSA PCR nasal screens	• Included patients who had a pulmonary infection, had blood and/or respiratory cultures, received intranasal mupirocin, had a MRSA PCR nasal screen result, and had vancomycin administered within 48 hours • Predetermined noninferiority margin 5% • N = 250	• Mupirocin (overall): NPV 95% vs. 99%; ARR, -4%; (90% CI, -8% to 0.2%; *P* = 0.31) • Mupirocin (≤ 2 doses): NPV 96% vs. 99%; ARR, -3%; (90% CI, -7% to 2%; *P* = 0.22) • Vancomycin: NPV 98% vs. 96%; ARR, 2%; (90% CI, NR; *P* = 0.41)

Authors' Conclusion

- MRSA PCR may be less reliable if intranasal mupirocin is administered prior to the screen → effort should be made to delay administration of mupirocin until after the MRSA PCR is collected

ARR = absolute risk reduction; CI = confidence interval; NR = not reported

Source:
Am J Health-System Pharm. 2020;77(23):1965-1982.

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MRSA – Colonization

Prevalence of MRSA is correlated to PPV and NPV

In infections that have a high prevalence for MRSA, like SSTI, the PPV increases while the NPV decreases

In infections that have a low prevalence for MRSA, like UTI or intra-abdominal infection, the PPV decreases while the NPV increases

Source:
Pharmacotherapy. 2018;38(12):1216-1228.

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Effect of Colonization on Subsequent MRSA Infection

Davis, *et al.* 2004 → prospective, multicenter, observational cohort study

Purpose	Methods	Results
Evaluate the impact of asymptomatic nares MRSA colonization on the development of subsequent MRSA infection	• Included patients who had nare cultures performed within 48 hours after admission to an observed hospital unit • N = 758	• *S. aureus* colonization at admission, n (%) = 163 (22); MRSA (n = 26), MSSA (n = 137) • Subsequent MRSA infection (MRSA vs. MSSA colonization at admission), n/N (%): 5/26 (19) vs. 2/137 (1.5); RR, 13; (95% CI, 2.7-64) • Subsequent MRSA infection (MRSA vs. no colonization at admission), n/N (%): 5/26 (19) vs. 12/595 (2); RR, 9.5; (95% CI, 3.6-25)

Authors' Conclusion

- MRSA colonization of nares, either present at admission to the hospital or acquired during hospitalization, increases the risk for MRSA infection

RR = relative risk; CI = confidence interval

Source:
Clin Infect Dis. 2004;39:776-782.

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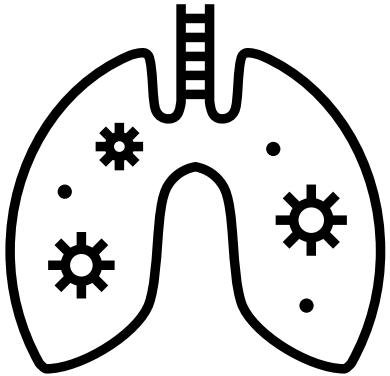
Evidence for MRSA PCR in Respiratory Infections



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MRSA Nasal PCR for PNA

Dangerfield B, *et al*. 2014 → single center, retrospective, cohort study			
Purpose	**Methods and Design**	**PNA Classification**	**Results**
• Evaluate the MRSA nasal PCR to predict culture-confirmed MRSA PNA • Calculate the sensitivity, specificity, PPV, and NPV of the MRSA nasal PCR	• January 2009-July 2011 • Patients were included if they had confirmed PNA, MRSA nasal PCR, and culture • N = 435	• HCAP: 54.7% • CAP: 34.3% • HAP: 11%	• Sensitivity: 88.0% • Specificity: 90.1% • PPV: 35.4% • NPV: 99.2% • 30-day mortality (empiric anti-MRSA antibiotics vs. no empiric anti-MRSA antibiotics): 0 vs. 3 deaths; *P* = 0.4

Source:
Antimicrob Agents and Chemo. 2014;58(2):829-864.

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Authors' Conclusion

- Excellent NPV; a negative MRSA nasal PCR can be reasonably used to guide antibiotic de-escalation

Source:
Antimicrob Agents and Chemo. 2014;58(2):829-864.

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MRSA Nasal PCR for PNA

Parente D, *et al*. 2018 → meta-analysis			
Purpose	**Methods and Design**	**PNA Classification**	**Results**
• Evaluate the diagnostic value of MRSA nasal screening in MRSA PNA	• 22 studies • 5163 patients	• Only reported for 11 studies • 3 studies (27%) included all PNA types • 2 studies (18.2%) included CAP and HCAP • 1 study (9%) included HAP • 5 studies (45.5%) included VAP	All types of PNA • Sensitivity: 70.9% • Specificity: 90.3% • PPV: 44.8% • NPV: 96.5%

Source:
Clin Infect Dis. 2018;67(1):1-7.

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MRSA Nasal PCR for PNA

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Source:
Clin Infect Dis. 2018;67(1):1-7.

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MRSA Nasal PCR for PNA

Parente D, *et al*. 2018 → meta-analysis

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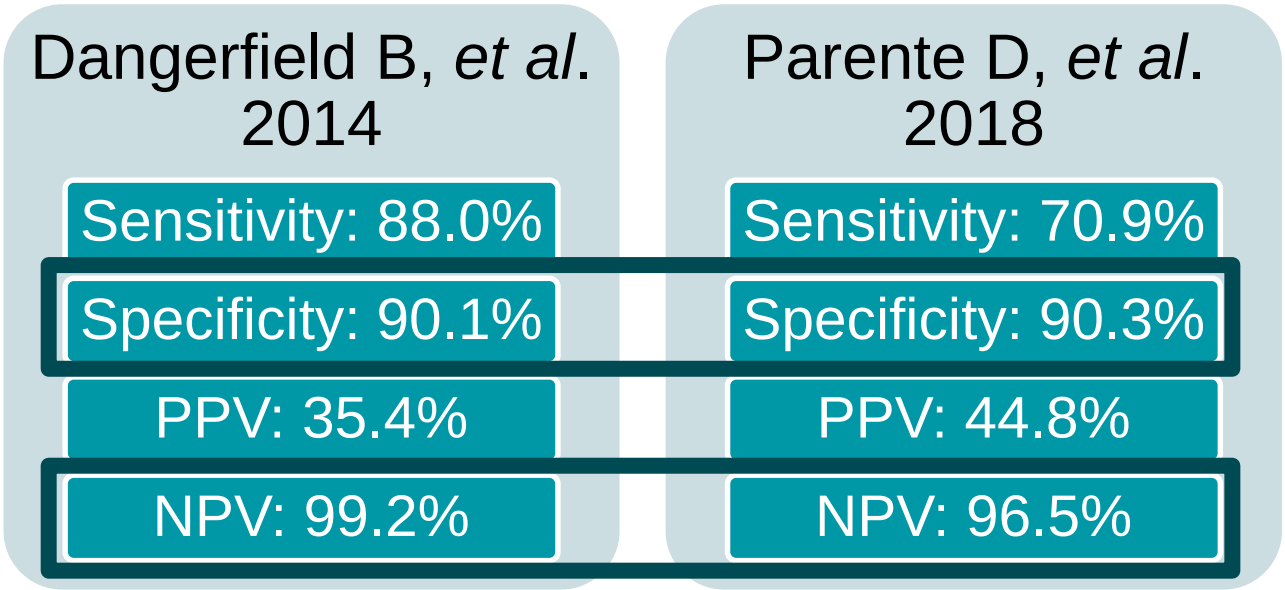
Authors' Conclusions

- A positive MRSA nares test is not diagnostic of MRSA PNA, but a negative result can rapidly and effectively rule it out
- Valuable tool for antimicrobial stewardship pharmacists to de-escalate empiric anti-MRSA therapy in patients with PNA who are not nasally colonized with MRSA, specifically those with CAP/HCAP

Source:
Clin Infect Dis. 2018;67(1):1-7.

Compare



Sources:
Antimicrob Agents and Chemo. 2014;58(2):829-864.
Clin Infect Dis. 2018;67(1):1-7.

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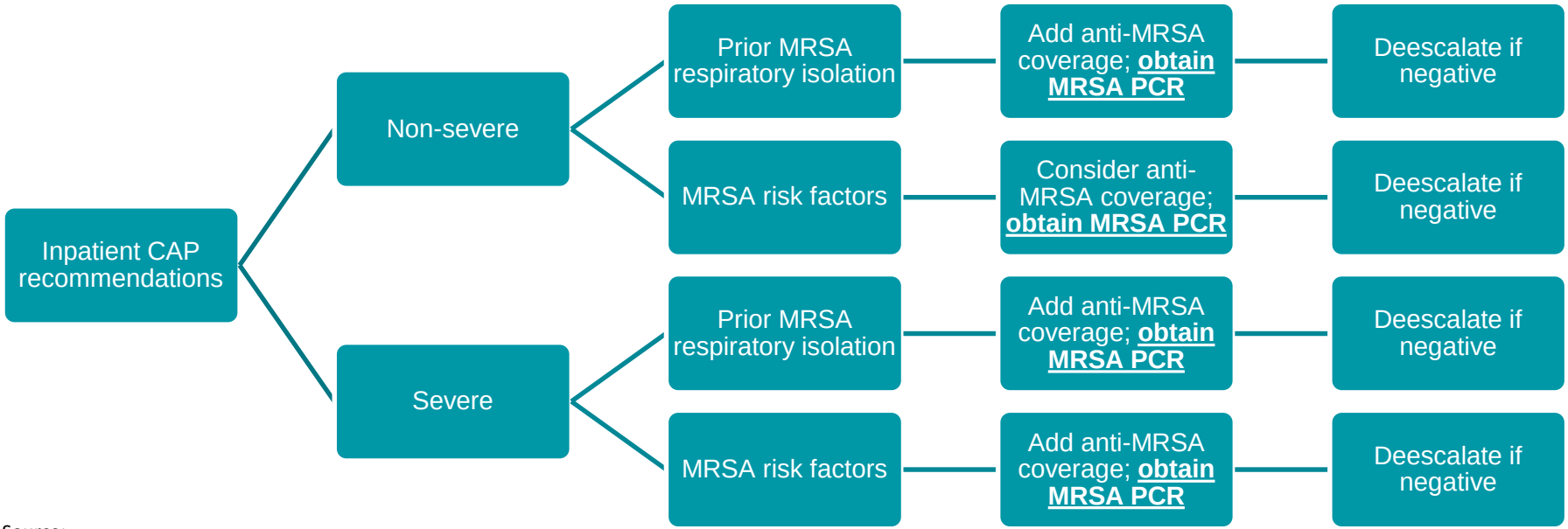
MRSA Coverage in Respiratory Infections – CAP

2019 ATS/IDSA CAP Guideline Recommendations



Source:

Am J Respir Crit Care Med. 2019;200(7):45-67.

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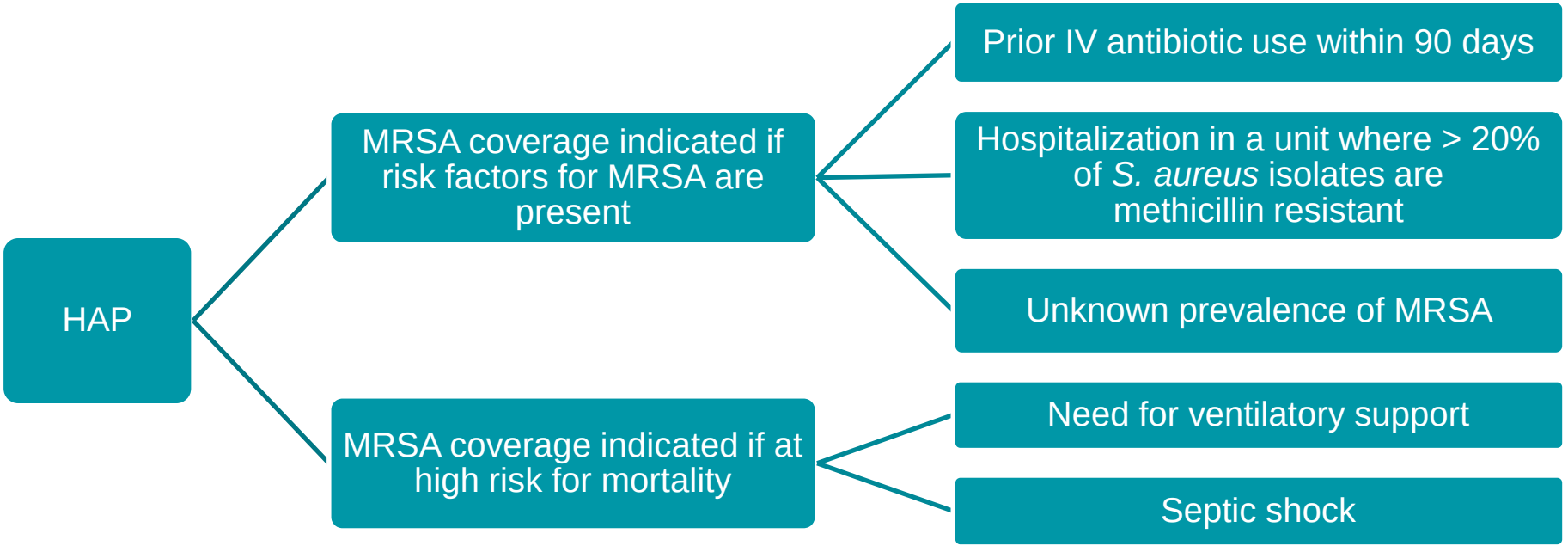
MRSA Coverage in Respiratory Infections – HAP

2016 ATS/IDSA Guidelines for the management of HAP/VAP Recommendations



Source:
Clin Infect Dis. 2016;63(5):61-111.

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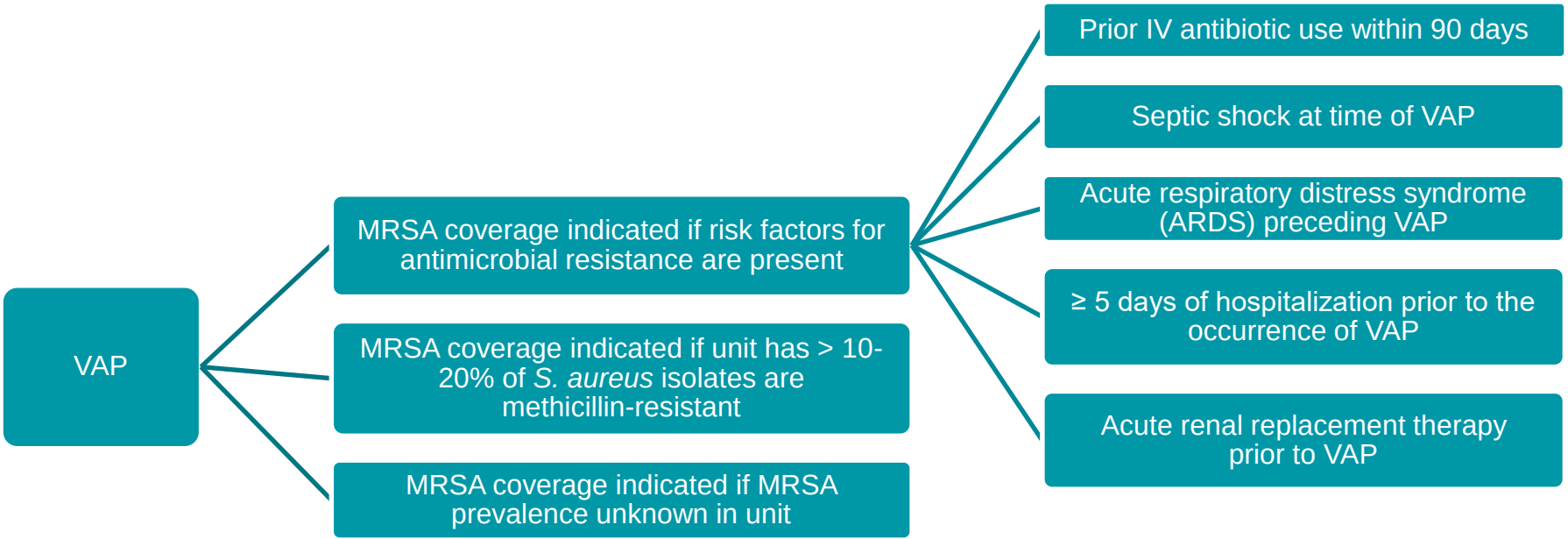
MRSA Coverage in Respiratory Infections – VAP

2016 ATS/IDSA Guidelines for the management of HAP/VAP Recommendations



Source:

Clin Infect Dis. 2016;63(5):61-111.

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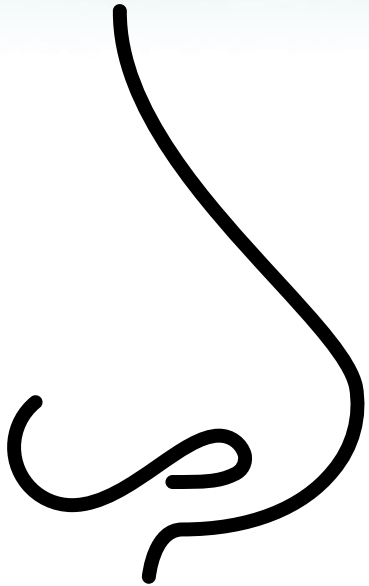
Does the Nose Know? The Value of MRSA Nares PCR in SSTI



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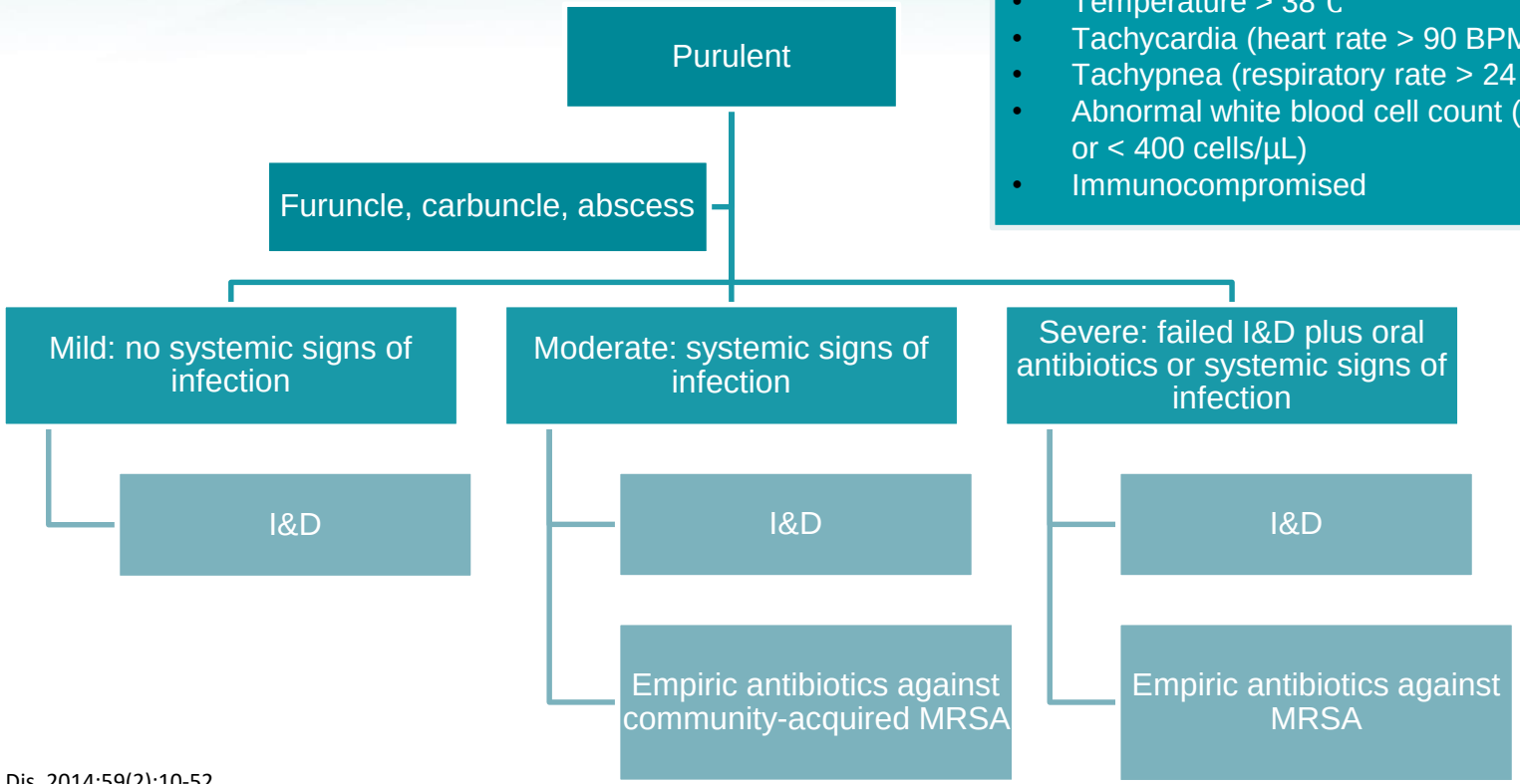
SSTI Treatment Recommendations

Systemic signs of infection:
- Temperature > 38℃
- Tachycardia (heart rate > 90 BPM)
- Tachypnea (respiratory rate > 24 BPM)
- Abnormal white blood cell count (> 12,000 or < 400 cells/µL)
- Immunocompromised



Source:
Clin Infect Dis. 2014;59(2);10-52.

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- Immunocompromised

Non-purulent

Necrotizing infection, cellulitis, erysipelas

Mild: typical cellulitis/erysipelas with no focus of purulence

Oral antibiotics against *Staphylococcus* and *Streptococcus* species

Moderate: typical cellulitis/erysipelas with systemic signs of infection

Intravenous antibiotics against *Staphylococcus* and *Streptococcus* species

Severe: failed oral antibiotic treatment, systemic signs of infection, or those with clinical signs of deeper infection

Emergent I&D

Empiric broad-spectrum antibiotics

Source:

Clin Infect Dis. 2014;59(2);10-52.

SSTI

Recommendations for Empiric MRSA Coverage

- Moderate and severe purulent SSTI
- Cellulitis associated with risk factors
- High local MRSA infection rate
- Surgical site infection in patients who have MRSA risk factors
- Necrotizing fasciitis
- Pyomyositis
- Clostridial gas gangrene or myonecrosis
- Febrile neutropenia

Source:
Clin Infect Dis. 2014;59(2);10-52.

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Clinical Utility of Negative MRSA Nasal Surveillance PCR in SSTI

Burgoon R, *et al.* 2022

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Study Design and Methods

Retrospective, cohort analysis at a tertiary academic medical center

July 2014 – June 2020

Included patients who had a MRSA nasal PCR performed during their hospitalization and had a primary diagnosis of SSTI

Patients separated into two groups (negative MRSA nasal PCR and positive MRSA nasal PCR) in a 2:1 ratio

Source:
Am J Infect Control. 2022;50;941-946.

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Primary Diagnosis Types

- Cutaneous abscess
- Furuncle and carbuncle
- Cellulitis and acute lymphangitis
- Acute lymphadenitis
- Pilonidal cyst and sinus
- Other local infections of skin and subcutaneous tissue
- Intraoperative and postprocedural complications of skin and subcutaneous tissue

Source:
Am J Infect Control. 2022;50;941-946.

Baseline Characteristics

Demographics	MRSA-positive nasal PCR (N = 156)	MRSA-negative nasal PCR (N = 317)
Age (years), median (IQR)	59 (45-71)	58 (47-69)
Male, n (%)	88 (56)	180 (57)
Weight (kg), median (IQR)	78 (68-100)	86 (68-105)
Height (cm), median (IQR)	173 (163-180)	170 (163-180)
Race, n (%)		
White	112 (72)	200 (63)
Black	43 (28)	103 (33)
Other	1 (1)	14 (4)
Prior anti-MRSA therapy in 3 months, n (%)	24 (15)	72 (23)

IQR = interquartile range

Source:

Am J Infect Control. 2022;50;941-946.

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SSTI Location

- Face: 45%
- Lower extremities: 31%
- Unspecified: 24%
- Trunk: 22%
- Upper extremities: 17%
- Multiple sites: 2%
- Head: 1%

Source:
Am J Infect Control. 2022;50;941-946.

Vancomycin Utilization

Outcome	MRSA-positive nasal PCR (N = 156)	MRSA-negative nasal PCR (N = 317)	*P*-value
Duration of vancomycin therapy (days), median (IQR)	4 (3-6)	3 (2-5)	0.01
Doses of vancomycin administered, median (IQR)	6 (3-10)	5 (3-8)	0.3
Number of vancomycin levels collected, median (IQR)	2 (10-4)	2 (1-3)	0.43

IQR = interquartile range

Source:
Am J Infect Control. 2022;50;941-946.

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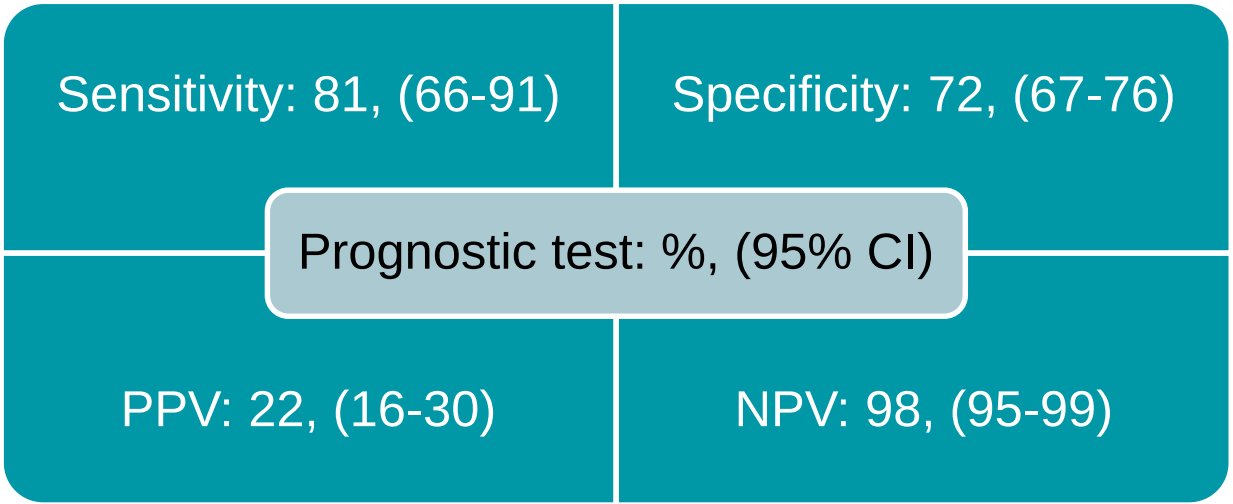
Prognostic Test Statistics



CI = confidence interval

Source:

Am J Infect Control. 2022;50;941-946.

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Authors' Conclusions

- Potential to decrease the duration of vancomycin therapy using a negative MRSA nasal PCR result
- High NPV of MRSA nasal PCR, similar to other studies
- Implement a MRSA nasal screening review as an antimicrobial stewardship tool for de-escalating vancomycin therapy

Source:
Am J Infect Control. 2022;50;941-946.

Presenter's Critique

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Strengths

- Sample size
- Large time frame
- Multiple SSTI sites were included
- Similar results to previous studies in different infections

Limitations

- Retrospective
- Could not account for anti-MRSA therapy given outpatient or inpatient
- Identification was based on ICD-10 codes

ICD = International Classification of Diseases

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Does a Positive MRSA Nasal Screen Predict the Risk for MRSA SSTI?

Hitchcock AM, *et al.* 2023

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Study Design and Methods

Single-center, retrospective cohort study at a tertiary academic medical center

December 2018 – October 2021

Included patients who had a MRSA nasal screen and wound culture results obtained within 48 hours of starting antibiotic therapy

Excluded patients if they had a history of MRSA infection within 1 year prior to the index admission

Source:
Ann of Pharmacotherapy. 2023;57(6):669-676.

Baseline Characteristics

Demographics	N = 300
Male gender, n (%)	181 (60)
Age (years), mean (SD)	56 (15)
Weight (kg), mean (SD)	92 (31)
Residence, n (%)	
Home	276 (92)
Nursing facility	19 (6)
Homeless	5 (2)
Comorbidities, n (%)	
Diabetes	138 (46)
Hemodialysis	6 (2)
Peritoneal dialysis	4 (1)
Persons who inject drugs	31 (10)

SD = standard deviation

Source:
Ann of Pharmacotherapy. 2023;57(6):669-676.

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Diagnosis, n (%)

Abscess, 108 (36)	Cellulitis, 50 (17)	Ulcer, 41 (14)	Wound with osteomyelitis, 37 (12)
Surgical site infection, 18 (6)	Burn, 10 (3)	Multiple diagnoses*, 10 (3)	Other**, 26 (9)

*Multiple diagnoses: patients with > 1 infectious diagnosis in > 1 location during the same encounter
**Other diagnoses: gangrene (n = 9), prosthetic infection (n = 9), necrotizing fasciitis (n = 4), septic arthritis (n = 3), pyomyositis (n = 1)

Source:
Ann of Pharmacotherapy. 2023;57(6):669-676.

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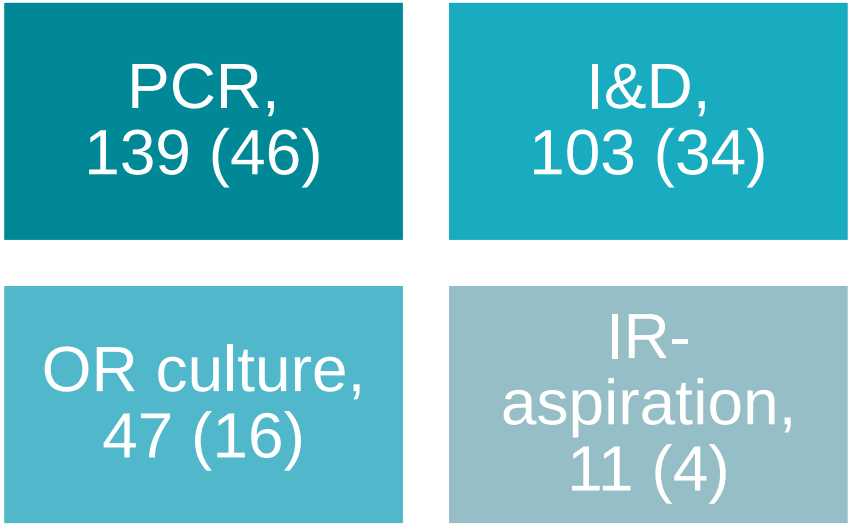
Infection Location, n (%)

Lower extremities, 126 (42)	Face or neck, 52 (17)	Trunk, 41 (14)	Groin or buttocks, 30 (10)
Upper extremities, 24 (8)	Spine, 12 (4)	Multiple sites, 8 (3)	Hip, 7 (2)

Source:
Ann of Pharmacotherapy. 2023;57(6):669-676.

McLeod Health

Culture Type, n (%)



Source:
Ann of Pharmacotherapy. 2023;57(6):669-676.

OR: operating room
IR: interventional radiology

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Wound Culture and MRSA Nasal Screen Results

	MRSA wound culture (+) (N = 55)	MRSA wound culture (-) (N = 245)	Total (N = 300)
Total cohort (purulent and non-purulent SSTI)			
MRSA nasal screen (+), n (%)	35 (64)	15 (6)	50 (17)
MRSA nasal screen (-), n (%)	20 (36)	230 (94)	250 (83)

Source:
Ann of Pharmacotherapy. 2023;57(6):669-676.

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Wound Culture and MRSA Nasal Screen Results

	MRSA wound culture (+) (N = 34)	MRSA wound culture (-) (N = 123)	Total (N = 157)	MRSA wound culture (+) (N = 21)	MRSA wound culture (-) (N = 122)	Total (N = 143)
	Purulent SSTI cohort			Non-purulent SSTI cohort		
MRSA nasal screen (-), n (%)	23 (68)	8 (7)	31 (20)	12 (57)	7 (6)	19 (13)
MRSA nasal screen (+), n (%)	11 (32)	115 (93)	126 (80)	9 (43)	115 (94)	124 (87)

Source:
Ann of Pharmacotherapy. 2023;57(6):669-676.

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Performance Characteristics of MRSA Nasal Screening

Characteristic, %, (95% CI)	Purulent SSTI (n = 157)	Non-purulent SSTI (n = 143)	Total Cohort (N = 300)
MRSA prevalence	22, (16-29)	15, (10-22)	18, (14-23)
Sensitivity	68, (49-82)	57, (34-77)	64, (50-76)
Specificity	94, (87-97)	94, (88-98)	94, (90-96)
PPV	74, (55-88)	63, (39-83)	70, (55-82)
NPV	91, (85-95)	93, (86-96)	92, (88-95)

CI = confidence interval

Source:
Ann of Pharmacotherapy. 2023;57(6):669-676.

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Authors' Conclusion

- Positive MRSA nasal screen → large increase in the probability of MRSA SSTI
- Negative MRSA nasal screen → small but potentially significant decrease in the probability of MRSA SSTI
- Augments existing literature in this area and may improve empiric antibiotic therapy guidance for patients with SSTI

Source:
Ann of Pharmacotherapy. 2023;57(6):669-676.

Presenter's Critique

Strengths

- Sample size
- Large time frame
- Included multiple types and locations of SSTI, with purulent vs. non-purulent noted

Limitations

- Retrospective
- Excluded patients with a history of MRSA infections

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Determining the Utility of MRSA Nares Screening in Antimicrobial Stewardship

Mergenhagen KA, *et al*. 2020

McLeod Health

Study Design, Methods, and Inclusion

Retrospective cohort study across Veterans Affairs (VA) medical centers nationwide

January 2007 – January 2018

Included patients who were tested for MRSA colonization via the nares upon admission or inpatient transfer

Total of 245,833 unique patients with 561,325 cultures from a variety of anatomical sites

Source:

Clin Infect Dis. 2020;71(5):1142-1180.

Baseline Characteristics

Demographic	N = 561,325
Male, n (%)	540,583 (96)
Age (years), mean (SD)	68 (12)
Culture site, n (%)	
Urine	223,050 (40)
Wound	138,647 (25)
Respiratory	90,912 (16)
Blood	70,185 (13)
Intra-abdominal	22,446 (4)
Other	4,817 (1)
Nasal Screening	**N = 245,833**
On admission, n (%)	237,229 (97)
PCR, n (%)	181,179 (74)
Standard culture techniques, n (%)	64,654 (26)

SD = standard deviation

Source:
Clin Infect Dis. 2020;71(5):1142-1180.

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Efficacy Characteristics of MRSA Nares Screening by Wound Culture Type

Wound Culture Type	Sensitivity, %, (95% CI)	Specificity, %, (95% CI)	PPV, %, (95% CI)	NPV, %, (95% CI)
Wound site unspecified (n = 136,078)	60, (59-61)	83, (82-83)	34, (34-35)	93, (93-93)
Wound site sterile (n = 72,542)	58, (58-59)	85, (85-86)	36, (36-37)	94, (93-94)

CI = confidence interval

Source:
Clin Infect Dis. 2020;71(5):1142-1180.

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Authors' Conclusion

- Negative MRSA PCR taken within 7 days of culture is useful for predicting the absence of MRSA in subsequent clinical culture
- MRSA PCR is a stewardship tool to avoid the use or deescalate anti-MRSA therapy
- MRSA PCR is not a tool to predict current MRSA infection

Source:
Clin Infect Dis. 2020;71(5):1142-1180.

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Presenter's Critique

Strengths

- Sample size and nationwide study
- Assessed sterile vs. nonsterile cultures

Limitations

- Retrospective
- Did not assess if patient had been decolonized recently
- Majority of wounds were unspecified

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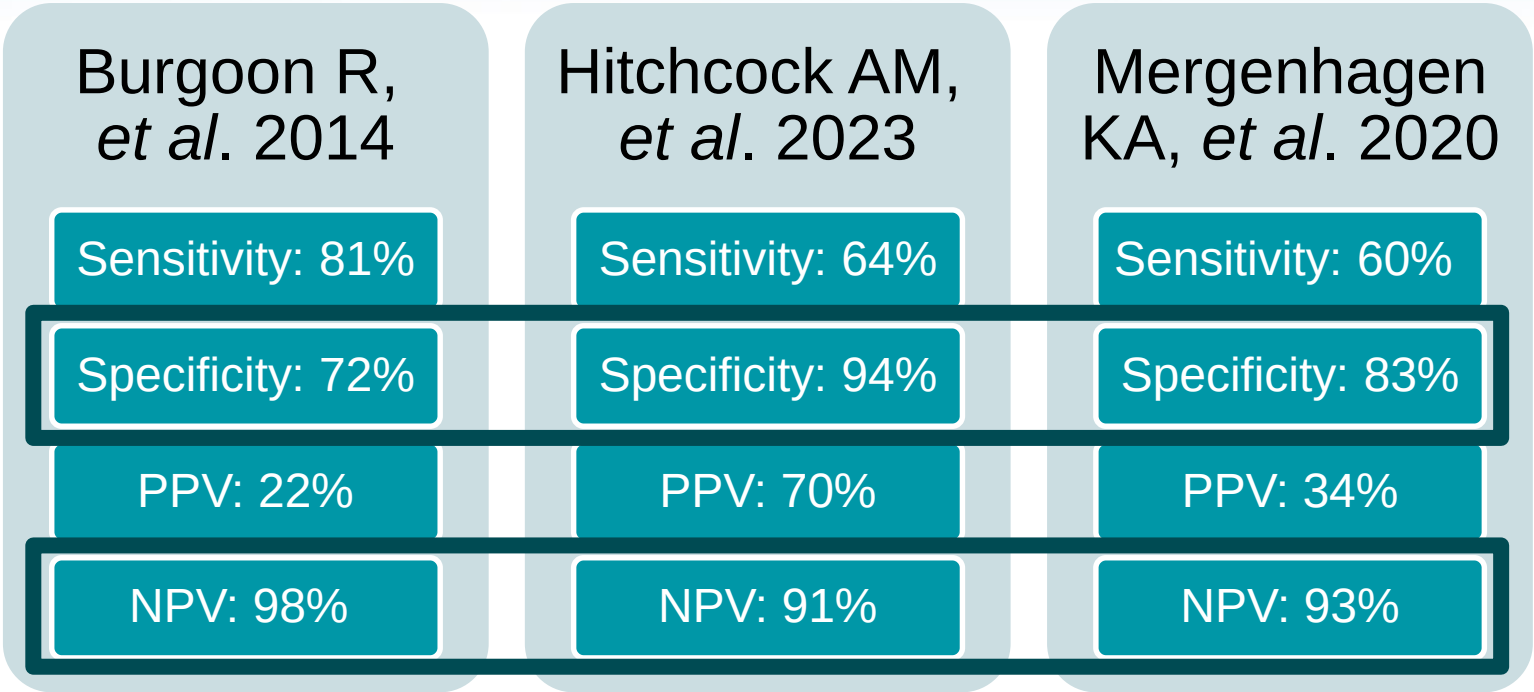
Compare



Sources:
Am J Infect Control. 2022;50;941-946.
Ann of Pharmacotherapy. 2023;57(6):669-676.
Clin Infect Dis. 2020;71(5):1142-1180.

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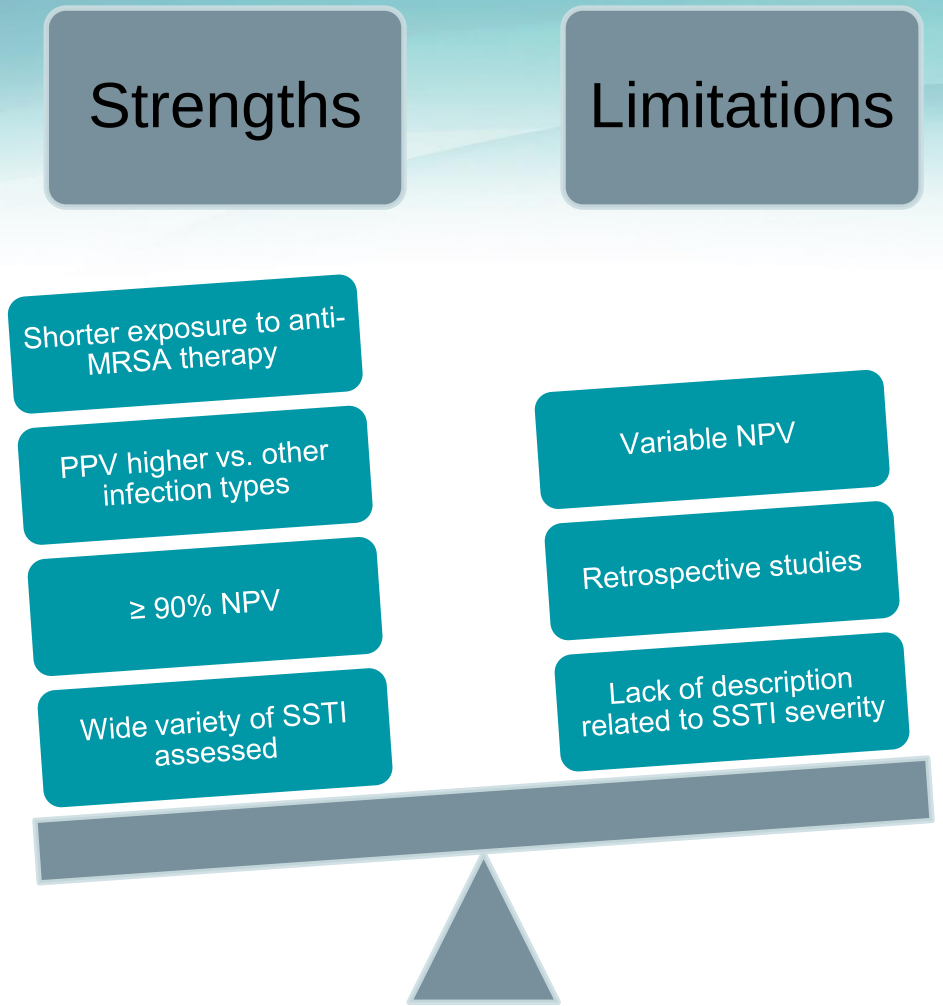
Strengths and Limitations of Nasal MRSA PCR in SSTI



Proposed Algorithm for the Use of MRSA PCR in SSTI

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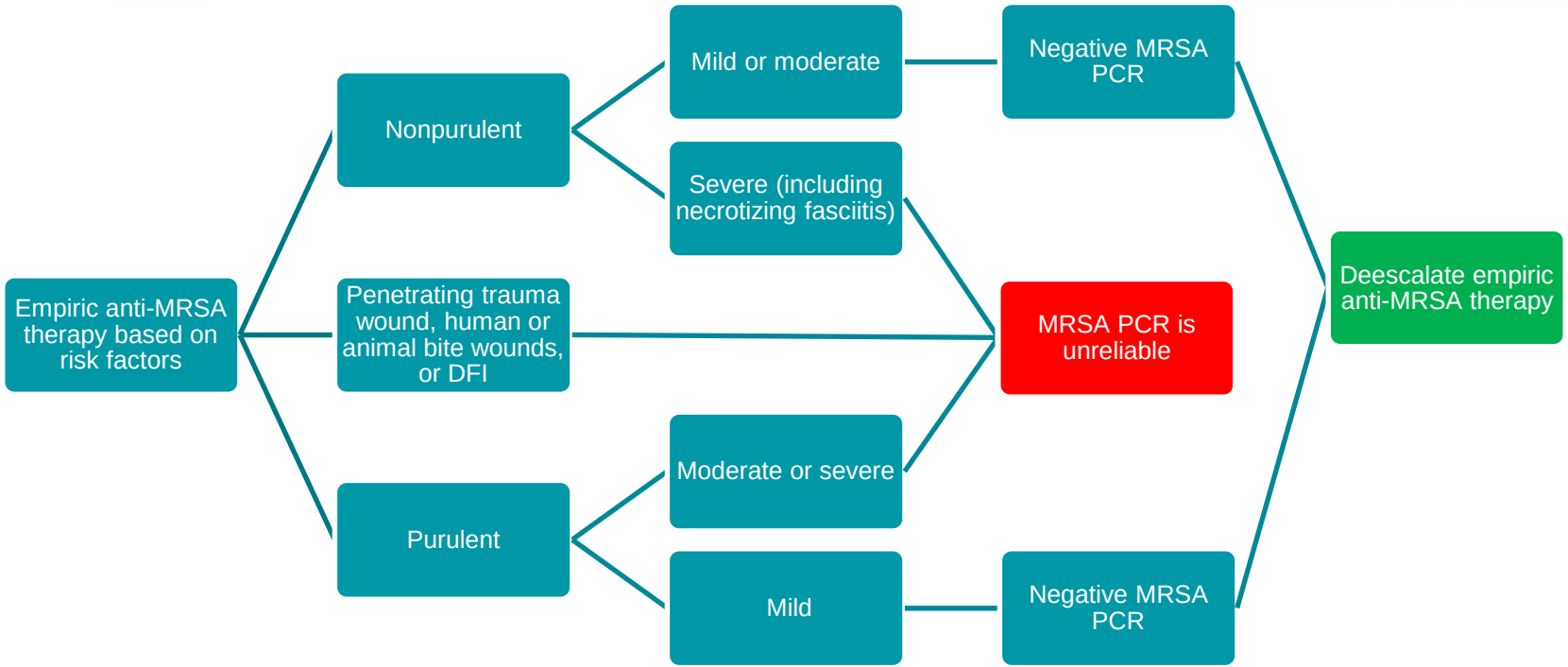

Future Directions

Correlation Between Patients With MRSA Nares Colonization and MRSA DFI

McLeod Health

Brondo, *et al*. 2022 → single-center, retrospective medical record review

Purpose	Methods	Results
To evaluate the utility of MRSA nares testing for prediction of MRSA in DFI	• October 2013 – October 2019 • Patients included had listed diagnosis of diabetes, MRSA nares results, and wound, bone, or tissue cultures collected during the same admission • N = 200	***MRSA Nares Test Results*** • Negative (N = 176) - Non-MRSA DFI, n (%): 165 (94) - MRSA DFI, n (%): 11 (6) • Positive (N = 24) - Non-MRSA DFI, n (%): 10 (42) - MRSA DFI, n (%): 14 (58) ***MRSA Nares Test Validity*** • Sensitivity: 56% • Specificity: 94% • PPV: 58% • NPV: 94%

Authors' Conclusions

- Expands on prior literature supporting the strong correlation of NPV for MRSA nares and DFI
- Suggest the ability to use a negative MRSA nares test to effectively rule out MRSA DFI, which may allow for faster de-escalation of empiric anti-MRSA antibiotic therapy

Source:

Intern J or Low Extrem Wound. 2022;21(4):502-505.

Utility of MRSA PCR Beyond Respiratory Infections

McLeod Health

Noeldner HM, *et al.* 2022 → retrospective cohort study across 3 hospitals

Purpose	Method and Design	Results
• To determine the clinical utility of MRSA PCR assays beyond respiratory indications by estimating its predictive value for clinical cultures from blood, bone, and soft tissue	• March 2019 – February 2020 • 40% of *Staphylococcus aureus* isolates were MRSA • Included patients who had a clinical culture within 3 days of a MRSA PCR	Any clinical culture • Sensitivity: 67.5% • Specificity: 88.8% • PPV: 11.0% • NPV: 99.3% Bone and soft tissue • Sensitivity: 55.0% • Specificity: 92.7% • PPV: 50.0% • NPV: 92.7%

Authors' Conclusion

- A negative MRSA PCR obtained within 3 days of a culture has a high NPV for MRSA infections in blood, bone, and soft tissue

Source:

Antimicrob Steward & Healthcare Epidem. 2022;2:1-3.

Assessment Question #1

What classification of pneumonia is a MRSA PCR indicated per the ATS/IDSA guidelines?

a. CAP
b. HCAP
c. HAP
d. VAP
e. a, c
f. All of the above

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Assessment Question #2

Which of the following studies does not assess the MRSA nasal PCR in SSTIs?

a. Parente D, *et al.* 2018
b. Burgoon R, *et al.* 2022
c. Hitchcock AM, *et al.* 2023
d. Mergenhagen KA, *et al*. 2020

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c. Hitchcock AM, *et al.* 2023
d. Mergenhagen KA, *et al*. 2020

Assessment Question #3

Which of the following clinical scenarios would the MRSA PCR be unreliable if obtained within 48 hours of presentation, per the presenter's conclusions?

a. Mild cellulitis (nonpurulent SSTI)
b. Moderate erysipelas (nonpurulent SSTI)
c. Moderate SSTI due to a dog bite
d. Mild abscess (purulent SSTI)

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References

1. Carr AL, Daley MJ, Merkel KG, et al. Clinical Utility of Methicillin-Resistant *Staphylococcus aureus* Nasal Screening for Antimicrobial Stewardship: A Review of Current Literature. Pharmacotherapy. 2018;38(12):1216-1228.
2. Siddiqui AH, Koirala J. Methicillin-Resistant *Staphylococcus aureus*. StatPearls [Internet]. Last updated April 2, 2023. Methicillin-Resistant Staphylococcus aureus - StatPearls - NCBI Bookshelf (nih.gov)
3. Davis KA, Stewart JJ, Crough HK, et al. Methicillin-Resistant *Staphylococcus aureus* (MRSA) Nares Colonization at Hospital Admission and Its Effect on Subsequent MRSA Infection. Clin Infect Dis. 2004;39:776-782.
4. Cheung GYC, Bae JS, and Otto M. Pathogenicity and virulence of *Staphylococcus aureus*. Virulence. 2021;12(1):547-569.
5. Peacock SJ, Paterson GK. Mechanisms of Methicillin Resistance in *Staphylococcus aureus*. Annu Rev Biochem. 2015;84:577-601.
6. Khehra N, Padda IS, and Swift CJ. Polymerase Chain Reaction (PCR). StatPearls [Internet]. Last updated March 6, 2023. Polymerase Chain Reaction (PCR) - StatPearls - NCBI Bookshelf (nih.gov)
7. Landro L. (2016, September 12). The Informed Patient - The Ultimate Battle Against MRSA. Wall Street Journal. The Ultimate Battle Against MRSA - WSJ
8. Shreffler J and Huecker MR. Diagnostic Testing Accuracy: Sensitivity, Specificity, Predicative Values and Likelihood Ratios. StatPearls [Internet]. Last updated March 6, 2023. Diagnostic Testing Accuracy: Sensitivity, Specificity, Predictive Values and Likelihood Ratios - StatPearls - NCBI Bookshelf (nih.gov)
9. Chaudhry A, Allen B, Paylor M, et al. Evaluation of the reliability of MRSA screens in patients undergoing universal decolonization. Am J Health-System Pharm. 2020;77(23):1965-1982.
10. Ghaddara, et al. Efficacy of a povidone iodine preparation in reducing nasal methicillin-resistant *Staphylococcus aureus* in colonized patients. Am J of Infect Control. 2020;48:456-459.
11. Dangerfield B, Chung A, Webb B, et al. Predictive Value of Methicillin-Resistant *Staphylococcus aureus* (MRSA) Nasal PCR PCR Assay for MRSA Pneumonia. Antimicrob Agents and Chemo. 2014;58(2):829-864.

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References

12. Parente DM, Cunha CB, Mylonakis E, et al. The Clinical Utility of Methicillin-Resistant *Staphylococcus aureus* (MRSA) Nasal Screening to Rule Out MRSA Pneumonia: A Diagnostic Meta-analysis with Antimicrobial Stewardship Implications. Clin Infect Dis. 2018;67(1):1-7.
13. Metlay JP, Waterer GW, Long AC, et al. Diagnosis and Treatment of Adults with Community-acquired Pneumonia. Am J Respir Crit Care Med. 2019;200(7):45-67.
14. Kalil AC, Metersky ML, Klompas M, et al. Management of Adults with Hospital-acquired and Ventilator-associated Pneumonia: 2016 Clinical Practice Guidelines by the Infectious Diseases Society of America and the American Thoracic Society. Clin Infect Dis. 2016;63(5):61-111.
15. Stevens DL, Bisno AL, Chambers HF, et al. Practice Guidelines for the Diagnosis and Management of Skin and Soft Tissue Infections: 2014 Update by the Infectious Diseases Society of America. Clin Infect Dis. 2014;59(2);10-52.
16. Burgoon RB, Weeda E, Mediwala KN, et al. Clinical utility of negative methicillin-resistant *Staphylococcus aureus* (MRSA) nasal surveillance PCRs in skin and skin structure infections. Am J Infect Control. 2022;50;941-946.
17. Hitchcock AM, Seabury RW, Kufel WD, et al. Does a Positive Methicillin-Resistant *Staphylococcus aureus* (MRSA) Nasal Screen Predict the Risk of MRSA Skin and Soft Tissue Infection? Ann of Pharmacotherapy. 2023;57(6):669-676.
18. Mergenhagen KA, Starr KE, Wattengel BA. Determining the Utility of Methicillin-Resistant *Staphylococcus aureus* Nares Screening in Antimicrobial Stewardship. Clin Infect Dis. 2020;71(5):1142-1180.
19. Senneville E, Albalawi Z, Asten SA, et al. IWGDF/IDSA Guidelines on the Diagnosis and Treatment of Diabetes-related Foot Infections (IWGDF/IDSA 2023). Clin Infect Dis. 2023:1-23.
20. Brondo J, Morneau K, Hopkins T, et al. Correlation Between Patients With Methicillin-Resistant *Staphylococcus aureus* Nares Colonization and MRSA Diabetic Foot Infections. Intern J or Low Extrem Wound. 2022;21(4):502-505.
21. Noeldner HM, Bliek ZJ, Jones NE, et al. Clinical Utility of methicillin-resistant *Staphylococcus aureus* nasal polymerase chain reaction (PCR) assays beyond respiratory infections. Antimicrob Steward & Healthcare Epidem. 2022;2:1-3.

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Thank you!

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