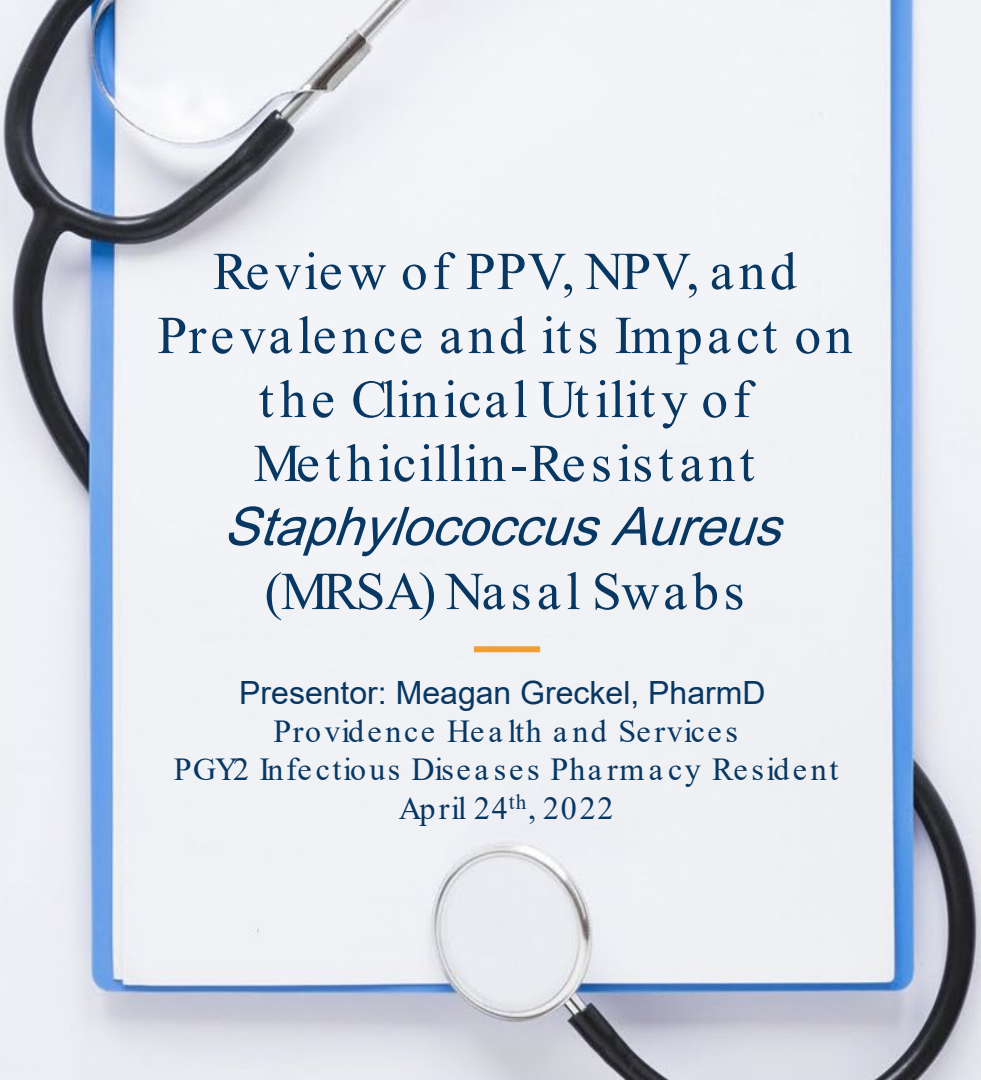

Review of PPV, NPV, and Prevalence and its Impact on the Clinical Utility of Methicillin-Resistant *Staphylococcus Aureus* (MRSA) Nasal Swabs

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April 24th, 2022

DISCLOSURES

Dr. Meagan Greckel, faculty for this CE activity, has no relevant financial relationship(s) with ineligible companies to disclose.

LEARNING OBJECTIVES

01 **EXPLAIN** the definition of prevalence, sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and pre-test probability in the utilization of MRSA nasal swabs.

02 **DETERMINE** how MRSA prevalence impacts the PPV and NPV and how we can apply this to patient care.

03 **IDENTIFY** situations where the results of the PPV and NPV of MRSA nasal swabs may not apply.

PRE-TEST QUESTIONS

1. True or false : prevalence effects PPV, NPV, specificity, and sensitivity.

A. True

B. False

PRE-TEST QUESTIONS

2. (Select one of the following) As MRSA prevalence decreases:

A. The PPV increases and NPV decreases

B. The PPV decreases and NPV decreases

C. The PPV decreases and NPV increases

PRE-TEST QUESTIONS

3. With a 10% prevalence of potential MRSA pneumonia, the calculated PPV of a MRSA nasal swab was 44.8%, and the NPV was 96.5%. What does this mean?

A. 96.5% of patients with a negative swab did not have an MRSA infection
B. 55.4% of patients with a negative MRSA nasal swab did not have an MRSA infection
C. 44.8% of patients with a positive swab actually had an MRSA infection
D. 3.5% of patients with negative swab are false negatives and have an MRSA infection
E. Answers A, C, and D are correct

BACKGROUND

- Current Infectious Diseases Society of America (IDSA) guidelines recommend empiric MRSA coverage in infections based on specific risk factors:
  - Community -acquired pneumonia (CAP)
  - Hospital -acquired pneumonia (HAP)
  - Ventilator -acquired pneumonia (VAP)
  - Bone and joint infections
  - Purulent skin and soft tissue infections (SSTIs)
- Inappropriate vancomycin use ranges 20 -70%
- Pre- and post -test probability may alter the decision to use MRSA nasal swabs in areas with variable prevalence

Metlay JP et al. Am J Respir Crit Care Med. 2019 Oct 1;200(7):e45-e67.
Palmer et al. Clinical Infectious Diseases, Volume 63, Issue 5, 1 September 2016, Pages e61–e111.
Berbari EF et al. Clinical Infectious Diseases, Volume 61, Issue 6, 15 September 2015, Pages e26–e46.
Stevens DL et al. Clinical Infectious Diseases, Volume 59, Issue 2, 15 July 2014, Pages e10–e52.
Kim, Nak-Hyun et al. Antimicrobial agents and chemotherapy vol. 59,2 (2015): 811-7.

PREVALENCE DEFINITION

How common a disease process is found:

- In an at-risk population during a specified time period
- Similar to **pre-test probability**
- Differs from incidence
- Post-test probability based on prevalence and test results

Tenny S, Hoffman MR. Prevalence. StatPearls Publishing; 2022.
Prinzi A. Why Pretest and Posttest Probability Matter in the Time of Covid-19. ASM. 2020 June 8.

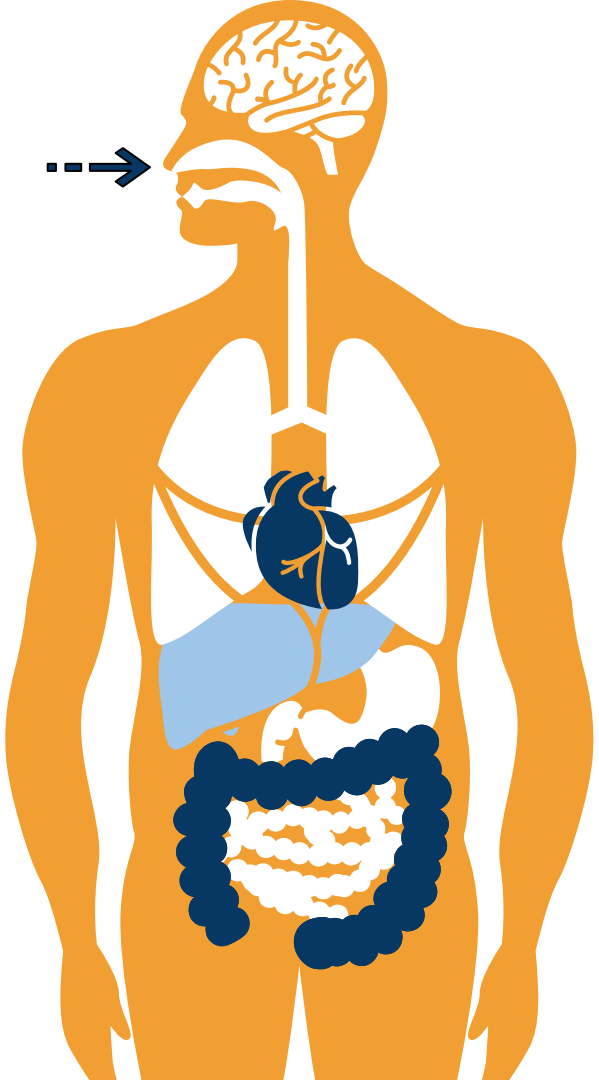
MRSA COLONIZATION

1 in 3 (33%)

people carry *S. aureus* in the nasopharynx

1 in every 50 (2%)

people carry MRSA in the nasopharynx



Healthcare Settings- Preventing the Spread of MRSA. CDC and Prevention, 2019 Feb 28.

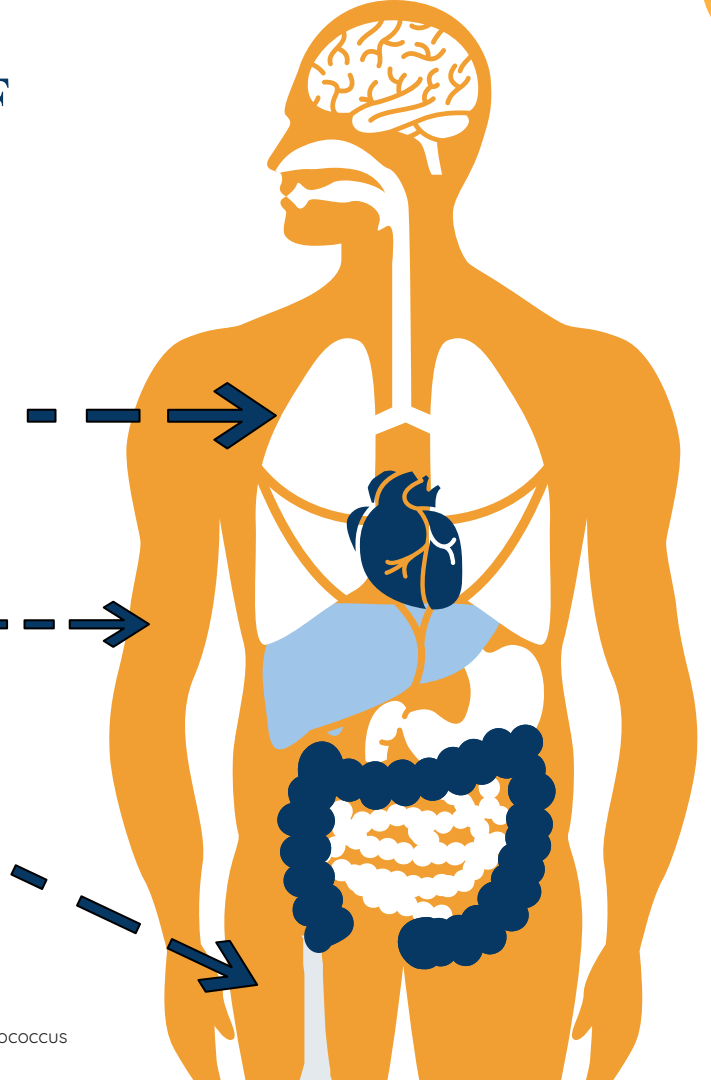
MRSA PREVALANCE PER SITE OF INFECTION

3-12% CAP

16-20% HAP/VAP

10-22% SSTI

9-15% Osteomyelitis



Aliberti S et al. Lancet Infect Dis. 2016 Dec;16(12):1364-1376.
Emerging Infections Program. Healthcare-Associated Infections: Community Interface Surveillance Report. Invasive Staphylococcus aureus, 2019. CDC and Prevention. 2022 Jan 4.

DEFINITIONS

Positive predicted value (PPV): r $= \frac{True\ positives}{True\ positives + false\ positives}$

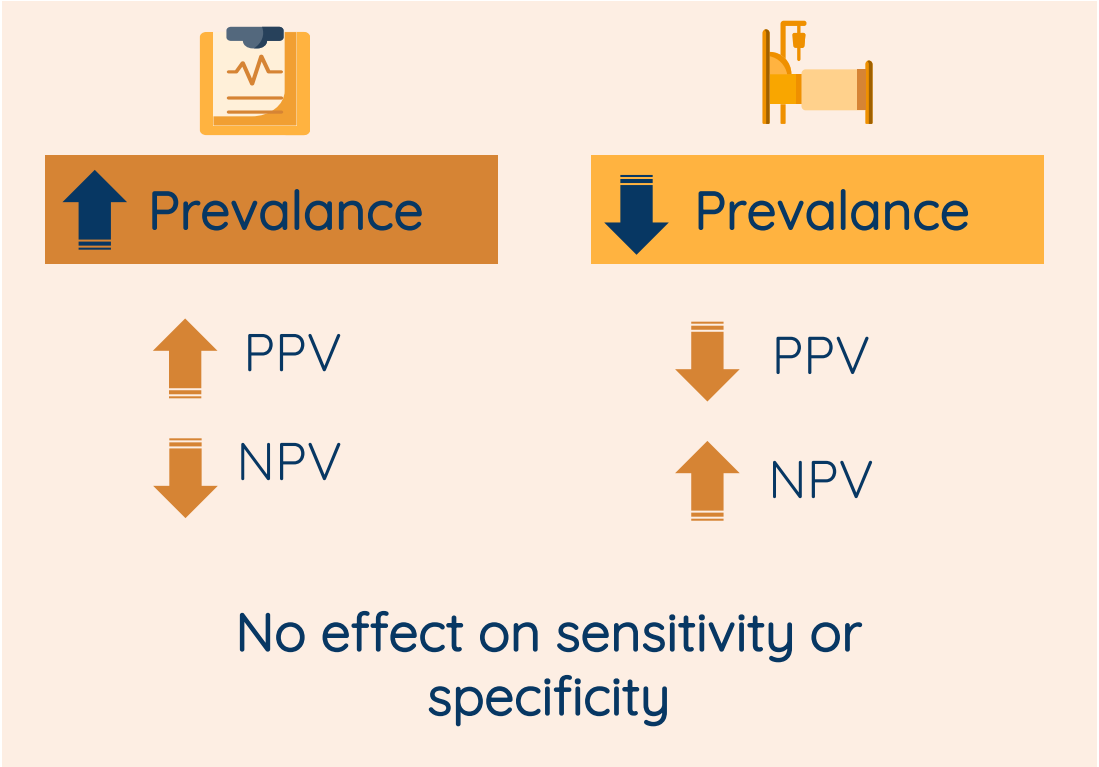
Negative predicted value (NPV): r $= \frac{True\ negatives}{True\ negatives + false\ negatives}$

Sensitivity: $= \frac{True\ positives}{All\ subjects\ with\ disease}$ “SNOUT”

Specificity: $= \frac{true\ negatives}{All\ subjects\ with\ disease}$ “SPIN”

Safari, Saeed, et al. Emergency (Tehran, Iran), Shahid Beheshti University of Medical Sciences, 2015.

PREDICTIVE VALUES AND PREVALENCE OF DISEASE



Safari, Saeed, et al. Emergency (Tehran, Iran), Shahid Beheshti University of Medical Sciences, 2015.

EXAMPLE # 1

MRSA NAAT used to screen 400 patients.

PPV: 19/57
= 33%

NPV: 342/343
= 99.7%

	MRSA infection	No MRSA	Total
+ test	19	38	57
- test	1	342	343
Total	20	380	400

EXAMPLE # 2

MRSA NAAT used to screen 400 patients.

PPV: 114/148
= 80%

NPV: 252/258
= 97.7%

	MRSA infection	No MRSA	Total
+ test	114	28	148
- test	6	252	258
Total	120	280	400

WHEN PPV AND NPV MAY NOT APPLY

- In infections with low prevalence of MRSA among *Staph aureus* isolates and without risk factors
  - Low pre-test probability
  - MRSA nasal swab not necessary
  - No need for anti-MRSA agent

Example #3: MRSA swab ordered in a patient with CAP and no risk factors

CONCLUSIONS

- MRSA nasal swabs can be a useful tool in certain infections when the NPV is high, and MRSA is of clinical concern
- The practice of analyzing the pre- and post-test probability of a MRSA nasal swab can help a clinician determine if obtaining a test is necessary

POST-TEST QUESTIONS

1. True or false : prevalence effects PPV, NPV, specificity, and sensitivity.

A. True

B. False

POST-TEST QUESTIONS

2. (Select one of the following) As MRSA prevalence decreases:

A. The PPV increases and NPV decreases

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C. The PPV decreases and NPV increases

POST-TEST QUESTIONS

3. With a 10% prevalence of potential MRSA pneumonia, the calculated PPV of a MRSA nasal swab was 44.8%, and the NPV was 96.5%. What does this mean?

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THANK YOU!

Questions?

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April 24th, 2022

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