

# Methicillin-resistant *Staphylococcus aureus* (MRSA)

## Summary

*Staphylococcus aureus* (*S. aureus*), a common commensal and human pathogen, can cause a variety of skin and soft tissue infections, invasive infections and toxin-mediated syndromes. Methicillin-resistant *S. aureus* (MRSA) are a subset of *S. aureus* that are resistant to beta-lactam antibiotics, except ceftaroline.

First reported in 1968, MRSA progressively became a major cause of infections among hospitalized patients, particularly among patients with one or more co-morbid conditions. MRSA infections in these populations have been referred to as health care-associated MRSA (HA-MRSA).

A new strain of MRSA (USA 300) began to appear in the community in 1999. By 2011, USA 300 was considered relatively widespread among healthy persons in the community. The term Community-associated MRSA (CA-MRSA) refers to MRSA infections acquired in the community without healthcare association.

## Agent

*S. aureus* are gram-positive cocci that appear microscopically as grape-like clusters. *S. aureus* is one of the most commonly isolated bacterial pathogens in humans. It is an important cause of skin and soft tissue infections (SSTIs), endovascular infections, pneumonia, septic arthritis, endocarditis, osteomyelitis, sepsis, foreign-body and device related infections.

Methicillin-resistant *S. aureus* (MRSA) are resistant to beta-lactam antibiotics, including penicillinase-resistant penicillins (e.g., methicillin, oxacillin, nafcillin) and cephalosporins, with the exception of ceftaroline. HA-MRSA are typically resistant to multiple classes of antimicrobials. CA-MRSA are resistant to fewer non- Beta- lactam classes of antimicrobials than HA-MRSA.

## Transmission

Reservoir:

A large percentage of the population harbors (60%) *S. aureus* intermittently, with a mean carriage state of 27-37%. Between 1 to 1.8% of the general population is colonized with MRSA. Colonization rates among healthcare workers is higher and probably in the 5-7% range. The anterior nares are colonized most densely, but the throat, axilla, perineum, vagina, and rectum are also common sites of colonization.

Mode of transmission:

Most often through direct skin-to-skin contact, but can be transmitted through contaminated surfaces or items, such as sports equipment, wound dressings, towels, or linens.

Period of communicability:

For as long as the organism is present; colonization is usually transient but may persist for years in 10% to 20% of affected persons.

## Clinical Disease

Incubation period:

Variable. Some persons may be colonized with *S. aureus* or MRSA and never develop infection, while others may develop infection without evidence of prior colonization.

Illness:

In contrast with HA-MRSA, CA-MRSA infections tend to occur in healthy younger patients.

Most CA-MRSA infections are skin and soft tissue infections, such as abscesses and cellulitis. MRSA skin lesions are frequently confused with spider bites by both patients and clinicians. MRSA, like methicillin resistant *S. aureus*, can cause bacteremia, sepsis, pneumonia, septic arthritis, osteomyelitis, and other foci of infection. Risk factors for severe staphylococcal infections include surgery, transplantation, immune system disorders, and chronic diseases such as diabetes mellitus and cirrhosis of the liver.

HA-MRSA strains are typically seen among people with healthcare exposures. Patients with HA-MRSA tend to be older than individuals with CA-MRSA and often have one or more associated comorbidities. HA-MRSA can cause healthcare associated pneumonia, bacteremia, surgical infections, including orthopedic surgeries, device associated and invasive infections.

MRSA is the leading cause of healthcare-associated infections in neonatal intensive care units (NICUs). MRSA colonization is the greatest risk factor leading to infection. Colonized infants also serve as a potential reservoir for the transmission of MRSA through the hands of healthcare workers thus, leading to outbreaks. Active surveillance in ICUs has demonstrated to be effective decreasing the number of outbreaks, as a way of early identification for the implementation of infection control measures. At the time of this publication, it is estimated that less than half of US hospitals conduct active MRSA NICU surveillance.

Low birth weight, prematurity, caesarean section and prolonged lengths of stay predispose infants to colonization. The exact rates of horizontal MRSA transmission vary between institutions. Studies investigating transmission mechanisms reveal conflicting results. However, NICU events leading to transmission are deemed among the most important mechanisms for neonate acquisition of MRSA. Recent reports of increasing rates of CA-MRSA in the NICU do demonstrate that introduction of MRSA into the NICU may occur via multiple routes.

## Laboratory Diagnosis

Gram-stained smears of material from lesions can provide presumptive evidence of infection. Isolation of *S. aureus* from culture is definitive. Molecular typing is a helpful tool investigating outbreaks. Refer to the Centers for Disease Control and Prevention (CDC) Guidelines on laboratory detection of MRSA for specific antimicrobial susceptibility testing recommendations, available at <http://www.cdc.gov/mrsa>.

## Treatment

Many common skin infections caused by MRSA will heal without treatment. However, some SSTIs require incision and drainage, and some may require antibiotics. Oral antibiotics that may treat MRSA include clindamycin, azithromycin, macrolides, sulfamethoxazole/trimethoprim or oral quinolones with gram positive activity, such as levofloxacin. Variable susceptibility patterns exist. Serious MRSA infections, particularly those requiring hospitalization, may require intravenous antibiotic therapy. Intravenous antibiotics that may treat MRSA include vancomycin, daptomycin (excluding pneumonia), ceftaroline and linezolid (which is also available orally but should only be used for serious infections and for a limited amount of time). For detailed recommendations on the treatment of CA-MRSA infections, refer to CDC's Strategies for

Clinical Management of MRSA in the Community available at <http://www.cdc.gov/mrsa> . Additional information also may be found in the American Academy of Pediatrics. Staphylococcal Infections, In: Pickering LK, Baker CJ, Long SS, McMillan JA, eds. Red Book: 2012 Report of the Committee on Infectious Diseases. 29<sup>th</sup> ed. Elk Grove Village, IL. 2012.

## Surveillance

### Reporting:

Individual cases of MRSA infection are not reportable in New Mexico. Report suspected clusters or outbreaks of MRSA in any setting to the Epidemiology and Response Division at 505-827-0006.

## Control Measures

### 1. Case management

#### 1.1. Isolation:

1.1.a For the general population: None recommended. All wounds should be kept covered. Frequent hand washing, and good personal hygiene should be emphasized. Personal items such as razors, towels, and clothing should not be shared.

1.1.b For primary and secondary school children: None recommended. All wounds should be kept covered. Frequent hand washing, and good personal hygiene should be emphasized. Personal items such as razors, towels, and clothing should not be shared.

1.1.c For sports team participants: All wounds should be kept covered. If a wound cannot be covered adequately, consider excluding from practice and competitions until skin lesions have healed or can be covered adequately. Frequent hand washing, and good personal hygiene should be emphasized. Personal items such as razors, bar soap, towels, clothing, and equipment should not be shared.

1.1.d For child care attendees and staff: All wounds should be kept covered. If a wound cannot be covered adequately, consider excluding until skin lesions have healed or can be covered adequately. Frequent hand washing, and good personal hygiene should be emphasized. Personal items such as razors, towels, clothing and equipment should not be shared.

1.1.e For hospitalized patients: Patients infected or colonized with MRSA should be managed with contact precautions for multidrug-resistant organisms for the duration of illness. Guidelines from CDC are available at <http://www.cdc.gov/ncidod/dhqp/>.

1.1.f For patients in non-hospital health care settings (e.g., long-term care facilities, physicians' offices, dialysis centers): Standard precautions should be used. Contact precautions may be considered in special situations, such as patients with draining wounds. Guidelines from CDC are available at [http://www.cdc.gov/ncidod/dhqp/ar\\_multidrugFAQ.html](http://www.cdc.gov/ncidod/dhqp/ar_multidrugFAQ.html).

1.1.g For persons in correctional facilities, including prisons and jails: In general, inmates with non-draining wounds or wounds with minimal drainage, contained by a simple dressing, can be housed in general population. Factors entering into decisions about where to house inmates with MRSA infections include the degree to which wound drainage can be contained, the ability or willingness of an inmate to follow infection control instructions, and available housing options. Refer to the Federal Bureau of Prisons Clinical Practice Guidelines on management of MRSA infections for detailed guidelines on appropriate control measures (<http://www.bop.gov/news/medresources.jsp>).

## 1.2. Prophylaxis:

1.2.a Decolonization: The effectiveness of decolonization therapy of any kind for preventing *S. aureus* infections has not been well-established. Recolonization is common and development of resistance to systemic and topical agents during decolonization therapy has been described.

1.2.b Decolonization can be a useful tool to halt outbreaks. Mupirocin ointment application combined with chlorhexidine gluconate (CHG) bathing are the most frequently used interventions with demonstrated effectiveness. The safety of CHG has not been established for infants. The Food and Drug Administration has warned exercising caution when using CHG cloths in premature infants and all infants under 2 months.

1.2.c Decolonization has been found to be a successful tool decreasing surgical-associated MRSA infections, particularly Orthopedic and Cardiac surgery.

## 2. Contact management

2.1. Isolation: None required.

2.2. Prophylaxis: Not applicable.

## 3. Prevention

3.1. Keep draining wounds covered with clean, dry bandages. If wounds cannot be kept covered, do not participate in activities that involve skin-to-skin contact with other persons.

3.2. Clean hands regularly with soap and water or alcohol-based hand gel (if hands are not visibly soiled). Always clean hands immediately after touching infected skin or any item that has come in contact with a draining wound.

3.3. Maintain good general hygiene with regular bathing.

3.4. Do not share personal items such as towels, clothing, and bedding, bar soap, razors, and athletic equipment.

3.5. Launder towels, clothing and bedding that have come in contact with wound drainage after each use.

3.6. Clean equipment and environmental surfaces with which multiple persons have bare skin contact with an over the counter detergent/disinfectant that specifies *Staphylococcus aureus* on the label and is suitable for the type of surface.

3.7. Appropriate cleaning and disinfection of all medical equipment and inert surfaces is required of all healthcare organizations. This include elimination of possible biofilm formation. Terminal cleaning between patient use in acute care settings and residents of long term care facilities is essential to decrease rates of transmission. Adjuvant use of ultraviolet light devices or hydrogen peroxide vaporizers may serve a complementary role to appropriate cleaning and disinfection.

3.8. Active surveillance has a role in organizations where MRSA is prevalent. This may be a very effective way to decrease transmission in neonatal and adult ICUs.

3.9. Given the increasing rates of CA-MRSA in NICUs, depending on the organization, interventions to mitigate the introduction of MRSA in NICU should be considered. These may include routine screening and potential decolonization of parents and caregivers in the pre-natal and post -natal period.

3.10. Chlorhexidine bathing may also be a useful tool in adult ICUs.

3.11. The establishment of protocols for decolonization of patients colonized with MRSA prior to Cardiac or Orthopedic surgery should be considered by centers where these services are offered.

3.12. Immunization: Not applicable.

## References

American Academy of Pediatrics. In: Kimberlin, DW, et al eds. Red Book: 2018 Report of the Committee on Infectious Diseases. 31st ed. Itasca, IL: American Academy of Pediatrics; 2018.

Centers for Disease Control and Prevention. Methicillin-resistant *Staphylococcus aureus* Infections. Available at <http://www.cdc.gov/mrsa>

Federal Bureau of Prisons. Clinical Practice Guidelines for the Management of methicillin-resistant *Staphylococcus aureus* (MRSA) infections. 2012. Available at <http://www.bop.gov/news/medresources.jsp>.

See Methicillin-resistant *S. aureus* (MRSA) Fact Sheets ([English](#)) ([Spanish](#)).