



**Louisiana Office of Public Health
Infectious Disease Epidemiology
Section**
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Summary Information on Methicillin Resistant *Staphylococcus aureus* (MRSA)

A brief history of the origins of MRSA

Staphylococcus aureus was sensitive to penicillin when it was introduced in the late 1940s but resistance developed almost immediately. *S.aureus* acquired a β lactamase capable of inactivating the β lactam ring which is at the core of the penicillin molecule. Lactamase-resistant antibiotics (methicillin, nafcillin, oxacillin) remained effective until the early 1960s when *S.aureus* acquired a new gene that modified its penicillin binding protein. These strains were named methicillin resistant *Staphylococcus aureus* or MRSA.

MRSA started in hospitals and other medical care institutions

MRSA quickly became known for its ability to cause large hospital outbreaks and become endemic. Most strains of MRSA are sporadic but a few strains have the ability to spread very rapidly throughout an institution and reach epidemic levels. MRSA became progressively more common. In 1999 the proportion of MRSA among *S.aureus* hospital acquired infections in the USA was estimated at 50%, with large local variations.

MRSA has spread in the community and now is considered to be also a community acquired organism

The actual prevalence of community acquired MRSA cannot be accurately determined BUT it is estimated that 40% of adult cases may be acquired outside the hospital (Chambers HF, Emerg Inf Dis 2001, 7:178-182). Community acquired MRSA infections are commonly reported in miscellaneous groups: patients with cystic fibrosis, day-care centers, wrestling teams, prisons.

The prevalence of CA-MRSA infection was estimated at 208/100,000 in Chicago (Hussain FM, Pediatr Inf Dis J 2000, 19:1163-1166). The prevalence seems to have increased from 10/100,000 in 1988/90 to 259/100,000 in 1993/95.

In Louisiana, it is estimated that

- 30% of the general population is carrier of Staphylococci
- 1% of the low risk population is a carrier of MRSA.
- 5-20% of high risk population is a carrier of MRSA (patients with multiple hospitalization, residents of long term facilities, chronically ill patients, inmates in detention facilities...)
- This means that out of a 4,500,000 population, 1,500,000 are carriers of *S. aureus* and 45,000 are carriers of MRSA.

Hospital acquired MRSA (HA-MRSA) shows multi-resistance to other antibiotics while community acquired MRSA (CA_MRSA) remains multi-sensitive

Resistant to:	CA-MRSA	HA-MRSA
Erythromycin	2-8 %	50-60%
Clindamycin	2-5 %	30-40 %
Tetracycline	10-20 %	70-80 %
Tmp-sxt*	2-10 %	20-40 %
Ciprofloxacin	1-5 %	27.4 %
Vancomycin	0 %	0 %

*Tmp-sxt = Trimethoprim-sulfamethoxazole

HA-MRSA strains show much more resistance to all other antibiotics

MRSA are usually NOT more virulent than other *S.aureus*.

Many strains tend to be simple colonizers; they are present on the skin or mucosa and cause no infection, no disease. Others have the same pathogenic potential than regular *S.aureus*. No differences were found in animal lethality, in production of extracellular enzymes or toxins, in intraleukocyte survival.

However CA-MRSA strains may be more virulent:

In 1999 CDC reported four cases of lethal MRSA infections among children (12months to 13 years from Minnesota and N.Dakota) who clearly had community acquired infections (hepatic abscess, brain abscess and necrotizing pneumonia). Unlike HA-MRSA strains, CA-MRSA stains produce superantigens (SEB and SEC, but not TSST-1). Superantigen production is a recently described virulence factor of both staphylococci and streptococci and is important because superantigen production by these microbes in immunologically naive persons can cause toxic shock syndrome.

Colonized individuals are the main reservoir of MRSA

People are normally colonized by *S.aureus*. Some patients are more often colonized than others: newborns, diabetics, patients with skin diseases (eczema), hemodialysis patients. A small fraction of these *S.aureus* are MRSA. The proportion of MRSA depends on the locale.

The sites of colonization are:

- **NASAL area**
- perineum, anal area
- axillary areas, finger tips
- tracheostomy sites, wounds, sputum from intubated patient

Detection of carriers (in outbreaks or endemic situations)

- Rotate unmoistened nylon swabs five times around anterior portion of nares with gentle pressure on nares
- Roll swab onto plates of selective media (Mannitol salt agar) with fixed concentration of antibiotics
- Incubate at 30-35 °C for \geq 48 hours
- MRSA carriers: 30,000 CFU per swab

MRSA main mode of transmission is by contact

Staphylococci are transmitted by direct skin-to-skin contact. The source of infection may be a person with infection or a person that is colonized. Usually the organism spreads from hands of the infected/colonized person to the skin of another person. In general, transmission of staphylococci does not occur by the airborne route or through contaminated objects (fomites). **Therefore the single best way to prevent transmission of staphylococci is routine handwashing.**

Droplet transmission occurs only in very special circumstances such as from patients with tracheostomies. MRSA is rarely transmitted by the environment, BUT in some institutionalized populations it is of major concern: burns units, hydrotherapy.

Colonization is not a sufficient reason to treat

MRSA colonization does not warrant treatment or hospital admission. The decision to treat a MRSA infection should be made based on the clinical judgment of the attending physician. Hospital, nursing home, extended-care facility admission of a colonized or infected MRSA patient is acceptable medical practice.

There are very few indications for treatment of colonized patients or carriers

Elimination of **MRSA carriage** is NOT systematically recommended for the following reasons:

- 1-Difficulty in obtaining and in confirming elimination of colonization
- 2-Promotion of resistance to other antibiotics
- 3-Complications due to side effects
- 4-Relapses are frequent and multiple treatments would be necessary
- 5-High cost of monitoring results

How to attempt eradication of carriage?

In some cases, physicians decide to treat carriers. The following regimens have been used for eradication of nasal carriage:

- Most antibiotics do not reach sufficient concentrations in nasal secretions
- Susceptibility testing necessary prior to eradication

Topical

Mupirocin 2% ointment	tid	3 days
Vancomycin 5%	tid	14-28 days
Bacitracin (with syst)	tid	5 days
Fusidic acid 4%	tid	14 days

Oral

Rifampin 600 mg	qd	5 days
Trimethoprim Sulfa 160/800 mg	bid	5 days
Minocycline 100mg	bid	14 days
Ciprofloxacin 750mg	bid	14 days

The main problems are the emergence of resistance (particularly with quinolones and rifampin) and relapse and recolonization.

What prevention measures to take when a MRSA patient is diagnosed in a hospital?

Place the patient in **contact isolation**:

- Strict handwashing; Use of antimicrobial soap for personnel and patient bathing when MRSA contact is involved
- Gloves for direct contact with infected tissues
- Aprons or gowns for patient care
- Mask if coming within six feet of patients whose sputum is positive
- Patient placement in private rooms whenever possible. No placement of MRSA patients with other high risk patient in same room
- Some hospitals do systematically screen all patients

There is **NO** need to:

- Systematically screen medical personnel
- Treat colonized patient or medical care providers

MRSA patients can be transferred or discharged

Hospitals can transfer patients with active infection to nursing homes/extended-care facilities if the clinical manifestations of infection show signs of improvement and if the nursing home / extended care facility is equipped to manage the wound and necessary antibiotic therapy. Denial of admission to a nursing home / extended care facility should be based on medical eligibility, not on culture results.

A patient colonized by MRSA while hospitalized should be discharged once that accompanying medical condition is under control.

What to do in an outbreak situation in a hospital or long term care facility?

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Carry out epidemiologic investigation

- Identify extent of patient colonization
- Identify staff colonized
- Establish links between patients /patient-staff
- Evaluate relative importance of modes of transmission
 - transient hand contamination
 - common source carriers
 - common source vehicle
- Select appropriate interventions to address epidemiologic situation
- Isolation and cohorting
- Eradication of colonization among patients and staff

Common disinfectants are effective against MRSA

MRSA sensitivity to antibacterial disinfectants is no different from that of other bacteria. Most commonly used disinfectants are effective.

What to do if one suspects a community acquired MRSA outbreak (in an institution, sports group, school, prison)?

1-Education

Education is essential and should address staphylococcal infection, access to medical care and good personal hygiene

Patients (or inmates /classmates /team members /family members) **should practice good personal hygiene**: Close contact among individuals may place them at increased risk for transmission of skin-colonizing or skin-infecting organisms.

Recommendations include:

- frequent handwashing, daily showers, easy access to sinks and plain soap (in this setting, the usefulness of antibacterial soap is unknown).
- daily showers
- avoid touching wounds or drainage of others and should have hands should be washed with soap as soon as possible after touching wounds or dressings.
- Avoid sharing clothes, towels, toiletries and any other object that may contribute to transmission
- Personnel that provide wound care should follow Standard Precautions

2-Environmental measures

The environment plays a minor role in MRSA transmission

- Enable good hygiene by providing easy access to sinks, waterless disinfectants, showers...
- Ensure frequent exchanges of laundry (linen and clothing). Staff handling dirty laundry need to be protected. There is no need to institute extra-precautions for laundry. Routine laundry procedures are sufficient.
- Ensure adequate environmental cleaning. There is no need to institute extra-precautions. Routine environmental cleaning is sufficient

3-Surveillance

- Encourage patients or inmates /classmates /team members /family members) to report skin lesions. Keep log of individual with lesions (date of onset, location within the institution /group, severity, treatment, duration and outcome)
- Skin infections that require antibiotic treatment **should be evaluated with appropriate cultures** or other diagnostic tests. Efforts to monitor the etiology of skin disease should be linked to these data to determine whether MRSA is a problem in the facility.
- Include in the log data on culture dates, results and sensitivity patterns
- Review the log and determine any transmission foci /patterns

4-Active case finding

In some circumstances, active case finding may be necessary:

- Evaluate cellmates /roommates /team members / for skin lesions on admission/at regular intervals
- Evaluate close contacts of MRSA cases

5-Appropriate diagnosis and treatment

- Provide easy access to wound care
 - Optimize wound care by ensuring the presence of adequately trained personnel
 - Ensure that incision and drainage are performed by trained staff and not by inmates /playmates /any lay member of the group
 - Dispose of bandages and other soiled materials properly
 - Optimal **treatment of MRSA disease** should be based on the infecting organism's **antimicrobial susceptibility** result and, when available, input by infectious disease experts.
- (see also MMWR October 26, 2001 / 50:42: 919-922)