

Questions About MRSA and Answers From the Experts

Laura Stokowski, RN, MS

Medscape Nurses. 2006;8(2) ©2006 Medscape

Posted 11/01/2006

The Uncertainties Surrounding Multidrug-Resistant Organisms

Over the past several months, we have received dozens of questions about multidrug-resistant organisms (MDROs). In particular, readers have asked about methicillin-resistant *Staphylococcus aureus* (MRSA) and vancomycin-resistant *Enterococcus* (VRE) through our Ask the Expert feature on *Medscape Nurses*. Clearly, nurses and other clinicians are concerned about MDROs, and are seeking answers to many practical, clinical questions ranging from the best way to identify patients with MRSA to what healthcare professionals should do if they have personally had an MRSA infection. The fact that there is no single set of guidelines that all hospitals are required to follow no doubt adds to the confusion. One hospital handles MRSA patients one way, whereas another hospital handles them a different way; both are correct -- a situation that is perplexing to many healthcare professionals.

We took your questions to the following experts: John Jernigan, MD, MS, and Rachel Gorwitz, MD, MPH, Medical Epidemiologists with the US Centers for Disease Control and Prevention (CDC); Elizabeth Bancroft, MD, SM, Medical Epidemiologist with the Los Angeles County Department of Health Services; and Shannon Oriola, RN, CIC, COHN, Chair, Association for Professionals in Infection Control and Epidemiology (APIC) Public Policy Committee.

How are MDROs -- MRSA and VRE -- defined? The term MRSA refers to those strains of *S aureus* bacteria that have acquired resistance to the antibiotics methicillin, oxacillin, nafcillin, cephalosporins, imipenem, and/or other beta-lactam antibiotics. Enterococci are gram-positive bacteria that are found normally in the gastrointestinal and female genital tracts. All enterococci have intrinsic low-level resistance to some antibiotics. In recent years, however, some strains of enterococci have acquired high-level *resistance* to multiple antibiotics, including aminoglycosides, ampicillin, and vancomycin. Infection caused by VRE is of special concern, however, because it is very difficult to treat.

What is the difference between *colonization* and *infection* with bacteria, such as MRSA and VRE? *Colonization* refers to the presence of microorganisms in or on a host with growth and multiplication, but without tissue invasion or damage. In the case of MRSA, the body site most commonly colonized is the anterior nares.^[1] Other body sites that may be colonized with MRSA include open wounds, the respiratory tract, perineum, upper extremities, umbilicus (in infants), urinary tract, and axilla. VRE colonization is generally in the stool. MRSA or VRE colonization can serve as a reservoir for the spread of these microorganisms to others, and can lead to infection in the host. Colonized patients are also known as asymptomatic carriers.

Infection is the entry and multiplication of microorganisms in the tissues of the host leading to local or systemic signs and symptoms of infection. MRSA and VRE can cause invasive and life-threatening infections, such as osteomyelitis, bacteremia, endocarditis, pneumonia, urinary tract infections, intra-abdominal or pelvic infections, vascular line sepsis, and wound and surgical infections.

What is community-acquired MRSA? How is it different from healthcare-acquired MRSA? In epidemiologic investigations, MRSA infections in persons who have not been recently (within the past year) hospitalized or had a medical procedure (such as dialysis, surgery, or catheters) are classified as community-associated MRSA (CA-MRSA) infections. The strains of MRSA that most commonly cause CA-MRSA infections are distinct from those that were already established in healthcare settings. These new strains have now also entered and are being transmitted in some healthcare facilities. However, Rachel Gorwitz, MD, MPh, Medical Epidemiologist with the CDC, emphasizes that clinical management of MRSA infections does not depend on categorization of the infection as healthcare-associated vs community-associated or on strain typing. Treatment of an infection possibly caused by MRSA should be based on the clinical syndrome, severity of the infection, and local resistance patterns. Similarly, infection control practices should be uniform for all patients colonized or infected with MRSA. Most MRSA infections in otherwise healthy individuals in the community present as skin or soft-tissue infections, such as a boils or abscesses. MRSA skin lesions are frequently confused with spider bites by both patients and healthcare providers. The lesion is red, swollen, and painful and may have pus or other drainage (Figures 1 and 2). Less commonly, CA-MRSA infections present as more serious or invasive infections, such as bloodstream infections, pneumonia, or osteomyelitis. (Readers may also wish to review these [photographs of MRSA infections](#) from the County of Los Angeles, California, Department of Health Services.)



Figure 1.

Cutaneous abscess located on the hip of a prison inmate, which had begun to spontaneously drain, releasing its purulent contents. The abscess was caused by MRSA bacteria.



Figure 2.

Cutaneous abscess on the knee, caused by MRSA.

I am confused by the need to isolate a patient who was diagnosed with MRSA in a wound years ago. The hospitals where I have worked state "once an MRSA patient, always an MRSA patient." The wound is healed and gone and there are no signs of active infection. Do we really need to isolate these patients? Individuals who become colonized with MRSA tend to remain colonized for months or even years.^[1] It is important to realize that individuals colonized with MRSA can serve as reservoirs for MRSA and transmit the bacteria to others, just as those infected with MRSA. This is why many hospitals choose to assume that patients who were formerly colonized with MRSA are likely to still be colonized with MRSA. Their medical records are flagged so that contact precautions can immediately be resumed if these patients return to the hospital. Another option would be to obtain nasal cultures or series of cultures to determine whether former MRSA patients are indeed still colonized.

Our hospital policy is to isolate every patient who is admitted to our hospital unit. Everyone is treated as if they are colonized with MRSA until proven otherwise. Once we obtain a negative culture (usually within 24 hours), we take them out of isolation. Please comment on this policy. Screening all or a high-risk subset of patients for MRSA upon admission to the facility or nursing unit is known as "active surveillance." It is a strategy used to control the transmission of pathogens, such as MRSA, that is widely practiced in northern Europe and Canada and is becoming more common in hospitals throughout the United States. Active surveillance cultures are recommended by the Society for Healthcare Epidemiology of America (SHEA).^[2] In a study recently conducted at Brigham and Women's Hospital in Boston, Massachusetts, routine MRSA admission cultures and contact isolation precautions resulted in a 67% hospital-wide reduction in MRSA bacteremia.^[3]

The aim of active surveillance cultures is to identify every patient who is colonized with MRSA and to use contact precautions to prevent the spread of MRSA to other patients or to healthcare workers. In some hospitals, high-risk patients are assumed to be carriers of MRSA, and contact precautions are used until a negative culture is obtained.

MRSA and VRE infections increase the duration of hospitalizations, increase mortality, and increase costs.^[2] The use of active surveillance cultures and contact isolation is one of several important strategies available for preventing the transmission of MRSA. Active surveillance of all admissions, as described above, can be streamlined further with the use of rapid diagnostic technology, such as polymerase chain reaction, which can provide a result in 2 hours once the specimen is set up to be processed in the laboratory.

What is the correct protocol for taking patients off of MRSA precautions? If a formerly MRSA-positive patient becomes negative after 3 consecutive negative cultures, do you still consider this patient to be an MRSA carrier, or do you consider him/her to be free of MRSA and take him/her out of contact precautions? There is no single, correct protocol for taking patients off of contact precautions. If patients have been colonized in the recent past, healthcare facilities should make an attempt to prove that they are no longer colonized before taking them out of isolation. There are no data in regard to how many cultures should be taken for this purpose. or for

the interval between cultures. At this time, healthcare facilities should establish their own protocols detailing both the number of cultures required and the length of time between cultures, but according to some experts, it seems reasonable to discontinue contact precautions when 3 or more surveillance cultures are repeatedly negative over the course of a week.

How should patients with MRSA be handled in the emergency department? Should they be isolated? Is isolation with a curtain sufficient? Can these patients use a shared bathroom?

MRSA is being seen with increasing frequency in emergency departments (EDs). It is the most common identifiable cause of purulent skin and soft-tissue infections among patients presenting to EDs.^[4] Contact precautions for MRSA patients were designed for private room settings, a luxury that is not always available in the ED. When it isn't possible to place the patient in a separate room, the principles of contact precautions can still be applied in areas that are separated only by curtains. *Remember that the primary route of transmission of MRSA from patient to patient is via the transiently contaminated hands of healthcare workers.* Although it may not be an option in most EDs to provide a separate bathroom for MRSA patients, it makes the most sense in this environment to focus on the things that you *can* do to prevent transmission of MRSA, such as hand hygiene, wearing gloves and gowns for contact, and proper disinfection of the area after the patient is discharged. Patients should also be educated about how to prevent further transmission of the infection, eg, keeping wounds or lesions covered with clean, dry bandages; practicing good hand hygiene; and avoiding the sharing of contaminated items.^[4]

To transport an MRSA patient, we have been told to place a clean gown over the patient and place a mask on the patient. Is this the best approach? Shannon Oriola, RN, CIC, COHN, recommends that, when transporting an MRSA patient, a chief concern is avoiding actions that require the nurse or other attendant to touch the patient and then possibly contaminate environmental surfaces (door handles, elevator buttons, etc). If a single caregiver is transporting the patient, gown and gloves are worn until the patient is on the stretcher or wheelchair, and then gloves are removed and hands are washed. This caregiver then transports the patient without having any direct patient contact. If it is anticipated that the patient might require some hands-on intervention during the transport; the safest approach is to have 2 individuals transport the patient. One wears gown and gloves and is responsible for touching the patient, if needed, during the transport. The other individual, without gloves, handles the doors and elevator buttons. A mask is required only if the patient is on droplet precautions as recommended by the CDC.

I work in the operating room as a nurse anesthetist. Is it necessary to change the soda lime after every MRSA/VRE or HIV patient? We currently do change it, but is it really necessary?

Soda lime is used in breathing systems to absorb exhaled CO₂ during anesthesia. A mixture of calcium oxide and sodium or potassium hydroxide, soda lime, was once thought to be bactericidal. It is now known that soda lime is toxic to some microorganisms,^[5] but only if combined with CO₂ to form a saturated solution with a pH > 12.^[6] Even then, some organisms can survive for extended periods of time within the canister because they are deposited on desiccated surfaces, which are nontoxic.^[6]

Even if viable bacteria, such as *S aureus*, do pass unimpeded through the anesthetic circuit, the potential for transmission to other patients depends on many other factors,^[6] including the number of pathogens, their virulence, and their distribution; how frequently the anesthesia circuit is used and the time between cases; and the immune competence of patients. These variables all contribute to the overall risk of acquiring a respiratory cross-infection following anesthesia.^[6]

In their 2003 report, *Guidelines for the Prevention of Healthcare-Associated Pneumonia*, the CDC considered this issue but was unable to make a recommendation. Here is the wording from the report: "No recommendation can be made about the frequency of routinely cleaning and disinfecting unidirectional valves and carbon dioxide absorber chambers (Unresolved issue).^[7]"

What is the best way to manage a patient with MRSA on a behavioral health unit?

Most behavioral health units are low-risk settings for the transmission of MRSA and for infection with MRSA. Patients usually take part in group and activity therapies that make isolation impractical. For this reason, most behavioral health units are treated like community settings, and are considered exempt from hospital isolation guidelines. The exception would be if a patient has an actively draining wound infected or colonized with MRSA. Wounds, if present, should be covered with clean, dry dressings. Gloves and gowns are worn by caregivers if wound contact is necessary.

The best way to prevent the transmission of MRSA on the behavioral health unit is to educate patients and staff members to practice good hand hygiene. Patients should not share potentially contaminated personal items, such as towels, soap, or razors.

If a patient is treated for MRSA or VRE with intravenous antibiotics, is he/she no longer colonized? Treating for MRSA or VRE infection with intravenous antibiotics, even with successful resolution of the infection, does not always mean that colonization is eradicated, emphasized John Jernigan, MD, MS, of the CDC. Signs and symptoms of clinical infection may be gone (fever, swelling, erythema, and purulent drainage) and the white blood cell count may return to normal following antibiotic treatment. However, colonization with MRSA or VRE can persist, and the patient can continue to be a carrier.

Please help our staff determine the correct way to clean in a room after a patient with MDRO has occupied it. We are not sure about how to clean the drapes, walls, and surfaces. Careful cleaning of patient rooms and medical equipment is important to overall control of transmission of MDRO and other pathogens in healthcare facilities. Follow routine cleaning procedures for floors and walls. Surfaces that are visibly soiled should be washed first before disinfecting. Frequently touched surfaces (eg, bed rails, overbed tables, doorknobs, equipment in the immediate vicinity of the patient, bathroom fixtures in the patient's room, etc) deserve special focus and should be cleaned on a more frequent schedule compared with that for minimal touch surfaces (eg, floors). Most US Environmental Protection Agency (EPA)-registered hospital disinfectants should adequately inactivate pathogens, such as MRSA and VRE. Cleaning of curtains is recommended when they are visibly soiled.

At our hospital, MRSA patients are in private rooms but they may also leave their rooms. They have access to the hallway vending machines, cafeteria, etc. Doesn't this contaminate the environment, especially if patients don't comply with precautions? The HICPAC 2006 guideline, *Management of Multidrug Resistant Organisms in Healthcare Settings*, recommends that, if MRSA colonized or infected patients do not have draining wounds, diarrhea, or uncontrolled secretions, healthcare organizations should establish ranges of permitted ambulation, socialization, and use of common areas on the basis of their risk to other patients and on the ability of the colonized or infected patients to observe proper hand hygiene and other recommended precautions to contain secretions and excretions.^[8] Noncompliant patients should be confined to their rooms.

We are seeing more patients in the home health setting with a history of MRSA. Clinicians are asking about self-protection and would like guidance about the level of precautions that they should take. There are 2 issues in the home health setting, just as there are in the hospital. How do caregivers protect themselves, and how do they prevent transmitting the bacteria to other patients in their care? Many home healthcare patients are at increased risk for infection because of the presence of wounds, invasive tubes and catheters, or conditions that result in a compromised immune system. The primary means to prevent transmission from a colonized or infected patient is through diligent hand hygiene. Hands should be cleaned before entering the home, after removing gloves, and before leaving the home. The home healthcare professional should carry both antiseptic soap for washing hands under running water and alcohol-based hand gel. Home health nurses should follow standard precautions when caring for patients colonized or infected with pathogens, such as MRSA, which means wearing gloves for contact with blood or body fluids, secretions, excretions, mucous membranes, and nonintact skin. Gloves should be worn when changing dressings, and a gown if there is a risk for clothing coming into contact with wounds or other sources of contamination. In addition, protective eyewear is appropriate for procedures likely to generate splashes or sprays of body fluids. Soiled dressings should be disposed of carefully to prevent contamination. This can be accomplished by first placing the soiled dressing in a plastic zipper-type bag, and then putting it into the trash.

Common sense dictates that even though the setting is different, the principles used to prevent transmission remain the same. A nurse would not sit on the bed of a patient on contact precautions with an MRSA-colonized wound in the hospital and should not do so in the home.^[8] Other efforts should be focused on preventing cross-transmission of a MDRO via the nurse's clinical bag, clothing, or equipment that are carried from home to home. Supplies and equipment should be dedicated for the patient, when possible. When not possible, reusable equipment must be cleaned with a hospital-grade disinfectant. Supplies and equipment should be removed from the bag before gloving so that there is no need to reach into the equipment bag with a contaminated hand.^[9] Alternatively, the bag can be left in the car and the necessary supplies taken into the home. Reusable equipment that must be cleaned outside of the home should be placed in a plastic bag for transport out of the home for subsequent cleaning and disinfection.^[8]

What about clients with VRE or MRSA who are cared for at home under hospice care? Nurses and caregivers may not be aware of the patient's MRSA- or VRE-positive status and only general precautions are used. There is no special cleaning in the home or careful handwashing by family, and no surface cleaning of bathrooms or light switches, etc. The patient is also in contact with family, children, and infants at home. In a patient's own home, the most important infection control measure is good handwashing by all household members. Healthy family members may have patient contact as long as hand hygiene is practiced.

Healthcare professionals should always be told whether a patient is colonized or infected with a MDRO, such as MRSA or VRE. The precautions that should be taken by healthcare professionals are the same as those for home healthcare.

The CDC recommends the following precautions for family caregivers of infected persons in their homes^[10]:

- Caregivers should wash their hands with soap and water after physical contact with the infected or colonized person and before leaving the home;
- Towels used for drying hands after contact should be used only once;
- Disposable gloves should be worn if contact with body fluids is expected, and hands should be washed after removing the gloves;
- Linens should be changed and washed if they are soiled as well as on a routine basis;
- The patient's environment should be cleaned routinely and when soiled with body fluids; and
- Notify physicians and other healthcare personnel who provide care for the patient that the patient is colonized with an MDRO.

What is the best way to attempt to eliminate colonization in a patient? In a prison setting, is it necessary to place the patient in a strict lockdown with no contact with others, or can they be in the general population as long as a wound is covered? There is debate about the best way to decolonize a patient, or indeed whether it is even a good idea to attempt to do so. Most existing protocols for decolonization suggest 5 days of mupirocin ointment to the nares along with 5 days of chlorhexidine showers. However, *Staphylococcus* can quite easily develop resistance to mupirocin, so the overuse of decolonization could lead to increased resistance of MRSA to mupirocin. Elizabeth Bancroft, MD, SM, Medical Epidemiologist with the Los Angeles County Department of Health, discourages practitioners from attempting decolonization in patients except in the situation of recurrent infections without an ongoing source of MRSA. Her rationale is that there is no point in trying to decolonize someone who is constantly coming into contact with MRSA because of their environment or because of risky behaviors. Decolonization is sometimes attempted in a group of people but only when there is a closed cohort. such as a day care. household. or athletic team. with ongoing continued

transmission of MRSA. When group decolonization is being considered, surveillance cultures prior to decolonization from all group members are probably unnecessary because nasal swabs are not 100% sensitive. All group members should undergo the decolonization regimen simultaneously.^[11]

Prison inmates with MRSA do not need to be isolated as long as the wound or source of infection can be contained. With wounds, this means that the inmate is able to keep a clean, dry bandage over the wound and is taught proper hygienic disposal of bandages. The soiled bandage should be placed in a plastic zipper-type bag before being placed in the regular trash. If the inmate has MRSA in the urine and is incontinent, isolation is necessary, but if they are continent, then interaction with the general population is permitted. These recommendations are based on practicality (isolation beds are very limited in a correctional facility), needs of the inmates for socialization, needs of the correctional facility to free up resources and staff, and lack of evidence that strict isolation is required in correctional facilities to control the transmission of MRSA. The biggest challenge now to correctional facilities, according to Dr. Bancroft, is the continued importation of MRSA from the outside.

School nurses are beginning to see CA-MRSA in the school system. Physicians are sometimes remiss in having the families notify the schools, and we generally find out about the diagnosis from neighbors and other parents! What policies should the school put into effect to protect other students, especially those who are immunocompromised? Recommendations include contacting your state department of health to see whether they already have guidelines or policies in place for handling MRSA and VRE in your state's schools. (See [State Health Agencies](#) for links to all state health departments.) Many states already have such guidelines. Although not identical, the guidelines are very similar in many respects. Children who are colonized with MRSA should not be excluded from the classroom. Open, draining wounds should be covered with clean, dry bandages. If bandages are changed at school, they must be disposed of in a manner that does not expose others to contamination. Persons who provide wound care should wear gloves and practice diligent handwashing.

Some state health departments also have policies in regard to the placement of students with MRSA colonization or infections in classrooms with students who have medical conditions resulting in immune system suppression. There may also be specific guidelines in regard to the exclusion from the classroom of students with MRSA or VRE who also have possible symptoms of infection, such as fever, cough, rash, or diarrhea. Transmission of MRSA among sports participants is another concern. Close physical contact, a break in the skin, and sharing of equipment and clothing place young athletes at increased risk for MRSA acquisition. CDC measures for preventing MRSA transmission among sports participants include^[12]:

- Cover all wounds. If a wound cannot be covered adequately, consider excluding players with potentially infectious skin lesions from practice or competitions until the lesions are healed or can be covered adequately.
- Encourage good hygiene, including showering and washing with soap after all

practices and competitions.

- Ensure availability of adequate soap and hot water.
- Discourage sharing of towels and personal items (eg, clothing or equipment).
- Establish routine cleaning schedules for shared equipment.
- Train athletes and coaches in first aid for wound and recognition of wounds that are potentially infected.
- Encourage athletes to report skin lesions to coaches and encourage coaches to assess athletes regularly for skin lesions.

When MRSA infection is suspected, students should be referred to their primary care provider for evaluation and treatment.

What guidelines are there to prevent the spread of MRSA in long-term care facilities? Can long-term care facilities refuse to accept patients with MRSA? In long-term care facilities, colonized and infected residents serve as the primary reservoirs of MRSA. Asymptomatic colonization of residents' nares is common and difficult to eradicate, even with treatment. Long-term care facilities can safely care for and manage MRSA patients by following appropriate infection control practices. In addition, long-term care facilities should be aware that persons with MRSA, VRE, and other infections may be protected by the Americans with Disabilities Act or other applicable state or local laws or regulations.

The most important component of an infection control program for a long-term care facility is education of staff members with regard to hand hygiene. In making decisions on whether to use contact precautions, one reasonable strategy is to consider the individual patient's clinical situation. For independent residents, one approach is to follow standard precautions, making sure that gloves and gowns are used for contact with uncontrolled secretions, pressure ulcers, draining wounds, stool incontinence, and ostomy tubes/bags. For patients who are totally dependent on healthcare personnel for care and activities of daily living, and for those whose infected secretions or drainage cannot be contained, contact precautions in addition to standard precautions may be more appropriate.

As a rule, long-term care residents who are colonized with MRSA and who do not have draining wounds, diarrhea, or uncontrolled secretions should not be placed in strict isolation or restricted from dining rooms or group activities in an attempt to control transmission of MRSA. Such patients should be permitted to participate in group meals and activities if wounds are covered, bodily fluids are contained, and the patients observe good hygienic practices.

Can a pregnant woman who has frequent bouts with MRSA pass the infection on to her fetus? Approximately 5% to 15% of women of childbearing age carry *S aureus* in

their vagina.^[13] Some recent studies have identified a low prevalence of MRSA in vaginal-rectal cultures obtained to screen for group B streptococcal colonization during late pregnancy.^[14] *S aureus* can be transmitted from the maternal genital tract to the fetus or newborn during pregnancy, labor, or delivery, but this type of transmission leading to serious infection or other adverse outcomes appears to be rare.^[15] There are no recommendations to routinely screen pregnant women for *S aureus* or MRSA colonization or to attempt decolonization in pregnant women with a history of MRSA infection.

Decolonization is sometimes considered in a patient (pregnant or otherwise) with a history of recurrent MRSA infections that are unresponsive to other measures. Vaginal delivery and breastfeeding are not contraindicated in a woman with MRSA colonization or infection. Active lesions should be kept covered with clean, dry bandages, and women should wash their hands well, particularly after changing wound dressings and before touching their newborn. Obstetrics departments should follow their hospital policy in regard to infection control practices for patients who are known or suspected to be infected or colonized with MRSA.

What precautions should healthcare workers, such as nurses, take if they have been treated for an MRSA infection? Is it safe for them to continue taking care of patients? Nurses and other healthcare workers who do not have active infections or who have wounds that can be covered and controlled with dressings are permitted to work. Colonization alone does not prevent healthcare workers from working unless they are epidemiologically linked to transmission of an infection. The new HICPAC guideline recommends obtaining cultures of healthcare personnel for target MDROs only when there is epidemiologic evidence linking the healthcare staff member to ongoing transmission.^[8]

References

1. Boyce JM. Diagnosis and treatment of serious antimicrobial resistant Staphylococcus aureus infection. Clin Updates Infect Dis. 1998;4.
2. Muto CA, Jernigan JA, Ostrowsky BE, et al. SHEA guideline for preventing nosocomial transmission of multidrug-resistant strains of Staphylococcus aureus and Enterococcus. Infect Control Hosp Epidemiol. 2003;24:362-386. Available at: http://www.shea-online.org/Assets/files/position_papers/SHEA_MRSA_VRE.pdf Accessed October 13, 2006.
3. Huang SS, Yokoe DS, Hinrichsen VL, et al. Impact of routine intensive care unit surveillance cultures and resultant barrier precautions on hospital-wide methicillin-resistant Staphylococcus aureus bacteremia. Clin Infect Dis. 2006;43:971-978. [Abstract](#)
4. Moran GJ, Krishnadasan A, Gorwitz RJ, et al. Methicillin-resistant *S. aureus* infections among patients in the emergency department. N Engl J Med. 2006;355:666-674. [Abstract](#)
5. Leijten DT, Rejger VS, Mouton RP. Bacterial contamination and the effect of filters in anaesthetic circuits in a simulated patient model. 1992;21:51-60.

6. Langevin PB, Rand KH, Layon AJ. The potential for dissemination of *Mycobacterium tuberculosis* through the anesthesia breathing circuit. *Chest*. 1999;115:1107-1114. [Abstract](#)
7. Tablan OC, Anderson LJ, Besser R, Bridges C, Hajjeh R. Guidelines for preventing health-care associated pneumonia, 2003. *MMWR Recomm Rep*. 2004;53:1-36.
8. Siegel JD, Rhinehart E, Jackson M, Chiarello L; Healthcare Infection Control Practices Advisory Committee. Management of multi-drug resistant organisms in healthcare settings, 2006. US Centers for Disease Control and Prevention. Available at: <http://www.cdc.gov/ncidod/dhqp/pdf/ar/mdroGuideline2006.pdf> Accessed October 19, 2006.
9. Boling PA. The health care worker, resistant bacteria (MRSA) and preventing contagion. *Clin Geriatr*. 2004;12:17-20.
10. US Centers for Disease Control and Prevention. Multidrug-resistant organisms in non-hospital healthcare settings. December 2000. Available at: http://www.cdc.gov/ncidod/dhqp/ar_multidrugFAQ.html Accessed October 23, 2006.
11. Gorwitz RJ, Jernigan DB, Powers JH, Jernigan JA. Strategies for clinical management of MRSA in the community: summary of an experts' meeting convened by the Centers for Disease Control and Prevention. 2006. Available at: http://www.cdc.gov/ncidod/dhqp/ar_mrsa_ca_04meeting.html Accessed October 6, 2006.
12. Gantz N, Harmon H, Handy J, et al. Methicillin-resistant *Staphylococcus aureus* infections among competitive sports participants -- Colorado, Indiana, Pennsylvania, and Los Angeles County, 2000-2003. *MMWR*. 2003;52;793-795.
13. Guinan ME, Dan BB, Guidotti RJ, et al. Vaginal colonization with *Staphylococcus aureus* in healthy women. *Ann Intern Med*. 1982;96:944-947. [Abstract](#)
14. Andre P, Thebaud B, Guibert M, et al. Maternal-fetal *Staphylococcal* infections: a series report. *Am J Perinatol*. 2000;17:4237.
15. Chen KT, Huard RC, Della-Latta P, Saiman L. Prevalence of methicillin-sensitive and methicillin-resistant *Staphylococcus aureus* in pregnant women. *Obstetr Gynecol*. 2006;108:482-487.

Suggested Readings

- Harbarth S, Masuet-Aumatell C, Schrenzel J, et. al. Evaluation of rapid screening and pre-emptive contact isolation for detecting and controlling methicillin resistant *Staphylococcus aureus* in critical care. *Crit Care*. 2006;10:R25. Available at: <http://www.medscape.com/viewarticle/523530> Accessed October 6, 2006.
- Turabelidze G, Lin M, Wolkoff B, Dodson D, Gladbach S, Bao-Ping Z. Personal hygiene and methicillin-resistant *Staphylococcus aureus* infection. *Emerg Infect Dis*. 2006;12:422-427. Available at: <http://www.medscape.com/viewarticle/525120> Accessed October 23, 2006.

Related Resources

- Association for Professionals in Infection Control and Epidemiology. Available at: <http://www.apic.org/> Accessed October 23, 2006.
- The Society for Healthcare Epidemiology of America. Drug resistant organisms. Available at: <http://www.shea-online.org/news/mdros.cfm> Accessed October 23, 2006.
- US Centers for Disease Control and Prevention. MRSA in healthcare settings. Available at: http://www.cdc.gov/ncidod/dhqp/ar_mrsa_spotlight_2006.html Accessed October 23, 2006.

Laura Stokowski, RN, MS, Staff Nurse, Inova Fairfax Hospital for Children, Falls Church, Virginia; Editor, Medscape Ask the Experts Advanced Practice Nurses

Disclosure: Laura A. Stokowski, RN, MS, has disclosed no relevant financial relationships.
