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MRSA Guidelines

1. Introduction & Basic Facts About MRSA

The purpose of these guidelines is to provide information to persons managing MRSA patients or MRSA outbreaks in institutions and the community in Louisiana and to establish uniformity of procedures for prevention, surveillance, diagnosis, patient transfer, infection control and outbreak management.

Soon after introduction of penicillin to treat *Staphylococcus aureus* infections, resistance to penicillin started developing. In the 1950s, the threat of penicillin-resistant *S. aureus* was contained by the introduction of methicillin, an antibiotic effective against penicillin-resistant *S. aureus*. Although starting in the 1960s, methicillin-resistant *S. aureus* (MRSA) did not become very prevalent until the 1980s.

1.1. *Staphylococcus aureus* (*S. aureus*)

Staphylococcus aureus is a gram-positive coccus that thrives on human skin and mucous membranes, grows rapidly under either aerobic or anaerobic conditions and can be carried by its host for long periods of time without causing clinical consequences. However, if given the opportunity, *S. aureus* can be responsible for a variety of serious diseases, most notably suppurative skin infections, cellulitis, wound infections, abscesses, pneumonia and sepsis. The organism elaborates toxins, which cause such diverse manifestations as gastroenteritis and toxic shock syndrome. It is important to note the distinction between *S. aureus*, which is coagulase positive and the coagulase negative *Staphylococcus*, which includes *Staphylococcus epidermidis*, the most common organism found on the skin.

1.2. Penicillin and Methicillin

Originally all *S. aureus* were sensitive to penicillin but soon after penicillin was put in clinical use, penicillin resistance developed. *S. aureus* had acquired the ability to inactivate the β -lactam ring of penicillin. Currently more than 95% of *S. aureus* are resistant to penicillin. Methicillin is a synthetic antibiotic related to penicillin with modified radicals designed to protect the penicillin ring against penicillinase. In the 1960's, *S. aureus* acquired methicillin resistance by changing the configuration of the penicillin binding protein. *S. aureus* resistant to oxacillin, methicillin and a few other related antibiotics, are all known under the generic term methicillin resistant *S. aureus* or MRSA

1.3. MRSA Started in Hospitals and Other Medical Care Institutions: Hospital Associated MRSA or HA-MRSA

MRSA was initially reported in the 1960's and it quickly became known for its ability to cause large hospital outbreaks and become endemic. Since then, MRSA has become progressively more common. As a result, MRSA infections are often the source of a great deal of concern in institutions. Most strains of MRSA are sporadic but a few strains have the ability to spread very rapidly throughout an institution and reach epidemic levels. In 1999, the proportion of MRSA among *S. aureus* hospital associated infections in the USA was estimated at 50% with large local variations.

Because these organisms are resistant to many antibiotics, the infections are particularly difficult to treat. At the same time,

employees and patients of institutions may become colonized with MRSA and may serve as a source for infection for others. Outbreaks of MRSA infections in institutions are rare.

Institutions are taking measures to limit the introduction or spread of MRSA among their patients and staff. These measures have met with limited success. Some have led to problems in other institutions. There have been problems regarding transfer of MRSA-infected or -colonized patients between institutions. In addition, there is wide variation among institutions and medical providers in methods of treatment, infection-control policies, handling of colonized patient and staff, outbreak control and prevention. In some instances, MRSA is not viewed seriously enough and outbreaks occur without appropriate response. In other situations, MRSA is viewed with such fear that costly and unnecessary precautions are undertaken.

Many HA-MRSA strains tend to be colonizers, which are present on the skin or mucosa and cause no infection, no disease. Others have the same pathogenic potential as regular *S. aureus*. No difference is found in animal lethality, in production of extracellular enzymes or toxins, or in intraleukocyte survival.

1.4. MRSA as a Community Associated Organism (CA-MRSA)

MRSA has spread in the community and now is also be a community-associated organism. These community-associated strains have been isolated from people without risk factors (Redbook 2003). Community associated MRSA infections are commonly reported in miscellaneous groups: patients with cystic fibrosis, day-care centers, wrestling teams and prisons (Estrada, 2001).

To date, most MRSA strains isolated from patients with CA-MRSA infections have been microbiologically distinct from those endemic in healthcare settings, suggesting that some of these strains may have arisen de novo in the community via acquisition of methicillin resistance genes by established methicillin-susceptible *S. aureus* (MSSA) strains. Two pulsed-field types, termed USA300 and USA400 according to a typing scheme established at the Centers for Disease Control and Prevention (CDC), have accounted for the majority of CA-MRSA infections characterized in the United States, whereas pulsed-field types USA100 and USA200 are the predominant genotypes endemic in healthcare settings. USA300 and USA400 genotypes almost always carry type IV of the staphylococcal chromosomal cassette (SCC) *mec*, the mobile genetic element that carries the *mecA* methicillin-resistance gene. This genetic cassette is smaller than types I through III, the types typically found in healthcare associated MRSA strains and is hypothesized to be more easily transferable between *S. aureus* strains.

CA-MRSA infections appear to be an emerging phenomenon worldwide. The genetic background of CA-MRSA organisms was different in three continents. The suggestion is that dissemination of a single CA-MRSA clone did not occur around the world but rather suggests the possibility of simultaneous co-evolution of CA-MRSA organisms in different locations (Vandenesch 2003).

Unique clones of MRSA are increasingly responsible for community-acquired infections.

The antimicrobial patterns of these strains are unique and differ from HA-MRSA, because they are resistant to methicillin but are not multi-drug resistance. Many are sensitive to trimethoprim-sulfamethoxazole, clindamycin, aminoglycosides and quinolones). European isolates appeared more resistant (i.e., to kanamycin, tetracycline and fusidic acid) than U.S. and Oceanian isolates (Vandenesch, 2003).

The actual incidence of CA-MRSA cannot be accurately determined, but it is estimated that 40% of adult cases may be associated with acquisition outside the hospital (Chambers, 2001). The prevalence of CA-MRSA infection was estimated at 208 per 100,000 in Chicago (Hussain, 2000). The prevalence seems to have increased from 10 per 100,000 in the years 1988-1990 to 259 per 100,000 in 1993-1995. Overall incidence of invasive MRSA in the general population has recently been estimated to range from 20 to 40 infections per 100,000 population (Fridkin, 2005).

1.5. Colonization

Colonization is the presence, growth and multiplication of the organism in one or more body sites without observable clinical symptoms or immune reaction. A 'carrier' refers to an individual who is colonized with MRSA. MRSA colonization can occur on the skin surface, wound or pressure ulcer surface, in the sputum, or in the urine. One of the most common sites of colonization in both Health Care Workers (HCWs) and residents is the anterior nares. While personnel may become colonized with MRSA, they rarely develop infections with the organism.

MRSA infection is a condition whereby the bacteria has invaded a body site, is multiplying in tissue and is causing clinical

manifestations of disease, such as fever, suppurative wound, pneumonia or other respiratory illness or symptoms, or other signs of inflammation (warmth, redness, swelling). Infection is confirmed by positive cultures from sites such as blood, urine, sputum, or wound.

S. aureus is a common colonizer of skin and mucous membranes. Colonization may be transient (few weeks) or last for long periods of time (months). Some patients are more often colonized than others: newborns, diabetics, patients with skin diseases (eczema), hemodialysis patients.

The **sites of colonization** are:

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

Staphylococci are transmitted by direct skin-to-skin contact. The source of infection may be an infected or a colonized individual. Usually the organism spreads from hands of the infected/colonized individual to the skin of another individual. In general, transmission of staphylococci does not occur by droplet, airborne or indirect contact with contaminated objects (fomites).

Colonized and infected residents serve as the major reservoir of MRSA in long term care facilities. Contaminated environmental surfaces have not been shown to play a significant role during outbreaks in long term care facilities. Asymptomatic colonization of residents' noses with MRSA is common in long term care facilities. In the few prevalence surveys performed in freestanding long term care facilities located in areas where MRSA is common, about 10% of residents were colonized.

MRSA colonization may disappear with treatment and reappear weeks or months later. Several studies have shown that in a one year follow up, about 50% of colonized individuals do clear colonization; the median time to clearance was 6 months and 25% had negative intermittent test results.

1.6 Risk factors for colonization

The following factors have been identified as increasing the risk that a patient will have a HA-MRSA infection:

- Prior prolonged hospitalization
- Preceding antimicrobial therapy
- Close proximity to a resident colonized or infected with MRSA
- Presence of open wounds and/or pressure ulcers
- Presence of invasive devices, such as gastrostomy tubes, tracheostomy tubes, intravascular lines, indwelling urinary catheters, etc.

1.7 Prevalence

In Louisiana, it is estimated that:

- 30% of the general population are carriers of Staphylococci
- 1% of the low risk population are carriers of MRSA.
- 5% to 20% of high risk population are carriers 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.

1.8 Transmission

The main mode of transmission of MRSA is person to person via hands, usually of HCWs or residents. Colonization of hands of personnel may be either transient, such as a single day, or of longer duration, such as several weeks. Colonization of the HCW may occur if proper handwashing and barriers (such as gowns and gloves) are not used appropriately.

MRSA may be aerosolized in the droplets from a coughing or sneezing resident or from a ventilator exhaust port of an intubated resident who has MRSA in his or her sputum. The organism may also be aerosolized during the irrigation of a wound containing MRSA. However, the role of aerosolization in the transmission of MRSA is not known.

Although MRSA has been isolated from environmental surfaces, transmission to residents is thought to be minimal, except

in burn units.

1.9 Virulence

When patients with MRSA have been compared to patients with methicillin-susceptible *S. aureus* (MSSA), MRSA colonized patients more frequently develop symptomatic infections (Davis KA 2004; Muder, 1991). Furthermore, higher case fatality rates have been observed for certain MRSA infections, including bacteremia (Cosgrove, 2003; Melzer, 2003; Selvey, 2000; Romero-Vivas 1995; Blot, 2002; Reed, 2005), poststernotomy mediastinitis (Mekoutso, 2001) and surgical site infections (Engemann 2003).

Multi Locus Sequence Typing (MLST) and PFGE (Pulse Field Gel Electrophoresis) analysis showed that within a continent, the genetic background of CA-MRSA strains did not correspond to that of HA-MRSA in the same continent, suggesting that CA-MRSA did not emerge from local HA-MRSA.

1.10 Clinical

The signs and symptoms of a MRSA infection are similar to the symptoms of an infection due to other staphylococci. “Pimples”, rashes, pus-filled boils, especially when warm, painful, red or swollen, can indicate a staphylococcal skin infection. Impetigo is one example of a skin infection that can be caused by staphylococci, including MRSA.

These skin infections commonly occur at sites of visible skin trauma, such as cuts and abrasions and areas of the body covered by hair (e.g., back of neck, groin, buttock, armpit, beard area of men).

Staphylococci, including MRSA, can also cause more serious infections such as severe skin infection, deep abscesses, surgical wound infections, bloodstream infections and pneumonia. The symptoms could include high fever, swelling, heat and pain around a wound, headache, fatigue and other symptoms.

2. Management of MRSA in Institutions

Institutions are at particular risk of having populations with high antimicrobial resistance. The factors that may increase antimicrobial resistance in hospitals are (McGowan, 1994):

- Greater severity of illness in hospitalized patients
- More severely immunocompromised patients
- Newer devices and procedures in use
- Increased introduction of resistant organisms from the community
- Ineffective infection control and isolation practices and compliance
- Increased use of antimicrobial prophylaxis
- Increased empiric polymicrobial antimicrobial therapy
- High antimicrobial usage per geographic area per unit time

2.1. Hospital Admission

MRSA infection does not warrant hospital admission. Treatment of a MRSA infection may be accomplished as an outpatient, in a home/extended care facility or in an acute care setting. This decision should be made based on the clinical judgment of the attending physician, possibly with the input of an infectious disease consultant.

2.2. Nursing Home/Extended Care Facility

A patient with clinical MRSA infection **can be admitted or treated in a nursing home/extended care facility**. 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 patient 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 infected or colonized by MRSA while hospitalized, should be discharged once the accompanying medical condition is under control. Thus, a patient colonized with MRSA may be discharged from an acute-care setting to a nursing home/extended-care facility or to home with a positive MRSA culture. **Facilities may not refuse admission to such patients.**

If a patient is known to be colonized or infected by MRSA and is transferred to another health care facility, the receiving facility must be notified that the patient is colonized or infected with MRSA. **Written** communication (e.g., on the patient transfer form) that the patient is colonized or infected with MRSA **must** accompany the transferring paperwork to the receiving institution.

2.3. Discharge to Private Home

Patients colonized and/or infected with MRSA may be transferred home if families and/or home health care services are equipped to manage the patient and antibiotic therapy. If the patient is to be discharged from an acute-care or nursing home/extended-care facility to a private home, there will be a need to educate the family that there is a difference in risk between MRSA infection in the setting of a health care facility versus the home setting. The patient's family will invariably have noted the attention to infection control practices while their relative was hospitalized or in the nursing home/extended-care facility and will be concerned.

Reassure the family that MRSA colonization is common in healthy people.

2.4. Infection Control in Institutions

Isolation and precautions taken in institutions are aimed at preventing the transmission of MRSA from one patient to another, from a patient to a health care worker and from a health care worker to a patient. Given the prevalence of MRSA in both the populations in health care facilities and in the community and the impracticality of screening everyone for MRSA, prevention of transmission has to rely on the principle of universal precautions. Everyone should be handled as if they could be infected or colonized with MRSA.

The measures to prevent transmission of MRSA are

- 1-**Standard precautions** (CDC 1996; 2007) supplemented with
- 2-**Contact precautions** (should be used with patients known to be infected or colonized with MRSA).

In the following section, CDC recommendations are presented with the strength of the recommendation categorized as IA, IB, IC and II. The meaning of these categories is the following:

Categories

As in previous CDC/HICPAC guidelines, each recommendation is categorized on the basis of existing scientific data, theoretical rationale, applicability and economic impact. The CDC/HICPAC system for categorizing recommendations is as follows:

Category IA. Strongly recommended for implementation and strongly supported by well-designed experimental, clinical, or epidemiologic studies.

Category IB. Strongly recommended for implementation and supported by certain experimental, clinical, or epidemiologic studies and a strong theoretical rationale.

Category IC. Required for implementation, as mandated by federal or state regulation or standard

Category II. Suggested for implementation and supported by suggestive clinical or epidemiologic studies or a theoretical rationale.

No recommendation. Unresolved issue. Practices for which insufficient evidence or no consensus regarding efficacy exist.

2.4.1. Standard Precautions and Contact Precautions

From CDC's Hospital Infection Control Practices Advisory Committee Recommendations for Isolation Precautions in Hospitals available at <http://www.cdc.gov/ncidod/hip/ISOLAT/isopart2.htm>

There are two tiers of HICPAC isolation precautions. In the first and most important tier are those precautions designed for the care of all patients in hospitals, regardless of their diagnosis or presumed infection status. Implementation of these "Standard Precautions" is the primary strategy for successful nosocomial infection control. In the second tier are precautions designed only for the care of specified patients. These additional "Transmission-Based Precautions" are for patients known or suspected to be infected by epidemiologically important pathogens spread by airborne or droplet transmission or by contact with dry skin or contaminated surfaces.

2.4.1.1. Standard Precautions

Standard Precautions synthesize the major features of Universal Precautions (UP or Blood and Body Fluid Precautions), (designed to reduce the risk of transmission of bloodborne pathogens) and Body Substance Isolation (BSI), designed to reduce the risk of transmission of pathogens from moist body substances) and applies them to all patients receiving care in hospitals, regardless of their diagnosis or presumed infection status. Standard Precautions apply to 1) blood; 2) all body fluids, secretions and excretions except sweat, regardless of whether or not they contain visible blood; 3) non-intact skin; 4) mucous membranes. Standard Precautions are designed to reduce the risk of transmission of microorganisms from both recognized and unrecognized sources of infection in hospitals.

Use Standard Precautions, or the equivalent, for the care of all patients. Category IB

A. Handwashing

(1) Wash hands after touching blood, body fluids, secretions, excretions and contaminated items, whether or not gloves are worn. Wash hands immediately after gloves are removed, between patient contacts and when otherwise indicated to avoid transfer of microorganisms to other patients or environments. It may be necessary to wash hands between tasks and procedures on the same patient to prevent cross-contamination of different body sites. Category IB

(2) Use a plain (nonantimicrobial) soap for routine handwashing. Category IB

(3) Use an antimicrobial agent or a waterless antiseptic agent for specific circumstances (e.g., control of outbreaks or hyperendemic infections), as defined by the infection control program. Category IB (See Contact Precautions for additional recommendations on using antimicrobial and antiseptic agents.)

B. Gloves

Wear gloves (clean, nonsterile gloves are adequate) when touching blood, body fluids, secretions, excretions and contaminated items. Put on clean gloves just before touching mucous membranes and nonintact skin. Change gloves between tasks and procedures on the same patient after contact with material that may contain a high concentration of microorganisms. Remove gloves promptly after use, before touching noncontaminated items and environmental surfaces and

before going to another patient and wash hands immediately to avoid transfer of microorganisms to other patients or environments. Category IB

C. Mask, Eye Protection, Face Shield

Wear a mask and eye protection or a face shield to protect mucous membranes of the eyes, nose and mouth during procedures and patient-care activities that are likely to generate splashes or sprays of blood, body fluids, secretions and excretions. Category IB

D. Gown

Wear a gown (a clean, nonsterile gown is adequate) to protect skin and to prevent soiling of clothing during procedures and patient-care activities that are likely to generate splashes or sprays of blood, body fluids, secretions, or excretions. Select a gown that is appropriate for the activity and amount of fluid likely to be encountered. Remove a soiled gown as promptly as possible and wash hands to avoid transfer of microorganisms to other patients or environments. Category IB

E. Patient-Care Equipment

Handle used patient-care equipment soiled with blood, body fluids, secretions and excretions in a manner that prevents skin and mucous membrane exposures, contamination of clothing and transfer of microorganisms to other patients and environments. Ensure that reusable equipment is not used for the care of another patient until it has been cleaned and reprocessed appropriately. Ensure that single-use items are discarded properly. Category IB

F. Environmental Control

Ensure that the hospital has adequate procedures for the routine care, cleaning and disinfection of environmental surfaces, beds, bedrails, bedside equipment and other frequently touched surfaces and ensure that these procedures are being followed. Category IB

G. Linen

Handle, transport and process used linen soiled with blood, body fluids, secretions and excretions in a manner that prevents skin and mucous membrane exposures and contamination of clothing and that avoids transfer of microorganisms to other patients and environments. Category IB

H. Occupational Health and Bloodborne Pathogens

(1) Take care to prevent injuries when using needles, scalpels and other sharp instruments or devices; when handling sharp instruments after procedures; when cleaning used instruments; when disposing of used needles. Never recap used needles, or otherwise manipulate them using both hands, or use any other technique that involves directing the point of a needle toward any part of the body; rather, use either a one-handed "scoop" technique or a mechanical device designed for holding the needle sheath. Do not remove used needles from disposable syringes by hand and do not bend, break, or otherwise manipulate used needles by hand. Place used disposable syringes and needles, scalpel blades and other sharp items in appropriate puncture-resistant containers, which are located as close as practical to the area in which the items were used and place reusable syringes and needles in a puncture-resistant container for transport to the reprocessing area. Category IB

(2) Use mouthpieces, resuscitation bags, or other ventilation devices as an alternative to mouth-to-mouth resuscitation methods in areas where the need for resuscitation is predictable. Category IB

I. Patient Placement

Place a patient who contaminates the environment or who does not (or cannot be expected to) assist in maintaining appropriate hygiene or environmental control in a private room. If a private room is not available, consult with infection control professionals regarding patient placement or other alternatives. Category IB

2.4.1.2. Transmission-Based Precautions: Contact Precautions

Transmission-Based Precautions are designed for patients documented or suspected to be infected with highly transmissible or epidemiologically important pathogens for which additional precautions beyond Standard Precautions are needed to interrupt transmission in hospitals. There are three types of Transmission-Based Precautions: Airborne Precautions, Droplet Precautions and Contact Precautions. They may be combined for diseases that have multiple routes of transmission. When used either singularly or in combination, they are to be used in addition to Standard Precautions.

Contact precautions are the most relevant for MRSA transmission and are discussed below.

Contact Precautions are designed to reduce the risk of transmission of epidemiologically important microorganisms by direct or indirect contact. Direct-contact transmission involves skin-to-skin contact and physical transfer of microorganisms to a susceptible host from an infected or colonized person, such as occurs when personnel turn patients, bathe patients, or perform other patient-care activities that require physical contact. Direct-contact transmission also can occur between two patients (e.g., by hand contact), with one serving as the source of infectious microorganisms and the other as a susceptible host. Indirect-contact transmission involves contact of a susceptible host with a contaminated intermediate object, usually inanimate, in the patient's environment. Contact Precautions apply to specified patients known or suspected to be infected or colonized (presence of microorganism in or on patient but without clinical signs and symptoms of infection), with epidemiologically important microorganisms that than can be transmitted by direct or indirect contact.

In addition to Standard Precautions, use Contact Precautions, or the equivalent, for specified patients known or suspected to be infected or colonized with epidemiologically important microorganisms that can be transmitted by direct contact with the patient (hand or skin-to-skin contact that occurs when performing patient-care activities that require touching the patient's dry skin), or indirect contact (touching), with environmental surfaces or patient-care items in the patient's environment.
Category IB

A. Patient Placement

Place the patient in a private room. When a private room is not available, place the patient in a room with a patient(s) who has active infection with the same microorganism but with no other infection (cohorting). When a private room is not available and cohorting is not achievable, consider the epidemiology of the microorganism and the patient population when determining patient placement. Consultation with infection control professionals is advised before patient placement.
Category IB

B. Gloves and Handwashing

In addition to wearing gloves as outlined under Standard Precautions, wear gloves (clean, nonsterile gloves are adequate) when entering the room. During the course of providing care for a patient, change gloves after having contact with infective material that may contain high concentrations of microorganisms (fecal material and wound drainage). Remove gloves before leaving the patient's room and wash hands immediately with an antimicrobial agent or a waterless antiseptic agent. After glove removal and handwashing, ensure that hands do not touch potentially contaminated environmental surfaces or items in the patient's room to avoid transfer of microorganisms to other patients or environments. Category IB

C. Gown

In addition to wearing a gown as outlined under Standard Precautions, wear a gown (a clean, nonsterile gown is adequate) when entering the room if you anticipate that your clothing will have substantial contact with the patient, environmental surfaces, or items in the patient's room, or if the patient is incontinent or has diarrhea, an ileostomy, a colostomy, or wound drainage not contained by a dressing. Remove the gown before leaving the patient's environment. After gown removal, ensure that clothing does not contact potentially contaminated environmental surfaces to avoid transfer of microorganisms to other patients or environments. Category IB

D. Patient Transport

Limit the movement and transport of the patient from the room to essential purposes only. If the patient is transported out of the room, ensure that precautions are maintained to minimize the risk of transmission of microorganisms to other patients and contamination of environmental surfaces or equipment. Category IB

E. Patient-Care Equipment

When possible, dedicate the use of noncritical patient-care equipment to a single patient (or cohort of patients infected or colonized with the pathogen requiring precautions) to avoid sharing between patients. If use of common equipment or items is unavoidable, then adequately clean and disinfect them before use for another patient. Category IB

2.4.2. Hand Hygiene recommendations

Hand hygiene is an important part of standard and contact precautions, specific recommendations are presented below.

Discontinuation of contact precautions is acceptable after a single culture from the nares and the site of infection are negative

The CDC Guideline for Hand Hygiene in Health-Care Settings: Recommendations of the Healthcare Infection Control Practices Advisory Committee and the HICPAC/SHEA/APIC/IDSA Hand Hygiene Task Force is available at

These recommendations are designed to improve hand-hygiene practices of HCWs and to reduce transmission of pathogenic microorganisms to patients and personnel in health-care settings. This guideline and its recommendations are not intended for use in food processing or food-service establishments and are not meant to replace guidance provided by FDA's Model Food Code.

1. Indications for handwashing and hand antisepsis

- A. When hands are visibly dirty or contaminated with proteinaceous material or are visibly soiled with blood or other body fluids, wash hands with either a non-antimicrobial soap and water or an antimicrobial soap and water (IA).*
- B. If hands are not visibly soiled, use an alcohol-based hand rub for routinely decontaminating hands in all other clinical situations described in items 1C--J (IA) (74,93,166,169,283,294,312,398). Alternatively, wash hands with an antimicrobial soap and water in all clinical situations described in items 1C--J (IB).*
- C. Decontaminate hands before having direct contact with patients (IB).*
- D. Decontaminate hands before donning sterile gloves when inserting a central intravascular catheter (IB).*
- E. Decontaminate hands before inserting indwelling urinary catheters, peripheral vascular catheters, or other invasive devices that do not require a surgical procedure (IB).*
- F. Decontaminate hands after contact with a patient's intact skin (e.g., when taking a pulse or blood pressure and lifting a patient) (IB).*
- G. Decontaminate hands after contact with body fluids or excretions, mucous membranes, non-intact skin and wound dressings if hands are not visibly soiled (IA).*
- H. Decontaminate hands if moving from a contaminated-body site to a clean-body site during patient care (II).*
- I. Decontaminate hands after contact with inanimate objects (including medical equipment) in the immediate vicinity of the patient (II).*
- J. Decontaminate hands after removing gloves (IB).*
- K. Before eating and after using a restroom, wash hands with a non-antimicrobial soap and water or with an antimicrobial soap and water (IB).*
- L. Antimicrobial-impregnated wipes (i.e., towelettes) may be considered as an alternative to washing hands with non-antimicrobial soap and water. Because they are not as effective as alcohol-based hand rubs or washing hands with an antimicrobial soap and water for reducing bacterial counts on the hands of HCWs, they are not a substitute for using an alcohol-based hand rub or antimicrobial soap (IB).*
- M. Wash hands with non-antimicrobial soap and water or with antimicrobial soap and water if exposure to Bacillus anthracis is suspected or proven. The physical action of washing and rinsing hands under such circumstances is recommended because alcohols, chlorhexidine, iodophors and other antiseptic agents have poor activity against spores (II).*
- N. No recommendation can be made regarding the routine use of nonalcohol-based hand rubs for hand hygiene in health-care settings. This is an unresolved issue.*

2. Hand-hygiene technique

- A. When decontaminating hands with an alcohol-based hand rub, apply product to palm of one hand and rub hands together, covering all surfaces of hands and fingers, until hands are dry (IB). Follow the manufacturer's recommendations regarding the volume of product to use.*
- B. When washing hands with soap and water, wet hands first with water, apply an amount of product recommended by the manufacturer to hands and rub hands together vigorously for at least 15 seconds, covering all surfaces of the hands and fingers. Rinse hands with water and dry thoroughly with a disposable towel. Use towel to turn off the faucet (IB). Avoid using hot water, because repeated exposure to hot water may increase the risk of dermatitis (IB).*
- C. Liquid, bar, leaflet or powdered forms of plain soap are acceptable when washing hands with a non-antimicrobial soap and water. When bar soap is used, soap racks that facilitate drainage and small bars of soap should be used (II).*
- D. Multiple-use cloth towels of the hanging or roll type are not recommended for use in health-care settings (II).*

3. Surgical hand antisepsis

- A. Remove rings, watches and bracelets before beginning the surgical hand scrub (II).*
- B. Remove debris from underneath fingernails using a nail cleaner under running water (II).*
- C. Surgical hand antisepsis using either an antimicrobial soap or an alcohol-based hand rub with persistent activity is recommended before donning sterile gloves when performing surgical procedures (IB).*

- D. *When performing surgical hand antisepsis using an antimicrobial soap, scrub hands and forearms for the length of time recommended by the manufacturer, usually 2--6 minutes. Long scrub times (e.g., 10 minutes) are not necessary (IB).*
- E. *When using an alcohol-based surgical hand-scrub product with persistent activity, follow the manufacturer's instructions. Before applying the alcohol solution, prewash hands and forearms with a non-antimicrobial soap and dry hands and forearms completely. After application of the alcohol-based product as recommended, allow hands and forearms to dry thoroughly before donning sterile gloves (IB).*

4. Selection of hand-hygiene agents

- A. *Provide personnel with efficacious hand-hygiene products that have low irritancy potential, particularly when these products are used multiple times per shift (IB). This recommendation applies to products used for hand antisepsis before and after patient care in clinical areas and to products used for surgical hand antisepsis by surgical personnel.*
- B. *To maximize acceptance of hand-hygiene products by HCWs, solicit input from these employees regarding the feel, fragrance and skin tolerance of any products under consideration. The cost of hand-hygiene products should not be the primary factor influencing product selection (IB).*
- C. *When selecting non-antimicrobial soaps, antimicrobial soaps, or alcohol-based hand rubs, solicit information from manufacturers regarding any known interactions between products used to clean hands, skin care products and the types of gloves used in the institution (II).*
- D. *Before making purchasing decisions, evaluate the dispenser systems of various product manufacturers or distributors to ensure that dispensers function adequately and deliver an appropriate volume of product (II).*
- E. *Do not add soap to a partially empty soap dispenser. This practice of "topping off" dispensers can lead to bacterial contamination of soap (IA).*

5. Skin care

- A. *Provide HCWs with hand lotions or creams to minimize the occurrence of irritant contact dermatitis associated with hand antisepsis or handwashing (IA).*
- B. *Solicit information from manufacturers regarding any effects that hand lotions, creams, or alcohol-based hand antiseptics may have on the persistent effects of antimicrobial soaps being used in the institution (IB).*

6. Other Aspects of Hand Hygiene

- A. *Do not wear artificial fingernails or extenders when having direct contact with patients at high risk (e.g., those in intensive-care units or operating rooms) (IA).*
- B. *Keep natural nails tips less than 1/4-inch long (II).*
- C. *Wear gloves when contact with blood or other potentially infectious materials, mucous membranes and non-intact skin could occur (IC).*
- D. *Remove gloves after caring for a patient. Do not wear the same pair of gloves for the care of more than one patient and do not wash gloves between uses with different patients (IB).*
- E. *Change gloves during patient care if moving from a contaminated body site to a clean body site (II).*
- F. *No recommendation can be made regarding wearing rings in health-care settings. Unresolved issue*

Surveillance and Management of MRSA in Institutions

These recommendations apply during normal situations, not to evaluate and manage an outbreak situation. Outbreak management and treatment are presented in following sections.

2.5.1. Screening

The Healthcare Infection Control Practices Advisory Committee (HICPAC) guideline for the control of multidrug-resistant bacteria also promote the use of active surveillance cultures for high-risk patients when other measures have failed to control the spread of antimicrobial-resistant bacteria

2.5.1.1. The case for screening with active surveillance cultures

The purpose of screening with active surveillance cultures is to prevent patient-to-patient transmission through detection of both colonized and infected patients and implementation of isolation precautions known to reduce the risk of dissemination of antimicrobial-resistant pathogens. Use of active surveillance cultures has been shown to improve detection of antimicrobial-resistant pathogens, compared with reliance on culture of specimens collected for clinical reasons alone.

Operationally, use of active surveillance cultures involves the collection of specimens for culture whether or not the patient is exhibiting signs or symptoms of infection. For MRSA, swab samples for culture are generally collected from the anterior nares and sometimes from other sites, including wounds.

Once a patient is identified as being colonized or infected, isolation precautions are generally used to prevent the spread of antimicrobial-resistant pathogens to other patients. Contact precautions, which have been shown to be effective in reducing transmission of VRE and MRSA, include the physical separation (typically in private rooms) of infected and colonized patients from other patients, use of appropriate hand hygiene and use of clean gowns and gloves by healthcare workers during all contact with the patient or the patient's environment. In specific circumstances, patients carrying antimicrobial-resistant pathogens may also undergo treatment to eradicate colonization, which, if successful, could interrupt the potential for spread.

Active surveillance cultures to high risk units is recommended

When used during an outbreak, active surveillance cultures have been convincingly demonstrated to interrupt the spread of MRSA. The evidence supporting the use of active surveillance cultures for the control of antimicrobial-resistant bacteria in circumstances other than during an outbreak is more limited. Most of the available reports describe surveillance programs applied to high-risk units (such as ICUs and dedicated wards for immunocompromised patients) or specific populations of high-risk hospital patients (such as long-term care facility residents or hemodialysis patients). As a result, the findings of these studies are not easily extrapolated to patients and circumstances in which the risk of transmission of antimicrobial-resistant bacteria might be lower.

Active surveillance cultures to all hospitalized patients is not recommended

Few published reports have examined application of active surveillance cultures to all hospitalized patients. Many of the available studies were not designed to assess the effectiveness of an active surveillance culture program in reducing transmission or infection, but rather were undertaken to determine how colonized or infected patients could be most efficiently and affordably detected. In each case, the investigators concluded that targeted surveillance of high-risk patients, such as is advocated by the previous SHEA and HICPAC guidelines, offers the optimum strategy to detect colonized and infected patients.

2.5.1.2. The European “search and destroy approach is not (yet) recommended

In Denmark, The Netherlands and several other European countries, ‘**search and destroy**’ methods have been employed to reduce MRSA to the status of an uncommon nonendemic pathogen in recent years. This longstanding, intensive, coordinated campaign relies on targeted screening of high-risk patients. If multiple cases of MRSA colonization or infection are detected, entire units may be closed for comprehensive screening and cleaning. In addition, healthcare workers may be screened for MRSA carriage and if colonized, not allowed to work until successfully decolonized.

The high prevalence of MRSA colonization and infection already seen in various regions of the United States represents a particular challenge, as this was not the case in nearly any of the European nations when “search and destroy” programs were initially implemented. Moreover, the impact of community-associated MRSA colonization and infection on the effectiveness and feasibility of using active surveillance cultures in the United States and other affected nations is unknown. Given the rapid spread of community-associated MRSA strains, it may be particularly challenging to control MRSA with any strategy that focuses exclusively on the hospital.

2.5.1.3. Previous US recommendation: Optional systematic screening of patients - No screening of staff unless in an outbreak situation.

Routine screening misses a significant fraction of colonized individuals. Routine screening is usually followed by treatment for decolonization, which often fails and is difficult to verify. Screening of employees leads to treatment for decolonization and exclusion, thus disrupting services. This approach proves to cause chaos and have little preventive value. Relying on screening provides a very false sense of security. The only effective way to prevent transmission is the scrupulous implementation of standard and contact precautions.

2.5.1.4. Conduct culture surveys to assess the efficacy of the enhanced MRSA control interventions.

- Conduct serial (e.g., weekly, until transmission has ceased and then decreasing frequency) unit-specific point prevalence culture surveys of MRSA to determine if transmission has decreased or ceased.
- Repeat point-prevalence culture surveys at routine intervals or at time of patient discharge or transfer until transmission has ceased.
- If indicated by assessment of the MRSA problem, collect cultures to assess the colonization status of roommates and other patients with substantial exposure to patients with known MRSA infection or colonization.
- Obtain cultures of healthcare personnel for targeting multi-drug resistant organisms (MDRO), when there is epidemiologic evidence implicating the healthcare staff member as a source of ongoing transmission.

2.5.2. Culturing Patients

Cultures are recommended upon the appearance of clinical signs of tissue invasion including serosanguinous fluid (even in the absence of purulence), purulent drainage and erythema at the site of a wound, fever, elevated WBC count, or other manifestation of infection.

Culturing any wound site in individuals with a previous history of MRSA infection or colonization upon admission or readmission to a hospital or nursing home should be considered if clinically indicated.

Culturing should follow specific procedures for obtaining specimens that have been established by the bacteriological laboratory to which the specimen(s) will be sent. Gloves should be worn when obtaining specimens. Hands should be washed before and after obtaining cultures.

Sampling the anterior nares is usually sufficient; throat, endotracheal tube aspirate, percutaneous gastrostomy sites and perirectal or perineal cultures may be added to increase the yield. Swabs from several sites may be placed in the same selective broth tube prior to transport.

2.5.3. Decolonization

Carriers of MRSA are often colonized for long periods of time. During the period that they remain colonized, these patients are at added cumulative risk for infection and can serve as a potential source for transmission to others.

To preempt these phenomena, a number of approaches to decolonize patients have been evaluated for patients either colonized or infected with MRSA. Strategies to eradicate MRSA colonization have included the use of a range of agents applied either topically (generally to the anterior nares) or systemically. The overall utility of decolonization strategies for patients colonized or infected with MRSA was the subject of a recent systematic review. On the basis of the results of 6 trials that included 384 participants, the authors of the study concluded that the available evidence is inadequate to recommend the use of topical or systemic agents to eliminate MRSA colonization. Unfortunately, aggressive attempts to institute programs to eradicate MRSA have been accompanied by the emergence of MRSA strains that are resistant to mupirocin, the topical antimicrobial agent most commonly used for nasal decolonization.

Consult with physicians with expertise in infectious diseases and/or healthcare epidemiology on a case-by-case basis regarding the appropriate use of decolonization therapy for patients or staff during limited periods of time, as a component of an intensified MRSA control program.

When decolonization for MRSA is used, perform susceptibility testing for the decolonizing agent against the target organism in the individual being treated or the MDRO strain that is epidemiologically implicated in transmission. Monitor susceptibility to detect emergence of resistance to the decolonizing agent. Consult with a microbiologist for appropriate testing for mupirocin resistance, since standards have not been established.

Because mupirocin-resistant strains may emerge and because it is unusual to eradicate MRSA when multiple body sites are colonized, do not use topical mupirocin routinely for MRSA decolonization of patients as a component of MRSA control programs in any healthcare setting.

Limit decolonization of health care providers (HCP) found to be colonized with MRSA to persons who have been epidemiologically linked as a likely source of ongoing transmission to patients. Consider reassignment of HCP if decolonization is not successful and ongoing transmission to patients persists.

2.5.3. Surveillance Data Collection and Analysis

Data Collection: Each acute and nursing home/extended-care facility who want to evaluate whether they have a high

colonization rate with MRSA should maintain a surveillance line-listing of the names and other appropriate information of current and past residents/patients who are known to be colonized or infected with MRSA with classification as colonization, community associated infection or hospital associated infection.

Analysis: A surveillance line listing should be maintained and reviewed by the designated infection control person to monitor trends over time.

A method of analysis is to calculate the incidence rates of institution-associated infections per 1000 patients' days as follows:
MRSA Incidence Rate =

$$\frac{\text{\# of active institution associated infections during the month}}{\text{\# of patient days for the month}} \times 1000$$

Use of Analysis: Based on the analysis of the data, an endemic or epidemic rate can then be determined. Case counts or rates should be reported to appropriate medical staff or committees. Large or sudden increases in the MRSA incidence rate should alert infection control and medical staff about breakdown of infection control procedures or an outbreak of MRSA.

Identification of an outbreak: An outbreak of MRSA is defined as three or more epidemiologically linked cases of MRSA occurring within a 30-day period, or a substantial increase in the number of MRSA cases from the baseline endemic rate, even if cases are not epidemiologically linked.

2.6. Other Preventive Measures Applicable to Institutions

2.6.1. Modifications to Standard /Contact Precautions

When transmission continues despite adherence to Standard and Contact Precautions and cohorting patients, assign dedicated nursing and ancillary service staff to the care of MDRO patients only. Some facilities may consider this option when intensified measures are first implemented.

Stop new admissions to the unit or facility if transmission continues despite the implementation of the enhanced control measures.

Implement patient-dedicated or single-use disposable non-critical equipment (e.g., blood pressure cuff, stethoscope) and instruments and devices.

Monitor (i.e., supervise and inspect) cleaning performance to ensure consistent cleaning and disinfection of surfaces in close proximity to the patient and those likely to be touched by the patient and HCP (e.g., bedrails, carts, bedside commodes, doorknobs, faucet handles).

Obtain environmental cultures (e.g., surfaces, shared medical equipment) when there is epidemiologic evidence that an environmental source is associated with ongoing transmission of the targeted MDRO.

Vacate units for environmental assessment and intensive cleaning when previous efforts to eliminate environmental reservoirs have failed.

2.6.2. Infected Health Care Worker

Health care workers are expected to be as colonized or infected as any other individual from the community where CA-MRSA is becoming increasingly prevalent. Currently, it is not justified to assume that a health care worker with MRSA has been infected in their work place.

For health care workers with MRSA infection, restriction from patient care or food handling activities is only indicated for those employees who have active lesions that cannot be *reliably* contained by a dressing or other barrier method. No work restrictions are necessary for personnel who are colonized unless they have been epidemiologically implicated in *S. aureus* transmission within the facility.

2.6.3. Prevention of Antibiotic Resistance

It has been noted that some outbreaks of MRSA in nursing homes/extended-care facilities have followed indiscriminate use of some broad-spectrum oral antibiotics. Although the literature does not definitely prove this association, it is prudent to

avoid using antibiotics on all patients unless absolutely necessary. When antibiotic therapy is needed and if the situation is appropriate, narrow-spectrum antibiotics should be selected rather than broad-spectrum antibiotics.

2.6.4. Skin Breakdown

Since many MRSA infections are associated with decubiti ulcers, skin breakdowns in adults and tracheostomy and gastrostomy sites in children, attention must be paid to maintaining the skin integrity of all patients.

3. Hemodialysis and End Stage Renal Disease (ERSD) patients

Repeated hospitalizations and surgeries and administration of prolonged courses of antimicrobial agents increase exposure to potential pathogens and create opportunities for antimicrobial resistance in this population. The rate of invasive MRSA infection has often been reported to be higher than for any other known patient population and is 100 times higher than for the general population. Infections are the second most common cause of death in ESRD patients, accounting for nearly 14 % of deaths (*U.S. Renal Data System 2006*). The organisms most frequently associated with catheter-access--related bacteremias are coagulase-negative staphylococci (38%), and *S. aureus* (29%).

Persons receiving hemodialysis are especially vulnerable to vascular-access infections because they require vascular access for prolonged periods and undergo frequent puncture of their vascular-access site. Furthermore, patients colonized with MRSA can serve as a reservoir for transmission in health-care settings. The primary risk factor for bacterial infections among dialysis patients is vascular-access type. Risk is highest for catheters, intermediate for grafts and lowest for native arteriovenous fistulas.

The most basic strategy to prevent catheter-related bacteremias, including invasive MRSA infections among hemodialysis patients, is minimizing the use of catheters for long-term vascular access.

3. Management of Community Associated MRSA

Some settings have factors that make it easier for MRSA to be transmitted.

- These factors, referred to as the 5 C's, are as follows: Crowding, frequent skin-to-skin Contact, Compromised skin (i.e., cuts or abrasions), Contaminated items and surfaces and lack of Cleanliness.
- Locations where the 5 C's are common include schools, dormitories, military barracks, households, correctional facilities and daycare centers.

3.1. Discharge of MRSA Patient in the Community

A patient with MRSA infection may be treated as an outpatient and may live in the home environment.

3.2. Education

The family needs to be educated about MRSA, its transmission and management. The patient's family members/caretakers need to understand that extraordinary infection control measures, beyond good handwashing and careful handling of soiled dressings, are not necessary in the home. If there is a highly susceptible family member (e.g., child with cystic fibrosis or immunocompromised patient), more extensive precautions might be in order. Because of the lack of selective antibiotic pressure in the home setting, even if family members and/or caretakers become transiently colonized with MRSA, they will usually not remain permanently colonized.

3.3. Screening

There is no need to screen family members for the same reasons mentioned in the section on MRSA management in institutions.

3.4. Culture

- For minor infections that are not going to be treated with antibiotics, routine cultures are not recommended.
- For severe infections treated with antibiotics, culturing and performing antibiotic sensitivity tests would allow optimizing antibiotic treatment.

3.5. Reporting requirements for MRSA

Any cluster of illness is reportable to the Louisiana Office of Public Health Infectious Disease Epidemiology Section (Call the 24 hr. number 800-256-2748 and speak with an epidemiologist.) An individual case of MRSA is not reportable by healthcare providers.

3.6. Personal care guidelines

- Wash your hands frequently.
- Carry alcohol-based hand gel with you so you can sanitize your hands if soap and water are not available.
- Cover your nose and mouth with a tissue when you cough or sneeze. Throw the tissue in a wastebasket and wash your hands.
- Take a bath or shower every day. This will help reduce the amount of bacteria on your skin.
- Keep your fingernails short to keep the bacteria from growing under and on your nails.
- Change your sheets and towels regularly.
- Change your clothes daily and wash them before wearing again.
- Do not share towels, razors, toothbrushes, or other personal items.
- Take good care of your skin. Remember, MRSA lives on your skin. Any break or crack in your skin can allow it to enter and cause an infection. If you get a cut or scrape, clean it with soap and water and then cover it with a bandage.
- Take care of yourself: eat right, exercise, quit smoking and avoid stress.
- Get medical care at the first sign of infection in a cut, such as redness, swelling, pain, or pus.
- Tell your health care providers that you have had MRSA in the past.

- If you work in a health care setting, you may need to take special precautions. Consult with your employer.

When to wash hands at home:

- Before preparing food, eating, or drinking
- Before and after touching your eyes, nose, mouth, genitals, sores, acne, boils, or rashes
- Before and after changing bandages
- Before and after smoking
- Before and after blowing your nose
- After touching urine, feces and body fluids - this includes items soiled with body fluids, such as bedding
- After cleaning the bathroom, changing your bedding and doing laundry
- After going to the bathroom
- After coughing or sneezing
- After touching things other people touch, such as phones, door knobs, or shopping carts

3.7 Preventing spread to others

- Cover your wound. Keep wounds that are draining or have pus covered with clean, dry bandages until healed. Follow your healthcare provider's instructions on proper care of the wound. Pus from infected wounds can contain staph, including MRSA; keeping the infection covered will help prevent the spread to others. Bandages and tape can be discarded with the regular trash.
- Clean your hands frequently. You, your family and others in close contact should wash their hands frequently with soap and water or use an alcohol-based hand sanitizer, especially after changing the bandage or touching the infected wound.
- Do not share personal items. Avoid sharing personal items, such as towels, washcloths, razors, clothing, or uniforms that may have had contact with the infected wound or bandage. Wash sheets, towels and clothes that become soiled with water and laundry detergent. Use a dryer to dry clothes completely.
- If you go to a gym, disinfect all equipment after using it. This is standard policy for gyms and the gym should supply disinfectant. Shower well with soap before and after using a public sauna, hot tub or pool. Shower immediately after participating in sports or working out at the gym. Shower before any intimate skin-to-skin contact with another person. Showering will reduce the amount of bacteria on your skin and reduce the risk of spreading bacteria to the other person.
- Do not poke or squeeze sores.
- Do not touch sores, especially ones that cannot be covered with a bandage or clothing, such as sores on your face. If you do touch a sore, wash your hands immediately.
- Cover any infected sores with a bandage. Wash your hands immediately after putting on the bandage.
- If you have a leaking sore, put extra dressings over it to keep the drainage from leaking through. Be careful not to get any pus or body fluids on surfaces or other people.
- Wear clothes that cover your bandages and sores, if possible.
- Be especially careful if you are around people who have weak immune systems, such as newborn babies, the elderly, or anyone with a chronic disease. If they get MRSA, it can make them very ill.
- Be careful if you are around someone who has a skin condition, such as eczema, or someone who just had surgery. They may be more likely to get an infection.
- If MRSA is in your urine or feces, clean your bathroom well. If other people handle your urine or feces, they should wear gloves and wash their hands well afterwards.
- Do not participate in contact sports until your sores have healed (sweating can cause a bandage to loosen and lead to contact with equipment and other people).
- Do not go to a public gym, sauna, hot tub or pool until sores have healed.
- Do not get manicures, massages or hair cuts until sores have healed.

3.8 Pets and MRSA

Pets, such as dogs and cats, can also get MRSA. Pets can have active infections or they can be carriers. In some cases the source of repeated infections may be a pet. If a pet shows any signs of a skin infection, get a veterinarian to test the pet. Pets with MRSA can be treated. There is no need to get rid of an MRSA infected pet.

If a pet is diagnosed with MRSA, do not touch the pet's infections and make sure to wear gloves when changing bandages. Consider keeping children separated from the pet until its sores have healed.

3.9 Environment disinfection, utensils and laundry

3.9.1 Home disinfection

Use a disinfectant to regularly clean surfaces. Pay attention to items that are frequently touched — light switches, doorknobs, phones, toilets, sinks, tubs, kitchen counters, cell phones, pagers and computer keyboards. Wipe the surface or object with the disinfectant and let it dry. If body fluids or pus get onto surfaces, you need to do the following:

1. Put on disposable gloves.
2. Wipe up the fluids with a paper towel.
3. Throw the paper towel in the trash.
4. Clean the surface thoroughly using disinfectant and a paper towel.
5. Throw the paper towel in the trash.
6. Then wipe the surface again with the disinfectant and let it dry for at least 30 seconds.
7. Throw the paper towel in the trash.
8. Remove your gloves and throw them in the trash.
9. Wash your hands or use an alcohol-based hand sanitizer.

Disinfectants to use

- Use any cleaner you can buy at the grocery store that has the word “disinfectant” on it. Remember to read the label and follow the directions.
- Make your own solution of bleach and water: Mix one tablespoon bleach into one quart of water in a spray bottle and label it “bleach solution.” Make it fresh each time you plan to clean because the bleach evaporates out of the water making it less effective. Never mix bleach with other cleaners, especially ammonia. Keep the bleach solution away from children and don’t put it in bottles that could be mistaken for something to drink.

How often to clean?

MRSA bacteria can live on surfaces for days, weeks and months. It is important to clean regularly. For items or surfaces you touch frequently, clean them every day.

3.9.2 Laundry: Dirty clothes and bedding can spread MRSA bacteria.

- When collecting your laundry or changing your sheets, hold the dirty laundry away from your body and clothes. This will prevent getting any bacteria on your clothes.
- Wear disposable gloves to handle laundry that is soiled with body fluids, like drainage from a sore, urine or feces. Immediately put the laundry into the washer or into a plastic bag until it can be washed.
- Wash your laundry with warm or hot water. Use bleach if possible.
- Dry in a warm or hot dryer and make sure the clothes are completely dry.
- Wash your hands after handling dirty sheets or clothing and before handling clean laundry, even if you have been wearing gloves.
- Throw gloves away after taking them off. Do not reuse them.

3.9.3 Facility

- Clean the facility and used recreational equipment daily with a commercial disinfectant or a daily prepared solution of 1:100 bleach and water mix (1 tablespoon bleach in 1 quart of water).
- Phenol-containing sprays such as Lysol® can be used to disinfect upholstered/cloth surfaces.
- Utensils, dishes, clothes and other laundry should be washed normally with hot water and normal detergents. Laundry should be dried on the hottest setting.
- Discourage the sharing of personal care items, towels, sheets, etc.
- Transport soiled items in a plastic bag or other waterproof container.

4. Day Care, Schools

There are several reasons why the school setting is of concern for MRSA. Throughout the USA, MRSA infections have become more common in schools. Staphylococci, including MRSA, are spread by direct contact. In school settings, there are many opportunities for direct contact among students, especially those on athletic teams or in residential facilities. A MRSA outbreak can cause much anxiety for parents, students and staff. MRSA infection can vary widely in severity. Identifying a MRSA infection can be difficult because the symptoms of MRSA infection are similar to those of other skin infections. Several states, including Louisiana, have reported MRSA infections among wrestling, football teams, all contact sports teams and even in residential dormitories.

Factors that have been associated with the spread of MRSA skin infections include close skin-to-skin contact, openings in the skin such as cuts or abrasions, contaminated items and surfaces, crowded living conditions and poor hygiene.

4.1 Hand washing and hand care

- All employees and children should have ample access to soap, water and clean towels.
- Small alcohol-based hand sanitizers can be beneficial for employees to carry when soap and water is unavailable.
- Use liquid soap instead of shared bar soap that is mild and non-irritating.
- Do not add soap to a partially empty soap container. This can lead to bacterial contamination.
- Wash hands:
 - After any contact with staff or child's nose, mouth, eyes, ears, groin, anus, blood, or bodily fluids (includes, sneezing, coughing, blowing your nose, rubbing eyes, eating, using the restroom, etc.).
 - Before and after direct contact with another person or their belongings especially if infected or a known carrier.
 - Wash hands before coming into and leaving the daycare facility.
 - Anytime hands are visibly dirty or soiled.
- Discourage the use of extended artificial nails especially when caring for wounds.
- Keep nails neatly trimmed short and free of debris under the nail.
- Use moisturizers or hand lotions to keep skin healthy.

4.2 Management of a student reported to have MRSA

Consider taking the following steps:

4.2.1 Confirm the diagnosis

If a school staff member observes a child with open draining wounds or infections, refer the child to the school nurse and notify parents/guardians. Confirming the diagnosis may require contacting the doctor and family of the student to ensure that accurate medical information is available.

4.2.2 Follow routine infection control precautions.

Use the following infection control precautions with a student who has MRSA infection if school staff has to touch the student:

Wear gloves when handling the student, or touching blood, body fluids, secretions, excretions and any items contaminated with these fluids. Gloves should be used before touching mucous membranes and non-intact skin. Gloves should be removed after use and handwashing performed before touching non-contaminated items and environmental surfaces and before tending to another student.

4.2.3 Wounds:

- Handle all wounds as potential MRSA infections until confirmed with culture and sensitivity tests.
- Do not allow other children or employees to contact the infected person's wound or objects with which the infected person may have contaminated unknowingly (bedding, toys, personal care items, etc.)

- Encourage the parent to take the child to the physician.
- Ask the parent to keep you informed of the child's condition and culture results.
- Draining wounds should be kept covered.
- Other persons or children should not come into contact with an employee's or child's infection or wound.
- Non-contact activities are permissible if the wound is covered at all times and the person/child practices good hygiene - frequent hand washing, showering and clean clothes.
- Contact activities should be suspended until the wound is completely healed.
- Clean non-sterile gloves should be used by employees caring for the child's wound or infection.
- Change gloves when moving from one body site to another or from one child to another.

4.2.4 Wound care (if done at day care center or school)

- Follow all instructions exactly as given by the physician.
- Keep the wound covered.
- Change the dressings as instructed by the physician. This is usually at least twice a day or when drainage becomes apparent, whichever is sooner.
- Always wear clean gloves right before touching the site.
- Remove gloves and throw them away before touching any non-contaminated object or other person.
- Wash hands after removal of gloves and when moving from one site or patient to the next.
- Throw away contaminated items used for wound change in a separate bag from regular trash.
- Wash with soap and water reusable items such as scissors and tweezers. Then wipe them with 70% isopropyl alcohol (rubbing alcohol) and allow to air dry. These items can be used again, but only for that child.

4.2.5 Medications:

- Only give antibiotics prescribed by a physician for that child.
- Never share antibiotics or topical treatments.
- Finish all antibiotics prescribed even if the wound has completely healed.
- Never give antibiotics to children or employees to attempt to prevent an infection.
- Misuse or overuse of antibiotics can lead to harm to the child and spread of resistant bacteria.

4.3 Environment disinfection, utensils and laundry (see section 3.9).

Follow routine procedures for cleaning the environment. In general, use routine procedures with a freshly prepared solution of commercially available cleaner such as detergent, disinfectant-detergent or chemical germicide. No special disinfection is recommended. Linens (e.g., from cots) that may contain blood, secretions, or excretions should be handled in a manner to prevent skin, mucous membrane and clothing exposure.

Closing school to be cleaned or disinfected when an MRSA infection occurs

- Covering infections will greatly reduce the risks of surfaces becoming contaminated with MRSA. In general it is not necessary to close schools to "disinfect" them when MRSA infections occur. MRSA skin infections are transmitted primarily by skin-to-skin contact and contact with surfaces that have come into contact with someone else's infection.
- When MRSA skin infections occur, cleaning and disinfection should be performed on surfaces that are likely to contact uncovered or poorly covered infections.
- Cleaning surfaces with detergent-based cleaners or Environmental Protection Agency (EPA)-registered disinfectants is effective at removing MRSA from the environment.
- It is important to read the instruction labels on all cleaners to make sure they are used safely and appropriately.
- Environmental cleaners and disinfectants should not be used to treat infections.
- The EPA provides a list of EPA-registered products effective against MRSA: <http://epa.gov/oppad001/chemregindex.htm>

4.4. School attendance, exclusion

Unless directed by a physician, students with MRSA infections should not be excluded from attending school. Students and staff with a MRSA infection can attend school regularly as long as the wound is covered and they are receiving proper treatment.

Students and staff do not need to be isolated or sent home in the middle of the day if a suspected staphylococcal or MRSA infection is noticed. Wash the area with soap and water and cover it lightly. Those who touch the wound should wash their hands immediately. The student should be encouraged to have the wound looked at by their healthcare provider as soon as possible to confirm a MRSA infection and determine the best course of treatment. The wound should be kept lightly covered until it has dried completely.

Exclusion from school should be reserved for those with wound drainage ("pus") that cannot be covered and contained with a clean, dry bandage and for those who cannot maintain good personal hygiene.

Students with active infections should be excluded from activities where skin-to-skin contact is likely to occur (e.g., sports) until their infections are healed.

4.5 Parent and media notification

Usually, it should not be necessary to inform the entire school community about a single MRSA infection. When an MRSA infection occurs within the school population, the school nurse and school physician should determine, based on their medical judgment, whether some or all students, parents and staff should be notified. Prior to parent notification, discuss the issue with the school administrator. If necessary, consult with the Louisiana Office of Public Health Infectious Disease Epidemiology Section by calling 800-256-2748, a 24-hr phone number.

4.6 Students with immune suppression or HIV

Students with weakened immune systems may be at risk for more severe illness if they get infected with MRSA. These students should follow the same prevention measures as all others to prevent staph infections, including practicing good hygiene, covering wounds (e.g., cuts or abrasions) with clean dry bandages, avoiding sharing personal items such as towels and razors and contacting their doctor if they think they have an infection.

4.7 Closing schools because of an MRSA infection

The decision to close a school for any communicable disease should be made by school officials in consultation with local and/or state public health officials. However, in most cases, it is not necessary to close schools because of an MRSA infection in a student. It is important to note that MRSA transmission can be prevented by simple measures such as hand hygiene and covering infections.

5. Sports

5.1 MRSA is a problem for sports persons

There are several reasons why athletes are concerned about MRSA. Throughout the USA, MRSA infections are becoming more common in community settings, including sports. Staph (including MRSA), are spread by direct contact. In many sports settings, there are many opportunities for direct contact among athletes. Several states, including Louisiana, have reported MRSA infections among wrestling, football teams and other sports teams.

Factors that have been associated with the spread of MRSA skin infections include close skin-to-skin contact, openings in the skin such as cuts or abrasions, contaminated items and surfaces, crowded living conditions and poor hygiene.

5.2 Environmental cleaning

- All environmental hard surfaces that may come in contact with body fluids should be (1) cleaned and (2) sanitized daily with an EPA-approved disinfectant, including benches, weights, workout machines, etc.
- All floors/wall padding in athletic settings should be washed daily (if room is used).
- Locker rooms, including any shower areas should be cleaned daily, if used. If soap is furnished, it should NOT be bar soap and it should be accessible from a wall dispenser.
- Towels should not be shared. If they are washed at school, they should be washed in soap and water at 71°C (160°F) minimum and dried in a hot dryer.
- Ensure that athletic areas, locker rooms and restrooms all have separate cleaning mops and buckets and that all mops (washable micro-fiber heads or disposable mop cloths preferred), and buckets are cleaned regularly.

5.3 Wrestling Room and Mats

- Wipe down padding along walls, benches and door pulls/knobs with a quaternary ammonium (quat) or bleach solution (household bleach diluted 1:100 with water) after practices/matches. Please refer to the manufacturer's directions for recommended contact times for the various disinfectants.
- Clean floors when mats are stored and before mats are used again.
- Use "dedicated" mops to clean athletic areas and wash mop heads on a regular basis. May use Swiffer®- style mop with disposable mop cloths that are discarded after each use.
- May use mat tape to cover small holes and small tears on top and bottom surfaces of mats. Tape mats together for practice as well as for matches to cover up mat sides that are in poor condition.
- Promptly replace mat coverings when there are medium to large holes and/or large areas of excessive wear.
- Clean and sanitize mats before and after practice and matches. When mats are rolled up, all sides of mats should be cleaned before they are rolled up.
- Use "dedicated" mop heads to clean mat surfaces. Wash these mop heads on a regular basis.

5.4 Weight Room

- Replace all torn and worn out padding on weight machines.
- Place wall dispensers with 60% alcohol-based (or greater) hand sanitizer at entrances/exits inside weight room. Athletes/coaches should be instructed to use hand sanitizer when entering and leaving weight room (minimum use, may use more often). If hands are visibly dirty, they should use soap and water to wash before entering the weight room.
- Remove tape from weight bars and grips. (Metal surfaces are easier to wipe down.)
- Wipe down grips on weights and lifting belts at least daily.
- Clean floors, benches, supports, pads, light switches and door pulls/knobs daily.

5.5 Locker Rooms/Shower Rooms

- Provide wall-mounted dispensers for soap in shower room (next to showers).
- Soap dispensers should have disposable soap "unit" refills.
- Provide adequate shower facilities in new and remodeled schools.

5.6 Sports Equipment

- Schedule regular cleanings for sports equipment: balls (footballs, basketballs, baseballs, soccer balls, softballs, volley balls), racket grips, bats, gloves, pads, etc.
- Clean and sanitize sports equipment that comes in direct contact with the skin of players, such as wrestling headgear, football helmets and fencing equipment (including wires), after each use.

5.7. First Aid

- Hand sanitizers (60% alcohol or greater) are in first aid kit –to be used when soap and water are not available.
- When caring for any athlete injury, disposable gloves are used and hands are sanitized, both before and after providing first-aid.
- Scoops are used (not hands) to take ice out of cooler to make ice packs for injuries. Scoop is cleaned daily when in use and NOT stored in ice container.
- Single-use portions of antibiotics, salves and other ointments are removed from any larger dispensing unit prior to application. Any un-used product is NOT returned to the original dispenser, but discarded.
- Athletes with open, potentially contagious wounds are kept from participating in contact sports until wounds have healed. Athletes are prohibited from wrestling until wounds have healed - even if wounds are covered.
- Athletes with potential skin infections are referred to the team physician or their own medical provider.

5.8 Coach

- Include 60% or greater alcohol-based hand sanitizer in coach's first aid kit so that coaches/trainers will always be able to sanitize hands before and after caring for each injured player when soap and water is not readily available.
- Have disposable gloves readily available in first aid kit for use when caring for the scrapes and cuts of players. Use gloves once then discard, wash hands or use hand sanitizer immediately after removing gloves.
- Check athletes for skin infections before practice or games/matches. Do not let athletes participate in wrestling if they have potentially contagious wounds, even if covered. Consider not letting athletes participate in any contact sport if they have a potentially contagious wound.
- Refer athletes with potential skin infections either to the team physician or their own medical provider. Culturing wounds should be encouraged.
- Use scoop (not hands) when taking ice out of cooler to make ice packs to treat sports injuries. Also, clean scoop daily when in use and do not store scoop in ice cooler.
- Do not have shared "drinking" water bottles; each player should have his/her own water container.
- Shower immediately after matches/games/practices when there is physical contact with the athletes.

5.9 Athlete

- Remind athletes that washing their hands with warm, soapy water frequently is one of the best things they can do to prevent MRSA and other diseases.
- Strongly encourage showering with soap and water immediately after practice/games/matches.
- Remind athletes NOT to share personal hygiene items (bar soap, towels, razors), clothing or water bottles.
- Remind athletes NOT to share antibiotics or ointments and salves.
- Remind athletes NOT to touch other peoples' skin infections.
- Remind athletes NOT to touch face, nose or groin while in practice/matches/games.
- Ask athletes to consider refraining from cosmetic shaving.
- Ask athletes to treat any draining wound as a potential skin infection.
- Encourage athletes who use the weight room to wear workout clothing that minimizes contact with benches, weight equipment, etc.
- Remind athletes to wear practice clothes/uniforms only once, then wash them with soap and water and dry in a hot dryer.
- Remind athletes to report skin abrasions, wounds and potential skin infections to a coach/trainer and/or the school nurse.
- Ask athletes to avoid whirlpools or common tubs. Individuals with scratches or open wounds can easily infect others in this kind of environment.
- Inform parents of all these precautionary measures.

5.10 Education of Athletes/Parents

- Athletes are encouraged to follow good hygiene practices, including frequent hand washing, showering immediately following each practice or competition and NOT sharing “drinking” water bottles.
- Athletes are instructed to NOT share personal hygiene items (bar soap, razors etc.), or topical ointments, antibiotics and salves.
- Athletes are encouraged to promptly report abrasions, lacerations or skin infections to a coach/team trainer, or school nurse.
- Athletes are encouraged to refrain from cosmetic shaving and from using whirlpools or common tubs.
- Athletes who use weight room are encouraged to wear workout clothes that minimize skin contact with benches and equipment.
- Athletes are reminded to wash practice clothes/uniforms with soap and warm water and dry in a hot dryer.
- Patients are informed of infection control precautionary measures, such as the importance of hand washing, showering immediately after sports activities and washing practice clothes/uniforms after they are worn once.

5.11 Outside Groups Using High School Athletic Facilities

- Continue to ensure that custodians know schedule for outside events and are available to clean before students use any of the equipment/facilities.
- Instruct outside groups to use the “standard school-recommended” cleaning products if they are responsible for any cleaning (i.e. wrestling mats, weight room equipment, shower facilities).

6. Prisons and Jails

6.1 MRSA is a problem for prison healthcare

There are several reasons why prison health professionals are concerned about MRSA. Throughout the USA, MRSA infections are becoming more common in community settings, including prisons. Staph, (including MRSA), are spread by direct contact. In prison settings, there are many opportunities for direct contact among inmates. MRSA outbreaks can cause much anxiety for inmates and staff and MRSA infection can vary widely in severity. Identifying a MRSA infection can be difficult because the symptoms of MRSA infection are similar to those of other skin infections.

6.2 Management of an inmate reported to have MRSA

Consider taking the following steps:

- Confirm the diagnosis. This may require contacting a medical provider to ensure that accurate medical information is available.
- Follow routine infection control precautions. Use the following infection control precautions with an inmate who has MRSA infection if staff has to touch the inmate:
 - Wear gloves when handling the inmate, or touching blood, body fluids, secretions, excretions and any items contaminated with these fluids. Gloves should be used before touching mucous membranes and non-intact skin. Gloves should be removed after use and handwashing performed before touching non-contaminated items and environmental surfaces and before tending to another inmate.
 - Linens that may contain blood, secretions, or excretions should be handled in a manner to prevent skin, mucous membrane and clothing exposure.
 - Follow routine procedures for cleaning the environment. In general, use routine procedures with a freshly prepared solution of commercially available cleaner such as detergent, disinfectant-detergent or chemical germicide. No special disinfection is recommended.

6.3 Personal Hygiene for all inmates and employees:

- All employees and inmates should have ample access to soap, water and clean towels.
- Small alcohol-based hand sanitizers can be beneficial for employees to carry when soap and water is unavailable.
- Commercial disinfectants or bleach solutions (as described earlier) should be used to daily clean equipment or other parts of the facility especially those which have come in contact with the infected person.
- Phenol-containing sprays such as Lysol® can be used to disinfect upholstered/cloth surfaces.
- Soiled laundry should be carried in a plastic or waterproof container and hands should be washed thoroughly after handling any laundry.

6.4 Assessment of Wound:

- Treat all wounds as potential MRSA infections until confirmed with culture and sensitivities.
- Do not allow other inmates to contact the infected person's wound or objects with which the infected person may have contaminated unknowingly (bedding, exercise equipment, personal care items, etc.)
- Arrange for the patient to be seen by a healthcare provider.
- Address concern for MRSA with the physician and ask for the results of the culture and sensitivities.
- If pus continues to build under the skin without drainage, a physician should be consulted to determine if surgical drainage of the wound is necessary.

6.5 Wound care:

Follow all instructions given by the physician exactly.

- Keep the wound covered.
- The infected patient should have no contact with other individuals until the wound is completely healed.
- If possible, the individual should be given his/her own cell.
- Train the individual properly on changing his/her own wound cleanly if the individual is able to do so.

- Change the dressings as instructed by the physician. This is usually at least twice a day or when drainage becomes apparent; whichever is sooner.
- Always wear clean gloves right before touching the site.
- Remove gloves and throw them away before touching any non-contaminated object or other person.
- Wash hands after removal of gloves and when moving patient from one site to the next.
- Throw away contaminated items used for wound change in a separate bag from regular trash.
- Wash with soap and water reusable items such as scissors and tweezers. Then wipe them with 70% isopropyl alcohol (rubbing alcohol) and allow to air dry. These items can be used again, but only for that individual.

6.6 Medications:

- Only give antibiotics prescribed by a physician for that individual.
- Never share antibiotics or topical treatments.
- Finish all antibiotics prescribed even if the wound has completely healed.
- Never give antibiotics to other inmates or employees to attempt to prevent an infection.
- Misuse or overuse of antibiotics can lead to harm to the patient and spread of resistant bacteria.

6.7 Inmates with immune suppression or HIV

Inmates with weakened immune systems may be at risk for more severe illness if they get infected with MRSA. These inmates should follow the same prevention measures as all others to prevent staph infections, including practicing good hygiene, covering wounds (e.g., cuts or abrasions), with clean dry bandages, avoiding sharing personal items such as towels and razors and contacting the medical staff if they think they have an infection.

7. Treatment

7.1 Treatment of Infection

MRSA should be considered an infecting organism (as opposed to a colonizing organism or a contaminant) if a positive culture was obtained from a site showing clear clinical signs of tissue inflammation, e.g., purulent drainage, erythema, induration or growth is reported from a normally sterile site.

While serious MRSA infections, such as pneumonia or bacteremia, are grounds for hospital admission, many less severe MRSA infections can be effectively treated in an extended-care facility such as a nursing home, or as an outpatient.

HA-MRSA is frequently resistant to many of the antibiotics available for treatment. Therefore culturing and testing antibiotic sensitivity is essential.

Minimizing the antibiotic pressure that favors the selection of resistant strains is essential in controlling the emergence of these strains in the hospital and the community, regardless of their origin (Chambers, 2001).

Therefore, the physician must exercise clinical judgment to decide whether antibiotic treatment is warranted in addition to local care. Many staphylococcal infections even recurrent furunculosis (American College of Physicians, 1991), do not need antibiotic treatment.

MRSA treatment guidelines are available from different organizations. Since these vary from time to time, it is best to refer to these guidelines available in textbooks of infectious diseases, pocket handbooks and numerous websites.

7.2 Decolonization (in the rare circumstances where decolonization is recommended)

Decolonization refers to treatment of colonized persons with antibiotics or other measures to eradicate the organism from the site of colonization (skin and mucous membranes).

7.2.1 Decolonization in Institutions

Current literature has not conclusively demonstrated that routine decolonization of a person colonized with MRSA is an effective method of infection control (Boyce 1991, Bradley, 1991, Smith, 1991). Treatment of the carrier state among hospital staff appears to have no effect on the spread of MRSA. Additionally, numerous studies of the effectiveness of various antibiotic or antiseptic regimens have failed to provide adequate proof of the overall usefulness of decolonization. It has been suggested in the literature that “decolonization should not be employed in nursing home settings unless patient-to-patient contact can be minimized or eliminated and even then, the ability of the current regimens to eliminate the carrier state in this population must be considered uncertain” (Smith, 1991).

However, there may be medical reasons for the need for elimination of colonizing MRSA:

- If an outbreak and if, upon appropriate laboratory and epidemiological analysis, it appears that a patient or staff member is epidemiologically linked with an outbreak of MRSA, decolonization may be considered.
- If patients who are colonized with MRSA are immunocompromised or are more likely to spread the organisms due to behavior (e.g., developmentally disabled or confused), decolonization could be considered. However, even in these patients, the current literature has not conclusively demonstrated that routine decolonization is effective.
- Decolonization may be used to prevent another recurrence of infection in a patient who has had repeated infections caused by the same strain. (**NOTE:** This does not pertain to those that are only colonized and have never developed infection).

7.2.2 Decolonization Regimens (not routinely recommended):

Numerous antibiotics either used alone or in combination have been used to manage the carrier state with generally poor or inconsistent results. Antiseptics (chlorhexidine, hexachlorophene, povidone-iodine) have been used in handwashing, bathing and shampooing to remove resident MRSA. Currently, there is little or no consensus as to the most effective way to eradicate colonizing MRSA. Specific treatment regimens for decolonization (e.g., treatment of an epidemiologically associated index case), should be made on a case-by-case basis.

It must be understood that the use of antibiotics may prolong the carrier state. Treatment of colonization is not without complications. Failure to eradicate colonization may result in a broader pattern of resistance in MRSA than was present prior to the attempt at decolonization. Indiscriminate use of agents to eradicate colonization potentially creates a strong selective pressure that could encourage the emergence of resistance.

7.2.3 Staff Member Colonized with MRSA

Routine decolonization of staff is not recommended. If MRSA is spread within institutions, it is generally by transfer of organisms from an infected patient to the hands of employees and then to another patient. These employees carry the organisms only transiently (a few hours). Because of this, decolonization is unlikely to impact nosocomial spread and must not replace well-established principles of infection control and hygiene.

7.2.4 Community Associated MRSA

There is no need to decolonize contacts of CA-MRSA (family members, day care students, prison inmates, sports team members, etc.).

7.2.5 Surgical Prophylaxis

“Antimicrobial prophylaxis can decrease the incidence of infection, particularly wound infection, after certain operations, but this benefit must be weighed against the risks of toxic and allergic reactions, emergence of resistant bacteria, drug interactions, super-infection and cost”(Nichols, 2001).

Refer to available guidelines such as:

- The Medical Letter • Vol. 43 (Issue W1116-1117B) October 29, 2001
Medical Letter consultants generally recommend antimicrobial prophylaxis only for procedures with high infection rates, those involving implantation of prosthetic material and those in which the consequences of infection are especially serious.
- Quality Standard for Antimicrobial Prophylaxis in Surgical Procedures Clinical Infectious Diseases 1994;18: 422-7

8. Laboratory Considerations

8.1 Role of the Lab

Laboratories can be of great assistance in detection of MRSA, therefore many assume that all such infections are diagnosed using the microbiology laboratory. However, this may not always be the case. Specimens may not be collected for all suspected MRSA and if a specimen is collected, an etiologic agent may not be identified. Furthermore, a positive laboratory report does not mean the patient has MRSA infection. Isolation of a pathogenic organism may merely represent colonization of the patient by the organism. To accurately interpret laboratory findings, clinical and historical data are needed to confirm the identification of MRSA. Therefore, laboratories can be of benefit in surveillance activities, but laboratory reports are not sufficient for the identification and confirmation of MRSA infection. A cooperative working relationship between the laboratory and infection control practitioner is essential to assess MRSA activity in any facility.

Culture and susceptibility testing methods for identification of *Staphylococcus aureus* should be performed as established by the National Committee of Clinical Laboratory Standards (NCCLS). Upon submission of isolates for MRSA identification, labeling the specimen “MRSA suspect” may expedite and bring attention to proper handling of specimens. In turn, the laboratory should provide reports that should be easy to read, available in one specific location and reported in a timely manner.

Save organisms isolated from culture, if possible, according to the each individual institutional policy or practice. Each facility should establish their own policy or length of time that these isolates should be stored. Storing these isolates may be useful in the event of an outbreak.

MRSA is identified by a bacterial culture and antibiotic sensitivity of the suspected site of infection or colonization (e.g., blood, sputum, urine, wound, exudate, pressure ulcer material). Two criteria are necessary for the organism to be identified as MRSA. First, the organism is identified as *Staphylococcus aureus* or coagulase-positive *Staphylococcus* species. Second, the antibiotic sensitivity test will show that the organism is resistant to oxacillin or methicillin.

8.2 Procedures for Obtaining Cultures to Identify MRSA

8.2.1 Surface cultures of broken skin or weeping lesions

If a culture is needed from broken skin, a pressure ulcer, etc., gently wipe area with a sterile gauze pad moistened with saline. The site should then be swabbed with the culture swab, using a rolling motion. If a Gram stain is indicated, an additional swab should be taken from the site for the Gram stain. If the site is suppurative (pus producing) or shows tissue destruction, culture the area most heavily involved. Indicate the anatomical location of the site that was cultured on the culture requisition form. Gloves must be worn while obtaining cultures. Gloves should then be removed, placed in the appropriate waste disposal unit and hands should be thoroughly washed with soap and water.

8.2.2 Cultures of residents with confirmed or suspected deep tissue infections, urinary tract infections and respiratory infections

Follow facility protocols for obtaining sterile specimens for culture from these sites.

8.2.3 Nares (Nostrils)

If a culture of the nares is warranted, the culture should be taken with a sterile swab moistened with sterile saline or culture tube transport medium. The swab should be placed gently in one nostril and allowed to remain 2 to 3 seconds. The same swab can be used for each nostril. The culture swab is then placed in the transport medium and labeled appropriately. The laboratory should be instructed to screen only for MRSA.

8.3. Active Surveillance

The Emerging Pathogens Active Sentinel Surveillance system has been maintained in hospitals that voluntarily participate in reporting monthly lab aggregate data and individual case reports of MRSA, Vancomycin Resistant Enterococci (VRE) and

also Drug Resistant *Streptococcus Pneumoniae* (DRSP). The field epidemiologists have been identifying the primary laboratory contact person in each acute care facility within their assigned regions and are actively recruiting new hospital lab reporting sites to participate in this surveillance activity.

The system collects laboratory data on total number of isolates grown and number that were resistant

- In an effort to standardize denominator data, report one culture per patient, per hospitalization.
- Each month, aggregate totals (minus duplicates on a single patient) for *Staphylococcus aureus*, Enterococcus and *Streptococcus pneumoniae* should be reported – this number includes resistant and susceptible isolates.
- For the same time period, report the number of these isolates which are resistant (VRE, MRSA and DRSP).

9. Management of Outbreaks

- When an outbreak is recognized, immediate reinforcement of infection control procedures (e.g., handwashing, standard precautions) to all staff is necessary.
- Call the Infectious Disease Epidemiology Section at 1-800-256-2748

9.1 Institutional Outbreaks

Assessing the extent of the outbreak:

First establish a case definition for infection and colonization. All patients in the unit or wing where the cases have occurred may need to be cultured for MRSA.

Personnel should be cultured only if symptomatic or epidemiologically linked to transmission. In those situations, cultures should include the nares and any skin lesion. Culture-positive staff should be assessed on a case-by-case basis using the Employee Health Guidelines of the institution.

Nares (nose)

Culturing to establish colonization is generally not indicated. In outbreak settings, in which search for carriers is worthwhile, a culture should be obtained using one sterile swab moistened with sterile saline. The swab should be gently swirled in each anterior nares (the opening of each nostril) for 2 to 3 seconds. The same swab can be used for both nares. The swab should be placed in a transport system and labeled prior to shipping to a qualified laboratory for identification and susceptibility testing. The laboratory should be instructed to screen the specimen for MRSA only.

Surface cultures of broken skin

Standard laboratory protocols should be followed to obtain specimens for culture.

Before a culture is obtained from broken skin (a decubitus ulcer, an open wound, a gastrostomy, or a tracheostomy site), the area should be wiped with a sterile gauze pad moistened with sterile saline. The site should then be swabbed with a sterile culture swab using a gently rolling motion. If the site is purulent, the culture should be obtained from the most heavily involved area. The anatomical site of the specimen(s) should be clearly indicated on the requisition slip.

9.2 Management of Patients and Staff

During an outbreak, all MRSA infected patients should be physically separated from MRSA-negative patients with no staff crossover between the two groups (cohorting). Strict cohorting may not be achievable, but efforts to minimize the number of persons caring for MRSA-positive patients/residents should always be a goal. Two consecutive negative cultures 24 hours apart obtained 48 hours after completion of antibiotics are grounds for release from cohort.

Decolonization of patients or staff is not routinely recommended. This has not proven to be an effective control measure, because recolonization occurs. However, if staff is found to be epidemiologically linked to the outbreak, decolonization may be considered (see Recommendations regarding decolonization).

Patient-care providers who are colonized or infected with MRSA should be educated about the particular importance of handwashing.

Providers who are only colonized or who have infections that can be covered may continue to work except in certain high-risk areas such as newborn nurseries or oncology wards as defined by facilities; providers with open infections that cannot be covered should be excluded from direct patient care until the infections are cleared.

In general, it is not necessary or recommended to treat colonized employees with antibiotics. It may be warranted in an outbreak situation to treat an employee who is epidemiologically linked to the outbreak. This should be done only if there is strong evidence implicating the employee as a transmitter. Multiple specimens may be required in order to determine if the

employee is a part of the outbreak or is only transiently colonized. An epidemiologically linked culture-positive employee should be counseled regarding infection control precautions and any deficiencies should be corrected first. Facilities that consider treating colonized employees should refer to the treatment section of these guidelines.

9.3 Epidemiologic Investigation

Careful surveillance for additional infection or colonization should be undertaken. Weekly patient assessments on previously infected MRSA patients in extended-care facilities may be warranted.

Epidemic analysis of the outbreak should be made, including collecting information on all MRSA-infected patients such as:

- patient's location in the institution (before and after cohorting)
- date of admission and recent previous admissions
- names of caregivers who have had direct contact with the patient
- body site of infection or colonization
- age, sex and race
- diagnosis
- treatment given

These factors should be evaluated for the group of MRSA-infected patients to look for common features which may lead to specific control strategies.

During an MRSA outbreak, there are no reasons a nursing home/extended-care facility or hospital should restrict the transfer of patients between facilities or be closed to new admission, provided there is room. Nursing homes/extended-care facilities may continue to discharge patients, provided the guidelines for admission/discharge are followed. However, restriction of admissions or discharges should occur if it is determined that the facility is not following the proper protocols in caring for the residents already in the facility.

9.4 Pulsed Field Gel Electrophoresis (PFGE) and Phage Typing

PFGE is one tool available to assist public health officials, infection control practitioners, laboratory personnel, physicians, etc. in their efforts to determine if seemingly unrelated isolates of the same organism are indeed the same strain. This has implications in disease surveillance and outbreak investigations. The test is not useful for managing individual patients.

PFGE is a laboratory technique that divides bacterial DNA into fragments. These fragments are embedded into a gel. An electric current is applied to the gel, causing the fragments to move across the gel. This movement leaves a pattern of bands. These bands are compared to determine the relatedness of different organisms. Ideally, the pattern of the bands among the outbreak isolates will be the same while those not related to the outbreak will be different. However, all of the bands from the outbreak organism may not be the same, for various reasons; therefore, the following guidelines are used. Isolates with more than a six band difference are considered unrelated to the outbreak organism. Isolates with a four to six band difference are considered possibly related to the outbreak organism and those with two or three band difference are usually considered subtypes of the outbreak organism.

PFGE does have some limitations-most notably time. It takes on the average 2 to 4 days to prepare organisms for testing. Also, it cannot always distinguish between all strains of an organism. Other typing methods may need to be used in conjunction with PFGE.

Because of the cost of this test, its use will be limited to situations such as nosocomial outbreaks, in which results will clearly assist in prevention and control measures.

Check with the Department of Health and Hospitals, Office of Public Health, Epidemiology Section for further assistance at (504) 219-4563 (ask for your surveillance epidemiologist).

In general, phage typing has been replaced by PFGE to evaluate MRSA isolates from an outbreak.

9.5 Community Outbreaks

Community outbreaks have been reported among prison inmates, players of contact sports, family members, schools and day care centers. Most of the infections were benign skin or soft tissue infections. However, there were rare, severe infections.

Outbreaks occurring in a small group do not need to be investigated. Outbreaks involving large numbers of people are often investigated, but the investigations usually do not provide much information useful for prevention. Most outbreaks are not the result of a single source but result from transmission from person to person. Report an outbreak to Infectious Disease Epidemiology Section and discuss with a Surveillance Epidemiologist the need for an investigation.

The recommendations are:

- Evaluate with appropriate cultures severe infections and treatment failures of presumed *S. aureus* infections.
- Treat infections based on infecting organism's antibiograms
- Educate and recommend good personal hygiene: handwashing (particularly after touching infected lesions) and daily showers
- Employees providing care should follow standard precautions.

Use of PFGE is not routinely recommended in community associated outbreak investigation. Several investigators used PFGE in research projects on CA-MRSA to characterize the genotypes of isolates of CA-MRSA and compared those with the genotypes of HA-MRSA. They found the genotypes of CA-MRSA isolates to be closely related to each other, yet distinguishable from HA-MRSA isolates. This genotypic clustering of CA-MRSA strains vs. HA-MRSA strains has been noted by several investigators (Fey, 2001; Charlebois 2001).

10. SURVEILLANCE

10.1 Passive Surveillance

Invasive MRSA infection (positive culture from a sterile site), is a reportable condition in Louisiana. However MRSA became reportable at a time when infections were not very frequent. Any infection causing signs and symptoms was reportable. Colonization with MRSA was never reportable. With MRSA becoming the predominant *Staphylococcus aureus* strain in hospital and its increasing frequency in community associated staphylococcal infections, passive reporting of all isolates is no longer practical or useful therefore the objective of passive reporting is now **to identify invasive staphylococcal infection to detect any shift in the incidence of virulent invasive MRSA.**

10.1.1 Case Definition of Reportable MRSA

10.1.2 Clinical Case Definition

A disease with signs and symptoms of systemic or focalized infection of internal organ (septicemia, internal abscess ...). **NOTE:** Superficial infection (boils, abscesses, carbuncles...) isolates from urine, sputum, nasal swabs, wound exudates and any other isolate from colonization are not reportable.

10.1.3 Lab Confirmation

Isolation of a methicillin (oxacillin) resistant *Staphylococcus aureus*

10.2 Laboratory Based Surveillance (MRSA and other selected antibiotic resistant microorganisms)

10.2.1 Reporting of Aggregate Data by Participating Laboratories

The goals of the Antibiotic Sensitivity Active Surveillance System is to estimate the percent of selected bacteria in the state that are resistant to antibiotics (MRSA, VRSA, DRSP and VRE), by the reporting of laboratory aggregate data.

Participating microbiology laboratories should report the total number of *Staphylococcus aureus*, *Streptococcus pneumoniae* and enterococcus species isolated in their lab for each month. Among these isolates, the total number of drug resistant or drug intermediate resistant isolates should be reported.

Duplicate isolates on a patient should not be counted.

Aggregate Laboratory Data forms are used for reporting. This form is to be filled out and returned to the Infectious Disease Epidemiology Department by the 20th of the next month. For instance, January data should arrive by the 20th of February. A quarterly and annual report of the cumulative data by public health region and statewide are sent back.

10.2.2 Submission of Isolates by All Laboratories

All cases of Vancomycin Resistant (intermediate or fully resistant) *S. aureus* (VRSA) are still reportable, whatever the site. Culture isolates should be forwarded to the state laboratory.

11. Vancomycin Resistant *Staphylococcus Aureus* (VRSA)

After MRSA became more prevalent in the 1980s, Vancomycin became increasingly used since it was often the only antibiotic effective for the treatment of HA-MRSA life threatening infections. Unfortunately, Vancomycin was also over used, for example, routine surgical prophylaxis, decolonization of patients and treatment of minor infections. In the late 1990s, Vancomycin Intermediate Resistant *S. aureus* (VISA) were reported. The source of the resistance seems to be a transfer of resistance genes, particularly VanA from VRE.

Since 1989, a rapid increase in the incidence of infection and colonization with VRE has been reported by U.S. hospitals. This increase poses important problems such as the possibility that the vancomycin-resistant genes present in VRE can be transferred to other gram-positive microorganisms (e.g., *Staphylococcus aureus*). Conjugative transfer of the VanA gene has been demonstrated in vitro (Noble 1992).

There is much greater concern about VRSA than there is for VRE. VRSA could become the most prevalent staphylococcus infecting humans. Staphylococci are more virulent and cause more infections than enterococci. It is of utmost importance to prevent the dissemination of VRSA.

11.1 Precautions in Institutions

In general, the precautions are the same as for MRSA. Standard and contact precautions should be applied meticulously for all patients since cases of VRSA are present and may go undiagnosed for a long time. A patient with known VISA/VRSA should be placed in a private room and have dedicated patient-care items. HCWs providing care to such patients should follow contact precautions (i.e., wearing gowns, masks and gloves and using antibacterial soap for hand washing).

11.2 Prevention of VRSA Depends on Prevention of VRE

The Hospital Infection Control Practices Advisory Committee for preventing and controlling the spread of vancomycin resistance, with a special focus on VRE was issued in 1995 (HICPAC, 1995). Preventing and controlling the spread of vancomycin resistance will require coordinated, concerted efforts from all involved hospital departments and can be achieved only if each of the following elements is addressed:

- prudent vancomycin use by clinicians
- education of hospital staff regarding the problem of vancomycin resistance
- early detection and prompt reporting of vancomycin resistance in enterococci and other gram-positive microorganisms by the hospital microbiology laboratory
- immediate implementation of appropriate infection-control measures to prevent person-to-person transmission of VRE

For further recommendations see:

MMWR September 22, 1995 / 44(RR12); 1-13: Recommendations for Preventing the Spread of Vancomycin Resistance - Recommendations of the Hospital Infection Control Practices Advisory Committee (HICPAC)

11.3 Laboratory Reporting

Whenever resistance is suspected, *S. aureus* should be tested for resistance to vancomycin using a MIC method. The isolation of *S. aureus* with confirmed or presumptive vancomycin resistance should be reported immediately to the Office of Public Health and an isolate forwarded to the State Laboratory.

These isolates are of national interest and will be forwarded to the CDC laboratories.

GLOSSARY

BODY SUBSTANCE ISOLATION: An infection control measure used to prevent transmission of infectious organisms from person-to-person. **Body substance isolation is no longer used.** New Isolation guidelines were issued by CDC in 1996 that has rendered this term obsolete.

CARRIER: A person who is colonized with methicillin-resistant *Staphylococcus aureus* (MRSA). The organism may be present in the nares (nose), sputum, urine, an open wound, in the stool or on the skin without clinical manifestations of disease. A carrier may transmit the organism to another person through direct contact, usually by contact with hands.

COHORT: A group of MRSA positive patients (infected or colonized), who is physically separated, grouped together (as much as is architecturally allowed), during an outbreak and cared for by staff who do not care for MRSA negative patients.

COLONIZATION: Presence of MRSA on tissue without the presence of symptoms or clinical manifestations of illness or infection. A carrier is a person who is colonized with MRSA.

DECOLONIZATIONS: Elimination of MRSA carried by persons through the use of infection control measures and/or antibiotics.

DRSP: Drug Resistant *Streptococcus Pneumoniae*

ENDEMIC RATE: The usual rate or prevalence of persons infected and/or colonized with MRSA in a facility. The endemic rate in each facility will be unique.

EPIDEMIC: See Outbreak

EPIDEMIOLOGICALLY-LINKED: The finding of a factor or factors that may relate to the spread of MRSA and that are shared by patients with MRSA, e.g., care by a common infected employee, sharing a room.

ERADICATION: Elimination of infections and/or colonization of MRSA in a facility through implementation of infection control and hygiene measures and/or antibiotics.

FOMITE: An inanimate object that may become contaminated by pathogenic organisms, such as MRSA. Examples include stethoscopes, blood pressure cuffs, handkerchiefs, bed linens and clothing.

GISA: Glycopeptide-Intermediate *S. aureus*. The term glycopeptide refers to a group of antimicrobial agents that includes vancomycin and teicoplanin. Since the first two VISA isolates in the United States were also resistant to teicoplanin, the term glycopeptide-intermediate *S. aureus* (GISA) was used to indicate this broader resistance profile. While GISA may be a more specific term for strains intermediate to both vancomycin and teicoplanin, not all VISA strains are intermediate to teicoplanin; therefore, VISA is a more accurate and more widely used term.

INFECTION: Invasion and multiplication of MRSA in tissue with the manifestation of clinical symptoms of infections such as increased white blood cell count, fever, lesions, boils, drainage from a break in skin continuity and erythema.

INVASIVE DISEASE: Clinical manifestations of symptoms caused by MRSA such as furuncles, boils, pneumonia, carbuncles, septicemia, or osteomyelitis.

INVASIVE SITE: Any place on an individual's body where the normal skin or mucous membrane barrier is broken, either by natural or artificial means, including decubitus ulcers, surgical incisions, intravenous or urinary catheters and feeding gastrostomy or jejunostomy sites.

MLST: Multi-Locus Sequence Typing is an unambiguous procedure for characterising isolates of bacterial species using the sequences of internal fragments of seven house-keeping genes. Approximately 450 to 500 internal fragments of each gene are used, as these can be accurately sequenced on both strands using an automated DNA sequencer. For each house-keeping gene, the different sequences present within a bacterial species are assigned as distinct alleles and for each isolate, the alleles at each of the seven loci define the allelic profile or sequence type (ST).

MRSA (METHICILLIN-RESISTANT STAPHYLOCOCCUS AUREUS): A gram-positive bacteria that grows in clusters like grapes and is coagulase positive and is resistant to methicillin and other semisynthetic antibiotics (e.g., nafcillin and oxacillin) that are effective against most strains of *S. aureus*.

MSSA (METHICILLIN-SENSITIVE STAPHYLOCOCCUS AUREUS): a *STAPHYLOCOCCUS AUREUS* STRAIN THAT IS STILL SENSITIVE TO OXACILLIN AND METHICILLIN.

NOSOCOMIAL INFECTION: An infection associated in a hospital, nursing home, or other health care facility.

OUTBREAK: In hospitals: Three or more cases of epidemiologically linked MRSA infections within 30 days of hospitalization

In nursing homes/extended-care facilities: Three or more cases of epidemiologically linked MRSA infections within a 30 day period, OR any substantial increase in number of cases from the endemic rate even if not epidemiologically linked.

PFGE (Pulse Field Gel Electrophoresis) is a laboratory technique that divides bacterial DNA into fragments. These fragments are embedded into a gel. An electric current is applied to the gel, causing the fragments to move across the gel. This movement leaves a pattern of bands. These bands are compared to determine the relatedness of different organisms. Ideally, the pattern of the bands among the outbreak isolates will be the same while those not related to the outbreak will be different. However, all of the bands from the outbreak organism may not be the same, for various reasons; therefore, the following guidelines are used. Isolates with more than a six band difference are considered unrelated to the outbreak organism. Isolates with a four to six band difference are considered possibly related to the outbreak organism and those with two or three band difference are usually considered subtypes of the outbreak organism.

SA (*Staphylococcus Aureus*): A gram-positive bacteria which grows in clusters like grapes and is coagulase positive; SA may be sensitive to methicillin, cephalosporins, nafcillin and oxacillin, in which case it is referred to as MSSA (methicillin-sensitive *Staphylococcus aureus*).

SURVEILLANCE: Monitoring of patient data at regular intervals to determine the number and characteristics of new infections and distribution within a facility.

SUSCEPTIBILITY TESTING: The laboratory tests used to determine if an organism could be effectively treated with particular antibiotics. Patterns of antibiotic susceptibility of MRSA isolates can be used to indicate epidemiologic linkage and identify outbreaks. The only antibiotic susceptibility tests that are of importance in determining antibiotic therapy for MRSA infections are penicillin, oxacillin, vancomycin and TMP-SMX.

TRANSMISSION: The passage of MRSA from a colonized or infected individual to a person previously free of the organism.

VRSA (VANCOMYCIN-RESISTANT STAPHYLOCOCCUS AUREUS): A gram-positive bacteria that grows in clusters like grapes and is coagulase positive and is resistant to vancomycin.

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Table of Contents

1. Introduction & Basic Facts About MRSA.....	1
1.1 <i>Staphylococcus aureus</i> (<i>S. aureus</i>)	1
1.2 Penicillin and Methicillin.....	1
1.3 MRSA Started in Hospitals and Other Medical Care Institutions: Hospital Associated MRSA or HA-MRSA.....	1
1.4 MRSA as a Community Associated Organism (CA-MRSA).....	2
1.5 Colonization.....	2
1.6 Risk factors for colonization.....	3
1.7 Prevalence.....	3
1.8 Transmission.....	3
1.9 Virulence.....	4
1.10 Clinical.....	4
2. Management of MRSA In Institutions.....	5
2.1 Hospital Admission.....	5
2.2 Nursing Home/Extended Care Facility.....	5
2.3 Discharge to Private Home.....	5
2.4 Infection Control in Institutions.....	5
2.4.1 Standard Precautions and Contact Precautions.....	6
<i>From CDC’s Hospital Infection Control Practices Advisory Committee Recommendations for Isolation Precautions in Hospitals available at http://www.cdc.gov/ncidod/hip/ISOLAT/isopart2.htm</i>	
.....	6
2.4.2 Hand Hygiene recommendations.....	8
<i>CDC Guideline for Hand Hygiene in Health-Care Settings: Recommendations of the Healthcare Infection Control Practices Advisory Committee and the HICPAC/SHEA/APIC/IDSA Hand Hygiene Task Force available at http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5116a1.htm</i>	
.....	8
Surveillance and Management of MRSA in Institutions.....	10
2.5.1 Screening.....	10
2.5.1.1 The case for screening with active surveillance cultures.....	10
2.5.1.2 The European “search and destroy approach is not (yet) recommended.....	11
2.5.1.3 Previous US recommendation: -Optional systematic screening of patients -No screening of staff unless in an outbreak situation.....	11
2.5.1.4 Conduct culture surveys to assess the efficacy of the enhanced MRSA control interventions.....	11
2.5.2 Culturing Patients.....	12
2.5.3 Decolonization.....	12
2.5.3 Surveillance Data Collection and Analysis.....	12
2.6 Other Preventive Measures Applicable to Institutions.....	13
2.6.1 Modifications to Standard /Contact Precautions.....	13
2.6.2 Infected Health Care Worker.....	13
2.6.3 Prevention of Antibiotic Resistance.....	13
2.6.4 Skin Breakdown.....	14
3. Hemodialysis and End Stage Renal Disease (ERSD) patients.....	14
3. Management of Community Associated MRSA.....	15

3.1. Discharge of MRSA Patient in the Community	15
3.2. Education	15
3.3. Screening	15
3.4. Culture	15
3.5. Reporting requirements for MRSA.....	15
3.6. Personal care guidelines.....	15
3.7. Preventing spread to others.....	16
3.8. Pets and MRSA.....	16
3.9. Environment disinfection, utensils and laundry	17
3.9.1. Home disinfection.....	17
3.9.2. Laundry: Dirty clothes and bedding can spread MRSA bacteria.	17
3.9.3. Facility	17
4. Day Care, Schools.....	18
4.1. Hand washing and hand care	18
4.2. Management of a student reported to have MRSA.....	18
4.2.1. Confirm the diagnosis.	18
4.2.2. Follow routine infection control precautions.....	18
4.2.3. Wounds:	18
4.2.4. Wound care (if done at day care center or school)	19
4.2.5. Medications:.....	19
4.3. Environment disinfection, utensils and laundry see section 3.7.....	19
4.4. School attendance, exclusion.....	19
4.5. Parent and media notification	20
4.6. Students with immune suppression or HIV	20
4.7. Closing schools because of an MRSA infection.....	20
5. Sports	21
5.1. MRSA is a problem for sports persons.....	21
5.2. Environmental cleaning	21
5.3. Wrestling Room and Mats	21
5.4. Weight Room.....	21
5.5. Locker Rooms/Shower Rooms	21
5.6. Sports Equipment.....	22
5.7. First Aid	22
5.8. Coach	22
5.9. Athlete.....	22
5.10. Education of Athletes/Parents.....	23
5.11. Outside Groups Using High School Athletic Facilities	23
6. Prisons and Jails.....	24
6.1. MRSA is a problem for prison healthcare	24
6.2. Management of an inmate reported to have MRSA	24
6.3. Personal Hygiene for all inmates and employees:	24
6.4. Assessment of Wound:	24
6.5. Wound care:	24
6.6. Medications:.....	25
6.7. Inmates with immune suppression or HIV	25
7. Treatment	26
7.1. Treatment of Infection	26

7.2. Decolonization (in the rare circumstances where decolonization is recommended).....	26
7.2.1 Decolonization in Institutions	26
7.2.2. Decolonization Regimens (not routinely recommended):	26
7.2.3. Staff Member Colonized with MRSA	27
7.2.4. Community Associated MRSA.....	27
7.2.5. Surgical Prophylaxis	27
8. Laboratory Considerations.....	28
8.1. Role of the Lab.....	28
8.2. Procedures for Obtaining Cultures to Identify MRSA	28
8.2.1. Surface cultures of broken skin or weeping lesions	28
8.2.2. Cultures of residents with confirmed or suspected deep tissue infections, urinary tract infections and respiratory infections.....	28
8.2.3. Nares (Nostrils).....	28
8.3. Active Surveillance.....	28
9. Management of Outbreaks.....	30
9.1. Institutional Outbreaks.....	30
9.2 Management of Patients and Staff	30
9.3 Epidemiologic Investigation	31
9.4 Pulsed Field Gel Electrophoresis (PFGE) and Phage Typing	31
9.5 Community Outbreaks	31
10. SURVEILLANCE	33
10.1. Passive Surveillance	33
10.1.1. Case Definition of Reportable MRSA	33
10.1.2. Clinical Case Definition.....	33
10.1.3. Lab Confirmation.....	33
10.2. Laboratory Based Surveillance (MRSA and other selected antibiotic resistant microorganisms)	33
10.2.1. Reporting of Aggregate Data by Participating Laboratories	33
10.2.2. Submission of Isolates by All Laboratories	33
11. Vancomycin Resistant <i>Staphylococcus Aureus</i> (VRSA).....	34
11.1 Precautions in Institutions.....	34
11.2 Prevention of VRSA Depends on Prevention of VRE.....	34
11.3 Laboratory Reporting.....	34
GLOSSARY	35
Bibliography	37