SURVEILLANCE PROTOCOL
Staphylococcus aureus Infections of Public Health Significance: Community-Acquired Methicillin Resistant *Staphylococcus aureus* (CA-MRSA) Infections and Vancomycin Intermediate or Vancomycin Resistant *Staphylococcus Aureus* (VISA/VRSA) infections, also called Glycopeptide Intermediate or Glycopeptide Resistant Staphylococcus Aureus (GISA/GRSA)

Public Health Action

1. Educate laboratories and providers to report suspect or confirmed cases of vancomycin resistant or vancomycin intermediate resistant *Staphylococcus aureus* to the local health department immediately.

2. Request reporting of outbreaks of methicillin resistant *Staphylococcus aureus* on the basis of 64CSR7.3.3.b.15: 'outbreak or cluster of any illness or condition, suspect or confirmed.' Request voluntary reporting of community-acquired methicillin-resistant *Staphylococcus aureus* as a condition of public health importance and as part of a continuing outbreak investigation of community-acquired MRSA associated with inmates in corrections and regional jails in West Virginia.

3. Educate providers and the general public about appropriate antimicrobial use.

4. Educate hospitals about facility-based and community-based interventions for control of antimicrobial resistance in hospitals.

5. If a case of CA-MRSA infection is reported,
   a. Investigate as follows:
      i. Determine if the case meets the case definition:
         (1) Culture-confirmed MRSA from any site; plus
         (2) Clinical signs of infection, including, but not limited to, fever and signs of systemic illness or local inflammation (warmth, redness, swelling, tenderness); plus
         (3) Absent history of hospital or nursing home stay during the previous year.
      ii. Complete the *Staphylococcus aureus* supplemental investigation form. Attach laboratory test results and completed yellow card and forward to IDEP.
      iii. Assure that the isolate is transmitted to Office of Laboratory Services for PFGE.
   b. Educate the patient about appropriate antibiotic use, hand hygiene and transmission of resistant *Staphylococcus aureus*.
   c. Collaborate with IDEP to alert the medical community regarding this unusual occurrence.

6. If an outbreak of CA-MRSA is reported:
    a. Consult IDEP. Likely, you will be requested to initiate the investigation with the supplemental investigation form using a variation of this expanded working case definition:
        i. Positive culture for MRSA from any site (either colonization or infection) OR history of skin infection AND epidemiological link to a culture-positive case AND no culture obtained.
    b. Make certain all isolates are transmitted to the Office of Laboratory Services;
    c. Collaborate with IDEP to develop control recommendations and alert the local medical community to the occurrence of CA_ MRSA.

7. If a case of probable/possible vancomycin resistant or vancomycin intermediate *Staphylococcus aureus* is reported, assure that all of the following is accomplished immediately (MMWR, 1997; 46:624):
    a. The isolate(s) must be forwarded to the Office of Laboratory Services immediately for confirmation.
    b. The patient must be isolated according to CDC recommendations:
        i. Private room
        ii. Contact precautions (gown, mask, gloves, antibacterial soap for hand washing)
        iii. Minimize the number of persons with access to colonized and infected patients
        iv. Dedicate specific health care workers to provide one-on-one care for the colonized or infected patient or the cohort of colonized and infected patients.
    c. Infection control should:
        i. Inform all personnel providing direct patient care of the epidemiologic implication of such strains and of the infection-control precautions necessary for their containment;
        ii. Monitor and strictly enforce compliance with contact precautions and other recommended infection-control practices;

8. If vancomycin resistance or intermediate resistance is confirmed, infection control should (MMWR, 1997; 46:624):
    a. Determine whether transmission has already occurred by obtaining baseline cultures (before initiation of precautions) for staphylococci with reduced susceptibility to vancomycin form the anterior nares and hands o all health-care workers, roommates, and others with direct patient contact;
    b. Assess efficacy of precautions by monitoring health-care personnel for acquisition of staphylococci with reduced susceptibility to vancomycin in consultation with IDEP;
    c. Avoid transfer of patients within or between facilities, and if transfer is necessary, fully inform the receiving institution or unit of the patient's colonization/infection status and appropriate precautions; and
    d. Consult with IDEP prior to discharge.

9. For all confirmed cases of vancomycin resistant or vancomycin intermediate resistant *Staphylococcus aureus*:
   a. Complete a yellow card, front and back. Attach laboratory studies. Attach a completed *Staphylococcus aureus* supplemental investigation form. Forward the completed report to IDEP.
   b. Collaborate with IDEP and infection control in completing a contact investigation and a full epidemiological investigation, including additional laboratory studies and interviews of contacts.

Disease Control Objectives

1. When a case of VISA/VRSA is identified, prevent the development of new cases by:
   a. Appropriate isolation;
   b. Appropriate contact investigation with isolation of infected or colonized contacts;
   c. Appropriate monitoring of hospital staff to assure adherence to infection control measures.
2. When an outbreak of resistant staphylococcal infection is identified, prevent additional cases by: appropriate investigation and implementation of control measures.

Disease Prevention Objectives

1. Prevent cases of resistant *Staphylococcus aureus* by education of health care providers and the general public about:
   a. Appropriate use of antibiotics, including / especially vancomycin;
   b. Appropriate management (screening / isolation) of patients with resistant infections including methicillin-resistant *Staphylococcus aureus* and vancomycin resistant *Staphylococcus aureus*.
   c. Considerations for implementation of community-based and facility-based measures to reduce nosocomial transmission of resistant organisms.

Disease Surveillance Objectives

1. Detect the first case of VISA/VRSA when it occurs in West Virginia.

2. Detect secondary cases of VISA/VRSA colonization or infection, if they occur in West Virginia.

3. Characterize persons with VISA/VRSA, including medical history, underlying disease, and risk factors (including breaks in skin integrity and previous hospitalization and previous antibiotic use).

4. Detect community-acquired cases of MRSA in West Virginia.

5. Characterize risk factors for community-acquired MRSA in West Virginia.

Public Health Significance

Staphylococcus aureus is uniquely adapted to cause disease in humans. The reservoir for the bacteria is the anterior nares in humans; 40% of people are colonized with *Staphylococcus* at any given time. Colonization means that the bacteria is carried in the body without causing illness. Many individuals are persistently colonized (estimated half-life of colonization is 40 months); others are intermittently colonized. Many who are nasally colonized also carry the organism on their hands, and this likely represents the major mode of transmission from one person to another. Nosocomial transmission of *Staphylococcus aureus* occurs primarily via the hands of health care workers. Rates of staphylococcal colonization and infection are increased in persons with diabetes, patients on dialysis (hemodialysis or peritoneal dialysis), injecting drug users and others with disturbances of skin integrity (e.g., burns, indwelling lines, etc.). Persons with human immunodeficiency virus infection are also at increased risk for colonization and infection with *Staphylococcus*.

Staphylococci can also survive dessication for days to weeks, and can travel great distances through the air. Nasal carriers and patients with burns can shed large numbers of organisms into the air. It is uncertain to what extent aerial dissemination plays a role in transmission.

While colonization obviously does not result in infection in most persons, infections with *Staphylococcus* can be life-threatening. The organism is virulent and invasive. Sepsis can result in rapid multi-organ failure and death. Deep-seated infections in bones or soft tissue can occur anywhere in the body, and are extremely difficult to treat, requiring weeks of antibiotics.

In addition to these characteristics, *Staphylococcus aureus* has developed resistance to almost every antibiotic ever used to treat it. By the late 1950's, almost 50% of all strains were resistant to penicillin. In 1960, methicillin – a penicillinase-resistant beta-lactam – was discovered to be effective in treatment of *Staphylococcus*. Methicillin-resistant strains of staphylococci emerged in the late 1970's, and have added enormously to the expense of modern hospital care because of the money required to treat and isolate patients infected with this organism. Once only found in tertiary medical care centers, MRSA subsequently spread to nursing homes and smaller community hospitals. In the last few years, MRSA has even been identified as a cause of community-acquired infection in previously healthy children, with a few resultant deaths. Unfortunately, MRSA has maintained the virulence of the native organism. There is no difference in mortality among hospitalized inpatients with MRSA and methicillin-sensitive *Staphylococcus aureus*.

Vancomycin intermediate resistant *Staphylococcus aureus* was first identified in Japan in 1996. Several VISA cases have been reported in the U. S. from patients on peritoneal dialysis. All patients had previous infections with MRSA, and had received vancomycin therapy. The first case of vancomycin resistant staphylococcus aureus was reported in 2002.

In recent years MRSA outbreaks have been reported in children attending child care, inmates and men who have sex with men. During 2003, four outbreaks of Community-acquired MRSA were investigated in West Virginia. One outbreak occurred in state corrections and regional jails. Three other outbreaks occurred in close-knit family or social groups in locations widely scattered across West Virginia.

Clinical Description

Staphylococcus aureus is a major cause of skin infections (e.g., cellulitis, boils, impetigo, etc), soft-tissue infections including abscesses, respiratory infections including pneumonia and sinusitis, bone, joint and endovascular infections (e.g., endocarditis, vascular graft infections, etc.). Serious infections include bacteremia, endocarditis, metastatic infections, sepsis and Staphylococcal toxic shock syndrome.

Investigators should be certain they understand the difference between colonization and infection:

- *Infection* = positive culture + clinical signs of illness or inflammation likely due to invasion by the bacterium.
- *Colonization* = positive culture + no signs of illness or inflammation

Etiologic Agent

The gram positive bacteria *Staphylococcus aureus*.

Reservoir

Humans, and rarely animals.

Mode of Transmission

The major site of colonization is the anterior nares; 20-30% of the general population are nasal carriers of coagulase-positive staphylococci. Autoinfection is responsible for at least one-third of infections. Persons with a draining lesion or any purulent discharge are the most common sources of epidemic spread. Transmission is through contact with a person who either has a purulent lesion or is an asymptomatic (usually nasal) carrier of a pathogenic strain. Some carriers are more effective disseminators of infection than others. The role of contaminated objects has been over stressed; the hands are the most important instrument for transmitting infection. Airborne spread is rare, but has been demonstrated in infants with associated viral respiratory disease.

Incubation Period

Variable and indefinite; commonly 4-10 days.

Period of Communicability:

As long as purulent lesions continue to drain or the carrier state persists. Autoinfection may continue for the period of nasal colonization or duration of active lesions.

Outbreak Recognition

Since no case of vancomycin intermediate or vancomycin resistant *Staphylococcus aureus* has ever been identified in West Virginia, one case is defined as an outbreak.

In West Virginia, cases of community-acquired MRSA have to date only been identified in regional jails and correctional facilities in our state. Therefore, one community-acquired case is defined as an outbreak. WVDHHR is continuing to ask for reporting of MRSA cases in regional jails and corrections as part of an ongoing outbreak investigation. Other community-acquired cases should also be reported.

In hospitals and health care facilities, an outbreak of MRSA is defined as the occurrence of MRSA cases above the normally expected rate.

Case Definition S*taphylococcus aureus* (SA) infection with decreased susceptibility to vancomycin, including both vancomycin-intermediate and vancomycin resistant *Staphylococcus aureus*

Clinical Description

Staphylococcus aureus can produce a variety of syndromes with clinical manifestations including skin and soft tissue lesions, empyema, and pyarthrosis, bloodstream infections, pneumonia, osteomyelitis, septic arthritis, endocarditis, sepsis and meningitis

Laboratory Criteria for Diagnosis

1. Isolation of *Staphylococcus aureus* from any body site; and

2. Intermediate or high level resistance of the SA isolate to vancomycin according to the NCCLS approved standards and recommendations (MIC 8-16 µg per ml for VISA and MIC $\geq$ 32 µg per ml for VRSA)

Case Classification

Confirmed: A clinically compatible case of vancomycin intermediate or vancomycin resistant *Staphylococcus aureus* that is laboratory confirmed (MIC 8-16 µg per ml for VISA and MIC $\geq$ 32 µg per ml for VRSA)

Comment: A standardized data collection form should be used for all reported Vancomycin Intermediate or vancomycin resistant *Staphylococcus aureus* through the National Notifiable Disease Surveillance System (NNDSS).

Case definition for community acquired methicillin resistant *Staphylococcus aureus* infection *(draft working case definition)*

Clinical Description

Staphylococcus aureus can produce a variety of syndromes with clinical manifestations including skin and soft tissue lesions, empyema, and pyarthrosis, bloodstream infections, pneumonia, osteomyelitis, septic arthritis, endocarditis, sepsis and meningitis

Laboratory Criteria

1. Isolation of Staphylococcus aureus from any body site; and

2. Resistance to oxacillin (Methicillin-resistant strains are resistant to oxacillin and all other β-lactam drugs, including the cephalosporins).

Epidemiological Criteria

Absent history of hospital or nursing home stay in the year prior to onset.

Case Classification

Confirmed: A clinically compatible case of methicillin resistant *Staphylococcus aureus* that meets the epidemiological criteria and is laboratory confirmed.

Expanded working case definition for *outbreaks* of possible community acquired methicillin resistant *Staphylococcus aureus* infection *(draft working case definition)*

Clinical Description

Staphylococcus aureus infection can produce a variety of syndromes with clinical manifestations including skin and soft tissue lesions, empyema, and pyarthrosis, bloodstream infections, pneumonia, osteomyelitis, septic arthritis, endocarditis, sepsis and meningitis.

Staphylococcus aureus colonization is not associated with clinical signs of illness or inflammation.

Laboratory Criteria

1. Isolation of Staphylococcus aureus from any body site; and

2. Resistance to oxacillin (Methicillin-resistant strains are resistant to oxacillin and all other β-lactam drugs, including the cephalosporins).

Epidemiological Criteria

Absent history of hospital or nursing home stay in the year prior to onset.

Case Classification

Probable:	A clinically compatible case that meets the epidemiological criteria and is epidemiologically-linked to a confirmed case.
Confirmed (infection):	A clinically compatible case of methicillin resistant *Staphylococcus aureus* that meets the epidemiological criteria and is laboratory confirmed.
Confirmed (colonization):	A case without clinical signs or symptoms that meets the epidemiological criteria and is laboratory confirmed.

Preventive interventions

Health care facilities (hospitals, nursing homes, jails and DOC) should:

1. Maintain a line listing of all bacterial isolates identified in the facility with sufficient information that nosocomial infection rates can be calculated

2. Take measures to reduce unnecessary and inappropriate antimicrobial use

3. Develop policies and procedures to identify and isolate patients colonized or infected with resistant *Staphylococus aureus*

4. Monitor compliance with infection control procedures, including and especially hand washing

Preventing unnecessary antibiotic use is extremely important in the community as well. WVDHHR has developed physician and patient information sheets on appropriate management of pediatric upper respiratory infections.

Treatment

For treatment of serious *Staphylococcus aureus* infections, nafcillin has been the intravenous drug of choice and multiple effective oral antibiotics are available. Options are more limited with MRSA; vancomycin is the drug of choice for severe infections, although some strains are effectively treated with trimethoprim-sulfamethoxazole and other alternative agents. Vancomycin is more expensive, more toxic and more difficult to administer that the antistaphylococcal penicillins. Preferred regimens for Vancomycin intermediate or resistant staphylococcal infections are unknown, as there is yet little experience with these organisms.

Surveillance indicators

- Proportion of investigations with complete demographic information
- Proportion of cases with complete information on underlying medical condition and risk factors
- Proportion of cases with complete information on history of hospital, nursing home and corrections stay in the past 12 months
- Proportion of cases with specimen source and clinical diagnosis reported
- Proportion of cases with antibiotic sensitivity profile reported