SURVEILLANCE PROTOCOL
Staphylococcus aureus Infections of Public Health Significance: Community-Associated 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)

Provider Responsibilities

1) Report any of the following immediately to your local health department by phone and by completing the provider (yellow) section of the West Virginia Electronic Disease Surveillance System (WVEDSS) form (For copies of all WVEDSS forms, see http://www.wvdhhr.org/idep/a-z/a-z_WV_ReportableDisease_TABLE.asp). Forward the completed WVEDSS form to your local health department and attach a copy of the laboratory slip.
   a) Outbreaks of CA-MRSA. Outbreaks are defined as:
      i) Two or more epidemiologically-linked cases of CA-MRSA occurring in at least two distinct households, including two or more cases occurring in a sports team; OR
      ii) An increase in the incidence of CA-MRSA over the expected incidence specified by person, place and time.
   b) Any case of GISA/GRSA. A single case of GISA/GRSA is defined as an outbreak and should be reported immediately.

2) Report invasive CA-MRSA within one week of diagnosis by completing the provider (yellow) section of the West Virginia Electronic Disease Surveillance System (WVEDSS) form (For copies of all WVEDSS forms, see http://www.wvdhhr.org/idep/a-z/a-z_WV_ReportableDisease_TABLE.asp). Forward the completed WVEDSS form to your local health department and attach a copy of the laboratory slip. Invasive CA-MRSA should meet ALL of the following criteria:
   a) Oxacillin-resistant *Staphylococcus aureus* isolated from blood, CSF, pleural fluid, peritoneal fluid, synovial fluid, pericardial fluid, a sterile surgical specimen or deep aspirate or another sterile site (i.e., not sputum, stool, urine, wound swab, nasal, axillary or groin swab, etc.)
   b) Absent history of hospitalization, nursing home stay or surgery or an indwelling line within the year prior to onset of symptoms.

3) Submit isolates of GISA/GRSA to the Office of Laboratory Services (OLS) immediately for confirmation. OLS may be accessed as follows:
   a) Phone: 304-558-3530
   b) Web: http://www.wvdhhr.org/labservices/index.cfm

c) Mailing address: 167 11th Ave
South Charleston, WV 25303

4) Submit paper copies of laboratory reports to the local health department via fax.

5) Notify infection control immediately and institute control measures for GISA/GRSA immediately upon recognition, as follows (MMWR, 1997; 46:624):
   a) 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.
   b) 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;

6) If vancomycin resistance or intermediate resistance is confirmed by OLS / CDC, infection control should (NEJM 1999; 340:493-501.):
   a) Continue isolation in a private room
      i) Minimize the number of persons caring for the patient
      ii) Begin one-on-one care by specified personnel
   b) Initiate epidemiologic and laboratory investigations with the assistance of IDEP and the CDC.
   c) Educate all health care personnel about the epidemiology of *S aureus* with intermediate resistance to glycopeptides and about appropriate infection-control precautions.
   d) Monitor and strictly enforce compliance with contact precautions.
   e) Determine whether transmission has already occurred by performing base-line cultures of specimens from hands and nares of the following:
      i) Those with physical contact with the patient
      ii) The patient's health care providers
      iii) The patient's roommates.
   f) Continue contact precautions (gown, mask, gloves, and antibacterial soap for hand washing).
   g) Assess efficacy of precautions by monitoring personnel for acquisition of the isolate.
   h) Consult with the IDEP before transferring the patient (for emergencies only) or discharging him or her.
   i) Inform the following appropriate personnel about the presence of a patient with glycopeptide-intermediate *S aureus*:

i) Patient's accepting physician;
ii) Admitting or emergency room personnel;
iii) Personnel admitting patients to unit.

7) Complete the provider section of the WVEDSS 'Antibiotic Resistant *Staphylococcus aureus'* form and submit to the local health department. Forward a paper copy of the laboratory result to the local health department as well.

Laboratory Responsibilities

1) If the laboratory identifies an isolate of GISA/GRSA:
   a) Immediately notify the physician and the infection control practitioner;
   b) Immediately refer isolates to the OLS for confirmatory testing. Call 304-558-3530 to arrange testing.
   c) A single case of GISA/GRSA is defined as an outbreak and should be reported to the local health department immediately.

2) If requested, collaborate with public health officials to forward isolates of methicillin resistant *Staphylococcus aureus* to the Office of Laboratory Services for further testing.

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. A single case of vancomycin-resistant or vancomycin intermediate resistant *Staphylococcus aureus* is defined as an outbreak.

2) Request reporting of outbreaks of CA-MRSA immediately on the basis of 64CSR7.3.3.b.15: 'outbreak or cluster of any illness or condition, suspect or confirmed.'

3) Request reporting of invasive CA-MRSA within one week of diagnosis.

4) Educate providers and the general public about appropriate antimicrobial use. Contact IDEP for educational materials or see http://www.wvdhhr.org/IDEP/a-z/a-z-antibiotic-resistance.asp.

5) Educate hospitals about facility-based and community-based interventions for control of antimicrobial resistance in hospitals. See: http://www.cdc.gov/drugresistance/healthcare/default.htm

6) When a case of GISA/GRSA is reported:
   a) Isolate the patient: Immediately assure that the case-patient is isolated in accordance with CDC recommendations (MMWR, 1997; 46:624).

b) Assure the laboratory investigation is completed: the isolate is forwarded to OLS
c) Notify IDEP immediately.
d) Collaborate with IDEP on a comprehensive contact investigation if the case is confirmed.

7) For all confirmed cases of GISA/GRSA:

a) Complete: the WVEDSS form.
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.

8) **When an outbreak of CA-MRSA infection is reported**,

a) Investigate as follows:
   i) Notification: Immediate reporting of all outbreaks is required. Call 800-423-1271 or 304-558-5358.
   ii) Case ascertainment: Determine if the cases meet 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) Epidemiological criteria (person, place and time) specific to the outbreak.
   iii) Reporting:
      (1) Complete the WVEDSS Antibiotic Resistant *Staphylococcus aureus* form for each case.
      (2) Forward a paper copy of the laboratory report to IDEP.
   iv) Laboratory investigation: Consult with IDEP to determine if isolates should be referred to OLS for PFGE.
   v) Epidemiological investigation: In some cases a more thorough epidemiological investigation may be called for, including a case-control or cohort study. Consult IDEP.
b) Educate the patient about:
   i) Appropriate antibiotic use. Antibiotics are not effective for viral infections such as colds, and flu. Information on appropriate antibiotic use is available on the CDC website at http://www.cdc.gov/drugresistance/community/index.htm
   ii) Hand and personal hygiene: Wash regularly with soap and hot water.
   iii) Don't share personal items.
   iv) Cover wounds.
c) If the outbreak occurs on a sports team, follow the guidelines prepared by CDC, found at: http://www.cdc.gov/mmwr/PDF/wk/mm5233.pdf:
   i) Cover all wounds. If a wound cannot be covered adequately, consider excluding players with potentially infectious skin lesions from practice or competitions until the lesions are healed or can be covered adequately.
   ii) Encourage good hygiene, including showering and washing with soap after all practices and competitions.
   iii) Ensure availability of adequate soap and hot water.

iv) Discourage sharing of towels and personal items (e.g., clothing or equipment).
v) Establish routine cleaning schedules for shared equipment.
vi) Train athletes and coaches in first aid for wounds and recognition of wounds that are potentially infected.
vii) Encourage athletes to report skin lesions to coaches and encourage coaches to assess athletes regularly for skin lesions.

d) If the outbreak occurs in a jail, prison or correctional facility, follow the Bureau for Prisons guidelines found at: http://www.nicic.org/Library/019356.
e) If the outbreak occurs in a health care facility, refer the facility to appropriate guidelines, many of which can be found at: http://www.cdc.gov/ncidod/dhqp/guidelines.html. Investigation of outbreaks in healthcare settings may be resource intensive and require specialized skills and knowledge.
f) Collaborate with IDEP to alert the medical community when an outbreak occurs.

Disease Control Objectives

1) When a case of GISA/GRSA 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 vancomycin;
   b) Appropriate management (screening / isolation) of patients with resistant infections including methicillin-resistant *Staphylococcus aureus* and vancomycin resistant *Staphylococcus aureus*.
   c) Implementation of community-based and facility-based measures to reduce nosocomial transmission of resistant organisms.

Disease Surveillance Objectives

1) Detect the first case of GISA/GRSA when it occurs in West Virginia.
2) Detect secondary cases of GISA/GRSA colonization or infection, if they occur in West Virginia.
3) Characterize persons with GISA/GRSA, including medical history, underlying disease, and risk factors (including breaks in skin integrity and previous hospitalization and previous antibiotic use).

4) Detect and characterize outbreaks of community-acquired MRSA in West Virginia.
5) Characterize risk factors for outbreaks of 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; 30 to 50% of healthy adults are colonized, with 10 to 20% persistently colonized. Colonization means that the bacteria is carried in the body without causing illness. Many who are nasally colonized also carry the organism on their hands, and this results in 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 desiccation 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. MRSA has been associated with necrotizing pneumonia after infection with influenza A. Several communities around the United States have now reported MRSA as the most common type of staphylococcal skin infections. The strain of Staphylococcus aureus causing community-acquired infections has caused outbreaks in prisons, military recruits and high school sports teams. The strain can produce a virulence factor known as 'Panton-Valentine Leukocidin.' This virulence factor may be responsible for high rates of necrotizing skin infections in persons colonized with the strain.

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 childcare and camps, in 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. During 2004, outbreaks were identified in high school sports teams, and outbreaks continued to be reported in correctional facilities. During 2005, some facilities in West Virginia reported that the majority of their outpatient *Staphylococcus aureus* infections are now methicillin-resistant.

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.

Skin infections from the new community-acquired strains have frequently been mistaken for 'spider bites.'

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.

Outbreaks of Community-acquired MRSA are defined as:

1. Two or more epidemiologically-linked cases of CA-MRSA occurring in at least two distinct households, including two or more cases on a sports team; OR
2. An increase in the incidence of CA-MRSA over the expected incidence as defined by person, place and time.

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: *Staphylococcus 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 4-8 Φg per ml for VISA and MIC ≥ 16 Φg per ml for VRSA)

Case Classification

Confirmed: A clinically compatible case of vancomycin intermediate or vancomycin resistant *Staphylococcus aureus* that is laboratory confirmed (MIC 4-8 Φg per ml for VISA and MIC ≥ 16 Φg 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 associated methicillin resistant *Staphylococcus aureus* (CA-MRSA) 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 for CA-MRSA

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).

Laboratory Criteria for Invasive CA-MRSA

1. Isolation of Staphylococcus aureus from a usually sterile site (e.g., blood, CSF, peritoneal fluid, pericardial fluid, pleural fluid, synovial fluid, a sterile surgical specimen, a deep aspirate or another usually sterile site; i.e., not sputum, urine stool, nasal or axillary swabs, wound swabs, etc.)
2. Resistance to oxacillin (Methicillin-resistant strains are resistant to oxacillin and all other *β*-lactam drugs, including the cephalosporins).

Epidemiological Criteria

During the one year prior to onset, absent history of:
1. hospital or nursing home stay or surgery; or

2. indwelling line

Case Classification

Confirmed CA-MRSA: A clinically compatible case of methicillin resistant *Staphylococcus aureus* that meets the epidemiological criteria and is laboratory confirmed.
Confirmed CA-MRSA, invasive: A clinically compatible case of CA-MRSA that meets the epidemiological criteria and the laboratory criteria for invasive CA-MRSA.

Expanded working case definition for *outbreaks* of possible community acquired methicillin resistant *Staphylococcus aureus* infection *(draft working case definition – modify to suit the situation)*

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

Epidemiological criteria are specific to the outbreak (e.g., members of a sports team, residents of a correctional facility, staff and students at a school or daycare, etc.). Epidemiological criteria are usually expressed in terms of person, place and time.

Case Classification

Probable (infection): 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. CDC has developed physician and patient information sheets on appropriate management of upper respiratory infections in the community. See: http://www.cdc.gov/drugresistance/community/

Treatment

Guidelines for treatment of CA-MRSA are found at:
http://www.cdc.gov/ncidod/dhqp/pdf/ar/CAMRSA_ExpMtgStrategies.pdf

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 complete antibiotic sensitivity profile reported

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