

Community-Associated Methicillin-Resistant *Staphylococcus aureus* in Minnesota

Background

Staphylococcus aureus is part of the normal human flora. Its ecological niche is typically the anterior nares, although it can also be isolated from the skin, vagina, rectum, or perineum. Approximately 20% of humans are persistently colonized with *S. aureus* (children more than adults), 60% are intermittently colonized, and another 20% are rarely colonized.

S. aureus is most often spread to others via contaminated hands. The skin and mucous membranes are usually effective barriers against infection; however, if these barriers are breached (e.g., skin damage due to trauma or mucosal damage due to viral infection) *S. aureus* may gain access to underlying tissues or to the bloodstream and cause infection. Persons who are immunocompromised or who have invasive devices, such as central venous catheters or tracheostomy tubes, are particularly vulnerable to infection.

Penicillin was introduced in 1941, and penicillin-resistant strains of *S. aureus* were reported in hospitalized patients in 1942. Community strains of *S. aureus* remained sensitive to penicillin for many years; however, by the 1970s penicillin resistance was widespread in the community as well as in healthcare settings. Methicillin, a semisynthetic penicillin derivative, was introduced in 1960, and methicillin-resistant strains of *S. aureus* (MRSA) were identified in 1961. As new antimicrobial agents have been introduced, resistant strains typically have been identified within a short period of time. The recent

emergence of *S. aureus* strains with decreased susceptibility to vancomycin is of substantial concern because vancomycin has been the mainstay of treatment for serious *S. aureus* infections. The first cases of *S. aureus* with intermediate resistance to vancomycin (VISA) (minimum inhibitory concentration [MIC]=8 µg/mL) were reported in the late 1990s. In 2002, 2 cases of vancomycin-resistant *S. aureus* (VRSA) (MIC ≥32 µg/mL) were reported, and in 2004 a third case was reported, all in the United States. Fortunately, these VRSA isolates were susceptible to other antimicrobial agents.

Antimicrobial Resistance Mechanisms in *S. aureus*

Resistance to beta-lactam antimicrobials (all penicillins and cephalosporins) in *S. aureus* is determined by the presence of the *mecA* gene, which encodes the low affinity penicillin-binding protein PBP2A. The *mecA* gene is part of the staphylococcal cassette chromosome *mec* (SCC*mec*), a mobile genetic element that may also contain genetic structures that encode resistance to non-beta-lactam antimicrobials. The prevailing hypothesis to explain the origin of MRSA is that MRSA strains have evolved a number of times via horizontal transfer of *mecA* from other staphylococcal species into distinct methicillin-susceptible *S. aureus* (MSSA) strains. The transfer of *mecA* from *S. epidermidis* to *S. aureus* has been demonstrated *in vivo* during antimicrobial therapy.

Since 70% to 75% of coagulase-negative staphylococci have the *mecA* gene and are therefore resistant to methicillin, there is great potential for the development of resistant clones. The spread of such resistant clones is then facilitated by antimicrobial pressure.

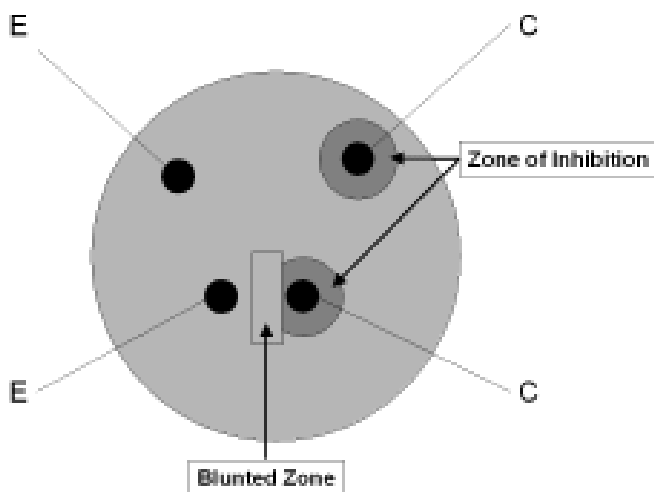
In 1956, soon after the introduction of erythromycin (a macrolide), strains of *S. aureus* with erythromycin resistance were reported. Additionally, resistance to clindamycin (a lincosamide) is increasingly being reported. Resistance to macrolides, lincosamides, and streptogramins B (MLS_B phenotype) antimicrobials is caused by several mechanisms. One mechanism, which confers resistance to macrolides, but not to lincosamides, is the *msrA* gene. This gene encodes an efflux pump, which pumps macrolides out of the bacterial cell before they can bind to the ribosome. Another resistance mechanism is the production of a methylase by the *erm* gene. This gene causes methylation of the ribosomal target, which inhibits protein synthesis. The *erm* gene confers cross-resistance to macrolides, lincosamides, and streptogramins B and is regulated in two ways: expression of resistance can be

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Figure 1. Inducible Macrolide-Lincosamide-Streptogramin B (MLS_B) Phenotype



Inducible clindamycin resistance can be detected by placing a 2- μ g clindamycin (C) disk 15-26 mm away (edge to edge) from a 15- μ g erythromycin (E) disk as part of the normal disk diffusion procedure. Following incubation, a flattening of the zone in the area between the disks where both drugs have diffused indicates that the organism has inducible clindamycin resistance.

constitutive (methylase produced all of the time) or inducible (methylase produced only in the presence of a macrolide inducer). Strains of *S. aureus* with constitutive resistance to MLS_B antimicrobials are phenotypically resistant to macrolides and lincosamides. Inducible strains appear phenotypically resistant to macrolides and susceptible to lincosamides, but have the genotypical profile for resistance to both macrolides and lincosamides. Inducible resistance can be detected by disk diffusion (D-test), in which an erythromycin disk is placed in close proximity to a clindamycin disk. If the strain has inducible *erm*, erythromycin will diffuse into the media on one side of the clindamycin disk and "turn on" the *erm* gene. The bacterial cells that have inducible resistance will grow in the presence of clindamycin, resulting in a D-shaped zone around the clindamycin disk as shown in Figure 1.

Isolate Characterization

SCC*mec* has been classified into 5 types based on polymorphisms occurring in conserved genes. Three SCC*mec* types (I, II, and III) have been identified in healthcare-associated (HA)-MRSA isolates from several countries. SCC*mec* types II and III are large and, in addition to *mecA*, contain resistance determinants for non-beta-

lactam antimicrobials. More recently, 2 additional SCC*mec* types (IV and V) have been identified. SCC*mec* types IV and V have been identified in community-associated (CA)-MRSA isolates and are smaller than types I-III and lack resistance determinants other than *mecA*.

Healthcare-Associated MRSA

The first nosocomial outbreak of HA-MRSA in the United States was reported in 1968. The prevalence of HA-MRSA in the United States has increased over time. Data from the National Nosocomial Infection Surveillance (NNIS) system demonstrate that the proportion of MRSA among nosocomial *S. aureus* infections in intensive care unit (ICU) patients rose from 2.4% in 1975 to 29% in 1991 to 55.3% in 2000.

Established risk factors for MRSA infection include recent hospitalization or surgery, residence in a long-term care facility, dialysis, and indwelling percutaneous medical devices and catheters.

Community-Associated MRSA

The first reports of penicillin-resistant *S. aureus* strains in the community were published approximately 20 years after the introduction of penicillin. Similarly, the first reports of MRSA

strains in the community appeared in the early 1980s, approximately 20 years after the introduction of methicillin.

The term "community-acquired MRSA" has been used to describe MRSA infection diagnosed outside of the hospital or within 48 to 72 hours of admission. In some early studies, persons with recent hospitalization or long-term care residence were classified as having community-acquired MRSA because their MRSA infection was noted upon or shortly after hospital admission. Because it is difficult to determine where MRSA is acquired, the term "community-associated" (CA) MRSA has been used more recently to describe MRSA with onset in the community in persons who lack traditional risk factors for HA-MRSA. However, studies have used different criteria to define these risk factors. The term "non-multiresistant" (i.e., resistant to ≤ 2 antimicrobial classes) MRSA has also been used to describe MRSA isolates that differ from multiresistant HA-MRSA isolates. The use of differing terminology and definitions has resulted in some confusion and makes it difficult to compare data from different studies.

In an attempt to standardize the definition of CA-MRSA, the Centers for Disease Control and Prevention (CDC) Active Bacterial Core Surveillance (ABCs) sites (Connecticut, Georgia, Maryland, and Minnesota), which have conducted surveillance for CA-MRSA since 2001, define CA-MRSA as MRSA that has been isolated from patients who have *no* history of

- 1) positive culture for MRSA from any body site obtained more than 48 hours after admission to a hospital (if hospitalized);
- 2) prior MRSA infection or colonization;
- 3) hospitalization, surgery, residency in a long-term care facility, hemodialysis, or peritoneal dialysis within the past year; or
- 4) current indwelling percutaneous devices or catheters.

This is also the definition that the Minnesota Department of Health (MDH) has used in conducting surveillance for CA-MRSA since 2000.

CA-MRSA Outside of Minnesota

The first reports of MRSA occurring in the community in patients without established risk factors appeared in the 1980s. These reports described

MRSA isolates that were generally susceptible to antimicrobials other than beta-lactams and infections that typically involved skin and soft tissue. Early reports described CA-MRSA infections in injection drug users (Detroit), indigenous populations (e.g., Australia, New Zealand, and Canada), and children (e.g., Chicago and Texas). Although most of these infections were not serious, severe and fatal infections, including necrotizing pneumonia and sepsis, were also reported. CA-MRSA cases have now been reported throughout the United States, including in North Dakota, Nebraska, Alaska, Illinois, Colorado, Pennsylvania, California, southern New England, Texas, Wisconsin, and Tennessee, as well as in many other parts of the world.

Outbreaks of CA-MRSA have been reported among injection drug users, group home residents, men who have sex with men, military recruits, players of close contact sports, and correctional facility inmates. To date, only 2 reports of CA-MRSA transmission in daycare have been published, although such transmission may be underreported. Some studies have found that racial minorities, indigenous peoples, and persons with low household income are overrepresented among those with CA-MRSA infections. See Table 1 for assessment of CA-MRSA patient risk factors.

CA-MRSA in Minnesota

In 1996, the MDH began receiving reports of MRSA infections in young,

previously healthy patients who appeared to have none of the established risk factors for MRSA infection. Most of the reported infections involved skin and soft tissue and were not severe, although some had resulted in hospitalization. In 1997, MDH was notified of the death of a previously healthy 7-year-old Minnesota girl due to CA-MRSA infection. Disturbingly, 3 more reports of deaths in previously healthy children due to CA-MRSA infection followed: a 16-month-old North Dakota girl in 1998 and a 13-year-old Minnesota girl and a 12-month-old North Dakota boy in 1999 (Table 2). None of the 4 children had histories of hospitalization in the year prior to their death, and none had family members who were healthcare workers. All 4 CA-MRSA isolates had the *mecA* gene by polymerase chain reaction (PCR) assay, and no isolate produced toxic shock syndrome toxin-1. The isolates from these 4 cases were susceptible to all antimicrobial agents tested except beta-lactam antimicrobials, in contrast with HA-MRSA, which is typically multi-resistant. All 4 cases had similar pulsed-field gel electrophoresis (PFGE) patterns (genetic fingerprints), but differed by an average of greater than 10 bands compared with PFGE patterns from HA-MRSA isolates from several Minnesota hospitals. A report on these 4 deaths in the August 20, 1999, *Morbidity and Mortality Weekly Report (MMWR)* sparked nationwide interest in CA-MRSA and concern about a possible change in the epidemiology and virulence of MRSA.¹

Minnesota Indian Health Service Retrospective Study

One of the 4 CA-MRSA deaths reported in the 1999 *MMWR* was in an American Indian child from rural North Dakota. A 1996 national survey of Indian Health Service (IHS) facilities found that 40% of *S. aureus* isolated from IHS patients in the Midwest and Northern Plains was MRSA. Concern about possible community acquisition of MRSA with subsequent severe infection prompted a retrospective study of CA-MRSA at a northern Minnesota IHS facility. The proportion of *S. aureus* isolates that were MRSA had increased rapidly in this community since 1994. In the 1997 study period, 55% of 112 *S. aureus* isolates identified were MRSA, and 74% of MRSA isolates were classified as CA-MRSA after a review of patient medical records. No significant differences were identified between CA-MRSA and CA-MSSA patients in age, sex, site of infection (skin, 89% vs. 94%), hospitalization due to infection, number of clinic or emergency room visits in the prior year, underlying chronic health conditions, or exposure to antimicrobials in the prior year. CA-MRSA appeared to have replaced CA-MSSA as the predominant strain of *S. aureus* in this community.²

Minnesota Retrospective CA-MRSA Study, 1996-1998

To better define the epidemiological and microbiological features of CA-MRSA, a retrospective review of all MRSA patients and isolates identified at 10 Minnesota hospitals during 1996-1998 was conducted.³ The hospitals, selected to represent different geographic regions of Minnesota (4 in the Minneapolis-St. Paul metropolitan area, 6 in greater Minnesota), identified a total of 2,568 cases of MRSA during the 3-year period studied. Of these, 354 cases were classified as CA-MRSA after a review of patient medical records. Patients who were colonized but not infected with CA-MRSA were not included in the study.

CA-MRSA patients were young (median age, 16 years), most had skin infections (89%), and most (76%) had no underlying medical conditions. Although most CA-MRSA patients were diagnosed and treated as outpatients, 29% of patients with CA-MRSA

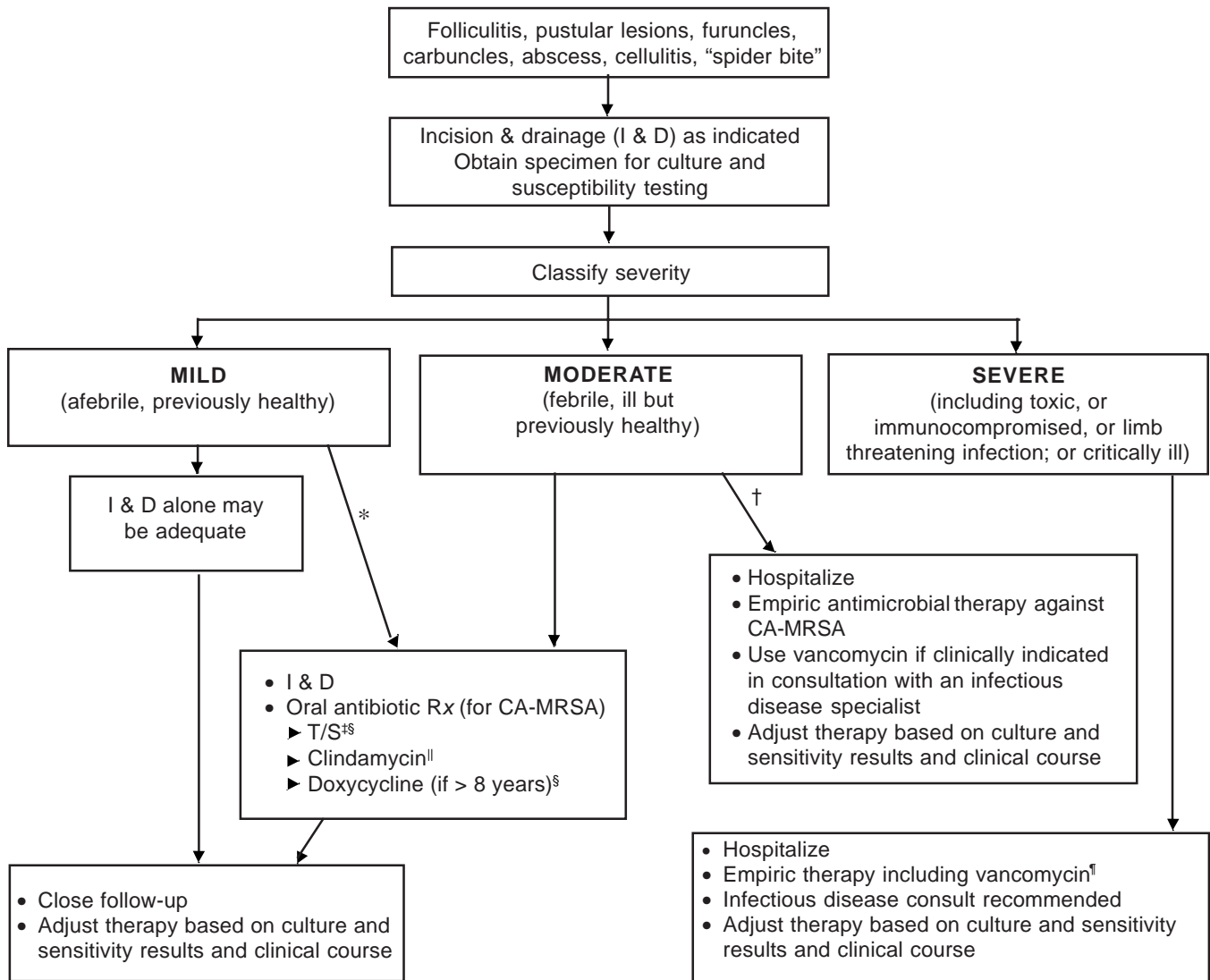
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Table 1. Assessment of CA-MRSA Patient Risk Factors

Although risk factors for CA-MRSA infection are not well defined, certain population groups may have a higher incidence of CA-MRSA infections. When assessing patients with skin and soft tissue infections, as well as patients with more severe illness that may be due to *S. aureus*, the following risk factors should increase the level of suspicion for CA-MRSA.

- History of MRSA infection or colonization in patient or close contact
- High prevalence of CA-MRSA in the local community or patient population
- Recurrent skin disease
- Crowded living conditions (e.g., homeless shelters, military barracks)
- History of incarceration
- Participation in contact sports
- Skin or soft tissue infection with poor response to beta-lactam antimicrobials
- Recent and/or frequent antibiotic use
- Injection drug use
- CA-MRSA outbreaks have also been noted among Native Americans and Pacific Islanders, urban pediatric populations, and men who have sex with men

Figure 2. A Suggested Initial Management Approach for Suspected Community-Associated Methicillin-Resistant *Staphylococcus aureus* (CA-MRSA) Skin and Soft Tissue Infections (Communities in Which CA-MRSA Strains are Prevalent)



* If using antimicrobials

† If area of involvement is extensive, or if systemic symptoms are clinically concerning, or if there are compliance/follow-up concerns

‡ T/S=trimethoprim/sulfamethoxazole

§ T/S and doxycycline are not recommended treatments for Group A *Streptococcus* infection.

|| Do D-test if CA-MRSA isolate is erythromycin-resistant, clindamycin susceptible. There are a significant number of D-test positive CA-MRSA isolates in Minnesota.

¶ Broad empiric therapy may be appropriate; consult with an infectious disease specialist. *AAP Red Book* recommends use of nafcillin ± gentamicin in addition to vancomycin for empiric therapy of life-threatening infections.

Additional notes:

- Use quinolones, linezolid, daptomycin or quinupristin-dalfopristin (Q/D) only in consultation with an infectious disease specialist.
- If initial parenteral therapy, consider switching to oral therapy based on susceptibility results if the patient is afebrile for 24 hours, clinically improved, able to take oral therapy, and close follow-up is possible. For severe infections, consult with an infectious disease specialist.
- Duration of treatment for most skin and soft tissue infections is 7-10 days, but may vary depending on severity of infection and clinical response.
- Consider hospitalization for infants less than 1 month of age.
- Obtain blood cultures on febrile infants with skin infection, and others as clinically indicated.

infections were hospitalized, and 2 patients died due to their CA-MRSA infections.

More than 90% of the CA-MRSA isolates were susceptible to all antimicrobial agents, with the exception of beta-lactams and erythromycin. Of those 334 patients treated with an antimicrobial, 84% were initially treated with an antimicrobial to which their isolates were non-susceptible. Isolates of MRSA that differed from a reference strain (MR14, the most common CA-MRSA strain) by 6 bands or fewer were characterized as belonging to a single clonal group. Of those CA-MRSA isolates tested by PFGE, 86% belonged to a single clonal group.

Prospective Sentinel Site Surveillance for CA-MRSA

In 1999, the Minnesota Communicable Disease Reporting Rules were amended to require that all cases of serious illness or death due to CA-MRSA be reported to MDH and that selected sentinel surveillance site hospital laboratories report all cases of MRSA to MDH. This change allowed MDH to begin conducting prospective surveillance in 2000. The resources required to do population-based surveillance in Minnesota (~10,000 MRSA cases/year) precluded the possibility of population-based surveillance. Therefore, 12 sentinel hospital laboratories were selected to

represent different geographic regions of Minnesota; 6 were located in the Twin Cities 7-County Metropolitan Area and 6 were located in non-metropolitan Minnesota. Those hospital laboratories served both outpatient and inpatient populations, and together the 12 sentinel hospital laboratories served approximately 16% of Minnesota's population. The objectives of the surveillance were to characterize epidemiological differences between patients with CA- and HA-MRSA infections and microbiologic and/or molecular differences between CA- and HA-MRSA isolates.

All cases of MRSA from the 12 sites were reported to MDH. Patients with an MRSA isolate were identified through the sentinel hospital laboratories, and hospital infection control practitioners (ICPs) abstracted information from patient medical records. If the patient had no inpatient medical record, primary care providers were contacted for HA-MRSA risk factor information. Cases were classified as CA- or HA-MRSA using the CDC case definition. CA-MRSA patients were interviewed by MDH staff to confirm the absence of HA-MRSA risk factors. All MRSA isolates from sentinel site laboratories were sent to the MDH Public Health Laboratory. All available CA-MRSA isolates were tested, and 25% of HA-MRSA isolates from each site were randomly selected for testing. Isolates were confirmed as *S. aureus*, and

antimicrobial susceptibility testing (including oxacillin) by broth micro-dilution and PFGE subtyping was performed. Staphylococcal toxin testing and SCCmec type testing was performed in collaboration with Dr. Jerome Etienne at the French Reference Centre for Staphylococci in Lyon, France.

In 2000, 4,612 patients with positive *S. aureus* cultures were reported from 10 hospitals⁴ (data on total *S. aureus* infections were not available at 2 facilities); approximately 25% were MRSA (range 10%-49%). Of all MRSA cases, 85% (937/1,100) were HA-MRSA, 12% (131/1,100) were CA-MRSA, and 3% (32/1,100) could not be classified. The proportion of MRSA that was community-associated ranged from 4% to 50% per hospital. CA-MRSA patients were younger than HA-MRSA patients with a median age 23 years versus 68 years ($p < 0.001$). Skin and soft tissue infections were more common among CA-MRSA cases than among HA-MRSA cases (75% versus 36%, odds ratio [OR]=4.25, 95% confidence interval [CI]=2.97-5.90). CA-MRSA patients were more likely than HA-MRSA patients to be nonwhite (OR=3.13; 95% CI=2.16-4.32). CA-MRSA isolates were more likely to be susceptible to ciprofloxacin, clindamycin, gentamicin, and trimethoprim/sulfamethoxazole (adjusted odds ratio [AOR]=2.44, 95% CI=1.35-3.86). CA-MRSA isolates were also more likely to belong to 1 of 2 PFGE clonal groups in both univariate and multivariate analysis. Among all MRSA isolates, 119 distinct PFGE patterns and 5 clonal groups containing 3 or more isolates were identified. CA-MRSA isolates were more likely to contain SCCmecIV and different exotoxin gene profiles (e.g., Panton-Valentine leukocidin [PVL] genes) than HA-MRSA isolates. PVL has been associated with skin abscesses and necrotizing pneumonia. PVL was also identified in 8 isolates (including the 4 MMWR isolates) from fatal CA-MRSA cases, 6 with necrotizing pneumonia.

Minnesota CA-MRSA Antimicrobial Susceptibility Trends

Susceptibility trends for Minnesota CA-MRSA isolates were examined in 1996-1998 and 2000-2003. During the study period, CA-MRSA isolate

Table 2. Four Pediatric Deaths Due to Community-Associated Methicillin-Resistant *Staphylococcus aureus* (CA-MRSA), Minnesota and North Dakota, 1997-1999*

	Case 1	Case 2	Case 3	Case 4
Age	7 years	16 months	13 years	12 months
Gender	Female	Female	Female	Male
Race	African American	American Indian	White	White
Syndrome	Septic joint, pneumonia/empyema	Sepsis	Necrotizing pneumonia/sepsis	Necrotizing pneumonia/sepsis
Antimicrobial Susceptibility	T/S, tet, cip, gent, ery, clind, vanc [†]	T/S, tet, cip, gent, ery, clind, vanc [†]	T/S, tet, cip, gent, ery, clind, vanc [†]	T/S, tet, cip, gent, ery, clind, vanc [†]

* Adapted from Centers for Disease Control and Prevention. Four pediatric deaths from community-acquired methicillin-resistant *Staphylococcus aureus*—Minnesota and North Dakota, 1997-1999. *MMWR Morb Mortal Wkly Rep.* 1999;48:707-710.

[†]T/S = trimethoprim-sulfamethoxazole, tet=tetracycline, cip=ciprofloxacin, gent=gentamicin, ery=erythromycin, clind=clindamycin, vanc=vancomycin

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susceptibilities to erythromycin and ciprofloxacin significantly decreased. Antimicrobial susceptibilities among Minnesota CA-MRSA isolates in 2003 are as follows:

• Ciprofloxacin	70%
• Clindamycin	84%
• Erythromycin	28%
• Gentamicin	100%
• Linezolid	100%
• Mupirocin*	99%
• Rifampin	100%
• Q/D	100%
• Tetracycline	92%
• T/S	100%
• Vancomycin	100%

*Using a breakpoint of MIC $\geq 4 \mu\text{g}$ (no standard NCCLS breakpoint)

Inducible Clindamycin Resistance Among Erythromycin-Resistant, Clindamycin-Susceptible CA-MRSA Isolates in Minnesota

In 2000-2001, 84% of erythromycin-resistant, clindamycin-susceptible CA-MRSA isolates were found to have inducible clindamycin resistance. However, a marked decrease in inducible clindamycin resistance has been noted since 2002.

Most erythromycin-resistant, clindamycin-susceptible isolates without inducible clindamycin resistance belong to a CA-MRSA clonal group that has increased in prevalence over the past 2 years in Minnesota. As new strains of CA-MRSA emerge in a community, the proportion of CA-MRSA isolates with inducible clindamycin resistance may change significantly and affect the choice of empiric therapy. D-testing will identify strains with inducible

clindamycin resistance. The National Committee for Clinical Laboratory Standards has published recommendations and methods for D-testing.⁵

Clinical Implications of Inducible Clindamycin Resistance

Inducible clindamycin resistance is important because erythromycin-resistant strains of *S. aureus* may have inducible resistance to clindamycin. In this setting, constitutive mutants, which can occur at a frequency of $\sim 10^{-7}$ cfu, may be selected during a course of clindamycin therapy. Caution in using clindamycin is indicated in patients with infections due to strains of *S. aureus* with inducible clindamycin resistance, particularly if the inoculum is high. Rapid development of clindamycin resistance has been demonstrated *in vitro*, and clinical failures related to clindamycin therapy for *S. aureus* infections have been reported.

Current MDH CA-MRSA Projects

Sentinel surveillance is ongoing. MDH is also participating in population-based surveillance for invasive MRSA infections in Ramsey County. In addition, MDH is conducting a CA-MRSA risk factor study and is initiating a CA-MRSA colonization study and a household transmission study.

Management of Skin and Soft Tissue Infections

CA-MRSA skin and soft tissue infections typically manifest as pustular lesions, abscesses, furuncles, carbuncles, and cellulitis. The

presence of necrotic lesions, which are frequently misidentified as spider bites, is another manifestation of CA-MRSA infections. There are no brown recluse spiders, which can cause necrotic wounds, in the midwestern United States. Household members of the patient may also have a history of such infections.

Guidance from the CDC on the management of suspect CA-MRSA infections is forthcoming, but interim pediatric recommendations have been developed by Dr. Carol Baker and Dr. Robert Frenck.⁶ General recommendations have been developed by the Washington State Department of Health.⁷ The Washington State interim recommendations can be accessed online at www.doh.wa.gov/Topics/Antibiotics/MRSAinterimGuide.doc. A suggested algorithm from MDH is outlined in Figure 2.

It is critical that all abscesses are drained promptly and that material from purulent lesions is sent for culture and susceptibility testing. D-testing should be conducted for erythromycin-resistant, clindamycin-susceptible isolates.

In previously healthy patients with small (< 5 cm) abscesses and no systemic signs of infection, incision and drainage without antimicrobial therapy is effective in many patients.⁸ In previously healthy patients with systemic signs of infection, antimicrobial therapy in addition to prompt drainage is indicated. Discharge instructions should emphasize the need for a return visit if no clinical improvement occurs within 48 hours.

Patients with suspected severe *S. aureus* infection should be hospitalized and empiric antimicrobial therapy for CA-MRSA should be initiated promptly in areas where CA-MRSA is known to be prevalent.

Patients should also be instructed to cover lesions with clean, dry bandages; to keep their skin clean and intact; and to clean their hands frequently with soap and water or an alcohol-based hand rub. In addition, patients should be instructed not to share personal items such as razors,

Table 3. Measures for Preventing Staphylococcal Skin Infections Among Sports Participants

- Cover all wounds. If a wound cannot be covered adequately, consider excluding players with potentially infectious skin lesions from practice or competitions until the lesions are healed or can be covered adequately.
- Encourage good hygiene, including showering and washing with soap after all practices and competitions.
- Ensure availability of adequate soap and hot water.
- Discourage sharing of towels and personal items (e.g., clothing or equipment).
- Establish routine cleaning schedules for shared equipment.
- Train athletes and coaches in first aid for wounds and recognition of wounds that are potentially infected.
- Encourage athletes to report skin lesions to coaches and encourage coaches to assess athletes regularly for skin lesions.

Source: Centers for Disease Control and Prevention

towels, washcloths, clothing, or sports equipment with others. (Table 3 lists suggestions from the CDC for preventing staphylococcal skin infections among sports participants.)

At this time there is no routine recommendation for decolonization with mupirocin (Bactroban) or systemic antimicrobials. However, decolonization may be considered in patients with recurrent CA-MRSA infection or in households where multiple members have skin and soft tissue infections. Please contact MDH if a CA-MRSA cluster is identified outside of a household setting.

For More Information:

- Additional information about CA-MRSA from the MDH and CDC is available online at:
 - ▶ www.health.state.mn.us/divs/idepc/diseases/mrsa/index.html, and
 - ▶ www.cdc.gov/ncidod/hip/ARESIST/mrsa_comm_faq.htm
- The Bureau of Prisons clinical practice guidelines for the management of MRSA infections in correctional facilities can be

accessed at: www.nicic.org/Downloads/PDF/2003/019356.pdf.

Please contact MDH at 612-676-5414 or 1-877-676-5414 with any questions about CA-MRSA.

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National Handwashing Awareness Week, December 5-11, 2004

During handwashing week, it is important for healthcare workers to know that alcohol-based hand rubs replaced soap and water as the leading recommended tool for hand antisepsis in the 2002 revision of CDC's "Guideline for Hand Hygiene in Health-Care Settings." Alcohol-based hand rubs have been found to be more effective than handwashing with plain or antimicrobial soaps and can be used as long as hands are not visibly soiled. Alcohol-based hand rubs also have the following additional advantages.

- They are less time-consuming than handwashing.
- They are more easily accessible than soap and water because their use does not require sinks and plumbing.
- They are more easily tolerated because they are typically less irritating to the hands than soap and water.
- They do not promote antimicrobial resistance.

The full guideline can be accessed online at: www.cdc.gov/handhygiene.

Asthma and the Interactive Asthma Plan—An Update

Healthcare providers who treat patients with asthma are encouraged to use downloadable, interactive software developed by the Minnesota Department of Health (MDH) to develop an individualized asthma action plan (AAP) for each of their patients with asthma.* This software contains updated formulary information from 7 key Minnesota health plans. If you downloaded this software when it first became available in November 2003, you should do a second download now to update your original software. In addition to the updated formulary information, an AAP printed with the updated software contains consent language that is compliant with HIPAA (Health Insurance Portability and Accountability Act) FERPA (Family Educational Rights and Privacy Act), and Minnesota consent law. The updated consent box allows healthcare providers to give permission for a child to carry his or her inhaler medication in school, as permitted by the Minnesota Asthma Inhaler Law (Minnesota Statutes 121A.22).

The AAP is a tool to help patients and healthcare providers manage and prevent asthma symptoms; it also offers information that is crucial for those who care for or have contact with patients. The National Heart, Lung, and Blood Institute (NHLBI) recommends written AAPs for everyone with asthma.¹ Minnesota's strategic plan for addressing asthma calls for written AAPs for all pediatric and adult patients who have persistent asthma (levels 2-4); it also recommends that Minnesota providers follow the NHLBI guidelines when treating asthma.²

The software for the interactive AAP uses symptom information supplied by the healthcare provider to determine the severity level of the patient's asthma: (1) mild intermittent, (2) mild persistent, (3) moderate persistent, or (4) severe persistent. The program then presents appropriate disease

management choices for the identified severity level. The downloadable version allows providers to save individualized AAPs and patient data on a personal computer, and it offers the user the ability to access the same AAPs via their local intranet while maintaining confidentiality. Intranet network installation of the software is useful for providers who travel to multiple clinic sites or who share AAPs and pharmaceutical information with other providers within the same intranet network.

The final AAP can be printed in English and/or Spanish. The software also enables the provider to create and print a prescription for the selected prescribed asthma medications. By selecting "All Medications" (rather than a specific health plan) from the health plan box, the AAP can be used in any state in the United States. The software also provides space for a clinic or health plan to insert its own logo or other identifying information and to enter multiple healthcare providers' names and numbers onto the same database.

In a series of asthma trainings for school personnel throughout Minnesota this fall, the interactive AAP has been introduced to more than 400 school nurses and other school health staff. They received a comprehensive manual, *Managing Asthma in Minnesota Schools: A Comprehensive Resource and Training Manual for School Personnel*,³ which can be viewed online. (See link in references below.) The "All Health Staff" section of this manual contains much of the information that is presented at the trainings.

School health personnel are being encouraged to have more contact with physicians and others who treat school-aged children with asthma. Schools are also encouraged to seek written AAPs for their students with asthma. School nurses may be sending home to parents samples of

the interactive AAP form. If you receive an AAP form from a parent or school health office, please go to www.mnasthma.org/AAP/, complete an AAP for the student, and print multiple copies, including at least 1 for the parents and 1 for the school.

The desktop/downloadable interactive AAP is also available on a CD. If you would like to receive a CD with the AAP software, or provide any feedback on the AAP, please contact MDH at susan.ross@health.state.mn.us or at 612-676-5629. For other information or to provide educational information to your patients regarding asthma, please visit the MDH asthma Web site at www.health.state.mn.us/divs/hpcd/cdee/asthma.

*Development of the AAP was supported by Grant/Cooperative Agreement #U59/CCU522470 from the Centers for Disease Control and Prevention (CDC).

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The Changing Epidemiology of HIV

More than 20 years have passed since descriptions of acquired immunodeficiency syndrome (AIDS) were first reported in the medical literature. Human immunodeficiency virus (HIV) was identified as the cause of AIDS in 1984, and shortly thereafter a test to detect antibodies to this virus became available to diagnose HIV infection.

Although HIV/AIDS was first recognized in the United States, research shows that HIV was likely introduced to humans around 1930 as a zoonosis from chimpanzees (simian immunodeficiency virus [SIV]) in central Africa, presumably during the slaughter of these hunted animals. Subsequent mutations in SIV enabled the virus to be transmitted from person to person and to cause immunodeficiency in humans. Although highly active

antiretroviral therapy (HAART), introduced in 1996, has successfully extended and improved the lives of many people living with HIV/AIDS, the case fatality rate for HIV infection remains greater than 90%.

UNAIDS (Joint United Nations Programme on HIV/AIDS) estimates that nearly 5 million people were newly infected with HIV during 2003, bringing the total number of people living with HIV/AIDS to 38 million worldwide.¹ Ninety-five percent of this total reside in low- and middle-income countries² where resources and/or political will to support prevention and treatment programs are scarce. More than any other disease, HIV/AIDS is a biological phenomenon inextricably enmeshed with emotions, economics, politics, and culture. Successfully addressing HIV/

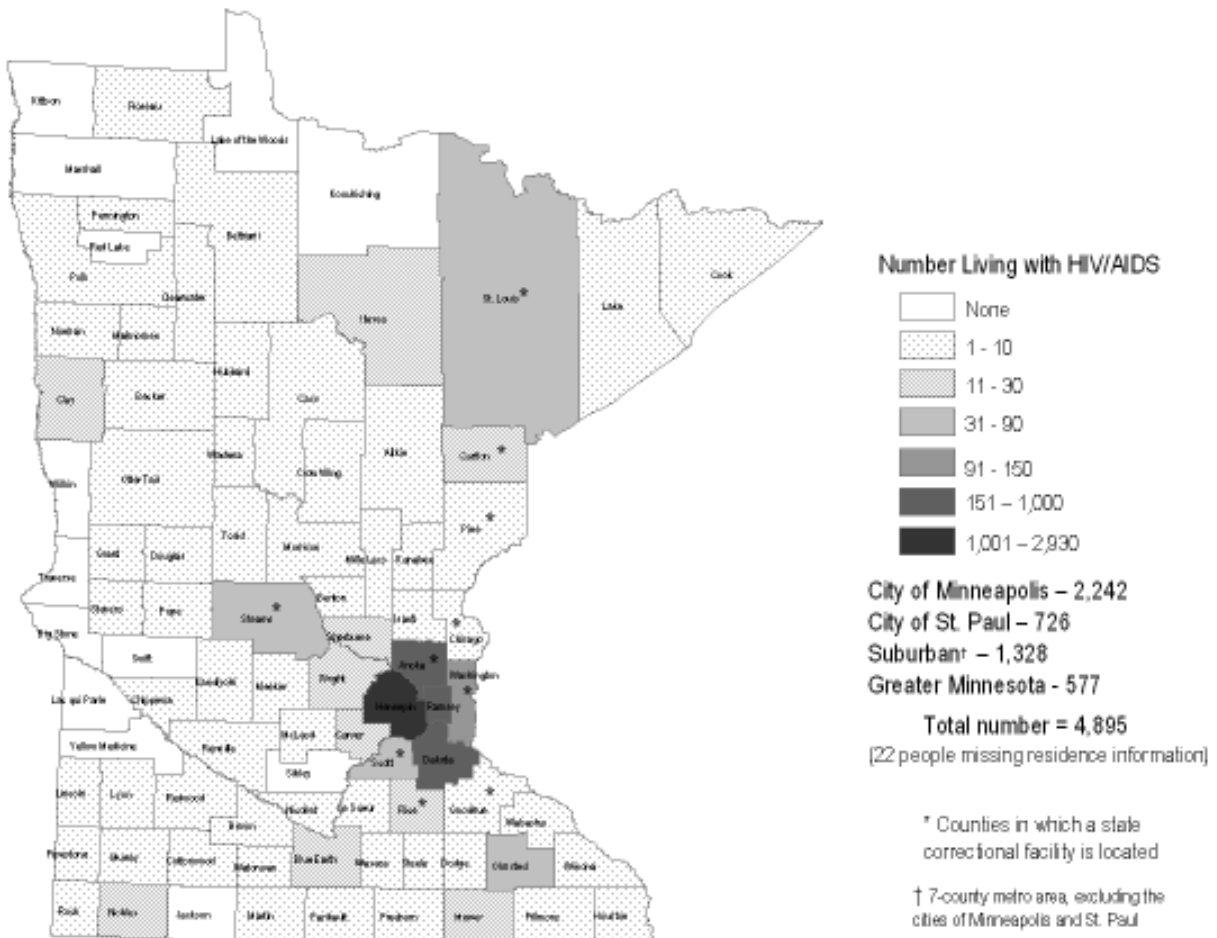
AIDS requires commitment and action on multiple levels.

Women and Youth

Unlike the global HIV/AIDS pandemic, where women represent more than 50% of cases, only 30% of the estimated 40,000 annual infections in the United States occur among women.^{2,3} The lower rate among women is a reflection of the natural history of the epidemic in this country. In the years after the first known U.S. cases of AIDS were diagnosed in 1981, the disease devastated gay communities nationwide, leaving few men who have sex with men (MSM) untouched, as they either personally fell ill or experienced the loss of partners and friends. Although MSM

continued...

Figure 1. Living HIV/AIDS Cases in Minnesota by County of Residence, 2003



are still disproportionately affected, accounting for an estimated 42% of U.S. cases³ and 59% of Minnesota cases, HIV has permeated every corner of the state and nation, affecting men, women, and children of all ages, races, ethnicities, and sociobehavioral groups.

Since the beginning of the HIV/AIDS epidemic, males have accounted for the majority of new HIV infections diagnosed each year in Minnesota. However, both the number and the proportion of HIV cases among females have increased over time. In 1991, women represented 15% (69/470) of Minnesota HIV diagnoses; in 2003, they represented 24% (65/266). During the 1980s, white women accounted for the majority of newly diagnosed cases among females; however, since 1991 the number of new infections among women of color has exceeded the number among white women. In 2003, women of color accounted for 88% of the 65 new HIV infections among Minnesota women, but they comprised only 11% of the state's general female population. African American (n=20) and African-born (n=28) females made up 84% of cases among women of color in 2003. Heterosexual exposure is the primary mode of HIV transmission for women.

In contrast to older adults, the gender distribution of HIV cases among adolescents and young adults is more equal. During 2001-2003, 45% (48/106) of HIV diagnoses among persons aged 13 through 24 years in Minnesota were female compared to only 25% (176/697) among adults aged 25 years or older. More than 90% of young men diagnosed with HIV in Minnesota identify male-to-male sex as a risk factor; the majority of young women identify heterosexual exposure as their only risk factor.

Adolescents and young adults are populations of growing concern. More cases of chlamydia and gonorrhea are diagnosed among adolescents and young adults than among any other age group; for example, in 2003, persons aged 15 through 24 years accounted for 70% (7,509) of the 10,714 cases of chlamydia reported in Minnesota. This statistic is concerning because the presence of chlamydia or gonorrhea confers an elevated risk of transmitting or acquiring HIV if either sexual partner is infected and also

indicates that unprotected vaginal and/or anal intercourse is occurring. Because years often pass between the time of HIV infection and diagnosis, disease surveillance data, which are based on age at diagnosis, likely underestimate the extent of the HIV/AIDS epidemic among youth.

Not Just an Urban Disease

Although HIV infection is more common in areas with higher population densities and greater poverty, HIV or AIDS has been diagnosed in more than 80% of Minnesota's counties. Figure 1 shows the geographic distribution of persons living with HIV/AIDS by county at the end of 2003. Additionally, the proportion of suburban residents among annual HIV diagnoses has steadily increased over time, from 20% (72/356) in 1993 to 35% (92/266) in 2003.

Greater Diversity

The number of new HIV infections diagnosed among foreign-born persons in Minnesota has steadily increased from 19 cases in 1990 to 71 cases in 2003. This increase has been largely driven by the increase of cases among African-born persons, from 7 cases in 1990 to 55 cases in 2003. Foreign-born persons are disproportionately affected by HIV; they represent only 5% of the total Minnesota population (U.S. Census 2000), but 27% of HIV diagnoses in 2003. Among African-born persons this disparity is even more striking; while African-born

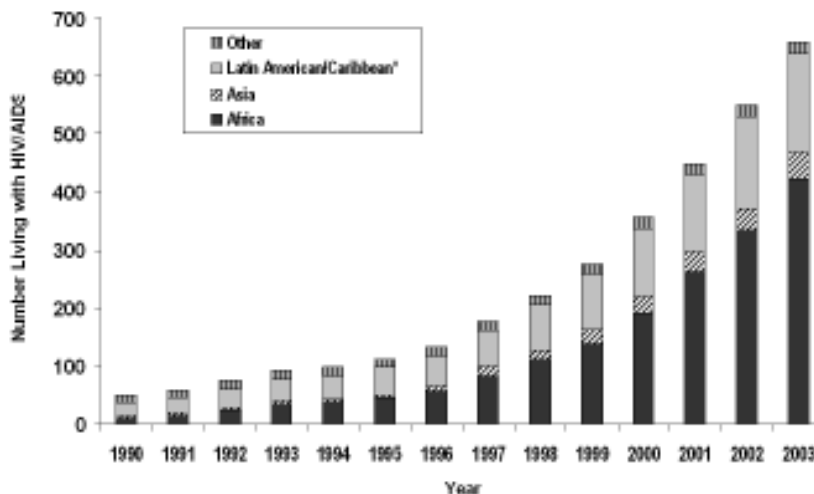
persons make up less than 1% of the Minnesota population, they accounted for 21% of HIV infections diagnosed in 2003.

Figure 2 shows the increasing number of Minnesota residents living with HIV/AIDS over time who originate from other regions of the world. Significant barriers to providing effective HIV prevention and access to services exist for immigrants to Minnesota. This population, unlike the general U.S. population, has not been exposed to 20 years of HIV education and prevention messages and often has difficulty understanding and accessing the U.S. healthcare system. Myths, denial, and intense stigma around HIV coupled with language barriers and sometimes traumatic personal histories are daunting impediments to open discussions with patients about HIV and sexual health. A resource for clinicians interested in providing culturally sensitive health care can be found at the end of this article.

Resurgence of HIV Among MSM?

Recent outbreaks of syphilis among MSM in many U.S. cities, including Minneapolis, and data documenting an increase in risk behaviors among MSM in some cities have raised concerns that HIV may be expanding in this population once again. In Minnesota, 44% of the 68 MSM diagnosed with syphilis in 2003 were also coinfected with HIV.

Figure 2. Foreign-Born Persons Living with HIV/AIDS in Minnesota by Region of Birth, 1990-2003



*Latin American/Caribbean = Mexico, Caribbean countries, Central/South American countries

The Centers for Disease Control and Prevention (CDC) identifies multiple factors that may be at play in a possible resurgence: the difficulty of maintaining over time the behavior change initiated by many MSM during the 1980s and 1990s; overconfidence in HIV drugs without concern for toxicities; lack of direct experience by most young MSM with HIV/AIDS; substance use; and, particularly for minority communities, racism, stigma, and less access to services.

It is not clear if MSM who are infected with syphilis are engaging in behaviors that put their partners at risk for HIV infection. Anecdotal reports indicate that there are many men who are adopting strategies that reduce the risk of HIV transmission, but such strategies may not be as effective in protecting them from other sexually transmitted infections, such as syphilis. To date, there has been no significant increase in HIV diagnoses among MSM in any of the cities reporting syphilis outbreaks. However, concern remains high, and diligence in prevention, screening, and treatment in this population is critical.

Success Stories

In the early 1980s, thousands of hemophiliacs in the United States were infected with HIV through the blood supply. Since the advent of blood bank screening for HIV in 1985, HIV cases resulting from the receipt of blood or blood products have diminished significantly; the current risk of HIV transmission from the blood supply is 1:4,000,000.⁴

In 1992, more than 900 children in the United States were diagnosed with AIDS as a result of perinatal HIV transmission (during pregnancy, labor, delivery, and/or breastfeeding); 25% to 30% of infants born to untreated HIV-infected women during that year become infected.⁵ However, after the announcement in 1994 of the results of the Pediatric AIDS Clinical Trials Group protocol 076, the U.S. Public Health Service (PHS) published guidelines for the use of zidovudine (ZDV) to reduce perinatal HIV transmission. In 1995, PHS issued guidelines recommending universal counseling and voluntary HIV testing of all pregnant women and treatment for those infected. Minnesota HIV/AIDS surveillance data indicate that these PHS recommendations have been

implemented with success. During 1982-1994, the rate of perinatal transmission in Minnesota was 25% (23 cases per 93 births to HIV-infected women); the rate decreased to 10% (10/98) in 1995-1999 and to 2% (3/141) in 2000-2003.

Despite this success, challenges remain. Of the 11 perinatal infections in Minnesota since 1996 more than half (n=6) occurred among foreign-born mothers resulting in a rate of transmission during the period 1996-2003 more than 5 times that of white, U.S.-born women (11% vs. 2%). Evidence demonstrates that efforts are needed to improve both the acceptability of prenatal HIV testing among foreign-born pregnant women for whom stigma, language, and denial are significant barriers and to ensure universal offering of prenatal HIV testing. A random sample of Twin Cities Metropolitan Area medical charts of delivering women during 1998-1999 indicated that in only 62% of cases was a prenatal HIV test performed.⁶ MDH supports the CDC recommendation⁷ that voluntary HIV testing be included with the standard battery of prenatal tests (voluntary because women have the opportunity to decline, or opt out of, the test).

The Clinician's Role

Healthcare providers are encouraged to discuss sexual health issues with their patients and to consider routine HIV and STD screening of their sexually active patients. Healthcare providers play an integral role in public health by reporting disease to the MDH. HIV infection, AIDS, chlamydia, gonorrhea, and syphilis are all conditions reportable to the MDH. Data collected from healthcare providers are summarized and used to help educate, target prevention efforts, plan for services, and develop policy. Thank you for your assistance with this important public health activity!

For More Information

- To read the CDC's revised guidelines for HIV counseling, testing, and referral, go to www.cdc.gov/mmwr/preview/mmwrhtml/rr5019a1.htm.
- For information about culturally-appropriate health care, visit the Center for Cross-Cultural Health's Web site at www.crosshealth.com.
- MDH's guide to routine HIV

testing during pregnancy, including local resources, is available at www.health.state.mn.us/divs/idepc/diseases/hiv/hivtestingguide2003.html.

- For more information on HIV/AIDS clinical support and consultation services for health care providers, call the Midwest AIDS Training & Education Center (MATEC) at 612-626-3609 and ask for their *MN-Tel: HIV Consultation Network* brochure.
- MDH's annual HIV/AIDS surveillance reports are available at www.health.state.mn.us/divs/idepc/diseases/hiv/hivstatistics.html.
- HIV/AIDS cases can be reported to MDH by calling 612-676-5414 or 877-676-5414.

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How to Receive an E-mail Notification When the Newest *Disease Control Newsletter* is Available on the Internet

The Minnesota Department of Health offers a free electronic subscription service that allows you to receive automatic e-mail notices when the *Disease Control Newsletter* and certain other publications are updated or new information is added.

If you subscribe to this service, you will need to provide your e-mail address. Your address will be used only to provide you with the material you have requested. We will not share your e-mail address with anyone else or use it for any other purpose.

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The *Disease Control Newsletter* is available on the MDH Acute Disease Investigation and Control (ADIC) Section web site (<http://www.health.state.mn.us/divs/idepc/newsletters/dcn/index.html>).

If you require this document in another format such as large print, Braille, or cassette tape, call 612-676-5414 or, in Greater Minnesota, call 1-877-676-5414