ILLINOIS DEPARTMENT OF PUBLIC HEALTH

Illinois Infectious Disease Report

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Outbreak of Methicillin-Resistant *Staphylococcus aureus* Skin Infections Among High School Athletes in Illinois

By Stephanie M. Borchardt, M.P.H., Ph.D.

Introduction

Although outbreaks of methicillin-resistant *Staphylococcus aureus* (MRSA) have typically been associated with health-care institutions, MRSA is an emerging cause of skin infection in the community. Outbreaks of MRSA have recently been documented among participants of competitive sports including rugby [1], football [2], wrestling [3] and fencing [4]. Risk factors for MRSA skin infection identified in these reports include football player positions (i.e. cornerback and wide receiver), skin abrasions, body shaving and sharing towels. This report describes a cluster of MRSA and methicillin-sensitive *S. aureus* (MSSA) skin infections among high school students and staff and identifies potential risk factors for infection.

Methods

On Sept. 21, 2004 the Illinois Department of Public Health (IDPH) was notified by the Tazewell County Health Department (TCHD) about a cluster of MRSA skin infections among high school football players and a high school dance team member. Additional students presenting with suspicious skin lesions were evaluated by the high school nurse and were instructed to see their physician if necessary. Students with draining skin lesions were excluded from school and school-affiliated activities until their skin lesion was no longer draining and they were taking appropriate antibiotic treatment for 24 hours or their culture was negative for *S. aureus*.

A confirmed case of MRSA was defined as a skin or soft tissue infection (e.g., cellulitis, folliculitis, or skin abscess) occurring in a student, faculty member or close contact of a student or faculty member that was laboratory confirmed as MRSA between Aug. 31 and Sept. 30, 2004. A probable case of MRSA was defined similarly as a skin or soft tissue infection occurring in a student, faculty member or close contact of a student or faculty member that was not laboratory confirmed but was epidemiologically linked to a laboratory confirmed MRSA case between Aug. 31 and Oct. 1, 2004. Cases of MSSA were defined similarly.

The high school athletic locker rooms were examined and the varsity football coach, janitorial staff and infected students were interviewed concerning athletes' routines and locker room cleaning practices. A combination of face-to-face and telephone interviews were conducted with student cases and affected staff to assess skin injuries, hygienic practices, physical contact, sharing of personal items and other potential exposures accrued from Aug. 31 to Sept. 30. Face-to-face interviews were completed for students present at school, whereas, students who were restricted from school, due to their infection, were interviewed over the telephone.

MRSA and MSSA isolates were characterized at the Illinois Department of Public Health Laboratory by pulsed-field gel electrophoresis (PFGE) subtyping. Antibiotic susceptibility testing was performed at local clinical laboratories.

On Sept. 28, 2004 the high school, in cooperation with TCHD, sponsored a *S. aureus* screening clinic for high school students and family members of high school students and students from several neighboring districts. The purpose of the screening clinic was to provide physician evaluation of skin lesions, laboratory testing of specimens from suspect skin lesions and treatment for skin infections.

Results

Interviews were completed for all MRSA and six of seven MSSA cases. Three cases (one hospitalized) of MRSA skin infection were identified among two football players and one member of the high school dance team. Seven MSSA cases were identified among two football players, one soccer player, one member of the dance team, two students without sports affiliation and a school janitor. Ten probable cases were identified, although none of these individuals

were cultured, for *S. aureus*. Analyses were limited to laboratory confirmed cases of MRSA or MSSA. The three MRSA cases and seven MSSA cases had 13 infections at the following sites: elbow (2), foot (2), ankle (2), wrist (1), lower leg (1), abdomen (1), forearm (1), back (1), buttock (1) and upper arm (1).

PFGE subtyping was performed for two of three MRSA case isolates and three of seven MSSA case isolates. In addition, five noscocomial MRSA isolates and one nosocomial MSSA isolate were subtyped for comparison. PFGE patterns from the two MRSA case isolates were each unique (Figure 1). However, two MSSA case isolates from a football player and a dance team member were 96 percent similar by PFGE. Two separate pairs of nosocomial MRSA isolates were indistinguishable by PFGE, although none matched an outbreak case isolate.

The following behaviors, which may contribute to person-to-person transmission of staff were identified: defense positions (e.g. defensive lineman, linebacker or safety), starters on the team, playing the majority of game-time during the season, wearing a game or practice uniform more than once without laundering between use, greater than 10 cuts, abrasions or turf burns and having skin-to-skin contact with a teammate with a skin infection during the season.

The dance team changed into their uniforms before football games in the same weight room used by football players for training and reported sharing clothes with fellow dance team members. The school janitor case reported skin-to-skin contact with students through "high-fives" and "knuckle-busters".

Discussion

Outbreaks of community-associated MRSA have been described among players of competitive sports. To our knowledge this is the first report of MRSA infection in a high school dance team member. Physicians should be aware of the potential for MRSA infections in sports participants when evaluating patients and making treatment decisions.

Community-associated MRSA isolates have been reported to have distinct molecular features, by PFGE, compared with heath care-associated isolates. Investigators speculate that community-associated MRSA infections are not caused by MRSA strains that originated in health care settings [5]. Similarly, we found the MRSA and MSSA isolates from this outbreak to be genetically distinct from nosocomial MRSA and MSSA isolates from the same geographic area. Genetic similarity among two MSSA isolates from a high school football player and dance team member suggests that fomite transmission in the weight room contributed to transmission in this outbreak.

Although this investigation did not determine the source of MRSA or MSSA spread definitively, several factors might have contributed to transmission among the football players and dance team members. First, abrasions and other skin trauma could have facilitated entry of *S. aureus*. Second, frequent physical contact among football players during practice could have facilitated transmission. Third, use of shared equipment (e.g. weight benches), clothing or towels that were not cleaned or laundered between users could have served as a vehicle for *S. aureus* transmission.

Our ability to detect risk factors associated with *S. aureus* transmission was limited by the small number of cases. Many physicians did not order cultures of suspect *S. aureus* lesions, therefore possibly underestimating the number of cases associated with this outbreak. Not all case isolates were available for PFGE subtyping, which limited our ability to determine the relatedness of outbreak isolates.

This outbreak of staphylococcal infections demonstrated a variety of plausible transmission modalities, which underscores the need for thorough hygiene recommendations to control transmission of *S. aureus* regardless of its antimicrobial susceptibility pattern. In this outbreak, control of staphylococcal transmission was achieved by recommending students maintain good hygiene and avoid contact with drainage from skin lesions of other students. Coaches and parents were instructed to ensure all practice and game uniforms were laundered at least once a week, special attention was given to wound care for players and skin lesions were covered with an occlusive dressing before play. School administrators were to ensure items used in sporting and/or athletic-related activities (e.g., weight benches) were cleaned after each use and football players avoid sharing towels or other personal items.

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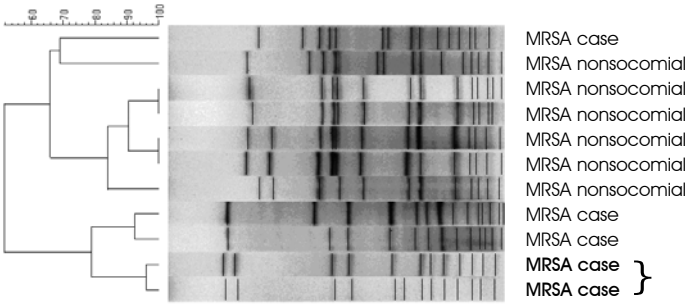
Figure 1. Dendrogram of pulsed-field gel electrophoresis patterns from school outbreak or nosocomial MRSA and MSSA isolates.



A Case of Orf Virus Disease in Madison County

By Raquel Griffith, M.P.H.

In July 2004, a 16-year-old male from Madison County was bitten by a sheep while washing the sheep in preparation for a county fair. Approximately three days later, the teenager developed a skin lesion at the site where the bite had occurred (Figure 1). Within three weeks from the time he was bitten, the teenager sought care from a local clinician only after a football-associated injury occurred in the same area as the bite. From the interview between the clinician, the teenager and the teen's family, the unusual looking lesion was suspected of being consistent with a zoonotic parapox virus known as orf. Collaborative efforts between the clinician, the local laboratory and the Madison County Health Department, quickly identified the lesion as being orf disease. Later, orf was confirmed through polymerase chain reaction (PCR) assays performed by the U.S. Centers for Disease Control and Prevention (CDC). Shortly after the teenager's medical visit, the lesion completely healed with no medical treatment.

Orf in Animals

Orf, also known as contagious ecthyma or "scabby mouth," is a disease of sheep and goats. It is an acute infectious skin disease that causes papules and vesicles to develop primarily around the lips, legs, and feet of young animals. Occasionally infection occurs around the nostrils, the eyes and the udders.[1]

Orf disease can develop in flocks where orf has not been previously established.[2] The orf vaccine is helpful in minimizing the severity of the disease in a flock. However, newly vaccinated sheep can also spread orf since the vaccine is the live-attenuated form of the virus. The vaccine is usually introduced to an animal by scarifying the un-wooled side of the animal skin, such as the inner part of the thigh or the tail fold.[2] If done correctly, a newly vaccinated animal should only have a localized reaction that does not spread. Flocks may develop herd immunity through multiple re-infections.

Whether it is the natural form or the vaccinated form of the disease, orf is contagious. In approximately seven days, a vesicle develops on the skin at the site of an infection. The vesicle then progresses to a pustular before becoming a scab. After the scab drops off, the area usually heals without scarring within 2 to 3 weeks. Desiccation does not change the infectivity of orf. The virus can live in dried scab for long periods of time; it has been recovered from dried crusts after 12 years.[1]

Orf in Humans

Orf disease is transmissible to humans through direct contact with infected animals or contaminated equipment such as knives and shears. Orf is probably a relatively common occupational disease among sheep and goat handlers and veterinarians, but is rarely diagnosed. Person-to-person transmission is rare.[3]

Orf disease in humans is similar to the disease in animals. Within 3 to 6 days a single lesion or few lesions develop mostly on the dorsal side of the hand, fingers or face. The lesions are usually large nodules (about one-half inch in diameter) with minor to no discomfort. The lesions then develop into vesicles, pustules, and a thick crust (Figure 1). The disease is self-limiting and usually completely heals within three months without scarring or treatment. There is no human vaccine for orf disease.

When should orf disease be reported?

Orf is caused by a parapoxvirus (a double-stranded DNA virus) and is in the same poxvirus family as smallpox, monkeypox, molluscum contagiosum and cowpox (Figure 2). The signs and symptoms of orf can be mistaken for other diseases that are considered bioterrorism agents. Differential diagnosis of orf includes monkeypox, cowpox and cutaneous anthrax. In Illinois, it should be reported under the category of an unusual case or cluster of cases. The diagnosis of orf can be made in only a limited number of laboratories. The local public health department and state health department can work together to facilitate testing of samples from suspect cases. Preparations for collection and testing of suspected orf lesions should follow the CDC's monkeypox protocol (www.cdc.gov/ncidod/monkeypox/lab.htm). Once the specimen has been collected, IDPH will make arrangements with CDC to have the specimen tested.

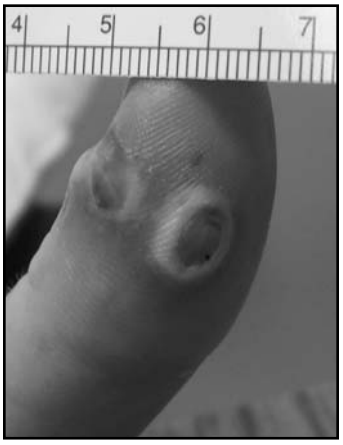


Figure 1: A picture of the teen's thumb 22 days after bite. Stage 2 (target) - A bulla with an iris-like configuration (nodule with a red center, a white middle ring, and a red periphery)

Prevention

Infected animals are considered infectious until all lesions have completely healed, which can take up to six weeks. During this time, animal owners should consider animal isolation and seek the advice of veterinarians about the possibility of vaccinating for orf. Other basic precautionary measures that should be taken to minimize orf transmission to people, especially children, include:

- When handling infected animals, handlers should wear protecting garments over clothing or change work clothes and boots at the end of the workday and use heavy duty gloves that can be washed regularly.
- Handlers should regularly cleanse contaminated animal pens and cages and any tools used in shearing animals.
- Show animals should not participate in any public activities, such as fairs and petting zoo situations, until all lesions have healed.
- When possible, adults and children should immediately wash hands and faces after being in contact with animals, especially those with skin lesions.
- Persons with suspected orf should visit a health care provider and discuss their history of contact with sheep and goats to aid in the identification of orf.

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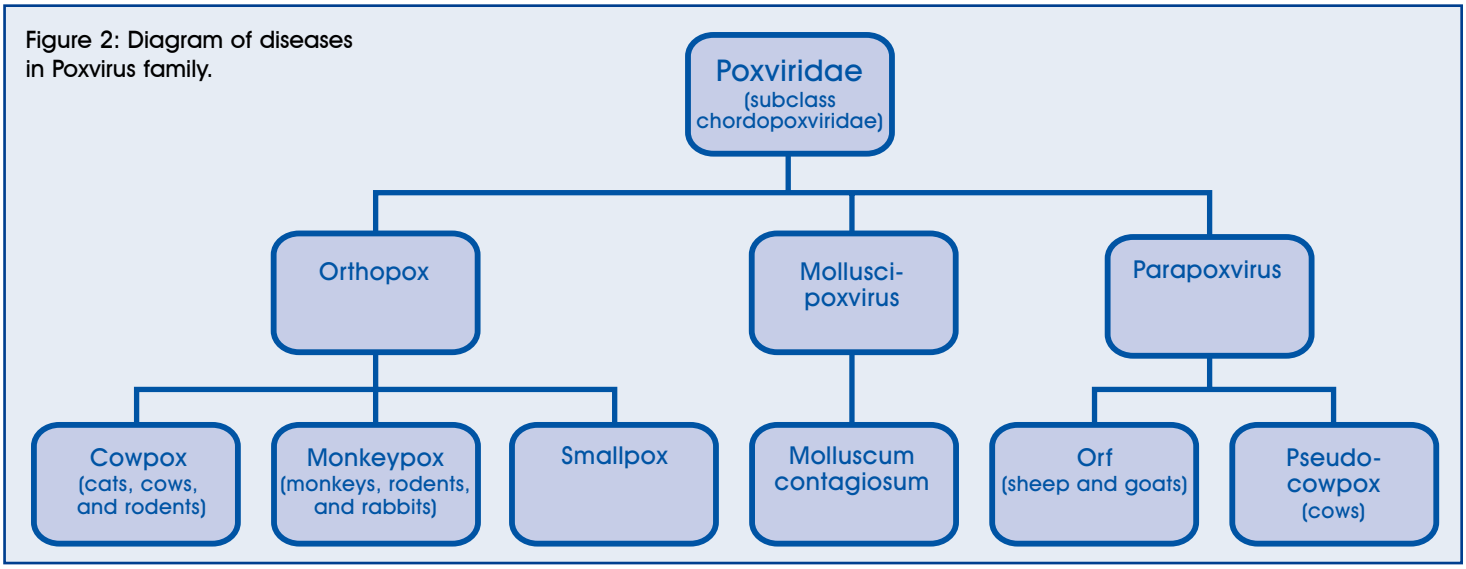
Figure 2: Diagram of diseases in Poxvirus family.



Surveillance is Information for Action: Cryptosporidiosis

Jonathan Yoder M.S.W., M.P.H.

Q: What public health action is triggered when a case of cryptosporidiosis is reported to the local health department?

A: Cryptosporidiosis is a parasitic infection affecting the epithelial cells of the gastrointestinal, biliary and respiratory tracts in humans as well as more than 45 other vertebrate species. Infection is caused the by a protozoan parasite (*Cryptosporidium* species) shed in the feces in the form of an oocyst, which has a hard shell to protect it from the environment. *Cryptosporidium* is classified as an emerging infectious agent; its role as a human pathogen has only been recognized since around 1980. Human infections from this parasite have been documented in nearly every country.

Predominant symptoms of cryptosporidiosis include profuse and watery diarrhea accompanied by abdominal cramping. Less frequently, affected persons experience nausea, vomiting, anorexia and fever. In immune-competent persons, infections normally last 1 to 2 weeks. Persons at risk for more severe, life-threatening symptoms are young children, pregnant women, and those with weakened immune systems.

Outbreaks have most commonly been associated with person-to-person and waterborne modes of spread. Foodborne and animal-to-person spread has also been documented. Waterborne cryptosporidiosis outbreaks related to drinking water have occurred in both large and small communities, with the largest outbreak occurring in Milwaukee, Wis. in 1993, affecting an estimated 403,000 people. Because of its natural chlorine resistance, traditional methods of chemical water treatment are not completely effective for removing this pathogen. The U.S. Centers for Disease Control and Prevention has provided information on effective home filtration methods on the following website: http://www.cdc.gov/ncidod/dpd/parasites/cryptosporidiosis/factsht_crypto_prevent_water.htm

Cryptosporidium has emerged as the leading cause of reported outbreaks of gastroenteritis related to treated swimming venues (e.g. chlorinated swimming pools) over the past decade (Figure 1) (*1*). In July 2001 in Tazewell County, an outbreak sickened 358 swimmers at a water park. It is believed that a fecal accident by an ill swimmer led to the contamination of a water park pool; contamination was subsequently spread to other pools in the water park. In 2004, swimming pool outbreaks included a community pool in DeKalb County and a hotel pool in Cook County. Because of its association with recreational water, cryptosporidiosis exhibits seasonality (Figure 2).

Figure 1. Recreational water-associated outbreaks of gastroenteritis in treated water venues, by etiologic agent – United States, 1993-2002 (N=64) (1)

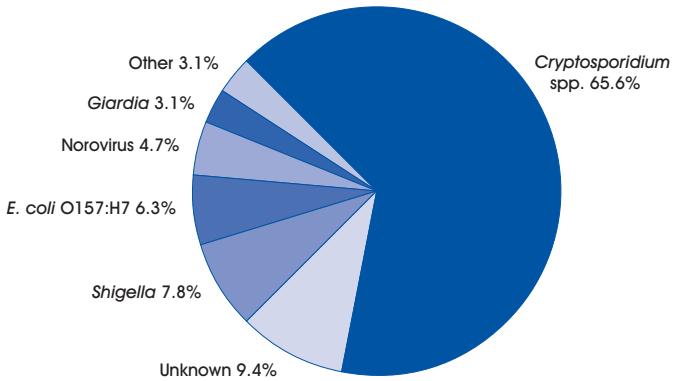
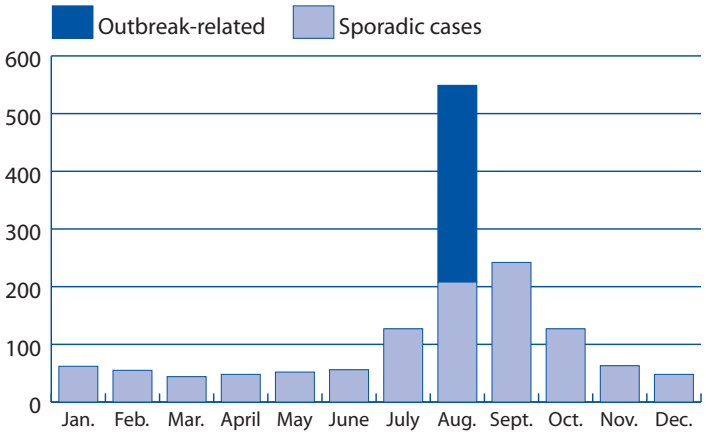


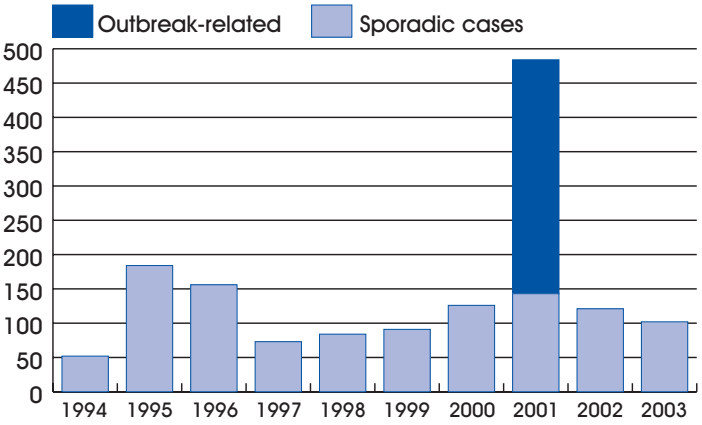
Figure 2. Number of cases of cryptosporidiosis by month of illness onset – Illinois, 1994-2003 N=1473)



Cryptosporidiosis is a notifiable disease in Illinois and must be reported as soon as possible during normal business hours but within seven days. According to Illinois Administrative Code Title 77, Section 690.365, criteria for a laboratory-confirmed case are identification of the *Cryptosporidium* species, positive antigen detection or a positive PCR test (in a gastrointestinal specimen). The U.S. Centers for Disease Control and Prevention defines laboratory-confirmed cryptosporidiosis as the detection—in symptomatic

or asymptomatic persons—of *Cryptosporidium* oocysts in stool by microscopic examination, or in intestinal fluid or small-bowel biopsy specimens, or oocyst or sporozoite antigens by immunodiagnostic methods (e.g. ELISA), or by PCR techniques when routinely available, or demonstration of reproductive stages in tissue preparations (2). From 1994 through 2003, 1,473 cases of cryptosporidiosis were reported in Illinois (median annual cases =112) (Figure 3). During this time period there was only one reported outbreak of cryptosporidiosis; however, that 2001 outbreak accounted for 23 percent of the total cases for this decade.

Figure 3. Number of reported sporadic and outbreak-related cases of cryptosporidiosis by year – Illinois, 1994-2003 (N=1473)

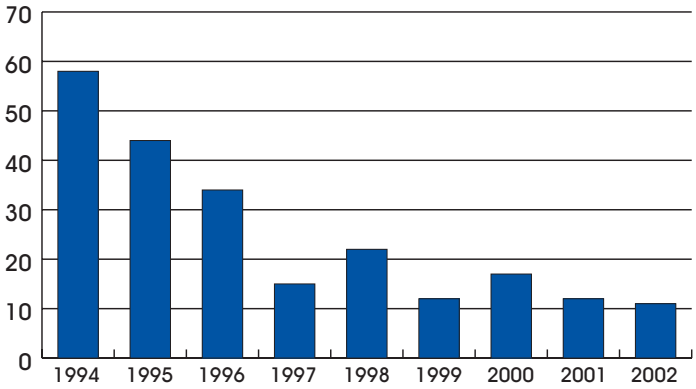


Cryptosporidiosis is also reportable as an AIDS-defining condition in persons infected with HIV. To meet the case definition, intestinal symptoms of cryptosporidiosis must persist more than a month. Surveillance for AIDS-associated cryptosporidiosis (Figure 4) is independent of the cryptosporidiosis surveillance system maintained by the IDPH Communicable Disease Control Section. Therefore, duplicate reporting may occur if cases met the case definition for AIDS and cryptosporidiosis.

Factoid

Both Howard Ricketts and Stanislas von Prowazek died of the disease they were investigating (epidemic typhus). The organism was subsequently named in honor of them: *Rickettsia prowazekii*. This organism is carried by the human body louse. The disease was common in prisons and has afflicted the homeless and displaced. Ricketts trained at Rush Medical College, and worked at the University of Chicago.

Figure 4. Number of AIDS cases with cryptosporidiosis by year – Illinois, 1994-2002 (N=225)



In the event of a diagnosis of cryptosporidiosis, ill persons should be advised to wash their hands with soap and water after using the toilet and before eating or preparing food, to avoid swimming in recreational water (pools, hot tubs, lakes or rivers, the ocean, etc.) during illness and for at least two weeks after diarrhea stops, and to avoid fecal exposure during sexual activity (3). Caregivers of ill children should wash their hands after changing diapers. Food handlers and those in sensitive occupations should not return to work until symptoms have resolved. Environmental control measures (e.g. closing any implicated facilities, hyper-chlorinating swimming pools) should be performed as needed to control transmission from suspected or confirmed sources. Cryptosporidiosis surveillance data allows for recognition of emerging outbreaks and establishing the impact of control measures. Active surveillance activities, such as alerting local medical providers and high-risk groups (e.g. daycares, swimming pool operators) to the presence of an outbreak, serve the additional purpose of raising awareness, which may lead to an increase in diagnostic testing and enhancement of community-wide control measures.

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Article Alert

In an effort to keep you updated on published articles related to infectious diseases, please be aware of the following:

Malone JL, Ijaz K, Lambert L, Rosencrans L, Phillips L, Tomlinson V, Arbise M, Moolenaar RL, Dworkin MS, Simoes EJ. Investigation of healthcare-associated transmission of Mycobacterium tuberculosis among patients with malignancies at three hospitals and at a residential facility. Cancer 2004;101(12):2713-21.

Bisgard KM, Pascual FB, Ehresmann KR, Miller CA, Cianfrini C, Jennings CE, Rebmann CA, Gabel J, Schauer SL, Lett SM. Infant pertussis: who was the source? Pediatr Infect Dis J 2004;23(11):985-9.

Kulesh DA, Loveless BM, Norwood D, Garrison J, Whitehouse CA, Hartmann C, Mucker E, Miller D, Wasieloski LP Jr, Huggins J, Huhn G, Miser LL, Imig C, Martinez M, Larsen T, Rossi CA, Ludwig GV. Monkeypox virus detection in rodents using real-time 3'-minor groove binder TaqMan assays on the Roche LightCycler. Lab Invest 2004;84(9):1200-8.

Passaro DJ, Scott M, Dworkin MS. E-mail surveys assist investigation and response: a university conjunctivitis outbreak. Epidemiol Infect 2004; 132(4):761-4.

Watson JT, Pertel PE, Jones RC, Siston AM, Paul WS, Austin CC, Gerber SI. Clinical characteristics and functional outcomes of West Nile Fever. Ann Intern Med 2004;141(5):360-5.

Ruiz MO, Tedesco C, McTighe TJ, Austin C, Kitron U. Environmental and social determinants of human risk during a West Nile virus outbreak in the greater Chicago area, 2002. Int J Health Geogr 2004;3(1):8.

Huhn GD, Chase RA, Dworkin MS. Monkeypox in the Western hemisphere (letter). N Engl J Med. 2004;350(17):1790-1; author reply 1790-1.

Swanson J, Lancaster M, Anderson J, Crandell M, Haramis L, Grimstad P, Kitron U. Overwintering and establishment of Aedes albopictus (Diptera: Culicidae) in an urban La Crosse virus enzootic site in Illinois. J Med Entomol 2000;37(3):454-60.

Upcoming Events

North Central States Epidemiology Meeting, March 17th and 18th, 2005, Chicago, Illinois, University of Illinois at Chicago

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