MINNESOTA DEPARTMENT OF HEALTH
DISEASE CONTROL NEWSLETTER

Volume 38, Number 1 (pages 1-32) January/July 2010

Annual Summary of Communicable Diseases Reported to the Minnesota Department of Health, 2009

Introduction
Assessment of the population's health is a core public health function. Surveillance for communicable diseases is one type of assessment. Epidemiologic surveillance is the systematic collection, analysis, and dissemination of health data for the planning, implementation, and evaluation of health programs. The Minnesota Department of Health (MDH) collects information on certain infectious diseases for the purposes of determining disease impact, assessing trends in disease occurrence, characterizing affected populations, prioritizing control efforts, and evaluating prevention strategies. Prompt reporting allows outbreaks to be recognized in a timely fashion when control measures are most likely to be effective in preventing additional cases.

In Minnesota, communicable disease reporting is centralized, whereby reporting sources submit standardized report forms to MDH. Cases of disease are reported pursuant to Minnesota Rules Governing Communicable Diseases (Minnesota Rules 4605.7000 - 4605.7800). The diseases listed in Table 1 (page 2) must be reported to MDH. As stated in the rules, physicians, health care facilities, laboratories, veterinarians and others are required to report these diseases. Reporting sources may designate an individual within an institution to perform routine reporting duties (e.g., an infection control preventionist for a hospital). Data maintained by MDH are private and protected under the Minnesota Government Data Practices Act (Section 13.38). Provisions of the Health Insurance Portability and Accountability Act (HIPAA) allow for routine disease reporting without patient authorization.

Since April 1995, MDH has participated as an Emerging Infections Program (EIP) site funded by the Centers for Disease Control and Prevention (CDC) and, through this program, has implemented active hospital- and laboratory-based surveillance for several conditions, including selected invasive bacterial diseases and food-borne diseases.

Isolates for pathogens associated with certain diseases are required to be submitted to MDH (Table 1). The MDH Public Health Laboratory (PHL) performs microbiologic evaluation of isolates, such as pulsed-field gel electrophoresis (PFGE), to determine whether isolates (e.g., enteric pathogens such as *Salmonella* and *Escherichia coli* O157:H7, and invasive pathogens such as *Neisseria meningitidis*) are related, and potentially associated with a common source. Testing of submitted isolates also allows detection and monitoring of antimicrobial resistance, which continues to be an important problem.

Table 2 summarizes cases of selected communicable diseases reported during 2009 by district of the patient's residence. Pertinent observations for some of these diseases are presented below.

Incidence rates in this report were calculated using disease-specific numerator data collected by MDH and a standardized set of denominator data derived from U.S. Census data. Disease incidence is categorized as occurring within the seven-county Twin Cities metropolitan area (metropolitan area) or outside of it in Greater Minnesota.

Anaplasmosis
Human anaplasmosis (formerly known as human granulocytic ehrlichiosis) is caused by *Anaplasma phagocytophilum*, a rickettsial organism transmitted to humans by bites from *Ixodes scapularis* (the blacklegged tick). The same tick also transmits the etiologic agents of Lyme disease and babesiosis. *A. phagocytophilum* can also be transmitted by blood transfusion.

In 2009, 317 anaplasmosis cases (6.1 cases per 100,000 population) were

continued on page 4

Inside:

Table 1. Diseases Reportable to the Minnesota Department of Health

Report Immediately by Telephone

Anthrax (*Bacillus anthracis*) a
Botulism (*Clostridium botulinum*)
Brucellosis (*Brucella* spp.) a
Cholera (*Vibrio cholerae*) a
Diphtheria (*Corynebacterium diphtheriae*) a
Hemolytic uremic syndrome a
Measles (rubeola) a
Meningococcal disease (*Neisseria meningitidis*) (all invasive disease) a, b
Orthopox virus a
Plague (*Yersinia pestis*) a
Poliomyelitis a
Q fever (*Coxiella burnetii*) a
Rabies (animal and human cases and suspected cases)
Rubella and congenital rubella syndrome a
Severe Acute Respiratory Syndrome (SARS) (1. Suspect and probable cases of SARS. 2. Cases of health care workers hospitalized for pneumonia or acute respiratory distress syndrome.) a
Smallpox (variola) a
Tularemia (*Francisella tularensis*) a
Unusual or increased case incidence of any suspect infectious illness a

Report Within One Working Day

Amebiasis (*Entamoeba histolytica/dispar*)
Anaplasmosis (*Anaplasma phagocytophilum*)
Arboviral disease (including but not limited to, LaCrosse encephalitis, eastern equine encephalitis, western equine encephalitis, St. Louis encephalitis, and West Nile virus)
Babesiosis (*Babesia* spp.)
Blastomycosis (*Blastomyces dermatitidis*)
Campylobacteriosis (*Campylobacter* spp.) a
Cat scratch disease (infection caused by *Bartonella* spp.)
Chancroid (*Haemophilus ducreyi*) c
Chlamydia trachomatis infection c
Coccidioidomycosis
Cryptosporidiosis (*Cryptosporidium* spp.) a
Cyclosporiasis (*Cyclospora* spp.) a
Dengue virus infection
Diphyllobothrium latum infection
Ehrlichiosis (*Ehrlichia* spp.)
Encephalitis (caused by viral agents)
Enteric *E. coli* infection (*E. coli* O157:H7, other enterohemorrhagic [Shiga toxin-producing] *E. coli*, enteropathogenic *E. coli*, enteroinvasive *E. coli*, enterotoxigenic *E. coli*) a
Enterobacter sakazakii (infants under 1 year of age) a
Giardiasis (*Giardia lamblia*)
Gonorrhea (*Neisseria gonorrhoeae*) c
Guillain-Barre syndrome e
Haemophilus influenzae disease (all invasive disease) a,b
Hantavirus infection
Hepatitis (all primary viral types including A, B, C, D, and E)
Histoplasmosis (*Histoplasma capsulatum*)
Human immunodeficiency virus (HIV) infection, including Acquired Immunodeficiency Syndrome (AIDS) a, d
Influenza (unusual case incidence, critical illness, or laboratory confirmed cases) a
Kawasaki disease
Kingella spp. (invasive only) a, b
Legionellosis (*Legionella* spp.) a
Leprosy (Hansen's disease) (*Mycobacterium leprae*)
Leptospirosis (*Leptospira interrogans*)
Listeriosis (*Listeria monocytogenes*) a
Lyme disease (*Borrelia burgdorferi*)
Malaria (*Plasmodium* spp.)
Meningitis (caused by viral agents)
Mumps
Neonatal sepsis, less than 7 days after birth (bacteria isolated from a sterile site, excluding coagulase-negative *Staphylococcus*) a, b
Pertussis (*Bordetella pertussis*) a
Psittacosis (*Chlamydophila psittaci*)
Retrovirus infection
Reye syndrome
Rheumatic fever (cases meeting the Jones Criteria only)
Rocky Mountain spotted fever (*Rickettsia rickettsii*, *R. canada*)
Salmonellosis, including typhoid (*Salmonella* spp.) a
Shigellosis (*Shigella* spp.) a
Staphylococcus aureus (vancomycin-intermediate *S. aureus* [VISA], vancomycin-resistant *S. aureus* [VRSA], and death or critical illness due to community-associated *S. aureus* in a previously healthy individual) a
Streptococcal disease (all invasive disease caused by Groups A and B streptococci and *S. pneumoniae*) a, b
Syphilis (*Treponema pallidum*) c
Tetanus (*Clostridium tetani*)
Toxic shock syndrome a
Toxoplasmosis (*Toxoplasma gondii*)
Transmissible spongiform encephalopathy
Trichinosis (*Trichinella spiralis*)
Tuberculosis (*Mycobacterium tuberculosis* complex) (Pulmonary or extrapulmonary sites of disease, including laboratory confirmed or clinically diagnosed disease, are reportable. Latent tuberculosis infection is not reportable.) a
Typhus (*Rickettsia* spp.)
Unexplained deaths and unexplained critical illness (possibly due to infectious cause) a
Varicella-zoster disease (1. Primary [chickenpox]: unusual case incidence, critical illness, or laboratory-confirmed cases. 2. Recurrent [shingles]: unusual case incidence, or critical illness.) a
Vibrio spp. a
Yellow fever
Yersiniosis, enteric (*Yersinia* spp.) a

Sentinel Surveillance (at sites designated by the Commissioner of Health)

Methicillin-resistant *Staphylococcus aureus*
Clostridium difficile

a Submission of clinical materials required. If a rapid, non-culture assay is used for diagnosis, we request that positives be cultured, and isolates submitted. If this is not possible, send specimens, nucleic acid, enrichment broth, or other appropriate material. Call the MDH Public Health Laboratory at 651-201-4953 for instructions.

b Isolates are considered to be from invasive disease if they are isolated from a normally sterile site, e.g., blood, CSF, joint fluid, etc.

c Report on separate Sexually Transmitted Disease Report Card.

d Report on separate HIV Report Card.

e Reportable as of October 1, 2009-September 30, 2011

Table 2. Cases of Selected Communicable Diseases Reported to the Minnesota Department of Health by District of Residence, 2009

Disease	Metropolitan (2,810,414)	Northwestern (153,218)	Northeastern (320,342)	Central (715,467)	West Central (229,186)	South Central (286,956)	Southeastern (486,517)	Southwestern (218,293)	Unknown Residence	Total (5,220,393)
	District (population per U.S. Census 2009 estimates)									
Anaplasmosis	84	40	43	123	5	5	13	4	0	317
Arboviral disease										
LaCrosse	0	0	0	0	0	0	0	0	0	0
West Nile	0	1	0	0	2	0	0	1	0	4
Babesiosis	10	4	0	9	3	1	4	0	0	31
Campylobacteriosis	442	19	28	127	39	46	110	88	0	899
Cryptosporidiosis	41	15	25	56	36	39	58	79	0	349
Escherichia coli O157 infection	57	4	2	23	12	6	22	4	0	130
Hemolytic Uremic Syndrome	8	2	1	4	1	0	0	0	0	16
Giardiasis	349	7	23	101	21	32	66	29	50	678
Haemophilus influenzae disease	36	8	10	5	4	4	10	2	0	79
HIV infection other than AIDS	319	3	3	19	5	4	13	4	0	370
AIDS (cases diagnosed in 2009)	159	2	2	10	1	3	6	1	0	184
Legionellosis	16	0	2	1	2	2	6	1	0	30
Listeriosis	2	0	0	0	0	0	1	0	0	3
Lyme disease	444	51	125	287	40	23	88	7	0	1,065
Meningococcal disease	12	0	2	1	1	0	0	0	0	16
Mumps	5	0	1	0	0	0	0	0	0	6
Pertussis	510	33	16	492	9	10	44	20	0	1,134
Salmonellosis	331	20	21	67	26	34	51	28	0	578
Sexually transmitted diseases	11,555	332	702	1,200	331	550	1,201	409	685	16,965
Chlamydia trachomatis - genital infections	9,395	292	634	1,074	304	501	1,038	367	581	14,186
Gonorrhea	1,764	39	61	104	26	40	140	35	93	2,302
Syphilis, total	218	1	1	11	0	6	16	2	8	263
Primary/secondary	66	0	1	2	0	0	1	1	0	71
Early latent*	43	0	0	3	0	0	0	0	0	46
Late latent**	69	0	5	6	1	3	6	3	3	96
Congenital	0	0	0	0	0	0	0	1	0	1
Other***	0	0	0	0	0	0	0	0	0	0
Shigellosis	60	1	0	5	1	3	7	2	0	79
Streptococcus pneumoniae disease	320	35	65	106	35	33	63	29	0	686
Streptococcal invasive disease - Group A	109	7	18	19	7	5	21	3	0	189
Streptococcal invasive disease - Group B	250	16	35	41	20	25	43	24	0	454
Toxic Shock Syndrome	4	0	2	0	0	1	1	0	0	8
Tuberculosis	128	1	1	9	1	0	15	6	0	161
Viral hepatitis, type A	20	0	0	4	2	2	2	0	0	30
Viral hepatitis, type B (acute infections only, not perinatal)	29	1	2	0	1	2	2	2	0	39
Viral hepatitis, type C (acute infections only)	7	1	2	1	3	0	1	0	0	15
Yersiniosis	7	0	0	0	2	1	3	0	0	13

* Duration ≤1 year
** Duratin >1 year
*** Includes unstaged neurosyphilis, laten syphilis of unknown duration, and latent syphilis with clinical manifestations

County Distribution within Districts
Metropolitan - Anoka, Carver, Dakota, Hennepin, Ramsey, Scott, Washington
Northwestern - Beltrami, Clearwater, Hubbard, Kittson, Lake of the Woods, Marshall, Pennington, Polk, Red Lake, Roseau
Northeastern - Aitkin, Carlton, Cook, Itasca, Koochiching, Lake, St. Louis
Central - Benton, Cass, Chisago, Crow Wing, Isanti, Kanabec, Mille Lacs, Morrison, Pine, Sherburne, Stearns, Todd, Wadena, Wright
West Central - Becker, Clay, Douglas, Grant, Mahnomen, Norman, Otter Tail, Pope, Stevens, Traverse, Wilkin
South Central - Blue Earth, Brown, Faribault, LeSueur, McLeod, Martin, Meeker, Nicollet, Sibley, Waseca, Watonwan
Southeastern - Dodge, Fillmore, Freeborn, Goodhue, Houston, Mower, Olmsted, Rice, Steele, Wabasha, Winona
Southwestern - Big Stone, Chippewa, Cottonwood, Jackson, Kandiyohi, Lac Qui Parle, Lincoln, Lyon, Murray, Nobles, Pipestone, Redwood, Renville, Rock, Swift, Yellow Medicine

reported (Figure 1), nearly as high as the record 322 cases reported in 2007. The 317 cases in 2009 represent a 14% increase from the 278 anaplasmosis cases (5.3 per 100,000 population) reported in 2008 and a 70% increase from the median number of 186 cases (range, 139 to 322 cases) reported from 2004 through 2008. It is also markedly higher than the median number of cases reported annually from 1996 to 2003 (median, 56 cases; range, 14 to 149). One hundred ninety-eight (62%) cases reported in 2009 were male. The median age of cases was 58 years (range, 5 to 96 years), 19 years older than the median age of Lyme disease cases. Onsets of illness were elevated from June through August and peaked in July (37% of cases). In 2009, 29% of anaplasmosis cases (90 of 313 cases with known information) were hospitalized for their infection, for a median duration of 4 days (range, 1 to 18 days). One case died from complications of anaplasmosis in 2009.

A. phagocytophilum co-infections with the agents of Lyme disease and/or babesiosis can occur from the same tick bite. During 2009, 9 (3%) anaplasmosis cases were also confirmed cases of Lyme disease, and 7 (2%) were confirmed cases of babesiosis. Because of under-detection, these numbers may underestimate the true frequency of co-infections.

The risk for anaplasmosis is highest in many of the same areas where the risk of Lyme disease is greatest. In 2009, approximately two-thirds of anaplasmosis cases described *I. scapularis* exposures in Aitkin, Beltrami, Cass, Crow Wing, Hubbard, Itasca, or Pine Counties. The remainder occurred in other counties of eastern, northern, and southeastern Minnesota, or in Wisconsin.

Arboviral Diseases

LaCrosse encephalitis and Western equine encephalitis historically have been the primary arboviral encephalitides found in Minnesota. During July 2002, West Nile virus (WNV) was identified in Minnesota for the first time; subsequently, 455 human cases (including 14 fatalities) were reported from 2002 to 2009. In 2009, WNV cases were reported from 37 states and the District of Columbia; nationwide, 720 human cases of WNV disease were reported, including 32 fatalities. The largest WNV case counts during 2009 occurred in Texas (115 cases), California (112), and Colorado (103).

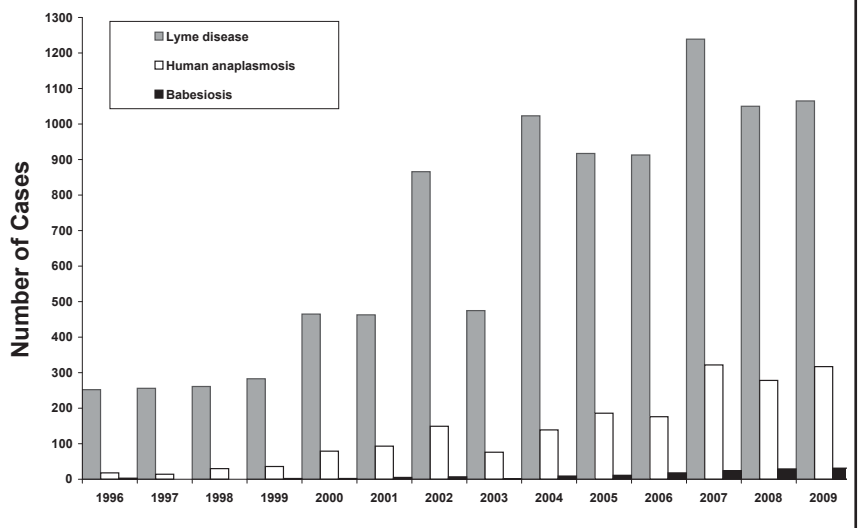
In Minnesota, 4 cases of WNV disease were reported in 2009 (the lowest annual case total to date). Three cases had West Nile (WN) fever, and 1 had neuroinvasive disease (encephalitis). The median age of all WN cases was 47 years (range, 28 to 70 years). All cases occurred among residents of western and central Minnesota. Similar to previous years, onset of symptoms for 3 cases occurred in mid to late summer (August 24 to October 4). However, a single case had a much earlier onset (June 24).

The field ecology of WNV is complex. The virus is maintained in a mosquito-to-bird transmission cycle. Several mosquito and bird species are involved in this cycle, and regional variation in vector and reservoir species is likely. In 2009, cool spring and early summer weather likely lead to delayed amplification of WNV between birds and mosquitoes, likely contributing to the decreased incidence of human cases. Interpreting the effect of weather on WNV transmission is extremely complex, leading to great difficulty in predicting how many people will become infected in a given year. WNV appears to be established throughout Minnesota; it will probably be present in the state to some extent every year. The disease risk to humans, however, will likely continue to be higher in central and western Minnesota where the primary mosquito vector, *Culex tarsalis*, is most abundant.

During 2008, there was a nationwide recall of a commercial WNV IgM test kit after many false-positive test results were identified in several states. All of the WNV test kits currently available are labeled for use on serum to aid in a presumptive diagnosis of WNV infection in patients with clinical symptoms of neuroinvasive disease. Positive results from these tests should be confirmed at the PHL or CDC.

During 2009, no cases of LaCrosse encephalitis were reported to MDH. The disease, which primarily affects children, is transmitted through the bite of infected *Aedes triseriatus* (Eastern Tree Hole) mosquitoes. Persons are exposed to infected mosquitoes in wooded or shaded areas inhabited by this mosquito species, especially in areas where water-holding containers (eg, waste tires, buckets, or cans) that provide mosquito breeding habitats are abundant. From 1985 through 2009, 124 cases were reported from 21 southeastern Minnesota counties, with a median of 5 cases (range, 1 to 13 cases) reported annually. The median case age was 6 years. Disease onsets

Figure 1. Reported Cases of Anaplasmosis, Babesiosis, and Lyme Disease, Minnesota, 1996-2009



Includes 9,528 Lyme disease cases, 1,913 anaplasmosis cases, and 142 babesiosis cases

have been reported from June through September, but most onsets have occurred from mid-July through mid-September.

Babesiosis
Babesiosis is a malaria-like illness caused by the protozoan *Babesia microti* or other *Babesia* organisms. *B. microti* is transmitted to humans by bites from *Ixodes scapularis* (the blacklegged tick), the same vector that transmits the agents of Lyme disease and anaplasmosis. *Babesia* parasites can also be transmitted by blood transfusion.

In 2009, a record number of 31 babesiosis cases (0.6 per 100,000 population) were reported, 2 cases more than the previous record of 29 cases in 2008. The median annual number of babesiosis cases since 2006 (median, 27 cases, range, 18 to 31) is notably higher than the median number of annual cases from 1996 to 2005 (median, 2 cases; range, 0 to 10). Nineteen (61%) babesiosis cases reported in 2009 were male. The median age of the cases was 61 years (range, 5 to 82 years). Onsets of illness were elevated from June through August and peaked in July (39% of cases). In 2009, 16 (52%) cases were hospitalized for their infection for a median duration of 5 days (range, 2 days to > 2 months). No cases died from complications of babesiosis in 2009.

Babesia co-infections with the etiologic agents of Lyme disease or anaplasmosis can occur from the same tick bite, although the majority of babesiosis infections are asyptomatic. During 2009, 3 (10%) babesiosis cases were also confirmed cases of Lyme disease, and 7 (23%) were confirmed or probable cases of anaplasmosis.

Two babesiosis cases during 2009 likely acquired *B. microti* from blood transfusions. The remainder reported probable *I. scapularis* exposures in counties of east-central, north-central, northwest, and southeastern Minnesota, and in Wisconsin, many of the same counties where the risk for Lyme disease and anaplamosis is greatest.

Campylobacteriosis
Campylobacter continues to be the most commonly reported bacterial enteric pathogen in Minnesota (Figure 2). There were 899 cases of culture-confirmed *Campylobacter* infection reported in 2009 (17.2 per 100,000 population). This is similar to the 886 cases reported in 2008 and to the median annual number of cases reported from 2001 to 2008 (median, 903 cases; range, 843 to 953). In 2009, 48% of cases occurred in people who resided in the metropolitan area. Of the 871 *Campylobacter* isolates confirmed and identified to species by MDH, 89% were *C. jejuni* and, 10% were *C. coli*.

The median age of cases was 34 years (range, 1 month to 92 years). Forty-six percent of cases were between 20 and 49 years of age, and 14% were 5 years of age or younger. Fifty-eight percent of cases were male. Sixteen percent of cases were hospitalized; the median length of hospitalization was 3 days. Forty-eight percent of infections occurred during June through September. Of the 818 (91%) cases for whom data were available, 159 (19%) reported travel outside of the United States during the week prior to illness onset. The most common travel destinations were Mexico (n=39), Europe (n=25), Central or South America or the Caribbean (n=20), and Asia (n=11).

There was one outbreak of campylobacteriosis identified in Minnesota in 2009. In February, an outbreak of *C. jejuni* infections was associated with a restaurant in Dakota County. Ten culture-confirmed and one probable patron-case was identified. Lettuce that had most likely been cross-contaminated from raw or undercooked chicken was identified as the source of the outbreak.

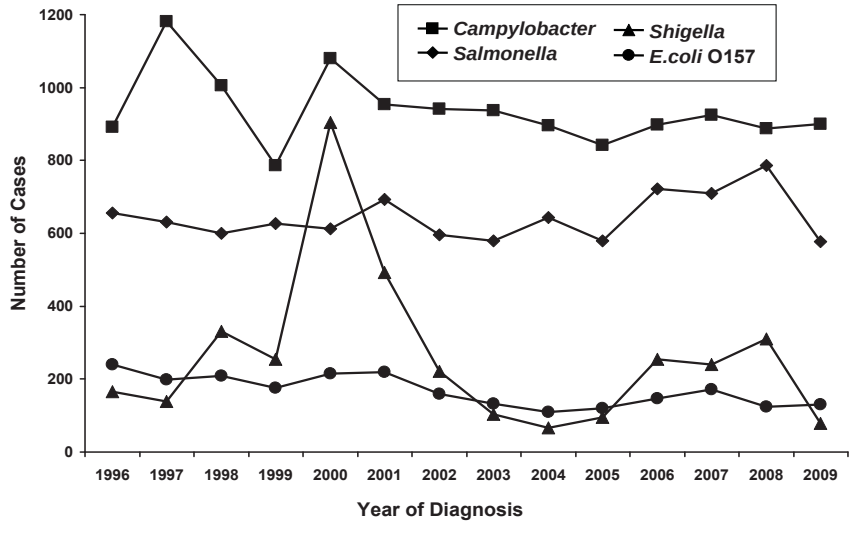
A primary feature of public health importance among *Campylobacter* cases was the continued presence of *Campylobacter* isolates resistant to fluoroquinolone antibiotics (e.g., ciprofloxacin), which are commonly used to treat campylobacteriosis. In 2009, the overall proportion of quinolone resistance among *Campylobacter* isolates tested was 23%. However, 70% of *Campylobacter* isolates from patients with a history of foreign travel during the week prior to illness onset, regardless of destination, were resistant to fluoroquinolones. Twelve percent of *Campylobacter* isolates from patients who acquired the infection domestically were resistant to fluoroquinolones.

In June 2009, a rapid test became commercially available for the qualitative detection of *Campylobacter* antigens in stool. Twenty-three patients were positive for *Campylobacter* by a rapid test conducted in a clinical laboratory in 2009. However, only 3 (13%) of the specimens were subsequently culture-confirmed, thus meeting the surveillance case definition for inclusion in MDH case counts totals.

Cryptosporidiosis
During 2009, 349 confirmed cases of cryptosporidiosis (6.7 per 100,000

continued...

Figure 2. Reported Cases of *Campylobacter*, *Salmonella*, *Shigella*, and *Escherichia coli* O157:H7 Infection, Minnesota, 1996-2009



population) were reported. This is 77% higher than the median number of cases reported annually from 1998 to 2008 (median, 197 cases; range, 91 to 302). The median age of cases in 2009 was 26 years (range, 9 months to 101 years). Children 10 years of age or younger accounted for 28% of cases. Sixty-three percent of cases occurred during July through October. The incidence of cryptosporidiosis in the Southwestern, West Central, South Central, and Southeastern districts (36.2, 15.7, 13.6 and 11.9 cases per 100,000, respectively) was significantly higher than the statewide incidence. Only 41 (12%) reported cases occurred among residents of the metropolitan area (1.5 per 100,000). Fifty-two (15%) cases required hospitalization, for a median of 3 days (range, 1 to 15 days).

Four outbreaks of cryptosporidiosis were identified in 2009, accounting for 28 laboratory-confirmed cases. One recreational waterborne outbreak occurred, including 37 cases (21 laboratory-confirmed) associated with a community aquatic center. One outbreak of cryptosporidiosis associated with calf contact among workers at a zoo accounted for 4 cases (2 laboratory-confirmed). Two outbreaks associated with daycares accounted for 4 (3 laboratory-confirmed) and 2 (both laboratory-confirmed) cases, respectively.

***Escherichia coli* O157 Infection and Hemolytic Uremic Syndrome (HUS)**

During 2009, 130 culture-confirmed cases of *Escherichia coli* O157 infection (2.5 per 100,000 population) were reported. The number of reported cases represents a 20% decrease from the median number of cases reported annually from 1997 to 2008 (median, 162 cases; range, 110 to 219). During 2009, 57 (44%) cases occurred in the metropolitan area. One hundred seven (82%) cases occurred during May through October. The median age of cases was 18 years (range, 9 months to 78 years). Twenty-five percent of cases were 4 years of age or younger. Forty-seven (36%) cases were hospitalized; the median duration of hospitalization was 3 days (range, 1 to 26 days). None died.

In addition to the 136 culture-confirmed *E. coli* O157 cases, 89 cases of Shiga-toxin producing *E. coli* (STEC) infection were identified in 2009. Of those, culture confirmation was not possible in 11, and therefore it is unknown if those were O157 or another serogroup. Among the remaining 78 cases of STEC other than O157, *E. coli* O26 accounted for 19 cases, *E. coli* O111 for 15, *E. coli* O777 for 15, and *E. coli* O103 for 13. These four serogroups represented 79% of all non-O157 STEC.

Eleven *E. coli* O157:H7 outbreaks were identified during 2009. Ten outbreaks involved foodborne transmission, including six outbreaks with cases in multiple states, and one outbreak involved contact with animals. The 11 outbreaks resulted in a median of only 3 culture-confirmed cases per outbreak (range; 1 to 7 cases).

In April, 1 case of *E. coli* O157:H7 infection was part of a multi-state outbreak that resulted in 15 cases in 4 states. Pre-packaged lettuce was implicated as the vehicle.

In May, 6 cases of *E. coli* O157:H7 infection with the same PFGE subtype were part of a multi-state outbreak that resulted in 77 cases in 33 states. Refrigerated cookie dough was implicated as the vehicle. This investigation resulted in a recall of the implicated product.

An outbreak of *E. coli* O157:H7 infections associated with a graduation party in Mower County occurred in May. Seven culture-confirmed cases were identified. One case who reported developing bloody diarrhea prior to preparing potato salad served at the event was the likely source of contamination.

In June, 2 cases of *E. coli* O157:H7 infection with the same PFGE subtype occurred in residents of Hennepin County. Both cases reported consuming dishes containing steak at sit down restaurants in the 7 days prior to illness onset. Product invoice information indicated that the cases had consumed the same product that came from the same meat supplier in Kansas.

In June, an infection control preventionist from a Mower County hospital reported that a large number of employees from one company had presented to the emergency room with bloody diarrhea. The company had held an employee lunch catered by a local grocery store the week prior. A total of 7 culture-confirmed cases and 9 probable cases were identified. Three cases were hospitalized. One culture-confirmed case did not attend the company lunch but did consume ground beef purchased at the same grocery store. An inspection of the grocery store suggested that cross-contamination from ground beef used to make meatloaf to ready-to-eat foods served at the lunch could have occurred. However, the specific food vehicle and the source of contamination were not confirmed.

In June, 1 case of *E. coli* O157:H7 infection was part of a multi-state outbreak that resulted in 23 cases in nine states. Ground beef was implicated as the vehicle. This investigation resulted in a recall of the implicated product.

An outbreak of *E. coli* O157:H7 infections associated with a daycare in Douglas County occurred in August. Custom slaughtered beef that was served at the daycare tested positive for the *E. coli* O157:H7 outbreak strain and was implicated as the vehicle; although subsequent person-to-person transmission was also documented. A total of 7 culture-confirmed cases were identified and 1 case developed HUS.

In August, 3 cases of *E. coli* O157:H7 infection with the same PFGE subtype occurred in Minnesota residents. All three reported eating at locations of a Mexican style restaurant chain. An additional case identified in a Washington state resident also reported eating at one of the restaurant locations in Minnesota. Additional cases identified in California and Colorado did not report eating at the restaurant chain but did report beef exposures. An inspection of the restaurant suggested that cross-contamination from steak could have occurred. However, the specific food vehicle and the source of contamination were not confirmed.

In September, 2 cases of *E. coli* O157:H7 infection were part of a multi-state outbreak that resulted in 9 cases in six states. Romaine lettuce was implicated as the vehicle.

In October, 2 cases of *E. coli* O157:H7 infection with the same PFGE subtype occurred in Minnesota residents that had visited an orchard and petting zoo in Scott County. Both cases developed HUS; neither died. Indirect or direct contact with the animals or their manure was the source of the infections.

In November, 5 cases of *E. coli* O157:H7 infection with the same PFGE subtype were part of a multi-state outbreak that resulted in 25 cases in 17 states. No cases developed HUS; 1 case died. Blade tenderized steaks from a national chain of restaurants were implicated as the vehicle for the national outbreak and resulted in a recall of this product. However, the Minnesota cases did not eat at this restaurant chain and instead reported eating ground beef. A traceback investigation identified a potential common denominator in a company that supplied beef products to multiple plants that in turn supplied steaks or ground beef consumed by cases. However, the traceback investigation was not considered sufficiently strong to conclusively implicate that company.

Hemolytic Uremic Syndrome

In 2009, 16 HUS cases were reported. There were no fatal cases. From 1997 to 2009, the median annual number of reported HUS cases in Minnesota was 16 (range, 10 to 25), and the overall case fatality rate was 6.0%. In 2009, the median age of HUS cases was 3 years (range, 1 to 73 years); 13 of the 16 cases occurred in children. All 16 cases were hospitalized, with a median hospital stay of 9 days (range, 2 to 43 days). All 16 HUS cases reported in 2009 were post-diarrheal. *E. coli* O157:H7 was cultured from the stool of 9 (56%) cases; 2 (13%) additional HUS cases were positive for *E. coli* O157:H7 by serology. Non-O157 STECs were identified in the stools of 2 (13%) cases, 1 with *E. coli* O111:NM and 1 with *E. coli* O121:H19. In 2009, there were 5 outbreak-associated HUS cases.

Giardiasis

During 2009, 678 cases of *Giardia* infection (13.0 per 100,000) were reported. This represents a 11% decrease from the 765 cases reported in 2008 and a 39% decrease from the median number of cases reported annually from 1998 through 2008 (median, 1,105, cases; range, 765 to 1,556). Of the total number of *Giardia* cases for 2009, 12% represented positive tests during routine screenings of recent immigrants and refugees.

The median age for all cases reported in 2009 was 26.5 years (range, 1 month to 104 years). The median age among non-immigrant cases was 42 years (range, 1 month to 104 years). Twenty-two percent of cases were less than 5 years of age, and 21% of cases were over 50 years of age. No outbreaks of giardiasis were identified in 2009.

Guillain-Barré Syndrome

Guillain-Barré syndrome (GBS) is an uncommon immune-mediated neurologic disorder causing limb weakness or numbness, ascending paralysis, and in severe cases respiratory failure and death. The estimated background rate of GBS is 1-2 cases per 100,000 people. The exact cause of GBS is unknown. It is often preceded by an antecedent illness such as gastrointestinal or respiratory infection, and rarely vaccinations.

In 2009, GBS was added to the Minnesota Rules Governing Communicable Diseases for a duration of 2 years. While not an infectious disease, it was added to aid post-licensure safety monitoring of the 2009 novel influenza A H1N1 vaccine. Enhanced surveillance was conducted October 1, 2009 through May 31, 2010.

In 1976, concerns about a possible large outbreak of a swine-origin influenza virus (influenza A/New Jersey/76 [Hsw1N1]; influenza A/NJ/76 (H1N1) virus), lead to a mass vaccination campaign in the United States. Epidemiologic studies showed a small, but significant, risk of GBS in adults vaccinated 6 to 8 weeks prior; the estimated risk was approximately 10 cases of GBS per 1 million vaccines. The increased risk, combined with the fact the influenza virus did not spread as expected, resulted in the termination of the vaccine program. Underlying reasons for the association between the 1976 vaccine and GBS remain unknown.

In 2009, the emergence of a novel pandemic swine-origin H1N1 influenza virus prompted rapid development of an influenza A (H1N1) 2009 vaccine. The association between GBS and the 1976 vaccine lead to theoretical concerns about a similar association existing with the 2009 vaccine. While the influenza A (H1N1) vaccine was anticipated to be as safe as the seasonal influenza vaccine, active post-licensure surveillance was initiated to rapidly identify all incident cases of GBS.

As part of EIP, Minnesota was one of 10 states which monitored the safety of the 2009 influenza A H1N1 vaccine. MDH established a network with all neurology clinics statewide that reported suspected GBS cases weekly. In addition, all hospital medical records departments screened discharge records biweekly to assure no GBS cases were missed. MDH reviewed medical records using a standardized case report form for each suspect GBS case. Information on antecedent infections and vaccination history, including influenza A H1N1 vaccine, in the 42 days prior to onset of GBS symptoms was collected. Case status was assigned according to Brighton clinical criteria.

As of December 31, 2009, MDH investigated 45 reports of possible GBS. Of these, 18 (40%) cases had confirmed GBS, 21 (47%) were non-cases, 5 (11%) were out of state residents, and 1 (2%) was still under investigation. MDH will continue to review medical charts in 2010 to identify incident cases. Nationally, CDC is evaluating whether there is an excess risk of GBS related to influenza A H1N1 vaccination; preliminary data showed a slightly increased risk of 0.8 excess cases per million vaccinees, no different than the excess risk associated with some seasonal influenza vaccines.

***Haemophilus influenzae* Disease**

Seventy-nine cases of invasive *Haemophilus influenzae* disease (1.5 per 100,000 population) were reported in 2009. Cases ranged in age from newborn to 97 years (median, 65 years). Thirty-two (41%) cases had pneumonia, 30 (38%) had bacteremia without another focus of infection, 4 (5%) had peritonitis, 2 (3%) had meningitis, 2 (3%) had epiglottitis, and 9

continued...

(11%) had other conditions. Nine (11%) deaths were reported among these cases.

Of 71 *H. influenzae* isolates for which typing was performed at MDH, 7 (10%) were type f, 5 (7%) type a, 2 (3%) type b, 1 (1%) type e, and 56 (79%) were untypeable.

Two cases of type b (Hib) disease occurred in 2009, compared to 5 cases in 2008, 1 case in 2007, and 4 cases in 2006. These Hib cases were identified in children 1 to 9 years of age. In 2009, 1 case presented with pericarditis, and 1 presented with tracheitis and pneumoniitis. One of the cases was fully vaccinated, and the other had an unclear vaccination history.

The 9 deaths occurred in patients ranging in age from 1 year to 97 years. Six cases presented with bacteremia without another focus of infection, and 3 cases presented with pneumonia. All 9 cases had *H. influenzae* isolated from blood. Six had significant underlying medical conditions. Of the 9 cases who died, 7 case-isolates were untypeable, 1 was serotype a, and 1 was serotype e.

HIV Infection and AIDS

Surveillance for AIDS has been conducted in Minnesota since 1982. In 1985, Minnesota became the first state to make HIV infection a name-based reportable condition; all states now require name-based HIV infection reporting.

The incidence of HIV/AIDS in Minnesota is moderately low. In 2007, state-specific AIDS rates ranged from 1 per 100,000 population in Vermont to 24.9 per 100,000 in New York. Minnesota had the 11th lowest AIDS rate (3.8 cases per 100,000). Similar comparisons for HIV (non-AIDS) incidence rates are not possible because some states only began named HIV (non-AIDS) reporting recently.

As of December 31, 2009, a cumulative total of 9,163 cases of HIV infection, 5,655 AIDS cases and 3,508 HIV (non-AIDS) cases had been reported among Minnesota residents. Of the 9,163 HIV/AIDS cases, 3,056 (33%) are known to have died.

The annual number of AIDS cases reported in Minnesota increased steadily from the beginning of the epidemic through the early 1990s, reaching a peak of 370 cases in 1992. Beginning in 1996, the annual number of new AIDS diagnoses and deaths among AIDS cases declined sharply, primarily due to new antiretroviral therapies. In 2009, 184 new AIDS cases (Figure 3) and 85 deaths among persons living with HIV infection were reported.

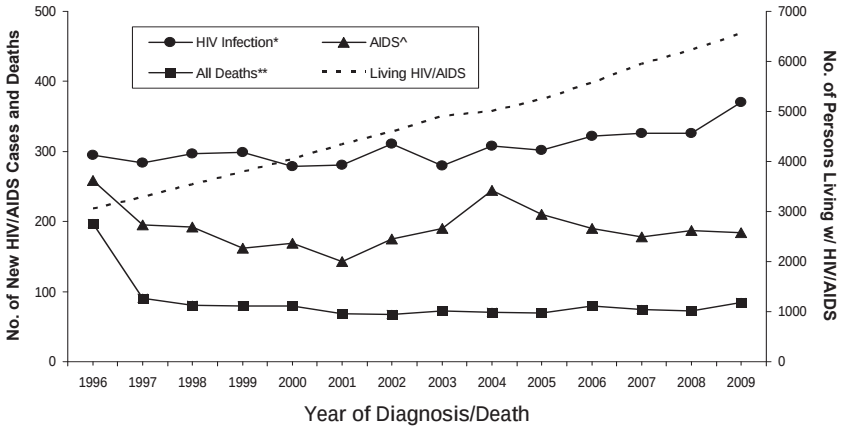
The annual number of newly diagnosed HIV (non-AIDS) cases reported in Minnesota has increased from 198 in 2004 to 279 in 2009 (a 41% increase). This trend, coupled with improved survival, has led to an increasing number of persons in Minnesota living with HIV or AIDS. By the end of 2009, an estimated 6,552 persons with HIV/AIDS were assumed to be living in Minnesota.

Historically, and in 2009, over 80% (319/370) of new HIV infections (both HIV [non-AIDS] and AIDS at first diagnosis) reported in Minnesota occurred in the metropolitan area. However, HIV or AIDS cases have been diagnosed in residents of more than 90% of counties statewide. HIV infection is most common in areas with higher population densities and greater poverty.

The majority of new HIV infections in Minnesota occur among males. Trends in the annual number of new HIV infections diagnosed among males differ by race/ethnicity. New infections occurred primarily among white males in the 1980s and early 1990s. Whites still comprise the largest proportion of new HIV infections among males. New infections among white males decreased between 1991 and 2000, from 297 to 99. However since then the trend has reversed, and in 2009 there were 170 new infections among white males (72% increase). The decline among U.S.-born black males has been more gradual, falling from a peak of 79 new infections in 1992 to a low of 33 new infections in 2003. However, since 2003 the number of new infections among U.S.-born black males has increased, with 64 new infections diagnosed in 2009. The number of HIV infections diagnosed among Hispanic males decreased slightly in 2007 from the previous year (32 versus 38) and that trend continued in 2009, with 17 new infections reported among Hispanic males. The number of new infections among African-born males increased in 2009 to 19 from 12 in 2008.

Females account for an increasing percentage of new HIV infections, from 11% of new infections in 1990 to 20% in 2009. Trends in HIV infections diagnosed annually among females also differ by race/ethnicity. Early in the epidemic, whites accounted for the majority of newly diagnosed infections in women. Since 1991, the number of

Figure 3. HIV/AIDS in Minnesota: Number of New Cases, Prevalent Cases, and Deaths by Year, 1996-2009



* Includes all new cases of HIV infection (both HIV (non-AIDS) and AIDS at first diagnosis) diagnosed within a given calendar year.

** Deaths among AIDS cases, regardless of cause.

^ Includes all new cases of AIDS diagnosed within a given calendar year, including AIDS at first diagnosis. This includes refugees in the HIV+ Resettlement Program, as well as, other refugee/immigrants diagnosed with AIDS subsequent to their arrival in the United States.

new infections among women of color has exceeded that of white women. The annual number of new HIV infections diagnosed among U.S.-born black females had remained stable at 22 or fewer cases during 2001 to 2004, but increased to 28 new cases in both 2005 and 2006. In 2009 there were 19 new infections diagnosed among U.S.-born black females. In contrast, the number of new infections among African-born females increased greatly from 4 cases in 1996 to 41 in 2002. However, since 2002 the number of new HIV infections in African-born females has decreased steadily, with 18 new cases diagnosed in 2006. Since 2007, the number of new cases among African-born females has stayed stable at about 24 new infections per year (22 in 2009). The annual number of new infections diagnosed among Hispanic, American Indian, and Asian females is small, with 10 or fewer cases annually in each group.

Despite relatively small numbers of cases, persons of color are disproportionately affected by HIV/ AIDS in Minnesota. In 2009, non-white men comprised approximately 12% of the male population in Minnesota and 42% of new HIV infections among men. Similarly, persons of color comprised approximately 11% of the female population and 74% of new HIV infections among women. It bears noting that race is not considered a biological cause of disparities in the occurrence of HIV, but instead race can be used as a proxy for other risk factors, including lower socioeconomic status and education.

A population of concern for HIV infection is adolescents and young adults (15 to 24 years of age). The number of new HIV infections among males in this age group has remained higher than new infections among females since 1999. Since 2001, Minnesota has seen a steady increase in new cases among males in this age group, with 78 cases reported in 2009, the highest seen since 1986. The number of new HIV infections among females has also increased slightly since 2007, from 13 cases to 18 cases in 2009. From 2007 to 2009, the majority (55%) of new infections among male adolescents and young adults were among youth of color (88/160), with young African American males accounting for 62% of the cases among young males of color. During the same time period, young women of color accounted for 67% of the cases diagnosed, with young African American women accounting for 42% of cases among young women of color. Between 2007 and 2009, 95% (152/160) of new cases among males were attributed to male-to-male sex. Among females, 96% (44/46) of new cases were attributed to heterosexual sex.

Since the beginning of the HIV epidemic, male-to-male sex has been the predominant mode of exposure to HIV reported in Minnesota, although the number and proportion of new HIV infections attributed to men who have sex with men (MSM) has declined since 1991. In 1991, 70% (318/455) of new HIV infections were attributed to MSM (or MSM who also inject drugs); in 2009, this group accounted for 60% of new infections (220/370). However, current attitudes, beliefs, and unsafe sexual practices documented in surveys among MSM nationwide, and a current epidemic of syphilis among MSM documented in Minnesota and elsewhere, warrant concern. Similar to syphilis increases in other U.S. cities and abroad, 50% of the recent syphilis cases in Minnesota among MSM were co-infected with HIV, some for many years. “Burn out” from adopting safer sexual practices and exaggerated confidence in the efficacy of HIV treatments may be contributors to resurging risky sexual behavior among MSM.

The number and percentage of HIV infections in Minnesota that are attributed to injection drug use has declined over the past decade for men and women, falling from 12% (54/455) of cases in 1991 to 2% (9/370) in 2009. Heterosexual contact with a partner who has or is at increased risk of HIV infection is the predominant mode of exposure to HIV for women. Eighty-nine percent of 231 new HIV diagnoses among women between 2007 and 2009 can be attributed to heterosexual exposure after re-distributing those with unspecified risk.

Historically, race/ethnicity data for HIV/ AIDS in Minnesota have grouped U.S.-born blacks and African-born persons together as “black.” In 2001, MDH began analyzing these groups separately, and a marked trend of increasing numbers of new HIV infections among African-born persons was observed. In 2009, there were 41 new HIV infections reported among Africans. While African-born persons comprise less than 1% of the state’s population, they accounted for 11% of all HIV infections diagnosed in Minnesota in 2009.

HIV perinatal transmission in the United States decreased 81% between 1995 and 1999. The trend in Minnesota has been similar but on a much smaller scale. While the number of births to HIV-infected women increased ten-fold between 1990 and 2009, the rate of perinatal transmission decreased six-fold, from 18% in 1990 to 1995 to 3% in 1996–2006. The overall rate of transmission for 2007 to 2009 was 0.5%; however, it was twice that among foreign-born mothers.

Inf uenza

In April, 2009, novel A H1N1 emerged as a new influenza virus starting the first influenza pandemic in over 30 years.

Hospitalized Cases

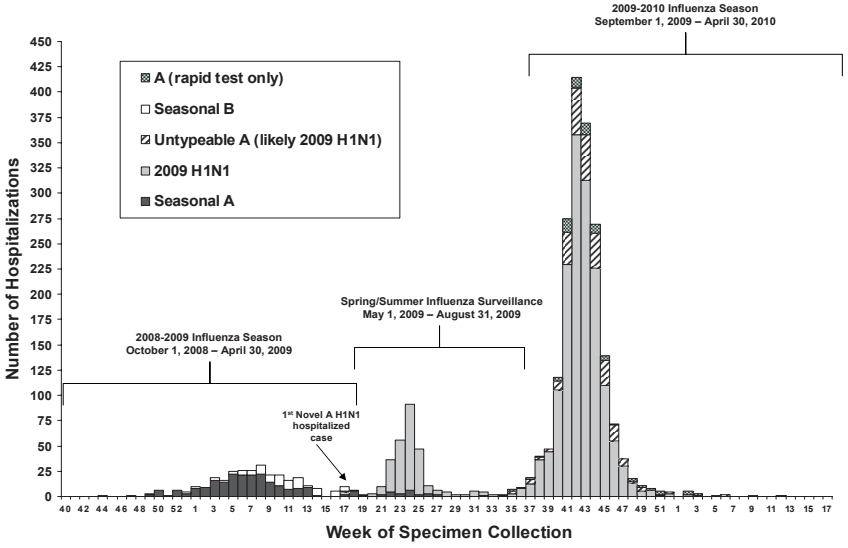
Surveillance for pediatric (<18 years of age) laboratory-confirmed hospitalized cases of influenza was established during the 2003-2004 influenza season. During the 2006-2007 season surveillance was expanded to include adults. During the novel H1N1 pandemic period (April 2009-April 2010), MDH requested that clinicians collect a throat or nasopharyngeal swab or other specimen from all patients admitted to a hospital with suspect influenza and submit the specimen to the PHL for influenza testing.

During the pandemic period there were 1,824 laboratory-confirmed hospitalized cases of H1N1 influenza, 34.9 hospitalizations per 100,000 persons, compared to 5.8 hospitalizations per 100,000 during the 2008-2009 influenza season. Since September 1, 2009, other hospitalized cases of influenza have included 239 that were untypeable influenza A (likely novel H1N1), and 77 that were positive by rapid influenza testing only but these cases could not be further chararcterized because specimens weren’t available for additional testing at the PHL.

There was a 500% increase in the number of laboratory-confirmed

continued...

Figure 4. Hospitalized Cases of Influenza by Week and Influenza Type, Minnesota, October 2008 – April 2010



influenza hospitalizations in the pandemic season compared to the 2008-2009 influenza season (Figure 4). Whereas the typical influenza season has peak activity during late December, January, or February, the pandemic period was noted to have two distinct waves, with a peak in cases in late October-November. The pandemic period was also notable for the near complete replacement of seasonal influenza strains with 2009 novel H1N1 influenza.

Among hospitalized 2009 novel H1N1 cases, 44% were <18 years of age, 7% were 18-24 years of age, and 49% were 25 years of age and older. Median age was 24.1 years. Fifty-six percent of cases were residents of the metropolitan area. Six hundred seventy-eight (37%) of 1,824 cases were diagnosed with pneumonia. Three hundred fifty-two (19%) cases required admission into an intensive care unit. Of these, 166 (47%) were placed on mechanical ventilation. Thirty (2%) cases had an invasive bacterial co-infection. Eighty-three percent of adult and 51% of pediatric cases had at least one chronic medical condition that would put them at increased risk for influenza disease.

Deaths

During the pandemic period, MDH increased its efforts to identify deaths related to influenza. All deaths among persons with recent influenza-like illness (ILI) were investigated. Specimens were submitted to MDH and tested by PCR, culture, and serology at the PHL or at the CDC Infectious Diseases Pathology Branch. In addition to investigating deaths reported through hospital surveillance, MDH partnered with medical examiners and hospital pathologists to identify cases. Death certificates were also used to identify any deaths with influenza, "flu," or H1N1 listed as a cause of death and as a means of cross-checking known hospitalized 2009 H1N1 cases.

During the pandemic period, there were 63 novel H1N1 confirmed deaths, 4 influenza A-type unspecified deaths, 2 influenza B deaths, and 3 deaths associated with an influenza syndrome where no testing was performed. The median age was 51 years. Three (4%) deaths were among persons 0-4 years, 6 (9%) 5-18 years, 23 (32%) 19-49 years, 24 (33%) 50-64 years, and 16 (22%) 65 years of age and older. Forty-four percent of cases were from the metropolitan area. Sixty-one (85%) cases had underlying medical conditions, and 57 (79%) had been hospitalized.

Laboratory Data

The Minnesota Laboratory System (MLS) Influenza Surveillance Program is made up of more than 100 clinic- and hospital-based laboratories, voluntarily submitting rapid test data on a weekly basis. Eight of the laboratories report viral culture testing results. Tracking these data assists healthcare providers with diagnosis of ILI and provides an indicator of the progression of the influenza season as well as prevalence of other respiratory disease pathogens in the community.

Between August 30, 2009 and May 1, 2010, laboratories reported on 44,484 rapid influenza tests; 6,146 (14%) were positive for influenza. Of these, 5,963 (97%) were positive for influenza A, 65 (1%) were positive for influenza B, and 118 (2%) were positive for influenza A/B not differentiated. Percent positive of rapid influenza tests peaked October 18-24, 2009 at 27%. Between August 30, 2009 and May 1, 2010, Minnesota virology laboratories reported data on 10,990 viral cultures, 844 (8%) of which were positive for influenza. Of these, 841 (>99%) were positive for influenza A and 3 (0.4%) were positive for influenza B. Percent positive of influenza cultures peaked during November 1-7, 2009 at 27%.

Between April 2009 and April 2010, 318 (98%) of 324 influenza isolates further characterized in the PHL were subtyped as influenza A 2009 H1N1, 5 (2%) were subtyped as influenza A-type unspecified, and 1 (0.3%) was influenza B/Brisbane-like.

Influenza Sentinel Surveillance

MDH has conducted sentinel surveillance for ILI through outpatient medical providers since 2000 as a way to monitor the impact of influenza. Sentinel provider sites include private practice clinics, public health clinics, urgent care centers, emergency rooms, and college student health centers. In 2009-2010, there were 27 sites in 21 counties. Participating providers report the total number of patient visits each week and number of patient visits for ILI by age group (0-4 years, 5-24 years, 25-64 years, >65 years). Percentage of ILI peaked October 11-17, 2009 at 6.1%. Sentinel providers also submit specimens to the PHL for PCR testing from a subset of patients. From April 2009 to April 2010, the PHL tested 1,414 specimens for influenza by PCR; 453 (32%) were confirmed influenza A 2009 H1N1, 25 (2%) influenza A-type unspecified, 3 (0.2%) seasonal influenza A/(H1), 3 (0.2%) seasonal influenza A/(H3), and 2 were influenza B (0.1%).

ILI Outbreaks (Schools and Long Term Care Facilities)
Between 1988 to 2009, a probable outbreak of ILI in a school was defined as a doubled absence rate with all of the following primary influenza symptoms reported among absent students: rapid onset, fever, illness lasting 3 or more days, and at least one secondary influenza symptom (e.g., myalgia, headache, cough, coryza, sore throat, or chills). A possible ILI outbreak in a school was defined as a doubled absence rate with reported symptoms, including two of the primary influenza symptoms and at least one secondary symptom. Prior to the 2009-2010 influenza season, the number of schools reporting influenza outbreaks ranged from a low of 38 schools in 20 counties in 1996-1997 to 441 schools in 71 counties in 1991-1992.

The definition of ILI outbreaks changed for the 2009-2010 school year. Schools reported when the number of students absent with ILI reached 5% of total enrollment or three or more students with ILI were absent from the same elementary classroom. During the 2009-2010 school year, 1,302 schools in 85 counties reported ILI outbreaks.

An influenza outbreak is suspected in a long-term care facility (LTCF) when three or more residents in a single unit present with a cough and fever or chills during a 48- to 72-hour period. An influenza outbreak is confirmed when at least one resident has a positive culture, PCR, or rapid antigen test for influenza. Four facilities in four counties reported outbreaks from April 2009 – April 2010. Three facilities reported outbreaks in 2008-2009. Surveillance for outbreaks in LTCFs began in the 1988-1989 season. Prior to the 2008-2009 season, the number of long-term care facilities reporting ILI outbreaks has ranged from a low of six in 1990-1991 to a high of 140 in 2004-2005.

Legionellosis
During 2009, 30 confirmed cases of legionellosis (Legionnaires' disease [LD]) were reported including 17 cases (53%) among residents of the metropolitan area and 13 cases among Greater Minnesota residents. Three (10%) cases died. Older adults and elderly persons were more often affected, with 22 (73%) cases occurring among individuals 50 years of age and older (median, 58 years; range, 43 to 88 years). Eleven (37%) cases had onset dates in June through September. Travel-associated legionellosis accounted for 5 (17%) cases, defined as spending at least 1 night away from the case's residence in the 10 days before onset of illness.

Confirmed LD case criteria includes X-ray confirmed pneumonia and positive results for one or more of the following tests: culture of *Legionella* spp., or detection of *L. pneumophila*, serogroup 1 infection by *Legionella* urinary antigen, direct fluorescent antigen, or by acute and convalescent antibody titers with a four-fold or greater rise to >1:128. A single antibody titer at any level is not of diagnostic value for LD. For detection of LD, the Infectious Diseases Society of America recommends urinary antigen assay and culture of respiratory secretions on selective media. Culture is particularly useful because environmental and clinical isolates can be compared by molecular typing in outbreaks and in investigations of healthcare-associated LD.

Listeriosis
Three cases of listeriosis were reported during 2009. All cases were hospitalized; none of the cases died. The median age of cases was 80 years (range, 1 day to 85 years). Two cases had *Listeria monocytogenes* isolated from blood. One case had *L. monocytogenes* isolated from blood and conjunctiva. None of the cases were part of a recognized outbreak. The 3 cases reported is lower than the median annual number of cases reported from 1996 through 2008 (median, 8 cases; range, 4 to 19).

Lyme Disease
Lyme disease is caused by *Borrelia burgdorferi*, a spirochete transmitted to humans by bites from *Ixodes scapularis* (the blacklegged tick) in Minnesota. The same tick vector also transmits the agents of human anaplasmosis and babesiosis.

In 2009, 1,065 confirmed Lyme disease cases (20.4 cases per 100,000 population) were reported (Figure 1), slightly more than the 1,050 cases reported in 2008 but 14% fewer than the record number of 1,239 cases reported in 2007. The median number of 1,037 cases (range, 913 to 1,239 cases) reported from 2004 through 2009 is considerably higher than the median number of cases reported annually from 1996 through 2003 (median, 373 cases; range, 252 to 866). Six hundred sixty-nine (63%) confirmed cases in 2009 were male. The median age of cases was 39 years (range, <1 to 87 years). Physician-diagnosed erythema migrans (EM) was present in 769 (72%) cases. Three hundred thirty-nine (32%) cases had one or more late manifestations of Lyme disease (including 228 with a history of objective joint swelling, 88 with cranial neuritis, 5 with lymphocytic meningitis, 15 with radiculoneuropathy, and 12 with acute onset of second or third degree atrioventricular conduction defects), and confirmation by a positive Western immunoblot. Onsets of illness were elevated from June through August and peaked in July (45% of EM cases), corresponding to the peak activity of nymphal *I. scapularis* ticks in mid-May through mid-July.

Lyme disease co-infections with the etiologic agents of anaplasmosis and babesiosis can occur from the same tick bite. During 2009, 9 (1%) Lyme disease cases also were confirmed or probable cases of anaplasmosis, and 3 (<1%) were confirmed cases of babesiosis. Because of under-detection, these numbers likely underestimate the true frequency of co-infections.

Most cases in 2009 either resided in or traveled to endemic counties in north-central, east-central, or southeast Minnesota or in western Wisconsin. Crow Wing and Cass Counties had the highest number of reported *I. scapularis* exposures for cases exposed in Minnesota, (91 [21%] of 424 cases who reported a single county of exposure in Minnesota). Four hundred forty-four (42%) cases occurred among residents of the metropolitan area, of whom only a minority (17%) were likely exposed to *I. scapularis* ticks in the metropolitan area, primarily Anoka and Washington Counties.

A revised national surveillance case definition for Lyme disease was implemented in 2008, replacing a case definition in use since 1996. The 2008 case definition clarified certain laboratory and epidemiologic criteria

continued...

for case classification and added a probable case category. Comparison of 2008 and 2009 case numbers in Minnesota using both definitions demonstrated that application of the revised case definition yielded a slightly larger number of cases than the old definition (2008: 1,050 versus 1,007 cases; 2009: 1,065 versus 1,021 cases). In addition, 223 and 481 probable cases (physician-diagnosed cases that did not meet clinical evidence criteria for a confirmed case but that had laboratory evidence of infection) were reported in 2008 and 2009, respectively.

Measles

One case of measles was reported during 2009. The case was confirmed by positive measles IgM serology. The case was a 7-month-old child residing in Jackson County. Clinical symptoms were suggestive of measles, including a high fever and maculopapular rash that progressed from head to trunk to extremities. The prodrome included diarrhea, cough, coryza, and conjunctivitis. The child had no known exposure to measles, including no known history of travel-associated exposure. No secondary cases were identified.

Meningococcal Disease

Sixteen cases of *Neisseria meningitidis* invasive disease (0.3 per 100,000 population) were reported in 2009, compared to 30 cases in 2008. There were 8 (50%) serogroup B cases, 5 (31%) serogroup C, and 3 (19%) serogroup Y. In addition, there were 2 culture-negative suspect cases that were positive by PCR for group B in the PHL.

Cases ranged in age from 4 months to 86 years, with a median of 20 years. Seventy-five percent of the cases occurred in the metropolitan area. Three (19%) cases had bacteremia without another focus of infection, 10 (63%) had meningitis, 2 (13%) had pneumonia, and 1 (6%) had septic arthritis. One death occurred in a 69-year-old who died of meningitis attributed to serogroup B.

In January 2005, a meningococcal polysaccharide-protein conjugate vaccine for serogroups A,C,Y, and W-135 (MCV4) was licensed for use in the United States for persons aged 11 to 55 years. In 2007, the license was approved to include 2 to 10 year-olds. The Advisory Committee on Immunization Practices (ACIP) and American Academy of Pediatrics recommend immunization with the new vaccine at age 11-12 years, or at high school entry, as well as for college freshmen living in dormitories, and other groups in the licensed age range previously determined to be at high risk. In 2006, MDH in collaboration with the CDC and other sites nationwide, began a case-control study to examine the efficacy of MCV4.

In 2009, 5 cases occurred among 11-22 year olds. One case had serogroup B disease and was not in school. Two of the cases in the MCV4 study for this age had serogroup Y disease and both were in high school; they were not vaccinated. One case had a positive PCR result for serogroup C and was vaccinated, and the last case had serogroup C and was not vaccinated; they were in high school and college, respectively.

Methicillin-Resistant *Staphylococcus aureus* (MRSA)

Strains of *Staphylococcus aureus* that are resistant to methicillin and all available beta-lactam antibiotics are referred to as methicillin-resistant *S. aureus* (MRSA). Traditional risk factors for healthcare-associated (HA) MRSA include recent hospitalization or surgery, residence in a long-term care facility, and renal dialysis.

In 1997, MDH began receiving reports of healthy young patients with MRSA infections. These patients had onset of their MRSA infections in the community and appeared to lack the established risk factors for MRSA. Although most of the reported infections were not severe, some resulted in serious illness or death. Strains of MRSA cultured from persons without HA risk factors for MRSA are known as community-associated MRSA (CA-MRSA). CA-MRSA is defined as: a positive culture for MRSA from a specimen obtained <48 hours of admission to a hospital in a patient with no history of prior MRSA infection or colonization; no presence of indwelling percutaneous devices or catheters at the time of culture; and no history of hospitalization, surgery, residence in a long-term care facility, hemodialysis, or peritoneal dialysis in the year prior to the positive MRSA culture.

MDH initiated surveillance for CA-MRSA at 12 sentinel hospital laboratories in January 2000; thus, 2009 was the tenth year of surveillance. The laboratories (six in the metropolitan area and six in Greater Minnesota) were selected to represent various geographic regions of the state. Infection preventionists at the sites have had the huge burden to report all cases of MRSA identified at their facilities, and for the first 6 years of surveillance submitted all CA-MRSA isolates to MDH. The purpose of this surveillance is to determine demographic and clinical characteristics of CA-MRSA infections in Minnesota, to identify possible risk factors for CA-MRSA, and to identify the antimicrobial susceptibility patterns and molecular subtypes of CA-MRSA isolates. A comparison of CA- and HA-MRSA using sentinel site surveillance data from 2000 demonstrated that CA- and HA-MRSA differ demographically and clinically, and that their respective isolates are microbiologically distinct.

In 2009, 3,401 cases of MRSA infection were reported by the 12 sentinel laboratories. 56% of these cases were classified as CA-MRSA, 42% were classified as HA-MRSA, and 3% could not be classified. CA-MRSA infections increased from 131 cases (12% of all MRSA infections reported) in 2000 to 1,898 cases in 2009.

The CDC classifies MRSA isolates into pulsed-field types (PFTs) (currently USA100-1200) based on genetic relatedness. CA-MRSA isolates are most often classified as PFT USA300 or USA400. In Minnesota, the predominant CA-MRSA PFT has changed dramatically over time. In 2000, 63% of CA-MRSA isolates were USA400 and 4% were USA300. In 2006, only 10% of CA-MRSA isolates were USA400 and 78% were USA300. Because USA400 isolates are much more likely than USA300 isolates to demonstrate inducible clindamycin resistance (ICR) on disk diffusion testing, the change in the predominant CA-MRSA PFT has also been associated with a decrease in the proportion of erythromycin-resistant, clindamycin-sensitive CA-MRSA isolates demonstrating ICR, from 93% in 2000 to 10% in 2006.

In 2007, MDH started collecting isolates from CA-MRSA and HA-MRSA invasive (isolated from a normally sterile body site) infections. Antimicrobial susceptibility and PFGE testing were performed on submitted isolates. Please refer to the MDH antibiogram for details (pages 28-29).

In 2005, as part of the EIP Active Bacterial Core surveillance (ABCs) system, MDH initiated population-based invasive MRSA surveillance in Ramsey County. In 2005, the incidence of invasive MRSA infection in Ramsey County was 19.8 per 100,000 and was 19.4, 18.5 and 19.9 per 100,000 in 2006, 2007, and 2008 respectively. In 2008, surveillance was expanded to include Hennepin County. The incidence rate for MRSA infection in Ramsey and Hennepin Counties in 2009 was 17.0 per 100,000 (Ramsey 22.9/100,000 and Hennepin 14.4/100,000). MRSA was most frequently isolated from blood (76%), and 13% (35/279) of cases died. Thirteen percent (37/279) of cases had no reported healthcare-associated risk factors in the year prior to infection.

Critical illnesses or deaths due to community-associated *S. aureus* infection (both methicillin-susceptible and-resistant) are reportable in Minnesota, as is vancomycin-intermediate and vancomycin-resistant *S. aureus*.

S. aureus that have developed resistance mechanisms to vancomycin are called vancomycin-intermediate (VISA) or vancomycin-resistant *S. aureus* (VRSA), as detected and defined according to Clinical and Laboratory Standards Institute (CLSI) approved standards and recommendations (Minimum Inhibitory Concentration [MIC]=4-8 ug/ml for VISA and MIC≥16 ug/ml for VRSA). Patients at risk for VISA and VRSA generally have underlying health conditions such as diabetes and end-stage renal disease requiring dialysis, previous MRSA infections, recent hospitalizations, and recent exposure to vancomycin.

VISA infections are rare but in the past 2 years there has been an increase in the reported number of cases. MDH confirmed 1 case in 2000 and 3 cases in 2008. All of these cases had traditional risk factors for VISA infection including histories of diabetes, non-healing MRSA-positive leg ulcers, end-stage renal disease requiring renal dialysis, and vancomycin use. In 2009, 3 cases were reported. Interestingly, 2 cases were methicillin-susceptible SA (MSSA) and 1 was MRSA. The 2 MSSA cases had no reported recent history of vancomycin use though both had prolonged exposure to other antibiotics. All 3 case-isolates were susceptible to daptomycin. None of the cases had a history of dialysis and 1 MSSA case was diabetic. Of note, 4 of the 6 2008-2009 cases were clustered near the Minnesota-Wisconsin border. Three of these were MSSA and none had traditional VISA risk factors except longstanding antibiotic use.

Mumps

During 2009, 6 cases of mumps (0.13 per 100,000) were reported. All 6 cases were laboratory confirmed, including 1 (17%) case confirmed by both positive mumps IgM serology and a demonstrated rise in mumps IgG between acute and convalescent serologic specimens, and 5 (83%) cases confirmed by mumps IgM serology only. None of the 6 cases was epidemiologically linked to a source case, demonstrating that asymptomatic infections are occurring, and suggesting that mumps is under-diagnosed. Cases ranged in age from 25 to 70 years. All cases occurred in persons older than 21 years of age; 3 (50%) cases occurred in persons 22 through 33 years of age; 1 (17%) case occurred in persons 34 through 49 years of age; and 2 (33%) cases occurred persons 50 years and older.

No cases had a documented history of 2 doses of mumps-containing vaccine; 1 case (17%) had a documented history of 1 dose. Two cases (33%) reported a history of receiving 1 dose of mumps-containing vaccine but these reports were not verified. No cases reported a previous history of mumps disease; and 3 (50%) had unknown history of disease as well as unknown vaccination status, 1 of whom was born before 1957 and 2 of whom were born after 1957.

Mumps surveillance is complicated by nonspecific clinical presentation in nearly half of cases, asymptomatic infections in an estimated 20% of cases, and suboptimal sensitivity and specificity of serologic testing. Mumps should not be ruled out solely on the basis of negative laboratory results. Providers are advised to test for other causes of sporadic parotitis including parainfluenza virus types 1 and 3, Epstein-Barr virus, influenza A virus, coxsackie A virus, echovirus, lymphocytic choriomeningitis virus, human immunodeficiency virus, and other noninfectious causes such as drugs, tumors, immunologic diseases, and obstruction of the salivary duct.

Neonatal Sepsis

Statewide surveillance includes reporting of any bacteria (other than coagulase-negative *Staphylococcus*) isolated from a sterile site in an infant <7 days of age, and mandatory submission of isolates.

In 2009, 45 cases of neonatal sepsis (0.62 cases per 1,000 live births) were reported compared to 69 cases (0.93 cases per 1,000 live births) in 2008. Among these cases, all were identified via blood or cerebral spinal fluid (CSF). Most cases (82%) were culture-positive within the first 2 days of life. In 2009, group B *Streptococcus* was the most common bacteria isolated (16) followed by *Escherichia coli* (11), *Streptococcus viridians* (7), *Haemophilus influenzae* (5), and 1 each of *Enterobacter sakazakii*, *Salmonella* spp., Group A *Streptococcus*, *Listeria* spp., *Proteus mirablis*, and *Streptococcus* spp.

Pertussis

During 2009, 1,134 cases of pertussis (21 per 100,000 population) were reported, compared to 1,034 in 2008 and 393 in 2007. The most recent peak of 1,571 cases occurred in 2005. Laboratory confirmation was available for 852 (75%) cases, 38 (4%) of which were confirmed by culture and 814 (96%) of which were confirmed by PCR. In addition to the laboratory-confirmed cases, 149 (13%) cases were epidemiologically linked to laboratory-confirmed cases, and 123 (11%) met the clinical case definition only. Six hundred twenty-four (55%) of the reported cases occurred in residents of Greater Minnesota.

Paroxysmal coughing was the most

continued...

commonly reported symptom. One thousand forty-four (92%) of the cases experienced paroxysmal coughing. One fourth (292, 26%) reported whooping. Although commonly referred to as "whooping cough," very young children, older individuals, and persons previously immunized may not have the typical "whoop" associated with pertussis. Post-tussive vomiting was reported in 471 (42%) of the cases. Infants and young children are at the highest risk for severe disease and complications. Pneumonia was diagnosed in 27 (2%) cases, 3 (11%) of whom were <18 months of age. Fourteen (1%) cases were hospitalized; 7 (50%) of the hospitalized patients were younger than 6 months of age.

Due to waning of immunity from either natural infection or vaccine, pertussis can affect persons of any age. The disease is increasingly recognized in older children and adults. During 2009, cases ranged in age from 14 days to 81 years. One hundred thirty-six (12%) cases occurred in adolescents 13 to 17 years of age, 226 (20%) cases occurred in adults 18 years of age and older, 646 (57%) occurred in children 5-12 years of age, 93 (8%) occurred in children 6 months through 4 years of age, 31 (3%) occurred in infants <6 months of age, and 2 (<1%) occurred in persons of unknown age. The median age of cases during 2009 was 11 years, compared with a median age of 13 years in 2005, the most recent previous peak incidence year.

Infection in older children and adults may result in exposure of unprotected infants who are at risk for the most severe consequences of infection. During 2009, 47 pertussis cases were reported in infants <1 year of age. A likely source of exposure was identified for 18 (38%) cases; 10 (21%) were infected by adults 18 years of age and older, 1 (2%) was infected by an adolescent 13 to 17 years of age, and 7 (15%) were infected by a child <13 years of age. For the 29 (62%) cases with no identified source of infection, the source was likely from outside the household. Vaccinating adolescents and adults with Tdap will decrease the incidence of pertussis in the community and thereby minimize infant exposures.

Although unvaccinated children are at highest risk for pertussis, fully immunized children may also develop the disease. Disease in those previously immunized is usually mild. Efficacy for currently licensed vaccines is estimated to be 71 - 84% in preventing serious disease. Of the 113 cases who were 7 months to 6 years of age, 70 (62%) were known to have received at least a primary series of 3 doses of DTP/DTaP vaccine prior to onset of illness; 35 (31%) received fewer than 3 doses and were considered preventable cases. Vaccine history was unavailable for the remaining 8 (7%) cases.

MDH reporting rules require that clinical isolates of *Bordetella pertussis* be submitted to the PHL. Of the 39 culture-confirmed cases, 35 (90%) of the isolates were received and sub-typed by PFGE. Eleven distinct PFGE patterns were identified. Five of these patterns occurred in only a single case isolate. The most common pattern identified accounted for 15 (43%) of the total isolates.

In 2009 no case-isolates of pertussis were tested in Minnesota for susceptibility to erythromycin, ampicillin, or trimethoprim-sulfamethoxazole. However, nationally isolates have had low minimum inhibitory concentrations, falling within the reference range for susceptibility to the antibiotics evaluated. Only 11 erythromycin-resistant *B. pertussis* cases have been identified in the United States to date.

Laboratory tests should be performed on all suspected cases of pertussis. Culture of *B. pertussis* requires inoculation of nasopharyngeal mucous on special media and incubation for 7 to 10 days. However, *B. pertussis* is rarely identified late in the illness; therefore, a negative culture does not rule out disease. A positive PCR result is considered confirmatory in patients with a 2-week history of cough illness. PCR can detect non-viable organisms. Consequently, a positive PCR result does not necessarily indicate current infectiousness. Patients with a 3-week or longer history of cough illness, regardless of PCR result, may not benefit from antibiotic therapy. Cultures are necessary for molecular and epidemiologic studies and for drug susceptibility testing. Whenever possible, culture should be done in conjunction with PCR testing. Serological tests are not standardized and are not acceptable for laboratory confirmation at this time.

Pertussis remains endemic in Minnesota despite an effective vaccine and high coverage rates with the primary series. Reported incidence of pertussis has consistently increased over the past 10 years, particularly in adolescents and adults. One of the main reasons for the ongoing circulation of pertussis is that vaccine-induced immunity to pertussis wanes approximately 5-10 years after completion of the primary series, leaving adolescents and adults susceptible.

Rabies

Rabies is caused by the rabies virus, an enveloped RNA virus from the Rhabdoviridae family and *Lyssavirus* genus. The virus is highly antigenic, only infects mammals, and has been identified worldwide. All warm-blooded mammals are susceptible to rabies but infection is dependent on the viral variant, the amount of virus inoculated, and the site of the bite. In Minnesota, the reservoir species are the skunk and multiple species of the bat.

In 2009, 69 (2.8%) of 2,433 animals submitted for testing were positive for rabies (Figure 5). This is similar to 2008, when 70 (2.3%) of 2,985 submitted animals tested positive for rabies. The majority of positive animals in 2009 were skunks 27/56 (48%), followed by cattle 3/51 (6%), bats 29/789 (4%), horses 1/13 (8%), dogs 4/644 (0.6%), and cats 5/716 (0.7%). No raccoons, (0/72) tested positive for rabies. There were no human cases of rabies.

The median number of positive animals reported annually from 1998 to 2007 was 69 (range, 39 to 94). From 2003 to 2009, 207/407 (51%) skunks, 141/4,205 (3%) bats, 23/4,881 (0.5%) dogs, 23/5,586 (0.4%) cats, 34/415 (8%) cattle, and 0/588 raccoons submitted and tested were positive for rabies. From 1988 to 2002, three raccoons tested positive for rabies; these occurred in 1989, 1990, and 1993. Presumably they were infected with one of the two skunk strains of rabies endemic in Minnesota.

Rubella

One case of rubella was reported during 2009. The case was a 31-year-

old female residing in Dakota County. The case was laboratory-confirmed by PCR, positive rubella IgM serology, and a documented seroconversion from negative to positive rubella IgG between acute and convalescent serologic specimens drawn 11 days apart. Her symptoms were consistent with rubella. The case had no documented history of vaccination for rubella. She did not travel outside of Minnesota during the exposure period. Rubella is not known to be circulating in The United States; the last reported rubella case in Minnesota occurred in 2000.

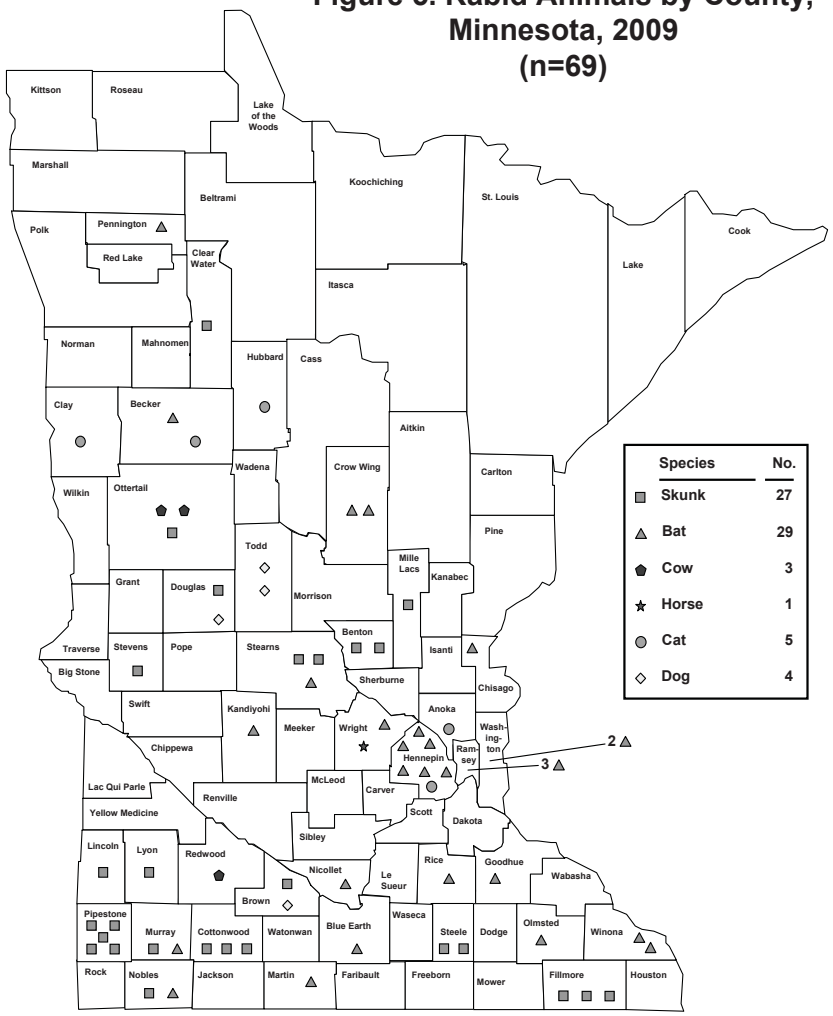
Salmonellosis

During 2009, 578 culture-confirmed cases of *Salmonella* infection (11.1 per 100,000 population) were reported. This represents an 8% decrease from the median annual number of cases reported from 1998 to 2008 (median, 626 cases; range, 576 to 725) (Figure 2). Of the 83 serotypes identified in 2009, 5 serotypes, *S. Enteritidis* (121), *S.* Typhimurium (106), *S.* Newport (45), *S.* Montevideo (26), and *S.* Saintpaul (16) accounted for 54% of cases. *Salmonella* was isolated from stool in 510 (88%), urine in 36 (6%), and blood in 25 (4%) cases. There were 5 cases of *S.* Typhi infection. Only 1 of the *S. Typhi* cases traveled internationally (India). Twenty-six percent of salmonellosis cases were 11 years of age or younger. Twenty-four percent of cases were hospitalized for their infection.

Of the 512 cases who were interviewed, 86 (17%) traveled internationally during the week prior to their illness onset. Three cases died: an 81-year-old case died of intestinal T-cell lymphoma 2 days after *Salmonella* was isolated from a blood specimen; an 86-year-old case died of metastatic colon cancer 5 days after *Salmonella* was isolated from a stool specimen; a 70-year-old case died of end-stage renal disease 4 days after *Salmonella* was isolated from a stool specimen.

Twenty-one cases were part of eight outbreaks identified in 2009. Six outbreaks involved cases in multiple states. Four of the outbreaks involved foodborne transmission. One outbreak involved contact with animals. One outbreak was the result of person-to-person transmission. In two outbreaks the vehicle of transmission was not identified. The eight outbreaks resulted in a median of only 2 culture-confirmed cases per outbreak (range; 1 to 5 cases).

Figure 5. Rabid Animals by County, Minnesota, 2009 (n=69)



In February, 2 cases of *S.* Oranienburg infection were part of a multi-state outbreak that resulted in 16 cases in 11 states among passengers of a cruise ship. The route of transmission was not determined.

From February through April, 5 cases of *S.* Saintpaul infection were part of a multi-state outbreak that resulted in 228 cases in 13 states. Alfalfa sprouts were implicated as the vehicle and were traced back to seed from a single distributor in Kentucky.

An outbreak of *S*. Brandenburg infections associated with a daycare in Kandiyohi County was identified in March. Person-to-person transmission resulted in 2 culture-confirmed cases.

In April, 2 cases of *S*. Cubana infection were part of an outbreak that included 14 cases in Canadian residents. Sprouts were implicated as the vehicle.

In June, 2 cases of *S*. Oranienburg infection were part of an outbreak associated with a jazz festival in New Orleans that resulted in 51 cases in 19 states. The route of transmission was not determined.

In October, 1 case of *S*. Typhimurium infection was part of a multi-state outbreak that resulted in 85 cases in 31 states. Contact with African dwarf frogs from a breeder in California were the source of the infections.

An outbreak of *S*. IV infections associated with a Cub Scout potluck in Blue Earth County was identified in November. Three culture-confirmed and

continued...

29 probable cases occurred. Gravy was implicated as the vehicle and bearded dragons, owned by the gravy preparer, were the ultimate source of the contamination.

In December, 4 cases of *S*. Montevideo infection were part of a multi-state outbreak that resulted in 272 cases in 44 states. Pepper-coated salami was implicated as the vehicle. This investigation resulted in the recall of the implicated product.

Sexually Transmitted Diseases (STDs)

Active surveillance for gonorrhea and chlamydia involves cross-checking laboratory-reported cases against cases reported by clinicians. Although both laboratories and clinical facilities are required to report STDs independently of each other, an episode of STD is not considered a case for surveillance purposes until a corresponding case report is submitted by a clinical facility. Case reports contain demographic and clinical information that is not available from laboratory reports. When a laboratory report is received but no corresponding case report is received within 45 days, MDH mails a reminder letter and case report form to the corresponding clinical facility. Active surveillance for syphilis involves immediate follow-up with the clinician upon receipt of a positive laboratory report. Cases of chancroid are monitored through a mostly passive surveillance system. Herpes simplex virus and human papillomavirus infections are not reportable.

Although overall incidence rates for STDs in Minnesota are lower than those in many other areas of the United States, certain population subgroups in Minnesota have very high STD rates. Specifically, STDs disproportionately affect adolescents, young adults, and persons of color.

Chlamydia

Chlamydia trachomatis infection is the most commonly reported infectious disease in Minnesota. In 2009, 14,186 chlamydia cases (288 per 100,000 population) were reported, representing a 1% decrease from 2008 (Table 3).

Adolescents and young adults are at highest risk for acquiring chlamydial infection (Table 4). The chlamydia rate is highest among 20 to 24-year-olds (1,652 per 100,000), with the next highest rate among 15 to 19-year-olds (1,196 per 100,000). The incidence of chlamydia among adults 25 to 29 years of age (731 per 100,000) is considerably lower but has increased in recent years. The chlamydia rate among females (410 per 100,000) is more than twice the rate among males (164 per 100,000), a difference most likely due to more frequent screening among women.

The incidence of chlamydia infection is highest in communities of color (Table 4). The rate among blacks (2,038 per 100,000) is over 15 times higher than the rate among whites (132 per 100,000). Although blacks comprise approximately 4% of Minnesota's population, they account for 29% of reported chlamydia cases. Rates among Asian/Pacific Islanders (324 per 100,000), American Indians (511 per 100,000), and Hispanics (633 per 100,000) are over two to six times higher than the rate among whites.

Chlamydia infections occur throughout the state, with the highest reported rates in Minneapolis (741 per 100,000) and St. Paul (687 per 100,000). While there was an overall decrease of 1% across the state in 2009 the greatest decrease for chlamydia was seen in the Minneapolis with a decrease of 6% compared to only 1% in each of the remaining geographic regions shown in Table 4.

Gonorrhea

Gonorrhea, caused by *Neisseria gonorrhoeae*, is the second most commonly reported STD in Minnesota. In 2009, 2,302 cases (42 per 100,000 population) were reported, representing a 24% decrease from 2008 (Table 3).

Adolescents and young adults are at greatest risk for gonorrhea (Table 4), with incidence rates of 163 per 100,000 among 15 to 19-year-olds, 237 per 100,000 among 20 to 24-year olds, and 134 per 100,000 among 25 to 29-year-olds. Gonorrhea rates for males (42 per 100,000) and females (51 per 100,000) are comparable. Communities of color are disproportionately affected by gonorrhea, with nearly one half of cases reported among blacks. The incidence of gonorrhea among blacks (546 per 100,000) is 36 times higher than the rate among whites (15 per 100,000). Rates among Asian/Pacific Islanders (15 per 100,000), American Indians (80 per 100,000), and Hispanics (58 per 100,000) are up to five times higher than among whites.

Gonorrhea rates are highest in the cities of Minneapolis and St. Paul (Table 4). The incidence in Minneapolis (188 per 100,000) is 33% higher than the rate in St. Paul (141 per 100,000), nearly six times higher than the rate in the suburban metropolitan area (32 per 100,000), and over nine times higher than the rate in Greater Minnesota (20 per 100,000). Geographically in 2009, Minneapolis and Greater Minnesota saw the greatest drop in cases with 32% and 31% respectively, with St. Paul and the suburban area posting decreases of 17% and 13% respectively.

The prevalence of quinolone-resistant *N. gonorrhoeae* (QRNG) continues to be an issue in Minnesota as well as nationally. In 2007, the MDH recommended that fluoroquinolones (eg, ciprofloxacin) no longer be used for the treatment of gonorrhea in Minnesota.

Syphilis

Surveillance data for primary and secondary syphilis are used to monitor morbidity trends because they represent recently acquired infections. Data for early syphilis (which includes primary, secondary, and early latent stages of disease) are used in outbreak investigations because they represent infections acquired within the past 12 months and signify opportunities for disease prevention.

Primary and Secondary Syphilis

The incidence of primary/secondary syphilis in Minnesota is lower than that of chlamydia or gonorrhea (Table 3), but has remained elevated since an outbreak was observed in 2002 among men who have sex with men (MSM). In 2009, there were 71 cases of primary/secondary syphilis in Minnesota (1.4 cases per 100,000 persons). This represents a decrease of 39% compared to the 116 cases (2.4 per 100,000 population) reported in 2008.

Early Syphilis

In 2009, the number of early syphilis cases decreased by 28%, with 117

cases occurring compared to 163 cases in 2008. The incidence remains highly concentrated among MSM. Of the early syphilis cases in 2009, 106 (91%) occurred among men; 96 (91%) of these men reported having sex with other men; 53% of the MSM diagnosed with early syphilis were co-infected with HIV.

Congenital Syphilis

One case of congenital syphilis was reported in Minnesota in 2009 (Table 3). This was the first case since 2006.

Chancroid

No cases were reported in 2009. The last case was reported in 1999.

Shigellosis

During 2009, 79 culture-confirmed cases of *Shigella* infection (1.5 per 100,000 population) were reported (Figure 2). This represents a 75% decrease from the 311 cases reported in 2008, and a 67% decrease from the median number of cases reported annually from 1999 to 2008 (median, 238 cases; range, 68 to 904). In 2009, *S. sonnei* accounted for 46 (58%) cases, *S. flexneri* for 27 (34%), *S. boydii* for 4 (5%), and *S. dysenteriae* for 2 (3%). Cases ranged in age from 1 to 96 years (median, 16 years). Forty-six percent of cases were ≤10 years of age; children ≤5 years of age accounted for 30% of cases. Eighteen (23%) cases were hospitalized. Seventy-five percent of cases resided in the metropolitan area, including 33% in Hennepin County and 21% in Ramsey County. No outbreaks of shigellosis were identified in 2009.

Every twentieth *Shigella* isolate received at MDH is tested for antimicrobial resistance. Three isolates were tested in 2009; 100% were resistant to trimethoprim-sulfamethoxazole, 33% were resistant to ampicillin, and 33% were resistant to both ampicillin and trimethoprim-sulfamethoxazole. All isolates tested were susceptible to ceftriaxone.

***Streptococcus pneumoniae* Disease**

Statewide active surveillance for invasive *Streptococcus pneumoniae* (pneumococcal) disease began in 2002, expanded from the metropolitan area, where active surveillance was ongoing since 1995. In 2009, 686 (13.1 per 100,000) cases of invasive

Table 3. Number of Cases and Rates (per 100,000 population) of Chlamydia, Gonorrhea, Syphilis and Chancroid - Minnesota, 2005-2009

	2005		2006		2007		2008		2009	
Disease	No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate
Chlamydia	12,355	251	12,975	264	13,480	274	14,414	293	14,186	288
Gonorrhea	3,505	71	3,316	67	3,479	71	3,054	62	2,302	47
Syphilis, Total	210	4.3	188	3.8	186	3.8	263	5.3	214	4.4
Primary/Secondary	71	1.4	47	1.0	59	1.2	116	2.4	71	1.4
Early Latent	48	1.0	58	1.2	55	1.1	47	1.0	46	0.9
Late Latent	88	1.8	81	1.6	72	1.5	100	2.0	96	2.0
Other*	1	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Congenital**	2	2.8	2	2.8	0	0.0	0	0.0	1	1.4
Chancroid	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0

* Includes unstaged neurosyphilis, latent syphilis of unknown duration, and late syphilis with clinical manifestations.
** Congenital syphilis rate per 100,000 live births.
Note: Data exclude cases diagnosed in federal or private correctional facilities

Table 4. Number of Cases and Incidence Rates (per 100,000 population) of Chlamydia, Gonorrhea, and Primary/Secondary Syphilis by Residence, Age, Gender, and Race/Ethnicity, Minnesota, 2009

	Chlamydia		Gonorrhea		Syphilis	
Demographic Group	No.	Rate	No.	Rate	No.	Rate
Total	14,186	288	2,302	47	71	1.4
*Residence**						
Minneapolis	2,834	741	721	188	38	9.9
St. Paul	1,972	687	404	141	10	3.5
Suburban**	4,589	233	639	32	18	0.9
Greater Minnesota	4,210	185	445	20	5	0.2
Age						
<15 years	146	14	20	2	0	0.0
15-19 years	4,478	1,196	610	163	2	0.5
20-24 years	5,326	1,652	764	237	12	3.7
25-29 years	2,339	731	427	134	11	3.4
30-34 years	969	274	217	61	8	2.3
35-44 years	690	84	169	21	24	2.9
≥45 years	238	14	95	6	18	1.1
Gender						
Male	3,992	164	1,032	42	71	2.9
Female	10,194	410	1,269	51	--	--
Transgender^^	--	--	1	--	--	--
Race^/Ethnicity						
White	5,720	132	673	15	53	1.2
Black	4,136	2,038	1,108	546	11	5.4
American Indian	414	511	65	80	1	1.2
Asian	546	324	26	15	0	0.0
Other ^^	607	--	100	--	6	--
Unknown^^	2,763	--	330	--	0	--
Hispanic^^^	907	633	83	58	6	4.2

* Residence information missing for 581 chlamydia cases and 93 gonorrhea cases.
** Suburban is defined as the seven-county metropolitan area (Anoka, Carver, Dakota, Hennepin, Ramsey, Scott, and Washington Counties), excluding the cities of Minneapolis and St. Paul.
^ Case counts include persons by race alone. Population counts used to calculate results include race alone or in combination.
^^ No comparable population data available to calculate rates.
^^^ Persons of Hispanic ethnicity may be of any race.
Note: Data exclude cases diagnosed in federal or private correctional facilities.

continued...

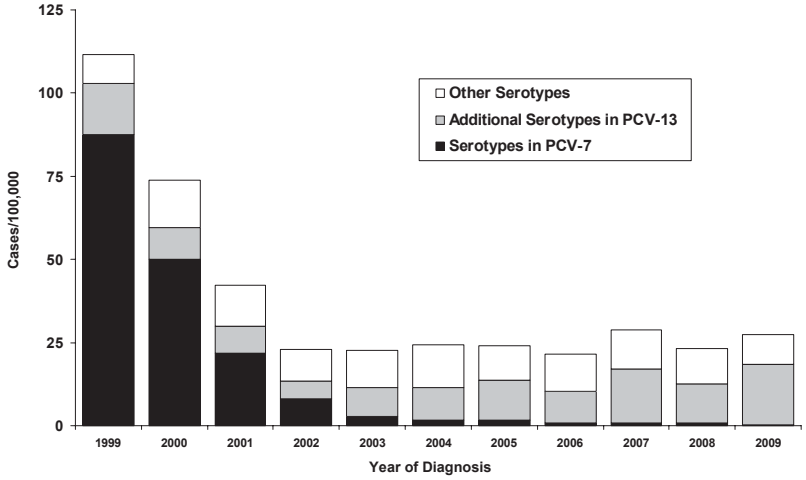
pneumococcal disease were reported. By age group, annual incidence rates per 100,000 were 27.3 cases among children aged 0-4 years, 4.1 cases among children and adults aged 5-39 years, 14.1 cases among adults 40-64 years, and 36.7 cases among adults aged 65 years and older.

In 2009, pneumonia accounted for 407 (59%) cases of invasive pneumococcal disease among all cases (i.e., those infections accompanied by bacteremia or isolation of pneumococci from another sterile site such as pleural fluid). Bacteremia without another focus of infection accounted for 222 (32%) cases statewide. Pneumococcal meningitis accounted for 27 (4%) cases. Sixty-four (9%) cases died. Health histories were available for 48 (75%) of the cases who died. Of these, 40 had an underlying health condition reported. The conditions most frequently reported were solid organ malignancy (14), diabetes (10), and atherosclerotic cardiovascular disease/coronary artery disease (10).

In 1999, the year before the pediatric pneumococcal conjugate vaccine (Prevnar, Wyeth-Lederle [PCV-7]) was licensed, the rate of invasive pneumococcal disease among children <5 years in the metropolitan area was 111.7 cases/100,000. Over the years 2000-2002 there was a major downward trend in incidence in this age group (Figure 6). Rates in each of the subsequent 7 years were somewhat higher, although there has not been a continuing upward trend. Based on the distribution of serotypes among isolates from these cases, this increase was limited to disease caused by non-vaccine serotypes (i.e. serotypes other than the 7 included in PCV-7 [Figure 6]). This small degree of replacement disease due to non-PCV-7 serotypes, similar to that seen in other parts of the country, has been far outweighed by the declines in disease caused by PCV-7 serotypes. This trend supports the need for ongoing monitoring, however, because further increases due to non-vaccine serotypes are possible.

In March 2010, the FDA approved a new 13-valent pediatric pneumococcal conjugate vaccine (PCV-13 [Prevnar 13, Wyeth Pharmaceuticals]) which will replace PCV-7. The new vaccine provides protection against the same

Figure 6. Invasive Pneumococcal Disease Incidence Among Children <5 Years of Age, by Year and Serotype Group, Metropolitan Area, 1999-2001; Minnesota, 2002-2009



PCV-13 contains the 7 serotypes in PCV-7 (4,6B,9V,14,18C,19F and 23F) plus 6 additional serotypes (1,3,5,6A,7F and 19A)

serotypes in PCV-7, plus 6 additional serotypes (serotypes 1, 3, 5, 6A, 7F, and 19A). Since 2007, the majority of invasive pneumococcal disease cases among children under the age of 5 years have been caused by the 6 new serotypes included in PCV-13 (Figure 6). In 2009, almost half of cases occurring among Minnesotans of all ages were caused by 3 of the new PCV-13-included serotypes: 7F, 19A, and 3.

Of the 639 isolates submitted for 2009 cases, 153 (24%) isolates were resistant to penicillin and 7 (1%) exhibited intermediate-level resistance using nonmeningitis breakpoints (Note: CLSI penicillin breakpoints changed in 2008; refer to the MDH Antibiogram [see pages 28-29] for details.); 136 isolates (21%) exhibited multi-drug resistance (i.e., high-level resistance to two or more antibiotic classes).

Streptococcal Invasive Disease - Group A

MDH has been conducting active surveillance since 1995 for invasive disease caused by group A Streptococcus (GAS), also known as *Streptococcus pyogenes*. Invasive GAS is defined as GAS isolated from a usual sterile site such as blood, cerebral spinal fluid, or from a wound when accompanied with necrotizing fasciitis or streptococcal toxic shock syndrome (STSS).

One hundred eighty-nine cases of invasive GAS disease (3.6 per 100,000), including 21 deaths, were reported in 2009, compared to 185 cases and 20 deaths in 2008. Ages of cases ranged from 4 days to 94 years (median, 50 years). Fifty-eight percent of the cases were residents of the metropolitan area. Fifty-nine (31%) cases had bacteremia without another focus of infection, 27 (14%) cases had cellulitis, and 18 (10%) cases had an abscess. There were 15 (8%) cases of primary pneumonia and 6 (3%) cases of necrotizing fasciitis. Fifteen (8%) cases had septic arthritis and/or osteomyelitis, and 3 (2%) had STSS. Eight (4%) cases were residents of eight different long-term care facilities.

The 21 deaths included 6 cases of bacteremia without another focus of infection, 4 cases of cellulitis, and 3 cases of pneumonia. The 8 remaining fatal cases had pneumonia and STSS (2), cellulitis and necrotizing fasciitis (1), STSS (1), necrotizing fasciitis (1), peritonitis (1), mastoiditis (1), and septic arthritis (1). The deaths occurred in persons ranging in age from 1 month to 89 years. Health histories were available for 20 cases who died and all had significant underlying medical conditions reported. The conditions most frequently reported were diabetes (6) and atherosclerotic cardiovascular disease/coronary artery disease (5).

Streptococcal Invasive Disease - Group B

Four hundred fifty-four cases of

invasive group B streptococcal disease (8.7 per 100,000 population), including 25 deaths, were reported in 2009. These cases were those in which group B *Streptococcus* (GBS) was isolated from a normally sterile site. This represents the largest number of GBS cases reported since surveillance was initiated in 1995.

By age group, annual incidence was highest among infants <1 year of age (53.0 per 100,000 population) and those aged 70 years or older (33.7 per 100,000). Twenty-one (84%) of the 25 case-deaths were among those age 65 years and older. Fifty-five percent of cases were residents of the metropolitan area. Bacteremia without a focus of infection occurred most frequently (45% of cases), followed by cellulitis (15%), osteomyelitis (9%), pneumonia (8%), septic arthritis (5%), and meningitis (2%). The majority (76%) of cases had GBS isolated from blood; other isolate sites included joint fluid (9%) and bone (9%).

Forty-three cases were infants or pregnant women (maternal cases), compared to 45 cases in 2008. Sixteen infants developed early-onset disease (occurred within 6 days of birth [0.22 cases per 1,000 live births]), and 21 infants developed late-onset disease (occurred at 7 to 89 days of age [0.29 cases per 1,000 live births]). One stillbirth/spontaneous abortion was associated with six maternal GBS infections.

Since 2002, there has been a recommendation for universal prenatal screening of all pregnant women at 35 to 37 weeks gestation. In light of this, MDH reviewed the maternal charts for all 16 early-onset cases reported during 2009. Overall, 12 (75%) of 16 women who delivered GBS-positive infants underwent prenatal screening for GBS. Of these, 6 (50%) were positive**,** 5 (42%) negative, and 1 (8%) had an unknown result. Two of the four women who did not receive prenatal screening were screened upon admission to the hospital and prior to delivery. Among the 16 women who delivered GBS-positive infants, five (32%) received intrapartum antimicrobial prophylaxis (IAP). Of the six women with a positive GBS screen, three (50%) received IAP. Of the three women with a positive GBS screen who did not receive IAP, two (67%) refused IAP.

Toxic Shock Syndrome

In 2009, 8 cases of suspect or probable staphylococcal toxic shock syndrome (TSS) were reported. Of the reported cases, 7 were female and the median age was 20 years (range, 10 to 64 years). Five of the 8 were menstrual-associated, 1 was wound-associated, 1 was associated with staphylococcal pneumonia, and one was unknown.

Tuberculosis

In both the United States, and Minnesota in particular, the incidence of tuberculosis (TB) disease declined dramatically in 2009. The number of new cases of TB disease reported annually in the United States has decreased each year since 1993, albeit at a decelerating rate of decline in recent years. In 2009, however, the number of TB cases reported nationally (11,450) decreased by 11.4% from the number reported in 2008 (12,905). This was the largest single-year decrease recorded since national TB surveillance began in 1953. In Minnesota, the incidence of TB disease increased throughout much of the 1990s and fluctuated during the past decade, with peaks in 2001 (239 cases) and 2007 (238 cases). In 2009, 161 new cases of TB disease (3.1 per 100,000) were reported in Minnesota. This represents declines of 24% in the number (211 cases) and 23% in the rate (4.0 per 100,000) of TB disease reported statewide in 2008. In particular, from 2008 to 2009 in Minnesota, the number of TB cases reported among U.S.-born persons decreased 43%, while that among foreign-born persons decreased 23% In 2009, Minnesota's TB incidence rate was below the national rate (3.8 per 100,000) but above both the median rate among 51 U.S. states and reporting areas (2.7 per 100,000) (Figure 7) and the U.S. Healthy People 2010 objective of 1.0 case per 100,000 population.

Reasons for the dramatic and unpredicted decrease in the incidence of TB disease nationwide during 2009 are unclear and are being investigated by CDC. While the decline may represent an actual reduction in the rate of disease due to improved TB control efforts or demographic changes among high-risk populations, other causes (e.g., under-diagnosis or reporting artifacts related to changes in the national TB case definition, TB case report form, and reporting software systems that occurred during 2009) also may have influenced the reported figures. The 24% decrease in the number of TB cases reported in Minnesota in 2009 follows an 11% decrease in 2008 cases (211) compared to 2007 (238). This likely is due to dramatic decreases in the number of primary refugees resettling in Minnesota in recent years. Notably, as the number of new refugees and immigrants arriving in Minnesota from sub-Saharan Africa has declined markedly since 2006, the percentage of foreign-born TB cases statewide who originate from that region also has decreased, from 66% in 2007 to 55% in 2009 (Figure 8).

The most distinguishing characteristic of the epidemiology of TB disease in Minnesota continues to be the large proportion of TB cases reported among foreign-born persons. Eighty percent of TB cases reported in Minnesota during 2009 occurred among persons born outside the United States. In contrast, only 60% of TB cases reported nationwide in 2009 were foreign-born. The 129 foreign-born TB cases reported in Minnesota during 2009 represented 30 different countries of birth; the most common region of birth among these patients was sub-Saharan Africa (55%), followed by South/Southeast Asia (26%). The ethnic diversity among foreign-born TB cases in Minnesota reflects the unique and constantly changing demographics of immigrant and other foreign-born populations arriving statewide. This diversity also poses significant challenges in providing culturally and linguistically appropriate TB prevention and control services for populations most affected by and at risk for TB in Minnesota.

Twelve percent of the foreign-born TB cases reported in Minnesota in 2009 were diagnosed within 12 months after arriving in the United States. These cases likely represent persons who acquired TB infection outside the United States and began progressing to active TB disease prior to immigrating. Of 12 TB cases 15 years of age or older who were diagnosed during 2009 within 12 months of arriving in the United States and who arrived as immigrants or refugees, only 4 (33%) had any

continued...

TB-related condition noted in their pre-immigration medical exam results. These findings highlight the need for clinicians to have a high index of suspicion for TB among newly arrived foreign-born persons, regardless of the results of medical exams performed overseas. Three-fourths of foreign-born TB cases reported in Minnesota during 2009 were diagnosed 2 or more years after arriving in the United States. These data suggest that more than half of foreign-born TB cases reported in Minnesota may be preventable by focusing on thorough domestic screening, evaluation, and treatment of latent TB infection among recently arrived refugees, immigrants, and other foreign-born persons.

The majority (65%) of foreign-born TB cases in 2009 were 15 to 44 years of age, whereas only 34% of U.S.-born TB cases occurred among persons in this age category. In contrast, 34% of U.S.-born TB cases were 45 years of age or older, while only 28% of foreign-born TB cases occurred in this age group. The proportion of pediatric patients <15 years of age was considerably larger among U.S.-born TB cases than among foreign-born cases (34% versus 7%, respectively), although most of these U.S.-born cases were children born in the United States to foreign-born parents. These first-generation U.S.-born children appear to experience an increased risk of TB disease that more closely resembles that of foreign-born persons. Presumably, these children may be exposed to TB as a result of travel to their parents' country of origin and/or visiting or recently arrived family members who may be at increased risk for TB acquired overseas.

The majority (81%) of TB cases reported during 2009 were identified as a result of presenting for medical care. Targeted public health interventions identified an additional 9% of TB cases in 2009. These methods of case identification included TB contact investigations (6%), follow-up evaluations subsequent to abnormal findings on pre-immigration exams performed overseas (2%), and domestic refugee health examinations (1%). The remaining 10% of new TB cases were identified through a variety of other means. In 2009, the percentage of TB cases identified through TB contact investigations returned to its usual level, after having increased from an annual average of 5% from 2004 through 2007 to 13% in 2008 due to three large TB outbreaks that occurred in specific populations during 2008.

Aside from foreign-born persons, other high-risk population groups comprise much smaller proportions of the TB cases in Minnesota. Among cases reported in 2009, persons with certain medical conditions (excluding HIV infection) that increase the risk for progression from latent TB infection to active TB disease (e.g., silicosis, diabetes, prolonged corticosteroid therapy or other immunosuppressive therapy, end stage renal disease, etc.) were the most common of these other high-risk population groups, representing 14% of cases. Substance abuse (including alcohol abuse and/or illicit drug use) was the second most common of these other risk factors, with 6% of TB cases having a history of substance abuse during the 12 months prior to their TB diagnoses. Seven (4%) of the 161 TB cases reported in Minnesota during 2009 were infected with HIV; 6 (86%) of those HIV-infected TB cases were foreign-born, including one person each from Burma, Ethiopia, Liberia, Mexico, Tanzania, and Zambia. The percentage of new TB cases with HIV co-infection in Minnesota remains less than that among TB cases reported nationwide (10.2% in 2009). Other risk groups, such as homeless persons, correctional facility inmates, and residents of nursing homes, each represented only 1-2% of TB cases reported during 2009. Notably, after

Figure 7. Tuberculosis Incidence Rates per 100,000 Population, United States and Minnesota, 1995-2009

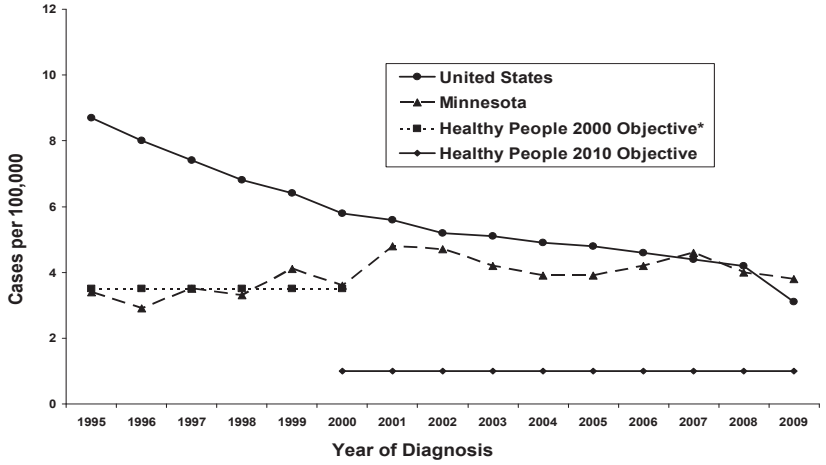
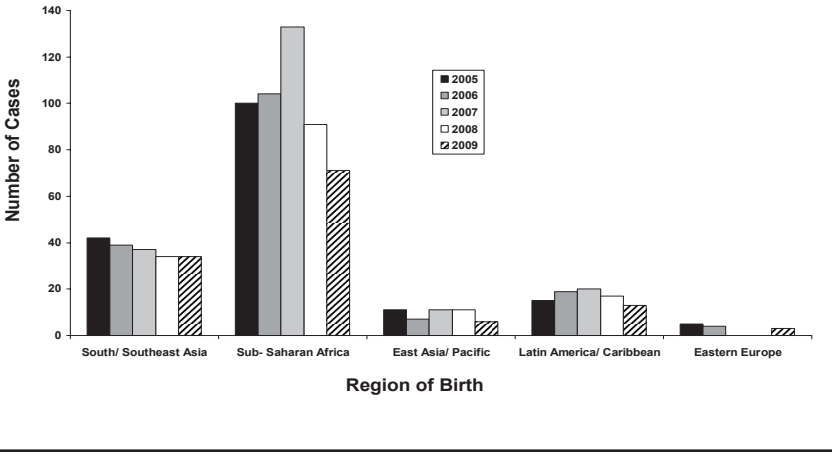


Figure 8. Foreign-Born Tuberculosis Cases by Region of Birth and Year of Diagnosis, Minnesota, 2005-2009



having increased to 5% in 2008 during a TB outbreak among homeless persons in the Twin Cities metropolitan area, the percentage of homeless TB cases declined to 2% in 2009, which was comparable to prior years during the past decade.

Twenty-one (24%) of the state's 87 counties reported at least 1 case of TB disease in 2009, with the large majority (84%) of cases occurring in the metropolitan area, particularly in Hennepin (38%) and Ramsey (25%) counties, both of which have public TB clinics. From 2005 to 2009, however, the percentage of TB cases statewide that occurred in Hennepin County decreased from 50% to 38%, whereas the percentage reported in Ramsey County increased from 18% to 25%. Sixteen percent of TB cases reported statewide during 2009 occurred in the five suburban metropolitan counties (i.e., Anoka, Dakota, Carver, Scott, and Washington). Olmsted County represented 5% of cases reported statewide in 2009. The remaining 16% of cases occurred in primarily rural areas of Greater Minnesota. MDH calculates county-specific annual TB incidence rates for Hennepin, Ramsey, and Olmsted Counties, as well as for the five-county suburban metropolitan area and collectively for the remaining 79 counties in Greater Minnesota. In 2009, the highest TB incidence rate statewide was reported in Ramsey County (8.1 cases per 100,000 population), followed by Olmsted County (5.6 cases per 100,000 population) and Hennepin County (5.3 cases per 100,000 population). In 2009, the incidence rates in the five-county suburban metropolitan area (2.2 cases per 100,000), and Greater Minnesota (1.1 cases per 100,000) were considerably lower than that in the state overall. From 2008 to 2009, the TB incidence rates in Greater Minnesota, Hennepin County, and Ramsey County decreased 42%, 38%, and 8%, respectively. In contrast, the TB incidence rate in suburban metropolitan area increased 10% from 2008 to 2009.

Although identification of *Mycobacterium tuberculosis* in a clinical specimen remains the gold standard for the diagnosis of TB disease, the national TB case surveillance definition includes individuals with TB risk factors and signs or symptoms consistent with active TB whose acid-fast bacilli cultures are negative or were not obtained, but who improved clinically or radiologically while on TB therapy. The number of TB cases reported in Minnesota in 2009 included 40 (25%) such cases.

The prevalence of drug-resistant TB in Minnesota, particularly resistance to isoniazid (INH) and multi-drug resistance, exceeds comparable national figures for 2008 (the most recent year for which complete national data are available). In 2009, 20 (17%) of 120 culture-confirmed TB cases with drug susceptibility results available were resistant to at least one first-line anti-TB drug (i.e., isoniazid [INH], rifampin, pyrazinamide, or ethambutol). In particular, 12 (10%) cases were resistant to INH, and 2 (2%) cases were multidrug-resistant (i.e., resistant to at least INH and rifampin). Drug resistance is more common among foreign-born TB cases than it is among U.S.-born cases in Minnesota. Of particular concern, 3 (23%) of 13 MDR-TB cases reported from 2005 through 2009 were resistant to all four first-line drugs. These 3 pan-resistant MDR-TB cases represented three different countries of birth (China, Somalia, and the United States).

Another clinical characteristic of particular significance in Minnesota is the preponderance of extrapulmonary disease among foreign-born TB patients. Just over half (54%) of foreign-born TB cases reported from 2005 through 2009 had an extrapulmonary site of disease; in contrast, only approximately one-third (34%) of U.S.-born TB cases had extrapulmonary TB. The most common extrapulmonary sites of TB disease were lymphatic, bone/joint, peritoneal, and pleural. The unusually high incidence of extrapulmonary TB disease in Minnesota emphasizes the need for clinicians to be aware of the local epidemiology of TB and to have a high index of suspicion for TB, particularly among foreign-born patients and even when the patient does not present with a cough or other common symptoms of pulmonary TB.

Unexplained Critical Illnesses and Deaths of Possible Infectious Etiology (UNEX) and Medical Examiner Infectious Deaths Surveillance (MED-X)

Surveillance for unexplained critical illnesses and deaths of possible infectious etiology (UNEX) began in September 1995. Primary focus is given to cases <50 years of age with no significant underlying conditions, however, any case should be reported regardless of the patient's age or underlying medical conditions; to determine if further testing may be indicated. In addition to provider reporting, death certificates are reviewed for any cases <50 years of age with no significant underlying conditions for possible unexplained infectious syndromes.

In 2006, MDH also began Medical Examiner Infectious Deaths Surveillance (MED-X) to evaluate all medical examiner (ME) cases for infectious-related deaths. MDH distributes specimen collection kits to the ME offices and materials to help guide the number and type of specimens collected. All ME offices are encouraged to participate. MDH in particular works with the Minnesota Regional Medical Examiner Office (MRMEO), the Hennepin County Medical Examiner Office, Midwest Forensic Pathology, Ramsey County Medical Examiner Office, and Lakeland Pathology. Medical examiners report explained and unexplained cases to MDH. Unexplained deaths in previously healthy individuals <50 years of age are included regardless of infectious hallmarks; this primarily includes Sudden Unexplained Infant Deaths (SUIDS). In addition, MDH reviews death investigations at MRMEO to capture a population-based rate that includes cases not autopsied. Cases found through active surveillance that have infectious pre-mortem and/or post-mortem findings indicating a possible infectious-related death for which a pathogen was not identified are also considered for UNEX surveillance and are followed-up with testing if they are <50 years of age and previously healthy.

Testing of pre-mortem and post-mortem specimens is conducted at the PHL and the CDC Infectious

continued...

Diseases Pathology Branch (IDPB). Cases are excluded from UNEX if they are determined to be explained by providers, are not critically ill, or have no infectious disease hallmarks.

Due to the increased submission of specimens during the H1N1 pandemic and the development of an integrated UNEX/MED-X system, the numbers reported for 2009 are difficult to compare with previous years. There were 201 cases that met criteria for UNEX surveillance (157 deaths and 44 critical illnesses) in 2009, compared to 88 cases in 2008. Of the 201, 133 were reported by providers, 11 were found on death certificate review, 51 were found through review of medical examiner records, and 6 were found through other reporting methods. Of the 51 found through MED-X, only 5 were <53 years of age and 10 had autopsies. Among the 201 cases, 90 cases presented with respiratory symptoms, 35 with neurologic symptoms, 24 with cardiac symptoms, 16 with sudden unexpected death (SUD), 14 with shock/sepsis; 13 with an illness that did not fit a defined syndrome including more than one syndrome, 5 with gastrointestinal (GI) illness, and 4 with a hepatic syndrome. The age of cases ranged from 1 week to 104 years. The median age was 29 years among 133 reported cases and 69 years among 68 non-reported cases, with an over all median age of 43 years. Fifty percent resided in the metropolitan area and 50% were male.

There were 116 cases that had specimens tested at the PHL and/or the CDC IDPB. Of those, 48 had one or more pathogens identified as a potential cause of the illness (Table 5). Cases were identified as confirmed (n=41), possible (n=4), or probable (n=3) based on the type of testing performed, the anatomic site of the specimen and the clinical syndrome. The most frequently identified pathogens include 21 cases of novel 2009 H1N1 influenza A, 7 *S. pneumoniae,* and 5 *S. aureus* (Table 5). There were also several cases caused by pathogens not expected to occur in Minnesota. One case was in a 21-month-old female with onset of acute rash and sepsis following a tick bite. Serologic, PCR and IHC testing revealed an infection with *Rickettsia rickettsii*, the agent of Rocky Mountain Spotted Fever (RMSF). While there have been sporadic reports of RMSF in Minnesota in the past, this represented the first confirmed endemic case in Minnesota. There was also a case of vaccine-associated poliomyelitis identified in an individual with acute flaccid paralysis. Finally, a case of hantavirus was identified in a 52-year-old female who had recently returned to Minnesota from a rafting trip on the Colorado River in the southwestern United States.

There were 201 MED-X cases in 2009; 127 of these also met UNEX criteria. Based on MRMEO data, the population-based rate of potential infectious disease related deaths as reported to MEs was 14.5 per 100,000. The median age of the cases was 48 years, and 51% were male. There were 82 (41%) cases found through death investigation report review, the majority of which were cases that did not have autopsies (n=69 [84%]). MEs reported 102 (51%) cases, death certificate review identified 16 (8%) cases, and 1 case was found through other reporting methods. The most common syndrome was pneumonia/upper respiratory infection (n=88 [43%]).

Among the 125 autopsied cases, the most common pathologic finding was myocarditis (n=19, [15%]). Of the 201 cases, 51 (25%) were confirmed to have had an infectious cause, 127 (63%) had possible infectious causes, and 23 (11%) were due to non-infectious causes. Pathogens determined as related to the cause of death are described above for the 127 UNEX cases. Among those explained by the provider, pathogens identified as the confirmed or possible cause of death included *S. pneumoniae* (n=4), *S. aureus* (n=5), *E. coli* (n=3), *Enterococcus* spp. (n=3), *Streptococcus* spp. (n=2), and 1 each of *Clostridium dificile*, hepatitis C, *Klebsiella pneumoniae*, and *Pseudomonas aeruginosa*.

Varicella and Zoster

Minnesota reporting rules require that unusual case incidence, individual critical cases, and deaths due to varicella and zoster be reported. The reporting rules also allow for the use of a sentinel surveillance system to monitor varicella and zoster incidence until that system no longer provides adequate data for epidemiological purposes, at which time case-based

Table 5. Unexplained Cases with Pathogen Identif ed as Conf rmed, Probable, or Possible Cause of Illness, UNEX and MED-X, 2009

Pathogen Identif ed	Total Cases*
Adenovirus	1
Blastomyces dermatitidis	1
Chlamydiaceae spp.	1
Enterococcus	1
Escherichia coli	1
Group A Streptococci	2
Group B Streptococci	2
Haemophilus influenzae	2
Hantavirus	2
Influenza A virus (seasonal)	1
Influenza A Novel H1N1	2
Klebsiella oxytoca	21
Mycoplasma pneumoniae	1
Neisseria meningitidis type B	1
Parainfluenza	1
Picornavirus	1
Vaccine-derived poliovirus	3
Powassan virus	1
Pseudomonas spp.	2
Respiratory Syncytial virus	1
Rickettsia rickettsii (Rocky Mountain Spotted Fever)	1
Staphylococcus aureus	5
Streptococcus pneumoniae	7
Other *Streptococcus* spp.	1
Total	62

* Some cases had multiple pathogens identified as possible coinfections contributing to illness/death.

surveillance will be implemented. This summary represents the fourth full year of surveillance.

No varicella-related deaths were identified in 2009. Two cases of critical illness due to varicella were reported; both were female. One case was 5 years of age and had a documented history of 1 dose of varicella-containing vaccine. She had an underlying medical condition but was not being treated with immunosuppressive drugs. The case was hospitalized for 1 day with concurrent fever and pneumonia; however, the etiology of the pneumonia was undetermined. The other case was 3 years of age and had not received varicella vaccine. She had no known underlying conditions. The case was hospitalized for 6 days because of complications including cerebellitis and ataxia.

Surveillance includes reporting of outbreaks from schools. An outbreak of varicella in a school is defined as 5 or more cases within a 2-month period in persons <13 years of age, or 3 or more cases within a 2-month period in persons 13 years of age and older. An outbreak is considered over when no new cases occur within 2 months after the last case is no longer contagious. During the 2009-2010 school year, MDH received reports of outbreaks from 20 schools in 16 counties involving 180 students and 2 staff. By comparison MDH received reports of outbreaks from 24 schools in 15 counties involving 261 students and no staff during the 2008-2009 school year. The number of cases per outbreak ranged from 4 to 26 (median, 9) during the 2009-2010 school year and 3 to 39 (median, 8) during the 2008-2009 school year.

Surveillance also includes reporting of individual cases from sentinel schools throughout Minnesota. These data are used to extrapolate to the statewide burden of sporadic disease. For the 2009-2010 school year, 80 sentinel schools were selected; 79 participated. A case of varicella is defined for sentinel school reporting as an illness with acute onset of diffuse (generalized) maculopapulovesicular rash without other apparent cause. During the 2009-2010 school year, MDH received 29 reports of varicella from 18 (23%) sentinel schools. One sentinel school reported a cluster of cases that met the outbreak definition. Five (17%) of 29 reported cases were included in this outbreak. The 24 cases not associated with an outbreak represent sporadic varicella incidence. Based on sentinel school data, an estimated 546 sporadic cases of varicella would have been expected to occur during a school year among the 870,941 total school-aged children (in Minnesota schools with >99 students), representing 0.06% of this population, for an incidence rate of 62.7 per 100,000 population. Estimated grade level-specific annual incidence rates are 107.8 per 100,000 (447 of 414,739) for elementary school students; 26.6 per 100,000 (40 of 148, 935) for middle school students; and 20.8 per 100,000 (59 of 283,870) for high school students.

Beginning in 2007, varicella surveillance included reporting of individual cases from selected sentinel child care sites. In 2009, MDH received no reports of varicella cases from the 120 selected child care sites (including 47 child care centers and 73 sentinel licensed home daycares). Because this program has historically generated very few reports of cases, case-based reporting of varicella in all child care settings was initiated in February 2010.

All suspected or confirmed cases of zoster with disseminated disease or complications other than post-herpetic neuralgia, irrespective of age, are reportable. During 2009, 16 such cases were reported; all were hospitalized. Nine cases were >60 years of age; 4 were 30 to 59 years of age; and 3 were less than 30 years of age, including 1 7-year-old case with aseptic meningitis. Eight of the cases (50%) had underlying conditions or were being treated with immunosuppressive drugs. Seven cases had encephalitis, 3 had meningitis, 3 had severe ocular involvement, 2 had disseminated disease, and 1 had cellulitis. One case with encephalitis subsequently died. Death certificate data were reviewed to identify zoster-related deaths in 2009. Twelve deaths were identified. Cases ranged in age from 39 to 96 years; 1 (8.3%) was <60 years of age.

MDH currently conducts zoster surveillance in all schools. During the 2009-2010 school year, MDH received 94 reports of zoster from schools in 32 counties, representing 0.01% of the total school population of 913,751 for an incidence rate of 10.3 per 100,000. Ages ranged from 6 to 18 years. As opposed to varicella, which is mainly diagnosed by school heath personnel and parents, nearly all (99%) of the 79 zoster cases for whom an interview could be obtained were provider-diagnosed. All cases of zoster in individuals <18 years of age are reportable.

Beginning September 1, 2010, the Minnesota school and child care immunization law will require health care provider verification of varicella disease history. In the past, a parental report was acceptable.

Viral Hepatitis A

In 2009, 30 cases of hepatitis A (HAV) (0.6 per 100,000 population) were reported. Twenty (67%) cases were residents of the metropolitan area, including 12 (40%) residents of Hennepin or Ramsey Counties. Fifteen (50%) of the cases were male. Cases ranged in age from 10 months to 71 years (median, 41 years). Nineteen (63%) cases were white, 1 (3%) was black, 1 (3%) was American Indian, and 1 (3%) was Asian; race was unknown for 8 (27%) cases. Hispanic ethnicity was reported for 2 cases (0.9 per 100,000).

A risk factor was identified for 24 (80%) of the cases, 2 (8%) of whom had known exposure to a confirmed hepatitis A case. These persons became infected following exposure to a close contact, representing missed opportunities to administer immune globulin (IG) or HAV vaccine. Of the remaining 22 cases with a risk factor identified, 11 were associated with travel. Of these 11 cases, 7 (64%) traveled to Mexico, Central America, or South America.

In 2009, there were no outbreaks of hepatitis A. HAV vaccine is now recommended for post-exposure prophylaxis of healthy persons aged 12 months to 40 years. HAV vaccine used for post-exposure prophylaxis gives longer protection than IG, is often more readily available, and is easier to administer.

Viral Hepatitis B

In 2009, 39 cases of symptomatic acute hepatitis B virus (HBV) infection (0.7

continued...

per 100,000 population) were reported, with no deaths. In addition to the 39 cases, four individuals with documented asymptomatic seroconversions were reported. Prior to 2006, both symptomatic cases and asymptomatic seroconvertors were counted as incident cases. This change in case counting criteria should be considered when examining case incidence trends.

MDH also received 567 reports of newly identified cases of confirmed chronic HBV infection in 2009. Prior to 2009, confirmed and probable chronic cases were reported in the year in which they were first reported. Beginning in 2009, only confirmed cases are reported, and cases are reported in the year in which case confirming data are available. A total of 18,519 persons are assumed to be alive and living in Minnesota with chronic HBV. The median age of chronic HBV cases in Minnesota is 41.

Acute cases ranged in age from 14 to 77 years (median, 40 years). Twenty-nine (74%) of the 39 cases were residents of the metropolitan area, including 11 (28%) in Hennepin County and 12 (31%) in Ramsey County. Thirty (77%) cases were male and 18 (46%) were adolescents or young adults between 13 and 39 years of age. Fifteen (38%) were white, 5 (13%) were black, 4 (10%) were Asian, and 1 (3%) was of other race; race was unknown for 14 (36%) cases. One case was known to be of Hispanic ethnicity (0.5 per 100,000). Although the majority of cases were white, incidence rates were higher among blacks (2.0 per 100,000) and Asian Pacific Islanders (2.0 per 100,000) than among non-Hispanic whites (0.3 per 100,000).

MDH attempts to ascertain risk factor information and possible modes of transmission by collecting information reported by the case to his/her health care provider and by interviewing the case directly, if possible. A case may report more than one risk factor. Seven (18%) cases reported having sexual contact with one or more partners within 6 months prior to onset of symptoms. Of these, 3 (43%) reported sexual contact with two or more partners, 3 (43%) were males who reported having one or more male sexual partners, 1 (14%) was a male who reported sexual contact with one female partner, and 3 (43%) cases were females who reported one or more male sexual partners. One (3%) case reported having sexual contact with a known carrier of hepatitis B surface antigen (HBsAg). No risk factor was identified for 28 (72%) cases.

In addition to the 39 hepatitis B cases, 4 perinatal infections were identified in infants who tested positive for HBsAg during post-vaccination screening performed between 9 and 15 months of age. The infants were born in 2008. The perinatal infections were identified through a public health program that works to ensure appropriate prophylactic treatment of infants born to HBV-infected mothers. All four infants were born in the United States and had received hepatitis B immune globulin and 3 doses of hepatitis B vaccine in accordance with the recommended schedule and were therefore considered treatment failures. Despite these treatment failures, the success of the public health prevention program is demonstrated by the fact that an additional 321 infants born to HBV-infected women during 2008 had post-serologic testing demonstrating no infection.

Viral Hepatitis C

In 2009, 15 cases of symptomatic acute hepatitis C virus (HCV) infection (0.3 per 100,000) were reported. In addition to the 15 cases, 11 individuals with asymptomatic, laboratory-confirmed acute HCV infection were reported. Prior to 2006, both symptomatic and asymptomatic acute infections were counted as incident cases. This change in case counting criteria should be considered when examining case incidence trends.

Eight (53%) of the 15 cases resided in Greater Minnesota. The median age was 44 years (range, 32 to 61 years). Ten (67%) cases were male. Eight (53%) were white, 3 (20%) were black, and 1 (7%) was American Indian; race was unknown for 3 (20%) cases.

MDH attempts to ascertain risk factor information for the 6 months prior to onset of symptoms by collecting information reported by the case to his/her health care provider and by interviewing the case, if possible. A case may report more than one risk factor, and may report different information to his/her health care provider than to MDH. Among the 15 cases, 1 (7%) used injection drugs; 1 (7%) had sexual contact with a known HCV-infected partner; 1 (7%) had a needle stick, 1 (7%) had multiple sexual partners, and 2 (13%) had one sexual partner. No risk factor was identified for 9 cases.

MDH received 1,798 reports of newly identified anti-HCV positive persons in 2009, the vast majority of whom are chronically infected. A total of 33,359 persons are assumed to be alive and living in Minnesota with past or present HCV infection. The median age of these cases is 53. Because most cases are asymptomatic, medical providers are encouraged to consider each patient's risk for HCV infection to determine the need for testing. Patients for whom testing is indicated include: persons with past or present injection drug use; recipients of transfusions or organ transplants before July 1992; recipients of clotting factor concentrates produced before 1987; persons on chronic hemodialysis; persons with persistently abnormal alanine aminotransferase levels; healthcare, emergency medical, and public safety workers after needle sticks, sharps, or mucosal exposures to HCV-positive blood; and children born to HCV-positive women. Infants born to HCV-infected mothers should be tested at 12 to 18 months of age, as earlier testing tends to reflect maternal antibody status. Persons who test positive for HCV should be screened for susceptibility to hepatitis A and B virus infections and immunized appropriately.

Use of a Reduced (4-Dose) Vaccine Schedule for Postexposure Prophylaxis to Prevent Human Rabies

Recommendations of the Advisory Committee on Immunization Practices (ACIP) *MMWR* March 19, 2010 / Vol. 59 / No. RR-2;1-9.

This article from the MMWR has been edited.

Introduction

Rabies is a zoonotic disease caused by RNA viruses in the family *Rhabdoviridae*, genus *Lyssavirus*. Virus is transmitted in the saliva of rabid mammals via a bite. After entry to the central nervous system, these viruses cause an acute, progressive encephalomyelitis. The incubation period usually ranges from 1 to 3 months after exposure, but can range from days to years. Rabies can be prevented by avoidance of viral exposure and initiation of prompt medical intervention when exposure does occur. In the United States, animal rabies is common. In a recent study, approximately 23,000 persons per year were estimated to have been exposed to potentially rabid animals and received rabies postexposure prophylaxis (PEP). With the elimination of canine rabies virus variants and enzootic transmission among dogs, human rabies is now rare in the United States, with an average of 1 or 2 cases occurring annually since 1960.

Prompt wound care and the administration of rabies immune globulin (RIG) and vaccine are highly effective in preventing human rabies following exposure. A variety of empirical schedules and vaccine doses have been recommended over time, based in part on immunogenicity and clinical experience in areas of the world with enzootic canine or wildlife rabies. As more potent vaccines were developed, the number of vaccine doses recommended for PEP has decreased, and studies aimed at further revision and reduction of PEP schedules and doses in humans have been encouraged. By the latter half of the 20th century, a 4- to 6-dose, intramuscular regimen using human diploid cell vaccine (HDCV) or purified chick embryo cell vaccine (PCECV) was being recommended. In the United States, a 5-dose PEP vaccine regimen was adopted during the 1980s. In 2007, when human rabies vaccine was in limited supply, an ad hoc National Rabies Working Group was formed to reassess the recommendations for rabies prevention and control in humans and other animals. In 2008, a smaller ACIP Rabies Workgroup was formed to review rabies vaccine regimen options. This report provides updated ACIP recommendations regarding the use of a 4-dose vaccination regimen, replacing the previously recommended 5-dose regimen, for rabies PEP in previously unvaccinated persons.

Rationale for Reduced Doses of Human Rabies Vaccine

A detailed review of the evidence in support of a reduced, 4-dose schedule for human PEP has been published. The totality of the evidence, obtained from the available peer-reviewed literature, unpublished data sources, epidemiologic reviews, and expert opinion strongly supports a reduced vaccination schedule (Table 1, page 27). Since the 19th century, prophylactic interventions against rabies have recognized the highly neurotropic characteristics of lyssaviruses and have aimed at neutralizing the virus at the site of infection before it can enter the human central nervous system. To accomplish this, immunologic interventions must be prompt and must be directed toward local virus neutralization, such as local infiltration with RIG and vaccination. Modern recommended rabies PEP regimens emphasize early wound care and passive immunization (i.e., infiltration of RIG in and around the wound) combined with active immunization (i.e., serial doses of rabies vaccine). Accumulated scientific evidence indicates that, following rabies virus exposure, successful neutralization and clearance of rabies virus mediated via appropriate PEP generally ensures patient survival. The induction of a rabies virus-specific antibody response is one important immunologic component of response to vaccination. Development of detectable rabies virus-specific neutralizing antibodies is a surrogate for an adequate immune response to vaccination. Clinical trials of human rabies vaccination indicate that all healthy persons develop detectable rabies virus-neutralizing antibody titer rapidly after initiation of PEP. For example, in a literature review conducted by the ACIP Rabies Workgroup of at least 12 published rabies vaccination studies during 1976-2008 representing approximately 1,000 human subjects, all subjects developed rabies virus-neutralizing antibodies by day 14.

Observational studies indicate that PEP is universally effective in preventing human rabies when administered promptly and appropriately. Of the >55,000 persons who die annually of rabies worldwide, the majority either did not receive any PEP, received some form of PEP (usually without RIG) after substantial delays, or were administered PEP according to schedules that deviated substantially from current ACIP or World Health Organization recommendations. For example, a review of a series of 21 fatal human cases in which patients received some form of PEP indicated that 20 patients developed signs of illness, and most died before day 28. In such cases, in which widespread infection of the central nervous system occurs before the due date (i.e., day 28) of the fifth vaccine dose, the utility of that dose must be nil. In the United States, of the 27 human rabies cases reported during 2000-2008, none of the patients had a history of receiving any PEP before illness, and this is the most common situation for human rabies deaths in both developed and developing countries. In India, an analysis from two animal bite centers during 2001-2002 demonstrated that in 192 human rabies cases, all deaths could be attributed to failure to seek timely and appropriate PEP, and none of them could be attributed to a failure to receive the fifth (day 28) vaccine dose. Even when PEP is administered imperfectly or not according to established scheduled dose recommendations, it might be generally effective. Several studies have reported cases involving persons who were exposed to potentially rabid animals and who received less than 5, 4, or even 3 doses of rabies vaccine

continued...

but who nevertheless did not acquire rabies. For example, in one series from New York, 147 (13%) of 1,132 patients had no report of receiving the complete 5-dose vaccine regimen. Of these patients, 26 (18%) received only 4 doses of vaccine, and two of these patients were exposed to animals with laboratory-confirmed rabies. However, no documented cases of human rabies occurred. The ACIP Rabies Working Group estimates that >1,000 persons in the United States receive rabies prophylaxis annually of only 3 or 4 doses, with no resulting documented cases of human rabies, even though >30% of these persons likely have exposure to confirmed rabid animals. In addition, no case of human rabies in the United States has been reported in which failure of PEP was attributable to receiving less than the 5-dose vaccine course. Worldwide, although human PEP failures have been reported very rarely, even in cases in which intervention appeared both prompt and appropriate, no cases have been attributed to the lack of receipt of the fifth human rabies vaccine dose on day 28.

In vivo laboratory animal studies using multiple animal models from rodents to nonhuman primates have underscored the importance of timely PEP using RIG and vaccine, regardless of the absolute number of vaccine doses used or the schedule. For example, in a study in which 1, 2, 3, 4, or 5 doses of rabies vaccine were used in a Syrian hamster model in combination with human rabies immune globulin (HRIG), no statistically significant differences in elicited protection and consequent survivorship were observed among groups receiving different doses. In the same study, using a murine model, no differences were detected in immunogenicity and efficacy of PEP with 2, 3, or 4 vaccine doses. In another study using a nonhuman primate model, 1 dose of cell-culture vaccine, in combination with RIG administered 6 hours postexposure, provided substantial protection. In another study, a 3-dose regime was evaluated in a canine model and determined to be effective in preventing rabies. Compared with older, nerve tissue-based products, adverse reactions associated with modern human rabies vaccination are uncommon. A review by the Workgroup of published and unpublished human rabies vaccine clinical trials and Vaccine Adverse Event Reporting System data identified no adverse events that were correlated to a failure to receive the fifth vaccine dose. As some adverse reactions might be independent clinical events with each vaccine administration, the omission of the vaccine dose on day 28 might have some positive health benefits. Otherwise, the overall safety of human rabies PEP is expected to be unchanged from the evidence provided in the 2008 ACIP report.

Preliminary economic assessments support the cost savings associated with a reduced schedule of vaccination. The ACIP Rabies Workgroup has estimated that, assuming 100% compliance with a recommended vaccine regimen, a change in recommendation from a 5-dose schedule to a 4-dose schedule would save approximately $16.6 million in costs to the U.S. health-care system. Persons who receive rabies vaccination might see some savings related to deletion of the fifth recommended dose of vaccine, measured in both the cost of the vaccine and the costs associated with the additional medical visit.

Revised Rabies Postexposure Prophylaxis Recommendations

(Table 2, page 31). Rabies PEP includes wound care and administration of both RIG and vaccine.

Unvaccinated Persons

For unvaccinated persons, the combination of RIG and vaccine is recommended for both bite and nonbite exposures, regardless of the time interval between exposure and initiation of PEP. If PEP has been initiated and appropriate laboratory diagnostic testing (i.e., the direct fluorescent antibody test) indicates that the animal that caused the exposure was not rabid, PEP may be discontinued.

A regimen of 4 1-mL vaccine doses of HDCV or PCECV should be administered intramuscularly to previously unvaccinated persons (Table 2, page 31). The first dose of the 4-dose regimen should be administered as soon as possible after exposure. The date of the first dose is considered to be day 0 of the PEP series. Additional doses then should be administered on days 3, 7, and 14 after the first vaccination. Recommendations for the site of the intramuscular vaccination remain unchanged (e.g., for adults, the deltoid area; for children, the anterolateral aspect of the thigh also is acceptable). The gluteal area should not be used because administration of vaccine in this area might result in a diminished immunologic response. Children should receive the same vaccine dose (i.e., vaccine volume) as recommended for adults.

HRIG Use

The recommendations for use of immune globulin in rabies prophylaxis remain unchanged by the revised recommendation of a reduced rabies vaccine schedule. HRIG is administered once to previously unvaccinated persons to provide rabies virus-neutralizing antibody coverage until the patient responds to vaccination by actively producing virus-neutralizing antibodies. HRIG is administered once on day 0 at the time PEP is initiated, in conjunction with human rabies vaccines available for use in the United States. If HRIG was not administered when vaccination was begun on day 0, it can be administered up to and including day 7 of the PEP series. If anatomically feasible, the full dose of HRIG is infiltrated around and into any wounds. Any remaining volume is injected intramuscularly at a site distant from vaccine administration. HRIG is not administered in the same syringe or at the same anatomic site as the first vaccine dose. However, subsequent doses (i.e., on days 3, 7, and 14) of vaccine in the 4-dose vaccine series can be administered in the same anatomic location in which HRIG was administered.

Previously Vaccinated Persons

Recommendations for PEP have not changed for persons who were vaccinated previously. Previously vaccinated persons are those who have received one of the ACIP-recommended pre- or postexposure prophylaxis regimens (with cell-culture vaccines) or those who received another vaccine regimen (or vaccines other than cell-culture vaccine) and had a documented adequate rabies virus-neutralizing antibody response. Previously vaccinated persons, as defined above, should receive 2 vaccine doses (1.0 mL each in the deltoid), the first dose immediately and the second dose 3

days later. Administration of HRIG is unnecessary, and HRIG should not be administered to previously vaccinated persons to avoid possible inhibition of the relative strength or rapidity of an expected anamnestic response. Local wound care remains an important part of rabies PEP for any previously vaccinated persons.

Vaccination and Serologic Testing

All healthy persons tested in accordance with ACIP guidelines after completion of at least a 4-dose regimen of rabies PEP should demonstrate an adequate antibody response against rabies virus. Therefore, no routine testing of healthy patients completing PEP is necessary to document seroconversion. When titers are obtained, serum specimens collected 1-2 weeks after prophylaxis (after last dose of vaccine) should completely neutralize challenge virus at least at a 1:5 serum dilution by the rapid fluorescent focus inhibition test (RFFIT). The rabies virus-neutralizing antibody titers will decline gradually since the last vaccination. Minimal differences (i.e., within one dilution of sera) in the reported values of rabies virus-neutralizing antibody results might occur between laboratories that provide antibody determination using the recommended RFFIT. Commercial rabies virus antibody titer determination kits that are not approved by the Food and Drug Administration are not appropriate for use as a substitute for the RFFIT. Discrepant results might occur after the use of such tests, and actual virus-neutralizing activity in clinical specimens cannot be measured.

Management of Adverse Reactions, Precautions, and Contraindications

Management of Adverse Reactions

Recommendations for management and reporting of vaccine adverse events have not changed. These recommendations have been described in detail previously.

Immunosuppression

Recommendations for rabies pre- and postexposure prophylaxis for persons with immunosuppression have not changed. General recommendations for active and passive immunization in persons with altered immunocompetence have been summarized previously. This updated report discusses specific recommendations for patients with altered immunocompetence who require rabies pre- and postexposure prophylaxis. All rabies vaccines licensed in the United States are inactivated cell-culture vaccines that can be administered safely to persons with altered immunocompetence. Because corticosteroids, other immunosuppressive agents, antimalarials, and immunosuppressive illnesses might reduce immune responses to rabies vaccines substantially, for persons with immunosuppression, rabies PEP should be administered using a 5-dose vaccine regimen (i.e., 1 dose of vaccine on days 0, 3, 7, 14, and 28), with the understanding that the immune response still might be inadequate. Immunosuppressive agents should not be administered during rabies PEP unless essential for the treatment of other conditions. If possible, immunosuppressed patients should postpone rabies preexposure prophylaxis until the immunocompromising condition is resolved. When postponement is not possible, immunosuppressed persons who are at risk for rabies should have their virus-neutralizing antibody responses checked after completing the preexposure series. Postvaccination rabies virus-neutralizing antibody values might be less than adequate among immunosuppressed persons with HIV or other infections (*29,30*). When rabies pre- or postexposure prophylaxis is administered to an immunosuppressed person, one or more serum samples should be tested for rabies virus-neutralizing antibody by the RFFIT to ensure that an acceptable antibody response has developed after completing the series. If no acceptable antibody response is detected after the final dose in the pre- or postexposure prophylaxis series, the patient should be managed in consultation with their physician and appropriate public health officials.

continued on page 31

TABLE 1. Summary of evidence in support of a 4-dose postexposure prophylaxis regimen - United States, 2010

Evidence	Conclusion	Sources
Rabies virus pathogenesis	High neurotropism of rabies virus requires immediate immunization (local infiltration with human rabies immune globulin [HRIG] and vaccination) to neutralize virus at the site of infection and prevent viral entry into the central nervous system.	Published literature, expert national and international opinion, and historic observations
Experimental animal models	Protection in animal models was elicited without regard to the absolute number of vaccine doses used.	Published literature, expert national and international opinion, and unpublished data
Human clinical studies	All patients develop adequate levels of virus-neutralizing antibodies by day 14, without any additive value of a 5th dose of vaccine administered at day 28 (in regards to any substantive increase in measured virus-neutralizing antibody levels).	Published literature, expert national and international opinion, and unpublished data
Epidemiologic surveillance	No human rabies cases were identified in patients who received appropriate wound care, HRIG, and 4 doses of vaccine.	Published literature, expert national and international opinion, and unpublished data
Health economics	Expected positive national benefits are related to omission of a 5th dose (e.g., minimized travel expenses, reduced time out of work, health-care workers have more time for other patients, and fewer adverse reactions).	Published literature and expert national opinion

Antimicrobial Susceptibilities of Selected Pathogens, 2009

On the following pages is the *Antimicrobial Susceptibilities of Selected Pathogens, 2009*, a compilation of antimicrobial susceptibilities of selected pathogens submitted to MDH during 2008 in accordance with Minnesota Rule 4605.7040. Because a select group of isolates is submitted to MDH, it is important to read the notes entitled "Sampling Methodology" and "Trends, Comments, and Other Pathogens." Please note the data on inducible clindamycin resistance for Group A and B *Streptococcus* and community associated methicillin-resistant *Staphylococcus aureus.*

continued...

Trends, Comments, and Other Pathogens	
1 *Campylobacter* spp.	Ciprofloxacin susceptibility was determined for all isolates (n=823). Only 30% of isolates from patients returning from foreign travel were susceptible to quinolones. Most susceptiblities were determined using 2009 CLSI breakpoints for *Campylobacter.* Susceptiblities for gentamicin and azithromycin were based on an MIC ≤ 2µg/ml.
2 *Salmonella enterica* (non-typhoidal)	Antimicrobial treatment for enteric salmonellosis generally is not recommended.
3 *Neisseria gonorrhoeae*	Routine resistance testing for *Neisseria gonorrhoeae* by MDH PHL was discontinued in 2008. Susceptibility results were obtained from the CDC Regional Laboratory in Cleveland, Ohio, and are for isolates obtained through the Gonococcal Isolate Surveillance Program. Isolates (n =122) were received from the Red Door Clinic in Minneapolis. 85% were susceptible to cefpodoxime. Resistance criteria for cefixime, cefpodoxime, and azithromycin have not been established; data reflect reduced susceptibility using provisional breakpoints [minimum inhibitory concentration (MIC) ≥0.5 µg/ml, ≥0.5 µg/ml, and ≥ 2.0µg/ml, respectively].
4 *Neisseria meningitidis*	In 2009, 1 case-isolate demonstrated intermediate susceptibility to penicillin and ampicillin, as well as resistance to trimethoprim/sulfamethoxazole. There were no 2009 case-isolates with ciprofloxin resistance. In 2008, 2 isolates obtained from cases occuring in northwestern Minnesota had nalidixic acid MICs >8 µg/ml and ciprofloxacin MICs of 0.25 µg/ml, indicative of resistance.
5 Group A *Streptococcus*	The 170 isolates tested represent 90% of 189 total cases. Among 19 erythromycin-resistant, clindamycin-susceptible isolates, 11 (58%) had inducible resistance to clindamycin by D-test.
6 Group B *Streptococcus*	100% (16/16) of early-onset infant, 100% (21/21) of late-onset infant, 50% (3/6) of maternal, and 90% (368/411) of other invasive GBS cases were tested. Among 71 erythromycin-resistant, clindamycin-susceptible isolates, 36 (51%) had inducible resistance to clindamycin by D-test. Overall, 66% (270/408) were susceptible to clindamycin and were D-test negative (where applicable). 75% (30/40) of infant and maternal cases were susceptible to clindamycin and were D-test negative (where applicable).
7 *Streptococcus pneumoniae*	The 639 isolates tested represented 93% of 686 total cases. Reported above are the proportions of case-isolates susceptible by meningitis breakpoints for cefotaxime, ceftriaxone (intermediate = 1.0 µg/ml, resistant ≥ 2.0 µg/ml) and penicillin (resistant ≥ 0.12 µg/ml). By nonmeningitis breakpoints (intermediate = 2.0 µg/ml, resistant ≥ 4.0 µg/ml), 92% (590/639) of isolates were susceptible to cefotaxime and ceftriaxone. By nonmeningitis breakpoints (intermediate = 4.0 µg/ml, resistant ≥ 8.0 µg/ml), 90% (575/639) of isolates were susceptible to penicillin. Isolates were screened for high-level resistance to rifampin at a single MIC; all were ≤ 2 µg/ml. 21% (136/639) of isolates were resistant to two or more antibiotic classes and 17% (111/639) were resistant to three or more antibiotic classes. (CLSI also has breakpoints for oral penicillin V; refer to the most recent CLSI recommendations for information).
8 *Mycobacterium tuberculosis* (TB)	National guidelines recommend initial four-drug therapy for TB disease, at least until first-line drug susceptibility results are known. Of the 20 drug-resistant TB cases reported in 2009, 17 (85%) were in foreign-born persons, including 2 of the 3 multidrug-resistant (MDR-TB) cases for 2009 (i.e., resistant to at least isoniazid [INH] and rifampin). There were no cases of extensively drug-resistant TB (XDR-TB) (i.e., resistance to at least INH, rifampin, any fluoroquinolone, and at least one second-line injectable drug).
Invasive methicillin-resistant *Staphylococcus aureus* (MRSA)	3,401 cases of MRSA infection were reported in 2009 through 12 sentinel sites, of which 206 (6%) were invasive (blood isolates were 77% of 206). Of these invasive cases, 72% (149/206) had an isolate submitted and antimicrobial susceptibility testing conducted. Of invasive cases with an isolate, 77% were epidemiologically classified as healthcare-associated. Susceptibilities were as follows: 100% to daptomycin, doxycycline, linezolid, minocycline, quinupristin/dalfopristin, and vancomycin; 99% to gentamicin, mupirocin, rifampin, tetracycline, trimethoprim/ sulfamethoxazole; 25% to levofloxacin; 9% to erythromycin. 52% were susceptible to clindamycin by broth microdilution; however, an additional 31 isolates (21%) were positive for inducible clindamycin resistance by D-test (32% susceptible and D-test negative). Of community-associated (CA) cases (71% of 48 had isolates), susceptibilities were as follows: 100% to daptomycin, doxycycline, gentamicin, linezolid, minocycline, quinupristin/dalfopristin, rifampin, trimethoprim/sulfamethoxazole, vancomycin; 97% to mupirocin, tetracycline; 62% to levofloxacin; 15% to erythromycin. 74% were susceptible to clindamycin by broth microdilution; however, an additional 4 isolates (17%) were positive for inducible clindamycin resistance by D-test (62% susceptible and D-test negative). In addition to sentinel reporting, MDH received reports of 3 case isolates (1 MRSA and 2 MSSA) with intermediate resistance to vancomycin (MIC 4-8 µg/ml).
Bordetella pertussis	In 2009 no cases of pertussis were tested for susceptibility in Minnesota. Nationally, only 11 erythromycin-resisitant *B.pertussis* cases have been identified to date.
Escherichia coli O157:H7	Antimicrobial treatment for *E. coli* O157:H7 infection is not recommended.

Antimicrobial Susceptibilities of Selected Pathogens, 2009

MINNESOTA MDH DEPARTMENT OF HEALTH

Sampling Methodology
† all isolates tested
‡ ~10% sample of statewide isolates received at MDH
§ isolates from a normally sterile site

		Campylobacter spp. [1‡]	*Salmonella* Typhimurium [2†]	Other *Salmonella* serotypes (non-typhoidal) [2‡]	*Shigella* spp. [‡]	*Neisseria gonorrhoeae* [3]	*Neisseria meningitidis* [4†§]	Group A *Streptococcus* [5†§]	Group B *Streptococcus* [6†§]	*Streptococcus pneumoniae* [7†§]	*Mycobacterium tuberculosis* [8†]
Number of Isolates Tested		83	103	46	7	122	16	170	408	639	120
		% Susceptible									
ß-lactam antibiotics	amoxicillin									88	
	ampicillin		81	85	86		94	100	100		
	penicillin					0	94	100	100	75	
	cefixime					100					
	cefuroxime sodium									84	
	cefotaxime							100	100	87	
	ceftriaxone		98	96	100	100	100			87	
	meropenem						100			87	
Other antibiotics	ciprofloxacin	76[1]	99	100	100	92	100				
	levofloxacin						100	99	99	99	
	azithromycin	98				100	100				
	erythromycin	98						86	58	72	
	clindamycin							98/91[5]	75/66[6]	87	
	chloramphenicol		85	94	86					99	
	gentamicin	82									
	spectinomycin					100					
	tetracycline	34				37		93		87	
	trimethoprim/sulfamethoxazole		94	96	14		75			79	
	vancomycin							100	100	100	
TB antibiotics	ethambutol										98
	isoniazid										90
	pyrazinamide										93
	rifampin						100				98

The MDH Antibiogram is available on the MDH Web site at:
www.health.state.mn.us/divs/idepc/dtopics/antibioticresistance/antibiogram.html.

Laminated copies can be ordered from: Antibiogram, Minnesota Department of Health, Acute Disease Investigation and Control Section, PO Box 64975, St. Paul, MN 55164 or by calling 651-201-5414.

16th Annual Emerging Infections in Clinical Practice and Public Health Conference
Friday, November 19, 2010 (See Program, p. 31)
Radisson University Hotel, Minneapolis

REGISTRATION FORM

PLEASE PRINT OR TYPE:

Name _____

Aff liation _____

Department _____

Address _____

Mail Stop _____

City _____

State _____

Zip _____

☐ Home ☐ Off ce

Off ce Telephone Number _____

E-mail _____

Degree _____

_____

MAIL TO:

Emerging Infections Conference, 2009
Off ce of Continuing Medical Education
University of Minnesota
University Park Plaza, Suite 601
2829 University Avenue SE
Minneapolis, MN 55414
or Fax to: 612-626-7766

Phone: 612-626-7600 or 1-800-776-8636
or Online: www.cmecourses.umn.edu

PAYMENT METHOD

☐ Check (payable to University of Minnesota)

☐ VISA ☐ MasterCard ☐ American Express

Cardholder Name _____

Card No. _____

Exp. Date _____

Signature _____

Registration Fees:	On or Before October 22, 2010	After October 22, 2010
☐ Physician	$160	$215
☐ Non-Physician (NP, RN, PA, etc.)	$135	$160
☐ Medical Industry Professional	$160	$215

U of M/Mayo Clinic/MDH (U of M employees must have ID to qualify for these rates)

☐ Adjunct faculty	$110	$135
☐ Non-Physician (NP, RN, PA, etc.)	$85	$110
☐ Resident/Fellow/Student	$25	$25

Special Needs _____

More Information at www.cmecourses.umn.edu (Click on “Course Calendar”)

continued...

16th Annual Emerging Infections in Clinical Practice and Public Health: Emerging Vector-borne Diseases

Conference Program Includes:

- H1N1 2009: Lessons Learned and National Response - Nicole Lurie, M.D., M.S.P.H.
- Vaccine Response and Technologies for Emerging Infectious Disease Threats - Jesse Goodman, M.D., M.P.H.
- Endemic Vector-borne Diseases- What's Emerging and What's Changing? - Melissa Kemperman, M.P.H.
- Dengue: Emerging Issues - Kay M. Tomashek, M.D., M.P.H.
- Malaria - Update on Treatment, Prophylaxis, and Resistance - Chandy John, M.D., M.S.
- Update on the New Pediatric Vaccines - Patricia Ferrieri, M.D.
- What's New in Infection Control - Susan Kline, M.D., M.P.H.
- Hot Topics from MDH - Richard Danila, Ph.D., M.P.H.
- Case Presentations and Panel Discussion - Moderator: Phil Peterson, M.D. Panel: Chandy John, M.D., M.S. Mark Schleiss, M.D., Rajesh Prabhu, M.D., Mark Sannes, M.D., M.S., Abinash Virk, M.D.
- Cases from the Travel Desk - Abinash Virk, M.D.
- The Future: Predictions for Emerging Infections - Michael T. Osterholm, Ph.D., M.P.H.

---

continued from page 27

TABLE 2. Rabies postexposure prophylaxis (PEP) schedule - United States, 2010

Vaccination status	Intervention	Regimen*
Not previously vaccinated	Wound cleansing	All PEP should begin with immediate thorough cleansing of all wounds with soap and water. If available, a virucidal agent (e.g., povidine-iodine solution) should be used to irrigate the wounds.
	Human rabies immune globulin (HRIG)	Administer 20 IU/kg body weight. If anatomically feasible, the full dose should be infiltrated around and into the wound(s), and any remaining volume should be administered at an anatomical site (intramuscular [IM]) distant from vaccine administration. Also, HRIG should not be administered in the same syringe as vaccine. Because RIG might partially suppress active production of rabies virus antibody, no more than the recommended dose should be administered.
	Vaccine	Human diploid cell vaccine (HDCV) or purified chick embryo cell vaccine (PCECV) 1.0 mL, IM (deltoid area†), 1 each on days 0,§ 3, 7 and 14.¶
Previously vaccinated**	Wound cleansing	All PEP should begin with immediate thorough cleansing of all wounds with soap and water. If available, a virucidal agent such as povidine-iodine solution should be used to irrigate the wounds.
	HRIG	HRIG should not be administered.
	Vaccine	HDCV or PCECV 1.0 mL, IM (deltoid area†), 1 each on days 0§ and 3.

* These regimens are applicable for persons in all age groups, including children.

† The deltoid area is the only acceptable site of vaccination for adults and older children. For younger children, the outer aspect of the thigh may be used. Vaccine should never be administered in the gluteal area.

§ Day 0 is the day dose 1 of vaccine is administered.

¶ For persons with immunosuppression, rabies PEP should be administered using all 5 doses of vaccine on days 0, 3, 7, 14, and 28.

** Any person with a history of pre-exposure vaccination with HDCV, PCECV, or rabies vaccine adsorbed (RVA); prior PEP with HDCV, PCECV or RVA; or previous vaccination with any other type of rabies vaccine and a documented history of antibody response to the prior vaccination.

continued from page 27

Variation from Human Rabies Vaccine Package Inserts

These new ACIP recommendations differ from current rabies vaccine label instructions, which still list the 5-dose series for PEP. Historically, ACIP review and subsequent public health recommendations for the use of various biologics has occurred after vaccine licensure and generally are in agreement with product labels. However, differences between ACIP recommendations and product labels are not unprecedented. For example, during the early 1980s, ACIP review and recommendations concerning the intradermal use of rabies vaccines occurred well in advance of actual label claims and licensing. On the basis of discussions with industry representatives, alterations of current product labels for HDCV and PCEC are not anticipated by the producers of human rabies vaccines licensed for use in the United States.

References

Available at: http://www.cdc.gov/mmwr/PDF/rr/rr5703.pdf

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

MINNESOTA MDH DEPARTMENT OF HEALTH

625 Robert Street North
P.O. Box 64975
Saint Paul, Minnesota 55164-0975

Presort Standard
U.S. Postage
PAID
Permit No. 171
St. Paul, MN