DEPARTMENT OF HEALTH

DISEASE CONTROL NEWSLETTER

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Annual Summary of Communicable Diseases Reported to the Minnesota Department of Health, 2017

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 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 reports 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 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 preventionist for a hospital). Data maintained by MDH are private and protected under the Minnesota Government Data Practices Act (Section 13.3805).

Since April 1995, MDH has participated as an Emerging Infections Program (EIP) site funded by the U.S. 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, foodborne diseases, tickborne diseases, and hospitalized influenza cases.

Isolates of pathogens from certain diseases are required to be submitted to MDH (Table 1). The MDH Public Health Laboratory (PHL) performs microbiologic and molecular evaluation of isolates, such as pulsed-field gel electrophoresis (PFGE) and whole genome sequencing, 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.

Table 2 summarizes cases of selected communicable diseases reported during 2017 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 (unless otherwise indicated).

Anaplasmosis

Anaplasmosis, caused by *Anaplasma phagocytophilum*, is a rickettsial disease transmitted by bites from *Ixodes scapularis*, the blacklegged tick. Although the organism that causes anaplasmosis was previously known by other names and thought to be a part of the genus *Ehrlichia*, anaplasmosis and ehrlichiosis (due to *E. chaffeensis*) are distinct diseases caused by different rickettsial species. The same tick vector also transmits the etiologic agents of Lyme disease, babesiosis, ehrlichiosis (due to *E. muris*), and Powassan virus. In rare circumstances, *A. phagocytophilum* may be transmitted by blood transfusion.

In 2017, 638 confirmed or probable cases of anaplasmosis (11.6 cases per 100,000 population) were reported, down from the 733 cases reported in 2016 (Figure 1). Despite some annual fluctuations in reported cases, the overall trend is an increase in yearly case totals over time, with a median of 632 cases reported per year since 2010. Sixty percent (385) of cases reported were male. The median age of cases was 58 years (range, 2 to 97), 15 years older than the median age of confirmed Lyme disease cases. As is typical, most cases had illness onsets during the summer months, with 65% of cases reporting illness onsets in June and July. In 2017, 165 (26%) cases were hospitalized for their infection, with a median duration of 4 days (range, 1 to 34 days).

Arboviral Diseases

Mosquito-borne Arboviruses

Historically, the primary arboviral encephalitides found in Minnesota have been La Crosse encephalitis, Western equine encephalitis (WEE), and West Nile virus (WNV) encephalitis, but in recent years other viruses, like Jamestown Canyon

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Table 1. Diseases Reportable to the Minnesota Department of Health

REPORT IMMEDIATELY BY TELEPHONE

Anthrax (*Bacillus anthracis*) M
Botulism (*Clostridium botulinum*)
Brucellosis (*Brucella* spp.) M
Cholera (*Vibrio cholerae*) M
Diphtheria (*Corynebacterium diphtheriae*) M
Free-living amebic infection M
(including at least: *Acanthamoeba* spp., *Naegleria fowleri*, *Balamuthia* spp., *Sappinia* spp.)
Glanders (*Burkholderia mallei*)
Hemolytic uremic syndrome M
Measles (rubeola) M
Melioidosis (*Burkholderia pseudomallei*)
Meningococcal disease (*Neisseria meningitidis*) (invasive) M S
Middle East Respiratory Syndrome (MERS) M
Orthopox virus M
Plague (*Yersinia pestis*) M
Poliomyelitis M
Q fever (*Coxiella burnetii*) M
Rabies (animal and human cases and suspected cases)
Rubella and congenital rubella syndrome M
Severe Acute Respiratory Syndrome (SARS) M R
Smallpox (variola) M
Tularemia (*Francisella tularensis*) M
Unusual or increased case incidence of any suspect infectious illness M
Viral hemorrhagic fever M
(including but not limited to Ebola virus disease and Lassa fever)

REPORT WITHIN ONE WORKING DAY

Amebiasis (*Entamoeba histolytica/dispar*)
Anaplasmosis (*Anaplasma phagocytophilum*)
Arboviral disease
(including, but not limited to, La Crosse encephalitis, eastern equine encephalitis, western equine encephalitis, St. Louis encephalitis, West Nile virus disease, Powassan virus disease, and Jamestown Canyon virus disease)
Babesiosis (*Babesia* spp.)
Blastomycosis (*Blastomyces dermatitidis*)
Campylobacteriosis (*Campylobacter* spp.) M
Carbapenem-resistant Enterobacteriaceae (CRE) M
Cat scratch disease (infection caused by *Bartonella* species)
Chancroid (*Haemophilus ducreyi*)
Chikungunya virus disease
Chlamydia trachomatis infections
Coccidioidomycosis
Cronobacter sakazakii in infants under one year of age M
Cryptosporidiosis (*Cryptosporidium* spp.) M
Cyclosporiasis (*Cyclospora* spp.) M
Dengue virus infection
Diphyllobothrium latum infection
Ehrlichiosis (*Ehrlichia* spp.)
Encephalitis (caused by viral agents)
Enteric *Escherichia coli* infection M
(*E. coli* O157:H7, other Shiga toxin-producing *E. coli*, enterohemorrhagic
E. coli, enteropathogenic *E. coli*, enteroinvasive *E. coli*, enteroaggregative
E. coli, enterotoxigenic *E. coli*, or other pathogenic *E. coli*)
Giardiasis (*Giardia intestinalis*)
Glanders
Gonorrhea (*Neisseria gonorrhoeae* infections)
Haemophilus influenzae disease (all invasive disease) M S
Hantavirus infection
Hepatitis (all primary viral types including A, B, C, D, and E) B
Histoplasmosis (*Histoplasma capsulatum*)
Human immunodeficiency virus (HIV) infection, including Acquired Immunodeficiency Syndrome (AIDS) B
Influenza M
(unusual case incidence, critical illness, or laboratory-confirmed cases)
Kawasaki disease
Kingella spp. (invasive only) M S
Legionellosis (*Legionella* spp.) M
Leprosy (Hansen's disease) (*Mycobacterium leprae*)
Leptospirosis (*Leptospira interrogans*)
Listeriosis (*Listeria monocytogenes*) M
Lyme disease (*Borrelia burgdorferi*, and other *Borrelia* spp.)
Malaria (*Plasmodium* spp.)
Meningitis (caused by viral agents)
Mumps M
Neonatal sepsis M S
(bacteria isolated from a sterile site, excluding coagulase-negative *Staphylococcus*) less than seven days after birth
Pertussis (*Bordetella pertussis*) M
Psittacosis (*Chlamydophila psittaci*)
Retrovirus infections
Salmonellosis, including typhoid (*Salmonella* spp.) M
Shigellosis (*Shigella* spp.) M
Spotted fever rickettsiosis
(*Rickettsia* spp. infections, including Rocky Mountain spotted fever)
Staphylococcus aureus M
(only vancomycin-intermediate *Staphylococcus aureus* [VISA], vancomycin-resistant *Staphylococcus aureus* [VRSA], and death or critical illness due to community-associated *Staphylococcus aureus* in a previously healthy individual)
Streptococcal disease - invasive disease caused by Groups A and B streptococci and *S. pneumoniae* M S
Streptococcal disease - non-invasive *S. pneumoniae*
(urine antigen laboratory-confirmed pneumonia)
Syphilis (*Treponema pallidum*) B
Tetanus (*Clostridium tetani*)
Toxic shock syndrome M
Toxoplasmosis (*Toxoplasma gondii*)
Transmissible spongiform encephalopathy
Trichinosis (*Trichinella spiralis*)
Tuberculosis (*Mycobacterium tuberculosis* complex) M
(pulmonary or extrapulmonary sites of disease, including clinically diagnosed disease). Latent tuberculosis infection is not reportable.
Typhus (*Rickettsia* spp.)
Unexplained deaths and unexplained critical illness (possibly due to infectious cause) M
Varicella (chickenpox) M
Vibrio spp. M
Yellow fever
Yersiniosis, enteric (*Yersinia* spp.) M
Zika virus disease B
Zoster (shingles) M
(all cases <18 years old; unusual case incidence/complications regardless of age)

SENTINEL SURVEILLANCE*

*Diseases reportable through sentinel surveillance are reportable based on the residence of the patient or the specific health care facility. Sentinel surveillance is not statewide reporting.
Staphylococcus aureus M S
Candidemia (*Candida* spp.) (blood isolates only) M S
Carbapenem-resistant *Acinetobacter* spp. (CRA), and *Pseudomonas aeruginosa* (CR-PA) M
Clostridium difficile M
Severe Acute Respiratory Illness M
Respiratory syncytial virus (RSV)

Reportable Diseases, MN Rule 4605.7040

FOOTNOTES

M Submission of clinical materials required. Submit isolates or, if an isolate is not available, submit material containing the infectious agent in the following order of preference: a patient specimen; nucleic acid; or other laboratory material. Call the MDH Public Health Laboratory at 651-201-4953 for instructions.
S Invasive disease only: isolated from a normally sterile site, e.g.: blood, CSF, joint fluid, etc.
R In the event of SARS or another severe respiratory outbreak, also report cases of health care workers hospitalized for pneumonia or acute respiratory distress syndrome.
B Also report a pregnancy in a person with Zika; or a person chronically infected with hepatitis B, HIV, or syphilis.

- For diseases that require immediate reporting call 24 hours a day, 7 days a week: 651-201-5414 or 1-877-676-5414.
- Report forms can be downloaded at: http://www.health.state.mn.us/diseasereport

Table 2. Cases of Selected Communicable Diseases Reported to the Minnesota Department of Health by District of Residence, 2017

	District (population per U.S. Census 2016 estimates)									
Disease	Metropolitan (3,033,634)	Northwestern (158,650)	Northeastern (325,082)	Central (749,813)	West Central (240,606)	South Central (290,300)	Southeastern (504,358)	Southwestern (217,509)	Unknown Residence	Total (5,519,952)
Anaplasmosis	116	94	105	201	63	11	44	4	0	638
Babesiosis	10	13	6	11	8	2	9	0	0	59
Blastomycosis	8	7	13	11	0	3	2	0	0	44
Campylobacteriosis	465	27	31	153	46	90	132	105	0	1049
Cryptosporidiosis	99	25	19	60	37	37	91	113	0	481
Escherichia coli O157 infection	36	2	0	13	10	7	13	15	0	96
Hemolytic uremic syndrome	1	0	0	4	0	2	1	1	0	9
Giardiasis	286	20	51	104	25	28	54	75	0	643
Haemophilus influenzae disease	62	5	12	17	5	6	14	4	0	125
HIV (non-AIDS)	176	3	4	11	2	4	13	4	0	217
AIDS (diagnosed in 2016)	116	2	2	7	6	2	7	2	0	144
Legionnaires' disease	64	1	7	11	3	3	7	2	0	98
Listeriosis	7	0	2	4	0	1	0	0	0	14
Lyme disease	672	69	143	306	80	27	94	17	0	1,408
Measles (rubeola)	69	0	0	4	0	2	0	0	0	75
Meningococcal disease	2	0	1	1	0	0	1	0	0	5
Mumps	56	12	1	1	0	1	1	0	0	72
Pertussis	381	13	57	177	8	22	67	6	0	731
Q Fever (acute)	1	0	0	0	0	0	1	0	0	2
Q Fever (chronic)	0	0	0	1	0	0	0	0	0	1
Salmonellosis	482	64	37	110	37	47	72	67	0	916
Sexually transmitted diseases	21,473	478	1,435	2,488	819	1,001	2,084	641	562	30,981
Chlamydia trachomatis - genital infections	15,647	357	1,179	2,076	659	887	1,695	548	480	23,528
Gonorrhea	5,102	103	235	321	145	97	350	84	82	6,519
Syphilis, total	724	18	21	91	15	17	39	9	0	934
Primary/secondary	226	6	6	29	7	7	8	3	0	292
Early latent*	256	7	8	25	5	4	5	3	0	313
Late latent**	240	5	7	37	3	6	26	3	0	327
Congenital	2	0	0	0	0	0	0	0	0	2
Shigellosis	68	0	2	6	1	0	3	6	0	86
Streptococcal invasive disease - Group A	204	11	23	31	13	15	42	20	0	359
Streptococcal invasive disease - Group B	286	10	50	85	27	42	46	30	0	576
Streptococcus pneumoniae disease	221	11	42	79	27	31	53	18	0	482
Tuberculosis	130	2	1	15	1	12	14	3	0	178
Tularemia	4	2	0	0	0	0	0	0	0	6
Varicella	297	2	10	52	14	18	24	15	0	432
Viral hepatitis, type A	24	0	1	3	0	2	0	0	0	30
Viral hepatitis, type B (acute infections only, not perinatal)	18	0	1	3	0	0	0	1	0	23
Viral hepatitis, type C (acute infections only)	29	3	7	11	4	1	2	2	0	59
West Nile virus	10	1	0	4	3	1	1	10	0	30
Zika virus	8	0	0	2	0	0	1	0	0	11

* Duration ≤1 year
** Duration >1 year

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

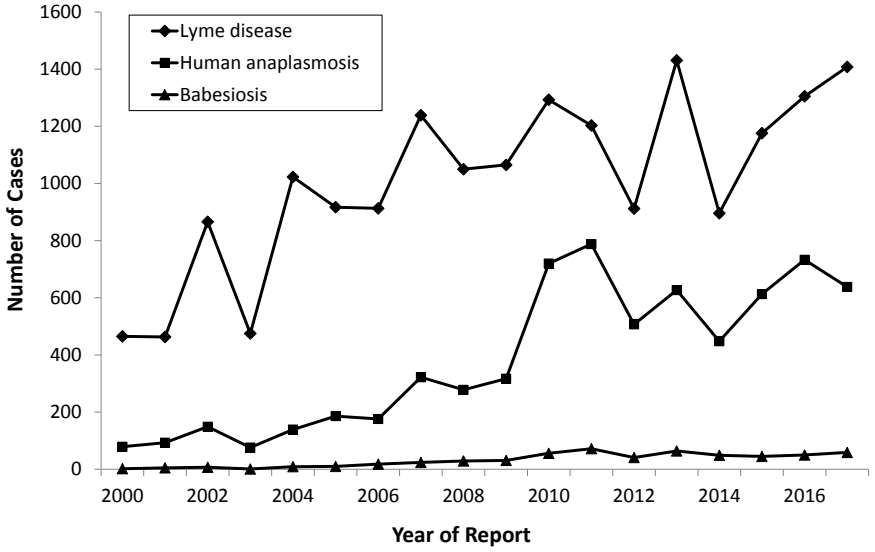
have emerged as significant causes of disease. While WNV and WEE are maintained in mosquito-to-bird transmission cycles involving several different species of each, La Crosse and Jamestown Canyon viruses use mammals instead of birds as part of their transmission cycles. WNV is established throughout Minnesota, and will probably be present in the state to some extent every year, whereas human cases of other diseases may occur more sporadically. Interpreting the effect of weather on arboviral transmission is complex, making it difficult to predict the number of people who will become infected in any given year.

In Minnesota, 30 WNV disease cases were reported in 2017, considerably fewer than 83 cases in 2016. Thirteen (43%) had neuroinvasive presentations including encephalitis or meningitis, and there was 1 death. The other 17 cases had West Nile fever. Eighty percent of the cases were male, and the median age was 59 years (range, 16 to 86). Fifteen cases were hospitalized. The majority of cases (83%) reported symptom onset in July, August, or September. Seventeen asymptomatic WNV-positive blood donors were also identified in 2017. Risks for human WNV infection continue to be higher in central and western Minnesota where the primary mosquito vector, *Culex tarsalis*, is most abundant.

In 2017, 1 La Crosse encephalitis case was reported. The case was a female in her teens, and she presented with encephalitis in early September. The disease, which primarily affects children, is transmitted through the bite of infected *Aedes triseriatus* (Eastern Tree Hole) mosquitoes, and is maintained in a cycle that includes mosquitoes and small mammals. Exposure to infected mosquitoes typically occurs in wooded or shaded areas inhabited by this species, especially in areas where water-holding containers (e.g., waste tires, buckets, or cans) that provide breeding habitats are abundant. Since 1985, 144 cases have been reported from 22 Minnesota counties, primarily in the southeastern part of the state. Many people who are infected have no apparent symptoms, but severe disease is more common in children. Most people report an illness onset during the typical arboviral season from mid-July through mid-September.

In 2017, 22 cases of Jamestown Canyon virus disease, a California group virus related to La Crosse, were reported. The virus is transmitted by *Aedes* mosquitoes, and the maintenance cycle in nature is thought to include deer and other large mammals. Much remains unknown about the clinical spectrum of Jamestown Canyon virus, but the typical presentation includes fever, and in more severe cases, meningitis or encephalitis. The virus is likely widespread in Minnesota. Cases were aged 10 to 78 years, with a median of 61 years, and 73% were male. Fourteen (64%) presented with neuroinvasive disease, including meningitis or encephalitis, and most were residents of counties in north central and northeastern Minnesota. Due to the mosquito vectors involved in the transmission cycle for this virus, disease onsets can occur from late spring through the early part of the fall.

Figure 1. Reported *I. scapularis*-borne Disease Cases, 2000-2017



Tickborne Arboviruses

Powassan virus (POW) is a tickborne flavivirus that includes a strain (lineage II or "deer tick virus") that is transmitted by *Ixodes scapularis*. The virus can cause encephalitis or meningitis, and long-term sequelae occur in approximately half of those patients. Approximately 10-15% of cases are fatal. Since the first case in 2008, there has been cases every year except for 2014 and 2015, with a peak of 11 cases in 2011 (range, 1 to 11). Seven cases of POW were reported in 2017. All but 1 were male, and ages ranged from 9 to 74 years, with a median of 61. Although cases of non-neuroinvasive disease have been reported in previous years, all of the patients in 2017 presented with meningitis or encephalitis. Similar to other tick-borne diseases, the majority of patients report being exposed to ticks in north central Minnesota, and illness onsets follow a similar pattern as is seen for other tickborne diseases, with cases first experiencing symptoms between May and July. Based on findings from routine tick surveillance activities, the virus appears to be widely distributed in the same wooded parts of the state that are endemic to other pathogens transmitted by *I. scapularis.*

Babesiosis

Babesiosis is a malaria-like illness caused by a protozoan parasite, typically *Babesia microti*, which infects red blood cells. *B. microti* is transmitted to humans by bites from *Ixodes scapularis* (the blacklegged tick), the same vector that transmits the agents of Lyme disease, human anaplasmosis, one form of human ehrlichiosis, and a strain of Powassan virus. *Babesia* parasites can also be transmitted by blood transfusion. Although most people infected with *Babesia* have asymptomatic infections, people with weak immune systems, other co-morbidities, and the elderly can become seriously ill.

In 2017, 59 confirmed and probable babesiosis cases (1.1 per 100,000 population) were reported, up from the 50 cases in 2016. Despite slight

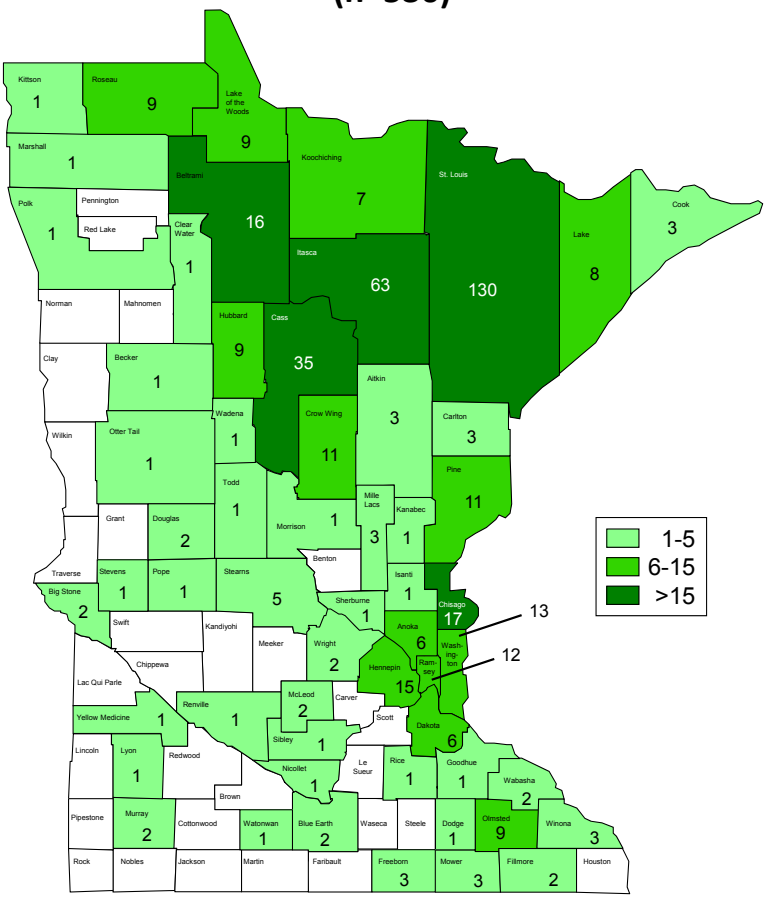
annual fluctuations, case totals since 2009 (range, 31 to 72) have been consistently higher than reported totals from 2000 to 2008 (range, 1 to 29) (Figure 1), and the overall trend is toward increasing numbers. Demographic and case characteristics are similar in recent years. In 2017, 34 (58%) of the cases occurred in males. The median case age was 64 years (range, 7 to 94), up from 61 in 2016, and older than the median ages for both anaplasmosis (58 years) and for confirmed cases of Lyme disease (43 years). Onsets of illness peaked in the summer months; 47 (87%) of 54 patients with known onset reported first experiencing symptoms in June, July, or August. Nineteen (32%) cases were hospitalized for their infection in 2017 for a median duration of 6 days (range, 2 to 14 days). Although severe complications like organ failure were reported in 7 cases, there were no deaths attributable to babesiosis in 2017.

Blastomycosis

In 2017, 44 blastomycosis cases were reported, an increase over the 39 cases in 2016 and 34 cases in 2015. The median age was 40.5 years (range, 6 to 76); 32 (73%) were male. Thirty-two (78%) cases were white, 4 (10%) were American Indian/Alaska Native, 2 (5%) were Asian/Pacific Islander, 1 (2%) was mixed race, and 3 were unknown race. Thirty-two (73%) cases were hospitalized for a median of 9 days (range, 1 to 37). Seven (16%) cases died, which is a higher fatality rate than the normally observed 9-10%. Blastomycosis was the cause of death in 6 of the 7. Seventeen cases (40%) had immunocompromising health conditions or medications, including 9 (20%) with diabetes, 4 (10%) taking corticosteroids, and 2 (5%) on chemotherapy for cancer. Thirty-four (77%) cases had pulmonary infection, 2 (5%) had extra-pulmonary infection, and 8 (18%) had disseminated infection.

From 1999 to 2017, 613 blastomycosis cases were reported; the median annual number is 33 (range, 22 to 46). Exposure information is available for 514 cases. The largest number, 129 (25%), were likely exposed in St. Louis County. Sixty-three (12%) cases were likely exposed in Itasca County, 35 (7%) in Cass County, 16 (3%) in Chisago County, 16 (3%) in Beltrami County, and 15 (3%) in Hennepin County. (Figure 2).

Figure 2. Human Blastomycosis Cases by Probable County of Exposure*, 1999-2017 (n=530)



* 47 cases of blastomycosis were exposed in Wisconsin, 7 in other states, 10 in Canada, and 1 in South America. Location of exposure is unknown for 108 cases.

Brucellosis

Brucellosis is an acute or chronic illness caused by bacteria of the *Brucella* genus. There are five important species of *Brucella*: *B. abortus*, *B. melitensis*, *B. suis*, *B. canis*, and *B. ovis*, of which cattle, goats, pigs, dogs, and sheep are the respective reservoir animals. Transmission can occur though ingestion of unpasteurized dairy products, contact with infected animal tissue, or inhalation of aerosolized bacteria in a laboratory setting. Minnesota's livestock have been brucellosis free since 1985; most infections are acquired in *Brucella*-endemic countries.

In 2017, 3 confirmed cases were reported; all were infected with *B. melitensis*. Ages were 3, 37, and 69 years; 2 were female. All were hospitalized and survived. Two cases likely acquired *B. melitensis* by ingesting unpasteurized camel, cow, and/or goat milk in Africa, and 1 likely acquired *B. melitensis* while making cheese from unpasteurized cow milk in Mexico. Two case clinical isolates resulted in exposure of 18 clinical laboratory staff.

From 2007 to 2017, 20 cases were reported. Thirteen likely acquired their infection outside the United States and 7 were domestically acquired. The median number of cases reported annually was 2 (range 0 to 4). Thirteen were infected with *B.* melitensis, 5 with *B. suis*, 1 with *B. abortus,* and 1 with an unidentified *Brucella* species diagnosed by serology only. The median age of cases was 51 years (range, 3 to 86). Ten of 24 cases for which race and ethnicity were known were black, 7 were white, 5 were Hispanic, and 2 were Asian/ Pacific Islander.

Campylobacteriosis

There were 1,049 culture-confirmed *Campylobacter* cases reported in

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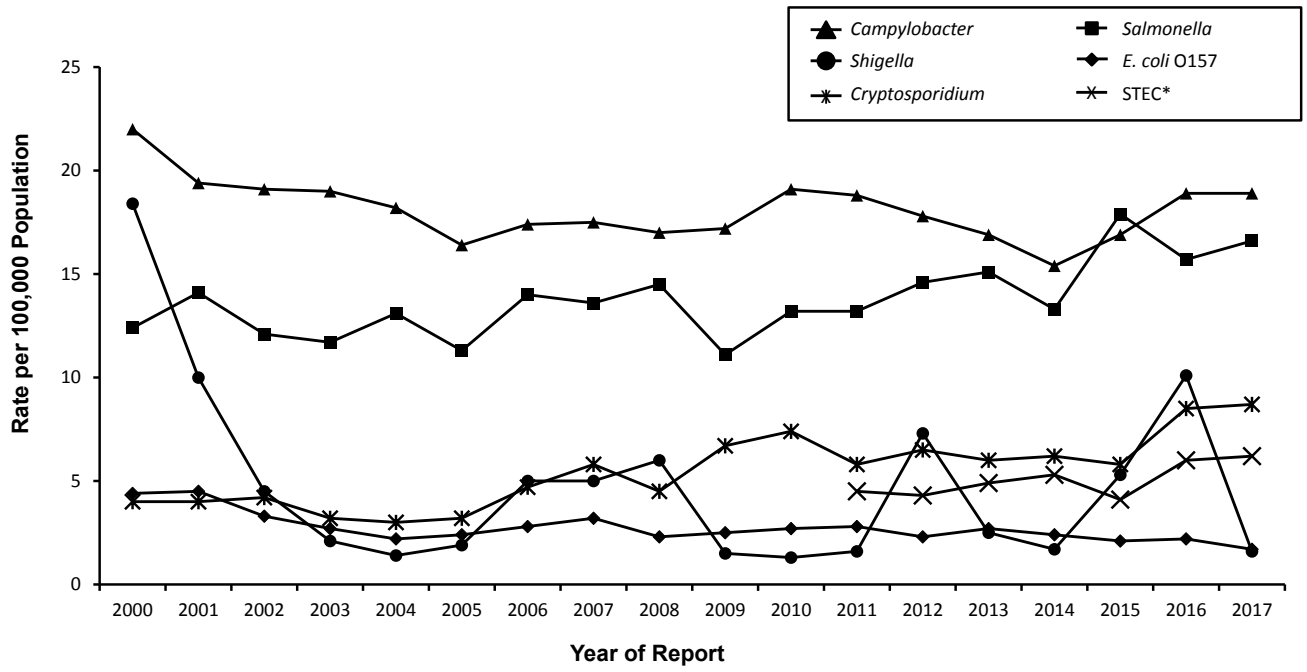
Figure 3. Incidence of Selected Enteric Pathogens, 2000-2017



*STEC (Shiga toxin producing *E. coli*) includes O157 and non-O157 STEC case counts.

2017 (18.9 per 100,000 population). This is similar to the 1,042 cases reported in 2016, but a 14% increase from the annual median of 917 cases reported from 2007 to 2016 (range, 834 to 1,042). In 2017, 44% of cases occurred in people who resided in the metropolitan area. Of the 981 *Campylobacter* isolates confirmed and identified to species by MDH, 84% were *C. jejuni* and 9% were *C. coli*.

The median age of cases was 39 years (range, 4 months to 91 years). Forty-one percent were between 20 and 49 years of age, and 10% were ≤5 years of age. Fifty-five percent were male. Fifteen percent were hospitalized; the median length of hospitalization was 2 days. Forty-eight percent of infections occurred during June through September. Of the 959 cases for whom data were available, 167 (17%) reported travel outside the United States during the week prior to illness onset. The most common travel destinations were Europe (n=41), Asia (n=40), Central or South America or the Caribbean (n=35), Mexico (n=30), Africa (n=12), and the Middle East (n=7).

One foodborne outbreak was identified in 2017. Two culture-confirmed *C. jejuni* infections were associated with an event at a restaurant. The vehicle of transmission was suspected to be raw oysters.

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 2017, the overall proportion of quinolone resistance among *Campylobacter* isolates tested was 28%. However, 80% 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. Eighteen percent of *Campylobacter* isolates from patients who acquired the infection domestically were resistant to fluoroquinolones.

In 2009, a culture-independent test (CIDT) became commercially available for the qualitative detection of *Campylobacter* antigens in stool. In 2017, 420 patients were positive for *Campylobacter* by an antigen detection CIDT conducted in a clinical laboratory. However, only 133 (32%) of the specimens were subsequently culture-confirmed. Beginning In 2015, some clinical laboratories in Minnesota began testing stool specimens with PCR-based gastrointestinal pathogen panels, another type of CIDT. In 2017, 791 patients were positive for *Campylobacter* by a PCR gastrointestinal panel; 575 (73%) of these specimens were culture-confirmed. Only culture-confirmed cases met the surveillance case definition for inclusion in MDH case count totals.

Carbapenem-resistant *Enterobacteriaceae* (CRE) and *Pseudomonas aeruginosa* (CRPA)

Carbapenem-resistant *Enterobacteriaceae* (CRE) and *Pseudomonas aeruginosa* (CRPA) are Gram-negative bacilli that most commonly occur among patients with significant health care exposures, co-morbid conditions, invasive devices, and those who have received extended courses of antibiotics. Invasive infections caused by CRE, such as carbapenem-resistant *Klebsiella pneumoniae,* are associated with higher morbidity and mortality than those caused by carbapenem-susceptible *Enterobacteriaceae*. Another opportunistic pathogen associated with health care settings, *Acinetobacter baumannii,* can also become resistant to carbapenems. Carbapenem-resistant *A. baumannii* (CRA) is increasingly recognized as one of the leading causes of health care-associated infections

worldwide, and is associated with high mortality rates and unfavorable clinical outcomes. *P. aeruginosa* most commonly causes pneumonia in individuals with chronic lung diseases, particularly cystic fibrosis (CF), or those who are immunocompromised. Invasive infections caused by CRPA are associated with higher morbidity and mortality than those caused by carbapenem-susceptible *P. aeruginosa.* Carbapenem resistance can be acquired through a variety of mechanisms including transmissible genetic elements. Some CRE, CRA, and CRPA carry resistance genes that produce enzymes known as carbapenemases. Certain carbapenemases (e.g., *K. pneumoniae* carbapenemase [KPC]) can easily spread between bacteria of similar species. KPC is the predominant carbapenemase in the United States. Other carbapenemases (e.g., New Delhi metallo-β-lactamase [NDM], Verona integron-encoded metallo-β-lactamase [VIM], active on imipenem [IMP], and oxacillinase [OXA-48]) are more frequently identified in other countries. Resistance can also be acquired through the production of a β-lactamase effective against third-generation cephalosporins (e.g., AmpC β-lactamases or extended-spectrum β-lactamases [ESBLs]) when combined with porin mutations that prevent carbapenem antibiotics from entering the cell).

MDH first identified a KPC-producing CRE in February 2009, and began voluntary reporting, including isolate submission. In 2012, we used standardized CRE and CRA definitions developed by the EIP Multi-site Gram-negative Surveillance Initiative (MuGSI), and initiated active laboratory- and population-based surveillance in Hennepin and Ramsey Counties. This surveillance includes all isolates of *A. baumannii, Escherichia coli*, *Enterobacter* spp., or *Klebsiella* spp. from normally sterile sites or urine that are resistant to imipenem, meropenem, doripenem, or ertapenem using current Clinical and Laboratory Standards Institute (CLSI) breakpoints (ertapenem excluded for *Acinetobacter* isolates). An incident case is defined as the first eligible isolate of each species collected from a Hennepin or Ramsey County resident in 30 days. Statewide CRE surveillance was initiated in 2016 and includes *Citrobacter* spp. as well as *E. coli*, *Enterobacter* spp. and *Klebsiella* spp. The PHL tested all isolates for carbapenemase production using either a phenotypic assay (carbapenem inactivation method [CIM], modified carbapenem inactivation method [mCIM], or CarbaNP), or a PCR targeting KPC and NDM genes.

In 2017, 468 *Enterobacteriaceae* incident cases representing 441 patients were identified. Twenty-nine (6%) isolates (from 22 patients) were KPC positive (*E. cloacae* [10], *K. pneumoniae* [9], *K. oxytoca* [6],*C. freundii* [2], *E. coli* [1], and *R. planticola* [1]. Of note, 2 patients were positive for two different organisms producing KPC in the same calendar year. Six incident cases (representing 6 patients) were NDM positive (*K. pneumoniae* [3], *E. coli* [2], and *K. oxytoca* [1]]. All but 1 had exposure to health care overseas (Asia, Africa). Of the incident cases, 3 isolates (representing 3 patients) were IMP positive (*P. rettgeri* [2], *M. morgannii* [1]).

In 2017, 21 CRA incident cases from 17 patients were identified. One isolate was NDM positive, with the patient having received health care outside of the United States prior to initial culture.

Of the 22 Minnesota residents with KPC-positive isolates, the median age was 64 years (range, 23 to 94); 15 (68%) were male, and 8 (36%) were residents of Hennepin or Ramsey County. Twelve (55%) patients were white, 2 (9%) were black, 1 (5%) was American Indian, and 7 (32%) were of unknown race. Urine (12) was the most common source followed by wounds (3), sputum (3), lower respiratory tract (2), and other sites (3). Sixteen (72%) were hospitalized (10 hospitalized ≥3 days prior to culture); median length of stay was 14 days (range, 4 to 223). Seven patients (32%) required ICU care; in-hospital mortality was 5%. Other KPC-positive CRE isolates were collected in patients from outpatient settings (4), and long-term care facilities (2) without subsequent hospitalization within 30 days.

A total of 143 incident CRE cases (representing 137 patients) were reported in 2017. Of these, 90 were *Enterobacter* spp., 28 were *Klebsiella* spp., and 25 were *E. coli*. KPC was identified in 6 (4%) MuGSI CRE (*E. cloacae* [4] and *K. pneumoniae* [2]). CRE was most frequently isolated from urine (135) followed by blood (3), bone (2), and other sites (3). One incident case of CRA was reported for MuGSI, isolated from urine.

In 2017, 9 NDM-producing CRE and 1 NDM-producing CRA were detected. To date, 37 NDM-producing organisms (*K. pneumoniae* [17], *E. coli* [14], *K. oxytoca* [2], *C. freundii* [1], *P. rettgeri* [1], *A. baumannii* [2], and *Pseudomonas aeruginosa* [1]) from 28 patients treated in Minnesota have been detected. This includes 14 Minnesota residents and 14 non-residents, all but two of whom had received medical care outside the United States (23 patients) or in a non-Minnesota U.S. facility (3 patients) prior to their NDM-positive culture in Minnesota. In 2017, the PHL identified, and CDC confirmed, 3 IMP-producing CRE (*P. rettgeri* [2], *M. morgannii* [1]) from Minnesota residents (no history of travel or foreign health care exposures) and 4 OXA-48-producing isolates (*E. coli* [3] and *R. ornithinolytica* [1]) from two residents with significant health care exposure outside the United States prior to receiving healthcare in Minnesota, and two non-residents with no significant health care exposure outside the United States.

In summary, 8% of *Enterobacteriaceae* isolates tested by the PHL during 2017 were KPC-positive; 2 patients had multiple KPC-producing organisms isolated. Detection of NDM and OXA-48 serves as a reminder to clinicians that a travel history, including receipt of medical care outside the United States, is a critical component of early detection of CRE isolates with carbapenemases that are less common in the United States. CDC recommends performing rectal screening cultures to detect CRE colonization in newly admitted patients with known hospitalization outside the United States within the last 6 months). Active laboratory- and population-based surveillance for CRPA was initiated on August 1, 2016 in Hennepin and Ramsey Counties as part of MuGSI. This surveillance includes all isolates of *P. aeruginosa* collected from normally sterile sites, wounds, urine, sputum, throat cultures from CF patients, or other lower respiratory sites that are resistant to imipenem, meropenem, or doripenem using current CLSI breakpoints. An incident case was defined as the first report of CRPA, or a subsequent report of CRPA ≥ 30 days after the last incident report. The PHL tested all isolates submitted in 2017 for carbapenemase production. In 2017, 954 CRPA cases, representing 506 patients, were identified; 551 cases from 256 unique patients were reported in Hennepin and Ramsey County residents and met the MuGSI case definition; 380 (69%) cases were classified as incident. Thirty-seven

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(14%) patients had CF, accounting for 170 (31%) total CRPA MuGSI reports; 91 (54%) cases were considered incident. CF patients had an average of five separate reports of CRPA per year during 2017, while patients without CF had an average of one report of CRPA. Nine (2%) isolates from three patients were carbapenemase positive by a phenotypic screening test. Eight isolates were PCR-confirmed as carbapenemase-producers (CP), including 7 IMP-positive isolates and 1 VIM-positive isolate. Both patients with CP-CRPA were recent immigrants to the United States and had international healthcare exposure. One isolate collected from a Minnesota resident with no history of overseas healthcare exposure was found, by whole genome sequencing, to be carrying two potentially inducible genes (PDC-3 and OXA-50) capable of hydrolyzing carbapenems.

Of the 219 patients who did not have CF, the median age was 62 (range, 1 to 93); 119 (54%) were male; 128 (58%) were white, 51 (23%) were of unknown race, 29 (13%) were black, 7 (3%) were Asian/Pacific Islander, and 3 (1%) were American Indian. Sputum (149) was the most common source, followed by urine (122), wounds (66), lower respiratory sites (45), and other sterile sources (18). One hundred ninety-nine (52%) were hospitalized at the time of specimen collection, 90 (24%) were outpatients, 59 (15%) were in a long-term acute care hospital, and 29 (8%) were in a skilled nursing facility.

Among the 37 CF patients, the median age was 35 years (range, 19-66); 18 (49%) were male; 27 (73%) were white, 8 (22%) were of unknown race, and 2 (5%) were Asian/Pacific Islander. All isolates were collected from a respiratory site; 89% were collected from sputum. Thirty-two patients were hospitalized at the time of specimen collection, while the majority, 137 (81%) were seen in outpatient care settings.

CDC identified CRE as one of three urgent antibiotic resistance threats requiring immediate and aggressive action. In 2017, the World Health Organization (WHO) ranked the 12 bacteria that posed the greatest threat to human health: CRE, CRA, as well as CRPA are the three bacteria most urgently in need of development of new antibiotics.

Chikungunya

Chikungunya virus is a mosquito-borne alphavirus found in Africa, Asia, and Europe. In late 2013, locally acquired cases appeared for the first time in the Americas on the Caribbean island of St. Martin, and the virus subsequently has spread thoughout Central and South America. The virus is transmitted by the same *Aedes* spp. mosquitoes (*Ae. aegypti* and *Ae. albopictus*) that also transmit dengue and Zika viruses.

Unlike many other mosquito-borne viruses, most people who are infected with chikungunya develop symptoms. The most common symptoms are fever and joint pain, but patients may also experience headache, muscle aches, or rash. Symptoms usually begin 3-7 days after a person is bitten by an infected mosquito, and most recover within a week. Joint pain may persist for weeks to years after the initial illness.

In 2017, 4 cases were reported in Minnesota residents. The median case age was 39 (range, 20 to 61 years). All 4 resided in the metropolitan area and symptom onsets occurred all year, from February through December. All represented imported infections acquired abroad, and travel occurred to many areas of the world. Three traveled to Asia, while one visited South America.

Although national data are not final at the time of this report, nationwide, chikungunya cases were reported from at least 27 states. All cases in U.S. residents were acquired while traveling abroad, and no local transmission occurred in the continental United States in 2017.

Clostridium difficile

Clostridium difficile is an anaerobic, spore-forming, Gram-positive bacillus that produces two pathogenic toxins, A and B. *C. difficile* infections (CDI) range in severity from mild diarrhea to fulminant colitis and death. Transmission of *C. difficile* occurs primarily in healthcare facilities, where environmental contamination by *C. difficile* spores and exposure to antimicrobial drugs are common. The primary risk factor for development of CDI in healthcare settings is recent use of antimicrobials, particularly clindamycin, cephalosporins, and fluoroquinolones. Other risk factors for CDI acquisition in these settings are age >65 years, severe underlying illness, intensive care unit admission, nasogastric intubation, and longer duration of hospital stay.

In the early 2000s, a marked increase in the number of CDI cases and mortality due to CDI was noted across the United States, Canada, and England. Healthcare facility outbreaks have been associated with the emergence of a more virulent strain of *C. difficile*, designated North American PFGE type 1 (NAP1), toxinotype III.

In 2009, in an effort to better understand the burden of CDI, as part of EIP, MDH initiated population-based, sentinel surveillance for CDI at clinical laboratories serving Stearns, Benton, Morrison, and Todd Counties; in 2012 Olmsted County was added.

CDIs that occur outside the traditional healthcare settings (i.e., community-associated) have also been receiving increased attention. Community-associated (CA) CDI data from 2009-2011 across 10 EIP sites showed that 64% of CA CDI patients received prior antibiotics, and 82% had some outpatient healthcare exposure.

A CDI case is defined as a positive *C. difficile* toxin assay on an incident stool specimen from a resident (≥ 1 year of age) of one of the five counties. A CDI case is classified as healthcare facility-onset (HCFO) if the initial specimen was collected >3 days after admission to a healthcare facility. Community-onset (CO) cases who had an overnight stay at a healthcare facility in the 12 weeks prior to the initial specimen are classified as CO-HCFA, whereas CO cases without documented overnight stay in a healthcare facility in the 12 weeks prior to the initial specimen result are classified as CA. A more detailed set of case definitions is available upon request.

In 2017, 862 incident cases of CDI were reported (215 per 100,000 population), a slight decrease from 227 per 100,000 population in 2016. Sixty-two percent of the cases were classified as CA, 18% as CO-HCFA, and 19% as HCFO. The median ages for CA, CO-HCFA, and HCFO cases were 53 years, 62 years, and 75 years, respectively. Forty-five percent of CA cases were prescribed antibiotics in the 12 weeks prior to stool specimen collection compared to 76% of HCFO cases and 75% of CO-HCFA cases. Of the 532 putative CA cases eligible for interview, 361 were interviewed and confirmed as CA cases. Forty-nine percent of CA cases reported antibiotic use in the 12 weeks prior to illness onset date. Most common uses of antibiotics included treatment of ear, sinus, or upper respiratory infections (29%); dental procedures (12%); urinary tract infections (11%); and skin infections (4%).

Cryptosporidiosis

During 2017, 481 cases of cryptosporidiosis (8.7 per 100,000 population) were reported. This is markedly higher than the median number of cases reported annually from 2007 to 2016 (median, 331 cases; range, 235 to 465). The median age of cases was 26 years (range, 6 months to 88 years). Children 10 years of age or younger accounted for 20% of cases. Fifty-five percent of cases occurred during July through October. The incidence of cryptosporidiosis in the Southwestern, Southeastern, Northwestern, and West Central districts (52.0, 18.0, 15.8, and 15.4 cases per 100,000, respectively) was significantly higher than the statewide incidence. Only 99 (21%) reported cases occurred among residents of the metropolitan area (3.3 per 100,000). Forty-seven (10%) cases required hospitalization, for a median of 4 days (range, 2 to 19 days). No deaths were reported.

Six confirmed outbreaks of cryptosporidiosis were identified in Minnesota in 2017, accounting for 22 laboratory-confirmed cases. Two recreational water outbreaks occurred, accounting for 28 cases (12 laboratory-confirmed). Both waterborne outbreaks were associated with municipal pools/aquatic centers in Redwood County. Three outbreaks due to person-to-person transmission at child care centers accounted for 21 cases (5 laboratory-confirmed); the outbreaks occurred in Renville (n=2) and Redwood Counties. One outbreak probably due to foodborne transmission at a private home resulted in 9 cases (5 laboratory-confirmed).

Dengue

Dengue fever is one of the most frequently occurring mosquito-borne diseases worldwide, with an estimated 390 million infections, with nearly 100 million people experiencing symptomatic disease each year. Four serotypes of dengue virus are transmitted to humans through the bite of *Aedes aegypti* and *Ae. albopictus* mosquitoes. Dengue is considered endemic in more than 100 countries in tropical or subtropical regions around the world, and risk is widespread, especially where water-holding containers (e.g., waste tires, buckets, or cans) provide abundant mosquito breeding habitat.

In 2017, 11 cases were reported in Minnesota residents. The median case age was 32 years (range, 17 to 51) and onset of symptoms occurred throughout the year from January through November. Ten cases (91%) resided in the metropolitan area, and all infections were acquired abroad. Cases reported travel to many areas of the world, including to Southeast Asia (7), Mexico and Central America (2), and Africa (2).

Escherichia coli O157 and Other Shiga Toxin-producing *E. coli*, and Hemolytic Uremic Syndrome

During 2017, 96 culture-confirmed cases of *Escherichia coli* O157 infection (1.74 per 100,000 population) were reported. This represents a 26% decrease from the median number of cases reported annually from 2007 to 2016 (median, 129 cases; range, 115 to 163). Thirty-six (38%) cases occurred in the metropolitan area. Seventy-six (79%) cases occurred during May through October. The median age of the cases was 25 years (range, 11 months to 98 years). Seventeen percent were 4 years of age or younger. Thirty-three (34%) cases were hospitalized; the median hospital stay was 3 days (range, 1 to 16 days). No cases died.

In addition to the 96 culture-confirmed *E. coli* O157 cases, 246 cases of Shiga toxin-producing *E. coli* (STEC) infection were identified. Of these, culture-confirmation was not possible in 12, and therefore it is unknown if those were O157 or another serogroup. Among the remaining 234 cases, *E. coli* O103 accounted for 52 (22%) cases, *E. coli* O111 for 39 (17%), *E. coli* O26 for 32 (14%), *E. coli* O121 for 19 (8%), *E. coli* O145 for 17 (7%), and *E. coli* O45 for 2 (1%). The median age of the non-O157 STEC cases was 27 years (range, 5 months to 96 years). Thirty-two (14%) cases were hospitalized; the median hospital stay was 3 days (range, 1 to 18 days). One case, a 3-year-old, died.

CIDTs have become increasingly adopted by clinical laboratories for the detection of Shiga toxin in stool. One hundred ninety patient specimens that were positive by a CIDT conducted at a clinical laboratory were not subsequently culture-confirmed, and therefore did not meet the surveillance case definition for inclusion in case count totals.

Two *E. coli* O157 outbreaks were identified during 2017. One was associated with person-to-person transmission at a childcare facility in Douglas County. Eight cases, 4 laboratory-confirmed, were identified. One was associated with a restaurant. Eleven cases, 8 laboratory-confirmed, were identified. Falafel was implicated as the vehicle.

Three non-O157 STEC outbreaks were identified during 2017. One outbreak of *E. coli* O121 infections associated with person-to-person transmission occurred at a childcare facility. Twelve cases, 11 laboratory-confirmed, were identified. An outbreak of *E. coli* O undetermined infections associated with person-to-person transmission occurred at a childcare facility. Five cases, 2 laboratory-confirmed, were identified. An outbreak of *E. coli* O111 and O26 infections was associated with animal contact at a campground. Twenty-one cases, 3 laboratory-confirmed, were identified.

Hemolytic Uremic Syndrome (HUS)

In 2017, 9 HUS cases were reported. The number of reported cases is 33% fewer than the median number of cases reported annually from 2007 to 2016 (median, 13.5 cases; range, 10 to 22). In 2017, the median age of HUS cases was 6 years (range, 1 to 35); 6 cases occurred in children less than 7 years of age. All 9 cases were hospitalized, with a median hospital stay of 7 days (range, 3 to 17 days). One case, a 3-year-old, died. From 1997 through 2017, the overall case fatality rate among HUS cases was 5.0%. All 9 cases were post-diarrheal. *E. coli* O157:H7 was cultured from the stool of 6 cases, *E. coli* O145 was cultured from the stool of 2 cases, and *E. coli* O undetermined was isolated from the stool of 1 case. In 2017, there were no outbreak-associated HUS cases.

Giardiasis

During 2017, 643 cases of *Giardia* infection (11.7 per 100,000) were reported. This represents a 4% decrease from the median number of cases reported annually from 2007 through 2016 (median, 667 cases; range, 620 to 904). Recent immigrants and refugees accounted for 28% of all cases. An additional 15% of cases reported international travel in the 3 weeks prior to illness onset. Excluding recent immigrants and refugees, the median age of cases was 39 years (range, 7 months to 95 years). Sixteen percent were <10 years of age, and 36% were >50 years of age. Sixty percent of non-immigrant and refugee cases were male. *Giardia* infections showed a summer/fall seasonality;

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46% of non-immigrant and refugee cases occurred during July through October. Forty-two (7%) cases required hospitalization, for a median of 4 days (range, 1 to 56 days). Two outbreaks were identified that accounted for 3 laboratory-confirmed cases. One was an outbreak associated with person-to-person transmission at a child care center, and the other was an outbreak probably associated with consumption of surface water along a Lake Superior hiking trail.

Haemophilus influenzae

One hundred twenty-five invasive *Haemophilus influenzae* disease cases (2.3 per 100,000 population) were reported in 2017. Cases ranged in age from newborn to 102 years (median 65 years*).* Allowing for more than one syndrome per case, 73 (58%) cases had pneumonia, 34 (27%) had bacteremia without another focus, 10 (8%) had septic shock, 7 (6%) had meningitis, 3 (2%) had epiglottitis, 3 (2%) had septic arthritis, 1 (1%) had pyelonephritis, and 1 (1%) had otitis media. Eight (6%) cases died.

Of 119 *H. influenzae* isolates for which typing was performed at PHL, 20 were type f, 14 type a, 2 type b (Hib), 5 type e, 1 type d, and 77 were untypeable. The 2 type b Hib disease cases compared to 5 cases in 2016, 2 in 2015, and 1 in 2014. One was in a child 1-4 years of age, and 1 was in an adult >60 years of age; both survived. One had pneumonia and one had epiglottitis. The child was unvaccinated.

The 8 deaths occurred in patients ranging in age from 51 to 94 years. Five cases had pneumonia (of these, 2 also had septic shock), and 3 had bacteremia without another focus of infection. All 8 had *H. influenzae* isolated from blood. Co-morbidities were reported in all of them. Of the 8 that died, 6 case-isolates were untypeable, and 2 were serotype f.

Histoplasmosis

Histoplasmosis is caused by the soil-dwelling dimorphic fungus *Histoplasma capsulatum*. Infection typically results from inhalation of aerosolized spores, and symptomatic infections usually involve pulmonary disease, although disseminated or non-pulmonary infections occur. Asymptomatic infections are thought to be common. The geographic distribution is still under investigation, but the Mississippi River valley is known to be an endemic area. Additionally, geographic micro-foci exist inside and outside endemic areas, and are usually associated with soil containing bird or bat guano. Common activities associated with exposure include farming, exposure to soil enriched with bird or bat guano, remodeling or demolition of old buildings, and clearing trees or brush in which birds have roosted.

A new case definition was implemented in 2017; thus, case counts cannot be compared to previous years. In 2017, there were 36 confirmed and 147 probable cases of histoplasmosis reported. The median age of confirmed and probable cases was 54 years (range, 8 to 85); 118 (65%) were male. Of the 142 cases with race reported, 130 (92%) were white, 8 (6%) were black, 1 (0.7%) was Asian/Pacific Islander, and 3 (2%) reported more than one race. Of the 131 with ethnicity reported, 10 (8%) were Hispanic/Latino.

Seventy-four cases (40%) were hospitalized, and of the 102 whose status was known, 35 (34%) were immunocompromised. Eleven (7%) cases died, and histoplasmosis was the primary cause of death in 4 of those cases.

HIV Infection and AIDS

HIV/AIDS incidence in Minnesota remains moderately low. In 2016, state-specific HIV infection rates ranged from 1.5 per 100,000 population in Vermont to 31.8 per 100,000 in Georgia. Minnesota had the 14th lowest rate (6.2 cases per 100,000 population). In 2016, state-specific AIDS diagnosis rates ranged from 1.2 per 100,000 persons in Montana to 12.0 per 100,000 population in Louisiana. Minnesota had the 15th lowest rate (2.4 cases per 100,000 population).

As of December 31, 2017, a cumulative total of 11,598 cases of HIV infection (2,217 AIDS at first diagnosis, and 9,381 HIV [non-AIDS] cases) were reported among Minnesota residents. By the end of 2017, an estimated 8,789 persons with HIV/AIDS were living in Minnesota.

The annual number of AIDS cases reported in Minnesota increased steadily from 1982 through the early 1990s, reaching a peak of 361 cases in 1992. Beginning in 1996, the annual number of new AIDS diagnoses and deaths declined sharply, primarily due to better antiretroviral therapies. In 2017, 144 new AIDS cases (Figure 4) and 75 deaths among persons living with HIV infection in Minnesota were reported.

The number of HIV (non-AIDS) diagnoses has varied over the past decade. There was a peak of 279 newly diagnosed HIV (non-AIDS) cases in 2009, and a low of 217 new HIV (non-AIDS) cases reported in 2017.

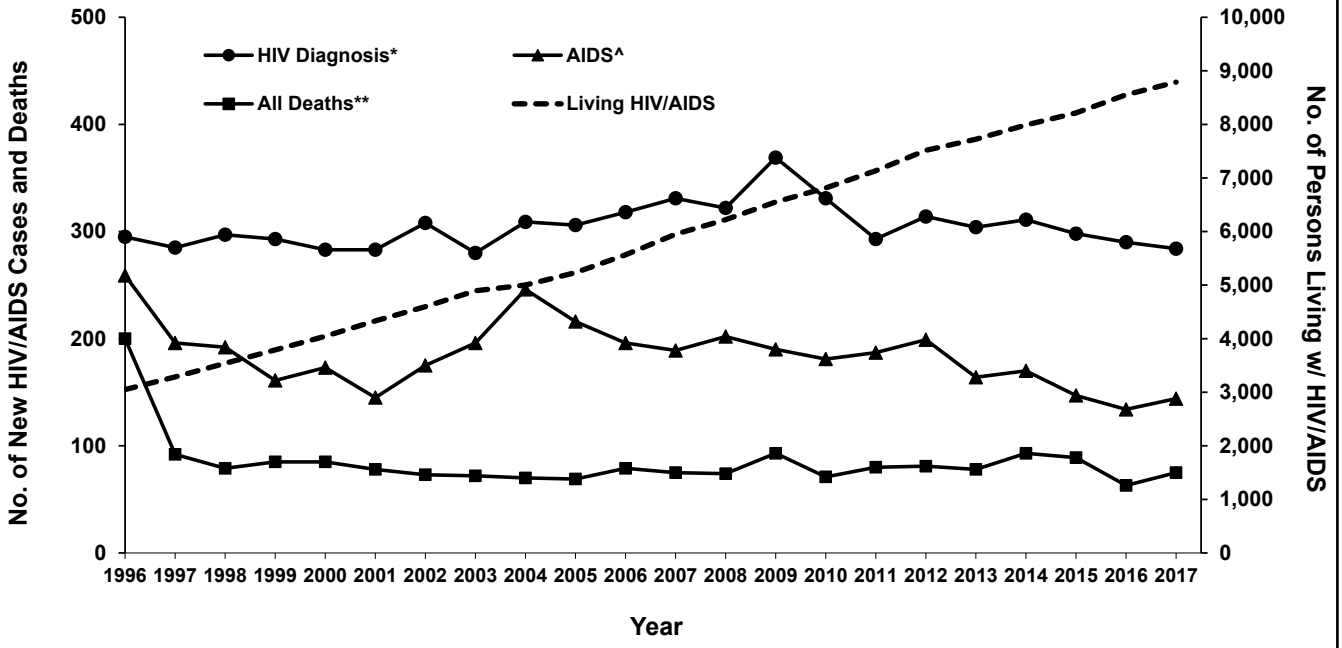
In 2017, 81% (229/284) of new HIV diagnoses (both HIV [non-AIDS] and AIDS at first diagnosis) occurred in the metropolitan area. In Greater Minnesota there were 55 cases in 29 counties. HIV infection is most common in areas with higher population densities and greater poverty.

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 number of HIV infections among males, but the proportion of cases that white males account for is decreasing. In 2017, there were 83 new infections among white males, which is more than one third of new HIV infections among males (39%). Among black African American males, there were 58 new HIV diagnoses in 2017, which is more than a quarter of new HIV infections among males (28%). Among Hispanic males of any race and black African-born males, there were 29 and 25 new HIV infections in 2017 respectively.

Females account for an increasing percentage of new HIV infections, from 11% of new infections in 1990 to 26% in 2017. 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. Since 1991, the number of new infections among women of color has exceeded that of white women. In 2017, women of color accounted for 80% of new HIV infections among females in Minnesota. The number of diagnoses among African-born women has been increasing over the past decade. In 2017, the number of new cases among African-born women was 35, accounting for 47% of all new diagnoses among women. In 2017, there were 18 cases (24%) diagnosed among African American women.

Despite relatively small numbers of cases, HIV/AIDS affects persons of

Figure 4. HIV/AIDS in Minnesota: Number of New Cases, Prevalent Cases, and Deaths by Year, 1996-2017



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

color disproportionately in Minnesota. In 2017, men of color comprised approximately 17% of the male population in Minnesota and 61% of new HIV diagnoses among men. Similarly, persons of color comprised approximately 13% of the female population in Minnesota and 80% of new HIV infections among women. It bears noting the use of race can be a proxy for other risk factors, including lower socioeconomic status and education, but race is not considered a biological cause of disparities in the occurrence of HIV.

A population of concern for HIV infection is adolescents and young adults (13-24 years). The number of new HIV infections among males in this age group has remained higher than new diagnoses among females since 1999, with 47 cases reported in 2017. The number of new HIV infections among adolescent females has remained relatively consistent over time; in 2017 there were 8 cases. From 2015 to 2017, the majority (65%) of new infections among male adolescents and young adults were among youth of color (99/154), with young black African American males accounting for 39% of cases among young males of color. During the same period, young women of color accounted for 80% (28/35) of the cases diagnosed, with young black African-born women accounting for 37% of cases among young women of color. Between 2015 to 2017 after re-distributing those with unspecified risk, 86% of new cases among young males were attributed to male-to-male sex. Among young females, 87% of new cases were attributed to heterosexual sex.

Since the beginning of the epidemic, male-to-male sex (MSM) has been the predominant mode of exposure to HIV reported in Minnesota. In 2017, MSM (including MSM who also inject drugs) accounted for 67% of new diagnoses among men. 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. In 2017, 84% of 74 new HIV diagnoses among women was attributed to heterosexual exposure. The number of cases among injection drug users (IDUs) (MSM/IDU and IDU) has remained similar over the past 3 years with 26 cases in 2017 compared to 27 cases in 2016, which indicates a continued pattern of increased HIV infection among IDUs in the state.

Historically, race/ethnicity data for HIV/AIDS in Minnesota have grouped non-African born blacks and black 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 black African-born persons was observed. In 2017, there were 60 new HIV infections reported among black Africans. While black African-born persons comprise less than 1% of the state's population, they accounted for 21% of all HIV infections diagnosed in Minnesota in 2017.

HIV perinatal transmission in the United States decreased 90% since the early 1990s. The trend in Minnesota has been similar. While the number of births to HIV-infected women increased nearly 7-fold between 1990 and 2017, the rate of perinatal transmission decreased 11-fold, from 15% in 1994-1996 to 1.8% over the last 3 years (2015-2017) with 1 HIV-positive birth in 2017.

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Influenza

Several influenza surveillance methods are employed. Data are summarized by influenza season (generally October-April) rather than calendar year.

Hospitalized Cases

Surveillance for pediatric (<18 years of age) laboratory-confirmed hospitalized cases of influenza in the metropolitan area was established during the 2003-2004 influenza season and expanded to include adults for the 2005-2006 influenza season. For the 2008-2009 season surveillance was expanded statewide. Since the 2013-2014 season, clinicians have been encouraged to 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 2017-2018 season (October 1, 2017 – April 30, 2018), 6,434 laboratory-confirmed hospitalized cases (116.6 cases per 100,000 persons) were reported, compared to 70.9 cases per 100,000 in 2016-2017, and 27.5 cases per 100,000 in 2015-2016. Cases included 5,374 influenza A (152 A [H1N1]pdm09, 2,440 H3, and 2,782 unknown A type), 1,018 influenza B (403 of Yamagata lineage and 19 of Victoria lineage), 7 positive for both influenza A and B, and 35 of unknown influenza type. Among the cases, 8% were 0-18 years, 11% were 19-49 years, 16% were 50-64 years, and 65% were 65 years of age and older. Residents of the metropolitan area made up 58% of cases.

Case report forms have been completed on 33% of the 2,603 metropolitan area cases selected for chart abstraction. Of these, 18% were diagnosed with pneumonia, 13% required admission into an intensive care unit, and 6% were placed on mechanical ventilation. An invasive bacterial co-infection was present in 9% of hospitalized cases. Antiviral treatment was prescribed for 93% of cases. Overall, 94% of adult cases and 6% of pediatric cases had at least one chronic medical condition that would have put them at increased risk for influenza disease.

Deaths

There were 6 pediatric influenza-associated deaths; 4 were positive for influenza A(H3) and 2 were positive for influenza A-not subtyped.

Laboratory Data

The Minnesota Laboratory System (MLS) Laboratory Influenza Surveillance Program is made up of more than 110 clinic- and hospital-based laboratories which voluntarily submit testing data on a weekly basis. These laboratories perform rapid testing for influenza and respiratory syncytial virus (RSV). Significantly fewer laboratories perform viral culture testing. Nine laboratories perform PCR testing for influenza, and three also perform PCR testing for other respiratory viruses. The PHL provides further characterization of submitted influenza isolates to determine the hemagglutinin serotype. Tracking laboratory results assists healthcare providers with patient diagnosis of influenza-like illness (ILI), and provides an indicator of the progression of the influenza season as well as prevalence of disease in the community. Between October 1, 2017 – May 19, 2018, laboratories reported data on 42,188 influenza PCR tests, 8,260 (20%) of which were positive for influenza. Of these, 326 (4%) were positive for influenza A (H3), 75 (1%) were positive for influenza A (H1N1) pdm09, 6,110 (74%) were positive for influenza A-not subtyped, and 1,749 (21%) were positive for influenza B.

Sentinel Surveillance

We conduct sentinel surveillance for ILI (fever >100° F, and cough, and/or sore throat in the absence of known cause other than influenza) through outpatient medical providers including those in private practice, public health clinics, urgent care centers, emergency rooms, and university student health centers. There were 29 sites in 22 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 during the week of February 4-10, 2017 at 6.7%.

Influenza Incidence Surveillance

MDH was one of eight nationwide sites to participate in an Influenza Incidence Surveillance Project. Five clinic sites reported the number of ILI patients divided by the total patients seen by the following age groups: <1 year, 1-4 years, 5-17 years, 18-24 years, 25-64 years, and ≥65 years, each week. Clinical specimens were collected on the first 10 patients with ILI for PCR testing at the PHL for influenza and 13 other respiratory pathogens. Minimal demographic information and clinical data were provided with each specimen.

From November 1, 2017 – May 11, 2018, these clinics saw 2,136 ILI patients. They submitted 234 specimens for influenza testing; 77 (33%) were positive for influenza. Of those, 49 (64%) were positive for influenza A (H3), 6 (8%) was positive for influenza A (H1N1)pdm09, 4 (5%) were positive for influenza A-type unspecified, 13 (17%) were positive for influenza B/Yamagata lineage, and 5 (6%) were positive for influenza B/Victoria lineage.

ILI Outbreaks (Schools and Long-Term Care Facilities)

Since 2009, schools reported outbreaks when the number of students absent with ILI reached 5% of total enrollment, or when three or more students with ILI were absent from the same elementary classroom. Six hundred ninety-eight schools in 72 counties reported ILI outbreaks during the 2017-2018 school year. The number of schools reporting ILI outbreaks since the 2009-2010 school year ranged from a low of 92 in 2013-2014 to a high of 1,302 in 2009-2010.

An influenza outbreak is suspected in a long-term care facility (LTCF) when two or more residents in a facility develop symptoms consistent with influenza 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 and there are other cases of respiratory illness in the same unit. Two hundred twelve facilities in 68 counties reported confirmed outbreaks during the 2017-2018 influenza season. The number of LTCFs reporting outbreaks ranged from a low of three in 2008-2009 to a high of 212 this season.

Legionnaires' Disease

In 2017, 98 confirmed cases of Legionnaires' disease (1.8 per 100,000 population) were reported. This was the second highest number of cases ever reported. In 2016, there were 115 cases (23 from an outbreak), but from 2011 to 2015, a median of only 51 cases was reported annually. The criteria for confirmation of a case are a clinically compatible illness and at least one of the following: 1) isolation of any *Legionella* organism from respiratory secretions, lung tissue, pleural fluid, or other normally sterile fluid by culture, or 2) detection of *L. pneumophila* serogroup 1 antigen in urine using validated reagents, or 3) seroconversion of fourfold or greater rise in specific serum antibody titer to *L. pneumophila* serogroup 1 using

validated reagents. A single antibody titer of any level is not considered diagnostic. Patients positive by PCR only are classified as suspect cases; in 2017, there were 5 suspect cases.

All 98 had pneumonia, and 96 (98%) were hospitalized, with a median duration of hospitalization of 5 days (range, 1 to 56 days). Of those hospitalized, 36 (38%) were admitted to an intensive care unit, and 19 (20%) required mechanical ventilation. Three (3%) cases died. Seventy-three (74%) cases were male. Older adults were more often affected, with 81 (83%) cases occurring among individuals ≥50 years (overall median age, 60 years; range, 26 to 88). Fifty-four (55%) cases had onset dates in June through September. Sixty-four (65%) cases were residents of the metropolitan area and 34 (35%) were residents of Greater Minnesota.

Two cases were associated with an outbreak at a rental accommodation, 2 cases with an outbreak at a senior living community, and 2 cases with an outbreak in another state. The remaining 92 cases (94%) were epidemiologically classified as sporadic. Of the 85 sporadic cases for whom information was available, 15 (18%) had traveled out of state, and 2 (2%) had traveled out of the country during the 10 days prior to illness onset.

The Infectious Diseases Society of America and the American Thoracic Society, in consensus guidelines on the management of community-acquired pneumonia in adults, recommend urinary antigen assay and culture of respiratory secretions on selective media for detection of *Legionella* infection. Culture is particularly useful for public health because environmental and clinical isolates can be compared by molecular typing in outbreak investigations. MDH requests that clinical laboratories submit isolates or available lower respiratory tract (sputum, BAL) specimens from confirmed and suspect cases for culture and molecular typing.

Listeriosis

Fourteen listeriosis cases were reported in 2017. All were hospitalized, and 4 (29%) died. The median age of cases was 68 years (range, newborn to 88 years). Ten (71%) had *Listeria monocytogenes* isolated from blood, 2 (14%) from cerebrospinal fluid (CSF), 1 (7%) from peritoneal fluid, and 1 (7%) from placenta. Three cases were pregnancy-associated; 1 was a maternal case whose neonate also had a positive isolate from blood, 1 case occurred in a mother who experienced a fetal loss at 17 weeks gestation, and 1 was a neonate who survived. Eleven (79%) cases were white, and 3 (21%) were Asian/Pacific Islander; 1 (7%) was of Hispanic ethnicity. The 14 cases are greater than the median number of cases reported from 1996 through 2016 (median, 7 cases; range, 3 to 19). In 2017, no cases were part of identified outbreaks.

In 2015, CIDTs became commercially available for the detection of *L. monocytogenes* nucleic acid in blood culture and CSF. In 2017, 1 specimen that was positive by a CIDT conducted at a clinical laboratory was not subsequently culture-confirmed, and therefore did not meet the surveillance case definition for inclusion in MDH case count totals.

Lyme Disease

Lyme disease is caused by *Borrelia burgdorferi*, a spirochete transmitted to humans by bites from *Ixodes scapularis,* the blacklegged tick. Recently, a new species of bacteria, *B. mayonii*, has also been identified as a cause of human disease, and 8 cases have been reported in Minnesota residents since 2013. In Minnesota, the same tick vector also transmits the agents of babesiosis, human anaplasmosis, one form of human ehrlichiosis, and a strain of Powassan virus.

In 2017, 1,408 confirmed Lyme disease cases (25.5 cases per 100,000 population) were reported. In addition, 910 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. Despite some yearly fluctuations, the number of reported cases of Lyme disease has been increasing, as evidenced by the median number of cases from 2009 through 2016 (median, 1,203; range, 896 to 1,431) compared to the median from 2000 to 2008 (median, 913; range, 463 to 1,239) (Figure 1).

Eight hundred sixty-five (61%) confirmed cases were male, and the median case age was 43 years (range, 1 to 91). Physician-diagnosed erythema migrans (EM) was present in 1,042 (74%) cases. Four hundred sixteen (30%) cases had one or more late manifestations of Lyme disease (including 291 with a history of objective joint swelling, 101 with cranial neuritis including Bell's Palsy, 11 with lymphocytic meningitis, 10 with acute onset of 2nd or 3rd degree atrioventricular conduction defects, and 7 with radiculoneuropathy) and confirmation by Western immunoblot (positive IgM ≤30 days post-onset or positive IgG). Of the 1,300 cases with known onset dates, onset of symptoms peaked from June through August, with 70% of EM cases experiencing symptom onset in June or July. This timing corresponds with peak activity of nymphal *I. scapularis* ticks in mid-May through mid-July. The majority of cases either resided in or traveled to endemic counties in north-central, east-central, or southeast Minnesota, or Wisconsin.

Malaria

Malaria is a febrile illness caused by several protozoan species in the genus *Plasmodium*. The parasite is transmitted to humans by bites from infected *Anopheles* genus mosquitoes. The risk of malaria is highest in the tropical and sub-tropical regions of the world. Although local transmission of malaria frequently occurred in Minnesota over 100 years ago, all of the cases reported in Minnesota residents in recent years have been imported infections acquired abroad.

In 2017, 67 cases (1.2 per 100,000 population) were reported. Fifty-seven (85%) cases were identified with *P. falciparum*, 4 (6%) with *P. vivax*, 4 (6%) with *P. ovale*, and 1 (1%) with mixed *Plasmodium* species infection. In 1 case, the species was unable to be determined. The median age of cases was 38 years (range, 4 to 78). Of the 59 cases with known race, 50 (85%) were black, 9 (15%) were white, and 1 identified as multi-racial. Sixty-five cases were Minnesota residents at the time of their illness, 52 (80%) of which resided in the metropolitan area. One patient was a resident of a country other than the United States. Of the 57 cases with known country of birth, only 10 (18%) were born in the United States. Sixty-two (93%) cases likely acquired malaria in Africa, 2 (3%) cases were likely acquired in Asia, and 1 patient reported travel to South America. Exposure information was not available for 2 cases. Twenty-three countries were considered possible exposure locations for malaria infections, including Liberia (17), Nigeria (11), Cameroon (5), Kenya (5), and Sierra Leone (5), as well as several other countries in sub-Saharan Africa.

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Measles

In 2017, 75 measles cases were reported as a result of an outbreak that began in Hennepin County involving the Somali community. This was the largest measles outbreak experienced since 1990, and the second major measles outbreak to affect the Minnesota Somali community in 6 years. Sixty-six cases were residents of Hennepin County, and the remaining were residents of Ramsey (3), Crow Wing (4) and LeSueur (2) counties.

Of the 75 cases, 68 (91%) were laboratory confirmed, and 7 (9%) were epidemiologically-linked to laboratory confirmed cases. Of those with lab testing done, 68 were positive by PCR and 68 were genotyped; of 68 genotyped, 63 (93%) were B3. The remaining 5 (7%) failed to be successfully genotyped.

The first 2 identified cases were confirmed on April 11 by the PHL. At the time the cases were reported, the outbreak was into its second generation with 9 infectious cases, and a third generation of 20 cases had already been exposed. The sibling of the second case had experienced a transient rash illness 2 weeks earlier, and was confirmed as the earliest case in the outbreak, with rash onset on March 30. This case had no international or domestic travel nor contact with any ill individuals. Though the source for the outbreak remains unknown, the genotype (B3) identified in the majority of cases is one that circulates year-round in many parts of the world including Sub-Saharan Africa. The outbreak continued through early July and was declared over on August 25 after two incubation periods had passed with no new cases.

Measles was transmitted in child care (n=32), household (n=26), school (4), health care (2), community (10), and unknown (1) settings. The median age for all cases was 2 years (range 3 months to 57 years). Sixty-one (81%) cases were of Somali descent; 1 (1%) was black and of non-Somali descent; 2 (3%) were white, Hispanic; and 11 (15%) were white, non-Hispanic. Of the 75 cases, 68 (91%) were unvaccinated, of those 68, 5 (7%) were too young for vaccine and 63 (93%) were of age but unvaccinated. In addition, 2 (3%) had 1 previous dose of MMR vaccine, 3 (4%) had 2 previous doses of MMR, and 2 (3%) adults with unknown status stated they were vaccinated but no documented doses could be located. Twenty-one (28%) cases were hospitalized (mean 5.5 days; range 2-18 days).

This outbreak was not unexpected, given the highly infectious nature of measles paired with the Somali community's steadily decreasing MMR vaccination rates in young children. At the time the outbreak began, the MMR rate for 24 month-old Somali children born in Minnesota was at 42%; and 36% in Hennepin County. Though MDH and local public health partners have done outreach work with this community since before the 2011 outbreak, the fear of autism, and the targeted activism of anti-vaccination groups to spread misinformation about MMR vaccine continue to undermine public health efforts.

This outbreak also underscores the importance of early recognition, reporting and testing of individuals with febrile rash illnesses, regardless of travel history. With the exception of 2011 and 2017, 1 to 2 cases are reported annually, with 96% due to import-associated cases. Typically, cases are reported soon after symptoms develop, allowing MDH and local public health agencies to take rapid action to prevent a larger outbreak. However, in 2011 and 2017, the first case in each outbreak was misdiagnosed and unreported to MDH, allowing transmission to occur without appropriate response measures.

Meningococcal Disease

Five *Neisseria meningitidis* (NM) invasive disease cases (0.09 per 100,000 population) were reported in 2017; 5 cases were reported in 2016. Three were serogroup B, 1 was serogroup C, and 1 case was serogroup Z. All cases were sporadic.

Cases ranged in age from 9 to 89 years. Two of the 5 occurred in the metropolitan area. Two cases had meningitis, 2 had bacteremia and septic shock, and 1 had bacteremia without another focus of infection. There were no deaths.

In 2017, the case-isolates showed no resistance to beta-lactams, while in 2016 1 case-isolate demonstrated intermediate resistance to both ampicillin and penicillin. No isolate had ciprofloxacin resistance.

Incidence of invasive NM was fairly stable at about 0.30 cases per 100,000 persons since 2005 (with the exception of 2008 when incidence increased to 0.57 cases per 100,000 persons); however, invasive NM has decreased since 2011. Quadrivalent conjugate MenACWY is recommended at 11-12 years with a necessary booster at age 16. Vaccination rates in 2017 for at least 1 dose among 13-17 year old Minnesota adolescents is 77%; rates for the necessary booster are lagging at 22% (Minnesota Immunization Information Connection).

From 2011-2016, the proportion of invasive NM cases that were serogroup B was 53% compared to the prior 6 years (2005-2010) when 36% of cases were serogroup B. Two menB vaccines are available. Clinicians should vaccinate patients 10 years of age and older with specific risk factors, and discuss MenB vaccine with patients who are 16-23 years old.

Mumps

In 2017, 72 mumps cases were reported. Sixty-one (85%) were classified as confirmed (tested positive by PCR), and 11 (15%) as probable (tested positive by IgM serology, or were epidemiologically-linked to another case or outbreak). Of the confirmed cases, 53 (87%) were genotyped as G which is the dominant genotype circulating in the United States since 2006, and 1 (2%) was genotyped as J and was related to international travel to Indonesia.

Sixty-two (86%) cases were related to three distinct outbreaks that occurred in Minnesota. The largest outbreak (45 cases, 63%) at the University of Minnesota Twin Cities campus began after multiple students came back from spring break in Texas with mumps. Five cases (7%) were related to an isolated outbreak occurring among Minnesota Wild National Hockey League players and staff, and 12 cases (16%) were related to an outbreak in an under-vaccinated community in Polk County. Ten additional cases (14%) were not outbreak-related; 2 cases acquired mumps from recent international or domestic travel, and 8 sporadic cases were not linked to outbreaks occurring within Minnesota or elsewhere.

The median age of cases was 22 years (range 1 to 57). Ten cases (14%) occurred in persons <18 years of age, 56 cases (78%) occurred in persons 18-49 years, and 6 cases (8%) occurred in persons ≥50 years of age. Seventy cases (97%) experienced parotitis, and 3 (4%) reported orchitis. One adult was hospitalized for 2 days with fever

and myalgia and recovered without complications.

Nineteen (26%) cases reported a history of receiving at least 1 dose of mumps-containing vaccine but had no documentation of those doses. Thirty-eight cases (53%) had a documented history of receiving 1 or 2 doses of mumps-containing vaccine. Eleven (15%) cases were unvaccinated, and 4 (6%) reported unknown vaccination status. No case reported a previous history of mumps disease.

Mumps surveillance is complicated by nonspecific clinical presentation in nearly half of cases, asymptomatic infections in an estimated 30% of cases, and suboptimal sensitivity and specificity of serologic testing. A number of viruses can cause sporadic parotitis including human herpes virus 6, enterovirus, Epstein-Barr, lymphocytic choriomeningitis virus, bocavirus, and human immunodeficiency virus. Acute bacterial parotitis may present with unilateral swelling. Noninfectious causes include drugs, tumors, and immunologic diseases.

Neonatal Sepsis

Statewide surveillance for neonatal sepsis 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 2017, 53 cases (0.77 cases per 1,000 live births) were reported compared to 59 cases in 2016. There were 5 deaths. All were identified via blood or cerebrospinal fluid (CSF). There were 4 meningitis cases. Most cases (87%) were culture-positive within the first 2 days of life. Group B *Streptococcus* was most common (20) followed by *Escherichia coli* (14), other *Streptococcus* spp. (4), *Streptococcus viridians* (3), *Enterococcus* spp. (2), *Klebsiella pneumoniae* (2), *Bacteroides fragilis (2),* and 1 each of *Haemophilus influenzae*, *Edwardsiella* spp., *Globicatella* spp., *Pasturella* spp., *Staphylococcus aureus*, and *Streptomyces* spp.

Pertussis

In 2017, 731 pertussis cases (13 per 100,000 population) were reported. Laboratory confirmation was available for 498 (68%) cases, 22 (4%) of which were confirmed by culture and 495 (99%) of which were confirmed by PCR. In addition, 84 (12%) cases met the clinical case definition and were epidemiologically linked to laboratory confirmed cases, and 142 (19%) met the clinical case definition only. Three hundred eighty-one (52%) cases occurred in residents of the metropolitan area.

Paroxysmal coughing was the most commonly reported symptom, which 686 (94%) cases experienced. Approximately one third (229) reported whooping. Although commonly referred to as “whooping cough,” very young children, older individuals, and persons previously immunized may not have the typical “whoop”. Post-tussive vomiting was reported in 340 (47%) cases. Infants and young children are at the highest risk for severe disease and complications. Pneumonia was diagnosed in 13 (2%) cases, only 2 (15%) of which were in infants; 5 (38%) were 2 to 16 years old, 6 (46%) were 20 to 70 years old. Thirteen (2%) cases were hospitalized; 6 (46%) hospitalized patients were <6 months of age. No deaths occurred.

Pertussis is increasingly recognized in older children and adults. During 2017, cases ranged in age from <1 month to 85 years. Two hundred nine (29%) cases occurred in adolescents 13-17 years, 199 (27%) in children 5-12 years, 180 (25%) in adults ≥18 years, 123 (17%) in children 6 months through 4 years, and 19 (3%) in infants <6 months of age. The median age of cases was 13 years. Infection in older children and adults may result in exposure of unprotected infants. During 2017, 39 cases were in infants <1 year of age. A likely source of exposure was identified for 20 of those cases; 2 were infected by adults ≥18 years, 1 by an adolescent 13-17 years, 16 by a child <13 years, and 1 case-exposure’s age was unknown. Nineteen infant cases had no identified source of infection. ACIP recommends vaccination of women at ≥20 weeks gestation during each pregnancy in an effort to protect young infants. Ensuring up-to-date vaccination of children, adolescents, and adults, especially those in contact with young children is also important. 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 disease, particularly as the number of years since vaccination increase. Disease in those previously immunized is usually mild. Efficacy for currently licensed DTaP vaccines is estimated to be 71-84% in preventing typical disease within the first 3 years of completing the series. Waning immunity sharply increases at 7 years of age, and most are susceptible by 11-12 years of age when Tdap booster is recommended. Recent studies suggest that immunity wanes sharply 2 years from receipt of Tdap. Of the 153 (21%) cases who were 7 months to 6 years of age, 69 (45%) were known to have received at least a primary series of 3 doses of DTP/ DTaP vaccine prior to onset of illness; 84 (55%) received fewer than 3 doses and were considered preventable cases.

Reporting rules require clinical isolates of *Bordetella pertussis* be submitted to the PHL in order to track changes in circulating strains. Isolates for all 17 culture-confirmed cases were received and sub-typed, with four distinct PFGE patterns identified. Nationally, isolates have had low minimum inhibitory concentrations (falling within the reference range for susceptibility) to erythromycin and azithromycin. Only 11 erythromycin-resistant *B. pertussis* cases have been identified in the United States.

Laboratory tests should be performed on all suspected cases. 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. Whenever possible, culture should be done in conjunction with PCR testing. Serological tests may be useful for those with coughs >2 weeks.

Pertussis remains endemic 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 middle school-aged children, adolescents, and adults.

Q Fever

Q fever is an acute or chronic illness caused by *Coxiella burnetii*. Cattle, sheep, and goats are the primary sources of human infection. Transmission can occur through contact with infected animal tissue, inhalation

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of aerosolized bacteria, ingestion of unpasteurized dairy products, and tick bites.

In 2017, 3 confirmed cases were reported, 2 acute and 1 chronic. The acute Q fever cases were a 46 year-old and 62 year-old who were most likely exposed through contact with goats; the chronic case was a 65 year-old who had an undetermined animal exposure. The chronic and 1 acute case were hospitalized, for 9 and 7 days respectively; all cases survived.

From 1997 to 2017, 21 confirmed acute cases, and 6 confirmed chronic cases were reported. The median age of acute cases was 58 years (range, 11 to 76 years); the median age of chronic cases was 65 years (range, 23 to 75 years). Ten (83%) cases for which both race and ethnicity were known were white, non-Hispanic, 1 (8%) was black, non-Hispanic, and 1 (8%) was mixed race, non-Hispanic. During this time, 16 (76%) of the 21 cases for whom exposure information was available were likely exposed through direct or indirect contact with infected animals, 3 (14%) were likely exposed through ingestion of unpasteurized dairy products, and 2 (10%) through a tick bite. Seven (50%) of the 14 cases with known occupations were employed in an agriculture-related occupation.

Rabies

In Minnesota, the animal reservoirs for rabies are skunks and multiple bat species. Dogs, cats, and livestock are generally exposed to rabies through encounters with skunks. Vaccinating these domestic animals for rabies provides a buffer between wildlife and people.

In 2017, 35 (1.8%) of 1,946 animals tested were positive for rabies. This is a nearly one and a half-fold decrease from 2016 (55 [2.6%]) and more consistent with the number of positive animals seen in 2014 and 2015. The majority of positive animals in 2017 were bats (20/35 [57%]), followed by skunks (10/35 [28.6%]), and there was one positive cow (1/35 [2.8%]), cat (1/35 [2.8%]), horse (1/35 [2.8%]), fox (1/35 [2.8%]) and raccoon (1/35 [2.8%]) (Figure 5). There were no human cases of rabies.

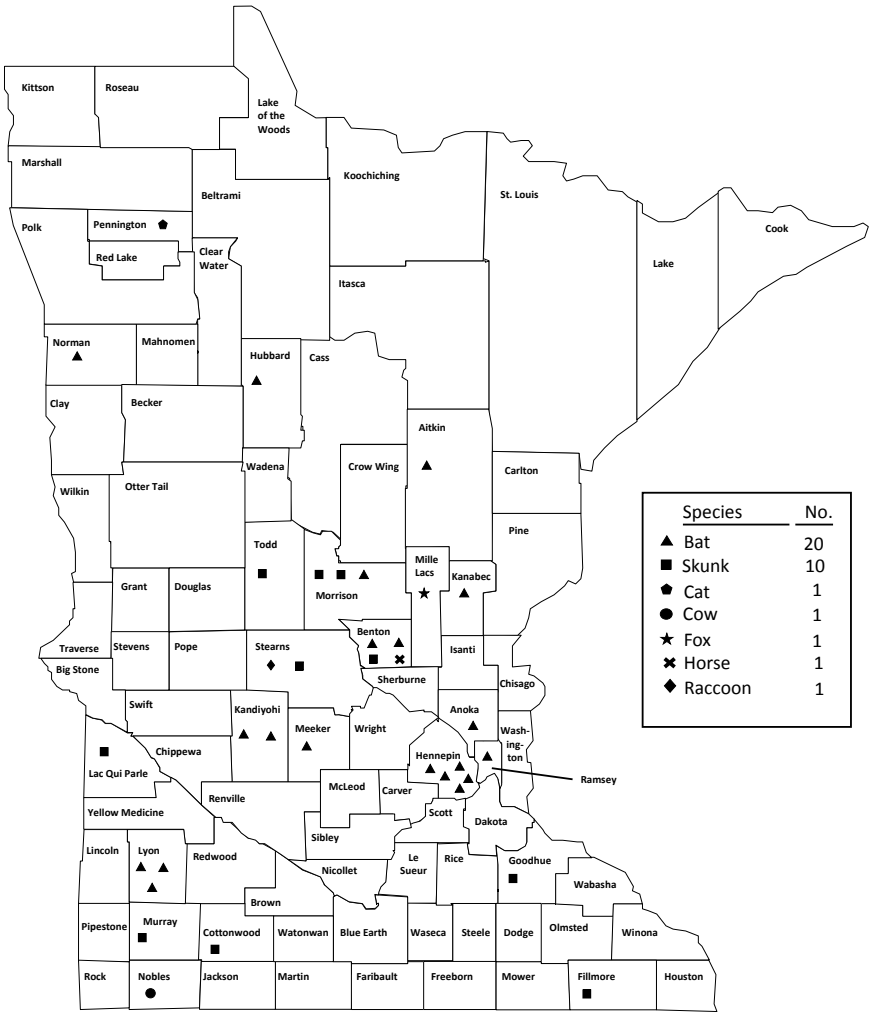
From 2003 to 2017, 833 (2.4%) of 35,224 animals tested were positive for rabies. The median number of rabies positive animals identified annually was 57 (range, 28 to 94). From 2003 to 2017, 320/698 (45.8%) skunks, 56/834 (6.7%) cattle, 364/10,080 (3.6%) bats, 9/323 (2.8%) horses, 46/10,626 (0.4%) cats, 28/9,831 (0.3%) dogs, 1/1,106 (0.1%) raccoons, and 10/1,721 (0.6%) other animals (fox [5], goat [2], woodchuck, bison, deer) tested positive for rabies. In contrast to the eastern United States, where raccoons are the most common source of terrestrial rabies, rabies in raccoons is rare in Minnesota. Previous to this 2017 case, the last rabid raccoon identified in Minnesota occurred in 1993.

Respiratory Syncytial Virus

Surveillance for respiratory syncytial virus (RSV) began as a pilot for cases who were hospitalized, <2 years of age, and had laboratory confirmed RSV from October 1, 2014-April 30, 2015. For the 2016-2017 respiratory season (October 1 – April 30), surveillance was expanded to include laboratory-confirmed RSV in hospitalized persons >18 years of age, with cases being identified retrospectively for the 2014-2015 and 2015-2016 seasons. Beginning in September 2016, RSV became reportable for all hospitalized residents of the metropolitan area who have laboratory-confirmed RSV.

From October 1, 2017-April 30, 2018, 1,090 cases were reported (18.8 cases per 100,000 persons) compared to 739 cases (13.4 cases per 100,000) in 2016-2017. The median age of cases was 11 months (range 1 week – 101 years). Sixty-four percent (688) were <2 years, 9% (93) were 2-4 years, 4% (48) were 5-17 years, 4% (46) were 18-49 years, 6% (66) were 50-64 years, and 12% (133) were ≥65 years of age. Of 196 (18%) cases with a known subtype, 15% (29) had RSV subtype A, 83% (163) had RSV subtype B.

Figure 5. Rabid Animals by County, 2017 (n=35)*



* Placement of symbol in county does not represent exact geographical location of the case.

Thirteen RSV-associated deaths were reported. The median age of RSV cases who died was 68 years (range 48-93), and 12 cases who died had underlying medical conditions. The most common underlying conditions included cardiovascular disease (67%), immunocompromised conditions (42%), and metabolic diseases (42%). Additionally, 75% RSV-associated deaths had a history of smoking.

Salmonellosis

In 2017, 916 *Salmonella* cases (16.6 per 100,000 population) were reported. This is a 24% increase from the median annual number of cases reported from 2007 to 2016 (median, 739 cases; range, 578 to 975).

Of the 92 serotypes identified in 2017, 5 serotypes, *S.* Enteritidis (233), *S.* Typhimurium (97), *S.* I 4,[5],12:i:- (96), *S.* Heidelberg (53), and *S.* Newport (49) accounted for 58% of cases. One large outbreak accounted for 44 of the *S.* Heidelberg cases. *Salmonella* was isolated from stool in 820 (90%), urine in 46 (5%), and blood in 41 (4%) cases. Other specimen sources included wound (2), gallbladder (2), genitals, aortic graft tissue, perianal abscess, abdominal abscess, and skin culture of groin.

Two hundred seven (23%) cases were hospitalized; the median length of hospital stay was 4 days (range, 1 to 30 days). Three culture-confirmed cases died; a 94 year-old who died of sepsis and urinary tract infection 1 day after *S.* Newport was isolated from a urine specimen; a 91 year-old who died of dementia with contributing factors including "gastrointestinal bleed" 3 days after *S.* Heidelberg was isolated from stool; and a 47 year-old who died of sepsis and probable aspiration pneumonia and *Salmonella* bacteremia 3 days after *S.* Enteritidis was isolated from stool.

Of the 831 cases with known travel history, 152 (18%) had travelled internationally during the week prior to their illness onset. There were 7 *S.* Typhi cases; 1 had traveled to or emigrated from India, 1 to Guatemala, 1 to Kenya, and 4 did not report any travel. There were 2 *S.* Paratyphi B cases; 1 travelled to Peru, and 1 to Pakistan.

In 2015, culture-independent tests (CIDTs) became commercially available for the detection of *Salmonella* nucleic acid in stool. In 2017, 43 patient specimens that were positive by a CIDT conducted at a clinical laboratory were not subsequently culture-confirmed, and therefore did not meet the surveillance case definition for inclusion in MDH case count totals.

One hundred twenty-three cases were part of 18 *Salmonella* outbreaks in 2017, including 3 cases that were part of three national outbreaks with no exposures in Minnesota, and 1 case that was part of an outbreak that began in 2016. Eight of the 14 Minnesota outbreaks involved foodborne transmission, 1 involved animal contact, and 5 were due to person-to-person transmission. Eight of the outbreaks, including the 3 non-Minnesota outbreaks, involved cases in multiple states. The 18 outbreaks resulted in a median of 3 culture-confirmed cases per outbreak (range, 1 to 44).

Six culture-confirmed cases and 1 probable case of *S.* Enteritidis infection were associated with ground beef purchased from a grocery store in Minneapolis. A subset of cases were exposed at a private party where the beef was served raw or medium rare.

Twelve culture-confirmed cases and 1 probable case of *S.* Enteritidis infection were part of an outbreak at a restaurant. A vehicle was not identified. Transmission occurred over 2 weeks. Multiple *Salmonella*-positive food workers, and opportunities for cross-contamination were identified. One of the culture-confirmed cases was the result of a subsequent laboratory exposure. Two culture-confirmed cases of *S.* I 4,5,12:i:- infection were identified who both ate tuna salad at a Minnesota restaurant. No specific ingredient or source of contamination was identified. Over a 5 month period, 44 culture-confirmed cases and 10 probable cases of *S.* Heidelberg infection were part of an outbreak at two Minnesota locations of a burger chain fast food restaurant with common ownership. Beef patties were associated with illness, but a specific ingredient was not identified. Eight of the confirmed cases were food workers, who may have contributed to transmission.

Over a 7 month period, 3 culture-confirmed *S.* Newport cases were identified who resided at the same long-term care facility and were likely exposed via person-to-person transmission. Five culture-confirmed cases and 6 probable cases of *S.* I 4,5,12:i:- infection among residents (and 4 probable cases among staff) who lived in the same unit of a long-term care facility were identified. The outbreak was likely caused by person-to-person transmission from contaminated hands of staff and/or contaminated environment.

Three culture-confirmed cases of *S.* I 4,5,12:i:- infection were reported from a child care center; the outbreak was suspected to be caused by person-to-person transmission. Two culture-confirmed case of *S.* Typhimurium infection were identified who attended the same in-home child care facility. Three culture-confirmed and 8 probable cases of *S.* Infantis infection were associated with an outbreak at a child care center.

One culture-confirmed case of *S.* Livingston infection in a Minnesota resident was part of a restaurant outbreak in Arizona. One Minnesota case of *S.* Montevideo infection was part of a casino restaurant outbreak in Iowa.

Over a 5 month period, 22 culture-confirmed cases of *Salmonella* infection (*S.* Enteritidis, n = 14; *S.* Typhimurium, n = 4; *S.* Braenderup, n = 3; *S.* Indiana, n = 1) were part of a multi-state outbreak linked to live poultry contact. Nationally, 1,120 cases from 48 states in this outbreak were infected with 10 *Salmonella* serotypes. National tracebacks identified five likely source hatcheries in five states.

One culture-confirmed case of *S.* Newport infection in Minnesota was part of an outbreak of cases nationally who were exposed to ground beef in Mexico.

Ten culture-confirmed *S.* Enteritidis cases were part of a multi-state outbreak of 151 cases from 36 states that was associated with romaine lettuce. State and national tracebacks did not identify a single brand, supplier, or growing region.

One culture-confirmed case of *S.* Kiambu infection and 3 culture-confirmed cases of *S.* I 6,7:-:1,5 (a monophasic variant of *S.* Thompson) infection were part of a multi-state outbreak of 220 cases in 23 states. The outbreak was associated with Maradol papayas imported from Mexico. Two culture-confirmed cases of *S.* Newport infection were part of a multi-state outbreak of 20 cases in 9 states. The suspected vehicle was watermelon; however, a common grower or

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distributor was not identified. One culture-confirmed case of *S.* Infantis infection in Minnesota was part of a multi-state outbreak of 48 cases in 14 states; mangoes from Mexico were the suspected vehicle.

Sexually Transmitted Diseases (STDs)

Gonorrhea and chlamydia in Minnesota are monitored through a mostly passive surveillance system involving review of submitted case reports and laboratory reports. Syphilis is monitored through active surveillance, which involves immediate follow-up with the clinician upon receipt of a positive laboratory report. 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 2017, 23,528 chlamydia cases (444 per 100,000 population) were reported, representing a 4% increase from 2016 (Table 3).

Adolescents and young adults are at highest risk for acquiring a chlamydia infection (Table 4). The chlamydia rate is highest among 20 to 24-year-olds (2,423 per 100,000), followed by the 15 to 19-year-old age group (1,606 per 100,000). The incidence of chlamydia among adults 25 to 29 years of age (1,180 per 100,000) is considerably lower but has increased in recent years. The chlamydia rate among females (574 per 100,000) is nearly twice the rate among males (311 per 100,000), a difference most likely due to more frequent screening among females.

Chlamydia infection incidence is highest in communities of color (Table 4). The rate among blacks (2,019 per 100,000) is 9.7 times higher than the rate among whites (209 per 100,000*).* Although blacks comprise approximately 5% of Minnesota's population, they account for 24% of reported chlamydia cases. Rates among Asian/Pacific Islanders (391 per 100,000), Hispanics (649 per 100,000), and American Indian/Alaska Natives (1,083 per 100,000) are over 2 to 5 times higher than the rate among whites.

Chlamydia infections occur throughout the state, with the highest reported rates in Minneapolis (1,293 per 100,000) and St. Paul (976 per 100,000). While there was an overall increase of 4% across the state in 2017, the greatest increase for chlamydia was seen in Minneapolis and the metropolitan area suburban area. These areas displayed an increase of 8%, as shown in Table 4*.* Every county in Minnesota had at least 2 cases in 2017.

Gonorrhea

Gonorrhea is the second most commonly reported STD in Minnesota. In 2017, 6,519 cases (123 per 100,000 population) were reported. This is the highest reported rate of gonorrhea in the last decade (Table 3).

Adolescents and young adults are at greatest risk for gonorrhea (Table 4), with rates of 316 per 100,000 among 15 to 19-year-olds, 489 per 100,000 among 20 to 24-year olds, and 362 per 100,000 among 25 to 29-year-olds. Gonorrhea rates for males (136 per 100,000) were higher than females (110 per 100,000). Communities of color are disproportionately affected by gonorrhea. The incidence of gonorrhea among blacks (875 per 100,000) is 20 times higher than the rate among whites (44 per 100,000). Rates among Asian/Pacific Islanders (90 per 100,000), Hispanics (134 per 100,000), and American Indian/Alaska Natives (561 per 100,000) are up to 13 times higher than among whites.

Gonorrhea rates are highest in the cities of Minneapolis and St. Paul (Table 4). The incidence in Minneapolis (563 per 100,000) is over 1.5 times higher than the rate in St. Paul (363 per 100,000), 6 times higher than the rate in the suburban metropolitan area (87 per 100,000), and 10 times higher than the rate in Greater Minnesota (54 per 100,000). In 2017, greater Minnesota saw the largest increase in cases at 39%.

The emergence of quinolone-resistant *N. gonorrhoeae* (QRNG) in recent years has become a particular concern. Due to the high prevalence of QRNG in Minnesota as well as nationwide, quinolones are no longer recommended for the treatment of gonococcal infections. Additionally, CDC changed the treatment guidelines for gonococcal infections in August 2012. CDC no longer recommends cefixime at any dose as a first-line regimen for treatment of gonococcal infections. If cefixime is used as an alternative agent, then the patient should return in 1 week for a test-of-cure at the site of infection. New CDC STD Treatment Guidelines were released in 2015.

Syphilis

Surveillance data for primary and secondary syphilis are used to monitor morbidity trends because these represent recently acquired infections. Data for early syphilis (which includes primary, secondary, and early latent stages of disease) are used in outbreak investigations because these 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 began in 2002 among men who have sex with men (MSM). In 2017, there were 292 cases of primary/secondary syphilis in Minnesota (5.5 cases per 100,000 persons). This represents a 5% decrease compared to the 306 cases (5.8 per 100,000) reported in 2016.

Early Syphilis

In 2017, the number of early syphilis cases increased by 8%, with 605 cases, compared to 557 cases in 2016. The incidence remains highly concentrated among MSM. Of the early syphilis cases in 2017, 511 (84%) occurred among men; 426 (70%) of these were MSM; 46% of the MSM diagnosed with early syphilis were co-infected with HIV. However, the number of women reported has continued to increase from 2012.

Congenital Syphilis

Two congenital syphilis cases were reported in 2017.

Chancroid

Chancroid continues to be very rare in Minnesota. The last case was reported in 1999.

Shigellosis

In 2017, 86 culture-confirmed cases of shigellosis (1.6 per 100,000 population) were reported. This represents an 85% decrease from the 556 cases reported in 2016, and is 54% less than the median annual number of cases reported during 2007-2016 (median, 185.5 per year; range, 66 to 556). *S. sonnei* accounted for 48 (56%) cases, *S. flexneri* for 36 (42%) cases, and *S. dysenteriae* for 1 (1%) case. The species was not identified in 1 (1%) case. Cases ranged in age from 5 months to 84

Table 3. Number of Cases and Rates (per 100,000 Persons) of Chlamydia, Gonorrhea, and Syphilis, 2013-2017

	2013		2014		2015		2016		2017	
Disease	**No.**	**Rate**	**No.**	**Rate**	**No.**	**Rate**	**No.**	**Rate**	**No.**	**Rate**
Chlamydia	18,724	353	19,897	375	21,238	400	22,675	428	23,528	444
Gonorrhea	3,872	73	4,073	77	4,097	77	5,104	96	6,519	123
Syphilis, Total	537	10.1	629	11.9	654	12.3	852	16.1	934	17.6
Primary/Secondary	193	3.6	257	4.8	246	4.6	306	5.8	292	5.5
Early latent	139	2.6	159	3.0	185	3.5	251	4.7	313	5.9
Late latent	205	3.9	213	4.0	220	4.1	289	5.4	327	6.2
Congenital*	0	0.0	0	0.0	3	4.3	6	8.7	2	3.0

*Congenital syphilis rate per 100,000 live births.
Note: Data exclude cases diagnosed in federal or private correctional facilities.

years (median, 36.5 years). Twenty percent of cases were ≤5 years of age; 65% of cases were 18 years of age or older. Fifty-eight percent of cases were male. Twenty (23%) cases were hospitalized. No cases died.

Thirty-eight percent of cases reported either non-white race (24 of 80 cases) or Hispanic ethnicity (12 of 79 cases). Of the 78 cases for which travel information was available, 23 (29%) travelled internationally (11 of 44 [25%] *S. sonnei*, and 12 of 33 [36%] *S. flexneri*). Seventy-nine percent of cases resided in the metropolitan area, including 33% in Hennepin County and 22% in Ramsey County.

Two (2%) cases were part of two *Shigella* outbreaks (one outbreak was identified in 2016). Both outbreaks were due to person-to-person transmission of *S. sonnei* in child care facilities.

In 2017, 90 patients were positive for *Shigella* by a culture-independent diagnostic test conducted in a clinical laboratory. Thirty-one (38%) of the 82 specimens that were received at MDH were subsequently culture-confirmed and therefore met the surveillance case definition for inclusion in MDH case count totals.

In 2017, 43 of the 84 *Shigella* isolates received at MDH were tested for antimicrobial resistance. Of the 43 isolates, 81% (35 isolates) were resistant to trimethoprim-sulfamethoxazole, 46% (20 isolates) were resistant to ampicillin, and 23% (10) had decreased susceptibility to azithromycin (DSA). All of the DSA isolates were collected from adult males. Among the 7 cases with available information, 4 (57%) reported sexual contact with a male during the week before illness onset.

Table 4. Number of Cases and Incidence Rates (per 100,000 Persons) of Chlamydia, Gonorrhea, and Primary/Secondary Syphilis by Residence, Age, Race/Ethnicity, and Gender, 2017

	Chlamydia		Gonorrhea		Primary/ Secondary Syphilis	
Disease	**No.**	**Rate**	**No.**	**Rate**	**No.**	**Rate**
Total	23,528	444	6,519	123	292	5.5
Residence						
Minneapolis	4,946	1,293	2,155	563	110	28.8
St. Paul	2,781	976	1,036	363	26	9.1
Suburban	7,906	362	1,900	87	90	4.1
Greater Minnesota	7,397	301	1,334	54	66	2.7
Age						
<15 years	148	14	32	3	0	0.0
15-19 years	5,909	1,606	1,164	316	9	2.4
20-24 years	8,617	2,423	1,740	489	60	16.9
25-29 years	4,396	1,180	1,349	362	69	18.5
30-34 years	2,098	612	901	263	51	14.9
35-44 years	1,630	239	823	121	51	7.5
≥45 years	712	34	498	23	52	2.5
Gender						
Male	8,180	311	3,568	136	252	9.6
Female	15,330	574	2,939	110	38	1.4
Transgender^^	18	-	6	-	2	-
Race^/Ethnicity						
White	9,643	209	2,052	44	154	3.3
Black	5,673	2,019	2,457	875	55	19.6
American Indian/ Alaska Native	729	1,083	378	561	32	47.5
Asian/PI	863	391	198	90	15	6.8
Other^^	354	-	80	-	0	-
Unknown^^	1,079	-	247	-	5	-
Hispanic^^	1,623	649	336	134	31	12.4

* Residence information missing for 480 cases of chlamydia and 82 cases of gonorrhea.
** Suburban is defined as the 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.

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Staphylococcus aureus

Invasive *Staphylococcus aureus* (SA) infections are classified into one of three categories: hospital-onset (HO-SA), healthcare-associated, community-onset (HACO-SA), and community-associated (CA-SA). SA must be isolated from a normally sterile body site more than 3 days after the date of initial hospital admission for a case to be considered HO-SA. HACO-SA cases have at least one HA risk factor identified in the year prior to infection; examples of risk factors include residence in a long term care facility, recent hospitalization(s), dialysis, presence of an indwelling central venous catheter, and surgery. CA-SA cases do not have any identifiable HA risk factors present in the year prior to infection.

In 2005, as part of the EIP Active Bacterial Core surveillance (ABCs) population-based surveillance of invasive methicillin-resistant SA (MRSA) was initiated in Ramsey County; surveillance was expanded to include Hennepin County in 2008. The incidence rate was 14.9 per 100,000 in 2017 (Ramsey: 12.9/100,000 and Hennepin: 15.9/100,000) compared to 11.6 per 100,000 population in 2016. In 2017, MRSA was most frequently isolated from blood (77%, 192/249), and 13% (33/249) of the cases died in the hospital. HACO-MRSA cases comprised the majority (67%, 166/249) of invasive MRSA infections in 2017; CA-MRSA cases accounted for 23% (57/249), and 10% (26/249) cases were HO-MRSA. The median age for all cases was 63 years (range, <1 to 97); the median age was 63 (range, <1 to 88), 66 (range, 16 to 95), and 53 (range, 2 to 97) for HO-, HACO-, and CA-MRSA cases, respectively.

In August 2014, as part of ABCs, population-based surveillance of invasive methicillin-sensitive SA (MSSA) was initiated in Hennepin and Ramsey Counties. The incidence rate was 29.6 per 100,000 in 2017 (Ramsey: 29.5/100,000 and Hennepin: 29.6/100,000) compared to 26.5 per 100,000 population in 2016. In 2017, MSSA was most frequently isolated from blood (75%, 366/491), and 7% (35/491) of the cases died in the hospital. HACO-MSSA cases comprised the majority (49%, 243/491) of invasive MSSA infections in 2017; CA-MSSA cases accounted for 41% (200/491), and 10% (48/491) cases were HO-MSSA. The median age for all cases was 60 years (range, <1 to 99); the median age was 53 (range, <1 to 98), 62 (range, 6 to 99), and 58 (range, <1 to 93) for HO-, HACO-, and CA- MSSA cases, respectively.

Vancomycin-intermediate (VISA) and vancomycin-resistant *S. aureus* (VRSA) are reportable in Minnesota, as detected and defined according to Clinical and Laboratory Standards Institute approved standards and recommendations: a minimum inhibitory concentration (MIC)=4-8 µg/ml for VISA and MIC≥16 µg/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. There have been no VRSA cases in Minnesota. Prior to 2008, the PHL had confirmed 1 VISA case. Between 2008 and 2016, PHL has confirmed 18 VISA cases; 2008 (3), 2009 (3), 2010 (2), 2011 (5), 2013 (3), and 2016 (2). Among all Minnesota VISA cases, 10 (53%) were male and the median age was 64 years (range, 27 to 86). Of those cases with known history, (17), 89% reported recent exposure to vancomycin. No cases of VISA were confirmed in 2017.

Streptococcal Invasive Disease – Group A

Invasive Group A streptococcal disease (GAS) is defined as GAS isolated from a usually sterile site such as blood, cerebrospinal fluid, or a wound when accompanied with necrotizing fasciitis or streptococcal toxic shock syndrome (STSS). Three hundred fifty-nine cases (6.2 cases per 100,000 population), including 34 deaths, were reported in 2017, compared to 277 cases and 24 deaths in 2017. The median age of cases was 60 years (range, newborn to 101 years). Fifty-seven percent of cases were residents of the metropolitan area. Allowing for multiple presentations per patient, 129 (36%) had cellulitis, 87 (24%) bacteremia without another focus of infection, 70 (19%) septic shock, 40 (11%) pneumonia, 36 (10%) abscess, 30 (8%) septic arthritis and/or osteomyelitis, 19 (5%) necrotizing fasciitis, and 11 (3%) had STSS. Thirty-nine (11%) cases were residents of long-term care facilities. Sixteen facilities had a single case, six facilities had 2 or more cases including one facility that had 6 cases. Three of the 17 facilities had 1 case in 2017, and additional cases in 2016 or 2018. The 34 deaths included 11 that presented with just septic shock; 6 bacteremia without another focus of infection; 6 cellulitis; 1 pneumonia; 3 both septic shock and pneumonia; 2 both pneumonia and cellulitis; 1 both septic shock and cellulitis; 1 with necrotizing fasciitis and septic shock; 1 pneumonia with necrotizing fasciitis and septic shock; 1 septic arthritis with septic shock and STSS; and 1 case with an unknown infection type. Of the 34 deaths, the most frequently reported underlying conditions were diabetes (12), current smoker (10), chronic kidney disease (8), current alcohol abuse (8), cirrhosis (7), heart failure (7), chronic obstructive pulmonary disease (6), obesity (5), chronic skin breakdown (4), and current non-injecting drug use (4). Twenty-six fatal cases had two or more underlying conditions, and 2 had none reported.

Streptococcal Invasive Disease – Group B

Five hundred seventy-six cases of invasive group B streptococcal (GBS) disease (10.4 per 100,000 population), including 32 deaths, were reported in 2017. By age group, annual incidence was highest among infants <1 year of age (50.0 per 100,000 population) and cases aged ≥70 years (40.5 per 100,000). Eighteen (35%) of the 32 deaths were among cases ≥65 years. Fifty percent of cases were residents of the metropolitan area. Bacteremia without a focus of infection occurred most frequently (32%), followed by cellulitis (20%), septic arthritis (7%), abscess (6%), osteomyelitis (5%), pneumonia (5%) and meningitis (1%). The majority (80%) of cases had GBS isolated from blood; other isolate sites included joint fluid (10%) and bone (1%).

Forty-two cases were infants or pregnant women (maternal cases), compared to 38 cases in 2016. Twenty infants developed early-onset disease (occurred within 6 days of birth [0.3 cases per 1,000 live births]), and 13 infants developed late-onset disease (occurred at 7 to 89 days [0.2 cases per 1,000 live births]). Six stillbirth/spontaneous abortions were associated with the 9 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, we reviewed the maternal charts for all early-onset cases reported in 2017. Overall, 12 of 20 women who delivered GBS-positive infants underwent prenatal screening for GBS. Of these, 1 was positive and 11 negative. One of the 8 women who did not receive

prenatal screening was screened upon admission to the hospital and prior to delivery, and was positive. Among the 20 women who delivered GBS-positive infants, 9 received intrapartum antimicrobial prophylaxis (IAP) including the woman with a positive GBS screened after hospital admission.

Streptococcus pneumoniae Invasive Disease

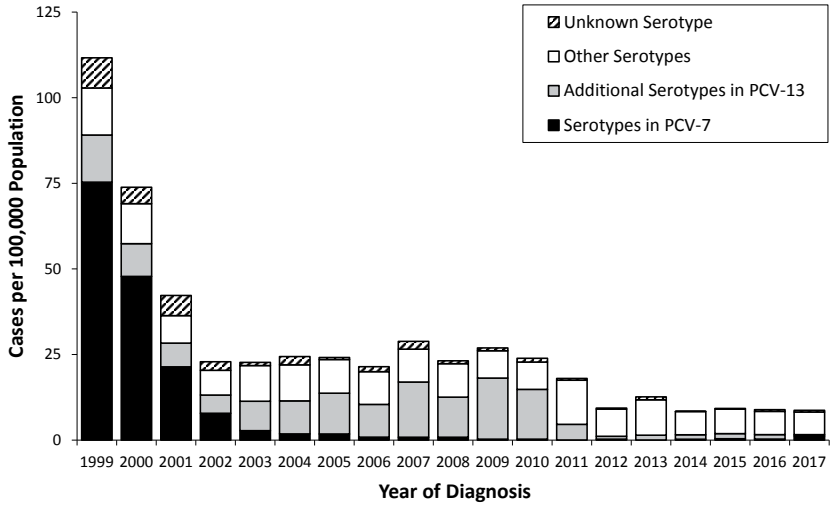
In 2017, 482 (8.7 per 100,000) cases of invasive pneumococcal disease (IPD) were reported. By age group, annual incidence rates per 100,000 were 8.5 cases among children aged ≤4 years, 1.6 cases among children and adults aged 5-39 years, 10.4 cases among adults 40-64 years, and 26.9 cases among adults aged ≥65 years.

Pneumonia occurred most frequently (53% of infections), followed by bacteremia without another focus of infection (23%), septic shock (9%), and meningitis (6%). Forty-seven (10%) cases died. Health histories were available for 44 of these deaths; of these, 37 had an underlying health condition reported. The conditions most frequently reported were chronic kidney disease (8), atherosclerotic cardiovascular disease (8), emphysema/chronic obstructive pulmonary disease (7), diabetes (7), cardiac failure (6), current smoker (6), and solid organ malignancy (6).

In 1999, the year before the pediatric pneumococcal conjugate vaccine (Prevnar [PCV-7]) was licensed; the rate of IPD among children <5 years of age 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 8 years were level or somewhat higher. 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).

In March 2010, the U.S. Food and Drug Administration approved a 13-valent pediatric pneumococcal conjugate vaccine (PCV-13 [Prevnar 13]) which replaced PCV-7. This vaccine provides protection against the same serotypes in PCV-7, plus 6 additional serotypes (serotypes 1, 3, 5, 6A, 7F, and 19A). From 2007 to 2010, the majority of IPD cases among children <5 years of age has been caused by the 6 new serotypes included in PCV-13 (Figure 6). Since 2011, the majority of IPD cases among children <5 years of age has been caused by serotypes not included in PCV-13.

Figure 6. Invasive Pneumococcal Disease Incidence Among Children <5 Years of Age, by Year and Serotype Group, Metropolitan Area, 1999-2001; Minnesota, 2002-2017



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).

In 2017, 19% of cases with isolates available for testing were caused by 6 of the PCV-13-included serotypes: 3 (10%), 19F (4%), 19A (2%), 7F (2%), 9V (<1%), and 18C (<1%).

In August 2014, the Advisory Committee on Immunization Practices (ACIP) recommended that all adults ≥65 years receive 1 dose of PCV-13 followed by 1 dose of 23-valent pneumococcal polysaccharide vaccine 6 to 12 months later. Among adults ≥65 years, 14% of cases in 2017 had PCV-13 serotypes.

Of the 455 isolates submitted for 2017 cases, 81 (18%) isolates were resistant to penicillin using meningitis breakpoints. Using non-meningitis breakpoints, 2 (<1%) of 455 isolates were resistant to penicillin. (Note: CLSI penicillin breakpoints changed in 2008). Multi-drug resistance (i.e., high-level resistance to two or more antibiotic classes) was exhibited in 69 (15%) isolates.

Tetanus

One case of tetanus was reported in 2017. A 65 year-old male, who received his last tetanus-containing vaccine in 1972, sustained a puncture wound from rusty nails in an attic. He presented to a clinic 1 week later with malaise and jaw dysfunction. He was admitted to a hospital to receive tetanus immune globulin and was discharged within 1 day.

Toxic Shock Syndrome

In 2017, 2 cases of staphylococcal toxic shock syndrome (TSS) were reported. Both cases occurred in females <18 years old. They were hospitalized, and both survived.

Eleven cases of confirmed streptococcal toxic shock syndrome (STSS) were also reported. Of the reported cases, 7 were female (64%), and the median age was 42 years (range, newborn to 64 years). All cases were hospitalized, and 1 case was fatal. One case was wound-associated; 1 was postpartum; 1 burn; and 1 postsurgical.

Toxoplasmosis

In 2017, 9 cases were reported, similar to the 7 reported in 2016, and 9 reported in 2015. Two cases had immunocompromising conditions. Seven cases were diagnosed with ocular toxoplasmosis, 1 with generalized toxoplasmosis, and 1 was diagnosed with cerebral toxoplasmosis. There were no pregnant cases. The median age of cases was 42 years (range, 14 to 60). Six cases were male. Two cases were white, 5 were black, and 2 were of unknown race; 8 cases were non-Hispanic and 1 was of unknown ethnicity.

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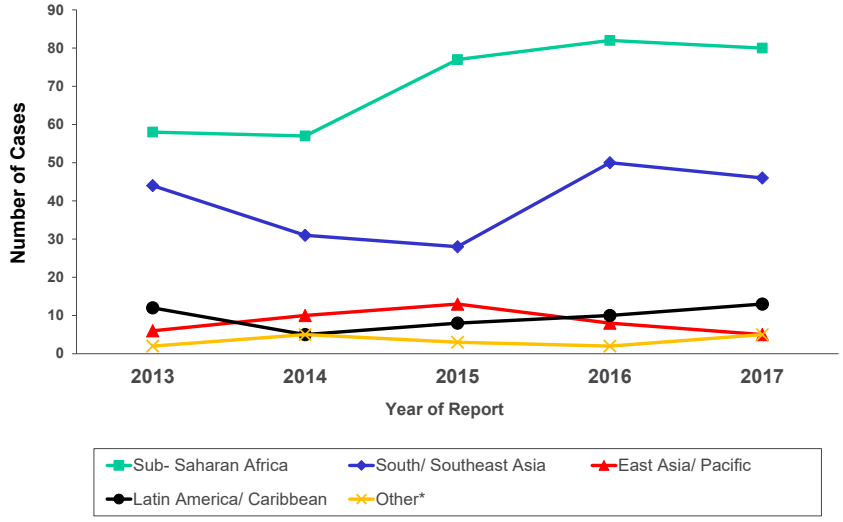
Figure 7. Non U.S.-Born Tuberculosis Cases by Region of Birth and Year of Report, 2013 – 2017



Tuberculosis

In 2017, 178 tuberculosis (TB) cases (3.2 per 100,000 population) were reported. This represents a 6% increase in the number of cases compared to 2016, when there were 168 cases. The TB incidence rate in Minnesota has typically been lower than the overall rate in the United States, but Minnesota's rate in the last couple of years has been higher than the national rate (2.8 per 100,000 in 2017). Despite an increase in the number and rate of new cases in Minnesota over the past few years, the TB case count has decreased 25% since 2007, when 238 cases were reported, and has remained under 200 since 2009. Eight (4%) cases from 2017 have died, 4 of whom died due to TB disease.

There was an increase in the number of TB cases in the youngest and oldest age groups, two groups at higher risk of developing active TB disease. In 2017, 7% of TB cases were <5 years at the time of diagnosis, compared to 4% in 2016. Twenty-two percent of cases were 65 years of age and older, compared to 16% in 2016.

Twenty-two (25%) counties had at least 1 TB case in 2017. The majority (73%) of cases occurred in the metropolitan area, primarily in Hennepin (39%) and Ramsey (21%) Counties. Twenty-two (12%) were from the other 5 metropolitan counties. The remaining 27% of cases were reported from Greater Minnesota, representing a 4% increase from 2016. Among metropolitan area counties, the highest TB incidence rate in 2017 was reported in Ramsey County (7.0 per 100,000), followed by Hennepin County (5.7 per 100,000). The TB incidence rate for all Greater Minnesota counties combined was 1.9 per 100,000.

Most (78%) TB cases were identified as a result of individuals seeking medical care for symptoms of disease. Various targeted public health interventions identified the majority of the remaining 22% of cases. Such case identification methods are high priority core prevention and control activities and include contact investigations (14%), domestic refugee health assessments (1%), and follow-up evaluations of individuals with abnormal findings on pre-immigration exams where infectious TB disease had been ruled out (<1%). An additional 3% were identified through other screening (e.g., other immigration medical exams, employment screening, other targeted testing for TB). Six (3%) cases were diagnosed with active TB disease incidentally while being evaluated for another medical condition.

TB incidence is disproportionately high among racial and ethnic minorities in Minnesota as well as in the United States. In 2017, 7 cases occurred among non-Hispanic whites, a case rate of 0.2 per 100,000. In contrast, among non-Hispanic persons of other races, 95 cases occurred among Africans/blacks (25.8 cases per 100,000), 51 among Asian/Pacific Islanders (17.9 cases per 100,000), and 6 cases among American Indian/Alaska Natives (8.9 cases per 100,000). Nineteen cases were Hispanic persons of any race (6.6 cases per 100,000). The majority of Hispanic (68%), black (84%), and Asian cases (100%) were non-U.S. born.

In 2017, the percentage of TB cases in Minnesota occurring in persons born outside the United States was 84%, compared to 70% of TB cases reported nationally. The 149 non-U.S. born TB cases represented 31 different countries of birth; the most common region of birth among these cases was Sub-Saharan Africa (54% of non-U.S. born cases), followed by South/Southeast Asia (31%), Latin America (including the Caribbean) (9%), and East Asia/Pacific (3%). Patients from other regions (North Africa/Middle East, Eastern Europe, and Western Europe) accounted for the remaining 3% of cases (Figure 7).

Individuals in other high risk groups comprised smaller proportions of the cases. Note that patients may fall under more than one risk category. Thirty-one percent occurred in persons with certain medical conditions that increase the risk for progression from latent TB infection (LTBI) to active TB disease (e.g., diabetes, prolonged corticosteroid or other immunosuppressive therapy, end stage renal disease), up from 18% in 2016. The next most common risk factor was substance abuse (including alcohol abuse and/or injection and non-injection drug use) during the 12 months prior to their TB diagnosis (4%). Four percent of cases were co-infected with HIV, down from 7% in 2016. Four percent also reported being homeless during the 12 months prior to diagnosis, 3% were residents of long-term care facilities, and 1% were in a correctional facility at time of diagnosis.

By site of disease, 54% of cases had pulmonary disease exclusively. Another 13% had both pulmonary and extrapulmonary sites of disease, and 32% had extrapulmonary

disease exclusively. Among the 81 patients with an extrapulmonary site of disease, the most common sites were lymphatic (52%), followed by musculoskeletal (21%). Extrapulmonary disease is generally more common among persons born outside the United States. Fifty-two percent of non-U.S. born patients had at least one extrapulmonary site of disease, compared to only 10% of U.S.-born cases.

Of 141 culture-confirmed TB cases with drug susceptibility results available, 32 (23%) were resistant to at least one first-line anti-TB drug (i.e., isoniazid [INH], rifampin, pyrazinamide, or ethambutol), including 22 (16%) cases resistant to at least INH. There were 9 new cases of multidrug-resistant TB (MDR-TB or resistance to at least INH and rifampin) reported in 2017, compared to 8 MDR-TB cases in 2016. In the 5-year period before that (2011-2015), there were a total of 5 MDR-TB cases.

Tularemia

Tularemia is an acute illness caused by *Francisella tularensis* subspecies *tularensis* (type A) or *holarctica* (type B). Routes of transmission include arthropod bites (particularly ticks and deer flies), contact with infected animals, and exposure to contaminated water or soil. There are six main clinical forms of disease and all include fever: ulceroglandular, glandular, pneumonic, oropharyngeal, oculoglandular, and typhoidal.

In 2017, 6 tularemia cases were reported; 4 were culture-confirmed cases, 2 were probable cases. Four cases had ulceroglandular, 1 had glandular, and 1 case had pneumonic tularemia. Two cases had type B tularemia, 2 had type A tularemia, and 2 were diagnosed by serology only and had an unidentified subtype. The median age of cases was 37.5 years (range, 6 to 79); 4 were female. Five cases were hospitalized, and all survived. Four cases likely acquired tularemia from a tick or deerfly bite, 1 from a cat bite, and 1 acquired tularemia by inhaling the bacteria, likely while mowing his lawn. This is the greatest number cases reported in one year since 1953 when there were also 6 cases reported.

From 2007 to 2017, 16 tularemia cases were reported, with a range of 0 to 6 cases annually. Ten cases had ulceroglandular, 3 had glandular, 2 had typhoidal, and 1 had pneumonic tularemia. Eight of 12 cases with a known tularemia subtype had type B, and 4 had type A. The median age of cases was 42.5 years (range, 2 to 87). Ten cases were most likely exposed through a tick or biting fly bite, 2 cases through water exposures, 2 cases through a cat scratch or bite, 1 case was exposed by inhaling the bacteria, and 1 case's exposure could not be determined. Twelve of 14 cases for which race was known were white, 1 was black, and 1 was American Indian/ Alaska Native.

Unexplained Critical Illnesses and Deaths of Possible Infectious Etiology and Medical Examiner Deaths Surveillance

MDH conducts surveillance for unexplained deaths and critical illnesses in an effort to identify those that may have an infectious etiology. This surveillance is performed through two complementary surveillance systems, Unexplained Critical Illnesses and Deaths of Possible Infectious Etiology (known as UNEX), and Medical Examiner (ME) Infectious Deaths Surveillance (known as MED-X) which is not limited to deaths with infectious hallmarks. 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 conducted or facilitated by MDH may be indicated. Testing of pre-mortem and post-mortem specimens is conducted at the PHL and the CDC Infectious Diseases Pathology Branch (IDPB).

In 2017, 80 cases met UNEX criteria (69 deaths, 11 critical illnesses), compared to 97 cases in 2016. Of the 80, 51

Table 5. UNEX/MED-X Pathogens Identified as Confirmed, Probable, or Possible Cause of Illness, 2017*

Pathogen Identified	UNEX (n=33)	MED-X (n=53)**
Adenovirus type 7	1	0
Aerococcus urinae	1	0
Aspergillus spp.	0	2
Candida spp.	2	0
Capnocytophaga canimorsus	1	0
Clostridium difficile	0	1
Clostridium spp.	1	0
Enterococcus spp.	1	2
Epstein-Barr virus	1	0
Escherichia coli	0	4
Group A Streptococcus/ *Streptococcus pyogenes*	2	5
Group B Streptococcus	0	2
Haemophilus influenzae	1	0
Haemophilus influenzae type F	1	0
Herpes simplex virus 1	1	0
Influenza A virus (no hemagglutinin typing information available)	0	4
Influenza A – H3	6	0
Influenza B	2	1
Klebsiella pneumoniae	1	3
La Crosse encephalitis virus	1	0
Legionella spp.	1	0
Metapneumovirus	0	1
Parainfluenza virus type 2	2	0
Parainfluenza virus type 3	1	0
Parainfluenza virus type 4	2	0
Proteus mirabilis	1	0
Respiratory syncytial virus	2	3
Staphylococcus aureus	1	12
Staphylococcus aureus - MRSA	0	1
Staphylococcus spp.	0	1
Serratia marcescens	1	0
Streptococcus spp.	2	5
Streptococcus intermedius	1	2
Streptococcus pneumoniae	4	4

* Some cases had multiple pathogens identified as possible coinfections contributing to illness/death.
** MED-X includes pathogens identified by the Medical Examiner. If the cause was found through testing at MDH/CDC it is included in the UNEX column.

continued...

(64%) were reported by providers, 28 (35%) were found by death certificate review, and 1 (1%) was discovered by public health investigation. Forty-one (51%) cases presented with respiratory symptoms, 20 (25%) with sudden unexpected death, 8 (10%) with neurologic symptoms, 3 (4%) with shock/sepsis, 4 (5%) with cardiac symptoms, 1 (1%) with gastrointestinal illness, and 3 (4%) with multiple symptoms. The age of cases ranged from newborn to 70 years. The median age was 15 years among 52 reported cases, and 44.5 years among 28 non-reported cases found through active surveillance. Fifty-four percent resided in the metropolitan area and 50% were female.

There were 257 MED-X cases in 2016; 69 of these also met UNEX criteria. The median age of the cases was 48 years, and 55% were male. There were 180 (70%) cases found through death certificate review; MEs reported 75 (29%) cases. The most common syndrome was pneumonia/upper respiratory infection (106 [41%]).

There were 148 potential UNEX or MED-X cases that had specimens tested at the PHL and/or the IDPB. Thirty-three cases had pathogens identified as confirmed, probable, or possible cause of illness, including 29 UNEX deaths (Table 5). Thirty-four were determined to be non-infectious. Among 38 unexplained deaths occurring in those <50 years of age without any immunocompromising conditions, UNEX helped to identify the pathogen(s) involved in 13 (34%) cases. MED-X surveillance detected an additional 53 cases with pathogens identified by MEs as the cause of death (Table 5). Cases with pathogens of public health importance detected included a 59 year-old male who presented to the emergency room with acute respiratory distress syndrome and rhabdomyolysis. PHL testing detected *Legionella* spp. by PCR leading to a public health investigation. UNEX laboratory testing detected *Capnocytophaga canimorsus* infection in a whole blood sample from a 60 year-old male who had traveled to Minnesota for a conference, succumbed to sepsis-like syndrome, but the family declined autopsy. Further investigation determined the man had a splenectomy from an earlier accident, and also was a dog owner. Finally, UNEX surveillance was able to diagnose a case of La Crosse encephalitis in a 14 year-old female. A public health investigation found that she lived near a private property with large numbers of used tires that were collecting rainwater.

Varicella and Zoster

In 2017, 432 varicella cases (8.0 per 100,000 population) were reported, the highest incidence since 2013. Two hundred ninety-seven (69%) were from the metropolitan area. Cases ranged from 7 weeks to 85 years of age. Sixty-one cases (14%) were <1 year, 170 (39%) were 1-6 years, 99 (23%) were 7-12 years, 29 (7%) were 13-17 years, and 73 (17%) were ≥18 years of age. Nine cases were hospitalized; 1 was 9 months, 2 were 5-14 years, and 6 were >24 years of age. Four had severe disease and/or complications including pneumonia, viral labyrinthitis, bacterial superinfection, and dehydration. One was immunocompromised and 2 had a co-morbidity. Seven had never received varicella-containing vaccine; 4 were adults who had never been offered the vaccine, 1 had a history of previous disease, 1 was underage for vaccination, and 1 was unvaccinated due to parental refusal. One case who was immunocompromised had been vaccinated with 1 dose of varicella vaccine, and 1 case had unknown history of vaccination. There were no varicella-related deaths.

Varicella cases are often identified by parents/guardians reporting to schools and child care facilities, rather than directly reported by a clinician. Of the 430 cases for which information regarding diagnosis was available, 313 (73%) had visited a health care provider, 28 (7%) had consulted a provider or clinic by telephone, 7 (2%) had been identified by school health personnel, and 82 (19%) had not consulted a health care provider. Of the 320 cases for which information regarding laboratory testing was available, 153 (36%) had testing performed.

Eleven percent of cases occurred as part of an outbreak, defined as ≥5 cases in the same setting. Three outbreaks occurred in schools. All were charter or private schools offering grades K though 9 or higher. Two outbreaks included several sets of unvaccinated siblings. The largest outbreak had 21 cases; 3 cases were fully vaccinated, and 18 were unvaccinated. Of the unvaccinated cases, 10 were due to parental refusal; 8 were unknown because a parent interview could not be obtained. Two outbreaks occurred in the infant rooms of child care centers; each had 9 cases, all of whom were too young to be vaccinated. In one outbreak, hand, foot and mouth disease was clinically diagnosed or suspected by health care providers of several cases; specimens from 5 cases were submitted by parents using kits supplied by MDH for further characterization. All 7 cases tested positive for VZV by PCR, and all 5 specimens tested at MDH were negative for enteroviruses by PCR.

Zoster cases in children <18 years of age are reportable; 77 cases were reported. Cases may be reported by school health personnel, child care staff, or healthcare providers. Ages ranged from 10 months to 17 years (median 11 years). Varicella vaccine became a requirement for entry into kindergarten and 7th grade in 2004, and the incidence of zoster in children has declined from 15.7 per 100,000 population in 2006 to 6.0 per 100,000 population in 2017. In 2017, the PHL performed strain typing on specimens from 28 zoster cases. Of the 23 vaccinated cases, 20 (87%) were positive for the vaccine strain and 3 (13%) were positive for the wild type virus. All 5 unvaccinated cases were positive for the wild type virus. Although the vaccine strain can reactivate and cause zoster, our data suggest that the incidence of zoster is lower in vaccinated children which is consistent with previously published findings.

Zoster with dissemination or complications (other than post-herpetic neuralgia) in persons of any age is also reportable; 65 such cases were reported, and 59 were hospitalized. Cases ranged from 15 to 93 years of age, with a median age of 61. Thirty-nine (60%) had co-morbidities or were being treated with immunosuppressive drugs. Twenty-nine had disseminated rash or disease, 18 had meningitis, 8 had cellulitis or other bacterial superinfection, 5 had encephalitis, 9 had Ramsay-Hunt Syndrome, 2 had Bell-like palsy, and 1 had pneumonia. Cases with disseminated

rash or disease tended to be older than cases with meningitis without dissemination (median age of 68 vs. 44 years), and were more likely to have immunocompromising conditions or immunosuppressive drug treatment (82% vs. 15%). Two deaths occurred, 1 with encephalitis, and 1 with disseminated disease. Twenty-four percent of cases ≥60 years of age had received zoster vaccine.

Viral Hepatitis A

In 2017, 30 cases of hepatitis A (0.6 per 100,000 population) were reported. Twenty-four cases were residents of the metropolitan area. Twenty-one cases were male. The median age of cases was 37 years (range 2 to 75). Race was known for 29 cases; 24 (80%) were white, 3 (10%) were black, and 2 (7%) were Asian/Pacific Islander Two (7%) cases were known to be of Hispanic ethnicity.

Eleven cases were associated with travel. No risk factor was identified for the other 19 cases. No outbreaks occurred.

Viral Hepatitis B

In 2017, 23 cases of acute hepatitis B virus (HBV) infection (0.4 per 100,000 population) were reported. In 2012, the case definition for acute hepatitis B was revised to include laboratory confirmed asymptomatic acute cases. Four of the 23 cases were asymptomatic, laboratory-confirmed infections.

The median age of cases was 45 years (range 17 to 67). Eighteen (78%) cases were residents of the metropolitan area, including 7 (30%) in Hennepin County, and 8 (35%) in Ramsey County. Sixteen (70%) cases were male, and 11 (48%) were between 13-39 years of age. Race was known for 21 cases; of those, 11 were white, 5 were black, and 5 were Asian/Pacific Islander. No cases were of Hispanic ethnicity. Incidence rates were higher among Asians (0.2 per 100,000) and blacks (1.6 per 100,000), than among non-Hispanic whites (0.2 per 100,000).

Two hundred fifty-one reports of newly identified cases of confirmed chronic HBV infection were received in 2017. A total of 24,486 persons are estimated to be alive and living in Minnesota with chronic HBV infection. The median age of chronic HBV cases in Minnesota is 45 years.

In addition to the 23 hepatitis B cases, no perinatal infections were identified in infants born to HBsAg positive mothers. Three hundred forty-six infants born to HBV-infected women during 2015 had post-serologic testing demonstrating no infection.

Viral Hepatitis C

In 2017, 59 cases of acute hepatitis C virus (HCV) infection (1.1 per 100,000) were reported. In 2012, the case definition for acute hepatitis C changed to include documented asymptomatic seroconversion. Of the 59 cases, 16 (27%) were asymptomatic, laboratory-confirmed acute infection.

Thirty (51%) cases resided in Greater Minnesota. The median age of all cases was 32 years (range, 18 to 66). Thirty-four (58%) cases were male. Race was known for 57 cases; of those, 35 (61%) were white, 16 (28%) were American Indian/Alaska Native, and 6 (11%) were black. Three (5%) cases were known to be of Hispanic ethnicity.

MDH received 1,867 reports of newly identified chronic hepatitis C infections in 2017. In 2016, the case definition for chronic hepatitis C changed to exclude those previously reported. A total of 34,720 persons are estimated to be alive and living in Minnesota with chronic HCV infection. The median age of these cases is 58 years.

Zika Virus

Zika virus is a mosquito-borne flavivirus that was initially discovered in 1947 in Uganda, and the first human cases were identified in 1952. Historically this virus occurred only sporadically in Africa and Asia, but it gained attention after it resulted in outbreaks in Micronesia in 2007 and French Polynesia in 2013-2014. In spring 2015, cases were reported from Brazil, representing the first time the virus had been found in the Americas. Since then, the virus has spread to most countries and territories in the Western Hemisphere, and infections during pregnancy have been associated with adverse fetal outcomes, including microcephaly. Zika has been shown to be transmitted perinatally as well as through sexual contact, a route of transmission that has never before been associated with a mosquito-borne virus. The mosquito vectors for humans are the same *Aedes* spp. mosquitoes (*Ae. aegypti* and *Ae. albopictus*) that transmit dengue virus and Chikungunya virus. The outbreak in the Americas peaked in 2016, but cases are still reported from around the region.

Most people (up to 80%) infected with Zika virus do not develop symptoms, and of those that do, most will develop mild symptoms like fever, rash, joint pain, and conjunctivitis. Symptoms usually begin 3-7 days after a person is bitten by an infected mosquito, and most recover within a week. In some cases, severe complications such as Guillain-Barré syndrome can occur in patients following infection. With such a high proportion of asymptomatic infections, it is possible that many infections go undetected.

In 2017, 11 cases of Zika virus disease were reported in Minnesota residents. The median case age was 23 years (range, 15 to 39). Cases resided throughout Minnesota, although the majority (8) were from the metropolitan area, and were reported throughout the year. All cases presented with relatively mild illnesses or were asymptomatic and tested because they were pregnant. Five women in 2017 were found to have laboratory evidence of Zika virus infection during pregnancy, and to date, none of these infections have been associated with adverse pregnancy outcomes. All of the cases represented imported infections acquired abroad, with patients reporting travel to five different countries and territories in the Americas, with Mexico (7) being the most common destination.

Nationwide, human cases of Zika virus disease were reported from 42 states and the U.S. territories of Puerto Rico and the U.S. Virgin Islands. Most U.S. cases were acquired while traveling abroad, although local transmission continued into early 2017 in Florida and Texas, resulting in 7 locally acquired cases (2 from Florida and 5 from Texas).

Emerging Infections in Clinical Practice & Public Health:
New Insights, New Approaches

November 16, 2018

Radisson Blu-Mall of America
Bloomington, MN

7:00 *am*	*Registration and Continental Breakfast*
7:55	**Welcome and Introductions**
8:00	**Keynote: Respiratory Viruses – Does Airborne Transmission Occur?**
8:45	**Questions and Discussion**
	Trish Perl, MD, UT Southwestern
9:00	**Current and Future Antimicrobials for Highly Resistant Gram-Negative Infections**
9:30	**Questions and Discussion**
	Betsy Hirsch, PharmD, RPh, University of Minnesota
9:45	**Epidemiologic and Environmental Insights on Legionella**
10:15	**Questions and Discussion**
	Laura Cooley, MD, MPHTM, Centers for Disease Control and Prevention
10:30	*Refreshment Break*
10:45	**Hot Topics**
11:15	**Questions and Discussion**
	Richard Danila, PhD, MPH, Minnesota Department of Health
11:30	**The Influenza Vaccine We Need: Challenges and Opportunities**
12:00 pm	**Questions and Discussion**
	Michael Osterholm, PhD, MPH, University of Minnesota CIDRAP
12:15	**Lunch**
1:15	**What's New in Vaccines?**
1:45	**Questions and Discussion**
	Nicole Basta, PhD MPhil, School of Public Health, University of Minnesota
2:00	**Parasitic Infections and Tropical Diseases: Infection from the Travel Desk**
2:30	**Questions and Discussion**
	Abinash Virk, MD, Mayo Clinic
2:45	*Refreshment Break*
3:00	**Herpes Viruses Across the Lifespan**
3:30	**Questions and Discussion**
	Mark Schleiss, MD, University of Minnesota
3:45	**Panel: Interesting and Unusual Case Presentations of Public Health Importance**
	Moderator: *Dimitri Drekonja*
	Panelists: *Nipunie Rajapakse, MD, Mayo Clinic; John Alpern, MD, CTH, HealthPartners; Alison Galdys, MD, University of Minnesota*
4:30	*Evaluations & Adjourn*

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