DEPARTMENT OF HEALTH

DISEASE CONTROL NEWSLETTER

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Annual Summary of Communicable Diseases Reported to the Minnesota Department of Health, 2018

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 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: Minnesota Rules Governing Communicable Diseases (Minnesota Rules 4605.7000-4605.7800). The MDH Public Health Laboratory (PHL) performs microbiologic and molecular evaluation of isolates, such as pulsed-field gel electrophoresis (PFGE) and whole genome sequencing (WGS), to determine whether isolates (e.g., enteric pathogens such as *Salmonella* and *Escherichia coli* O157:H7, and invasive pathogens such as Group A streptococcus) 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 2018 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 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 2018, 496 confirmed or probable cases (8.9 cases per 100,000 population) were reported, down from the 638 cases reported in 2017 (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 627 cases reported per year since 2010. Sixty-two percent (307) of cases reported were male. The median age of cases was 61 years (range, 2 to 92), 17 years older than the median age of confirmed Lyme disease cases. As is typical, most cases had illness onsets during the summer months, with 72% of cases reporting illness onsets in June and July. In 2018, 132 (27%) cases were hospitalized for their infection, with a median duration of 4 days (range, 2 to 33 days).

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Table 1. Diseases Reportable to the Minnesota Department of Health

Reportable Diseases, MN Rules 4605.7000 to 4605.7900

Diseases Reportable to the Minnesota Department of Health

651-201-5414 or 1-877-676-5414 — 24 hours a day, 7 days a week

REPORT IMMEDIATELY BY TELEPHONE

- Anthrax (*Bacillus anthracis*)
- Botulism (*Clostridium botulinum*)
- Brucellosis (*Brucella* spp.)
- Cholera (*Vibrio cholerae*)
- Diphtheria (*Corynebacterium diphtheriae*)
- Free-living amebic infection (including at least: *Acanthamoeba* spp., *Naegleria fowleri*, *Balamuthia* spp., *Sappinia* spp.)
- Glanders (Burkholderia mallei) *
- Hemolytic uremic syndrome
- Measles (rubeola)
- Melioidosis (Burkholderia pseudomallei) *
- Meningococcal disease (*Neisseria meningitidis*) (invasive)
- Middle East Respiratory Syndrome (MERS)
- Orthopox virus
- Plague (*Yersinia pestis*)
- Poliomyelitis
- Q fever (*Coxiella burnetii*)
- Rabies (animal and human cases and suspected cases)
- Rubella and congenital rubella syndrome
- Severe Acute Respiratory Syndrome (SARS)
- Smallpox (variola)
- Tularemia (*Francisella tularensis*)
- Unusual or increased case incidence of any suspect infectious illness
- Viral hemorrhagic fever (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*)
- *Candida auris* **
- Campylobacteriosis (*Campylobacter* spp.)
- Carbapenem-resistant Enterobacteriaceae (CRE)
- 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
- Cryptosporidiosis (*Cryptosporidium* spp.)
- Cyclosporiasis (*Cyclospora* spp.)
- Dengue virus infection
- *Diphyllobothrium latum* infection
- Ehrlichiosis (*Ehrlichia* spp.)
- Encephalitis (caused by viral agents)
- Enteric *Escherichia coli* infection (*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*)
- Gonorrhea (*Neisseria gonorrhoeae* infections)
- *Haemophilus influenzae* disease (all invasive disease)
- Hantavirus infection
- Hepatitis (all primary viral types including A, B, C, D, and E)
- Histoplasmosis (*Histoplasma capsulatum*)
- Human immunodeficiency virus (HIV) infection, including Acquired Immunodeficiency Syndrome (AIDS)
- Influenza (unusual case incidence, critical illness, or laboratory-confirmed cases)
- Kawasaki disease
- *Kingella* spp. (invasive only)
- Legionellosis (*Legionella* spp.)
- Leprosy (Hansen's disease) (*Mycobacterium leprae*)
- Leptospirosis (*Leptospira interrogans*)
- Listeriosis (*Listeria monocytogenes*)
- Lyme disease (*Borrelia burgdorferi*, and other *Borrelia* spp.)
- Malaria (*Plasmodium* spp.)
- Meningitis (caused by viral agents)
- Mumps
- Neonatal sepsis (bacteria isolated from a sterile site, excluding coagulase-negative *Staphylococcus*) less than seven days after birth
- Pertussis (*Bordetella pertussis*)
- Psittacosis (*Chlamydophila psittaci*)
- Retrovirus infections
- Salmonellosis, including typhoid (*Salmonella* spp.)
- Shigellosis (*Shigella* spp.)
- Spotted fever rickettsiosis (*Rickettsia* spp. infections, including Rocky Mountain spotted fever)
- *Staphylococcus aureus* (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*
- Streptococcal disease - non-invasive *S. pneumoniae* (urine antigen laboratory-confirmed pneumonia)
- Syphilis (*Treponema pallidum*)
- Tetanus (*Clostridium tetani*)
- Toxic shock syndrome
- Toxoplasmosis (*Toxoplasma gondii*)
- Transmissible spongiform encephalopathy
- Trichinosis (*Trichinella spiralis*)
- Tuberculosis (*Mycobacterium tuberculosis* complex) (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)
- Varicella (chickenpox)
- *Vibrio* spp.
- Yellow fever
- Yersiniosis (enteric Yersinia spp. regardless of specimen source)
- Zika virus disease
- Zoster (shingles) (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*
- Candidemia (*Candida* spp.) (blood isolates only)
- Carbapenem-resistant *Acinetobacter* spp. (CRA), and *Pseudomonas aeruginosa* (CR-PA)
- *Clostridium difficile*
- Severe Acute Respiratory Illness
- Respiratory syncytial virus (RSV)

TO REPORT

DEPARTMENT OF HEALTH

- For immediate reporting call: 651-201-5414 or 1-877-676-5414.
- Report forms and more information: www.health.state.mn.us/diseasereport

FOOTNOTES

- 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.
- Invasive disease only: isolated from a normally sterile site, e.g.: blood, CSF, joint fluid, etc.
- 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.
- Also report a pregnancy in a person with Zika; or a person chronically infected with hepatitis B, HIV, or syphilis.

* Beginning July 13, 2018 pursuant to 4605.7080.
** Beginning August 1, 2018 pursuant to 4605.7080.
*** Nontuberculous Mycobacteria (extrapulmonary) expected reportable fall 2019 pursuant to 4605.7080.

Table 2. Cases of Selected Communicable Diseases Reported to the Minnesota Department of Health by District of Residence, 2018

	District (population per U.S. Census 2017 estimates)									
Disease	Metropolitan (3,077,416)	Northwestern (158,973)	Northeastern (324,914)	Central (757,631)	West Central (241,968)	South Central (291,389)	Southeastern (507,073)	Southwestern (217,242)	Unknown Residence	Total (5,576,606)
Anaplasmosis	104	105	99	110	43	4	29	2	0	496
Babesiosis	7	10	6	17	1	0	8	0	0	49
Blastomycosis	21	6	12	10	2	0	6	1	0	58
Botulism (Infant)	1	0	0	0	0	0	0	0	0	1
Campylobacteriosis	593	13	48	175	57	78	152	122	0	1,238
Cryptosporidiosis	142	14	29	54	35	56	133	69	0	532
Escherichia coli O157 infection	52	4	3	22	8	4	12	10	0	115
Hemolytic uremic syndrome	10	0	0	0	0	0	1	0	0	11
Giardiasis	270	7	46	35	26	26	46	52	0	508
Haemophilus influenzae disease	48	5	7	16	5	6	8	7	0	102
HIV (non-AIDS)	175	2	6	13	8	8	12	4	0	228
AIDS (diagnosed in 2018)	95	3	2	5	1	2	5	3	0	116
Legionnaires' disease	94	2	8	8	5	17	16	2	0	152
Listeriosis	4	0	0	2	0	2	1	0	0	9
Lyme disease	399	61	134	218	45	16	67	10	0	950
Measles (rubeola)	2	0	0	0	0	0	0	0	0	2
Mumps	10	0	0	1	0	0	2	0	0	13
Pertussis	199	13	41	60	6	10	58	10	0	397
Q Fever (acute)	1	0	0	0	0	0	1	0	0	2
Q Fever (chronic)	0	0	0	1	0	0	0	1	0	2
Salmonellosis	565	23	41	103	48	65	86	78	0	1,009
Sexually transmitted diseases	21,757	648	1,561	2,543	791	1,178	2,363	671	512	32,024
Chlamydia trachomatis - genital infections	15,411	468	1,213	2,023	634	1,036	1,809	634	403	23,564
Gonorrhea	5,648	142	324	438	146	124	516	97	107	7,542
Syphilis, total	698	38	24	82	11	18	38	7	2	918
Primary/secondary	232	13	6	23	5	4	7	2	0	292
Early latent*	205	20	9	29	4	4	12	1	2	286
Late latent**	255	4	8	30	2	10	18	3	0	330
Congenital	6	1	1	0	0	0	1	1	0	10
Other***	0	0	0	0	0	0	0	0	0	0
Shigellosis	121	0	0	9	3	4	6	3	0	146
Streptococcal invasive disease - Group A	201	16	31	31	13	16	47	12	0	367
Streptococcal invasive disease - Group B	294	10	44	82	31	39	53	26	0	579
Streptococcus pneumoniae disease	231	21	44	61	26	31	42	22	0	478
Tuberculosis	121	0	2	9	5	11	16	8	0	172
Tularemia	2	0	0	0	0	0	0	0	0	2
Varicella	197	7	10	43	19	14	20	15	0	325
Viral hepatitis, type A	9	0	2	2	2	0	1	0	0	16
Viral hepatitis, type B (acute infections only, not perinatal)	11	1	0	1	0	2	1	0	0	16
Viral hepatitis, type C (acute infections only)	27	9	9	4	7	0	3	1	0	60
West Nile virus	19	5	0	5	13	4	3	14	0	63
Zika virus	1	0	0	0	0	0	0	0	0	1

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

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

Endemic Mosquito-borne Arboviral Diseases

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 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, 63 WNV disease cases were reported in 2018, slightly more than the median number of cases per year (49) from 2012 to 2017, but considerably fewer than in record years. Thirty-five (56%) had neuroinvasive presentations including encephalitis or meningitis, and there were 2 deaths in older adults. The other 28 cases had West Nile fever. Seventy percent of the cases were male, and the median age was 62 years (range, 21 to 91). Thirty-nine (62%) cases were hospitalized. The majority of cases (95%) reported symptom onset in July, August, or September. Twenty-one asymptomatic WNV-positive blood donors were also identified in 2018. Risks for human WNV infection continue to be higher in central and western Minnesota where the primary mosquito vector, *Culex tarsalis*, is most abundant.

For the first time since 2009, there were no cases of La Crosse encephalitis reported. 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 2018, 11 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 21 to 82 years, with a median of 58 years, and 91% were male. Seven (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.

Imported Mosquito-borne Arboviral Diseases

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 2018, 13 cases were reported in Minnesota residents. The median case age was 38 years (range, 8 months to 69 years) and onset of symptoms occurred primarily in the latter half of the year from July through November. Twelve resided in the metropolitan area, and all infections were acquired abroad. Cases reported travel to many areas of the world, including to Haiti (7), Southeast Asia (3), Africa (2), and Central America (1).

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 throughout 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.

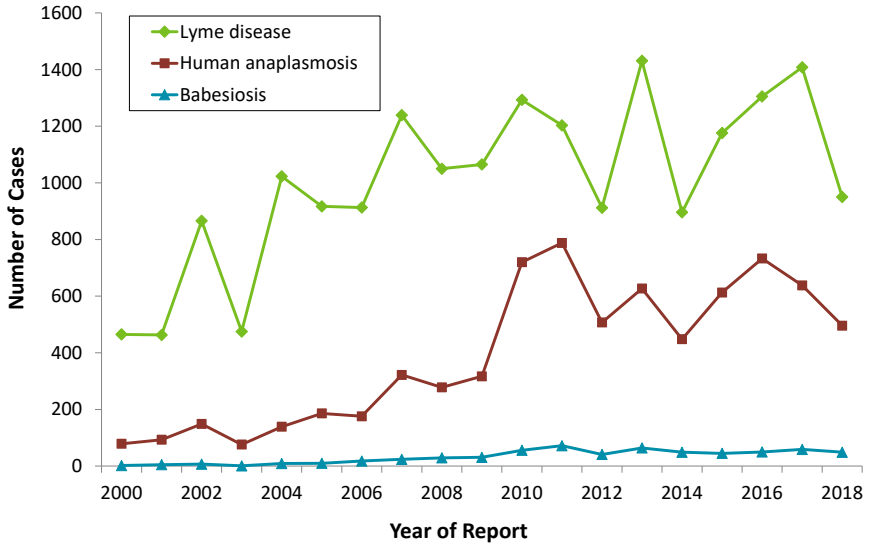
Unlike many other mosquito-borne viruses, most people who are infected with chikungunya develop symptoms. The most common symptoms are fever and joint pain, but patients may also experience headache, muscle aches, or rash. Symptoms usually begin 3-7 days after a person is bitten by an infected mosquito,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

In 2018, 7 cases were reported in Minnesota residents. The median case age was 38 (range, 30 to 76 years). Five resided in the metropolitan area and symptom onsets occurred all year, from February through November. All represented imported infections acquired abroad, and travel occurred to many areas of the world. Four traveled to Asia, two went to Africa, and one visited the Caribbean.

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

Figure 1. Reported *I. scapularis*-borne Disease Cases, 2000-2018



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.

Although the outbreak in the Americas peaked in 2016, cases are still reported from around the region. The risk for infection persists throughout many areas of the world, but the ability to detect a new outbreak varies by country, and reporting of new outbreaks may be delayed several weeks to months. Since most people (up to 80%) that are infected with Zika do not develop symptoms, it is possible that many infections, and even small outbreaks, may go undetected.

In 2018, only 1 case of Zika virus disease was reported, and 1 asymptomatic blood donor was also identified. The case was a symptomatic, non-pregnant female who traveled to Asia, and the donor was a male with a recent history of travel to Mexico.

Endemic Tick-borne Arboviral Disease

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 have been cases every year except for 2014 and 2015, with a peak of 11 cases in 2011 (range, 1 to 11). Three cases of POW were reported in 2018. Two of the three were female, and ages ranged from 48 to 61 years. Although cases of non-neuroinvasive disease have been reported in previous years, all of the patients in 2018 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 *I. 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 2018, 49 confirmed and probable babesiosis cases (1.1 per 100,000 population) were reported, down slightly from the 59 cases in 2017. 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 2018, 33 (67%) of the cases occurred in males. The median case age was 64 years (range, 5 to 84), identical to 2017, and older than the median ages for both anaplasmosis (61 years) and for confirmed cases of Lyme disease (44 years). Onsets of illness peaked in the summer months; 36 (86%) of 42 patients with known onset reported first experiencing symptoms in June, July, or August. Fifteen (31%) cases were hospitalized for their infection in 2018 for a median duration of 4 days (range, 2 to 10 days). A single case had severe complications (e.g., organ failure), but there were no deaths attributable to babesiosis.

Blastomycosis

In 2018, 58 blastomycosis cases were reported, the highest number since enhanced surveillance began in 1999. The 2 previous years (2017, 2016) had the third and fourth highest counts, 44 and 39 cases. The median age was 45.5 years (range, 5 to 90); 45 (78%) were male. Thirty-eight (75%) cases were white, 8 (16%) were black, 2 (4%) were American Indian/Alaska Native, 2 (4%) were Asian/Pacific Islander, 1 (2%) was mixed race, and 7 were unknown race. Thirty-five (60%) cases were hospitalized for a median of 7 days (range, 1 to 197). Eight (14%) cases died, which is a higher fatality rate than the normally observed 9-10%, and the second year in a row with an increased case fatality rate. Blastomycosis was the cause of death for all 8. Twenty-one cases (40%) had immunocompromising health conditions or medications, including 12 (28%) with diabetes, 3 (9%) taking corticosteroids, and 2 (5%) on medications for rheumatoid arthritis. Forty-two (72%) cases had pulmonary infection, 3 (5%) had extra-pulmonary infection, and 13 (22%) had disseminated infection.

From 1999 to 2018, 671 blastomycosis cases were reported; the annual median is 33.5 cases (range, 22 to 58). The median annual incidence statewide is 0.63 cases/100,000

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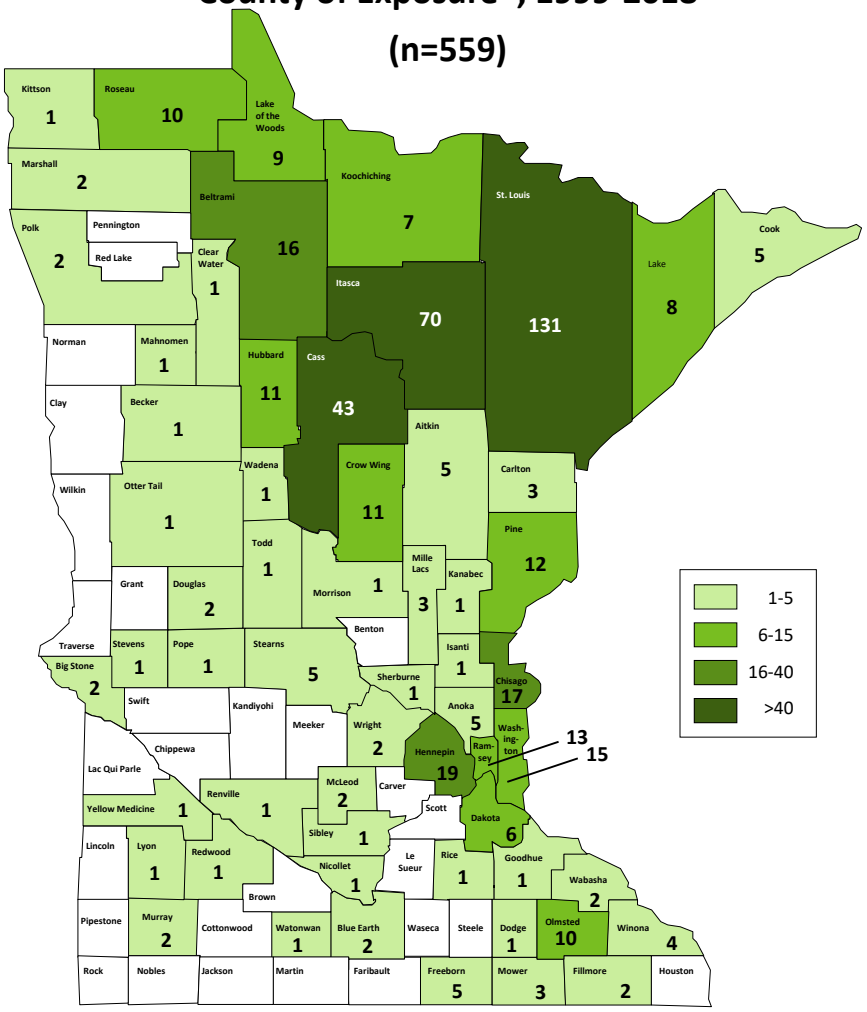
Figure 2. Human Blastomycosis Cases by Probable County of Exposure*, 1999-2018

(n=559)



* 52 cases were exposed in Wisconsin, 8 in other states, 10 in Canada, and 1 in South America. Exposure location is unknown for 112 cases.

population, but was 1.03 cases/100,000 in 2018. Exposure information is available for 559 cases. The largest number, 131 (23%), were likely exposed in St. Louis County. Seventy (13%) cases were likely exposed in Itasca County, 43 (8%) in Cass County, 19 (3%) in Hennepin County, 17 (3%) in Chisago County, and 16 (3%) in Beltrami County (Figure 2).

Botulism

Botulinum toxin, a neurotoxin, is produced by the spore-forming bacteria *Clostridium botulinum* and other related species. There are 8 distinct toxin types: A, B, C, D, E, F, G, and H. Toxin types A, B, E, F, and H can cause human intoxication. Botulism is characterized by a descending, bilateral paralysis that can be fatal without treatment. Botulism spores are ubiquitous in the environment and cause three main forms of intoxication: foodborne, wound, and intestinal-toxemia, which includes infant botulism and adult intestinal toxemia. Infant botulism, which is the most common form in the United States, results from the ingestion of *C. botulinum* spores that germinate into vegetative bacteria that colonize the intestinal tract, producing toxin that is absorbed into the circulation.

In 2018, 1 infant botulism case was reported. No foodborne or wound cases were reported. The infant was a 26 week-old who presented to the hospital with symptoms including weakened cry, inability to feed, progressive weakness, and ptosis. She was hospitalized for 11 days, received human botulism immune globulin and made a full recovery. The infant tested positive for *C. botulinum* toxin type B.

From 2001-2018, 14 cases of infant botulism and 2 cases of foodborne botulism were reported. The median age of infants was 19 weeks (range 5 to 41 weeks), and 8 (57%) were male. Eleven (79%) cases were caused by botulinum toxin type B and 3 (21%) by toxin type A; since 2006 all infant cases in Minnesota have been caused by toxin type B. Eleven infants were known to be hospitalized, for a median of 15 days (range 8 to 30 days); one infant did not require hospitalization. The 2 foodborne cases were of toxin type A, and occurred in 2009 in two men consuming home-canned asparagus. Both were hospitalized for 6 and 16 days. No deaths occurred among the infant or foodborne botulism cases.

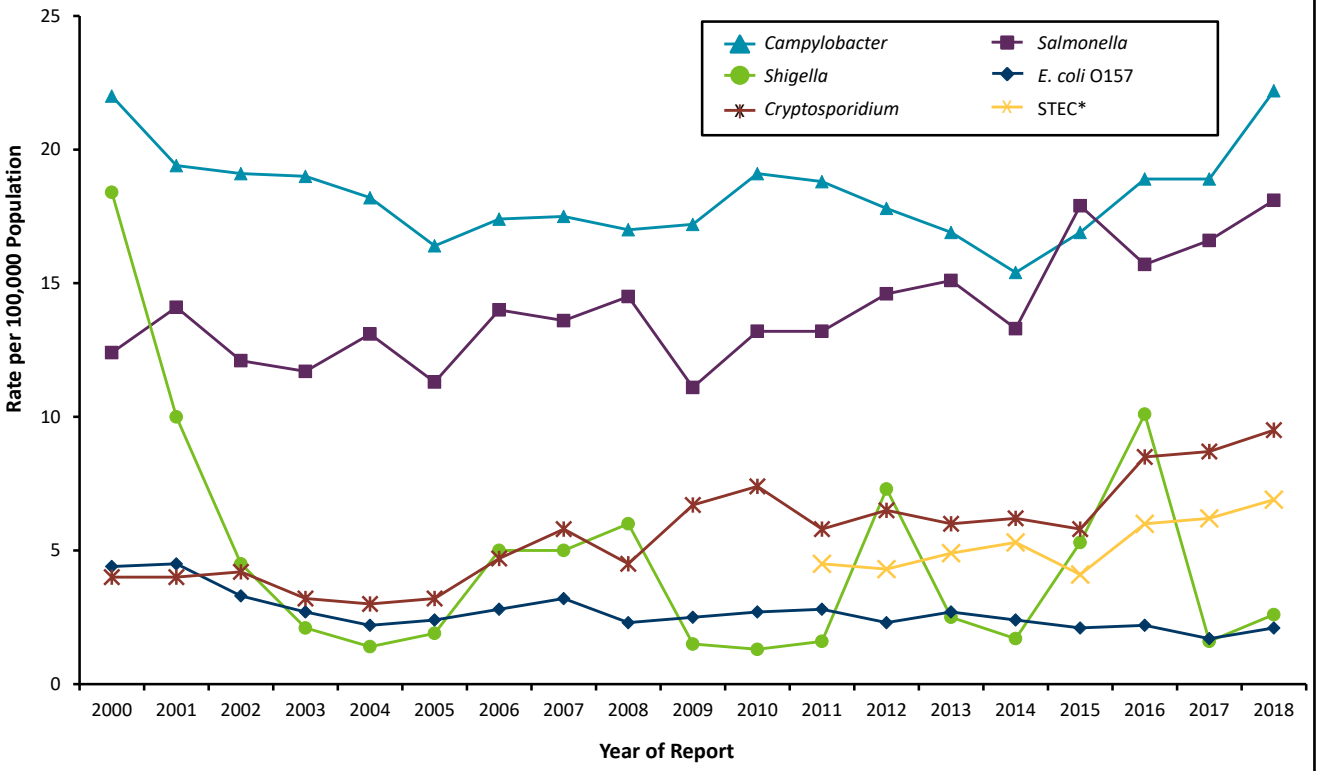
Brucellosis

Brucellosis is an acute or chronic illness caused by bacteria of the *Brucella* genus. There are 5 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 through 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 2018, 2 confirmed cases were reported; both were infected with *B. melitensis.* Case ages were 34 and 49 years; both were male; both were hospitalized and survived. The exposure for both cases was likely ingesting unpasteurized camel milk in Africa. One case's clinical isolate resulted in exposure of seven clinical laboratory staff.

From 2007 to 2018, 22 cases were reported. Fifteen 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). Fifteen 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 48 years (range, 3 to 86). Thirteen of the 22 cases for which race was known were black, 7 were white (of which 1 identified as Hispanic), and 2 were Asian/Pacific Islander.

Figure 3. Incidence of Selected Enteric Pathogens, 2000-2018



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

Campylobacteriosis

There were 1,238 culture-confirmed *Campylobacter* cases reported in 2018 (22.2 per 100,000 population). This is an 18% increase over the 1,049 cases reported in 2017, and a 32% increase from the annual median of 939.5 cases reported from 2008 to 2017 (range, 834 to 1,049) (Figure 3). In 2018, 48% of cases occurred in people who resided in the metropolitan area. Of the 1,178 *Campylobacter* isolates confirmed and identified to species by MDH, 83% were *C. jejuni* and 12% were *C. coli*.

The median age of cases was 36 years (range, 3 months to 95 years). Forty-two percent were between 20 and 49 years of age, and 9% were ≤5 years of age. Fifty-five percent were male. Fifteen percent were hospitalized; the median length of hospitalization was 4 days. Forty-five percent of infections occurred during June through September. Of the 1,126 cases for whom data were available, 233 (21%) reported travel outside the United States during the week prior to illness onset. The most common travel destinations were Europe (n=67), Mexico (n=52), Asia (n=47), Central or South America or the Caribbean (n=36), Africa (n=17), and the Middle East (n=12).

Seven outbreaks of *Campylobacter* infections were identified. Three outbreaks were due to foodborne transmission. One outbreak was associated with chicken liver pâté served at a restaurant, one outbreak was associated with a restaurant with an unknown vehicle of transmission, and one multistate outbreak was associated with consumption of chicken livers. An additional probable foodborne outbreak was likely caused by chicken wings served at a restaurant. Two animal contact outbreaks were identified; the vehicle of transmission was contact with puppies for both outbreaks. One outbreak of *Campylobacter* infections was associated with a child care facility, but the route of transmission was not confirmed.

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 2018, the overall proportion of quinolone resistance among *Campylobacter* isolates tested (n=129) was 40%. However, 89% 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. Twenty-one 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 2018, 74 patients were positive for *Campylobacter* by an antigen detection CIDT conducted in a clinical laboratory. However, only 17 (23%) 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 2018, 1,235 patients were positive for *Campylobacter* by a PCR gastrointestinal panel; 955 (77%)

continued...

of these specimens were culture-confirmed. Only culture-confirmed cases met the surveillance case definition for inclusion in MDH case count totals.

Candidemia

In 2017, surveillance began for candidemia among residents of the metropolitan area. Candidemia is a bloodstream infection with *Candida* fungal species, and is one of the most common types of healthcare-associated bloodstream infections in the United States. Risk factors include prolonged hospitalization in an intensive care unit, having a central venous catheter, a weakened immune system, recent surgery (especially abdominal surgery), recently receipt of antibiotics, total parenteral nutrition, kidney failure, hemodialysis, and diabetes.

In 2018, 139 cases of candidemia were reported among residents of the metropolitan area. The overall incidence rate was 4.5 per 100,000, and the highest county-level incidence was in Ramsey County (6.0 per 100,000). The median age was 57 years (range, newborn to 94 years). Seventy-five cases (54%) were male; 105 (76%) were white, 16 (12%) were black, 5 (4%) were Asian/Pacific Islander, 3 (2%) were American Indian/Alaska Native, and race was unknown for 10 cases.

Of the 139 cases, 97% were hospitalized at time of diagnosis, and 56 (41%) died while hospitalized. Underlying conditions included malignancy (37%), chronic lung condition (29%), diabetes (27%), renal disease (26%), neurologic condition (22%), skin condition (16%), and chronic liver disease (13%). Healthcare risk factors included receiving systemic antibiotics in the 14 days prior to diagnosis (94%); presence of a central venous catheter in the 2 days prior to diagnosis (75%); being admitted to the ICU in 14 days prior to, or 14 days after diagnosis (41%); and having surgery in the 90 days before diagnosis (37%).

More than 17 different *Candida* species are known to be agents of human infection; however, the two most common species comprised over 50% of candidemia infections. Of the 139 cases, 44% were *C. albicans*, 28% *C. glabrata*, 16% *C. parapsilosis*, 4% *C. tropicalis*, 4% *C. dubliniensis*, 3% *C. guilliermondii*, 2% *C. krusei,* and 3% with other species including *C. lipolytica, C. kefyr*, and *C. lusitaniae*. Three cases (2%) were co-infected with both *C. albicans and C. glabrata,* and 1 case (0.7%) was infected with *C. albicans, C. glabrata,* and *C. dubliniensis* at the time of incident specimen collection.

As primarily a healthcare-associated infection, injection drug use (IDU) has not been considered a common risk factor for candidemia. However, with the increasing opioid epidemic, IDU has been reported as an increasingly common condition associated with candidemia. In 2017, only 2/143 (1.4%) cases had IDU documented in their medical chart. However, in 2018, 15 (10.8%) cases had IDU documented in their medical chart. MDH has started collecting additional information regarding IDU in 2019 to monitor the changing trends in IDU and candidemia epidemiology.

Carbapenem-resistant *Enterobacteriaceae* (CRE), *Acinetobacter baumannii* (CRA), and *Pseudomonas aeruginosa* (CRPA)

Carbapenem-resistant *Enterobacteriaceae* (CRE), *Acinetobacter baumannii* (CRA), and *Pseudomonas aeruginosa* (CRPA) are Gram-negative bacilli that most commonly occur among patients with significant healthcare 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*. Carbapenem-resistant *A. baumannii* (CRA) is recognized as one of the leading causes of healthcare-associated infections worldwide, and is associated with high mortality rates and unfavorable clinical outcomes. 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 called carbapenemases. Certain carbapenemase genes (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 oxacillinase-48 [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 for all *Enterobacteriaceae* and *A. baumannii* resistant to imipenem, meropenem, doripenem, or ertapenem using Clinical and Laboratory Standards Institute (CLSI) breakpoints (ertapenem excluded for *Acinetobacter* isolates). In 2012, MDH used standardized EIP CRE and CRA definitions and initiated active laboratory- and population-based surveillance in Hennepin and Ramsey Counties. As a subset of statewide reporting, this surveillance includes all isolates from normally sterile sites or urine of the three most common types of CRE (*Escherichia coli*, *Enterobacter* spp., or *Klebsiella* spp.) and *A. baumannii* that are resistant to imipenem, meropenem, or doripenem. An incident case is defined as the first eligible isolate of each species collected from a Hennepin or Ramsey County resident in 30 days. In 2016, MDH initiated statewide CRE surveillance. MDH also tracks other *Enterobacteriaceae* including, but not limited to *Morganella* spp., *Proteus* spp., and *Providencia* spp. The PHL tests all CRE isolates for carbapenemase production using a phenotypic assay (modified carbapenem inactivation method [mCIM] or CarbaNP), and conducts PCR on isolates with a positive phenotypic test for KPC, NDM, OXA-48-like, VIM, and IMP genes. All CRA isolates are tested by PCR for KPC, NDM, OXA-48, VIM, and IMP genes, along with *Acinetobacter*-specific OXA genes (OXA-23, OXA-24, and OXA-58).

In 2018, 517 CRE incident cases representing 486 patients were identified from Minnesota residents; the most common cases were *Enterobacter* spp. (239) and *Klebsiella* spp. (124), followed by *E. coli* (70), *Citrobacter* spp. (32), *Serratia* spp. (23), *Proteus* spp. (11), *Providencia* spp. (7), *Morganella* spp. (5), and

other *Enterobacteriaceae* (6). Among 517 incident cases, there were 122 CRE incident cases (representing 118 patients) reported among residents of Hennepin and Ramsey Counties. Among these 122, 62 (51%) were *Enterobacter* spp., 35 (29%) *Klebsiella* spp., and 25 (20%) were *E. coli*. KPC was identified in 4 (3%); all were *E. cloacae*. CRE was most frequently isolated from urine (116), followed by blood (2) and other sites (4). We identified 10 additional surveillance cases (from 9 patients) through colonization screening. Among surveillance cases, there were 4 *K. pneumoniae*, 2 *E. cloacae*, and 2 *E. coli* isolates harboring carbapenemases (NDM [5], KPC [3], and OXA-48 [1]).

Among the 517 incident cases, 44 (9%) were carbapenemase-producing organisms. Twenty-seven (61%) cases (from 23 patients) were KPC positive (*E. cloacae* [13], *K. pneumoniae* [7], *K. oxytoca* [1], *C. freundii* [5], and *E. coli* [1]). Of note, 1 case was positive for 2 different organisms producing KPC in the same calendar year. Five incident cases (from 5 patients) were NDM positive (*E. coli* [3], *K. pneumoniae* [1], and *K. aerogenes* [1]). Two NDM-positive cases had healthcare exposure outside of the United States (India). Seven cases (from 7 patients) were OXA-48 positive (*E. coli* [5] and *K. pneumoniae* [2]) and 5 cases (from 5 patients) were IMP positive (*P. rettgeri* [3], *P. vulgaris* [1], and *M. morgannii* [1]). For colonization screening, 7 cases (78%) had healthcare exposure outside of the United States or from an area in the United States where carbapenemases are more common.

Among 40 Minnesota residents with carbapenemase-producing isolates, the median age was 61 years (range, 3 to 94); 21 (53%) were female; 16 (40%) were residents of Hennepin or Ramsey County, 4 were residents of Anoka County, and 2 residents each were of Dakota, Scott, and Washington Counties. Seventeen (43%) were inpatients at the time of specimen collection, 13 (33%) were in outpatient settings, 7 (18%) were in long-term acute care hospitals, and 3 (8%) were in long-term care facilities. Urine (27) was the most common isolate source followed by sputum (4), wound (3), blood (3), and other sites (3).

Detection of NDM and OXA-48 serve as a reminder to clinicians that assessing travel history to identify receipt of healthcare outside the United States is a critical component of early detection of CRE isolates with carbapenemases that are less common in the United States. In April 2019, MDH released recommendations for admission colonization screening to detect carbapenemase-producing organisms (CPO). In line with CDC recommendations, MDH strongly recommends that Minnesota hospitals screen on admission patients who received healthcare abroad in the last 12 months; healthcare abroad includes ambulatory surgery, hemodialysis, or an overnight stay. Furthermore, MDH recommends Minnesota hospitals consider screening patients on admission who received healthcare in the U.S. regions of Chicago, New Jersey, and New York City where CPO are more common.

In 2018, CDC released the Containment Strategy which provides guidance when responding to cases of novel or rare multidrug-resistant organisms (MDROs) including CPOs. Novel or rare MDROs are epidemiologically important because these organisms cause severe, difficult-to-treat infections, and have the potential to spread within healthcare settings. MDH utilizes the Containment Strategy in response to all single cases of carbapenemase-producing CRE, CRA, and CRPA. This rapid and aggressive action includes prompt identification of the organism, notification and investigation with healthcare facilities, and response or "containing the spread" in an effort to slow the spread of novel or rare MDROs in Minnesota.

In 2018, 20 CRA incident cases representing 15 patients were identified from clinical cultures among Minnesota residents. Urine (7) was the most common isolate source followed by wound (5), sputum (4), other sites (3), and blood (1). Eleven (55%) were hospitalized at the time of culture collection. Other CRA isolates were collected from patients in long-term care facilities (4), outpatient settings (3), and long-term acute care hospitals (2). Three CRA isolates possessed genes for carbapenemase production (2 OXA-23, 1 OXA-24). Of 20 CRA incident cases, 7 incident cases were reported for MuGSI and isolated from urine (5), wound (1), and blood (1). None were found to harbor a carbapenemase.

Active laboratory- and population-based surveillance for CRPA was initiated August 1, 2016 in Hennepin and Ramsey Counties as part of MuGSI and ended July 31, 2018. This surveillance included all CRPA isolates collected from normally sterile sites, wounds, urine, sputum, throat cultures from cystic fibrosis (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 the 2018 surveillance year (August 1, 2017-July 31, 2018) for carbapenemase production. Only 7 CRPA isolates (from 4 patients) were carbapenemase-producers (IMP [1], VIM [1]); 2 isolates were found, by whole genome sequencing, to be carrying potentially inducible genes (OXA-50 and OXA-2/OXA-50/PDC-7) capable of hydrolyzing carbapenems. Since there is an extremely low percentage (<1%) of CRPA isolates found to be carbapenemase-producers, the PHL has discontinued surveillance testing of CRPA isolates for carbapenemase production, but will perform testing on submitted isolates upon request of the submitting facility or clinical laboratory.

In the 2018 surveillance year, 801 CRPA incident cases representing 568 patients were identified from clinical cultures among Minnesota residents. Of 801 incident cases, 440 cases from 279 unique patients were reported in Hennepin and Ramsey County residents. Urine (268) was the most common source, followed by sputum (52), wounds (18), and lower respiratory sites (14). Among the 279 patients, median age was 58 years (range, <1 to 98); 210 (75%) were white, 31 (11%) were black, 8 (3%) were Asian/Pacific Islander, and 30 (11%) were of unknown race. Ninety-six (34%) were inpatient at the time of specimen collection including 36 patients who had their culture collected in the intensive care unit, 105 (38%) were outpatient, 34 (12%) were in the emergency department, 25 (9%) were in a long-term acute care hospital, and 19 (7%) were in a long-term care facility. More than half (144) were hospitalized within 30 days of their specimen collection date.

Clostridioides difficile

Clostridioides 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

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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. Most notable was a series of large-scale outbreaks in Quebec first reported in March 2003. During this period, Quebec hospitals reported a 5-fold increase in healthcare-acquired CDI. These and other healthcare facility (e.g., long-term care facilities) 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 in Minnesota, 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 2018, 868 incident cases of CDI were reported in the five sentinel counties (210 per 100,000 population), a decrease from 215 per 100,000 population in 2017. Sixty-one percent of these cases were classified as CA, 21% as CO-HCFA, and 18% as HCFO. The median ages for CA, CO-HCFA, and HCFO cases were 55, 64, and 73 years, respectively. Fifty-four percent of CA cases were prescribed antibiotics in the 12 weeks prior to stool specimen collection compared to 86% of HCFO cases and 85% of CO-HCFA cases. Of the 526 putative CA cases eligible for interview, 366 were interviewed and confirmed as CA cases. Fifty-two 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 (38%); dental procedures (16%); urinary tract infections (10%); and skin infections (7%). Prevention efforts should focus on appropriate antibiotic use.

Cryptosporidiosis

In 2018, 532 cases of cryptosporidiosis (9.54 per 100,000 population) were reported. This is markedly higher than the median number of cases reported annually from 2008 to 2017 (median, 342 cases; range, 235 to 481). The median age of cases in 2018 was 23.5 years (range, 3 months to 92 years). Children 10 years of age or younger accounted for 22% of cases. Sixty percent of cases occurred during July through October. The incidence of cryptosporidiosis in the Southwestern, Southeastern, South Central, and West Central districts (31.8, 26.2, 19.2, and 14.5 cases per 100,000, respectively) was significantly higher than the statewide incidence. Only 142 (27%) cases occurred among residents of the metropolitan area (4.6 per 100,000). Fifty-six (11%) cases were hospitalized, for a median of 4 days (range, 2 to 31 days). Three deaths were reported.

Fourteen confirmed outbreaks of cryptosporidiosis were identified, accounting for 34 laboratory-confirmed cases. Five recreational water outbreaks of cryptosporidiosis occurred, accounting for 108 cases (15 laboratory-confirmed). Three occurred at campgrounds (Goodhue, Le Sueur, and Waseca Counties), one was associated with a splash pad (Carver County), and one occurred at a municipal pool (Nicollet County). Two outbreaks associated with animal contact accounted for 8 cases (5 laboratory-confirmed); these outbreaks occurred in Rock and Stevens Counties. Seven outbreaks due to person-to-person transmission at child care centers accounted for 30 cases (14 laboratory-confirmed); the outbreaks occurred in Blue Earth (n=2), Kandiyohi (n=2), Carver, Fillmore, and Stearns Counties.

Cyclosporiasis

There were 156 cyclosporiasis cases reported in 2018 (2.80 per 100,000 population). This is markedly higher than the number of cases reported from 2008 to 2017 (range, 0 to 23 per year). In 2018, 44% of cases occurred in people who resided in the metropolitan area.

The median age of cases was 41 years (range, 13 to 88 years). Fifty-three percent were female. Three percent were hospitalized; the median length of hospitalization was 3 days (range, 2 to 8 days). Ninety percent of cases occurred during May through July. Of the 53 non-outbreak cases for whom data were available, 11 (20.1%) reported travel outside the United States during the 2 weeks prior to illness onset.

Four confirmed foodborne outbreaks of cyclosporiasis were identified in 2018, accounting for 100 laboratory-confirmed cases. A multi-state outbreak associated with vegetable trays purchased at convenience stores resulted in 62 Minnesota cases (all laboratory-confirmed). An outbreak associated with cilantro consumption at two independent restaurants in Hennepin County resulted in 73 cases (19 laboratory-confirmed). An outbreak associated with basil consumption at a restaurant in Ramsey County resulted in 16 cases (8 laboratory-confirmed). A multi-state outbreak associated with salads at a fast food restaurant resulted in 11 Minnesota cases (all laboratory-confirmed).

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

During 2018, 115 culture-confirmed cases of *Escherichia coli* O157 infection (2.06 per 100,000 population) were reported. The number of reported cases represents a 10% decrease from

the median number of cases reported annually from 2008 to 2017 (median, 126.5 cases; range, 96 to 146). During 2018, 52 (45%) cases occurred in the metropolitan area. Eighty-five (74%) cases occurred during May through October. The median age of the cases was 27 years (range, 7 months to 88 years). Twelve percent of the cases were 4 years of age or younger. Thirty (26%) cases were hospitalized; the median hospital stay was 3 days (range, 1 to 47 days). Two cases, a 73-year-old female and a 46-year-old female, died.

In addition to the 115 culture-confirmed *E. coli* O157 cases, 270 cases of Shiga toxin-producing *E. coli* (STEC) infection were identified. Of those, culture-confirmation was not possible in 1, and therefore it is unknown if this was O157 or another serogroup. Among the remaining 269 cases, *E. coli* O103 was the serogroup for 68 (25%) cases, *E. coli* O111 for 45 (17%), *E. coli* O26 for 28 (10%), *E. coli* O145 for 15 (6%), *E. coli* O121 for 10 (4%), and *E. coli* O45 for 5 (2%). The median age of the non-O157 STEC cases was 28.5 years (range, 4 months to 90 years). Forty-one (15%) cases were hospitalized; the median hospital stay was 2 days (range, 1 to 28 days). One case, a 63-year-old female, died.

Culture-independent tests (CIDTs) have become increasingly adopted by clinical laboratories for the detection of Shiga toxin in stool. Two hundred twenty-two 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.

Two *E. coli* O157 outbreaks were identified during 2018. Both outbreaks were due to foodborne transmission, and were part of national investigations. These outbreaks resulted in 14 laboratory-confirmed Minnesota cases, with 2 and 12 cases, respectively. In May, a national outbreak was associated with romaine lettuce. Twelve cases were identified in Minnesota. Three cases developed hemolytic uremic syndrome (HUS), and 2 cases died. In October, a national outbreak was associated with chicken salad. Two laboratory-confirmed cases were identified in Minnesota. Neither case developed HUS or died.

Three non-O157 STEC outbreaks were identified during 2018. One outbreak was due to person-to-person transmission, one was due to waterborne transmission, and one was due to animal contact. An outbreak of *E. coli* O111 infections was associated with a petting zoo at a campground. Five laboratory-confirmed cases were identified. Two cases developed HUS but none died. An outbreak of both *E. coli* O121 and *Cryptosporidium* infections was associated with a campground. Seventy-nine cases were identified, including 2 laboratory-confirmed cases of *E. coli* O121 infections and 5 laboratory-confirmed cases of *Cryptosporidium* infections. No cases developed HUS or died. An outbreak of *E. coli* O103 infections associated with person-to-person transmission occurred at a childcare facility in Martin County. Five cases, including 1 laboratory-confirmed, were identified. No cases developed HUS or died.

Hemolytic Uremic Syndrome (HUS)

In 2018, 11 HUS cases were reported. The number of reported cases is similar to the median number of cases reported annually from 2008 to 2017 (median, 12.5 cases; range, 9 to 17). In 2018, the median age of HUS cases was 46 years (range, 1 year to 81 years); 4 of the 11 cases occurred in children less than 7 years of age. All 11 cases were hospitalized, with a median hospital stay of 9 days (range, 3 to 48 days). From 1997 through 2018, the overall case fatality rate among HUS cases was 5.5%. Nine of the 11 HUS cases reported in 2018 were post-diarrheal. *E. coli* O157:H7 was cultured from the stool of 8 (73%) cases, *E. coli* O111 was cultured from the stool of 2 (18%) cases, and *E. coli* O777 was isolated from the stool of 1 (9%) case. In 2018, there were 5 outbreak-associated HUS cases. All outbreak-associated HUS cases were hospitalized; the median hospital stay was 11 days (range, 3 to 47 days), and 1 died.

Giardiasis

During 2018, 508 cases of *Giardia* infection (9.1 per 100,000) were reported. This represents a 22% decrease from the median number of cases reported annually from 2008 through 2017 (median, 654 cases; range, 620 to 846). Recent immigrants and refugees accounted for 8% of 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 35 years (range, 7 months to 98 years). Eighteen percent were <10 years of age, and 30% were >50 years of age. Fifty-seven percent of non-immigrant and refugee cases were male. *Giardia* infections had a summer/fall seasonality; 48% of non-immigrant and refugee cases occurred during July through October. Thirty-eight (7%) cases required hospitalization, for a median of 4 days (range, 2 to 27 days). Seven outbreaks were identified in Minnesota that accounted for 16 laboratory-confirmed cases. Five outbreaks were associated with person-to-person transmission in child care settings. One outbreak was associated with consumption of surface water along a Lake Superior hiking trail, and one outbreak was associated with swimming at a beach. Additionally, six Minnesota residents were involved in two outbreaks associated with backcountry camping trips in states outside Minnesota.

Haemophilus influenzae

One hundred two invasive *Haemophilus influenzae* disease cases (1.8 per 100,000 population) were reported in 2018. Cases ranged in age from newborn to 97 years (median 62 years*).* Allowing for more than one syndrome per case, 42 (33%) cases had pneumonia, 33 (26%) bacteremia, 13 (10%) meningitis, 9 (7%) septic shock, 3 (2%) epiglottitis, 3 (2%) septic arthritis, 2 (2%) cellulitis, 2 (2%) endometritis, 2 (2%) empyema, and the following each had 1 (1%): cholangitis, chorioamnionitis, endometritis, kidney infection, liver abscess, otitis media, pericarditis, and pyelonephritis. Twelve (12%) cases died.

Of 99 *H. influenzae* isolates for which typing was performed at PHL, 13 were type a, 1 type b (Hib), 6 type e, 12 type f, and 66 were untypeable. The 1 Hib disease case compared to 2 cases in 2017, 5 in 2016, 2 in 2015, and 1 in 2014. The case was a child <1 year of age, who had meningitis and survived. The child had received one Hib vaccination.

The 12 deaths occurred in patients ranging in age from newborn to 97 years. Seven cases had bacteremia without another focus of infection, (of these, 1 also had septic shock), and 5 had pneumonia. All 12 had *H. influenzae* isolated from blood. Co-morbidities were reported in 9 of them. Of the 12 that died, all case-isolates were untypeable.

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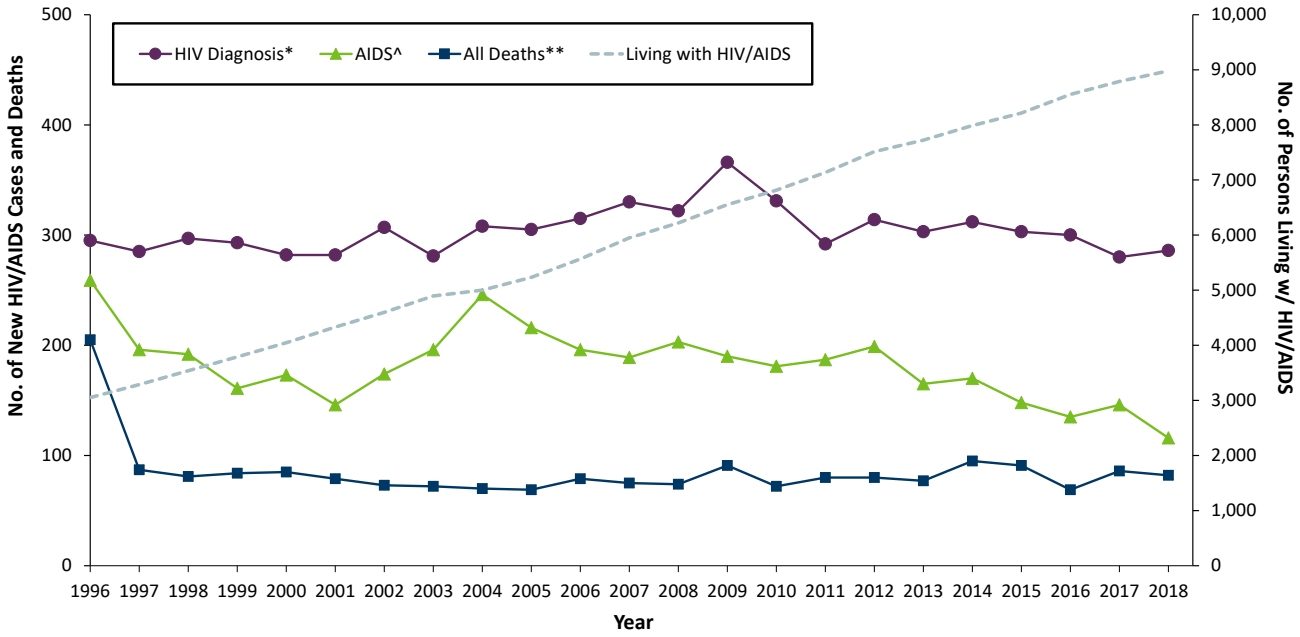
Figure 4. HIV/AIDS: Number of New Cases, Prevalent Cases, and Deaths by Year, 1996-2018



* 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.

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, though disseminated or non-pulmonary infections are possible. 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, the current case count can only be compared with that year. In 2018, there were 57 confirmed cases and 127 probable cases of histoplasmosis compared to 36 confirmed cases and 147 probable cases in 2017. The median age of cases was 46.5 years (range, 4 months to 84 years); 118 (64%) were male. Of the 157 cases with race reported, 137 (87%) were white, 7 (5%) were black, 6 (4%) were Asian/ Pacific Islander, 4 (3%) were American Indian/Alaska Native, and 3 (2%) reported more than one race. Of the 138 with ethnicity reported, 7 (5%) were Hispanic.

Seventy-two cases (39%) were hospitalized, and of the 152 whose status was known, 37 (39%) were immunocompromised. Three (2%) cases died, and histoplasmosis was the primary cause of death in 1 of those cases.

HIV Infection and AIDS

HIV/AIDS incidence in Minnesota remains moderately low. In 2017, state-specific HIV infection rates ranged from 2.1 per 100,000 population in Wyoming to 30.0 per 100,000 in Georgia. Minnesota had the 16th lowest rate (6.0 cases per 100,000 population). In 2017, state-specific AIDS diagnosis rates ranged from 0.9 per 100,000 persons in New Hampshire to 12.5 per 100,000 population in Georgia. Minnesota had the 16th lowest rate (2.6 cases per 100,000 population).

As of December 31, 2018, a cumulative total of 11,852 cases of HIV infection (2,267 AIDS at first diagnosis, and 9,585 HIV [non-AIDS] cases) were reported among Minnesota residents. By the end of 2018, an estimated 8,981 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 2018, 116 new AIDS cases (Figure 4) and 82 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 278 newly diagnosed HIV (non-AIDS)

cases in 2009, and a low of 215 new HIV (non-AIDS) cases reported in 2017, which is lower than 228 cases reported in 2018.

In 2018, 77% (221/286) of new HIV diagnoses (both HIV [non-AIDS] and AIDS at first diagnosis) occurred in the metropolitan area. In Greater Minnesota there were 65 cases in 35 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 2018, there were 93 new infections among white males, which is slightly less than half of new HIV infections among males (43%). Among black African American males, there were 49 new HIV diagnoses in 2018, which is about a quarter of new HIV infections among males (23%). Among Hispanic males of any race and black African-born males, there were 34 and 23 new HIV infections in 2018 respectively.

Females account for an increasing percentage of new HIV infections, from 11% of new infections in 1990 to 24% in 2018. 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 2018, women of color accounted for 69% of new HIV infections among females in Minnesota. The number of diagnoses among African-born women has been increasing over the past decade. In 2018, the number of new cases among African-born women was 25, accounting for 37% of all new diagnoses among women. In 2018, there were 13 cases (19%) diagnosed among African American women.

Despite relatively small numbers of cases, HIV/AIDS affects persons of color disproportionately in Minnesota. In 2018, men of color comprised approximately 17% of the male population in Minnesota and 57% of new HIV diagnoses among men. Similarly, persons of color comprised approximately 13% of the female population in Minnesota and 69% 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, and race is not considered a biological cause of disparities in the occurrence of HIV.

In 2018, there were 103 diagnosed with HIV <30 years of age, accounting for 36% of all cases. Most of these cases were among young males; 83% of cases <30 years were male. The average age at diagnosis in 2018 was 34 years for males and 38 years for females. 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 33 cases reported in 2018, which is lower than 47 cases reported in 2017. The number of new HIV infections among adolescent females has remained relatively consistent over time; in 2018 there were 5 cases. From 2016 to 2018, the majority (66%) of new infections among male adolescents and young adults were among youth of color, with young black African American males accounting for 34% of cases among young males of color. During the same period, young women of color accounted for 75% of the cases diagnosed, with young black African American women accounting for 43% of cases among young women of color.

Since the beginning of the epidemic, male-to-male sex (men who have sex with men; MSM) has been the predominant mode of exposure to HIV reported in Minnesota. In 2018, MSM (including MSM who also inject drugs) accounted for 71% 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 2018, 31% of 69 new HIV diagnoses among women was attributed to heterosexual exposure. The number of cases among people who inject drugs (IDU and MSM/IDU mode of exposure) has increased slightly over the past 3 years with 32 cases in 2018 compared to 26 cases in 2017, which indicates a continued pattern of increased HIV infection among people who inject drugs 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 2018, there were 48 new HIV infections reported among black Africans. While black African-born persons comprise less than 1% of the state’s population, they accounted for 17% of all HIV infections diagnosed in Minnesota in 2018.

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 2018, with 65 births to pregnant persons in 2018, the rate of perinatal transmission decreased, from 15% in 1994-1996 to 0.6% over the last 3 years (2016-2018), with 1 HIV-positive birth in 2017.

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. For the 2014-2015 season, influenza B subtyping was added.

During the 2018-2019 influenza season (October 1, 2018 – April 30, 2019), there were 2,490 laboratory-confirmed hospitalized cases (45.5 cases per 100,000 persons compared to 116.6 cases per 100,000 in 2017-2018 and 70.9 cases per 100,000 in 2016-2017) reported. Cases included

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2,377 influenza A (670 A[H1N1] pdm09, 287 H3, and 1,420 unknown A type), 101 influenza B (12 of Yamagata lineage and 4 of Victoria lineage), 4 positive for both influenza A and B, and 8 of unknown influenza types. Among the cases, 13% were 0-18, 18% were 19-49, 25% were 50-64, and 45% were 65 years of age and older. Median age was 62 years. Residents of the metropolitan area made up 53% of cases.

Case report forms have been completed on 66% of the 1,326 metropolitan area cases. Of these, 29% were diagnosed with pneumonia, 21% required admission into an intensive care unit, and 8% were placed on mechanical ventilation. An invasive bacterial co-infection was present in 12% of hospitalized cases. Antiviral treatment was prescribed for 93% of cases. Overall, 93% of adult and 47% of pediatric cases had at least one chronic medical condition that would have put them at increased risk for influenza disease.

Pediatric Deaths

There were 2 pediatric influenza-associated deaths, 1 positive for influenza A (H3), and 1 positive for influenza B/Victoria lineage.

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. 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 September 30, 2018–May 18, 2019, laboratories reported data on 44,297 influenza molecular tests, 6,032 (14%) of which were positive for influenza. Of these, 121 (2%) were positive for influenza A (H3), 333 (6%) were positive for influenza A (H1N1)pdm09, 5,430 (90%) were positive for influenza A-not subtyped, and 148 (2%) 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 17 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 January 6-12, 2019 at 4.7%.

Influenza Incidence Surveillance

MDH was one of 12 nationwide sites to participate in Optional Influenza Surveillance Enhancements. Four 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 September 30, 2018–May 18, 2019, these clinics saw 1,448 ILI patients. They submitted 236 specimens for influenza testing; 33 (14%) were positive for influenza. Of those, 10 (30%) were positive for influenza A (H3), 14 (42%) was positive for influenza A (H1N1)pdm09, 1 (3%) were positive for influenza A-type unspecified, 1 (3%) were positive for influenza B/Yamagata lineage, 3 (9%) were positive for influenza B/ Victoria lineage, and 3 (9%) were positive for influenza C.

ILI Outbreaks in 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. Three hundred eighty-three schools in 74 counties reported ILI outbreaks during the 2018-2019 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. Sixty facilities in 37 counties reported confirmed outbreaks during the 2018-2019 influenza season. The number of LTCFs reporting outbreaks ranged from a low of three in 2008- 2009 to a high of 212 in 2017-2018.

Legionnaires' Disease

In 2018, 152 confirmed cases of Legionnaires' disease (2.7 per 100,000 population) were reported. This is the highest number of cases ever reported, and a 55% increase over the 98 cases reported in 2017. Prior to 2016, there were never more than 60 cases reported annually. The CDC 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 currently classified as suspect cases; in 2018, there were 10 suspect cases.

All 152 had pneumonia, and 148 (97%) were hospitalized, with a median duration of hospitalization of 5 days (range, 1 to 49 days). Of those hospitalized, 57 (38%) were admitted to an intensive care unit, and 31 (21%) required mechanical ventilation. Eight (5%) cases died. One hundred five (69%) were male. Older adults were more often affected, with 125 (82%) occurring among individuals ≥50 years (overall median age, 64 years; range, 32 to

96). Ninety-six (63%) cases had onset dates in June through September. Ninety-four (62%) were residents of the metropolitan area and 58 (38%) were residents of Greater Minnesota.

Five cases were associated with an outbreak at a senior living community, 1 case was associated with an outbreak linked to a hospital that was detected in early 2019, and 6 cases were associated with outbreaks in other states. The remaining 140 cases (92%) were epidemiologically classified as sporadic. Of the 131 sporadic cases for whom information was available, 16 (12%) had traveled out of state, and 1 (<1%) 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

Nine listeriosis cases were reported in 2018. All were hospitalized, and 2 died. The median age of cases was 75 years (range, newborn to 92 years). Five had *Listeria monocytogenes* isolated from blood, 2 from pleural fluid, 1 from cerebrospinal fluid (CSF), and 1 from bile. Two cases were pregnancy-associated; both were neonates who had a positive culture from blood and who survived. Eight cases were white, and 1 was Asian/Pacific Islander; none were of Hispanic ethnicity. The 9 cases was similar to the median number of cases reported from 1996 through 2017 (median, 7.5 cases; range, 3 to 19). In 2018, 1 case was part of a multistate outbreak of 10 cases in 7 states associated with avocadoes.

In 2018, 1 case with *L. monocytogenes* isolated from a stool specimen was reported. The case was tested as part of a stool donation program, reported no symptoms, and was not included in official case counts; however, the isolate was closely related to a national case isolate by whole genome sequencing.

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, *B. mayonii*, has also been identified as a cause of human disease, and 9 cases have been reported in Minnesota residents since 2013, 1 in 2018. 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 2018, 950 confirmed Lyme disease cases (17 cases per 100,000 population) were reported. In addition, 591 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 2017 (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).

Five hundred eighty-eight (62%) confirmed cases were male, and the median case age was 44 years (range, 1 to 91). Physician-diagnosed erythema migrans (EM) was present in 601 (63%) cases. Three hundred eighty-nine (41%) cases had one or more late manifestations of Lyme disease (including 282 with a history of objective joint swelling, 84 with cranial neuritis including Bell's Palsy, 4 with lymphocytic meningitis, 20 with acute onset of 2nd or 3rd degree atrioventricular conduction defects, and 9 with radiculoneuropathy) and confirmation by Western immunoblot (positive IgM ≤30 days post-onset or positive IgG). Of the 876 cases with known onset dates, onset of symptoms peaked from June through August, with 69% 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 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 2018, 59 cases (1 per 100,000 population) were reported. Fifty (85%) cases were identified with *P. falciparum*, 3 (5%) with *P. vivax*, 2 (3%) with *P. ovale*, 1 (2%) with mixed *Plasmodium* species, and in 1 the species was unable to be determined. The median age of cases was 37 years (range, 2 to 72). Of the 55 cases with known race, 45 (82%) were black, 7 (13%) were white, 1 (2%) was Asian/Pacific Islander, and 1 (2%) identified as their race as "Other." Fifty-five cases were Minnesota residents at the time of their illness, 49 (89%) of which resided in the metropolitan area. Of the 50 cases with known country of birth, only 15 (30%) were born in the United States. Fifty-six (95%) cases likely acquired malaria in Africa, 2 (3%) cases were likely acquired in Asia, and 1 patient reported travel to Central America. Exposure information was not available for 1 case. Eighteen countries were considered possible exposure locations for malaria infections, including Liberia (20), Nigeria (8), Kenya (6), Sierra Leone (6), and Ghana (5) as well as several other countries in sub-Saharan Africa.

Measles

Three measles cases were reported in 2018, 2 of which occurred in Minnesota residents. One was a 5 year-old black, non-Hispanic resident of Hennepin County. The second was a 2 year-old black, non-Hispanic non-U.S. resident. Both children were unvaccinated and presented with fever, rash, cough, coryza, and

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conjunctivitis upon returning from Kenya in August. Both required hospitalization and recovered without complications. The third case was a 2 year-old white, non-Hispanic resident of Ramsey County. The child had a history of 1 age-appropriate dose of MMR, and became ill after returning from Israel in early September. This case was not hospitalized; his illness was mild and did not resemble classic measles infection.

All 3 cases were laboratory confirmed by PCR at the PHL. The first 2 cases with travel to Kenya were genotyped as B3, and the third case with travel to Israel could not be genotyped. The third case was lab-confirmed with other viral etiologies in addition to measles. All 3 cases were considered international importations (exposed to measles outside of the United States) and were not epidemiologically linked to each other or to any other known cases or outbreaks.

Meningococcal Disease

For the first time ever, there were no *Neisseria meningitidis* (NM) invasive disease cases in 2018. There were 5 cases in 2017, and 5 cases in 2016. Incidence of invasive NM was 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 incidence has decreased since 2011. The quadrivalent conjugate vaccine, MenACWY is recommended at 11- 12 years with a booster at age 16. Vaccination rates for at least 1 dose among 13-17 year old Minnesota adolescents is 78.5%; rates for the booster are lagging at 26.9% (Minnesota Immunization Information Connection, 2018 data). Meningococcal B vaccine is recommended for persons 10 years of age and older with specific risk factors. It should especially be considered for those 16-23 years of age, especially in outbreak situations.

Mumps

In 2018, 13 mumps cases were reported. Eleven (85%) were classified as confirmed (tested positive by PCR), and 2 (15%) as probable (tested positive by IgM serology or were linked to another case or outbreak). All of the confirmed cases were genotyped as G, which is the dominant genotype circulating in the United States since 2006.

Two (15%) cases reported a history of receiving at least 1 dose of mumps-containing vaccine but had no documentation of those doses. Four (31%) cases had a documented history of receiving 1 or 2 doses of mumps-containing vaccine. Two (15%) cases were unvaccinated, and 5 (38%) reported unknown vaccination status. No case reported a previous history of mumps disease.

Eight (62%) cases were acquired in Minnesota and were not linked to outbreaks occurring elsewhere, and 5 (38%) acquired mumps from international travel. The median age of cases was 32 years (range 20 to 85). Nine cases (69%) occurred in persons 18-49 years, and 4 (31%) occurred in persons ≥50 years of age. Twelve cases (92%) experienced parotitis, and 5 (38%) reported orchitis. One unvaccinated adult was hospitalized for 1 day with fever, arthralgia, and bilateral orchitis and recovered without complications.

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 parainfluenza virus types 1 and 3, influenza A virus, 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 2018, 38 cases (0.55 cases per 1,000 live births) were reported compared to 53 cases in 2017. There were 6 deaths. All were identified via blood. There was 1 meningitis case. Most cases (87%) were culture-positive within the first 2 days of life. Group B *Streptococcus* was most common (12) followed by *Escherichia coli* (11), *Haemophilus influenzae* (6)*, Streptococcus viridians* (2), *Enterococcus* spp. (2), *Klebsiella pneumoniae* (2), and 1 each of Group A *Streptococcus,* other *Streptococcus* spp., and *Citrobacter* spp.

Pertussis

In 2018, 397 pertussis cases (7 per 100,000 population) were reported. Laboratory confirmation was available for 280 (71%) cases, 19 (7%) of which were confirmed by culture and 262 (94%) by PCR. In addition, 60 (15%) cases met the clinical case definition and were epidemiologically linked to laboratory confirmed cases, and 56 (15%) met the clinical case definition only. One hundred ninety-two (48%) cases occurred in residents of the metropolitan area.

Paroxysmal coughing was the most commonly reported symptom, which 369 (93%) cases experienced. Approximately one third (118) 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 185 (47%) cases. Infants and young children are at the highest risk for severe disease and complications. Pneumonia was diagnosed in 8 (2%) cases, only 2 of which were in infants; 3 were 2 to 16 years old, 2 were 20 to 70 years old. Five (1%) cases were hospitalized; 2 (33%) hospitalized patients were <6 months of age. No deaths occurred.

Pertussis is increasingly recognized in older children and adults. During 2018, cases ranged in age from <1 month to 86 years. One hundred (25%) cases occurred in adolescents 13-17 years, 105 (26%) in children 5-12 years, 92 (23%) in adults ≥18 years, 74 (19%) in children 6 months through 4 years, and 14 (4%) 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 2018, 24 cases were in infants <1 year of age. A likely source of exposure was identified for 11 of those cases; 3 were infected by adults ≥18 years (one mother and two fathers), 1 by an adolescent 13-17 years, 6 by a child <13 years of age, and for 1 the age was unknown. Eleven 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.

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 97 (24%) cases who were 7 months to 6 years of age, 40 (41%) were known to have received at least a primary series of 3 doses of DTP/DTaP vaccine prior to onset of illness; 54 (56%) received fewer than 3 doses and were considered preventable cases.

Isolates of *Bordetella pertussis* must be submitted to the PHL in order to track changes in circulating strains. Isolates for 17 (90%) culture-confirmed cases were received and sub-typed, with two 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.

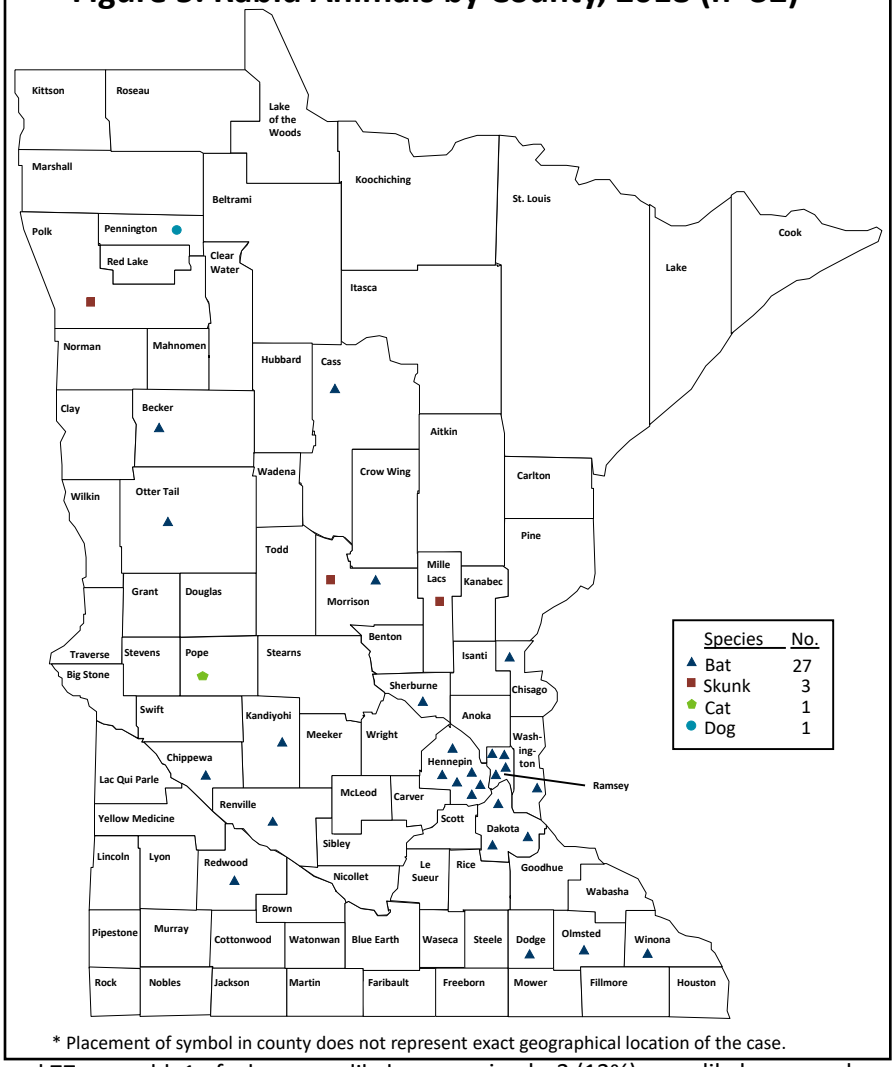
Q Fever

Q fever is an acute or chronic illness caused by *Coxiella burnetii*. Cattle, sheep, and goats are the primary sources of infection. Transmission can occur through contact with infected animal tissue, inhalation of aerosolized bacteria, ingestion of unpasteurized dairy products, and tick bites.

In 2018, 4 confirmed cases were reported, 2 acute and 2 chronic. The acute Q fever cases were a 70 year-old and 77 year-old, 1 of whom was likely exposed through cattle contact, the other had an undetermined exposure. The chronic cases were a 5 year-old and a 71 year-old who both likely had sheep exposures. All 4 cases were hospitalized; the acute cases were hospitalized for 2 and 31 days respectively, and the chronic cases were hospitalized for 8 and 13 days respectively. All cases survived.

From 1997 to 2018, 23 confirmed acute cases, and 8 chronic cases were reported. The median age of acute cases was 59 years (range, 11 to 77 years); the median age of chronic cases was 53 years (range, 5 to 75 years). Thirteen (81%) cases for which both race and ethnicity were known were white, non-Hispanic; 2 (13%) were black, non-Hispanic; and 1 (6%) was mixed race, non-Hispanic. During this time, 19 (79%) of the 24 cases for whom exposure information was available were likely exposed through direct or indirect contact with infected animals, 3 (13%) were likely exposed through ingestion of unpasteurized dairy products, and 2 (8%) through a tick bite. Eight (53%) of the 15 cases with known occupations were employed in an agriculture-related occupation.

Figure 5. Rabid Animals by County, 2018 (n=32)*



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

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 2018, 32 (1.5%) of 2,175 animals tested were positive for rabies. This is similar to 2017 (35 [1.8%]) and consistent with the number of positives seen in 2014 and 2015. The majority of positive animals in 2017 were bats (27/32 [84.4%]), followed by skunks (3/32 [9.4%]), and there was 1 positive cat (1/32 [3.1%]) and dog (1/32 [3.1%]) (Figure 5). There were no human cases of rabies.

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From 2003 to 2018, 865 (2.5%) of 37,369 animals tested were positive for rabies. The median number of rabies positive animals identified annually was 55 (range 28 to 94). From 2003 to 2018, 323/714 (45.2%) skunks, 56/881 (6.4%) cattle, 391/10,755 (3.6%) bats, 9/335 (2.7%) horses, 47/11,221 (0.4%) cats, 29/10,475 (0.3%) dogs, 1/1,162 (0.1%) raccoons, and 10/1,821 (0.5%) 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.

Respiratory Syncytial Virus

Beginning September 2016, laboratory-confirmed respiratory syncytial virus disease (RSV) became reportable for all hospitalized residents of the metropolitan area. Any death occurring statewide within 60 days of a positive RSV test is also reportable.

From October 1, 2018–April 30, 2019, 721 cases were reported (12.9 cases per 100,000 persons) compared to 1,090 cases (18.8 cases per 100,000) from October 2017-April 2018. The median age was 9 months (range: 8 days–98 years). Forty percent (285) were <6 months, 15% (109) were 6-11 months, 16% (117) were 1 year to <2 years, 9% (68) were 2-4 years, 3% (24) were 5–17 years, 2% (12) were 18–49 years, 4% (27) were 50–64 years, and 11% (79) were >65 years of age. Overall, 53% of RSV cases were male and 48% were white.

Forty-one percent of cases had a co-morbid condition at the time of their illness, and the presence of a co-morbid condition increased significantly as age increased. The most common comorbid conditions for cases <2 years of age were prematurity (13%), neurologic conditions (4%), asthma/reactive airways disease (3%), and cardiovascular disease (3%). For cases 2-18 years of age, neurologic conditions (24%), history of prematurity (14%), and asthma (21%) were most common. The most common underlying conditions for adults 18-64 years of age and older adults (≥65 years) were chronic metabolic diseases (46% and 43% respectively), cardiovascular disease (33% and 72% respectively), and chronic lung diseases (26% and 34% respectively).

Of 159 RSV cases with a known subtype, 78% (124) tested positive for RSV subtype A, 21% (30) were positive with RSV B, and 1 was positive with both RSV A and B.

Eighteen RSV-associated deaths were reported for the 2018–2019 respiratory season. The median age of fatal RSV cases was 81 years (range 4 months–98 years), and 14 cases who died had underlying medical conditions. Identification of additional RSV-associated deaths is ongoing.

Salmonellosis

In 2018, 1,009 *Salmonella* cases (18.1 per 100,000 population) were reported. This is a 31% increase from the median annual number of cases reported from 2008 to 2017 (median, 768 cases; range, 578 to 975), and the highest number of *Salmonella* cases reported since at least 1988.

Of the 99 serotypes identified in 2018, 5 serotypes, *S.* Enteritidis (264), *S.* Typhimurium (104), *S.* I 4,[5],12:i:- (88), *S.* Infantis (42), and *S.* Saintpaul (40) accounted for 53% of cases. *Salmonella* was isolated from stool in 860 (85%), urine in 87 (9%), and blood in 54 (5%) cases. Other specimen sources included abscess (3), wound (2), cerebrospinal fluid, peritoneal fluid, and synovial fluid.

Two hundred forty (24%) cases were hospitalized; the median length of hospital stay was 4 days (range, 2 to 60 days). Five culture-confirmed cases died: a 75 year-old died of septic shock and *Salmonella* bacteremia; an 86 year-old died of chronic obstructive pulmonary disease and community-acquired pneumonia, with contributing Gram-negative sepsis secondary to *S.* Enteritidis and *E. coli* urinary tract infection; a 72 year-old died of acute respiratory distress syndrome and *Salmonella* bacteremia; a 99 year-old died of "natural" causes 6 days after *S.* Enteritidis was isolated from urine; and, an 80 year-old who of multiple causes including sepsis and *Salmonella* colitis.

Of the 912 cases with known travel history, 141 (15%) had travelled internationally during the week prior to their illness onset. There were 4 *S.* Typhi cases associated with travel to or immigration from India, Liberia, Guatemala, and Nepal. There were 3 *S.* Paratyphi A cases; 2 travelled to India and 1 had no known international travel. There were 4 *S.* Paratyphi B cases; 1 was not able to be interviewed, and 3 had no known travel history.

In 2015, culture-independent tests (CIDTs) for the detection of *Salmonella* nucleic acid in stool became commercially available. In 2018, 73 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 sixty cases were part of 20 *Salmonella* outbreaks in 2018, including 18 cases that were part of outbreaks that began in 2015 or 2017. Fifteen of the 20 outbreaks involved foodborne transmission, 2 involved animal contact, and 3 were due to person-to-person transmission. Ten of the outbreaks involved cases in multiple states. The 20 outbreaks resulted in a median of 4 culture-confirmed cases per outbreak (range, 1 to 32).

Eleven culture-confirmed and 5 probable cases of *S.* Enteritidis infection were associated with a restaurant outbreak. The vehicle of transmission was smoked chicken. The most plausible explanation for the outbreak was undercooking of the smoked chicken that was served on the implicated meal date. Six culture-confirmed cases of *S.* Infantis (n=3), *S.* Enteritidis (n=2), and *S.* Typhimurium (n=1) infection were associated with a second restaurant outbreak. Three of the infections were from two food workers. A single outbreak vehicle was not identified. Thirty-two culture-confirmed cases and 1 probable case of *S.* Enteritidis infection were part of an extended outbreak at a third restaurant. The investigation included four rounds of environmental health interventions, including three rounds of employee stool specimen submissions. A single outbreak vehicle was not identified. The outbreak was ongoing for 5 months, indicating there was a reservoir for the bacteria in the restaurant; this reservoir could have been food workers, the environment, or both. Two culture-confirmed cases of *S.* Enteritidis infection were part of an outbreak at a fourth restaurant. The vehicle and source of contamination were not identified. Two culture-confirmed cases of *S.* I 4,[5],12:i:- infection were associated with an outbreak at a fifth restaurant. The vehicle and source of contamination were not identified.

Six culture-confirmed cases of *S.* Thompson infection were part of a sixth restaurant outbreak. One of the cases was a food worker; however, the outbreak vehicle was not identified.

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

Four culture-confirmed and 1 probable case of *S.* Typhimurium infection were part of a multi-state outbreak of 265 cases in 8 states associated with commercially produced chicken salad sold at grocery stores. Seven culture-confirmed cases of *S.* Enteritidis infection were associated with raw breaded chicken products that were distributed primarily through a pop-up pantry program in unlabeled bags. The outbreak included 6 cases in Wisconsin, and chicken from case households in both states tested positive for the outbreak strain. Twenty-five culture-confirmed and 11 probable cases of *S.* Sandiego (n=23) and *S.* IIIb 61:l,v:1,5,7 infection (2 cases) were linked to a multi-state outbreak of 101 cases in 10 states that was associated with commercially distributed pasta salad. These numbers include 1 case who was positive for both serotypes and was therefore counted as 2 cases. A subset of the Minnesota cases attended a wedding where the pasta salad was served. The pasta salad was produced at a central commissary kitchen in Nebraska; the source of contamination was not identified.

Twenty culture-confirmed cases of *Salmonella* infection (*S.* Enteritidis, n = 17; *S.* Indiana, n = 2; and *S.* Montevideo, n = 1) were part of a multi-state outbreak linked to live poultry contact. Nationally, 334 cases from 47 states in this outbreak were infected with 6 *Salmonella* serotypes. Four culture-confirmed cases of *S.* Infantis infection were part of a multi-state outbreak of 129 cases in 32 states. Laboratory and epidemiological evidence suggests that the outbreak strain occurs widely in live chickens and a variety of raw chicken products.

Four culture-confirmed cases of *Salmonella* infection (*S.* Montevideo, n=2; *S.* Cubana, n=2) were part of a multi-state outbreak associated with alfalfa sprouts. One culture-confirmed case of *S.* Mbandaka infection was linked to a multi-state outbreak of 135 cases in 36 states. The implicated product was a dry breakfast cereal; multiple food samples also tested positive, and the company issued a recall. Five culture-confirmed cases of *S.* Typhimurium infection were included in a multi-state CDC-defined outbreak that may have been associated with spices. Two culture-confirmed cases of *S.* Newport infection were linked to a multi-state outbreak of 403 cases from 30 states. The implicated vehicle was raw ground beef from a single supplier; the supplier subsequently recalled approximately 12 million pounds of beef products. Two culture-confirmed cases of *S.* Typhimurium infection were associated with hedgehog contact; these cases were part of a multi-state outbreak that included 17 cases in 11 states. Hedgehogs were purchased from a variety of sources, including hedgehogs bred in-house in Minnesota, and some were positive for the outbreak strain of *Salmonella*.

Two culture-confirmed and 2 probable cases of *S.* I 4,[5],12:i:- infection were associated with a pig roast event. A single vehicle was not identified.

Among the 18 *Salmonella* cases in 2018 who were part of outbreaks that began before 2018, 2 (*S.* Heidelberg) were part of a 2015 outbreak associated with dairy calves, 2 (*S.* Infantis*)* were part of a 2017 child care outbreak, 2 (*S.* Montevideo) were part of a 2017 casino outbreak in Iowa, and 12 (*S.* Paratyphi B var. L(+) tartrate(+), n=7; *S.* Thompson, n=3; *S.* Okatie, n=1; and *S.* Weltevreden, n=1) were part of a multi-state outbreak associated with kratom. Kratom is a product derived from a tree endemic to Southeast Asia having opioid or stimulant properties.

Sexually Transmitted Diseases

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 2018, 23,564 chlamydia cases (444 per 100,000 population) were reported. This is the same rate as in 2017 (Table 3).

Table 3. Number of Cases and Rates (per 100,000 Persons) of Chlamydia, Gonorrhea, and Syphilis, 2014-2018

Disease	2014		2015		2016		2017		2018	
	No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate
Chlamydia	19,897	375	21,238	400	22,675	428	23,528	444	23,564	444
Gonorrhea	4,073	77	4,097	77	5,104	96	6,519	123	7,542	142
Syphilis, Total	629	11.9	654	12.3	852	16.1	934	17.6	918	17.3
Primary/Secondary	257	4.8	246	4.6	306	5.8	292	5.5	292	5.5
Early latent	159	3.0	185	3.5	251	4.7	313	5.9	286	5.4
Late latent	213	4.0	220	4.1	289	5.4	327	6.2	330	6.2
Congenital*	0	0.0	2	2.9	7	10.2	2	3.0	10	15.1

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

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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 (2,385 per 100,000), followed by the 15 to 19-year-old age group (1,624 per 100,000). The incidence of chlamydia among adults 25 to 29 years of age (1,155 per 100,000) is considerably lower but has increased in recent years. The chlamydia rate among females (562 per 100,000) is nearly twice the rate among males (324 per 100,000), most likely due to more frequent screening among females.

Chlamydia infection incidence is highest in communities of color (Table 4). The rate among black non-Hispanics (2,025 per 100,000) is 9.7 times higher than the rate among white non-Hispanics (209 per 100,000*).* Although black, non-Hispanic persons comprise approximately 5% of Minnesota's population, they account for 24% of reported chlamydia cases. Rates among Asian/Pacific Islanders (419 per 100,000), Hispanic, any race (751 per 100,000), and American Indian/ Alaska Natives (1,148 per 100,000) are over 2 to 6 times higher than the rate among white, non-Hispanic persons.

Chlamydia infections occur throughout the state, with the highest reported rates in Minneapolis (1,255 per 100,000) and St. Paul (982 per 100,000). Greater Minnesota had the greatest increase in rates between 2017 and 2018 at 5%. Every county in Minnesota had at least 4 cases in 2018.

Gonorrhea

Gonorrhea is the second most commonly reported STD in Minnesota. In 2018, 7,542 cases (142 per 100,000 population) were reported. This is the highest reported rate of gonorrhea in the last decade with a 15% rate increase compared to 2017 (Table 3).

Adolescents and young adults are at greatest risk for gonorrhea (Table 4), with rates of 339 per 100,000 among 15 to 19- year-olds, 543 per 100,000 among 20 to 24-year olds, and 434 per 100,000 among 25 to 29-year-olds. Gonorrhea rates for males (159 per 100,000) were higher than females (125 per 100,000).

Communities of color are disproportionately affected by gonorrhea. The incidence of

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, 2018

Disease	Chlamydia		Gonorrhea		Primary/ Secondary Syphilis	
	No.	Rate	No.	Rate	No.	Rate
Total	23,564	444	7,542	142	292	5.5
Residence						
Minneapolis	4,801	1,255	2,361	617	111	29.0
St. Paul	2,798	982	1,121	393	30	10.5
Suburban	7,812	358	2,166	99	91	4.2
Greater Minnesota	7,750	316	1,787	73	60	2.4
Age						
<15 years	108	10	31	3	0	0.0
15-19 years	5,972	1,624	1,248	339	15	4.1
20-24 years	8,482	2,385	1,930	543	39	11.0
25-29 years	4,304	1,155	1,619	434	61	16.4
30-34 years	2,206	643	1,168	334	54	15.7
35-39 years	1,191	363	611	186	43	13.1
40-44 years	582	165	357	101	24	6.8
45-49 years	306	75	238	59	21	5.2
50-54 years	239	59	185	46	16	4.0
55+ years	174	13	153	12	19	1.4
Gender						
Male	8,528	324	4,186	159	248	9.4
Female	15,017	562	3,346	125	44	5.7
Transgender^^	19	x	10	x	0	x
Race^/Ethnicity						
White	9,640	209	2,640	57	138	3.0
Black	5,690	2,025	2,601	926	70	24.9
American Indian/ Alaska Native	773	1,148	443	658	35	52.0
Asian/PI	924	419	188	85	12	5.4
Other^^	365	x	68	x	1	x
Unknown^^	4,293	x	1,142	x	8	x
Hispanic^^	1,879	751	460	184	28	11.2

* Residence information missing for 403 cases of chlamydia and 107 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.

gonorrhea among black, non-Hispanics (926 per 100,000) is 16 times higher than the rate among white, non-Hispanics (57 per 100,000). Rates among Asian/Pacific Islanders (85 per 100,000), Hispanic, any race (184 per 100,000), and American Indian/Alaska Natives (658 per 100,000) are up to 12 times higher than among white, non-Hispanic persons.

Gonorrhea rates are highest in the cities of Minneapolis and St. Paul (Table 4). The incidence in Minneapolis (617 per 100,000) is over 1.5 times higher than the rate in St. Paul (393 per 100,000), 6 times higher than the rate in the suburban metropolitan area (99 per 100,000), and 8 times higher than the rate in Greater Minnesota (73 per 100,000). In 2018, the city of Minneapolis saw the largest increase in cases at 35%.

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 2018, there were 292 cases of primary/secondary syphilis in Minnesota (5.5 cases per 100,000 persons), which is the same number of cases and rate as in 2017.

Early Syphilis

In 2018, the number of early syphilis cases decreased by 4%, with 578 cases, compared to 605 cases in 2017. The incidence remains highly concentrated among MSM. Of the early syphilis cases in 2018, 484 (84%) occurred among men; 363 (62%) of these were MSM; with 39% of the MSM diagnosed with early syphilis that were co-infected with HIV. However, the number of women reported has continued to increase over the past 10 years from 5 early syphilis cases in 2008 to the highest number of cases reported in 2018 at 94.

Congenital Syphilis

Ten congenital syphilis cases were reported in 2018, which is the highest number of cases reported for Minnesota in more than 50 years. Syphilis may be passed from a pregnant person to the unborn baby through the placenta.The infection can cause miscarriages and stillbirths, and infants born with congenital syphilis can suffer a variety of serious health problems, including deformities, seizures, anemia, and jaundice. The CDC reported that the number of infants born with syphilis has more than doubled in the past 4 years and last year reached a 20-year high. In Minnesota, the number and rate of congenital syphilis cases among infants has increased over the past 5 years from 0 in 2014 to 15.1 per 100,000 live births in 2018.

Shigellosis

In 2018, 146 culture-confirmed cases of shigellosis (2.6 per 100,000 population) were reported. This represents a 70% increase from the 86 cases reported in 2017, and is 29% more than the median annual number of cases reported during 2008-2017 (median, 113.5; range, 66 to 556). *S. sonnei* accounted for 82 (56%) cases, *S. flexneri* for 55 (38%) cases, and *S. boydii* for 1 (1%) case. Species was not identified for 8 (5%) cases. Cases ranged in age from 1 to 87 years (median, 38 years). Eight percent of cases were ≤5 years of age; 85% were 18 years of age or older. Sixty-nine percent of cases were male. Forty-five (31%) cases were hospitalized. No cases died.

Thirty-three percent of case were either non-white race (33 of 134 cases) or Hispanic ethnicity (17 of 134 cases). Of the 126 cases for which travel information was available, 39 (31%) travelled internationally (26 of 75 [35%] *S. sonnei*, and 10 of 44 [23%] *S. flexneri*) prior to onset. Eighty-three percent of cases resided in the metropolitan area, including 49% in Hennepin County and 15% in Ramsey County.

No outbreaks of shigellosis were reported in 2018.

In 2018, 224 patients were positive for *Shigella* by a culture-independent diagnostic test conducted in a clinical laboratory. Of the 215 specimens that were received at MDH, 116 (54%) were subsequently culture-confirmed and therefore met the surveillance case definition for inclusion in case count totals.

In 2018, 57 of the 140 *Shigella* isolates received at MDH were tested for antimicrobial resistance. Of the 57 isolates, 86% (49 isolates) were resistant to trimethoprim-sulfamethoxazole, 77% (44 isolates) were resistant to ampicillin, and 63% (36) had decreased susceptibility to azithromycin (DSA). Thirty-four (94%) of 36 of the DSA isolates were collected from adult males. Among the 27 adult male cases with DSA infection and available information, 17 (63%) reported sexual contact with a male during the week before illness onset.

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 >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 EIP, 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 12.9 per 100,000 in 2018 (Ramsey: 11.8/100,000 and Hennepin: 13.5/100,000) compared to 14.9 per 100,000 population in 2017. In 2018, MRSA was most frequently isolated from blood (83%, 183/221), and 10% (23/221) of the cases died in the hospital. HACO-MRSA cases comprised the majority (62%, 137/221) of invasive MRSA infections in 2018; CA-MRSA cases accounted for 24% (53/221), and 14% (31/221) cases were HO-MRSA.

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The median age for all cases was 58 years (range, <1 to 94); the median age was 53 (range, 8 to 91), 62 (range, <1 to 89), and 49 years (range, 2 to 94) for HO-, HACO-, and CA-MRSA cases, respectively.

In August 2014, invasive methicillin-sensitive SA (MSSA) was initiated in Hennepin and Ramsey Counties. The incidence rate was 32.7 per 100,000 in 2018 (Ramsey: 33.4/100,000 and Hennepin: 32.3/100,000) compared to 29.6 per 100,000 population in 2017. In 2018, MSSA was most frequently isolated from blood (79%, 439/556), and 10% (58/556) of the cases died in the hospital. HACO-MSSA cases comprised the majority (58%, 324/556) of invasive MSSA infections in 2018; CA-MSSA cases accounted for 31% (171/556), and 11% (61/556) cases were HO-MSSA. The median age for all cases was 60 years (range, <1 to 97); the median age was 61 (range, <1 to 94), 61 (range, 1 to 97), and 57 years (range, 2 to 95) for HO-, HACO-, and CA- MSSA cases, respectively.

Vancomycin-intermediate (VISA) and vancomycin-resistant *S. aureus* (VRSA) are reportable, 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 infection, recent hospitalization, 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, the PHL confirmed 18 VISA cases: 2008 (3), 2009 (3), 2010 (2), 2011 (5), 2013 (3), and 2016 (2). Among all cases of VISA in Minnesota, 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 or 2018.

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 sixty-seven cases (6.6 cases per 100,000 population), including 37 deaths, were reported in 2018, compared to 359 cases and 34 deaths in 2017. The median age of cases was 60 years (range, newborn to 99 years). Fifty-five percent of cases were residents of the metropolitan area. Allowing for multiple presentations per patient, 140 (38%) had cellulitis, 71 (19%) bacteremia without another focus of infection, 83 (23%) septic shock, 51 (14%) pneumonia, 25 (7%) abscess, 33 (9%) septic arthritis and/or osteomyelitis, 25 (7%) necrotizing fasciitis, and 11 (3%) had STSS. Twenty-three cases (6%) were injection drug users in 2018, compared to 10 (3%) in 2017. Forty-four (12%) cases were residents of long-term care facilities. Eighteen facilities had a single case, nine facilities had 2 or more cases including one facility that had 5 cases. A cluster of isolates from 53 cases from the west metropolitan area were determined to be indistinguishable from one another using whole genome sequencing. A review of the cases revealed that these cases were primarily residents of 19 different long term care facilities and had underlying wounds. An investigation of shared services between these facilities revealed that this cluster was associated with a single wound care provider who was contracted by these facilities.

The 37 deaths included 25 that presented with just septic shock, 7 bacteremia without another focus of infection, 8 cellulitis, and 12 pneumonia (individuals could have more than one infection type). Of the 34 deaths, the most frequently reported underlying conditions were obesity (10), current tobacco smoker (8), diabetes (7), chronic kidney disease (7), heart failure (7), atherosclerotic cardiovascular disease (7), chronic obstructive pulmonary disease (4), asthma (4), current alcohol abuse (3), dementia (3), peripheral vascular disease (3), cirrhosis (2), and chronic skin breakdown (2). Twenty-one fatal cases had two or more underlying conditions, and 5 had none reported.

Streptococcal Invasive Disease – Group B

Five hundred seventy-nine cases of invasive group B streptococcal (GBS) disease (10.4 per 100,000 population), including 28 deaths, were reported in 2018. By age group, annual incidence was highest among infants <1 year of age (44.7 per 100,000 population) and cases aged ≥70 years (39.9 per 100,000). Fifteen (54%) of the 28 deaths were among cases ≥65 years. Fifty-one percent of cases were residents of the metropolitan area. Bacteremia without a focus of infection occurred most frequently (31%), followed by cellulitis (24%), septic arthritis (9%), septic shock (8%), abscess (5%), pneumonia (5%), osteomyelitis (4%), and meningitis (3%). The majority (83%) of cases had GBS isolated from blood; other isolate sites included joint fluid (10%), peritoneal fluid (3%), cerebrospinal fluid (1%), and bone (1%).

Twenty-nine cases were infants and 4 were maternal cases, compared to 42 cases in 2017. Twelve infants developed early-onset disease (occurred within 6 days of birth [0.2 cases per 1,000 live births]), and 17 infants developed late-onset disease (occurred at 7 to 89 days [0.2 cases per 1,000 live births]). Four stillbirth/spontaneous abortions were associated with the 4 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 2018. Overall, 6 of 12 women who delivered GBS-positive infants underwent prenatal screening for GBS. Of these, 1 was positive and 5 were negative. One of the 6 women who did not receive prenatal screening was screened upon admission to the hospital and prior to delivery, and was positive. Among the 12 women who delivered GBS-positive infants, 7 received intrapartum antimicrobial prophylaxis. An update of GBS perinatal prevention guidance was

published by the American College of Obstetricians and Gynecologists, and by the American Academy of Pediatrics in July 2019.

Streptococcus pneumoniae Invasive Disease

In 2018, 478 (8.6 per 100,000) cases of invasive pneumococcal disease (IPD) were reported. By age group, annual incidence rates per 100,000 were 7.9 cases among children aged ≤5 years, 2.7 cases among children and adults aged 5-39 years, 9.0 cases among adults 40-64 years, and 25.6 cases among adults aged ≥65 years.

Pneumonia occurred most frequently (55% of infections), followed by bacteremia without another focus of infection (15%), septic shock (12%), and meningitis (6%). Forty-six (10%) cases died. Health histories were available for all 46 deaths; of these, 43 had an underlying health condition reported. The conditions most frequently reported were current tobacco smoker (12), emphysema/ chronic obstructive pulmonary disease (11), cardiac failure (10), chronic kidney disease (10), diabetes (8), current alcohol abuse (8), and obesity (8).

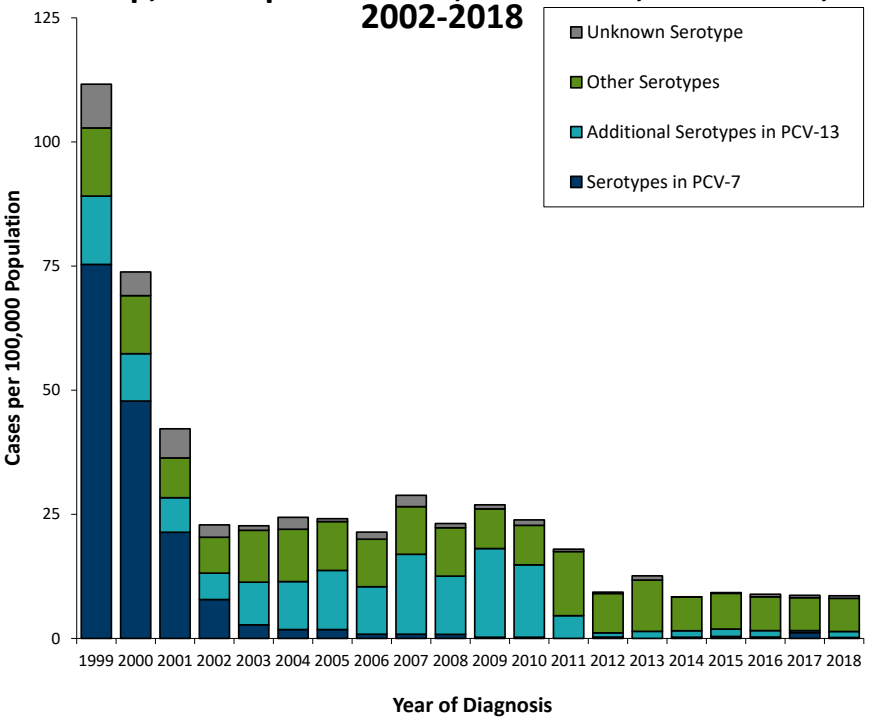
In 1999, the year before the pediatric pneumococcal conjugate vaccine (Prevnar [PCV-7]) was licensed; the rate of IPD among children <5 years of age in the metropolitan area was 111.7 cases/100,000. Over the years 2000-2002 there was a major downward trend in incidence in this age group (Figure 6). Rates 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 was 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. In 2018, 18% of cases with isolates available for testing were caused by 6 of the PCV-13-included serotypes: 3 (13%), 19A (2%), 19F (2%), 7F (<1%), 6A (<1%), and 4 (<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 2018 had PCV-13 serotypes.

Of the 452 isolates submitted for 2018 cases, 72 (16%) isolates were resistant to penicillin using meningitis breakpoints. Using non-meningitis breakpoints, 4 (<1%) of 452 isolates were resistant to penicillin. (Note: CLSI penicillin breakpoints changed in 2008).

Figure 6. Invasive Pneumococcal Disease Incidence Among Children <5 Years of Age, by Year and Serotype Group, Metropolitan Area, 1999-2001; Minnesota, 2002-2018



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).

Tetanus

One case of tetanus was reported in 2018. A 17 year-old unvaccinated male stepped on a nail at a construction site 12 days before he presented to a clinic. He developed spasms in his jaw, a stiff neck, fever, and general muscle spasms. He received tetanus immune globulin at a clinic and was then admitted to a hospital. After 3 days hospitalization, his fever and neck pain resolved but he still had peripheral muscle spasms. The case's mother refused to have him receive a tetanus-containing vaccine prior to discharge.

Toxoplasmosis

Toxoplasmosis is an illness caused by the coccidian protozoan *Toxoplasma gondii* and cats are the primary reservoir. *T. gondii* transmission in the United States is primarily foodborne, through handling or consumption of undercooked pork, lamb, or venison containing bradyzoites, the microscopic tissue cyst form of the parasite. People also can be infected through direct contact with cat feces that contains *Toxoplasma* oocysts or though consumption of food or water that has been contaminated with oocysts.

In 2018, 15 cases were reported (14 confirmed and 1 probable), an increase over the 9 reported in 2017, and 7 reported in 2016. Eight cases had immunocompromising conditions. Seven cases

continued...

were diagnosed with ocular toxoplasmosis, 3 with generalized toxoplasmosis, 4 with cerebral toxoplasmosis, and 1 unknown type. There were no pregnant cases. The median age of cases was 53 years (range, 20 to 83 years). Eleven cases (73%) were male. Nine cases were white, 1 was black, and 5 were of unknown race; 9 cases were non-Hispanic, while 1 was Hispanic, and 5 were of unknown ethnicity. Three of the confirmed cases and the probable case were associated with an outbreak, in which a large family group were infected after consuming undercooked venison on their annual hunting trip. A sample of their venison tested positive for *Toxoplasma*.

Tuberculosis

In 2018, 172 tuberculosis (TB) cases (3.1 per 100,000 population) were reported. This represents a 3% decrease in the number of cases compared to 2017, when there were 178 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 few years has been higher than the national rate (2.8 per 100,000 in 2018). Despite the higher TB case counts and rates in Minnesota recently, the TB case count has decreased 28% since 2007, when 238 cases were reported, and has remained under 200 since 2009. Four (2%) cases from 2018 died, 1 of whom died due to TB disease.

Twenty-seven (31%) counties had at least 1 TB case in 2018. The majority (70%) of cases occurred in the metropolitan area, primarily in Hennepin (31%) and Ramsey (20%) Counties. Thirty-three (19%) were from the other 5 metropolitan counties. The remaining 30% of cases were reported from Greater Minnesota, representing a 3% increase from 2017. Among metropolitan area counties, the highest TB incidence rate in 2018 was reported in Ramsey County (6.2 per 100,000), followed by Hennepin County (4.3 per 100,000). The TB incidence rate for all Greater Minnesota counties combined was 2.0 per 100,000.

The largest group of new TB cases was the 25-44 year age group at time of diagnosis (42%), followed by cases 65 years and older (18%). Two percent of new cases were <5 years of age when they were diagnosed.

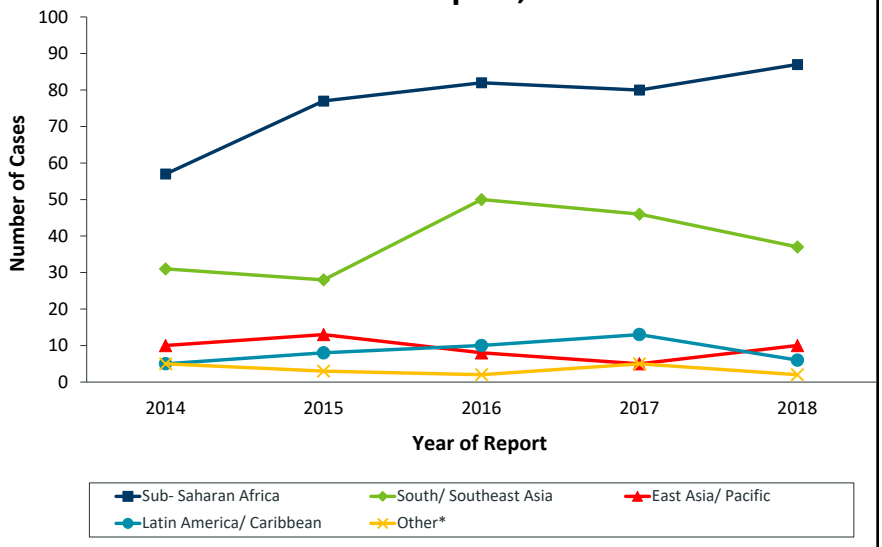
Most (78%) TB cases were identified only after seeking medical care for symptoms of disease. Various targeted public health interventions identified the majority of the remaining 22% of cases. Such case identification methods are high priority core prevention and control activities, and include contact investigations (6%) and follow-up evaluations of individuals with abnormal findings on pre-immigration exams where infectious TB disease had been ruled out (3%). An additional 9% 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 it is among cases reported nationally. In 2018, 12 cases occurred among non-Hispanic whites, a case rate of 0.3 per 100,000. In contrast, among non-Hispanic persons of other races, 97 cases occurred among blacks/African-born persons (24.9 cases per 100,000), and 52 among Asian/Pacific Islanders (17.5 cases per 100,000). Ten cases were Hispanic persons of any race (3.3 cases per 100,000). One case was reported as multi-racial. The majority of Hispanic (60%), Asian (90%), and black cases (91%) were non-U.S. born.

In 2018, the percentage of TB cases in Minnesota occurring in persons born outside the United States was 83%, compared to 70% of TB cases reported nationally. The 142 non U.S.-born TB cases represented 30 different countries of birth; the most common region of birth among these cases was Sub-Saharan Africa (61% of non-U.S. born cases), followed by South/Southeast Asia (26%), East Asia/Pacific (7%), and Latin America (including the Caribbean) (4%). Patients from other regions (North Africa/Middle East, and Eastern Europe) accounted for the remaining 1% 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. Twenty-seven percent occurred in persons with certain medical conditions that increase the risk for progression from latent TB infection to active TB disease (e.g., diabetes, prolonged corticosteroid or other immunosuppressive therapy, end stage renal disease). The next most common risk factor was substance abuse

Figure 7. Non U.S.-Born Tuberculosis Cases by Region of Birth and Year of Report, 2014 – 2018



* "Other" includes: Eastern Europe, North Africa/Middle East, and Western Europe

(including alcohol abuse and/ or injection and non-injection drug use) during the 12 months prior to their TB diagnosis (6%). Three percent of cases were co-infected with HIV. Two percent reported being homeless during the 12 months prior to diagnosis, 2% were residents of long-term care facilities, and 1% were in a correctional facility at time of diagnosis.

By site of disease, 47% of cases had pulmonary disease exclusively. Another 14% had both pulmonary and extrapulmonary sites of disease, and 38% had extrapulmonary disease exclusively. Among the 90 patients with an extrapulmonary site of disease, the most common sites were lymphatic (51%), followed by musculoskeletal (18%). Extrapulmonary disease is generally more common among persons born outside the United States, as seen in cases reported nationally as well as in Minnesota. Fifty-six percent of non U.S.-born cases in Minnesota had at least one extrapulmonary site of disease, compared to only 33% of U.S.-born cases.

Of 130 culture-confirmed TB cases with drug susceptibility results available, 25 (19%) were resistant to at least one first-line anti-TB drug (i.e., isoniazid [INH], rifampin, pyrazinamide, or ethambutol), including 16 (12%) cases resistant to at least INH. There were 7 new cases of multidrug-resistant TB (MDR-TB, or resistance to at least INH and rifampin) reported in 2018, making up 5% of culture-confirmed 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 2018, 2 cases were reported; 1 was culture-confirmed, and 1 was a probable case. One case had glandular and the other had pneumonic tularemia. One case had type A tularemia, and the other was diagnosed by serology only and had an unidentified subtype. Case ages were 25 and 69 years old; 1 was male, 1 was female. One case was hospitalized, and both survived. One case likely acquired tularemia by inhaling the bacteria, the other case's exposure route was unknown.

From 2007 to 2018, 18 tularemia cases were reported, with a range of 0 to 6 cases annually. Ten cases had ulceroglandular, 4 had glandular, 2 had pneumonic, and 2 had typhoidal tularemia. Eight of 13 cases with a known tularemia subtype had type B, and 5 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, 2 cases were exposed by inhaling the bacteria, and 2 cases' exposures could not be determined. Thirteen of 16 cases for which race was known were white, 1 was black, and 1 was American Indian/ Alaska Native, and 1 was Asian/Pacific Islander.

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 MDH PHL and the CDC Infectious Diseases Pathology Branch (IDPB).

In 2018, 111 cases met UNEX criteria (80 deaths, 31 critical illnesses), compared to 80 cases in 2017. Of the 111, 96 (86%) were reported by providers and 15 (14%) were found by death certificate review. Forty-one (37%) cases presented with respiratory symptoms; 27 (24%) with sudden unexpected death; 24 (22%) with neurologic symptoms; 7 (6%) with shock/sepsis; 6 (5%) with cardiac symptoms; 2 (2%) with gastrointestinal illness, 1 (1%) with hepatic symptoms, and 3 (3%) with multiple symptoms. The age of cases ranged from newborn to 72 years. The median age was 6 years among 96 reported cases, and 39 years among 15 non-reported cases found through active surveillance. Sixty-two percent resided in the metropolitan area, 50% were female, and 8% were non-Minnesota residents who were either hospitalized in Minnesota or investigated by a Minnesota ME.

There were 257 MED-X cases in 2018; 80 of these also met UNEX criteria. The median age of the cases was 44 years, and 57% were male. There were 155 (60%) cases found through death certificate review; MEs reported 97 (38%) cases. The most common syndrome was pneumonia/upper respiratory infection (n=94 [37%]).

There were 193 potential UNEX or MED-X cases that had specimens tested at the PHL and/or the IDPB. Fifty-four cases had pathogens identified as confirmed, probable, or possible cause of illness, including 43 UNEX deaths (Table 5). Fifty-five were determined to be non-infectious. Among 52 unexplained deaths occurring in those <50 years of age without any immunocompromising conditions, UNEX helped to identify the pathogen(s) involved in 29 (56%) cases. MED-X surveillance detected an additional 47 cases with pathogens identified by MEs as the cause of death (Table 5). Cases with pathogens of public health importance detected included a 57 year-old male who was found deceased in his home. He had recently traveled to Louisiana, and at the time of his

Table 5. UNEX/MED-X Pathogens Identified as Confirmed, Probable, or Possible Cause of Illness, 2018*

Pathogen Identified	UNEX (n=54)	MED-X (n=47)**
Adenovirus type 1	1	0
Aspergillus fumigatus	0	1
Bifidobacterium spp.	0	1
Blastomyces dermatitidis	0	1
Candida albicans	0	1
Candida krusei	0	1
Candida spp.	1	0
Citrobacter koseri	0	1
Clostridioides difficile	0	1
Clostridium perfringens	1	2
Coxsackievirus B5	2	0
Enterobacter cloacae	0	1
Enterobacter spp.	0	1
Escherichia coli	1	3
Group A Streptococcus/*Streptococcus pyogenes*	1	2
Group B Streptococcus	1	2
Haemophilus influenzae	5	0
Influenza A virus (no hemagglutinin typing information available)	0	3
Influenza A – H1	1	0
Influenza A – H3	5	0
Influenza B	2	1
Influenza C	1	0
Jamestown Canyon virus	2	0
Klebsiella pneumoniae	2	1
Legionella pneumophila serogroup 1	2	0
Mycobacterium tuberculosis	0	1
Parainfluenza virus type 2	2	0
Parainfluenza virus type 3	2	1
Parainfluenza virus type 4	1	0
Proteus mirabilis	1	2
Psuedomonas spp.	0	1
Pseudomonas putida	0	1
Respiratory syncytial virus	6	1
Rhinovirus	1	0
Staphylococcus aureus	6	5
Staphylococcus aureus - MRSA	1	4
Staphylococcus spp.	3	1
Streptococcus spp.	6	0
Streptococcus anginosus	0	1
Streptococcus constellatus	0	1
Streptococcus dysgalactiae	0	1
Streptococcus pneumoniae	7	6
West Nile virus	5	0

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

death, his travel companion had been admitted with *Legionella* pneumonia. Although the ME had initially declined autopsy, the PHL was able to culture *L. pneumonphila* serogroup 1 from a blood sample collected for toxicology screening confirming the outbreak and leading to a public health investigation. UNEX testing detected coxsackievirus B5 in multiple specimens from a neonate and a 7 year-old who presented with myocarditis within days of each other to a tertiary care hospital. Finally, UNEX surveillance was able to diagnose *Mycobacterium tuberculosis* complex in a 55 year-old male who had succumbed to accidental head injuries. Granulomatous lesions in the lungs were noted on autopsy, and following the diagnosis at IDPB, a public health contact investigation was initiated. No secondary TB cases were identified.

Varicella and Zoster

In 2018, 325 varicella cases (5.8 per 100,000 population) were reported. One hundred ninety-seven (61%) were from the metropolitan area. Cases ranged from 19 days to 73 years of age. Forty-one cases (13%) were <1 year, 108 (33%) were 1-6 years, 86 (26%) were 7-12 years, 23 (7%) were 13-17 years, and 67 (21%) were ≥18 years of age. Eight cases were hospitalized; 3 were <1 year, 3 were 4-15 years, and 2 were >18 years of age. Seven of the hospitalized cases had never been vaccinated; 3 were underage for vaccination, 1 was unvaccinated due to parental refusal, 1 had a medical contraindication to vaccination, and 2 were adults who had never been offered the vaccine. In addition, there was 1 case that was reported while already hospitalized, and was likely a nosocomial infection. There were no varicella-related deaths.

Varicella cases are often identified by parents/guardians reporting to schools and childcare facilities, rather than directly reported by a clinician. Of the 325 cases for which information regarding

diagnosis was available, 222 (68%) had visited a health care provider, 27 (8%) had consulted a provider or clinic by telephone, 1 had been identified by a school health professional, and 75 (23%) had not consulted a health care provider. Of the 317 cases for which information regarding laboratory testing was available, 117 (37%) had testing performed. Ten percent of cases occurred as part of an outbreak, defined as ≥5 cases in the same setting. Three outbreaks occurred in schools. Two were public schools, and one was a private school. The largest outbreak had 13 cases; 1 case was partially vaccinated, and 12 were unvaccinated. Of the unvaccinated cases, 9 were due to parental refusal, 1 was unvaccinated due to a previous report of disease, and 2 cases were unvaccinated because their parents reported they forgot to vaccinate.

Zoster cases in children <18 years of age are reportable in Minnesota; 61 cases were reported in 2018. Cases may be reported by school health personnel, child care staff, or healthcare providers. Ages ranged from 1 to 17 years (median 10 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 4.7 per 100,000 population in 2018. In 2018, the PHL performed strain typing on specimens from 13 cases. Twelve of these cases had been vaccinated and of these, 11 (92%) were positive for the vaccine strain and 1 (8%) was positive for the wild type virus. The 1 unvaccinated case was 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 than in unvaccinated 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; 89 such cases were reported, and 83 were hospitalized. Cases ranged from 13 to 92 years of age, with a median age of 61. Fifty-six (63%) had co-morbidities or were being treated with immunosuppressive drugs. Thirty-three had disseminated rash or disease, 31 had meningitis, 20 had cellulitis or other bacterial superinfection, 4 had encephalitis, 1 had meningioencephalitis, 11 had Ramsay-Hunt Syndrome, and 2 had pneumonia. Cases with disseminated rash or disease tended to be older than cases with meningitis without dissemination (median age of 62 vs. 44 years), and were more likely to have immunocompromising conditions or immunosuppressive drug treatment (83% vs. 46%). Four deaths occurred, 2 had meningitis, 1 had meningitis and Ramsay-Hunt Syndrome, and 1 had cellulitis or other bacterial superinfection. All deaths were in cases ≥50 years of age. Fifteen percent of cases ≥50 years of age had received zoster vaccine.

Viral Hepatitis A

In 2018, 16 cases of hepatitis A (0.3 per 100,000 population) were reported. Nine cases were residents of the metropolitan area. Ten cases were male. The median age of cases was 48 years (range 20 to 87). Race was known for 15 cases; 9 (56%) were white, 3 (19%) were black, 2 (13%) were Asian/ Pacific Islander, and 1 (6%) was reported as other race. One (6%) case was known to be of Hispanic ethnicity.

Six cases were associated with international travel. Four cases had risk factors that have been seen in national outbreaks, including injection and non-injection drug use, homelessness/transient housing, and men who have sex with men. No risk factor was identified for the 6 remaining cases. No outbreaks occurred.

Viral Hepatitis B

In 2018, 16 cases of acute hepatitis B virus (HBV) infection (0.3 per 100,000 population) were reported. In 2012, the case definition for acute hepatitis B was revised to include laboratory confirmed asymptomatic acute cases. Five of the 16 cases were asymptomatic, laboratory-confirmed infections.

The median age of cases was 46 years (range 22 to 69). Eleven (69%) cases were residents of the metropolitan area. Twelve (75%) cases were male. Race was known for all 16 cases; 7 were white, 4 were black, 3 were Asian/ Pacific Islander, 1 was American Indian/Alaskan Native, and 1 was multiracial. No cases were of Hispanic ethnicity.

Two hundred forty-two reports of newly identified cases of confirmed chronic HBV infection were received in 2018. A total of 25,335 persons are estimated to be alive and living in Minnesota with chronic HBV infection. The median age of chronic HBV cases in Minnesota is 46 years.

In 2018, there were no perinatal hepatitis B infections identified in infants born to hepatitis B-positive mothers. Three hundred seventy-eight infants born to hepatitis B-positive women during 2017 had post-serologic testing demonstrating no infection.

Viral Hepatitis C

In 2018, 60 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 60 cases, 17 (28%) were asymptomatic, laboratory-confirmed acute infection.

Thirty-three (55%) cases resided in Greater Minnesota. The median age of all cases was 29 years (range, 19 to 63). Twenty-seven (45%) cases were male. Race was known for 56 cases; of those, 37 (62%) were white, 16 (27%) were American Indian/ Alaska Native, 1 (2%) was black, 1 (2%) was Asian, and 1 (2%) was reported as other race. One (2%) case was known to be of Hispanic ethnicity.

MDH received 1,501 reports of newly identified chronic hepatitis C infections in 2018. In 2016, the case definition for chronic hepatitis C changed to exclude those reported as having resolved their infection. A total of 33,856 persons are estimated to be alive and living in Minnesota with chronic HCV infection. The median age of these cases is 58 years.

Emerging Infections in Clinical Practice & Public Health
Emerging Pathogens and Innovative Approaches

November 15, 2019

Radisson Blu-Mall of America
Bloomington, MN

7:00 *am*	*Registration and Continental Breakfast*
7:55	**Welcome and Introductions**
8:00	**Keynote: Climate Change and Microbes: The Good, the Bad, and the Ugly**
8:45	**Questions and Discussion**
	Phillip Peterson, MD, University of Minnesota
9:00	**Challenges and Opportunities for Public Health in the New Era of Molecular Diagnostics**
9:30	**Questions and Discussion**
	Gregory L. Armstrong, MD, Centers for Disease Control and Prevention
9:45	**Ebola in the DRC**
10:15	**Questions and Discussion**
	Mary Choi, MD, 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	**Influenza Vaccines and Impact on Disease**
12:00 pm	**Questions and Discussion**
	Brendan Flannery, PhD, Centers for Disease Control and Prevention
12:15	**Lunch**
1:15	**CDI Prevention: Current and Future**
1:45	**Questions and Discussion**
	Dale Gerding, MD, Hines Veterans Affairs Hospital, Loyola University Stritch School of Medicine
2:00	**Cases from the Travel Desk**
2:30	**Questions and Discussion**
	Abinash Virk, MD, Mayo Clinic
2:45	*Refreshment Break*
3:00	**Outpatient Antimicrobial Stewardship: It Can be Done Effectively and Well**
3:30	**Questions and Discussion**
	Kati Shihadeh, PharmD, BCIDP, Denver Health Medical Center
3:45	**Challenging Cases of Public Health Interest**
	Moderator: *Dimitri Drekonja, MD, MS, Minneapolis VA Healthcare System*
	Public Health Expert: *Stacy Holzbauer, DVM, MPH*
	Panelists: *TBD*
4:30	*Evaluations & Adjourn*

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November 15, 2019

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