pennsylvania
DEPARTMENT OF HEALTH

Pennsylvania Epi Notes

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Rare Tick-borne Infections

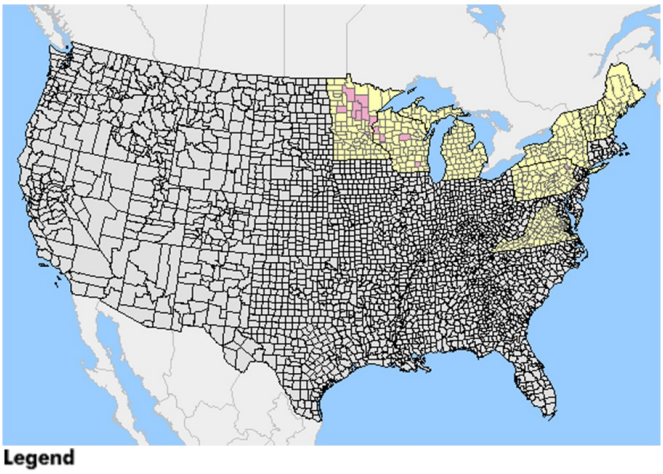
Powassan Virus

Background

Powassan virus infection is a rare tick-borne disease found mostly in southern Canada and the northern United States. Powassan was first identified in a five-year-old boy in Ontario, Canada in 1958. Powassan has subsequently been identified in the United States in Minnesota, Wisconsin, Michigan, New York, Vermont, New Hampshire, Maine and Virginia.[1] From 1958-2010, fewer than 60 cases were identified in the United States, and fewer than 100 cases were reported in North America.

Powassan is transmitted by the deer tick *Ixodes scapularis*, a tick which resides in tall grasses and vegetation and also transmits Lyme disease. It may also be transmitted by *Ixodes cookei,* a tick which resides in or near the burrows of smaller mammals such as woodchucks, although these ticks tend to bite humans less frequently. Powassan is typically transmitted from May to December, with most cases occurring from June to September when tick activity is highest.[2]

Locations of Powassan Virus Cases, United States, 2011



Legend

Positive Test Results*
No Positive Test Results**
Historically Not Found

* Data demonstrates local jurisdiction of residence and not necessarily the locale where the infection was acquired.

** States and counties in yellow are those in which virus activity has been reported historically, but no positive test results have been reported or no surveillance has occurred this year.

Graphic courtesy United States Geological Survey (USGS): http://diseasemaps.usgs.gov/2011/pow_us_human.html
Data obtained from CDC's Arbonet Program

Although Powassan is transmitted to humans via the bite of deer ticks, the virus is a member of the flavivirus family that also contains mosquito-transmitted agents such as West Nile virus. The symptoms of Powassan infection are similar to those reported with West Nile virus illness. Powassan symptoms include headache, vomiting, fever, weakness, loss of coordination, confusion, speech difficulties and memory loss. Powassan virus may also cause a more severe illness, including encephalitis and/or meningitis. Symptoms typically appear four to 18 days after a bite from an infected tick. About 10 percent of persons diagnosed with Powassan will die from the illness. Treatment is supportive, as there is no specific therapy for Powassan virus infection. (Powasan Virus Fact Sheet)

Case Study

In August 2011, a 31-year-old Pennsylvania man developed fever, muscle weakness, headache, altered mental status, stiff neck and muscle pain. He sought care with his primary care physician and was subsequently hospi-

(Rare Tick-borne Illnesses continued)

talized and presumptively diagnosed with West Nile virus infection. Testing of the patient's cerebrospinal fluid (CSF) was positive for Powassan virus, confirmed by the Centers for Disease Control and Prevention (CDC) laboratory.

Ixodes scapularis

Photo courtesy CDC/Michael L. Levin, PhD

The patient had not traveled outside of Pennsylvania in the weeks prior to his illness. He reported frequent outdoor activity on his farm and often rode an all-terrain vehicle (ATV) in wooded areas near his farm. The patient did not recall having received a tick bite, although he had noted ticks outside his home. He had also observed a "bull's eye rash" on his abdomen in August 2011. A "bull's eye rash" is consistent with Lyme disease infection, which is transmitted by the same tick as Powassan virus but is not usually seen with flavivirus infections. However, testing of specimens from this patient found no evidence of Lyme disease.

After a five day hospitalization, the patient was released and recovered at home. He continued to experience periods of vertigo and confusion.

This case of Powassan virus infection is the first reported in a human in Pennsylvania, although Powassan virus has been previously found in ticks and rodents in Pennsylvania.[3]

Prevention

Preventing tick bites is the best way to prevent Powassan virus infection and other tick-borne illnesses. When spending time outdoors, particularly in wooded areas, tick bite prevention involves use of insect repellant containing DEET, wearing light colored clothing and long pants, and avoiding walking or hiking in brush and long grasses. After spending time outdoors, individuals should perform thorough tick checks, particularly in the late spring to early fall months, and shower with soap and water. If symptoms of a tick-borne infection should occur, seek medical attention. (Powassan Virus Fact Sheet)

References

1. United States Geological Survey: http://diseasemaps.usgs.gov/pow_us_human.html
2. Minnesota Department of Health: http://www.health.state.mn.us/divs/idepc/diseases/powassan/basics.html
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Tick-borne Relapsing Fever

Background

Tick-borne Relapsing Fever (TBRF) is a rare bacterial illness transmitted by *Ornithodoros* ticks. In North America, the causative organism is usually the spirochete *Borrella hermsii*, although other species of *Borrelia* are also capable of causing the disease. In the U.S., most cases occur in the West and Southwest and typically are transmitted in rodent-infested settings, as the ticks primarily feed on rodents. *Ornithodoros* ticks are "soft ticks," unlike the "hard ticks" that transmit Lyme disease. Soft ticks typically feed on a human for about one hour, in contrast to hard ticks, which stay attached for hours and must feed for a minimum of 24 hours to infect a human.[1]

Ornithodoros hermis

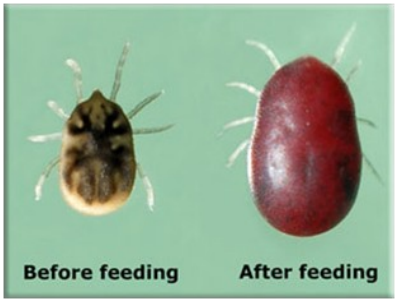


Photo courtesy CDC/Gary Hettrick

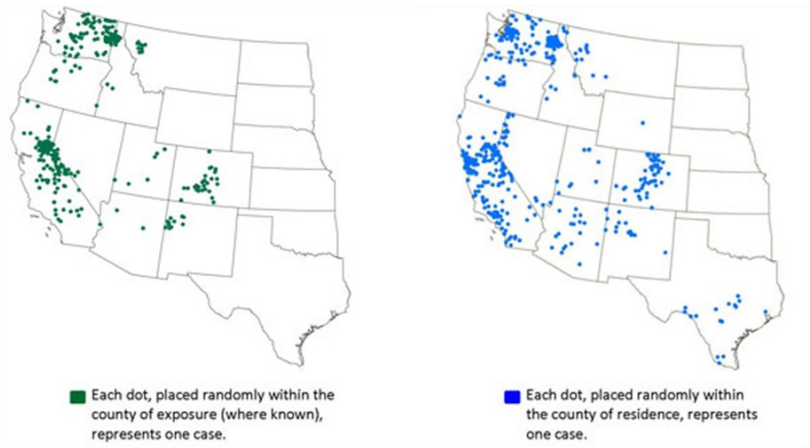
TBRF is characterized by approximately three days of fever, followed by a period of up to a week without fever, then another bout of fever. Relapses may occur one to four times. The end of each febrile period may be characterized by an extremely high fever of up to 106°F. Other symptoms include body aches, muscle pain, joint pain, headache, nausea, vomiting, lack of appetite, dry cough, light sensitivity, rash, neck pain, eye pain, confusion and dizziness.[1] The disease can be effectively treated with a number of antibiotics.

(Rare Tick-borne Illnesses continued)

Case Study
On July 12, 2012, a 32-year-old woman in Pennsylvania developed a fever, chills and a headache. Her symptoms persisted for two more days, whereupon she sought care at a local hospital. The hospital identified spirochetes on a blood smear obtained from the patient; *Borrelia hermsii* was later confirmed by the Centers for Disease Control and Prevention (CDC). The patient recovered after treatment with doxycycline.

TBRF is not known to occur in Pennsylvania, so a travel history was obtained from the patient. She had recently traveled to Colorado, where she stayed with relatives in a home not known to be rodent-infested, located near a golf course. She had participated in a number of outdoors activities including running, walking and biking.

Locations of TBRF Cases by Exposure and Residence, United States 1990-2011



Graphic courtesy CDC: http://www.cdc.gov/relapsing-fever/distribution/

Of note, a relative with whom the patient had stayed also developed symptoms consistent with TBRF. The family member was also treated and recovered. Although the host family felt that ticks were uncommon in their area, they had recently found a tick on the family dog.

Prevention
The tick species that transmit TBRF are not known to be present in Pennsylvania, but travelers to areas in which the disease is endemic should be aware of the potential for infection, particularly when staying in rustic areas or participating in outdoor activities. Travelers can avoid TBRF infection by avoiding rodent-infested buildings and using insect repellent containing DEET.[1]

References
1. CDC: http://www.cdc.gov/relapsing-fever/

H3N2v "Swine" Flu Associated with Fairs

Since the 2009 H1N1 pandemic, much attention has been given to the prompt recognition of illness from unusual influenza viruses, especially those that are transmitted from pigs to people. Influenza viruses that normally circulate in swine populations and cause sporadic infection in humans have been termed "variant" by the CDC and World Health Organization (WHO).[1] Variant influenza viruses are denoted by inclusion of a "v" when naming the virus subtype. In recent years, H1N1v, H1N2v and H3N2v have been detected in the United States.

One of the major concerns with interspecies transmission of influenza viruses is the potential for adaptation to humans, potentially leading to widespread person-to-person transmission. Well-adapted viruses that are novel to human immune systems pose a significant risk of pandemic (worldwide) spread. For this reason, human infections with novel influenza viruses (including variant viruses) are reportable in the United States to the CDC. In turn, so as to monitor worldwide trends, novel infections are reported by the CDC to the WHO as required under the International Health Regulations.[1]

A new H3N2v virus was first isolated from pigs in the United States in 2010, and, since that time, the virus has been found to be circulating widely in the nation's swine population.[2] In 2011, this variant H3N2 virus acquired the matrix or "M" gene of the 2009 H1N1 human pandemic influenza virus. The first hu-

(H3N2v Associated with Fairs continued)

man H3N2v infections with this recombinant strain were identified in the summer of 2011. It appears that this genetic characteristic may increase the virus' ability to be transmitted from pigs to people, as the virus has caused more documented human infections than any other variant influenza virus. While the virus may be more adept at causing infection in humans exposed to infected pigs, there have been few instances where the virus has been transmitted from person to person, and there has been no documentation of sustained transmission within households or communities. During 2011 and 2012, 319 confirmed human H3N2v cases have been identified in 13 states (Hawaii, Illinois, Indiana, Iowa, Maine, Maryland, Michigan, Minnesota, Ohio, Pennsylvania, Utah, West Virginia and Wisconsin).[3]

A review of human infection with swine influenza described 50 cases reported in the literature from 1958 through 2005.[4] This review concluded that there are no clinical features that distinguish human infection with swine influenza from infection with seasonal human influenza. While the frequency of swine-to-human transmission has apparently increased with the emergence of the H3N2v virus, clinical findings are largely consistent with this historical assessment. Symptoms associated with H3N2v infection have been mostly mild and similar to infection with seasonal influenza viruses. The symptoms usually include fever, cough and sore throat, although body aches, nausea and vomiting may occur. Like seasonal influenza, variant viruses have the ability to cause more severe illness, including pneumonia. In 2012, of the 307 H3N2v cases nationwide, 16 (5 percent) persons were hospitalized; and there was one (0.3 percent) fatality. [3]

The vast majority of human H3N2v cases in the United States have been in children.[5] Serologic surveys indicate that there is a lack of cross-protective immunity in children < 10 years of age.[6,7] Adolescents and adults may have developed a cross-protective immunity after exposure to seasonal influenza viruses in the late 1990s. The current seasonal influenza vaccine does not provide protection against H3N2v infection.[5]

In 2011 and 2012, H3N2v infection was confirmed in 14 Pennsylvania residents who were exposed to pigs in agricultural settings. In 2011, there were three laboratory-confirmed cases, all in children under 10 years of age. The three children had exhibited pigs or visited the swine barn at a single county fair in Pennsylvania.

In 2012, 11 laboratory-confirmed human cases of H3N2v were identified in individuals who attended three county fairs in Pennsylvania during the month of August. In addition to these confirmed cases, case-finding by the Pennsylvania Department of Health (DOH) identified 30 probable cases of H3N2v infection in persons attending these fairs. A probable case met clinical criteria (fever ≥100°F with cough and/or sore throat) and were epidemiologically linked (contact with one or more confirmed cases of H3N2v virus infection or attendance at an event where confirmed cases had been identified), but for which no laboratory testing for H3N2v virus infection had been performed. All probable and confirmed cases had spent time in a fair swine barn and had direct or indirect contact with pigs. Pigs showing clinical signs of illness (e.g., cough, fever, lethargy) were confirmed to have H3N2v infection at one of these three fairs. A summary of the 2012 H3N2v cases is found in Table 1. Most cases were in children, with only five individuals (12 percent) >18 years of age (Figure 1). There were no hospitalizations or deaths associated with H3N2v infection in Pennsylvania.

Table 1: Demographics of laboratory-confirmed and probable H3N2v cases identified in Pennsylvania, 2012

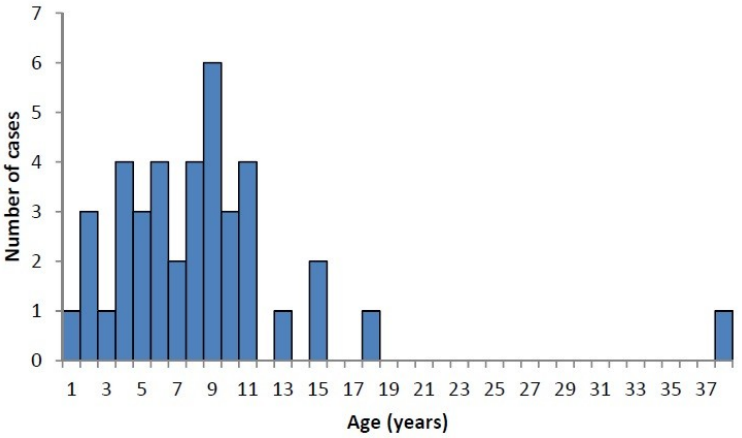
	Confirmed	Probable	All Cases
Number of cases	11	30	41
Median age (years)*	6	8	8
Age range*	3-18	1-38	1-38
Number <18 years*	10 (91%)	26 (93%)	36 (93%)
Sex			
Female	6	18	24
Male	5	12	17
Hospitalized	0	0	0
Deaths	0	0	0

* Age missing for one probable case and one confirmed case

(H3N2v Associated with Fairs continued)

Influenza viruses can be transmitted from pigs to people by aerosol and droplet routes, as well as by direct contact with a virus-contaminated surface. Because of the multiple mechanisms of transmission, the CDC produced recommendations for persons who may be in direct or indirect contact with pigs. These recommendations included avoiding eating and drinking in areas where swine are present, avoiding contact with pigs that look ill and washing hands with soap and water after contact. In addition to these general recommendations, CDC advised persons at high risk for infection (including children younger than 5 years, people 65 years and older, pregnant women, and people with certain long-term health conditions) to avoid pigs and swine barns entirely during the 2012 fair season.[8,9] CDC also discouraged bringing toys, pacifiers, cups, baby bottles, strollers, or similar items into pig areas. While the classic signs of influenza in swine include lethargy, fever, dyspnea, cough, poor appetite, conjunctivitis, and eye and nose discharge, pigs may be infected with H3N2v and other swine influenza viruses with no apparent signs of illness.[10] Thus, people should practice good hand hygiene regardless of the apparent swine health status. There is no risk of influenza infection associated with eating pork products.

Figure 1: Age distribution for laboratory-confirmed and probable H3N2v cases identified in Pennsylvania, 2012



In addition to diagnostic testing for human infections with swine influenza viruses during the winter influenza season, DOH will be conducting surveillance for H3N2v infections associated with agricultural fairs in 2013. With efficient diagnostic testing, organized case investigations and attention to good preventive behaviors, the Pennsylvania public health community and residents of the commonwealth can work together to prevent, detect and better understand interspecies transmission of influenza.

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Influenza Testing—Skip the Serology

The Allegheny County Health Department (ACHD) receives hundreds of reports of positive serologic (antibody) influenza tests during each influenza season. The CDC specifically notes that "Serologic testing (antibody detection) is not recommended for routine patient diagnosis" in their influenza testing guidelines (Table 1). This is because initial serologic testing cannot distinguish between past infection and recent infection or vaccination and is therefore not useful as a clinical diagnostic tool. While it is true that paired serologic specimens obtained at least three weeks apart can diagnose infection that occurred in the recent past, newer methods have relegated this type of testing to the research realm.

The decision to test a patient for influenza is complex and begins with clinical judgment of whether the patient has an illness consistent with influenza in a setting of circulating influenza virus in the community. Serologic testing may delay the diagnosis of influenza and result in treatment delays, and a single test could be misinterpreted as indicative of recent infection and lead to inappropriate treatment. Since influenza anti-viral treatment is most effective when prescribed early, clinicians need prompt and meaningful information to add to their clinical judgment when making a decision to treat.

In addition to its limited clinical utility, serologic testing is also an unnecessary healthcare expense for patients. According to the Mayo Clinic, a serologic influenza test costs $172.60 (Mayo Clinic Test Catalog, Influenza).

Despite CDC recommendations, limited clinical utility and expense, positive serologic tests represent 9 percent to 29 percent of all positive influenza tests received by ACHD in a given influenza season (Figure 1). During the 2011-2012 season, serologic testing results accounted for 26 percent of reported influenza test results, more than RT-PCR (25 percent) or viral culture (6 percent).

ACHD reviewed serologic influenza tests reported from October 2010 to May 2011 to identify the hospitals and healthcare systems

Table 1: Influenza Virus Testing Methods

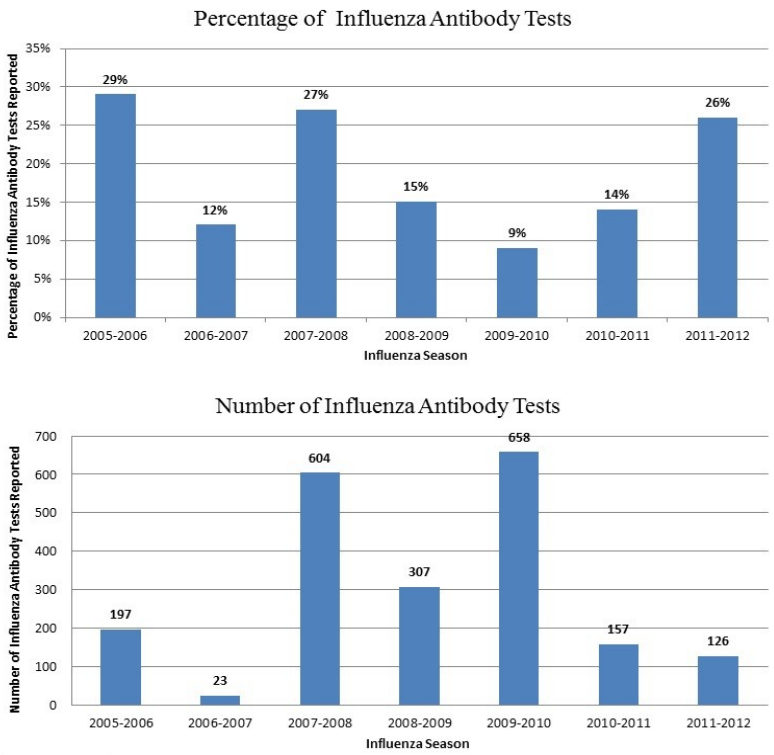
Method[1]	Types Detected	Acceptable Specimens[3]	Test Time[3]	CLIA Waived
Viral cell culture (conventional)	A and B[2]	NP swab, throat swab, NP or bronchial wash, nasal or endotracheal aspirate, sputum	3-10 days	No
Rapid cell culture (shell vials; cell mixtures)	A and B[2]	As above	1-3 days	No
Immunofluorescence, Direct (DFA) or Indirect (IFA) Antibody Staining	A and B[2]	NP swab or wash, bronchial wash, nasal or endotracheal aspirate	1-4 hours	No
RT-PCR[4] (singleplex and multiplex; real-time and other RNA-based) and other molecular assays	A and B[2]	NP swab, throat swab, NP or bronchial wash, nasal or endotracheal aspirate, sputum	Varied (Generally 1-6 hours)	No[5]
Rapid Influenza Diagnostic Tests[6]	A and B	NP swab, (throat swab), nasal wash, nasal aspirate	<30 min.	Yes/No

1. Serologic (antibody detection) testing is not recommended for routine patient diagnosis.
2. May be adapted to identification of specific subtypes
3. Ref: Leland, et al. 2007, *Clin Micro Rev* 20: 49-78. Approved respiratory specimens vary among FDA cleared influenza assays.
4. Reverse transcriptase polymerase chain reaction, including FDA-approved test systems, reference laboratory testing using ASR or lab-developed reagents
5. Random-access, single cartridge tests may be moderately complex
6. Immunochromatographic lateral flow and membrane-based immunoassays

* These tests use antibodies to detect the presence of influenza virus antigen in a patient specimen. They are not serologic tests.

Table courtesy of CDC: http://www.cdc.gov/flu/professionals/diagnosis/clinician_guidance_ridt.htm

Figure 1: Percentage and Number of Influenza Antibody Tests Reported to NEDSS for Allegheny County by Influenza Season



(Influenza Testing continued)

reporting these tests. During this period, ACHD received 2,859 influenza test results among which 403 (14 percent) were serologic tests. Among the 356 serologic tests with ordering information, the vast majority (88 percent) were ordered by hospitals.

ACHD met with the central laboratory of a local health system which encompassed many of the hospitals identified to discuss the results of this analysis. Laboratory staff demonstrated how influenza tests are ordered in the hospitals. They hypothesized that, since influenza tests are displayed alphabetically, hospital staff might be selecting "antibody" tests because they show up first in the list. Likewise, if clinicians fail to specify exactly which influenza test they want, ancillary staff might translate the order to mean a serologic test. The hospital system is considering eliminating influenza serologic tests from the menu of influenza testing options.

Despite these efforts, serologic test ordering does not appear to have abated. ACHD would be interested in working with other health departments to better understand the scope of the problem and to identify possible interventions which may reduce ordering of this useless clinical test and encourage the proper use of appropriate influenza testing.

Healthmap.org

Whether you are interested in learning about the occurrence of infectious diseases in your own backyard or half-way around the world, HealthMap can keep you connected to public health issues in real time. Founded in 2006, HealthMap is a disease tracking tool that incorporates a comprehensive overview of many data sources that monitor disease events and trends worldwide.

The system is user-friendly and provides an innovative approach to guide public health preparedness efforts. At no cost, this surveillance tool is available to help you stay informed of present global health concerns, and it's all available as issues are emerging! In addition, HealthMap has developed an application entitled Outbreaks Near Me which allows the user to access all HealthMap related information, as well as report outbreaks, through an interactively designed interface. This application has the functionality to alert you when a local outbreak is taking place. It also allows you the opportunity to be the first to report an outbreak through your own eyewitness account.

An additional facet of HealthMap includes Flu Near You. Individuals who are 13 years of age or older and a resident of the U.S. may register to participate in this program, which monitors flu activity across the nation. Once registered, participants will receive a brief weekly survey to document their health status. Responses from this survey can help provide better insight and understanding of the presence of flu within the community.

For more information, check out: http://www.healthmap.org.

Some additional resources available for health-related information include:
www.health.state.pa.us (Pennsylvania Department of Health)
www.cdc.gov (Centers for Disease Control and Prevention)
www.who.int (World Health Organization)
www.nih.gov (National Institute of Health)

Cases of select notifiable diseases in Pennsylvania (as of 11/30/2012)*

	Total cases reported for previous 5 years				
Disease	2012 †	2011	2010	2009	2008
Chlamydia	50,723	52,884	47,518	43,068	42,233
Gonorrhea	14,164	13,770	12,883	10,138	11,071
Campylobacter	1,550	1,762	1,624	1,542	1,554
Pertussis (whooping cough)	1,466	547	763	468	368
Salmonella	1,457	1,844	1,809	1,701	1,721
Giardia	574	792	786	837	873
Legionella	274	502	324	383	408
Cryptosporidiosis	257	457	485	465	326
Varicella (chicken pox)	244	337	373	461	853
Shigella	109	121	634	1,201	248

* Confirmed cases only
† Case counts for 2012 are provisional and subject to change. Counts for earlier years are for complete years.

Disease Reporting

Healthcare practitioners, healthcare facilities and clinical laboratories are required to report certain diseases to the Pennsylvania Department of Health. In addition to the diseases on the list, all disease outbreaks and/or unusual occurrences of disease are reportable within the commonwealth. In most cases, reporting must be done electronically via Pennsylvania's version of the National Electronic Disease Surveillance System (PA-NEDSS). To request a PA-NEDSS account, healthcare providers may email PA-NEDSS@pa.gov; please include your contact information and the name and address of the facility for which you will be reporting.

Employment Opportunities

The State Civil Service Commission is currently accepting applications for the following Pennsylvania Department of Health positions:

- Epidemiologist
- Epidemiology Program Specialist
- Epidemiology Research Associate
- Public Health Physician

To apply, click on the links above or visit the Pennsylvania State Civil Service Commission website and click on Job Seekers.

Complete a civil service application for employment for each test announcement for which you are interested. The commission will send you the results of your examination or rating. If you meet the minimum requirements and pass the test, your name will be placed on the list of eligible candidates (eligible list) for that job title according to your score. Positions in the merit system are filled from this pool of eligible candidates. When a job vacancy occurs, the hiring agency requests an eligible list from which to interview for that job title. If you are ranked high enough on the eligible list, you will be contacted for a job interview.
See How to Get a Civil Service Job for more information.

Pennsylvania Epi Notes

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