

Amebiasis

INTRODUCTION

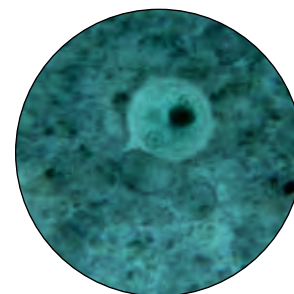
Amebiasis is a parasitic disease caused by the organism *Entamoeba histolytica*. In 2013, amebiasis was the fourth leading cause of death from parasitic diseases worldwide (Hotez, 2015). While there are other *Entamoeba* species that inhabit humans, none are as pathogenic as *E. histolytica*.

Up to 90% of infected persons do not experience symptoms (Haque, Huston, Hughes, Houpt, & Petri, 2003). Symptoms can be mild (infrequent diarrhea) to severe (fulminant colitis or liver abscesses). Symptoms include fever, weight loss, dehydration, abdominal cramps, and diarrhea. Symptoms can persist for months without proper treatment. In rare cases, the infection can spread to other organs, causing liver abscesses or skin lesions. Individuals can carry the parasite for weeks to years without experiencing any symptoms.

Amebiasis is common in countries with poor sanitation. In the United States, the

disease is mainly observed in immigrants from such countries, travelers to tropical areas, institutionalized persons, immunocompromised persons, and people who have contact with fecal matter during sex (Centers for Disease Control and Prevention, 2015). Amebiasis has also been observed in men who have sex with men worldwide (Shelton, 2004).

Healthcare providers have to report suspect or confirmed cases of amebiasis within one week to the health department. A confirmed case of amebiasis requires a valid laboratory diagnosis.



SURVEILLANCE SUMMARY

Surveillance History

Reportable in Texas since 1986

Population at Higher Risk

Travelers to endemic countries

Notable Outbreaks

None

Cases Per Year

38.7 per year

Seasonality

Summer

Caseload

1,030

Disease Transmission

The incubation period is generally 2 to 4 weeks, with a range of a few days to several months or years. The disease is transmitted via the fecal-oral route, similar to other gastrointestinal infections. The parasite is shed in the feces of infected persons, and subsequently spread to others via several ways.

Consumption of contaminated food and water are the most common sources of infection. People who care for infants can get infected after changing diapers. Certain sexual practices, such as anal and oral-anal sex, carry an increased risk for amebiasis and other gastrointestinal infections. Even small amounts of the parasite are known to cause disease. Since the disease is often asymptomatic, an infected person can unknowingly transmit the infection to others (Shelton, 2004).

Epidemiology in Houston

From 2005 to 2014, there were 387 cases of amebiasis reported in Houston. As Figure 1

shows, the number of cases increased during the years 2006 to 2008 and the case count

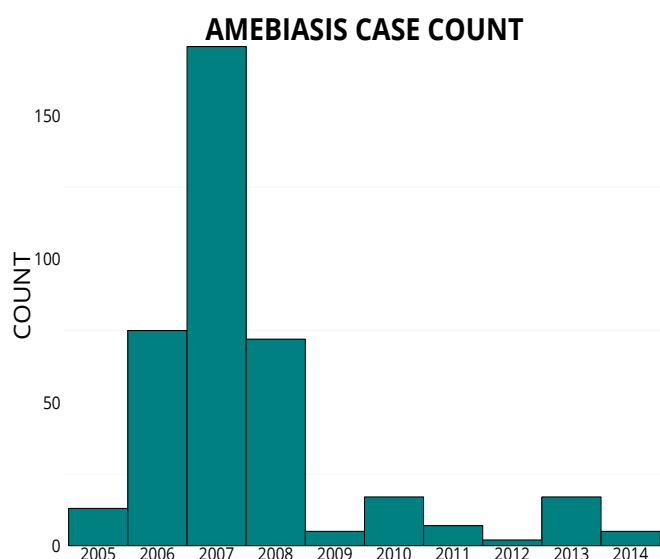


FIGURE 1. Amebiasis case count.

Amebic Meningitis and Encephalitis

INTRODUCTION

Several types of amoebas, including *Balamuthia spp.*, *Naegleria fowleri*, and *Acanthamoeba spp.*, have rarely been known to cause human central nervous system (CNS) infection, including encephalitis, meningitis, and meningoencephalitis. Meningitis is the inflammation of the

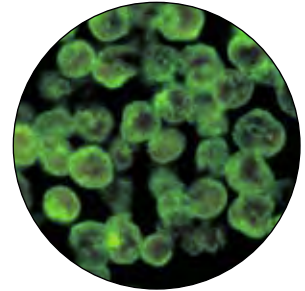
meninges, a thin, membranous tissue covering the brain and the spinal cord, while encephalitis is the inflammation of the brain. Meningoencephalitis is a combination of the two conditions with inflammation of the brain and its membranous tissues (Heymann, 2008) (Texas Department of States Health Services, Amebic Central Nervous System (CNS) Infections, 2015).

Primary amebic meningoencephalitis (PAM) occurs when meningoencephalitis is caused by an amoeba. The main cause for PAM is the free-living form of the amoeba *Naegleria fowleri*. Human exposure to *Naegleria fowleri* occurs when water containing amoeba enters the nose. Transmission occurs when the free-living form of the amoeba, a trophozoite, penetrates the nasal tissue and migrates to the brain via the olfactory nerves causing PAM (Heymann, 2008) (Texas Department of States Health Services, Primary Amebic Meningoencephalitis (PAM), 2015).

The incubation period for PAM is 3 to 15 days. Initial signs and symptoms consist of sudden onset of headache, fever, nausea and vomiting, and stiff neck. As the disease

progresses additional symptoms might develop, including photophobia, mental-state abnormalities, hallucinations, delirium, seizures, and coma. After the onset of symptoms, the disease progresses rapidly and usually results in death within 3 to 7 days (Heymann, 2008) (Texas Department of States Health Services, Primary Amebic Meningoencephalitis (PAM), 2015).

The principal causes for amebic meningitis and encephalitis are *Balamuthia spp.* and *Acanthamoeba spp.* The free-living form of these two amoeba species reaches the central nervous system through the blood. Those infected are frequently chronically ill or immunosuppressed patients with no history of swimming or no known source of infection. The symptoms include seizures, partial paralysis, mental status changes, fever, muscular weakness, double vision, sensitivity to light, and other neurologic problems (Heymann, 2008) (Centers for Disease Control and Prevention, *Acanthamoeba* – Granulomatous Amebic Encephalitis (GAE); Keratitis, 2013) (Centers for Disease Control and Prevention, 2011).



SURVEILLANCE SUMMARY

Surveillance History

Reportable year: Reportable in Texas since 2013.

Population at Higher Risk

Outdoor swimmers

Notable Outbreaks:

None

Cases Per Year

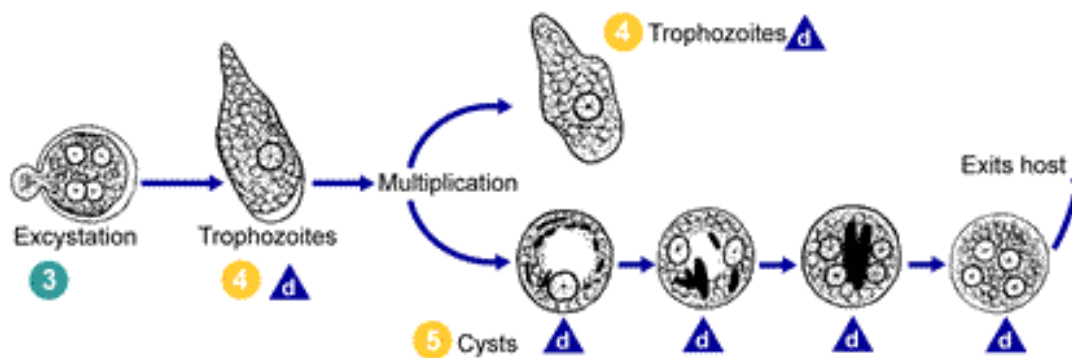
0

Seasonality

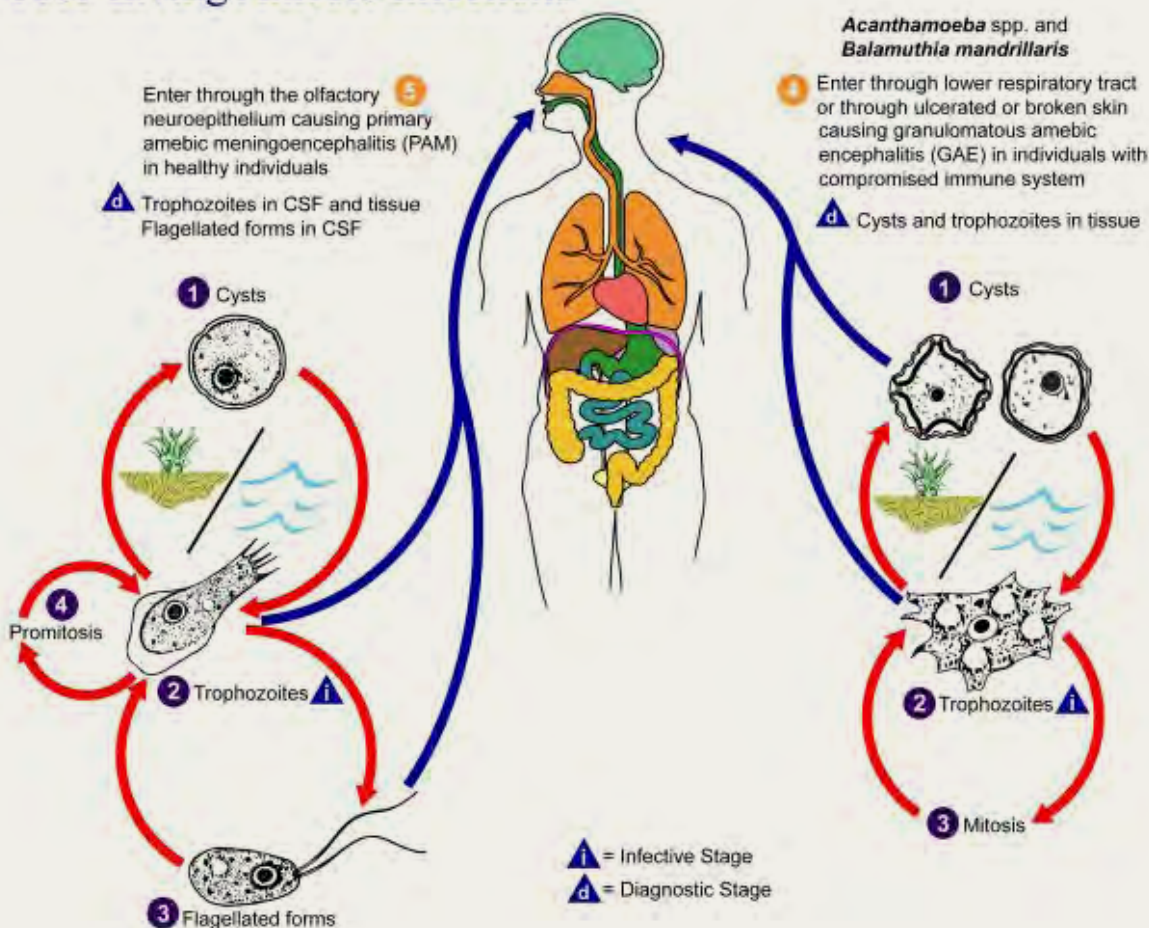
Summer for certain types

Caseload

0



Free-Living Amebic Infections



Disease Transmission

Naegleria fowleri (an amoeba) is found in warm fresh water such as rivers, lakes and ponds. Exposure occurs when people go swimming or diving in warm stagnant freshwater places, like lakes and rivers. Amoebas are thought to be introduced to the brain by forced entry of water up the nose during fresh-water recreational activities, such as diving. The organism has also been found in tap water and can be introduced to the brain when tap water is used for nasal irrigation or sinus flushes. However, people do not become infected from drinking contaminated water (Texas Department of States Health Services, Primary Amebic Meningoencephalitis (PAM), 2015).

Balamuthia amoebas are thought to enter the body when soil containing *Balamuthia* comes in contact with skin wounds and cuts, or when dust containing *Balamuthia* is breathed in or gets in the mouth. Once inside the body, the

amoebas can then travel to the brain and cause granulomatous amebic encephalitis (GAE). GAE is a severe disease of the brain that is fatal in over 95% of cases. It can take weeks to months to develop the first symptoms of *Balamuthia* GAE after initial exposure to amoebas (Centers for Disease Control and Prevention, 2011).

Balamuthia amoebas live freely in soil around the world. Gardening, playing with dirt, or breathing in soil carried by the wind might increase the risk for infection. *Balamuthia* might also be present in fresh water. There have been reports of *Balamuthia* GAE infection in dogs that swam in ponds. However, there have been no reported human cases where the only potential exposure was swimming (Centers for Disease Control and Prevention, 2011).

Acanthamoeba is a microscopic, free-living amoeba that can cause rare, but severe infections of the eye, skin, and

central nervous system. The amoeba is found worldwide in the environment in water and soil. The amoeba can be spread to the eyes through contact lens use, cuts or skin wounds, or by being inhaled into the lungs. Most people will be exposed to *Acanthamoeba* during their lifetime, but very few will become sick from this exposure (Centers for Disease Control and Prevention, 2013).

While *Naegleria fowleri* infection usually occurs in young healthy individuals, *Acanthamoeba* and *Balamuthia* infections typically appear in the immune compromised (Heymann, 2008) (Texas Department of States Health Services, Primary Amebic Meningoencephalitis (PAM), 2015).

Epidemiology in Houston

There were no cases of amebic meningitis or encephalitis reported in Houston from 2005 to 2014.

Acanthamoeba and *Balamuthia* meningitis and encephalitis cases have occurred in Texas. In 2009-2014, there were two Texas cases of *Balamuthia* (2010 and 2014) and one Texas case of *Acanthamoeba* (2012). From 2005 to 2014, there were 9 cases of amebic meningoencephalitis cases reported in the state of Texas (Texas Department of States Health Services, Amebic Central Nervous System (CNS) Infections, 2015) (Texas Department of States Health Services, Primary Amebic Meningoencephalitis

Public Health Action

The only way to prevent *Naegleria fowleri* infections is to refrain from water-related activities in stagnant waters. If you do plan to take part in water-related activities, here are some measures that might reduce risk:

- Avoid water-related activities in bodies of warm stagnant freshwater during periods of high water temperature and low water levels.

- Hold the nose shut or use nose clips when taking part in water-related activities in bodies of warm freshwater such as lakes, rivers, or hot springs.
- Avoid digging in or stirring up the sediment while taking part in water-related activities in shallow, warm, freshwater areas.
- Use only sterile, distilled, or lukewarm previously boiled water if you use a Neti-Pot or syringe for nasal irrigation or sinus flushes (Texas Department of States Health Services, Primary Amebic Meningoencephalitis (PAM), 2015).

Currently, there are no known ways to prevent infection with *Balamuthia* or *Acanthamoeba* since it is unclear how and why some people become infected while others do not (Centers for Disease Control and Prevention, 2013) (Centers for Disease Control and Prevention, 2011).

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Anaplasmosis

INTRODUCTION

Anaplasmosis is a rare bacterial disease caused by *Anaplasma phagocytophilum*. The disease is transmitted by ticks.

Symptoms typically develop 1 to 2 weeks after being bitten by an infected tick and include fever, headache, muscle pain, and confusion. In rare cases, a rash develops. The majority

of infections occur during the summer months, when people and ticks are most active. Cases can occur year-round, however.

Severe complications from the illness include labored breathing, hemorrhage, renal failure, or neurological problems. Less than

1% of cases are fatal (CDC, 2013).

The majority of infections occur during the summer months, when people and ticks are most active. Cases can occur year-round, however.

Disease Transmission

A. phagocytophilum is endemic to several species of ticks, including the American dog tick (*Dermacentor variabilis*), blacklegged tick (*Ixodes scapularis*), and the Western blacklegged tick (*Ixodes pacificus*). Both the American dog tick and blacklegged tick can be found in eastern Texas. When an infected tick bites a human, there is a potential for the bacteria to then infect the human. The disease is more common in the northern Midwest and Northeastern States, including Wisconsin, Minnesota, and Maine. Incidence in Texas is relatively low. Recent analysis indicates that the geographic range of anaplasmosis is increasing over time (Dahlgren, Heitman, Drexler, Massung, & Behravesh, 2015).

Epidemiology in Houston

Given that ticks are uncommon in densely populated areas, cities such as Houston have a low rate of incidence. In the past 10 years, Houston did not have any cases of anaplasmosis.

According to the CDC, annual reported cases have increased since the disease became reportable in 1999. Over 90% of all reported cases in the US come from just six states: New York, Connecticut, New Jersey, Rhode Island, Minnesota, and Wisconsin (CDC, 2013). While any person can become ill with

the disease, the elderly see the highest rate of reported illness.

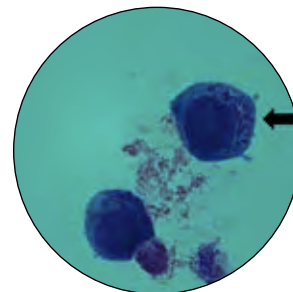
Public Health Action

The City of Houston promotes general awareness about tick-borne diseases such as Lyme, ehrlichiosis, and anaplasmosis. When traveling in dense foliage, hiking on trails, or walking through a field, it is important to be vigilant for tick bites. This is especially true during the summer months when ticks are more likely to bite humans.

Prevention methods include:

- Avoiding areas with ticks when possible
- Wearing light-colored clothing so that ticks can be easily seen and be removed prior to biting
- Wearing long-sleeved shirts and tuck pants into socks or boots
- Applying permethrin to clothes or insect repellents containing DEET; DEET can be used safely on children and adults (EPA, 2007)
- Checking regularly for ticks when in their habitat
- Protecting pets with approved tick repellents after discussing the best options with a veterinarian

Ticks that have already bitten can be removed



SURVEILLANCE SUMMARY

Surveillance History

Nationally notifiable since 1999

Population at High Risk

- Hikers
- Travelers
- The elderly

Notable Outbreaks

None

Cases Per Year

0

Seasonality

June and July

Caseload

8



with tweezers. Attempt to remove the entire tick and not just the body. A detached head can still transmit disease causing bacteria. After removal, wash the bite area with rubbing alcohol, iodine, or soap and water.

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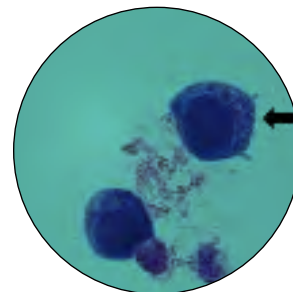
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SURVEILLANCE SUMMARY

Surveillance History

Nationally notifiable since 1999

Population at High Risk

- Hikers
- Travelers
- The elderly

Notable Outbreaks

None

Cases Per Year

0

Seasonality

June and July

Caseload

8



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WORKS CITED

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Anthrax

INTRODUCTION

Bacillus anthracis is a spore-forming bacterium that causes the acute infectious disease anthrax. Anthrax has three major clinical forms classified by the route of entry of the bacteria into the body:

- **Inhalation:** a disease resembling a viral respiratory illness, followed by distress from tissues not receiving enough oxygen. Considered the most dangerous.
- **Cutaneous:** an infection of a wound that produces a lesion on the skin. Generally considered the least dangerous.
- **Intestinal:** severe abdominal distress followed by fever and signs of septicemia. This form is very rare.

Inhalation infections result when the bacteria spores are inhaled. This is especially a concern with weaponized anthrax. Intestinal infection results when a person ingests spores into the gut via food or drink. Cutaneous infections occur when *B. anthracis* bacteria are able to bypass the protective skin and cause an infection.

Disease Transmission

Anthrax usually affects livestock (e.g., cattle, sheep, goats) as well as wild herbivores. Humans rarely become infected except as a result of occupational exposure to infected animals or contaminated animal products, such as tissues, hides, or wool. Typically, anthrax infections are more prevalent in agricultural and impoverished regions with inadequate disease control systems. Person-to-person anthrax is rare and has only been observed in the cutaneous form when a person has direct contact with a skin lesion (CDC, 2013).

A special type of cutaneous anthrax is injection anthrax. It has been observed in Europe among heroin users. Injection anthrax is especially severe and requires immediate medical attention (Grunow, et al., 2012).

Anthrax is endemic in Central and South America, sub-Saharan Africa, parts of Asia, and Eastern Europe.

Small cuts or open wounds are often the point of entry of the bacteria into the host.

Anthrax is a notifiable condition in Texas and the United States. It should be reported within an hour of suspicion by a physician, laboratory, or other caregiver in order to initiate public health action.

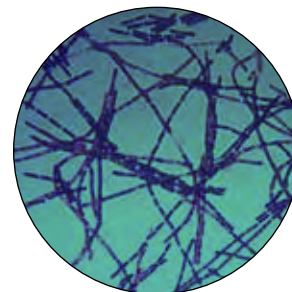
Occasionally, travelers to parts of the world where anthrax is endemic have contracted the disease.

Epidemiology in Houston

No case of anthrax has been reported in Houston since 1922. Available data suggests that as early as 1903, anthrax was not considered a public health concern in the Houston area. Dr. F. J. Slataper, the City Pathologist and Chemist reported that one "culture [was] examined for anthrax" in 1912 (Slataper, 1913).

In the early 1900s the number of anthrax cases reported nationally was approximately 130 per year. The current incidence of naturally occurring anthrax infections in humans is 1-2 per year (CDC, 2013).

The cutaneous form of anthrax is more common than the other forms. During the



SURVEILLANCE SUMMARY

Surveillance History

Nationally notifiable since 1944.

Population at Higher Risk

Animal handlers

Notable Outbreaks

None

Cases Per Year

0

Seasonality

June, July, August and September

Caseload

15

whole of the 20th century, at least 71 cases of inhalation anthrax were reported in the United States (Holty, et al., 2006). The overall case fatality rate exceeded 75%. Following the bioterrorist attacks in October 2001 in which anthrax was introduced through the postal system, the case-fatality rate among patients with inhalation disease was 45%. Though there were suspected cases reported in Houston in 2001, none were confirmed.

Certain professions, such as laboratory workers and persons working directly with animals or animal products, are at increased risk of exposure to anthrax. However, the risk is still very low.

Laboratory Testing

Current testing in the HHD laboratory includes real-time PCR and conventional culture methods for clinical or environmental isolates. Testing by PCR is based on three markers specific to the bacterium. PCR from a direct clinical patient sample culture or from an isolate can be reported as confirmatory. Confirmatory testing includes tests for capsule production and gamma phage lysis, along with characteristic culture morphology and biochemistry. Antimicrobial susceptibility for *B. anthracis* can also be performed in the laboratory. Advances in genotyping methods have led to improved analysis of the genetic variation and relatedness of *B. anthracis*.

Bacillus Anthracis Tests Conducted at HHD Laboratory

2006	22
2007	16
2008	16
2009	15
2010	20
2011	45
2012	33
2013	27
2014	28
2015	19

White Powder Runs

There are only three ways that anthrax can be detected: (1) clinical presentation in people; (2) clinical presentation in animals; or, (3) environmental detection by systems like the United States Postal Service (USPS) Biohazard Detection System (BDS), or manual sampling and laboratory analysis.

Disease progression after the onset of symptoms of inhalational anthrax can be very rapid and the case fatality rate can be very high, especially if there are delays in diagnosis and treatment. Factors that determine the scale of the public health response include how the anthrax was detected and the corresponding exposure risk assessments. The public health response would potentially have four goals: (1) remove the source of the anthrax spores, (2) remove people from the area of exposure risk and decontaminate the people and the site, (3) provide prophylaxis to persons who had exposure risk but no onset of symptoms, and (4) diagnose and treat individuals with exposure risk and signs or symptoms.

An example of narrow public health response would be an anthrax exposure in a confined space like a research laboratory. The response would be limited to the number of people with exposure risk since the exposure area is known, and access would be confined to a small number of people.

A public health response to a BDS alarm would be confined to the immediate building and people who had been inside the area with exposure risk within the time the release may have occurred, accounting for delays in the BDS analysis and alarm. Houston tested such a response with the USPS on June 28, 2011. The response involved securing the building, calmly evacuating the workers, getting them through decontamination, and providing them with post-exposure prophylaxis such as Ciprofloxacin. Once the immediate public health function is completed, law enforcement partners at the United States Postal Inspection Service (USPIS) and Federal Bureau of Investigations (FBI) would continue with their criminal investigation.

Current guidance from CDC, particularly in the form of the Cities Readiness Initiative (CRI) grant, prescribes a robust and wide response to an aerosolized anthrax bioterrorism attack that emphasizes the need to dispense antibiotics to the public within the first 48 hours of an aerosolized exposure risk. In Houston, our plan is to issue post-exposure medication via 50 public Points of Dispensing (POD) sites for the general public as well as closed POD sites for infrastructure personnel. The basic premise of the response is to use an incident command system organization to facilitate a non-medical mass dispensing model. Rapid throughput at an average rate of 1,000 regimens per hour per site is achieved through a heads-of-households model to deploy medications to individuals for their families. These POD sites would be coordinated through the Houston Health Departmental Operations Center and the Houston Emergency Operations Center.

Along with all of our regional local health department partners, we tested this mass dispensing plan on November 2, 2013 as part of the Regional Allocation Distribution and Dispensing (RADD) full scale exercise. For our portion of the RADD exercise, we engaged representatives from across City Departments to operate three POD sites and demonstrated Houston's ability to perform this critical public health response.

The Houston Fire Department (HFD) Hazardous Materials (HazMat) Team is frequently called out on unidentified substance concerns which are also known as "white powder runs" because they typically involve white powder in mail packages. These requests became very common late in 2001 as the "Amerithrax" incident became known. Since then, requests have declined but



Public Health Action

Cases of anthrax are rare, sporadic, and generally confined to persons who have traveled to countries where the disease is endemic, or who have had contact with an infected animal. Because it is so rare, if someone were to become ill without a history of travel or interaction with diseased animals, bioterrorism activity would be suspected and would prompt immediate notification by HHD to the appropriate authorities, including the FBI and CDC. A coordinated investigation would ensue to determine the source of the illness.

CDC has classified anthrax as a Category A agent. Category A agents are those that pose the greatest possible threat to public health, may spread across a large area, and need public awareness as well as a great deal of planning to protect the public's health.

The ability of anthrax to be used as a biological weapon was demonstrated in the United States in October 2001. Individuals in Florida, New York City, and Washington, D.C. received letters sent through the postal system containing cultivated anthrax spores. Five letters were sent from Trenton, New Jersey and caused 22 cases of anthrax infection. Following the anthrax attacks, the United States Postal Service (USPS) implemented a screening system to detect anthrax being distributed in the mail system.

Persons potentially exposed to anthrax should seek medical attention immediately. Treatment with antibiotics is administered for 60 days. In an emergency situation, the anthrax vaccine may be administered to prevent infection, though the efficacy of post-exposure vaccination has not been documented (CDC, 2015). The vaccine is not routinely administered except to military personnel and livestock.

have not disappeared. The response to a "white powder run" is based on an established protocol between law enforcement, FBI, HFD HazMat, and the HHD Lab. Once FBI determines that there is a potential threat requiring analysis of the substance, then HazMat will collect the sample, conduct preliminary presumptive testing, and then bring a sample to the HHD Lab for confirmatory testing done via PCR and culture. A positive result would then trigger public health control measures as well as a law enforcement investigation to identify and apprehend the perpetrators.

In July of 2014, the Houston Health Department was invited along with our HFD HazMat partners to participate in a drill at a commercial facility with a complex mail handling area. The drill addressed the issues around risk assessment, personal protective equipment (PPE), collection of the item, and field sampling.



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Arbovirus Infection

INTRODUCTION

Arboviruses are vector-borne diseases transmitted by arthropods, usually mosquitoes, and are known to cause illnesses in humans and animals. Illnesses can range in severity from acute fevers of short duration, to mild aseptic meningitis, to encephalitis with coma and death. Arboviral activity

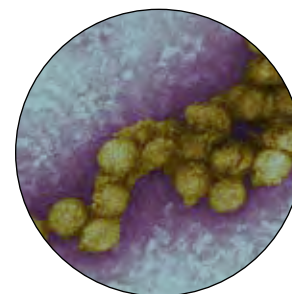
in Texas is usually represented by five distinct illnesses: California encephalitis (CE), St. Louis encephalitis (SLE), Eastern equine encephalomyelitis (EEE), Western equine encephalomyelitis (WEE), West Nile virus (WNV) and dengue fever (Texas Department of State Health Services, 2013).

Arboviral diseases can be difficult to prevent and control. The pattern of outbreaks is generally unpredictable and the lifecycle of the virus can involve avian, equine, and the canine population in addition to humans.

West Nile virus is currently the most common mosquito-borne illness in Texas. Historically, the virus was commonly found in Africa, West Asia, and the Middle East but appeared in the eastern United States in the

summer of 1999. The virus is closely related to the St. Louis Encephalitis virus found in early 1930s in the United States. West Nile virus can infect humans, birds, mosquitoes, horses, and some other animals. Up to 80 percent of people infected with West Nile virus will have no symptoms; however, some infections can result in serious illness or death. People over 50 years of age and those with weakened immune systems are at higher risk of becoming seriously ill if infected. (L.Heymann, 2008). All the five arboviruses previously listed have similar signs and symptoms but vary in severity.

WNV is a reportable condition in Texas and must be reported within seven days according to the Texas Health and Safety Code.



SURVEILLANCE SUMMARY

Surveillance History

Reportable in Texas since 2001, St. Louis Encephalitis: Reportable in Texas since 1964

Population at Higher Risk

Those with outdoor occupations or hobbies

Notable Outbreaks

WNV: 2002, 2012.
Other: None

Cases Per Year

WNV: 41.1 per year,
Other: 2.5 per year

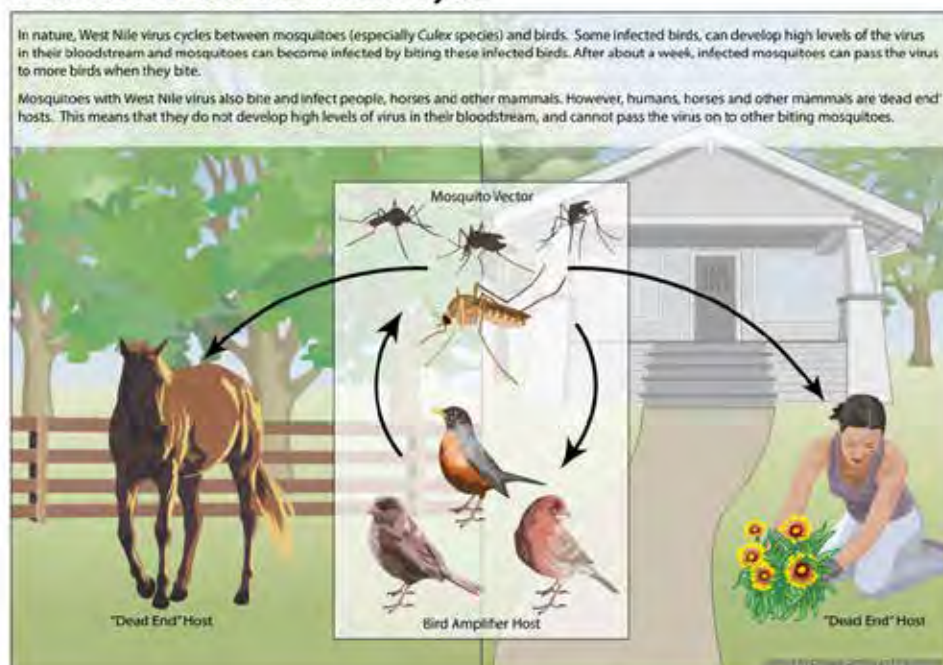
Seasonality

Late summer and early fall.

Caseload

1851

West Nile Virus Transmission Cycle



Disease Transmission

Most arboviruses are transmitted by mosquitoes but can be transmitted by ticks and sandflies. The incubation period of West Nile virus in humans is 3 to 14 days.

While there is no evidence that West Nile virus is spread from person to person or from animal to person through normal exposures, in rare cases transmission has occurred through organ transplant and blood transfusion (L.Heymann, 2008).

Epidemiology in Houston

Cases of West Nile disease usually occur in the late summer or early fall; however, due to the moderate temperatures in Texas, West Nile virus can be found year round.

West Nile disease is well situated to thrive in Houston. Outbreaks occur when seasonal changes and weather conditions affect avian populations. Houston's bayous and riparian environs make the city a ready environment for outbreaks when weather conditions permit.

The City of Houston identified its first case of West Nile Virus and outbreak in 2002, with 70 cases and four fatalities reported. In the last 10 years in Houston, 411 cases of West Nile virus were reported. Two large outbreaks occurred in 2012 and 2014, as reflected in Figure 1.

In 2012 and 2014, Houston experienced unusually large WNV caseloads. These two years account for over half of the cases reported during the 10 year period from 2005 to 2014. Many factors about the epidemiology of WNV are not well understood. However, Houston's humid, wet, and hot climate is known to contribute to the unusually high number of cases. Many of the cases occurred in the northern half of Houston, as seen in Figure 2.

The 2012 WNV season was the worst on record for Texas and the United States. Texas alone accounted for one third of the 5,674 WNV cases and one third of the 286 WNV deaths reported in the U.S.

WEST NILE VIRUS CASE COUNT

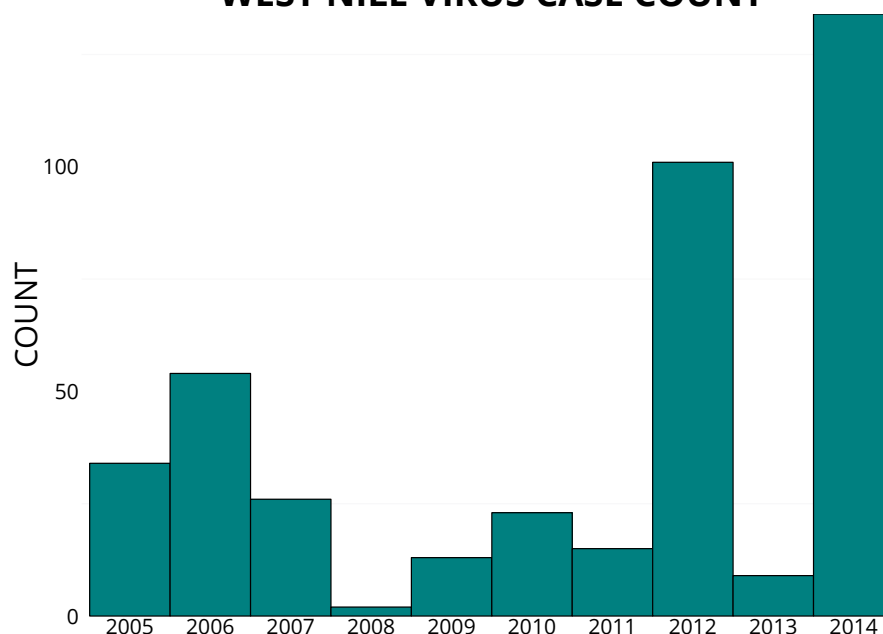


Figure 1. West Nile Virus case count.

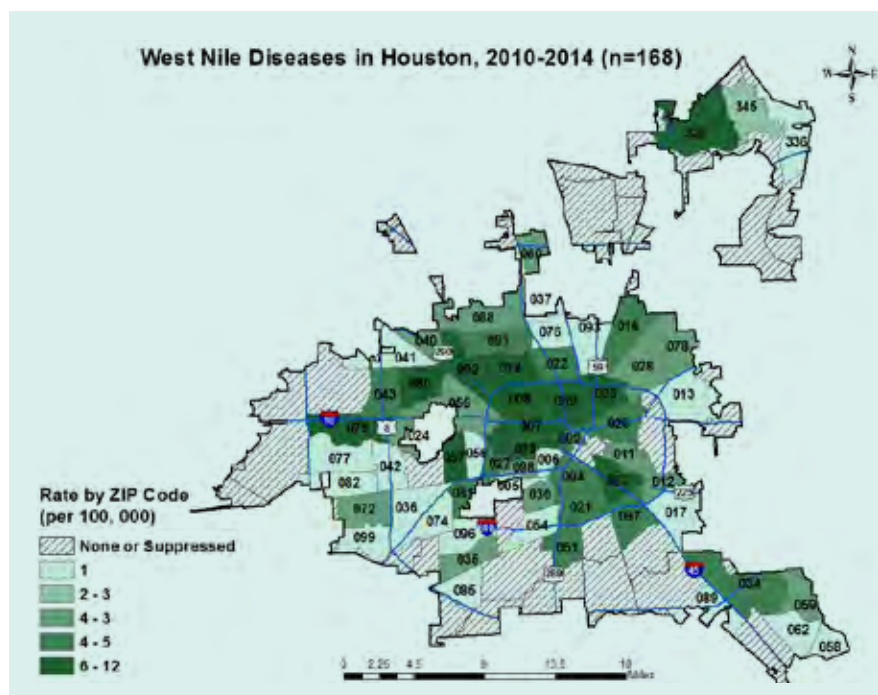


Figure 2. West Nile Virus cases by zip code.

Public Health Action

The Arbovirus Surveillance Program at the Texas Department of State Health Services was created to detect arboviral activity in mosquitoes prior to the beginning of outbreaks.

Mosquito control activities in Houston are conducted by the Harris County Public Health and Environmental Services (HCPHES) Mosquito Control Division. The division was established in 1965 in response to the outbreak of SLE. Details of the demographic and clinical information of patients in Houston are shared with HCPHES MC so mosquito control activities can be targeted to specific locations where transmission likely occurred. In 2014, positive mosquito pools in Harris County accounted for about 33% of the state positive pools.

The Mosquito Control Division at Harris County conducts surveillance, mosquito control, education, and research to prevent and control mosquito-borne diseases. The division also monitors the *Culex* mosquito population, the primary transmitter of SLE and WNV, conducts laboratory analysis of mosquito samples to detect SLE and WNV, monitors and tests live and dead birds for SLE and WNV, and conducts ground and aerial spraying activities in areas with confirmed SLE and WNV (Harris County Public Health and Environmental Services, 2014).

Currently there is no vaccine for West Nile virus, or other arboviruses.

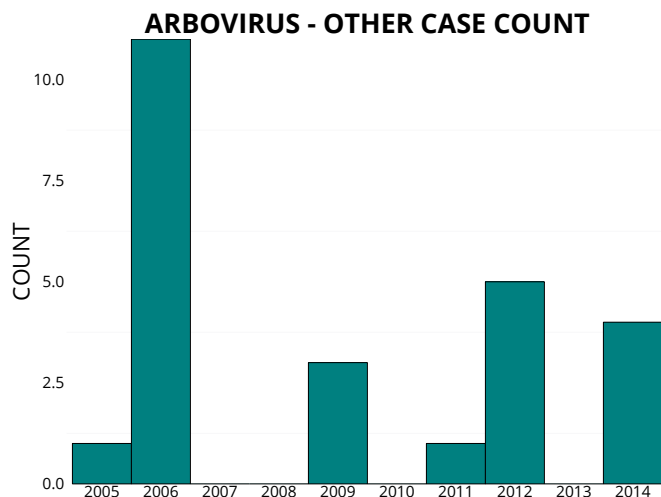


Figure 3. Arbovirus case accounts for Flavivirus, Japanese Encephalitis, La Crosse, St. Louis Encephalitis.



THE BEST FORMS OF PREVENTION INCLUDE THE FOLLOWING:

1. Use of insect repellents when outside.
2. Regularly drain standing water, including water that collects in empty cans, tires, buckets, clogged rain gutters and saucers under potted plants because mosquitoes breed in stagnant water.
3. Wear long sleeves and pants outside at dawn and dusk when mosquitoes are most active.
4. Ensure there are screens on all exterior doors and windows to keep mosquitoes from entering the home.



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Babesiosis

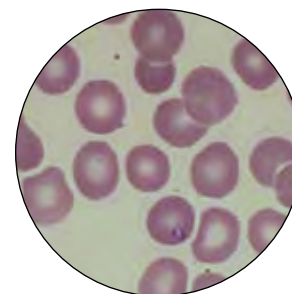
INTRODUCTION

Babesiosis is a tick-borne emerging illness caused by *Babesia* parasites that infect and destroy red blood cells. *Babesia microti* is the most common *Babesia* parasite that causes Babesiosis in humans. It is endemic in the Northeast and Midwest regions of the United States

(U.S. Department of Health and Human Services, 2015). General signs and symptoms of Babesiosis are similar to that of influenza, which can result in misdiagnosis. Common symptoms include fever, chills, sweats, fatigue, and headache along with less common symptoms of cough and sore throat. Clinical presentation of babesiosis varies depending on the status of an individual's immune system. Asymptomatic and moderate infections

generally occur in people who do not have other predisposing illnesses. Half of children and a quarter of previously healthy adults who are infected with *B. microti* have no symptoms (Vannier & Krause, 2012).

Babesiosis became reportable in Texas in 2013. All confirmed and suspect cases are to be reported within 1 week. No cases have been reported by HHD since 2013.



SURVEILLANCE SUMMARY

Surveillance History

Reportable in Texas since 2013

Population at Higher Risk

- Older adults.
- Those at risk for renal, lung disease or an organ transplant.
- Those with compromised immune systems.

Notable Outbreaks

None

Cases Per Year

0 per year

Seasonality

June, July and August

Caseload

1

Disease Transmission

Babesiosis is transmitted by ticks that carry *Babesia* parasites; *B. microti* being the most common. *B. microti* is spread by Ixodes scapularis ticks, which are most commonly found in wooded, brushy, or grassy areas in certain regions and seasons. When a tick bites an individual, the parasite enters the body and has the potential of infecting and destroying red blood cells. The incubation period for the illness can range from 7 days to more than 9 weeks. Seroprevalence studies show that most infections are asymptomatic. In some cases, infected persons without symptoms may have low-level parasitemia for months, possibly for longer than a year, making transmission via blood transfusion an issue (Heymann, 2014). Cases are most often reported in the Midwest and Northeast during warm weather months when tick bites are most common (U.S. Department of Health and Human Services, 2015).

Transmission of the parasites through blood transfusions has occurred and can happen anywhere and during anytime of the year. There are currently no licensed *Babesia* tests available for screening prospective blood donors. Persons who test positive for *Babesia*

infection are advised to refrain from donating blood (U.S. Department of Health and Human Services, 2009).

Epidemiology in Houston

Babesiosis is rare in Houston and in Texas. Since becoming a reportable condition in 2013, there have been no cases in Houston; Texas had 2 reported cases. In the United States, the condition is reportable in 27 states, mostly in the Northeast and Midwest where it is endemic.

During 2013, 1,762 cases were reported to the Centers for Disease Control and Prevention (CDC). A large majority (95%) of the reported cases were from seven states: Connecticut, Massachusetts, Minnesota, New Jersey, New York, Rhode Island, and Wisconsin (U.S. Department of Health and Human Services, 2015). Individuals traveling to these states should take precautionary measures to decrease their likelihood of contracting a tick-borne disease.

Public Health Action

Public health agencies are responsible for educating the public on the risk of and how to



prevent tick bites. Public health agencies must also continue passive surveillance programs to monitor incidence among residents in order to effectively target prevention campaigns. Investigations detailing the geographic location where a tick exposure most likely occurred, provides important information to state and regional organizations for informing the public and for posting disease warnings. No vaccine is available to protect people against babesiosis. People who live, work, or travel in tick-infested areas can take simple steps to help protect themselves against tick bites and tick-borne infections:

- Avoid areas that are likely to have ticks, particularly in spring and summer when ticks and tick nymphs feed.
- Wear light-colored clothing when going into areas with ticks so that ticks can be seen on the clothes more readily and be removed before attaching to the skin.
- Wear long-sleeved shirts and tuck pants into socks or boot tops.
- Apply permethrin (which kills ticks on contact) to clothes or insect repellents containing DEET to clothes and exposed skin can provide protection. DEET can be used safely on children and adults, but should be applied according to Environmental Protection Agency (EPA) guidelines to lower the risk of toxicity.
- Perform a tick check and remove attached ticks. It generally takes a tick 36 hours of attachment to successfully transmit the bacteria that causes tick-borne diseases.
- Reduce tick habitats around homes by removing leaves, brush and woodpiles around buildings and at the edges of yards. Discourage animals that may carry ticks, such as deer and rodents, from entering backyards by reducing hiding places.

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Botulism

INTRODUCTION

Botulism is a rare but potentially fatal disease caused by the bacterium *Clostridium botulinum*. The spores of these bacteria, which are present in soil, untreated water, and air, produce toxins in anaerobic conditions that can cause severe harmful effects when ingested.

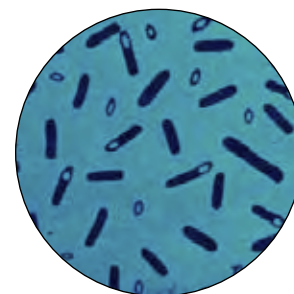
There are seven types of botulism toxin (A-G). Types A, B, E, and rarely F – can cause human botulism, while the other types cause animal botulism. The most recognized forms of human botulism are wound, foodborne, and infant (WHO, 2013).

Symptoms of botulism include double or blurred vision, drooping eyelids, slurred speech, difficulty swallowing, dry mouth, and muscle weakness. The most common type is infant botulism, which is characterized by symptoms like constipation, drooling, weakness, respiratory distress, and lack of appetite. If botulism is not treated immediately, it can lead to severe muscle paralysis (WHO, 2013).

Botulism toxin, the most potent naturally occurring toxin, is among the top five potential bioterrorism agents. Per Texas state

law, any suspected case of botulism is to be reported immediately to the health department by phone. Since botulism is a rare condition, one case of botulism is considered an outbreak situation.

Botulism symptoms are similar to those of other neurological diseases, such as Guillain-Barré syndrome, stroke, chemical intoxication, or myasthenia gravis (Arnon, et al., 2001, p. 1065). Clinicians should immediately treat patients with suspected botulism and not wait for laboratory confirmation, which can take days. The laboratory criteria for diagnosis are the detection of toxin in serum, stool, or contaminated food, or the isolation of the bacteria from stool (CDC, 2006).



SURVEILLANCE SUMMARY

Surveillance History

Nationally notifiable since 1947

Population at Higher Risk

Everyone, especially infants and injection drug users

Notable Outbreaks

None

Cases Per Year

0 per year

Seasonality

None

Caseload

9

Disease Transmission

The transmission routes, common sources, and incubation periods of the different types of botulism are described below in Table 1 (WHO, 2013).

Botulism is not spread person-to-person. *C. botulinum* spores are common in soil and elsewhere in the environment, including on vegetables. Botulism is primarily acquired by eating spore-contaminated food. The consumption of honey, corn syrup, and home-canned vegetables are common causes of infant botulism. Foodborne botulism is

caused by contaminated food, often home-canned foods with low acid content, improperly canned foods, foil-wrapped baked potatoes, and fermented seafood (FoodSafety.gov).

In wound botulism, the bacteria spores enter an open wound and produce toxin. Wound botulism is common among injection drug users. Inhalation botulism is caused by breathing in botulism toxins in the air. These toxins can be introduced into the air accidentally or deliberately by terrorists (WHO, 2013).

TYPE OF BOTULISM	COMMON SOURCES OF INFECTION	PERCENTAGE OF TOTAL BOTULISM CASES	INCUBATION PERIOD
Infant	Honey, corn syrup, home-canned vegetables	65%	3 – 30 days
Wound	Black-tar heroin; open wounds	20%	14+ days
Foodborne	Home-canned foods (low acid content), fermented seafood	15%	1 – 3 days
Inhalation	Accidental laboratory exposure; bioterrorism	Rare	1 – 3 days

TABLE 1. Botulism by type, common source of infection, prevalence, and incubation period.



Epidemiology in Houston

From 2005–2014, Houston has had only one case of botulism; in 2008, an infant contracted the disease. The case investigation was unable to find the source of infection. In the same time frame, Texas reported 65 cases, 49 of which were infant botulism. The Texas cases were reported throughout the state, though a considerable amount (20%) was reported in El Paso County (DSHS, 2015). In the United States, an average of 145 cases are reported annually to CDC, 65% of which are infant botulism, 20% are wound, and 15% are foodborne (CDC, 2015).

In the United States, home-canned vegetables are the most common source in botulism outbreaks. From 1996–2008, there were 116 outbreaks caused by foodborne botulism. Home-prepared foods were the cause in 48 outbreaks, of which 18 were traced to home-canned vegetables (CDC, 2012).

Public Health Action

While *C. botulinum* spores are heat-resistant (WHO, 2013), the harmful toxin released by the spores can be destroyed by heating contaminated food or water to an internal temperature of 185°F (85°C) for at least five minutes. People who eat home-canned foods (e.g. low acidic, non-pickled foods) should boil the food before eating it. The bacteria do not grow in acidic environments, so toxins will not be generated in acidic foods. A low pH cannot destroy pre-formed toxin. Pickling, sugar syrup, or sufficient brining should prevent the growth of *C. botulinum*. CDC recommends always using a pressure

canner for low-acid vegetables, meat, fish, and poultry. Boiling water canners cannot eliminate the spores. The United States Department of Agriculture has detailed, step-by-step instructions to properly can foods (NCHFP, 2009).

CDC advises consumers to discard any suspicious home-canned foods. Home-canned food, even if it looks, smells, or tastes normal, can still have *C. botulinum*. Containers that are damaged or altered should be thrown away. The same guideline applies to canned foods that are moldy, foul-smelling, or discolored (CDC, 2015).

To prevent infant botulism, parents and caregivers should avoid feeding infants honey, including honey-coated pacifiers, as the honey can be contaminated with *C. botulinum* spores. For wound botulism, the primary prevention is to avoid injecting drugs and get immediate treatment for infected wounds (Texas Department of State Health Services, 2015).

Botulism is treated by supportive care and antitoxin. Antitoxin for non-infant botulism is available through the CDC's Strategic National Stockpile at 20 CDC quarantine stations around the nation, including Houston. Antitoxin for infant botulism is available through the California Department of Health (CDC, 2015). Antitoxin is not readily available to the general public. Clinicians who suspect botulism in a patient must request the antitoxin immediately. When taken early, antitoxin can speed up recovery and reduce severity of symptoms (NIH, 2014).

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Brucellosis

INTRODUCTION

Brucellosis is a bacterial illness characterized by an acute onset of fever, night sweats, fatigue, anorexia, weight loss, headache, and painful joints. Severe infections of the central nervous system (CNS) or lining of the heart may occur. It is also called undulant fever since the fever is intermittent or

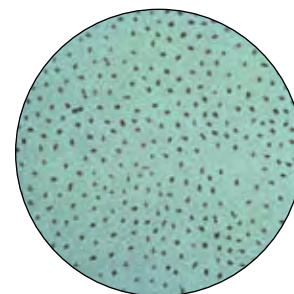
irregular. Brucellosis is found worldwide but is more prominent in Mediterranean countries, the Middle East, Africa, Central and South America, and Central Asia (Centers for Disease Control and Prevention, 2012) (Heymann, 2008). Six species of *Brucella* bacteria,

including *B. abortus*, *B. melitensis*, *B. suis*, are pathogenic to humans. *Brucella* reservoirs include cattle, goats, sheep, pigs, horses, bison, elk, caribou, some deer, and dogs (Centers for Disease Control and Prevention, 2012; Heymann, 2008).

Disease Transmission

Humans become infected with brucellosis by coming into contact with animals or animal products that are contaminated with *Brucella* bacteria. Brucellosis is most commonly acquired by ingesting contaminated dairy products, such as unpasteurized milk or cheese. Contact with infected animal tissues and bodily fluids, such as blood, urine, discharge, and placentas, is another mode of transmission. Breathing in bacteria present in the environment, usually within slaughterhouses, may also lead to infection. No reports of person-to-person transmission of the bacteria have been documented. It typically takes one to two months for brucellosis to develop after exposure (Centers for Disease Control and Prevention, 2012. Heymann, 2008).

Brucella is considered a Class B bioterrorism agent by CDC. Category B includes the second highest priority agents that pose a risk to national security due to the following features: being moderately easy to disseminate, causing moderate morbidity and low mortality, and requiring specific enhancement of laboratory diagnostic capacity and enhanced disease surveillance. It can be spread for bioterrorism activities by contaminating foods or used as an aerosol for inhalation (Texas Department of States Health Services, 2015, Yagupsky & Baron, 2005, Southern Illinois School of Medicine, 2010).



SURVEILLANCE SUMMARY

Surveillance History

Nationally notifiable since 1944

Population at Higher Risk

- Animal handlers
- Persons who consume unpasteurized milk

Notable Outbreaks

None

Cases Per Year

1 per year

Seasonality

Summer and Spring

Caseload

44

Epidemiology in Houston

Human brucellosis is a rare disease in the United States, with only 100-200 cases per year. From 2005 to 2014, there were 157 brucellosis cases reported in the state of Texas (Centers for Disease Control and Prevention, 2012, Texas Department of States Health Services, 2015).

Brucella infections are rarely reported in Houston. Between 2005 and 2014, a total of 12 cases of brucellosis were reported in

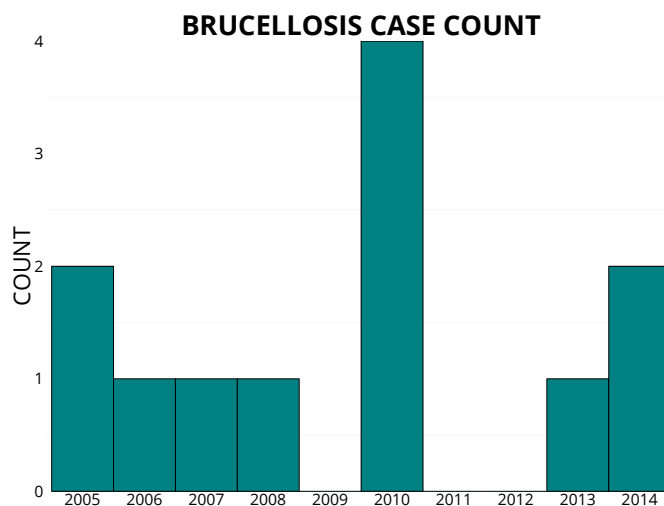


FIGURE 1. Brucellosis case count.

Houston residents, as seen in Figure 1. Of the 12 cases, 11 were persons of Hispanic ethnicity.

Most of the infections (75%) have been due to *B. melitensis*, while the remaining cases were not typed (17%) or due to *B. canis* (8%). Five of the brucellosis cases reported travel history, three reported consuming unpasteurized food products, and two reported contact with animal bodily fluids.

Laboratory Testing

While many laboratory tests are available, such as standard agglutination tests and ELISA, PCR has been shown to have superior specificity and sensitivity. Houston has the ability to conduct PCR testing on *Brucella* as well as traditional culturing. A positive PCR result gives a presumptive identification but does not determine the species. Culture testing is required for confirmatory results and is based on the results for hydrogen sulfide production, urease, gel formation, lysis by Tbilisi phage and PCR results. Each species has distinct results for these tests. Table 1 shows the number of specimens

tested for *Brucella* at HHD laboratory; none were positive for the organism.

Public Health Action

Public health action consists of passive surveillance, in which hospitals, clinics, and laboratories report positive cases to HHD, and the cases are interviewed. If there were an outbreak of brucellosis, HHD would enhance surveillance, notifying doctors and hospitals of an unusual incidence of disease, requesting them to consider brucellosis as part of the differential diagnosis of febrile patients, and to report in a timely manner all suspected cases. HHD would pursue confirmation of the source of infection in a given case and close contacts through follow-up interviews for exposure history. Epidemiologists would then assess the extent of disease transmission through possible serological screening of the household and other close contacts of the case. The BOE would also assess if the infection was naturally occurring or intentionally introduced into the environment. If bioterrorism is suspected, HHD will

involve Public Health Preparedness and law enforcement, including the FBI and Homeland Security.

Fortunately, treatment of brucellosis does exist, consisting of six weeks of 600-900 mg of rifampicin daily combined with doxycycline (200 mg) (Heymann, 2008).

Prevention strategies for brucellosis include:

- Avoiding unpasteurized dairy products (raw goat milk, unpasteurized milk or cheese made from unpasteurized milk).
- Wearing appropriate protective gear when handling feral swine and animal carcasses.
- Providing adequate ventilation in slaughterhouses, butcher shops, and meat processing plants.
- Disinfecting areas contaminated with animal body fluids.
- Tracing the source of infection to prevent additional exposures.
- Testing and immunizing suspected animals (Heymann, 2008).

To prevent brucellosis cases from occurring, public education about the health risks of contact with animals and animal products is vital. Education is especially important among persons who are more likely to consume unpasteurized food products, such as special ethnic foods. The BOE has received reports of unlicensed street vendors who have sold unpasteurized dairy products imported from other countries, unwittingly spreading disease to households and communities in Houston. The BOE works closely with the Bureau of Consumer Health in the investigation when such situations occur to find and eliminate sources of infection (Heymann, 2008).

TABLE 1. BRUCELLA TESTING AT HHD LABORATORY

2006	2007	2008	2009	2010	2011	2012	2013	2014
6	5	1	4	8	4	5	4	2

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Campylobacteriosis

INTRODUCTION

Campylobacteriosis is caused by *Campylobacter*, a bacterium found in the gastrointestinal tracts of animals, including chickens, cows, and dogs. The disease causes a broad range of symptoms, from self-limited gastroenteritis to septicemia, or infection of the blood. It is rare for campylobacteriosis to

cause death. Asymptomatic cases can also occur. CDC estimates that approximately 100 Americans die from campylobacteriosis each year (Mead, et al., 1999).

Campylobacteriosis is an acute zoonotic disease that varies in severity. The disease is characterized by diarrhea (occasionally watery and bloody), abdominal pain, malaise, fever, nausea, and vomiting. The symptoms usually resolve in 2 to 5 days, but can last as long as 10 days. Adults are more susceptible to relapse and chronic infections. *Campylobacter*

occasionally spreads to the bloodstream and causes a serious life-threatening infection.

Campylobacteriosis has been reportable in Texas since 1985. Confirmed cases should be reported to the state or local health department within one week of laboratory confirmation. A presumptive test for campylobacteriosis consists of visualization of spiral-shaped bacteria in specimens. A confirmation test consists of isolation of *Campylobacter* from stool or blood specimens.

Disease Transmission

Campylobacteriosis is commonly transmitted when contaminated food or drink is ingested. The bacteria are commonly found on chickens that often do not show any signs of illness. Approximately half of all raw chicken found in grocery stores are contaminated with the bacterium (CDC, 2014).

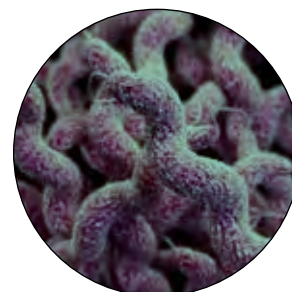
Poor handwashing and improper kitchen hygiene are frequently involved in the transmission of the disease. Mishandling of raw poultry and consumption of undercooked poultry are major risk factors for human campylobacteriosis. Contamination occurs when poultry and raw meats are handled or processed without subsequent careful washing of hands, cutting boards, utensils, or counter tops that have come into contact with the bacteria.

Sick animals such as dogs, cats, and farm animals can also be sources of infection. However, *Campylobacter* is not usually transmitted from person to person.

Epidemiology in Houston

From 2005-2014, there were 1,067 report-

ed cases of campylobacteriosis in Houston (Figure 1). Cases frequently go undiagnosed or unreported due to several factors, including persons who are ill that do not seek medical attention, and providers that do not submit required reports to the health department. Electronic lab reporting has alleviated much of the concern with the latter issue, as the lab



SURVEILLANCE SUMMARY

Surveillance History

Notifiable in Texas since 1985

Population at Higher Risk

- Persons with poor food handling practices
- Persons who consumed contaminated food or drink

Notable Outbreaks

None

Cases Per Year

106 per year

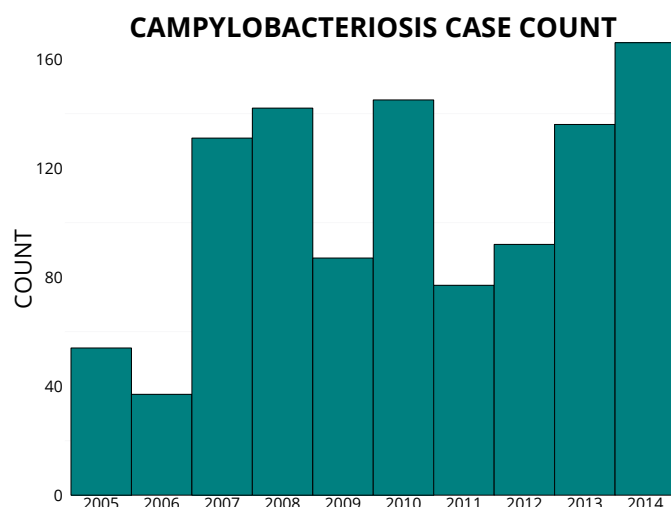
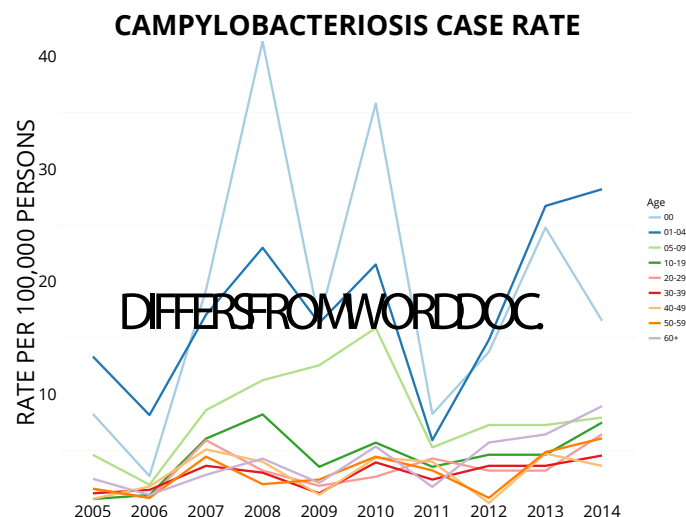
Seasonality

Summer and Spring

Caseload

1345



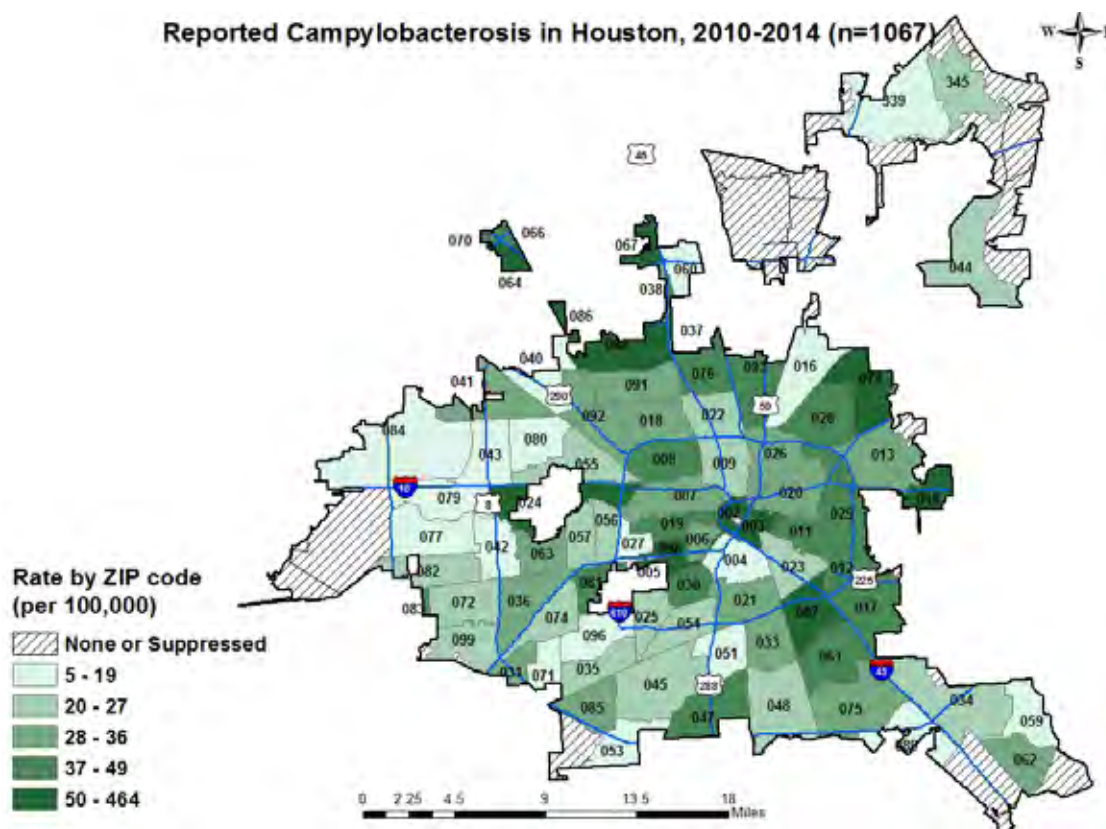
FIGURE 1. *Campylobacteriosis* case count.FIGURE 3. *Campylobacteriosis* case count by age.

results are now automatically transmitted to HHD. Still, recent estimates suggest that the true burden of the disease is under-reported by a factor of 30, which would suggest that approximately 30,000 cases occurred within the City of Houston (Scallan, et al., 2011).

Campylobacteriosis is seasonal in Houston with the highest number of cases in the spring and summer. The average incidence generally begins to increase in April, peaks in July, and tapers off in the fall and winter months.

Children aged 5 and under are at the highest risk of contracting the disease (Figure 2) due to a less developed immune systems when compared to healthy adults. In addition, children are more likely to practice unhygienic behaviors.

Campylobacteriosis afflicts all sections of Houston, as seen in Figure 4. Large outbreaks in a small area are relatively uncommon. Generally, *Campylobacter* is contracted when consuming undercooked poultry or food contaminated by raw chicken. The geographic spread of *campylobacteriosis* suggests that the

FIGURE 4. *Campylobacteriosis* counts by zip for 2010 - 2014.

more rural parts of Houston are disproportionately susceptible.

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Chagas Disease

INTRODUCTION

Chagas disease is a potentially life-threatening disease caused by the parasite *Trypanosoma cruzi*, which is transmitted to animals and people by insects, (Figure 1) that are found mainly in rural areas of Latin America where poverty is widespread (Bern, 2015). Chagas is a newly emerging

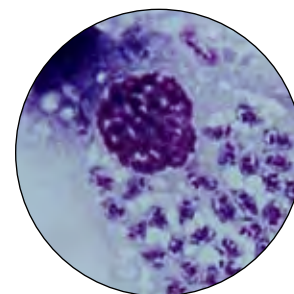


FIGURE 1. *Rhodnius prolixus* in the nymph stages through to adult (Wikipedia, 2015).

disease in the United States (Nunes, Dones, Morillo, Encina, & Ribero) and became reportable in Texas in 2013. Chagas disease has two phases (WHO - Chagas disease, 2015). The first phase is acute and lasts for about two months after infection (WHO - Chagas disease, 2015). The hallmark of the acute phase is detectable parasites in the blood (Bern, 2015). Though a high number of parasites circulate in the blood, in most cases symptoms are absent or mild. Characteristic first visible signs can be a skin lesion or a purplish swelling of the lids of one eye, fever, headache, enlarged lymph glands, pallor, muscle pain, difficulty in breathing, swelling and abdominal or chest pain (WHO - Chagas disease, 2015).

Following the acute phase, most infected people enter the indeterminate (asymptomatic) form of the chronic phase (called “chronic indeterminate”) during which few or no parasites are found in the blood. During this time, most people are unaware of their infection. Many people remain asymptomatic for life and never develop chronic symptoms (Texas Department of State Health Services, 2015).

Among those with the indeterminate chron-

ic form, about 20-30% of patients progress to the chronic symptomatic phase (more than two months post infection). This phase is also characterized by undetectable parasites in the blood. Individuals in this phase will develop debilitating and sometimes life-threatening medical problems over the course of their lives. These medical problems may include: heart rhythm abnormalities that can cause sudden death, a dilated heart (dilated cardiomyopathy) that doesn't pump blood well, and/or a dilated esophagus or colon, leading to difficulties with eating or passing stool (Texas Department of State Health Services, 2015).

Diagnosis of acute infection is based on the microscopic detection of the parasite in blood. During the chronic phase, because parasitemia is scarce, diagnosis requires the detection of IgG antibodies against *T. cruzi* antigens by at least two different serological methods (Rassi Jr, 2010).

The most important consequence of chronic *T. cruzi* infection is dilated cardiomyopathy (Nunes, Dones, Morillo, Encina, & Ribeiro, 2013), which occurs in 20 to 30% of infected persons (Bern, 2015) (Garcia, et al., 2015). Cardiologists in the U.S. should consider

SURVEILLANCE SUMMARY

Surveillance History

Notifiable in Texas since 2013

Population at Higher Risk

Originate in endemic foreign countries

Notable Outbreaks

None

Cases Per Year

1 per year

Seasonality

Summer and Spring

Caseload

19

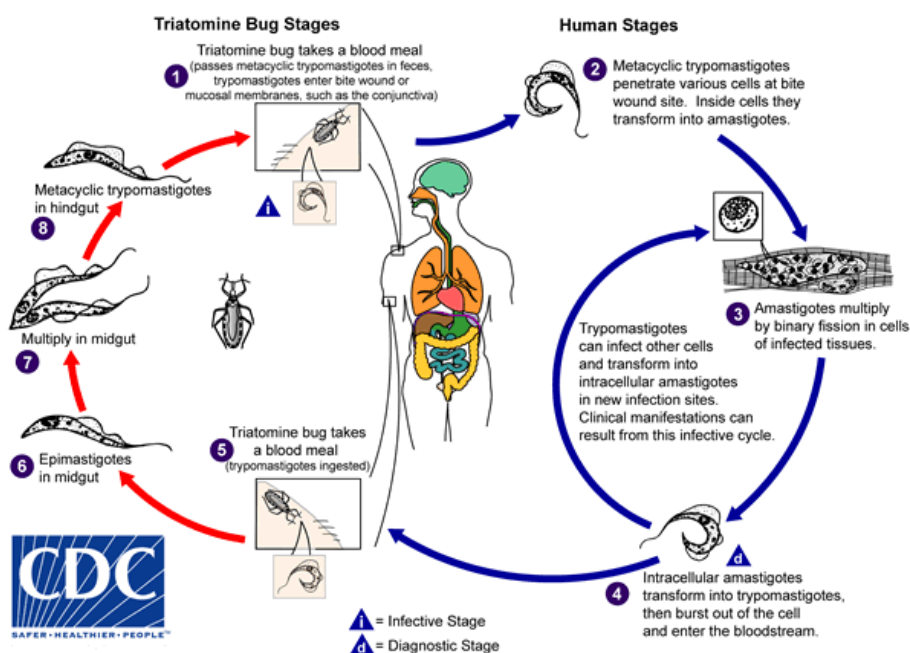
Chagas disease in their differential diagnoses for patients who may have clinically compatible EKG changes or nonischemic cardiomyopathy, even if the patients have no histories of residing in Chagas-endemic countries (Garcia, et al., 2015).

The World Health Organization (WHO) estimates that 8 to 10 million people are infected worldwide, mostly in Latin America where the disease is endemic (CDC - Chagas Disease, 2013), (Nunes, Dones, Morillo, Encina, & Ribeiro, 2013) (Nunes, Dones, Morillo, Encina, & Ribeiro, 2013), (Manne-Goehler, Ramsey, Salgado, Wirtz, & Reich, 2014).

As many as 8 million people in Latin America (Mexico, Central America, and South America) have Chagas disease (Rassi Jr, 2010), most of whom do not know they are infected (CDC - Chagas Disease, 2013). If untreated, infection is lifelong and can be life threatening (CDC - Chagas Disease, 2013). According to WHO prevalence estimates, 1.1 million people in Mexico are infected with *Trypanosoma cruzi* (Manne, Snively, Ramsey, Salgado, Barnighausen, & Reich, 2013) (Manne-Goehler, Ramsey, Salgado, Wirtz, & Reich, 2014).

Chagas disease is a serious health problem in Latin America and is an emerging disease in non-endemic countries, including the United States (Garcia, et al., 2015) (Nunes, Dones, Morillo, Encina, & Ribeiro, 2013) (Albajar-Vinas & Dias, 2014). Rising immigration from Latin American countries (Albajar-Vinas & Dias, 2014) and climate changes that make the United States more hospitable to its insect vectors are making Chagas disease a significant threat to public health (Kuehn, 2015).

Since national blood donor screening began in 2007, approximately 2,000 infected donors have been identified in the U.S. (Garcia, et al., 2015). The majority of infected U.S. residents are Latin American immigrants who were infected in their home countries (Bern, 2015). The CDC estimates that Chagas disease affects 300,000 U.S. residents who have emigrated from Latin American countries (Bern, 2015) and contributes to about 30,000 to 45,000 cases of cardiomyopathy in the United States each year (Kuehn, 2015).



Disease Transmission

In Latin America *T. cruzi* parasites are mainly transmitted by contact with triatomine bugs. These bugs typically live in the cracks of poorly-constructed homes in rural or suburban areas. They usually bite an exposed area of skin such as the face, and the bug defecates close to the bite. The parasites enter the body when the person inadvertently smears the bug feces into the bite, the eyes, the mouth, or into any skin break (WHO - Chagas disease, 2015).

In addition to triatomine bugs, *T.*

cruzi can also be transmitted by consumption of food contaminated with *T. cruzi* through contact with infected triatomine bug feces, blood transfusion from infected donors, passage from an infected mother to her newborn during pregnancy or childbirth, organ transplants using organs from infected donors, and laboratory accidents (WHO - Chagas disease, 2015) (Nunes, Dones, Morillo, Encina, & Ribeiro, 2013).

Up to 10% of infected mothers transmit the parasite to their infants (Yadon & Schmunis, 2009).

Epidemiology in Houston

The CDC recently reported rare cases of domestically acquired infection from a large nationwide follow-up study of infected blood donors (Garcia, et al., 2014). In addition to those cases, a study by Garcia et al. of blood donors in the Houston area found 35% (6 of 17) with evidence of locally (within the United States) acquired infection. Their findings suggest an unrecognized risk of human vector-borne transmission in southeast Texas. The authors concluded that education of physicians and public health officials is crucial for identifying the true disease burden and source of infection in Texas (Garcia, et al., 2014). This study suggests that the true prevalence of Chagas disease is much higher than reported.

In Houston, from 2005 to 2014, 5 cases of chronic indeterminate disease, and 3 cases of chronic symptomatic disease were reported to the HHD. All eight cases occurred during 2013 and 2014, and in adults aged 40 and above. Whether these 8 cases were acquired in the U.S. or not is unknown at this time. This number is likely to be an underestimation due to disease underreporting and minimal physician awareness about the disease.

Public Health Action

In endemic areas (Latin America), improved housing and spraying insecticide

inside housing to eliminate triatomine bugs has significantly decreased the spread of Chagas disease. Further, screening of blood donations for Chagas is another important public health tool in helping to prevent transfusion-acquired disease. Early detection and treatment of new cases, including mother-to-baby (congenital) cases, will also help reduce the burden of disease (CDC - Chagas Disease, 2013).

In the United States and in other regions where Chagas disease is now found but is not focused on preventing infection from blood transfusion, organ transplantation, and mother-to-baby (CDC - Chagas Disease, 2013). One example of this new focus is the initiation of screening for Chagas disease in blood donors in the U.S. in 2007.

Chagas disease is an emerging vector-borne disease in the United States that causes dilated cardiomyopathy in a third of infected individuals. Clinicians should consider screening for *T. cruzi* in those presenting with dilated cardiomyopathy (Garcia, et al., 2015).

The currently available drugs for Chagas disease are benznidazole and nifurtimox, which are effective in the acute phase but have shown mixed results in individuals with chronic infection, and are associated with adverse reactions in 20 to 40% of patients. Thus, new drugs or treatment strategies are needed (Albajar-Vinas & Dias, 2014) (Bern, 2015).

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Chancroid

INTRODUCTION

Chancroid is a sexually transmitted disease caused by the bacterium *Haemophilus ducreyi*. Chancroid is more common in developing countries, such as Asia, Africa, and the Caribbean. Though it is rare in industrialized countries, outbreaks occur sporadically (CDC, 2015).

The incubation period for chancroid is 4 days to 2 weeks. A fluid-filled bump (pus-tule) forms on the genitals, which turns into an ulcer (open sore). The ulcer is soft-edged and painful, which is a characteristic sign of the disease. The ulcers, called chancre, seen in syphilis patients are generally hard-edged and painless. When left untreated, the lymph nodes in the groin may swell, causing adenitis. Other symptoms include vaginal discharge, rectal bleeding, and pain while urinating, defecating, or having sex. Chancroid is treatable with antibiotics (CDC, 2014).

Since the ulcers are similar to those of herpes and syphilis, clinicians not familiar

with the disease may misdiagnose chancroid patients. While a culture test can confirm the presence of *H. ducreyi*, the test is not widely available in commercial labs. The CDC indicates a probable diagnosis of chancroid can be made if the following criteria are met: a) the patient has one or more painful ulcers; b) the clinical symptoms are typical of chancroid; c) the patient does not have syphilis (*T. pallidum*) as confirmed by a serologic test done after seven days of onset of the ulcers; d) a herpes test done on the ulcer exudate is negative. Chancroid is to be reported to the health department within one week (CDC, 2015).

Disease Transmission

Most people in the United States who contract chancroid have a history of recent travel to a country where the infection is prevalent. Chancroid is generally transmitted by sexual contact, including oral, vaginal, and anal. Nonsexual transmission occurs when the pus from the ulcer comes into contact with another person.

Uncircumcised males have a higher risk of contracting chancroid and other sexually transmitted infections. The warm, moist environment under the foreskin may play a role in increasing the growth of pathogens. Moreover, a person with chancroid has a higher risk of contracting HIV. Genital ulcers can bleed during sex, and when the blood comes into contact with the mouth or genitals, it can lead to HIV transmission (Weiss, Thomas, Munabi, & Hayes, 2006).

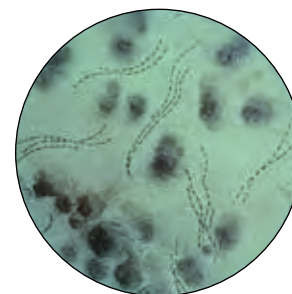
In other countries, chancroid has been commonly observed in sex workers and their clients. Compared to other sexually

transmitted infections, chancroid has a lower infectivity rate (WHO, 2001).

Epidemiology in Houston

Chancroid is rare in Houston, which recorded an average of 2 cases per year during 2005-2014. In the same time frame, Texas had an average of 5 cases per year (CDC, 2014) and the United States had approximately 19 cases per year (CDC, 2014). Since reliable lab tests are not widely available for *H. ducreyi*, the disease may be under-diagnosed. Hence, the actual case counts may be higher (CDC, 2015).

While rates are at historic lows, Houston continues to have disproportionately higher numbers relative to other major cities. The reason for this is unclear, but has been consistent since the 1990s when Houston, Dallas, New Orleans, and New York City accounted for 62% of all U.S. cases (Borchardt, Kenneth, & Noble, 1997).



SURVEILLANCE SUMMARY

Surveillance History

Nationally notifiable since 1944

Population at Higher Risk

- Sex workers
- Clients of sex workers

Notable Outbreaks

None

Cases Per Year

2 per year

Seasonality

None

Caseload

2

In the late 1980s, Houston recorded a chancroid outbreak of 35 cases. All cases were diagnosed in African American men. Eighteen cases were confirmed through medical record abstraction and laboratory confirmation. Seventeen of the 18 cases reported having multiple female sexual partners, including prostitutes. The patients were treated using antibiotics, and were cured within 2-3 weeks (Jones, Rosen, Clarridge, & Collins, 1990).

Public Health Action

Male latex condoms, when used consistently and correctly, can reduce the

risk of contracting chancroid. The CDC also recommends mutual monogamy, or the practice of having one sexual partner at a time, with a partner who has been tested and known to be uninfected. Individuals who have multiple sexual partners have a higher risk of contracting STDs.

Chancroid is treatable with the appropriate antibiotic regimen (azithromycin, ceftriaxone, ciprofloxacin, or erythromycin). Symptoms usually resolve within a week while on antibiotic therapy. Patients who do not respond to treatment include those who have coinfections, those who do not follow

the recommended dosage, or those whose who have an antibiotic-resistant infection. Sexual contacts of a chancroid patient should be treated if they had sexual contact in the 10 days prior to the onset of the patient's symptoms (CDC, 2015).

STD testing is recommended prior to having sex with a new partner. The Houston Health Department offers confidential HIV/STD testing at its Northside, Sharpstown, and Sunnyside Health Centers. The department's mobile clinic also offers testing and education at select sites in the Houston area.

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Chikungunya

INTRODUCTION

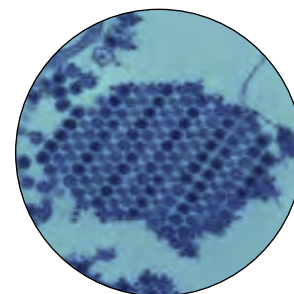
Chikungunya is a virus spread by mosquitoes (Murray, 2014). It was first identified in Tanzania in 1952.

Chikungunya means “that which bends up” in a local Tanzanian language, referring to the bent over posture as a result of the joint pain (CDC, 2014).

In the United States, it is usually acquired by travelers to countries where the virus is endemic. Symptoms include fever, joint pain, headache, muscle pain, joint swelling, and rash. Fever and joint pain are the most common symptoms. Dengue has similar symptoms, and in some cases, patients with chikungunya may be misdiagnosed as having dengue. The disease is rarely fatal. An individual generally recovers within a week and is immune to the virus for life, (CDC, 2015). However, the joint pain can persist for weeks

to years in some patients. For public health surveillance purposes, a chikungunya case is considered “confirmed” if it meets clinical and laboratory criteria (CDC, 2015).

Persons at risk for more severe disease include infants, the elderly, and immunocompromised persons. There is no treatment for the virus, other than supportive care. Chikungunya is to be reported to the health department within one week of diagnosis.



SURVEILLANCE SUMMARY

Surveillance History

Reportable in Texas since 2015

Population at Higher Risk

Persons traveling to tropical and subtropical areas

Notable Outbreaks

None

Cases Per Year

2 per year

Seasonality

None

Caseload

20

Disease Transmission

Chikungunya has been reported in over 60 countries worldwide. The incubation period is 4 to 7 days. *Aedes aegypti* and *Aedes albopictus* mosquitoes — which can also carry dengue — commonly spread the virus to humans. These mosquitoes generally bite humans during the daytime, but can also bite at night. Mosquitoes can acquire the virus after biting an infected person, and can subsequently transmit the virus to other people (Vega-Rua, et al., 2015).

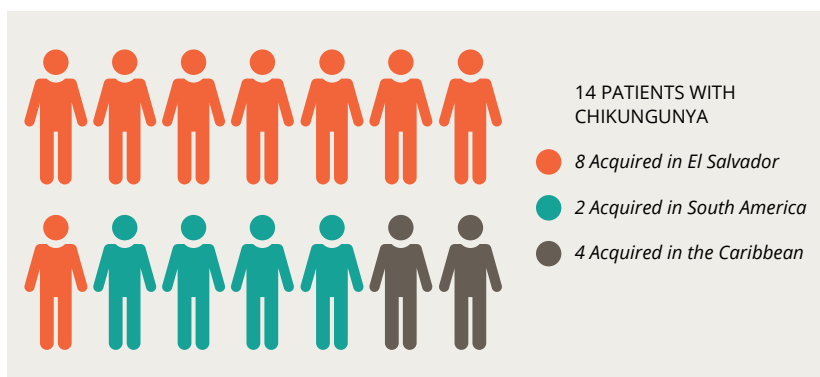
In rare cases, chikungunya can be transmitted from mother-to-child at the time of birth. It can theoretically spread via blood transfusions, though no documented cases exist to verify this mechanism (CDC, 2015).

Epidemiology in Houston

No cases of chikungunya had been reported in Houston until 2014, when Houston recorded 14 cases. All 14 patients acquired the virus outside the country; 8 acquired the virus in El Salvador, 2 in South America, and 4 in the Caribbean. The average age of the patients at

the time of disease onset was 46 years, with a range of 8 to 69 years. Of the 14 patients, four were hospitalized, 7 did not require hospitalization, and 3 did not have hospitalization information.

Before 2006, the virus was rarely reported in U.S. travelers. From 2006 to 2013, there was an average of 28 people per year in the U.S. who were infected with the virus, all of whom were travelers to endemic countries. The first local transmission of the virus in the



Western Hemisphere occurred in December 2013 in the Caribbean. The 2013 virus spread throughout the Caribbean, causing an outbreak.

In 2014, Texas had 114 travel-associated cases of chikungunya and the U.S. had 2,788. The first local transmission of the virus occurred in the United States in July 2014 in Florida, which had 11 locally-acquired cases in 2014 (CDC, 2015).

Public Health Action

Mosquito bite prevention is the best strategy to protect oneself from chikungunya. There is no vaccine for the disease. The CDC recommends using EPA-registered insect repellants that contain one of the following ingredients: DEET, Picaridin (KBR 3023, Bayrepel, or icaridin), IR3535, oil of lemon eucalyptus (OLE), or para-menthane-diol (PMD). Natural insect repellants such as essential oils have not been tested for effectiveness. When using both sunscreen

and insect repellent, the sunscreen must be applied first (CDC, 2015).

Individuals traveling to tropical areas should wear long-sleeve shirts and long pants or consider wearing permethrin-treated clothing. Homes should also be protected against mosquito habitation. The CDC recommends using window/door screens and to seal off any points of entry into the home. Since mosquitoes thrive in humid environments, it is also recommended to use air conditioning (CDC, 2015).

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Chlamydia

INTRODUCTION

Chlamydia is caused by the bacterium *Chlamydia trachomatis*. Chlamydia is the most commonly reported sexually transmitted disease seen in the United States today. According to the Centers for Disease Control and Prevention, an estimated 2.86 million Americans suffer from a new

chlamydia infection each year. Chlamydia cases are believed to be grossly underreported due to several factors: asymptomatic cases are often undiagnosed and not reported, chlamydia may co-exist with gonorrhea and may be reported only as gonorrhea, or the provider does not report the case or do laboratory tests for chlamydia. Confirmed cases of chlamydia are identified through isolation of the organism or serology tests (Centers for Disease Control and Prevention, 2015).

Men, women, and infants are affected, but women bear a disproportionate burden due to their increased risk for adverse reproductive consequences, such as pelvic inflammatory disease, ectopic pregnancy, and transmission to neonates during pregnancy and delivery (Texas Department of State Health Services, 2014).

Most people infected with chlamydia have no symptoms. CDC estimates as many as 90 percent of males and 70 to 95 percent of females will not experience any symptoms.

Disease Transmission

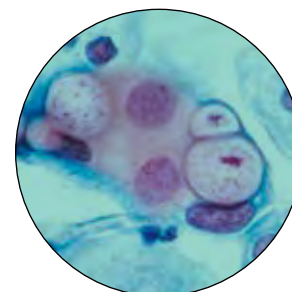
Chlamydia can infect anyone who is sexually active. Exposure to chlamydia can occur through vaginal, anal, or oral sex or congenitally from an infected mother to her child during a vaginal birth. After exposure to the bacteria there is a 7- to 21-day incubation period preceding symptoms. Transmission from an infected mother to her child results in neonatal conjunctivitis in 30% to 50% of exposed babies and pneumonia in 3% to 16% of exposed babies (Centers for Disease Control and Prevention, 2015).

However, when symptoms do occur, they usually include discharge from the genitals and a burning sensation when urinating. Infected persons can experience conjunctivitis and an infection of the lymph nodes due to chlamydia. Infants born to infected mothers are also known to experience conjunctivitis, as well as pneumonia (Centers for Disease Control and Prevention, Chlamydia, 2015).

Complications are uncommon in men. If complications do occur they may include epididymitis, characterized by pain and swelling in the testicles, and a syndrome called Reactive Arthritis (Centers for Disease Control and Prevention, Chlamydia, 2015).

Men and women can also get infected with chlamydia in their rectum, either by having receptive anal sex, or by spread from another infected site. Often an infection at this site has no symptoms as well though the most common symptoms include rectal pain, discharge, and bleeding (Centers for Disease Control and Prevention, 2015).

Certain risk factors associated with chlamydia transmission include new or multiple sex partners, adolescence, being a young woman, presence of another STD, history of STD infection, and lack of barrier contraception. People who have been successfully treated for chlamydia may become re-infected if they engage in sexual contact with an infected person. Chlamydia infection can facilitate the transmission of HIV (Centers for Disease Control and Prevention, 2015).



SURVEILLANCE SUMMARY

Surveillance History

Reportable in Texas since 1987

Population at Higher Risk

- Men who have sex with men
- Sexually active women 25 and older
- Pregnant women under 25

Notable Outbreaks

None

Cases Per Year

19,515 per year

Seasonality

None

Caseload

11,441

Epidemiology in Houston

Chlamydia trachomatis infection is the most commonly reported notifiable disease in Houston and the United States. It is among the most prevalent of all STDs, and since 1994, has comprised the largest proportion of all STDs reported to CDC. In 2014, a total of 1,441,789 chlamydial infections were reported to CDC in 50 states and the District of Columbia. This case count corresponds to a rate of 456.1 cases per 100,000 persons. During 1993–2011, the rate of reported chlamydial infection increased from 178.0 to 453.4 cases per 100,000 persons. From 2011 to 2013, the national rate of reported cases decreased from 453.4 to 443.5 cases per 100,000. From 2013 to 2014, the rate cases increased 2.8% to 456.1 cases per 100,000 persons, as shown in Figure 1 (Centers for Disease Control and Prevention, 2015).

The majority of cases were among the Hispanic population (44.1%), followed by the Black population (31.5%), and the White population (24.4%) (Texas Department of State Health Services, 2014; Texas Department of State Health Services, 2014 Annual Report: Texas STD Surveillance Report, 2015; Texas Department of State Health Services, 2011 Annual Report: Texas STD Surveillance Report, 2012).

From 2007 to 2014, the majority of reported cases in Texas were in the age group 20 to 24 years (37.7%), followed by 15 to 19 years (32.2%), 25 to 29 years (16.1%), and 30 to 34 years (6.9%) (Texas Department of State Health Services, 2015). HHD received an average of 19,515 cases per year from 2005 to 2014 (range from 10,929 to 25,000). A steady increase in the number of reported cases was observed each year as can be seen in Figure 1.

As seen in Figure 2, the majority of reported Houston/Harris County cases were female. This is consistent with national and state data and likely results from the fact that females are more susceptible to the disease as well as more likely to be tested for the presence of the disease.

The majority of the reported chlamydia cases were Black, followed by Hispanic, and White, (Figure 3). From 2005 to 2014, Figure 4 shows that the majority of reported cases within Houston were within the age group of 20 to 29 years, followed by 10 to 19 years.

Chlamydia is more common in densely populated or low socioeconomic status areas, as seen in Figure 5. Many of cases are concentrated in areas in the North or South Houston; though all residential ZIP codes in Houston have large numbers of cases. Chlamydia is the most commonly diagnosed STD in Texas. Texas also saw a similar trend as the rest of the U.S. with steady increases of chlamydia case counts except for a decrease of case counts from 2013 to 2014 (see Figure 1). From 2005 to 2014, Texas had an average of 106,862 yearly reported cases (range: 71,621 - 128,932). From 2007 to 2014, 76.6 percent of the reported Texas cases were female and 23.4 percent were male. From 2007 to 2014, Texas had at least twice as many reported female cases as male cases.

Chlamydia trachomatis infection is among the most prevalent of all STDs, and since 1994, has comprised the largest proportion of all STDs reported to CDC. In 2014, a total of 1,441,789 chlamydial infections were reported to CDC in 50

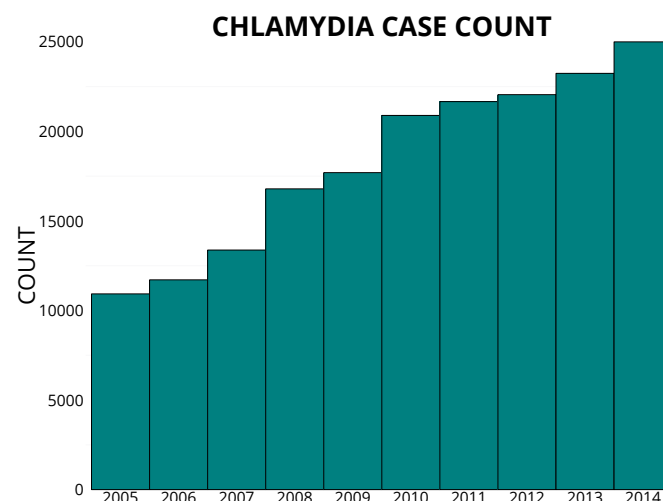


FIGURE 1. Chlamydia case count.

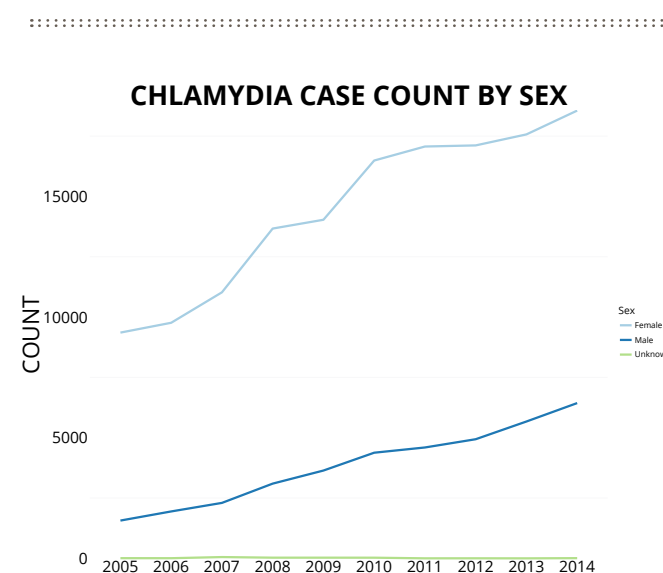


FIGURE 2. Chlamydia case count by sex.

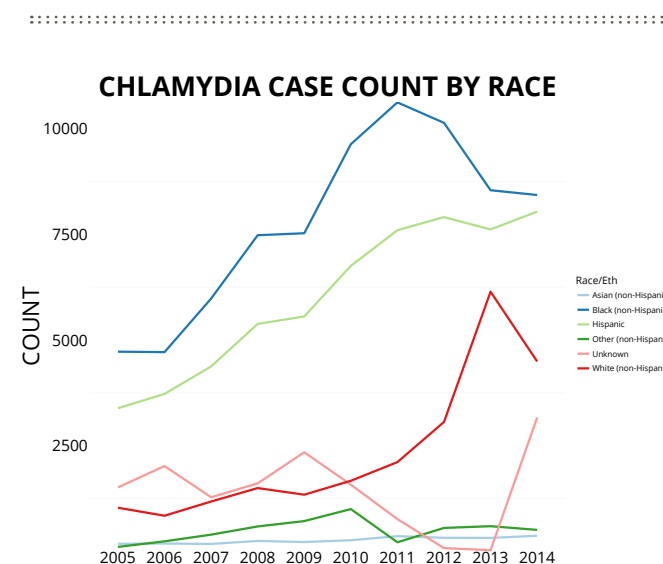


FIGURE 3. Chlamydia case count by race.

states and the District of Columbia. This case count corresponds to a rate of 456.1 cases per 100,000 persons. During 1993–2011, the rate of reported chlamydial infection increased from 178.0 to 453.4 cases per 100,000 persons. From 2011 to 2013, the national rate of reported cases decreased from 453.4 to 443.5 cases per 100,000. From 2013 to 2014, the rate cases increased 2.8% to 456.1 cases per 100,000 persons, as shown in Figure 1 (Centers for Disease Control and Prevention, 2015).

Public Health Action

Preventive measures that can be taken to reduce the spread of *Chlamydia trachomatis* infections include providing early health and sex education for high-risk groups. Also, because chlamydia is usually asymptomatic, screening is necessary to identify most infections. CDC recommends yearly chlamydia screening of all sexually active women age 25 or younger and older women with risk factors for infection (e.g., women who have a new or more than one sex partner). Men who have sex with men (MSM) engaging in receptive anal sex should be screened for rectal infection at least annually. Likewise, MSM engaging in insertive sex should be screened for urethral infection at least annually. Pregnant women should be screened at their first prenatal care visit. Pregnant women under 25 are at increased risk for chlamydia (e.g., women who have a new or more than one sex partner) and should be screened again in their third trimester. Routine screening is not recommended for men. Screening of sexually active young men should be considered in clinical settings with a high prevalence of chlamydia (e.g., correctional facilities and STD clinics) when resources permit and do not hinder screening efforts in women (Texas Department of State Health Services, 2013 Texas STD and HIV Epidemiologic Profile, 2014).

Chlamydia can be easily cured with antibiotics. Latex male condoms, used consistently and correctly, can reduce the risk of contracting chlamydia. The CDC also recommends mutual monogamy, or the practice of having one sexual partner at a time, with a partner who has been tested and known to be uninfected (Centers for Disease Control and Prevention, 2015).

CHLAMYDIA CASE COUNT BY AGE

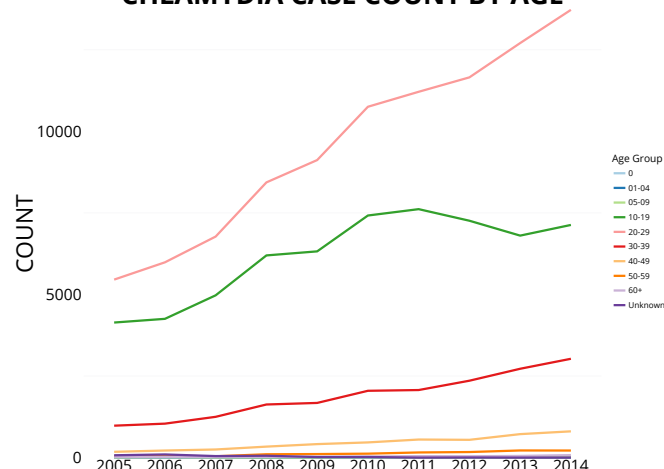


FIGURE 4. Chlamydia case count by age.

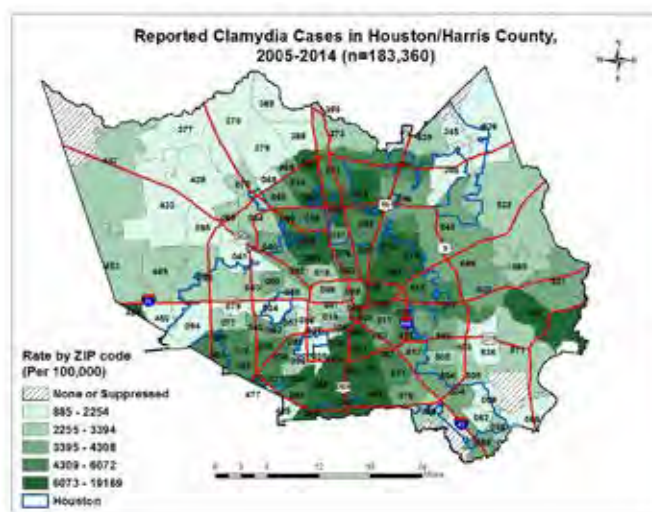


FIGURE 5. Reported Chlamydia cases in Houston/Harris County 2005 - 2014.

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Creutzfeldt-Jakob Disease

INTRODUCTION

Creutzfeldt-Jakob disease (CJD) is a very rare degenerative neurological disorder, which is incurable and always fatal. Like bovine spongiform encephalopathy (BSE), or mad cow disease, CJD is caused by prions, which are virus-like, misfolded proteins.

In the central nervous system, these prions rapidly cause brain degeneration by converting properly folded proteins to the same misfolded proteins of the prion. The newly converted proteins then cause more damage to properly folded proteins, leading to an exponential increase in the number of prions. The brain quickly takes on a spongiform appearance, or resembles a sponge in structure.

About one in four people with CJD initially show relatively mild symptoms of the disease, including progressive dementia, generalized weakness, changes in sleep pattern, loss of appetite, weight loss, and/or decreased sex drive. Vision problems and physical symptoms, such as muscle spasms, jerking movements, and muscle stiffness, are also common. Most patients die within six months of symptom onset.

Disease Transmission

The protease-resistant protein (PrP) can be transmitted during certain medical procedures, where a patient is exposed to infected tissues. The iCJD form is increasingly rare, with only occasional cases that have very long incubation periods (Brown, et al., 2012). As of 2012, 226 cases were documented to be caused by contaminated growth hormones worldwide, and 228 were caused by dura mater (the outermost membrane of the brain and spinal cord) grafts (Brown, et al., 2012). Very few had other sources of transmission, including blood transfusions (3), instrument contamination (6), other types of human-derived hormones (4), and corneal grafts (2) (Brown, et al., 2012). Incubation periods for all iCJD cases ranged from 1 to 42 years; however, most transmission types had a mean

CJD is divided into four categories based upon how the disease is acquired:

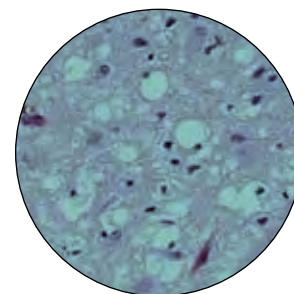
- Sporadic (sCJD) – caused by sporadic refolding of normal proteins in an otherwise healthy central nervous system
- Familial (fCJD) – caused by an inherited mutation in the genes coding for the normal protein, resulting in the prions
- Iatrogenic (iCJD) – caused by contamination from an infected person's tissue during a medical procedure, such as blood transfusions, human-derived pituitary growth hormones, gonadotropin hormones, or corneal transplants
- Variant (vCJD) – caused by consuming food that is contaminated with the prions that cause BSE, or mad cow disease.

transmission period less than 10 years (Brown, et al., 2012).

The vCJD form is transmitted through consuming beef that contains the prions causing BSE. These prions are transmitted among cattle when healthy animals are exposed to diseased tissue from other animals. Theories of how the disease began in cattle include a sporadic change in the PrP gene or transmission of the disease scrapie from sheep to cattle. Furthermore, historical accounts describe similar diseases in cattle (and sheep) as far back as the fifth century BCE (McAlister, 2005).

Epidemiology in Houston

Excluding variant CJD, approximately 85% of cases worldwide are the classic sporadic form; 5-15% are the familial form; and less than 5% are the iatrogenic form (World



SURVEILLANCE SUMMARY

Surveillance History

Notifiable in Texas since 1988

Population at Higher Risk

- Those genetically predisposed
- Persons undergoing medical procedures that contaminate a person's tissue
- Persons consuming food contaminated with prions

Notable Outbreaks

None

Cases Per Year

1 per year

Seasonality

None

Caseload

16

Health Organization, 2012). The sCJD form most commonly occurs in people over 60 and there is no apparent exposure event. The fCJD is an inherited genetic mutation, and it has been shown to be more common in certain ethnic groups, including Jewish people of Italian, Libyan, and Israeli descent (Finkelstein, 1998). These forms are caused by the PRNP gene, which encodes for the protease-resistant protein (PrP) (Gambetti, Kong, Zou, Parchi, & Chen, 2003).

From 2005–2014, a total of 14 cases of CJD were identified in Houston. Of these cases, 12 occurred in individuals over 50 years of age (Table 1). This suggests that these cases are the sporadic form, the risk for which increases with age. Despite decreases worldwide, Houston experienced higher rates in 2011 and 2014 (Table 1).

In the past 10 years, the rate of CJD in Texas was 0.77 cases per million

population; in the past 5 years, this rate increased to 0.85 cases per million due to increased surveillance efforts (Texas Department of State Health Services, 2015). However, CJD is often under-reported and misdiagnosed, due to lack of pre-mortem diagnostic testing (Texas Department of State Health Services, 2015). Nationally, the rate of CJD has been approximately 1.0–1.5 cases per million, resulting in approximately 9,630 deaths through 2013 (Centers for Disease Control and Prevention, 2015).

Public Health Action

The long incubation periods, often years to decades, present a problem for public health, as public health actions may prevent new cases, but do not address people who have the disease in the pre-clinical (undiagnosed) phase. Current strategies include restrictions on tissue donation from persons with a higher than normal risk for CJD, and

inclusion of prion-reducing steps during instrument sterilization. Additionally, despite the diminishing risk, embargoes on biological products from the United Kingdom remain in effect today due to fears of BSE or “mad cow disease”.

In 2005, the US Department of Agriculture confirmed BSE results in a cow from Texas, making it the first endemic case of BSE in the US (Rogers & Jones, 2005). Ongoing prevention efforts include identifying BSE in imported and domestically raised livestock. Furthermore, the WHO recommends that ruminant tissues should not be used in feed, as this could spread BSE throughout livestock (World Health Organization, 2012).

There is no cure for CJD. There is also no treatment that will slow the progression of the disease, once acquired. Supportive therapy can be used to treat some of the symptoms of the disease; however, in most cases, there are few months to provide this treatment before the disease becomes fatal.

Autopsy and post-mortem brain biopsy are the only methods of confirming a case of CJD. Following the death of a person suspected of having CJD, autopsy or postmortem biopsy are strongly encouraged. The National Prion Disease Surveillance Center provides autopsy services and support for the families of individuals suspected of dying from CJD.

TABLE 1: NUMBER OF CREUTZFELDT-JAKOB DISEASE CASES BY AGE GROUP, 2005-2014

AGE GROUP	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	GRAND TOTAL
0-9	0	0	0	0	0	0	0	0	0	0	0
10-19	0	0	0	0	0	0	0	0	0	0	0
20-29	0	0	0	0	0	0	0	0	0	0	0
30-39	1	0	0	0	0	0	0	0	0	0	1
40-49	0	0	0	0	0	1	0	0	0	0	1
50-59	0	1	0	0	0	0	1	1	1	1	5
60+	1	0	1	0	0	1	2	0	0	2	7
TOTAL	2	1	1	0	0	2	3	1	1	3	14

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Cryptosporidiosis

INTRODUCTION

Cryptosporidiosis is an intestinal infection caused by the parasite, *Cryptosporidium parvu*. The parasite is found in the feces of infected people and animals. *Cryptosporidium* has been identified as one of the most common causes of water-borne disease in humans in the United States (Centers

for Disease Control and Prevention, 2010). The parasite is found across the United States and throughout the world. *Cryptosporidium* is a leading cause of persistent diarrhea in those under one year of age in developing countries (World Health Organization, 2006).

Cryptosporidiosis is characterized by watery diarrhea. Other symptoms that may present after infection are: stomach cramps or pain, dehydration, nausea, vomiting, fever, and weight-loss. In healthy individuals, the infection may be asymptomatic or present with mild symptoms. Most healthy people recover from the illness in less than two weeks. In severely immunocompromised patients, the disease can be prolonged and life-threatening. Anyone with the infection, whether or not they show symptoms, can shed the parasites in their feces and pass on the disease.

Disease Transmission

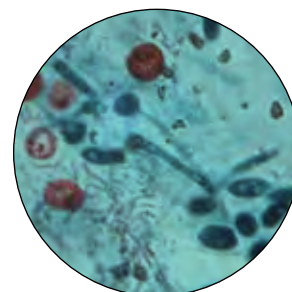
Cryptosporidiosis is contracted and spread through the fecal-oral route. An individual has to come into contact with *C. parvu* contaminated human or animal feces in water, food, or on objects and surfaces. Ingesting as few as 10 *C. parvu* oocysts, the parasitic stage shed by infected individuals, can result in infection. An infected person can shed 10,000,000 to 100,000,000 oocysts in a single bowel movement (Centers for Disease Control and Prevention, 2010). The parasites shed in the feces can survive in a moist environment for 2 to 6 months. The incubation period for the disease ranges from 1 to 12 days, with 7 days being the typical duration (Center for Food Security & Public Health, 2005).

Individuals that have HIV/AIDS are at a higher risk of contracting cryptosporidiosis and are more likely to face severe adverse effects from the infection. Individuals infected with HIV have difficulty overcoming the infection and may be unable to recover from cryptosporidiosis, leading to prolonged illness and possible death.

Cryptosporidiosis was added to the Nationally Notifiable Diseases List in 1995 for probable and confirmed cases. According to Texas state law, confirmed symptomatic or asymptomatic cryptosporidiosis cases must be reported within one week. In 2014, the Houston Health Department (HHD) received 35 reports of cryptosporidiosis.

The most common methods of transmission of the disease are: swallowing water in contaminated pools, drinking untreated water from contaminated lakes/streams, eating uncooked *C. parvu* contaminated foods, and touching your mouth with hands that have come into contact with *C. parvu* contaminated surfaces like toys, bathroom fixtures, and diapers (Centers for Disease Control and Prevention, 2010). Transmission of cryptosporidiosis is also possible during oral-anal sexual contact where there might be exposure to an infected person's feces.

Cryptosporidiosis has been identified in all parts of the world, making all individuals susceptible. In North America, approximately 2% of the population is infected at any given



SURVEILLANCE SUMMARY

Surveillance History

Notifiables in Texas since 1996

Population at Higher Risk

- Immunocompromised persons
- Young children and elderly
- Animal handlers
- Travelers
- Men who have sex with men

Notable Outbreaks

None

Cases Per Year

18 per year

Seasonality

Summer

Caseload

192

TABLE 1: NUMBER OF CRYPTOSPORIDIOSIS CASES BY SEX, 2005-2014

SEX	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	TOTAL
FEMALE	0	0	7	12	7	7	8	9	8	5	63
MALE	0	0	12	6	11	19	9	7	22	30	116
UNKNOWN	1	0	1	0	0	0	0	0	0	0	2
TOTAL	1	0	20	18	18	26	17	16	30	35	181

Of the 181 cases, persons aged 0-9 accounted for 39 cases and persons aged 40 and over accounted for 76 cases (Table 2). Seventy one cases (39%) had HIV and/or AIDS.

TABLE 2: NUMBER OF CRYPTOSPORIDIOSIS CASES BY AGE GROUP, 2005-2014

AGE GROUP	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	GRAND TOTAL
0	0	0	0	1	0	1	0	0	1	0	3
1-4	0	0	1	4	3	6	2	1	2	3	22
5-9	0	0	1	1	1	2	3	4	1	1	14
10-19	0	0	0	2	1	2	0	0	1	3	9
20-29	0	0	3	2	5	3	2	1	8	4	28
30-39	0	0	5	1	5	1	1	1	8	3	25
40-49	0	0	5	4	0	4	3	4	5	12	37
50-59	1	0	3	1	0	2	1	2	1	8	19
60+	0	0	2	2	2	2	5	3	3	1	20
Unknown	0	0	0	0	1	3	0	0	0	0	4
TOTAL	1	0	20	18	18	26	17	16	30	35	181

time and about 80% have been exposed (Center for Food Security & Public Health, 2005). While all people are at risk, the disease has different outcomes depending on health status. Healthy individuals can fight off the infection in 7 to 14 days, but immuno-compromised individuals (especially those with AIDS) can face lifelong symptomatic infections which may contribute to mortality (Centers for Disease Control and Prevention, 2010).

Epidemiology in Houston

From 2005 to 2014, 181 cases of Cryptosporidiosis were reported by the Bureau of Epidemiology (Figure 1). Men accounted for 116 (69%) of all reported cases (Table 1).

High risk groups for cryptosporidiosis are young children, the elderly, the immunocompromised, and men who have sex with men (MSM).

Public Health Action

There is no vaccine available for preventing cryptosporidiosis. The infectious oocysts that are found in the feces of infected animals and people are poorly inactivated by chlorine or iodine, making chemical disinfection difficult (Centers for Disease Control and Prevention, 2010). Washing hands is the most effective means of preventing cryptosporidiosis transmission. Immunocompromised people should practice safe sex and wash their hands thoroughly after any contact with animals, stool, or the living areas of animals. Immunocompromised persons may also take additional precautions by washing, peeling, or cooking all vegetables to ensure safety.

CRYPTOSPORIDIOSIS CASE COUNT

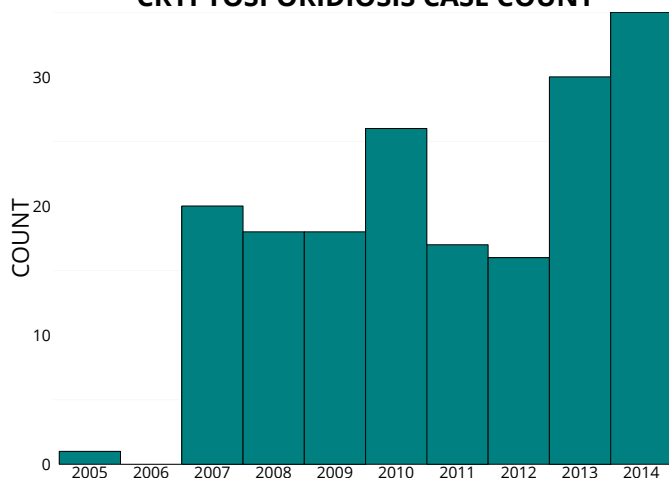


FIGURE 1. Cryptosporidiosis case count.

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Cyclosporiasis

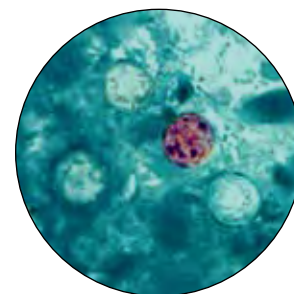
INTRODUCTION

Cyclosporiasis is an intestinal disease caused by the parasite *Cyclospora cayentanensis*. Symptoms of the disease include watery diarrhea, anorexia, fatigue, weight loss, nausea, vomiting and abdominal cramping (Herwaldt, 2000). The symptoms typically last for a few days, but if

the infection is left untreated, symptoms can last for months. It is possible for the infection to occur without any symptoms (Ortega & Sanchez, 2010, p. 220). Trimethoprim/sulfamethoxazole (TMP/SMX), also known as Bactrim, is used to treat the infection (CDC, 2013).

For public health surveillance, cyclosporiasis cases are classified as either

“confirmed” or “probable.” Confirmed cases require a laboratory diagnosis, which entails detection of *Cyclospora* in the infected person’s stool. Specimens are not usually tested for *Cyclospora* unless specifically requested by physicians (CDC, 2014). In Texas, any suspect or confirmed case of cyclosporiasis is to be reported to the health department within one week.



SURVEILLANCE SUMMARY

Surveillance History

Reportable in Texas since 2000

Population at Higher Risk

None

Notable Outbreaks

One

Cases Per Year

3 per year

Seasonality

Summer

Caseload

52

Disease Transmission

Cyclospora is transmitted through the consumption of contaminated food or water (Abanyie, Harvey, Harris, Wiegand, Gaul, & Desvignes-Kendrick, 2015, p. 2).

There have been several foods linked to *Cyclospora*. In 2014, cilantro imported from Mexico was linked to an outbreak of 304 cases, with 133 in Texas. Since the 1990s, *Cyclospora* outbreaks in the U.S. have been linked to imported raspberries, basil, mesclun lettuce, and snow peas (CDC, 2013). The incubation period of the disease is 2 to 14 days, with a mean of 7 days. The disease peaks during summer months in the United States.

dramatic increase in reporting since 2012 likely resulted from the large outbreaks observed in 2013 & 2014. While Houston did not have many cases linked to the outbreak, there likely was an increased awareness among physicians to test for the disease during that time period.

Epidemiology in Houston

Houston recorded 30 confirmed cases of cyclosporiasis from 2005 - 2014, and all occurred between 2012 and 2014. Table 1 below illustrates this trend. In the same time period, the state of Texas recorded 638 cases, 595 of which occurred between 2012 and 2014. In 2013 and 2014, the incidence of Texas cases was higher among individuals aged 40 years and above. (Texas Department of State Health Services, 2015). Part of the

CYCLOSPORIASIS CASE COUNT

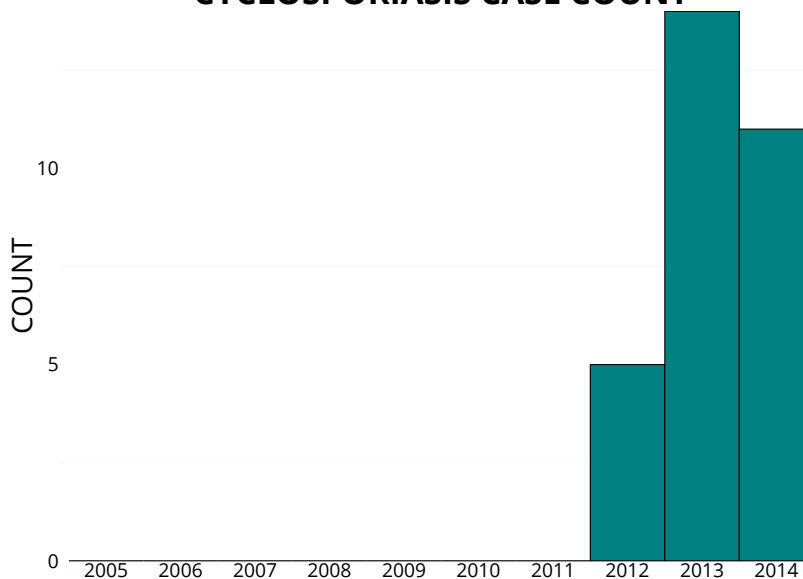


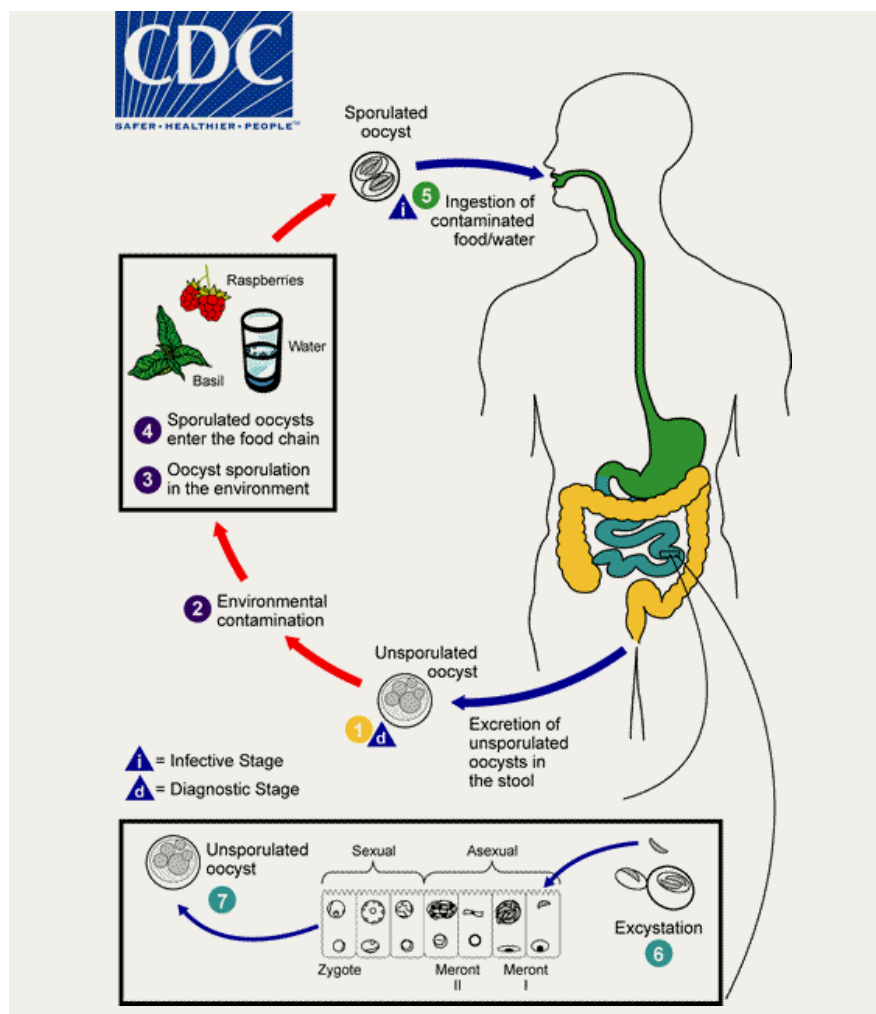
FIGURE 1. Cyclosporiasis case count



Public Health Action

The most effective prevention is to avoid contaminated food and water, especially food from unknown sources and untreated water. Fresh produce must be adequately washed with clean water prior to consumption. Travelers to countries with inadequate sanitation are advised to drink only purified water (Schneider, Silverberg, Richardson, & Schneider, 2015). Since the disease is not directly transmitted from person to person, emphasis of disease control has been placed on rapid identification and accurate contact tracing of implicated foods through food distribution networks.

The Houston Health Department continues to track cyclosporiasis in Houston through public health surveillance.



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Cysticercosis & Taeniasis

INTRODUCTION

Cysticercosis & taeniasis is an emerging food-borne illnesses caused by eating *Taenia*-contaminated beef or pork products. *Taenia* is a genus of parasitic tapeworms. Whether the disease is classified as cysticercosis or taeniasis depends on the life-cycle stage of the tapeworm. Consumption of

tapeworm eggs results in cysticercosis, whereas consumption of adult tapeworms results in taeniasis. The implementation of laws regarding feeding practices and inspection of animals has largely eliminated tapeworm within the United States; however, the parasite still impacts 50 million individuals worldwide (World Health Organization, 2015).

Infection with taeniasis-causing tapeworm species is often entirely asymptomatic or mild in its clinical presentation. If symptoms do develop, individuals may experience digestive issues such as abdominal pain, loss of appetite, weight loss, and upset stomach. Tapeworm segments (proglottids) being expelled by the body through the anus and in feces are visual indicators of taeniasis.

Infection can develop into the more serious

disease, cysticercosis. Larva enter the bloodstream and move throughout the body with the potential of infecting any organ within the body, which results in the formation of cysts. Neurocysticercosis, the infection of the central nervous system with *T. solium*, is the major cause of acquired epilepsy in the world (Texas Department of State Health Services, 2011).

Cysticercosis and taeniasis became reportable conditions in 2007. Reporting of confirmed or suspected taeniasis cases are required within a week. While there have been no cases reported by the Houston Health Department (HHD), the Texas Department of State Health Services (DSHS) has reported a total of 6 cases since 2007 (Texas Department of State Health Services, 2011).

Disease Transmission

Taeniasis occurs after eating beef or pork products contaminated with adult tapeworms. While rare in the US, the disease has high prevalence in Latin America, Africa, and South and Southeast Asia (Centers for Disease Control and Prevention, 2016). Eating raw or uncooked beef or pork products is the primary risk factor for acquiring taeniasis (Texas Department of State Health Services, 2011).

The incubation period for the disease varies depending on the tapeworm species that has infected the individual and generally ranges from 8-14 weeks (Centers for Disease Control and Prevention, 2016).

For a person to get cysticercosis, he or she must consume the taeniasis eggs from an infected person. This may happen directly, such as a person having eggs on his or her hands and touching their mouth. It can also happen indirectly, such as eating food or drinking water that has had contact with human feces containing the eggs (Centers for Disease Control and Prevention, Parasites-Cysticercosis, 2014) (Texas Department of State Health Services, 2002).



SURVEILLANCE SUMMARY

Surveillance History

Reportable in Texas since 2007

Population at Higher Risk

- Travelers to endemic areas
- Individuals who eat raw meat or other contaminated products

Notable Outbreaks

None

Cases Per Year

Cysticercosis: 1

Taeniasis: 0

Seasonality

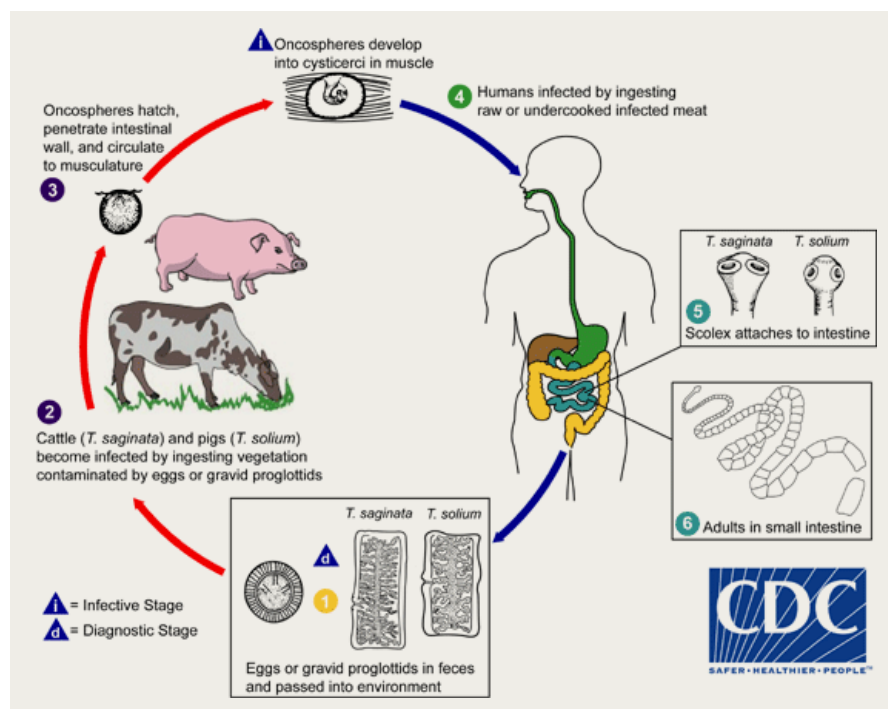
None

Caseload

Cysticercosis: 34

Taeniasis: 12





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Symptoms of cysticercosis may appear from weeks to 10 years after the infection (Centers for Disease Control and Prevention, Parasites-Cysticercosis, 2014) (Heymann, 2008).

Epidemiology in Houston

Taeniasis is a rare condition within Houston and within the US. Since it became a reportable condition in 2007, no cases have been reported in Houston. Only 6 cases have been reported in Texas. Nationally, less than 1,000 cases have been reported.

Since 2007, there have been 5 cases of cysticercosis in Houston and 65 cases reported in Texas (Texas Department of States Health Services, 2015).

While rare in the United States, the disease has high prevalence in Latin America, Africa, and South and Southeast Asia. Cysticercosis seen in developed countries is mostly a result of migration from endemic countries and less frequently due to travelers (Centers for Disease Control and Prevention, 2015) (Garcia, 2012).

Public Health Action

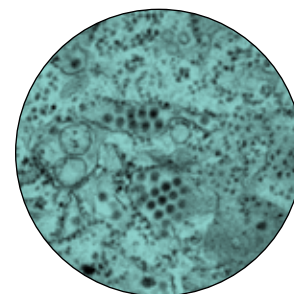
HHD interviews both taeniasis and cysticercosis cases to identify the sources of those infections to prevent further spread.

The risk of contracting taeniasis within the U.S. is limited. Improved agriculture and health standards have limited the chances of contracting tapeworm. Making sure to either cook meat completely or freeze or irradiate it, destroys tapeworm larva and prevents both cysticercosis and taeniasis. Maintaining good hygiene and practicing good hand-washing techniques also reduces transmission. Infection in animals is prevented by protection of the animal feed or grazing areas. In addition to cooking, freezing meat and irradiation will kill the cysts, which eliminates tapeworm development.

Dengue

INTRODUCTION

Dengue is a viral disease caused by any one of four dengue viruses (DEN-1, DEN-2, DEN-3, and DEN-4). It is spread by two species of infected mosquitoes, *Aedes aegypti* and *Aedes albopictus*. The disease is thought to have originated in either Africa or Southeast Asia between 100 and 800



years ago (Centers for Disease Control and Prevention, 2014). The movement of troops during World War II and the rise of air travel resulted in the introduction of the disease to new areas of the world (Gubler, 2002). The first dengue epidemic was identified during the 1950s in the Philippines and Thailand.

The disease is not an issue in most parts of the United States; most cases reported within the U.S. were acquired in other countries by travelers or immigrants. Globally, there are an estimated 390 million dengue infections yearly, with over 3 billion people at risk of infection from the dengue viruses (Brady, et al., 2012).

Infection with dengue virus can result in either dengue fever or dengue hemorrhagic fever (DHF). Dengue hemorrhagic fever is a more severe form of dengue infection. Dengue fever is characterized by a high fever, severe headache, severe pain behind the eyes, joint and bone pain, rash, and mild bleeding.

The symptoms of both conditions are similar, with DHF presenting with more aggressive variations of dengue fever symptoms.

DHF presents with fever that lasts from 2 to 7 days; persistent vomiting, and severe abdominal pain. Difficulty breathing may develop. Once symptoms present, there is a 24 to 48-hour period when the small blood vessels within the infected individual allow fluid to escape. DHF can be fatal if unrecognized. With timely medical care, however, risk of death due to DHF can be less than 1% (Centers for Disease Control and Prevention, 2014).

Dengue fever has been a reportable condition in Texas since 1931. Suspected or confirmed dengue fever cases are to be reported to the local health department within one week. The Houston Health Department (HHD) reported 8 cases of dengue fever in 2014.

SURVEILLANCE SUMMARY

Surveillance History

Reportable year: Reportable in Texas since 1931.

Population at Higher Risk

Travelers to endemic countries

Notifiable Outbreaks:

None

Cases Per Year

1.2

Seasonality

None

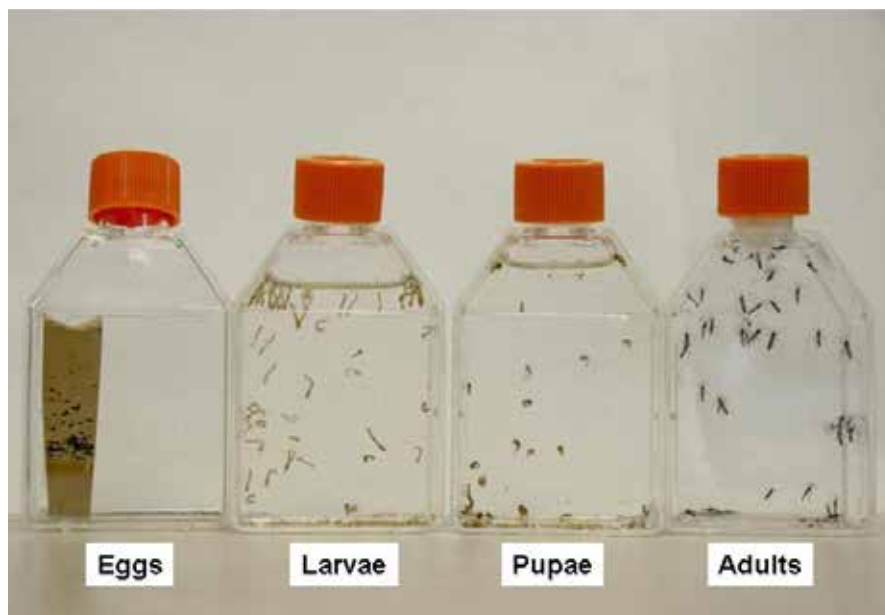
Caseload

139

Disease Transmission

Dengue is transmitted to humans by mosquitoes. Human to human transmission occurs rarely, but has been identified in some instances as a result of organ transplants, blood transfusions or transmission from infected mother to fetus. The most common transmitter in the western hemisphere is the *Aedes aegypti* mosquito, but *Aedes albopictus* can also carry the dengue virus. It is speculated that the *A. albopictus* mosquito species were introduced into Houston through used truck tires imported from Southeast Asia from recapping in 1985 (Nelson, 2004). The spare tires collected rain water and served as





breeding places for the mosquitoes.

After an infected mosquito bites an individual, the individual does not show symptoms for a period of 3 to 14 days; commonly 3 to 7 days. Once symptoms do present, they usually last 3 to 10 days. The mosquitoes become carriers of the dengue virus after feeding on an infected individual. For the mosquito to become infected, it must feed during a 5-day period when large amounts of virus are in the individuals' blood (Centers for Disease Control and Prevention, 2014). This usually occurs shortly before symptoms develop. Infected individuals who do not present with significant symptoms are still capable of passing on the dengue virus to mosquitoes. Once a mosquito has been infected, it remains infected for the remainder of its life (Centers for Disease Control and Prevention, 2014).

Travelers to tropical/sub-tropical countries are most at risk for contracting dengue. Dengue is an endemic disease in many tropical countries across Africa, Asia, the Americas, the Pacific, and the Caribbean. Residents of the United States most likely to contract the disease are those that live in Puerto Rico, the U.S. Virgin Islands, Samoa, and Guam. A year-round population of abundant *Aedes aegypti* makes Puerto Rico susceptible to outbreaks of dengue. Since the late 1960s, island-wide epidemics have occurred; the most recent outbreak being in 2007 where more than 1,000 cases were diagnosed (Centers for Disease Control and Prevention, 2014).

Epidemiology In Houston

Dengue is rare in Houston. From 2005 to 2014, there were a total of 12 cases

reported by HHD. There were no cases prior to 2012.

Public Health Action

There is no vaccine for preventing dengue. The best preventive measure for residents living in areas infested with *Aedes aegypti* is to eliminate the places where the mosquito lays its eggs, primarily artificial containers that hold water (Centers for Disease Control and Prevention, 2014).

Items that collect rainwater or are used to store water such as plastic containers, 55-gallon drums, buckets, or used automobile tires should be covered or properly discarded. Pet and animal watering containers and vases with fresh flowers should be emptied and scoured at least once a week. This will eliminate the mosquito eggs and larvae and reduce the number of mosquitoes present in these areas.

For travelers to areas with dengue, as well as for people living in areas with dengue, the risk of being bitten by mosquitoes indoors is reduced by utilization of air conditioning or windows and doors that are screened. Proper application of mosquito repellent containing 20 to 30 percent DEET as the active ingredient on exposed skin and clothing decreases the risk of being bitten by mosquitoes. The risk of dengue infection for international travelers appears to be small, unless an epidemic is in progress.

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Diphtheria

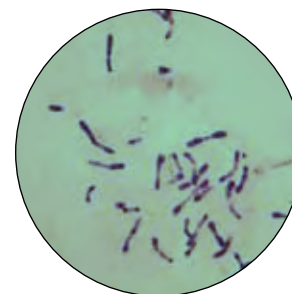
INTRODUCTION

Diphtheria is an uncommon, vaccine-preventable disease in the United States. It is caused by the toxins released by the gram positive bacilli bacteria *Corynebacterium diphtheria*.

There are two types of diphtheria: respiratory diphtheria and cutaneous diphtheria. Respiratory diphtheria develops two

to five days after exposure and is characterized by a sore throat, difficulty swallowing, a low-grade fever, and a temporary grayish-white membrane forming inside the throat. In moderate to severe cases swelling of the lymph nodes and tissues of the neck may give rise to a “bull-neck” appearance. Respiratory diph-

theria, left untreated, has been fatal due to the membrane restricting airways and complications involving the heart, nervous system, and kidneys. Cutaneous diphtheria is usually mild and consists of sores or shallow ulcers on the skin (Texas Department of States Health Services, 2013) (Tiwari, 2011).



Disease Transmission

Diphtheria is transmitted from person to person by respiratory droplets or direct contact with respiratory secretions, discharge from the skin lesions, or, rarely, contact with contaminated objects. Untreated patients are usually infectious for up to two weeks. However, some individuals can carry the bacteria without signs of the disease and may be infectious for six months or more. Diphtheria is only known to infect humans (Heymann D. L., Diphtheria, 2008) (Tiwari, 2011).

Epidemiology In Houston

No cases of diphtheria have been reported in the City of Houston, or even Texas, in over thirty years. Diphtheria was the most common causes of illness and death among children in early 1900s. Since the introduction and widespread use of diphtheria vaccines in the 1920's and 1930's and universal childhood immunization in the late 1940's, diphtheria has been continually decreasing in the United States. There have only been two cases recorded in the United States in the past decade (Centers for Disease Control and Prevention, 2013) (Centers of Disease Control and Prevention, 2015) (Texas Department of States Health Services, 2013).

Public Health Action

Suspect cases of diphtheria should receive diphtheria antitoxin immediately after bacteriologic specimens are taken without waiting for lab results. The most effective diphtheria prevention method is through vaccination. Children should receive a dose at two months, four months, and six months of age. A fourth dose should be given between 15 and 18 months of age and the fifth dose between four to six years. An additional booster is recommended for children 11 to 12 years of age. Adults should also receive a tetanus-diphtheria booster every ten years (Centers of Disease Control and Prevention, Diphtheria, Tetanus, and Pertussis Vaccine Safety, 2015).



SURVEILLANCE SUMMARY

Surveillance history

Nationally notifiable since 1944.

Population at higher risk

Unvaccinated individuals

Notifiable Outbreaks:

None

Cases per year

0

Seasonality

Fall

Caseload

4

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Drug Overdose Mortalities

INTRODUCTION

Mortalities due to drug overdose are the primary cause of injury related deaths among adults in the United States. For the past 20 years in the U.S. there has been an increase in deaths associated with drug overdose. Much of the increase can be attributed to widespread abuse of prescription drugs.

Drug overdose deaths, while not a reportable condition, have been deemed a public health concern that warrants surveillance. The

epidemic of opioid related deaths is correlated with sales for prescription opioids, which have quadrupled since 1999 (CDC 2015).



Description of Condition

Many drug related deaths are caused by misuse or overdose of prescription opioids for pain relief. Prescription opioids are prescribed to treat chronic pain that is moderate to severe in nature for common conditions such as back pain, osteoarthritis, surgery, injury, or cancer. Two contributing factor that result in the misuse or overdose of prescription opioids are that addiction from prescription opioids may develop from as little as one prescription, and addiction is difficult to stop (CDC 2015). Heroin users usually have a history of prescription opioid misuse (Wilson M. Compton 2016). The causes of drug overdose with heroin include ease of availability, low price, and high purity (Theodore J. Cicero, et al. 2014).

Risk factors for misuse and overdose of prescription opioid pain relievers include:

1. Multiple prescriptions from different providers and pharmacies during the same time period.
2. Using high doses daily or compulsive use.
3. A history of substance or alcohol abuse.
4. Having a mental illness.
5. Living in rural areas and having low income (CDC 2015). Individuals between the ages of 35 to 54 years, non-Hispanic White, or male gender account for the majority of drug overdose deaths due to opioid pain relievers.

Nationally, age-adjusted rates of drug overdose deaths involving opioids increased by 14% from 2000 to 2014. Heroin overdose death rates tripled from 1 per 100,000 to 3.4 per 100,000 between 2010 and 2014 (CDC MMWR 2016). From 2013 to 2014 the increase in drug overdose death rates was significant for both males and females, individuals ages 25 to 34, 35 to 44, 55 to 64, ≥65 years, and non-Hispanic Whites and non-Hispanic Blacks (CDC MMWR 2016).

Epidemiology in Houston

From 2004 to 2014, the rate of drug overdose deaths increased by 123% in the City of Houston. The age-adjusted rates of drug overdose deaths for Houston (14.9 per 100,000)

SURVEILLANCE SUMMARY

Surveillance History

Reportable in Texas since 1999

Population at Higher Risk

Those of white race, male gender, and older than 35 years

Notable Outbreaks

None

Cases Per Year

212

Seasonality

None

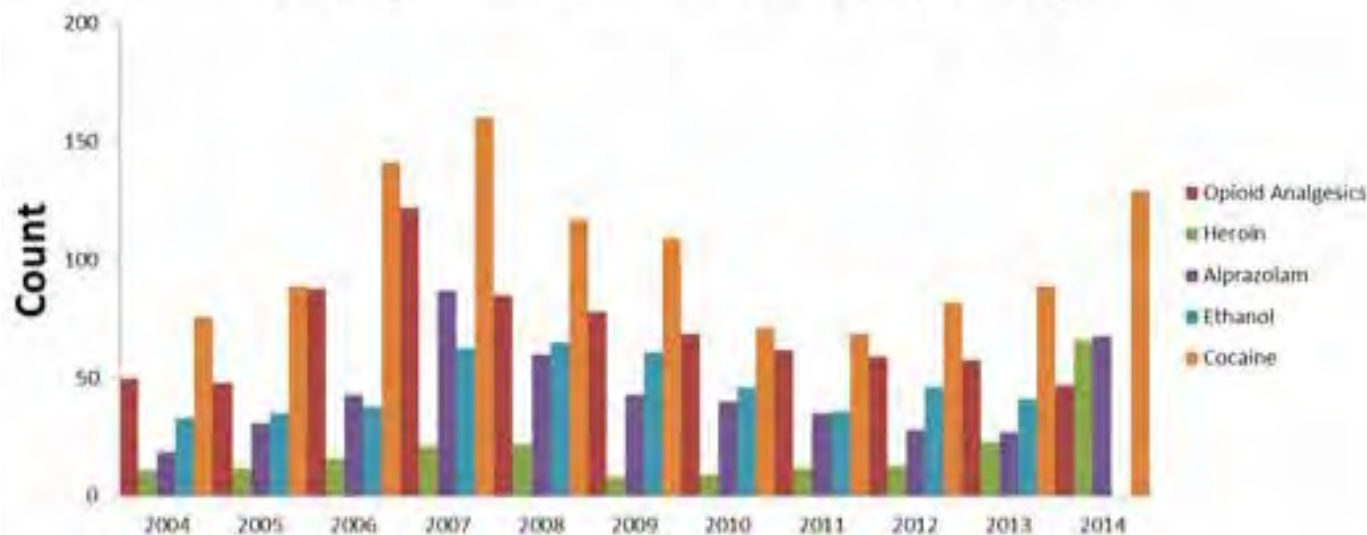
Caseload

0

Drug overdose death counts



Drug overdose deaths by drug



are comparable to national age-adjusted rates (14.7 per 100,000) in 2014. Drug overdose deaths related to all drugs ranged from 146 deaths (2004) to 321 (2014). Since 2004, the top 5 drugs included opioid pain relievers, alprazolam, heroin, ethanol and cocaine. Deaths related to opioid analgesics, alprazolam, and cocaine peaked in 2007. Risk factors for drug overdose deaths included White race, male gender, and ages greater than 35 years. ZIP codes with higher rates of drug overdose deaths were observed within the urban areas compared to the suburban areas of Houston.

Description of Surveillance Activities

In 2014, the Houston Health Department worked with the Harris County Forensic Institute to determine the status of drug misuse and unintentional deaths in the Greater Houston Metropolitan Area.

The Centers for Disease Control and Prevention (CDC) groups natural opioids, semisynthetic opioids, methadone, and other synthetic opioids as prescription drugs for the purpose of tracking and monitoring deaths due to opioid pain reliever (CDC MMWR 2011) (CDC MMWR 2016). A drug overdose death is an unintentional death when it results from misuse or overdose. The drug types related to death

are determined with a toxicology screen performed by the medical examiner.

Drug types that account for part of the increase in drug overdose deaths are opioid pain relievers and heroin (CDC MMWR 2016). Opioid pain relievers may be natural or synthetic which include types such as fentanyl, methadone, tramadol, propoxyphene, meperidine and other pain relievers. Opioid drug types may be further grouped into illicit or prescription; however, the toxicology tests performed by coroners and medical examiners may not distinguish between prescription and illicit fentanyl (CDC MMWR 2016). Heroin is an illicit drug which is often found to be an underlying cause of drug overdose death and is linked to misuse of opioid pain reliever.

Misclassification of heroin into the wrong drug type may occur due to similarity in how the human body processes heroin and morphine (CDC MMWR 2016). Other drug types may include prescription and illicit drugs such as carisoprodol, alprazolam, diazepam, cocaine, zolpidem, hydrocodone, hydro-morphine, oxycodone, and morphine.

Public Health Action

The public health problem of drug misuse and overdose is an epidemic of mortality, however, preventing overdose deaths due to opioid drugs includes intervening early at such points as dependence, addiction, disability, and other events (Gary Franklin 2014). Public health action must be comprehensive



and multidisciplinary. Drug overdose deaths can be prevented and controlled through safe prescribing practices, policies at the state and local level, and prescription drug monitoring programs (CDC 2015).

Due to the consistent high rates of drug overdose deaths, strategies to track and monitor drug overdose deaths can be implemented by public health. Strategies for local health departments to address the health issue of prescription opioid overdose misuse and deaths include:

1. Improve monitoring and detection of prescription opioid outbreaks.
2. Inform healthcare providers of the need to modify prescribing practices.
3. Connect healthcare providers with Prescription Drug Monitoring Programs.
4. Participate in state and local level interventions.
5. Raise awareness of naloxone as a lifesaving drug to reverse effects of drug overdose.
6. Encourage providers to use prescriptions with behavior change therapies.

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Ehrlichiosis

INTRODUCTION

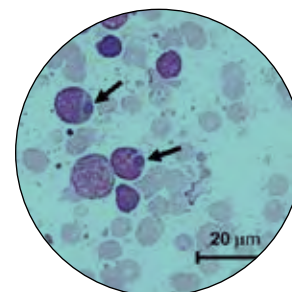
Ehrlichiosis refers to infection with the *Ehrlichia* bacteria. It was first recognized in the United States in 1986 and is found in areas where lone star ticks are common. The lone star tick generally transmits *Ehrlichia* in the southeastern and south-central United States. In 2009, a new strain of

ehrlichiosis was detected in the Midwestern U.S.

Symptoms of the disease include fever, headache, chills, malaise, and muscle pain. The severity of symptoms varies person to person, and some patients may not experience any symptoms at all. Any suspected case of ehrlichiosis is to be reported to the HHD within one week. Ehrlichiosis is diagnosed based on the clinical presentation and

laboratory test confirmation.

Symptoms caused by infection from the *Ehrlichia* species usually develop 1-2 weeks after a person is bitten by an infected tick. Tick bites are usually painless and about half of those who develop ehrlichiosis do not know if they were bitten. Ehrlichiosis became a reportable disease in 1999 (www.cdc.gov, 2013).



SURVEILLANCE SUMMARY

Surveillance History

Nationally notifiable since 1999

Population at Higher Risk

Older individuals

Notable Outbreaks:

None

Cases Per Year

0

Seasonality

Summer and Spring

Caseload

3

Disease Transmission

The pathogen is an intracellular organism that survives and reproduces in the white blood cells of an infected individual. Major animal reservoirs include white-tailed deer, dogs, and rodents.

A history of tick bite or exposure to tick-infested habitats is reported in 50% to 90% of cases. Most patients with ehrlichiosis are infected in the spring and summer, the season for adult ticks. Unlike other tick-transmitted diseases, reported rates of ehrlichiosis increase with age and most patients with the disease are older adults greater than 40 years of age (CDC, 2013).

Epidemiology in Houston

From 2005 to 2014, no cases of Ehrlichiosis were reported to the HHD. It is a rare disease with fewer than 10 cases reported each year in Texas. However, since many people with ehrlichiosis have no symptoms, it is difficult to estimate its true prevalence.

Public Health Action

Ehrlichiosis can be prevented by avoiding tick bites. Prevention strategies include:

- Avoid areas that are likely to have ticks, when possible, particularly in spring and summer when ticks and tick nymphs feed
- Wear light-colored clothing when going into areas with ticks so that ticks can be seen on the clothes more readily and be removed before attaching to the skin.



Gonorrhea

INTRODUCTION

Gonorrhea is a sexually transmitted disease caused by the bacterial agent *Neisseria gonorrhoeae*. This infection is characterized by symptoms including discharge and inflammation at the urethra, cervix, pharynx and anus.

Gonorrhea is the second most commonly reported sexually

transmitted disease within the United States. The United States alone detects and reports over 350,000 cases annually.

An infection can present as a single symptom or as a combination of symptoms. Symptoms vary among men and women. Women often have no symptoms. Some women, however, present with painful sensation during urination, increased vaginal discharge, and irregular vaginal bleeding. Men tend to be asymptomatic, but when symptoms occur they include burning sensation while urinating, white or yellow discharge from the penis, and painful, swollen testicles. Antimi-

crobial resistance is a growing concern in the treatment of gonorrhea, and the Centers for Disease Control and Prevention (CDC) now recommends using two drugs for treatment. Prompt identification and treatment of this disease is the key to controlling the spread of this condition and assisting in the containment of bacterial drug resistance.

Gonorrhea is a mandatory reportable disease in all states, including Texas. Confirmed and suspected cases of gonorrhea are reportable to the HHD Bureau of Epidemiology within one week of diagnosis.

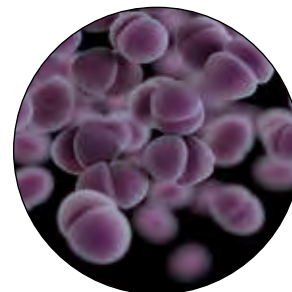
Disease Transmission

Transmission of gonorrhea is primarily through sexual contact with an infected individual. Gonorrhea transmission may be through oral, vaginal or anal contact routes. Gonorrhea can also be transmitted from mother to infant at the time of vaginal birth. The incubation period for this infection is 2 to 5 days but symptoms may not develop for up to 30 days (Healthwise, 2014). Risk factors include sexual contact without a latex condom, multiple sex partners, sexually active young adult, sex for money or drugs, lower socioeconomic status, and previous gonorrhea diagnosis.

Epidemiology in Houston

From 2005 to 2015, over 60,000 cases of gonorrhea were reported in Houston/Harris County (Figure 1). Approximately, 50% of the reported cases were persons between the ages of 20-29 (Figure 2). Data reflects that during the reporting period, the number of

cases reported in women were similar to the number of cases reported in men. The highest rates of infection were seen among teenagers and young adults. In 2014, Houston/Harris County ranked 3rd overall in reported gonorrhea cases, preceded only by Cook County (Illinois) and Los Angeles County (California) (Center for Disease Control, 2014).



SURVEILLANCE SUMMARY

Surveillance History

Reportable in Texas since 1941

Population at Higher Risk

- Teenagers to young adults
- African American

Notable Outbreaks

None

Cases Per Year

6,504

Seasonality

None

Caseload

6,107



GONORRHEA CASE COUNT

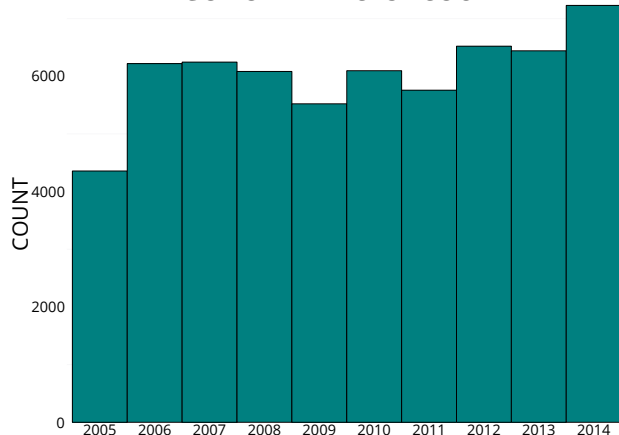


FIGURE 1: Gonorrhea case count.

GONORRHEA CASE COUNT BY AGE

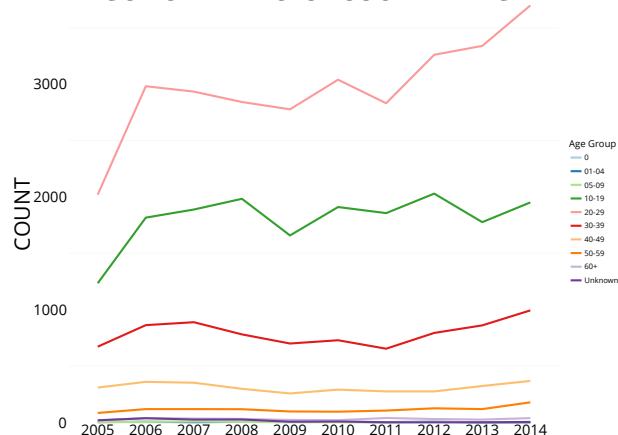


FIGURE 2: Gonorrhea case count by age.

Nationally, the Black population makes up the largest proportion of gonorrhea cases and has the highest rates of all racial/ethnic groups. Similarly, between 2005-2014, the Black population experienced a disproportionate burden of gonorrhea in Houston/Harris County (Figure 3).

Between 2005-2014 Blacks accounted for 38,907 cases, approximately 64% of all cases within Houston/Harris County.

Gonorrhea is endemic to all residential parts of Houston, (Figure 5). Areas with lower socioeconomic status or high density are disproportionately affected. There is also higher disease presence along the North and South corridors of Houston.

Nationally, the overall incidence of gonorrhea has steadily declined over the past 10 years due to increased awareness and public health interventions. Currently, CDC reports that the national gonorrhea rate is 106.1 cases per 100,000 population. Unfortunately, many cases of gonorrhea infections remain unreported. It is estimated that there are over 800,000 cases of gonorrhea within the United States. According to 2013 statistics only 40% of cases have actually been reported (Center for Disease Control, 2014).

Drug Resistance

Drug resistance is a public concern because those treated with the standard single dose therapy may continue to exhibit symptoms of the infection and transmit the infection to others. Untreated patients may have increased incidence of pelvic inflammatory disease, epididymitis, and increased transmission of HIV (HIV transmission rates have been shown to increase in those patients that were previously infected with *Neisseria Gonorrhoeae* bacterium). This translates into increased hospital time, complications involving advanced therapies and increases in overall healthcare cost. In order to manage this public threat, it is vital that providers consistently provide the most current disease management therapies.

Neisseria gonorrhoeae is a steadily evolving bacterium. Traditional single drug therapies have shown to be ineffective for a small percentage of the bacteria. *Neisseria gonorrhoeae* has shown some degree of resistance to Cefixime, Ceftriaxone, Azithromycin and Tetracycline. According to data provided by the CDC, approximately 1% of cases identified in 2011 were resistant to the primary therapy treatment option of Ceftriaxone (Center for Disease Control, 2014). Ceftriaxone has been the gold standard for the treatment of *Neisseria gonorrhoeae* for many years. Recently, due to the possibility of enhanced resistance, the CDC has released new therapeutic guidelines that recommend first line treatment with dual therapy medications. The latest recommendations are to treat *Neisseria gonorrhoeae* with both Ceftriaxone plus either Azithromycin or Doxycycline (Center for Disease Control, 2014).

Public Health Action

To contain gonorrhea, it is essential that rapid detection and early treatment are at the forefront of local and national efforts. Working closely with the CDC to enhance surveillance and prevention efforts is a priority that Houston/Harris County has taken in order to contain the spread of this condition. The Houston Health Department recommends utilizing the most updated treatment options to care for infected populations. It is the responsibility of healthcare professionals to stay current with evolving treatment recommendations.

GONORRHEA CASE COUNT BY RACE

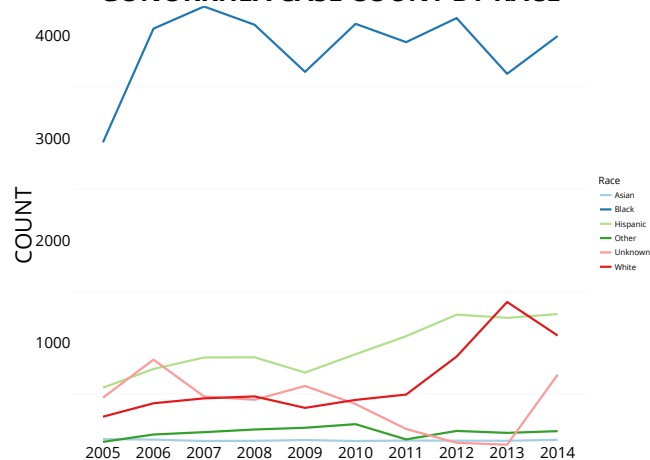


FIGURE 3: Gonorrhea count by race.

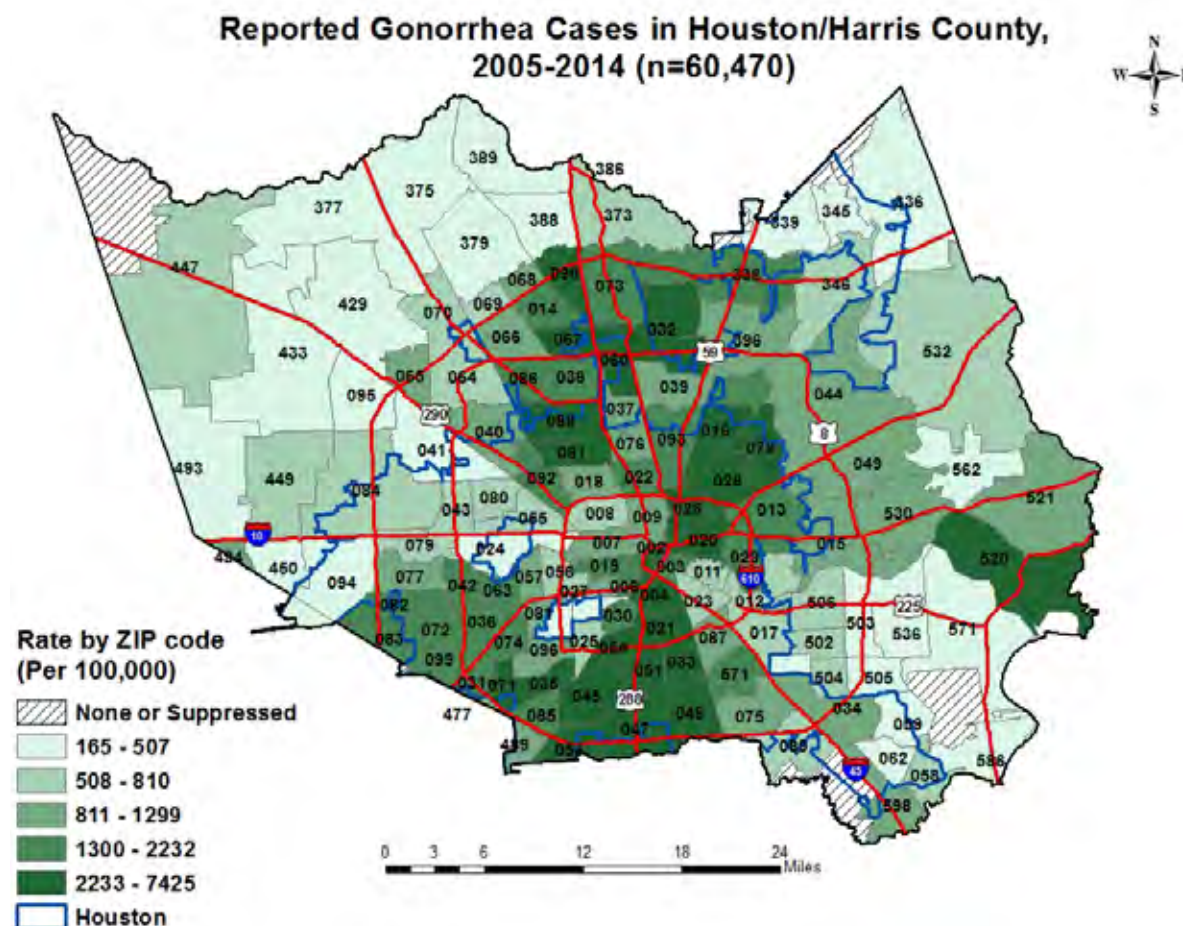


FIGURE 5. Gonorrhea cases in Houston/Harris County 2005-2014.

The Houston Health Department recommends risk reduction measures such as correct and consistent use of condoms, regular testing and community education and awareness. Specialized oversight of pregnant mothers infected with Gonorrhea is vital to limiting the spread of disease to newborn infants. Being proactive is the first step to ensuring the continued decline of gonorrhea.

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Haemophilus Influenzae, Type B

INTRODUCTION

Haemophilus influenzae is a gram-negative bacterium. Six different types exist (a-f). Historically, *Haemophilus influenzae* type B (Hib) has been the predominant strain to infect humans (Puig, et al., 2014). Since the introduction of the Hib vaccine to protect against type B, the other types

have posed a growing risk (Adam, Richardson, Jamieson, Rawte, Low, & Fisman, 2010). Hib may produce several types of infections, with the most common being meningitis and bacteremia (Heymann D., 2008). These clinical manifestations are of public health importance.

The disease became nationally reportable in 1991. A case is confirmed if it is clinically

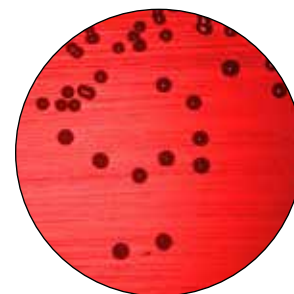
compatible, culture confirmed, and identified specifically as *H. influenzae* type B. The specimen used for isolation must be obtained from a normally sterile site within the body. A case is regarded as probable if it is clinically compatible and Hib antigen is detected in the cerebrospinal fluid. Antigen testing of urine or serum samples is unreliable for diagnosis.

Disease Transmission

H. influenzae is transmitted from person to person through inhalation or direct contact with droplets of respiratory tract secretions. The bacteria enter the body through the nasopharynx where they feed and grow for several months before symptoms develop. During this stage, a person is considered an asymptomatic carrier. Risk factors for contracting the disease include certain medical conditions such as sickle cell disease, being HIV positive, receiving chemotherapy, or anything that reduces the immune system's ability to fight an infection (CDC, 2014). Other risk factors include prolonged exposure to infected persons in places such as daycares or large foster homes (Heymann D., 2008).

Before 1985, Hib was the most common cause of bacterial meningitis and other severe infections among U.S. children aged less than 5 years (Wenger, Hightower, Facklam, Gaveneta, & Broome, 1990). As shown in Figure 1, Hib vaccines were introduced in the United States in 1985, 1987, and 1989 (Briere, Rubin, Moro, Cohn, Clark, & Messonnier, 2014). During 1989–2000, the annual incidence of invasive Hib disease in children aged less than 5 years decreased by 99%, to less than one case per 100,000 children (Briere,

Rubin, Moro, Cohn, Clark, & Messonnier, 2014). However, Hib remains a major cause of lower respiratory tract infections in infants and children in developing countries where the vaccine is not widely used (Zar, Madhi, Aston, & Gordon, 2013).



SURVEILLANCE SUMMARY

Surveillance History

Nationally notifiable since 1991

Population at Higher Risk

Elderly

Notable Outbreaks

None

Cases Per Year

1

Seasonality

- March-May
- September-December

Caseload

267

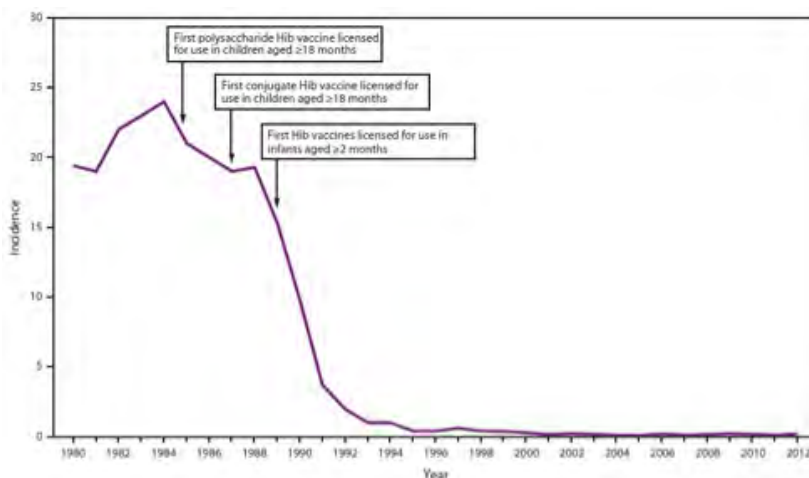


FIGURE 1. Estimated annual incidence (per 100,000 population) of invasive *Haemophilus influenzae* type b (Hib) disease in children aged 5 years – United States, 1980 - 2012 (Adapted from Briere, Rubin, Moro, Cohn, Clark, & Messonnier, 2014)

Epidemiology in Houston

From 2005 to 2014, there have been eight reported cases of *H. Influenzae*, type b. Figure 2 shows the majority of the cases were recorded in persons aged 30 years or older. These individuals may not have received a vaccine which became available to children in 1990.

Hib is very rare in Houston and generally affects the elderly. The disease is rare in children and young adults due to the effectiveness of the Hib vaccine. Unfortunately, the vaccine does not always work, as in the case of one Houston youth who contracted the disease in 2010.

As the proportion of Houstonians vaccinated against Hib grows over time, there should be significantly fewer cases of Hib disease reported to the Health Department. The City of Houston and the State of Texas currently have an incident rate of approximately 0.035 cases per 100,000 residents.

Vaccination coverage in the United States for Hib is approximately 82%. Texas is also at 82%, while Houston has coverage at 85% (DSHS, 2015).

Public Health Action

Routine vaccination to prevent Hib starting at two months is the main prevention activity. Prompt identification, evaluation, and treatment of contacts with an oral antibiotic are the major control activities adopted by the HHD. The national Hib vaccine program helped lower the rate of infection by 99% to less than 1 person per 100,000. Despite its lowered incidence rate, HHD continues to monitor for invasive *Haemophilus influenzae* because there are other types that are becoming more common as type B becomes less frequent.

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Hansen's Disease

INTRODUCTION

Hansen's disease, more commonly known as leprosy, is a chronic infectious disease usually affecting the skin, peripheral nerves, and mucous membranes. The disease is caused by a bacterium called *Mycobacterium leprae*. While rare in the United States, there is an average of

250,000 to 300,000 new cases reported annually worldwide (World Health Organization, 2010).

Humans are the natural reservoir of *Mycobacterium leprae*, but new research has identified armadillos as carriers as well. One in six armadillos found in Texas and Louisiana coastal marshes harbor leprosy (Taylor, Vitek, Enriquez, & Smedley, 1999). The raw organ, flesh or blood of infected armadillos contains large numbers of leprosy bacilli and contact with armadillos from some low lying environments in Louisiana and Texas may present

some increased risk for human infection (Sharma, et al., 2013).

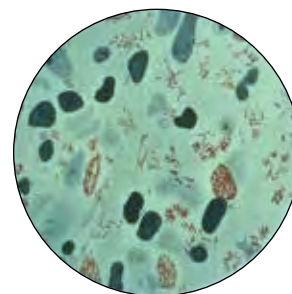
Symptoms usually include: symmetric skin lesions, nodules, plaques, ulcers on the soles of feet, and nosebleeds. There are no skin tests available for confirmation; a skin biopsy is needed for a definitive diagnosis.

Hansen's disease has been a reportable condition since 1984. Suspected or confirmed cases are to be reported to the Texas Department of State Health Services (DSHS) within one week. No cases have been reported by the Houston Health Department (HHD).

Disease Transmission

Mycobacterium leprae multiplies very slowly, approximately every 13 days (Hansen's Disease (Leprosy), 2013). The slow replication process results in a long incubation period and the delayed appearance of symptoms. The incubation period ranges between nine months to 20 years, with an average of four years for tuberculoid leprosy and eight years for lepromatous leprosy.

Even though most researchers believe that the bacterium is spread from person to person in respiratory droplets, the mode of transmission is uncertain and the rate of transmission is low (Taylor, Vitek, Enriquez, & Smedley, 1999). Approximately 95% of the world's population has a natural protection against or resistance to the bacteria that causes Hansen's disease. Persons with this resistance will not get Hansen's disease if they are exposed. For unknown reasons, a few people (approximately 5% of the world's population) have little or no protection to the bacteria (Texas Department of State Health Services, 2015).



SURVEILLANCE SUMMARY

Surveillance History

Reportable in Texas since 1984

Population at Higher Risk

Elderly

Notable Outbreaks:

None

Cases Per Year

0

Seasonality

None

Caseload

0

People in close contact with untreated, active disease patients are at highest risk. Once an infected individual begins treatment, they are no longer able to spread the disease.



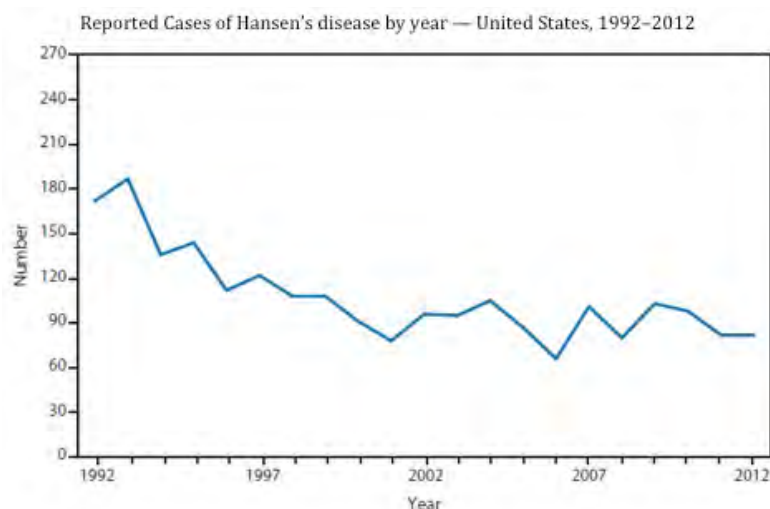


FIGURE 1. Reported cases of Hansen's disease by year in the United States (Centers for Disease Control and Prevention, 2012).

Epidemiology in Houston

There were no cases reported by the HHD. In 2010, Texas reported 36 cases (Centers for Disease Control and Prevention, 2012).

Since 1992, the occurrence of Hansen's disease has been declining in the U.S. (Figure 1). In 2012, among reported cases in the US, the age groups that accounted for the most cases were adults 25 to 39 years of age (n=19, incidence rate =0.03) and 40 to 64 years of age (n=21, incidence rate = 0.02) (Centers for Disease Control and Prevention, 2012). Confirmed cases occur more in males and in Asian/Pacific Islanders and whites more often than other racial groups.

Public Health Action

Houston is one of four locations where the Texas Hansen's Disease Program runs clinics that provide outpatient services to individuals with Hansen's disease. Early diagnosis and treatment of Hansen's disease may prevent the development of severe disabilities as well as prevent the spread of the disease to close contacts. This infection is treated with certain specific antibiotics, which generally take 12 months to two years to act. The treatment is very effective. It renders even the most severe cases non-infectious within a few days of treatment and patients need not be isolated. The disease does not spread easily and is not spread through casual contact. A person with Hansen's disease can continue to work and lead an active life.

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Hantavirus

INTRODUCTION

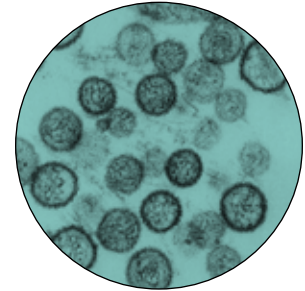
Hantavirus was first recognized in the United States in 1993, in the Four Corners area shared by New Mexico, Arizona, Colorado, and Utah. It manifested as a serious lung infection, initially referred to as the ‘mystery disease’, and was later called Hantavirus Pulmonary Syndrome (HPS)

(CDC, 2012). The infection may also manifest as hemorrhagic fever with renal syndrome (HRFS), which is the usual presentation in Asia and Europe. Hantavirus is found in the saliva, urine, and feces of infected rodents, which are the natural hosts/reservoirs.

Individuals with the disease may experience symptoms such as muscle aches, fever, fatigue, chills, nausea, vomiting, and diarrhea (Pringle, 2014). The most common symptoms are fever, chills, and muscle pain. Bodily discomfort, diarrhea, and lightheadedness are observed in half of patients. Patients may develop low blood pressure and shortness of breath due

to fluid-filled lungs. Patients with the fatal form of the disease can develop severe heart conditions (CDC, 2012). Hantavirus was fatal in 36% of the 606 cases reported to the CDC from 1993–2013 (CDC, 2014).

In the U.S., most of the infections have been caused by Sin Nombre (Four Corners) strain. Bayou virus, Black Creek Canal virus, and New York virus are the other strains that have caused isolated cases. The virus affects all races and age groups (Pringle, 2014). Hantavirus is to be reported to the health department within one week of diagnosis.



SURVEILLANCE SUMMARY

Surveillance History

Reportable in Texas since 1994

Population at Higher Risk

- Farmers
- People with direct contact to rodents

Notable Outbreaks:

None

Cases Per Year

0

Seasonality

Summer

Caseload

2

Disease Transmission

The incubation period of hantavirus is not well known due to the low number of cases; past data indicates patients get sick after 1 to 5 weeks of exposure. In the United States, deer mice, cotton rats, rice rats, and white-footed mice are the primary rodents that carry the virus. House pets such as dogs, cats, and pet store rodents are not believed to carry the virus. Humans acquire the infection through inhalation of rodent droppings, rodent bites, or ingestion of contaminated food or water. There is no evidence of person-to-person transmission (CDC, 2012).

Epidemiology in Houston

Harris County did not record any cases in 2014. Texas recorded 38 cases from 1993 to 2013. The United States recorded 606 cases, during the same time period of which 217 were fatal. States in the southwestern region, such as New Mexico, Arizona, Colorado, and California, have the greatest disease burden (CDC, 2014).

Public Health Action

Individuals can prevent hantavirus infection by eliminating mice or rats from their homes. Any rodent urine or feces contaminated areas must be cleaned using a disinfectant or a mixture of bleach and water. Holes around the house should be sealed (CDC, 2015). Any foods should be stored away or discarded in a tight-sealed trash can. Animal feed and pet food should be stored in tight-sealed plastic or metal containers (CDC, 2010). When the Houston Health Department is notified of a hantavirus case, it initiates an active investigation to identify the source of infection and possible contacts with similar symptoms. The department recommends consulting a pest/rodent exterminator if a patient suspects a rodent infestation in their home. The department continues to educate the public about rodent control and the need to maintain sanitary conditions.

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Heat Related Illness and Mortality

INTRODUCTION

Extreme heat is among the top weather-related causes of illness and death in the United States (National Weather Service 2016). From 2005 to 2014, the ten year average for heat related deaths was 124 in the U.S. (National Weather Service 2015). Heat related illness (HRI) and heat related

mortalities (HRM) occur mainly during the summer season, between May and September. HRIs and HRMs typically occur under conditions that involve extreme heat and

when the body is not able to cool off naturally. Morbidity and mortality due to heat exposure is preventable.

Description of Condition

A heat related illness occurs when an individual is seen in an emergency center for heat cramps, heat exhaustion, heat syncope, or heatstroke during the summer season. HRIs are tracked and monitored through syndromic surveillance of emergency center visits.

Heat related mortalities (HRM) are deaths that result from exposure to excessive heat or deaths that list hyperthermia as the underlying cause or contributing factor. HRMs are reported to the Houston Health Department by the Harris County Forensic Institute.

Risk factors for HRI and HRM include older adults, young children, and persons with chronic medical conditions (CDC 2006).

Individuals that work outdoors in hot environments are at increased risk for HRI or HRM (CDC 2014). HRM occurs more often among men compared to women. In addition, risk factors also include places such as houses with little to no air conditioning, construction sites, and cars (CDC 2015).

It is unclear what impact global warming will have on HRI and HRM. Global warming has been measured and monitored for the past 50 years and with an increase in the number and magnitude of heat waves an increase in morbidity and mortality resulting from climate change is a possibility (IPCC 2007).



SURVEILLANCE SUMMARY

Surveillance History

Population at Higher Risk

Notable Outbreaks

Cases Per Year

Seasonality

Caseload



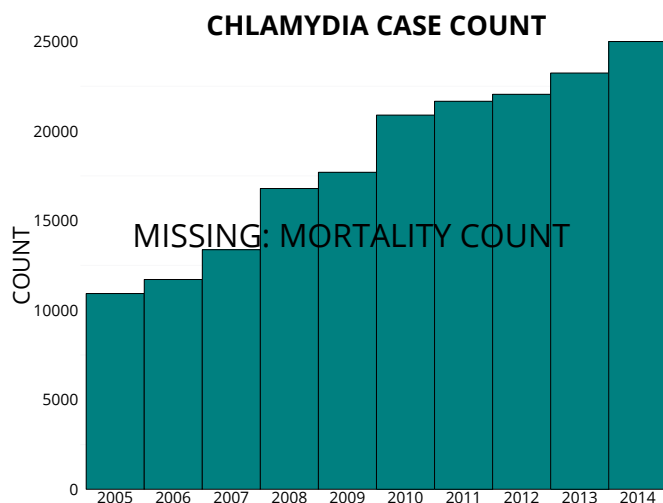


FIGURE 1. Heat related illness and mortality case count.

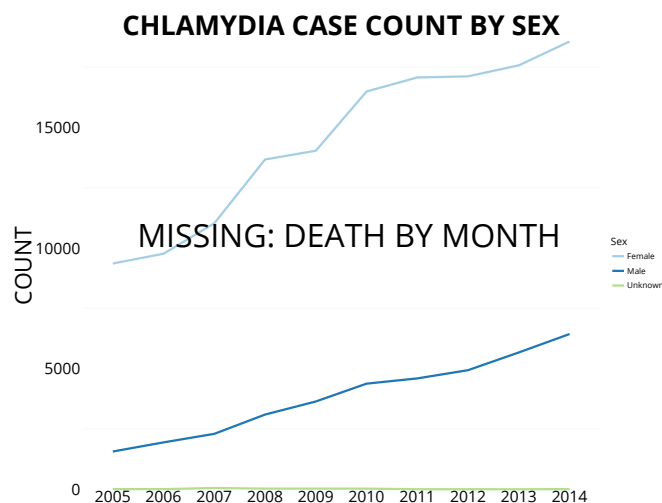


FIGURE 2.

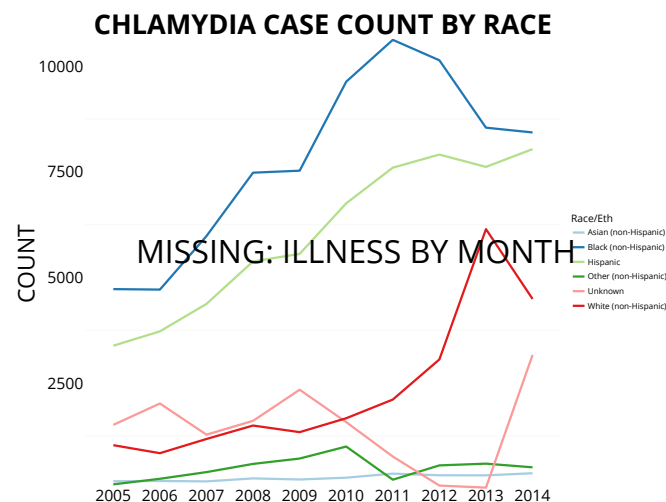


FIGURE 3.

Epidemiology in Houston

In Houston, HRI and HRM surveillance activities are conducted during the Spring and Summer months. From 2003 to 2014, there were a total of 50 HRMs due to heat exposure in the Houston area. The year with the highest count was 2011. On average there were 7 deaths per year during the reporting period. Based on 2013 to 2014 data, heat related deaths are more likely to occur when the average maximum temperatures are above 90 degrees Fahrenheit. From 2009 to 2014, there were a total of 1,154 visits to emergency centers for HRI (Table 3). The highest number of emergency center visits due to HRI is generally in September.

Public Health Action

Public health provides health education to remind individuals that heat exposure can be avoided. Individuals can take prevention measures such as:

1. Stay hydrated with water, avoid sugary beverages
2. Stay cool in an air conditioned area
3. Wear light weight, light colored loose fitting clothing

The Occupational Safety and Health Administration (OSHA) requires that employers provide employees a work environment free of recognized hazards that may cause death or serious physical harm to the employee (United States Department of Labor 1970).

Employers can prevent heat exposure in the workplace through the implementation of heat illness prevention programs. CDC's National Institute for Occupational Safety and Health guidance for employers includes information on acclimatization, work-rest schedules, adequate hydration, indices for monitoring environmental heat stress (including wet bulb globe temperature), and other recommendations that can be used for developing a heat illness prevention program (CDC 2014).

PREVENTION



DRINK
ENOUGH



NO ALCOHOL
& CAFFEINE



COOL
SHOWERING



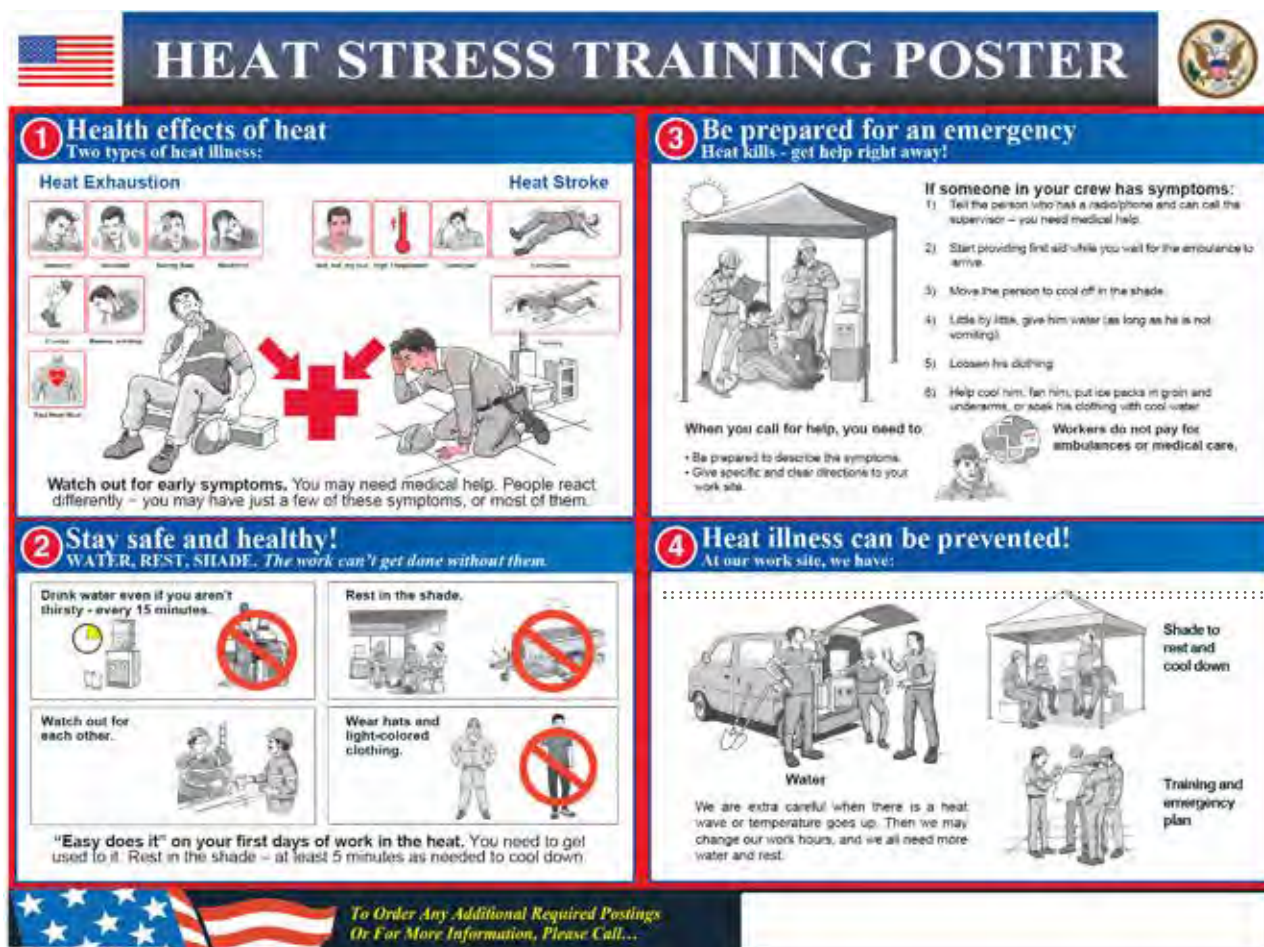
WEAR LIGHT
PROTECTION



DO NOT STAY
CLOSED CAR



LIMIT
OUTDOOR TIME



HEAT STRESS TRAINING POSTER

1 Health effects of heat
Two types of heat illness:

Heat Exhaustion
Symptoms: Dizziness, Nausea, Heavy Sweating, Headache, Weakness, Thirst, Rapid heartbeat, Pale or flushed skin, Muscle cramps, Fatigue, Loss of consciousness.

Heat Stroke
Symptoms: Hot, dry skin, High temperature, Confusion, Loss of consciousness.

Watch out for early symptoms. You may need medical help. People react differently – you may have just a few of these symptoms, or most of them.

2 Stay safe and healthy!
WATER, REST, SHADE. The work can't get done without them.

Drink water even if you aren't thirsty - every 15 minutes.

Rest in the shade.

Watch out for each other.

Wear hats and light-colored clothing.

"Easy does it" on your first days of work in the heat. You need to get used to it. Rest in the shade – at least 5 minutes as needed to cool down.

3 Be prepared for an emergency
Heat kills – get help right away!

If someone in your crew has symptoms:

- 1) Tell the person who has a radio/phone and can call the supervisor – you need medical help.
- 2) Start providing first aid while you wait for the ambulance to arrive.
- 3) Move the person to cool off in the shade.
- 4) Lie by side, give him water (as long as he is not vomiting).
- 5) Loosen his clothing.
- 6) Help cool him: fan him, put ice packs in groin and underarms, or soak his clothing with cool water.

When you call for help, you need to:

- Be prepared to describe the symptoms.
- Give specific and clear directions to your work site.

Workers do not pay for ambulances or medical care.

4 Heat illness can be prevented!
At our work site, we have:

Shade to rest and cool down

Water

Training and emergency plan

We are extra careful when there is a heat wave or temperature goes up. Then we may change our work hours, and we all need more water and rest.

To Order Any Additional Required Postings
Or For More Information, Please Call...

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Hemolytic Uremic Syndrome

INTRODUCTION

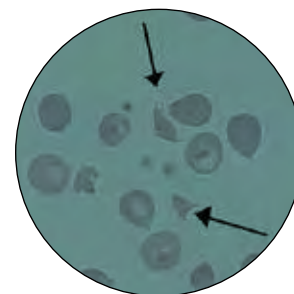
Hemolytic Uremic Syndrome (HUS) is a severe complication from diarrheal illness caused by shiga-toxin producing bacteria such as *Escherichia coli* or *Shigella*. Persons with HUS experience acute renal failure shortly after having recovered from a diarrheal illness. Approximately 2-15%

of *E. coli* O157:H7 cases progress to HUS (Tserenpuntsag, Chang, Smith, & Morse, 2005).

The progression to HUS is associated with patients ill with diarrhea and elevated white blood cells, protein and occult blood in the urine, and children under the age of 5 (Tserenpuntsag, Chang, Smith, & Morse, 2005). Persons who are ill with diarrhea and with these risk factors should be under the

close supervision of a physician as HUS can be deadly.

HUS is characterized by the acute onset of anemia, renal injury, and low platelet count. Most cases of HUS occur after a period of diarrhea. Often the diarrhea is bloody. A case is diagnosed as HUS when it meets both the laboratory criteria and begins within three weeks following the onset of an episode of acute diarrhea.



SURVEILLANCE SUMMARY

Surveillance History

Nationally notifiable since 1995

Population at Higher Risk

- People with diarrhea, elevated white blood cells, and protein and occult blood in their urine.
- Children under 5

Notable Outbreaks

None

Cases Per Year

0 per year

Seasonality

None

Caseload

2

Disease Transmission

HUS is a complication of a pre-existing bacterial infection. *E. coli* O157:H7 causes about 90% of HUS in the United States (Heymann, 2008). While the bacteria that causes HUS are transmittable, and the diseases therefore contagious, HUS itself is not transmittable or contagious.

Epidemiology in Houston

Since 2004, only two cases of HUS have been reported to the HHD. Both occurred in 2011. This is likely an underestimate as there have been 346 cases of STEC reported to the HHD. Assuming 2-15% of the STEC cases go on to develop HUS, one would expect to see approximately 7-52 cases of HUS reported.

The diagnosis of HUS is based on laboratory data. Anemia (low count of red blood cells) and a low platelet count can be measured by laboratory tests of a patient's blood. There is a specific pathology of red blood cells associated with HUS, seen by examination of a blood smear under a microscope. The blood cells assume the shape of a helmet. A urine analysis can reveal protein and blood in the urine, which would indicate HUS.

Public Health Action

In order to control the disease, the HHD Bureau of Epidemiology advises households and restaurants to strictly follow appropriate food safety protocols. Preventing illness from bacterial foodborne diseases is the best way to prevent HUS. Measures to minimize contamination with *E. coli* include:

- Consume only pasteurized milk and dairy products.
- Irradiate beef or heat thoroughly during cooking, especially ground beef, to 155 °F for at least 15 seconds.
- Chlorinate public water supplies and swimming pools.
- Provide adequate hygiene and sanitation in childcare centers.

HHD has worked diligently to contain the spread of *E. coli*. While reported case counts for the disease are up, it is believed that much of the increase is attributable to increased surveillance and awareness in the medical community and not to an actual increase in the number of persons contracting the disease.

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Hepatitis A

INTRODUCTION

Hepatitis A is a liver infection caused by the hepatitis A virus (HAV). It can range in severity from a mild illness lasting a few weeks to a severe illness lasting several months. More than 80% of adults with HAV have symptoms that last less than two months. Infected persons may experience

jaundice of the eyes and skin, pale stool, brown urine, abdominal pain, loss of appetite, lack of energy, nausea, vomiting, and fever. According to the Texas Department of State Health Services, up to 70% of illness in children younger than six years old is likely to be asymptomatic. In older children and adults, infection is usually symptomatic, with up to 70% having jaundice, or yellowing of

the skin and eyes. Antibodies produced in response to HAV last for life and protect against reinfection. Additionally, a two-dose vaccine has shown great efficacy in preventing infection. A confirmed case is one that meets the clinical case definition and occurs in a person who has either a laboratory confirmation or an epidemiological link with a person who has laboratory-confirmed HAV.

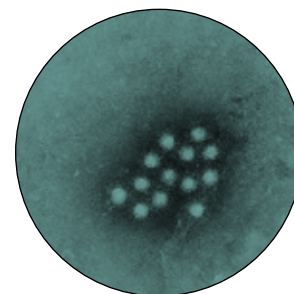
Disease Transmission

Hepatitis A is frequently passed from person to person by the fecal-oral route, often by consumption of contaminated food or water. It is not surprising that it occurs frequently in children who are less likely to practice proper hand-washing techniques. Daycare- and school-aged infected children without symptoms may cause transmission of the disease to a cluster of people in these group settings (CDC, 2015). Additionally, food handlers and caregivers may pass this virus to others during food preparation. People may also become ill by ingesting raw shellfish, such as oysters, which may be harvested from contaminated surface waters. There are usually food alerts sent to the public when this occurs.

Infection can also occur among specific high risk groups such as men who have sex with men and injection drug users (CDC, 2015). Providing educational information to high-risk groups may aid in preventing the disease. Other risks include healthcare providers and caregivers who may acquire the virus through patient care and individuals who are immunocompromised.

The virus has a 15- to 50-day incubation period (28-day average), in which the person

does not show symptoms. Hepatitis A does not result in chronic infection, unlike hepatitis B and C. Once infected, hepatitis A is rarely fatal, and only palliative care is recommended. Following infection, immunity conferred by the disease is life-long.



SURVEILLANCE SUMMARY

Surveillance History

Nationally notifiable since 1966

Population at Higher Risk

- Travelers in endemic areas
- School-aged children
- Injection drug users
- Men who have sex with men

Notable Outbreaks

None

Cases Per Year

10 per year

Seasonality

Spring and summer

Caseload

3,087

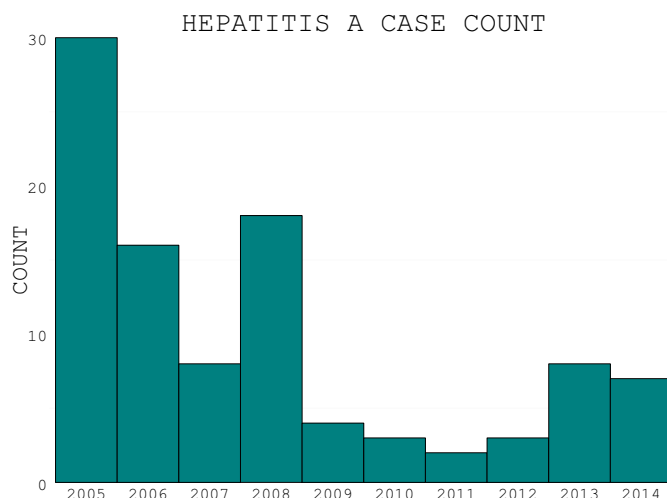


FIGURE 1. Hepatitis A cases reported to HHD, by year

Epidemiology in Houston

In Houston, there has been a decrease in disease occurrence beginning in 1995 when the vaccination of school children began. This decrease can be seen in Figure 1. HHD investigated 99 cases of hepatitis A from 2005 to 2014. The disease rate decreased from 1.6 per 100,000 in 2005 to 0.5 per 100,000 in 2014, with the lowest rate observed in 2011. HHD noticed a slight increase in reporting in 2008. This trend is consistent with national statistics on HAV. No cases of hepatitis A resulted in death during this period; however, the morbidity was frequently associated with hospitalizations. We observed older patients and those with chronic liver disease were more likely to be hospitalized for hepatitis A infection.

Hepatitis A still occurs in the United States, although not as frequently in recent years.

Public Health Action

The Hepatitis A virus is a high-priority notifiable condition because the source of exposure to the virus can be a common source exposing many people, such as a food handler or a daycare worker. In either scenario, it is a public health priority to stop the transmission of the virus to other people that come in contact with the confirmed case. Therefore, public health surveillance for hepatitis A is an ongoing effort.

The Houston Health Department investigates all reported cases of hepatitis A and adheres to national and state guidelines to provide correct prevention and control measures. The Bureau of Epidemiology obtains a list of all contacts of confirmed cases and provides recommendations and prophylaxis. Disease control efforts then focus on providing PEP. Additionally, Epidemiology works closely with Consumer Health and Immunizations to ensure restaurants and other service locations are safe and to provide vaccines in prevention and outreach efforts.

The two-dose series of hepatitis A vaccine is the best way to prevent HAV infection and is nearly 100% effective at protecting against acquiring the infection. The vaccine is part of the recommended childhood vaccination schedule by the Advisory

Hepatitis A In A Food Handler

During the summer of 2014, a 27 year-old male food handler who worked as a bartender at a local entertainment venue was confirmed to have an infection with hepatitis A virus. He was likely exposed to the virus four weeks prior to



the onset of symptoms during a missionary trip to Mexico. The individual was seen by a healthcare provider who failed to identify hepatitis A, and he returned eight days later for a repeat assessment. During the second visit, he was found to have clinical symptoms, including nausea, vomiting, diarrhea, and jaundice of the eyes. The laboratory results indicated active infection and met the case definition for acute hepatitis A virus infection. The Bureau of Epidemiology received a report of the case with only 10 days to provide PEP to the contacts of the person within the required timeframe.

A public health plan for a PEP clinic was developed to prevent and control further transmission of hepatitis A virus to the individual's coworkers and the public. The plan included efforts from Immunizations, Public Relations, Consumer Health, and the Texas Department of State Health Services. On the 14th day after exposure, the line list of employees who worked with the patient was received from the entertainment venue. All 37 employees of the catering company/entertainment venue were informed verbally and in writing about the plan, and the PEP clinic was scheduled within the timeframe for providing PEP.

The Epidemiology, Consumer Health, and Immunization staff visited the venue where the catering services are provided, and the department provided information on hepatitis A and offered coworkers of the bartender the opportunity for prophylaxis. All individuals identified as being within the PEP window and needing PEP from the health department attended the clinic session.

The original individual recovered fully within three weeks. The catering company monitored all employees for symptoms for 50 days, the maximum incubation period, during which no employees developed symptoms. This case is a reminder that public health plays a vital role in taking decisive action to prevent continued transmission of diseases in the community. The staff and resources of the health department make it possible to quickly mobilize clinical infrastructure and operationalize prevention and control measures in the event of a disease outbreak.

Committee on Immunization Practices (ACIP). Additionally, the vaccine is recommended for persons who are at high risk for getting HAV infection and those who could get seriously ill if infected.

These include all children aged one year or older, household contacts of infected persons, travelers to countries where hepatitis A is common, family and caregivers of adoptees from countries where hepatitis A is common, men who have sex with men, users of recreational drugs (whether injected or not), people with chronic liver disease (including hepatitis B or hepatitis C), and people with clotting-factor disorders.

Following exposure to the virus from a person confirmed to have HAV, post-exposure prophylaxis (PEP) is available and highly effective at preventing the spread of the virus. PEP consists of a single dose of immunoglobulin G to

exposed persons within 14 days of exposure. This intervention has been shown to be approximately 97% effective at preventing symptomatic disease (Novak & Bell, 2007).

It is also important to practice good hygiene including hand-washing after using the bathroom, changing diapers, and before preparing or eating food. Proper hand-washing decreases the likelihood of spreading and contracting the virus. This is especially important for those working in the food service industry, schools, daycare centers, group homes, and other settings where large numbers of people are served. Furthermore, ensuring sanitary conditions in food preparation areas and routinely disinfecting surfaces can help prevent disease transmission.

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Hepatitis B & D

INTRODUCTION

Hepatitis B is a contagious infection of the liver caused by the Hepatitis B virus (HBV). Hepatitis B infections are categorized into two stages, acute or chronic. The younger a person is when exposed to HBV, the greater the likelihood that the acute infection will develop into a chronic one.

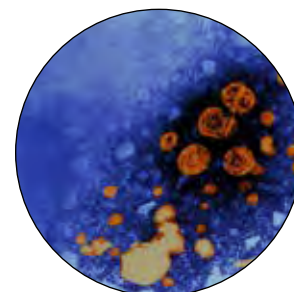
Specifically, the chances of an acute exposure developing into chronic hepatitis B is 90% for newborns born from chronically infected (HBsAg-positive) mothers, 25% to 30% for infants and children under 5 and less than 5% for adults (Lok & McMahon, 2007).

Hepatitis D is a liver infection caused by the Hepatitis D virus (HDV). Hepatitis D can only occur in individuals who are infected with the Hepatitis B virus because HDV requires the helper function of HBV to replicate. It is an uncommon disease in the United States. There is no vaccine for Hepatitis D, but it can be prevented in persons who are not already HBV-infected by Hepatitis B vaccination (CDC, 2015).

The presentation of symptoms for both acute and chronic hepatitis B varies depending on age and health status of the individual. Children aged 5 years or below and newly infected immunosuppressed adults are asymptomatic; whereas 30%–50% of persons

aged ≥ 5 years have initial signs and symptoms (CDC, 2015). Acute hepatitis B infections are short-term illnesses that develop within 6 months of exposure to HBV. Symptoms of acute hepatitis B are: jaundice, fatigue, mild fever, flu-like illness, abdominal pain and loss of appetite. Acute hepatitis B infection develops into chronic hepatitis B infection in some people if the HBV is not cleared by the body. Chronic Hepatitis B infections present with differing symptoms ranging from being asymptomatic to various, more severe liver diseases.

Acute hepatitis B, Hepatitis B identified prenatally or at delivery (acute & chronic), and perinatal hepatitis B (HBsAg-positive infants 24 months old or less) are reportable conditions. Cases of acute hepatitis B are to be reported to local health departments within 1 week. Perinatal hepatitis B cases are to be reported within 1 work day, and prenatal cases are to be reported within 1 week.



SURVEILLANCE SUMMARY

Surveillance History

Reportable in Texas as "serum hepatitis during the 1960's"

Population at Higher Risk

Men between 35-64 years of age

Notable Outbreaks

None

Cases Per Year

Hepatitis B: 29 per year
Hepatitis D: 0 per year

Seasonality

None

Caseload

21,433

Disease Transmission

HBV can be transmitted when blood or bodily fluids from an infected person enters the body of a person who is not immune. The incubation period for the disease ranges from 60 to 150 days, with symptoms usually presenting 90 days after being exposed with HBV.

HBV can be transmitted during certain high risk behaviors such as: sexual contact with an infected individual, sharing contaminated needles during intravenous drug use, through needle sticks or sharps exposure on the job, or from an infected mother to her baby during birth. HBV cannot be spread through food or water, breastfeeding, hugging,



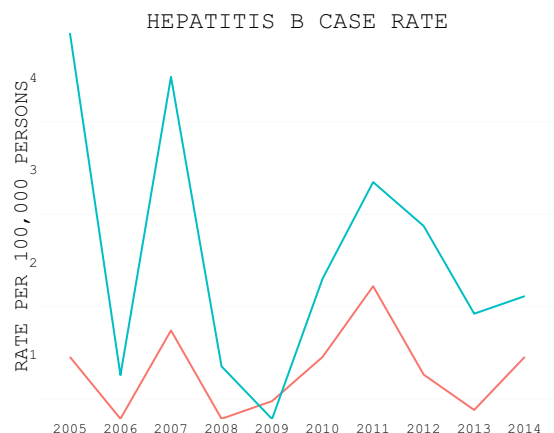


FIGURE 1. Hepatitis B (acute) case rate by sex.

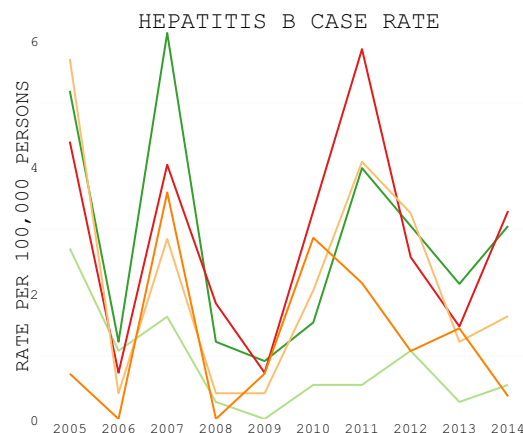


FIGURE 2. Hepatitis B (acute) case rate by age. The ages between 30 and 49 years had the highest rates during the review period. The lowest rates were seen between ages 1 through 19 as seen in Figure 2.

kissing, hand holding, coughing or sneezing. Pregnant women who are infected with HBV and do not take preventative measure frequently transmit the disease to their babies. Many of these babies develop life-long infections, and complications such as liver cirrhosis, hepatocellular cancer and liver failure. Hepatitis D has similar risk factors and mode of transmission to that of hepatitis B. The Hepatitis D virus most often infects intravenous drug users.

Epidemiology in Houston

During the period under review (2005-2014), a total of 292 cases of acute hepatitis B were reported to HHD. This value likely does not reflect the true burden of acute infection in Houston, as both acute and chronic hepatitis B are underreported nationally (CDC, 2015).

The average yearly rate of reported cases for males was higher than for females. Males showed higher rates than females in every year of the review period except in 2009. Both males and females experienced their highest rates in the years of 2005, 2007, and 2011, as seen in Figure 1.

Generally, Asian and Black/African American races had the highest rate in every year of the review period. Figure 3 shows Asians had no reported cases in five of the review period's years, which is contrary to the other years of the review period and also the endemicity of hepatitis B infection in Asia. However, this low number among Asians can be due to the fact that only acute HCV is reportable in Texas.

The HHD participates in the Texas Perinatal Hepatitis B Prevention Program (a program run by the HHD's Bureau of Immunization). This program aims to prevent the vertical transmission of HBV infection. In 2014, 233 cases of HBV were investigated by the Bureau of Immunization. This number is greater than those in previous years as result of the Bureau's recent access to both a city and state electronic surveillance system (NBS). Access to these systems has allowed the Bureau to conduct real-time investigation of positive HBsAg mothers.

Public Health Action

Hepatitis B is a vaccine preventable condition. Prevention is crucial because of the complexity and cost of treatment. Hepatitis B vaccination is recommended for all infants, children, and adults. The vaccine is given in 3 to 4 doses over a 6-month period. All doses are required for maximum protection. All pregnant women should be tested early in pregnancy to determine if they are infected with HBV. If the blood test is positive, the baby should receive post exposure prophylaxis (consists of vaccination and hepatitis B immune globulin) at birth.

The HHD starts active surveillance after receiving a positive HBV laboratory test or case report that indicates acute hepatitis B. The acute cases are followed up for more information and referral to the Texas Perinatal Hepatitis B Prevention Program.

The Texas Perinatal Hepatitis B Prevention Program aims to prevent transmission of HBV infection from mother to infant. It does so by (1) ensuring the screening of all pregnant women for the hepatitis B surface antigen (HBsAg), (2) reporting and tracking of HBsAg-positive pregnant women, (3) ensuring

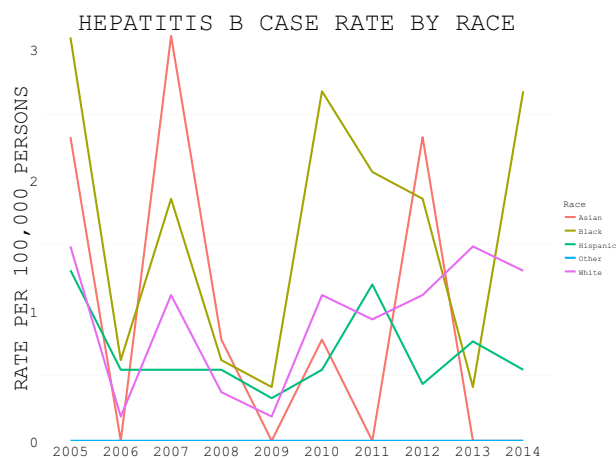


FIGURE 3. Hepatitis B (acute) case rate of infection by race.

vaccination of household contacts and sexual partners of HBsAg-positive pregnant women, and (4) identifying, managing (providing post-exposure prophylaxis), and reporting infants born to HBsAg-positive mothers and those born to mothers that were never screened. For this program, the Bureau of Epidemiology assists in identifying HBsAg-positive pregnant women, and infants born to infected mothers.

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Hepatitis C

INTRODUCTION

Hepatitis C is a contagious liver disease caused by an infection with the Hepatitis C virus (HCV). The virus was first discovered in 1989, and is currently a major health problem affecting an estimated 2% worldwide (185 million individuals) (Kohli, Shaffer, Sherman, & Kottlil, 2014).

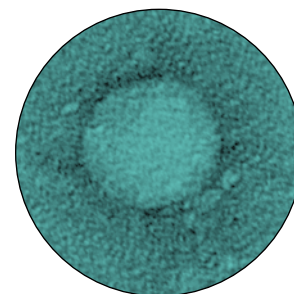
Over the past five years, new drugs have been approved for the treatment of HCV infection. These drugs allow for simplified and shortened treatments, and increased tolerability and efficacy than standard therapy. Remaining obstacles include access to appropriate care and treatment, and development of a vaccine (Webster, Klennerman, & Dusheiko, 2015).

HCV infection is primarily spread through blood products (blood of an infected person coming in contact with someone who is not infected). HCV infection is the most common blood borne infection in the United States (Kanwal, Lok, & El-Serag, 2013). Today, most people become infected with the Hepatitis C virus by sharing needles or other equipment to inject drugs. Before 1992, when widespread screening of the blood supply began in the United States, Hepatitis C was also commonly spread through blood transfusions and organ transplants (www.cdc.gov, 2015) (Jou & Muir, 2012) (Chan, 2014) (El-Serag, 2012). Other modes of transmission are sexual contact and vertical transmission (Feeney & Chung, 2014).

Hepatitis C can be either “acute” or “chronic.” Acute HCV infection is a short-term illness that occurs within the first 6 months

after someone is exposed to the Hepatitis C virus (www.cdc.gov, 2015). Most people (70%–80%) with acute Hepatitis C do not have symptoms (Webster, Klennerman, & Dusheiko, 2015) (www.cdc.gov, 2015). Yet some people experience symptoms consistent with acute viral hepatitis (fever, nausea, vomiting, abdominal pain, dark urine, clay-colored bowel movements, joint pain) and jaundice (a yellowing of the skin or eyes) (Texas Department of State Health Services, 2015). Approximately 15-20% of patients are able to clear acute HCV infection spontaneously (without treatment), and 80% of patients’ progress to chronic (long-term) HCV infection (Nelson, et al., 2011) (Webster, Klennerman, & Dusheiko, 2015).

Chronic HCV infection is a long-term illness that occurs when the Hepatitis C virus remains (the virus is detectable six months after infection (Feeney & Chung, 2014)) in a person’s body. Chronic HCV infection lasts a lifetime and leads to liver fibrosis (scarring of the liver) and eventually, cirrhosis (scarring of the majority of the liver), and decompensated cirrhosis (Webster, Klennerman, & Dusheiko, 2015). Factors that increase disease progression include alcohol intake, older age at



SURVEILLANCE SUMMARY

Surveillance History

Acute Hepatitis C reportable in Texas since 1992

Population at Higher Risk

- Persons with blood transfusions, blood products, or organ donations before June 1992
- Healthcare workers
- Injection drug users
- Infants born to HCV-infected mothers

Notable Outbreaks:

None

Cases per year

294

Seasonality

None

Caseload

35,473



HEPATITIS C (CHRONIC) CASE COUNT

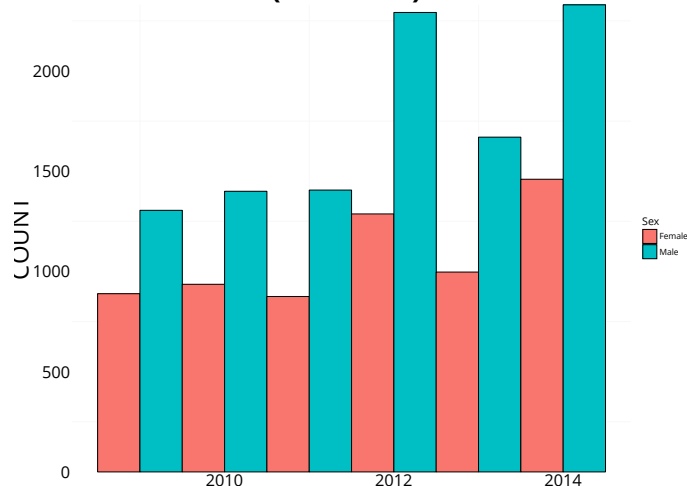


FIGURE 1. Hepatitis C (chronic) case count by sex.

HEPATITIS C (CHRONIC) CASE COUNT BY AGE

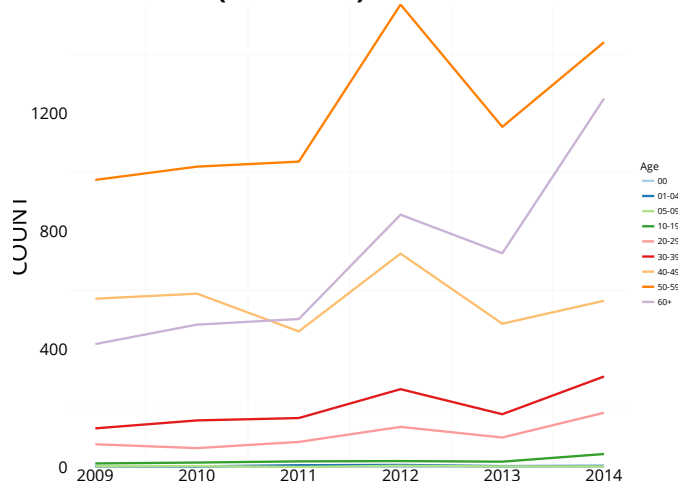


FIGURE 2. Hepatitis C (chronic) case count by age.

infection, obesity, co-infections with human immunodeficiency virus (HIV) or hepatitis B virus (HBV), and being male (Chan, 2014). Approximately 20% of chronic HCV patients develop cirrhosis within 25 years (Chan, 2014). The percentage of HCV-infected individuals with cirrhosis in the United States is expected to reach a peak of 45% in 2020 (Kanwal, Lok, & El-Serag, 2013). Cirrhosis is a risk factor for liver cancer (hepatocellular carcinoma) (El-Serag, 2012). About 25% of patients with cirrhosis develop hepatocellular carcinoma and/or decompensated liver disease (Kohli, Shaffer, Sherman, & Kottlilil, 2014). HCV-induced cirrhosis is the most common indication for liver transplantation in the United States (Kohli, Shaffer, Sherman, & Kottlilil, 2014). Individuals with chronic HCV infection have a decreased quality of life compared with the general population (Webster, Klennerman, & Dusheiko, 2015).

In Texas, acute Hepatitis C cases became reportable in 1992 (Texas Department of State Health Services, 2015). Since 2005, Texas has reported less than 100 cases of acute hepatitis C each year, with a historic low of 28 cases reported in 2013.

Disease Transmission

HCV infection can be transmitted through (1) blood products (including injected drug use), (2) sexual contact, or (3) vertically (from mother to child) (Feeney & Chung, 2014).

Sexual intercourse is another method of transmission, and persons in long-term monogamous partnerships have a lower risk (0%–0.6% per year) than persons with multiple partners or those at risk for sexually transmitted infections (0.4%–1.8% per year) (Jou & Muir, 2012). Men who have sex with men are also at increased risk (Jou & Muir, 2012).

The rate of vertical transmission (the third method of HCV transmission) ranges from 3% to 10% (Cottrell, Chou, Wasson, Rahman, & Guise, 2013) (Jou & Muir, 2012). Risk for HCV transmission to the neonate increases by 4- to 5-fold when the mother has both HCV and HIV infection (Jou & Muir, 2012). Mother-to-infant transmission is the leading

cause of childhood hepatitis C infection, with up to 4,000 new cases reported each year in the United States (Cottrell, Chou, Wasson, Rahman, & Guise, 2013).

The diagnosis of acute hepatitis C virus (HCV) infection is based on the detection in serum or plasma of HCV RNA, anti-HCV IgG, and elevation of alanine aminotransferase levels. However, none of these markers alone or in combination can be used to identify acute infection, since they may also be detectable during the chronic phase of infection. Identifying acute infections is important because it serves to describe modes of transmission and to detect and control outbreaks.

Epidemiology in Houston

Though only acute HCV infection is reportable in Texas, the Houston Health Department currently receives electronic lab results for both acute and chronic cases of Hepatitis C. Based on these lab results, the average number of cases reported was 2,816 per year from 2009 to 2014 with males being at least 40% greater than females as seen in Figure 1. In 2013 and 2014, the number of reported cases was greater amongst individuals within the age range of 50 to 59 years, which can be seen in figure 2.

Hepatitis C can be observed in all residential ZIP codes of Houston/Harris County, as seen in Figure 3. The map is a reflection of where baby boomers who undergo testing for hepatitis C reside and not a reflection of where the disease was contracted. Individuals with the disease likely contracted the virus 1-3 decades ago.

In the United States, there were an estimated 29,718 cases of acute hepatitis C virus infections reported in 2013. Approximately 2.7 million persons in the United States have chronic HCV infection. Infection is most prevalent among those born during 1945–1965 (Jou & Muir, 2012), the majority of whom were likely infected during the 1970s and 1980s when rates were highest. Most of those chronically infected persons remain undiagnosed because they don't look or feel sick, and have been infected for more than 20 years (Kanwal, Lok, &

Reported Chronic Hepatitis C in Houston/Harris County, 2014 (n=4413)

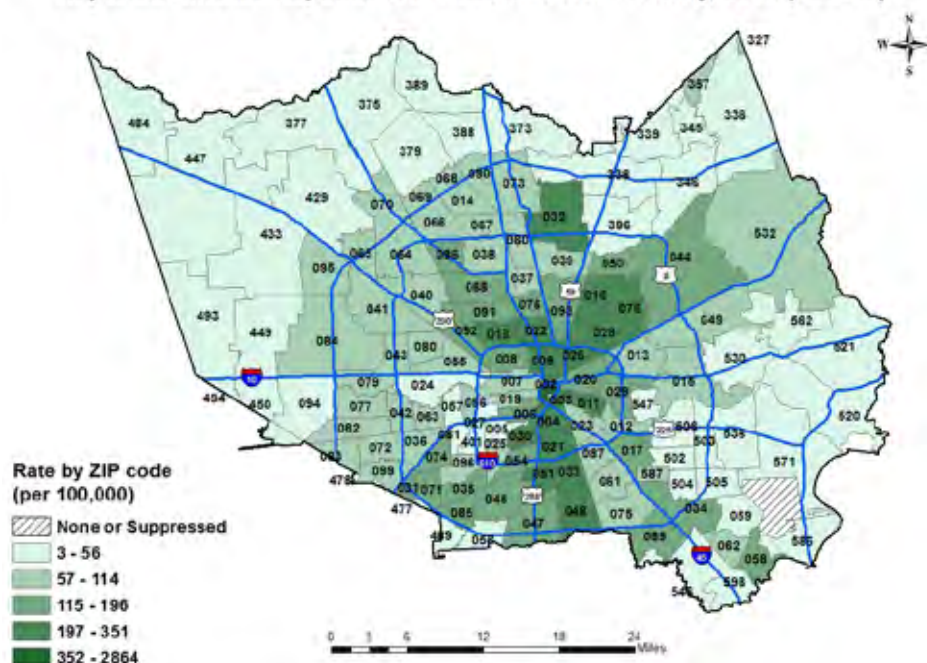


FIGURE 3. Reported Hepatitis C cases in Houston/Harris County.

El-Serag, 2013) (www.cdc.gov, 2015). Because most chronically infected persons are unaware of their diagnosis, the CDC recently recommended HCV screening for all persons born between 1945 and 1965 (Liang & Ghany, 2013).

Public Health Action

The HHD receives approximately three thousand lab results of positive HCV infection (2010 to 2014) annually, mostly of those chronically infected for the past 20 years. This large number represents a continuation of a great health burden that has been faced by the city of Houston since 1995. The number of reported cases of HCV infection grew during the period of 1995 (390 cases) to 2004 (2,915 cases) (Houston Department of Health, 2005).

In June 2005, Houston mayor Bill White formed the Hepatitis C Task Force to address concerns of groups that wanted more attention given to the disease. The Task Force offered the HHD \$75,000 to construct an epidemiologic profile of the disease in Houston. HHD accepted the contract to conduct a retrospective HCV surveillance project (later called 'Enhanced Hepatitis C Project'). The primary goal of the project was to obtain an epidemiologic profile of a representative sample of the hepatitis C-affected population of Houston. The profile was to include demographic, socioeconomic, behaviors/risk factors, co-morbidity, health outcomes, access to care, receipt of treatment, and quality of life data. These data were to be collected via medical record abstraction and phone interview of each individual of a new sample of HCV-infected patients created every six months (sampling being limited to 200 patients every 6 months began sometime between 2013 and 2014). Each sample was created using random sampling, stratified by zip code. The first sample was taken from the cases received during the

latter half of the year 2004. A second goal of the project was to educate medical providers on the importance of hepatitis C surveillance and disease reporting to the health department. The HCV surveillance project also aimed to assess the completeness of case reporting through the existing passive reporting system. The HCV surveillance project also would encourage physician registration and membership in a new Hepatitis C Sentinel Physician Network for the City of Houston, to improve the quality of reported data. This project is currently active.

Prevention interventions (i.e. education on safe sex practices, or getting injection drug users into treatment programs) require ongoing surveillance and analysis of acutely infected persons (Kleevens, Liu, Roberts, Jiles, & Holmberg, 2014) (Kanwal, Lok, & El-Serag, 2013).

No vaccine exists to prevent HCV infection. Thus the only way to prevent the spread of the disease is to focus on risk reduction (e.g. injection drug use or high risk sexual practices) through counseling of (1) high-risk non-infected individuals, (2) already infected individuals (counseling can reduce HCV transmission and progression of the infection), and (3) treatment of infected individuals.

Though no effective vaccine exists, HCV infection is potentially curable. Therapy for hepatitis C is undergoing a revolution. A greater understanding of the HCV has enabled efforts to improve efficacy and tolerability of HCV treatment (Au & Pockros, 2014). Several new drugs against the hepatitis C virus have reached the market and many others are in the end stages of development (Chan, 2014) (Kohli, Shaffer, Sherman, & Kottlil, 2014). However, the high cost of these new agents may be the biggest challenge to their implementation (Feeney & Chung, 2014).

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Hepatitis E

INTRODUCTION

Hepatitis E is a liver infection caused by the hepatitis E virus (HEV). It is a self-limited disease that does not result in chronic infection. While uncommon in the United States, hepatitis E is common in many parts of the world. One of the unique characteristics of HEV is that it displays different

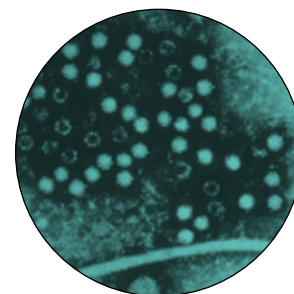
clinical and epidemiologic profiles depending on where the infection is acquired which is mainly due to the viral genotype. There are four genotypes of HEV, each displaying different epidemiological and clinical characteristics between developing and developed countries.

In the United States, when symptomatic hepatitis E does occur, it is usually the result of travel to a developing country where hepatitis E is endemic. Increasingly, sporadic hepatitis E cases not associated with travel have been identified in developed countries. No clear exposure was identified for these domestically acquired (non-travel related) cases. In most cases of an acute hepatitis infection, people recover fully. However, it can run a more aggressive course in pregnant women

(Viral Hepatitis - Hepatitis E Information, 2015).

Hepatitis E infection produces a clinical picture similar to hepatitis A virus (HAV) infection. While both infections are self-limited, HEV differs from hepatitis A with a lower rate of person-to-person transmission. The diagnosis of HEV infection depends on clinical and epidemiological features and exclusion of other causes of hepatitis, particularly HAV. Hepatitis E is diagnosed by screening for IgM anti-HEV in patients presenting with signs and symptoms of acute hepatitis.

Hepatitis E mortality in the general population ranges from about 1-3% (Heseltine, March 2012). Increased morbidity and mortality is found in patients with underlying liver disease (Heseltine, March 2012).



SURVEILLANCE SUMMARY

Surveillance History

Reportable in Texas since 1992

Population at Higher Risk

Travelers to endemic areas

Notable Outbreaks:

None

Cases Per Year

0

Seasonality

None

Caseload

67

Disease Transmission

Hepatitis E virus is usually spread by the fecal-oral route. The most common source of HEV infection is fecal contaminated drinking water. In developing countries, HEV genotypes 1 and 2 are spread by fecal contaminated drinking water. In developed countries sporadic cases of HEV genotype 3 have occurred following consumption of uncooked/undercooked pork or deer meat. Consumption of shellfish was a risk factor in a recently described 2008 outbreak in a cruise ship. HEV genotype 4, detected in China, Taiwan and Japan, has also been associated with foodborne transmission. People living in refugee camps or overcrowded temporary housing after natural disasters can be particularly at-risk. When symptoms occur, they usually develop 15 to 60 days (mean 40 days) after exposure. There

is a possibility of zoonotic spread of the virus. HEV RNA (genotypes 3 and 4)



had been extracted from pork, boar, and deer meat. Foodborne infection could occur from consumption of uncooked/undercooked meat or organs from infected animals (Viral Hepatitis - Hepatitis E Information, 2015).

Epidemiology in Houston

In Houston, there were three cases of hepatitis E reported to HHD between 2005 and 2014. One of the three cases was a 60-year-old woman who presented with elevated liver enzymes and acute icteric hepatitis to a Houston hospital after a recent trip to India. She had significant jaundice and abdominal pain. After extensive laboratory work was carried out, the laboratory and radiology reports revealed acute hepatitis E infection. HHD investigated the case to ensure there was no further spread of the disease. The patient was discharged in a stable condition and advised not to return to work until two weeks after her discharge.

Hepatitis E is rare in the United States, though studies have indicated that a high portion of the general public have antibodies to the virus. When a person contracts hepatitis E in the U.S., it is usually due to travel to a country where the virus is common (Viral Hepatitis - Hepatitis E Information, 2015).

Public Health Action

Prevention of hepatitis E relies primarily on good sanitation and the availability of clean drinking water. Travelers to de-



veloping countries may reduce their risk of infection by not drinking unpurified water. Boiling and chlorination of water will help inactivate HEV. Avoiding raw pork and venison can reduce the risk of HEV genotype 3 transmission. Immune globulin is not effective in preventing hepatitis E. There is currently no FDA-approved vaccine for hepatitis E in the United States, however, a recombinant vaccine was recently approved for use in China.

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Human Immunodeficiency Virus

INTRODUCTION

HIV/AIDS is a global pandemic, and the number of people living with HIV continues to increase. Human immunodeficiency virus (HIV) is a retrovirus that infects and kills the cells of the immune system called CD4 cells (often called T cells), a specific type of white blood cells and

key infection fighters. Upon infection, the virus replicates itself continuously and eventually the immune system deteriorates and loses its ability to fight off infections and progresses to the disease called acquired immunodeficiency syndrome (AIDS). AIDS is a group of serious illnesses and opportunistic infections. Untreated, HIV infected persons may develop AIDS after a period of time, from several months to over 15 years. General symptoms of AIDS include chills, fever, sweats, swollen lymph glands, weakness, and weight loss. There is no cure for HIV/AIDS. However; with the advent of HIV medications, people can now live longer and healthier lives.

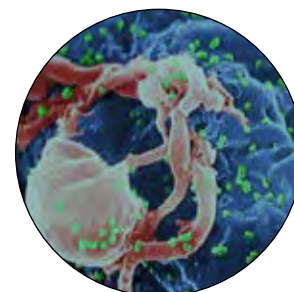
HIV has a two stage disease progression prior to becoming AIDS: acute infection (primary HIV infection) and clinical latency (chronic HIV infection). Acute infection occurs within 2 to 4 weeks after contracting HIV. Individuals at this stage may develop flu-like symptoms as a result of the body attempting to fight off the HIV infection. An infected individual is most infectious at this stage because large amounts of HIV are being produced in the body (Centers for Disease Control and Prevention, 2015). Chronic HIV infection develops after the body begins to produce antibodies and the level of HIV virus in the body decreases. The person is still infectious during this stage and may have no symptoms. Left untreated, virus reproduction may increase and CD4 levels decrease eventually progressing to AIDS.

Medicine to treat HIV, known as antiretroviral therapy (ART), can treat individuals at all stages of the disease if taken correctly and consistently. Treatment can also slow or prevent progression from one stage to

the next. It can also dramatically reduce the chance of transmitting HIV to someone else.

AIDS was recognized in 1981 and HIV was isolated in 1984, and was soon determined to be the cause of AIDS. The Centers for Disease Control and Prevention (CDC) developed a case definition for national surveillance purposes. According to the most recent 2014 case definition, an individual infected with HIV is considered to have AIDS once the CD4 cell levels fall below 200 cells/mm³ of blood (or a CD4 <14% if a CD4 count is not available). In addition, a case of AIDS can be defined by the occurrence of specific opportunistic infections or cancers in an HIV-infected person.

People with AIDS have such a compromised immune system that they are at greater risk for a number of severe illnesses, called



SURVEILLANCE SUMMARY

Surveillance History

AIDS reportable in Texas since 1983, HIV reportable in Texas since 1999

Population at Higher Risk

- Men who have sex with men
- African Americans
- Intravenous drug users

Notable Outbreaks

None

Cases Per Year

1266.3 per year

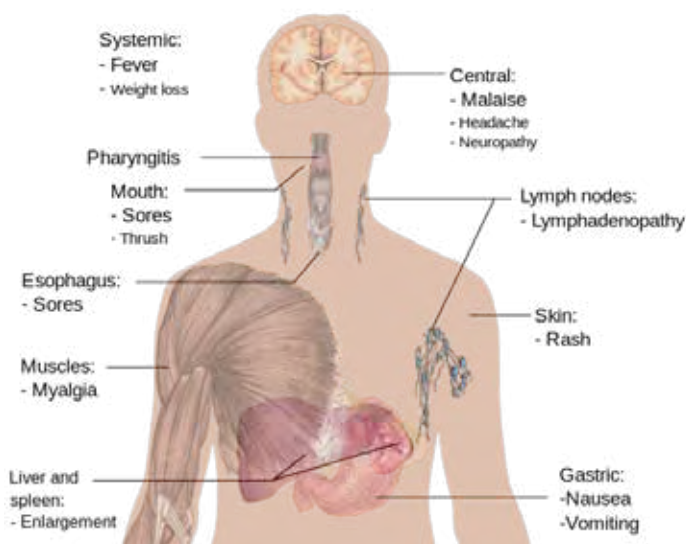
Seasonality

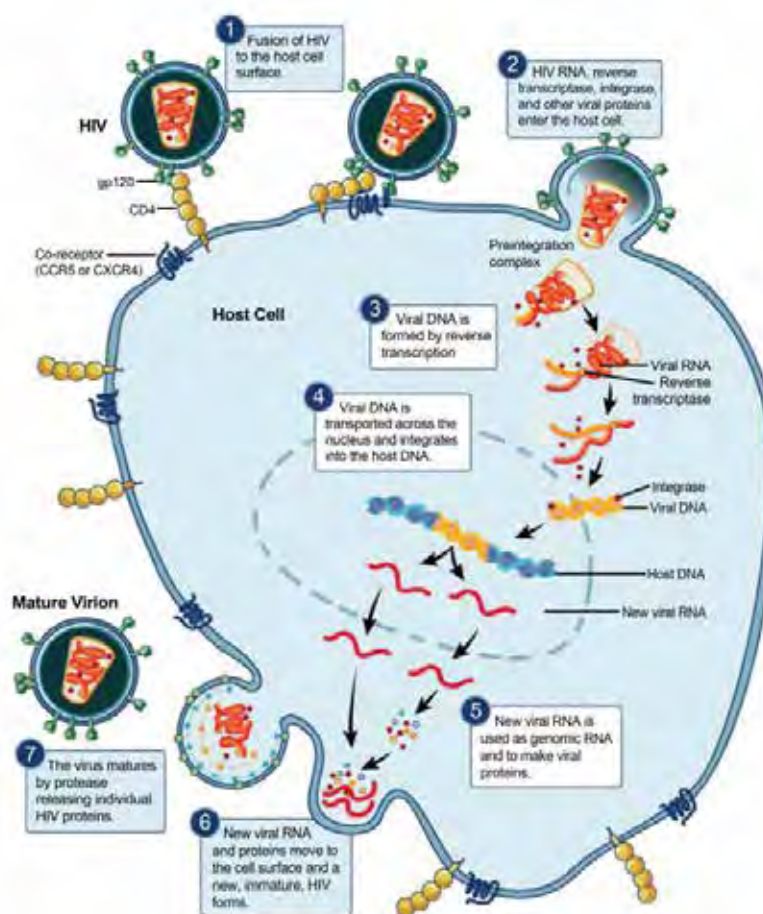
None

Caseload

67117

Main symptoms of Acute HIV infection





Disease Transmission

HIV can be transmitted through sexual contact, injection drug use, blood contact, and perinatally from mother to child.

In the United States, most infections occur as the result of unprotected sex with an infected partner. Unprotected anal sex is the highest-risk sexual behavior because of micro-tears that occur in the rectum allowing the HIV infection to enter the body (Centers for Disease Control and Prevention, 2015). Vaginal sex is the second highest risk behavior. Transmission can also occur by direct contact with certain bodily fluids from an HIV infected individual. These bodily fluids include blood, semen, rectal, vaginal, breast and pre-seminal fluid. The fluids can enter the body through breaks in the skin, the mucous membranes or by being directly injected into the bloodstream. HIV is also spread by intravenous drug use through the sharing of needles, syringes or other drug paraphernalia contaminated with HIV.

HIV can be transmitted by direct contact with HIV infected blood or by transfusion. Prior to 1985, there was an associated risk of receiving blood and its components from an HIV infected person. Since 1985, blood banks across the nation have established safeguards to screen all blood supplies for HIV antibodies and HIV genetic material.

Maternal to child transmission is possible during pregnancy, labor and delivery, and breastfeeding. Approximately one quarter to one third of untreated HIV-infected pregnant women transmit HIV to their babies. If an infected mother takes combination antiretroviral therapy during pregnancy, cesarean section is performed if deemed necessary, AZT is administered

to the newborn and breast feeding is not performed, the chance of the baby becoming infected is less than 5% (World Health Organization, 2015).

In the United States, there are approximately 50,000 new HIV infections yearly. Two groups are at particular risk for new infections, men who have sex with men (MSM), and Blacks. At the end of 2011, men who have sex with men (MSM), made up only 2% of the US population, but account for 57% (502,000 people) of the HIV infected population. Blacks not only account for a higher portion of new HIV infections, but also for those living with HIV and those ever diagnosed with AIDS. Blacks make up only 12% of the US population, but account for an estimated 44% of all new HIV infections among adults and adolescents (aged 13 years or older) in 2010 (CDC, 2015).

Additionally, Hispanics are disproportionately affected. Hispanics account for 17% of the U.S. population, but represent 21% of all new HIV infections (CDC, 2015).

Epidemiology in Houston

Houston is highly impacted by the HIV epidemic and ranks thirteenth nationally among metropolitan statistical areas (MSAs) for HIV cases, and first in the State of Texas for the number of people living with the disease. From 1981 to 2014, 30,525 cases of AIDS, and since 1999, 20,260 reported diagnoses of HIV (regardless of AIDS status) have been reported in Houston and Harris County.

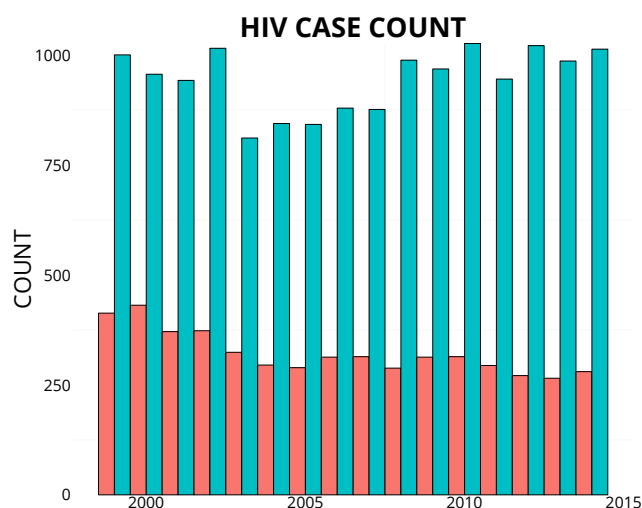


FIGURE 1. Case count for new HIV diagnoses by sex.

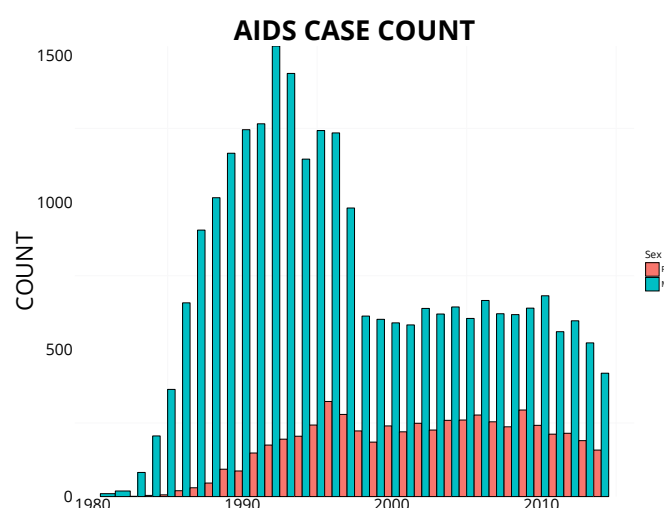


FIGURE 2. AIDS case count.

3.1 HIV/AIDS BY SEX

The rate of new HIV diagnoses decreased from 1999 to 2014 in Houston/Harris County, in males and females, which was consistent with trends in the U.S., as shown in Figure 1.

Analysis of AIDS cases in Houston/Harris County showed a rapid increase from 1981 through 1992. With the use of highly active antiretroviral therapy (HAART) in 1996, the number of new AIDS cases precipitously dropped through 1999, remained constant between 2000 and 2010, and then continued to decrease between 2010 and 2014 (Figure 2). The new combination therapy was able to reduce the progression from HIV infection to AIDS in people diagnosed early in the HIV disease process. HIV prevention efforts also reduced the rate of AIDS cases by reducing the number of new HIV infections. Since males make up the majority of AIDS cases, the trend of new AIDS diagnoses in males was quite similar to the trend in both sexes. Among females, the number of AIDS diagnoses steadily increased from 1985 to 1996, followed by steady decreases from 1997-1999. Since 2000, the number of AIDS

cases among females remained relatively constant. In 2014, females accounted for 27% of new AIDS cases in Houston/Harris County, with a relative rate ratio of males to females of 2.7.

3.2 HIV/AIDS BY RACE & ETHNICITY

Initially, AIDS was predominantly diagnosed in Whites, but since the mid-90s Blacks have made up over 50% of all new diagnoses. Figure 3 shows the percentage of new HIV diagnoses by race/ethnicity in adults and adolescents. While the proportion of blacks has stabilized since 2000, it still remains the highest affected race. Hispanics have experienced a significant increase in the relative proportion of diagnoses among the races.

Figure 4 shows the number of AIDS diagnoses by race/ethnicity. All races have shown recent decreases in the number of diagnoses for AIDS. There is hope that the AIDS epidemic can be ended by 2030 (Joint United Nations Programme on HIV/AIDS (UNAIDS), 2014).

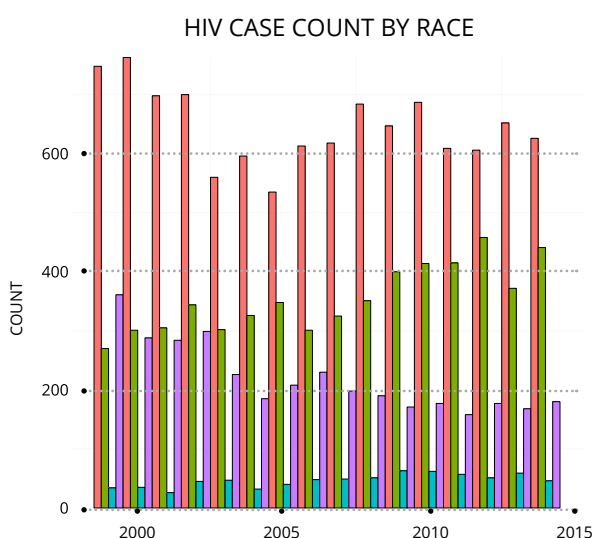


FIGURE 3. HIV case count by race.

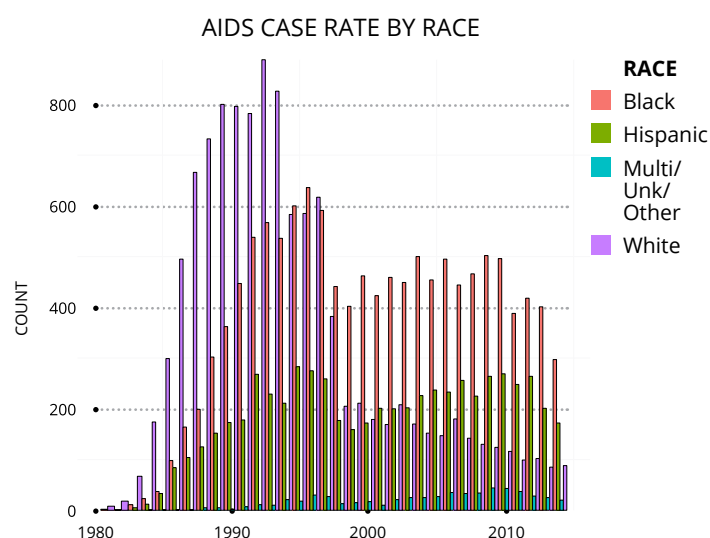


FIGURE 4. AIDS case count by race.

MALE HIV CASES BY TRANSMISSION FACTOR

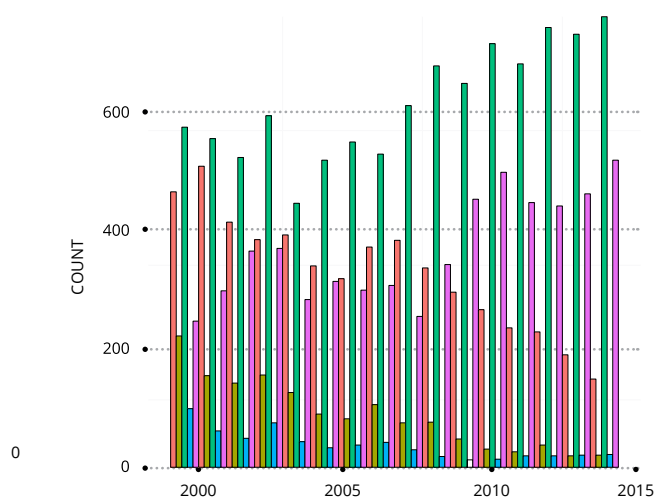


FIGURE 5. Male new cases of HIV by transmission category.

FEMALE HIV CASES BY TRANSMISSION FACTOR

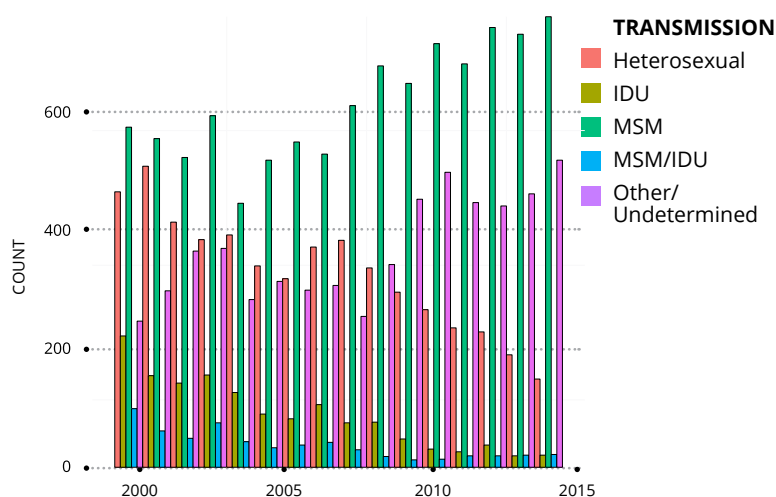


FIGURE 6. Female new cases of HIV case count by transmission.

3.3 HIV/AIDS BY TRANSMISSION CATEGORY

In males, the number of new HIV diagnoses among MSM increased from 2003 to 2014 in Houston/Harris County. No other groups showed any increase from 1999 to 2014, with new diagnoses among intravenous drug user (IDU) and heterosexuals slightly decreasing starting in 2006 (Figure 5).

Heterosexual contact was the main mode of transmission for women and it showed a decreasing trend along with IDU (Figure 6).

3.4 HIV/AIDS BY GEOGRAPHY

HIV Incidence Surveillance

Figure 7 is a map of new HIV diagnoses in 2014 by zip code. HIV incidence is the number of new HIV infections occurring

in a population during a specific time period, and prevalence is the total number of people who have the disease at any given moment. The number of new HIV diagnoses only tells how many people have been diagnosed with HIV within a year, but says nothing about when they were first infected. Knowing the number of new HIV infections occurring each year can provide a better understanding of HIV trends and help evaluate the effectiveness of HIV prevention efforts.

HIV incidence, new HIV infection occurring in a given period, can be estimated by using a CDC-developed statistical model. The model utilizes (1) results from a specific laboratory test performed on remnant blood specimens of newly diagnosed patients to determine recent HIV infection and (2) previous HIV testing and antiretroviral treatment history from

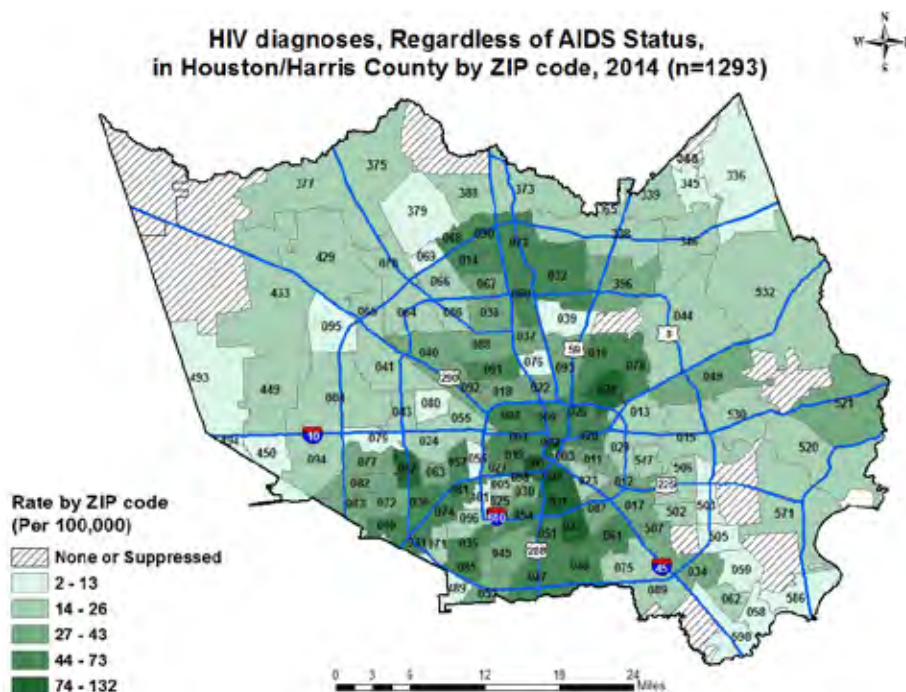


FIGURE 7. HIV diagnoses, regardless of AIDS status.

TABLE 1. HIV INCIDENCE ESTIMATION IN POPULATION (AGE 13 OR OLDER) BY KEY SUB-POPULATIONS, 2013.

	Cases	%	Rate	Relative Ratio of Rate*
TOTAL	1362	100%	31.2	
SEX				
Male	1061	78.5%	49.1	3.7
Female	291	21.5%	13.4	1.0
Race/Ethnicity				
White/Other	264	29.5%	19.2	1.0
Black	753	55.7%	94.3	5.1
Hispanic	335	24.8%	18.6	1.0
Age at Infection				
13 - 24 yrs	441	32.6%	59.7	3.8
25 - 34 yrs	483	35.7%	69.1	4.4
35 - 44 yrs	209	15.5%	33.7	2.1
45 yrs and over	220	16.3%	15.7	1.0
Mode of Exposure				
MSM	863	63.8%		
IDU	122	9.0%		
Other				

newly diagnosed patients (CDC Estimated HIV incidence in the United States, 2007-2010). HIV Surveillance Supplemental Report 2012;17 (No. 4)). There are 18 states, including 4 independently funded cities/counties, that are currently participating in HIV Incidence Surveillance. Houston/Harris Co. has been participating in this special project since it began in 2005. Since then, HIV Incidence Surveillance has been incorporated and integrated into routine HIV case surveillance.

The overall estimated number of HIV infections slightly increased among population of 13 years and over in Houston/Harris County from 2007 to 2013 (Figure 8). However, considering the growth of the Houston/Harris County population, the incidence rates were relatively stable within these years. The



ESTIMATED NEW HIV CASE COUNT

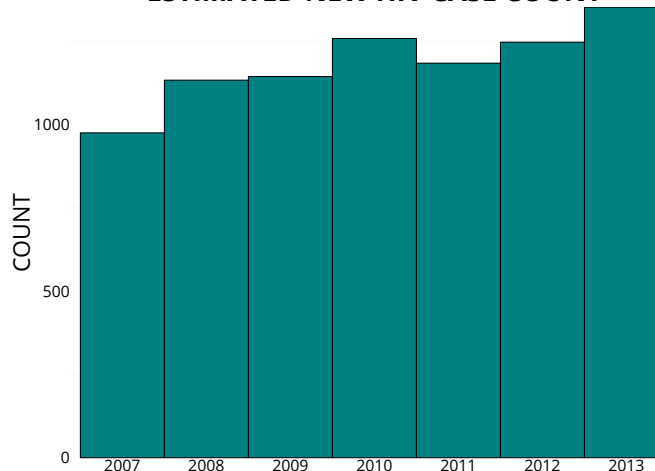


FIGURE 8. Estimated new HIV case count.

multi-year incidence estimates allow for a reliable examination of trends over time.

Table 1 summarizes the HIV incidence estimation in Houston/Harris County in 2013 by key sub-populations. Although there was no statistically significant change in HIV incidence for the seven-year period, certain groups, including Blacks, younger age groups and men who have sex with men, continued to be disproportionately affected by HIV.

Rates were calculated for all cases greater than 13 years of age at diagnosis. Data are reported for sub-groups (risk, sex, race and age) where there are a minimum of 200 reported HIV cases, 40 incidence tests (or 20 percent completeness), and 10 recent incidence results. Some demographic groups must be combined to satisfy the minimum number of reported cases required to calculate estimates. Since reliable denominator data are not available for risk groups, rates cannot be calculated. Table 1 HIV Incidence Estimation in population (age 13 or older) by Key Sub-populations, 2013.

In 2013, the estimated rate of new HIV infections in males (78.5 %) was 3.7 times the rate in females (21.5%). In 2013, the highest HIV incidence rates were among Blacks (94.3 per 100,000 persons) followed by Whites (19.2 per 100,000) and Hispanics (18.6 per 100,000 persons). The estimated HIV incidence rate among Blacks was 5 times more than Whites or Hispanics. Blacks and Hispanics accounted for 80.5% of the estimated new HIV infections in Houston/Harris County. Persons between 13-34 years of age were at the greatest risk of contracting HIV. In 2013, young adults between 13 to 34 years of age accounted for 68.3% of the estimated newly infected HIV cases. Those 13-24 of age accounted for 32.6% and those 25 to 34 of age accounted for 35.7% of the estimated incident cases. MSM accounted for 63.8% of estimated new HIV infections, while IDU accounted for 9%.

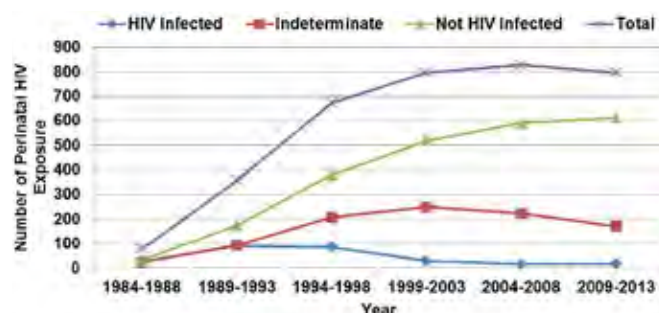


FIGURE 9. Number of Perinatal HIV exposures.

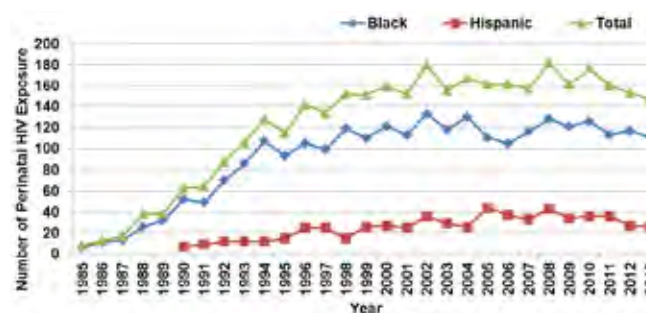


FIGURE 10. Perinatal HIV Exposures by Race/Ethnicity.

3.5 PERINATAL HIV EXPOSURE IN INFANTS

Figure 9 shows the number of infants born to HIV-infected mothers by the year of birth, stratified by the HIV infection status of the infants. Since perinatal cases sometimes have less than five cases per year, year of birth were grouped into five year intervals to protect patient's confidentiality. The data are reported through 2013. Infants proven to be HIV infected are classified as "HIV Infected". Infants who have been proven not to be HIV infected are classified as "Not HIV Infected." Infants whose final infection status have not been determined or has not been reported to the Health Department are classified as "Indeterminate."

The figure shows that the number of perinatal HIV-exposed infants increased from 1984 as the number of living HIV-infected women of childbearing age was increasing. It appeared to have reached a steady state of about 800 perinatal-exposed infants born every 5 years from 1999 through 2013. The number of HIV infected infants decreased from 1994 and reached a steady state of about 15 cases every 5 years from 2004 to 2013. During 2009-2013, the percentage of infants with HIV infection status as "HIV infected", "indeterminate" and "no HIV infected" were 2%, 21% and 77%, respectively. The indeterminate category refers to infants that have not had the appropriate number of HIV tests to conclude that the infant does not have HIV. This is usually due to difficulty in following the medical care of the infant after birth. The frequency of infants with perinatal HIV infection has decreased over time due to early diagnoses of HIV before and during pregnancy, treatment of the woman during pregnancy and labor and delivery, use of cesarean section if needed, prevention treatment of exposed infants and avoiding breast feeding of the infant.

Figure 10 shows the number of infants born to HIV-infected mothers by the year of birth, stratified by race/ethnicity categories. Averaging perinatal exposures for 2012 and 2013, 76% of the perinatal exposures were in Blacks, 18% in Hispanics, and 4% in Whites. This roughly reflected the race proportions of women of child bearing age living with HIV.

4 Public Health Action

HIV/AIDS surveillance programs in all U.S. states collect a core set of information about persons diagnosed with, living with, and dying from HIV infection and AIDS (Nakashima AK, 2003). HIV case surveillance data provide the basis for our

understanding of the disease burden and are used to monitor trends and disparities between groups as well as for planning and resource allocation at the federal, state, and local levels. Supplemental surveillance projects have historically provided complementary information about clinical outcomes of HIV infection and behaviors of HIV-infected persons. Although these supplemental surveillance activities have been instrumental in providing additional information for describing the epidemic, the utility of these surveillance projects, which were started in 1990, became progressively limited over time.

Changes in the AIDS case definition and the introduction of highly active antiretroviral therapy (HAART) in 1996 also brought about new challenges for describing the clinical outcomes of HIV infection. These limitations were made complex by the lack of linked medical record and interview data, the limited number of areas participating, and the lack of nationally representative estimates for HIV-infected patients in care and the complete absence of bio-behavioral surveillance directed at high risk populations. In order to address these emerging data needs on behaviors and clinical outcomes, and prevention and care services, HHD employs several approaches to HIV surveillance.

4.1 NATIONAL HIV BEHAVIORAL SURVEILLANCE (NHBS)

In 2002, as an initial step towards meeting one of the goals of the CDC HIV Prevention Strategic Plan, the CDC awarded supplemental funds to state and local health departments to develop and implement the NHBS. The goal is to strengthen the national capacity to monitor the HIV epidemic to better direct and evaluate prevention efforts, which has been further highlighted in the 2015 National HIV/AIDS Strategy for the United States (National HIV/AIDS Strategy for the United States, 2015). As a result, NHBS was established to monitor behaviors that put people at risk for HIV infection. NHBS targets three high-risk populations for HIV: men who have sex with men (MSM), injection drug users (IDU), and heterosexuals at increased risk of HIV infection (HET). NHBS project sites comprise state and local health departments in areas with the highest HIV/AIDS prevalence (CDC, 2014; CDC, 2015). Houston has been one of the NHBS participating sites since the projects inception in 2003.

Last sexual encounter of MSM risk factors

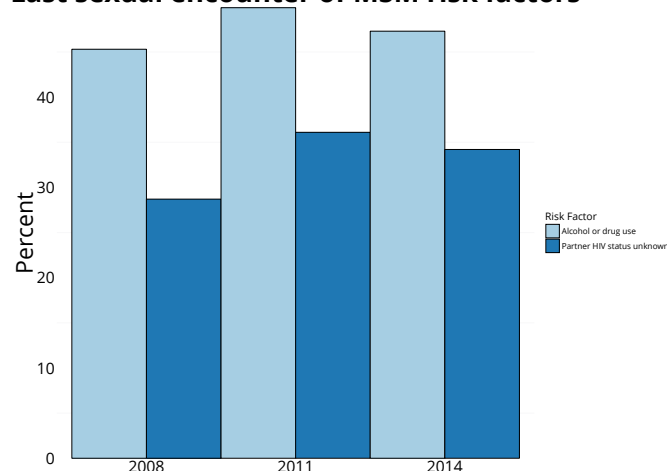


FIGURE 11. Last sexual encounter of MSM risk factors.

Last time of IDU risk factors

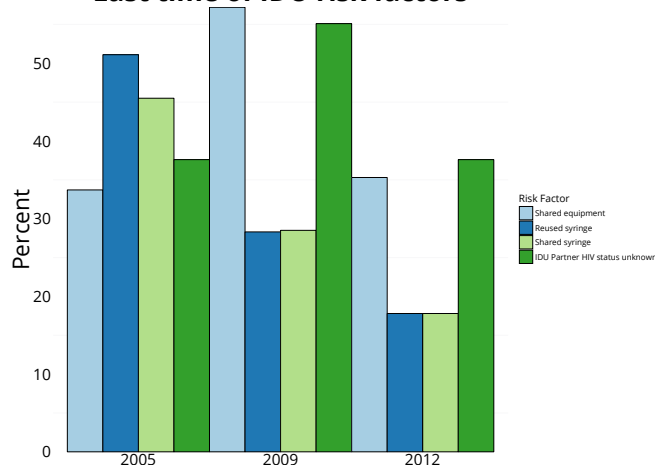


FIGURE 12. Last time of the IDU risk factors.

4.1.1 MSM High Risk Behaviors During Last Sex

Nearly half of the time, the use of alcohol and/or drugs occurred during the last sexual encounter in all MSM cycles, as seen in Figure 11.

4.1.2 IDU High Risk Behaviors By Survey Cycle

High risk behaviors reported among injection drug users (IDUs) during the three completed cycles of NHBS-IDU are displayed in Figure 13. Sharing of injection equipment comprised one of the major drug-related risk behaviors for current injectors (people who have injected non-prescribed drugs in the past 12 months). The results indicate a slight decrease in the proportions of participants involved in these risk behaviors during IDU3 (2012) when compared to the previous IDU2 cycle in 2009. The proportions of non-awareness of the HIV status of the last injecting partner were considered high, ranging from 37.6% to 55.1% with no clear pattern identified.

4.1.3 HET High Risk Behaviors By Survey Cycle (Year)

Figure 13 presents high risk behaviors reported by heterosexual, males and females, who participated in NHBS-HET (1, 2 and 3). Overall, females maintained higher rates of unprotected vaginal sex (UVS) in the past 12 months with their main and casual partners when compared to males. The use of alcohol and drugs during last sex was persistently higher for males than females. The proportions of females who were unaware of the HIV status of their last sex partner was slightly higher than that of males for the years 2007 and 2010, but lower in 2013. Although the rates for ever being tested among the HET males and females increased over time. Females tend to get tested more often than males.

4.2 HOUSTON MEDICAL MONITORING PROJECT (HMMP)

The Medical Monitoring Project (MMP) is a nationwide supplemental HIV surveillance system funded by CDC and designed to produce nationally representative estimates of behavioral and clinical characteristics of HIV-infected adults receiving medical care in the United States and Puerto Rico. It is supported by several government agencies and conducted by state and local health departments along with the Centers for Disease Control and Prevention (CDC). The City of Houston Health Department (HHD) is one of 23 city/state sites participating in the project. The purpose of the MMP is to produce population-based estimates of characteristics of persons living with HIV (PLWH) and receiving medical care in Houston/Harris County. The MMP provides information on risk behaviors, clinical outcomes, use of prevention services, and identifies met and unmet needs for HIV care and prevention services.

To improve the quality and usefulness of data, the MMP will help increase the representativeness of data compared to legacy systems, increase the relevance of data for use at the local level (e.g., for Ryan White Comprehensive AIDS Resources Emergency [CARE] and HIV prevention planning groups), and allow for collection of data from HIV-infected persons through

High risk heterosexuals risk factors

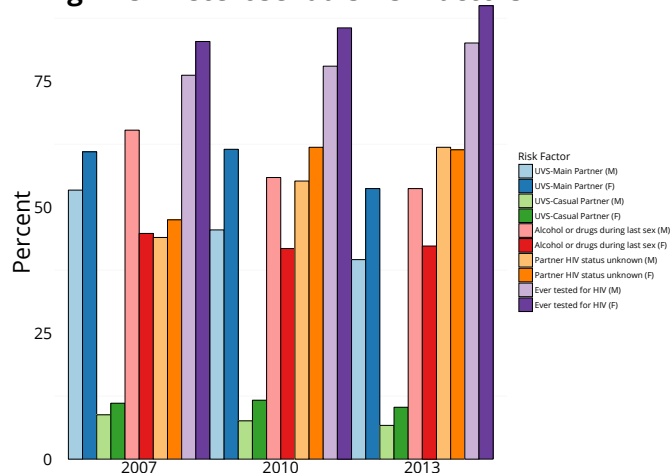


FIGURE 13. High risk heterosexuals' risk factors.

both interviews and medical record reviews (McNaghten et al, 2007). Also, the availability of data in the same jurisdictions over time allow for the conduct of trends analysis.

4.2.1 Demographic Characteristics

Trends in demographic characteristics of MMP participants between 2009 and 2013 are shown in Figure 15. In general, the survey showed slight fluctuations in the demographic characteristics over the survey period. Approximately 70% of participants were males compared to 28% of females. The majority of participants were Black (45.7-52.3%). While the proportion of White participants tended to decrease with each cycle year (28.5-18.4%), the proportion of Hispanics tended to increase (21.8-33.7%). Most participants were 40 or older (65.5-74.5%) and generally had greater than a high school education. Between the 2010 and 2013 cycles, the proportion of participants with higher than a high school education increased from 40.5% to 62.3%, while the proportion of those with only a high school diploma or GED decreased (38.4-19.2%) during the same period.

4.2.2 HIV Diagnosis, Stage of Disease and Antiretroviral Medication

Table 2 indicates time since HIV Diagnosis, Stage of HIV Disease and Current Antiretroviral Therapy Status among HIV-Infected persons in Houston/Harris County, Texas, 2009-2013. On the average, the majority of participants (51.3%) in

HMMP were diagnosed more than 10 years ago, followed by those diagnosed 5-9 years ago (27.5%) and those diagnosed less than 5 years (21.8%) ago. There was an increasing trend in the proportion of HIV patients taking antiretroviral therapy (ART) in Houston/Harris County with a range of 82.7% in 2009 to 94.9% in 2013. Based on the CDC surveillance classification of HIV disease stages, on the average, 9.7% of the participants were at Stage I (No AIDS, CD4+ T-lymphocyte count ≥ 500 cells/ μ L (or CD4% ≥ 29); 19.0% were at Stage II (No AIDS, CD4+ T-lymphocyte count 200-499 cells/ μ L (or CD4% = 14 to < 29); and 71.4% were at Stage III (Clinical AIDS or CD4+ T-lymphocyte count < 200 cells/ μ L (or CD4% < 14) (Table 1).

4.2.3 CD4+ T-lymphocyte Count and Most Recent HIV Viral Load

Table 3 presents the geometric mean CD4+ T-lymphocyte count and most recent HIV viral load detectability status of MMP participants, 2009-2013. Participants with a CD4 count of 500 or more cells/ μ L ranged from 38.6% in 2009 to 57.2% in 2012. The trends in CD4 count categories generally fluctuate across the period as follows: 4.8%-14.4% (0-199 Cells/ μ L); 9.8%-23.8% (200-349 Cells/ μ L) and 15.9%-22.8% (350-499 Cells/ μ L). On the average, about 67.6% of participants had undetectable viral loads based on their most recent HIV viral loads (Table 2). The year 2009 recorded the least proportion of patients with undetectable viral loads (55.6%) compared to the highest proportion of 78.9% obtained during 2012 cycle.

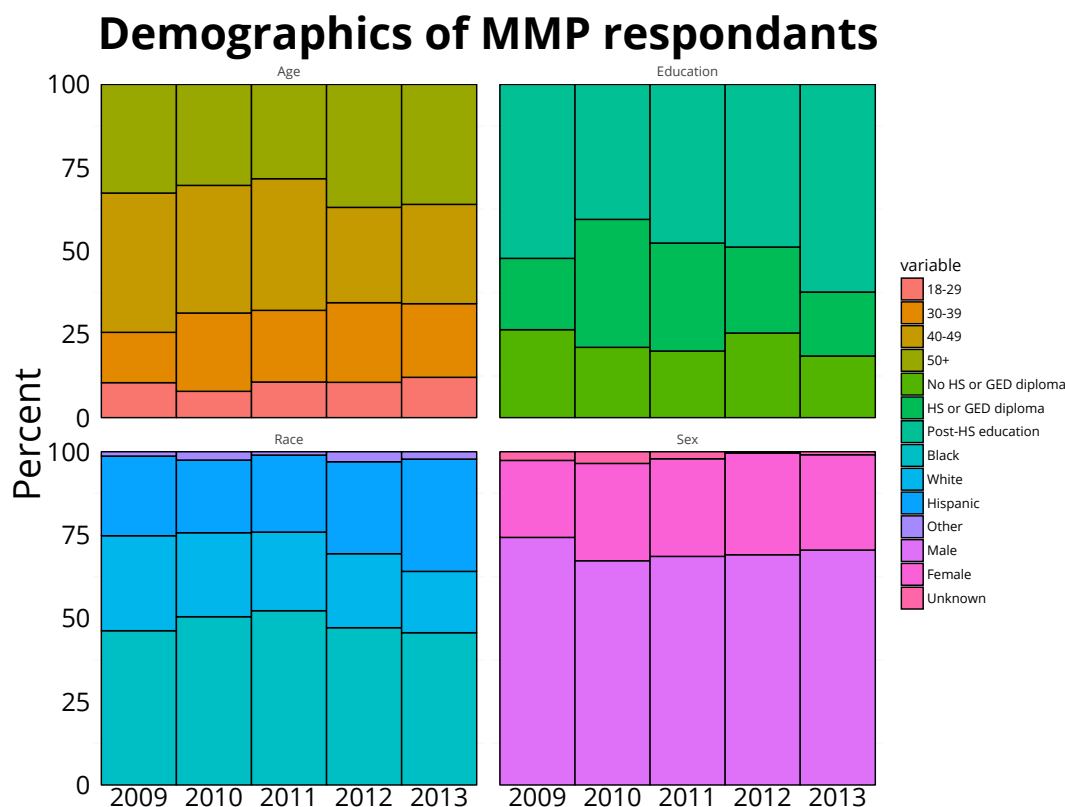


FIGURE 14. Demographics of MMP respondents.

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Influenza-associated Pediatric Mortality

INTRODUCTION

Influenza is a contagious respiratory illness caused by the influenza virus. There are three types of influenza viruses: A, B, and C (Texas Department of States Health Services, Influenza (Flu), 2015). Every year in the United States, millions of people get sick with influenza. Influenza epidemics

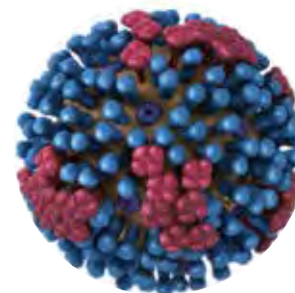
in the U.S. usually occur during the winter months. According to the Centers for Disease Control and Prevention, an estimated 23,607 (range 3,349-48,614) influenza-associated deaths and over 200,000 influenza-associated hospitalizations occur annually in the United States. The highest rates of influenza infection occur among children (Texas Department of States Health Services, Influenza (Flu), 2015) (Thompson, Shay, Zhou, & Bridges, 2010) (Centers for Disease Control and Prevention, Seasonal Influenza-Associated Hospitalizations in the United States, 2011).

Influenza-associated deaths in children became reportable for Texas in 2007. An influenza-associated pediatric death is defined as a death in a child under 18 years of age resulting from a clinically compatible illness that was confirmed to be influenza by an appropriate laboratory test (Texas Department

of States Health Services, Influenza-Associated Pediatric Mortality, 2015).

Influenza usually has a one to four day incubation period prior to symptoms occurring. Typical symptoms include fever, cough, runny nose, sore throat, and headache. Among children, middle ear infection, nausea, vomiting, and diarrhea are common. Some infected persons are asymptomatic (Texas Department of States Health Services, Influenza-Associated Pediatric Mortality, 2015).

Most people generally recover from influenza in less than two weeks, but some people can develop complications, such as pneumonia, and may die from influenza. Children less than five years of age are among the groups with the highest risk for serious health problems, hospitalizations, and deaths (Texas Department of States Health Services, Influenza-Associated Pediatric Mortality, 2015).



SURVEILLANCE SUMMARY

Surveillance History

Reportable in Texas since 2007

Population at Higher Risk

Unimmunized children

Notable Outbreaks

Higher incidence during 2009

Cases Per Year

2

Seasonality

Winter

Caseload

24

Disease Transmission

Influenza viruses are spread person to person by respiratory droplets generated when an infected person coughs, sneezes, or talks in close proximity to an uninfected person. Sometimes, influenza viruses are spread when a person touches a surface contaminated with influenza virus, and then touches his or her nose or mouth. A person can spread influenza one day before they feel sick and up to seven days or longer after they feel sick (Texas Department of States Health Services, Influenza (Flu), 2015).

During the yearly influenza season in industrialized countries, influenza often



appears earliest among school-aged children. The highest rates generally occur in children, with accompanying increases in school absences, doctor visits, and pediatric hospitalizations (Heymann, 2008).

Influenza A viruses normally seen in one species can sometimes cross over and cause illness in another species. Influenza viruses from different species can mix and create a new influenza A virus if viruses from two different species infect the same person or animal. The ability for influenza A to change hosts and create new types of influenza A severely limits the ability for the eradication of the virus (Texas Department of State Health Services, Influenza (Flu), 2015).

Epidemiology in Houston

In Houston, the highest number of reported influenza-associated pediatric deaths occurred in 2009 (N=9). Of the 17 cases reported between 2005-2014, the majority of pediatric deaths occurred in those less than a year of age (35.3%), followed by the 10 to 18 year age group (29.4%), the 1 to 4 year age group (23.5%), and the 5 to 9 year age group (11.8%).

In Texas from 2007 to 2014, the reported number of cases of influenza-associated pediatric mortality ranged from 7 to 54 cases. The highest amount of reported influenza-associated pediatric mortality cases occurred in 2009, as in Houston (Texas Department of State Health Services, Influenza-Associated Pediatric Mortality, 2015).

Public Health Action

The CDC recommends that everyone six months and older get the seasonal influenza vaccine yearly. Some children that are six months through eight years of age require two doses of the influenza vaccine. Children in this age group who are getting vaccinated for the first time, as well as some who have been vaccinated previously, will need two doses for full protection (Centers for Disease Control and Prevention, 2015).

Most people who develop influenza illness will recover with rest and fluids and will not need medication. Antiviral medications may shorten the duration

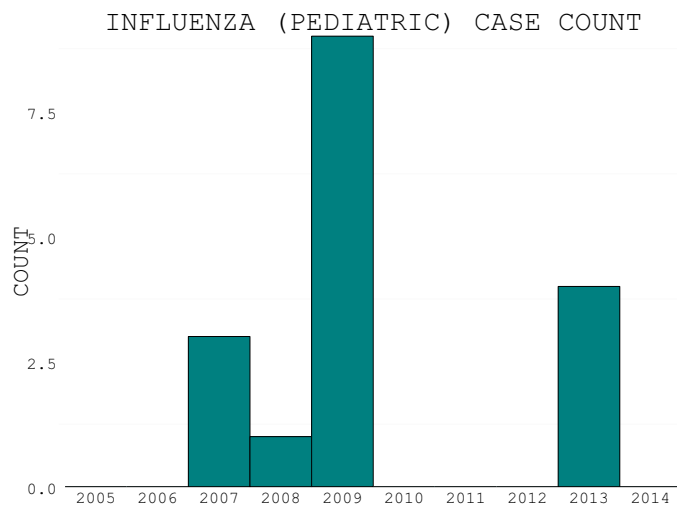
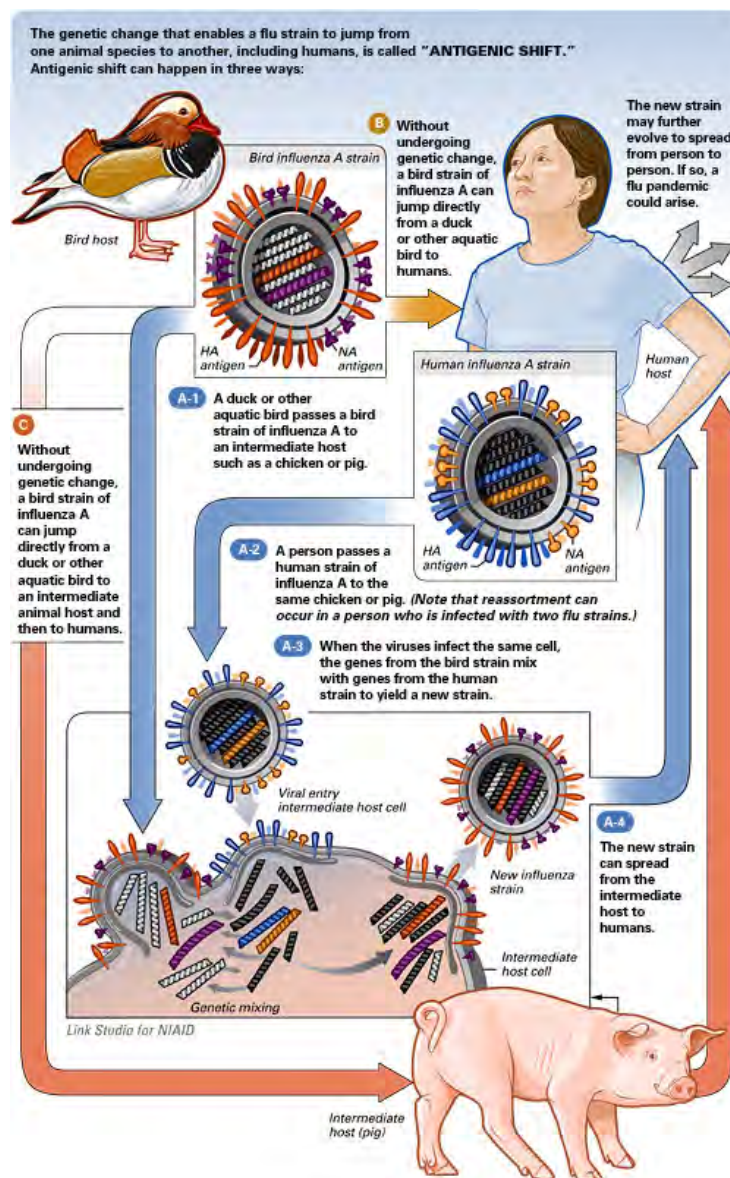
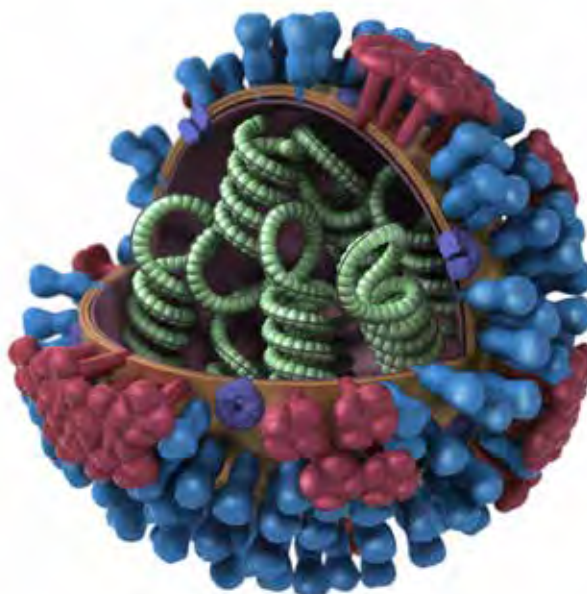


Figure 1 Influenza-associated pediatric mortality case count.



and severity of illness if given within the first 48 hours of the illness. Medications are usually prescribed to people who have a severe illness or to those who are at higher risk for developing serious illness or complications due to influenza (Texas Department of States Health Services, Influenza-Associated Pediatric Mortality, 2015).

The best way to prevent influenza is to get an influenza vaccine each year as soon as the vaccine is available to the public. Vaccination is associated with reductions in influenza-related respiratory illness, ear infections among children, physician visits among all age groups, hospitalizations, deaths among persons at high risk, and work absenteeism among adults (Texas Department of States Health Services, Influenza-Associated Pediatric Mortality, 2015).



Hemagglutinin



Neuraminidase



M2 Ion Channel



RNP

OTHER FORMS OF PREVENTION INCLUDE:

1. Hand washing and using alcohol-based hand sanitizers.
2. Avoiding touching your eyes, nose, or mouth.
3. Avoiding close contact with persons who are ill.
4. Staying home when you are ill (Texas Department of States Health Services, Influenza-Associated Pediatric Mortality, 2015).

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INTRODUCTION TO

Bureau of Public Health
Preparedness

Bureau of Public Health Preparedness

The Bureau of Public Health Preparedness (PHP) is responsible for activities that improve all communities, especially those that are most vulnerable, to help them prepare for and respond to public health emergencies. In this regard, PHP works within the larger Houston Health Department mission – for families and individuals to be self-sufficient in safe and healthy communities. PHP helps to build infrastructures that help the City of Houston respond to public health disasters

through planning, outreach, training, exercise, and response.

When preparing for, responding to, and recovering from a public health emergency, PHP collaborates with the Office of Emergency Management (OEM) utilizing the phases of emergency management: mitigation, preparedness, response and recovery. The Bureau fulfills its role in the Incident Command Structure (ICS) by working with all government agencies to reduce the risk of harm to the public before, during, and after a disaster or emergency, and works to recover and restore normal life operations as quickly as possible. We are always searching for ways to reduce the occurrence of such emergencies, and when we cannot prevent them from happening, to reduce their impact.

Problems Bureau Addresses

PHP focuses on 15 national disaster planning scenarios that were developed by several federal agencies in collaboration with the Department of Homeland Security. Those condensed scenarios are:

1	Nuclear Detonation	10-Kiloton Improvised Nuclear Device
2	Biological Attack	Aerosol Anthrax
3	Biological Disease Outbreak	Pandemic Influenza
4	Biological Attack	Plague
5	Chemical Attack	Blister Agent
6	Chemical Attack	Toxic Industrial Chemicals
7	Chemical Attack	Nerve Agent
8	Chemical Attack	Chlorine Tank Explosion
9	Natural Disaster	Major Earthquake
10	Natural Disaster	Major Hurricane
11	Radiological Attack	Radiological Dispersal Devices
12	Explosives Attack	Bombing Using Improvised Explosive Devices
13	Biological Attack	Food Contamination
14	Biological Attack	Foreign Animal Disease (Foot & Mouth Disease)
15	Cyber Attack	

The work of PHP addresses four of the essential public health services (Table 1).

TABLE 1. Essential Public Health Services Addressed By PHP.

Monitor health status to identify and solve community health problems

Diagnose and investigate health problems and health hazards in the community

Inform, educate, and empower people about health issues

Mobilize community partnerships and action to identify and solve health problems

Develop policies and plans that support individual and community health efforts

Enforce laws and regulations that protect health and ensure safety

Link people to needed personal health services and assure the provision of health care when otherwise unavailable

Assure competent public and personal health care workforce

Evaluate effectiveness, accessibility, and quality of personal and population-based health services

Research for new insights and innovative solutions to health problems

Why Bureau Addresses

Ensuring the safety of Houston is important not only for the health of the population, but also the economic and social wellbeing of the city and region. Preparing Houston to confront these potential emergencies is a preventive step that the PHP takes in order to mitigate potential effects of these emergencies.

What Bureau Does

PHP actively participates in national, regional, and local preparedness responses that include exercises and drills. PHP facilitates customized trainings and presentations on various disaster preparedness topics to different organizations and provides community liaisons at community and organizational functions as well as health fairs and expos to present and educate the population at-large on emergency preparedness. PHP provides leadership and management roles to the following response actions:

- Non-pharmaceutical interventions including social distancing, isolation, and quarantine—with the complement of wrap-around services required for day-to-day living.
- Administration or dispensing of life-saving medications (pills or injected vaccines) to a variety of threats ranging from hurricanes to pandemics to bioterrorism. Mass dispensing at Point of Dispensing (PODS) sites is the basic clinic model for delivery of public health services.
- Disease monitoring in multiple settings including the community at-large, emergency departments, hospitals and clinics, congregate settings (including nursing homes, jails, and emergency shelters). This surveillance includes sophisticated intelligence gathering and informatics techniques as well as definitive laboratory testing supporting both healthcare and public health practitioners.
- Mass fatality management and the coordination services for victim identification and survivor care and case management through the operation of Family Reception Centers and Family Assistance Centers.
- Operation of Community Reception Centers to provide screening and decontamination in the event of a radiation exposure incident.
- Coordination of mass care in sheltering scenarios when Red Cross is not available.
- Coordination of mental health, human services and case management.
- Coordination and consultation for threats like pandemics where continuation of operations and response overlap.

10-year Trends

In the past 10 years, the Bureau of PHP has confronted many challenging scenarios and conducted many activities to better prepare for future scenarios. Since 2005, PHP has conducted over 300 classes on weapons of mass destruction, in order to educate citizens, employees, and others on preparing for such an attack on the city.

In 2006 and 2008, the PHP played major roles in the response to Hurricanes Katrina, Rita, and Ike. While the majority of the effects of Hurricane Katrina were experienced in Louisiana, Houston became a major hub for relocation and shelter for victims of the hurricane. For all hurricanes, the city must be able to provide emergency shelter during the storm, work with external partners to provide shelter after the storm, and resume normal operations of the city as quickly as possible following the storm.

Pandemic influenza struck in 2009, causing significantly increased disease and economic burden on the city. PHP played a vital role in coordinating the response efforts internally and with external partners, such as providers, other departments, and other jurisdictions.

Finally, the West Africa Ebola epidemic presented a new threat to Houston and the rest of the United States. As a culturally diverse region with high levels of international travel and commerce, Houston was at a relatively higher risk than many other areas of the United States. PHP worked with epidemiology partners, medical providers, community-based organizations, academic institutions, and others to educate and prepare the city for a potential case of Ebola.

Program-specific Areas

All-hazards plans can provide a basic framework for responding to a wide variety of disasters, but planners typically address the kinds of disasters that might be expected to occur and its associated response actions, such as coordination of medical care (including treatment, transport, and tracking of the injured), disposition of the deceased, sanitation, vector control, mental health, and other coordination roles, as necessary.

Emergency planning normally begins with the identification of the disasters that have occurred in a community in the recent past. These are the known and generally the most probable hazards. Planners may then focus on the disasters that have occurred in the distant past by going through newspaper archives, history books, other documents, and by interviewing long-time residents. Other hazards may be added to the list if it is determined that there may be some probability of them causing risk to life, property, or to the environment. For example, new highways and rail lines mean more potential for hazardous materials accidents. These are the probable threats. “All-hazards” does not literally mean being prepared for any and all hazards that might manifest themselves in a particular community, state, or nation. Instead, it means that there are needs that commonly arise in many kinds of disasters, such as the need for emergency warning or mass evacuation, that can be addressed in a general plan. Furthermore, that plan can provide the basis for responding to unexpected events.

PHP works with several partners including our healthcare colleagues, our mental health partners, our medical examiner partners at Harris County Institute of Forensic Science, our broad base of community partners who provide a complement of human services, and our over 20,000 member workforce at the City of Houston.

10-year Vision for 2015 - 2025

The Bureau of PHP plans to continue to serve the citizens of Houston in preparation for and response to public health emergencies. In this vein, PHP will continue to provide the services that have been provided in the past, but with a focus on finding and implementing innovative, efficient means of improving the preparedness of Houston.

In order to build on the foundation that has been established, the PHP will need to create new partnerships, leverage existing partnerships for expanded capacity, and provide more direct information to the public.

Following the hurricanes, infectious disease, and terrorism threats in recent years, PHP continually updates plans for addressing these threats. Our goal is to have plans that are robust enough to be applied to situations but realistic in situation-specific needs.

BUREAU SUMMARY

- Staff size
- Bureau Budget
- Clients served
- Problem specific numbers (ie, drills run, immz given, etc)



INTRODUCTION TO
Bureau of Epidemiology

Bureau of Epidemiology

The Bureau of Epidemiology (BOE) is responsible for public health surveillance, disease investigation, and response to incidents of disease. Additionally, the BOE conducts research on epidemiologic trends in Houston and Harris County.

Public health surveillance involves continuous and systematic health data collection, analysis, and interpretation. In order to collect this information, the BOE performs 24/7 disease surveillance of notifiable conditions, with



epidemiologists on-duty and on-call at all times. Most of these conditions are infectious and require regular, frequent, and timely information to inform prevention and initiate public health action. Furthermore, disease surveillance is essential for planning, implementing, and evaluating public health policies and interventions. The information collected is vital for understanding the landscape of public health in Houston and allocating resources accordingly.

Problems Bureau Addresses

The BOE protects Houston from the threat of communicable diseases by conducting surveillance, which is used to inform public health action, such as administering antibiotics, prophylaxis, and vaccinations, educating the community, and mitigating the risks for future disease transmission. The work of the BOE addresses 5 of the 10 essential public health functions (Table 1). Through the Texas Health and Safety Code, Chapter 81, certain conditions are required to be reported from healthcare providers, healthcare facilities, laboratories, veterinarians, and others to local health departments. The BOE investigates these cases and submits suspect, probable, and confirmed cases to the Texas Department of State Health Services (DSHS), which subsequently submits data to CDC.

Why Bureau Addresses

Conducting public health surveillance and epidemiology underlies the basic mission of the public health system – to ensure conditions in which people can be healthy. Surveillance allows for estimating disease burden and health status, measuring the

TABLE 1. Essential Public Health Services Addressed By BOE.

Monitor health status to identify and solve community health problems

Diagnose and investigate health problems and health hazards in the community

Inform, educate, and empower people about health issues

Mobilize community partnerships and action to identify and solve health problems

Develop policies and plans that support individual and community health efforts

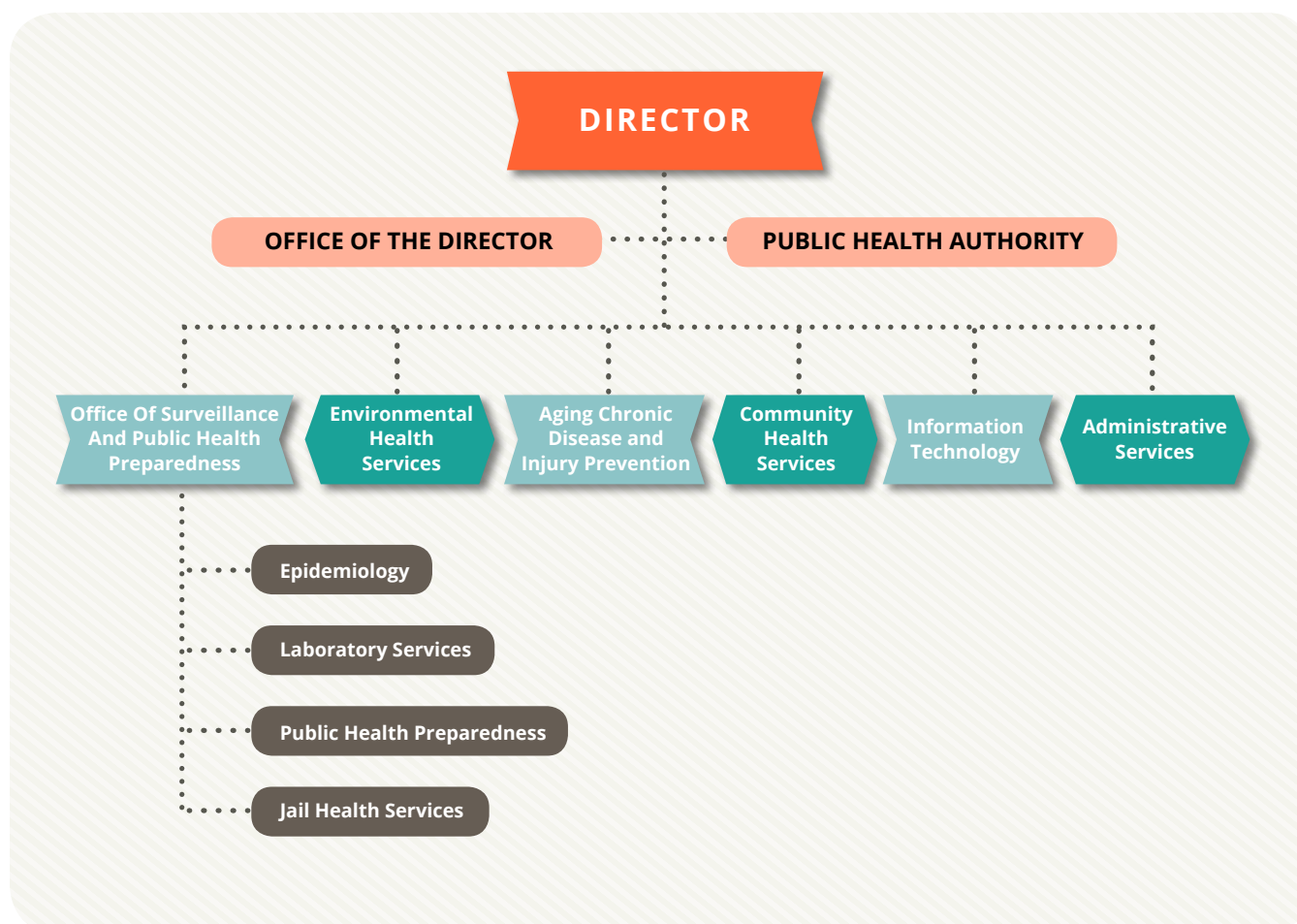
Enforce laws and regulations that protect health and ensure safety

Link people to needed personal health services and assure the provision of health care when otherwise unavailable

Assure competent public and personal health care workforce

Evaluate effectiveness, accessibility, and quality of personal and population-based health services

Research for new insights and innovative solutions to health problems



need for public health action, guiding decision- and policy-makers, and evaluating the effects of interventions. Through conducting surveillance and epidemiology for the City of Houston, the BOE is maintaining situational awareness of these potentially dangerous diseases to public health.

What Bureau Does

Methods of routine surveillance include passive and active surveillance. Passive surveillance relies upon reporters to submit reportable conditions and disease outbreaks to the local health department in a timely manner. These reports are received electronically, by mail, by phone, and by fax routinely. Active surveillance involves a special effort of disease investigators and epidemiologist to contact healthcare providers, laboratories, schools, or others to identify cases of particular interest. This method provides more comprehensive data, but requires considerably greater resources and is conducted over finite periods of time.

In addition to routine surveillance, the BOE conducts research on infectious diseases. The Grants, Research, and Special Projects program manages the National HIV Behavioral Surveillance (NHBS) and the Houston Medical Monitoring Project (MMP). Additionally, the BOE has conducted several other research projects in the past 10 years.

10-year Trends

Over the past 10 years, the BOE has undergone important developments in technology and the practice of surveillance. Additionally, the BOE has spearheaded efforts in protecting Houston from emerging and highly infectious diseases, such as the 2009 pandemic H1N1 influenza and the 2014 West Africa Ebola epidemic.

In 2013, the BOE embarked upon the process of integrating surveillance functions across disease groups. Prior to this, surveillance was divided for HIV, STDs, and other communicable diseases, in which teams focused on zoonotic, foodborne, hepatitis, vaccine-preventable, and other conditions. Additionally, these disease-specific groups managed research, data management, and other functions independently. Integration shifted the focus of groups from conducting all functions for a particular disease or group of diseases to conducting fewer functions, such as disease investigation, data management, or research. Now, disease investigation is conducted by geographically defined teams.

One of the most important developments in the past decade has been adopting informatics for the department and using informatics tools and methods to improve the work being done within the BOE and the HHD. One of these tools is a state-of-the-art information management system, Maven, in 2009. Subsequently, the BOE developed automated, electronic

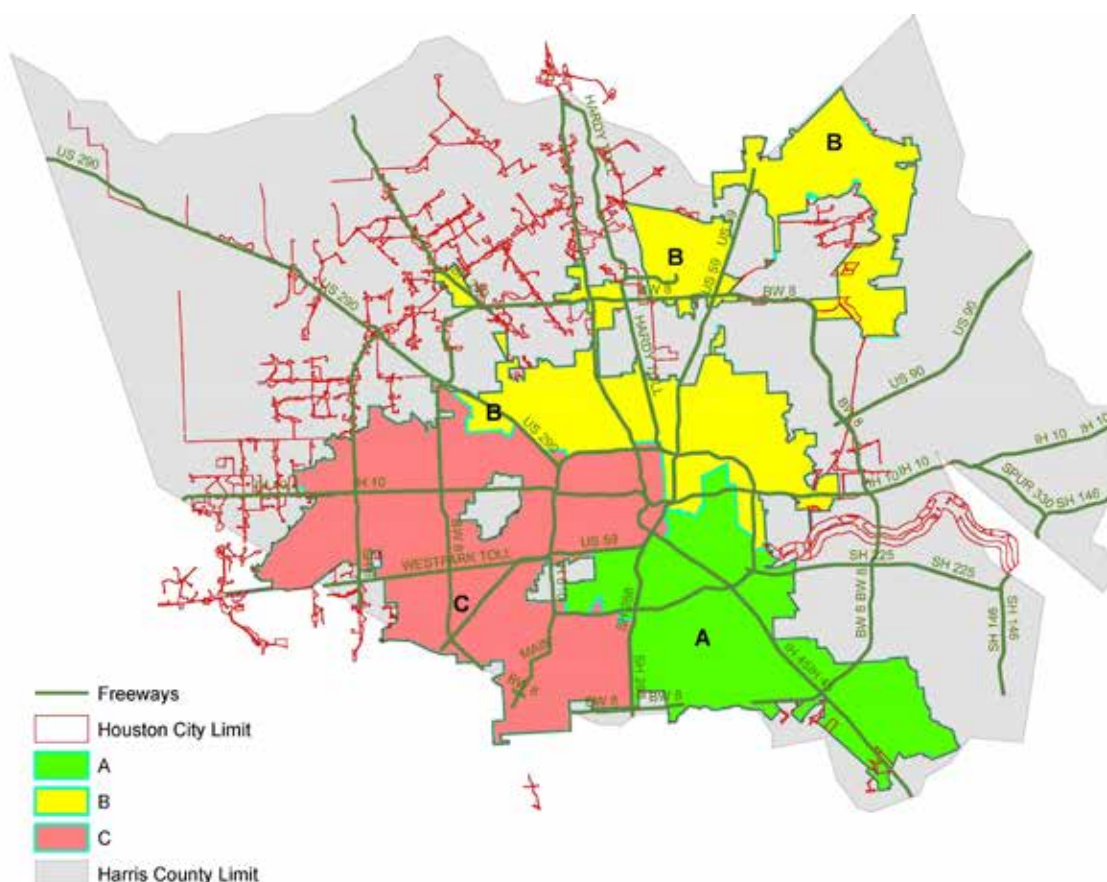


FIGURE 1. HHD Health Service Delivery Areas A, B, and C.

reporting mechanisms with Houston-area hospitals, laboratories, and blood banks. Another tool that has been continually developed over the past 10 years is syndromic surveillance. Syndromic surveillance is an investigational approach where disease indicators are continuously monitored to detect outbreaks earlier than traditional surveillance methods. The department adopted this technology in 2004, and since then, the BOE has expanded its scope to include over 30 hospitals in the Houston-area and several others across the state.

Over the past 10 years, the BOE has been on the fore-front of conducting surveillance and epidemiology for emerging infectious diseases. Much of this work is highlighted in this publication's disease-specific chapters, but two major events included the 2009 H1N1 pandemic and the 2014 Ebola epidemic in West Africa. In April 2009, the BOE identified one of the first cases of H1N1 nationwide, and was a member of the nationwide Novel Swine-Origin Influenza A (H1N1) Investigation Team. The BOE hired and organized additional resources for this response, in order to meet the increased surveillance demands. In 2014, with Ebola incidence on the rise in West African countries, the BOE initiated a region-wide conversation on planning and response months before the threat became a reality in Dallas, Texas. Throughout the epidemic, the BOE dedicated over 1,000 hours to educate Houston communities and conduct active surveillance for the virus, including daily phone or in-person follow-up with the person under monitoring.

Program-specific Areas

Disease Surveillance

After integrating surveillance functions, HIV, STDs, and all other reportable conditions surveillance has been conducted in geographically focused teams. Aligning with the HHD's Health Service Delivery Areas, teams are focused on conducting surveillance in South/Southeast (A), North/Northeast (B), and Central-West/Southwest regions of Houston (C) (Figure 1). This has allowed for an enhanced focus of surveillance, encompassing co-morbidities and the epidemiology of diseases at the community level.

Grants, Research, and Special Projects

The Grants, Research, and Special Projects program was created during the integration process to manage communicable disease grants, research, and other projects outside of passive and active surveillance. Currently, the program manages two large projects: the Houston Medical Monitoring Project (MMP) and the National HIV Behavioral Surveillance (NHBS) project. MMP examines HIV medical care in Houston, as part of a consortium of jurisdictions nationwide. NHBS conducts behavioral science research as part of a national consortium on three specific groups of high-risk individuals: men who have sex with men, intravenous drug users, and heterosexuals at increased risk for HIV infection. These important research endeavors supplement surveillance efforts,

allowing the HHD and others in the Houston-area to improve the health of Houston.

From 2012 to 2014, the BOE conducted the CDC-funded Assessing the Accuracy of Self-Report of HIV Test Behavior study. This work was designed to inform the accuracy of HIV incidence and prevalence estimates nationwide. Additionally, several smaller studies have been conducted over the past decade.

Informatics and Data Management

The Informatics and Data Management program, also created following the integration of surveillance, emerged from the need to modernize surveillance, research, and other functions within the BOE. In addition to improving BOE-specific functions, the Informatics and Data Management program has worked department-wide to meet the informatics needs of others at the HHD. The Program also works with external partners. Examples of this work include collaborating on the national Reportable Conditions Knowledge Management System, in order to enable electronic case reporting, and the Streamlining Hepatitis Automatic Reporting Project (SHARP). SHARP aims to automatically capture more comprehensive information on hepatitis cases in order to improve surveillance of these diseases. These advancements can be expanded to other conditions in the future. Most recently, the Program is selected to collaborate with the Public Health Informatics Institute on the EHR toolkit Pilot, and awarded NACCHO's planning grant to increase HPV vaccination rates through community planning and data visualization. The Program is also hosting Streaming Health Systems through Interprofessional Education (SHINE) fellows with the support from CSTE, CDC, NACCHO, ASTHO, and PHII.

10-year Vision for 2015 - 2024

The BOE plans to continue protecting the Houston community from the threat of communicable diseases. However, how public health has conducted surveillance for decades is fast-becoming obsolete; the BOE recognized the need to adopt and innovate technologies and methods to meet increasing demands and stay on the cutting edge of public health practice. In order to do this, the role of informatics and data management will be enhanced over the coming decade, especially as public health and BOE move towards automated, electronic case reporting.

Part of staying on the cutting edge of public health surveillance is remaining diligent in surveillance of new and re-emerging infectious diseases. Such as the 2009 H1N1 outbreak and the 2014 - 2015 Ebola epidemic, new communicable disease threats will continue to be an emphasis of the work in the BOE. The bureau plans to learn from and grow with past experiences, and in partnership with communities, healthcare, and researchers, the bureau plans to ensure Houston remains a safe and healthy place to live.

BUREAU SUMMARY

- Staff size
- Bureau Budget
- Clients served
- Problem specific numbers (ie, drills run, immz given, etc)



INTRODUCTION TO

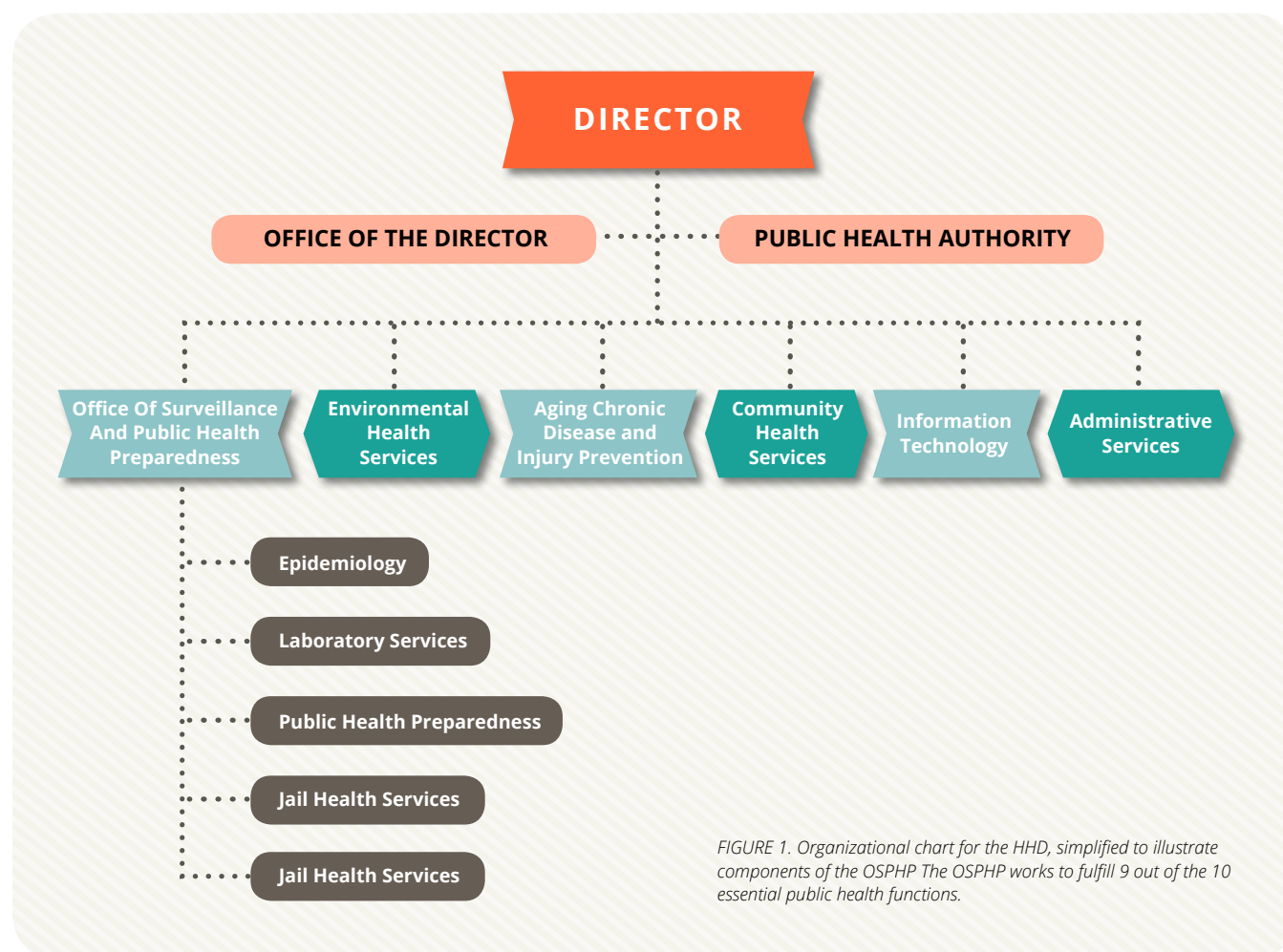
The Office of Surveillance and
Public Health Preparedness

The Office of Surveillance and Public Health Preparedness

The Office of Surveillance and Public Health Preparedness (OSPHP) is a division within the Houston Health Department (HHD). It is responsible for assuring the department's critical roles of detecting and monitoring disease and preparing for and responding to public health emergencies, both natural (such as hurricanes) and unnatural (such as acts of terrorism). These duties require the division to be vigilant and prepared to respond 24 hours a day, 7 days a week.

To fulfill these functions, the OSPHP consists of the following four bureaus: Epidemiology, Laboratory Services, Public Health Preparedness, and Jail Health Services. Additionally,

the OSPHP houses the Performance Improvement and Accreditation Team, which has been responsible for preparing the HHD for Public Health Accreditation (Figure 1).





The OSPHP works to fulfill 9 out of the 10 essential public health functions:

- Monitor and evaluate health status to identify community health problems
- Diagnose and investigate health problems and health hazards in the community
- Inform, educate, and empower people about health issues
- Mobilize community partnerships and action to identify and solve health problems
- Develop policies and plan that support individual and community health efforts
- Link people to needed personal health services and assure the provision of health care when otherwise unavailable
- Assure a competent public and personal health care workforce
- Evaluate effectiveness, accessibility, and quality of personal and population-based health services
- Research for new insights and innovative solutions to health problems

In addition to performing surveillance and public health preparedness, the OSPHP acquired a new direction in 2014, when the Bureau of Jail Health Services was moved into the division. This bureau broadened the focus of the division to include providing clinical care and care coordination to inmates of the municipal jails in the city.

INTRODUCTION TO

Performance Improvement and
Accreditation Team (PIAT)

Performance Improvement and Accreditation Team (PIAT)

The Performance Improvement and Accreditation Team (PIAT) is the coordinating team for Public Health Accreditation and quality improvement initiatives within the Houston Health Department (HHD). Public Health Accreditation is the measurement of a health department's performance against a set of nationally recognized, practice-focused, and evidence-based standards. It serves as a process that ensures a public health agency is committed to self-study and external reviews

by peers, in meeting required standards and continuously enhancing the quality of services provided. PIAT works strategically with staff to ensure that the HHD meets and exceeds the standards delineated by the Public Health Accreditation Board (PHAB), which ultimately benefit the health and well-being of Houstonians through:

- Increased funding opportunities and competitiveness for grant opportunities
- Improved business processes and efficiency
- Enhanced collaboration on health improvement initiatives
- Increased community involvement with the department
- Improved health outcomes for Houstonians

On December 12, 2014 PIAT succeeded in its primary objective of ensuring the HHD got accredited. The HHD became the first department in Texas and the second large city in the nation to be accredited by the Public Health Accreditation Board (PHAB). Although the departments' accreditation lasts five years, the team is already working on improvements to the last accreditation cycle and planning for reaccreditation.

Problems PIAT Addresses

Local health departments serve as the front line of public health across the nation. They are tasked with providing the Essential Public Health Services to their jurisdiction and communities. By facilitating performance improvement and obtaining accreditation status, PIAT is improving the delivery of these essential services to the City of Houston and directly meeting 2 of the 10 services (Table 1).



TABLE 1. Essential Public Health Services Addressed By BOE.

Monitor health status to identify and solve community health problems

Diagnose and investigate health problems and health hazards in the community

Inform, educate, and empower people about health issues

Mobilize community partnerships and action to identify and solve health problems

Develop policies and plans that support individual and community health efforts

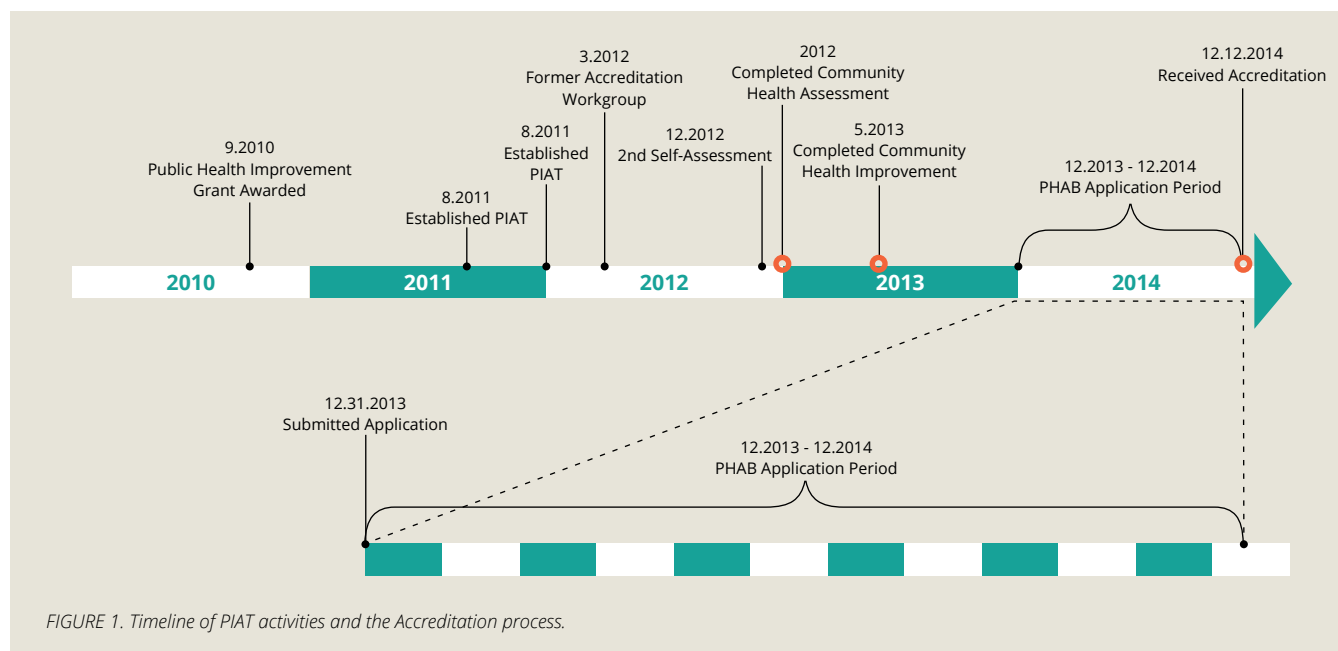
Enforce laws and regulations that protect health and ensure safety

Link people to needed personal health services and assure the provision of health care when otherwise unavailable

Assure competent public and personal health care workforce

Evaluate effectiveness, accessibility, and quality of personal and population-based health services

Research for new insights and innovative solutions to health problems



What PIAT Does

Accreditation efforts at the HHD began in September 2011, and were initially funded by the CDC National Public Health Improvement Initiative grant (Figure 1). The purpose of the grant was to assist departments in establishing a culture of quality improvement leading to improved efficiency, effectiveness, and health outcomes.

Since 2011, PIAT has taken many steps to prepare the department for accreditation, including:

- Training staff on Accreditation, Performance Management (PM), and Quality Improvement (QI) (Figure 2)
- Conducting departmental Performance Management and Accreditation Assessments
- Creating tools for proper documentation
- Conducting Mock Site Visits
- Developing games and educational materials
- Coordinating documentation collection and review
- Providing mentorship and technical assistance for other departments pursuing accreditation

10-year Trends

PIAT's 10-year vision is to have a PHAB-accredited department with improved program performance and efficiency through continuous quality improvement. Accreditation and quality improvement will be fully integrated and funded as core functions of the department, ensuring the HHD continues to operate at the highest possible standard. All new employees will learn about Public Health Accreditation and the guidelines for proper documentation. The department will continue its role as a national leader in public health accreditation, and PIAT will possess the resources and staff to provide even greater assistance to other health departments across the state of Texas.

In order to accomplish this, PIAT will be fully staffed, which will allow the team to provide appropriate training and preparation for accreditation activities, and facilitate and lead important departmental quality improvement projects. The team will continue to develop innovative tools, such as the Accreditation Documentation Management System (ADMS) and Good Doc/Bad Doc, to aid other departments pursuing accreditation.



FIGURE 2. Number of staff trained in each training offered by PIAT, 2012-14.

INTRODUCTION TO

Bureau of Jail Health Services

Bureau of Jail Health Services

The Bureau of Jail Health Services (JHS) operates two 24-hour minor emergency clinics within the Houston Police Department (HPD) jails. Inmates have distinct medical needs, and their care during incarceration falls on the City of Houston. These clinics triage the inmates, treat minor conditions, conduct medical follow-up, and refer to emergency care, if needed.

Some of the commonly treated medical conditions are:

- Minor injuries (lacerations, sprains, burns, and other wounds)
- Drug and alcohol intoxication/detoxification
- Diabetes
- Hypertension
- Seizure disorders
- Asthma
- Psychiatric disorders
- Chronic disability
- Coronary heart disease
- Pregnancy monitoring

The City of Houston jail system dates back to the 1840s, when the City constructed a two-story jail, which was referred to as the “Calaboose”, which was a common name for a municipal jail. Prior to the construction of the Calaboose, the Houston City Marshals (the forerunner of the current HPD) booked prisoners directly into a 24 feet by 24 feet blockhouse, which had neither heat nor ventilation.

The jail relocated twice more over the next century, until the HPD opened the Police Administrative Building in 1951 at 61 Reisner Street, which still houses the primary jail. Beginning in 1978, the JHS began operating a clinic at the Reisner Street jail, in order to provide a minimum level of necessary care to inmates. Furthermore, the City entered into a legal consent decree on September 21, 1989 to provide a minimum level of care to inmates. The consent decree has since been terminated, but JHS continues to maintain the 24-hour clinical services at the Reisner and Mykawa jail facilities.

Problems Bureau Addresses

A major issue that JHS addresses is attempted suicide in the inmate population. Historically and into the present, suicide has been the leading cause of unnatural death in jails (Frank & Aguirre, 2013). The rate has been approximately 47 per 100,000, or over four times the rate in the general population (Hanson, 2010; Mumola, 2005).

In addition to psychiatric concerns, the JHS provides care for all persons in custody. Inmates come with pre-existing conditions (e.g. heart disease, chronic disabilities) and may suffer acute conditions (e.g. physical injuries). The clinics work

TABLE 1. Essential Public Health Services Addressed by JHS.

Monitor health status to identify and solve community health problems

Diagnose and investigate health problems and health hazards in the community

Inform, educate, and empower people about health issues

Mobilize community partnerships and action to identify and solve health problems

Develop policies and plans that support individual and community health efforts

Enforce laws and regulations that protect health and ensure safety

Link people to needed personal health services and assure the provision of health care when otherwise unavailable

Assure competent public and personal health care workforce

Evaluate effectiveness, accessibility, and quality of personal and population-based health services

Research for new insights and innovative solutions to health problems

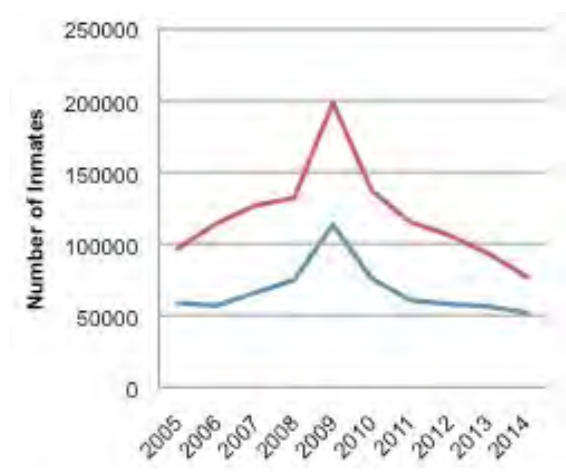


FIGURE 1. Number of inmates screened and treated in HPD jails, 2005 - 2014

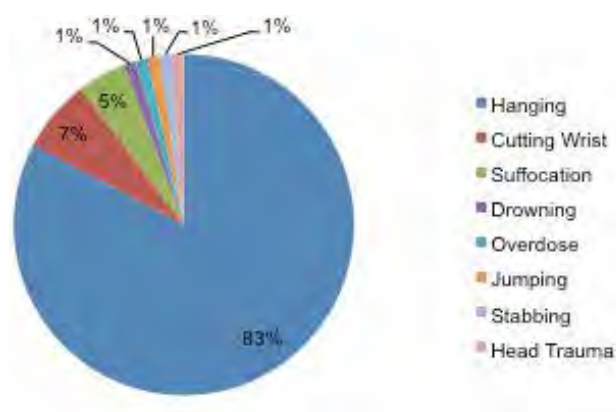


FIGURE 2. Attempted suicides in HPD jails by method, 2014

closely with hospitals in order to provide emergency care that cannot be provided in the clinics. These services meet 2 of the 10 essential public health services (Table 1).

Why Bureau Addresses

The inmates are the custody of the HPD, so necessary medical care falls on the City to provide. Providing this care will reduce morbidity and mortality in this population. For some inmates, this is the only care that is provided in their lives.

What Bureau Does

Each inmate that is brought into either jail facility is screened and triaged by clinical assistants and jail medical specialists in order to assess if the patient has any medical problems or needs. If the inmate is identified to have a medical need, s/he is referred to the jail clinic for treatment. If the clinic is able to provide the necessary level of care, the patient receives treatment and medical follow-up is conducted, as appropriate.

If the inmate requires a higher level of care, s/he is transferred to a local hospital for care, until the inmate is able to be transferred back to the jail.

10-year Trends

The Bureau of JHS has maintained the clinics at both Houston jail locations over the past 10 years. Currently, the jail staffs two medical doctors, a pharmacist, and over 25 jail medical specialists and clinical assistants. Little has changed in the past 10 years in the operations of the clinics; however, the number of inmates screened and treated has fluctuated throughout the period.

The number of inmates screened and treated peaked in 2009, with 198,532 screened and 113,273 of those received treatment (Figure 1). Likewise, the number of patients referred for outside care also peaked in 2009 at 1,250.

Trends in attempted suicides in the jail has not followed the same trends in the past several years. In fact, 2009 saw the second lowest number of attempted suicides (9) and 2013 saw the highest (27). The method of attempted suicide has most commonly been hanging (82.7%) (Figure 2). Approximately 60% of suicide attempts were black (non-Hispanic) inmates (Figure 3), and approximately 80% were male.

10-year Vision for 2015 - 2025

Municipal jails are quickly disappearing in Texas, in favor of larger county- or state-run facilities. This is because municipal facilities typically only hold prisoners for short periods and for low-level crimes. The Houston City Council approved an agreement with Harris County on September 23, 2015 to build a joint inmate processing center. This is the first step in transferring the City's municipal jail services over to Harris County, a move that former Mayor Annise Parker said will result in "direct savings from the first day". The joint processing center is scheduled to open in October 2017, with the City's facilities closing the month after.

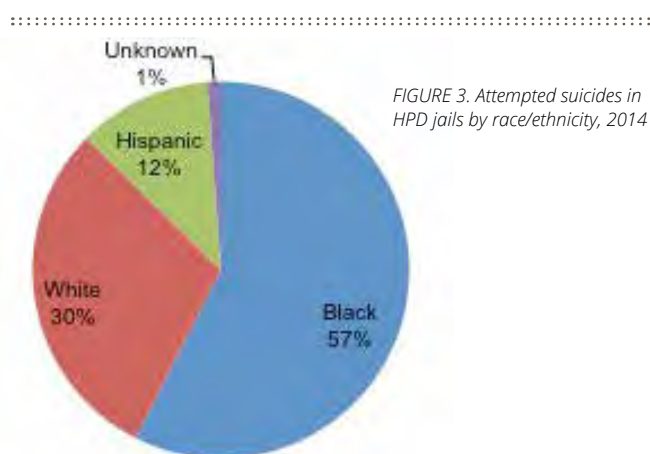


FIGURE 3. Attempted suicides in HPD jails by race/ethnicity, 2014

BUREAU SUMMARY

- 33 Personnel
- \$##
- 120,000 screened per year
- 67,000 treated per year

INTRODUCTION TO

Bureau of Laboratory Services

Bureau of Laboratory Services

The Bureau of Laboratory Services (BLS) provides a wide range of clinical and environmental testing for the City of Houston, the 17-county Texas Health Service Region 6/5 South, and many medical facilities throughout the region. Primarily, the public health laboratory conducts infectious disease and environmental testing in order to ensure the public's health. Furthermore, the BLS participates in many federal programs to accomplish this goal.



The BLS is split into two major functional areas: clinical and environmental laboratories. The clinical laboratory focuses on infectious disease surveillance testing, while the environmental laboratory focuses on testing water, soil, air, industrial waste, food, and other, non-clinical samples. The clinical laboratory also houses a biosafety level (BSL) 3 facility, which conducts testing on highly virulent pathogens, such as Ebola, tuberculosis, and others.

Problems Bureau Addresses

Surveillance is a critical component of public health, fulfilling the first, second, and ninth essential public health services (Table 1). The laboratory is a critical part of surveillance, in addition to epidemiology, as it tests for the infectious diseases and environmental hazards that threaten the health of Houstonians and their environment.

The diseases of public health interest that the laboratory investigates include influenza, HIV, STDs, vaccine-preventable diseases, foodborne diseases, and many others. The environmental laboratory tests samples for dangerous heavy metals (such as lead), foodborne pathogens, and water contaminants, hazardous waste.

Why Bureau Addresses

Conducting public health surveillance and epidemiology underlies the basic mission of the public health system – to ensure conditions in which people can be healthy. Surveillance allows for estimating disease burden and health status, measuring the need for public health action, guiding decision- and policy-makers, and evaluating the effects of interventions. Through conducting clinical and environmental testing,

TABLE 1. Essential Public Health Services Addressed By BLS.

Monitor health status to identify and solve community health problems

Diagnose and investigate health problems and health hazards in the community

Inform, educate, and empower people about health issues

Mobilize community partnerships and action to identify and solve health problems

Develop policies and plans that support individual and community health efforts

Enforce laws and regulations that protect health and ensure safety

Link people to needed personal health services and assure the provision of health care when otherwise unavailable

Assure competent public and personal health care workforce

Evaluate effectiveness, accessibility, and quality of personal and population-based health services

Research for new insights and innovative solutions to health problems

the BLS assists the Bureau of Epidemiology and others in monitoring disease burden and health status in several critical areas.

What Bureau Does

The BLS conducts testing using microbiology, biochemistry, chemistry, and molecular techniques. Proficiency in these methods is maintained periodically, and the BLS is inspected and accredited by eight different agencies to ensure that all testing is performed in a reliable and accurate manner.

10-year Trends

The BLS has gone through significant changes over the last decade. Testing technology changes quickly and the BLS strives to provide the most up-to-date and cutting edge technology for the Houston community. During the last decade, the clinical laboratory has significantly expanded our molecular testing capabilities. Molecular detection for *Mycobacterium tuberculosis* (TB), Human Immunodeficiency Virus (HIV), influenza virus, dengue virus, SARS Co-V, MERS Co-V, and norovirus are several examples of new molecular tests that has improved the laboratory's capacity to accurately and efficiently conduct testing. These tests are highly sensitive and specific which provides the BLS and the Houston Health Department with high-quality data to act upon.

The last decade has seen two major events for the laboratory. The first was the 2009 H1N1 influenza pandemic. The BLS was inundated with specimens and performed over 10,000 more tests than in a typical influenza season (Figure 1). The laboratory staff responded by working a significant number of overtime hours and hiring temporary staff to maintain the processing and testing of specimens.

MISSING

FIGURE 1. Influenza testing volume by season (July-June), 2008-2014. *2009 season includes testing in April, May, and June after H1N1 was identified in Houston

The second major event was relocating to a newer and larger facility in early 2012. The laboratory relocated from the Braeswood Boulevard location in the heart of the Texas Medical Center to the Houston Veterans Affairs Medical Center campus located on Holcombe Boulevard. The previous facility on Braeswood was unable to meet the electrical demands of new testing equipment and maintain a consistent temperature controlled environment that is crucial to diagnostic testing. Two buildings were purchased on the Holcombe campus and

remodeled to accommodate the laboratory's needs and to provide a safe and controlled environment for testing. The new facility allowed for the design and construction of a new BSL-3 facility to accommodate the TB and Laboratory Response Network (LRN) testing needs of the laboratory.

Over the past several years, the laboratory has seen a decline in testing volume (Figure 1). This is due primarily to decreased patient visits at the HHD clinics and partnering community-based clinics as well as decreased testing needs from environmental health partners, internally and externally.

MISSING

FIGURE 1. Testing volume for the Bureau of Laboratory Services, 2007-2014

Program-specific Areas

Molecular Diagnostics

The Molecular Diagnostics is a CDC LRN reference laboratory that provides testing to the seventeen surrounding counties with a total population of more than six million. The laboratory is also a member of the Food Emergency Response Network (FERN). This section works closely with other laboratories, first responders, the FBI, and others to conduct critical testing for bioterrorism agents, or weapons of mass destruction.

Virology and Serology

The Virology and Serology section conducts HIV/STD serology, vaccine-preventable disease (VPD) serology, diagnostic virology, and rabies testing. The section performs moderate- to high-complexity procedures for the isolation and identification of various viral pathogens. These pathogens include respiratory viruses, West Nile virus and other encephalitides, and dengue virus. The BLS is one of four laboratories across Texas that provides zoological (animal) testing of rabies.

Microbiology

The microbiology laboratory serves as a regional reference laboratory for foodborne outbreak surveillance testing and is nationally recognized as an active PulseNet network laboratory, a national network of laboratories that perform standardized molecular subtyping ("fingerprinting") of foodborne disease-causing bacteria for the early detection of foodborne disease outbreaks. The laboratory is also an active participant in the National Antibiotic Resistance Monitoring System

(NARMS). Finally, the BLS provides TB testing for the Bureau of TB Control and providers throughout the region.

Health Center Support

The Health Center Support section provides clinical testing support to the health centers and conducts pollen and mold spore counts for the greater-Houston area. The tests conducted for the health centers are primarily for HIV and STDs. The pollen and mold counts are used to determine allergen levels for the general public, media, and medical providers.

Lead and Heavy Metals

The environmental section of the BLS provides testing on environmental and blood specimens for lead and heavy metals. These metals can be very dangerous for human and environmental health. In children, high lead levels can cause developmental and cognitive problems. The laboratory conducts testing for the Bureau of Community and Children's Environmental Health.

Clean Water Testing

The BLS conducts testing on potable and environmental water sources, such as bayous and lakes. The environmental water testing examines ten parameters to assess water safety. For potable water, the laboratory conducts bacterial testing to ensure that water is safe to drink for area residents



Milk and Dairy

The Milk and Dairy section conducts testing on raw and process dairy samples to ensure compliance with state and federal regulations. The testing ensures that the dairy supply is free from harmful foodborne pathogens.

10 Year Vision For 2015-2025

The laboratory plans to continue improving capacity to meet the public health testing needs of the City of Houston and the surrounding counties. In order to do this, the BLS plans to continue transitioning from classical diagnostic methods to molecular-based diagnostic methods. Recently, the BLS has adopted the GenMark, MALDI-TOF, and Illumina MiSeq molecular technologies. These technologies improve the accuracy of testing for respiratory viruses, TB, foodborne bacteria, and many other harmful bugs. The BLS plans to also acquire a Next Generation Sequencing instrument to assist with identifying foodborne bacteria.

The BLS plans to expand the base of clients in the area that are served by our clinical and environmental sections. This is going to be facilitated with a remote order-entry system, where providers and others will be able to order tests and receive results electronically from the BLS. Our goal at the Bureau of Laboratory Services is to provide the community and our partners with the most up-to-date and accurate test results as possible. The laboratory will continue to evaluate the needs of the community and plan for future testing needs to serve our city.

BUREAU SUMMARY

- Staff size
- Bureau Budget
- Clients served
- Problem specific numbers (ie, drills run, immz given, etc)

Invasive Streptococcal Infections

INTRODUCTION

Streptococcal infections are any type of infection caused by the streptococcus group of bacteria. Infections vary in severity from mild throat infections to life-threatening infections of the blood or organs. Most streptococcal infections can be treated with antibiotics. Many strains of the bacteria are

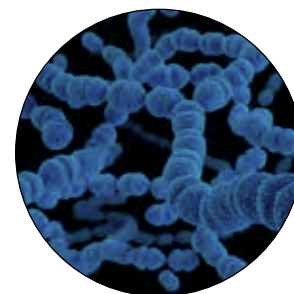
naturally occurring in the human body and normally do not cause disease. For example, *S. viridans* is found in the GI tract and *S. agalactiae* is found in the female genital tract. There are three groups of Streptococcus bacteria that are of concern to public health: Group A Streptococcus (*S. pyogenes*), Group B Streptococcus (*S. agalactiae*) and *Streptococcus pneumoniae*.

Group A Streptococcus (GAS) can cause both invasive disease (such as meningitis or blood stream infections) and non-invasive disease (such as strep throat). It can be found on the surface of the skin and inside the throat, and commonly affects adults and children. GAS is highly virulent and is often associated with septicemia, streptococcal toxic shock syndrome, strep throat, wound infections, and may induce some immunologic diseases such as rheumatic fever. It is the most frequent cause of necrotizing fasciitis, commonly referred to as “flesh eating bacteria.” GAS can affect all age groups but more frequently affects the older population. Infection is associated with skin lesions and IV drug abuse and can result in severe illness, including death.

Group B Streptococcus is often associated with septicemia, and pneumonia or meningitis in neonates. According to the Centers for Disease Control and Prevention, Group B Streptococcus is the most common cause of life-threatening infections in newborns

and pregnant women. It can sometimes cause urinary tract infections, skin infections, bone infections, blood infections and pneumonia, particularly in vulnerable individuals, such as the elderly and those with diabetes. The bacteria can be passed on to the baby through the amniotic fluid (a clear liquid that surrounds and protects the unborn baby in the womb) or as the baby passes through the birth canal during labor.

Streptococcus pneumoniae causes pneumonia, respiratory infections, ear and sinus infections, septicemia, endocarditis, bloodstream infections (bacteremia) and meningitis (inflammation of the membranes that surround the brain and spinal cord). It is frequently associated with children in daycare. Mortality for all strains can be as high as 50 percent depending on the clinical presentation. The symptoms of *S. pneumoniae* infections vary according to the site of infection. It may be present in the throat or on the skin without causing any symptoms or illness at all. When *Streptococcus pneumoniae* organisms are present in a part of the body that is normally sterile such as the bloodstream or spinal fluid, it is called an “invasive” infection, and is more likely to require hospitalization. *Streptococcus pneumoniae* is the most common cause of community-associated pneumonia, which can cause severe and life-threatening illness in infants and the elderly.



SURVEILLANCE SUMMARY

Surveillance History

Nationally notifiable since 1995

Population at Higher Risk

- Infants and elderly
- Children in daycares
- Persons with diabetes

Notable Outbreaks

None

Cases Per Year

128

Seasonality

Winter

Caseload

3,780

Disease Transmission

Streptococci are spread by contact with respiratory droplets or through direct contact with persons who are infected particularly through contact with open wounds or sores, coughs and sneezes. Indirect contact through contam-

inated objects can result in infection. Individuals with compromised immune systems are at a higher risk of infection and disease.

Transmission of group B streptococcus from mother to infant occurs shortly before or during delivery. After delivery, infants are

occasionally infected via person-to-person transmission in the hospital nursery. Two distinct forms of illness occur. Early onset disease (1-7 days after delivery) is characterized by sepsis, respiratory distress, apnea, shock, pneumonia and meningitis, is acquired in utero or during delivery, and occurs more frequently in low birth weight infants. Late onset disease (from 7 days to several months after delivery) is characterized by sepsis and meningitis, is acquired by person-to-person contact, and occurs in full-term infants.

Epidemiology in Houston

In Houston, between 2005 and 2014, 1,275 cases of invasive streptococcal disease were reported to the Bureau of Epidemiology.

In Houston, the majority of cases (446 cases) of invasive streptococcus occurred in persons > 60 years of age, followed by ages 50-59 and infants.

The number of reported cases of invasive group A streptococcus disease in Houston has continued to increase since 2004. Reported cases ranged from 15 (0.6 cases per 100,000 population) in the year 2005 to 60 (2.9 cases per 100,000 population) in 2014.

The highest age-specific incidence rates of invasive group A streptococcal disease are seen in infants.

In Houston, the highest age-specific incidence rates of invasive Group B strep were seen in infants, followed by adults aged 60 years or more.

Public Health Action

The Centers for Disease Control and Prevention guidelines for the treatment and prevention of Group B Streptococcal disease are recommendation for universal prenatal screening for vaginal and rectal group B strep colonization of all pregnant women at 35-37 weeks gestation. This and other awareness and prevention activities have resulted in a steady decline in the number of early onset Group B Streptococcal infections in newborns.

Vaccination with pneumococcal conjugate vaccine (PCV) and polysaccharide vaccine (PPV) can help prevent infection with *Streptococcus pneumoniae*. The PPV has been available since 1977 and is used mainly for adults over 65 and those with certain chronic illnesses such as diabetes or pulmonary disease. Only one dose is needed unless it is given prior to age 65. When a second dose is needed, it should be given at least five years after the first dose. PPV is not effective in children less than two years old.

PCV has been available since 2000 and is recommended for all children between ages 2-23 months and for certain children up to age 5. *Streptococcus pneumoniae* infections can be prevented by careful and frequent hand washing, especially after contact with respiratory secretions or items that may be contaminated with the bacteria.

Multidrug-resistant *Streptococcus pneumoniae* (MDRSP)

Antibiotics are commonly used to treat bacterial infections, like *Streptococcus pneumoniae* (pneumococcus). However, bacteria can evolve from exposure to antibiotics and adapt to new environments by changing their structures or mutating their genetics. This allows bacteria to survive despite antibiotic use and is known as antibiotic resistance.

S. pneumoniae has become resistant to one or many antibiotics and can lead to treatment failures. The number of *S. pneumoniae* that have developed resistance to multiple types of antibiotics is increasing, and is known as multidrug-resistant *Streptococcus pneumoniae* (MDRSP). This is a major concern because MDRSP is challenging to treat and carries a higher risk of causing complications.

MDRSP is associated with increased costs compared to infections caused by non-resistant (susceptible) pneumococcus. These costs include hospital readmission from treatment failures; need for alternative antibiotics that are often times more expensive; need for surveillance to track resistance patterns; educational requirements for patients, physicians, and microbiologists; and the development of new antibiotic drugs. The Public health community is working to reduce MDRSP by educating patients and physicians on the dangers associated with the overuse of antibiotics and by promoting pneumococcal vaccinations.

Public health campaigns advocate for increased vaccination rates as a method of disease prevention, which can lead to fewer infections and reduce the need for antibiotic use.

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Legionellosis

INTRODUCTION

Legionellosis is an acute bacterial disease caused by gram negative bacteria of the genus *Legionellae*. *Legionella pneumophila* is the most common species associated with the disease. There are two distinct forms of legionellosis: Legionnaires' disease and Pontiac fever. The more severe

respiratory, Legionnaires' disease, is characterized by fever, myalgia, cough, and diffuse pneumonia. Other symptoms may include diarrhea, abdominal pain, and a non-productive cough. Death can occur in 10-15% of legionellosis cases. The second form, Pontiac

fever, is a milder illness without pneumonia, and is self-limiting. The incubation period for Legionnaires' disease is 2-10 days, most often 5-6 days; Pontiac fever takes 5-66 hours, most often 24-48 hours (Heymann, 2008).



Disease Transmission

Legionellosis is spread via airborne transmission from an environmental source. Direct person-to-person transmission has not been documented. The bacteria can be found in stagnant water, particularly water heated between 77°F and 108°F. Such water can be found in hot water tanks, air conditioning cooling towers, and spas. *L. pneumophila* becomes a danger when water containing the bacteria is aerosolized and inhaled by a susceptible person (Heymann, 2008) (Texas Department of State Health Services, Legionellosis, Task Force/Recommendations, 2014).

Risk factors for infection include age (most cases are over 50 years of age), a history of diabetes mellitus, renal disease and malignancy, chronic lung illnesses, a compromised or weakened immune system, prior organ transplantation, and heavy smoking. The disease affects males at a much higher rate, with a male to female ratio of approximately 2.5 to 1. Nationally, outbreaks of Legionellosis have been associated with spas, whirlpools, cruise ships, cooling towers, grocery store misting systems, and potting soil (Heymann, 2008) (Centers for Disease Control and Prevention, 2013).

Epidemiology in Houston

Between 2005 and 2014, 78 cases of legionellosis were reported to the HHD Bureau of

Epidemiology. The trend in the City of Houston was similar that of Texas, in which there was a substantial increase of reported cases from 2011 to 2014. In Houston, the case count went from 2 in 2011 to 21 in 2014. The cause of this increase in cases in both Texas and the City of Houston may be due to improvement of legionellosis surveillance, increased electronic laboratory reporting, and increased use of laboratory tests to diagnosis illnesses.

Of the 78 Houston cases, over half were 60 years or older (57.7%), followed by 40 to 49 years (17.9%), 50 to 59 years (14.1%), and 30 to 39 years (7.7%). Similarly, the majority of reported cases in Texas were also within

SURVEILLANCE SUMMARY

Surveillance History

Notifiable in Texas since 1984

Population at Higher Risk

- Immunocompromised persons
- Persons with diabetes history or chronic lung illnesses
- Heavy smokers

Notable Outbreaks

2 outbreaks

Cases Per Year

8 per year

Seasonality

Summer

Caseload

248

LEGIONELLOSIS CASE COUNT

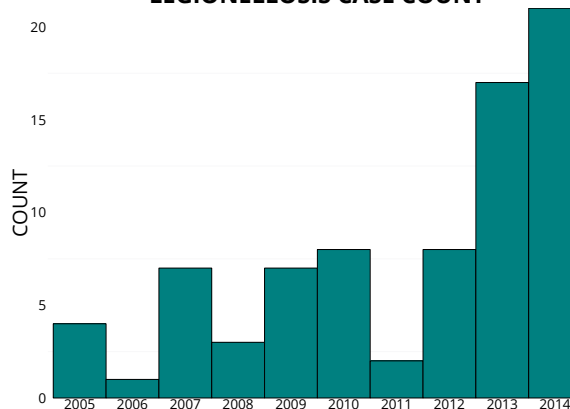


FIGURE 1. Legionellosis case count.

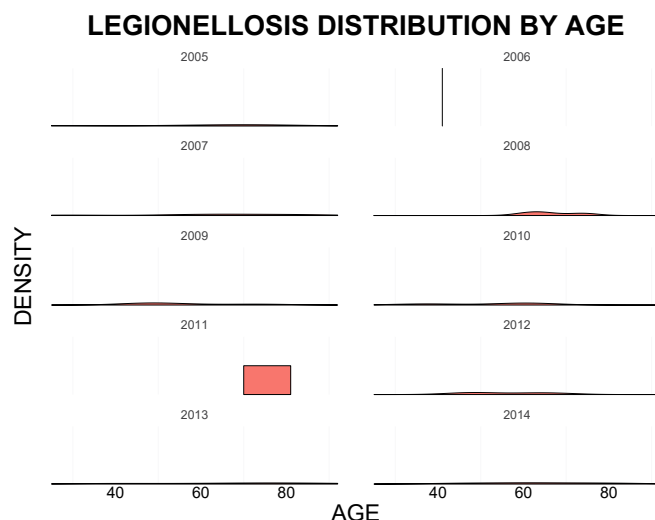


Figure 2 Legionellosis case count by age.



Figure 3 Legionellosis case count by race.

the age group of 60 years or older (54.8%) from 2009 to 2014 (Texas Department of States Health Services, 2015).

From 2005 to 2014, 50 (64.1%) of the Houston cases were male, and 28 (35.9%) were female. The majority of affected persons were White (37.1%), followed by Black (28.2%), and Hispanic (16.7%).

Only 6.4% of the 78 Houston cases were known to be fatal, which is well below the average of 10-15% nationwide. Two outbreaks were identified between 2005 and 2014 in the City of Houston, and both were associated with an exposure in two separate apartment dwellings, with two cases per outbreak.

From 2005 to 2014, there were 1,270 legionellosis cases reported in Texas. The case count more than doubled from 111 cases in 2011 to 256 cases in 2014 (Texas Department of States Health Services, 2015). Annually, the Centers for Disease Control and Prevention (CDC) estimates that between 8,000 and 18,000 legionellosis cases occur in the United States. Only a fraction of these cases are reported to public health. The majority of reported cases are sporadic; however, travel-associated outbreaks, outbreaks in community settings, and health-care and occupational outbreaks do occur in the United States (Centers for Disease Control and Prevention, 2013).

Public Health Action

Surveillance systems enable the Houston Health Department to follow up on reported cases. Each case within the City of Houston jurisdiction is contacted to obtain potential exposures and identify additional cases in order to implement control measures in outbreaks to prevent more cases.

Man-made water supplies are the primary sources for legionellosis; therefore conditions known to enhance *Legionella* growth need to be avoided. Cooling towers should be drained when not in use and mechanically cleaned at least twice a year to remove buildup and sediment. Appropriate biocides should be used to limit growth of *Legionella* bacteria and the formation of protective layer of microorganisms. Maintaining hot water system temperatures at 122°F or higher may reduce the risk of transmission. Also, tap water should not be used in

respiratory therapy devices (Heymann, 2008) (Occupational Safety and Health Administration, 2015).

There are no vaccines that can prevent legionellosis. Persons at increased risk of infection may choose to avoid high-risk exposures, such as being in or near a hot tub or spa (Centers for Disease Control and Prevention, 2013).



Legionnaire Hot (Water) Zone

Overview

On September 13, 2012, the Houston Health Department (HHD), Bureau of Epidemiology (BOE) received the first reported case of Legionellosis in Houston, Texas from a hospital Infection Control Provider. This report was followed by a second report from another hospital via electronic lab reporting on September 14, 2012. Epidemiologists initiated an investigation to determine if the two community-acquired Legionnaires disease cases were acquired from residential potable water because both cases resided in the same apartment building.

The BOE completed the investigation and found the two Legionnaire's disease cases were caused by *Legionella pneumophila* species, the hot water system in the apartment building was contaminated with *L. pneumophila* species, and the apartment building was the only potential exposure during the 10 day incubation period; suggesting an epidemiological link. Even though the *Legionella* serogroup was not confirmed via clinical and environmental isolates, the epidemiological link is supported by the spatial – temporal relationship between the two cases. Public health actions taken were to complete the epidemiological investigation, to notify hospital infection control staff of a possible community-acquired Legionella outbreak to increase diagnostic capacity, to coordinate with Environmental Health to decontaminate the hot water system at the apartment, and to disseminate information regarding Legionnaire's disease to the apartment building management and tenants to prevent and control additional Legionellosis cases. Recommendations included notifying the apartment building owner to establish a Legionella control and management program, informing apartment building residents to seek medical evaluation if they had symptoms of Legionnaire's disease, and requesting healthcare staff to submit specimens to a laboratory for isolate identification.

Investigation

Two cases of community-acquired Legionnaire's disease were identified in two individuals whose illness was associated with the hot water system in their apartment building in Houston, Texas. The reported date of onset for the first case was 09/01/2012 and the individual was discharged after 2 days of medical care in the hospital. The reported date of onset for the second case was 09/07/2012 and the individual died after 7 days of medical care in the hospital. The time between admission to the hospital and environmental sampling was 23 days and 15 days respectively. The time between report to the HHD and environmental sampling was 15 days and 14 days respectively. No additional cases of Legionnaires disease or Pontiac fever associated with the apartment building were reported during the investigation period.

Outbreak Characteristics

Both cases occurred in September in the Northwest part of Houston. September has been identified in the literature as one of the peak months for Legionnaire's disease. In 2010, there were 3,346 incidence cases of Legionellosis in the US. According to the Center for Disease Control (CDC), Texas had 136 incidence cases of Legionellosis in 2010. The highest number of incidence cases occurred during the months of June to October.

Cases ranged in age from 63 to 68 years (mean 65.5 years), 50% were male, one of the two cases was White and the other case was Hispanic. Nationally the highest incidence rates (3.28 cases per 100,000) were among individuals older than 65 year of age.

Both cases had a positive history of medical risk factors: cigarette smoking (10 cigarettes a day), diabetes, and hypertension. The case that resulted in death was home bound.

Neither case spent any nights away from home in the 10 days before disease onset. In the 10 days before onset one case had initiated employment with a senior living facility (08/30/2012).

The mean hospital stay for survivors and non-survivors was 4.5 days. Since neither case had visited nor stayed at a healthcare setting in the 10 days prior to onset of symptoms, neither case was nosocomially acquired.

Laboratory testing was performed in the clinical samples. In both clinical specimens, *Legionella pneumophila* serogroup 1 was identified by urine antigen test. Neither case had a clinical isolate available to identify the serogroup. Since the clinical protocol for treating pneumonia requires antibiotic treatment before the urine antigen test results are available, it is rare to obtain clinical isolates from sputum cultures. It is not known, if serology or direct fluorescent antibody testing was performed.

Environmental investigation was warranted because the two sporadic cases of community-acquired Legionnaire's disease occurred within a one week period and the two individuals were exposed to a limited number of water sources. The apartment building houses 105 units. The apartment building had no history of prior violations with COH Environmental Health Division.

The Environmental Health Division performed the environmental assessment and provided the BOE with a case summary. The environmental samples were collected by the apartment complex management. A private contractor lab processed the samples. The environmental sample collected on September 28, 2012 identified *L. pneumophila* serogroup 14 in the hot water system and no *L. pneumophila* was detected in the chiller system. After disinfection, the environmental sample collected on October 17, 2012 did not identify any *L. pneumophila*.



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Leishmaniasis

INTRODUCTION

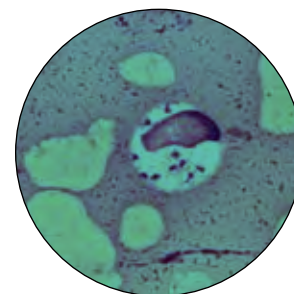
Leishmaniasis is a disease caused by infection with *Leishmania* parasites. The parasites are spread through the bite of infected phlebotomine sand flies. There are over 30 species of *Leishmania* capable of infecting sand flies. The disease is found in the tropics, subtropics and southern Europe,

threatening 350 million people in over 88 countries (World Health Organization, 2015). The disease is not common in Texas or other parts of the United States. Most cases identified in the US are the result of traveling to or living in other countries (Centers for Disease Control and Prevention, 2013).

The disease presents in various forms, with the most common forms being cutaneous leishmaniasis and visceral leishmaniasis. Symptoms of the disease vary depending on the form of leishmaniasis. Cutaneous leishmaniasis is characterized by skin sores that begin as lumps or bumps, but can develop into ulcers if not treated. Visceral leishmaniasis affects internal organs (spleen, liver or bone marrow are commonly impacted) causing fever, weight loss, enlargement of spleen and abnormal blood tests. In some individuals,

infection with leishmaniasis can be asymptomatic regardless of the form of the infection.

Cutaneous leishmaniasis usually heals without treatment, providing the infected person immunity to further infection (Texas Department of State Health Services, 2011). Visceral leishmaniasis is much more difficult to treat if symptoms do develop. It requires long-term use of anti-parasitic medication; however, medications have traditionally been unsuccessful in treating the condition (Texas Department of State Health Services, 2011). Leishmaniasis became a reportable condition in Texas in 2007. From 2007 to 2014, 44 cases of leishmaniasis were reported in Texas. All confirmed or suspect cases are to be reported to local health departments within 1 week. From 2005 to 2014, HHD reported 3 cases, all of which were in 2012.



SURVEILLANCE SUMMARY

Surveillance History

Notifiable in Texas since 2007

Population at Higher Risk

Travelers to endemic areas

Notable Outbreaks

None

Cases Per Year

0 per year

Seasonality

None

Caseload

4

Disease Transmission

Leishmaniasis is a parasitic disease; the carrier of the infection is the parasite, *Leishmania*. The parasite infects phlebotomine sand flies which pass the infection to the human population. Sand flies breed in forested areas, burrows of small rodents and caves. These locations are where humans are most likely to become infected with the disease (World Health Organization, 2015). The bites from infected female sand flies are the main mode of transmission for the disease (Centers for Disease Control and Prevention, 2013).

The two forms of leishmaniasis, visceral and cutaneous, that are seen in humans have differing incubation periods. Cutaneous leishmaniasis has an incubation period that ranges from 7 days to as long as several months.

Visceral leishmaniasis has an incubation period that ranges from 10 days to several years; in most cases, symptoms develop after two to 6 months.

Sand flies are usually active during cooler times of the day which correspond to the early evening and early morning hours. There is a risk of infection during hotter times of day if an area that is home to sand flies is disturbed during their usual rest period.

Epidemiology in Houston

Since Leishmaniasis became a reportable condition in 2007, Houston has reported 3 cases. Most cases of leishmaniasis that are reported in the U.S. originate in Latin America. Most cases were identified in areas from northern Mexico to northern Argentina

(Texas Department of State Health Services, 2011).

Public Health Action

There are no vaccines or drugs that prevent leishmaniasis. The most effective means of preventing infection is to minimize the risk of being bitten by sand flies. According to the recommendations made by the CDC, when outdoors:

- Minimize the amount of exposed skin by wearing long-sleeved tops and pants, tuck shirts into pants
- Apply insect repellent to exposed skin and under the ends of sleeves and pant legs. The most effective repellents generally are those that contain the chemical DEET

When indoors,

- Stay in well-screened or air-conditioned areas.
- Spray living and sleeping areas with an insecticide to kill insects.
- Use a bed net tucked under the mattress if not sleeping in a well-screened or air-conditioned area. If possible, use a bed net that has been soaked in or sprayed with a pyrethroid-containing insecticide. The same treatment can be applied to screens, curtains, sheets, and clothing (clothing should be retreated after five washings).

All individuals are at risk of contracting leishmaniasis if they live or are visiting areas that are home to populations of phlebotomine sandflies. Travelers visiting Afghanistan, Algeria, Brazil, Iran, Iraq, Peru, Saudi Arabia and Syria should be cautious during the active period of sandflies since these countries account for more than 90% of the world cases of cutaneous leishmaniasis (Ashford, Desjeux, & de Raadt, 1992).



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Listeriosis

INTRODUCTION

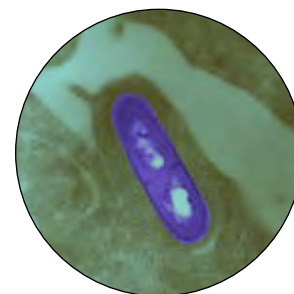
Listeriosis is a bacterial infection caused by eating food contaminated with the bacterium *Listeria monocytogenes*. While rare in the United States, *Listeria* accounts for 1600 illnesses and 260 deaths yearly (Painter & Slutsker, 2007).

The general symptoms associated with listeriosis are fever

muscle ache, stiff neck, and instances of diarrhea, confusion and convulsions. These symptoms vary from person to person depending on health status and immune system condition. People with healthy immune systems and no other pre-disposing condition may be asymptomatic after infection (Painter & Slutsker, 2007). High risk individuals like newborns, older adults, individuals with auto-immune diseases or receiving

immune-system suppressing drugs have the highest incidence rates of the disease (Goulet, King, Vaillant, & de Valk, 2013).

Listeriosis has been a notifiable condition in Texas since 1986. Suspect or confirmed cases are to be reported to the local health department within one week. The Houston Health Department (HHD) had 2 reported listeriosis cases in 2014.



SURVEILLANCE SUMMARY

Surveillance History

Notifiable in Texas since 1986

Population at Higher Risk

Pregnant women

Notable Outbreaks

One (2005)

Cases Per Year

5 per year

Seasonality

None

Caseload

83

Disease Transmission

Listeriosis is transmitted through the consumption of contaminated food. It is associated with deli meats, raw vegetables, seafood salads, unpasteurized milk, and soft Mexican cheese (queso fresco). Almost all listeriosis infections are invasive, meaning that the infection spreads beyond the gastrointestinal tract to other parts of the body. The infection has an incubation period that ranges from 3 to 70 days (Goulet, King, Vaillant, & de Valk, 2013).

Over 90% of people who get *Listeria* infections are in a higher risk group. Persons with AIDS are almost 300 times more likely to be infected with listeriosis than people with

healthy immune systems (U.S. Department of Health and Human Services, 2015). Pregnant women are about 20 times more likely than other healthy adults to be infected with listeriosis, with about one-third of listeriosis cases occurring during pregnancy (U.S. Department of Health and Human Services, 2015). Infected pregnant women may experience only a mild, flu-like illness; however, infections during pregnancy can lead to miscarriage or stillbirth, premature delivery, and serious infections in the newborn.

Epidemiology in Houston

Listeriosis is rare in Houston, averaging 5 cases per year. Between 2005 and 2014, there

TABLE 1: NUMBER OF LISTERIOSIS CASES BY AGE GROUP, 2005-2014

Age Group	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Grand Total
0 - 4	1	1	6	0	0	0	0	0	0	0	8
5 - 19	1	0	1	0	0	0	0	0	0	1	3
20 - 64	3	4	8	3	4	6	1	2	3	1	36
Unknown	0	1	0	0	0	0	0	0	0	0	1
Total	5	6	15	3	4	6	1	2	4	2	48

TABLE 2: NUMBER OF LISTERIOSIS CASES BY RACE AND ETHNICITY, 2005-2014

Racial Group	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Grand Total
Asian	0	0	0	0	0	1	0	1	0	0	2
Black	0	0	2	1	0	0	0	0	1	2	6
Hispanic	4	3	9	1	2	3	0	0	1	0	23
White	1	1	3	1	1	2	1	1	2	0	13
Other	0	1	0	0	0	0	0	0	0	0	1
Unknown	0	1	1	0	1	0	0	0	0	0	3
Total	5	6	15	3	4	6	1	2	4	2	48

were a total of 48 cases reported to the HHD. There was a peak in 2007 of 15 reported cases. In all other years, the number of cases reported ranged from a high of 6 cases in 2006 and 2010 to a low of 1 case in 2011 (Table 1). The 2007 spike in cases was not linked to any common source outbreak; it was the result of more sporadic cases during that year.

Listeriosis mostly impacts infants, pregnant mothers and the elderly. Of the 48 cases reported: six cases were in pregnant women, eight cases were in newborn infants, and 16 cases were from ages 10 to 39 and 20 cases in individuals 60 years and older.

The disease burden was greater in Hispanics than in any other racial group. From 2005 to 2014, individuals who identified as Hispanic accounted for 23 of the 48 cases (Table 2). Hispanics have a higher risk factor for contracting listeriosis since they are more likely to eat unpasteurized cheeses like queso fresco (Centers for Disease Control and Prevention, 2001).

Public Health Action

The HHD laboratory analyzes isolates of bacteria for each case of *Listeria* in order to subtype the isolate. By “subtyping” we mean that isolates of *Listeria* are grouped into sub-clusters of isolates based on DNA analysis. With subtyping, we gain additional information. Subgroups of *Listeria* cases, grouped together by DNA analysis, are very closely related and likely to come from the same source.

This information can help an epidemiologist determine which cases likely ate a common food item.

Before 2014, *Listeria* isolates were subtyped by a laboratory technique, called pulsed-field gel electrophoresis (PFGE). PFGE is a biotechnology that allows the laboratory to determine a DNA “fingerprint”. Cases with indistinguishable DNA fingerprint are likely caused by a common food exposure.

In 2014, the Centers for Disease Control and Prevention (CDC) began using a new laboratory technique, called whole genome sequencing, to subtype *Listeria* bacteria. As part of the “*Listeria*

initiative” implemented in 2014, *Listeria* isolates are now sent to the CDC laboratory which sequences the entire genome. This enables investigators to create dendrograms based on DNA analysis that can more precisely determine which isolates are related. The laboratory thus provides epidemiologists with a good “head start” in determining which cases of *Listeria* are associated with an outbreak.

The bacteria that causes listeriosis can survive in cold temperatures, keeping the refrigerator at 40°F or lower and the freezer 0°F or lower can help eliminate *Listeria*. It is recommended by the CDC that higher risk individuals should take the following precautions:

- Avoid eating hot dogs, luncheon meats, cold cuts, other deli meats (e.g., bologna), or fermented or dry sausages unless they are heated to an internal temperature of 165°F or until steaming hot just before serving.
- Avoid getting fluid from hot dog and lunch meat packages on other foods, utensils, and food preparation surfaces, and wash hands after handling hot dogs, luncheon meats, and deli meats
- Avoid eating soft cheeses such as feta, queso blanco and queso fresco unless it is made with pasteurized milk.

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Lyme Disease

INTRODUCTION

Lyme disease is caused by the bacterium *Borrelia burgdorferi*, and is the most common tick-borne illness in the United States (CDC). The bacterium is transmitted to humans through the bite of the deer tick (*Ixodes scapularis*). Since discovery of the disease in children and adults in Lyme,

Connecticut, in 1977, its incidence has increased steadily in the United States (Wright, Riedel, Talwani, & Gilliam, 2012) (Lyme Disease - CDC, 2015) (Stanek, Wormser, Gray, & Strle, 2012).

Between 1992 and 2006, the number of cases of Lyme disease reported to the Centers for Disease Control and Prevention (CDC) increased from 9,908 cases per year to 19,931 cases per year (Wright, Riedel, Talwani, & Gilliam, 2012). Between 2007 and 2014, about 30,000 cases were reported to the CDC annually. However, a recent study conducted by the CDC estimates that approximately 300,000 cases of Lyme Disease are diagnosed in the United States annually (10 times greater than the number of cases reported) (Lyme Disease – CDC, 2015) (Kuehn, 2013).

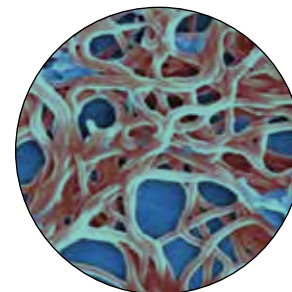
There are three clinical stages of Lyme disease (early localized, early disseminated, and late) and clinical manifestations are different at each stage. The 'early localized' stage occurs 3 to 30 days after a tick bite, and presents with the characteristic erythema migrans rash (80% of patients develop this rash). Erythema migrans appears as a uniform red-colored oval to circular rash with a diameter of 16 cm (range of 5 to 70 cm), and eventually resolves, even without treatment. This stage can also be accompanied by symptoms similar to a viral illness (fatigue, malaise, fever, chills, muscle pain, and headache) (Wright, Riedel, Talwani, & Gilliam, 2012) (Lyme Disease - CDC, 2015).

If left untreated, the bacteria spread from the skin to other organs of the body via the blood and lymphatic system. The 'early disseminated stage' can present with Lyme carditis (heart palpitations or an irregular heart beat), multiple skin lesions (multiple

erythema migrans lesions), joint and muscle pain (and joint swelling), inflammation of the brain and spinal cord, and facial paralysis (characterized by loss of muscle tone or droop on one or both sides of the face). Lyme carditis is not a common complication, occurring in only 4 to 10 percent of patients (Lyme Disease - CDC, 2015) (Stanek, Wormser, Gray, & Strle, 2012).

The 'late' stage usually manifests with arthritis (occurs in up to 60 percent of patients), and peripheral neuropathy (characterized by shooting pains, numbness, or tingling in the hands or feet). (Wright, Riedel, Talwani, & Gilliam, 2012) (Lyme Disease - CDC, 2015).

The presence of a single erythema migrans lesion, in addition to a history of possible exposure to infected ticks, is sufficient to make a clinical diagnosis. Laboratory diagnosis can



SURVEILLANCE SUMMARY

Surveillance History

Notifiable in Texas since 1986

Population at Higher Risk

Exposure to tick bites in high-incidence states

Notable Outbreaks

None

Cases Per Year

5 per year

Seasonality

Summer

Caseload

464



be utilized in the form of direct (i.e. culture that detects the bacterium itself) or indirect (i.e. serology to detect antibodies that were created in response to the bacterium) testing (Alao & Decker, 2012) (Lyme Disease - CDC, 2015).

However, the state of Texas requires laboratory confirmation

Disease Transmission

The bacterium responsible for Lyme disease, *Borrelia burgdorferi*, is spread to a human via the bite of an infected tick. The blacklegged tick (or deer tick, *Ixodes scapularis*) spreads the disease in the northeastern, mid-Atlantic, and north-central United States. The western blacklegged tick (*Ixodes pacificus*) spreads the disease on the Pacific Coast (Lyme Disease - CDC, 2015) (Wright, Riedel, Talwani, & Gilliam, 2012).

Ticks can attach to any part of the human body but are often found in hard-to-see areas such as the groin, armpits, and scalp. In most cases, the tick must be attached for 36 to 48 hours or more before the Lyme disease bacterium can be transmitted (Lyme Disease - CDC, 2015).

Humans are most commonly infected by immature ticks called nymphs. Nymphs are tiny (less than 2 mm) and difficult to see; they feed during the spring and summer months. Adult ticks can also transmit Lyme disease bacteria, but they are much larger and are more likely to be discovered and removed before they have had time to transmit the bacteria. Adult *Ixodes* ticks are most active during the cooler months of the year (Lyme Disease - CDC, 2015).

Epidemiology in Houston

Texas is considered a low-incidence state for Lyme disease. In Houston, an average of 5 cases were reported annually from 2005 to 2014. During this time frame, the number of cases involving females was greater than in males almost every year, as seen in Figure 1.

in order for a case of Lyme disease to be reportable (Epi Case Criteria Guide, 2015, 2015). In Texas, from 2005 to 2014, the average number of cases reported annually to the state health department was 103 (Texas DSHS - Human Cases for Last Ten Years, 2015).

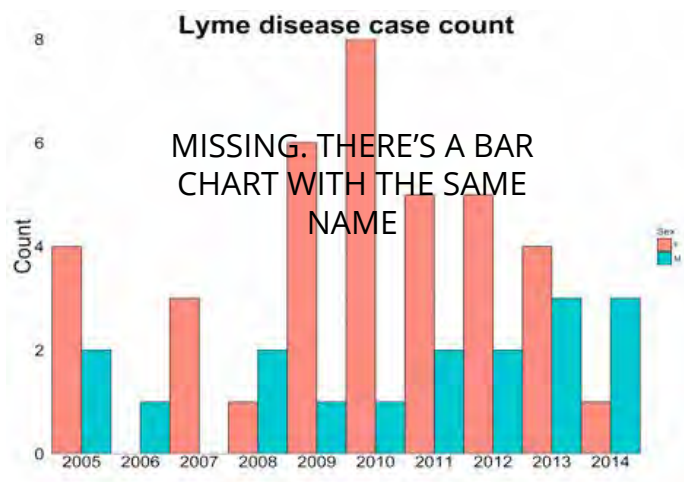


FIGURE 1. Lyme disease case count by sex.

Public Health Action

The prevention of Lyme disease involves several strategies. The most important measure is to avoid areas of high tick numbers, such as wooded or grassy areas. Other strategies involve using an insect repellent (i.e. DEET), wearing light-colored protective clothing, performing frequent body checks for ticks following outdoor activities, bathing following outdoor activities, and reducing tick habitat (i.e. grass mowing, deer exclusion fencing, removing leaf litters and wood-piles). Removal of ticks within 24 hours of attachment can usually prevent acquisition of Lyme disease (Wright, Riedel, Talwani, & Gilliam, 2012) (Lyme Disease - CDC, 2015).

Most cases of Lyme disease can be treated successfully with a few weeks of oral antibiotics (Alao & Decker, 2012).

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Malaria

INTRODUCTION

Malaria is a leading cause of morbidity and mortality world wide. It is caused by parasites from the genus *Plasmodium*. There are five species that infect humans: *P. falciparum*, *P. vivax*, *P. knowlesi*, *P. ovale*, and *P. malariae*. Global travel and commerce have increased the

risk of exposure to malaria and reintroduced the disease to regions where it had been eradicated.

Malaria is caused by a parasite that infects the Anopheles mosquito that commonly feeds on humans. People who contract malaria typically present with high fevers, chills, flu-like illness, headaches, enlarged spleen, perspiration, and general malaise. In severe malaria (caused by *P. falciparum*), clinical findings such as confusion, coma, neurologic focal signs, severe anemia, and respiratory

difficulties can occur. Although malaria can be a deadly disease, illness and death from malaria can usually be prevented. Approximately 1,500 cases of malaria are diagnosed in the United States each year. The vast majority of cases in the United States are in travelers and immigrants returning from countries where malaria transmission occurs, many from sub-Saharan Africa and South Asia. Children of immigrants from endemic countries are at risk of bringing the disease into the U.S.

SURVEILLANCE SUMMARY

Surveillance History

Nationally notifiable since 1944

Population at Higher Risk

Travelers in endemic areas

Notable Outbreaks

None

Cases Per Year

18 per year

Seasonality

Summer

Caseload

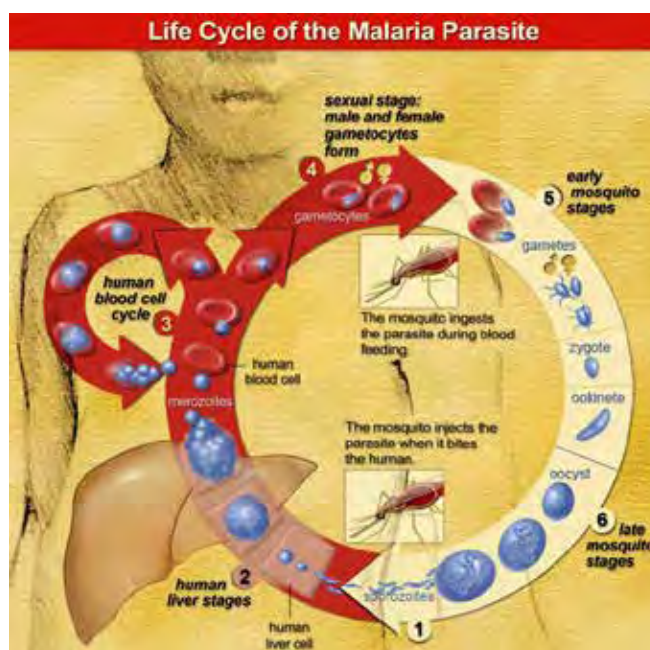
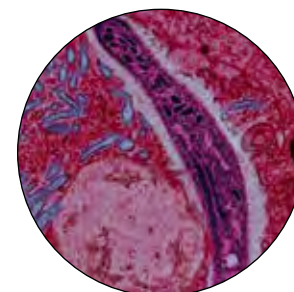
222

Disease Transmission

A person contracts malaria from the bite of an infective female Anopheles mosquito. Only the Anopheles mosquitoes can transmit malaria and must have been infected through a previous blood meal taken from an infected person. Malaria cannot be spread directly from person to person.

Once a person is bitten, the parasite enters the bloodstream and travels to the liver. The infection develops in the liver before re-entering the bloodstream and invading the red blood cells. The parasites grow and multiply in the red blood cells. At regular intervals, the infected blood cells burst, releasing more parasites into the blood. Infected blood cells usually burst every 48 - 72 hours. Each time they burst, the infected person will have a bout of fever, chills and sweating.

In the United States, malaria is usually imported from travelers who visit countries where the disease is endemic. Some of these travelers are oil workers working offshore in endemic countries. Malaria can also be spread through blood transfusions and the sharing of needles, but this is very rare.



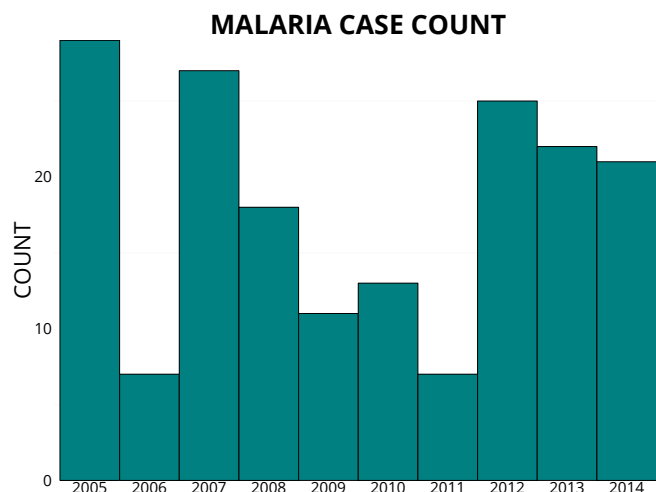


FIGURE 1. Malaria case count.

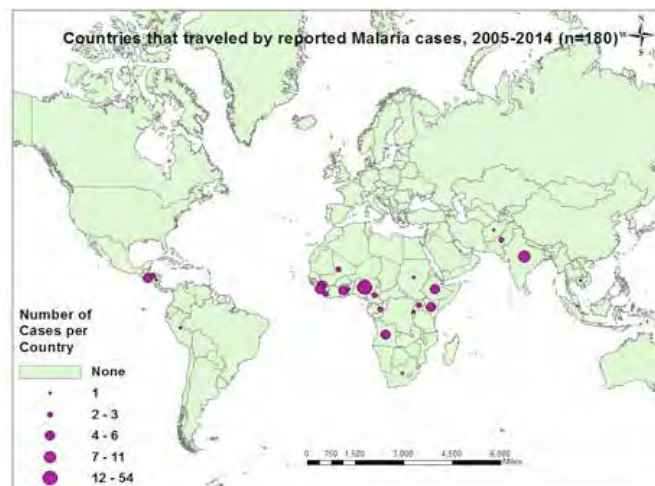


FIGURE 15. Country of origin counts for reported Malaria cases.

Epidemiology in Houston

Malaria is predominantly a tropical disease which is endemic to many regions of the world. Houston is home to a large population of immigrants from malaria endemic countries. The city has an emerging population of African national communities (including one of the largest Nigerian communities in the nation), and many of these residents travel with their families to visit their home countries. This population and others who travel to these countries are at increased risk of exposure to the malaria parasite. Malaria is rarely transmitted in the United States (Centers for Disease Control and Prevention, 2012).

A total of 180 cases of Malaria were reported to the Houston Health Department Bureau of Epidemiology from 2005 to 2014. All 180 cases were imported with no known local transmission of the disease. There were more cases of malaria reported in males compared to females. This is most likely due to the fact that most of the reported cases come from providers that work with oil workers in endemic countries. Some of these individuals were likely to have taken prophylaxis treatments in incomplete dosages. The chart below shows the source of origin for imported malaria cases in Houston, Texas.

The vast majority of cases in the United States are in travelers and immigrants returning from countries where malaria transmission occurs; any from sub-Saharan Africa and South Asia. Nigeria and India reported higher numbers of cases than other countries.

Public Health Action

Surveillance activities in Houston focus on imported cases of malaria and local malaria transmission. Prophylaxis is the

preventative medicine for malaria that acts to suppress and then eliminate the parasite after it invades the blood cells but before it multiplies. It is important to note that prophylaxis is not 100% effective in preventing disease. Vaccines are being developed for malaria but currently no vaccine exists for malaria. The use of mosquito repellants, such as DEET and mosquito nets in endemic areas is highly recommended.

Malaria is a curable disease if diagnosed early and treated promptly. Malaria can be suspected based on the patient's travel history, symptoms, and the physical findings at examination. For a definitive diagnosis, laboratory tests must demonstrate the presence of malaria parasites or their components. It is important for health care providers to obtain a travel history from febrile patients. Fever in a person who has recently traveled in a malaria-endemic area should always be immediately evaluated using the appropriate diagnostic tests for malaria.



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Multi-drug Resistant Organisms

INTRODUCTION

Multi-drug resistant organisms (MDROs) are defined as Healthcare-associated infections, predominantly caused by bacteria that are resistant to one or more classes of antimicrobial agents. Antibiotic resistant bacteria cause more than 2 million illnesses and at least 23,000 deaths each year in the

United States. MDROs are found in many health care settings such as acute care hospitals, long term care facilities, nursing homes, and rehabilitation facilities. There are more than 70 identified MDROs. The Texas Department of State Health Services (DSHS) mandated the reporting of Carbapenem-resistant Enterobacteriaceae (CRE)-Klebsiella species, CRE-Escherichia coli, and Multidrug

resistant-Acinetobacter (MDR-A) beginning April 2014. Healthcare facilities in the City of Houston jurisdiction are required to report cases of CRE and MDR-A to the Houston Health Department (HHD) within one working day. HHD investigates all cases of MDRO. Confirmed and probable cases of CRE and MDR-A are reported to DSHS within 30 day.

Disease Transmission

CRE and MDR-A pose very little risk to healthy people. People who have a weakened immune system, chronic lung disease, diabetes, require a prolonged hospital stay, or are taking long courses of certain antibiotics are most at risk of getting MDRO infection. Transmission for CRE and MDR-A organisms can occur via direct person-to-person contact with infected or colonized individuals, particularly contact with wounds or stool of an infected patient. Transmission can also occur via secondary contact with contaminated medical devices (e.g. vascular and urinary catheters), contaminated equipment, and environmental surfaces. Additionally, healthcare workers who frequently touch these objects in the patient's environment often become vectors of transmission if hand hygiene compliance and/or transmission-based precautions are not properly followed.

There is no set incubation period for exposure-to-illness onset. Symptoms associated with CRE and MDR-A infections generally vary based on the site that is infected (e.g., cough if in the lungs, urinary symptoms if in the bladder) but can also include general symptoms like fever or chills. The period of communicability is unknown and may last as

long as the organism is present in the individual. Some CRE patients can be colonized for up to a year from initial laboratory diagnosis. Acinetobacter is capable of surviving on inanimate surfaces for extended periods of time, from a few weeks to a month or more. When outbreaks occur, often due to incomplete surface cleaning of the environment and medical instrument, and Acinetobacter becomes endemic to a healthcare setting, implementing successful and sustainable elimination can prove to be extremely difficult.



SURVEILLANCE SUMMARY

Surveillance History

Population at Higher Risk

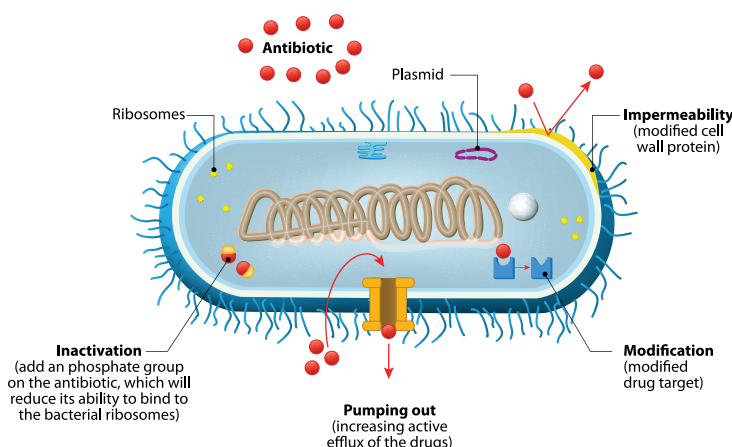
Notable Outbreaks

Cases Per Year

Seasonality

Caseload

MECHANISMS OF ANTIMICROBIAL RESISTANCE



MDRO CASE COUNT BY AGE

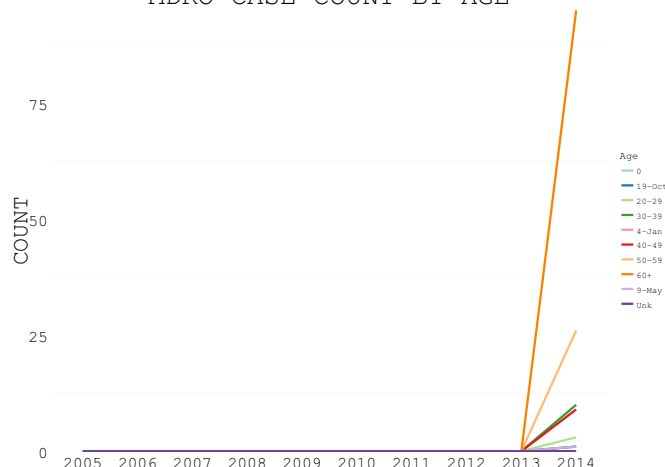


FIGURE 1. MDRO cases by Age groups, 2014.

MDRO CASE COUNT BY RACE

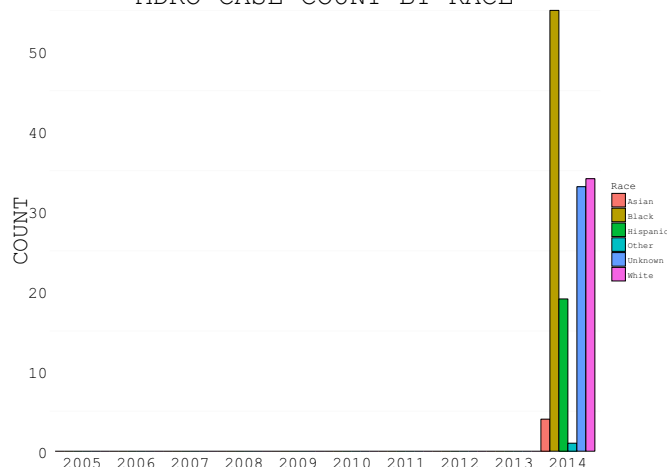


FIGURE 2. MDRO cases by Race, 2014.

Epidemiology In Houston

DSHS mandated the reporting of CRE and MDR-A in April 2014. That year, the Houston Health Department reported 146 cases. Cases were distributed proportionately between males (74) and females (72). The highest number of cases were reported in people 70 years and older (n=62), followed by the age group 60 to 69 years (n=34). Figure 1 shows the case count by age in the year 2014.

Out of 146 reported MDRO cases, race was unknown for 30 cases. The highest number of cases were found in Blacks (n=55), followed by Non-Hispanic Whites (n=34). Figure 2 illustrates the MDRO case distribution by race, where race was known (n=116). The most commonly reported organism was CRE-*Klebsiella pneumoniae* (~60%), followed by MDR-A (~35%).

Public Health Actions

Prevention of antimicrobial resistance depends on appropriate clinical practices that should be incorporated into all routine patient care. These include optimal management of vascular and urinary catheters, prevention of lower respiratory tract infection in intubated patients, accurate diagnosis of infectious etiologies, and judicious antimicrobial selection and utilization. Educational intervention and monitoring for adherence

to recommended environmental cleaning practices are also an important determinant for success in controlling transmission of MDROs. CDC has recommended the use of Standard and Contact Precautions for MDROs. The HHD immediately addresses all reports of CRE and MDR-A. When a report is received, an investigator contacts the infection control at the facility and reviews the control measures in place. During the interview, the investigator also inquire about other relevant information (patient's ICU admission status, travel history, use of any indwelling or invasive devices, previous hospitalization). This allows detection of newly emerging pathogens, monitoring of epidemiologic trends, and measuring the effectiveness of interventions. In addition, HHD also plans to conduct a hospital assessment for Healthcare-associated infections in acute care settings, long term care facilities, outpatient facilities and hemodialysis centers. The assessment will utilize the Infection Control Assessment Tool. This tool was developed by CDC to assist health departments in assessing infection prevention practices and guide quality improvement activities. The basic elements of an infection prevention program are designed to prevent the spread of infection in healthcare settings. When these elements are present and practiced consistently, the risk of infection among patients and healthcare personnel is reduced.

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Measles

INTRODUCTION

Measles is a respiratory disease caused by a virus that is known to only infect humans. The clinical presentation of measles is characterized by a rash, fever (up to 105°F) and the three C's: cough, coryza, and conjunctivitis. Other symptoms include anorexia and diarrhea. The incubation

period of measles ranges from 7 to 21 days, however the rash usually appears about 14 days after the person is exposed. Immuno-compromised persons may not develop a rash (CDC, 2014).

The measles rash usually lasts 5 - 6 days. It generally begins at the hairline and then involves the face and upper neck. During the next 3 days, the rash gradually proceeds

downward and outward, reaching the hands and feet. The rash fades in the same order that it appears, from head to extremities.

For the purpose of public health surveillance, measles can be classified in only one way: confirmed. A confirmed case is a person with symptoms plus a laboratory confirmation or a person who is ill and epidemiologically linked to a laboratory confirmed measles case.

Disease Transmission

Measles is a common disease throughout the world. There is no known animal reservoir, and an asymptomatic carrier state has not been documented. Measles is one of the most contagious of all infectious diseases, with >90% attack rates among susceptible close contacts. It is transmitted from person to person via large respiratory droplets. Airborne transmission via aerosolized droplets has been documented in closed areas (e.g., an office examination room) for up to two hours after a person with measles occupied the area (CDC, 2014). Measles is endemic in many countries and results in approximately 150,000 deaths per year (WHO, 2015). This number has fallen dramatically since the 1980s, when the virus caused 2.6 million deaths per year. Immunity is life-long after infection. Adults born before 1957 are likely to have been infected naturally and are considered immune.

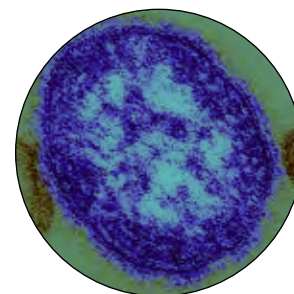
Epidemiology in Houston

Houston has seen only six measles cases from 2005 - 2014. These cases have been sporadic and mostly contracted outside the City of Houston. At least one case was suspected to have been part of a larger multi-state

outbreak. The average annual incidence rate for the past ten years is less than 0.03 cases per 100,000 Houstonians with an average of 0.6 cases per year.

Public Health Action

Public health action is basically comprised of two functions: surveillance for the disease and



SURVEILLANCE SUMMARY

Surveillance History

Nationally notifiable since 1944

Population at Higher Risk

Unimmunized travelers in endemic areas

Notable Outbreaks

None

Cases Per Year

1 per year

Seasonality

Winter and early spring

Caseload

3,506



vaccination of contacts to prevent the spread of measles. A highly vaccinated population, supported by a vigilant surveillance system, is the key to preventing major outbreaks. HHD conducts passive surveillance for measles. Local hospitals, health care providers, schools, and daycare centers are required to report all suspected measles cases to the Bureau of Epidemiology. In addition, lab tests for measles are sent to HHD automatically in an electronic format. In Houston, a single case of measles is considered a potential outbreak situation and requires prompt investigation and implementation of control measures to reduce the disease occurrence and the magnitude of the outbreak. When a report of a suspected measles case is received, either from a physician or a lab test, a prompt investigation is conducted. In Houston, all reports require investigation with identification of close contacts. Investigative efforts include identifying the source of infection and contact tracing of all possible exposed persons. Samples, including throat swabs and serum, are collected and tested for the virus and identification of antibodies.

In outbreaks and special situations, susceptible individuals who have no documentation of receiving the vaccine may be vaccinated. The disease can affect any person who does not have immunity gained from the vaccine or previous exposure. HHD offers immunization services to the community through its health centers. Two doses of the measles vaccine are recommended for all children and adults (McLean, Fiebelkorn, Temte, & Wallace, 2013).

The Measles Outbreak That Almost Was

On August 20, 2013, a local hospital notified the Houston Health Department of a confirmed case of measles in a one year old Hispanic male. The patient presented at the local hospital with cough, congestion, fever and rash. The rash, which started on August 13th began on the cheeks and forehead, and then spread to the rest of the body. A blood specimen was drawn and the patient received supportive care. Avoidance of daycare until the rash resolved was recommended. On August 15, the patient was seen by the family physician as a follow up to the emergency room visit.

The patient was unvaccinated and did not have any known travel history. The initial blood specimen was IgM positive for measles, which was also confirmed by the public health laboratory. A culture from a throat swab specimen was positive for adenovirus but failed to isolate measles, which may be due to the specimen not having been collected during the optimum period of three days from the rash onset.

The Houston Health Department implemented prevention and control measures to stop the spread of disease transmission. The activities included obtaining a line list of exposed individuals, completing active surveillance and distributing a health alert.

The source of infection remains unknown. Type of exposure settings included the patient's household, hospital emergency center, and family physicians office. Only one index case was identified.

Since measles is highly contagious and there were three known settings where individuals were exposed, there was concern for secondary cases. The Bureau of Epidemiology was notified of an ill, exposed patient who was in the hospital waiting room on August 15, 2013. The patient was a vaccinated two-year-old female who had developed a rash and a low grade fever. The patient returned to the hospital for further evaluation, and the ER physician determined the rash was due to eczema and was non-measles related. No other monitored cases have developed rash-like illnesses during the incubation period.

The hospital emergency center waiting room and the family physician's waiting room were contacted to obtain a line list of exposed individuals while the confirmed case was in the waiting room. The Bureau of Epidemiology monitored 125 exposed persons for symptoms, and no secondary cases were found. Houston Health Department completed active surveillance for the exposed individuals in the various settings up until September 6, 2013.

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Meningococcal Infections, Invasive

INTRODUCTION

Meningococcal disease is a serious condition caused by the bacterium *Neisseria meningitidis*. It usually manifests as meningitis or septicemia (infection of the blood). The initial symptoms of meningitis include sudden fever, intense headache, nausea, vomiting, stiff neck, and confusion.

Septicemic cases have similar symptoms as well as a rash. The disease can progress rapidly into shock then death. Mortality is associated with approximately 10%-15% of cases (CDC, 2015). People who survive the disease often have permanent injury to their hearing, cognitive functions, or kidneys.

Public health surveillance of this disease is based upon receipt of reports of suspected cases presenting with these symptoms and of those diagnoses supported by serologic tests

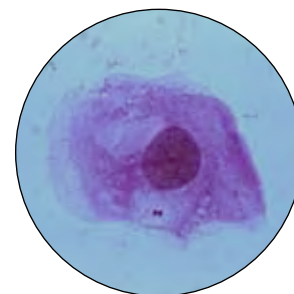
and bacterial staining. A common gram stain is used to identify *N. meningitidis* in blood, cerebral spinal fluid, and other normally sterile sites (CDC, 2015).

Five serogroups of *N. meningitidis* (A, B, C, Y, and W-135) cause nearly all cases of invasive meningococcal disease. Currently, serogroups B, C, and Y cause the majority of US infections; serogroup A is extremely rare in the US; and W-135 causes a small number of cases.

Disease Transmission

Humans are the only natural reservoir of *N. meningitidis*. An estimated 5 - 10% of adults carry the bacteria in their noses and throats without symptoms or complications. Most serogroups that are carried in this manner do not cause disease. However, it is not well understood why some persons may come into

contact with and even carry disease-causing serogroups with no apparently ill effects, while others succumb to sudden, severe disease. Bacteria are transmitted through respiratory droplets that become aerosolized by coughing, sneezing, or from close contact with an infected person.



SURVEILLANCE SUMMARY

Surveillance History

Reportable in Texas since 1984

Population at Higher Risk

Elderly

Notifiable Outbreaks

None

Cases Per Year

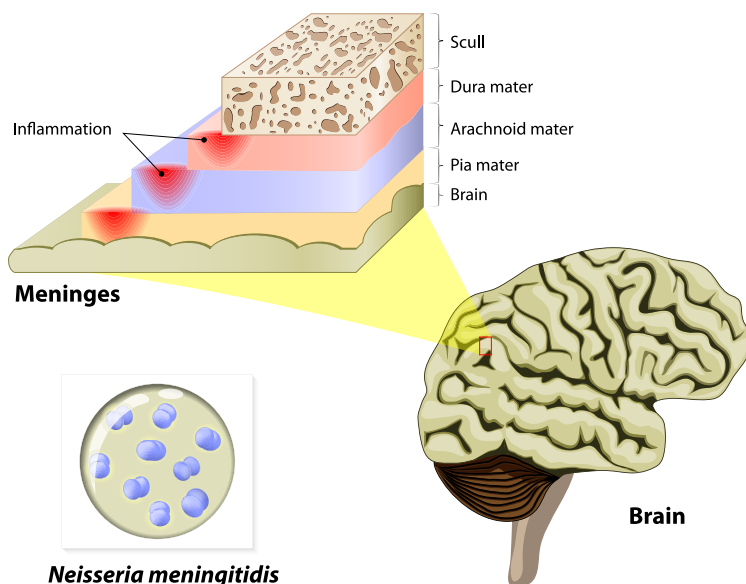
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Seasonality

None

Caseload

0



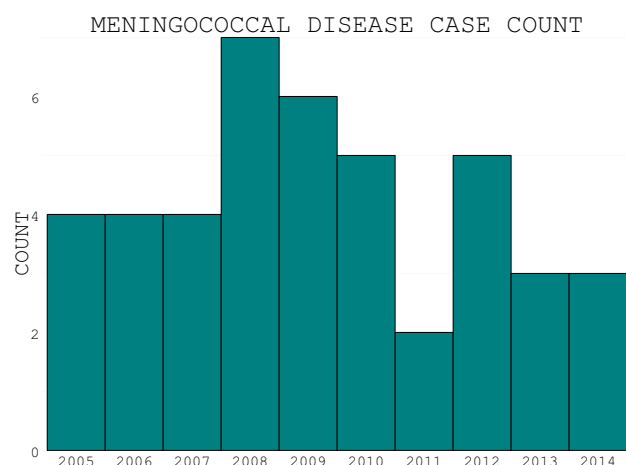


FIGURE 1. Meningococcal disease (invasive) case count.

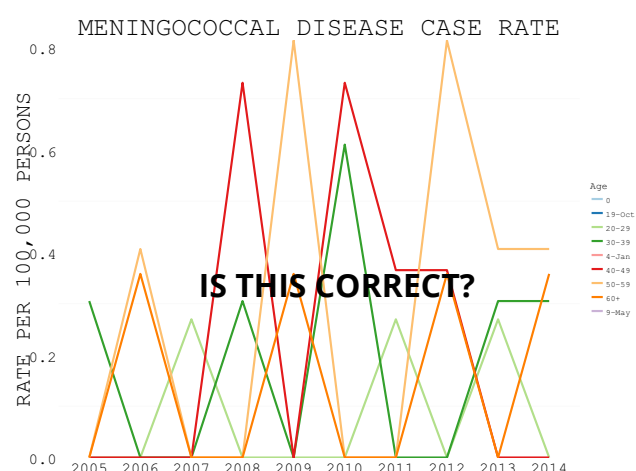


FIGURE 2. Meningococcal disease (invasive) incidence rate by age.

Epidemiology In Houston

Meningococcal disease occurs year-round in Houston, but the majority of the cases occur seasonally, during the winter and early spring. The disease normally occurs sporadically in the city, with rare instances of clustering or outbreaks. An average of four cases per year has been reported. Figure 1 shows each year's case count for 2005-2014. Case counts ranged from 2 to 7 during this time period. Overall, there has been a decrease from the 2000 - 2004 time period, where an average of 18 cases per year was reported.

Of the 43 cases reported to the HHD, nine cases (21%) died from the illness. Of the nine deaths, two were children under the age of five and one was over the age of 65. The 21% mortality rate is higher than the national average of 10%-15% (CDC, 2015). The incidence rate is generally low, though there was a spike for infants that lasted from 2006 to 2010 (Figure 2). This is consistent with national trends where infants are at the highest risk for contracting the disease.

Meningococcal Disease At TSU



In the spring of 2007, the Bureau of Epidemiology received a call on a Friday afternoon from a local hospital reporting a case of meningococcal meningitis in a 21 year old male. The patient was hospitalized and

in critical condition. The patient was student at Texas Southern University (TSU), an historically black university in Houston's Third Ward, with an student enrollment of 10,000. Given the risk of secondary disease, the BOE faced a serious situation.

Neisseria meningitidis, the causative organism, is routinely found in the throats and nasal passages of 10% of the population. However in certain populations such as dormitory students or barracked soldiers that rate can climb to 50%. It is spread through oral and nasal secretions, often by sharing eating utensils. For reasons not well understood the bacteria can become pathogenic, dodging the body's natural defenses, traveling from the back of the throat and crossing membranes to the meninges.

The BOE acted promptly and issued a notification to the school regarding the seriousness of the situation, telling the administration to warn students about the signs and symptoms and to seek medical attention immediately if suffering from any.

The BOE was notified that the student had died and was also notified that another 21-year-old male patient was suspected of having meningococcal meningitis and was also a student at TSU. Within an hour of notification, an epidemiologist was at the hospital reviewing records.

Bacterial meningitis can induce fear in a population. To avoid panic and prevent a grave situation from getting worse, public health authorities must act quickly and confidently. That Saturday night, all available epidemiologists were notified to report to the Health department the following morning. By noon on Sunday, data on class enrollment had been gathered and the two students had been classmates. This was the link needed. The BOE assessed the information to determine how large of a control effort would be needed?

As is often the case with reports of diseases that have the potential for major health implications, the department determined it necessary to conduct a large intervention. The Houston Health Department had never attempted an intervention of this size. It would require 5,000 doses or more of Rifampin, the standard prophylaxis for meningococcal outbreaks. The health department

Public Health Action

The passive surveillance system run by HHD continually monitors for cases of meningococcal disease and conducts contact tracing for every case reported in a Houston resident. Contact tracing involves the identification, follow-up, and diagnosis of persons who have come into contact with a case. The BOE follows the recommendations of the American Academy of Pediatrics (AAP) and provides oral rifampin as antimicrobial prophylaxis for the close contacts of infected persons as the principal method of disease prevention. Such preventative medication is initiated in collaboration with public health nurses, epidemiologists, and pharmacists within 24-48 hours after the first case has been identified and reported to the health department. Mass vaccination is done in response to a community outbreak in an effort to prevent secondary cases.

CDC recommends routine vaccination of young adolescents with the meningococcal vaccine at 11 - 12 years of age. Vaccination is also recommended for college freshmen living in dormitories.



committed resources for the mass prevention campaign. It was now a matter of organization.

Fortunately, every person in the health department was trained in the Incident Command Structure, an emergency response system developed and adopted by fire departments after the California wildfires of the 1970s. After the Columbia Shuttle disaster in 2003 then-president George W. Bush issued an executive order mandating all agencies and personnel receiving federal funds be trained in the Incident Command System (ICS) and the National Incident Management Structure (NIMS) of which ICS is a part. We had been trained. We were ready.

On Monday morning, a briefing was held that outlined the goals and objectives of Operation University Clinic. Personnel were divided into leadership or staffing roles depending on their training and expertise. They were then grouped into sections: Operations, Logistics, Finance/Administration, and Planning. The Incident Commander directed the activity with a command staff assigned to medical intelligence, public relations, and personnel safety. He designated a deputy commander in case he was called away, ready to take over and start issuing commands.

Three days later the operation was concluded. In that time, over 3,000 students had been interviewed and given medication to ward off illness. The lines of students waiting for meds were long but they were orderly. Nearly 100 departmental employees were deployed during the incident including epidemiologists, nurses, pharmacists, data entry staff and other experts. Many worked 18 hour days. People, who felt like they had symptoms, were quickly shuttled to hospitals for evaluations. Family members of the cases were sought out and given medication directly. The relief in their faces was evident.

In the end, the health department successfully carried out its intervention. While the first student tragically died, the second student was successfully treated. He recovered fully and was able to return to his classes. The prophylaxis campaign worked, as there were no other cases.

It would take a few days for things to return to normal at the BOE. People were debriefed in groups and an after action report of the incident was prepared. The system worked.

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Mumps

INTRODUCTION

Mumps is a viral illness caused by the mumps virus, a member of the *Paramyxoviridae* family of viruses. The first vaccine against mumps was licensed in the United States in 1967. Due to routine vaccination of children, there has been a 99% decrease in mumps cases nationwide.

Cases of mumps still occur worldwide and the virus may be contracted by anyone not immunized against the virus (Centers for Disease Control and Prevention, 2015). Although mumps is no longer common in the United States, outbreaks continue to occur. These outbreaks have commonly occurred in places where individuals have had prolonged, close contact with a person who has mumps;

attending the same class, playing on the same sports team, or living in the same dormitory.

Symptoms usually appear within 14 to 18 days of exposure and include fever, headache, muscle ache, and swelling of the glands around the jaw. About 20% of infected individuals do not have any symptoms. The disease may present as a lower respiratory illness, particularly in preschool-aged children.

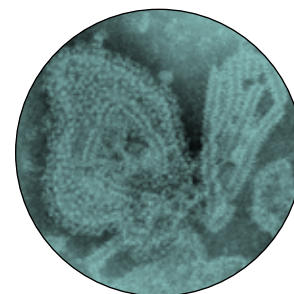
Disease Transmission

Mumps is spread by droplets of saliva or mucus when the infected person coughs, sneezes, or talks. Utensils used by an infected person, such as cups or soft drink cans, can also be contaminated with the virus, which may spread to others if those items are shared. Mumps can occasionally cause more serious complications, especially in adults, such as: inflammation of the testicles (orchitis) in males who have reached puberty; inflammation

of the brain (encephalitis); inflammation of the tissue covering the brain and spinal cord (meningitis); inflammation of the ovaries (oophoritis) and/or breasts (mastitis) in females who have reached puberty; and sometimes deafness.

Epidemiology in Houston

In Houston, 15 cases of mumps were reported to the Bureau of Epidemiology from 2005 to 2014. Of the reported cases, 11 were males



SURVEILLANCE SUMMARY

Surveillance History

Nationally notifiable since 1968

Population at Higher Risk

- Unvaccinated individuals
- College students
- Healthcare workers
- International travelers

Notable Outbreaks:

None

Cases Per Year

2

Seasonality

Winter and early spring

Caseload

3,791

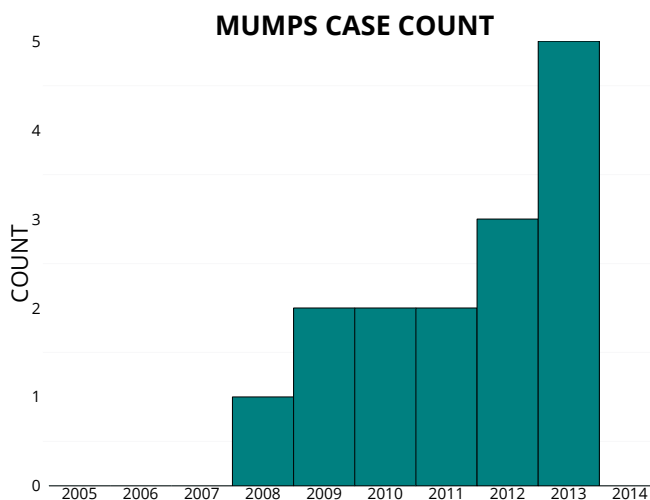


FIGURE 1. Mumps case count.

and four were females. The majority of the cases were individuals with no previous vaccination history, college and university students, healthcare professionals, and international travelers who are at increased risk for mumps. Although there were no confirmed cases in 2014, the BOE investigated 799 suspected cases of mumps.

Public Health Action

Mumps can be prevented with the MMR (Measles, Mumps, and Rubella) or MMRV (Measles, Mumps, Rubella, and Varicella) vaccines. The vaccines prevent most, but not all, cases of mumps and resulting complications. Receiving two doses of the vaccine is 88% effective

(range of 66 - 95%) at preventing mumps; one dose is 78% (range of 49 - 92%) effective (Centers for Disease Control and Prevention, 2015). Current recommendations for mumps vaccination for children are: one dose at the age of one and the second dose between four and six years of age.

The first vaccine against mumps was licensed in the United States in 1967. By 2005, mumps rates declined by more than 99% as a result of the high two-dose vaccination coverage among children. There is no treatment for mumps other than treating the symptoms. Anyone who is not immune from either a previous mumps infection or from vaccination is susceptible to mumps.

In outbreaks and special situations, susceptible people who have no documentation of receiving the vaccine can be given the MMR vaccine since the vaccination has no adverse effect in people already immunized.

Mumps is a reportable disease in Texas. A received report initializes a surveillance investigation. Investigation efforts include identifying the source of infection, contact-tracing of all possible exposed persons, and identifying potential secondary cases. It is also an opportunity to provide public education about signs and symptoms of the disease. This allows for early detection of new cases.

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Pertussis

INTRODUCTION

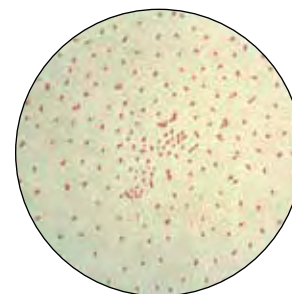
Pertussis is a contagious, acute bacterial infection of the respiratory tract caused by the bacterium, *Bordetella pertussis*. The condition is a vaccine preventable condition, but immunity diminishes 5 to 10 years after completion of the childhood vaccination series. Prior to the availability of the

vaccine in the 1940s, pertussis was one of the most common childhood diseases and a major cause of mortality in 20th century America (Centers for Disease Control and Prevention, 2015). Since the introduction of the vaccine, incidence has decreased by more than 80% when compared to the pre-vaccine era. In developing countries, pertussis continues to be a major health problem, with 195,000 deaths resulting from the disease in 2008 (Centers for Disease Control and Prevention, 2015).

Once exposed to the bacterium, symptoms usually develop within 4 to 10 days, but can take as long as 3 weeks. Early symptoms of pertussis are similar to those of the common cold, often resulting in a misdiagnosis. Early symptoms can last for 1 to 2 weeks. Symptoms usually include: runny nose, low-grade fever, mild cough and apnea (pause in breathing seen in babies). The later-stage symptoms

that develop are more indicative of pertussis. This stage is characterized by fits of many rapid coughs that are followed by a high-pitched “whoop”, vomiting during or after coughing fits, and exhaustion after coughing fits. The disease can cause illness in infants, teens and adults. Infants, especially infants under 6 months, have the highest rates (National Centre for Immunization Research and Surveillance of Vaccine Preventable Diseases, 2008).

A clinical case of pertussis is defined as an acute cough illness lasting at least 2 weeks that may be accompanied by a “whooping” sound when inhaling or vomiting after coughing, which has no apparent cause. Pertussis has been a notifiable condition within the United States since the 1920s. Suspected or confirmed cases are to be reported to DSHS within one work day. In 2014, HHD reported 100 cases of pertussis.



SURVEILLANCE SUMMARY

Surveillance History

Nationally reportable since 1973

Population at Higher Risk

Infants and unvaccinated persons

Notable Outbreaks:

None

Cases Per Year

82

Seasonality

None

Caseload

1,504

Disease Transmission

Pertussis is a human disease. No non-human source of the disease is known to exist. Adolescents and adults are an important reservoir for *B. pertussis* and are often the source of infection for infants. Pertussis has an incubation period ranging from 4 to 21 days. Transmission most commonly occurs by the respiratory route through contact with respiratory droplets, or by contact with airborne droplets of respiratory secretions. Transmission occurs less frequently by contact with freshly contaminated articles of an infected person. Infants under 6 months, vaccinated children, adolescents, and adults often do not have the typical whoop.



TABLE 1: NUMBER OF PERTUSSIS CASES BY AGE GROUP, 2005-2014

Age Group	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Grand Total
0	17	14	28	52	65	22	16	25	82	32	353
1-4	2	5	2	7	13	7	8	10	28	13	95
5-9	5	9	7	4	21	10	9	6	25	14	110
10-19	9	7	5	5	20	8	2	2	29	18	105
20-29	3	4	1	2	15	3	1	1	5	4	39
30-39	3	3	2	4	8	1	4	5	10	1	41
40-49	2	1	5	1	2	4	1	2	5	3	26
50-59	1	2	2	0	3	0	3	2	2	6	21
60+	1	0	2	1	1	0	1	1	10	9	26
Unknown	2	0	0	0	0	0	0	0	0	0	2
Total	45	45	54	76	148	55	45	54	196	100	818

Pertussis remains endemic in the United States with epidemic cycles every 3-4 years despite routine childhood pertussis vaccination for more than half a century and high coverage levels in children for more than a decade. A primary reason for the continued circulation of *Bordetella pertussis* is that immunity to pertussis wanes approximately 5-10 years after completion of childhood pertussis vaccination, leaving adolescents and adults susceptible to pertussis (National Centre for Immunisation Research and Surveillance of Vaccine Preventable Diseases, 2008).

Individuals that have taken the vaccine series are only partially protected from the condition and it is possible for them to be infected by *Bordetella pertussis*. Individuals that have taken the vaccine series are only partially protected from the condition and it is possible for them to be infected by *Bordetella pertussis*. The illness may present with milder symptoms, or may be asymptomatic. Vaccinated individuals that become infected are also capable of spreading the disease to others. The group most at risk for infection is unimmunized or incompletely immunized infants. Adolescents and adults are often found to be the source of infection for infants within a household (Centers for Disease Control and Prevention, 2015).

Epidemiology in Houston

Pertussis most often affects newborns and unimmunized and under-immunized individuals. All infants younger than 6 months and all other infants that have not received 3 doses of diphtheria and tetanus toxoids and acellular pertussis (DTaP) vaccine are especially vulnerable to *B. pertussis* infection. From 2005-2014, HHD reported 818 cases. Individuals under the age of one accounted for 353 cases, about 43% of all pertussis cases (Table 1).

There was a jump in cases reported in 2009 and 2013 with 148 and 196 cases, respectively. Pertussis is an endemic and cyclic condition with peaks in disease every 3 to 5 years. The peak years were followed by a marked decrease in reported cases.

The burden of disease is greatest in the Hispanic community. Hispanics have accounted for the highest number of pertussis cases each year from 2005-2014 (Figure 01). Of the 818 cases

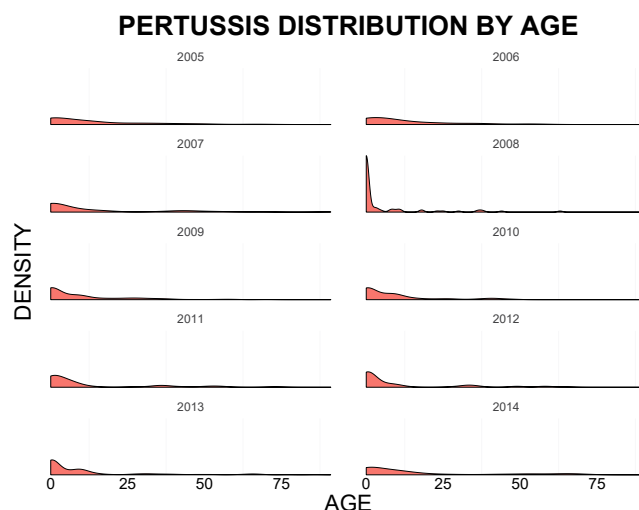


FIGURE 1. Pertussis case count by race.

reported by HHD, 512 cases (63%) were identified in individuals that identify as Hispanic. The high rates within the Hispanic community may be due to a low level of immunization coverage in this group.

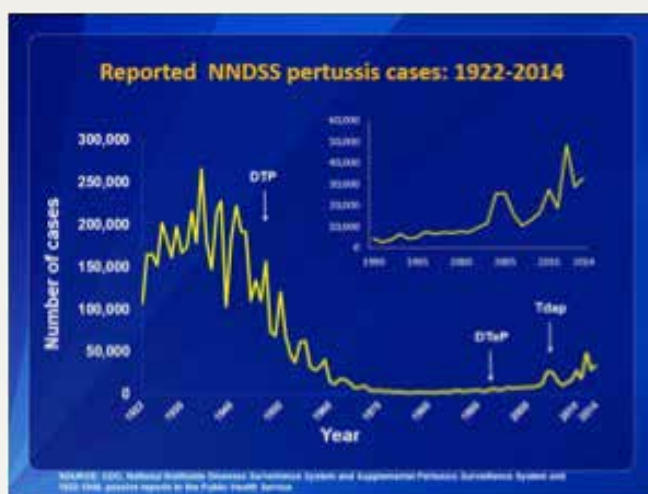
Public Health Action

The Bureau of Epidemiology (BOE) conducts passive as well as active surveillance for pertussis. Local hospitals, health care providers, schools and day care centers report all suspected pertussis cases to the BOE for investigation and for disease control purposes. Hospitals and health care providers are contacted on a monthly basis by local investigators to identify any cases not reported through the passive surveillance system. Specimens are sent by investigators to the DSHS laboratory for confirmatory testing.

Immunization remains the most important approach in the control of pertussis. Primary vaccination against *B. pertussis* infection is given in three doses of a combined vaccine that also includes diphtheria and tetanus. Education of the public, particularly parents of infants, is critical to promoting timely

Pertussis, The Persistent Problem

Pertussis is a vaccine preventable condition with a distinct four year cycle. In addition to the cyclical pattern, national surveillance data indicates there was an increase in number of cases when Tdap — the acellular pertussis vaccine for adolescents and adults — was introduced in 2005 (CDC, 2015). The age groups that are at highest risk for infection by *B. pertussis* are infants less than one year of age and school aged children between 7 to 10 years of age. Hispanic children are at higher risk for Pertussis. These trends and risk factors are also observed in the Houston surveillance data (CDC, 2015).



This case study summarizes the investigation involving 3 school aged children in a private religious school.

On October 17, 2013, the Houston Health Department received a pertussis PCR positive laboratory report from Texas DSHS in an 8-year old third grader (patient A) who attends a private religious school in Houston. After contacting the school nurse, it was learned that there was a second case of pertussis in a 9-year old classmate (patient B), who was not previously reported and was physician diagnosed based on clinical symptoms. This child appeared to be the index case based on the chronology that had been provided. The school nurse also provided information on a possible third case in an 8 year old fellow classmate (patient C), who was also being evaluated by a physician for pertussis.

Patient A: This was an 8-year old child who was PCR positive for pertussis, with a cough onset date of October 4, 2013. The child was treated with a regimen of antibiotics and was fully vaccinated. Members of the family were given prophylaxes and adults were referred for a vaccination booster. No one else was ill in the family or had a travel history prior to the onset of the child's illness.

Patient B: This was a 9-year old child who was physician diagnosed based on clinical characteristics. Cough onset date of September 9, 2013. The child was treated with two regimens of antibiotics, was fully vaccinated and appeared to be the index case. Members of the family were given prophylaxes and adults were referred for a vaccination booster. No one else was ill in the family or had a travel history prior to the onset of the child's illness.

Patient C: Laboratory specimens had been collected for this 8 year old child who was being evaluated for pertussis. This child was a classmate of patient A and patient B who were pertussis epi-linked.

On October 22, 2013 Patient C investigation was completed. This student did not meet the case definition for pertussis and culture is still pending. Two additional cases of pertussis were reported to BOE from St. Mark's Episcopal School Nurse. The first case was an 11-year old 5th grader who was physician diagnosed, and the second was a prior unreported diagnosed case in an 11-year old 5th grader from August 20, 2013 whom the nurse suspected to be the true index case.

Patient D: This was an 11-year old student who was physician diagnosed based on clinical characteristics and a positive PCR. Preliminary finding on this case was forwarded to Harris County Public Health and Environmental Service (HCPHES) based on jurisdiction. The school was also referred to HCPHES because the school is in their jurisdiction.

Patient E: This 11-year old student was a previously unreported case of pertussis with a cough onset date of August 20, 2013. The student was clinically diagnosed and treated on August 22, 2013 and parents were provided prophylaxis and vaccination by the family physician. However, because the school nurse did not become aware of this case until the antibiotic treatment was completed, the child attended classes while still contagious. According to school records, the student was fully vaccinated and had a travel history to Germany just prior to entering school on August 21, 2013.

Houston Health Department took several steps to prevent and control the spread of disease transmission: 1) a health alert was distributed, 2) monitoring of exposed individuals, and 3) prophylaxis clinic held at school. The HHD released a health alert letter to the school nurse for disseminating to parents of children who attended this school. The letter outlined the CDC recommendations for immunization and prophylaxis. Monitoring of school children continued until the end of the twenty-one day incubation period. HHD worked with HCPHES (the school is in HCPHES jurisdiction) to hold a vaccination and prophylaxis clinic at this school, as requested by the school nurse.

vaccination, and recognition of the importance of disease control.

When a confirmed case of pertussis occurs, the BOE implements disease control measures for the case, household and other close contacts, as well as for the immediate environment in which the case lives, works, or plays. In some instances, this may include quarantine. Inadequately immunized household contacts under age seven may be excluded from school, day care centers and public gatherings for 21 days after last exposure, or until cases and contacts have received at least five days of a seven days preventative antibiotic therapy. Investigators attempt to identify the source of infection of the case, and to verify the immunization status of close contacts.

In the case of an outbreak of pertussis, the BOE will recommend protection of health workers who have been exposed to pertussis cases with a course of erythromycin, clarithromycin and azithromycin. In addition to health care workers, all household and close contacts of a suspected or confirmed case of pertussis transmission should be given preventative antibiotic therapy to end *B. pertussis* transmission.

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Plague

INTRODUCTION

Plague is a severe bacterial illness caused by *Yersinia pestis*. It is naturally occurring in several rodent populations worldwide, and is often spread by fleas. During the Middle Ages, the disease, also known as the “Black Death”, killed tens of millions of people worldwide. Since 541 AD, it has caused

no less than three pandemics (Stenseth, et al., 2008). Even today, outbreaks of plague are occasionally seen in developing countries.

Plague occurs in three forms: bubonic (most common), septicemic and pneumonic (least common). Each form presents with varying clinical symptoms.

Bubonic plague infects the lymph glands and begins with fever, chills, headache, and weakness, followed by the formation of buboes (acutely swollen lymph nodes) that are often black, giving rise to the name “Black Death”. Septicemic plague is an infection

of the blood which results in blood vessel necrosis, skin lesions, and gangrene. Severe bubonic plague can develop into septicemic plague. Pneumonic plague infects the lungs and presents with severe bronchopneumonia (inflammation of the lungs), cough (with blood), difficulty in breathing, and chest pain.

By Texas law, any suspected case of plague should be immediately reported to the local health department for evaluation and follow-up. Even one case of confirmed plague in Houston is considered an outbreak.

Disease Transmission

Human plague usually occurs due to the bite of an infected flea, through the bite/scratch of an ill animal, or contact with infected tissues. The incubation period is generally 2-8 days, and the illness usually manifests itself as bubonic plague. The case fatality rates vary from 30% to 100% (Stenseth, et al., 2008).

The case fatality rate for an untreated case of bubonic plague is between 50-60%. Approximately 14% of cases receiving treatment are fatal (Stenseth, et al., 2008). A small percentage of plague cases may also develop pneumonic plague, which is contagious via respiratory droplets. The incubation period for this form of plague is only 1-6 days, and the disease is fatal if untreated; the case-fatality rate in patients receiving treatment is approximately 57% (Stenseth, et al., 2008).

Direct exposure to aerosolized *Y. pestis* can cause pneumonic plague. This method of exposure has been identified as a possible agent for use in a bioterrorism attack; however, no such event has occurred (Centers for Disease Control and Prevention, 2005).

Epidemiology in Houston

Plague is a rare disease in the United States. In recent decades an average of 7 human cases have been reported with most (54%) occurring in the southwestern part of the country (Kugeler, Staples, Hinckley, Gage, & Mead, 2015). Between 2005 and 2014, no positive human cases were reported in Houston. There has been positive detection of the disease in animal populations mainly in Western Texas (Texas Department of State Health Services (DSHS), 2004-2013).

Public Health Action

The HHD response to a confirmed case of plague will differ depending on whether the incident is naturally occurring or a potential act of terrorism. The presentation of the illness will also influence the response. In general, epidemiologists will interview the case(s) to identify the source of exposure and other persons that may be at risk for developing illness. All persons at risk for contracting the plague will



SURVEILLANCE SUMMARY

Surveillance History

Reportable in Texas since 2013

Population at Higher Risk

- Persons exposed to infected animals in endemic areas
- Persons who keep exotic pets, such as prairie dogs, wild rabbits, and armadillos

Notable Outbreaks:

None

Cases Per Year

0

Seasonality

Late spring to early fall

Caseload

6

be closely monitored and provided with post exposure prophylaxis.

If the cases are possibly due to an intentional release of *Y. pestis*, the Federal Bureau of Investigation (FBI) will be contacted and a joint forensic epidemiology investigation conducted. Strict

isolation procedures should be taken for all persons with pneumonic plague to prevent the spread of the disease. Quarantine may also be considered if conventional control methods are deemed insufficient to curb the spread of disease. Additionally, due to the

potential for the introduction of disease into the animal population, the regional zoonotic surveillance work group will be consulted to coordinate any required veterinary response.

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Poliomyelitis

INTRODUCTION

Poliomyelitis, commonly known as “Polio,” is a potentially fatal disease caused by the poliovirus. The virus is an enterovirus and a part of the family of viruses, Picornaviridae. About 72% of the people infected with the disease do not experience any symptoms, but can still transmit the virus

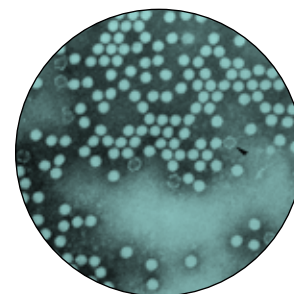
(CDC, 2014).

The three symptomatic forms of polio include abortive (subclinical), non-paralytic, and paralytic poliomyelitis. Abortive polio is mild and characterized by sore throat, fever, nausea, vomiting, or influenza-like illness. Non-paralytic polio infections have symptoms like stiffness of the neck, back, and/or legs. Paralytic polio causes muscle paralysis, which may lead to permanent paralysis or recovery. There are three types of paralytic polio: spinal, which affects the spinal cord (79% of cases); bulbar, which affects the brainstem; and bulbospinal, which affects both the spinal cord and brainstem. The disease can become lethal as a result of breathing problems due to paralysis. In some cases, individuals with paralytic polio may develop post-polio syndrome, even after 15 to 40 years, characterized by muscle pain and weakness (CDC, 2015).

Before the introduction of the vaccine in 1955, there were several outbreaks of paralytic polio cases, with a peak of 21,000 cases in 1952. Since 1988, countries have been working toward eliminating polio through the Global Polio Eradication Initiative and other

programs (The Global Polio Eradication Initiative, 2010). The initiative has been the largest international public health effort to eradicate polio globally. (World Health Organization, 2014).

Any suspect case of polio must be reported to the health department within 1 working day. A confirmed polio case requires a compatible clinical history and a laboratory diagnosis (clinical specimen from stool or CSF).



SURVEILLANCE SUMMARY

Surveillance History

Reportable in Texas since 1986

Population at Higher Risk

Unimmunized persons

Notable Outbreaks:

Multiple in 1940's-1950's

Cases Per Year

0

Seasonality

Summer and fall

Caseload

4

TABLE 1: TYPES OF POLIOMYELITIS, ASSOCIATED SYMPTOMS, AND PREVALENCE

Form of Polio	Symptoms	Percent of Patients	Recovery
Asymptomatic	None	72%	Unknown
Abortive (subclinical)	Low grade fever Sore throat	24%	1 week
Non-paralytic	Stiffness in neck, back, or legs	1-5%	2-10 days
Paralytic	Paralysis Muscle aches Loss of reflexes	<1%	Paralysis present for more than a year becomes permanent

Disease Transmission

The incubation period of the disease is usually 6 to 20 days, with a range of 3 to 35 days. The poliovirus spreads through person-to-person contact and is most contagious during the period 7 to 10 days before and after the onset of symptoms. The virus is shed in the feces and nasal/oral secretions of an infected person and even an infected person without symptoms can spread the disease. Poliovirus cannot survive for too long outside the human body. The virus can be inactivated by heat, formaldehyde, chlorine, or ultraviolet light.

Epidemiology in Houston

The last case of a naturally occurring poliovirus in Houston was reported in 1971. The city had its last polio case in 1988, which was an adverse event followed by oral polio vaccination. There were multiple outbreaks in the 1940s and 1950s. During these outbreaks, infections peaked from June to September.

Since 1979, no case of polio has been reported in the United States. Polio was eradicated from the countries in the Western

Hemisphere in 1994, however, the virus is still endemic in Afghanistan and Pakistan (The Global Polio Eradication Initiative, 2010).

Public Health Action

There is no cure for polio; however, the vaccination can effectively prevent it. In the United States, children are recommended four doses of the vaccine in early childhood, starting at the age of two months, four months, 6-18 months, and a booster dose at 4-6 years of age. There are two types of polio vaccines: oral poliovirus vaccine (OPV) and inactivated poliovirus vaccine (IPV). The IPV is highly effective in producing immunity, with 99% of the recipients become immune after three doses. The United States has not used OPV since 2000 (Centers for Disease Control and Prevention, 2011).

HHD provides immunization services at its health centers. The HHD Bureau of Immunizations continues to do outreach activities to increase polio vaccination rates in the community.

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Q Fever

INTRODUCTION

Q fever is a zoonotic disease caused by the bacterium *Coxiella burnetii*. Sheep, cattle, and goats are the common reservoirs of the bacterium, though other animals such as pets and ticks can carry it. The bacteria is shed particularly in the amniotic fluid of infected animals, but also in their

milk, urine, and excrement. Generally, humans become infected by direct exposure to these animals or inhalation of airborne *Coxiella burnetii* particles (Raoult & Maurin, 1999).

Coxiella burnetii bacteria are able to survive in the environment for long periods of time, as it can withstand heat, drying agents, and common disinfectants. Due to its potency, the bacteria has the potential to be used as a biological weapon (Madariaga, Rezai, Trenholme, & Weinstein, 2003).

There are two manifestations of Q fever — acute and chronic. About 50-60% of patients infected with the bacterium do not experience symptoms. Manifestations of acute disease include influenza-like illness, pneumonia, or hepatitis. The primary manifestation of the chronic form of Q fever is endocarditis, or the

inflammation of the heart valves. Endocarditis (inflammation of the inner layer of the heart) is observed in 60-70% of patients with chronic Q fever. Pregnant women and immunocompromised patients are at a greater risk of developing the chronic infection (Hartzell, Wood-Morris, Martinez, & Trotta, 2008).

The disease became reportable in the United States in 1999. Any suspected case of Q fever has to be reported to the health department within one working day. For public health surveillance, a case of Q fever can be classified as “confirmed” or “probable.” A confirmed case requires a compatible clinical history and laboratory confirmation, while a probable case only requires a compatible clinical history. Q fever became a notifiable disease in the United States in the year 1999.

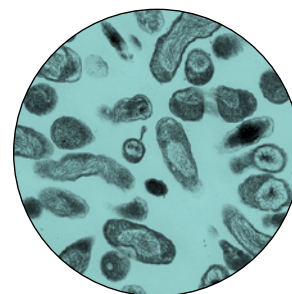
Disease Transmission

The incubation period of Q fever is one to three weeks. The most common way infection in humans occurs is by inhaling airborne particles from the birth fluids of infected animals or contaminated dust particles. Tick bites, consumption of raw milk and dairy products and person-to-person are less common routes of transmission (CDC, 2013).

Risk factors for Q fever include: working in an occupation involving contact with animals or animal products, or close contact with someone who has had Q fever (CDC, 2013).

Epidemiology in Houston

From 2005-2014, Houston recorded two cases, both of which had onset dates in 2014. In the same time period, Texas reported an average of 14 cases per year. Since it is a rare



SURVEILLANCE SUMMARY

Surveillance History

Reportable in Texas since 2002

Population at Higher Risk

Persons in contact with sheep, goats, and cattle

Notable Outbreaks:

None

Cases Per Year

0

Seasonality

Spring and early summer

Caseload

16

disease and over half of infected people do not experience symptoms, it is considered underreported (Dahlgren, Haberling, & McQuiston, 2014).



Public Health Action

People who are around sheep, cattle, and goats—including farmers, veterinarians, sheep workers, and meat processors—need to take extra precautions to avoid the disease. The birth products and fluids of animals need to be properly handled and disposed of. A vaccine for Q fever has been developed in Australia, though it is not available in the United States (CDC, 2013).

The milk from infected animals should not be consumed raw or unpasteurized. Heating the milk at 145°F for at least 30

minutes, or 161°F for at least 15 minutes is enough to kill the bacteria (NASPHV, 2013).

People who work in occupations dealing with livestock need to be vigilant with personal protective equipment – they must wear an N95 mask, gloves, rubber boots, and protective clothing. High pressure hoses should not be used for cleaning, as dust particles can aerosolize. Any manure, bedding, and other contaminated materials need to be properly sealed to prevent infection (NASPHV, 2013).

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Rabies

INTRODUCTION

Rabies is caused by a virus that affects the central nervous system (i.e., the brain). The disease is usually transmitted by the bite of an animal already infected with rabies. In very rare cases transmission has occurred from person-to-person via organ transplantation. Stricter guidelines for cornea and

organ donation have reduced this risk significantly. Infection with the rabies virus may cause a number of neurological problems,

including anxiety, paralysis, hallucinations and eventually results in coma and death (CDC, 2015).

Disease Transmission

Rabies transmission generally occurs from the bite of an infected animal. Wild animals such as bats, coyotes, foxes, raccoons, and skunks are the most common carriers. However, domestic animals and rodents can also transmit the virus. Airborne transmission of the rabies virus from bats occurs very rarely and usually only in a laboratory setting.

Risk factors for contracting rabies include high-risk jobs (e.g., veterinarian, laboratory worker, animal control personnel) or traveling to developing countries where the disease is endemic.

Epidemiology in Houston

Houston had one reported case of rabies in 2009, but the individual had contracted the illness while elsewhere in Texas. Prior to that case, Houston has not had a case of rabies since the 1990s. Between 1950 and 1999, there were three reported deaths from rabies. Two of the fatal cases were exposed to the virus while travelling abroad; the third occurred as a result of an infection from a bat.

In 2006 a teenager from Humble contracted and died of rabies. This tragic event led to a tremendous increase in the numbers of bats being submitted to the Bureau of Laboratory

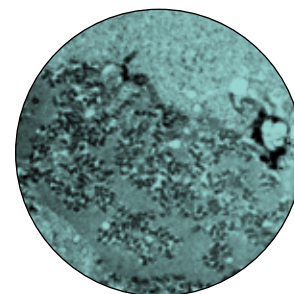
Services by concerned residents. This led to the observed increase in tested bats. The surge in tested bats led to an increase in the number of positive tests, yet the relative proportion of positive tests remained constant for that period. The increased amount of tests continued until a more streamlined triage and submission protocol was developed in collaboration with animal control authorities.

Public Health Action

Rabies is best prevented by avoiding contact with high-risk animals, such as bats. When an individual encounters a potentially infected animal, it is important to contact animal control to safely capture and dispose of the animal.

When an animal is suspected of having rabies, animal control will test the animal for the disease. If the animal does test positive for rabies, the individual must receive a series of shots over the course of the next month. Rabies has a nearly 100% mortality rate when infected individuals do not receive the vaccinations.

Persons who regularly come into contact with high risk animals should seek out vaccination against rabies as a protective measure.



SURVEILLANCE SUMMARY

Surveillance History

Nationally reportable since 1944

Population at Higher Risk

- Having certain high risk jobs (veterinarian, laboratory worker, animal control personnel)
- Travelers to endemic countries

Notable Outbreaks

None

Cases Per Year

0

Seasonality

Spring and summer

Caseload

569



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Rubella

INTRODUCTION

Rubella is a disease caused by the rubella virus. It is also known as German measles or three-day measles. The first manifestation of rubella is usually a rash that begins on the face and spreads to other parts of the body. In children, the symptoms are often mild with a low fever lasting two or

three days. Older children and adults may also have swollen glands and symptoms similar to a cold before the rash appears. Aching joints may occur in some cases, especially among young women. About half of the people who get rubella do not have symptoms. When rubella infection occurs during pregnancy, especially during the first trimester, serious consequences may result, including miscarriage, fetal death/stillbirth, and a constellation of severe birth defects known as congenital rubella syndrome (CRS).

The United States has achieved the goal of eliminating endemic rubella transmission and CRS through routine vaccination. Elimination of endemic rubella was documented and verified in the United States in 2004. However, because of international travel to countries without routine rubella vaccination, imported cases of rubella are still common (Centers for Disease Control and Prevention, 2014). This makes continuous vigilance an important part of our surveillance system, especially since Houston is the most ethnically diverse metropolitan area in the U.S.

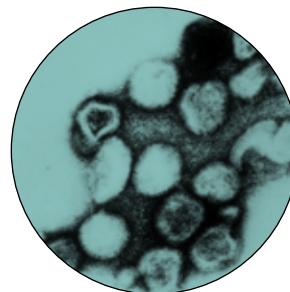
Disease Transmission

Rubella is spread from person-to-person via airborne transmission or droplets from the respiratory secretions, such as coughing or sneezing, of infected persons. The incubation period of rubella is approximately 12 to 23 days (with a 14 day average). Rubella may be transmitted by persons who are asymptomatic; this can occur in up to 50% of all rubella virus infections (Texas Department of State Health Services, 2015).

Epidemiology in Houston

During the period of 2005-2014, the BOE did not receive any reports of rubella or CRS to the Bureau of Epidemiology. In Texas, there have been no reported cases of rubella since 2004 and no reported cases of CRS since 1998 (Texas Department of State Health Services, 2015). With the advent of the rubella vaccine in 1969, the incidence of rubella has decreased drastically. The last rubella epidemic occurred in the United States from 1964-1965 and resulted in 12.5 million cases of rubella

infection and about 20,000 babies with CRS (Centers for Disease Control and Prevention, 2014).



SURVEILLANCE SUMMARY

Surveillance History

Nationally notifiable since 1944

Population at Higher Risk

Unvaccinated individuals traveling to endemic areas

Notable Outbreaks:

None

Cases Per Year

0

Seasonality

Late winter and spring

Caseload

3,482



Public Health Action

There is no treatment for rubella; however, rubella is a vaccine-preventable disease. The vaccine is currently required for school entry in the State of Texas. The most effective and economic measure to prevent rubella and avoid CRS in babies is to immunize all children and ensure all women of childbearing age are immunized. The rubella vaccine is given as part of the MMR (Measles, Mumps, and Rubella) vaccine. The vaccine is given in two doses at 12-18 months of age and at four to six years of age.

In outbreaks and special situations, susceptible individuals who have no documentation of receiving the vaccine can be recommended to receive the MMR vaccine, since it has no adverse effects in individuals already immunized. Since rubella has been eliminated in the United States, one case is considered a potential outbreak. Rubella is an infectious disease for which up to 50% of cases are asymptomatic, and investigation of an apparently isolated case could reveal additional cases. In order to maintain elimination of the disease, high vaccination rates must be maintained among children and women of childbearing age, particularly women born outside of the United States.

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Salmonellosis

INTRODUCTION

Salmonellosis is a bacterial illness usually characterized by diarrhea, abdominal pain, nausea, and sometimes vomiting. Most patients develop symptoms 12 to 72 hours after infection. The illness usually lasts 4 to 7 days and most patients recover without treatment. Children under five years of age,

the elderly, and people with weakened immune systems are at greater risk of developing severe symptoms. Mortality is generally low; among 45,970 cases reported nationally from 1996 to 2005, there were 215 (0.5%) deaths (Behraves, et al., 2011).

Salmonellosis was classified as unspecified dysentery or diarrhea prior to 1954 in Texas, and became reportable as Salmonellosis in 1954. Salmonellosis is to be reported to the health department within one week of diagnosis.

Disease Transmission

People become infected with *Salmonella* by ingesting contaminated food or water (WHO, 2008). The incubation period is typically 12-72 hours after infection, and the disease can last up to a week. The principal reservoirs are animals, including poultry, livestock, reptiles, and pets. *Salmonella* is naturally present in the intestines and feces of these animals, and the bacteria can subsequently spread to humans (CDC, 2015).

The major vehicles of transmission are foods of animal origin, including poultry, meats, eggs, unpasteurized milk, and other dairy products. Infections are introduced to farm animals by feeds and fertilizers prepared from contaminated meat scraps, fishmeal, and bones. Other foods such as raw vegetables and fruits have also been implicated as a source of infection (Jackson, Griffin, Cole, Walsh, & Chai, 2013).

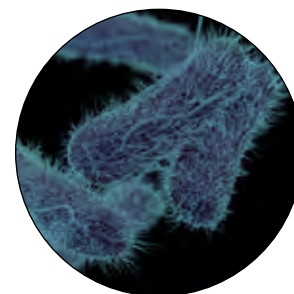
Epidemiology in Houston

In the ten-year period from 2005 through 2014, the BOE recorded 2,612 salmonellosis cases. The case count peaked in 2008, with 473 cases. The average case count for this period is 261 cases per year. An estimated 1 million cases occur annually in the United States, including 19,000 hospitalizations and 380 deaths (CDC, 2015). Figure 1 shows

the case count from 2005 to 2014 by year in Houston.

From 2005 to 2014, the incidence of salmonellosis in Houston was highest among children under the age of 5. The average incidence rate for this time period was 56 cases per 100,000. Similarly, the 2012 CDC Food-Net study found the rate of salmonellosis in this age group to be 65 cases per 100,000, the highest of all age groups (CDC, 2014). The estimated actual case count of salmonellosis in the U.S. is 1 million per year (Scallan, et al., 2011). For the City of Houston, the estimated annual case count is 7,500. This higher case estimate can be attributed to the under-diagnosis and under-reporting of the disease.

The sex distribution of the cases is approximately equal. Among the 2,612 cases, there are 1300 females and 1260 males, with 52 cases unknown. Figure 2 below illustrates the distribution of 2014 cases (n=260) in the City of Houston. Zip codes 77066 and 77064 had



SURVEILLANCE SUMMARY

Surveillance History

Reportable in Texas since 1954

Population at Higher Risk

- Children in daycares
- Persons who care for young children
- Persons who handle pets or livestock
- Persons who eat raw or under cooked poultry, eggs, or raw milk products or drink raw milk or untreated water

Notable Outbreaks

4 (2006, 2008 (2), 2010)

Cases Per Year

261

Seasonality

Summer

Caseload

6,039



the highest rates of the disease, with 154 and 101 cases per 100,000 residents, respectively.

Public Health Action

The best approach to prevent *Salmonella* is to avoid eating raw or under-cooked food, and to prevent cross-contamination while handling food. Personal hygiene and frequent hand washing are also important preventative measures. Supervised hand washing is highly encouraged in children under five years old.

Salmonella are frequently harbored in reptiles including turtles, so they are not considered desirable pets for small children. Tourists traveling to developing countries should follow the adage “Boil it, cook it, peel it, or forget it.”

The health department relies on reports from health providers, hospitals and commercial laboratories to conduct salmonellosis surveillance. The City of Houston Bureau of Laboratory Services uses pulsed field gel electrophoresis to assist in identifying outbreaks. The BOE is actively working with randomly selected medical facilities to promote surveillance.

A Case of Mistaken Identity

Overview

In May 2008, Houston Health Department (HHD) was notified by HHD Laboratory of a pulsed-field gel electrophoresis (PFGE) cluster of *Salmonella Saintpaul* of the pattern HU.JN6X01.0004 consisting of two cases. Additional cases with the same pattern were identified soon after the initial notification to multiple public health departments, including HHD, Harris County Public Health and Environmental Services (HCPHES), and New Mexico Health Department.

On May 23, Texas Department of State Health Services (DSHS) and Centers for Disease Control and Prevention (CDC) organized a conference call between the three public health departments in which epidemiologists first considered possible hypotheses about sources of the bacteria, and developed a case definition. A confirmed case was defined as a laboratory-confirmed infection of *Salmonella Saintpaul* isolated on or after 5/5/2008, matching by XbaI PFGE to the pattern HU.JN6X01.0004. Following the conference call the epidemiologists began investigating the source of the *Salmonella* exposure.

The outbreak continued to grow, with a large proportion reporting exposure to salsa and to raw tomatoes, though epidemiologists were unable to identify a single exposure source that would explain all of the cases in the Houston area. However, jalapeno peppers sampled by the Food and Drug Administration (FDA) at a McAllen, Texas packing plant tested positive with the *Salmonella Saintpaul* outbreak strain.

FDA ordered an alert in June 2008 which implicated tomatoes as the source of exposure. The result of this was that supermarkets did not market tomatoes in many grocery stores. On July 21, 2008, FDA announced publicly that tomatoes were safe to eat, but FDA now said that jalapeno and serrano peppers may have the *Salmonella* bacteria.

By late July 2008, the outbreak had concluded with a reported 1,256 confirmed cases associated with the *Salmonella Saintpaul* investigation. These cases come from 43 states, the District of Columbia, and Canada. Onset dates range from April 10 to July 5, 2008. Texas had the second highest incidence rate among the states, 10-19.9 cases per million persons (475 cases). New Mexico had the highest incidence rate, greater than or equal to 20 cases per million persons (103 cases).

Investigation

Initially two *Salmonella Saintpaul* cases of the pattern were identified within the HHD jurisdiction in May 2008. Following the conference call with HHD, HCPHES, and New Mexico Health Department on May 23rd, epidemiologists began interviewing cases using a long, hypothesis questionnaire.

By June 25, 2008, HHD interviewed twelve Houston cases using a questionnaire devised by the CDC which had questions specifically about consuming tomatoes. HHD reported the first death from this strain in a Houston resident. The decedent's entire family was ill after eating at a Houston Tex-Mex restaurant.



In July, an Epi Aid team was dispatched from the CDC to assist HCPHES epidemiologists in investigating 10 cases (two from Canada and eight from Harris County) associated with a Tex-Mex restaurant chain. The idea was that better exposure information could be obtained by interviewing a subgroup of cases that were ill from exposure at the same restaurant chain, since the cases were likely to recall specific food items that made them sick.

After a tomato recall, the outbreak was still occurring. The epidemiologists concluded that other foods, such as jalapeno peppers, could likely be a source of infection. HHD re-interviewed all 16 Houston cases using a modified “spicy foods” questionnaire, which asked for specific information regarding consumption of raw peppers and other spicy foods. On July 15, 2008, HHD forwarded an Excel spreadsheet to the Epi Aid team that listed restaurants, dates of exposure, and onset dates of illness for the 16 Houston cases. GIS mapping was

used to show the locations of cases and restaurants.

Results of the “spicy food” questionnaire showed that a large proportion of cases ate at Mexican or Tex-Mex restaurants. However, many persons in the Houston area who were not ill also frequent these restaurants.

On July 17, 2008, yet another modified questionnaire specific to the restaurant chain under investigation by the Epi Aid team was completed. HHD interviewed one Houston resident who ate at a restaurant in the chain and a healthy companion as a control.

This outbreak, first detected by the HHD Laboratory and the New Mexico Health Department in May 2008, grew to over 1,256 laboratory-confirmed cases by the time it ended in July. The investigation involved many agencies at all levels of public health, and served as a basis for future outbreak investigations of possible exposure from imported produce.

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the highest rates of the disease, with 154 and 101 cases per 100,000 residents, respectively.

Public Health Action

The best approach to prevent Salmonellosis is to avoid eating raw or undercooked food, and to prevent cross-contamination while handling food. Personal hygiene and frequent hand washing are also important preventative measures. Supervised hand washing is highly encouraged in children under five years old.

Salmonella are frequently harbored in reptiles including tur-

tles, so they are not considered desirable pets for small children. Tourists traveling to developing countries should follow the adage “Boil it, cook it, peel it, or forget it.”

The health department relies on reports from health providers, hospitals and commercial laboratories to conduct salmonellosis surveillance. The City of Houston Bureau of Laboratory Services uses pulsed field gel electrophoresis to assist in identifying outbreaks. The BOE is actively working with randomly selected medical facilities to promote surveillance.

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Severe Acute Respiratory Syndrome

INTRODUCTION

In March 2003, the World Health Organization announced a new disease that was first reported among people in Hong Kong, China, Guangdong Province, China, and Hanoi, Vietnam. The disease was subsequently named Severe Acute Respiratory Syndrome (SARS). Initial cases presented with

atypical pneumonia, and several hospital workers became infected after being in contact with infected patients. Over the next few months, the illness spread to more than two dozen countries in North and South America, Europe, and Asia before the SARS global outbreak of 2003 was contained. Since 2004, there have been no known cases of SARS reported anywhere in the world (Centers for Disease Control And Prevention, 2012).

SARS is a viral respiratory illness caused by the SARS-associated coronavirus (SARS-CoV). It has a high overall case-fatality rate of approximately 10%, increasing to over 50% in persons older than 60 years of age (World Health Organization, 2004).

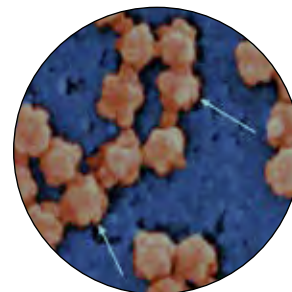
Initial symptoms are systemic and non-specific and include fever, headache, and muscle pain. Respiratory symptoms typically begin 2 to 7 days after the onset of systemic symptoms and may include a nonproductive cough and difficulty breathing in the absence of upper respiratory tract symptoms like a runny nose and sore throat. Almost all patients with laboratory evidence of SARS-CoV infection have radiological evidence of pneumonia, and most (70-90%) develop lymphopenia, or a low level of white blood cells important to the immune system (Centers for Disease Control and Prevention, 2012).

A potential SARS case could have no symptoms or could have symptoms similar to a mild-to-moderate respiratory illness. A mild-to-moderate illness is defined as having a temperature of greater than 100.4° F (38° C) and one or more symptoms of respiratory illness (cough, shortness of breath, difficulty breathing, or low oxygen levels in the blood). Potential cases may also present with severe

respiratory illness, defined as having a temperature of greater than 100.4oF (38C), one or more clinical finding of respiratory illness (cough, shortness of breath, difficulty breathing, or low oxygen levels in the blood), and either x-ray evidence of pneumonia, findings of respiratory distress syndrome, or autopsy findings consistent with pneumonia or respiratory distress syndrome without an alternate identifiable cause (Centers for Disease Control And Prevention, 2012) (World Health Organization, 2004).

Disease Transmission

The primary method by which SARS appears to spread is close person-to-person contact. SARS-CoV is thought to be transmitted most readily by respiratory droplets produced when



SURVEILLANCE SUMMARY

Surveillance History

Reportable in Texas since 2003

Population at Higher Risk

Healthcare workers

Notable Outbreaks

None

Cases Per Year

0

Seasonality

None

Caseload

0



an infected person coughs or sneezes. Droplet spread can happen when droplets from the cough or sneeze of an infected person are propelled a short distance (generally up to 3 feet) through the air and deposited on the mucous membranes of the mouth, nose, or eyes of nearby persons. The virus also can spread when a person touches a surface or object contaminated with infectious droplets and then touches his or her mouth, nose, or eyes. In addition, it is possible that SARS-CoV might spread more broadly through the air or by other unknown routes. The median incubation period is 4 to 6 days, and most people present with symptoms between 2 and 10 days after exposure (Centers for Disease Control And Prevention, 2012).

Epidemiology in Houston

In Houston, several illnesses were reported to the health department as possible cases of SARS. Reporting of potential cases was particularly prevalent among Asians or those with Asian contacts. All those reported cases were fully investigated, but none met the case definition for SARS. At the end of the 2003 pandemic there were 8,098 cases and 774 deaths (case fatality of 9.6%) reported from 29 countries worldwide, including the United States (Centers for Disease Control and Prevention, 2012) (World Health Organization, 2004).

No SARS-related deaths occurred in the US. The U.S. reported 159 suspect cases and 33 probable cases. Only eight of the probable cases had laboratory evidence of SARS-CoV infection. International travel to areas of high SARS prevalence was the main epidemiological risk factor. In the United States, no evidence of SARS-CoV infection was detected by serologic testing of household contacts of SARS cases or of the health-care workers who cared for SARS patients (Centers for Disease Control And Prevention, 2012). Since 2004, there have not been any known cases of SARS reported anywhere in the world.

Public Health Action

During the 2003 epidemic, the Houston Health Department was on high alert throughout the duration of the epidemic. The BOE provided current SARS information to the public by phone or by community audience lectures, often targeting Asian communities in Southwest Houston to educate and inform them on the disease. The BOE also provided information to healthcare providers regarding disease information and diagnosis. Healthcare workers were educated in specimen collection, storage, and transportation to reference laboratories in Austin and at the Centers for Disease Control and Prevention (CDC), the only laboratories capable of running the necessary tests at that time (Houston Health Department, Bureau of Epidemiology, 2004).

Health alerts and advisories on the disease were also issued as needed, and a SARS outbreak contingency plan was immediately made for the City of Houston. The plan covers, among other issues, surveillance, prevention, and control in various settings, including isolation and quarantine (Houston Health Department, Bureau of Epidemiology, 2004).

No vaccines have been developed for SARS, and no specific antiviral treatment has been shown to be effective. It is not yet clear whether persons who have recovered from SARS-CoV infection develop long-lasting protective immunity or whether they are susceptible to re-infection and disease, as is the case with other human coronaviruses (Centers for Disease Control And Prevention, 2012) (World Health Organization, 2004).

Given the current absence of SARS, current public health actions are aimed at applying the lessons learned from the 2003 outbreak to ongoing routine and specific surveillance aimed at early detection in the case of SARS reemergence. These activities include online emergency room distress surveillance, flu-like illness surveillance, school syndromic surveillance, influenza and pneumonia mortality surveillance, and over-the-counter drug use surveillance. These surveillance tools provide the best possibility for early detection of a possible reemergence of the disease (Houston Health Department, Bureau of Epidemiology, 2004).

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Shiga-Toxin *Escherichia Coli*

INTRODUCTION

Hundreds of strains of *Escherichia coli* (*E. coli*) bacteria cause diarrhea illness of varying severity. A subgroup of *E. coli*, known as shiga-toxin producing *E. coli*, or STEC, can cause severe illness with bloody diarrhea and abdominal cramps. Occasionally, STEC infections may damage the kidneys,

leading to hemolytic uremic syndrome (HUS). This complication is serious and requires immediate medical attention. Historically, *E. coli* O157:H7 has been regarded as the most serious strain of *E. coli*. Other bacteria can produce the shiga toxin, such as *Shigella dysenteriae*, which can progress into HUS.

In 2001, Texas designated all STEC infections as a reportable disease. Prior to that, only STEC infections from O157:H7

were required to be reported. Infections from non-shiga toxin producing *E. coli* are not reported to HHD. Laboratory confirmed cases of STEC are reportable to HHD within one week. A confirmed case of STEC is one that meets laboratory criteria for diagnosis (isolation of *E. coli* O157:H7 or shiga toxin *E. coli*), whereas a suspect case of STEC is a case of HUS occurring after a known diarrhea episode.

Disease Transmission

STEC is generally a foodborne illness. The primary source is livestock that harbor the bacteria without becoming ill. The pathogen is sometimes transmitted through ingestion of improperly cooked hamburger meat. However, many foods may be contaminated at the farm, or at some other point in the food production or distribution. Large outbreaks have been associated with ground beef, salami, raw milk, cider, apples, sprouts, and lettuce produced on farms with manure or water contaminated with infected feces. The incubation period is 2 to 10 days (CDC, 2015).

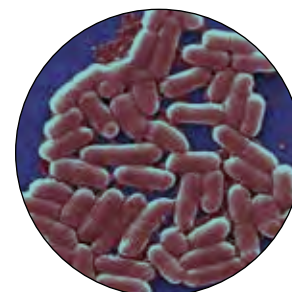
An individual may be infected by direct contact with infected animals or their manure. Petting zoos have been implicated as sources of STEC infections. STEC can be spread person-to-person, though the fecal-oral route, or by exposure to sewage-contaminated water.

Epidemiology in Houston

STEC infections have been more frequently reported in the past 10 years than in previous decades. Increased awareness about the disease and testing among physicians, as well as

increased utilization of electronic lab reporting (ELR) have contributed to the increased reporting. Hospitals and public health laboratories that use ELR have the ability to send disease data directly to the health department. ELR alleviates the reporting burden on the physicians, who otherwise would be required to submit a paper report to the health department via fax.

In Texas, case counts have approximately doubled in the past 3 years. Incidence, nonetheless, remained very low at approximately 2 cases per 100,000 Texans (Texas Department of State Health Services, n.d.). Data for the nation also indicates an upwards trend for



SURVEILLANCE SUMMARY

Surveillance History

- Type O157:H7 reportable in Texas since 1994
- All Enterohemorrhagic *E. coli* reportable in Texas since 2001
- All Shiga-toxin producing *E. coli* reportable in Texas since 2013

Population at Higher Risk

- Elderly and young children
- Persons with direct contact with animals

Notable Outbreaks

None

Cases Per Year

33

Seasonality

Summer

Caseload

847



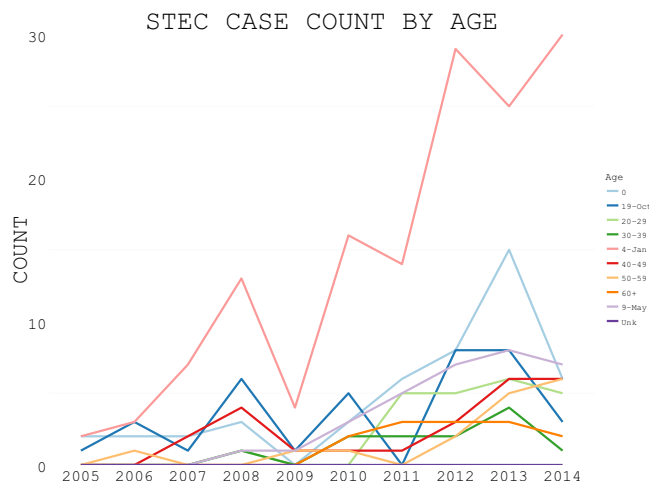


FIGURE 1. STEC case count by age.

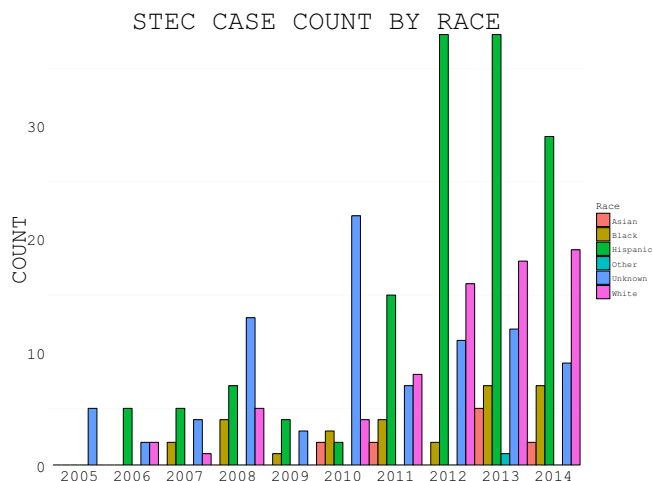


FIGURE 2. STEC case count by race.

STEC infections. Much of the increase could be attributable to increased testing, increased reporting, or non-O157 forms of the disease.

Figure 1 shows the majority of STEC cases in Houston have affected persons aged 0-5 years. In 2014, 52% of the total 68 cases reported to HHD were children aged 0-5 years. In recent years, Hispanics have had a disproportionate number of reported STEC cases, as can be seen in Figure 2. The exact reason for these demographic patterns is unknown and may just be an artifact of improved surveillance activities.

Nationally, STEC infections from laboratory confirmed reports underestimate the true burden of disease by an estimated factor of 50. Part of the reason for underreporting is that many people do not seek medical care when they become ill. Research on STEC infections suggests there are approximately 265,000 infections in the United States each year. Of these, approximately 5,200 are laboratory confirmed and reported (Scallan, et al., 2011). Applying the same estimate to Houston's data would suggest that there are approximately 3,500 STEC infections each year within the City.

For cases of *E. coli* O157, HHD laboratory utilizes PFGE techniques to obtain DNA fingerprints of isolates. These fingerprints are sent from Houston, Harris County, and nearby counties. These isolates are sent to PulseNet as part of a national epidemiological surveillance system.

STEC infections occur in a seasonal pattern. The majority of cases occur during summer. While beef consumption generally remains constant throughout the year, cattle shed larger amounts of *E. coli* in the summer months (Sodha, et al., 2015), which likely leads to the increased incidence rate during the summer.

Public Health Action

Severe complications from STEC infections, such as HUS, are the major reason to be concerned about rapid detection, reporting, and control of *E. coli* infections. In addition to being the main cause of acute renal failure in children below 5 years of age, 3-5% of HUS cases die as a result of the illness. Mild *E. coli* infections do not require antibiotics and resolve on their

MEASURES TO MINIMIZE CONTAMINATION INCLUDE:

- Consume only pasteurized milk and dairy products.
- Adequately heat food, especially ground beef.
- Swim only in pools with proper levels of chlorination.
- Use proper handwashing techniques.

own. For more serious infections, supportive care is appropriate. Antibacterial agents are not recommended in high risk populations as they may increase the risk of complications such as HUS.

In order to control the disease, HHD advises households and restaurants to follow scientific principles of food safety. Single cases can turn into large outbreaks. To prevent this, the BoE attempts to interview all cases of STEC and succeeds in reaching about 90% of cases. Patients are interviewed to determine whether they are associated with a local outbreak at a daycare or livestock show. In the event of an outbreak, an epidemiologist will monitor other cases in the outbreak and intervene to end the outbreak. The BOE assigns very high priority to investigating cases of *E. coli* O157:H7. This particular strain may be linked to eating contaminated beef, cheese, or other foods. Completed interviews of all STEC cases are faxed to Texas DSHS to provide DSHS with data that might be used to detect food or animal exposures.

HHD has encouraged physicians and hospitals to test stool samples for *E. coli*. The data suggest that testing has increased, which is likely why the incidence rate has increased. Still, both

local and national rates of STEC are underreported. In many cases of possible STEC cases, stool samples are not collected or, if collected, the appropriate tests may not be ordered or available at the local laboratory.

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Shigellosis

INTRODUCTION

Shigellosis is a gastrointestinal disease caused by the *Shigella* bacterium. The severity of symptoms can range from asymptomatic infections to severe diarrhea. Symptoms typically include watery diarrhea (occasionally with blood or mucus), fever, vomiting, and abdominal pain. Without treatment,

symptoms usually resolve within 7 days.

Immunocompromised individuals are at an increased risk of developing complications, including hemolytic uremic syndrome (HUS), Reiter's syndrome, and severe electrolyte loss.

Disease Transmission

Humans are the main reservoirs for *Shigella* bacteria. There are four sub-types: *S. dysenteriae*, *S. flexneri*, *S. boydii*, *S. sonnei*. Each serogroup differs in its geographical distribution and pathogenicity.

In the United States, high-risk populations include staff and children in child-care centers, their families, and persons in custodial institutions. After accidents involving stools, it is necessary to use adequate strength detergents and sanitizers to prevent the spread of illness.

Transmission usually occurs via the fecal-oral route. Poor personal hygiene and inadequate handwashing facilitate the spread of the disease. A major concern is personal hygiene among food handlers, who may contaminate food or drinks. The *Shigella* bacteria can be transmitted between partners during oral or anal sex (CDC, 2015). Infected persons swimming in public pools is another avenue for the spread of the disease. Occasionally, shigellosis is associated with seafood that has been harvested in sewage contaminated waters (Iwamoto, 2010).

Epidemiology in Houston

Prior to 1954, shigellosis cases were reported as 'dysentery' or 'diarrhea.' It has been one of the most common reportable diseases in Houston. The BOE generally receives reports of *S. sonnei* and *S. flexneri*. *S. flexneri*

and HUS and Reiter's syndrome are not specific to shigellosis and are fairly uncommon. HUS can be life threatening (CDC, 2015).

Confirmed cases of shigellosis are reportable to HHD within 1 week.

is frequently associated with men who have sex with men (MSM). From 2005 to 2014, [Houston had an average of 197 cases of shigellosis reported each year. In general, the trend has been downward, but 2007, 2008, and 2013 saw spikes in reported cases. These spikes indicate how quickly shigellosis can spread in a community.

During 2005-2014, there were 8 outbreaks caused by *Shigella* bacteria (Table 1).

The BOE contacts shigellosis cases to determine exposure and possible outbreaks. Children in daycare facilities are at risk of person-to-person spread. If a patient attends daycare, the daycare facility is contacted in order to determine whether there are other cases at the daycare and to educate the daycare's staff. If an outbreak is detected, then the



SURVEILLANCE SUMMARY

Surveillance History

Reportable in Texas since 1954

Population at Higher Risk

- Children in daycares
- Persons who care for young children
- Travelers in countries with unsafe food or water supply

Notable Outbreaks:

8 outbreaks

Cases Per Year

197

Seasonality

None

Caseload

1,854



SHIGELLOSIS DISTRIBUTION BY AGE

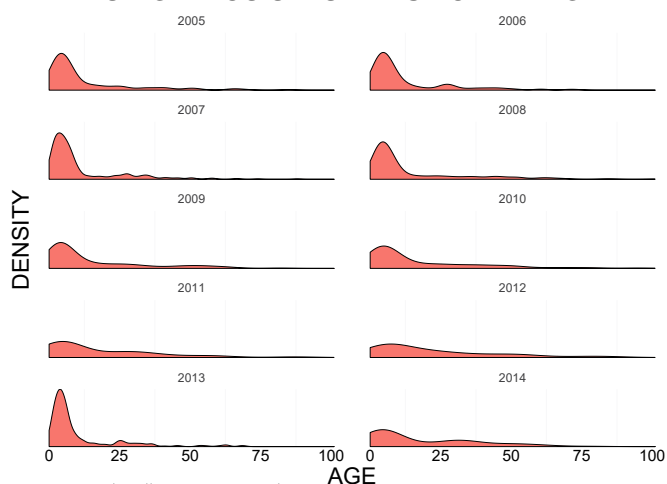


FIGURE 1. Shigellosis case count by age.

epidemiologist must collect additional stool samples from other attendees and recommend interventions. Outbreaks may also be associated with other exposures, such as oral sex among the MSM community. Occasionally, cases may be associated with a multi-state outbreak linked to a particular food item.

From 2005 to 2014, over 50% of reported cases were in children aged 0-9 (Figure 1). Men and women had similar rates of infection. Racial and ethnic trends are difficult to ascertain with confidence because the majority of cases are reported with unknown race/ethnicity. From 2006 to 2011, Hispanics accounted for the majority of cases where race/ethnicity was known. Since 2012, Whites have accounted for the largest proportion of cases with known race/ethnicity. Annual reported cases peaked in 2007 with 455 cases. The lowest number of reported cases occurred in 2011 with 47 cases. The number of cases reported to HHD is estimated to be a fraction of the total burden of disease. Public Health researchers have

estimated that the number of actual cases of shigellosis is 33.3 times higher than the number of reported cases. (Scallan, et al., 2011) That would put the estimated true incidence of disease at approximately 2030 each year for the City of Houston.

In 2013, the HHD detected a large *Shigella* cluster with 175 cases in the region. Of the cases, 132 were found to be genetically similar; the other 43 cases had closely related genetic structures. Patterns of transmission were detected within the cluster, which spread through daycares in the region. Figure 2 shows the geographic spread of shigellosis cases in 2013.

Public Health Action

Mildly infected persons usually recover quickly without antibiotics. Antibiotics may be prescribed after careful consideration of potential antibiotic resistance (APHA, 2008). There is currently no vaccine available for shigellosis. Personal

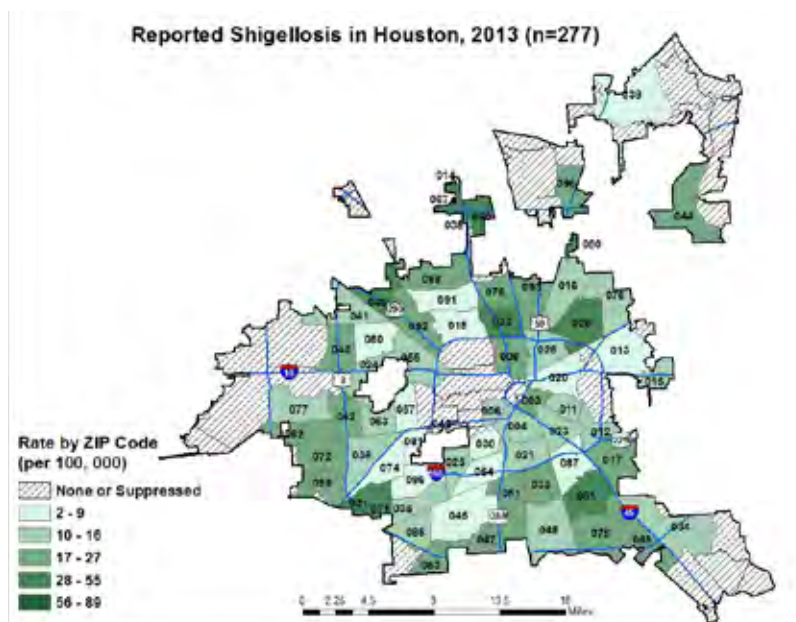


FIGURE 2. Map of shigellosis cases in Houston, 2013

Outbreak At A Private School

On October 5, 2007, the BOE received a report of an outbreak of *Shigella* at a private school. In a school with 180 students, four students were sick in the previous two weeks with laboratory-confirmed shigellosis. The most recent case, a fourth grade student, became ill and was hospitalized with *Shigella* infection on September 27, 2007. In addition, three teachers and at least six other students were sick with diarrhea, but they had not visited a medical provider.

The index cases were two students who lived in the same neighborhood near the school and carpooled to school together. One student, a fifth grader, was hospitalized overnight on September 13. Her mother became ill and was also hospitalized. The other student, in the first grade, did not see a physician, but he was absent from school on September 12 – 14. Despite his being absent during the three days, the disease spread in the first grade classroom to two other students and the teacher. The index case in the first grade has a sister who attended class in the fourth grade at the same school. This fourth grader had a bout of diarrhea for one day only, and she may have infected the fourth grader who was hospitalized on September 27.

Many of the students had siblings who attended other private schools in Houston. Principals and administrators at these other private schools had told the principal of the school under investigation that these other schools had experienced an unusually high number of children sick with gastroenteritis. However, HHD was unable to confirm whether other schools were the source of infection at the school under investigation.

In summary, a total of one fifth grader, two first graders, one fourth grader and the mother of a first-grade student were all lab-confirmed *Shigella sonnei* cases. A fourth grader and the mother of the index case in the fifth grade were hospitalized. Three ill teachers were probable cases. The last case occurred September 27 in the fourth grader.

A PFGE pattern, obtained for two stool samples collected at the school, was *S. sonnei* HUJ16X01.0219. This pattern has been seen in 115 Houston-area cases in 2007. Between September 1 and December 31, 2007, there were 67 Houston-area cases, the majority of which were in Harris County jurisdiction. Figure 1 below shows the case count by public health jurisdiction.

The students who were ill obtained a note from their doctor giving them permission to return to school. Since the three teachers had not seen a doctor for treatment, the epidemiologist asked that the teachers be excused from their job until two stool specimens were obtained that were negative for shigellosis. The school complied with this request, and the teachers each gave specimens which turned out to be negative for shigellosis. All teachers were allowed to return to school on October 15.

Drug-resistant *Shigella*

In July 2012, the National Antimicrobial Resistance Monitoring System (NARMS) confirmed that four isolates of *Shigella* from an outbreak in LA County displayed decreased susceptibility to azithromycin (DSTAzM). The bacteria harbored a plasmid-encoded macrolide resistance gene, *mphA*. The antimicrobial resistance is significant because physicians prescribe azithromycin and other macrolides empirically to treat patients with diarrhea. If bacteria are resistant, the antimicrobial will not work properly. Some of the first cases were men who had sex with men (MSM). Patients resided mostly in large urban centers.

In April 2013, the CDC contacted urban health departments, including Houston, regarding the situation. Houston, which has a large MSM population, could become a geographical hotspot for an outbreak of *Shigella* with Azithromycin resistance. A concern was that the *mphA* plasmid might be communicable between the MSM population and the pediatric population that is prone to shigellosis. By April 2013, the CDC had compiled a list of 69 *Shigella* cases with DSTAzM resistance that had been detected between 2001 and 2013.

In April 2013, the CDC asked for five Houston cases with dates of specimen collection between March 2010 and April 2012 to be interviewed using a DSTAzM *Shigella* Project Questionnaire. HHD interviewed three of the five cases and faxed the completed questionnaires to the CDC.

It appeared in 2014 that that an outbreak of DSTAzM resistant *Shigella* was centered in Houston. The question asked was whether the cases were mainly among MSM or among the general (pediatric) population.

Missing

FIGURE 1. Number of cases of *S. sonnei* HUJ16X01.0219 by health department jurisdiction, in each month, September 1, 2007 to December 31, 2007.

In 2014, twelve Houston cases with the *S. flexneri* strain were reported with dates of specimen collection during December 2013 and January 2014. HHD reviewed medical records for all twelve cases and interviewed six cases. The HHD Laboratory forwarded eight isolates to NARMS for testing for antimicrobial susceptibility.

HHD investigators found that among the twelve cases reported in 2014, five were adults and seven cases were children. All of the adult cases were men under age 40 and HIV positive. Three of the adult cases reported having sex with a man in the twelve months prior to illness. Among the seven pediatric cases, six were African-American. None of the children appeared to be infected with HIV.

CDC sent the antibiotic resistance testing results. Of eight *S. flexneri* isolates tested, four were resistant to azithromycin, tetracycline and sulfisoxazole, and were also positive for the mphA gene.

The epidemiologist at HHD was unable to demonstrate that the pediatric cases were linked to the adult cases. However,

the investigation may provide useful data to the CDC to demonstrate that transmission of the mphA gene could occur between the MSM population and the pediatric population.

PulseNet (which utilizes PFGE) and NARMS (which tests for antimicrobial resistance) provide very powerful tools to detect patterns in shigellosis cases. The initial cases demonstrated that certain PFGE patterns were associated with azithromycin resistance. These PFGE patterns were then used to guide further epidemiological follow up by the local health department (HHD). Cases in Houston with the strain pattern were linked to the national outbreak. The epidemiological follow up in Houston provided important clues about the disease transmission, which may in turn be valuable to other urban health departments.

Barriers still exist due the fact that case-patients are sometimes reluctant to share their exposure histories with the local health department. In the outbreak of 12 Houston cases in 2014, only half of the case-patients were available to be interviewed.

hygiene and frequent hand washing are the most important preventative activities for all age groups. Supervised handwashing is encouraged in all daycare centers. When in developing countries, travelers are advised to only drink boiled or treated water. Avoid undercooked or uncooked foods. Commercial laboratories should send *Shigella* isolates to the HHD laboratory for serotyping and comparison with national databases.

Several national surveillance systems exist to monitor shigellosis in the United States: the National Notifiable Disease Surveillance System (NNDSS) collects and compiles reports for case counts; the National Antimicrobial Resistance Monitoring System (NARMS) collects information on antibiotic resistant cases of shigellosis; PulseNet collects information on molecular patterns found within the *Shigella* organism and is used to detect outbreaks; and the National Outbreak Reporting System (NORS) collects reports on outbreaks of shigellosis and other diseases. HHD, in partnership with DSHS, participates with these surveillance systems and others to keep Houstonians protected.



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Smallpox

INTRODUCTION

Smallpox is a disease caused by the variola virus. There are two types of variola – variola major and variola minor. Variola major is more common and contagious, and can kill up to 30% of cases. Smallpox has existed for thousands of years. Early settlers of the Americas introduced the disease to

the native tribes, causing a reduction in the native population. Historically, people acquired immunity to smallpox through variolation, or the deliberate infection with the disease. In 1796, Edward Jenner developed a vaccination method against the disease. Successful vaccination efforts throughout the centuries led the World Health Organization to declare the world free of smallpox in 1980 (Riedel, 2005, pp. 21 - 25). Smallpox is the only human disease that has been eliminated through vaccination.

Symptoms of the disease include high fever, rash, malaise, head and body aches, and vomiting. The virus is most contagious when

the rash evolves into sores in the mouth and throat. The rash then spreads to the entire body. Once the skin lesions turn into scabs, the person is no longer infectious. A smallpox rash differs from a chickenpox rash in that the smallpox rash spreads to the entire body, including the arms, legs, and face, whereas the chickenpox rash is mostly concentrated on the torso (CDC Emergency Risk Communication Branch, 2007).

Smallpox was reportable in Texas until 1980. It became reportable again in 2001 after the anthrax attacks. Any suspect case of smallpox is to be reported to the health department immediately.

Disease Transmission

The incubation period of smallpox is 7 to 17 days, with an average of 12 to 14 days. The most common ways smallpox spreads are via respiratory droplets or direct contact with skin lesions or body fluids of an infected person. Exposure to contaminated clothing or bedding materials is also a common source of infection (Kiang & Krathwohl, 2003, pp. 229 - 230).

According to the CDC, there has to be prolonged face-to-face contact for smallpox to spread. The household contacts of a person with smallpox are at greatest risk for infection. There are no animal reservoirs of smallpox (CDC Emergency Risk Communication Branch, 2009).

Epidemiology in Houston

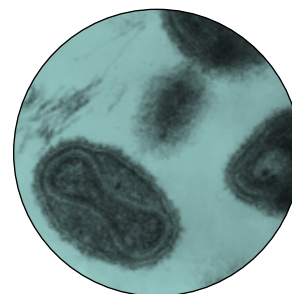
The United States recorded its last smallpox case in 1949 in Hidalgo, Texas. Houston had its last reported case in 1942. In the 1800s,

there were multiple outbreaks of smallpox in Houston. The last two outbreaks occurred during the 1920s and early 1930s. In the outbreak of 1925 - 1927, the city recorded 541 cases, while in the outbreak of 1930 - 1931, there were 279 cases (Houston Department of Health and Human Services, 2005).

Public Health Action

There is no cure for smallpox, and the best prevention is the smallpox vaccine. In the United States, routine vaccination of the public ended in 1972, after there were no reported cases in the prior two decades. Immunity is likely to wane after 5 - 10 years, therefore almost everyone in the United States is susceptible to the smallpox virus. Any person who has survived from smallpox is considered immune (Kennedy, Ovsyannikova, & Poland, 2009, p. D74).

Smallpox is considered a potential bioterrorist weapon. In the event of a bioterrorist



SURVEILLANCE SUMMARY

Surveillance History

Reportable in Texas until 1980. Reportable again in 2001.

Population at Higher Risk

None

Notable Outbreaks

1800's, multiple, 1925-1927, and 1930-1931

Cases Per Year

0

Seasonality

None

Caseload

0

attack, the Houston Health Department has has a public health response plan in place,

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Spotted Fever Rickettsioses

INTRODUCTION

Rocky Mountain Spotted Fever (RMSF) is an illness caused by *Rickettsia rickettsii*, a bacterial pathogen transmitted by ticks. Several species of ticks are associated with the disease, including the American dog tick, the brown dog tick, and the Rocky Mountain wood tick. Despite its name, RMSF is

most commonly found in the Southeast United States. It can also be found throughout North, Central, and South America (CDC, 2013).

Disease onset usually begins approximately a week after a tick bite. While there are several rickettsial illnesses in the United States, RMSF is the most severe and frequently reported. Symptoms include fever, headache, malaise, vomiting, or neurological signs in later stages. Most cases also report a rash, often on the palms or the soles of the feet. Diagnosis can

be difficult, due to non-specific symptoms, if tick exposure is unknown.

RMSF is treatable with tetracyclines, a class of antibiotics. If untreated, it may lead to a variety of disorders involving the nervous system, respiratory system, gastrointestinal system, and renal system and is fatal in approximately 5%-20% of untreated cases (Chapman, 2006). Complications include paralysis of lower limbs, gangrene, hearing loss, and language disorders.

Disease Transmission

RMSF is transmitted to humans by members of the *Ixodes* tick family. The disease has been detected widely across the United States, Mexico, Central America, the southern part of Canada, and South America. The states with the highest reported incidence rates are North Carolina, Oklahoma, Missouri, Delaware, Arkansas, and Tennessee. *Ixodes* ticks transmit the *Rickettsia* bacterium through their bites. Risk factors for RMSF are frequent exposures to dogs and living near wooded areas or environments with high grass. The majority of infections occur during the summer months, which coincide with an increase in the tick population and outdoor activity.

Epidemiology in Houston

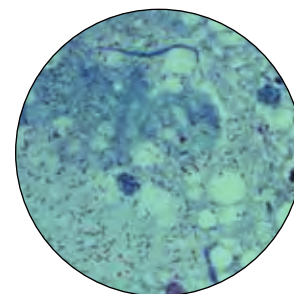
RMSF has been a reportable disease in the United States since the 1920s and in Texas since 1951. Cases occurred sporadically during the 1950s in Houston, possibly associated with travel and exposures to surrounding areas. From 2005 to 2014, ten cases were reported. No cases were identified in

children, and six of the ten were between the ages of 40 and 49.

Public Health Action

Appropriate antibiotic treatment should be initiated immediately when there is a suspicion of RMSF, because without treatment approximately 20% of cases will be fatal.

RMSF has never been endemic to Houston, so there is limited public health action for the disease in the greater-Houston area. Public health actions are limited to identifying exposure and travel histories from cases and providing public health information to persons who expect to travel or work in areas where they are likely to have repeated tick exposures.



SURVEILLANCE SUMMARY

Surveillance History

Nationally reportable since the 1920's

Population at Higher Risk

- Travelers in endemic areas
- Exposure to tick bites

Notable Outbreaks:

None

Cases Per Year

1

Seasonality

Late spring and summer

Caseload

79



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Submersion Injury Surveillance

INTRODUCTION

Submersion injuries include drowning and near-drowning. Submersion injury is at the top of the list of unintentional injury deaths for all ages and the leading cause of injury deaths among children aged 1 to 4 years in the United States (CDC MMWR 2012) (CDC MMWR 2012). Submersion

injuries occur more often during the months with warmer temperatures. In the United States, from 2005 to 2009, 40% of submersion injuries resulted in death. Risk factors for submersion injuries include children four

years and younger, male gender, and swimming pools (CDC MMWR 2012). Submersion injuries can be prevented by taking personal precautions when near or around water.

Description of Surveillance Activity

In Texas, submersion injuries became reportable in 1994 (Texas Administrative Code 1994). Reporters of submersion injuries include hospitals, the Houston Fire Department EMS (HFD EMS), news media, the HHD Bureau of Vital Statistics, the Harris County Medical Examiner's Office and other health departments (i.e., Harris County Public Health and Environmental Services (HCPHES), Galveston County Health District and Texas Department of State Health Services (TDSHS) (HHD OSPHP 2000). From 1994 to 2009, the Houston Health Department tracked and monitored submersion

injuries through routine reporting processes. A complimentary surveillance system is the Texas EMS and Trauma Registries System (Texas DSHS 2015).

From 1994 to 2014 there was a change in the case definition. In the past, the case definition of drowning was a death resulting from suffocation within 24 hours of submersion in water and a "near-drowning" was defined as survival for at least 24 hours after submersion in water (Texas DSHS 1998). In 2015, a submersion injury is defined as the process of experiencing respiratory impairment from submersion or immersion in liquid (Texas DSHS 2015).



SURVEILLANCE SUMMARY

Surveillance History

Population at Higher Risk

Notable Outbreaks

Cases Per Year

Seasonality

Caseload



Epidemiology in Houston

From 2005 to 2008, there were 23 drownings in Houston. Sixty-four percent (64%) of these drownings occurred among individuals younger than 20. Eighty-two percent (82%) were male, and 52% occurred in swimming pools. During the same time period there were 52 near drownings. Twenty-nine percent were below 20 years of age, 71% were male and 82% occurred in swimming pools.

Most submersion injuries occur during the Spring and Summer months in the U.S. In Houston, most submersions occur from April to October.

Public Health Action

Public health surveillance for submersion injuries includes various activities. One activity is the tracking and monitoring of drownings and near drownings using passive surveillance. The surveillance data is obtained from provider reports to the health department. The information is used to ascertain the epidemiology of submersion injuries in Houston and direct public health action and policy. Another activity was participation in the Houston Trauma LINK which is a coalition of health-care and government agencies directed at reducing morbidity and mortality of childhood injuries, including drownings and near-drownings, in Houston and Harris County (Houston Trauma LINK (Linking Information Networking Knowledge) 2016). The coalition prepared injury fact sheets and reports on submersion injury up to 2006. HHD participated from 2004 to 2007.

Finally public health releases messages to educate the public on how to avoid drownings and near-drownings:

MESSAGES TO EDUCATE THE PUBLIC ON HOW TO AVOID DROWNINGS AND NEAR—DROWNINGS

Watch children and do not leave them unattended around pools, bathtubs, or other bodies of water.

Wear lifejackets: all boaters and weaker swimmers

Avoid alcohol use while swimming, boating, water skiing, or supervising children;

Learn survival swimming skills (all parents and children).

Assure environmental protections (e.g., isolation pool fences and lifeguards) are in place

Assure all caregivers and supervisors have training in cardiopulmonary resuscitation.

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Syphilis

INTRODUCTION

Syphilis is a sexually transmitted disease (STD) that is caused by the corkscrew shaped bacterium, *Treponema pallidum*. The infection is often called the “great imitator” because many of its symptoms are shared by other diseases. While it can be managed by antibiotics, untreated syphilis

may develop into a lifelong, debilitating disease. Laboratory testing is required to confirm a positive syphilis diagnosis.

Syphilis affects both men and women and can infect a fetus during pregnancy. Infection of the fetus, termed congenital syphilis, is dependent on how long a woman has been infected prior to delivery. The risk of infecting the fetus is highest if the mother is in the early stages of the infection. If the mother receives treatment for syphilis prior to the 16th week of pregnancy, the fetus will most likely be born uninfected (Centers for Disease Control and Prevention, 2014). Pregnant women infected with syphilis have a higher risk of delivering a stillborn infant or delivering a baby who dies shortly after birth. If the baby is not treated shortly after birth, the baby may develop serious problems within a few weeks. Untreated infants may become developmentally delayed, have seizures and die (Centers for Disease Control and Prevention, 2014).

The incubation period for syphilis is estimated to be between 10 to 90 days, with the average length being 21 days.

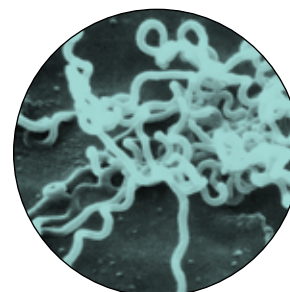
The disease is reportable at all three stages: primary, secondary, and latent. Primary is the initial stage after a recent infection. It is identified by the appearance of one or more round, painless, firm sores (called chancres) at the site where the bacteria entered the body. With early treatment, the infection can be halted and transmission to others prevented. If untreated, the sores heal but the infection progresses into the secondary stage. A confirmed or suspected primary or secondary stage case is reportable to DSHS within one work day.

Secondary stage of the infection is characterized by a skin rash that can go unnoticed.

Other symptoms include: hair loss, mucous patches, and malaise. The symptoms resolve themselves over time, but lack of treatment progresses the infection into its latent stage. Latent stage also referred to as the “hidden stage” begins after secondary symptoms disappear. The infected person will continue to have syphilis, even though they show no symptoms. If left untreated, the infection remains inside of the body and has a possibility of damaging organs including the brain, nerves, bones, blood vessels and the liver. The effects of the damage may show up years later in the form of numbness, paralysis, difficulty coordinating muscle movements, gradual blindness and dementia. A confirmed/suspect latent stage case is reportable to DSHS within one week.

Late stage syphilis develops in 15% of untreated syphilis cases; it can appear 10 to 20 years after first becoming infected with the disease (Centers for Disease Control and Prevention, 2014). At this stage, the disease can damage internal organs resulting in difficulty moving, gradual blindness and dementia. Late stage syphilis is grouped into gummatous syphilis and cardiovascular syphilis. Gummatous syphilis is characterized by skin lesions that can impact any organ, but are most commonly found on the skin. Cardiovascular syphilis occurs from the destruction of the tissue around the heart. The damage the disease has caused the body may be serious enough to cause death.

Syphilis has been a notifiable condition since 1941. Suspected or confirmed primary and secondary stage syphilis cases are to be reported to the local health department within one day; all other stages of syphilis are to be reported within one week.



SURVEILLANCE SUMMARY

Surveillance History

Reportable in Texas since 1941

Population at Higher Risk

- Black men who have sex with men (25-34 years)
- White males (30-39 years)
- Hispanic males (35-44 years)
- Black females (20-30 years)

Notable Outbreaks:

One (2012)

Cases Per Year

346

Seasonality

None

Caseload

30,609

Disease Transmission

Syphilis is predominately transmitted through sexual intercourse with an infected person who has an infectious syphilis sore (sores frequently occur on the external genitals, vagina, and anus or in the rectum, but are sometimes found on the lips and in the mouth). Symptoms may develop 10 to 90 days (average 21 days) after infection. Syphilis can be transmitted from mother to child, either in the uterus or during the birthing process, leading to a condition known as congenital syphilis.

Sharing of needles during intravenous drug-use and handling infectious blood or specimens from infected patients also provide ways of transmitting disease. The transmission of syphilis through blood or blood product transfusions is rare because blood donations are systematically screened for signs of the infection.

Epidemiology in Houston

Primary And Secondary Syphilis

Surveillance of syphilis is conducted by the HHD Bureau of Epidemiology for the City of Houston and Harris County. Between 2005 and 2014, HHD reported 16,042 syphilis cases (excluding congenital). Of the 16,042 cases reported, primary and secondary syphilis accounted for 3,458 cases.

Continuing a trend that began in 2000, there was a consistent year to year increase in primary and secondary syphilis cases (Figure 1). In 2007, cases peaked at 436 cases. After 2007,

case counts decreased for four years with a low of 263 cases in 2010. In 2012, HHD identified an outbreak of syphilis. From January to July 2012, there was a 97% increase in infectious syphilis cases in comparison to the same time period in 2011. Primary syphilis greatly facilitates the spread of HIV as a result of the painless sore that develops at the site of sexual contact during the disease's primary stage (Zetola & Klausner, 2007). In the 2012 outbreak, approximately 39% of those with infectious syphilis were also infected with HIV.

The burden of disease has disproportionately impacted the Black population of Houston/Harris County (Table 1). A total of 2,069 cases (60%) were reported within this racial/ethnic group. Asians had the lowest number of reported primary and secondary syphilis cases with a total of 33 cases. The burden of illness has a focus on young adults. Individuals between 20-29 years of age are heavily impacted; they account for 1,470 cases (43%).

Men are disproportionately impacted by syphilis in Houston/Harris County (Table 2). From 2005 to 2014, the number of male primary and secondary syphilis cases was 2,808, while females accounted for 650 cases. The data suggests that women did not contribute significantly to the transmission of infections to men and that transmission was occurring chiefly among men.

Syphilis is rare in the rural parts of Houston, as seen in Figure 2. Like other STIs, the illness is predominantly in areas with dense populations and lower socio-economic status.

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FIGURE 1. Syphilis case count.

FIGURE 2. Primary & Secondary stage syphilis cases.

TABLE 1: NUMBER OF PRIMARY AND SECONDARY SYPHILIS CASES BY RACE, 2005-2014

Racial Group	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Grand Total
Asian	1	4	3	5	3	3	6	3	0	5	33
Black	114	226	275	230	218	183	167	272	179	205	2069
Hispanic	63	74	78	74	50	42	57	131	61	89	719
White	77	77	80	63	47	34	36	84	60	56	614
Other	0	0	0	0	0	1	0	3	1	5	10
Unknown	0	0	0	2	0	0	0	0	3	8	13
Total	255	381	436	374	318	263	266	493	304	368	3458

TABLE 2: NUMBER OF PRIMARY & SECONDARY SYPHILIS CASES BY BIRTH SEX IN HARRIS COUNTY, 2005-2014

Racial Group	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Grand Total
Female	51	56	95	82	69	53	55	83	50	56	650
Male	204	325	341	292	249	210	211	410	254	312	2808
Total	255	381	436	374	318	263	266	493	304	368	3458

Congenital Syphilis

City of Houston and Harris County report the greatest number of congenital syphilis cases within Texas. The rate of the disease in Texas (19.4 per 100,000 residents) exceeds the national rate (8.5 cases per 100,000 live births) (Filipowicz & Lucas, 2014). Congenital syphilis is concentrated within the Black and Hispanic population of Houston/Harris County (Table 3). Of the 310 cases reported by HHD, 176 cases were identified in individuals that identified as Black and 97 cases were identified in individuals that identified as Hispanic.

**TABLE 3: NUMBER OF CONGENITAL SYPHILIS CASES BY RACE IN HARRIS COUNTY, 2005-2014**

Racial Group	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Grand Total
Asian	0	0	0	1	0	0	0	0	0	0	1
Black	6	13	16	31	29	21	17	12	15	16	176
Hispanic	10	7	17	9	14	14	6	6	8	6	97
White	1	3	2	4	1	5	1	4	1	2	24
Other	0	1	0	0	0	1	1	0	0	1	4
Unknown	0	0	5	0	1	2	0	0	0	0	8
Total	17	24	40	45	45	43	25	22	24	25	310

Public Health Action

Syphilis is relatively simple to cure in its early stages. It is typically treated with a single injection of penicillin. Additional doses are needed for persons who have been infected for longer than a year. For persons that are penicillin allergic, other antibiotics are available to treat syphilis. Treatment will kill the bacteria and prevent further damage, but it will not repair damage already done. Since this is a treatable infection, it is important that persons at risk for infection be screened on an on-going basis. Only laboratory tests, such as demonstration of *T. pallidum* in late lesions by fluorescent antibody or special stains, can confirm whether a person has syphilis.

At the HHD Bureau of Epidemiology, epidemiologists identify outbreaks and Disease Intervention Specialists (DIS) refer people at high risk to testing sites. Testing and treatment is provided at several of our Health Service Centers: Sharpstown, 6201 Bonhomme; Sunnyside, 4605 Wilmington; and Northside, 8504 Schuller. In addition, the HHD deploys a mobile clinic that offers confidential testing for syphilis and other diseases, including HIV, chlamydia, hepatitis C, and gonorrhea.

The Syphilis Threshold Monitoring Tool, an evaluation tool developed by DSHS, is utilized monthly to monitor 12 and 24 months of syphilis data. The tool is critical in identifying whether syphilis case counts are no longer within expected limits. The situation is considered at warning levels when cases

increase to the mean +1 standard deviation (SD). A situation is said to be in rapid response when cases have increased to the mean + 2 SD. During the 2012 outbreak, the tool identified rapid response levels consecutively in March, April, May and June of that year.

Congenital Syphilis

Congenital syphilis surveillance for Harris County and City of Houston is conducted by the Bureau of Epidemiology. The Bureau classifies babies born to infected women into three categories (A-baby, C-baby and F-baby). An "A-baby" is a baby born to an infected mother that has received syphilis treatment at least 30 days before the birth of the baby. Additionally, an "A-baby" must have received optional preventative treatment from doctors after birth. An "F-baby" classification occurs when the mother, after testing, shows no positive signs of infection with syphilis. Both "A" and "F" babies are considered non-cases.

The classification of "C-Baby" is given the child born to an infected woman that did not receive treatment at least 30 days prior to giving birth; A "C-baby" is considered a probable case. The hospital where the child was born is responsible for providing treatment to the child. In the event that the mother and child are discharged, the Bureau of Epidemiology contacts the mother and notifies her that she should return to the hospital so that the child can receive 10-days of treatment for possible

congenital syphilis infection. A mother that has no history of having received treatment for syphilis is assigned to a DIS who will conduct further disease investigation and provide resources for receiving treatment. All probable syphilis cases are sent to DSHS in Austin for review. DSHS Austin makes the final decision on whether a case is a confirmed congenital syphilis case.

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Tetanus

INTRODUCTION

Tetanus is a rare, vaccine-preventable disease in the United States. It is caused by spores produced by the bacterium *Clostridium tetani*, which is found in the soil, dust, and manure. The bacteria enter the body through wounds or cuts caused by contaminated objects, such as pins or nails.

Symptoms of tetanus include muscle spasms, difficulty swallowing, seizures, headache, fever, and high blood pressure. The illness is also called “lockjaw” due to the jaw spasms that patients experience, which prevent them

from opening their mouth. Tetanus is fatal in about 10 to 20 percent of cases. Most tetanus cases have been observed in unvaccinated or under vaccinated persons (Centers for Disease Control and Prevention, 2011).

Disease Transmission

Tetanus spores can enter the body through wounds, cuts, burns, or scratches. The average incubation period is 10 days, with a range of 3-21 days. Patients with shorter incubation periods have been linked to heavy contaminated wounds, more severe disease, and worse prognosis. The disease is not transmitted from person-to-person. In rare cases, tetanus is linked to surgery, insect bites, dental infections, compound fractures, chronic infections, IV drug use, and superficial wounds (Centers for Disease Control and Prevention, 2015).

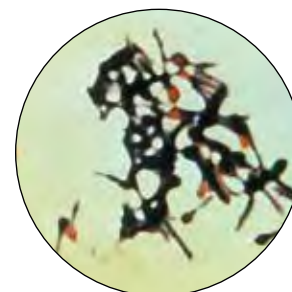
Epidemiology in Houston

No cases of tetanus have been reported to Houston or Harris County between 2005-2014. In that period, only 16 cases were

reported in Texas. The U.S. has had an average of 29 cases per year have been reported from 1996-2009 in the United States. (Centers for Disease Control and Prevention, 2015). Texas recorded a total of 16 cases from 2005 to 2014, and none of them were reported in Houston or Harris County.

Public Health Action

The best prevention strategy for tetanus is to stay up-to-date on the tetanus vaccine schedule. Children should receive the tetanus shot as part of the DTaP series. Persons aged 13 years and over should receive a one-time dose of Tdap, and a Td booster once every ten years. All wounds and cuts should be treated immediately using an antibiotic to prevent infection (World Health Organization, 2014).



SURVEILLANCE SUMMARY

Surveillance History

Nationally reportable since the late 1940's

Population at Higher Risk

- Unvaccinated persons
- Intravenous drug users

Notable Outbreaks:

None

Cases Per Year

0

Seasonality

None

Caseload

6

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Trichinosis

INTRODUCTION

Trichinosis (also known as Trichinellosis) is a parasitic disease caused by the intestinal roundworm *Trichinella spiralis*. The parasite forms cysts in muscles. Humans become infected by ingesting the larvae of the *Trichinella* worm in raw or undercooked meat. Early signs and symptoms

include increased white blood cell count, fever, muscle soreness, and swelling of the upper eyelids which in turn may be followed by retinal hemorrhaging, pain, and photophobia. Diarrhea and abdominal pain are also characteristic. Symptoms that follow include thirst, sweating, chills, weakness, and prostration. Depending on the number of larvae ingested, the illness ranges from an imperceptible infection to potentially fatal conditions that might present as early as 5 days after ingestion.

Disease Transmission

Persons that eat raw or undercooked meat, particularly bear, pork, or any wild game, are at risk for trichinosis (CDC, 2012). Feral swine in Texas often have trichinosis and may be a source of infection. Safety from infection has increased with the inspection of pork in the United States. If one cooks meat to 160°F (71°C) the risk of infection is significantly lowered. Processed meats pose little risk of infection.

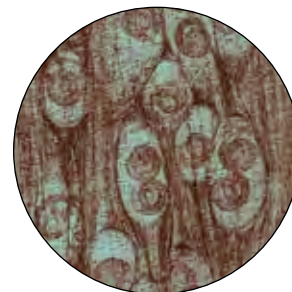
Epidemiology in Houston

There were two reported cases of trichinosis in Houston during 2005-2014: one case in 2011 and one in 2012. However, both cases were considered to be isolated incidents.

Due to limited data, there is no information on the populations who are generally affected by the disease in Houston, or how Houston's disease rates and trends compare to the nation. In general, hunters and consumers of wild game are at the highest risk of contracting the illness, though the risk is still very small.

A case is confirmed in the laboratory by demonstration of *Trichinella* larvae in tissue obtained by muscle biopsy or positive antibody test. Trichinosis became reportable in 1966. The reporting of trichinosis to local health agencies takes place within the passive surveillance system of HHD. HHD relies upon hospitals, clinics, private providers, and others to report positive or suspected cases as they occur.

Infection was once very common in the United States, but now it is quite rare. Today, this number is much lower at less than 2%. The majority of currently reported cases are not related to consumption of undercooked pork, but rather bear and other wild game meat. Other parts of the world have seen



SURVEILLANCE SUMMARY

Surveillance History

Reportable in Texas since 1966

Population at Higher Risk

Consumers of game meat

Notable Outbreaks:

None

Cases per year

0

Seasonality

Winter

Caseload

5



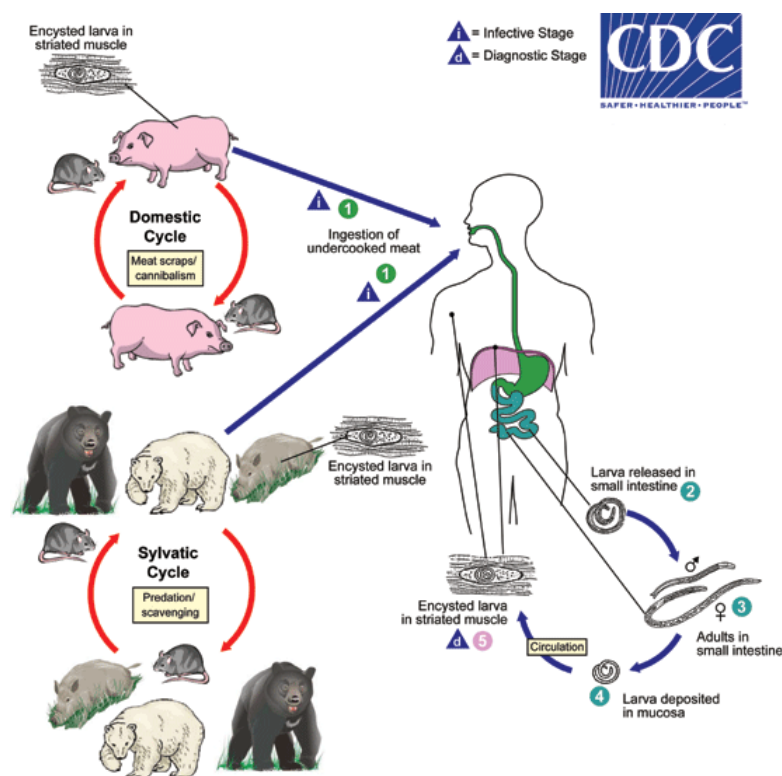
outbreaks as a result of infected horse, walrus, and dog meats.

From 2008-2012 there were 84 cases reported nationally. Of those, 33% were from a single outbreak in California in 2008 (Wilson, Hall, Montgomery, & Jones, 2015). The number of cases has been very low in the past two decades because of public awareness of the danger of eating raw or undercooked pork products, commercial and home freezing of pork, and legislation prohibiting the feeding of raw meat garbage to hogs.

Public Health Action

Trichinosis can be treated during the intestinal stage and muscular stage with anti-parasite drugs.

Increased public awareness of consumption of undercooked meats and advancements in the sanitary storage of meat products are direct causes of the rapid decline in trichinosis cases (CDC, 1999). Further education targeting hunters regarding proper preparation of wild game meat would also prove beneficial.



PREVENTION STRATEGIES INCLUDE:

- Proper cooking of meats.
- Freeze meats for 30 days.
- Irradiate meats (usually commercial).
- Clean grinders thoroughly before and after processing meats.
- Freeze meats at 5°F (-15°C) for 30 days or -13°F (-25°C) for 10 days (pieces 6" thick).
- Educate hunters on the proper cooking of wild meats.

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Tuberculosis

INTRODUCTION

Approximately one-third of the world's population is infected with tuberculosis (TB). Each year, 9 million people become sick with TB and 2 million people die from it. Among people living with HIV, TB is the leading cause of death (CDC, 2015).

TB has steadily decreased over the last 50 years in the United States as a result of the introduction of new TB medications, early detection, and directly observed therapy. Still, TB continues to linger. In 2014, there were 9,412 newly reported TB cases in the U.S. This equates to a TB case rate of 3 cases per 100,000 persons; a decrease of 2.2% from 2013, the smallest decrease in over a decade (CDC, 2013).

Drug Resistance

Over the past 10 years, the percentage of TB drug resistance ranged from 5-15% of total reported TB cases. The most common resistance was to either Isoniazid or Rifampin, two of the first-line drugs. Multi-drug resistance (MDR), defined as being resistant to at least Isoniazid and Rifampin, was only 2% or less of all reported TB cases. In four of the ten years no MDR cases were reported.

Drug resistance is detected by drug susceptibility testing which is performed routinely on all TB cases with a positive culture. In Houston, the City of Houston Laboratory and local hospitals perform these tests. Once the City Laboratory suspects drug resistance, the specimen is sent to a CDC Laboratory for Molecular Detection for Drug Resistance (MDDR); a rapid test to identify drug resistance. The test looks for specific mutations in the DNA sequencing of the bacteria.

Upon receiving lab results of drug resistance, the TB Nurse Case Manager assigned to the patient consults with a TB expert to guide TB treatment. This is standard protocol for all drug resistant cases. Treatment regimens may include second-line drugs and/or fluoroquinolones.

The general symptoms of TB disease include feelings of sickness or weakness, weight loss, fever, and night sweats. The symptoms of TB disease of the lungs also include coughing, chest pain, and the coughing up of blood. Symptoms of TB disease in other parts of the body depend on the area affected (CDC, 2015).

Disease Transmission

TB is transmitted when an individual inhales *M. tuberculosis*. When TB bacteria are inhaled by a healthy person, the immune system is usually strong enough to defend the body and the bacteria remains harmless, producing no infection or subsequent disease. If, however, the bacteria are more powerful than the response produced by the immune system to stop the attack, infection begins and disease may follow (Dyer, 2010).

Tuberculosis (TB) is a disease caused by germs that are spread from person to person through the air when a person with TB disease of the lungs or throat coughs, sneezes



SURVEILLANCE SUMMARY

Surveillance History

Nationally reportable since 1951

Population at Higher Risk

- Those born outside of the U.S.
- Healthcare workers
- Those with diabetes or HIV
- Those with a history of being homeless, prison or jail time, or drug or alcohol abuse

Notable Outbreaks

None

Cases Per Year

240

Seasonality

None

Caseload

1,419



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FIGURE 1. Tuberculosis case count.

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FIGURE 2. Tuberculosis case count by race.

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FIGURE 3. Tuberculosis case count by risk factor.



or speaks (3,1). TB usually affects the lungs, but it can also affect other parts of the body, such as the brain, the kidneys, or the spine. A person with TB can die if they do not get treatment (CDC, 2015).

The risk of developing TB is determined by a person's immune system, co-morbidities, and exposure to persons with TB. The risk for developing TB disease is 10% over a lifetime if infected with only *M. tuberculosis* (MTB), with no risk factors. The risk increases to 30% over a lifetime if diabetic and infected with MTB. However, the risk is much higher for those infected with both MTB and HIV, between 7 and 10% each year (CDC, n.d.).

Epidemiology in Houston

The number of reported TB cases in Houston has a downward trend from 2005 to 2014, (Figure 1). In 2014, the number increased by almost 5% (from 186 to 195).

From 2005 to 2014 Hispanics had the highest number of reported TB cases each year. Since 2005, the number of African-American TB cases has steadily declined from 96 to 49

cases. During the reporting period, the TB program increased outreach efforts to provide education, points of referral and prompt identification and treatment including those identified during outbreak TB investigations.

The greatest TB risk factor in Houston is being foreign born. The number of foreign born cases has steadily decreased during the period 2005 to 2013. However, in 2014, an increase of reported cases among foreign born residents was observed. The number of foreign born individuals moving to Houston continues to increase. Identifying and treating foreign-born TB cases and their contacts remains a high priority for the TB program.

TB cases and case rates decreased among U.S.-born residents. Although the case rates decreased among foreign-born individuals there was an increase in the total number of cases among foreign-born individuals. The rate among foreign-born persons in the United States in 2014 was 13.4 times higher than among U.S.-born persons (CDC, 2013).

Racial/ethnic minorities continue to be disproportionately affected by TB in the United States. Asians continue to be the racial/ethnic group with the largest number of TB cases. Com-

pared with non-Hispanic Whites, the TB rate among Asians was 28.5 times higher, whereas rates among non-Hispanic Blacks and Hispanics were each eight times higher. Four states (California, Texas, New York, and Florida), representing approximately one third of the U.S. population, accounted for half of all TB cases reported in 2014. HIV status was known for 86% of TB cases reported in 2014. Among persons with TB who had a known HIV test result, 6.3% (506 of 8,072) had a positive test result for HIV infection. Among persons aged ≥ 15 years with TB, 99% had known homelessness status, long-term care status, and incarceration status. Among persons aged ≥ 15 years with TB, 5.5% reported being homeless within the past year, 2.2% were residing in a long-term care facility at the time of TB diagnosis, and 4.2% were confined to a detention or correctional facility at the time of TB diagnosis (CDC, 2015).

Public Health Action

The Houston Health Department (HHD) Bureau of Tuberculosis Control employs methods that promote TB core activities and strategies to attain TB Program and National TB objectives. These activities promote treatment and case management of persons with active TB and contact investigation, TB surveillance and reporting, as well as program evaluation.

TB cases are reported to the Bureau of Tuberculosis by either private providers or from hospital admission reports within 24 hours of diagnosis as is required by the Texas Health and Safety Code. The TB staff responds to the reports by interviewing patients suspected or confirmed of having TB. Investigations are conducted in shelters, schools, businesses, and households to ensure all contacts are identified and treated, as needed. During the interview process, contacts are elicited from the patient in order to identify additional individuals who should be tested for TB. This is determined by how much time an individual spent with the TB case; if they live, work, or socialize together. Screening for TB is performed using either a tuberculin skin test (TST) or QuantiFERON-TB Gold blood test (QFT).

Drug Resistant TB, A Glimpse Into The Future

A patient from a North African country arrived in Houston, Texas to visit her family. Feeling ill, she went to an Urgent Care treatment center and presented with signs and symptoms of tuberculosis (TB) and a corresponding cavitory chest x-ray.

The City of Houston Bureau of Tuberculosis conducted an interview with the patient at which point the patient shared that she had been diagnosed with TB in her home country and was placed on a standard four-drug regimen. She took the medication for two months but stopped when she could no longer afford it. Soon after, she began to feel ill again and decided to go to a different physician who started her on the same standard four-drug regimen. She stopped taking the medication (again) once she began to feel better. This occurred right before she traveled to the United States.

Based on the information collected, the TB Program collected a sputum sample and requested the lab send the specimen to Centers for Disease Control and Prevention (CDC) to test for multi-drug resistance. Sure enough, the patient was found to be resistant to both Isoniazid and Rifampin (two of the four standard drugs used for treating TB).

A consultation with the State of Texas, the CDC, and the Division of Quarantine-Atlanta, led to a decision to either place the patient on the Do Not Board list or to treat in a secure treatment location. The patient agreed to remain in the United States for TB treatment. She was transferred to Texas Center for Infectious Diseases (TCID), in San Antonio, Texas, to prevent transmission of MDR TB to family members in her household. After two months of treatment at TCID, the patient was discharged and returned to Houston to continue her treatment.

Unfortunately, before the patient could complete treatment, the patient's visa expired and she was required to return to her home country. The TB Program encouraged her to contact her local health department to continue and complete her treatment. Whether or not she completed treatment is unknown. Even with best efforts, existing barriers may prevent completion of treatment.



A full-time TB staff member is dedicated to working specifically with foreign born patients (i.e. immigrants and refugees). By screening and treating those exposed to TB, potential future cases may be averted. The TB program uses the medication 3HP, a once-a-week dosage, which has resulted in completion of treatment rates in the eighty to ninety percentile.

Nurse case management is provided for suspected TB cases, confirmed TB cases, and contacts in accordance with CDC and State of Texas guidelines. Many cases are presented with co-morbidities (i.e. diabetes, HIV) which require more intensive monitoring and coordinating with TB experts. Nurse Case Managers (NCMs) review sensitivities for any drug resistance, obtain specialized consults for difficult cases, review bacteriology and clinical information to determine when to discontinue home isolation, and review all patient charts to determine if criteria has been met for treatment completion. In addition, genotyping is used to identify epi-links to ensure all suspected cases and cases are identified in the community.

Field staff provides directly observed therapy (DOT) for the duration of the TB treatment. DOT is conducted in homes, businesses, shelters, schools, or even under a bridge to ensure treatment adherence. The TB Field staff are trained to identify side effects to medication and to provide transportation, as needed, to clinic appointments. Incentives (e.g., gift cards for gas, food, and metro) are used to encourage patients to take medicine and to keep clinic appointments throughout their lengthy 6 to 9-month TB medication regimen.

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Tularemia

INTRODUCTION

Tularemia is a zoonotic disease caused by the bacterium *Francisella tularensis* (*F. tularensis*). In humans the disease generally presents as an acute febrile illness. Depending on the route of infection and the immune response symptoms of tularemia may vary and can include skin ulcers,

pharyngitis, ocular lesions, swollen lymph nodes, or pneumonia (Dennis, Inglesby, & Henderson, 2001).

Clinical diagnosis is supported by evidence or history of a tick or deerfly bite, exposure to tissues of a mammalian host of *F. tularensis*, or

exposure to potentially contaminated water. Low doses of *F. tularensis* can cause severe illness in humans and can be fatal if not treated properly (Dennis, Inglesby, & Henderson, 2001) (Centers for Disease Control and Prevention, 2015).

Disease Transmission

Tularemia generally results from an environmental exposure which can occur through several routes. The most common routes of exposure include the bite of infected ticks, deerflies, and other insects, as well as handling infected animal carcasses, consuming contaminated food or water, and inhaling the bacterium in the environment. Rodents, rabbits, and hares are the most common animal reservoirs for *F. tularensis*, Person-to-person transmission has not been documented (Centers for Disease Control and Prevention, 2015).

Epidemiology in Houston

Since tularemia became a reportable disease in Texas, no cases have been identified in Houston, and only 10 cases have been identified in the entire state (Centers for Disease Control and Prevention, 2013).

Tularemia, with decreasing incidence since the 1940s, was initially viewed as a minimal public health threat. This viewpoint led to its removal from the nationally notifiable disease list in 1994. Concern over tularemia as a weapon of bioterrorism changed this perception, and tularemia became nationally reportable again on January 1, 2000. It was added to the Texas list of notifiable conditions in 2002 (Texas Department of State Health Services, 2010).

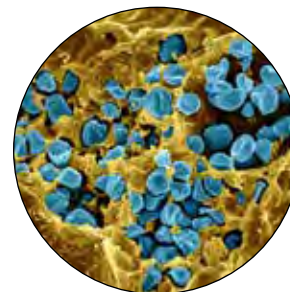
Tularemia is generally considered to result from an environmental exposure. An increase in the reporting of tularemia in the late spring and summer months is associated with an increase in outdoor activity and an increase in exposure to ticks and deerflies (Centers for Disease Control and Prevention, 2015).

Tularemia is now a relatively rare disease in the United States. The annual number of cases peaked at 2,291 in 1939, declined dramatically through the 1950s and 1960s, and have remained relatively stable since. From 2005-2013, a total of 1,244 cases were reported nationwide, at an average of 138 cases per year.

Human cases of tularemia are predominate in late summer and fall, primarily due to higher exposure to deerflies and ticks. Previous cases have been common in the winter due to exposure to infected rabbits. Men are more exposed to tularemia than women. Activities such as hunting, trapping, butchering, and farming, may expose more men than women. In recent North American cases, disease occurred most commonly in the Midwest, Utah, and Massachusetts (Dennis, Inglesby, & Henderson, 2001) (Foley & Nieto, 2010)

Laboratory testing

Current laboratory tests for *F. tularensis*, include real-time polymerase chain reaction (PCR) and conventional culture methods.



SURVEILLANCE SUMMARY

Surveillance History

Reportable in Texas since 1947

Population at Higher Risk

- People participating in outdoor activities involving animals
- Travelers to the Midwest

Notable Outbreaks

None

Cases per year

0

Seasonality

Late spring and summer

Caseload

7

TABLE 1: FRANCISELLA TULARENSIS TESTING AT HHD LABORATORY

2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
0	2	1	0	1	0	2	2	0	2

PCR testing is dependent on three markers specific to the bacteria. A positive PCR result for all three markers is a presumptive identification and requires culture methods for confirmation. Culture methods include a direct fluorescence antibody (DFA), and slide agglutination test for confirmation, based on PCR results, morphology and biochemical results.

Table 1 above shows the total number of clinical labs performed by the HHD Laboratory for *F. tularensis* by year.

Public Health Action

Prevention of tularemia includes standard practices for the prevention of tick and insect bites, such as using insect repellent containing DEET and treating clothing with the repellent permethrin. Hand washing with soap and warm water is strongly recommended after handling animals or animal carcasses. Food must be cooked thoroughly and water must come from a safe source (Centers for Disease Control and Prevention, 2015).

Treatment for tularemia generally consists of a standard course of antibiotics, tailored to the patient's age, weight, and other personal factors. Currently there is no approved vaccine for tularemia (Centers for Disease Control and Prevention, 2015).

F. tularensis, is considered a Category A bioterrorism agent. Category A includes the highest priority agents that pose a risk to national security due to the following features: the agents can be easily disseminated or transmitted person-to-person, cause high mortality with potential for major public health impact, may cause public panic and social disruption, and require special action for public health preparedness (Southern Illinois School of Medicine, 2010).

Due to tularemia's status as a Category A disease, HHD aggressively investigates any report of tularemia. Cases must be quickly evaluated to determine the source of exposure.

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Typhus

INTRODUCTION

Typhus fever can be classified as two types, murine (endemic) typhus and epidemic typhus. Murine typhus caused by fleas infected with the bacteria *Rickettsia typhi*. Symptoms of murine typhus are generally mild and include fever, headaches, chills, nausea and occasionally rashes on the

upper body. Epidemic typhus, caused by *Rickettsia prowazekii*, is transmitted by lice. A suspected or confirmed case of typhus fever is

to be reported to the local health department within 1 week.

Disease Transmission

Murine typhus is transmitted through the bites of *R. typhi* infected fleas. Fleas found on rodents are the natural hosts and transmitters of the disease. The disease is most commonly transferred from one host to another by the rat flea, *Xenopsylla cheopis*, and the cat flea, *Ctenocephalides felis* (Texas Department of State Health Services, 2011). Once an individual is infected, there is an incubation period of 6 to 14 days. Usually the disease is mild and goes unrecognized. The disease shares symptoms with a range of other diseases making it difficult to recognize. Rash is characteristic of the disease but it presents in less than 50% of cases (Civen & Ngo, 2015).

Epidemic typhus is transmitted to humans through exposure to infected louse feces. Person-to-person transmission is not applicable for either murine or epidemic typhus, but contrary to murine typhus, humans can be reservoirs for epidemic typhus. Although outbreaks are rare, prisoners, refugees, and homeless persons are susceptible to infection due to unsanitary living conditions.

Globally, murine typhus is endemic in tropical and subtropical regions, especially in cities and ports where there are large numbers of urban rats (Blanton, Vohra, Bouyer, & Waler, 2015). In the United States, the disease is concentrated in the suburban areas of Texas and California.



SURVEILLANCE SUMMARY

Surveillance History

Reportable in Texas since 1922

Population at Higher Risk

People who visit or live in rodent infested buildings or close to harbor environments

Notable Outbreaks

None

Cases Per Year

3

Seasonality

None

Caseload

47

Epidemiology in Houston

Only murine typhus fever is found in Texas (Texas Department of State Health Services, 2011). Murine typhus is endemic to Texas, but cases rarely occur in Houston. The disease is concentrated in rural and suburban portions of the state. Murine typhus cases most often occur in spring and summer (Civen & Ngo, 2015). From 2005 to 2014, there were a total of 30 cases reported with peaks of 12 and 11 cases in 2013 and 2014, respectively (Figure 1). In 2014, HHD reported 11 suspected or confirmed cases of murine typhus.

The illness has a low fatality rate (less than 1%), but Houstonians that are elderly or

TYPHUS FEVER-FLEABORNE, MURINE CASE COUNT

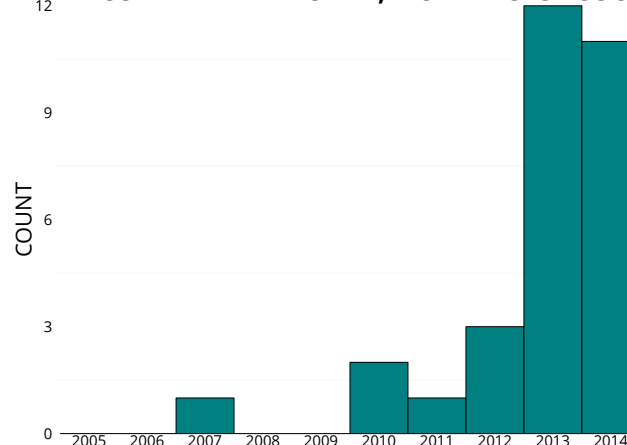


FIGURE 1. Typhus fever-flea borne case count.

immuno-compromised face a greater risk of experiencing more severe symptoms than those with healthy immune systems (Civen & Ngo, 2015). Houstonians that come into contact with rodents and cats that carry infected fleas are at greater risk of getting infected.

Public Health Action

All individuals are at risk of contracting typhus fever. For residents of Houston, murine typhus is the disease that is most concerning. The most effective method of controlling murine typhus is to reduce the rodent population. Promoting flea control measures for pets, especially cats, prevent infected fleas from transmitting disease to humans.

Any flea-borne illness prevention activities should include the use of gloves and masks when cleaning areas which are known to be rodent-infested, the use of flea-control products prior to cleaning rodent nests, and periodic examination of attics and exterior walls.

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Varicella

INTRODUCTION

Chickenpox, caused by the *varicella zoster* virus, is a highly contagious childhood disease that affected almost all children under the age of ten years until the vaccine became available in the mid-1990's. Most cases are fairly mild, with the child experiencing 7 to 10 days of discomfort. A small

percentage of chickenpox sufferers require hospitalization (Heymann, 2008) (Ali, Nguyen, & Jumann, 2003).

Chickenpox is characterized by the classic rash (papulovesicular rash) of spots or poxes. The rash may also be atypical in appearance (maculopapular rash), with few spots but generalized red areas on the skin. The varicella virus can remain dormant in the body and erupt years later in a different form of skin disease, called shingles or herpes zoster (Heymann, 2008).

Although uncommon, vaccinated persons may still develop chickenpox, known as breakthrough varicella. Breakthrough chickenpox is almost always mild, with fewer than 50 poxes, or skin lesions, and shorter duration of illness (Heymann, 2008).

Symptoms of chickenpox include a mild fever, headache, tiredness, and loss of appetite for one to two days before the

appearance of the rash or pox. The rash may first show up on the face, chest, and back then spread to the rest of the body, including inside the mouth, eyelids, or genital area. It usually takes about one week for all the pox to become scabs (Centers for Disease Control and Prevention, 2011).

The incubation period for chickenpox is 10 to 21 days (with an average of 2 weeks). A shortened incubation period can be encountered in immunocompromised patients. Although complications from chickenpox are generally uncommon, the most common is bacterial infection of the skin, initiated at the site of a chickenpox blister that has broken or was scratched open. Other complications include viral or bacterial pneumonia and encephalitis (swelling of the brain) (Heymann, 2008).

Disease Transmission

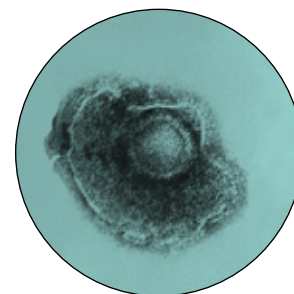
Varicella is spread person-to-person by direct contact with an infected person, droplet or airborne spread of fluid from the blisters, or secretions of the respiratory tract of chickenpox cases. In contrast to other pox viruses, such as vaccinia or variola, scabs from varicella lesions are not infective (Heymann, 2008).

Varicella in unvaccinated persons is one of the most readily communicable of diseases, especially in the early stages of the disease; secondary attack rates in susceptible household contacts range from 61% to 100%. Patients with varicella are generally considered to be infectious two days before the appearance of the rash and seven days after onset, when the vesicles have crusted. Vaccinated persons

with breakthrough varicella are generally less likely to spread the virus to others (Heymann, 2008).

Epidemiology in Houston

The epidemiology of chickenpox in Houston must be viewed in the context of the nationwide decline in numbers of cases seen since the introduction of the varicella vaccine. Routine use of the varicella vaccine was implemented in 1995, following the recommendation of the American Academy of Pediatrics. In the late 1980's,



SURVEILLANCE SUMMARY

Surveillance History

Nationally notifiable since 2003

Population at Higher Risk

Unvaccinated children

Notable Outbreaks

No notable outbreaks

Cases Per Year

376 per year

Seasonality

Winter and early spring

Caseload

2318



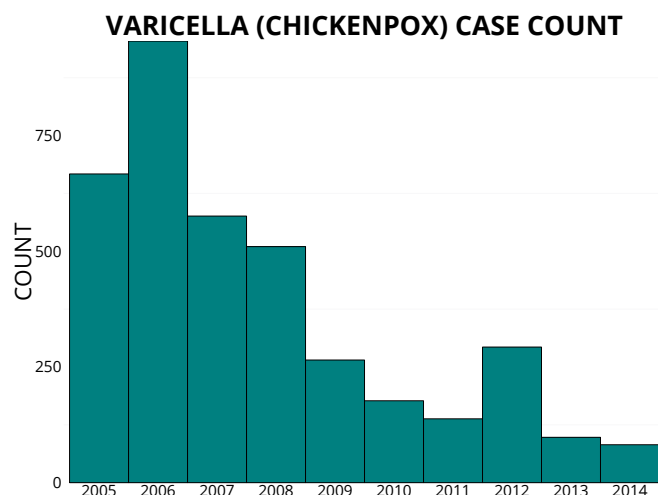


FIGURE 1. Varicella case count.

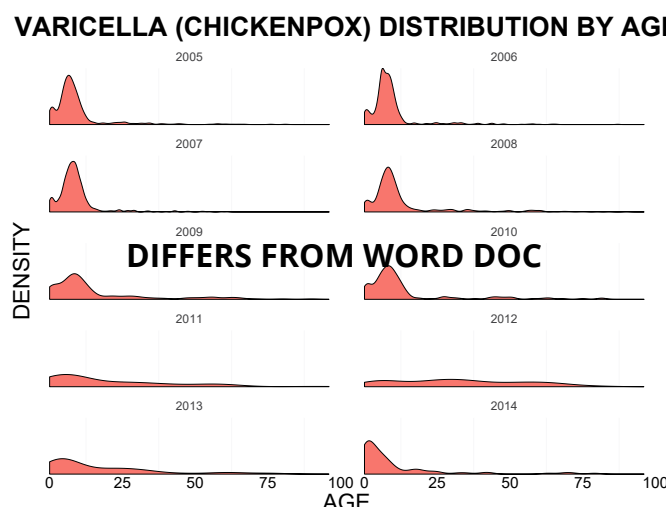


FIGURE 2. Varicella case count by age.



FIGURE 3. Varicella case count by race. From 2005 to 2014, 1,805 (48%) of the Houston cases were male, and 1,945 (52%) were female. The majority were Hispanic (46%), followed by white (27%), and black (12%).

there were approximately 4 million cases of chickenpox each year in the United States, resulting in approximately 11,000 hospitalizations and 100 deaths each year. Due to the routine administration of the varicella vaccine, the number of annual cases in the United States has decreased by more than 90% (Ali, Nguyen, & Jumann, 2003).

From 2005 to 2014, there were 53,698 chickenpox cases reported in the state of Texas, or an average of 5,370 cases per year. There has been a steady decline in the number of cases over this period, with the exception of 2006. (Texas Department of State Health Services, 2015).

In Houston between 2005 and 2014, 3,760 cases of chickenpox were reported to the Houston Health Department (HHD) Bureau of Epidemiology; an average of 376 cases per year. The City of Houston reported a trend similar to that of Texas from 2005 to 2014; a decrease in cases in all years except for 2006. The number of chickenpox cases grew from 667 cases in 2005 to 954 cases in 2006. Houston had a less substantial increase from 2011 to 2012 (138 and 293 cases respectively).

The overwhelming majority of the cases were within the 5 to 9-year-old age group (45%), followed by the 10 to 19-year-old age group (19%) and the 1 to 4-year-old age group (14%). In 2014, however, the majority of cases were in the less than 1-year-old age group. The recommended age to receive the first varicella vaccination is between 12 to 15 months, thus those within the less than 1-year-old age group is one of the most vulnerable populations (Centers for Disease Control and Prevention, Routine Varicella Vaccination: Information for Healthcare Providers, 2012).

Public Health Action

Active and passive surveillance are performed by the Houston Health Department in response to all rash illnesses reported by childcare facilities, hospitals, public/private schools, and physician's offices. Educational material on infection control practices and recommendations to stop the spread of disease is provided to each of these facilities. With potential outbreak scenarios, site visits are conducted.

Chickenpox Party

Of all vaccine preventable conditions, varicella accounts for one of the highest rates of disease. Nationally, outbreaks due to varicella are rare since the chickenpox vaccine was introduced, and the occurrence of outbreaks decreased even more after the CDC implemented the two-dose vaccination requirement in 2006. The vaccine is effective at preventing onset of disease. The public health message in this story is that undervaccination results in cases that could have been prevented.

On March 5, 2014 the Houston Health Department (HHD) received a varicella report involving a 17-year-old Hispanic female as the index case. After subsequent investigation, it was discovered that this case was linked to two households.

There were five members in Household A, three of which were clinically diagnosed with varicella. Diagnosed cases in this household included the mother of the household, the 17-year-old reported case, and her 4-month-old daughter. The 17-year-old mother and her 4-month-old daughter had fully recovered, but the 34-year-old head of the household (female) was still experiencing symptoms. The onset dates of their symptoms were February 4 and February 16, respectively. The other two members in the household were asymptomatic. Four of the five members in this household were fully vaccinated against varicella with the exception 4-month-old daughter.

There were five members in Household B, two of which were clinically diagnosed with varicella. Diagnosed cases in this household included a 5-year-old son (vaccinated with one dose) and an 11-year-old son who was fully vaccinated. The

other three members in the household were asymptomatic and fully vaccinated.

On March 7, the Houston Health Department contacted the nurses of the two schools involved to obtain vaccination history of students who were classmates of the cases. All classmates of the cases were fully vaccinated. Neither school reported new cases of varicella.

On March 10, HHD contacted the mother of Household B and was told that the 5-year-old and 7-year-old siblings had both recovered and would be attending school after receiving permission from their family physician. The onset dates for both of the siblings' symptoms was March 4. The school nurse reported that none of the classmates had developed any symptoms and would continue monitoring until the end of the incubation period.

The activities implemented to prevent and control the spread of disease transmission included:

1. Monitoring classroom contacts in schools new cases.
2. Reinforcing hygiene measures as recommended to decrease the risk of infection.
3. Referring the under-vaccinated 5-year-old boy from Household B for the second dose.
4. Conducting follow-up to monitor the status of the cases that were still experiencing symptoms.

Self-isolation was recommended for symptomatic cases until the end of the contagious period.

The best way to prevent chickenpox is to get vaccinated. Children, adolescents, and adults should have two doses of the vaccine. Receiving two doses of the vaccine is about 98% effective at preventing chickenpox. A small percentage of newly immunized people will develop a mild rash. Pregnant women and infants younger than 1 year-old should not be vaccinated (Heymann, 2008) (Centers for Disease Control and Prevention, 2011).

Beginning in 2012, the Bureau of Epidemiology began working with the CDC and local school districts to determine varicella vaccine efficacy based on vaccination history and diagnosis of varicella in the students.

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Vibriosis

INTRODUCTION

Vibriosis is an illness caused by a group of bacteria in the genus *Vibrio*. There are about a dozen species known to cause disease in humans. *Vibrio* infections are usually transmitted via food or water.

Vibrio is found in coastal marine waters and is one of

the most common organisms in surface waters throughout the world. Communities adjacent to warm sea or ocean waters are the most prone to its dangers, including Houston. Filter-feeding mollusks (e.g., oysters, mussels, scallops) become contaminated with *Vibrio* more easily than other sea creatures. A person can be infected from exposure to seawater or consumption of raw or undercooked seafood.

Vibrio infections tend to increase during the summer months when more people are

outside for recreation and fishing, and when the warm and salty environments favor bacterial growth. The peak month for *Vibrio* infection occurs is June for the Gulf Coast states and August for the non-Gulf states.

Vibriosis symptoms include sudden onset of diarrhea, nausea, or abdominal cramps and fever is often involved. In some cases, *Vibrio* infections become life threatening and require significant medical treatment.

Disease Transmission

Vibriosis is acquired when an individual swims in seawater contaminated with *Vibrio* bacteria or consumes raw or undercooked seafood that has been contaminated. Person-to-person transmission is rare or non-existent.

Individuals with weakened or compromised immune systems are at an increased risk of

acquiring *vibriosis* than an otherwise healthy person.

Transmission may spike as a result of coastal flood disasters, including hurricanes. During such a disaster large communities become exposed to potentially contaminated seawater (www.cdc.gov, 2013).



SURVEILLANCE SUMMARY

Surveillance History

Reportable in Texas since 1986

Population at Higher Risk

Persons eating undercooked or raw seafood/immune compromised/open wounds in salt water

Notable Outbreaks

None

Cases Per Year

3.3 per year

Seasonality

June, July, and August

Caseload

159



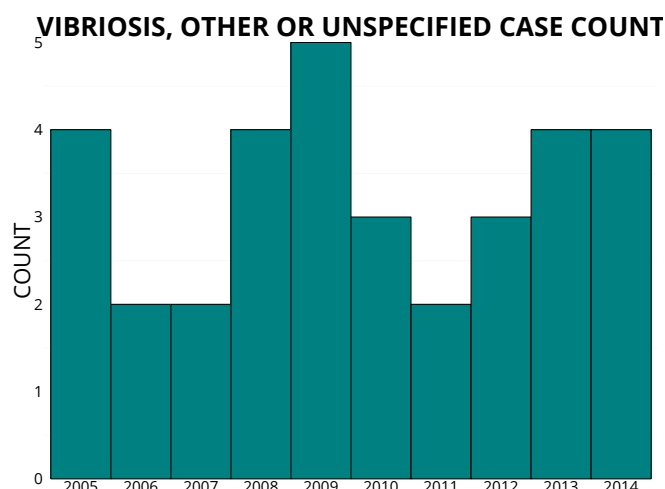


FIGURE 1. Cases of *Vibriosis* in Houston, Texas, from 2005-2014

Epidemiology in Houston

Figure 1 is a graphical representation of the trend in the overall number of *Vibrio* cases, including *cholera*, reported to the Houston Health Department (HHD) from 2005-2014. There were 33 cases of *Vibriosis* reported to the HHD during the 10-year period. In the United States, there is an estimated 80,000 illnesses, 500 hospitalizations, and 100 deaths each year in the United States (www.cdc.gov, 2013).

Vibriosis is any species of the family *Vibrionaceae* other than toxigenic *Vibrio cholera* 01 Or 0139. *Cholera* became reportable to the Texas Department of State Health Services in 1986.

Public Health Action

Public health measures focus on educating consumers on the risks associated with eating raw or undercooked seafood. Seafood handlers or processors need specific education on handling and storage of seafood and in the use of seawater in food handling. The populations most at risk are those who consume raw or undercooked shellfish, fishermen, and people who prepare crabs, lobsters, or fish. Immunocompromised persons and people with chronic liver disease, alcoholism, or high levels of iron should be especially wary about a shellfish diet. Cooking seafood thoroughly can diminish the risk of *Vibrio* infection. Additionally, cross-contamination of seafood with other foods during food preparation should be avoided.

Cholera Onboard



On May 5, 2009, a two-year-old male presented to a hospital emergency room with symptoms of diarrhea and dehydration. A specimen was sent to the Houston Health Department laboratory, which later reported that the child's specimen most closely resembles *Vibrio cholerae*. In June 2009, the Texas Department of State Services' laboratory confirmed this result.

The public health investigation revealed the child was the only one sick in the four-member household. The patient had no underlying medical condition and had no known ill contacts. The family had just returned from a trip to Pakistan from April 10, 2009 to May 5, 2009. The patient started to show symptoms on the return flight to the United States with 10+ watery stools per day. The mother reported that the child drank only bottled water while in Pakistan. In the US, the patient did not attend day care and occasionally went to church.

According to the patient's mother, the airline provided a row of seats exclusively for the family's use, provided a special garbage bag for the soiled diapers and provided additional diapers for the child's use. The mother was the sole caretaker for the child during the flight. Based on this information, risk to airline passengers was determined to be minimal. HHD requested that family members donate stool specimens in order to rule out carrier status. The family members submitted specimens to the Public Health Laboratory their specimens were negative for *V. cholerae*.

Cholera is one of nine "quarantinable diseases." The CDC has authority to enforce quarantine measures at major U.S. airports. Under federal law, airlines are required to report to the CDC Quarantine Office immediately any case of diarrhea illness (three or more loose stools in a 24-hour period) on an international flight destined to the U.S.

HHD and CDC found there was little risk of spread to the other passengers or to the general population.

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A Wedding in the Dominican Republic



From November 15, 2010 through March 4, 2011, the Dominican Republic reported 470 confirmed *cholera* cases, with 4 deaths. In January 2011, suspect *cholera* cases were reported in the United States.

Epidemiologists determined that many of the cases reported in the U.S. had attended a January wedding in the Dominican Republic. Nationwide, epidemiologists identified 11 cases (9 confirmed and 2 suspect) among attendees (Massachusetts, 6; New York City, 4; Houston Texas, 1) and 2 asymptomatic travelling companions (Massachusetts, 1; New York City, 1). The median patient age was 29 years; 90% were male.

Persons who attended the wedding were identified through surveillance and patient interviews. Cases were confirmed by isolating *Vibrio cholerae* or serologic evidence of recent infection. State health departments interviewed attendees with a questionnaire created by the Dominican Republic health officials. A Houston resident was among the attendees at the wedding and was interviewed by HHD surveillance.

All interviewed patients reported profuse diarrhea; 7 reported abdominal cramps, and 5 reported fever. The median incubation period was 2 days. All patients received antibiotics ≤ 3 days after onset; some were rehydrated; all recovered. The most commonly consumed items among patients included ice (9/9), lobster (8/9), soda (6/9), and king prawns (6/9).

Toxigenic *V. cholerae* serogroup O1, serotype Ogawa, biotype El Tor was isolated from 7 submitted stool specimens; DNA fingerprint patterns (using pulsed-field gel electrophoresis) of 4 isolates tested were indistinguishable from the Dominican Republic-related pattern. This laboratory evidence also linked the cases to the wedding in the Dominican Republic.

Viral Hemorrhagic Fever

INTRODUCTION

Viral hemorrhagic fever (VHF) refers to a group of rare illnesses that are caused by several distinct families of viruses. While some types of hemorrhagic fever viruses can cause relatively mild illnesses, many of these viruses cause severe, life-threatening disease.

VHF is caused by pathogenic strains from four different families of zoonotic viruses and includes the Ebola virus, Lassa virus, yellow fever virus, and several others. Specific case descriptions vary depending on the infecting virus. However, there are common symptoms among all VHF illnesses including fever and muscle aches followed by nausea, vomiting, and diarrhea.

Ebola

Ebola is a type of viral hemorrhagic fever, first identified in 1976 in Yambuku, Zaire (now the Democratic Republic of Congo). While rare in the United States, the disease is endemic to parts of Africa. It has resulted in over 20 outbreaks since its identification, the 2014 West African Outbreak in Guinea, Liberia, and Sierra Leone being the largest.

Ebola is caused by an infection from an Ebola virus strain. There are five identified Ebola virus species; four are known to cause disease in humans. The viruses are: Ebola virus, Sudan virus, Tai Forest virus, and Bundibugyo virus. Reston virus has caused disease in nonhuman primates, but not in humans (Centers for Disease Control and Prevention, 2015). Ebola is a deadly disease that requires rapid identification to prevent mortality. Symptoms characteristic of infection are: fever, severe headache, muscle pain, weakness, fatigue, diarrhea, vomiting, abdominal pain and unexplained bleeding or bruising. Hemorrhagic symptoms do not present until after the illness has progressed.

Public health authorities should be notified and isolation protocols should be implemented for any individual who present with symptoms of Ebola, or who have been in contact

with: blood or body fluids from a person sick with or who has died from Ebola, objects that have been contaminated with the blood or body fluids of a person sick with or who has died from Ebola, infected fruit bats and primates (apes and monkeys), or semen from a man who has recovered from Ebola (Centers for Disease Control and Prevention, 2015).

Viral hemorrhagic fevers are reportable conditions within Texas. Suspected or confirmed cases of any viral hemorrhagic fever are to be reported immediately to the state or local health authority. No cases of Ebola or any other viral hemorrhagic fever were reported between 2005 and 2014 in Houston. As a result of the 2014 Ebola Outbreak in West Africa, the Houston Health Department (HHD) conducted active monitoring of over 150 individuals.

Lassa Fever

Lassa Fever was discovered in 1969 in Lassa, Nigeria. Lassa is endemic to the west African countries of Sierra Leone, Liberia, Guinea, and Nigeria. The disease is transmitted by rats native to west Africa. Approximately 100,000 – 300,000 cases of Lassa Fever occur each year in Africa, with approximately 5,000 deaths. Lassa Fever is rarely diagnosed in the United States (Macher & Wolfe, 2006).

Marburg

Marburg is a rare type of hemorrhagic fever that was first discovered in 1967. It was initially discovered when an outbreak occurred in laboratories in Germany. Thirty-one people became ill and seven deaths were reported. The source of the illness was tissue from African green monkeys that had been imported for



SURVEILLANCE SUMMARY

Surveillance History

Nationally notifiable since 2010

Population at Higher Risk

Travelers in endemic areas in South America and Africa

Notable Outbreaks

None

Cases Per Year

0 per year

Seasonality

- July-October in Africa
- January-May in South America

Caseload

0

research (CDC, 2014).

Marburg is often found in African fruit bats. While the virus is deadly to humans, bats do not show any signs of illness from the Marburg virus. There has only been one case of Marburg in the United States. A traveler from Colorado contracted the illness after visiting a bat cave in Uganda (CDC, 2009).

Disease Transmission

VHFs are transmitted by contact with infected animals, bodily fluids, blood transfusions, syringes, or infective insect bites. Airborne transmission is not common and any occurrence may be an indicator of bioterrorism. Ebola, Marburg, Lassa fever, New World Arenaviruses, Crimean-Congo hemorrhagic fever, Bolivian hemorrhagic fever, and Argentine hemorrhagic fever viruses are transmissible from person-to-person. Rift Valley Fever, Omsk hemorrhagic fever and others are spread by arthropods like mosquitoes and ticks. Incubation periods vary by disease and health status of the infected individual, but a typical time period is 5 to 21 days (United States Department of Health and Human Services, 2015).

The hemorrhagic fever viruses are endemic to localities of their specific natural reservoirs. Generally, VHF diseases have been geographically distributed among Africa, Middle Eastern countries, Asian, and South America. The viruses are largely absent in the United States.

EBOLA

The natural reservoir of Ebola is not known and the means through which it first appeared in the human population has not yet been identified. Scientists believe that the first patient became infected through contact with an infected animal (Centers for Disease Control and Prevention, 2015). Once an infected individual develops symptoms, person to person transmission follows.

The incubation period of the disease is typically 5 to 7 days. It can be as short as 2 days and as long as 21 days (Fauci, 2014). A person with Ebola becomes infectious once symptoms have developed. To contract Ebola, an individual has to come into direct contact with bodily fluids from an Ebola infected individual that has developed symptoms or from an individual that has died from Ebola. The virus enters the body through broken skin or mucous membranes like those found in the eyes, nose or mouth. Ebola is not spread through the air or by water, and rarely is it spread through food. In some African countries, Ebola has been spread through food as a result of handling bushmeat (wild animals) or coming into contact with infected bats (Centers for Disease Control and Prevention, 2015).

Travelers returning to the United States from Ebola endemic countries are at low risk if they had no contact with an Ebola infected individual. Individuals most at risk of being infected are healthcare professionals caring for Ebola patients and family/friends in close contact with Ebola infected patients. As a result of the 2014 Outbreak, as of July 2015, 876 healthcare personnel in West Africa became infected with Ebola, of whom 509 died (World Health Organization, 2015).



Epidemiology in Houston

There have been no VHF cases reported by the Houston Health Department (HHD). Due to the 2014 West African Ebola Outbreak, the Bureau of Epidemiology conducted active monitoring/direct active monitoring of 152 travelers arriving from the West African countries impacted by the outbreak. Of the 152 travelers monitored, 150 were assessed as “low risk” and were actively monitored. Two were categorized as “some risk” which required direct active monitoring.

Public Health Action

There is no known immunotherapy against VHF and treatment is largely limited to supportive care. However, in the aftermath of the 2014 Ebola outbreak in Western Africa there is promising research into vaccines. Among the four different families of zoonotic viruses that cause VHF, antiviral treatment with ribavirin is recommended for Arenaviruses and Bunyaviruses but not for Filoviruses or Flaviviruses. No approved vaccine currently exists.

Surveillance and reporting measures are used to identify potential sources of transmission, to identify human and animal cases as early as possible, and to identify cases and clusters of human illness that may be associated with bioterrorist events.

Responses to identified sources of VHF vary depending on the jurisdiction's proximity to the source. These responses may include travel advisories when outbreaks occur in foreign countries, case investigation, contact tracing, physical isolation and quarantining, decontamination, and treatment procedures in local cases.

The 2014 West African Ebola outbreak required the implementation of national public health measures to prevent the spread of the disease within the United States. Travelers entering the United States from the impacted countries (Guinea, Liberia and Sierra Leone) were screened at five international airports for symptoms and provided a CARE (Check and Report Ebola) kit. The kit included information on the 21-day active monitoring or direct active monitoring that would be conducted by the state or local health department, a symptom log, a thermometer, and a mobile phone.

During the 21-day monitoring, a Person Under Monitoring

Houston, We May Have Ebola

Beginning in 2014, local public health departments carried most of the Person Under Monitoring (PUM) activities related to the West Africa Ebola Outbreak. The Houston Health Department implemented the guidelines for movement and monitoring of travelers returning from the affected areas, which were set forth by the Texas Department of State Health Services (DSHS). From 2014 to 2015, Houston had two individuals who were determined to be "Some Risk" based on their activities while in West Africa. Some Risk PUMs require active monitoring by public health. This section describes the experience of a Some Risk Person Under Monitoring (PUM) for Ebola Virus Disease after volunteering as a healthcare worker in the Ebola zone in West Africa.

Biography of Individual

Prior to becoming a physician the PUM was an astronaut. As an astronaut, the individual was placed on 10-day quarantine before going on a mission, and underwent a health check on return from a mission. Some of the experience and knowledge from his occupation as an astronaut carried over to the Ebola Treatment Units.

The individual continues to do work with Ebola through his current employer. One of the projects that he is involved in is the PODS which consist of computer and environmental systems. The PODS are portable and designed to be shipped to Ebola affected countries. (KPRC, HBJ)

The individual states that he would volunteer again. He traveled to Congo in December 2015. There was an opportunity to travel to the Ebola affected countries in the summer of 2015. However, one of the major factors in the decision making process is the amount of time required to complete the monitoring period during the post exposure period. There are not many concerns for safety.



The Notification

On January 10, 2015 the 64 year old male PUM arrived from Liberia. In accordance with protocols agreed upon between TX DSHS and HHD, OSPHP was notified of the some risk PUM on the same day of his arrival by TX DSHS.

The Screening Process

Upon arriving to the United States on January 10, 2015, the PUM was interviewed and screened by CDC staff. The CDC interview is completed using a questionnaire with items to determine the individual's risk classification. The screening process includes an assessment for signs, symptoms, and measured temperature. The PUM was classified as Some Risk, dispositioned to the state and local health department, and instructed to travel to Houston, Texas via airplane. The PUM was given an identification number, and care kit.

The clinical assessment of the PUM found that he had no fever and was not taking fever reducers. It was not necessary to conduct any diagnostic testing because the PUM had no symptoms. Based on an interview of the PUM, the outcome of the interview and screening process seemed "incongruous". The juxtaposition of CDC staff in personal protective equipment (PPE) during the airport screening process paired with the outcome to be granted permission to travel on a commercial flight to the PUMs city of residence seemed ironic and incongruous. From the perspective of the PUM it is ironic to allow an individual to travel to their city of residence in a commercial plane with other passengers after the label of some risk prior to the incubation period closing. Then after reaching their final destination the some risk PUM was instructed not to travel and placed on other movement restriction by the local health department based on TX DSHS issued guidance for monitoring and movement for individuals at Some Risk of Exposure to Ebola.

The Exposure Type

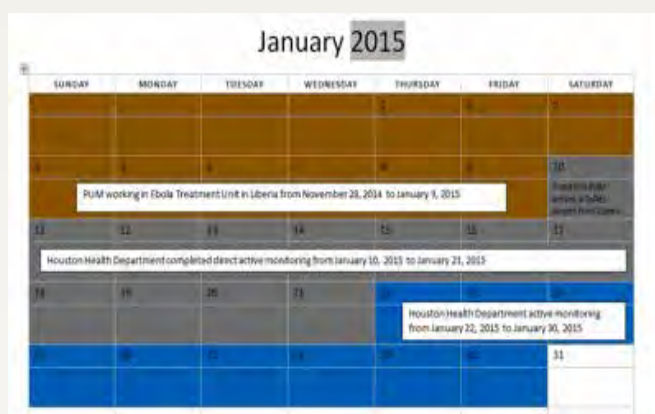
This individual's exposures were stratified into two layers. One layer was some risk and the second layer was low risk. The classification for risk category is determined based on a decision matrix consisting of exposure type and clinical criteria from TX DSHS and CDC. The PUM worked on Ebola Treatment Units (ETU) in Liberia from November 28, 2014 to January 09, 2015. During his volunteer period he traveled to two ETUs. His role was chief physician for ETU. In this role the PUM visited other ETU to conduct training for cold and hot zones.

From the PUM perspective, risk categories based on activities in Ebola outbreak countries made sense. However, some individuals may be difficult to categorize. For those individuals it may be necessary to include an intermediate risk category. In contrast to other individual's, his exposure

was straight forward. The weakness of the categories was that the classification relies on travelers self-report (word of the traveler) to assess exposures/contacts in Ebola country. There might be a question regarding the "truthfulness" of the traveler. Most exposure types will be straight forward, i.e., an individual was or was not around EVD patients. However, it is also possible that an individual was exposed to someone with early symptoms. It is these individuals who may require an intermediate risk category.

The Monitoring Activities and Movement Restrictions

The monitoring activities and movement restriction guidelines are implemented at the local level and the recommendations are communicated to local health departments by Texas DSHS and CDC. The isolation and quarantine activities were stratified to match the type of exposure. During his some risk classification, from January 10, 2015 to January 21, 2015, the Ebola PUM was quarantined at home. On January 22, 2015, he was reclassified as low risk. At that time the movement restrictions were removed because the activities during the latter half of his visit in Liberia did not include direct contact with EVD confirmed cases. The isolation and quarantine activities may differ from state to state. In Texas, some risk PUMs were allowed to complete the isolation and quarantine period at a location of their choosing, e.g. private residence, family member's home, hotel room.



The monitoring activities, differentiated according to exposure type, for this PUM can be grouped into two main time periods: 1) direct active monitoring period and 2) active monitoring period. The time periods are differentiated based on last date of exposure and exposure type in Ebola Affected areas. This method to determine communicable period is based on the disease incubation period. The benefit of this method is that it is used with various communicable diseases and is easy to determine using a calendar so that field epidemiologists can quickly calculate the monitoring period and type of activities necessary.

The PUM described the direct active monitoring activities as convenient. During the direct active monitoring period the visits were scheduled at a convenient time. The process to observe the temperature check consisted of a walk to front the gate and taking the temperature. This process did not constrain other activities the PUM had during the day as long

as he abided with the movement restrictions. The experience with home quarantine in terms of health and movement was a challenge in the sense that the PUM had to rely on social network (e.g., friends) to go shopping for daily mundane needs, such as food. The quarantine was constraining to the PUM, however, it was easy to understand why the quarantine was necessary. The PUM was aware that he would be subjected to home quarantine at the time of signing up to volunteer in the Liberia.

The PUM stated that the monitoring activities mostly impacted his work routine, and he took additional vacation time to cover the monitoring period. Also, he knew ahead of time that he was not going to travel during the monitoring period. In other words, he knew beforehand that upon his return, he would not make any travel plans during the post exposure period during which he would be considered communicable if symptomatic. The quarantine period had some impact on going to the grocery store and other normal activities. Overall, the quarantine did cause a change in the work routine.

The PUM felt that the local health department staff was polite and efficient. The daily monitoring activities were implemented in a manner that was considerate of his time. There appeared to be limitations on the local health department staff which consisted of the implementation processes. For example, he questioned whether the DAM step, which consisted of observation via Skype, was any more informative than self-report via phone. Based on the guidance from Texas DSHS, the alternative to visualization with Skype was to complete two, in person visits. Overall, the PUM appreciated the efforts of the local health department to minimize intrusion on routine activities.

Interactions With Other People

The PUM did not experience stigma or special recognition upon his return. For the most part, people did not inquire about the experience or ask him to talk about his trip to Liberia. However, he does talk about his experience in Liberia during his presentations about global health. With the exception of one group, it seems that people are not concerned or interested with the issue as much as when the Ebola Outbreak first caught the attention of the public.

Ebola Virus Disease Response

Houston Health Department implemented the guidelines and recommendations set forth by the Center for Disease Control and Prevention and Texas Department of State Health Services. In an attempt to protect the health of the public, public health responded with countermeasures such as isolation, quarantine, social distancing, risk communication, travel restrictions, and collaboration with healthcare settings (jama). Efforts were made to balance individual rights with the need to protect the health of the public.

Story 2

Dotted across Texas there are forgotten cemeteries with headstones bearing the names of entire families, those young and old, all with dates of death between 1918 and 1920; this was the Spanish flu. After World War I, soldiers returning home across the world spread pandemic Spanish influenza, ravaging their communities, and infecting half a billion people. Up to six percent of the world's population died. The oceans to the left and right of the United States did not protect her people over half a million lives were lost. It was the last time the United States government invoked its quarantine powers on a large scale on its own people.

Isolation and quarantine are measures of last resort used reluctantly to protect public health. It is disruptive and costly, both economically and politically. Health departments do not have Marine squads ready to do their bidding. The legal authority derives from the Commerce Clause of the U.S. Constitution. Under section 361 of the Public Health Service Act (42 U.S. Code § 264), the U.S. Secretary of Health and Human Services is authorized to take measures to prevent the spread of communicable diseases into the United States and between states. The states themselves have police powers to enforce isolation and quarantine to protect health and safety within their borders. The State of Texas exercised this power October 9, 2014 to quarantine four close family members of Thomas Eric Duncan in Dallas; a foreign national recently arrived from Liberia who would eventually die from Ebola. They were ordered "not to leave the apartment or to receive visitors without approval" until a time when it was certain they were not infected. During this time, government become wholly responsible for their care. People in full hazard gear breathing through respirators delivered food and sanitized their apartment. All their furniture, carpet and clothing was incinerated. Quarantine is stressful on the individuals, the community and those imposing it. It is also expensive; estimates for the Duncan family event exceed two million dollars.

The goal of public health during times of extraordinary circumstances is to enact procedures to interrupt the current cycle of events before things get out of hand. To this end, the Centers for Disease Control and Prevention (CDC) created the Persons Under Monitoring program (PUM). Simply put, travelers arriving to the U.S. from West African countries affected by Ebola are contacted daily by their local health department, usually by phone, to see ensure they are not becoming ill. Public health workers and epidemiologists record temperatures and note any symptoms resembling the onset of disease until the onset period has elapsed. In most cases this is pretty straightforward, but once, the PUM behaved unexpectedly.

For three months in early 2015, an American health care professional volunteered to work in a west African country affected by Ebola. There he cared for Ebola patients, but also

had direct contact with a physician who later contracted the disease. The volunteer was classified as a PUM with "Some Risk" when he arrived back in the US by CDC who met him at the airport. A PUM with "Some Risk" requires more than just checking in with local health officials as would be the case were he to have had no contact with patients. He required direct active monitoring.

Direct observation is a tool public health uses in some situations. Commonly, directly observed therapy (DOT) is used when a tuberculosis patient is evaluated to be at risk for medication noncompliance. Once a day for twelve months a public health worker will drive to a person's residence to watch a TB patient under DOT take their treatment medication. This is done because a missed TB dose can be a real hazard to the patient and the community and so the cost is justifiable. In the case of the Ebola PUM, he was assessed to have an elevated risk of contracting the disease due to his medical involvement with patients and the infected doctor. Thus, it was desirable to have an epidemiologist set eyes on him once a day during the 21 day onset period in addition to Skyping with him daily. He signed an acknowledgement form indicating he understood he could not travel long distances on public transportation. Otherwise, no further restrictions were placed on him provided that he remained asymptomatic and cooperative with the surveillance team. Nonetheless, the stress for this person, while perhaps not reaching the levels the Duncan family experienced, was undoubtedly high and his behavior reflected that. Though he was not ordered to do so, he secluded himself in a local hotel and had his father deliver meals, retrieving them from the parking lot after his father had left. When this arrangement became unworkable he wanted to get out of the city altogether and go to a state with fewer restrictions. The back and forth with the health department over how to do this escalated when he suddenly bought a plane ticket to Oregon, the doing of which would have violated his travel restrictions. At this point the CDC stepped in, issuing a direct verbal "DO NOT BOARD" order to him. That night he relocated to another hotel just outside the city limits and stayed there until his waiting period ended without further incident.

The practice of disease control in a public health setting is usually conducted by means of gentle persuasion, appealing to reason or sometimes to a person's sense of duty to their community. Confusion, fear, and failure to communicate are the enemies of civil order and it's the earnest hope of every public health professional that the full legal weight of their compulsory powers never need be exercised.



(PUMs) and local or state health department officials collaborate to identify any symptoms that may develop. A PUM will do a health check twice a day, reporting the information to the epidemiologist. A PUM under direct active monitoring will have direct observation from the state or local health department at least once per day to review symptoms and check temperature.

The Bureau of Epidemiology reported on 150 cases of active monitoring and 2 cases of direct active monitoring, by October 2015. All cases were monitored by epidemiologists for the 21-day period. In the initial interaction with the PUMs, epidemiologists were required to verify demographic information, to provide instruction on completing the temperature log and to conduct the exposure assessment to verify the PUMs' exposure category (high, some, low and none). The PUMs were expected to call their assigned epidemiologist daily to provide their measured temperature from the evening before and the morning of the call.

If a PUM developed symptoms, they were to contact the Bureau so that appropriate measures could be implemented to get the individual immediate medical care and to limit his or her contact with others.

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Yellow Fever

INTRODUCTION

The yellow fever virus is found mainly in tropical and subtropical areas in South America and Africa. The virus is transmitted to humans by the bite of an infected mosquito. Yellow fever is a very rare condition in the US, found primarily in travelers. Illness ranges in severity from fever to

severe liver disease. The disease is diagnosed based on symptoms, physical findings, laboratory testing, and travel history, including the possibility of exposure to infected mosquitoes.

Disease Transmission

Mosquitos carry the yellow fever virus from one host to another, primarily between monkeys, from monkeys to humans, and from person-to-person. Several different species of mosquitoes, mainly belonging to the genera *Haemagogus* and *Aedes* in South America and Africa, respectively, transmit the virus. These mosquitoes breed around houses (domestic), in the jungle (wild) or in both habitats (semi-domestic). There are three types of transmission cycles: sylvatic (or jungle), intermediate, and urban (Yellow Fever Fact sheet N°100, 2014).

Sylvatic (or jungle) yellow fever occurs in tropical rainforests. Wild mosquitoes infect monkeys, and the infected monkeys can then pass the virus to other mosquitoes that feed on them. The infected mosquitoes bite humans that enter the forest, resulting in occasional cases of yellow fever. The majority of infections occur in young men working in the forest (e.g. for logging).

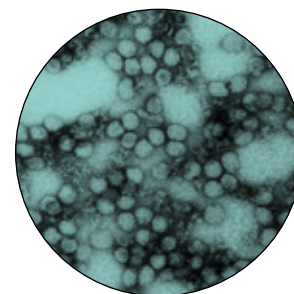
Intermediate yellow fever occurs in humid or semi-humid parts of Africa, in small-scale epidemics. Semi-domestic mosquitoes (those that breed in the wild and around households) infect both monkeys and humans. Increased contact between people and infected mosquitoes leads to transmission. Many separate villages in an area can suffer cases simultaneously. This is the most common type of outbreak in Africa. An outbreak can become a

more severe epidemic if the infection is carried into an area populated with both domestic mosquitoes and unvaccinated people.

Urban yellow fever is seen as a large epidemic and occurs when infected people introduce the virus into densely populated areas with a high number of non-immune people and *Aedes* mosquitoes. Infected mosquitoes transmit the virus from person-to-person.

Epidemiology in Houston

There has not been a reported case of yellow fever in Houston from 2005 to 2014. However, individuals traveling outside of the



SURVEILLANCE SUMMARY

Surveillance History

Nationally notifiable since 1944

Population at Higher Risk

Traveling to endemic areas in South America and Africa

Notable Outbreaks

None

Cases Per Year

0 per year

Seasonality

July-October in Africa, January-May in South America

Caseload

0



United States to countries where yellow fever virus is common, will either be recommended or required (for certain countries) to be vaccinated against yellow fever.

Public Health Action

Measures taken to prevent yellow fever virus infection include vaccination and avoiding mosquito bites. Yellow fever vaccine is recommended for persons aged ≥ 9 months who are traveling to or living in areas at risk for yellow fever virus transmission

(South America and Africa). Yellow fever vaccine may be required for entry into certain countries. Avoiding mosquito bites involves using an insect repellent (DEET), wearing protective clothing, and being aware of peak mosquito hours. Protective clothing consists of long-sleeves, long pants, and socks when outdoors. Clothing sprayed with permethrin also adds extra protection.

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Yersiniosis

INTRODUCTION

Yersiniosis is an infectious diseases caused by a bacterium of the genus *Yersinia*. In the United States, most human illness is caused by one species, *Y. enterocolitica*. Its most common reservoir is pigs. *Y. enterocolitica* belongs to a family of rod-shaped bacteria.

Other species of bacteria in this family can cause the plague (*Y. pestis*) or similar illnesses in primarily non-human hosts, with occasional transmission to humans (Yersiniosis, 2008). In other parts of the world, *Y. pseudotuberculosis* is the primary disease causing agent (Yersiniosis, 2008).

Yersiniosis can have a variety of symptoms depending on the age of the person infected. The infection is most common in young

children. Symptoms include fever, abdominal pain, and diarrhea, which is often bloody. Acute inflammation of the lymph nodes attached to the intestinal tract, systemic infection, or post-infection arthritis may also be seen. Acute symptoms typically develop within three to 7 days and may last up to 3 weeks. Yersiniosis is a reportable condition in Texas, requiring a report to public health within one week.

Disease Transmission

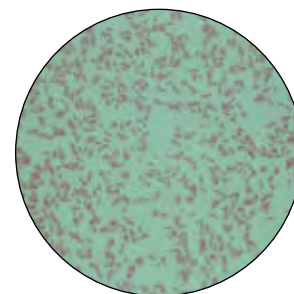
Infection is most often acquired by eating contaminated food, especially raw or undercooked pork products. Raw pork intestines (chitterlings) may be particularly risky. Outbreaks have also been attributed to tofu and milk. Unpasteurized milk has been an outbreak source. Post-pasteurization contamination has also been considered as a cause (Yersiniosis, 2008). Additionally, untreated water can be a source of the bacteria.

Secondary transmission of the bacteria is uncommon; however, fecal-oral transmission is a risk. Fecal shedding of the bacteria lasts at least as long as symptoms persist (usually 2 to 3 weeks in treated cases), while untreated cases may excrete the bacteria for several months.

Transmission has also been associated with household pets, primarily puppies and kittens, although this appears to be very rare.

Epidemiology of Disease in Houston

According to laboratory and case reports received and investigated by the Bureau of Epidemiology, there were eight cases of Yersiniosis in Houston from 2005 to 2014, for a rate of less than 0.1 per 100,000 persons.



SURVEILLANCE SUMMARY

Surveillance History

Reportable in Texas since 1998.

Population at Higher Risk

Persons consuming contaminated products such as raw or undercooked pork.

Notable Outbreaks

None.

Cases Per Year

0.8 per year.

Seasonality

Winter

Caseload

26

The disease mostly affects infants less than one year of age and elderly adults over 60, which follows national trends. Risk is generally higher in colder climates, with higher incidence in Scandinavian countries, Canada, and Russia (Gould, 2015).



Public Health Action

FoodNet monitors foodborne pathogens across the U.S. *Y. enterocolitica* is a notifiable condition that requires reporting within 1 week in Texas. Any group of cases of acute gastroenteritis or cases suggestive of appendicitis should be cultured for the bacteria as part of the routine testing of stool specimens by clinical laboratories serving populations at risk, such as children under 10 years of age, especially children less than one year of age and during winter months.

The important prevention methods are:

- Avoid eating raw or undercooked pork.
- Consume only pasteurized milk or milk products.
- Prepare meat and other foods in a sanitary manner and prevent cross-contamination in the kitchen.
- Wash hands and fingernails thoroughly with soap and water before preparing and eating food.



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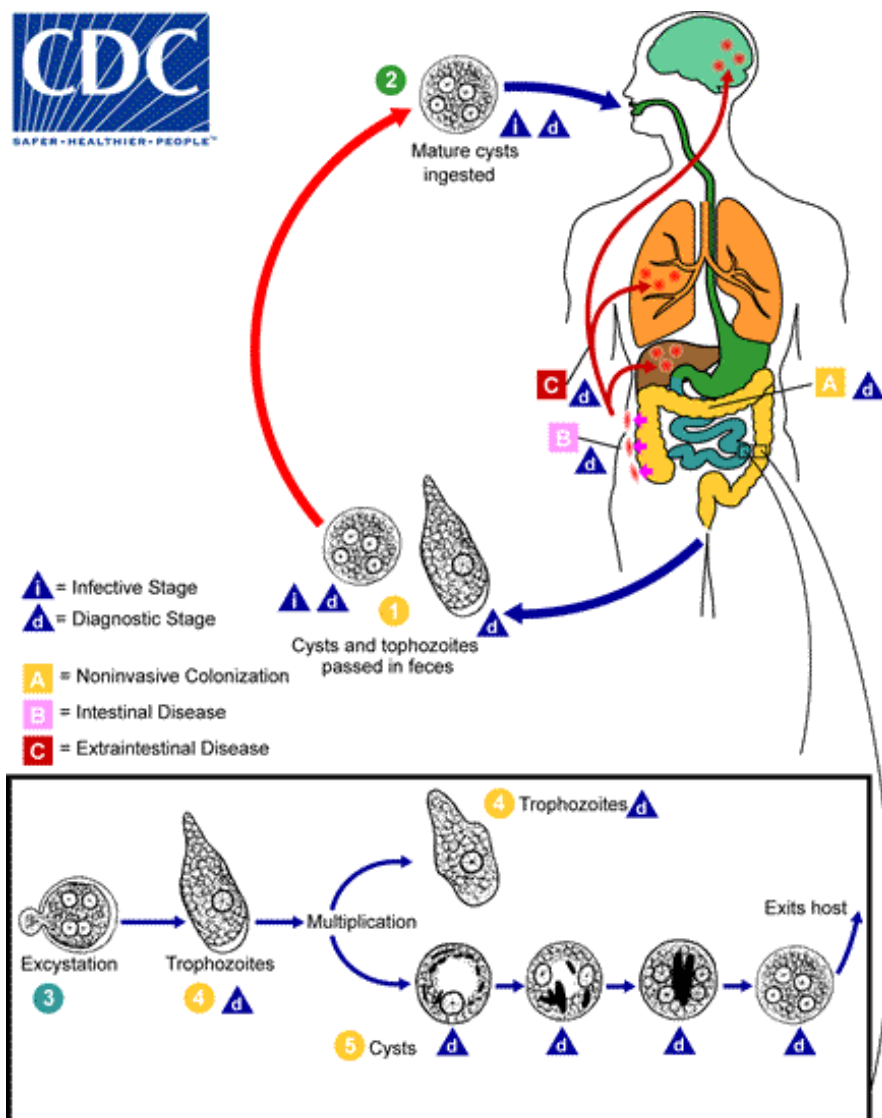
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- Apply permethrin (which kills ticks on contact) to clothes or insect repellents containing DEET to clothes and exposed skin to provide protection. DEET can be used safely on children and adults but should be applied according to Environmental Protection Agency (EPA) guidelines to lower the risk of toxicity.
 - Perform a tick check and remove attached ticks.
 - Reduce habitats around homes by removing leaves, brush and woodpiles around buildings and at the edges of yards. Discourage animals that may carry ticks such as deer and rodents from entering backyards by reducing hiding places.
 - Protect pets with approved tick repellents
- As a result of the rarity of this disease, the Houston Health Department has not conducted any recent prevention campaigns for Ehrlichiosis. If a suspected case is reported, epidemiologists will determine any exposures to ticks and trace the likely habitat.

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peaked in 2007, with 174 cases. Higher number of cases reported may be because of the higher number of refugee screenings for amebiasis done during this period. Refugees may get the infection because of the unsanitary conditions at the refugee camps or in their home country. Since 2009 the number of cases reported annually are less than 20.

Public Health Action

The best practices to prevent amebiasis are avoiding cross-contamination of food and water, and practicing proper hand hygiene. It is important to thoroughly wash hands prior to eating or handling food, and after using the toilet or changing diapers. Fruits and vegetables need to be washed adequately with clean water. Travelers to developing countries should avoid consuming uncooked foods and contaminated water. Travelers are advised to drink water boiled for at least one minute, only boiled or filtered water, and avoid drinks that have ice (DSHS, 2015).

Patients with symptomatic amebiasis can be treated with anti-parasitic drugs, including metronidazole or tinidazole.

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