

Plague

Plague is a Class A disease, and must be reported to the state within 24 hours.

Plague is an acute, febrile, zoonotic disease caused by *Yersinia pestis*, a Gram-negative coccobacillus in the family *Enterobacteriaceae*. Due to its high potential for use as a biological weapon, particularly for pneumonic plague, it remains a disease of high concern.

The infectious dose and incubation period may range anywhere from 10 to 500 organisms and one to eight days respectively, depending on the type of disease and mode of transmission. The disease can be spread through respiratory droplets, direct and indirect contact, fecal-oral transmission, and via insect vectors, especially the rat flea. Weaponized plague may be spread through true airborne transmission, if the organism is altered to permit the bacillus to be suspended in air for a long duration.

In the U.S. the principal epizootic hosts are: ground squirrels; prairie dogs and chipmunks; and a variety of burrowing rats that dwell near humans. Two varieties of rodents, the common black or roof rat (*Rattus rattus*) and the Norway rat or sewer rat (*Rattus norvegicus*), serve as excellent hosts for rat fleas. Plague is more commonly maintained in enzootic cycles among wild rodent populations from a large area spanning the Pacific coast to Texas, Oklahoma, Kansas and the Dakotas. However, human cases occur in two focal regions, mainly the southwestern states of New Mexico, northern Arizona, southern Colorado and Utah and the Pacific coast region of California, southern Oregon, and western Nevada. Sporadic cases occur annually within these two foci.

Between 1900 and 2017, 1045 confirmed or probable cases of plague occurred in the United States; over 80% exhibited the bubonic form, followed by septicemic, and pneumonic. An average of seven human plague cases (range: one to 17 cases) have been reported each year, affecting people of all ages, though 50% of cases occurred in the 12 to 45-year-old age group, with a range of one year-olds to 96 year-olds for all cases. There have been slightly more cases in males.

The last urban plague epidemic in the U.S. occurred in the 1924 to 1925 time period in Los Angeles; there has been no person-to-person transmission of plague reported since then. However, a recent report by the Centers for Disease Control and Prevention identified the first case of possible human-to-human transmission during a plague outbreak in Colorado in June, 2014.

Most cases of plague in Louisiana, if any, are reported in people that have traveled either to western parts of the U.S. or to international locations.

Although no longer available in the U.S., an inactivated whole-cell *Y. pestis* vaccine has been approved in the past; it is recommended only for persons older than 18 years of age whose occupation regularly places them at high risk for exposure to the bacillus, or plague-infected rodents. Prophylaxis is also indicated for people with close exposure to cases of pneumonic

plague. Infection control and prevention activities include standard and droplet precautions with appropriate personal protective equipment (PPE).

Taking personal protection precautions such as use of repellents containing DEET/permethrin, rodent and insect control, and employing steps to reduce rodent habitat around homes are necessary to reduce infection and transmission of plague.

Outbreak in Louisiana

All cases of human plague infection in Louisiana occurred from 1900 to 1925, when cases were restricted exclusively to port cities on the Pacific and Gulf coasts. No cases have been reported in Louisiana since a plague outbreak in New Orleans that ended in 1921. Early recognition of the importance and severity of the disease, together with implementation of strong preventive and control measures resulted in the control of the epidemic. Preventive measures, including a rat-trapping campaign, had already been in place since the detection of the first case of bubonic plague in the U.S. in 1912. Louisiana witnessed two plague outbreaks from 1900 to 1925, the result of increased trade and commerce between port cities in the U.S. and other countries. Both outbreaks occurred in the city of New Orleans.

The first outbreak occurred in the years 1914 to 1915, and resulted in 31 cases, of which 10 were fatal. The index case was identified as a Swedish sailor who arrived in New Orleans and died as a result of bubonic plague (<http://werehistory.org/new-orleans-disaster/>)

Charles Lundene, a Swedish sailor, arrived in New Orleans from an unknown location at approximately the beginning of May, 1914. By late June, he was living at a homeless shelter, where he developed a severe fever. Four days later, Lundene was transferred to Charity Hospital, where, they could do nothing for him. Chills came, and on June 27th his temperature rose to 105°F; the lymph glands in his groin were swollen. The next day, Lundene died in a strange city far from home, at the age of 49 years. Laboratory tests confirmed everyone's fears: Lundene was the first person on the eastern side of the United States to catch bubonic plague. An epidemiological investigation indicated that the deceased was a resident of the Volunteers of America Home located at 713 St. Joseph Street in New Orleans when he developed symptoms. He was later treated at Charity Hospital.

More cases of plague were identified thereafter at the rate of one case every three days, with a peak month in August. Rather than fight against the truth by ignoring the outbreak, the mayor, Martin Behrman, acknowledged the presence of the plague but assured the world there was no need to worry. The federal Public Health Service (PHS) was on the job, he explained, and the city of New Orleans would cooperate fully with the federal government on this important public health campaign. The Surgeon General was Rupert Blue, the PHS doctor who had stopped the

last yellow fever epidemic in New Orleans in 1905, and therefore had earned the trust of the people. Mayor Behrman was the leader of the powerful Democratic political machine known as the Choctaw Club. With a network of ward leaders, precinct captains, and block captains, the Choctaw Club could keep up with events across the city and also give orders to get things done.

As the weeks went by and more people fell ill – a total of 30 would contract bubonic plague, and 10 would die before the outbreak ended in late September, 1914 – there was an urgent need to find and kill all the rats carrying the disease. The federal government poured money into the city to hire squads of rat-catchers. Hundreds of rats were caught per day and each tagged with a location and date. At a laboratory set up next to City Hall, scientists dipped each dead rat in kerosene to kill the fleas, then, painstakingly combed all the fleas out of the rat's fur. They dissected each rat, looking for tell-tale lesions that indicated the likely presence of plague. If they found something suspicious, they examined the stomach contents of that rat's fleas under the microscope to find the *Yersinia pestis* bacteria. In the 18 months that the PHS worked in New Orleans, they carried out this process on approximately 375,000 rats, one for almost every man, woman, and child in the city.

The hard work, though, was not in killing the rats but depriving them of food and shelter. The previously lackadaisical methods of disposing of the city's garbage gave way to metal garbage cans with lids, picked up and disposed of regularly. An even more momentous change was in building construction. A new ordinance required all New Orleans structures to be rat-proofed. Wooden-floored houses had to be raised up off the ground and the space underneath kept clear, or else they had to have wire mesh and concrete over the entire floor and extending two feet up the side so that rats could not gnaw their way in. The rule applied not just to new construction, but to all existing structures. In a year and a half, 75,000 buildings in New Orleans were rat-proofed and around 7000 structures were demolished, including the historic St. Louis Hotel on Canal Street.

During those six years, scientific and medical authorities captured and examined almost half a million rats. They tore down whole sections of the city that they dubbed "plague zones", and eventually the disease ran its course.

The second outbreak occurred in New Orleans from 1919 to 1921 causing 25 cases and 11 deaths. In the late 1920s, New Orleans was declared free of bubonic plague.

To limit transmission of plague, a number of preventive measures were taken and ordinances were passed to strengthen the efforts. Residents were evacuated from the Volunteers of America Home and quarantined outside city limits. All furnishings inside the home were burned in a bonfire. Infected patients were placed in an isolated ward and were treated with anti-plague serum.

Other measures included implementation of a prevention strategy for the entire city, consisting of reducing the rat population through a massive trapping campaign, destruction of breeding sites, transformation of city landscapes, ‘rat-proofing’ of buildings, and enforcing the use of closed garbage cans. Housing codes were also enacted that mandated the elevation of dwellings above ground level. Houses of the infected were subjected to fumigation, burning, and complete leveling. In the 1960s, the wharves along this stretch of the river (that is, the area by Jackson Square) were demolished and replaced by the Moonwalk. The removal of these wharves eliminated the majority of the rat population in this area. These control and prevention activities proved to be very successful, and later served as a model to control plague outbreaks elsewhere in the country.