

What is plague?

Plague is an infection caused by a bacteria, *Yersinia pestis*, and is generally transmitted by infected fleas. Plague has been responsible for more human deaths than any other infectious agent in history, killing over 100 million people in the first great pandemic alone. Previously, plague would kill 70-90% of its victims. Consequently, plague is associated with irrational fear, panic, devastation and horror. However, with early diagnosis and our modern antibiotics, the death rate has been reduced to 15%. *During the second great pandemic in the Middle Ages, 1 in 3 people died (20-30 mil.) due to bubonic and pneumonic plague, when homes and workplaces were overrun with flea-infested rats.*

How common is the plague?

Worldwide, there are 1000-3000 cases of plague each year, primarily occurring in Africa, Asia and South America. Plague is found in the rodent population of every continent except Australia. In the United States, there is on average 10-15 sporadic cases per year, with only a few cases of the more deadly pneumonic form reported. *The last case of human to human transmission of plague in the United States occurred in Los Angeles in 1924-25 during the last US urban plague epidemic.*

How is plague spread?

Plague is predominantly transmitted between rats and other rodents by infected fleas. When there is a plague outbreak amongst the rat population and the infected rats die, infected fleas find other animals to bite including humans. The bite of an infected flea causes the transmission of *Yersinia pestis*, the bacteria that causes plague. When an infected person or animal has pneumonic (lung) plague, coughing can cause transmission of the bacteria from one person to another by inhalation of infected respiratory droplets. Plague is not otherwise spread between individuals with bubonic or septic plague.

Who is at risk?

Plague occurs naturally in the southwestern United States, primarily in the rural areas of New Mexico, Arizona, Colorado and California with generally less than 20 cases per year reported. In the United States, fleas live on plague-infected wild rodents, such as rock squirrels, ground squirrels, chipmunks, wood rats and

prairie dogs, which serve as the natural reservoir. Dogs and cats have been known to bring infected fleas with them from outside, transmitting plague to humans. Sometimes, domestic cats catch pneumonic plague from wild rodents and transmit the infection directly to humans. Individuals who are at risk are those that come in direct or indirect contact with infected rodents and their fleas. Those individuals who live, work or participate in outdoor recreational activities, especially hunters, campers, hikers and veterinarians are particularly at risk.

What are the various symptoms of plague?

- **Bubonic Plague--** (*lymph node infection*)

This most common form of plague occurs 2-6 days after exposure to an infected fleabite, or exposure to infected material through a break in the skin. The person develops an abrupt onset of high fever, chills, headache, weakness and fatigue along with a very hot, exquisitely tender, swollen lymph node called a bubo. Bubbles generally develop around the armpit, neck or groin area. If not treated early, the bubo can rupture and drain infectious pus. As the disease progresses, the bacteria can invade the bloodstream and the patient can become severely ill resulting in septic shock. In a small minority of patients, bacteria can migrate to the lung and cause pneumonia.

- **Pneumonic Plague--** (*lung infection*)

A severe respiratory illness develops as early as 1-3 days after exposure to inhaled droplets from an infected person or animal. Pneumonic plague can also occur if a person with bubonic or septic plague isn't treated and the infection spreads to the lungs. When the plague bacteria infect the lungs, a severe pneumonia develops and is accompanied by fever, chills, cough, difficulty breathing, shortness of breath, and bloody phlegm. Other symptoms may include nausea, vomiting, abdominal pain and diarrhea. Although not as common, pneumonic plague is much more contagious and can be spread from one person to another when an infected individual coughs or sneezes, thereby spreading *Yersinia pestis* in the air in miniscule respiratory droplets.

- **Septic Plague--** (*blood infection*)

People can get a plague infection with or without actually having a bubo or pneumonia. As the plague bacteria enter the bloodstream and multiply, the

individual becomes seriously ill, with a dangerously low blood pressure, shock, profuse bleeding and organ failure. Sometimes the infection can cause arterial blockage which results in gangrene. *The resultant areas of gangrenous dead tissue, usually at the fingertips, toes and nose become black and thus has given plague the title of "Black Death".*

How is plague diagnosed?

Plague is diagnosed when *Yersinia pestis* bacteria are found in samples taken from the blood, sputum or lymph nodes. These specimens are collected, grown under special conditions in the laboratory and are then identified under the microscope or with special fluorescent stains.

How is plague treated?

Plague is easily treated with a variety of antibiotics. Common antibiotics used include gentamicin, ciprofloxacin (Cipro[®]) and doxycycline. Because of the risk of transmission, patients with pneumonic plague must be quarantined and isolated from other individuals. Today, modern antibiotics are very effective for treating plague if initiated promptly.

How serious is the plague?

Plague is likely to cause illness or death if not treated promptly, so antibiotics must be started within 24 hours of the first symptoms. If bubonic plague is treated there is only a 15% chance of mortality (60% if untreated). Pneumonic plague is much more deadly however, with a 100% fatality if left untreated. Even with administration of antibiotics, 60% of patients may die with pneumonic plague. Death is predominantly associated with a delay in seeking care, a delay in diagnosis, or a delay in starting antibiotics.

Is there a vaccine to prevent plague?

Unfortunately, there is not currently a vaccine to prevent plague. Previously, there was a vaccine to prevent bubonic plague, but it did not prevent the more serious pneumonic plague form and it has been subsequently discontinued by its manufacturer. Research efforts are underway to find a new vaccine that is effective against all types of plague.

How do you prevent plague?

Since plague is naturally associated with poor sanitation, overcrowding, and large numbers of infected rodents, there are 3 main ways to prevent the spread of plague.

1. Control wild rodent and flea populations by good sanitation and housing conditions.
2. Focus on public health education of good rodent and flea control along with recognition of plague symptoms and high-risk activities and areas.
3. In the setting of actual plague cases, plague can be prevented with antibiotics and isolation of infected individuals. Even a simple surgical-type mask can reduce the spread of *Yersinia pestis* by preventing the inhalation of respiratory droplets from infected persons.

What if a person is exposed to the plague?

All individuals who have come into close contact (2 meters) of known persons infected with pneumonic plague should be placed under observation and given preventive antibiotic therapy for 7 days with doxycycline. Anyone developing a fever (greater than 38.5°C) or a new cough should seek medical care and be started on intravenous antibiotics.

If there is a concern about exposure, remove your clothes and place in a plastic bag. Showering with soap and water will reduce your chances of getting the disease. *Yersinia pestis* is a very sensitive bacteria and does not survive very long (less than 1 hour) in the environment. Consequently, extreme measures are not necessary for decontamination. A simple diluted bleach solution (1 part bleach, 9 parts water) can be used to disinfect personal items and hard surfaces.

Why is there concern about the plague?

There is concern that *Yersinia pestis* could be used as a biological weapon because it is relatively easy to obtain and grow in the laboratory. In addition, its highly contagious nature and high death rate for pneumonic plague could create an epidemic that would overwhelm the medical system, cause widespread panic and disruption of society, and would ultimately have a tremendous impact on our country.

In a bioterrorist setting, how would you get plague?

When we use the term bioterrorist setting, we generally refer to the malicious use of biological organisms to intentionally harm or kill people. Presumably, the technique of spreading plague would be to get the *Yersinia pestis* bacteria aerosolized into the air by some kind of device, thereby causing an outbreak of pneumonic plague. This is assumed to be the most ideal method from a terrorist's perspective, since pneumonic plague is very contagious and can be transmitted to a lot more people than just those individuals who were initially exposed. *Bioterrorism would be suspected when an abnormal number of previously healthy patients, in an area not known to have any plague-infected rodents and without any contact or risk factors for plague, presented to the hospital with severe plague pneumonia.*

Where can I get more information?

For further information, please refer to the webpage that has been created on plague and other bioterrorism agents at **USNH Okinawa's website** located at: www.med.navy.mil/sites/nhoki. This webpage provides general information on a variety of biological agents and has helpful links to other websites.

Another helpful website is the **Centers for Disease Control and Prevention** located at: www.bt.cdc.gov

Or, contact your local health care provider if you have further questions.

References:

1. Centers for Disease Control and Prevention, Division of Vector-Borne Infectious Diseases
2. Prevention of Plague: Recommendations of the Advisory Committee on Immunization Practices (ACIP) *MMWR 45 (RR-14): 1-15, 1996.*
3. *Plague as a Biological Weapon: Medical and Public Health Management JAMA 283:2281-2290, 2000.*
4. *Plague* Chapter 23, Textbook of Military Medicine: Medical Aspects of Chemical and Biological Warfare

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Plague FAQ's Prevention and Care

