

## **PLAGUE** (Black Death)

### **REPORTING INFORMATION**

- **Class A: Report immediately via telephone** the case or suspected case and/or a positive laboratory result to the local public health department where the patient resides. If patient residence is unknown, report immediately via telephone to the local public health department in which the reporting health care provider or laboratory is located. Local public health departments should report immediately via telephone the case or suspected case and/or a positive laboratory result to the Ohio Department of Health (ODH). Cases should also be entered into the Ohio Disease Reporting System (ODRS) within 24 hours of the initial telephone report to ODH.
- Reporting Form(s) and/or Mechanism:
  - *Immediately via telephone.*
  - For the local health department, the Ohio Disease Reporting System (ODRS) after the initial telephone report.
  - The Centers for Disease Control and Prevention (CDC) [Plague Case Investigation Report](#) (CDC 56.37) is available for use to assist in local health department disease investigation. Information collected on the form should be entered into ODRS and the form should be uploaded under the Administration module in ODRS.
- Key fields for ODRS reporting include: import status (whether the infection was travel-associated or Ohio-acquired), date of illness onset, and all the fields in the Epidemiology module.

### **AGENT**

*Yersinia pestis*, the plague bacillus, gram-negative coccobacillus, enterobacteriaceae

#### **Infectious Dose**

A single bite of an infectious flea. Each bite releases several thousand plague bacilli from the gut of the flea. Inhalation of a droplet of infectious mucous from a pneumonic plague patient.

### **CASE DEFINITION**

#### **Clinical Description**

Plague is transmitted to humans by fleas or by direct exposure to infected tissues or respiratory droplets; the disease is characterized by fever, chills, headache, malaise, prostration, and leukocytosis that manifests in one or more of the following principal clinical forms:

- Regional lymphadenitis (bubonic plague)
- Septicemia without an evident bubo (septicemic plague)
- Plague pneumonia, resulting from hematogenous spread in bubonic or septicemic cases (secondary pneumonic plague) or inhalation of infectious droplets (primary pneumonic plague)
- Pharyngitis and cervical lymphadenitis resulting from exposure to larger infectious droplets or ingestion of infected tissues (pharyngeal plague)

#### **Laboratory criteria for diagnosis**

##### Presumptive:

- Elevated serum antibody titer(s) to *Yersinia pestis* fraction 1 (F1) antigen (without documented fourfold or greater change) in a patient with no history of plague vaccination **OR**
- Detection of F1 antigen in a clinical specimen by fluorescent assay

##### Confirmatory:

- Isolation of *Yersinia pestis* from a clinical specimen **OR**
- A fourfold or greater change in serum antibody to *Y. pestis* F1 antigen

## **Case Classification**

Suspect: A clinically compatible case without presumptive or confirmatory laboratory results

Probable: A clinically compatible case with presumptive laboratory results

Confirmed: A clinically compatible case with confirmatory laboratory results

## **SIGNS AND SYMPTOMS**

Plague symptoms depend on how the patient was exposed to the plague bacteria. Plague can take different clinical forms, but the most common are bubonic, pneumonic, and septicemic.

- **Bubonic plague:** Bubonic plague accounts for 90% - 95% of cases. Patients develop sudden onset of fever, headache, chills, and weakness and one or more swollen, tender and painful lymph nodes (called buboes). This form usually results from the bite of an infected flea. The bacteria multiply in the lymph node closest to where the bacteria entered the human body. If the patient is not treated with the appropriate antibiotics, the bacteria can spread to other parts of the body. Untreated bubonic plague has a case fatality rate of 50% - 60%.
- **Septicemic plague:** Patients develop fever, chills, extreme weakness, abdominal pain, shock, and possibly bleeding into the skin and other organs. Skin and other tissues may turn black and die, especially on fingers, toes, and the nose. Septicemic plague can occur as the first symptom of plague or may develop from untreated bubonic plague. This form results from bites of infected fleas or from handling an infected animal.
- **Pneumonic plague:** Patients develop fever, headache, weakness, and a rapidly developing pneumonia with shortness of breath, chest pain, cough, and sometimes bloody or watery mucous. Pneumonic plague may develop from inhaling infectious droplets or may develop from untreated bubonic or septicemic plague after the bacteria spread to the lungs. The pneumonia may cause respiratory failure and shock. Pneumonic plague is the most serious form of the disease and is the only form of plague that can be spread from person to person (by infectious droplets). Untreated pneumonic plague, the fatality rate is nearly 100%.

## **DIAGNOSIS**

Appropriate specimens should be examined for evidence of plague if a person resides in, or has a recent travel history to, plague-infected areas; has been bitten by fleas; and presents with symptoms suggestive of plague (fever, lymphadenopathy). Specimens should be obtained from appropriate sites for isolating the bacteria. The preferred specimen for microscopic examination and isolation from a bubonic case is material from the affected bubo, which should contain numerous organisms. Blood cultures should be taken whenever possible. Specimens intended for culture should be taken **before** initiation of antibiotic treatment.

Please contact the ODH Bureau of Infectious Diseases at 614-995-5599 to arrange for specimens to be shipped to ODH Laboratory and CDC.

For further details, see Clinical Specimen Collection and Transport Guideline, in the [Microbiology Client Services Manual, Section 4](#) of the Infectious Disease Control Manual.

## **EPIDEMIOLOGY**

### **Source**

Plague is a worldwide zoonosis involving mammals and their fleas. Endemic foci persist in Africa, Asia, South America, and the western United States.

## **Occurrence**

Endemic plague has not been reported from Ohio. Human plague in the United States has occurred as mostly scattered cases in rural areas (median = 4, range 4-16 for 2012-2016). Most human cases in the United States occur in two regions:

- Northern New Mexico, northern Arizona and southern Colorado
- California, southern Oregon and far western Nevada.

## **Mode of Transmission**

The pneumonic form is spread through airborne droplets. The bubonic form is transmitted through the bite of an infected flea and by handling infected tissues.

## **Period of Communicability**

Bubonic plague is not transmitted person-to-person. The pneumonic form is highly contagious. There is no carrier state.

## **Incubation Period**

Ranges from 1 day to 7 days.

## **PUBLIC HEALTH MANAGEMENT**

### **Case**

#### Investigation

Plague should be considered in the febrile patient who has a history of travel to endemic areas, especially during the summer months (June to September). Travel history and contacts should be determined for the two weeks prior to the onset of illness. Complete the [Plague Case Investigation Report](#) (CDC 56.37) and upload the report under the Administration module in ODRS.

#### Treatment

Appropriate antibiotic treatment should begin as soon as plague is suspected. Parenteral forms of the antimicrobials streptomycin or gentamicin are recommended, but several other antimicrobials are also effective.

#### Isolation and Follow-up Specimens

The Ohio Administrative Code (OAC 3701-3-13, (S)) states that "a person with plague shall be placed in droplet isolation until completion of forty-eight hours of effective antimicrobial therapy." Cases of pneumonic plague should be held in strict respiratory isolation. Bubonic cases with no cough and a negative chest X-ray need only mask and gown isolation precautions. One serum specimen should be taken as early in the illness as possible to be followed by a second sample 1-4 months after antibiotic therapy has ceased.

#### Public Health Significance

High, especially for pneumonic plague, which is highly contagious. If bioterrorism is suspected, post-exposure prophylaxis may be recommended for persons who may have been exposed to the bacteria. Please note that there is an existing standing medical order issued by the Director of the Ohio Department of Health for Ohio local health departments in an emergency situation to dispense prophylactic antibiotics to persons with known or suspected exposure to *Yersinia pestis*. For further details, see [standing medical orders for public health emergencies](#).

### **Contacts**

Persons exposed in household or face-to-face contact with patients with pneumonic plague or to *Yersinia pestis* aerosols in the laboratory should be given 7 to 10 days course of antimicrobial therapy regardless of vaccination history.

## **Prevention and Control**

### Travelers

Travelers to western states (especially New Mexico and Arizona) should be warned to avoid handling living or dead wild animals and their fleas and to stay away from burrows. Gloves should be worn when skinning animals. Pets should be restrained and not allowed contact with wild rodents. Fleas should be controlled. Dogs and cats should not be fed raw rodents or rabbit meat. Rodent infestation should be discouraged around houses and yards. Insect repellents should be used to prevent flea bites; follow label instructions and avoid overuse.

### Vaccination

Plague vaccine is no longer commercially available. Vaccination against plague is not required by any country as a condition for entry. Vaccine has not been available since the mid 1990's when the manufacturer stopped production due to the short period of effectiveness and many side effects.

### **Special Information**

Plague is a candidate for acts of biological terrorism, especially due to the high contagious potential of the pneumonic form of the disease.

CDC Plague website: <http://www.cdc.gov/plague/>

CDC Plague Fact Sheet:

[https://www.cdc.gov/plague/resources/235098\\_plaguefactsheet\\_508.pdf](https://www.cdc.gov/plague/resources/235098_plaguefactsheet_508.pdf)

**What is plague?**

Plague is a bacterial disease that affects man and animals, especially rodents. Fleas pass the bacteria from animal to animal through their bites. Plague can exist in different forms and infected people may require strict isolation and disinfection procedures.

Millions of people in Europe died from plague in the Middle Ages, when human homes and places of work were inhabited by flea-infested rats. Today, the disease is relatively rare but can still be found in South America, Africa, Asia, and the southwestern United States. Globally, the World Health Organization receives reports of 1,000-3,000 cases of plague each year. The U.S. reports about 4 cases per year. There have been no reports of human plague acquired in Ohio.

**How is plague spread?**

The most common means of transmission is through the bite of infected fleas. Fleas become infected by feeding on rodents, such as the chipmunks, prairie dogs, ground squirrels, mice and rats. Cats have occasionally been diagnosed with plague.

Other important sources include the handling of tissues from infected animals (especially rabbits or rodents), airborne droplets from humans or household pets with plague pneumonia, and laboratory exposure.

**Can anyone get plague?**

Yes, but people living, working or visiting areas with infected rodents are at greater risk. Cats from endemic areas have also passed the disease to their owners and veterinarians.

**What are the symptoms of plague?**

The initial symptoms include inflamed and tender lymph glands in the body near where the infected flea bit the person, fever, chills, headache, and extreme exhaustion. The disease may progress to a generalized blood infection. Some cases also develop pneumonia. People with pneumonic plague may transmit the disease to other people when coughing. About 14% of all plague cases in the U.S. are fatal.

**How soon do symptoms occur?**

Symptoms usually begin within one to seven days after exposure to the plague bacteria.

**How is plague diagnosed?**

Laboratory tests can be performed on blood, sputum or fluid from a lymph node.

**Does past infection with plague make a person immune?**

Immunity after plague recovery is variable, and may not provide complete protection.

**What is the treatment for plague?**

Persons with plague should be hospitalized and medically isolated. Several antibiotics, including streptomycin, are effective in treating this disease.

**See also:**

CDC Plague website: <http://www.cdc.gov/plague/>