Plague

Yersinia Pestis

(Also Known as Pestis)

IMMEDIATELY REPORTABLE DISEASE

Per N.J.A.C. 8:57, healthcare providers and administrators shall immediately report **by telephone** confirmed and suspected cases of plague to the health officer of the jurisdiction where the ill or infected person lives, or if unknown, wherein the diagnosis is made. The health officer (or designee) **must immediately institute the control measures listed below in section 6, "Controlling Further Spread**," regardless of weekend, holiday, or evening schedules. A directory of local health departments in New Jersey is available at http://www.state.nj.us/health/lh/directory/lhdselectcounty.shtml.

If the health officer is unavailable, the healthcare provider or administrator shall make the report to the Department by telephone to 609.826.5964, between 8:00 A.M. and 5:00 P.M. on non-holiday weekdays or to 609.392.2020 during all other days and hours.

CDS Communicable Disease Service

NEW JERSEY DEPARTMENT of HEALTH and SENIOR SERVICES

June 2008

Plague (*Yersinia pestis*)

1 THE DISEASE AND ITS EPIDEMIOLOGY

A. Etiologic Agent

Plague is a zoonotic disease of rodents and their fleas caused by the bacterium *Yersinia pestis*.

B. Clinical Description and Laboratory Diagnosis

The initial signs and symptoms of plague are usually nonspecific and include fever, chills, malaise, muscle aches (myalgias), nausea, sore throat, headache, and weakness. Bubonic plague, the most common form of the disease, is a syndrome that includes painful swelling of lymph nodes (regional lymphadenitis). Pneumonic plague is a form of the illness resulting from hematogenous spread in bubonic or septicemic cases (secondary pneumonic plague) or inhalation of infectious droplets (primary pneumonic plague). Septicemic plague is a form caused by disseminated infection of the blood stream. Pneumonic plague refers to a form of the illness affecting the lungs. Meningeal plague, or plague affecting the membranes lining the brain and spinal cord, is rare. Both pneumonic and septicemic plague can be primary or they can result from another clinical form of plague. Untreated, bubonic plague is fatal in over 50% of cases, whereas septicemic and pneumonic plague are fatal in over 90% of cases. Treated septicemic and pneumonic plague are associated with a mortality rate of 14%. Laboratory diagnosis includes culture and identification of the organism from fluid aspirated from diseased lymph nodes, blood, cerebrospinal fluid (CSF), or sputum. The serologic methods include the passive hemagglutination test (PHA) or enzyme-linked immunosorbent assay (ELISA). Also, direct fluorescent antibody (DFA) staining and immunohistochemical (IHC) staining may be used for direct examination of clinical specimens.

C. Reservoirs

Certain wild rodents and their fleas carry *Y. pestis*. In the United States, ground squirrels and prairie dogs are the primary reservoirs of *Y. pestis*. Lagomorphs (rabbits and hares), wild carnivores (meat-eating mammals), and domestic cats may also be a source of infection to people.

D. Modes of Transmission

Plague is acquired naturally through the bite of an infected flea or through inhalation of *Y. pestis*–contaminated respiratory droplets, either through proximity to a human or animal case of pneumonic plague or by accidental exposure in a laboratory. Plague can also be acquired by handling tissues of infected animals or by being bitten or scratched by an infected animal. Plague might also be acquired through an intentional release of *Y. pestis*; for this reason, plague is considered a potential bioterroristic agent (see section H).

E. Incubation Period

The usual incubation period for primary pneumonic plague is estimated to be anywhere from one to four days (two to six days for bubonic plague). The incubation period for primary pneumonic plague ranges from one to six days.

F. Period of Communicability or Infectious Period

Patients with pneumonic plague are considered infectious throughout their symptomatic illness and for 72 hours following initiation of appropriate antibiotic treatment. The discharge from buboes is considered infectious.

G. Epidemiology

Wild rodent plague exists in large areas of South America, Africa, Eastern Europe, and Asia. In 1994, an outbreak of pneumonic and bubonic plague occurred among people in Surat, India. In the United States, wild rodent plague occurs primarily in ground squirrels, rabbits, and prairie dogs in the western part of the country. Other less frequent sources of infection include wild carnivores and domestic cats (and sometimes dogs). Human cases in the western United States occur sporadically, usually following exposure to wild rodents or their fleas. Approximately ten to 15 people are diagnosed with plague each year in the United States. Only small percentages (2%) of the plague cases that occur in the United States are pneumonic. No person-to-person transmission has been documented in the United States since 1925.

H. Bioterrorist Potential

Y. pestis is considered a potential bioterrorism agent. If effectively disseminated, *Y. pestis* could cause serious public health challenges, especially in terms of the public health system's ability to limit casualties and control other repercussions. Several features of *Y. pestis* contribute to its potential of being used as an agent of bioterrorism: (1) *Y. pestis* is distributed worldwide, (2) techniques for mass production and aerosol dissemination are available, and (3) the case-fatality ratio of primary pneumonic plague is high, with real potential for secondary spread. Therefore, *any* case of plague should be considered as a serious threat to public health. In the event that plague is used as a biological weapon, the first few (especially sporadic) cases will likely be missed or at least not attributed to a deliberate bioterrorist act. To avoid this, any suspect case of plague should be reported immediately by telephone to the local health department. The sudden appearance of many patients presenting with fever,

cough, a fulminant disease course, and high case-fatality ratio should cause one to consider plague in the differential diagnosis.

2 CASE DEFINITION

A. The New Jersey Department of Health and Senior Services (NJDHSS) Case Definition and the Centers for Disease Control and Prevention (CDC) Case Definition are the Same.

B. Case Classification

CONFIRMED
A clinically compatible case AND

Isolation of *Y. pestis* from a clinical specimen, OR

Fourfold or greater change in serum antibody titer to *Y. pestis* F1 antigen, OR

Positive IHC staining, if confirmation by culture or serology is not possible.

PROBABLE
A clinically compatible case AND

An epidemiologic link to a confirmed case, OR

Elevated serum antibody titer to *Y. pestis* F1 antigen (without fourfold or greater change) in a patient with no history of plague vaccination, OR

Detection of F1 antigen in a clinical specimen by fluorescent antibody test, OR

PCR evidence of *Y. pestis*, OR

IHC staining.

POSSIBLE
A clinically compatible case with a smear or isolate from affected tissues with the following characteristics: small, gram-negative, and/or bipolar-staining plump rods in single, short chains.

3 LABORATORY TESTING AVAILABLE

A. All Level A Clinical Laboratories in New Jersey Approved to Perform Comprehensive Microbiology Procedures are Capable of Isolating *Y. pestis* and Identifying the Organism or Performing the Appropriate Screening Tests to Determine If It Is a Possible Category A Agent. In Either Case, the Organism Must Then be Sent to the New Jersey Public Health and Environmental Laboratories (PHEL) for Confirmation.

B. In addition, PHEL Provides Services for Testing Clinical Specimens for *Y. pestis* (http://nj.gov/health/phel/lrn.shtml).

1. Specimens or isolates can be sent to PHEL after preliminary consultation with the Infectious and Zoonotic Diseases Program (IZDP) at 609.588.7500.

2. Clinical diagnostic specimens that should be collected from patients suspected of having plague include

   - **Blood:** Blood specimens should be obtained for *Y. pestis* isolation before administration of antibiotics. Two or more sequentially collected samples would be preferred as blood-borne *Y. pestis* is usually low in numbers and multiple sampling provides more opportunity for a successful recovery of the live organism.
   - **Serum:** Serum specimens should be collected for baseline evaluation, followed by a second specimen taken in the convalescent period (at least 14 days apart but preferably three to four weeks after onset of symptoms). Plasma and whole blood dried on filter paper are acceptable alternatives to serum.
   - **Respiratory secretions:** Respiratory secretions should be collected for staining, culture, and possible DNA amplification from persons with suspected pneumonic plague, including pharyngeal swabs, tracheal washes or aspirates, and sputum specimens. Transthoracic lung aspirates or collections of pleural fluid should be similarly evaluated.
   - **Tissues (biopsy):** Tissues, including lung, lymph node tissue, spleen, and liver, may be indicated for culture and other examinations.

3. A PHEL submission form (http://nj.gov/health/forms/lab-5.pdf) must accompany all samples.

4. Chain of evidence documentation will accompany all specimens (the PHEL submission form will include a chain of custody section). However, during a large-scale incident, this would probably be required only for the first several cases.

5. The mailing address is NJDHSS, Division of Public Health and Environmental Laboratories, Specimen Receiving and Records, PO Box 361, John Fitch Plaza, Trenton, NJ 08625-0361.

6. Call PHEL at 609.292.8396 for specific microbiologic consultation before submitting samples.

7. In certain circumstances, PHEL may forward clinical specimens to CDC for testing.

4 PURPOSE OF SURVEILLANCE AND REPORTING REQUIREMENTS

A. Purpose of Surveillance

- To identify potential sources of transmission in the United States (such as wild rodents or other animals)
- To identify sources of transmission and geographical areas of risk outside of the United States
- To stop transmission from such sources
- To identify cases and clusters of human illness that may be associated with a bioterrorism event

B. Laboratory and Healthcare Provider Reporting Requirements

NJDHSS requires that healthcare providers and laboratories report any suspect or known case of plague to the local health officer in the community where the patient resides (preferably by telephone with follow-up documentation filed electronically using the secure, Web-based Communicable Disease Reporting and Surveillance System [CDRSS]). (See data entry instructions below.)

NJDHSS requires that cases, or potential exposure that might be bioterrorist in nature, be **immediately reported** to the local health officer where the patient resides. If this is not possible, call NJDHSS IZDP at 609.588.7500 (weekdays) or 609.392.2020 (nights and weekends). A case of plague is defined by the reporting criteria in section 2A.

C. Local Departments of Health Responsibilities

NJDHSS requires that each local health officer **immediately** report any suspect or known case of plague to NJDHSS Communicable Disease Service, NJDHSS IZDP at 609.588.7500 (weekdays) or 609.392.2020 (nights and weekends).

5 CASE INVESTIGATION

A. Reporting Requirements

The New Jersey Administrative Code (NJAC 8:57-1.8) stipulates that each local health officer must report the occurrence of any case of plague, as defined by the reporting criteria in section 2. Current requirements are that the cases be **reported immediately** to NJDHSS IZDP at 609.588.7500 during normal business hours or 609.392.2020 after business hours and on weekends and holidays.

B. Case Investigation

1. The most important step a local health officer can take on learning of a suspect or confirmed case of plague, or potential exposure to plague, is to call NJDHSS Communicable Disease Service immediately during the day at 609.588.7500 or 609.392.2020 on nights and weekends.

2. NJDHSS Communicable Disease Service will oversee and direct the case investigation of plague in New Jersey residents in conjunction with CDC. If a bioterrorist event is suspected, NJDHSS and other response authorities will work closely with health officers (including, but not limited to, the regional epidemiologist and infection control professionals) and provide instructions and information on how to proceed.

3. Following immediate notification of NJDHSS, health officers may be asked to assist in investigating cases that live within their communities, including gathering the information necessary to complete the NJDHSS Plague form and data entry in CDRSS.

C. CDRSS

The mandatory fields in CDRSS include: disease, last name, county, municipality, gender, race, ethnicity, case status, report status.

The following table can be used as a quick reference guide to determine which CDRSS fields need to be completed for accurate and complete reporting of *Yersinia pestis* cases. The "CDRSS Screen" column includes the tabs which appear along the top of the CDRSS screen. The "Required Information" column provides detailed explanations of what data should be entered.

CDRSS Screen	Entry Considerations
Patient Info	Enter the disease name ("PLAGUE"), patient demographic information, illness onset date, and the date the case was reported to the local health department (LHD). There are no subgroups for *Y. pestis.*

CDRSS Screen	Entry Considerations
Addresses	Enter any alternate address (e.g., a work site). Use the Comments section in this screen to record any pertinent information about the alternate address (e.g., hours worked). Entering an alternate address will allow other disease investigators access to the case if the alternate address falls within their jurisdiction.
Clinical Status	Enter any treatment that the patient received and record the names of the medical facilities and physician(s) involved in the patient's care. If the patient received care from two or more hospitals, be sure that all are entered so the case can be accessed by all infection control professionals (ICPs) covering these facilities. If immunization status is known, it should also be entered here. If the patient is alive, select "NO" in the Mortality section. If the patient died, select "YES" in the Mortality section with the date of death.
Signs/Symptoms	Check appropriate boxes for signs and symptoms and indicate their onset. Make every effort to get complete information by interviewing the physician, the case patient, family members, ICP, or others who might have knowledge of the patient's illness. Also, information regarding the resolution of signs and symptoms should be entered.
Risk Factors	Enter complete information about risk factors as known.
Laboratory Eval	Select "MICROORGANISM IDENTIFIED." Specimen type, specimen collection date, test result, and, if applicable, test value should also be recorded. Specimen type "OTHER" should be described in the Comments section.
Contact Tracing	Information regarding contacts is not required for sporadic cases of this disease since it is not endemic to New Jersey. However, extensive investigation will be required of any case, imported or other.
Case Comments	Enter general comments (i.e., information that is not discretely captured by a specific topic screen or drop-down menu) in the Comments section. **NOTE:** Select pieces of information entered in the Comments section CANNOT be automatically exported when generating reports. Therefore, whenever possible, record information about the case in the fields that have been designated to capture this information; information included in these fields CAN be automatically exported when generating reports.

CDRSS Screen	Entry Considerations
Epidemiology	Since plague is not seen in New Jersey, case investigators will be directed regarding the completion of the Other Control Measures section on a case by case basis. Record name of and contact information for case investigators from other agencies (e.g., CDC, out-of-state health departments). Document communication between investigators in the Comments section.
Case Classification **Report Status**	Case status options are: "REPORT UNDER INVESTIGATION (RUI)," "CONFIRMED," "PROBABLE," "POSSIBLE," and "NOT A CASE." • All cases entered by laboratories (including LabCorp electronic submissions) should be assigned a case status of "REPORT UNDER INVESTIGATION (RUI)." • Cases still under investigation by the LHD should be assigned a case status of "REPORT UNDER INVESTIGATION (RUI)." • Upon completion of the investigation, the LHD should assign a case status on the basis of the case definition. "CONFIRMED," "PROBABLE" and "NOT A CASE" are the only appropriate options for classifying a case of *Y. pestis* (see section 2A). Report status options are: "PENDING," "LHD OPEN," "LHD REVIEW," "LHD CLOSED," "DELETE," "REOPENED," "DHSS OPEN," "DHSS REVIEW," and "DHSS APPROVED." • Cases reported by laboratories (including LabCorp electronic submissions) should be assigned a report status of "PENDING." • Once the LHD begins investigating a case, the report status should be changed to "LHD OPEN." • The "LHD REVIEW" option can be used if the LHD has a person who reviews the case before it is closed (e.g., health officer or director of nursing). • Once the LHD investigation is complete and all the data are entered into CDRSS, the LHD should change the report status to "LHD CLOSED." • "LHD CLOSED" cases will be reviewed by DHSS and be assigned one of the DHSS-specific report status categories. If additional information is needed on a particular case, the report status will be changed to "REOPENED" and the LHD will be notified by e-mail. Cases that are "DHSS APPROVED" cannot be edited by LHD staff (see Section C below).

CDRSS Screen	Entry Considerations
	If a case is inappropriately entered (e.g., a case of Group A Streptococcus was erroneously entered as a case of *Y. pestis*) the case should be assigned a report status of "DELETE." A report status of "DELETE" should NOT be used if a reported case of *Y. pestis* simply does not meet case definition. Rather, it should be assigned the appropriate case status, as described above.

6 CONTROLLING FURTHER SPREAD

A. Isolation and Quarantine Requirements (NJAC 8:57-1.10)

1. Patient Isolation Precautions

Initial decisions regarding patient isolation precautions should be based on the clinical presentation of patients with suspect plague (see Table below).

Initial Patient Isolation Precautions for Suspect Plague Patients

Clinical Presentation	Patient Isolation Precautions
Pneumonic or pharyngeal	Droplet
Septicemic	Droplet, until pneumonia is excluded
Bubonic	Standard

2. Minimum Period of Isolation of Patient

Droplet precautions are indicated for patients with plague until pneumonia is excluded and appropriate antibiotic therapy has been initiated. In patients with pneumonic plague, droplet precautions should be maintained for 72 hours after starting appropriate antibiotic therapy and until clinical improvement occurs.

3. Minimum Period of Quarantine of Contacts

See section 6B, Protection of Close Contacts.

B. Protection of Close Contacts

4. Cases with **pneumonic or pharyngeal plague** are considered infectious throughout their symptomatic illness and for at least 72 hours following initiation of appropriate antibiotic treatment.

5. A *close contact* is defined as known contact with a plague patient closer than six or seven feet.

6. All close contacts should be referred to their healthcare provider for evaluation and antibiotic prophylaxis. Close contacts should be under surveillance for symptoms suggestive of plague for seven days; whether this surveillance is passive or active should be based on the availability of public health resources.

7. If a contact of a pneumonic plague case is unable to receive or refuses antibiotic prophylaxis, he/she should be placed under quarantine for a seven-day period (review the NJDHSS Community Containment of Plague document http://nj.gov/health/er/documents/plague_guidelines.pdf).

8. Cases of septicemic plague should be managed as above until pneumonia has been excluded in the case-patient.

9. Prophylaxis for contacts of patients with **bubonic plague** is generally not indicated.

C. Managing Special Situations

1. Reported Incidence Is Higher Than Usual/Outbreak Suspected

Plague is not endemic in New Jersey. Cases of plague in New Jersey are most commonly associated with travel to the western part of the United States or another country where plague is endemic. Therefore, all suspected cases identified in New Jersey are considered "special situations" and must be reviewed by IZDP at 609.588.7500.

NOTE: If a bioterrorist event is suspected, NJDHSS and other response authorities will work closely with local health officers and healthcare providers to provide instructions and information on how to proceed.

D. Preventive Measures

1. Personal Preventive Measures and Education

1. To avoid cases of plague, people should reduce the likelihood of being bitten by infected fleas or being exposed to patients with pneumonic plague by:

- Understanding the modes of transmission of plague and heeding any plague advisories while visiting the southwestern United States
- Preventing rodent access to food and shelter by ensuring appropriate storage and disposal of food, garbage, and refuse
- Using insect repellents while camping in rural plague-infected areas and reporting dead or sick animals to park rangers or public health authorities
- Preventing flea infestations of their dogs and cats
- Avoiding unnecessary contact with rodents or lagomorphs and using protective gloves if handling is necessary

2. In a bioterrorism incident, whether overt or covert, the need for opening a mass prophylaxis clinic will be determined as quickly as possible. Decisions made with respect to opening such a clinic will be based on several considerations, including, but not limited to, the number of plague cases and contacts identified.

E. National and International Travel

For more information regarding national and international travel and plague, contact the CDC Travelers Health Office at 877.394.8747 or visit http://www.cdc.gov/travel/.

Additional Information

An NJDHSS *Plague Fact Sheet* is available at www.state.nj.us/health/cd.

The CDC surveillance case definition for plague is similar to the criteria outlined in section 2A of this chapter. CDC case definitions are used by state health departments and CDC to maintain uniform standards for national reporting. For reporting to NJDHSS, always refer to the criteria in section 2A.

References

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