



# Plague

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## Disease plan

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**Questions about this disease plan?**

**Contact the Utah Department of Health and Human Services Office of Communicable Diseases: 801-538-6191.**

## Critical clinician information

Clinical evidence
<p><b>General signs/symptoms</b></p> <ul style="list-style-type: none"><li>• Fever</li><li>• Chills</li><li>• Malaise (tiredness)</li><li>• Myalgia (muscle aches)</li><li>• Nausea</li><li>• Headache</li></ul> <p><b>Bubonic plague</b></p> <ul style="list-style-type: none"><li>• Bubo (swollen lymph nodes)</li></ul> <p><b>Septicemic plague</b></p> <ul style="list-style-type: none"><li>• Shock</li><li>• Abdominal pain</li><li>• Bleeding into the skin and other organs</li></ul> <p><b>Pneumonic plague</b></p> <ul style="list-style-type: none"><li>• Rapidly developing pneumonia</li><li>• Shortness of breath</li><li>• Chest pain</li><li>• Cough</li></ul>
<p><b>Period of communicability</b></p> <ul style="list-style-type: none"><li>• Patients with pneumonic plague are considered infectious throughout their symptomatic illness, and for 72 hours after effective antibiotic treatment is started.</li></ul>
<p><b>Incubation period</b></p> <ul style="list-style-type: none"><li>• Septicemic (1–7 days)</li><li>• Bubonic (2–8 days)</li><li>• Pneumonic (1–3 days)</li></ul>
<p><b>Mode of transmission</b></p> <ul style="list-style-type: none"><li>• Typically from infected fleas or animals</li><li>• Pneumonic plague can be passed through droplets containing the bacteria typically requiring direct or close contact with an infected person</li><li>• Scratches and bites from infected animals</li><li>• Direct handling of infected animal tissues</li><li>• Laboratory exposures</li></ul>
Laboratory testing
<p><b>Type of lab test/timing of specimen collection</b></p> <ul style="list-style-type: none"><li>• Culture and staining (all presumptive positive samples from commercial labs should be forwarded to the Utah Public Health Laboratory [UPHL] for final identification)</li><li>• Serology (acute and convalescent serum looking for fourfold rise)</li><li>• Rapid test (PCR testing can be conducted at UPHL)</li></ul>

**Type of specimens**

- Lymph node aspirate (1 mL shipped refrigerated)
- Sputum (1 mL shipped refrigerated)
- Bronchial/tracheal wash (1 mL shipped refrigerated)
- Serum (acute and convalescent 4–6 weeks or more after disease onset) (1 mL shipped refrigerated)

**Treatment recommendations**

**Type of treatment (see treatment section for dosing)**

- Gentamicin
- Fluoroquinolones (ciprofloxacin and levofloxacin)

**Contact management**

**Isolation of case**

- Bubonic and septicemic are not typically transmitted person to person and isolation and quarantine are generally not appropriate
- For pneumonic plague cases, droplet precautions should be maintained for 72 hours after treatment starts

**Quarantine of contacts**

- Persons who live in the household or anyone who has face-to-face contact with a case of pneumonic plague should receive prophylaxis and be placed under surveillance for 7 days. Those who refuse prophylaxis should be maintained in strict isolation with careful surveillance for 7 days.

**Infection control procedures**

- For pneumonic plague cases, droplet precautions should be maintained for 72 hours after treatment starts

## Why is plague important to public health?

Plague is a disease that affects humans and other mammals. Humans usually get plague after they are bitten by rodent fleas that carry the bacteria, or when they handle an animal infected with plague.<sup>1</sup> Although plague is treatable with antibiotics, without treatment,



the disease can cause serious illness or death. Utah has endemic plague each year in rodent burrows, which makes it more important to be diligent in finding potential cases and exposures.

The Centers for Disease Control and Prevention (CDC) considers the plague organism, *Yersinia pestis*, a Category A biological agent with the potential to be modified to be used by terrorists and others as a bioterrorism (BT) agent.<sup>2,3</sup> Early awareness and investigation of plague cases is critical to make sure the public's health is protected.

## Disease and epidemiology

### Clinical description

Initial signs and symptoms may be nonspecific with fever (which is usually present), chills, malaise (tiredness), myalgias (muscle aches), nausea, prostration (too tired and weak to do anything), sore throat, and headache.

- If the presentation is “bubonic,” then lymph nodes in the inguinal (groin), axillary (armpit), and cervical (neck) areas may become swollen, inflamed, and tender, and may suppurate (discharge pus). These are called buboes. If not treated with appropriate antibiotics, the bacteria could spread to other parts of the body.
- The presentation may become “septicemic,” where the organism becomes disseminated throughout the body including the meninges. Skin and other tissue 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 infected animals.
- If the presentation is “pneumonic,” pneumonia may be present. Pneumonic plague is especially concerning from an infection control and public health standpoint. This form may develop from inhaling infectious droplets, or may develop from untreated bubonic or septicemic plague after the bacteria has spread to the lungs. The pneumonia may cause respiratory failure and shock. This is the most serious form of the disease and is the only

form of plague that can be spread from person to person (through infectious droplets). Contacts must be identified and given prophylaxis or isolated if they refuse prophylaxis.

Plague can also present as “pharyngea,” with an inflamed pharynx, or “meningitis,” with nuchal rigidity, or “cutaneous,” but these forms are rare.

## Causative agent

Plague is caused by a bacterium known as *Yersinia pestis*. *Yersinia* species are gram-negative rods that can exhibit a bipolar or “safety pin” staining pattern.

## Differential diagnosis

Plague can be mistaken for influenza or other acute febrile illnesses, especially in initial stages.

## Laboratory identification

If plague is suspected, pre-treatment specimens should be taken if possible, but treatment should not be delayed. The laboratory should be notified if plague is suspected. Plague should be identified as a presumptive isolate at a clinical lab, and then forwarded to a reference lab and to the Utah Public Health Laboratory (UPHL) for final identification. All hospitals should be encouraged to report even SUSPECT cases of plague, as final identification can be a lengthy process. Specimens should be obtained from appropriate sites for isolating the bacteria, based on the clinical presentation, and may include<sup>4</sup>:

- Lymph node aspirate: An affected bubo should contain numerous organisms that can be evaluated microscopically and by culture.
- Blood cultures: Organisms may be seen in blood smears if the patient is septicemic. Blood smears taken from a suspected bubonic plague patient early in the course of illness are usually negative for bacteria by microscopic examination, but may be positive by culture.
- Sputum: Culture is possible from sputum of very ill pneumonic patients; however, blood is usually culture-positive at this time as well.
- Bronchial/tracheal washing may be taken from suspected pneumonic plague patients; throat specimens are not ideal for isolation of plague since they often contain many other bacteria that can mask the presence of plague.

In cases where live organisms are unculturable (such as postmortem), lymphoid, spleen, lung, and liver tissue or bone marrow samples may yield evidence of plague infection by direct detection methods such as direct fluorescent antibody (DFA) or PCR.

*Y. pestis* may be identified microscopically by examination of Gram, Wright, Giemsa, or Wayson's stained smears of peripheral blood, sputum, or lymph node specimen. Visualization

of bipolar-staining, ovoid, gram-negative organisms with a "safety pin" appearance permits a rapid presumptive diagnosis of plague.

If cultures yield negative results, and plague is still suspected, serologic testing is possible to confirm the diagnosis. One serum specimen should be taken as early in the illness as possible, followed by a convalescent sample 4–6 weeks or more after disease onset.

## Treatment

Plague is a very serious illness, but is treatable with commonly available antibiotics. The earlier a patient seeks medical care and receives appropriate treatment, the better the chances for a full recovery.

Begin appropriate therapy as soon as plague is suspected. Gentamicin and fluoroquinolones are typically first-line treatments in the U.S. Duration of treatment is 10–14 days, or until 2 days after fever subsides. Patients can be treated with intravenous or oral antimicrobials, depending on the severity of illness and other clinical factors.

The regimens listed below are guidelines only and may need to be adjusted depending on a patient's age, medical history, underlying health conditions, or allergies. Use appropriate clinical judgment. Additional information can be found at <http://www.cdc.gov/plague/healthcare/clinicians.html>.

Pediatric regimens are for children aged  $\geq 1$  month to  $\leq 17$  years. Only first-line treatment options are listed here. For additional treatment options, see [Antimicrobial Treatment and Prophylaxis of Plague: Recommendations for Naturally Acquired Infections and Bioterrorism Response](#).<sup>5</sup>

Antibiotic	Dose	Route of administration	Notes
Ciprofloxacin	Adults: 400 mg every 8 hrs	IV	FDA approved based on animal studies and clinical data. <sup>6</sup>
	Children: 10 mg/kg every 8 or 12 hrs (maximum 400 mg/dose)		
	Adults: 750 mg every 12 hrs	PO	
	Children: 15 mg/kg every 8 or 12 hrs		

	(maximum 500 mg/dose every 8 hrs or 750 mg/dose every 12 hrs)		
Levofloxacin	<b>Adults:</b> 750 mg every 24 hrs	IV or PO	FDA approved based on animal studies; clinical data for human plague is limited.
	<b>Children:</b> Weight <50 kg: 8 mg/kg every 12 hrs (maximum 250 mg/dose) Weight ≥50 kg: 500–750 mg every 24 hrs		
Moxifloxacin	<b>Adults:</b> 400 mg every 24 hrs	IV or PO	FDA approved based on animal studies; clinical data for human plague is limited. Moxifloxacin is a first-line treatment for adults but an alternative for children, since it is not FDA approved for use in children aged ≤17 years.
	<b>Children:</b> see notes		
Doxycycline  *First line for <b>bubonic or pharyngeal</b> plague ONLY*	<b>Adults:</b> 200 mg loading dose, then 100 mg every 12 hrs	IV or PO	Bacteriostatic, but FDA approved and effective in a randomized trial when compared to gentamicin. <sup>7</sup> No evidence of tooth staining after multiple short courses. <sup>8</sup>
	<b>Children:</b> Weight <45 kg: 4.4 mg/kg loading dose, then 2.2 mg/kg every 12 hrs (maximum 100		

	mg/dose)  Weight ≥45 kg: same as adult dose		
Gentamicin	<b>Adults:</b> 5 mg/kg every 24 hrs	IV or IM	Not FDA approved, but considered an effective alternative to streptomycin.* <sup>7,9</sup>
	<b>Children:</b> 4.5–7.5 mg/kg every 24 hrs		
Streptomycin	<b>Adults:</b> 1 g every 12 hrs	IV or IM	FDA approved based on clinical experience. Not widely available in the U.S. The IV formulation is not approved by FDA; however, the IM formulation has been given IV as an off-label use.* <sup>10</sup>
	<b>Children:</b> 15 mg/kg every 12 hrs (maximum 1 g/dose)		
<b>Treatment of pregnant people with plague</b>			
Gentamicin  AND ONE OF THE FOLLOWING	Same as adult dose	IM or IV	Not FDA approved, but considered an effective alternative to streptomycin.* <sup>7,9</sup>
Ciprofloxacin  OR	400 mg every 8 hrs	IV	FDA approved based on animal studies and clinical data. <sup>6</sup>
	500 mg every 8 hrs	PO	
Levofloxacin	Same as adult dose	IV or PO	FDA approved based on animal studies; clinical data for human plague is limited.

\*Since abscesses such as buboes have lower pH than most human tissues, transport of aminoglycosides into the bacterial cell may be reduced. Clinicians may consider alternative or dual therapy for patients with large buboes.



## Case fatality

The case fatality rate for untreated bubonic plague is 50–60%. Cases of untreated pneumonic or primary septicemic plague are invariably fatal. Appropriate therapy (if initiated early) will reduce the case fatality rate. Overall, about 11% of plague cases in the U.S. are fatal.<sup>11,12</sup>

## Reservoir

Plague is usually a zoonosis involving wild rodents as the natural hosts and their fleas as vectors for the disease. Plague is endemic in rodents throughout the southwestern U.S. Ground squirrels are the natural vertebrate host, but it can also be found in rats, prairie dogs, rabbits, hares, wild carnivores, chipmunks, mice, and domestic cats, as well as their fleas.

## Transmission

Typically plague occurs in humans when they come into contact with infected fleas or animals. During plague epizootics, many rodents die, which causes hungry fleas to seek other sources of blood. When people or animals visit the places where rodents recently died from plague, they are at risk of getting it from flea bites.

Humans can also become infected when they handle tissue or body fluids from an infected animal. A hunter who skins an animal without using proper precautions can become infected.



When a person has plague pneumonia, they may cough droplets containing the bacteria into the air. When they are inhaled by another person, the bacteria can cause pneumonic plague. Typically, this requires direct and close contact with the infected person.

Cats are particularly susceptible to plague and can be infected when they eat infected rodents. Sick cats can transmit infectious plague to owners or veterinarians.

## Susceptibility

All people are susceptible to this organism.

## Incubation period

The typical incubation period for septicemic plague is 1–7 days. Bubonic plague usually occurs between 2–8 days, and pneumonic plague occurs 1–3 days, following exposure.

## Period of communicability

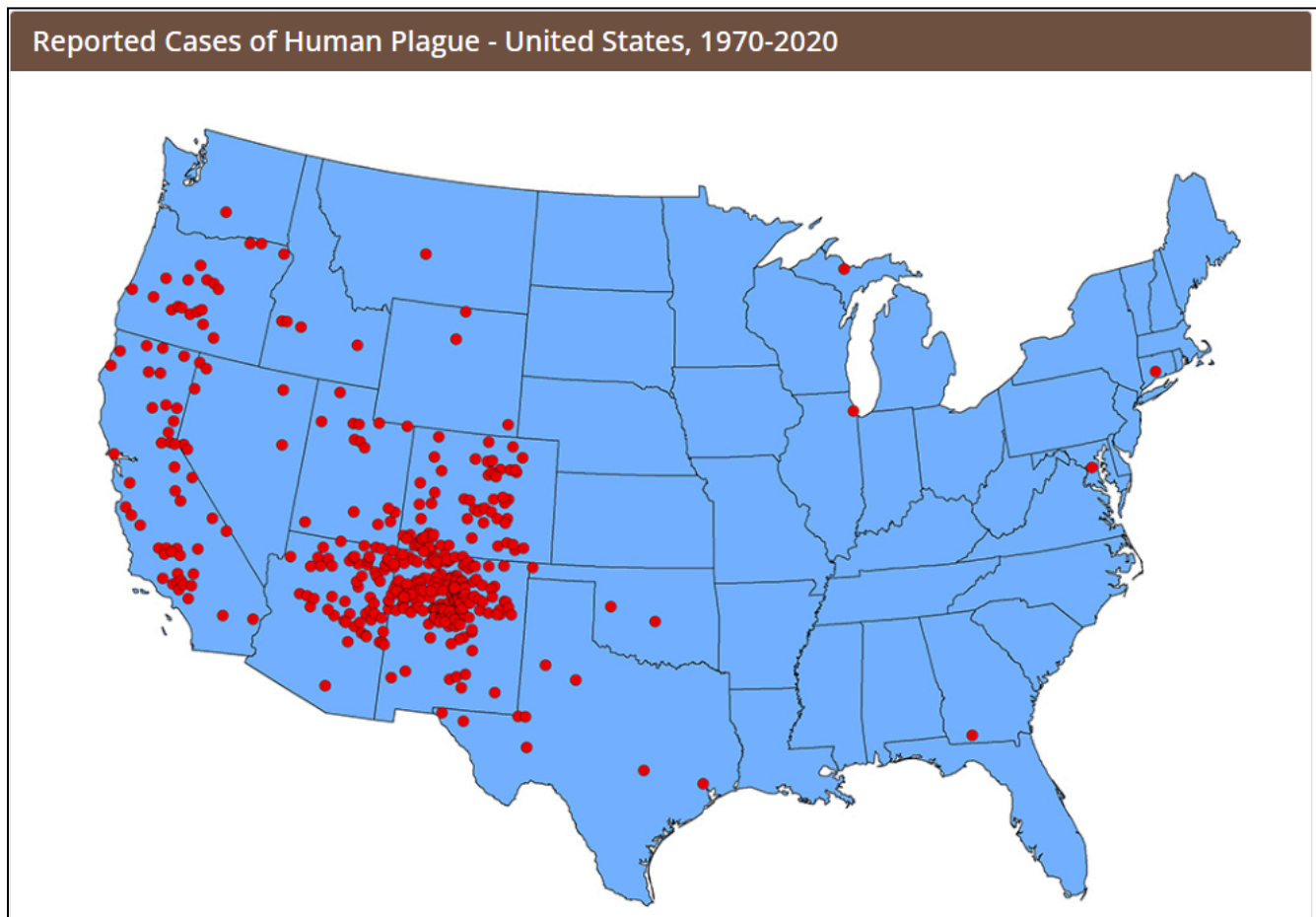
Patients with pneumonic plague are considered infectious throughout their symptomatic illness, and for 72 hours after effective antibiotic treatment starts. Discharge from lesions in patients with bubonic plague is considered infectious.

## Epidemiology

Cases of plague have occurred sporadically in rural areas of the western U.S. since the early 1900s.<sup>13</sup> Plague is considered an endemic zoonotic disease in Utah. Each year, rodent burrows in rural parts of the state are found to carry plague. In Utah, cats are frequent transmission vehicles. They acquire plague through hunting rodents, develop the disease, and then can transmit the disease.

The bubonic form of plague accounts for more than 80% of plague cases in the U.S.<sup>11</sup> The septicemic form occurs in about 10%. About 12% of plague patients in the U.S. develop pneumonic plague, of which 50% die.

An average of 7 human cases of plague are reported to the CDC each year in the U.S.<sup>11</sup> Internal DHHS data show that 2 cases of plague have been reported in Utah since 2009.



## Public health control measures

### Public health responsibility

- **Notify the Utah Utah Department of Health and Human Services (DHHS) Office of Communicable Diseases, the Utah Public Health Laboratory (UPHL), and the local health department by phone immediately.**
- Thoroughly investigate all suspect cases of disease.
- Determine the probable source (location) of the infection (including ruling out the possibility of a bioterrorism event).
- Determine if and where transmission is occurring in Utah.
- Provide education to the general public, clinicians, and first responders about disease transmission and prevention.
- Make sure cases are properly treated.
- Initiate active surveillance immediately upon notification of suspect cases.
- Identify contacts if pneumonic plague is suspected.
- Identify environmental risks that need to be remediated that could include (pets, handling infected animals, or around infected persons).

### Prevention

As this disease is a vector-borne illness, public health needs to make sure that evidence of endemic activity (either through rodent or flea trapping) is swiftly remediated. Working through sister agencies (such as the Division of Wildlife Resources and the National Park Service), affected rodent burrows should be dusted with pesticides, and warning signs posted for campers/visitors. Information should reinforce that people avoid interaction with rodents, etc.

Personal protective measures should be used while in a rural area where plague is endemic:

1. Reduce rodent habitat around your home, workplace, and recreational areas. Remove brush, rock piles, junk, cluttered firewood, and possible rodent food supplies, such as pet and wild animal food. Make your home and outbuildings rodent-proof.
2. Wear gloves when you handle or skin potentially infected animals to prevent contact between your skin and the plague bacteria. Contact your local health department if you have questions about disposal of dead animals.
3. Use repellent if you think you could be exposed to rodent fleas during activities such as when you camp, hike, or work outdoors. Products containing DEET can be applied to the skin as well as clothing, and products containing permethrin can be applied to clothing (always follow instructions on the label).

4. Keep fleas off of your pets by applying flea control products. Animals that roam freely are more likely to come in contact with plague-infected animals or fleas and could bring them into homes. If your pet becomes sick, seek care from a veterinarian as soon as possible.
5. Do not allow dogs or cats that roam free in endemic areas to sleep on your bed.

Large numbers of dead or sick rodents should be reported to the local health department, the Utah Department of Health and Human Services, or Utah Division of Wildlife Resources.

### Prevention in healthcare settings

Contact and droplet precautions are advised for healthcare settings; in addition, if the patient has evidence of pneumonic plague, respiratory isolation precautions should be put in place. Patients should be isolated until after 72 hours of appropriate antibiotic therapy.

## Chemoprophylaxis

Pre-exposure prophylaxis for first responders and healthcare providers who will care for patients with pneumonic plague is not considered necessary as long as standard and droplet precautions can be maintained. In cases of surgical mask shortages, patient overcrowding, poor ventilation in hospital wards, or other situations, pre-exposure prophylaxis might be warranted if there is an adequate supply of antimicrobials. Prophylaxis can be discontinued 48 hours after the last perceived exposure.<sup>4</sup>

Post-exposure prophylaxis is indicated in persons with known exposure to plague, such as close contact with a pneumonic plague patient, or direct contact with infected body fluids or tissues. Duration of post-exposure prophylaxis to prevent plague is 7 days.

The recommended antibiotic regimens for pre- and post-exposure prophylaxis are shown below. Pediatric regimens are for children aged  $\geq 1$  month to  $\leq 17$  years. Only first-line prophylaxis options are listed here. For additional prophylaxis options, see: [Antimicrobial Treatment and Prophylaxis of Plague: Recommendations for Naturally Acquired Infections and Bioterrorism Response](#).<sup>5</sup>

Antimicrobial	Dose	Route of administration	
Adults	Ciprofloxacin	500–750 mg every 12 hours	PO
	Levofloxacin	500–750 mg every 24 hrs	PO
	Moxifloxacin	400 mg every 24 hrs	PO
	Doxycycline	100 mg every 12 hrs	PO
Children	Ciprofloxacin	15 mg/kg every 12 hrs (maximum 750 mg/dose)	PO
	Levofloxacin	Weight <50 kg: 8 mg/kg every 12 hrs (maximum 250 mg/dose) Weight ≥50 kg: 500–750 mg every 24 hrs	PO
	Doxycycline <sup>†</sup>	Weight <45 kg: 2.2 mg/kg every 12 hrs Weight ≥45 kg: 100 mg every 12 hrs	PO
Pregnant people	Ciprofloxacin	500 mg every 8 hrs or 750 mg every 12 hrs	PO
	Levofloxacin	750 mg every 24 hrs	PO

<sup>†</sup>No evidence of tooth staining after multiple short courses.<sup>8</sup>

## Vaccine

A plague vaccine is no longer available in the U.S. New plague vaccines are in development, but are not expected to be commercially available in the immediate future.<sup>14</sup>

## Isolation and quarantine requirements

- Bubonic and septicemic plagues are not typically transmitted from person to person, **isolation** and **quarantine** are generally not appropriate.
- Precautions toward pneumonic plague should be taken due to the transmission of disease by droplets. Droplet precautions should be maintained for 72 hours after treatment starts. Persons who live in the household or have had face-to-face contact with a case with pneumonic plague should be educated on signs and symptoms and antibiotic prophylaxis is recommended through their healthcare provider. If contacts of pneumonic plague are unable to receive prophylaxis, quarantine for a 7-day period is required.
- While the plague bacillus can change quickly and spontaneously, it should not be considered an ongoing threat in an environmental setting. Therefore, no environmental **quarantine** is necessary.

## Case investigation

### Reporting

Plague is an immediately reportable disease in Utah.

Report any illness to public health authorities that meets any of the following criteria:

- A person with an acute illness consistent with plague AND clinical suspicion of plague.
- A laboratory order for plague, including, but not limited to, results positive for plague.
- A person whose healthcare record contains a diagnosis of plague.
- A person whose death certificate lists plague as a cause of death or a contributing factor to death.

Other recommended reporting procedures:

- All cases of plague should be reported.
- Reporting should be ongoing and routine.
- Reporting should be immediate.

### **Clinical criteria for reporting**

Plague is an acute febrile illness often accompanied by chills, headache, malaise, prostration, and leukocytosis. It may ultimately manifest in 1 or more of the following clinical forms:

- Regional lymphadenitis (bubonic plague)
- Septicemia without evident lymphadenitis (septicemic plague)
- Pneumonia (pneumonic plague)
- Pharyngitis with cervical lymphadenitis (pharyngeal plague)

### **Laboratory criteria for reporting**

- Any laboratory order for *Y. pestis* testing, including for culture, direct fluorescent antibody assay, or PCR, with or without results, OR
- Any identification of *Y. pestis* in a clinical laboratory (isolation, elevated serum antibody titer(s) to *Y. pestis* F1 antigen in a patient with no history of plague vaccination, or detection of *Y. pestis* specific antigens by fluorescent antibody assay, immunohistochemical assay, or PCR).

### **Epidemiologic linkage criteria for reporting**

- A suspected infection in a person that is epidemiologically linked to a person or animals with confirmatory plague laboratory evidence\* within the prior 2 weeks;
- A suspected infection in a person who had close contact with a confirmed pneumonic plague case, including, but not limited to, presence within 2 meters of a person with active cough due to pneumonic plague;
- A suspected infection in a person who lives in or has traveled within 2 weeks of illness onset to an area with confirmed plague epizootic activity.

\*confirmatory laboratory evidence as indicated below applies for humans and animals

### Vital records criteria for reporting

- Plague listed anywhere on a death certificate

### Other criteria for reporting

- A person whose healthcare record contains a diagnosis of plague

### Disease specific data elements to be included in the initial report

- Works, or recently worked, in a laboratory that handles *Y. pestis* isolates or clinical specimens from plague patients.
- Works, lives in, or recently traveled to a western state or region of the world with enzootic plague activity;
- History or evidence of a flea bite;
- Exposure to carcasses, tissues, or body fluids of potentially infected animals, such as wild rodents;
- Exposure to infectious respiratory droplets of a suspected human or animal pneumonic plague case;
- Sustained bites or scratches from a suspected infected animal;
- Has a companion animal with a suspected or confirmed *Y. pestis* infection;
- Has a household contact who has plague infection or is otherwise epidemiologically linked to a person with a confirmed or presumptive plague infection.

## Case definition

Plague (2020)<sup>15,16</sup>

### Clinical description

An illness characterized by acute onset of fever as reported by the patient or healthcare provider with or without 1 or more of the following specific clinical manifestations:

- Regional lymphadenitis (bubonic plague)
- Septicemia (septicemic plague)
- Pneumonia (pneumonic plague)
- Pharyngitis with cervical lymphadenitis (pharyngeal plague)

### Laboratory criteria for diagnosis

#### Confirmatory laboratory evidence

- Isolation of *Y. pestis* from a clinical specimen with culture identification validated by a secondary assay (bacteriophage lysis assay, direct fluorescent antibody assay) as performed by a CDC or laboratory response network (LRN) laboratory, OR

- Fourfold or greater change in paired serum antibody titer to *Y. pestis* F1 antigen

#### Presumptive laboratory evidence\*

- 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 *Yersinia pestis* specific DNA or antigens, including F1 antigen, in a clinical specimen by direct fluorescent antibody assay (DFA), immunohistochemical assay (IHC), or PCR

\*Other laboratory tests, including rapid bedside tests, are in use in some low resourced international settings, but are not recommended as laboratory evidence of plague infection in the U.S.

#### Epidemiologic linkage

- Person who is epidemiologically linked to a person or animals with confirmatory laboratory evidence within the prior 2 weeks;
- Close contact with a confirmed pneumonic plague case, including, but not limited to, presence within 2 meters of a person with active cough due to pneumonic plague; or
- A person who lives in, or has traveled within 2 weeks of illness onset to a geographically-localized area with confirmed plague epizootic activity in fleas or animals as determined by the relevant local authorities

### Case classification

#### Confirmed

- a clinically-compatible case with confirmatory laboratory evidence, OR
- a clinically-compatible case with presumptive laboratory evidence AND epidemiologic linkage.

#### Probable

- a clinically-compatible case with presumptive laboratory evidence without epidemiologic linkage in absence of an alternative diagnosis

#### Suspect

- a clinically-compatible case with epidemiologic linkage without laboratory evidence, OR
- confirmed or presumptive laboratory evidence without any associated clinical information.



Serial or subsequent plague infections in 1 individual should only be counted if there is a new epidemiologically-compatible exposure and new onset of symptoms

## Case investigation process

Suspect cases of plague should be investigated immediately, even if the cases haven't been confirmed. There are several immediate goals to the investigation process:

- **Notify the DHHS Office of Communicable Diseases or local health department by phone immediately.**
  - Do not leave a message on an answering machine; you must have a direct, in-person contact with an employee to make sure appropriate notification is made.
  - DHHS staff will ensure immediate notification to UPHL and the local health department (1-888-EPI-UTAH).
- **Actions taken with the case patient**
  - It is important to identify the source of each case. To do this, fill out both the disease investigation form as well as the BT investigation form. The possibility of bioterrorism needs to be ruled out as soon as possible.
  - Identify the type of disease. Is it septicemic, bubonic, or pneumonic?
  - Make sure infection control precautions are appropriate for the type of disease.
  - Learn whether the case has pets. If so, educate on prevention techniques intended for pets that can include not allowing pets that roam outdoors to get on your bed, using flea control products, and if a pet becomes sick, seek care from a veterinarian.
- Complete CMR in EpiTrax. Some of the information on this form must be provided by a clinician or other medical personnel.
- Verify case status.
- Complete the disease investigation form.
- Determine whether the patient had travel/exposure history consistent with acquisition of disease in Utah or elsewhere.
- If a patient acquired disease in Utah, identify the source of transmission and help to eliminate it.

## Outbreaks

Due to the serious nature of this disease, single cases should be investigated as soon as possible. Public health will assume that a single case could lead to an outbreak and will respond accordingly. Public health will have a critical mission to provide public, clinician, and first responder education in the event of a significant outbreak.

## Identifying case contacts

- Identify persons who had a household, hospital, or other close contact with persons with pneumonic plague and educate them about the symptoms of illness to facilitate diagnosis.
- Identify laboratory workers and healthcare providers exposed to specimens or laboratory isolates, and educate them about the symptoms of illness to facilitate diagnosis.

## Case contact management

Plague is only transmissible from person to person if it is pneumonic.

- IF the case is pneumonic, then make sure to quickly identify any close contacts to the patient from the date of symptom onset until after 72 hours of antibiotic treatment AND post exposure prophylaxis of those contacts is essential.
- Pneumonic plague is transmissible via droplets; therefore, appropriate contacts should be identified and notified of the potential exposure.
- Make sure contacts receive appropriate prophylaxis.
- Monitor contacts daily. If any report development of a fever or cough for 7 days after exposure, they should be seen immediately by a clinician.

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## Version control

Updated February 2024: Updated treatment and prophylaxis recommendations and minimum/required fields.

Updated November 2019: Updated “Plague Rules for Entering Laboratory Test Results”

Updated August 2019: Updated case definition per CSTE guidance and critical clinician information.

Update March 2016: Made changes per LHD suggestions.

Update Aug 2015: Made changes to document format.

Update Nov 2015: Updated most sections and added minimum data set.

## Plague rules to enter laboratory test results

The following rules describe how laboratory results reported to public health should be added to new or existing events in EpiTrax. These rules were developed for the automated processing of electronic laboratory reports, although they apply to manual data entry, as well.

### Test-specific rules

*Test-specific rules describe what test type and test result combinations are allowed to create new morbidity events in EpiTrax, and what test type and test result combinations are allowed to update existing events (morbidity or contact) in EpiTrax.*

Test type	Test result	Create a new event	Update an existing event
Antigen by DFA/IF	Positive	Yes	Yes
	Negative	No	Yes
	Equivocal	Yes	Yes
	Other	Yes	Yes
Culture	Positive	Yes	Yes
	Negative	No	Yes
	Equivocal	Yes	Yes
	Other	Yes	Yes
Total antibody	Positive	Yes	Yes
	Negative	No	Yes
	Equivocal	Yes	Yes
	Other	Yes	Yes
PCR/amplification	Positive	Yes	Yes
	Negative	No	Yes
	Equivocal	Yes	Yes
	Other	Yes	Yes

### Whitelist rules

*Whitelist rules describe how long an existing event can have new laboratory data appended to it. If a laboratory result falls outside the whitelist rules for an existing event, it should not be added to that event, and should be evaluated to determine if a new event (CMR) should be created.*

**Plague morbidity whitelist rule:** If the specimen collection date of the laboratory result is 1 year or less after the event date of the morbidity event, the laboratory result should be added to the morbidity event.

**Plague contact whitelist rule:** If the specimen collection date of the laboratory result is 14 days or less after the event date of the contact event, the laboratory result should be added to the contact event.

### **Graylist rule**

*We often receive laboratory results through ELR that cannot create cases, but can be useful if a case is created in the future. These laboratory results go to the graylist. The graylist rule describes how long an existing event can have an old laboratory result appended to it.*

**Plague graylist rule:** If the specimen collection date of the laboratory result is 30 days before to 7 days after the event date of the morbidity event, the laboratory result should be added to the morbidity event.

### **Other electronic laboratory processing rules**

- If an existing event has a state case status of “not a case,” ELR will never add additional test results to that case. New labs will be evaluated to determine if a new CMR should be created.



## EpiTrax minimum/required fields by tab

### Demographic

- County
- State
- Street
- City
- ZIP code
- Date of birth
- Birth gender
- Ethnicity
- Race
- First name
- Last name
- Phone number

### Clinical

- Date diagnosed
- Died
- Date of death
- Disease
- Onset date
- Hospitalized
- Did the patient or healthcare provider report an acute onset of fever?
- Syndrome
- Lymphadenitis, regional (buboe)
- Lymphadenitis, pharyngeal
- Pneumonia
- Septicemia

### Laboratory

- Organism
- Specimen sent to state lab
- Specimen source
- Test result
- Test type
- Collection date

### Investigation

- Occupation
- Imported from?
- What is the likely exposure setting? (around the person's home, recreational)
- Date of exposure
- Does the patient work in a clinical or microbiological lab processing samples that could potentially contain the organism?
- Was this illness epi-linked to any animal or human plague cases?
- Does the patient have any animal exposure in the 10 days prior to illness onset? If so, when and where was the contact, and what was the animal?
- Does the patient have a history of flea bites?
- Within 10 days of the onset of illness, did the patient travel or stay overnight somewhere other than the main residence? If yes, list dates and locations.

### Reporting

- Date first reported to public health

### Administrative

- Outbreak name
- Outbreak associated
- State case status