

Ontario Public Health Standards:  
Requirements for Programs, Services and Accountability

Infectious Disease Protocol

# **Appendix 1:**

## **Case Definitions and Disease-Specific Information**

### **Disease: Plague**

**Effective: May 2023**

# Plague

Communicable

Virulent

[Health Protection and Promotion Act \(HPPA\)](#)<sup>1</sup>

[Ontario Regulation \(O. Reg.\) 135/18 \(Designation of Diseases\)](#)<sup>2</sup>

## Provincial Reporting Requirements

Confirmed case

Probable case

As per Requirement #3 of the "Reporting of Infectious Diseases" section of the *Infectious Diseases Protocol, 2018* (or as current), the minimum data elements to be reported for each case are specified in the following:

- [O. Reg. 569](#) (Reports) under the HPPA;
- [The iPHIS User Guides](#) published by Public Health Ontario (PHO); and
- Bulletins and directives issued by PHO.<sup>3,4</sup>

## Type of Surveillance

Case-by-case

## Case Definition

### Confirmed Case

Laboratory confirmation of infection with clinically compatible signs and symptoms:

- Isolation of *Yersinia pestis* (*Y. pestis*) from an appropriate clinical specimen (e.g., body fluids)

**OR**

- A significant (i.e., fourfold or greater) rise in serum antibody titre to *Y. pestis* fraction 1 (F1) antigen by enzyme immunoassay (EIA) or passive

- haemagglutination/inhibition titre

### **Probable Case**

Clinically compatible signs and symptoms with one of the following laboratory results:

- Demonstration of elevated serum antibody titre(s) to *Y. pestis* F1 antigen (without documented significant [i.e., fourfold or greater] rise) in a patient with no history of plague immunization

**OR**

- Demonstration of *Y. pestis* F1 antigen by immunofluorescence

**OR**

- >1:10 passive haemagglutination/inhibition titre in a single serum sample in a patient with no history of vaccination or previous infection

**OR**

- Detection of *Y. pestis* antibody by EIA

**OR**

- Detection of *Y. pestis* nucleic acid

### **Outbreak Case Definition**

The outbreak case definition varies with the outbreak under investigation. Please refer to the *Infectious Diseases Protocol, 2018* (or as current) for guidance in developing an outbreak case definition as needed.<sup>3</sup>

The outbreak case definitions are established to reflect the disease and circumstances of the outbreak under investigation. The outbreak case definitions should be developed for each individual outbreak based on its characteristics, reviewed during the course of the outbreak, and modified, if necessary, to ensure that the majority of cases are captured by the definition. The case definitions should be created in consideration of the outbreak definitions.

Outbreak cases may be classified by levels of probability (*i.e.*, confirmed and/or probable).

Given the severity of disease and rarity of plague in Canada, and in the absence of travel-related or foreign exposure, a single confirmed case constitutes an outbreak.

## Clinical Information

### Clinical Evidence

Clinically compatible signs and symptoms are characterized by fever, chills, headache, malaise, prostration, and leukocytosis that are manifested 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 haematogenous 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)

### Clinical Presentation

Clinical illness is characterized by fever, chills, headache, malaise, prostration, nausea, sore throat, and leukocytosis manifesting in one or more of the three main forms of plague in humans:

1. Bubonic plague: The most common form of human plague, resulting from the bite of an infected flea that has fed on an infected rodent, such as a rat. It presents as acute lymphadenitis in lymph nodes that drain the site of the flea bite, forming a bubo. Flea bites on the legs typically result in the appearance of inguinal buboes. Axillary buboes can be associated with flea bites as well, and are often seen after the handling of infected animals. Cervical buboes are rare in industrialized countries, but are relatively common in developing countries where people sleep on dirt floors. Lymph nodes become swollen and tender and may suppurate; fever is present.

2. Septicemic plague: All forms of plague, including those without lymphadenopathy, may progress to septicemic plague, with dissemination of the bacillus by the bloodstream to diverse parts of the body, including the meninges.
3. Pneumonic plague: An infection of the lungs caused by the plague bacillus. Secondary involvement of the lungs results in pneumonia; mediastinitis or pleural effusion may develop. Secondary pneumonic plague is of special significance, since respiratory droplets may serve as the source of person-to-person transfer with resultant primary pneumonic plague.<sup>5,6</sup>

Untreated bubonic plague has a fatality rate of 50%; pneumonic and septicemic plagues are fatal if not treated.<sup>5</sup>

## Laboratory Evidence

### Laboratory Confirmation

Any of the following will constitute a confirmed case of plague:

- Positive *Y. pestis* culture with confirmation (See Section 4.2)
- A significant (i.e., fourfold, or greater) rise in *Y. pestis* antibody titre

### Approved/Validated Tests

- Standard culture for *Y. pestis* with biochemical confirmation
- *Y. pestis* serology
- Nucleic acid amplification test (NAAT) for *Y. pestis*
- Direct fluorescent antibody (DFA) for *Y. pestis* F1 antigen
- Confirmatory methods include combinations of the following methods: specific bacteriophage lysis, DFA for F1 antigen, NAAT, haemagglutination/inhibition titres, EIA for *Y. pestis* antibody
- Detection of *Y. pestis* nucleic acid

## Indications and Limitations

Not applicable

For further information about human diagnostic testing, contact the [Public Health Ontario Laboratories](#).

## Case Management

In addition to the requirements set out in the Requirement #2 of the “Management of Infectious Diseases – Sporadic Cases” and “Investigation and Management of Infectious Diseases Outbreaks” sections of the *Infectious Diseases Protocol, 2018* (or as current), the board of health shall investigate cases to determine the source of infection.<sup>3</sup> Refer to Provincial Reporting Requirements above for relevant data to be collected during case investigation.

Every case should be followed up as soon as possible to determine the source of exposure and eliminate the potential that the case is a result of bioterrorism.

Case investigation and follow-up will be done in consultation with the ministry, PHO and the Public Health Agency of Canada.

The following disease-specific information may also be collected:

- History of travel in the relevant incubation period;
- Exposure to fleas, rodents, wild carnivores or domestic cats;
- High risk occupation such as veterinary medicine or trapping; and
- Exposure to other potential cases.<sup>5</sup>

Provide education about the infection and how it is spread. Advise on the use of insecticides and repellants on clothing and luggage of infected persons.<sup>5</sup>

Treatment is under the direction of the attending health care provider. Refer to the resources and references listed below for more information on treatment.

*Y. pestis* may also be used as a bioterrorism agent. If bioterrorism is suspected, the Provincial Emergency Operations Centre (PEOC) will be activated to coordinate and direct the province's response under the [Emergency Management and Civil Protection Act](#).<sup>7</sup>

**Note:** Given the potential for the appearance of *Y. pestis* cases to signal a bioterrorism incident, investigation and follow-up may involve notification of law enforcement. If tampering, sabotage, or bioterrorism is suspected, the health unit shall immediately notify their local police service and the Health System Emergency Management Branch (HSEMB) Health Care Provider Hotline at 1-866-212-2272. A bioterrorism event would trigger activation of the provincial emergency operations centre, including the HSEMB of the ministry and relevant health emergency response plans, as well as those additional ministries with responsibilities for security, law enforcement, or other relevant areas of concern, as identified in the [Emergency Management and Civil Protection Act](#) and associated Order in Council. The [Ministry Emergency Response Plan \(MERP\)](#) provides information on how the ministry would respond to a health emergency.<sup>7,8</sup> Any requests for federal supplies of medical countermeasures for a *Y. pestis* bioterrorism incident must be made through HSEMB. The Provincial Emergency Operations Centre (PEOC) can be contacted by email at [EOCOoperations.MOH@ontario.ca](mailto:EOCOoperations.MOH@ontario.ca).

## Contact Management

Contacts of pneumonic plague are household members and those that have been within 2 meters of a coughing patient in the previous 7 days.<sup>5,6</sup>

For contacts of pneumonic plague:

- Provide antibiotic prophylaxis and place under surveillance for 7 days; those who refuse prophylaxis should be maintained in strict isolation with careful surveillance for 7 days.<sup>5</sup>

Contacts of bubonic plague are those that have had direct contact with infected body fluids or tissues (*e.g.*, fluids from buboes).

In all cases where a case or contacts have been exposed to fleas, eliminate fleas.<sup>5</sup>

# Outbreak Management

Please see the *Infectious Diseases Protocol, 2018* (or as current) for the public health management of outbreaks or clusters in order to identify the source of illness, manage the outbreak and limit secondary spread.<sup>3</sup>

A single case of plague should be managed with great urgency. If there is suspicion of a bioterrorism event, notify the ministry immediately.

In the absence of travel-related or foreign acquired exposure, one case should be considered an outbreak.

## Prevention and Control Measures

### Personal Prevention Measures

Preventive measures:

- Avoid exposure to fleas and take precautions to protect against flea bites by using insect repellents when traveling in endemic areas and control fleas on indoor pets.
- Wear gloves when hunting and handling wildlife.
- Veterinarians and their staff should wear gloves and masks when examining sick cats.<sup>5,6</sup>

### Infection Prevention and Control Strategies

Use routine practices for hospitalized cases as well as droplet precautions until pneumonia is excluded and appropriate therapy has been initiated; droplet precautions should be continued for 48 hours after initiation of effective treatment in cases with pneumonic plague.<sup>6</sup>

Refer to [PHO's website](#) to search for the most up-to-date information on Infection Prevention and Control (IPAC).



# Disease Characteristics

**Aetiologic Agent** - The causative agent of plague is *Yersinia pestis* (*Y. pestis*), a gram-negative *coccobacillus*.<sup>5,6</sup>

Aerosolized plague is a potential bioterrorism agent.

**Modes of Transmission** - Bubonic: Bite from an infected flea, which is the most common mode of transmission, or by handling tissues of an infected animal.<sup>6</sup>

Pneumonic: Inhalation of droplets or contact with sputum from an infected person or animal.<sup>6</sup>

Cats may occasionally transmit infection through bites, scratches, or respiratory droplets. Cats also develop plague abscesses that have been a source of infection to veterinary personnel.<sup>5</sup>

**Note:** Septicemic plague: All forms of plague may progress to septicemic plague.

**Incubation Period** – From 1-7 days for bubonic plague and 1-4 days for primary pneumonic plague.<sup>5</sup>

**Period of Communicability** - Bubonic plague is not usually transmitted directly from person to person, unless there is contact with pus from suppurating buboes.

Pneumonic plague can be highly communicable under appropriate climatic conditions, with overcrowding and cool temperatures facilitating transmission.<sup>5</sup>

Fleas may remain infective for months.<sup>5</sup>

**Reservoir** - Wild rodents, such as ground squirrels, play a key role in maintaining natural plague cycles by serving as amplifying hosts and sources of infection for the flea vectors of the disease. Rabbits and hares, wild carnivores and domestic cats may also become infected and act as sources of infection to people.<sup>5</sup>

**Host Susceptibility and Resistance** - Susceptibility is general.<sup>5</sup> Plague affects all age groups, though 50% of cases occur in ages 12 to 45.<sup>9</sup> Immunity after recovery is relative and may not protect against a large infective dose.<sup>5</sup>

Please refer to [PHO's Reportable Disease Trends in Ontario reporting tool](#) for the most up-to-date information on infectious disease trends in Ontario.

For additional national and international epidemiological information, please refer to the Public Health Agency of Canada and the World Health Organization.

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## Document History

| Revision Date | Document Section                 | Description of Revisions  |
|---------------|----------------------------------|---|
| April 2022    | Entire Document                  | New template. Appendix A and B merged. No material content changes. |
| April 2022    | Epidemiology: Occurrence section | Removed.  |
| April 2022    | ICD Codes                        | Removed.  |
| March 2023    | Bioterrorism                     | Addition of bioterrorism guidelines.                                |
| May 2023      | Case Management                  | Addition of contact information.                                    |