

**Forensic Epidemiology: Joint Training for Law Enforcement,  
Hazardous Materials and Public Health Officials on Investigate Responses  
to Bioterrorism**

**Case Study I – Pneumonic Plague Scenario**

***Learning Objectives***

- To understand how to conduct an investigation of a bioterrorist event caused by a communicable disease capable of person-to-person spread
- To be familiar with how and when to implement quarantine
- To know how quarantine can be enforced

***Facts, Questions, and Answers***

**Facts I**

A 44 year-old man with no previous health problems is admitted to the hospital with severe respiratory distress and fever. He is intubated in the emergency room and a chest x-ray reveals bilateral pneumonia. Cultures of sputum and blood are obtained, antibiotics are started and he is transferred to the medical intensive care unit on a ventilator. On hospital day 2, the hospital microbiology lab has isolated a gram-negative coccobacillus from 2 blood cultures and initial biochemical tests are suggestive of *Yersinia pestis*, the plague bacterium. An infectious disease consult is obtained and the suspicious bacterium is sent to the State Laboratory of Public Health in Raleigh for confirmation.

**Questions**

1. What are the implications of a suspected or confirmed case of pneumonic plague in the US?

*In the US, human plague is rare with about 10 cases reported per year to the CDC. Most infections occur in the southwest US from May to October when people are outdoors and come into contact with rodents and their fleas. Unexplained rodent deaths are an indicator of naturally occurring plague in the environment. Bubonic plague, the most common form, develops when infected rodent fleas bite people. Humans occasionally become infected by direct handling or inhalation of contaminated animal tissues or fluids, or inhalation of droplets from coughing patients.*

*The plague bacillus is considered a Category A bioterrorist agent by the CDC so a bioterrorist event must be quickly differentiated from a natural source of infection. The epidemiology of plague following a bioterrorist attack would differ substantially from that of naturally occurring infection. Dissemination would occur via aerosol and disease would present as a severe respiratory infection. The size of the outbreak would depend on factors including the quantity of biologic agent used, characteristics of the strain, environmental conditions and methods of aerosolization. Indications that plague had been intentionally released would be the occurrence of cases in locations not known to have enzootic infection, in persons without known risk factors, and in the absence of prior rodent deaths.*

2. At this stage, what communications, if any are necessary between law enforcement and public health?

*Law enforcement should be notified immediately of any suspected BT event.*

### Facts II

By the end of hospital day 2, the patient dies of overwhelming sepsis. Interviews with family members reveal that he became acutely ill one day before hospital admission while at work with a fever, cough, and shortness of breath. No other family members were ill and they did not have pets. The patient had recently returned from a business trip to Greenville, SC where he had traveled by car. He had not gone camping, was not a hunter, and had no known contacts with animals.

The day following the patient's death, the bacterium was confirmed as *Yersinia pestis* and was sent on to the CDC. The isolate sent from North Carolina was confirmed to be *Y. pestis* and an intense investigation of the possible source of the patient's infection was initiated by local and state health departments with assistance from CDC. This single case of plague pneumonia was considered to be an epidemic.

The incubation period for pneumonic plague is 1-6 days. The information collected to this point suggested the patient's potential exposure could have occurred in either NC or SC. This information led to environmental investigations (including outside activity locations and residential and work settings) in both NC and SC in an attempt to identify the source of the patient's infection. Law enforcement officials in NC and SC had been notified; local law enforcement and the FBI joined the investigation.

### Questions

1. What are the roles of public health and law enforcement at this stage of the investigation?

*Public health is still in the lead with assistance from law enforcement in the early discovery phase of the investigation.*

2. Under what circumstances might the respective roles of public health and law enforcement change?

*Once investigation reveals evidence of a crime (deliberate release of an infectious agent), law enforcement may take the lead.*

### Facts III

By day 4 of the investigation no new cases of pneumonic plague had emerged. All environmental cultures were negative thus far and nucleic acid detection tests were pending and expected to take several more days. Thorough inspection of the patient's automobile revealed a thin coating of pink, crusty material in the dashboard vents. Inspection of the patient's home and workplace were unrevealing.

Public health officials determined that people exposed to the patient while he was contagious included his family (wife and 3 children), all persons at his workplace (65 people), and healthcare workers involved in his care at the hospital. Law enforcement and public health believed that the patient was exposed via intentional point source aerosolization of plague in his vehicle.

#### Questions

1. Why weren't HAZMAT personnel who inspected the vehicle considered exposed?

*Plague would not be considered to be a threat in the environment 5 days after the release because the bacteria would be dead. This is unlike anthrax that is weaponized as a spore and can survive indefinitely in the environment. In addition, HAZMAT personnel are trained in personal protection equipment including respirator masks.*

2. What control measures are needed at this point?

*The control measure needed at this point is prevention of new cases by person-to-person spread. Thus, exposed individuals must be quarantined until treated prophylactically or until they have been observed for 7 days after the time of last exposure to the patient.*

3. What is the difference between isolation and quarantine?

*Isolation is for those who are symptomatic and communicable person-to-person either by direct contact (touching), droplet aerosol (indirect contact within 6 feet), or airborne (indirect contact at a greater distance). Quarantine is for those who are asymptomatic and possibly incubating a communicable disease and who must be isolated from the general public until they are beyond the incubation period or have received preventive therapy.*

4. How does this differ from anthrax?

*Anthrax is not communicable from person-to-person so quarantine of people is not indicated for control of this disease. However environments may remain contaminated with anthrax spores necessitating quarantine of buildings or places.*

#### Facts IV

The family agreed to quarantine in the home and all were started on doxycycline prophylaxis. With the cooperation of the LHD, the hospital infection control department and CDC, 50 work contacts and all involved healthcare workers at the hospital (12 people) were also quarantined and started on prophylaxis. 10 work contacts could not be reached as they were traveling. The destination of the travelers was known after interviews with family members and work colleagues. Five coworkers refused quarantine and were not cooperating with public health officials. One of these 5 individuals was reportedly ill with a flu-like illness.

#### Questions

1. Is there urgency in enacting quarantine? If so, why?

*Quarantine is urgent in this scenario because plague is capable of person-to-person spread via droplet aerosol and the ill, uncooperative work contact may be developing a secondary case of pneumonic plague and could spread it to others.*

2. Who authorizes quarantine?

*The local or state health director has authority to issue quarantine. X*

3. Who enforces quarantine? How?

*The local or state health director has authority to issue quarantine. State Law should articulate how law enforcement and public health officials work together to enforce quarantine.*

4. How long can people be detained in quarantine before they are given a hearing before a magistrate? Are they “under arrest”?

*Discussion points at this stage of the scenario will depend upon interpretation of the state law in the context of an existing public health emergency, including how a hearing before a judge would proceed, how and where quarantine violators would be detained, and an explanation of the due process provisions contained in the law.*

5. How can quarantine be enforced across state lines?

**Reference**

Inglesby TV, et al. Plague as biological weapon. Medical and public health management. JAMA. 2000; 283:2281-2290.