

Plague

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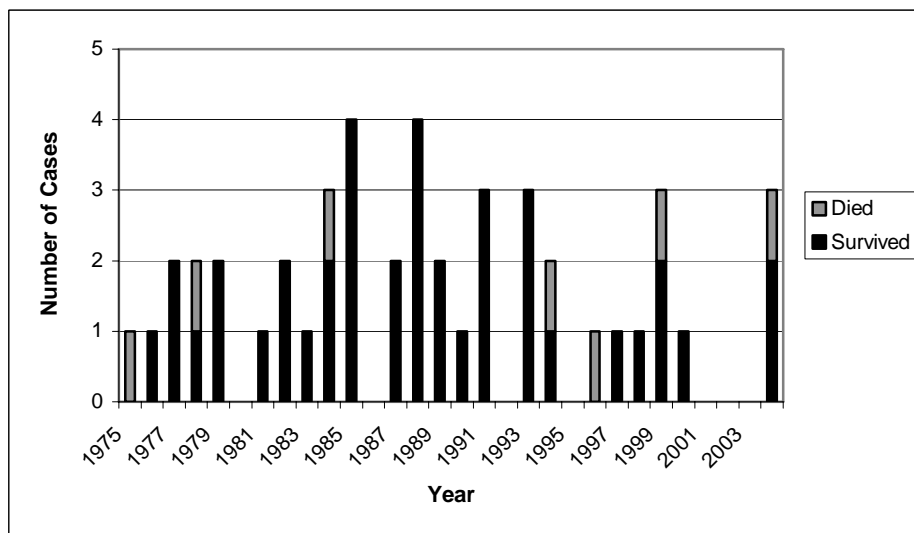
Epidemiology

Plague is an infection caused by the bacterium *Yersinia pestis*, a gram-negative, bipolar staining cocco-bacillus. Plague is endemic in the western United States and is maintained in a complex cycle among wild rodents and their fleas. Cases of plague most often occur in summer and early fall. Most cases also occur between 5,000 and 7,500 feet of elevation, which means the front range and southwestern Colorado are often affected.

The incidence of plague in non-human species in Colorado is changing. From 1947 through 1989, Colorado ranked 5th in the country for plague activity. From 1990 through 1999, Colorado ranked 2nd, and the incidence is expected to continue to increase. Due to recent wet springs and mild winters, 2005 is predicted to be an active plague year in Colorado.

The state of Colorado averages two human cases of plague per year; however, no human activity occurred between 2001 and 2003 (see Figure 1). In 2004, three human cases were reported in the state—one case each in Morgan, Pueblo and Weld Counties, including one fatal case. No human cases have been reported thus far in 2005.

Figure 1. Human Plague Cases in Colorado, 1975-2004



Although no human plague activity has occurred in the Tri-County Health Department region since 1967, Adams, Arapahoe and Douglas Counties continue to see non-human plague activity. Table 1 shows statewide and Tri-County non-human plague activity for 2004. To date in 2005, 42 species have tested positive for plague statewide, including one cat in Douglas County.



Table 1. Number of Plague-Positive Tests by Species in Colorado and the Tri-County Region, 2004

<i>Species</i>	Colorado	<u>Adams</u> County	<u>Arapahoe</u> County	<u>Douglas</u> County
Cats	22	0	0	0
Prairie Dogs	22	0	0	0
Coyotes	19	0	1	0
Flea Pools	13	0	1	0
Squirrels	8	1	0	0
Rabbits	7	0	0	0
Lynx	1	0	0	0
Total	92	1	2	0

Transmission and Risk Factors

Most human cases have a history of exposure in rural areas or in the western United States. About 85% of human cases are due to bites from infected fleas, which often appear in a linear pattern on the skin. Free-roaming pets, especially cats, have been increasingly implicated in human cases from bringing infected fleas into the home. Cats can also serve as a source of infection to humans exposed to them (via biting, scratching, or coughing). In 2004, 22 cats in Colorado tested positive for plague. Unlike cats, dogs rarely become ill and do not transmit plague directly. Other sources of infection include the skinning or handling of infected rodents and animals such as squirrels, rabbits and coyotes.

Human-to-human transmission can occur only with pneumonic plague. In the United States, the last case of human-to-human transmission was in Los Angeles in 1924. However, plague could be used as a bioterrorism agent and person-to-person transmission could occur in this situation (See “Plague as a Bioterrorism Agent”).

Clinical Features

Plague has an average incubation period of two to six days and presents in three forms:

- ❑ **Bubonic plague** is the most common form. Symptoms include abrupt onset of high fever, chills, malaise and presence of a unilateral, enlarged and extremely tender lymph node (bubo), usually in the inguinal, axillary or cervical regions. The fatality rate is 50-60% for *untreated* bubonic plague.
- ❑ **Septicemic plague** may develop secondary to bubonic plague or may present as primary bacterial sepsis with no noticeable bubo. Presentation includes septic shock syndrome with disseminated intravascular coagulation (DIC) and small vessel necrosis. The term “Black Death” refers to the gangrenous tissue as a result of DIC. The fatality rate is 100% for *untreated* cases of septicemic plague.
- ❑ **Pneumonic plague** is the least common form of the disease. Symptoms include fever, cough, dyspnea, chest pain and hemoptysis. Pneumonic plague can present as the primary form of illness or secondary to either bubonic or septicemic plague. *Untreated* cases have a 100% fatality rate.

Diagnosis

Laboratory diagnosis of plague can be obtained in several manners:

- ❑ **Aspirate from bubo** for gram stain, fluorescent antibody (DFA) stain, polymerase chain reaction (PCR) and culture
- ❑ **Blood cultures** (prior to antibiotic treatment) for PCR and culture
- ❑ **Chest X-ray** to rule out pneumonic plague
- ❑ **Sputum** for gram stain and culture (for those with suspected pneumonic plague)
- ❑ **Serum** for acute and convalescent antibody titers

Treatment

Plague can be easily treated with antibiotics, but treatment must begin early since the disease can progress rapidly. The treatment of choice is either streptomycin or gentamycin. When these are contraindicated, doxycycline or ciprofloxacin can be given. Dosages for adults and children are given below. Additionally, drainage of abscessed buboes may be necessary.

Adults

- ❑ Streptomycin—1 gram IM bid
- ❑ OR Gentamycin—5 mg/kg IM or IV qd
- ❑ Alternative: doxycycline 100 mg IV or ciprofloxacin 400 mg IV bid

Children

- ❑ Streptomycin—15 mg/kg IM bid (maximum daily dose = 2g)
- ❑ OR Gentamycin—2.5 mg/kg IM or IV tid
- ❑ Alternative: doxycycline (if <45 kg) 2.2 mg/kg or ciprofloxacin 15 mg/kg IV bid

Prophylaxis of close contacts is only indicated when the patient has primary or secondary pneumonic plague. Close contacts are defined as those having been within approximately 6 feet of the infectious person. Those contacts who are not considered close should be put on “fever watch” for seven days.

Close contacts should be prophylaxed for seven days with either doxycycline or ciprofloxacin. Adults should receive 100 mg of doxycycline orally bid OR 500 mg ciprofloxacin orally bid. Children should receive 2.2 mg/kg doxycycline orally (if <45 kg) OR 20 mg/kg ciprofloxacin orally bid.

Prevention

There is no vaccine available for plague. Therefore, healthcare providers should educate patients about the potential for plague and the precautions to minimize exposure to rodents and fleas.

Individual precautions include:

- ❑ Avoid contact with sick and dead rodents or rabbits. Flies or a dead animal smell can indicate an animal die-off. Prairie dog colony die-offs are often obvious to humans. All animal die-offs should be reported to the state or local health department.
- ❑ If you hunt or trap rabbits or animals such as coyotes, use hand and face protection while skinning and handling the animals.
- ❑ Domestic pets should avoid contact with rodents and should be bathed with flea shampoo or use flea powder. Flea collars have not been shown to be effective.
- ❑ Seek veterinary care for domestic cats who exhibit any swelling around the head or neck. Do not handle the animal without gloves and face protection.
- ❑ While hiking or spending time outdoors where fleas may be present, treat pants, socks, tops of shoes, legs, and arms with insect repellent.

Plague as a Bioterrorism Agent

The CDC has classified *Yersinia pestis* as a “Critical Biological Agent,” meaning that if it were used as a weapon, it could cause significant disease and death. The epidemiology of the disease following the release of plague would likely be very different from the epidemiology of naturally occurring infection. Symptoms would occur from one to six days after exposure and individuals would die quickly after symptom onset. This delay in symptom development would also allow infected individuals to travel and potentially spread the disease in a wider geographic region.

Because there are no environmental warning systems to detect aerosolized plague, the first indication of a bioterrorist attack of plague would likely be an outbreak of illness with pneumonic features. Therefore, quick recognition of the infection by medical professionals is essential in order to prevent the spread of the disease.

Reporting Requirements

Plague is a 24-hour notifiable disease for physicians and laboratories in Colorado and must be reported to the Colorado Department of Public Health and Environment at 303-692-2700 (daytime hours) or 303-370-9395 (after hours and weekends) or to Tri-County Health Department at 303-220-9200 (daytime hours) or 303-461-2342 (after hours and weekends).

For more information please contact your state or local health department:

Tri-County Health Department
(303) 220-9200 / After-hours pager (303) 461-2342
www.tchd.org

Colorado Department of Public Health and Environment Zoonotic Diseases
(303) 692-2700 / After-hours pager (303) 370-9395
<http://www.cdphe.state.co.us/dc/zoonosis/plague/plaguehom.html>

Other Resources

Centers for Disease Control and Prevention (CDC)
<http://www.cdc.gov/ncidod/dvbid/plague/index.htm>
<http://www.bt.cdc.gov/agent/plague/>
<http://www.bt.cdc.gov/agent/plague/trainingmodule/6/>

National Institutes of Health
<http://www.nlm.nih.gov/medlineplus/plague.html>

References:

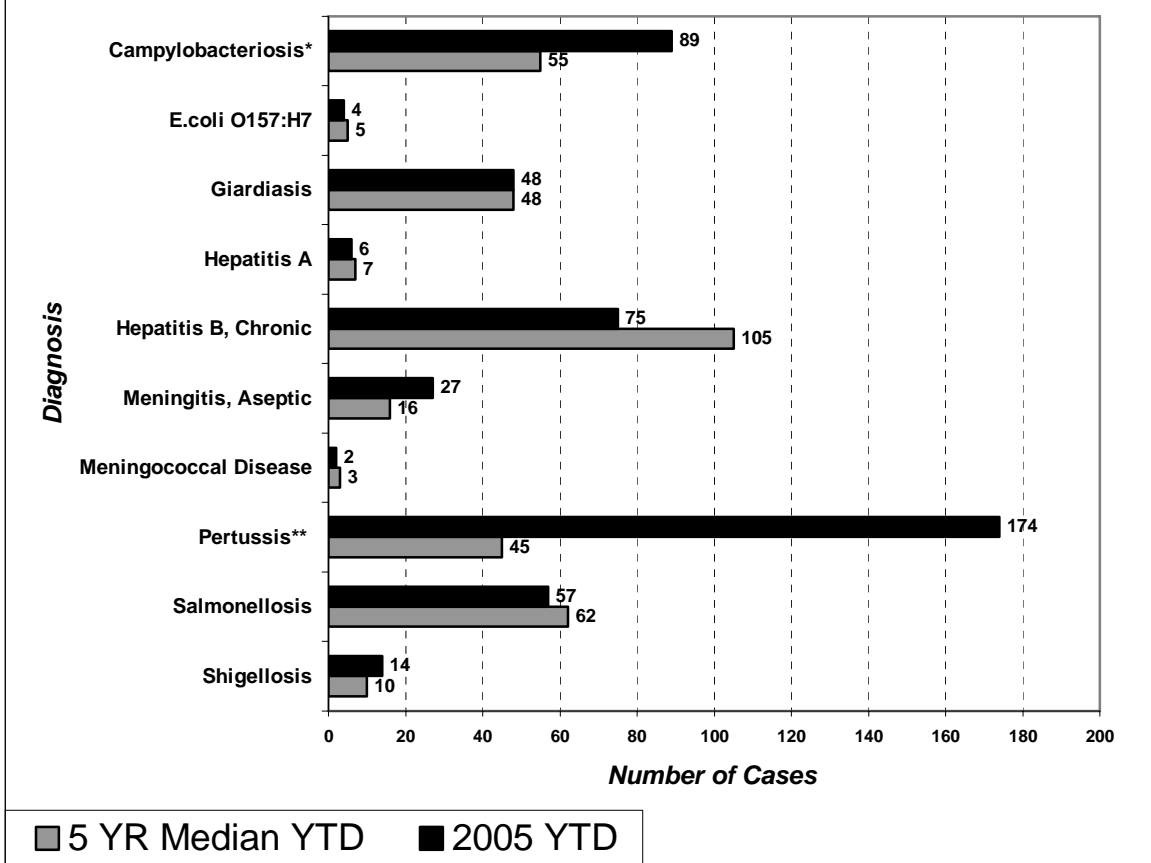
American Academy of Pediatrics. Plague. In: Pickering LK, ed. Red Book: 2003 Report of the Committee on Infectious Diseases. 26th ed. Elk Grove Village, IL: American Academy of Pediatrics; 2003:487-489.

Centers for Disease Control and Prevention, Division of Vector-Borne Infectious Diseases. Plague. [Electronic Media]. <http://www.cdc.gov/ncidod/dvbid/plague/info.htm>, accessed 6/3/2005.

Colorado's Electronic Disease Reporting System, Data obtained 7/20/05.

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

Selected Diseases by Date of Report Adams, Arapahoe, and Douglas Counties 2005 Year-to-date Through June



* The entire state of Colorado has seen increased reports of campylobacteriosis. Although the reason is currently unknown, investigation is ongoing.

** There has been an excessive number of pertussis cases in the state of Colorado in the past year, which has recently been declining and returning to normal levels.