Glossary of Terms

**Antibiotic** - any of a large group of chemical substances, produced by microorganisms or partially synthesized, and having the capacity to inhibit the growth of or to destroy bacteria and other microorganisms; used chiefly in the treatment of infectious diseases.

**Antibody** - any of a large number of proteins naturally existing in blood serum, or produced in response to stimulation by an antigen; reacts to overcome the toxic effects of a specific antigen, resulting in an autoimmune response (also called immunoglobulin).
Antigen - any of a class of substances, usually proteins or carbohydrates, that stimulate production of antibodies, and therefore an immune response to a specific disease

Antimicrobial - inhibiting the growth of or destroying microbes

Bacteria - plural of bacterium. Any of numerous microscopic, spherical, rod-shaped, or spiral organisms, various species of which produce disease. Bacteria are living cells with no distinct nucleus, and get their nutrition through absorption or a host, such as a person

Broad-spectrum - noting an antibiotic effective against a wide range of organisms

Cases - instances of an occurrence, such as a disease

Chronic disease - an ailment one has had a long time or that recurs frequently; not spreading

Contact - one who has lately been exposed to an infected person

Disease - a condition of an organ, part, structure, or system of the body in which there is incorrect function resulting from the effect of heredity, infection, diet, or environment; illness; sickness; ailment

Ecology - the branch of biology dealing with the relations between organisms and their environment

Environment - the aggregate of surrounding things, conditions, or influences, affecting the existence or development of someone or something

Epidemic - affecting at the same time a large number of persons in a locality, and spreading from person to person, as a disease not permanently prevalent there

Erythromycin - a broad-spectrum antibiotic, used chiefly in treatment of disease

Infection - the state of being affected by disease-producing germs

Infectious - communicable by infection, as from one person to another or from one part of the body to another; spreading

Monitoring - observing critically; checking closely or continuously

Mutate - to change; alter

Narrow-spectrum - noting an antibiotic effective against a small range of organisms

Outbreak - a sudden rise in the incidence of a disease

Pandemic - occurring over a wide geographic area and affecting an exceptionally high proportion of the population

Pathogen - any disease-producing organism

Penicillin - the first antibiotic, produced by the molds of the genus penicillium, primarily causing bacteria to stop growing rather than destroying it, used in medicines chiefly for infections caused by various bacteria

Pertussis - whooping cough

Plague - an epidemic disease of high mortality; pestilence
Protein - any of a group nitrogenous organic compounds of high molecular weight, synthesized by plants and animals that upon hydrolysis by enzymes yield amino acids, and that in animal metabolism are required by all life processes

Sanitary - clean, free of germs, unpolluted, antiseptic

Strain - a variety of microorganisms

Streptococcus pneumoniae - bacteria occurring in pairs or chains causing pneumonia, ear infections, and other diseases in humans

Surgeon general - the chief of medical services in one of the armed forces

Surveillance - close and continuous observation or testing

Transmittal - to convey infection abroad or to another

Virus - an infectious microbe that has no cell membrane; reproduces only in living cells

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**The Problem With Pertussis**

*Background Information*

Pertussis (better known as “whooping cough”) is a highly infectious respiratory infection caused by the bacterium *Bordetella pertussis*.

Symptoms begin to show as early as 4 days or as late as 21 days after contracting the disease. 3 clinical stages exist:

- **Catarrhal stage**: Characterized by runny nose, sneezing, low fever, mild cough (similar to common cold). During this stage, infected persons are at their most contagious. Cough becomes more severe over 1-2 weeks, leading to next stage.

- **Paroxysmal stage**: Usually the stage when (if) diagnosis takes place. Characterized by bursts (paroxysms) of rapid coughs and difficulty expelling thick mucus. The end of coughing outbursts usually accompanied by high-pitched whoop, and often a blue tint to the skin. Vomiting and exhaustion commonly follow. May last 1-10 weeks.

- **Convalescent stage**: Characterized by gradual recovery over 2-3 weeks, but lapses may occur for many months.

A clinical case of pertussis is defined as an acute cough illness lasting at least 2 weeks with either paroxysms (sudden or violent outbursts) of coughing, inspiratory (air drawn into lungs) “whoop,” or posttussive (after cough) vomiting without other apparent cause.

- Council of State and Territorial Epidemiologists (CSTE)
- Centers for Disease Control and Prevention (CDC)

The treatment of choice for pertussis is the antibiotic erythromycin. There are alternatives that can be prescribed for those patients who do not tolerate erythromycin well. Those that are cases as well as those who are close contacts are typically treated. Sometimes those at risk of contact are treated.
**Historical Trend**

The first described outbreak of pertussis was in the 16th century. The bacterium *Bordetella pertussis* (referred to as *B. pertussis*) was first isolated in 1906. It has only been found to occur in humans.

Throughout the 20th century, pertussis was one of the most common childhood diseases in the United States as well as many other countries. Before the vaccine became available in the 1940s, the annual number of reported cases typically exceeded 175,000. From 1980 to 1990 the annual incidence of pertussis averaged approximately 2900.

The vaccine greatly decreased the incidence, but since the 1970s has been the object of debate itself, as many reports and studies have linked it to possible reactions such as seizures, learning disabilities, and neurological disorders. In countries where rates of vaccination are low due to anti-vaccine movements, incidence of pertussis has been 10-100 times greater. Vaccines are typically not effective after 5-10 years. There are no vaccines currently (2005) licensed for use in persons age 7 or older.

**Case**

*(Yuma County, Arizona, May - October 1994)*

On May 23, 1994, a 2-month-old male infant was diagnosed and treated for bronchitis. He had exhibited a cough for a week but had no previous history of antibiotic treatment. His parents reported he had not received the pertussis vaccine. Within three days, he was hospitalized with severe cough, vomiting, problems breathing and blueness of the skin. *B. pertussis* infection was diagnosed and he received erythromycin treatment for 12 days. Symptoms continued, tests and cultures confirmed the persistence of pertussis organisms. Intravenous erythromycin treatment was initiated to no avail. The dosage was increased over the next week but his condition remained unchanged.

**Case Resolution**

Finally, susceptibility testing at the hospital laboratory suggested that the pertussis strain was resistant to erythromycin but sensitive to another antibiotic. Erythromycin was discontinued, the new antibiotic initiated, and his condition improved rapidly. Further testing at CDC confirmed that the strain was highly resistant to erythromycin.

About 2 weeks before the infant’s illness began, his 17-year-old mother had developed a cough associated with vomiting. A culture obtained from the mother was negative. She also had no history of recently receiving antibiotic treatment. Because of the case, the Yuma County Department of Public Health distributed culture kits and instructions to county residents and asked medical providers to obtain cultures from any patients with an unexplained acute cough lasting 7 or more days. Letters were also mailed to 2500 primary-care providers in Arizona to encourage collection of cultures for diagnosis, and health officials in two nearby California counties were alerted to the isolation of an erythromycin-resistant pertussis strain in Yuma County. A total of 18 confirmed cases were identified during the next
two months. In a period of enhanced surveillance, seven more cases were isolated, as well as 22 *B. pertussis* strains from persons in other Arizona counties and 13 from patients in California. All were susceptible to erythromycin.

**Follow-Up Case Note**

Due to the small number of samples tested for susceptibility, the number of possible resistant strains cannot be accurately estimated. However, the absence of additional erythromycin-resistant strains in Arizona and neighboring counties suggests that the resistance is not widespread. Erythromycin is the drug of choice for treating persons with *B. pertussis* as well as family and contacts who have been exposed. For adults who are susceptible to pertussis because of a decrease in vaccine-induced immunity or for infants who are too young to be adequately vaccinated and are at risk for severe disease, erythromycin treatment is also the primary control measure.

However, cultures should be obtained from persons who do not improve with erythromycin treatment. Most will not be positive for *B. pertussis* but these cultures should nevertheless be sent to CDC for further testing. Tests to evaluate susceptibility of *B. pertussis* have not been standardized and are not widely available. Efforts to standardize susceptibility testing are ongoing at CDC. Preliminary results of studies at CDC suggest the manner in which *B. pertussis* resists erythromycin is different from other notable bacteria. Studies related to this phenomenon are also ongoing.

This case is based on information contained in the Centers for Disease Control and Prevention Mortality and Morbidity Weekly Report (MMWR), and has been adapted for classroom use. Report issued November 11, 1994/ 43(44); 807-810 (MMWR Brief Report: Epidemiologic Notes and Reports Erythromycin-Resistant *Bordetella pertussis*—Yuma County, Arizona, May-October 1994)

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**Additional Post-Case Data**

Number of cases reported annually in the United States:

- 1993 ~ 6,500
- 2002 ~ 9,700
- 2003 ~ 11,500

**Of interest:**

- Of those diseases for which childhood vaccination is recommended in the United States, only pertussis increased in incidence during the last 20 years of the 20th century.
- Incidence in adults between 1990 and 2001 increased 400%, but much of this is thought to be the result of increased surveillance and reporting.
- There were an estimated 285,000 deaths worldwide in 2001 due to *Bordetella pertussis*.  

5 Issues Support Material