Pertussis in Louisiana

Theresa M. Sokol MPH, Mona Mehta MPH, Stacy Hall, MSN, and Raoult C. Ratard, MD, MPH&TM

Analysis of the surveillance data from the Louisiana Office of Public Health showed a progressive decline of pertussis in Louisiana. Louisiana rates are lower than those of the United States, and increased rates observed among adults in other states are not observed in Louisiana. This would likely be due a lack of suspicion for pertussis in adults and a resultant lack of diagnosis and reporting. Two recent outbreak investigations in a health facility are summarily described, showing that pertussis is still a major cause of concern for the health-care community.

Pertussis is a very contagious disease and, before vaccination, almost every child contracted this disease at a young age. Secondary attack rates in susceptible household contacts ranged from 90-100% and were estimated to be 50% among school contacts. Vaccination was introduced in the 1950s, and in countries with widespread vaccination coverage, the disease was brought under control.[1] However, while immunization brought the rates down, it did not achieve the same results as other childhood vaccines. Immunization controlled the disease but not the propagation of infection in the human population. Although most children are vaccinated against *B. pertussis* and the vaccine is quite effective up to age 12, approximately 50% of adults are nonimmune.[2] Since no booster is recommended beyond the age of 6 years in the United States, almost all adolescents and adults are susceptible. Given the level of protection of the pediatric population and the under-reporting of pertussis in older groups, it seems likely that the majority of pertussis cases in the United States at the present time occur in adolescents and adults.[3]

In contrast to 1990-1993, during 1994-1996 the average incidence among persons aged 5-9 years, 10-19 years, and 20 years or older in the United States increased 40%, 106%, and 93%, respectively.[4] Recent studies support the hypothesis that pertussis infection is very common among adults. Studies of prolonged cough illnesses in adolescents and adults indicate that between 12% and 32% are the result of *B. pertussis* infection, 20% in a Canadian study.[5]

Serological surveys for IgA antibody (IgA antibodies to pertussis antigens are only produced after a natural infection, not after immunization) suggest that infections in adults are as frequent in the United States as in Germany. Thus, there is no difference in the prevalence of adult infections between a country with generalized immunization (United States) and a country with no systematic pertussis immunization (Germany in the 1970s).[6]

POPULATION AND METHODS

Surveillance

Reporting of pertussis is mandated by law in Louisiana. Reports are received by phone, fax, mail-in cards, and in recent years mostly by using the web-based Louisiana Reportable Disease Database, which was initiated in 2001. Reported cases must meet the Centers for Disease Control case definitions to be counted in the state and in the national surveillance system.[7]

Clinical case definition: A cough illness lasting $\geq$ 2 weeks with one of the following: paroxysms of coughing, inspiratory "whoop," or post-tussive vomiting, without other apparent cause

The clinical case definition is appropriate for endemic or sporadic cases. In outbreak settings, a case may be defined as a cough illness lasting $\geq$ 2 weeks.

Laboratory criteria for diagnosis: Isolation of *Bordetella pertussis* from a clinical specimen or a positive polymerase chain reaction for *B. pertussis*. Because testing by polymerase chain reaction is not currently functional at the Office of Public Health (OPH) laboratory, the only criterion used in the Louisiana surveillance is the culture.

Case classification: A probable case is one that meets the clinical case definition, is not laboratory-confirmed, and is not epidemiologically linked to a laboratory confirmed case. A confirmed case is one that is either laboratory-confirmed or meets the clinical case definition and is epidemiologically linked to a laboratory-confirmed case.

Data collected for the case surveillance includes basic demographic and locating information on the case to enable a follow-up interview, basic clinical and laboratory data to allow accurate classification, and epidemiologic and risk-factor data to determine the extent of the investigation and preventive course to be taken. Clinical information is collected during primary surveillance.

Data entered in the Reportable Disease Database (RDD) web-based system were stored in an Oracle ® database. Data were extracted to a Microsoft Access ® database and analyzed using MS Access ® and MS Excel ® statistical tools. Some case investigations carried out in 2003 were reviewed. A summary is presented, and the implications for infection control are discussed.

Laboratory Diagnosis of Pertussis

Culture of pertussis is performed on nasopharyngeal secretions, obtained by aspiration or with a Dacron (polyethylene terephthalate) or calcium alginate swab. Special media (Regan-Lowe or fresh Bordet-Gengou) are required. The laboratory must have these media, which are not routinely used in hospital microbiology laboratories. Special transport media (Regan-Lowe) may be used to transport the specimens to the laboratory. Bordetella psertussis is a fastidious micro-organism so that cultures are often negative in spite of pertussis infection.

Because some studies have documented that direct fluorescent antibody testing of nasopharyngeal secretions has low sensitivity and variable specificity, it should not be relied on as a criterion for laboratory confirmation. Serologic testing for pertussis is available in some areas but is not standardized and, therefore, should not be relied on as a criterion for laboratory confirmation for national reporting purposes. Both probable and confirmed cases are reportable and are the basis for this article.

Case Investigation and Prevention in Health Care Facilities

Whenever a case is diagnosed in a health care facility, an investigation is initiated to identify additional cases and contacts at risk of developing pertussis. The cases and contacts must be isolated and treated to prevent transmission to other staff or patient in the facility. The investigation consists of a series of interviews of staff, patients, and infection-control personnel. A summary of recommended preventive measures is presented at the end of the discussion.

RESULTS

Analysis of Surveillance Data

Over the past 30 years, the number of cases of pertussis in Louisiana has progressively declined from approximately 25 to less than 10 cases per year (Figure 1). The trendline presented is based on the number of cases. The trend was not significant (c^2 for linear trend = 1.04, p = 0.30). In 2000, Louisiana saw an increase in the number of pertussis cases from the previous year. There was, however, a decline in pertussis cases in 2001 when compared to 2000. The incidence rates per 100,000 were 0.49 and 0.28 for the years 2000 and 2001, respectively, which

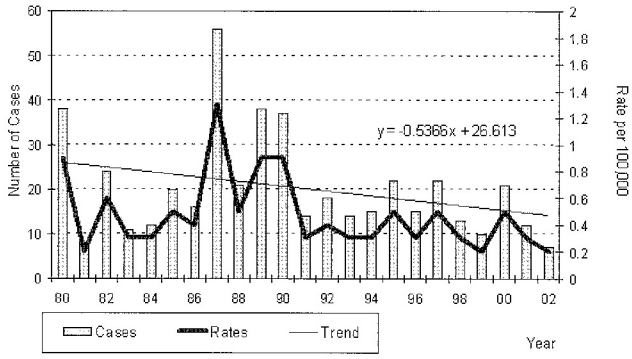

Figure 1. Pertussis cases and incidence rates in Louisiana, 1980-2001.

are below the national average of 2.88. The installation of the web based reporting did not have a significant impact on the reporting of cases.

The age-group distribution (Figure 2) shows that pertussis in Louisiana is still affecting children more than adults, with the highest rates being reported in children less than 5-years old. Rates decrease until adolescence and only show a slight increase in the elderly population over the age of 65. In 2000 and 2001, infants one year old and younger accounted for 33% of pertussis cases. Children who were 4 years old or younger accounted for 55% of the cases in 2000 and 2001. Rates among African-Americans show a pattern similar to those of whites (Figure 3). The vaccination status was the following for all cases: 50% status unknown, 25% immunized correctly, 12.5% not immunized although they should have been and 12.5% not immunized because they were too young (less than 2 months of age).

Cases of pertussis tend to increase in the summer and fall months. In 2000, 14 out of 21 (67%) of the cases occurred in the summer and fall months, with most of the cases occurring in July, 2000. There were no distinct temporal patterns detected in 2001. Fifty percent of the

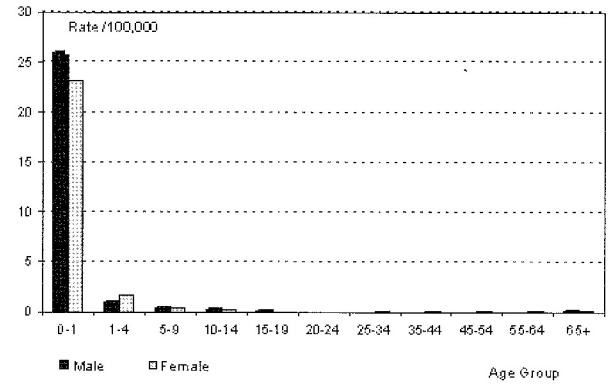

Figure 2. Average annual incidence rates of pertussis by gender and age in Louisiana, 1987-2001.

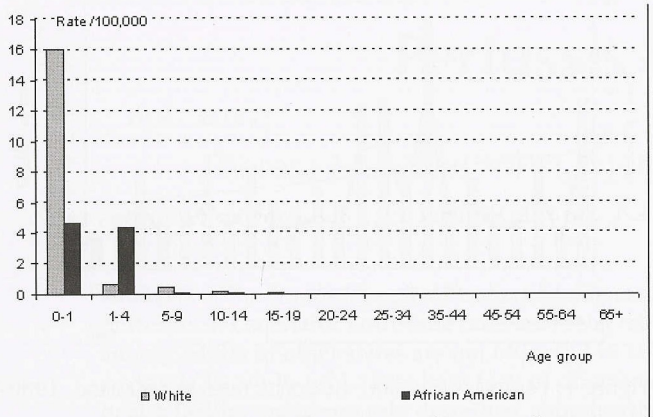

Figure 3: Average annual incidence rates of pertussis by race and age in Louisiana, 1987-2001.

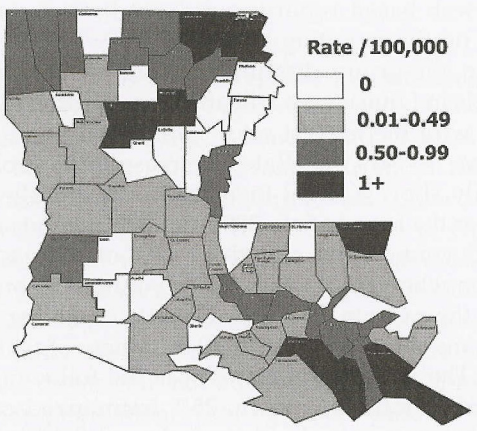

Figure 4. Average annual incidence rates of pertussis by parish in Louisiana, 1987-2002.

cases in 2001 occurred in the summer and fall months, while the other 50% occurred in the winter and spring months. A geographical distribution shows some areas of the state with higher reported rates (Figure 4).

The majority of cases hospitalized are infants, and 80% of infants less than 1 year old are hospitalized. The most common signs and symptoms among infants were paroxysmal cough (96%), whoop (77%), vomiting (62%), apnea (45%), seizures (12%). None of the reported cases experienced encephalitis. Cases in infants were confirmed by cultures (80%), and an additional 16% had positive lab tests that did not meet the criteria for "confirmed cases." Among those older than one year old, paroxysms (97%) and whoop (57%) were common. Hospitalization was less common among those older than 1 year (27%) and was not documented for any cases older than 14 years.

Investigation Reports

Investigation 1: On 02/08/2003 a 2-month-old infant visited the emergency department at hospital A for cough and congestion. The patient was discharged with no medication and parents were told to bring the child to a local pediatrician. On 2/13/2003, respiratory symptoms had increased and bronchiolitis was diagnosed; respiratory syncitial virus was initially suspected. An apnea spell, drop in blood oxygen saturation and acute respiratory distress caused the infant to be transferred to hospital B. At admission the infant was in respiratory distress, with severe cough, apnea, and vomiting. A gastrointestinal problem was then suspected. One week after admission, a diagnosis of pertussis infection was made subsequent to consultation from an infectious disease specialist. A culture was sent to the state laboratory for confirmation. The state laboratory confirmed pertussis by direct fluorescent antibody testing and culture. The patient's mother reported a history of cough for several weeks. Both parents were treated prophylactically. An investigation was undertaken in hospitals A and B to determine which personnel had been in close contact with the infant. Pediatrician A who had intubated the infant on admission on 2/13/2003 developed a low-grade fever and cough on 2/19/2003. On 2/26/2003 a pharyngeal swab of Pediatrician A was positive by direct fluorescent antibody testing. Other health care providers who had close contact with the infant also received prophylaxis, but none was found to be infected.

Investigation 2: On 09/10/2003, the Office of Public Health received notification from the state laboratory of a positive pertussis direct fluorescence (DFA) for a hospitalized 1-month-old infant. The onset of symptoms (mainly coughing) occurred on 08/28/03. The patient was admitted on 9/8/2003 and was treated with erythromycin. Cultures from pharyngeal swabs were not performed on 9/10/2003 because the patient had been on antibiotics for 48 hours prior to sample collection. Household members in close contact with the patient were the parents, grandparents, and an aunt and an uncle with a 7-month-old child. Among the health care workers exposed were a pediatrician, several nurses, and an X-ray technician. The mother began chemoprophylaxis on 09/10/03. The father reported a cough he described as "nothing I've ever had before" for the past 5 weeks. He had a culture and direct fluorescent antibody testing before starting on prophylactic treatment. His test results were negative. Other relatives and exposed health care workers were also treated prophylactically.

DISCUSSION

The epidemiologic pattern of pertussis in Louisiana is quite different than that of the United States as a whole. Currently, there is a resurgence of pertussis in the United States with no clear explanation for this increase. Pertussis is an epidemic disease with 2-to-5-year cycles. Immunization reduced the total number of cases but did not change the cycles, suggesting that immunization con-

trolled the disease but not the propagation of infection in the human population. However, this pattern is not observed in Louisiana. The increase in adult pertussis cases has not been seen in Louisiana. Louisiana has its highest rates among children aged less than 5 years old. The rates observed in Louisiana children are lower than those observed in the United States as a whole. A comparison of the immunization rates of children show that Louisiana rates have been close to the United States average over the past decade. The most likely cause of these different patterns is a lack of suspicion for pertussis in adults, and a resultant lack of diagnosis and reporting. The geographical distribution of pertussis reflects not only the actual differences in incidence of disease but also patterns of diagnosis and reporting. Such maps must be interpreted with caution. The surveillance data, as well the two case investigations reported above, indicate that pertussis infection tends to be underdiagnosed and underreported. Rapid identification of cases and rapid reporting are important to prevent transmission in households, daycare centers, and health care institutions.

Recommended Measures to be Taken by an Institution to Prevent Pertussis

Chemoprophylaxis: Erythromycin (40-50 mg/kg per day, orally, in four divided doses; maximum 2 g/day) for 14 days is recommended for all household contacts and other close contacts, such as those in child care, regardless of age and immunization status. Some experts recommend the estolate preparation. Other macrolides, clarithromycin and azithromycin, are often preferred because of better tolerance and lower number of doses. The sooner chemoprophylaxis is used, the better protection is afforded to contacts. Prophylaxis is administered regardless of immunization status because immunization may not prevent infection. People with mild illness that may not be recognized as pertussis can transmit the infection.

People who have been in contact with an infected person should be monitored closely for respiratory-tract symptoms for 21 days after the last contact with the infected person. They should be tested and then given antimicrobial therapy if cough develops within 21 days of exposure.

Health care contacts who are symptomatic or confirmed with pertussis should be excluded from giving medical care until the completion of 5 days of adequate antimicrobial therapy. Chemoprophylaxis should be considered for adult staff with close or extensive contact. Staff members should be monitored for respiratory-tract symptoms, and if symptoms develop, they should undergo culture for pertussis.

REFERENCES

1. Willems RJL, Mooi FR. From whole cell to acellular pertussis vaccines. *Reviews in Medical Microbiology* 1996;7:13-21.
2. Lambert HJ. Epidemiology of a small pertussis outbreak in Kent County, Michigan. *Public Health Rep* 1965;80:365-369.
3. Cherry JD. Pertussis in adults (Editorial). *Ann Intern Med* 1998;128:64-66.
4. Guris D, Strebel PM, Bardenheier B, et al. Changing epidemiology of pertussis in the United States: increasing reported incidence among adolescents and adults, 1990-1996. *Clin Infect Dis* 1999;28:1230-1237.
5. Senzilet LD, Halperin SA, Spike JS, et al. Pertussis is a frequent cause of prolonged cough illness in adults and adolescents. *Clin Infect Dis* 2001; 32:1691-1697.
6. Cherry JD. Epidemiological, clinical, and laboratory aspects of pertussis in adults. *Clin Infect Dis* 1999;28:S112-117.
7. CDC 1997. Case Definitions for Infectious Conditions Under Public Health Surveillance *MMWR* Vol. 46/No. RR10.

Ms. Sokol, **Ms. Mehta**, **Ms. Hall**, and **Dr. Ratard** work for the Infectious Disease Epidemiology Section, Louisiana Office of Public Health.

Take a Deep *Breadth*

As a professional, there never seems to be enough time to fully manage your business. That's why you should take advantage of Faulk & Winkler's full breadth of services. We focus on practice management, 401(k) pension plan design and administration, and partner compensation. From everyday accounting, to retirement planning and wealth management...

FAULK & WINKLER LLC
CPAs • Business Advisors • Wealth Managers

More Than Money

6811 Jefferson Highway
Baton Rouge, La. 70806-8108
Phone: 225-927-6811
Fax: 225-932-0000
www.fw-cpa.com