## Editorial

# Nosocomial Pertussis in the Nineties

James D. Cherry, MD, MSc

Pertussis (whooping cough) is an epidemic disease with significant morbidity and mortality.[1,2] Because of its severity, vaccine development was undertaken soon after the causative organism (*Bordetella pertussis)* was isolated. By the 1940s, effective pertussis vaccines became available, and their use has controlled epidemic pertussis in the United States over the last 30 years.

During the last 20 years, there has been extensive interest in pertussis and pertussis immunization. Like many illnesses that date to antiquity, there is much folklore about pertussis, and this includes misconceptions relating to the epidemiology of the disease and risks of immunization. Much of the misinformation relating to perceived vaccine reactions was resolved following extensive epidemiologic studies in the 1970s and 1980s.[3] Because of the extensive recent interest in and study of acellular pertussis vaccines, much is being learned about the epidemiology of pertussis and *B pertussis* infection.

In the prevaccine era, the average attack rate of reported pertussis in the United States was 157 per 100,000 population.[2] With the introduction and widespread use of pertussis vaccines, the attack rate fell approximately 150-fold from 1943 to 1976. During the 7-year period from 1976 through 1982, the attack rate remained between 0.5 and 1.0 per 100,000 population. From 1982 to 1993, the attack rate curve was modestly upward, reaching a rate of 2.3 per 100,000. In 1993, 6,588 cases were reported, which was the highest yearly number since 1968. Major outbreaks occurred in Chicago and Cincinnati.[4,5]

The apparent increasing incidence of pertussis in the United States has prompted considerable concern and thought as to its cause. It has been suggested that the problem is due to an increasing number of cases of pertussis in adults, who serve as the source of pediatric cases. It also has been suggested that the number of adult cases has increased because the majority of today's adults received their initial protection by immunization rather than by natural infection, as occurred in the prevaccine era.[6] Support for this idea is the commonly held belief that vaccine immunity is short lived, whereas immunity due to infection is lifelong.

A second idea as to the cause of the upswing in pertussis is that present whole-cell vaccines are not as effective as the vaccines that became available in the late 1960s and 1970s. Finally, it could be that the increasing incidence of pertussis since 1982 is not real but is an artifact due to an increased awareness of the disease, resulting in a greater interest in it by the academic and public sectors.

Pertussis is an epidemic disease with 2- to 5-year cycles.[2] Fine and Clarkson noted that this cycle did not change in spite of the reduction of total cases by immunization.[7] This indicates that immunization controls disease but does not control the prevalence of the organism in the population.

Using predominantly serologic methods, *B pertussis* has been shown to be an exceedingly common cause of cough illness in adults.[5,8,9] Since we demonstrated *B pertussis* throughout a 2½-year period in university students, we suggested that *B per-*

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*tussis* infections are endemic in adults and are the cause of epidemic cycles that predominately involve inadequately vaccinated children.[9] More recent data support this hypothesis. In a study in which sera collected from healthcare workers over a 5-year period were analyzed for significant antibody rises to *B pertussis* antigens, our group noted evidence of infection in 90%, and similar rates of infection occurred in each year during the 5-year study.[10] In a similar 3-year study of the elderly, it was found that 45% had evidence of a *B pertussis* infection (Mortimer, unpublished data, March 1995).

As stated above, the prevailing opinion is that immunity following infection is lifelong. Studies by members of our group suggest that this opinion is wrong. Utilizing the fact that IgA antibodies to pertussis antigens (pertussis toxin, filamentous hemagglutinin, and pertactin) result from infection and not vaccination, we studied their prevalence in young German and American men.[11] In Germany, routine childhood immunization was not carried out during the 1970s and 1980s, and pertussis was epidemic. To our surprise, the rate and mean values of IgA antibody in the two populations were similar, suggesting that adult infection rates were similar. Finally, in another study in Germany, we found that *B pertussis* infections were common in adults (133 per 100,000) and often occurred in those with a history of childhood pertussis.[12]

These data indicate that, both in populations in which pertussis is controlled by immunization and in populations in which pertussis is epidemic, endemic disease occurs in adults. It is my opinion that endemic disease in adults is responsible for the cyclic outbreaks and epidemics that mainly involve susceptible children.

Despite the overall success of pertussis immunization in the United States during the last 30 years, many outbreaks have occurred, and, on occasion, nosocomial spread has been a concern.[13-15] In this issue of *Infection Control and Hospital Epidemiology,* Christie and associates present a descriptive report of their approach to the containment of pertussis in their regional pediatric hospital during a large community epidemic. Their hospital is a 361-bed children's hospital with 3,764 employees. They implemented a vigorous 15-point control plan that included a program of early diagnosis, treatment, and prevention for employees; the immediate isolation of all patients with respiratory illnesses that might prove to be pertussis; the wearing of masks by patients, visitors, and personnel in the test referral center where pertussis cultures were performed; the restriction of patient travel and visitors; and restrictions in the employees' child care service.

In light of the new epidemiologic findings noted above and my interpretation of these findings, it is worthwhile to critique the hospital pertussis containment program presented by Christie and colleagues.

Overall, their program appears to have been effective in that only one child acquired pertussis in the hospital. Eighty-seven employees (2.3%) developed pertussis during the 6-month observation period. However, our serologic data in healthcare workers at the UCLA Medical Center suggest that yearly infection rates are considerably higher than 2.3%.[10] Depending on the criterion used, the yearly rate in our study varied between 4% and 40%. Based on our data, as well as the findings in other recent studies, I would suspect that healthcare workers and other adults in Cincinnati frequently had unrecognized *B pertussis* infections. The epidemic and the hospital program in 1993 led, in many instances, to the diagnosis, which at other times may have been missed. Of the 87 employees with pertussis, it is unclear how many of the cases were nosocomial and how many were acquired at home or in the community.

Seventeen percent of the employees received antimicrobial prophylaxis. Following this, the incidence in employees decreased. However, whether the decrease in cases was due to the antimicrobial prophylaxis or to the fact that there were no further susceptibles in the cohort is not known. The authors didn't mention adverse reactions and compliance with antimicrobial prophylaxis. In a recent study, we noted that, of 48 healthcare workers given prophylactic erythromycin, 56% had side effects, and only 44% completed the 14-day prophylactic course (Krause and Cherry, unpublished data, October 1993).

Although the use of erythromycin prophylaxis as employed in Cincinnati is in keeping with contemporary recommendations, I believe the practice should be questioned. I would suggest using erythromycin prophylactically only for high-risk patients. Rather than giving erythromycin prophylactically to large numbers of employees, with likely poor compliance, it might be better to concentrate on early treatment of employees with cough illnesses.

Certainly of most importance, in regard to nosocomial pertussis, is a general education program that increases awareness of disease in adults and infants.

Finally, I believe that new immunization programs with acellular pertussis vaccines, which include regularly scheduled adolescent and adult booster doses, could decrease the endemic circulation of *B pertussis* and decrease the risk of community outbreaks and nosocomial disease.

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# New TB Respirators Expected to Save Millions

**by Gina Pugliese, RN, MS, Medical News Editor**

### From NIOSH

The National Institute for Occupational Safety and Health (NIOSH) announced that it has certified the first 13 respirators under its new testing and certification requirements (*Federal Register* June 8, 1995:30338). The price estimates for this first round of respirators—some as low as $1—should mean considerable savings for the healthcare industry. "The tremendous decrease in cost is welcome news," said Human Health Services Secretary Donna E. Shalala. "In a time when regulatory actions are frowned upon, this is an excellent example of how a smart regulation can lead to considerable savings."

The new regulations, which became effective July 10, 1995, allow for a generation of respirator filters with less leakage, more efficiency, and easier breathing. Before the new regulation, the only respirator that met the filtration efficiency performance criteria outlined by the CDC for the prevention of tuberculosis cost approximately $8. The first 13 respirators certified under the new rule will range in price from less than $1 to $3, according to the manufacturers. All respirators certified by NIOSH under the new regulations will meet or exceed the CDC filtration efficiency performance criterion.

The exact savings to the healthcare industry cannot be predicted with certainty. However, a recent cost analysis of the 159 acute care inpatient Department of Veterans Affairs (VA) facilities in the US suggests that the VA alone may save up to $16 million annually. Given that the VA system only represents a small percentage of all hospital beds in the US, the savings nationwide could be extraordinary.

NIOSH Director Dr. Linda Rosenstock said, "We are thrilled with the impact of this regulation. Working closely with industry and employee representatives has resulted in better protection for workers and increased savings for industry. It is no surprise that this activity was recognized by Vice President Gore with a Hammer Award for its impact on redesigning government."

The first 13 respirators certified under the new regulations were chosen randomly from the submissions received before the July 7, 1995, deadline. NIOSH currently is working to certify another 120 respirators awaiting approval. For information on the newly certified respirators, contact NIOSH at (800) 35-NIOSH.

### From OSHA

On September 6, 1995, the Occupational Safety and Health Administration (OSHA) issued an updated enforcement policy for occupational exposure to tuberculosis in response to the recently revised NIOSH certification criteria. OSHA will accept the N-95 respirator, which meets the CDC criteria for respiratory protection, as the minimum level of respiratory protection for TB. The N-95 respirators also must be able to be (1) fit tested to obtain a face-seal leakage of less than 10%; (2) fit different facial sizes and characteristics; and (3) be able to be checked for face piece fit each time the respirator is put on. OSHA also will allow reuse of disposable respirators as long as the respirator maintains its functional and structural integrity. Each facility must have a protocol for the circumstnaces in which a respirator will be considered contaminated and not to be reused. OSHA notes that if a faciity chooses, they may continue to use HEPA respirators.

FROM: NIOSH. NIOSH change will save healthcare industry millions. Press release, August 25, 1995.

OSHA. Update: OSHA enforcement policy for occupational exposure to tuberculosis. Memorandum, September 6, 1995.

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