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Issue No. 9, May 2006, is part of a 12-part CME/CE activity (September 2005 – August 2006).

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Applicants will receive a certificate of participation from PPS by return mail within 6 to 8 weeks of the date of receipt of the completed evaluation/registration form.

#### Learning Objectives

After studying the literature presented in this Pediatric Respiratory Care series, participants will be able to:

- Identify respiratory disorders in pediatric patients
- Summarize risk factors for respiratory disorders in pediatric patients
- Select an appropriate therapeutic regimen for patients with pediatric respiratory disorders

#### Target Audience

This educational activity is designed for pediatricians, primary care physicians, pediatric and family nurse practitioners, neonatologists, infectious disease specialists, allergists, pulmonologists, immunologists, and other healthcare professionals involved in the care and management of pediatric respiratory patients.

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This program has been approved for 2.7 contact hours of continuing education by the American Academy of Nurse Practitioners. Program ID 0601034.

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# PEDIATRIC RESPIRATORY CARE

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## American Academy of Pediatrics Recommendations

### Use of Tdap Vaccines Protects Both Adolescents and Infants

**P**ertussis, also known as whooping cough, is an acute respiratory tract infection caused by *Bordetella pertussis*, a gram-negative coccobacillus that produces toxins that damage respiratory epithelial tissue and exerts systemic effects. Even with universal immunization of children using multiple doses of pediatric diphtheria and tetanus toxoids and acellular pertussis (DTaP) vaccine, the number of cases of pertussis has progressively increased among infants (younger than 6 months) and among adolescents (aged 11 to 18 years).

During the last 3 decades, reports of pertussis in the United States have steadily increased from a nadir of 1,010 cases in 1976 to

25,827 cases reported in 2004, the highest number since 1959. Because most contagious cases of pertussis in adolescents remain untreated, adolescents can be sources of pertussis for young infants, who are the most vulnerable to pertussis-related complications, hospitalization, and death.

In 2005, the US Food and Drug Administration (FDA) approved two tetanus toxoid, reduced diphtheria toxoid, and acellular per-

tussis (Tdap) vaccine products to be used as a single-dose booster immunization in individuals aged 10 through 18 years (Boostrix<sup>®</sup>)\* and in those aged 11 through 64 years (Adacel<sup>™</sup>).<sup>†</sup> Boostrix contains reduced quantities of the same tetanus toxoid, diphtheria toxoid, and pertussis antigens as those in Infanrix<sup>®</sup> (pediatric DTaP). Adacel contains the same tetanus toxoid content, but reduced quantities

of diphtheria toxoid, and pertussis antigens as those in pediatric DAPTACEL<sup>®</sup> (pediatric DTaP). There are no preparations containing pertussis antigens alone approved for use in the United States.

For use of Tdap vaccines in adolescents, the American Academy of Pediatrics recommends the following:

1. For booster immunization, adolescents aged 11 to 18 years should receive a single dose of Tdap rather than tetanus and diphtheria toxoids (Td) vaccine if they have completed the recommended childhood diphtheria and tetanus and whole-cell pertussis (DTP)/DTaP immunization series and have not received Td. The preferred age for Tdap immunization is 11 to 12 years.

*Adolescents can be sources of pertussis for young infants, who are the most vulnerable to pertussis-related complications, hospitalization, and death.*

*Continued*

#### Disclosures:

- \* Dr Piedra is an associate professor of molecular virology and microbiology, and pediatrics at Baylor College of Medicine. He has indicated relevant financial relationships as noted: he receives grant/research support from MedImmune, Inc.; is a speaker for MedImmune, Inc.; is an expert witness for Sanofi-Pasteur; and is an ad hoc consultant for GlaxoSmithKline, MedImmune, Inc., and Sanofi-Pasteur.
- † Dr Welliver is professor of pediatrics at the State University of New York at Buffalo. He has indicated relevant financial relationships as noted: he is a member of the speakers bureau for MedImmune Inc.; is an ad hoc consultant for Cubist, Inc. and MedImmune, Inc.; and receives clinical trials support from MedImmune Inc.
- ‡ Ms McBride is a senior managing editor for Thomson Professional Postgraduate Services<sup>®</sup>. She has indicated no relevant financial relationships.
- § Ms Jordan is a senior editor for Thomson Professional Postgraduate Services<sup>®</sup>. She has indicated no relevant financial relationships.
- || Mr Palangio is a medical writer for Thomson Professional Postgraduate Services<sup>®</sup>. He has indicated no relevant financial relationships.



*Strategies to reduce the spread of pertussis in infants, children, and adolescents include early diagnosis and treatment, as well as active immunization.*

## Use of Tdap Vaccines Protects Both Adolescents and Infants

*Continued*

- To provide protection against pertussis if they completed the recommended childhood DTP/DTPaP immunization series, adolescents 11 to 18 years of age who have received Td but not Tdap are encouraged to receive a single dose of Tdap. To reduce the risk of local and systemic reactions, an interval of at least 5 years between Td and Tdap is suggested. Tdap can be administered at intervals of less than 5 years, especially in settings of increased risk of acquiring pertussis, having complicated disease, or transmitting infection to vulnerable contacts. A study in children and adolescents has shown that as short an interval as approximately 2 years can be safe.
- Tdap and tetavalent meningococcal conjugate vaccine (MCV4 [Menactra®]) should be administered during the same visit if both vaccines are indicated. If simultaneous immunization is not feasible, MCV4 and Tdap can be administered

using either sequence. When not administered simultaneously, an interval of 1 month between vaccines is suggested.

The primary objective of these recommendations is to protect immunized adolescents against pertussis. The secondary objective is to reduce the reservoir of pertussis and thereby reduce the spread of the disease to unimmunized peers and individuals in other age groups, including infants. It has been speculated that high vaccine penetration among susceptible individuals (eg, >70%) might be necessary to achieve the secondary objective.

\*BOOSTRIX vaccine is not indicated for use in individuals younger than 10 years or older than 18 years.

†ADACEL vaccine is not indicated for use in individuals younger than 10 years or older than 65 years.

American Academy of Pediatrics Committee on Infectious Diseases. Prevention of pertussis among adolescents: recommendations for use of tetanus toxoid, reduced diphtheria toxoid, and acellular pertussis (Tdap) vaccine. *Pediatrics*. 2006;117:965-978.

### COMMENTARY

**ROBERT C. WELLIVER, MD, Professor of Pediatrics, State University of New York at Buffalo, Buffalo, New York.**

*Pertussis infection continues to increase in the United States. Particularly interesting is the greater number of cases identified in adolescents. This increase is partially explained by the use of better diagnostic techniques. However, more frequent cases in adolescents and adults may also result from waning immunity in vaccinated children who are no longer exposed to major epidemics of natural infection. Immunization of adolescents protects them, and may result in transmission of higher titers of antibody from young mothers to infants, thus preventing disease in this most susceptible population. Healthcare workers represent another group that may benefit from enhanced immunization.*

## Diagnosis, Treatment, and Prevention of Pertussis in Infants, Children, and Adolescents

Pertussis, a highly transmittable and potentially life-threatening respiratory tract illness despite high vaccination rates, has been on the rise worldwide, especially in infants, children, and adolescents. Since the early 1980s, the incidence of pertussis has been increasing, with peak outbreaks occurring every 3 to 4 years. Teenagers and young adults might be particularly susceptible to infection, as evidenced by numerous outbreaks in schools and workplaces.

Infants younger than 6 months also are at high risk to experience serious complications or require hospitalization. Furthermore, appearance of vaccine-resistant strains might be contributing to the resurgence of this disease.

Early diagnosis plays an important role in the management of pertussis. Diagnosis is primarily based on clinical findings, with laboratory tests providing confirmation. Signs and symptoms vary depending on age and immune status. Children display paroxysms of cough

*Continued*



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## **PRCI MISSION STATEMENT**

The PRCI is a multicomponent educational program on pediatric respiratory disorders designed for pediatricians, primary care physicians, pediatric and family nurse practitioners, neonatologists, infectious disease specialists, allergists, pulmonologists, immunologists, and other healthcare professionals involved in the care and management of pediatric respiratory patients. PRCI programs address issues concerning asthma, respiratory syncytial virus, and other respiratory tract infections and disorders. Methods to prevent, control, and treat respiratory illnesses in children are also evaluated.

# **Diagnosis, Treatment, and Prevention of Pertussis in Infants, Children, and Adolescents**

*Continued*

with an end inspiratory whoop, whereas infants demonstrate a nonspecific coughing illness with apnea and cyanosis, but without the whooping. Although positive laboratory tests can confirm the diagnosis, negative results cannot rule out the disease.

Recommended treatment regimens for pertussis include erythromycin, azithromycin, clarithromycin,\* and trimethoprim-sulfamethoxazole. A 14-day course of erythromycin is the treatment of choice for patients of all ages.

- Given within the first 7 to 10 days of the illness, erythromycin may lessen the duration and severity of symptoms.
- Administered later, erythromycin may not modify the disease, but it may reduce the risk of infecting others.
- Erythromycin can also be used in the prophylaxis of contacts.
- Side effects of erythromycin include gastrointestinal disturbance and pyloric stenosis in infants.

A 5- to 7-day course of azithromycin or a 7- to 10-day course of clarithromycin are effective alternatives to erythromycin. Trimethoprim-sulfamethoxazole (14-day course) should be considered in patients who cannot tolerate macrolides. The effectiveness of steroids, bronchodilators, or intravenous immunoglobulin has not been shown in controlled trials.

Active immunization is critical to reducing morbidity and mortality associated with pertussis. In the United States, the diphtheria, tetanus toxoid, and acellular pertussis (DTaP) vaccine is routinely administered to infants and children, with a primary vaccination schedule of 2, 4, and 6 months and booster doses at 15 to 18 months of age and at 4 to 6 years of age. Whole-cell pertussis vaccines are no longer available because of the high rates of adverse reactions

(local reactions, fever, and systemic symptoms).

Five DTaP vaccines are approved for use by the US Food and Drug Administration (FDA), but only 3 are commercially available (Tripedia®, Infanrix®, and DAPTACEL®).<sup>†</sup> There are no data demonstrating the superiority of any one vaccine over the others. Two modified formulations of tetanus toxoid, reduced diphtheria toxoid, and acellular pertussis (Tdap) vaccines were recently approved for use in adolescents and young adults. These adolescent/adult vaccines contain one third to one fourth the amount of pertussis antigens that infant vaccines contain. The efficacy of the adolescent/adult vaccines is estimated to be equivalent to that of the infant vaccines (ie, >85% protection). It is now recommended that a booster dose of Tdap be routinely used in adolescents aged 11 to 18 years in place of tetanus and diphtheria toxoids vaccine. Routine adult immunization might be the next step in the prevention of pertussis in the United States.

Strategies to reduce the spread of pertussis in infants, children, and adolescents include early diagnosis and treatment, as well as active immunization. All cases should be reported to local and state health departments. Vaccinating adolescents and young adults is hoped to reduce the reservoir of *B pertussis* in the overall population and decrease transmission to infants who are too young to be immunized or who have been incompletely immunized.

\*The FDA has not licensed any macrolide agent (ie, erythromycin, clarithromycin, and azithromycin) for use in infants aged <6 months.

<sup>†</sup>TRIPEDIA, INFANRIX, and DAPTACEL vaccines should not be administered to any infant younger than 6 weeks, or to individuals aged 7 years or older.

Munoz FM. Pertussis in infants, children, and adolescents: diagnosis, treatment, and prevention. *Semin Pediatr Infect Dis*. 2006;17:14-19.

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