

# VACCINATING FOR PERTUSSIS in the Emergency Department

## A Life-Saving Opportunity

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It has been more than 60 years since the first vaccines to prevent pertussis were introduced, and yet the disease persists today in our communities, often undiagnosed and untreated, sometimes with serious and rarely with fatal consequences. Reported cases of pertussis have risen dramatically, particularly among adolescents and adults, who not only suffer from the disease itself but pose a risk of transmission to others, including the most vulnerable group of all—infants in the first months of life.

The Advisory Committee on Immunization Practices (ACIP) of the Centers for Disease Control and Prevention (CDC) now recommends tetanus toxoid, reduced diphtheria toxoid and acellular pertussis vaccine adsorbed (Tdap; Adacel<sup>®</sup>, Boostrix<sup>®</sup>) rather than tetanus-diphtheria vaccine (Td) for disease prevention as well as wound management for adults and adolescents not previously vaccinated with Tdap (see sidebar, page 3).<sup>1,2</sup> The emergency department (ED) is a logical place to vaccinate against pertussis. Vaccination of physicians, nurses, and other health-care workers is equally important, as the annual rate of pertussis infection among that group is estimated at 7%.<sup>1</sup>

In March 2009, the American College of Emergency Physicians (ACEP) issued a policy statement supporting the full set of the CDC recommendations on Tdap, noting that emergency health-care workers should be vaccinated with Tdap to guard against tetanus, diphtheria, and pertussis and should consider Tdap vaccine for all adults coming to the ED with serious wounds.<sup>3</sup> The ACEP President Nick Jouriles, MD, FACEP, said, "Increasing rates of whooping cough in the general population make it even more important for emergency health-care workers to be up to date on their Tdap vaccine. It not only offers medical professionals protection but also prevents the spread of contagious disease to vulnerable patients who visit the emergency department."<sup>3</sup> The CDC recommendations also call for Tdap immunization of women of childbearing age before they become pregnant, or immediately postpartum.<sup>1</sup>

### THE PERSISTENCE OF PERTUSSIS

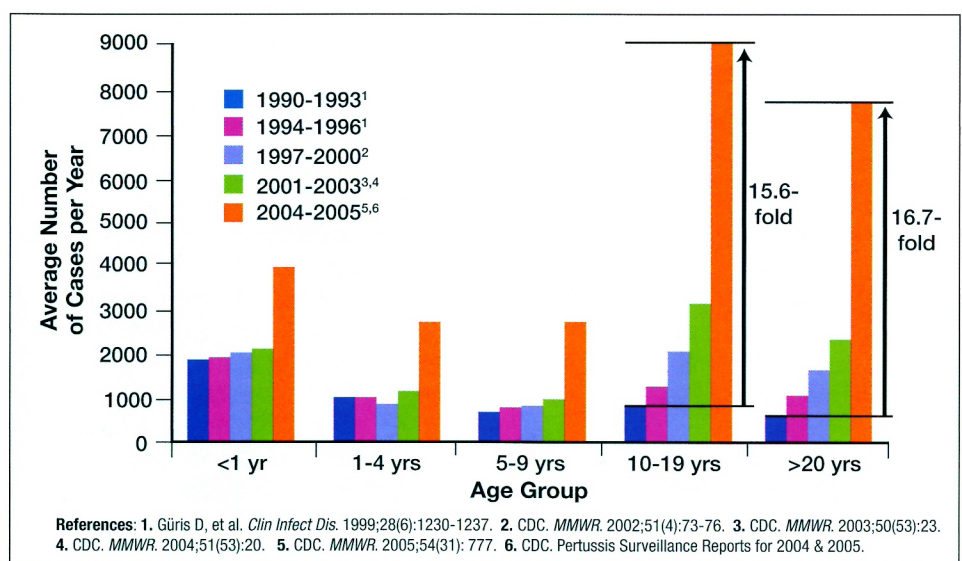
After whole-cell vaccines were introduced in the United States in the mid-1940s, their widespread use among children led to a significant decrease in the number of reported cases of pertussis and in the morbidity and mortality of the disease. However, since the early 1980s, reports of pertussis have increased, most dramatically among adults and adolescents (Figure 1). Total cases reported for all age groups were 25,827 in 2004 and 25,616 in 2005, a more than 5-fold increase since 1990<sup>4,6</sup> and the highest figures reported in more than 40 years.<sup>4,6</sup>

In 2007, the number of reported pertussis cases dropped to 10,454,<sup>7</sup> which may be in part a reflection of the cyclical nature of the

disease. However, a review of epidemiologic data concluded that pertussis has remained endemic in the population, even in the vaccine era, because of the persistence of a human reservoir of *Bordetella pertussis*.<sup>8</sup> The

review indicated that pertussis remains a common yet often unrecognized cause of persistent cough, even with significant improvements in diagnostic techniques; that reported cases are the small tip of a rather large iceberg;

FIGURE 1. Dramatic Growth in Reports of Adult and Adolescent Pertussis

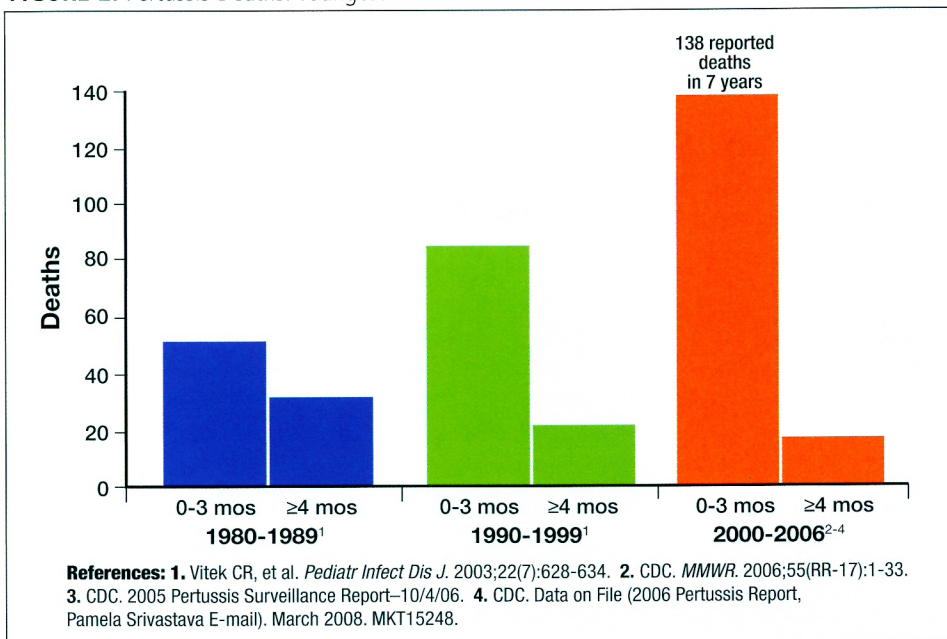


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**FIGURE 2.** Pertussis Deaths: Youngest Infants Are at Greatest Risk



and that an estimated 800,000 to 3.3 million cases of adult and adolescent pertussis occur each year in the United States.<sup>8</sup> Reasons for underreporting pertussis in adults and adolescents include wide variability of symptoms, difficulty of distinguishing pertussis from other respiratory illnesses, low level of awareness and lack of consultation by primary-care clinicians, and inconsistency in case definitions.

Pertussis persists because of several factors:

- Vaccine immunity is variable and diminishes over time. The protection conferred by childhood pertussis immunization

typically wanes by 10–15 years of age.<sup>4,9</sup>

- Underdiagnosis and inadequate use of chemoprophylaxis. Adolescent and adult pertussis is often atypical and is thus unsuspected, unrecognized, and untreated. These individuals continue to transmit pertussis to susceptible contacts, including infants.
- Incomplete immunization of children. Although childhood vaccination levels have increased in recent years, rates in some population groups are lower than in others. Many infants and young children

do not receive their vaccines on schedule, leaving them vulnerable to disease.

Studies show that when a source can be identified, infants are most likely to contract pertussis from a family member, especially the mother or father, but also siblings.<sup>9,10</sup> Adults and adolescents with pertussis may have only mild illness that resembles an upper respiratory infection or chronic cough illness, without the textbook symptoms of paroxysms, whoop, or posttussive vomiting. Infected individuals with mild disease constitute a source of serious, potentially life-threatening infection in infants and young children. Thus, vaccination of adults and adolescents in close contact with young infants may eliminate a substantial portion of infant pertussis if high coverage rates can be achieved.<sup>10</sup>

### COMPLICATIONS, HOSPITALIZATION, AND DEATH

Infants <12 months of age are most vulnerable to pertussis-related complications, hospitalization, and death. They may present atypically, with hypoxia, apnea, and bradycardia and little or no cough.<sup>1</sup> From 2000–2004, infants accounted for 19% of reported pertussis cases in the US but 92% of the deaths.<sup>1</sup> Among 12,174 infants for whom information was available in that time period, 63% were hospitalized, 56% had apnea, 13% developed pneumonia, 1.5% suffered seizures, and 0.8% died.<sup>1</sup>

The very youngest infants—those too young to have been immunized—are at greatest risk. Of 100 deaths (all ages) from

## PERTUSSIS: A HIGHLY COMMUNICABLE INFECTION

Pertussis, or whooping cough, is an acute respiratory infection caused by *Bordetella pertussis*, a gram-negative aerobic bacillus. A highly communicable infectious disease, pertussis is easily transmitted to and from individuals in all age groups via aerosolized droplets. The secondary attack rate among susceptible household contacts is 80%-90%.<sup>25</sup>

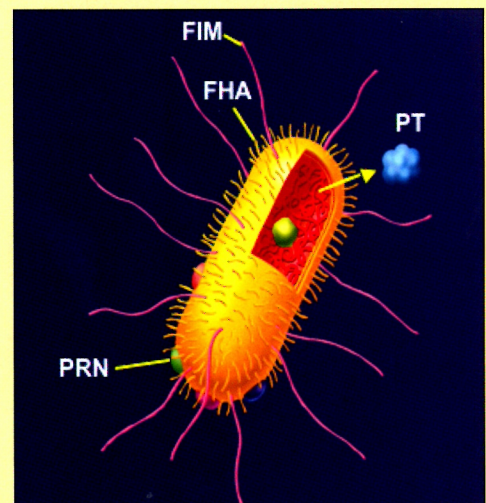
Classic pertussis involves a catarrhal phase (1-2 weeks), with symptoms resembling a cold or other upper respiratory infection; a paroxysmal phase (4-6 weeks) with spasmodic cough, posttussive vomiting, and inspiratory whoop; and a convalescent phase that usually lasts 2-6 weeks but may persist for months.<sup>25,26</sup>

Adults and adolescents may have an atypical presentation with mild or moderate symptoms; young infants may present with

hypoxia, apnea, and bradycardia and little or no cough. Because pertussis may be difficult to distinguish, especially in its early stages, from other respiratory illnesses, it can be transmitted before it is diagnosed or even suspected.<sup>25,26</sup>

The CDC recommends a course of a macrolide antibiotic to treat pertussis.<sup>25</sup> Erythromycin, clarithromycin, or azithromycin is recommended for treatment and prophylaxis of pertussis in persons ≥1 month of age; only azithromycin is recommended for those <1 month of age. For persons ≥2 months of age who are allergic to macrolides, trimethoprim and sulfamethoxazole can be used. Penicillins and cephalosporins are not effective against pertussis.<sup>25</sup>

The most effective treatment for pertussis, the CDC notes, is prevention through immunization.<sup>25</sup>



***B pertussis* organism**

PT = pertussis toxin  
PRN = pertactin  
FHA = filamentous hemagglutinin  
FIM = fimbriae

pertussis in 2000–2004, 76% occurred among infants 0–1 month of age at the onset of illness, and 14% occurred among infants 2–3 months of age. The case fatality rate in the first 2 months of life was 1.8%.<sup>1</sup>

Infant deaths from pertussis are rising in this country. There were 61 pertussis deaths among infants <12 months of age in the 1980s, 93 in the 1990s, and more than 150 so far in this decade.<sup>1,11–13</sup> The majority of deaths (138) occurred in infants ≤3 months of age (Figure 2). Hospitalizations are also increasing; the pertussis hospitalization rate for infants <6 months of age, for example, increased from 64.7 per 100,000 live births in 1994–1998 to 77.9 per 100,000 in 1999–2003, a 20% jump.<sup>14</sup>

Although pertussis in adults and adolescents is often mild or moderate, severe disease is not uncommon in those age groups. In one study, 28% of adults and 16% of adolescents experienced some type of complication; 6% of individuals 50 years of age and older were hospitalized, with a mean stay of 17 days.<sup>15</sup> On average, adolescents with pertussis miss 5 days of school and adults miss 7–10 days of work.<sup>15,16</sup> Up to 5% of adult patients with pertussis may develop pneumonia; hospitalization rates as high as 9%–12% have been reported in older adults.<sup>1,15,16</sup>

## WHY VACCINATE IN THE ED?

Wound management in EDs and physicians' offices offers an opportunity for updating pertussis immunization as well as providing protection against tetanus and diphtheria. In these cases, the ACIP recommends that Tdap be used in place of Td vaccine among persons not previously vaccinated with Tdap.

No additional paperwork (and only minimal additional cost) is required for use of Tdap. The Vaccine Information Statement (VIS) is available for free from the CDC and can be incorporated into the process of discharge. Tdap is no more difficult to store or use than Td, and its side-effect profile is comparable to that of Td. Administration of Tdap is straightforward; explanation of the few contraindications can be incorporated into ED procedural guidelines.

An ED visit also offers an opportunity to target other immunizations if feasible. A recent study found that parents favor having their adolescent children's immunization status checked, and appropriate immunizations given, at the time of any ED visit.<sup>17</sup> Each ED should consider the benefits and impacts of ED-based immunization efforts (number of vaccinations given, cost, effect on throughput) and should also consider the advantages of

## ACIP RECOMMENDATIONS FOR Tdap VACCINE

### Wound management<sup>1,2</sup>

- Tdap preferred over Td for adolescents and adults who have not previously received Tdap

### Adults<sup>1</sup>

- All adults 19–64 years of age should receive a single dose of Tdap if they have never received it and their last Td immunization was ≥10 years ago
- All adults anticipating close contact with infants <12 months of age (parents, child-care workers, health-care personnel, etc) should receive Tdap at least 2 weeks before the start of contact

### Adolescents<sup>2</sup>

- All adolescents 11–18 years of age should receive a single booster dose of Tdap instead of Td
- Preferred timing of vaccination is 11–12 years of age
- Adolescents who have previously received Td are encouraged to receive Tdap. Interval of 5 years from the last Td is encouraged, but intervals as short as 2 years are acceptable if pertussis risk is increased.

### Pregnant and postpartum women<sup>27</sup>

- Routine postpartum Tdap is recommended for women who have not previously received it, if >2 years have elapsed since the last Td vaccination
- Pregnant women whose last Td vaccination was ≥10 years ago can defer Tdap until after delivery if sufficient tetanus protection is likely
- Neither Tdap nor Td is contraindicated in pregnancy
- If Tdap is given during pregnancy (eg, heightened risk of pertussis), second or third trimester is preferred

### Health-care personnel<sup>1</sup>

- Health-care personnel with direct patient contact in hospitals or ambulatory-care settings should receive a single dose of Tdap as soon as feasible if they have not previously received Tdap
- Other health-care personnel should be vaccinated according to ACIP recommendations for adults
- Hospitals and ambulatory-care facilities should provide Tdap for personnel and use approaches that maximize vaccination rates

taking part in broader, community-based initiatives such as offering immunization clinics in malls.

## SWITCHING FROM Td To Tdap

The recommendations to use Tdap rather than Td for disease protection and wound management in adolescents and adults, and to vaccinate all health-care personnel “as soon as feasible,” were made in 2006 (see sidebar above).<sup>1,2</sup> One of the main obstacles to switching from Td to Tdap in the ED is lack of awareness by the health-care team. In 1 study assessing knowledge and attitudes about pertussis and vaccination among health-care professionals, most of the 1819 respondents (87%) did not plan to receive Tdap vaccine themselves.<sup>18</sup> Reasons cited included lack of a personal recommendation for vaccination (78%), receipt of vaccination as a child (51%), and perception that there was no significant risk of contracting pertus-

sis (38%).<sup>18</sup> Low levels of pertussis antibody have been reported in ED staff who have not been immunized since childhood.<sup>19</sup>

Other obstacles, identified by a recent discussion group of ED physicians meeting in Chicago, include not knowing a patient's vaccination history; needing a concerted institutional effort to change established vaccination protocols in the ED; lack of unified support for new policies from physicians, nurses, and pharmacists; lack of familiarity with pertussis disease and with the ACIP guidelines (“not on the radar”); patients' concerns about the pertussis component of Tdap; anti-vaccine sentiment in general; and cost and insurance reimbursement issues.

The group suggested that ED physicians partner with their colleagues in nursing, pharmacy, P&T committees, employee health, and hospital administration to implement the ACIP guidelines for Tdap in

**TABLE.** Which Vaccines for Which Patients in the ED?

Age	If pertussis vaccine indicated	If pertussis vaccine contraindicated
2 months–7 years of age	DTaP	DT
7–9 years <sup>a</sup> of age	Td	Td
10–18 years <sup>b</sup> of age	Tdap	Td
19–64 years of age	Tdap	Td
≥65 years of age	Td	Td

\*No pertussis vaccine is licensed for persons 7 through 9 years of age. <sup>b</sup>ACIP recommendations call for a single dose of Tdap for individuals 11 through 18 years of age and those 19 through 64 years of age. There are 2 Tdap vaccines: Adacel vaccine is licensed for individuals 11-64 years of age and Boostrix is licensed for those 10 through 64 years of age.  
 Source: Randolph J. Cordle, MD

their institutions and to educate their colleagues and patients accordingly. By vaccinating adolescents and adults with Tdap when they present for emergency care, ED physicians can contribute significantly to disease prevention in their communities and their institutions.

Two Tdap vaccines are currently approved in the United States: Adacel<sup>®</sup> (Tetanus Toxoid, Reduced Diphtheria Toxoid and Acellular Pertussis Vaccine Adsorbed)<sup>20</sup> and Boostrix.<sup>®21</sup> Both are administered as a single intramuscular injection of 0.5mL. Adacel vaccine is approved for persons 11 through 64 years of age,<sup>20</sup> and Boostrix is approved for persons 10 through 64 years of age.<sup>21</sup> Tdap is not currently approved for persons ≥65 years of age. Determining the response of elderly patients to Tdap vaccine is the subject of ongoing studies.

The table summarizes the use of Td, Tdap, and related vaccines in the ED setting.

**THE IMPORTANCE OF VACCINATING ED STAFF**

Health-care personnel (HCP) are at risk for being exposed to pertussis in both inpatient and outpatient facilities.<sup>1</sup> In 1 study, the annual incidence of *B pertussis* infection among ED staff was approximately 3-fold higher than among resident physicians (3.6%

vs 1.3%, respectively).<sup>22</sup> Another survey, conducted in Australia, found that 22% (21/97) of an ED staff showed serologic evidence of recent pertussis infection.<sup>23</sup>

Nosocomial outbreaks of pertussis attributable to HCP have been reported, including an outbreak at a Texas hospital in 2004 in which 11 newborns were diagnosed with pertussis after being exposed to a single health-care worker with the disease.<sup>24</sup> By vaccinating HCP with Tdap and reducing the number of cases of pertussis among HCP, hospitals will be able to reduce the costs associated with resource-intensive outbreak investigations and control measures.<sup>1</sup>

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