DIPHTHERIA AND TETANUS TOXOIDS AND ACELLULAR PERTUSSIS VACCINE ADSORBED/TETANUS TOXOID, REDUCED DIPHTHERIA TOXOID AND ACELLULAR PERTUSSIS VACCINE ADSORBED

Diphtheria and Tetanus Toxoids and Acellular Pertussis Vaccine Adsorbed/Tetanus Toxoid, Reduced Diphtheria Toxoid and Acellular Pertussis Vaccine Adsorbed

AHFS Class:

AHFS Class: Toxoids (80:08)

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Alert:

On August 10, 2026, the White House released an executive order that reaffirms the administration's prior directives regarding childhood vaccines that have been delayed due to litigation over the composition of the Advisory Committee on Immunization Practices (ACIP) and separate updates to the federal vaccine schedule. The order continues to organize the childhood immunization schedule in three distinct categories (Immunizations Recommended for All Children, Immunizations Recommended for Certain High-Risk Groups or Populations, and Immunizations Based on Shared Clinical Decision-Making) with changes to the historic individual vaccine placement within those categories. For additional information, see [Web] .

Introduction

Diphtheria and tetanus toxoids and acellular pertussis vaccine adsorbed (DTaP; Daptacel®, Infanrix®) and tetanus toxoid, reduced diphtheria toxoid and acellular pertussis vaccine adsorbed (Tdap; Adacel®, Boostrix®) are fixed-combination preparations containing tetanus and diphtheria toxins (toxoids) and acellular pertussis vaccine adsorbed onto an aluminum adjuvant and are used to stimulate active immunity to diphtheria, tetanus, and pertussis.[182,187,192,193]

Uses

Prevention of Diphtheria, Tetanus, and Pertussis Infection

DTaP (diphtheria and tetanus toxoids and acellular pertussis vaccine adsorbed) and Tdap (tetanus toxoid, reduced diphtheria toxoid and acellular pertussis vaccine adsorbed) vaccines are used to stimulate active immunity to diphtheria, tetanus, and pertussis.[182,187,192,193]

Tdap vaccines (Adacel®, Boostrix®) are also used during the third trimester of pregnancy to prevent pertussis in infants <2 months of age.[192,193]

There are currently 2 preparations of the DTaP (Daptacel®, Infanrix®) and 2 preparations of the Tdap (Adacel®, Boostrix®) vaccine in the US.[182,187,192,193] DTaP also is commercially available in fixed-combination vaccines containing diphtheria, tetanus, pertussis, and poliovirus antigens (DTaP-IPV; Kinrix®, Quadracel®);[221,223] a fixed-combination vaccine containing diphtheria, tetanus, pertussis, hepatitis B (HepB), and poliovirus antigens (DTaP-HepB-IPV; Pediarix®);[106] a combination vaccine containing diphtheria, tetanus, pertussis, poliovirus, and *Haemophilus influenzae* type b (Hib) antigens (DTaP-IPV/Hib; Pentacel®);[224] and a fixed-combination vaccine containing diphtheria, tetanus, pertussis, poliovirus, Hib, and HepB antigens (DTaP-IPV/Hib/HepB; Vaxelis®).[236] Antigen potency varies depending on the manufacturer.[182,187,192,193] The appropriate vaccine containing diphtheria, tetanus, and pertussis antigens is selected based on age and whether primary or booster immunization is indicated.[105,182,187,192,193,195,196] Although no longer available in the US, diphtheria and tetanus toxoids and whole-cell pertussis vaccine adsorbed (DTP, also referred to as DTwP) may still be used in other countries.[166]

Diphtheria, tetanus, and pertussis are bacterial infections that can cause potentially serious complications and death.[105,166] Diphtheria is a bacterial infection of the mucous membranes, spread by respiratory droplets or direct contact with infected skin lesions; it is most commonly caused by toxigenic strains of *Corynebacterium diphtheriae*.[105,166] *C. ulcerans* and *C. pseudotuberculosis* can also produce a diphtheria-like illness.[105] The most common presentation is an infection of the respiratory tract, which presents with membranous nasopharyngitis, obstructive laryngotracheitis, or bloody nasal discharge; cutaneous, vaginal, conjunctival, or otic infections also occur less commonly.[105] Most of the complications of diphtheria that can develop, including myocarditis, neuritis, and death, are caused by direct effects of the bacterial toxin.[166] Diphtheria rarely occurs in the US and other industrialized countries; however, it has been reported worldwide, especially in countries with suboptimal vaccination coverage.[166]

Tetanus is a potentially fatal disease caused by a neurotoxic exotoxin (tetanospasmin) produced by *Clostridium tetani*.[105,166] Tetanus is characterized by neurologic symptoms including trismus and severe, painful muscle spasms; these symptoms have a gradual onset, with progression occurring over several days.[105] While tetanus has been observed globally, it is reported most frequently in densely populated regions in hot, damp climates with soil rich in organic matter.[166] Tetanus is not transmitted person-to-person.[105,166] *C. tetani* usually enters the body through a wound.[105,166] In the US, tetanus is rare due to widespread active immunization practices; nearly all cases that occur are in those who have never received a tetanus vaccine or have not received their 10-year booster.[105]

Pertussis (whooping cough) is an acute respiratory tract infection caused by *Bordetella pertussis*.[105,166] The infection begins with mild symptoms similar to those found with the common cold (catarrhal phase), then progresses to a more severe, sometimes paroxysmal cough that is characterized by gasping (whooping) upon inspiration (paroxysmal phase); post-tussive emesis may also occur.[105,166] The most common complication leading to death is secondary bacterial pneumonia.[166] Recovery from pertussis is gradual, and symptoms may last as long as 10 weeks.[105] Pertussis is highly communicable and 80% of nonimmune or unvaccinated household contacts acquire the disease.[105,166] Transmission occurs via large respiratory droplets generated by coughing or sneezing or direct contact with respiratory secretions.[105,166] Pertussis remains endemic worldwide; immunity to the infection wanes over time following infection or immunization.[105,166]

Experts have inferred that after a complete vaccine series with the DTaP/Tdap vaccine, the vaccine has 100% efficacy for tetanus and 97% for diphtheria.[300] Within 1 year following the last dose of the series, vaccine efficacy against pertussis is 98% among children following receipt of DTaP and 73% among adolescents following Tdap; vaccine efficacy declines to 71% after 5 years following the DTaP vaccine and 34% after 4 years following the Tdap vaccine.[300] Administration of Tdap during pregnancy prevents 78% of pertussis cases and 90% of hospitalizations in infants <2 months of age.[300]

Primary and Booster Vaccination

Diphtheria and Tetanus Toxoids and Acellular Pertussis Vaccine Adsorbed (DTaP)

The Centers for Disease Control and Prevention (CDC)'s Advisory Committee on Immunization Practices (ACIP) and other experts (e.g., American Academy of Pediatrics [AAP]) provide recommendations for the prevention of diphtheria, tetanus, and pertussis.[105,196,199,237] These experts recommend that all infants receive primary immunization against diphtheria, tetanus, and pertussis.[105,196,237] Therefore, a fixed-combination preparation that contains antigens for all 3 diseases (DTaP) is preferred for primary and booster immunization in infants and children 6 weeks through 6 years of age, unless a component is contraindicated or should not be used.[105,199,237]

The complete vaccination series against diphtheria, tetanus, and pertussis in children <7 years of age generally requires 5 doses of DTaP.[199,237] ACIP, AAP, and other experts state that DTaP doses preferably should be administered at 2 months, 4 months, 6 months, 15–18 months, and 4–6 years of age.[199,237] The fourth DTaP dose (booster dose) may be given as early as 12 months of age, provided at least 6 months have elapsed since the third dose.[199,237] The fifth dose (booster dose) is not necessary if the fourth dose was administered at 4 years of age or older and at least 6 months after the third dose.[199,237]

According to ACIP, an accelerated vaccine schedule can be used in infants and children <7 years of age when warranted (e.g., in circumstances such as travel, potential loss to follow-up, or increased risk of pertussis exposure).[196] An accelerated schedule can be started as soon as the infant is 6 weeks of age, with the second and third doses administered no less than 4 weeks after each preceding dose.[196] The fourth dose should not be administered prior to 12 months of age and should be given at least 6 months after the third dose.[196] The fifth dose should not be administered before the age of 4 years.[196]

Primary immunization against diphtheria, tetanus, and pertussis can be integrated with primary immunization against Hib, hepatitis A, HepB, human papillomavirus (HPV), influenza, measles, mumps, rubella, meningococcal disease, pneumococcal disease, poliomyelitis, rotavirus, and varicella.[105,199,200]

If initiation or continuation of primary or booster immunization with DTaP is contraindicated because of the pertussis component, infants and children 6 weeks through 6 years of age should receive the fixed-combination preparation containing only diphtheria and tetanus toxoids (Td).[199,237]

The ACIP makes recommendations regarding vaccination of internationally adopted children and other immigrants.[245] In such patients, when the immunogenicity of vaccines previously received or the completeness of vaccine series is in question, healthcare providers can repeat the vaccinations or utilize serologic testing to determine which vaccines may be needed (if serologic tests are available to document protection against infection).[245] For the DTaP vaccine, the ACIP recommends revaccination with DTaP in patients who were vaccinated outside of the US and have no (or questionable) vaccination records; in such patients, serologic testing for specific IgG antibody to tetanus and diphtheria toxins is recommended in the event of a severe local reaction.[245] In patients whose records indicate receipt of at least 3 doses of DTaP,

serologic testing for specific IgG antibody to diphtheria and tetanus toxins can be conducted prior to administering additional doses of DTaP; alternatively, a single booster dose of DTaP can be given, followed by serological testing after 1 month, with revaccination as appropriate.[245]

ACIP, AAP, CDC, and other experts state that recommendations regarding use of inactivated vaccines in HIV-infected children are the same as those for individuals who are not infected with HIV.[156,199,237] *Similarly, DTaP is recommended in children with other immunocompromising conditions (excluding HIV), following the same schedule as in individuals who are not immunocompromised.*[199,237] *The possibility that inactivated vaccines, including DTaP, may be less immunogenic in immunocompromised individuals should be considered.*[105]

Tetanus Toxoid, Reduced Diphtheria Toxoid, and Acellular Pertussis Vaccine Adsorbed (Tdap)

Although safety and efficacy of Tdap have not been established for primary immunization or for use in children younger than 10 years of age,[192,193] *ACIP, AAP and other experts recommend that a single dose of Tdap be included in the vaccination series when* ***catch up immunization [off-label]***[†] *is indicated in patients ≥7 years of age who are unvaccinated or incompletely vaccinated against diphtheria, tetanus, and pertussis.*[196,199,237] *Children are considered fully vaccinated if they have received 5 doses of DTaP or have received 4 doses of DTaP with the fourth dose administered on or after the fourth birthday.*[199,237] *Patients who are 7–18 years of age and are not fully immunized with DTaP should receive a single dose of Tdap as one (preferably the first) dose of the catch-up series; if additional doses are needed, use the Td vaccine.*[196] *Patients who are >18 years of age who have never been vaccinated against pertussis, tetanus, or diphtheria should receive a 3-dose vaccine series containing 1 dose of Tdap (preferably the first dose, although Tdap can substitute for any of the Td doses in the primary series), followed by subsequent doses of Td at 4 weeks after the first dose and 6–12 months after the second dose.*[196]

Tdap (Adacel®, Boostrix®) is used for booster immunization against tetanus, diphtheria, and pertussis in adults and adolescents ≥10 years of age; Adacel® is specifically indicated in patients who are 10–64 years of age.[192,193]

ACIP, AAP, and other experts recommend that all adolescents who received primary immunization with DTaP, DTP (not commercially available in the US), DT (not commercially available in the US), or Td receive a booster dose of a preparation containing diphtheria and tetanus toxoids at 11–18 years of age (preferably at 11–12 years of age).[195,199,237] *Recommendations regarding use of inactivated vaccines in HIV-infected adults and adolescents are the same as those for individuals who are not infected with HIV.*[155] *In patients who received a catch-up dose of Tdap between 7–10 years of age, the adolescent booster dose of Tdap should be given only to those who received Tdap between 7–9 years of age, and is not necessary in those who received Tdap at 10 years of age.*[199]

Adults (≥19 years of age) who received primary immunization against diphtheria and tetanus should receive routine booster doses of Tdap or Td every 10 years.[195,200] *In addition, an emergency booster dose of Tdap or Td may be indicated in the event of injury and possible exposure to tetanus infection.*[200] *Adults who have never received a dose of Tdap should receive 1 dose of Tdap.*[195] *The Tdap booster dose can be administered regardless of the interval since the last dose of vaccine containing tetanus or diphtheria toxoids (e.g., Td).*[195]

A single Tdap dose is recommend for all adults 65 years of age or older who have not previously received a dose.[195] *Because only Tdap (Boostrix®) is labeled by FDA for booster immunization in adults 65 years of age or older,*[193] *Tdap (Boostrix®) should be used when feasible.*[195] *However, ACIP states that both Tdap (Adacel®) and Tdap (Boostrix®) are immunogenic and either Tdap vaccine would provide protection when used for booster immunization in this age group.*[195] *Because any opportunity to administer Tdap to adults 65 years of age or older should not be missed, ACIP states that providers may administer the Tdap vaccine (Adacel®, Boostrix®) that is available.*[195]

Tdap (Adacel®, Boostrix®) is used to immunize pregnant patients (i.e., provide passive protection) during the third trimester to prevent pertussis in infants from birth until they can begin the childhood DTap vaccination series (at 2 months of age).[192,193] *The ACIP and American College of Obstetricians and Gynecologists (ACOG) recommend that pregnant patients receive a dose of Tdap during each pregnancy, preferably in the early part of gestational weeks 27—36.*[200,205] *The Tdap vaccine should be administered in such patients regardless of prior vaccination.*[205] *The ACOG also recommends that all adults and adolescents who have or anticipate having close contact with an infant <12 months of age who have not previously received the Tdap vaccine should receive a single dose (ideally >2 weeks prior to close contact with the infant) to reduce the likelihood of pertussis and its transmission.*[205]

The Center for Infectious Disease Research and Policy (CIDRAP) has established the Vaccine Integrity Project to provide evidence-based guidance on vaccines.[77] *The Vaccine Integrity Project is an initiative dedicated to providing trusted, science-based information for informed vaccine choices.*[77] *A multi-disciplinary group of experts was convened by the Vaccine Integrity Project to independently conduct a systematic review and meta-analysis of the safety and effectiveness of Tdap vaccination during pregnancy.*[78] *Data from a total of 91 randomized and nonrandomized studies were included in the evidence review.*[78] *The totality of evidence continues to support the safety and effectiveness of Tdap vaccination during pregnancy when given according to the currently recommended time period between 27 and 36 weeks' gestation.*[78]

Maternal vaccination was associated with a decreased risk of pertussis infection and related complications in infants, and there was no meaningful increased risk of adverse effects (e.g., stillbirth, preterm birth, preeclampsia and eclampsia, chorioamnionitis, placental conditions, gestational diabetes, or other pregnancy-related adverse events) with Tdap vaccination compared with no vaccination.[78] For additional information, see [Web].[77]

Combination Vaccines Containing DTaP and Other Antigens

DTaP is commercially available in fixed-combination vaccines containing diphtheria, tetanus, pertussis, and poliovirus antigens (DTaP-IPV; Kinrix®, Quadracel®);[221,223] a fixed-combination vaccine containing diphtheria, tetanus, pertussis, HepB, and poliovirus antigens (DTaP-HepB-IPV; Pediarix®);[106] a combination vaccine containing diphtheria, tetanus, pertussis, poliovirus, and Hib antigens (DTaP-IPV/Hib; Pentacel®);[224] and a fixed-combination vaccine containing diphtheria, tetanus, pertussis, poliovirus, Hib, and HepB antigens (DTaP-IPV/Hib/HepB; Vaxelis®).[236]

When indicated based on the age and vaccination status of the child and when there are no contraindications to any of the individual components, combination vaccines containing DTaP and other antigens can be used instead of separate injections.[105,166] ACIP, AAP, and other experts state that a combination vaccine generally is preferred over separate injections of the equivalent component vaccines; considerations include provider assessment (e.g., number of injections, vaccine availability, likelihood of improved coverage, likelihood of patient return, storage requirements, cost), patient preference, and potential for adverse effects.[105,243]

When there are no contraindications to any of the individual components, the commercially available fixed-combination vaccine containing diphtheria, tetanus, pertussis, and poliovirus antigens (DTaP-IPV; Kinrix®) can be used in children 4 through 6 years of age to provide the fifth dose of the DTaP vaccination series and the fourth dose of the IPV vaccination series in those receiving primary immunization with Infanrix® (DTaP) and/or Pediarix® (DTaP-HepB-IPV).[223] Alternatively, the commercially available fixed-combination vaccine containing diphtheria, tetanus, pertussis, and poliovirus antigens (DTaP-IPV; Quadracel®) can be used in children 4–6 years of age to provide the fifth dose of the DTaP vaccination series and the fourth or fifth dose of the IPV vaccination series in those receiving primary immunization with Daptacel® (DTaP), Pentacel® (DTaP-IPV/Hib), and/or Vaxelis® (DTaP-IPV-Hib-HepB).[221]

The commercially available fixed-combination vaccine containing diphtheria, tetanus, pertussis, HepB, and poliovirus antigens (DTaP-HepB-IPV; Pediarix®) can be used for a 3-dose immunization series in infants and children 6 weeks through 6 years of age if there are no contraindications to any of the individual components.[106] Pediarix® should not be used for the initial dose of hepatitis B vaccine that is indicated in neonates.[166] For the prevention of diphtheria, tetanus, and pertussis in infants and children 6 weeks through 6 years of age, Pediarix® may be used for the initial 3 doses in the DTaP series or may be used to complete the first 3 doses of the DTaP series in children who have received 1 or 2 doses of Infanrix®.[106] Data are not available regarding the safety and efficacy of Pediarix® used following 1 or more doses of a DTaP vaccine from a different manufacturer.[106] Children who have received a 3-dose series of Pediarix® should complete the DTaP and IPV series according to the recommended childhood immunization schedule.[106] To complete the DTaP series, the manufacturer recommends that Infanrix® be used for the fourth dose of DTaP and either Infanrix® or Kinrix® (DTaP-IPV) be used as the fifth dose of DTaP since these vaccines contain the same pertussis antigens as Pediarix®.[106]

The combination vaccine containing diphtheria, tetanus, pertussis, poliovirus, and Hib antigens (DTaP-IPV/Hib; Pentacel®) can be used as a 4-dose series for immunization in infants and children 6 weeks through 4 years of age when doses of DTaP, IPV, and Hib vaccine are indicated and there are no contraindications to any of the individual components.[224] For prevention of diphtheria, tetanus, and pertussis, Pentacel® may be used for the initial 4 doses in the DTaP series at 2, 4, 6, and 15–18 months of age and a dose of Daptacel® or Quadracel® should be given at 4–6 years of age to provide the fifth dose of DTaP.[224] Pentacel® also may be used in infants and children 6 weeks through 4 years of age who have received 1 or more doses of Daptacel®.[224] Pentacel may also be used as the fourth dose in the DTaP series in children who have received a 3-dose series of Vaxelis®.[224] However, data are not available on the safety and effectiveness of mixed sequences of Pentacel® and DTaP vaccine from other manufacturers.[224]

The commercially available fixed-combination vaccine containing diphtheria, tetanus, pertussis, Hib, HepB, and poliovirus antigens (DTaP-IPV-Hib-HepB; Vaxelis®) can be used for a 3-dose immunization series in infants and children 6 weeks through 4 years of age when there are no contraindications to any of the individual components.[236] Vaxelis® should not be used for the initial dose of hepatitis B vaccine that is indicated in neonates.[166] Children who have received a 3-dose series of Vaxelis® should complete the 5-dose primary DTaP vaccination series with Pentacel®, Quadracel®, or Daptacel®.[236] Vaxelis® may also be used to complete the first 3 doses of the 5-dose DTaP series in infants and children who have received 1 or 2 doses of Pentacel® or Daptacel® and are scheduled to receive the other antigens in Vaxelis®.[236] Data are not available on the safety and immunogenicity of such mixed sequences, and data are also not available on the safety and effectiveness of using Vaxelis® following 1 or 2 doses of a DTaP vaccine from a different manufacturer.[236]

Postexposure Prophylaxis

Diphtheria

Regardless of immunization status, all close contacts of a patient with infection caused by toxigenic diphtheria require surveillance for evidence of disease for 7 days following their last exposure; they should also be cultured for C. diphtheriae and receive antimicrobial prophylaxis with oral erythromycin for 7–10 days or a single IM dose of penicillin G benzathine.[105] *Close contacts who are asymptomatic should receive an age-appropriate booster dose of DTaP, Tdap, or Td if they have not received a booster dose in the past 5 years.*[105] *Asymptomatic close contacts with incomplete or unknown vaccination history should be vaccinated with DTaP, Tdap, or Td, depending on their age.*[105] *Use of equine diphtheria antitoxin in close contacts who are not immunized is not recommended, since evidence has not shown a benefit associated with this practice.*[105] *Close contacts of patients infected with cutaneous or respiratory diphtheria that is not toxigenic do not require postexposure prophylaxis.*[105]

Tetanus

The risk of developing tetanus is dependent on the type of wound (clean/minor or not) and the immune status of the patient.[105] *When active immunization against tetanus is indicated as part of postexposure prophylaxis after injury and possible exposure to tetanus infection, an age-appropriate vaccine should be administered (DTaP, Tdap, or Td).*[105] *Patients with clean, minor wounds should be up-to-date with their vaccine (i.e., completed a primary series with the most recent dose in the past 10 years); patients who are not up-to-date should receive an age-appropriate vaccine.*[105] *In patients with non-clean or non-minor wounds (i.e., contaminated wounds, puncture wounds, avulsions, wounds resulting from flying or crushing objects, animal bites, burns, or frostbite), it should be determined whether the patient has completed a primary tetanus diphtheria vaccination series.*[105] *In those with such wounds who completed a primary vaccination series, it should be determined when their last dose was administered.*[105] *If the last dose was more than 5 years prior, an age-appropriate vaccine should be administered.*[105] *In patients with such wounds who have not completed the primary series or in those with an unknown vaccination history, IM tetanus immune globulin should also be administered in addition to age-appropriate vaccination.*[105] *Patients with non-clean or non-minor wounds who have HIV or other severe immunodeficiency should receive tetanus immune globulin regardless of immunization history.*[105]

Pertussis

Postexposure vaccination with DTaP or Tdap may be indicated in addition to anti-infective postexposure prophylaxis in household and other close contacts of an individual with pertussis.[105] *Regardless of vaccination status or age, all household and other close contacts of an individual with suspected pertussis should receive prophylaxis with an anti-infective active against B. pertussis (usually azithromycin, clarithromycin, or erythromycin; alternatively, co-trimoxazole).*[105,206] *In addition, all close contacts who are unimmunized or underimmunized should initiate or continue immunization with an age-appropriate vaccine (DTaP or Tdap) as soon as possible.*[105] *Tdap may be indicated in* ***children 7–9 years of age [off-label]***† *who did not previously complete the DTaP series.*

Dosage and Administration

■ General

Pretreatment Screening

- Prior to injection of DTaP, Tdap, or a combination vaccine containing DTaP, review patient's history regarding possible sensitivity and any previous adverse reactions and take all precautions known for prevention of allergic or any other adverse effects.[106,182,187,192,193,223,224]

Other General Considerations

- Syncope (vasovagal or vasodepressor reaction; fainting) may occur following vaccination.[106,182,187,192,193,223,224] Procedures should be in place to avoid falling injury.[106,182,223]

- Have epinephrine and other appropriate agents and equipment available for immediate use in case an anaphylactic reaction occurs.[106,182,187,192,193,223,224]

■ Administration

Diphtheria and tetanus toxoids and acellular pertussis vaccine adsorbed (DTaP) and tetanus toxoid, reduced diphtheria toxoid and acellular pertussis vaccine adsorbed (Tdap) are administered only by IM injection.[182,187,192,193] DTaP and Tdap should not be administered subcutaneously, intradermally, or IV.[182,187,192,193]

Diphtheria and tetanus toxoids and acellular pertussis vaccine adsorbed (DTaP) is also available in fixed-combination vaccines containing DTaP and poliovirus antigens (DTaP-IPV; Kinrix®, Quadracel®);[221,223] DTaP, hepatitis B (HepB), and poliovirus antigens (DTaP-HepB-IPV; Pediarix®);[106] DTaP, poliovirus, and *Haemophilus influenzae* type b (Hib) antigens (DTaP-IPV/Hib; Pentacel®);[224] and DTaP, HepB, poliovirus, and Hib antigens (DTaP-HepB-IPV/Hib; Vaxelis®).[236] Consult the prescribing information for these fixed-combination vaccines for additional information.[106,221,223,224,236]

To ensure delivery into muscle, IM injections should be made at a 90° angle to the skin using a needle length appropriate for the individual's age and body mass, thickness of adipose tissue and muscle at the injection site, volume to be administered, and injection technique.[134]

Depending on patient age, IM injections of DTaP or Tdap should be made into the anterolateral muscles of the thigh or deltoid muscle of the arm.[134] In adults, adolescents, and children 3 years of age or older, IM injections should preferably be made in the region of the deltoid muscle.[134] In infants and children 6 weeks through 1 year of age, IM injections should preferably be made into the anterolateral thigh;[106,182,187] alternatively, the deltoid muscle can be used in those 1 through 2 years of age if muscle mass is adequate.[134]

DTaP and Tdap should not be injected into the gluteal area or any area where there may be a major nerve trunk.[106,187,224] If the gluteal muscle is chosen for infants <12 months of age because of special circumstances (e.g., physical obstruction of other sites), it is essential that the clinician identify anatomic landmarks prior to injection.[134]

DTaP and Tdap should be inspected visually for particulate matter and discoloration prior to administration.[182,187,192,193,223,236] Prior to use, vials or prefilled syringes of DTaP or Tdap should be shaken vigorously until a uniform, turbid, white suspension results.[182,187,192,193,223,236] DTaP and Tdap should not be used if the vaccines cannot be resuspended.[106,182,193,223]

DTaP or Tdap should not be mixed with any other vaccine or solution.[106,182,187,192,193,221,223,224] Although DTaP is commercially available in a kit containing DTaP and inactivated poliovirus vaccine (DTaP-IPV) and Hib vaccine to provide a combination vaccine containing DTaP, poliovirus, and Hib antigens (DTaP-IPV/Hib; Pentacel®),[224] extemporaneous vaccine combinations of DTaP or Tdap and other commercially available vaccines should not be prepared by admixing the vaccines.[135]

Use of fixed-combination vaccines can reduce the number of injections a patient receives and alleviate concerns about the number of injections.[243] When multiple vaccines are administered during a single health-care visit, each parenteral vaccine should be given with a different syringe and at different injection sites.[134] Injection sites should be separated by at least 1 inch (if anatomically feasible) to allow appropriate attribution of any local adverse effects that may occur.[134] For infants and children receiving >2 vaccines in a single limb, the thigh is the preferred site due to greater mass.[134] For older children and adults, more than one IM injection can be administered into the deltoid muscle.[134,182,192,243]

DTaP (Daptacel®[187], Infanrix®[182]) and Tdap (Adacel®[192], Boostrix®[193]) should be stored at 2–8°C and should not be frozen. Any DTaP or Tdap vaccine that has been frozen should be discarded.[182,187,192,193]

Dosage

The dosing schedule (i.e., number of doses) and specific preparation for primary and/or booster immunization (i.e., DTaP, Tdap) varies depending on age.[182,187,192,193,196,237] The age-appropriate recommendations for the specific preparation used should be followed.[182,187,192,193,196,237]

If licensed and indicated for a patient's age, combination vaccines may be used interchangeably with monovalent formulations and other combination products with similar component antigens produced by the same manufacturer to continue a vaccine series.[243] Combination vaccines are not necessarily interchangeable with other combination vaccines from different manufacturers.[243] ACIP prefers that vaccine doses in a series come from the same manufacturer; however, if this is not possible or if the manufacturer of prior doses is not known, it is recommended to administer the vaccine that is available.[243]

DTaP (Daptacel®, Infanrix®) is used only in infants and children 6 weeks through 6 years of age.[182,187]

Tdap (Adacel®, Boostrix®) is used in patients ≥10 years of age; Adacel® is approved for use in patients up to 64 years of age.[192,193]

The usual dose of DTaP or Tdap is 0.5 mL.[105,182,187,192,193]

Adults

Primary Immunization in Adults 19 through 64 Years of Age

Although safety and efficacy of Tdap for primary immunization have not been established,[192,193] ACIP recommends that ***primary immunization [off-label]†*** *against diphtheria and tetanus in previously unvaccinated or incompletely vaccinated adolescents and adults 19 through 64 years of age include an initial Tdap dose, followed by a dose of Td given at least 4 weeks after the Tdap dose and a second dose of Td given 6–12 months after the first Td dose.[195,196] Alternatively, the Tdap dose may be substituted for any 1 of the 3 doses of Td.[195,196]*

Booster Doses in Adults 19 through 64 Years of Age

Adults who have received primary immunization against diphtheria and tetanus should receive routine booster doses of Td every 10 years.[195,196] In addition, an emergency booster dose of Td may be indicated in the event of injury and possible exposure to tetanus infection.[200] Because adults may be at risk for pertussis, ACIP and other experts recommend that a single dose of Tdap be used (instead of Td) when a booster dose is needed in adults 19 through 64 years of age who have not previously received Tdap, unless pertussis antigens are contraindicated or should not be used.[196] If Tdap is not available or was administered previously, Td should be used for booster doses.[196]

Booster Doses in Adults ≥65 Years of Age

A single dose of Tdap should be used (instead of Td) when a booster dose of vaccine containing tetanus and diphtheria toxoids is needed in adults ≥65 years of age who have not previously received Tdap.[196] When feasible, Boostrix® should be used in adults ≥65 years of age or older; however, ACIP states that either Tdap (Adacel®) or Tdap (Boostrix®) can be used when a dose of Tdap is indicated in this age group.[196]

Immunization During Pregnancy to Prevent Pertussis in Infants

The recommended dosage of Tdap in women during each pregnancy for the prevention of pertussis in infants <2 months of age is a single dose of Tdap (Adacel®, Boostrix®), administered during the third trimester of pregnancy.[192,193] Irrespective of vaccine history, ACIP and ACOG recommend administering a single dose of Tdap in all pregnant women, as early as possible between 27–36 weeks of gestation.[195,200,205]

Postexposure Prophylaxis of Tetanus

Patients who have completed the 3-dose primary tetanus vaccination series and have received a tetanus-toxoid containing vaccine within 5 years are protected against tetanus and do not require additional tetanus vaccination or tetanus immune globulin as part of wound management.[196] A booster dose of an age-appropriate tetanus-toxoid containing vaccine should be administered when there is a clean, minor wound (not tetanus prone) and >10 years have elapsed since the last booster dose of a tetanus toxoid-containing preparation.[196] If a wound is extensive (moderately or very tetanus prone), a booster dose of an appropriate tetanus toxoid-containing vaccine should be administered if >5 years have elapsed since the last dose of tetanus toxoid-containing vaccine.[192,193,196]

Patients who have received <3 doses of a tetanus toxoid-containing vaccine or whose vaccination status is unknown should receive a booster dose of an age-appropriate tetanus toxoid-containing vaccine regardless of wound type or severity.[196]

For most adults, Td is preferred for postexposure prophylaxis when a dose of a tetanus toxoid-containing vaccine is indicated.[196] Tdap (Adacel®, Boostrix®) may be preferred over Td in pregnant patients and adults who have not previously received a dose of Tdap.[196]

Pediatric Patients

Primary and Booster Immunization in Infants and Children 6 Weeks through 6 Years of Age

For primary immunization in infants and children 6 weeks through 6 years of age, ACIP, AAP, and other experts recommend that DTaP be given in a series of 3 primary doses and 1 or 2 booster doses.[105,196,199,237] The first 3 doses of DTaP should be given at 4- to 8-week intervals (usually at 2, 4, and 6 months of age) and the fourth dose (booster dose) given approximately 6–12 months after the third dose (usually at 15 through 18 months of age).[196,199,237] The fourth dose may be administered as early as 12 months of age, provided at least 6 months have elapsed since the third dose.[196,199,237] Some manufacturers recommend that this dose be given at 15–20 months.[182,187]

At 4 through 6 years of age (usually just prior to entry into school), children who received the fourth dose of the DTaP vaccination series at younger than 4 years of age should receive a fifth dose (booster dose).[196,199,237] The fifth dose is not necessary if the fourth dose was given at ≥4 years of age and at least 6 months after the third dose.[199,237]

For accelerated vaccination (e.g., for catch-up or prior to travel) in children 6 weeks to 6 years of age who did not receive DTaP at the usually recommended time in early infancy, a dose of DTaP should be given at the first visit and the second and third doses given at 4-week intervals after the first dose.[199,237] The fourth and fifth DTaP doses should then be given at 6-month intervals after the third dose.[199,237] A fifth dose is not necessary if the fourth dose was given at 4 years of age or older and at least 6 months after the third dose.[199,237]

If initiation or continuation of primary or booster immunization with DTaP is contraindicated because of the pertussis component, infants and children 6 weeks through 6 years of age should receive the fixed-combination preparation containing only diphtheria and tetanus toxoids (Td) to complete the series.[199,237]

Primary Immunization in Children and Adolescents 7 through 18 Years of Age

Although safety and efficacy of Tdap (Adacel®, Boostrix®) have not been established for primary immunization or for use in children ***<10 years of age [off-label]***[†],[192,193] *ACIP and AAP recommend that primary immunization against diphtheria, tetanus, and pertussis in previously unvaccinated or incompletely vaccinated children and adolescents 7 through 18 years of age include at least 1 dose of Tdap, unless pertussis antigens are contraindicated or should not be used.[199,237]*

The preferred primary immunization schedule recommended by ACIP and AAP for catch-up vaccination in children and adolescents 7 through 18 years of age is at least 1 dose of Tdap given at the first visit, with a dose of Td administered after at least 4 weeks.[199,237] If the patient was incompletely vaccinated but received their first dose of DTaP or Tdap/Td when the patient was ≥1 year of age, a second (and final) dose of Td is recommended 6 months later to complete the series.[199,237] If the first dose of DTaP was given when the patient was <1 year of age, a second dose of Td is recommended 4 weeks after the first dose, and a third (and final) dose of Td is recommended 6 months later to complete the series.[199,237] Additionally, the ACIP and AAP recommend that children who receive their first dose of Tdap at 7–9 years of age still receive the adolescent Tdap booster dose at 11 through 12 years of age.[199,237] Children who receive a dose of Tdap at 10 years of age should not receive a Tdap booster dose at 11 through 12 years of age.[105,199,237]

> ### Booster Doses in Adolescents 10 through 18 Years of Age
>
> *All individuals who received primary immunization with DTaP, DTP (not commercially available in the US), DT (not commercially available in the US), or Td should receive a booster dose of Tdap (Adacel®, Boostrix®) at 11 through 18 years of age (preferably at 11 through 12 years of age) and a routine booster dose of either Td or Tdap every 10 years to maintain adequate immunity against diphtheria and tetanus.*[105,195,199,200,237,]

> ### Postexposure Prophylaxis of Tetanus
>
> *Children and adolescents who have completed the 3-dose primary tetanus vaccination series and have received a tetanus-toxoid containing vaccine within 5 years are protected against tetanus and do not require additional tetanus vaccination or tetanus immune globulin as part of management for any type of wound.*[196,199,] *A booster dose of an age-appropriate preparation containing tetanus toxoids (DTaP, Tdap, Td) should be administered when there is a clean, minor wound (not tetanus prone) and >10 years have elapsed since the last booster dose of a tetanus-containing preparation.*[196,199,] *If a wound is extensive (moderately or very tetanus prone), a booster dose of an age-appropriate preparation containing tetanus toxoids (DTaP, Tdap, Td) should be administered if >5 years have elapsed since primary immunization against tetanus or since the last booster dose.*[196,199,]
>
> *In children <7 years of age, one dose of DTaP (Adacel®, Boostrix®) is recommended if their vaccination status is unknown or if they have received <3 doses of a tetanus toxoid-containing vaccine.*[196,199,] *Although Tdap is not approved in* ***children 7 through 10 years of age [off-label]†****, ACIP recommends 1 dose of Tdap in children ≥7 years of age who previously received <3 doses of a tetanus toxoid-containing vaccine.*[196,199,] *If >5 years have elapsed since the last dose of tetanus toxoid-containing vaccine, ACIP states that Tdap is preferred over Td in adolescents ≥11 years of who are unvaccinated or have an unknown history of Tdap vaccination.*[195,196,]

■ Special Populations

Hepatic Impairment

Manufacturers do not provide specific dosage recommendations for patients with hepatic impairment.[182,187,192,193,]

Renal Impairment

Manufacturers do not provide specific dosage recommendations for patients with renal impairment.[182,187,192,193,]

Geriatric Patients

Manufacturers do not provide specific dosage recommendations for geriatric patients.[182,187,192,193,]

Cautions

■ Contraindications

- Severe allergic reactions (e.g., anaphylaxis) after previous dose of DTaP, any vaccine component, or any vaccine containing tetanus, diphtheria, or pertussis antigens.[182,187,192,193,]
- Encephalopathy (e.g., coma, decreased level of consciousness, prolonged seizures) within 7 days of a previous dose of a vaccine containing pertussis antigens that is not attributable to another identifiable cause.[182,187,192,193,]
- Progressive neurologic disorder, including infantile spasms, uncontrolled epilepsy, or progressive encephalopathy (DTaP only).[182,187,]

■ Warnings/Precautions

Management of Acute Allergic Reactions

Prior to administration of DTaP or Tdap, the clinician should review the patient's history regarding possible sensitivity and any previous adverse reactions and should take all precautions known for prevention of allergic or any other adverse effects.[182,187,192,193,] Epinephrine and other appropriate agents and equipment should be available for immediate use in case an anaphylactic reaction occurs.[182,187,192,193,]

Guillain-Barré Syndrome and Brachial Neuritis

If Guillain-Barré syndrome (GBS) occurs within 6 weeks after receipt of a vaccine containing tetanus toxoid, the risk for GBS may be increased following a dose of DTaP or Tdap.[187,192,] Some manufacturers state that a decision to administer subsequent doses of DTaP, Tdap, or any vaccine containing tetanus toxoid in such patients should be based on careful consideration of the potential benefits and possible risks.[182,193,]

A review by the Institute of Medicine (IOM) found evidence of a causal relationship between tetanus toxoid and brachial neuritis and GBS.[187,192,193,]

Progressive or Unstable Neurologic Disorders

The manufacturers state that DTaP and Tdap are contraindicated in individuals with progressive neurologic disorder, including infantile spasms, uncontrolled epilepsy, or progressive encephalopathy.[182,187,192,193] DTaP and Tdap should be deferred in individuals with progressive or unstable neurologic conditions (e.g., cerebrovascular event, acute encephalopathic condition).[182,192,193] It is not known whether administration to individuals with an unstable or progressive neurologic disorder might hasten manifestations of the disorder or affect prognosis; administration in such individuals may result in diagnostic confusion between manifestations of the underlying illness and possible adverse effects of vaccination.[192,193]

Arthus-type Hypersensitivity Reactions

Individuals who experience Arthus-type hypersensitivity reactions after administration of a preparation containing tetanus toxoid adsorbed usually have very high serum tetanus antitoxin levels and usually should not receive additional routine or emergency booster doses of a preparation containing tetanus toxoid adsorbed more frequently than every 10 years, even if postexposure prophylaxis of tetanus is indicated.[193,196]

Individuals with Altered Immunocompetence

The possibility that the immune response to the vaccine and efficacy may be reduced in individuals immunosuppressed as the result of disease or immunosuppressive therapy should be considered.[182,187,192,193]

Unexplained Fever, Collapse, or Crying

The manufacturers state that the following adverse reactions reported in temporal relation to previous doses of a preparation containing pertussis antigens (e.g., DTaP, Tdap, DTP [not commercially available in the US]) should be considered precautions for, rather than absolute contraindications to, doses of DTaP or Tdap: a temperature of 40.5°C or greater within 48 hours of a dose that is unexplained by another cause; collapse or a shock-like state (i.e., a hypotonic-hyporesponsive episode) within 48 hours of a dose; or persistent, severe, inconsolable screaming or crying lasting ≥3 hours occurring within 48 hours of a dose.[182,187]

Whenever one of these adverse effects occurs in temporal relation to administration of a dose of DTaP, the decision to administer subsequent doses of DTaP or a dose of Tdap should be based on careful assessments of the potential benefits and risks of pertussis vaccine.[182,187]

Personal or Family History of Seizures

The manufacturers state that a seizure (with or without fever) occurring within 3 days of a dose of a preparation containing pertussis antigens (e.g., DTaP, Tdap, DTP [not commercially available in the US]) is considered a precaution (not a contraindication) for further doses of DTaP or Tdap.[182,187]

Although it is not known whether prophylactic use of antipyretics following administration of preparations containing pertussis antigens can decrease the risk of febrile seizures, some manufacturers state that acetaminophen or another appropriate antipyretic can be given at the time of DTaP vaccination and for 24 hours after the dose to reduce the possibility of postvaccination fever.[182,187]

Apnea in Premature Infants

Apnea has been reported following IM administration of vaccines in some infants born prematurely.[182,187] Decisions regarding when to administer an IM vaccine in infants born prematurely should be based on consideration of the individual infant's medical status and potential benefits and possible risks of vaccination.[182,187]

Syncope

Syncope can occur in association with injectable vaccines, including DTaP and Tdap;[182,187,192,193] syncope may be accompanied by transient neurological signs such as visual disturbance, paresthesia, and tonic-clonic limb movements.[182] Procedures should be in place to avoid falling injury and manage syncopal reactions.[182,187,192,193]

Limitations of Vaccine Effectiveness

DTaP or Tdap may not protect all individuals from diphtheria, tetanus, and pertussis.[187,192,193]

Specific Populations

> ### Pregnancy
>
> *Tdap (Adacel®, Boostrix®) is indicated for immunization during the third trimester of each pregnancy to prevent pertussis in infants <2 months of age.[192,193]*
>
> *Available data indicate that rates of major birth defects and miscarriage are similar in women who received Adacel® or Boostrix® 28–30 days prior to pregnancy and during pregnancy compared to background estimated rates.[192,193]*
>
> *A retrospective passive surveillance study compared outcomes between 225 women who received Adacel® during pregnancy and 675 controls matched by age and date of their first positive pregnancy test.[192] Of the Adacel® recipients, 110 were vaccinated in the first trimester, 33 during the second trimester, and 14 in the third trimester.[192] Twenty-nine had an unknown time of vaccination, and 39 had received Adacel® within 2 weeks prior to their last menstrual period.[192] Spontaneous abortions were reported in 15% of patients in the control group and 9.3% of Adacel® recipients.[192] The incidence of congenital anomalies was 8.4% in the control group and 6.7% in the group exposed to Adacel®.[192]*

An assessment of 1236 prospective reports from an ongoing registry of exposure to Adacel® indicate that rates of assessed outcomes (e.g., congenital anomalies, spontaneous abortions) in the prospective population were consistent with estimated background rates.[192]

Among 256 reports with known pregnancy outcomes in women exposed to Boostrix® within 28 days prior to conception or during pregnancy, 19 women with first trimester exposure to Boostrix® had no reported major birth defects and 3 spontaneous abortions.[193] Twenty-eight women exposed in the second trimester and 199 in the third trimester also reported no major birth defects; an additional 10 women that were exposed to Boostrix® at an unknown timing during pregnancy reported no major birth defects.[193]

Other spontaneous reports and postmarketing data have shown that out of 138 reports with known pregnancy outcomes, there were no major birth defects and 2 spontaneous abortions among 17 women exposed to Boostrix® in the first trimester.[193] Out of 26 exposures in the second trimester and 92 in the third trimester there were no major birth defects reported; 3 women exposed to Boostrix® at an unknown timing during pregnancy also had no major birth defects reported.[193]

Irrespective of vaccine history, ACIP and ACOG recommend administering a single dose of Tdap (Adacel® or Boostrix®) in all pregnant women during each pregnancy as early as possible between 27 and 36 weeks gestation.[195,200,205] Immunization with Tdap during the third trimester of pregnancy provides passive protection against pertussis via transplacental antibody transfer in infants <2 months of age.[193]

Clinicians are encouraged to register pregnant women who receive Tdap with the manufacturer's pregnancy registry at 800-822-2463 or [Web] (Adacel®) or 888-452-9622 or [Web] (Boostrix®).[192,193]

Lactation

It is not known whether Tdap (Adacel®, Boostrix®) is distributed into human milk and data on the effect on breast-fed infants or on milk production are not available.[192,193] The manufacturers state that Tdap should be used with caution in breast-feeding women.[192,193]

Pediatric Use

Safety and efficacy of DTaP (Daptacel®, Infanrix®) in children younger than 6 weeks of age or in children 7 years of age or older have not been established.[182,187]

Safety and efficacy of Tdap (Adacel®, Boostrix®) in children <10 years of age have not been established.[192,193]

Geriatric Use

Clinical studies evaluating the safety and efficacy of Tdap (Boostrix®) included adults ≥65 years of age, and this preparation is labeled by FDA for booster immunization in geriatric adults.[193]

Safety and efficacy of Tdap (Adacel®) have not been established in adults ≥65 years of age.[192] Although Tdap (Adacel®) is not labeled by FDA for use in adults ≥65 years of age,[192] ACIP states the vaccine can be used in this age group if it is the only Tdap vaccine available.[196]

Common Adverse Effects

Rates of adverse effects following DTaP (Daptacel®, Infanrix®) administration varied by dose number, with injection site reactions (pain, redness, swelling) the most frequent following doses 4 and 5.[182,187] Common systemic adverse effects with DTaP vaccination include fever, drowsiness, fussiness/irritability, inconsolable crying, loss of appetite, and lethargy.[182,187]

Following the first booster dose of Tdap (Adacel®), the most common adverse effects within the first 2 weeks of vaccination for adolescents were injection site pain (77.8%), headache (43.7%), body aches or muscle weakness (30.4%), tiredness (30.2%), injection site swelling (20.9%), and injection site redness (20.8%).[192] In adults 18–64 years of age, the most common adverse effects within the first 2 weeks were injection site pain (65.7%), headache (33.9%), body aches or muscle weakness (21.9%), tiredness (24.3%), injection site swelling (21%), and injection site redness (24.7%).[192] Within the first week after a second booster dose of Tdap (Adacel®), the most common adverse effects in patients 18–64 years of age were injection site pain (87.1%), myalgia (58.1%), headache (41.4%), malaise (33.3%), injection site swelling (6.9%), and injection site erythema (6.4%).[192]

Adverse effects reported in ≥15% of adolescents and adults 10–64 years of age following administration of Tdap (Boostrix®) were injection site reactions (pain, redness, swelling), headache, fatigue, and GI symptoms.[193] Increased arm circumference was also reported in adolescent patients.[193] In adults ≥65 years of age, the most common adverse effect was pain at the injection site.[193]

Drug Interactions

Immune Globulins

When both active and passive immunization against tetanus is indicated, DTaP or Tdap may be administered concomitantly with tetanus immune globulin at a different site using a separate syringe.[192,196] Administration into separate limbs is recommended.[134]

■ Immunosuppressive Agents

Individuals receiving immunosuppressive agents (e.g., corticotropin, corticosteroids, alkylating agents, antimetabolites, radiation therapy) may have a diminished immunologic response to DTaP and Tdap.[182,187,192,193]

■ Vaccines

DTaP

Vaccines such as DTaP and Tdap do not interfere with the immune response to other non-live (e.g., *Haemophilus influenzae* type b [Hib], hepatitis A, hepatitis B, human papillomavirus [HPV], influenza, meningococcal disease, pneumococcal disease, poliomyelitis) or live (e.g., measles, mumps, rubella [MMR], rotavirus, varicella) vaccines and can be administered simultaneously.[243] When administering DTaP concomitantly with other injectable vaccines, manufacturers recommend administering each parenteral vaccine using a different syringe and injection site.[182,187]

Clinical trials have evaluated the efficacy and safety of concurrent administration of DTaP (Infanrix®, Daptacel®) with the Hib conjugate vaccine, pneumococcal conjugate vaccine, MMR vaccine, poliovirus, and hepatitis B vaccine.[182,187] DTaP (Daptacel®) has also been evaluated concurrently with the varicella vaccine.[187]

Tdap

Tdap (Adacel®) has been administered concurrently with hepatitis B vaccine in adolescents 11 through 14 years of age without a decrease in the antibody response to any of the antigens.[192] Although the incidence of fever and injection site pain were similar when the vaccines were given concurrently or 4–6 weeks apart, the incidence of injection site erythema and swelling and swollen and/or sore joints and generalized body aches were slightly higher with concurrent administration.[192]

Tdap (Adacel®) has been administered concurrently with influenza virus vaccine inactivated (Fluzone®) in adults 19 through 64 years of age without a clinically important decrease in the antibody response to tetanus, diphtheria, and influenza antigens.[192] There was a lower antibody response to pertactin when Tdap (Adacel®) was administered concurrently with influenza virus vaccine inactivated, but responses to the other pertussis antigens (detoxified pertussis toxin, fimbriae types 2 and 3, filamentous hemagglutinin) were not affected.[192] Although the booster response to the tetanus antigen was lower in those receiving Tdap and influenza vaccine concurrently compared with those who received the vaccines 4–6 weeks apart, at least 98% of individuals in both groups achieved seroprotective levels of tetanus antitoxin.[192] The incidence of fever and injection site erythema and swelling were similar when the vaccines were given concurrently or 4–6 weeks apart; however, the incidence of injection site pain and swollen and/or sore joints were slightly higher with concurrent administration.[192]

Concurrent administration of Tdap (Boostrix®) and influenza virus vaccine inactivated (Fluarix®) was evaluated in adults 19 through 64 years of age randomized to receive the vaccines concurrently (at different injection sites) or 1 month apart.[193] The immune responses to the diphtheria, tetanus, and influenza antigens and the pertussis toxin antigen were noninferior following concurrent administration.[193] The immune responses to the pertussis filamentous hemagglutinin (FHA) and pertactin antigens (measured as geometric mean antibody concentrations [GMCs] of anti-FHA and anti-pertactin) were lower when Tdap (Boostrix®) was administered concurrently with Fluarix® compared with administration 1 month apart; however, it is not known whether efficacy of the vaccine is affected by the reduced response to these pertussis antigens.[193]

Concurrent administration of Tdap (Boostrix®) and recombinant zoster vaccine (Shingrix®) was evaluated in adults ≥50 years of age.[193] There was a lower antibody response to pertactin when Tdap (Boostrix®) was administered concurrently with the recombinant zoster vaccine, but immune response to the other antigens in Boostrix® or the antigen in Shingrix® were not affected.[193] The clinical significance of this reduced immune response to pertactin is not known.[193]

Description

Diphtheria and tetanus toxoids and acellular pertussis vaccine adsorbed (DTaP) stimulates active immunity to diphtheria, tetanus, and pertussis by inducing production of specific antitoxins and antibodies.[182,187,192,193] The acellular pertussis vaccine component includes several pertussis antigens and induces production of specific anti-pertussis antibodies; however, the mechanism of protection against the disease has not been fully determined.[182,187,192,193] There is no accepted serologic correlation of protection against pertussis.[182]

The immunologic response to a booster dose of Tdap (Adacel®) has been evaluated in adolescents and adults 11 through 64 years of age who were randomized to receive a dose of Tdap or tetanus and diphtheria toxoids adsorbed (Td); participants had not received a preparation containing diphtheria or tetanus toxoid within the last 5 years.[192] One month after the booster dose, antibody responses to the tetanus and diphtheria antigens in individuals who received Tdap were similar to that in individuals who received Td.[192] In addition, the antibody response to the pertussis antigens in Tdap was similar to that reported in infants who receive a 3-dose primary immunization series of DTaP (Daptacel®).[192]

The immunologic response to a booster dose of Tdap (Boostrix®) has been evaluated in adolescents 10–18 years of age who were randomized to receive a dose of Tdap or Td; 98% received the recommended series of 4 or 5 doses of DTaP and/or DTP (not commercially available in the US) in childhood.[193] One month after the booster dose of Tdap, antibody responses to the tetanus and diphtheria antigens were similar in both groups and there also was an acceptable booster response to the pertussis antigens in Tdap (i.e., the response was similar to that reported in infants who receive a 3-dose primary immunization series of DTaP [Infanrix®]).[193] In adults 19 through 64 years of age who had not received a dose of a preparation containing diphtheria and tetanus toxoids adsorbed within the last 5 years, a single booster dose of Tdap (Boostrix®) resulted in tetanus and diphtheria antitoxin levels 1 month after the dose that were seroprotective (i.e., at least 0.1 international units/mL) in 95.9 and 85.2% of patients, respectively.[193] There also was an acceptable booster response to the pertussis antigens.[193]

Based on prespecified criteria, administration of a dose of Tdap (Adacel®) in **adults 65 years of age or older [off-label]†** was associated with lower geometric mean antibody concentrations (GMCs) to the pertussis antigens (pertussis toxin, filamentous hemagglutinin, pertactin) compared with GMCs reported in infants who received a primary immunization series of DTaP (Daptacel®).[192]

In a randomized study in adults 65 years of age or older who had not received a dose of Td within 5 years, immune responses to the tetanus and diphtheria antigens measured 1 month after a single dose of Tdap (Boostrix®) were comparable to those attained in those who received a dose of Td.[193] In addition, the GMCs to the pertussis antigens 1 month following a single dose of Tdap (Boostrix®) in adults ≥65 years of age were noninferior to those reported in infants following a primary immunization series of DTaP (Infanrix®).[193]

Advice to Patients

The following information contains important points for the clinician to discuss with patients during counseling. For more comprehensive monographs suitable for distribution to the patient, please refer to the *AHFS Patient Medication Information* monographs available from MedlinePlus (in English and Spanish; written at a 6th- to 8th-grade reading level).

- Prior to administration of each vaccine dose, provide a copy of the appropriate CDC Vaccine Information Statement (VIS) to the patient or patient's legal representative as required by the National Childhood Vaccine Injury Act (VISs are available at [Web]).[182,187,192,193]
- Advise patients and/or caregivers of the risks and benefits of vaccination against diphtheria, tetanus, and pertussis and the importance of completing the primary immunization series and receiving recommended booster doses (unless there is a contraindication to further doses).[182,187,192,193]
- Advise patients that the vaccines may not provide protection in all vaccinees.[187,192,193]
- Advise caregivers to inform their clinician if their child had a seizure or collapsed, cried nonstop for ≥3 hours, or had a fever >40.5°C or any unusual behavior after a dose of DTaP.[182,187]
- Advise patients that they can report any adverse reactions that occur following vaccination to the Vaccine Adverse Event Reporting System (VAERS) at 800-822-7967 or [Web] .[182,187,192,193]
- Advise patients to inform their clinician of existing or contemplated concomitant therapy, including prescription and OTC drugs and dietary and herbal supplements, as well as any concomitant illnesses.[182,187,192,193]
- Advise patients to inform their clinician if they are or plan to become pregnant or plan to breast-feed.[192,193]
- Advise patients of other important precautionary information.[182,187,192,193]

Additional Information

The American Society of Health-System Pharmacists, Inc. represents that the information provided in the accompanying monograph was formulated with a reasonable standard of care, and in conformity with professional standards in the field. Readers are advised that decisions regarding use of drugs are complex medical decisions requiring the independent, informed decision of an appropriate health care professional, and that the information contained in the monograph is provided for informational purposes only. The manufacturer's labeling should be consulted for more detailed information. The American Society of Health-System Pharmacists, Inc. does not endorse or recommend the use of any drug. The information contained in the monograph is not a substitute for medical care.

Preparations

Excipients in commercially available drug preparations may have clinically important effects in some individuals; consult specific product labeling for details.

Diphtheria and Tetanus Toxoids and Acellular Pertussis Vaccine Adsorbed (DTaP)

ROUTES	FORMS	STRENGTHS	BRAND NAMES	MANUFACTURER
Parenteral	*Injectable suspension, for IM use*	*Diphtheria Toxoid 15 Lf units, Tetanus Toxoid 5 Lf units, and Acellular Pertussis Vaccine 23 mcg (of pertussis antigens) per 0.5 mL*	*Daptacel®*	*Sanofi Pasteur*
		Diphtheria Toxoid 25 Lf units, Tetanus Toxoid 10 Lf units, and Acellular Pertussis Vaccine 58 mcg (of pertussis antigens) per 0.5 mL	*Infanrix®*	*GlaxoSmithKline*

Tetanus Toxoid, Reduced Diphtheria Toxoid and Acellular Pertussis Vaccine Adsorbed (Tdap)

ROUTES	FORMS	STRENGTHS	BRAND NAMES	MANUFACTURER

Parenteral	*Injectable suspension, for IM use*	*Tetanus Toxoid 5 Lf units, Diphtheria Toxoid 2 Lf units, and Acellular Pertussis Vaccine 15.5 mcg (of pertussis antigens) per 0.5 mL*	*Adacel®*	*Sanofi Pasteur*
		Tetanus Toxoid 5 Lf units, Diphtheria Toxoid 2.5 Lf units, and Acellular Pertussis Vaccine 18.5 mcg (of pertussis antigens) per 0.5 mL	*Boostrix®*	*GlaxoSmithKline*

Diphtheria and Tetanus Toxoids and Acellular Pertussis Adsorbed and Inactivated Poliovirus Vaccine (DTaP-IPV)

ROUTES	FORMS	STRENGTHS	BRAND NAMES	MANUFACTURER
Parenteral	*For injection, for IM use*	*Diphtheria Toxoid 15 Lf units, Tetanus Toxoid 5 Lf units, Acellular Pertussis Vaccine 48 mcg (of pertussis antigen) and Poliovirus Type 1 29 DU, Poliovirus Type 2 7 DU, and Poliovirus Type 3 26 DU per 0.5 mL*	*Quadracel®*	*Sanofi Pasteur*
		Diphtheria Toxoid 25 Lf units, Tetanus Toxoid 10 Lf units, Acellular Pertussis Vaccine 58 mcg (of pertussis antigen) and Poliovirus Type 1 40 DU, Poliovirus Type 2 8 DU, and Poliovirus Type 3 32 DU per 0.5 mL	*Kinrix®*	*GlaxoSmithKline*

Diphtheria and Tetanus Toxoids and Acellular Pertussis Adsorbed, Hepatitis B (Recombinant) and Inactivated Poliovirus Vaccine Combined (DTaP-HepB-IPV)

ROUTES	FORMS	STRENGTHS	BRAND NAMES	MANUFACTURER
Parenteral	*Injectable suspension, for IM use*	*Diphtheria Toxoid 25 Lf units, Tetanus Toxoid 10 Lf units, Acellular Pertussis Vaccine 58 mcg (of pertussis antigen), Hepatitis B Surface Antigen 10 mcg, Poliovirus Type 1 40 DU, Poliovirus Type 2 8 DU, and Poliovirus Type 3 32 DU per 0.5 mL*	*Pediarix®*	*GlaxoSmithKline*

Diphtheria and Tetanus Toxoids and Acellular Pertussis Adsorbed, Inactivated Poliovirus and Haemophilus b Conjugate (Tetanus Toxoid Conjugate) Vaccine (DTaP-IPV/Hib)

ROUTES	FORMS	STRENGTHS	BRAND NAMES	MANUFACTURER
Parenteral	*Kit, for IM use*	*Injection, for IM use, Diphtheria Toxoid 15 Lf units, Tetanus Toxoid 5 Lf units, Acellular Pertussis Vaccine 48 mcg (of pertussis antigen), Poliovirus Type 1 40 DU, Poliovirus Type 2 8 DU, and Poliovirus Type 3 32 DU per 0.5 mL* *For injectable suspension, for IM use, Haemophilus b Polysaccharide 10 mcg, Tetanus Toxoid 24 mcg per 0.5 mL, ActHIB®*	*Pentacel®*	*Sanofi Pasteur*

Diphtheria and Tetanus Toxoids and Acellular Pertussis, Inactivated Poliovirus and Haemophilus b Conjugate and Hepatitis B Vaccine (DTaP-HepB-IPV/Hib)

ROUTES	FORMS	STRENGTHS	BRAND NAMES	MANUFACTURER

Parenteral	*Injectable suspension, for IM use*	*Diphtheria Toxoid 15 Lf units, Tetanus Toxoid 5 Lf units, Acellular Pertussis Vaccine 48 mcg (of pertussis antigen), Poliovirus Type 1 29 DU, Poliovirus Type 2 7 DU, Poliovirus Type 3 26 DU, Haemophilus b Polysaccharide 3 mcg, and Hepatitis B Surface Antigen 10 mcg per 0.5 mL*	*Vaxelis®*	*Sanofi Pasteur*

† Use is not currently included in the labeling approved by the US Food and Drug Administration.

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