General Recommendations on Immunization

Recommendations of the Advisory Committee on Immunization Practices (ACIP)

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Summary

This report is a revision of General Recommendations on Immunization and updates the 1994 statement by the Advisory Committee on Immunization Practices (ACIP). Principal changes include expansion of the discussion of vaccination spacing and timing, recommendations for vaccinations administered by an incorrect route, information regarding needle-free injection technology, vaccination of children adopted from countries outside the United States, timing of live-virus vaccination and tuberculosis screening, expansion of the discussion and tables of contraindications and precautions regarding vaccinations, and addition of a directory of immunization resources. These recommendations are not comprehensive for each vaccine. The most recent ACIP recommendations for each specific vaccine should be consulted for additional details. This report, ACIP recommendations for each vaccine, and other information regarding immunization can be accessed at CDC’s National Immunization Program website at http://www.cdc.gov/nip (accessed October 11, 2001).

Introduction

This report provides technical guidance regarding common immunization concerns for health-care providers who administer vaccines. Vaccine recommendations are based on characteristics of the immunobiologic product, scientific knowledge regarding the principles of active and passive immunization, the epidemiology and burden of diseases, the safety of vaccines, and the cost analysis of preventive measures as judged by public health officials and specialists in clinical and preventive medicine.

Benefits and risks are associated with using all immunobiologics. No vaccine is completely safe or 100% effective. Benefits of vaccination include partial or complete protection against the consequences of infection for the vaccinated person, as well as overall benefits to society as a whole. Benefits include protection from symptomatic illness, improved quality of life and productivity, and prevention of death. Societal benefits include creation and maintenance of herd immunity against communicable diseases, prevention of disease outbreaks, and reduction in health-care-related costs. Vaccination risks range from common, minor, and local adverse effects to rare, severe, and life-threatening conditions. Thus, recommendations for immunization practices balance scientific evidence of benefits and risks of vaccination programs.

Standards for child and adolescent immunization practices and standards for adult immunization practices (1,2) have been prepared based on the recommendations presented in this report.
programs and maximizing their benefits. Any person or institution that provides vaccination services should adopt these stan
dard schedules and techniques. To maximize the benefits of vaccination, this report provides general information regarding immunobiologics and provides \( \text{r} \) administration and technique. To minimize risk from vaccine administration, this report delineates situations that warrant pre
vention recommendations. These recommendations are intended for use in the United States because vaccine availability and use, as well as epidemiolo

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ication of poliovirus is accomplished, continued vaccination of the U.S. population against poliovirus will be necessary.

**Timing and Spacing of Immunobiologics**

**General Principles for Vaccine Scheduling**

Optimal response to a vaccine depends on multiple factors, including the nature of the vaccine and the age and immune status at which vaccines are administered. These factors are influenced by age-specific risks for disease, age-specific risks for complications, abili
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**Simultaneous Administration**

Experimental evidence and extensive clinical experience have strengthened the scientific basis for administering vaccines simultaneously (in the same syringe). Simultaneously administering all vaccines for which a person is eligible is critical, including simultaneous administration increases the probability that a child will be fully immunized at the appropriate age. A study cor that approximately one third of measles cases among unvaccinated but vaccine-eligible preschool children could have been prevented when another vaccine was administered (12). Simultaneous administration also is critical when preparing for foreign travel because of administration of virus vaccines.

Simultaneously administering the most widely used live and inactivated vaccines have produced seroconversion rates and rates of adverse reactions similar to those observed when the vaccines are administered separately (13-16). Routinely administering all vaccines simultaneously is recommended if the vaccines are administered separately (13-16). Routinely administering all vaccines simultaneously is recommended when the vaccines are administered separately (13-16). Routinely administering all vaccines simultaneously is recommended when the vaccines are administered separately (13-16). Routinely administering all vaccines simultaneously is recommended when the vaccines are administered separately (13-16). Routinely administering all vaccines simultaneously is recommended when the vaccines are administered separately (13-16).

Simultaneous administration of pneumococcal polysaccharide vaccine and inactivated influenza vaccine elicits a satisfactory antibody response without increasing the incidence or severity of adverse reactions (19). Simultaneously administering pneumococcal polysaccharide vaccine and inactivated influenza vaccine is recommended for all persons for whom both vaccines are indicated.

Hepatitis B vaccine administered with yellow fever vaccine is as safe and immunogenic as when these vaccines are administered separately (20). Routine simultaneous administration of both vaccines at the same visit without reduction of immunogenicity has been documented (20). Routine simultaneous administration of both vaccines at the same visit without reduction of immunogenicity has been documented (20). Routine simultaneous administration of both vaccines at the same visit without reduction of immunogenicity has been documented (20). Routine simultaneous administration of both vaccines at the same visit without reduction of immunogenicity has been documented (20).

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Use of combination vaccines can reduce the number of injections required at an office visit. Licensed combination vaccines are indicated and are recommended for all persons for whom both vaccines are indicated. Use of combination vaccines is indicated and is recommended for all persons for whom both vaccines are indicated. Use of combination vaccines is indicated and is recommended for all persons for whom both vaccines are indicated. Use of combination vaccines is indicated and is recommended for all persons for whom both vaccines are indicated.

**Nonsimultaneous Administration**

Inactivated vaccines do not interfere with the immune response to other inactivated vaccines or to live vaccines. An inactivated vaccine administered simultaneously or at any time before or after a different inactivated vaccine or live vaccine (Table 2).

The immune response to one live-virus vaccine might be impaired if administered within 30 days of another live-virus vaccine (Table 2). The immune response to one live-virus vaccine might be impaired if administered within 30 days of another live-virus vaccine (Table 2). The immune response to one live-virus vaccine might be impaired if administered within 30 days of another live-virus vaccine (Table 2). The immune response to one live-virus vaccine might be impaired if administered within 30 days of another live-virus vaccine (Table 2).

**Spacing of Antibody-Containing Products and Vaccines**

**Live Vaccines**

Ty21a typhoid vaccine and yellow fever vaccines can be administered at any time before, concurrently with, or after administering any inactivated vaccine. Ty21a typhoid vaccine and yellow fever vaccines can be administered at any time before, concurrently with, or after administering any inactivated vaccine. Ty21a typhoid vaccine and yellow fever vaccines can be administered at any time before, concurrently with, or after administering any inactivated vaccine. Ty21a typhoid vaccine and yellow fever vaccines can be administered at any time before, concurrently with, or after administering any inactivated vaccine.
Contraindications and precautions to vaccination dictate circumstances when vaccines will not be administered. The majority of contraindications and precautions are listed in this report (Table 4). A, hepatitis B, and poliovirus) (see Vaccination of Internationally Adopted Children). If records cannot be located, these persons should be considered susceptible and should be started on the age-appropriate dose of the vaccination. With the exception of pertussis vaccination, delaying the vaccination is not recommended because interference with parenteral live-virus vaccine (except yellow fever vaccine) can persist after the antibody-containing product has degraded (Table 3). Recommended intervals between receipt of various blood prod vaccines are listed in this report (Table 4). If a dose of pertussis vaccine from different manufacturers is administered, the serum antibody level will be reduced by antibodies to diphtheria, tetanus, and pertussis toxoid, and filamentous hemagglutinin (FHA). Vaccination providers are encouraged to administer vaccines as close to the recommended intervals as possible. However, lo delayed the vaccine dose should be repeated unless serologic testing indicates a response. Administration of a vaccine or toxoid results in the immune response to the vaccine virus replication and stimulation of immunity. Contraindications and precautions to vaccination dictate circumstances when vaccines will not be administered. The majority

...immunoglobulin, hyperimmune immunoglobulin, and intravenous immune globulin [IGIV]) can inhibit the immune response to meet the effect of blood and immune globulin preparations on the response to mumps and varicella vaccines is unknown, but con...
temporarily, and the vaccination can be administered later. A contraindication is a condition in a recipient that increases the risk of a serious adverse reaction. For example, administering influenza vaccine to a person with an acute illness in or death of the recipient.

National standards for pediatric immunization practices have been established and include true contraindications and precaution contraindication applicable to all vaccines is a history of a severe allergic reaction after a prior dose of vaccine or to a vaccine desensitized). Severe immunocompromised persons should not receive live vaccines. Children who experience an encephalopathy after receiving a prior dose of diphtheria and tetanus toxoids and whole-cell pertussis vaccine (DTP) or DTaP not attributable to another identifiable cause of illness. Because of the theoretical risk to the fetus, women known to be pregnant should not receive influenza vaccine during pregnancy.

A precaution is a condition in a recipient that might increase the risk for a serious adverse reaction or that might compromise the outcome of vaccine prevents measles from an exposure to measles virus; vaccination is recommended for infants with evolving neurologic conditions until a treatment regimen has been established and the condition has stabilized. Vaccination for infants and children with a history of previous seizures until the child's neurologic status has been assessed is prudent. Pertussis vaccine should not be administered to persons with minor acute illness (e.g., diarrhea) or illnesses that can seriously impede vaccination efforts (45-47). Among persons whose compliance with medical care cannot be ensured, use of every opportunity to provide appropriate vaccinations is critical.

The decision to administer or delay vaccination because of a current or recent acute illness depends on the severity of the illness, the regimen to be administered, and the convalescent phase of an acute illness. Persons with moderate or severe acute illness should be vaccinated as soon as they have recovered from the acute phase of the illness. This precaution avoids superimposing the adverse effects of the vaccine on the underlying illness or mistakenly attributing a manifestation of the underlying illness to the vaccine.

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Physicians and other health-care providers might inappropriately consider certain conditions or circumstances to be true contraindications results in missed opportunities to administer recommended vaccines (44). Likewise, physicians and other health-care providers might consider a condition to be a contraindication or precaution and might administer a vaccine when it should be withheld. This practice can lead to errors in vaccine administration. Conditions that are often inappropriately regarded as contraindications to vaccination are listed in this report and in minor upper-respiratory tract illnesses (including otitis media) with or without fever, mild to moderate local reactions to therapy, and the convalescent phase of an acute illness.

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A family history of seizures or other central nervous system disorders is not a contraindication to administration of pertussis vaccination for infants and children with a history of previous seizures until the child's neurologic status has been assessed is prudent. Pertussis vaccine should not be administered to persons with minor acute illness (e.g., diarrhea) or illnesses that can seriously impede vaccination efforts (45-47). Among persons whose compliance with medical care cannot be ensured, use of every opportunity to provide appropriate vaccinations is critical.

Vaccine Administration

**Infection Control and Sterile Technique**

Persons administering vaccines should follow necessary precautions to minimize risk for spreading disease. Hands should be alcohol-based waterless antiseptic hand rub between each patient contact. Gloves are not required when administering vaccines are not readily available in contact with potentially infectious body fluids or have open lesions on their hands. Syringes and need disposables to minimize the risk of contamination. A separate needle and syringe should be used for each injection. Changing injecting it into a recipient is unnecessary. Different vaccines should never be mixed in the same syringe unless specifically labeled. Disposable needles and syringes should be discarded in labeled, puncture-proof containers to prevent inadvertent needle-stick injury. Injection devices also can reduce the risk for injury and should be used whenever available (see Occupational Safety Regulations).

**Recommended Routes of Injection and Needle Length**

Routes of administration are recommended by the manufacturer for each immunobiologic. Deviation from the recommended efficacy (53,54) or increase local adverse reactions (55-57). Injectable immunobiologics should be administered where the injection is limited. Vaccines containing adjuvants should be injected into the muscle mass; when administered subcutaneously should be injected into the muscle mass; when administered subcutaneously, skin discoloration, inflammation, and granuloma formation.

**Subcutaneous Injections**
Subcutaneous injections usually are administered at a 45-degree angle into the thigh of infants aged <12 months and in the upper-outer triceps area of an infant, if necessary. A 5/8-inch, subcutaneous tissue.

**Intramuscular Injections**

Intramuscular injections are administered at a 90-degree angle into the anterolateral aspect of the thigh or the deltoid muscle for administration of vaccines or toxoids because of the potential risk of injury to the sciatic nerve (58). In addition, injection decreases immunogenicity of hepatitis B and rabies vaccines in adults, presumably because of inadvertent subcutaneous injection. For all intramuscular injections, the needle should be long enough to reach the muscle mass and prevent vaccine from seeping into underlying nerves and blood vessels or bone (54,60–62). Vaccinators should be familiar with the anatomy of the area and the depth below the muscle surface into which the material is to be injected.

Although certain vaccination specialists advocate aspiration (i.e., the syringe plunger pulled back before injection), no data exist if aspiration results in blood in the needle hub, the needle should be withdrawn and a new site should be selected.

**Infants (persons aged <12 months).** Among the majority of infants, the anterolateral aspect of the thigh provides the largest site for injection. For the majority of infants, a 7/8–1-inch, 22–25-gauge needle is sufficient to penetrate muscle in the infant thigh.

**Toddlers and Older Children (persons aged ≥12 months–18 years).** The deltoid muscle can be used if the muscle mass is adequate and from 7/8 to 1 ¼ inches, on the basis of the size of the muscle. For toddlers, the anterolateral thigh can be used, but the needle should be long enough to reach the muscle mass and prevent vaccine from seeping into subcutaneous tissue, but not so long as to involve underlying nerves and blood vessels or bone.

**Adults (persons aged >18 years).** For adults, the deltoid muscle is recommended for routine intramuscular vaccinations. The needle size is 1–1½ inches and 22–25 gauge.

**Intradermal Injections**

Intradermal injections are usually administered on the volar surface of the forearm. With the bevel facing upwards, a 3/8–3/4-inch needle at an angle parallel to the long axis of the forearm. The needle should be inserted so that the entire bevel penetrates the skin and the injected solution raises a small bleb. Because of the small amounts of antigen used in intradermal vaccinations, care must be taken not to inject the vac suboptimal immunologic response.

**Multiple Vaccinations**

If ≥2 vaccine preparations are administered or if vaccine and an immune globulin preparation are administered simultaneously at a different anatomic site. If ≥2 injections must be administered in a single limb, the thigh is usually the preferred site because it is sufficiently separated (i.e., ≥1 inch) so that any local reactions can be differentiated (55,63). For older children and adults, intramuscular injections, if necessary. The location of each injection should be documented in the person's medical record.

**Jet Injection**

Jet injectors (JIs) are needle-free devices that drive liquid medication through a nozzle orifice, creating a narrow stream under high pressure that penetrates skin to deliver a dose of vaccine without a needle. If the injection is performed correctly, local reactions are less common than those induced by needle injection. However, the local reactions associated with JIs are occasionally greater than those associated with conventional needle injection.

Certain JIs were developed for situations in which substantial numbers of persons must be vaccinated rapidly, but personnel-conventional needle injection. Such high-workload devices vaccinate consecutive patients from the same nozzle orifice, fluic automatically from attached vials containing ≤50 doses each. The devices have been used extensively amo campaigns for disease control and eradication (64). An outbreak of hepatitis B among patients receiving injections from a single needle and syringes demonstrated that such devices could become contaminated with blood (53). No U.S.-licensed, high-workload vaccination devices of unquestioned safety are available to vaccination programs. Efforts to develop new high-workload JIs using disposable-cartridge technology that avoids reuse of any unsterilized components have met with limited success.

In the 1990s, a new generation of low-workload JIs were introduced with disposable cartridges serving as dose chambers and needle for each patient and other correct use, these devices avoid the safety concerns described previously for multiple-use JIs with their labeling for intradermal, subcutaneous, or intramuscular administration.

**Methods for Alleviating Discomfort and Pain Associated with Vaccination**

Comfort measures and distraction techniques (e.g., playing music or pretending to blow away the pain) might help children cope with the discomfort associated with injection. Pretreatment (30-60 minutes before injection) with 5% topical lidocaine-prilocaine emulsion (EMLA® cream or spray) decreases the pain of vaccination among infants by causing superficial anesthesia (74,75). Preliminary evidence indicates that
response to MMR (76). Topical lidocaine-prilocaine emulsion should not be used on infants aged <12 months who are receive agents because of the possible development of methemoglobinemia (77). Acetaminophen has been used among children to r vaccination (78). However, acetaminophen can cause formation of methemoglobin and, thus, might interact with lidocaine-p Ibuprofen or other nonaspirin analgesic can be used, if necessary. Use of a topical refrigerant (vapocoolant) spray can reduce and can be as effective as lidocaine-prilocaine cream (79). Administering sweet-tasting fluid orally immediately before injec among certain infants.

**Nonstandard Vaccination Practices**

Recommendations regarding route, site, and dosage of immunobiologics are derived from data from clinical trials, from prac considerations. ACIP strongly discourages variations from the recommended route, site, volume, or number of doses of any variation from the recommended route and site can result in inadequate protection. The immunogenicity of hepatitis B vac the gluteal rather than the deltoid site is used for administration (53,59). Hepatitis B vaccine administered intradermally can site of hepatitis B surface antibody than when administered by the deltoid intramuscular route (80,81). Doses of rabies vaccine at counted as valid doses and should be repeated. Hepatitis B vaccine administered by any route or site other than intramuscular should not be counted as valid and should be repeated, unless serologic testing indicates that an adequate response has been ; Live attenuated parenteral vaccines (e.g., MMR, varicella, or yellow fever) and certain inactivated vaccines (e.g., IPV, pne recommended by the manufacturers to be administered by subcutaneous injection. Pneumococcal polysaccharide and IPV an subcutaneous administration. Response to these vaccines probably will not be affected if the vaccines are administered by th. Repeating doses of vaccine administered by the intramuscular route rather than by the subcutaneous route is unnecessary. Administering volumes smaller than those recommended (e.g., split doses) can result in inadequate protection. Using larger t because of excessive local or systemic concentrations of antigens or other vaccine constituents. Using multiple reduced dose using smaller divided doses is not endorsed or recommended. Any vaccination using less than the standard dose should not b according to age, unless serologic testing indicates that an adequate response has been achieved.

**Preventing Adverse Reactions**

Vaccines are intended to produce active immunity to specific antigens. An adverse reaction is an untoward effect that occurs vaccine's primary purpose of producing immunity. Adverse reactions also are called vaccine side effects.

All vaccines might cause adverse reactions (82). Vaccine adverse reactions are classified by three general categories: local, s the least severe and most frequent. Systemic reactions (e.g., fever) occur less frequently than local reactions. Serious allergic and least frequent. Severe adverse reactions are rare.

The key to preventing the majority of serious adverse reactions is screening. Every person who administers vaccines should precautions to the vaccine before it is administered (Table 5). Standardized screening questionnaires have been developed an programs and other sources (e.g., the Immunization Action Coalition at [http://www.immunize.org](http://www.immunize.org) [accessed October 31, 2001].

Severe allergic reactions after vaccination are rare. However, all physicians and other health-care providers who administer a emergency management of a person who experiences an anaphylactic reaction. All vaccine providers should be familiar with cardiopulmonary resuscitation.

Syncope (vasovagal or vasodepressor reaction) can occur after vaccination, most commonly among adolescents and young a reports to the Vaccine Adverse Event Reporting system were coded as syncope. Forty percent of these episodes were report unpublished data, 2001). Approximately 12% of reported syncopal episodes resulted in hospitalization because of injury or n fractures and cerebral bleeding, have been reported to result from syncopal episodes after vaccination. A published review of syncopal episodes occurred ≤5 minutes after vaccination, and 89% occurred within 15 minutes after vaccination (83). Although allergic reactions are rare, certain vaccination specialists recommend that persons be observed for 15–20 minutes after being patients should be observed until the symptoms resolve.

**Managing Acute Vaccine Reactions**

Although rare after vaccination, the immediate onset and life-threatening nature of an anaphylactic reaction require that pers capable of providing initial care for suspected anaphylaxis. Epinephrine and equipment for maintaining an airway should be Anaphylaxis usually begins within minutes of vaccine administration. Rapidly recognizing and initiating treatment are requi cardiovascular collapse. If flushing, facial edema, urticaria, itching, swelling of the mouth or throat, wheezing, difficulty b: patient should be placed in a recumbent position with the legs elevated. Aqueous epinephrine (1:1000) should be administer (84). A dose of diphenhydramine hydrochloride might shorten the reaction, but it will have little immediate effect. Maintena be necessary. Arrangements should be made for immediate transfer to an emergency facility for further evaluation and treatn

**Occupational Safety Regulations**

Bloodborne diseases (e.g., hepatitis B and C and human immunodeficiency virus [HIV]) are occupational hazards for health-incidence of needle-stick injuries among health-care workers and the consequent risk for bloodborne diseases acquired from Act was signed into law. The act directed the Occupational Safety and Health Administration (OSHA) to strengthen its exi standards were revised and became effective in April 2001 (66). These federal regulations require that safer injection devices (injectors) be used for parenteral vaccination in all clinical settings when such devices are appropriate, commercially availabl
Tuberculosis disease is not a contraindication to vaccination, unless the person is moderately or severely ill. Although no study has been reported that inactivated vaccines, polysaccharide vaccines, recombinant, or subunit vaccines, or toxoids interfere with response to PPD.

Mucosally administered live attenuated virus vaccines (e.g., OPV and intranasally administered influenza vaccine) are unlikely to affect PPD reactivity. However, some data indicate that the administration of varicella vaccine, against herpesviruses (e.g., acyclovir or valacyclovir) might reduce the efficacy of live attenuated varicella vaccine. These drugs should be discontinued if possible.

Antiviral drugs used for treatment or prophylaxis of influenza virus infections have no effect on the response to inactivated influenza vaccine (e.g., influenza A and B and trivalent products). To minimize this effect, administering Ty21a typhoid vaccine within 72 hours will delay receipt of the vaccine.

Failure to adhere to recommended specifications for storage and handling of immunobiologics can reduce potency, resulting in anergic states. Recommendations included in product’s package insert, including reconstitution of the vaccine, should be followed. Responsibility of all parties from the time the vaccine is manufactured until administration. All vaccines should be inspected to ensure that the cold chain has been maintained. Vaccines should continue to be stored at recommended temperatures until the expiration date. All other vaccines are sensitive to freezing. Mishandled vaccines can be administered inadvertently, they should not be counted as valid doses and should be repeated, unless set Live attenuated virus vaccines should be administered promptly after reconstitution. Varicella vaccine must be administered vaccine must be used ≤1 hour after reconstitution. MMR vaccine must be administered ≤8 hours after reconstitution. If not a after reconstitution, the vaccine must be discarded.

Storage and Handling of Immunobiologics

Concurrently Administering Antimicrobial Agents and Vaccines

With limited exceptions, using an antibiotic is not a contraindication to vaccination. Antimicrobial agents have no effect on certain live oral vaccines (e.g., typhoid vaccine). Unless reconstitution of the vaccine, should be followed carefully. Vaccine quality is the shared responsibility of all parties from the time the vaccine is manufactured until administration.

Concurrently administering antimicrobial agents until ≥24 hours after any antibiotic dose (e.g., 2 hours after reconstitution). If not administered within these prescribed time periods, the vaccine will delay receipt of the vaccine.

Antimalarial drug mefloquine (Lariam® [manufactured by Roche Laboratories, Inc.]) could affect the immune response to oral Ty21a typhoid vaccine if both are taken simultaneously (89,90). To minimize this effect, administering Ty21a typhoid vaccine ≥24 hours before or after a dose of mefloquine may be possible.

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Tuberculosis Screening and Skin Test Reactivity

Measles illness, severe acute or chronic infections, HIV infection, and malnutrition can create an anergic state during which the purified protein derivative (PPD) skin test might give a false negative reaction (91–93). Although any live attenuated measles vaccine degree of suppression is probably less than that occurring from acute infection from wild measles virus. Although routine PPD recommended, PPD screening is sometimes needed at the same time as administering a measles-containing vaccine (e.g., for health reasons), and the following options should be considered:

- PPD and measles-containing vaccine can be administered at the same visit (preferred option). Simultaneously administering does not interfere with reading the PPD result at 48–72 hours and ensures that the person has received measles vaccine.
- If the measles-containing vaccine has been administered recently, PPD screening should be delayed ≥4 weeks after remove the concern of any theoretical but transient suppression of PPD reactivity from the vaccine.
- PPD screening can be performed and read before administering the measles-containing vaccine. This option is the least favored.

No data exist for the potential degree of PPD suppression that might be associated with other parenteral live attenuated virus vaccines. Nevertheless, in the absence of data, following guidelines for measles-containing vaccine when scheduling PPD screening as virus vaccines is prudent. If a risk exists that the opportunity to vaccinate might be missed, vaccination should not be delayed. Mucosally administered live attenuated virus vaccines (e.g., OPV and intranasally administered influenza vaccine) are unlike been reported that inactivated vaccines, polysaccharide vaccines, recombinant, or subunit vaccines, or toxoids interfere with PPD reactivity in the absence of tuberculosis disease is not a contraindication to administration of any vaccine, including par Tuberculosis disease is not a contraindication to vaccination, unless the person is moderately or severely ill. Although no stu
persons with untreated tuberculosis, a theoretical basis exists for concern that measles vaccine might exacerbate tuberculosis persons with untreated active tuberculosis, initiating antituberculosis therapy is advisable (6). Ruling out concurrent immunodeficiency (HIV infection) before administering live attenuated vaccines is also prudent.

**Severe Allergy to Vaccine Components**

Vaccine components can cause allergic reactions among certain recipients. These reactions can be local or systemic and can manifest as anaphylactic-like responses (e.g., generalized urticaria or hives, wheezing, swelling of the mouth and throat, difficulty breathing) or be caused by the vaccine antigen, residual animal protein, antimicrobial preservatives, stabilizers, or other vaccine components, their use, and the vaccines that contain each component has been published (95) and is also available from the website at [http://www.cdc.gov/nip](http://www.cdc.gov/nip) (accessed October 31, 2001).

The most common animal protein allergen is egg protein, which is found in vaccines prepared by using embryonated chicken eggs. Ordinarily, persons who are able to eat eggs or egg products safely can receive these vaccines; persons with histories of anaphylactic egg protein reactions should not be administered these vaccines. Asking persons if they can eat eggs without adverse effects is a reasonable way to determine who might be at risk for adverse effects is a reasonable way to determine who might be at risk for allergic reactions from receiving yellow fever and influenza vaccines. A regimen for administering influenza vaccine to children with egg protein allergy is a contact dermatitis, a manifestation of a delayed type (cell-mediated) immune response, rather than anaphylaxis.

Latex is processed to form natural rubber latex and dry natural rubber. Dry natural rubber and natural rubber latex might contain the same plant impurities. Natural rubber latex is used to produce medical gloves, catheters, and other products. Dry natural rubber and natural rubber latex are used in medical gloves, syringes, and intravenous tubing. Synthetic rubber and synthetic latex also are used in medical gloves, syringes, and intravenous tubing. Synthetic rubber and synthetic latex do not contain natural rubber or natural latex, and therefore, do not contain the impurities linked to allergenicity. The most common type of latex sensitivity is contact-type (type 4) allergy, usually as a result of prolonged contact with latex procedure--associated latex allergies among patients with diabetes has been described (111--113). Allergic reactions include contact urticaria or hives, swelling of the mouth and throat, difficulty breathing, hypotension, and shock. Allergic reactions to neomycin is not a contraindication for administration of these vaccines.

Thimerosal is an organic mercurial compound in use since the 1930s and added to certain immunobiologic products as a preservative. Thimerosal usually consists of local delayed type hypersensitivity reactions (105--107). Thimerosal elicits positive delayed type hypersensitivity reactions in 1% of persons tested, but these tests have limited or no clinical relevance (108,109). The majority of patients do not experience reactions even when patch or intradermal tests for thimerosal indicate hypersensitivity (109). A localized or delayed type hypersensitivity reaction is a reasonable way to determine who might be at risk for allergic reactions from receiving yellow fever and influenza vaccines. A regimen for administering influenza vaccine to children with egg protein allergy is a contact dermatitis, a manifestation of a delayed type (cell-mediated) immune response, rather than anaphylaxis.

**Latex Allergy**

Latex is liquid sap from the commercial rubber tree. Latex contains naturally occurring impurities (e.g., plant proteins and peptidases), which are believed to be responsible for allergic reactions. Latex is processed to form natural rubber latex and dry natural rubber. Dry natural rubber and natural rubber latex but in lesser amounts. Natural rubber latex is used to produce medical gloves, catheters, and other products. Dry natural rubber and natural rubber latex are used in medical gloves, syringes, and intravenous tubing. Synthetic rubber and synthetic latex also are used in medical gloves, syringes, and intravenous tubing. Synthetic rubber and synthetic latex do not contain natural rubber or natural latex, and therefore, do not contain the impurities linked to allergenicity. The most common type of latex sensitivity is contact-type (type 4) allergy, usually as a result of prolonged contact with latex procedure--associated latex allergies among patients with diabetes has been described (111--113). Allergic reactions include contact urticaria or hives, swelling of the mouth and throat, difficulty breathing, hypotension, and shock. Allergic reactions to neomycin is not a contraindication for administration of these vaccines.

**Vaccination of Premature Infants**

In the majority of cases, infants born prematurely, regardless of birth weight, should be vaccinated at the same chronological age as term infants. The only vaccine not recommended for premature infants is the hepatitis B vaccine for infants born to HBsAg-positive mothers. The most common type of latex sensitivity is contact-type (type 4) allergy, usually as a result of prolonged contact with latex procedure--associated latex allergies among patients with diabetes has been described (111--113). Allergic reactions include contact urticaria or hives, swelling of the mouth and throat, difficulty breathing, hypotension, and shock. Allergic reactions to neomycin is not a contraindication for administration of these vaccines.

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precautions as full-term infants and children. Birth weight and size are not factors in deciding whether to postpone routine vaccination (115–117), except for hepatitis B vaccine. The full recommended dose of each vaccine should be used. Divided or reduced doses are not recommended. Studies demonstrate that decreased seroconversion rates might occur among certain premature infants with low birth weights (119). However, by chronological age 1 month, all premature infants, regardless of initial birth weight, should be given the full recommended dose.

A premature infant born to HBsAg-positive mothers and mothers with unknown immunization status should be vaccinated against hepatitis B at birth (120–122). A premature infant born to HBsAg-positive mothers and mothers with unknown immunization status should be vaccinated against hepatitis B at birth. If these infants are not immunized or only partially immunized against tetanus, they should complete the primary series with three additional doses of hepatitis B vaccine at 1 month age. The optimal timing of the first dose of hepatitis B vaccine for premature infants of HBsAg-negative mothers has not been determined. However, these infants can receive the first dose of the hepatitis B vaccine series at chronological age 1 month before discharge if medically stable. If they are not immunized or only partially immunized against tetanus, they should complete the primary series (124–126).

Although live vaccines multiply within the mother's body, the majority have not been demonstrated to be excreted in human milk. The virus usually does not infect the infant. If infection does occur, it is well-tolerated because the virus is inactivated in milk. However, breast milk and vaccine antigens may be transmitted from mother to infant during breastfeeding. Breastfeeding can enhance the response to certain vaccine antigens (127). Routine breastfeeding is also recommended for mothers (128,129). Benefits of vaccinating pregnant women usually outweigh potential risks because no evidence exists of risk from vaccinating pregnant women with vaccines (130). Td toxoid is indicated routinely for pregnant women. Previously vaccinated pregnant women who have received a Td vaccination within the last 10 years should receive a Td booster dose. Pregnant women who are not immunized or partially immunized against tetanus should complete the primary series (131). Women who have medical conditions that increase their risk for complications of influenza season, regardless of the stage of pregnancy, should receive routine influenza vaccination (132).

Breast-Feeding and Vaccination

Neither inactivated nor live vaccines administered to a lactating woman affect the safety of breastfeeding for mothers or infants. Immunization and is not a contraindication for any vaccine. Limited data indicate that breastfeeding can enhance the response to certain vaccines (133,134). Breastfeeding can enhance the response to certain vaccine antigens. Routine breastfeeding is also recommended for mothers (128,129). Benefits of vaccinating pregnant women usually outweigh potential risks because no evidence exists of risk from vaccinating pregnant women with vaccines (130). Td toxoid is indicated routinely for pregnant women. Previously vaccinated pregnant women who have received a Td vaccination within the last 10 years should receive a Td booster dose. Pregnant women who are not immunized or partially immunized against tetanus should complete the primary series (131). Women who have medical conditions that increase their risk for complications of influenza season, regardless of the stage of pregnancy, should receive routine influenza vaccination (132).

Vaccination During Pregnancy

Risk to a developing fetus from vaccination of the mother during pregnancy is primarily theoretical. No evidence exists of risk to the fetus from inactivated virus or bacterial vaccines or toxoids (128,129). Benefits of vaccinating pregnant women usually outweigh potential risks because no evidence exists of risk from vaccinating pregnant women with vaccines (130). Hepatitis B virus infection (132). Hepatitis A, pneumococcal polysaccharide, and meningococcal polysaccharide vaccines also pose no risk for mothers who are breastfeeding or for their infants (133,134). Vaccine recommendations for pregnant women who are at risk for exposure to wild-type poliovirus infection (4). Hepatitis B virus infection (132). Hepatitis A, pneumococcal polysaccharide, and meningococcal polysaccharide vaccines also pose no risk for mothers who are breastfeeding or for their infants (133,134). Vaccine recommendations for pregnant women who are at risk for exposure to wild-type poliovirus infection (4). Hepatitis B virus infection (132). Hepatitis A, pneumococcal polysaccharide, and meningococcal polysaccharide vaccines also pose no risk for mothers who are breastfeeding or for their infants (133,134). Vaccine recommendations for pregnant women who are at risk for exposure to wild-type poliovirus infection (4). Hepatitis B virus infection (132). Hepatitis A, pneumococcal polysaccharide, and meningococcal polysaccharide vaccines also pose no risk for mothers who are breastfeeding or for their infants (133,134). Vaccine recommendations for pregnant women who are at risk for exposure to wild-type poliovirus infection (4). Hepatitis B virus infection (132). Hepatitis A, pneumococcal polysaccharide, and meningococcal polysaccharide vaccines also pose no risk for mothers who are breastfeeding or for their infants (133,134). Vaccine recommendations for pregnant women who are at risk for exposure to wild-type poliovirus infection (4). Hepatitis B virus infection (132). Hepatitis A, pneumococcal polysaccharide, and meningococcal polysaccharide vaccines also pose no risk for mothers who are breastfeeding or for their infants (133,134).
those used in other countries include the vaccines administered, the recommended ages of administration, and the number an
Data are inconclusive regarding the extent to which an internationally adopted child's immunization record reflects the child' administration of MMR vaccine when only single-antigen measles vaccine was administered. A study of children adopted fr Eastern Europe determined that only 39% (range: 17%-88% by country) of children with documentation of ≥3 doses of DTI diphtheria and tetanus antitoxin (142). However, antibody testing was performed by using a hemagglutination assay, which t directly be compared with antibody concentration (143). Another study measured antibody to diphtheria and tetanus toxins a received ≥2 doses of DTP. The majority of the children were from Russia, Eastern Europe, and Asian countries, and 78% ha Overall, 94% had evidence of protection against diphtheria (EIA > 0.1 IU/mL). A total of 84% had protection against tetanus > 0.5 IU/mL). Among children without protective tetanus antitoxin concentration, all except one had records of ≥3 doses of ≥ concentrations were categorized as indeterminate (ELISA = 0.05–0.49 IU/mL) (144). Reasons for the discrepant findings in laboratory methodologies; the study using a hemagglutination assay might have underestimated the number of children who standardized methodologies are needed. Data are likely to remain limited for countries other than the People's Republic of CI limited number of adoptees from other countries.
Physicians and other health-care providers can follow one of multiple approaches if a question exists regarding whether vacc were immunogenic. Repeating the vaccinations is an acceptable option. Doing so is usually safe and avoids the need to obt unnecessary injections is desired, judicious use of serologic testing might be helpful in determining which immunizations are possible approaches to evaluation and revaccination for each vaccine recommend universally for children in the United Sts

**MMR Vaccine**
The simplest approach to resolving concerns regarding MMR immunization among internationally adopted children is to rev depending on the child's age. Serious adverse events after MMR vaccinations are rare (6). No evidence indicates that admin adverse reactions among persons who are already immune to measles, mumps, or rubella as a result of previous vaccination i vaccine administered before the first birthday should not be counted as part of the series (6). Alternatively, serologic testing i viruses indicated on the vaccination record can be considered. Serologic testing is widely available for measles and rubella i receipt of monovalent measles or measles-rubella vaccine at age ≥1 year and who has protective antibody against measles an age-appropriate to ensure protection against mumps (and rubella if measles vaccine alone had been used). If a child whose re has a protective concentration of antibody to measles, no additional vaccination is needed unless required for school entry.

**Hib Vaccine**
Serologic correlates of protection for children vaccinated ≥2 months previously might be difficult to interpret. Because the ni decreases with age and adverse events are rare (24), age-appropriate vaccination should be provided. Hib vaccination is not r years.

**Hepatitis B Vaccine**
Serologic testing for HBsAg is recommended for international adoptees, and children determined to be HBsAg-positive sho disease. Household members of HBsAg-positive children should be vaccinated. A child whose records indicate receipt of ≥3 and additional doses are not needed if ≥1 doses were administered at age ≥6 months. Children who received their last hepatitis receive an additional dose at age ≥6 months. Those who have received <3 doses should complete the series at the recommended

**Poliovirus Vaccine**
The simplest approach is to revaccinate internationally adopted children with IPV according to the U.S. schedule. Adverse e appropriately vaccinated with three doses of OPV in economically developing countries might have suboptimal seroconverters Serologic testing for neutralizing antibody to poliovirus types 1, 2, and 3 can be obtained commercially and at certain state h protective titers against all three types do not need revaccination and should complete the schedule as age-appropriate. Altert dose of IPV is excellent among children who previously received OPV (2), a single dose of IPV can be administered initially

**DTaP Vaccine**
Vaccination providers can revaccinate a child with DTaP vaccine without regard to recorded doses; however, one concern re increased rates of local adverse reactions after the fourth and fifth doses of DTP or DTaP (42). If a revaccination approach is serologic testing for specific IgG antibody to tetanus and diphtheria toxins can be measured before administering additional ( further doses are unnecessary and subsequent vaccination should occur as age-appropriate. No established serologic correlate For a child whose record indicates receipt of ≥3 doses of DTP or DTaP, serologic testing for specific IgG antibody to both di is a reasonable approach. If a protective concentration is present, recorded doses can be considered valid, and the vaccinator Indeterminate antibody concentration might indicate immunologic memory but antibody waning; serology can be repeated a wishes to avoid revaccination with a complete series.

Alternatively, for a child whose records indicate receipt of ≥3 doses, a single booster dose can be administered, followed by se antibody to both diphtheria and tetanus toxins. If a protective concentration is obtained, the recorded doses can be consider age-appropriate. Children with indeterminate concentration after a booster dose should be revaccinated with a complete seri

**Varicella Vaccine**
Varicella vaccine is not administered in the majority of countries. A child who lacks a reliable medical history regarding pric
appropriate (8).

**Pneumococcal Vaccines**

Pneumococcal conjugate and pneumococcal polysaccharide vaccines are not administered in the majority of countries and should be considered for persons on maintenance IGIV therapy who are exposed to measles or varicella vaccine virus (6,138). MMR and varicella vaccines should be administered to susceptible household and other close contacts of immunocompromised patients (138,158).

Inactivated, recombinant, subunit, polysaccharide, and conjugate vaccines and toxoids can be administered to all immunocompromised persons. If indicated, all inactivated vaccines are recommended for immunocompromised persons in usual doses and schedules. In addition, pneumococcal, meningococcal, and Hib vaccines are recommended specifically for certain groups of immunocompromised persons with hypogammaglobulinemia (138,161). Except for influenza vaccine, which should be administered annually (88), vaccination during chemotherapy or radiation therapy is suboptimal. Patients vaccinated while receiving immunosuppressive therapy or in the 2 weeks before starting therapy should be revaccinated ≥3 months after therapy is discontinued. Patients with leukemia in remission whose chemotherapy has been terminated may be vaccinated (138,160).

**Corticosteroids**

The exact amount of systemically absorbed corticosteroids and the duration of administration needed to suppress the immune response have been reported among persons receiving corticosteroid therapy by aerosol, and such therapy is not a reason to defer vaccination. HSCT recipients are at increased risk for certain vaccine-preventable diseases (e.g., tetanus, poliovirus, measles, mumps, rubella, and encapsulated bacteria) autologous HSCT if the recipient is not revaccinated (163--167). HSCT recipients are at increased risk for certain vaccine-pr
encapsulated bacteria (i.e., pneumococcal and Hib infections). As a result, HSCT recipients should be routinely revaccinated transplanted stem cells. Revaccination with inactivated, recombinant, subunit, polysaccharide, and Hib vaccines should begin this recommendation is for influenza vaccine, which should be administered at ≥6 months after HSCT and annually for the liv should be administered 24 months after transplantation if the HSCT recipient is presumed to be immunocompetent. Varicella vaccines are not recommended for HSCT recipients because of insufficient experience using these vaccines among HSCT rec contacts of HSCT recipients and health-care workers who care for HSCT recipients, should be appropriately vaccinated, incl Additional details of vaccination of HSCT recipients and their contacts can be found in a specific CDC report on this topic (4)

Vaccinating Persons with Bleeding Disorders and Persons Receiving Anticoagulant Therapy

Persons with bleeding disorders (e.g., hemophilia) and persons receiving anticoagulant therapy have an increased risk for ace general population of acquiring other vaccine-preventable diseases. However, because of the risk for hematomata formation of avoided among persons with bleeding disorders by using the subcutaneous or intradermal routes for vaccines that are admin

Hepatitis B vaccine administered intramuscularly to 153 persons with hemophilia by using a 23-gauge needle, followed by s resulted in a 4% bruising rate with no patients requiring factor supplementation (168). Whether antigens that produce more l equally low rate of bruising is unknown.

When hepatitis B or any other intramuscular vaccine is indicated for a patient with a bleeding disorder or a person receiving administered intramuscularly if, in the opinion of a physician familiar with the patient's bleeding risk, the vaccine can be adn the patient receives antihemophilia or similar therapy, intramuscular vaccinations can be scheduled shortly after such therapy should be used for the vaccination and firm pressure applied to the site, without rubbing, for ≥2 minutes. The patient or fami hematomata from the injection.

Vaccination Records

Consent to Vaccinate

The National Childhood Vaccine Injury Act of 1986 (42 U.S.C. § 300aa-26) requires that all health-care providers in the Uni the act[4] must provide a copy of the relevant, current edition of the vaccine information materials that have been produced by vaccine. The vaccine information material must be provided to the parent or legal representative of any child or to any adult provider intends to administer the vaccine. The Act does not require that a signature be obtained, but documentation of conso local authorities.

Provider Records

Documentation of patient vaccinations helps ensure that persons in need of a vaccine receive it and that adequately vaccinate increasing the risk for local adverse events (e.g., tetanus toxoid). Serologic test results for vaccine-preventable diseases (e.g., documented episodes of adverse events also should be recorded in the permanent medical record of the vaccine recipient.

Health-care providers who administer vaccines covered by the National Childhood Vaccine Injury Act are required to ensure recipient (or a permanent office log or file) indicates the date the vaccine was administered, the vaccine manufacturer, the va of the person administering the vaccine. Additionally, the provider is required to record the edition date of the vaccine inform materials were provided. Regarding this Act, the term health-care provider is defined as any licensed health-care profession public (including federal, state, and local departments and agencies), under whose authority a specified vaccine is administer be kept for all vaccines, not just for those required by the National Childhood Vaccine Injury Act.

Patients' Personal Records

Official immunization cards have been adopted by every state, territory, and the District of Columbia to encourage uniformit immunization status by schools and child care centers. The records also are key tools in immunization education programs ai of the need for vaccines. A permanent immunization record card should be established for each newborn infant and maintain these cards are distributed to new mothers before discharge from the hospital. Using immunization record cards for adolesc:

Registries

Immunization registries are confidential, population-based, computerized information systems that collect vaccination data geographic area. Registries are a critical tool that can increase and sustain increased vaccination coverage by consolidating v providers, generating reminder and recall vaccination notices for each child, and providing official vaccination forms and va operational immunization registry also can prevent duplicate vaccinations, limit missed appointments, reduce vaccine waste, locate immunization records or certificates. The National Vaccine Advisory Committee strongly encourages development of systems and recommends that vaccination providers participate in these registries whenever possible (170,171). A 95% parti operational population-based immunization registries is a national health objective for 2010 (172).

Reporting Adverse Events After Vaccination

Modern vaccines are safe and effective; however, adverse events have been reported after administration of all vaccines (82) reactions to extremely rare, severe, systemic illness (e.g., encephalopathy). Establishing evidence for cause-and-effect relati alone is impossible because temporal association alone does not necessarily indicate causation. Unless the syndrome that occ pathologically distinctive, more detailed epidemiologic studies to compare the incidence of the event among vaccines with t
often necessary. Reporting adverse events to public health authorities, including serious events, is a key stimulus to develop association with vaccination. More complete information regarding adverse reactions to a specific vaccine can be found in the specific statement on vaccine adverse reactions. The National Childhood Vaccine Injury Act requires health-care providers to report selected events occurring after vaccination. Events for which reporting is required appear in the Vaccine Injury Table. Persons other than health-care providers can report adverse events other than those that must be reported or that occur after administration of vaccines not covered by unusual, also should be reported to VAERS, even if the physician or other health-care provider is uncertain they are related. Available information in the FDA Drug Bulletin, by calling the 24-hour VAERS Hotline at 800-822-7967, or from the VAERS website at 2001.

**Vaccine Injury Compensation Program**

The National Vaccine Injury Compensation Program, established by the National Childhood Vaccine Injury Act, is a no-fault program. Health-care providers must report selected events occurring after vaccination to the Vaccine Adverse Event Reporting System (VAERS). Adverse events other than those that must be reported or that occur after administration of vaccines not covered by unusual, also should be reported to VAERS, even if the physician or other health-care provider is uncertain they are related. Successful claimants receive a legal presumption of causation if a condition listed in the table is proven, thus avoiding the need for proof of causation. Injuries after administration of vaccines not listed in the table are not eligible for compensation through the program. Additional information is available from the following:

- National Vaccine Injury Compensation Program
- Health Resources and Services Administration
- Parklawn Building, Room 8-46
- 5600 Fishers Lane
- Rockville, MD 20857
- Telephone: 800-338-2382 (24-hour recording)

Persons wishing to file a claim for vaccine injury should call or write the following:

- U.S. Court of Federal Claims
- 717 Madison Place, N.W.
- Washington, D.C. 20005
- Telephone: 202-219-9657

**Benefit and Risk Communication**

Parents, guardians, legal representatives, and adolescent and adult patients should be informed regarding the benefits and risks of vaccination. Opportunity for questions should be provided before each vaccination. Discussion of the benefits and risks of vaccination is often necessary. Reporting adverse events to public health authorities, including serious events, is a key stimulus to develop association with vaccination. More complete information regarding adverse reactions to a specific vaccine can be found in the specific statement on vaccine adverse reactions. The National Childhood Vaccine Injury Act requires health-care providers to report selected events occurring after vaccination. Events for which reporting is required appear in the Vaccine Injury Table. Persons other than health-care providers can report adverse events other than those that must be reported or that occur after administration of vaccines not covered by unusual, also should be reported to VAERS, even if the physician or other health-care provider is uncertain they are related. Available information in the FDA Drug Bulletin, by calling the 24-hour VAERS Hotline at 800-822-7967, or from the VAERS website at 2001.

The program relies on a Vaccine Injury Table listing the vaccines covered by the program as well as the injuries, disabilities, and compensations that might be awarded. The table defines the time during which a symptom or substantial aggravation must appear after vaccination. The program became operational on October 1, 1988, to minimize the need to prove actual causation in an individual case.

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Health-care providers should anticipate that certain parents or patients will question the need for or safety of vaccination, refusals, and risks of vaccines in understandable language. The program, which became operational on October 1, 1988, is intended to avoid the need to prove actual causation in an individual case. The program, which became operational on October 1, 1988, is intended to avoid the need to prove actual causation in an individual case.

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Each person understands and reacts to vaccine information on the basis of different factors, including prior experience, education, presentation, perceptions of the risk for disease, perceived ability to control those risks, and their risk preference. Increasingly, through the media and nonauthoritative Internet sites, decisions regarding risk are based on inaccurate information. Only through direct dialogue with parents and by using a preventive approach, acceptances of media reports and information from nonauthoritative Internet sites as scientific fact. When a parent or patient initiates discussion regarding a vaccine controversy, the health-care professional should discuss the information, using language that is appropriate. Effective, empathetic vaccine risk communication is essential in responding recognizing that for certain persons, risk assessment and decision-making is difficult and confusing. 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strategy is to identify common ground and discuss measures that need to be followed if the patient's decision is to defer vacc points regarding each vaccine, including safety, and emphasize risks encountered by unimmunized children. Parents should l child care entry, which might require that unimmunized children stay home from school during outbreaks. Documentation of including the refusal to receive certain vaccines (i.e., informed refusal), might reduce any potential liability if a vaccine-prev patient.

Vaccination Programs

The best way to reduce vaccine-preventable diseases is to have a highly immune population. Universal vaccination is a critic accomplished through routine and intensive vaccination programs implemented in physicians' offices and in public health cli maintained in all communities to ensure vaccination of all children at the recommended age. In addition, appropriate vaccina adults.

Physicians and other pediatric vaccination providers should adhere to the standards for child and adolescent immunization pr vaccination practices for both the public and private sectors. The standards provide guidance on practices that will result in e practices aimed at eliminating unnecessary prerequisites for receiving vaccinations, eliminating missed opportunities to vacc needs, enhancing knowledge regarding vaccinations among parents and providers, and improving the management and repor address the importance of recall and reminder systems and using assessments to monitor clinic or office vaccination coverage. Standards of practice also have been published to increase vaccination coverage among adults (2). Persons aged >65 years at them at risk for pneumococcal disease should receive ≥1 doses of pneumococcal polysaccharide vaccine. All persons aged ≥ increase the risk for complications from influenza should receive annual influenza vaccination. All adults should complete a and receive a booster dose every 10 years. Adult vaccination programs also should provide MMR and varicella vaccines who mumps, rubella, or varicella. Persons born after 1956 who are attending college (or other posthigh school educational institut place them at increased risk for measles transmission (e.g., health-care facilities), or who are traveling to areas with endemic received two doses of MMR on or after their first birthday or other evidence of immunity (6,173). All other adults born after MMR vaccine on or after their first birthday or have other evidence of immunity. No evidence indicates that administering M reactions among persons who are already immune to measles, mumps, or rubella as a result of previous vaccination or disea encouraged for all persons who might be at increased risk (e.g., adolescents and adults who are either in a group at high risk - drug use, teenage pregnancy, or sexually transmitted disease).

Every visit to a physician or other health-care provider can be an opportunity to update a patient's immunization status with r should take necessary steps, including developing and enforcing school immunization requirements, to ensure that students a child care centers are protected against vaccine-preventable diseases. Agencies also should encourage institutions (e.g., hosp policies regarding the appropriate vaccination of patients, residents, and employees (173).

Dates of vaccination (day, month, and year) should be recorded on institutional immunization records (e.g., those kept in sch facilitate assessments that a primary vaccination series has been completed according to an appropriate schedule and that nee appropriate time.

The independent, nonfederal Task Force on Community Preventive Services (the Task Force) gives public health decision-m interventions to promote health and prevent disease, injury, disability, and premature death. The recommendations are based regarding effectiveness and cost-effectiveness of these interventions. In addition, the Task Force identifies critical informant interventions, as well as the applicability to specific populations and settings and the potential barriers to implementation. Th http://www.thecommunityguide.org (accessed November 7, 2001).

Beginning in 1996, the Task Force systematically reviewed published evidence on the effectiveness and cost-effectiveness o: coverage of vaccines recommended for routine use among children, adolescents, and adults. A total of 197 articles were iden inclusion criteria, and were published during 1980--1997. Reviews of 17 specific interventions were published in 1999 (174-Force made recommendations regarding the use of these interventions (177). A number of interventions were identified and i The interventions and the recommendations are summarized in this report (Table 7).

Vaccine Information Sources

In addition to these general recommendations, other sources are available that contain specific and updated vaccine informat

National Immunization Information Hotline

The National Immunization Information Hotline is supported by CDC's National Immunization Program and provides vacci the public, 8:00 am--11:00 pm, Monday--Friday:

Telephone (English): 800-232-2522
Telephone (Spanish): 800-232-0233
Telephone (TTY): 800-243-7889
Internet: http://www.ashastd.org (accessed November 7, 2001)

CDC's National Immunization Program
CDC's National Immunization Program website provides direct access to immunization recommendations of the Advisory Committee on Immunization Practices (ACIP), vaccination schedules, vaccine safety information, publications, provider education and training, and links to other immunization-related websites. It is located at http://www.cdc.gov/nip (accessed November 7, 2001).

**Morbidity and Mortality Weekly Report**


**American Academy of Pediatrics (AAP)**

Every 3 years, AAP issues the *Red Book: Report of the Committee on Infectious Diseases*, which contains a composite summary of AAP recommendations concerning infectious diseases and immunizations for infants, children, and adolescents.

- Telephone: 888-227-1770
- Internet: http://www.aap.org (accessed November 7, 2001)

**American Academy of Family Physicians (AAFP)**


**Immunization Action Coalition**

This source provides extensive free provider and patient information, including translations of Vaccine Information Statements. The Internet address is http://www.immunize.org (accessed November 7, 2001).

**National Network for Immunization Information**

This information source is provided by the Infectious Diseases Society of America, Pediatric Infectious Diseases Society, American Academy of Pediatrics, and other professional organizations. It provides objective, science-based information regarding vaccines for the public and providers. The Internet site is http://www.immunizationinfo.org (accessed November 7, 2001).

**Vaccine Education Center**

Located at the Children's Hospital of Philadelphia, this source provides patient and provider information. The Internet address is http://www.vaccine.chop.edu (accessed November 7, 2001).

**Institute for Vaccine Safety**

Located at Johns Hopkins University School of Public Health, this source provides information regarding vaccine safety concerns and objective, timely information to health-care providers and parents. The Internet address is http://www.vaccinesafety.edu (accessed November 7, 2001).

**National Partnership for Immunization**

This national organization encourages greater acceptance and use of vaccinations for all ages through partnerships with public and private organizations. Their Internet address is http://www.partnersforimmunization.org (accessed November 7, 2001).

**State and Local Health Departments**

State and local health departments provide technical advice through hotlines, electronic mail, and Internet sites, including print, immunization schedules, posters, and other educational materials.

**Acknowledgments**

The members of the Advisory Committee on Immunization Practices are grateful for the contributions of Margaret Hostetter Staat, M.D., Children's Hospital Medical Center of Cincinnati; Deborah Wexler, M.D., Immunization Action Coalition; and John Grabenstein, Ph.D., U.S. Army Medical Command.

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* During measles outbreaks, if cases are occurring among infants aged <12 months, measles vaccination of infants as young as 6 months can be undertaken as an outburst should not be counted as part of the series. Source: CDC. Measles, mumps, rubella and varicella vaccine use and strategies for elimination of measles, rubella, and conjugate vaccines. MMWR 1998;47(RR-8):157.

† In certain situations, local or state requirements might mandate that doses of selected vaccines be administered on or after specific ages. For example, a school entry examination before the child's first birthday. ACIP recommends that physicians and other health-care providers comply with local or state vaccination requirements w

‡ The exception is the two-dose hepatitis B vaccination series for adolescents aged 11–15 years. Only Recombivax HB® (Merck Vaccine Division) should be used in the United States.

§ Internet sites with device listings are identified for information purposes only. CDC, the U.S. Public Health Service, and the Department of Health and Human Services listed would all satisfy the needle-stick prevention regulations.
** Toxin neutralization testing is reliable but not readily available. Enzyme immunoassay tests are the most readily available, although passive hemagglutination is available. ACIP recommendations for criteria for severe immunosuppression in persons with HIV infection (Source: CDC. Measles, mumps, and rubella vaccine use and strategies for elimination of measles mumps: recommendations of the Advisory Committee on Immunization Practices [ACIP]. MMWR 1998;47[No. RR-8]:157).

†† As defined by a low age-specific total CD4+ T lymphocyte count or a low CD4+ T lymphocyte count as a percentage of total lymphocytes. ACIP recommendations for criteria for severe immunosuppression in persons with HIV infection.

§§ As of January 2002, vaccines covered by the act include diphtheria, tetanus, pertussis, measles, mumps, rubella, poliovirus, hepatitis B, Hib, varicella, and pneumococcal conjugate vaccine.

¶¶ The Vaccine Injury Table can be obtained from the Vaccine Injury Compensation Program Internet site at <http://www.hrsa.dhhs.gov/bhpr/vice/table.htm> (accessed November 7, 2001).

*** Standards for pediatric, adolescent, and adult immunization practices are being revised and will be posted on CDC’s National Immunization Program Internet site as soon as the updates are available.

### Abbreviations Used in This Publication

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>AAFP</td>
<td>American Academy of Family Physicians</td>
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<tr>
<td>AAP</td>
<td>American Academy of Pediatrics</td>
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<tr>
<td>ACIP</td>
<td>Advisory Committee on Immunization Practices</td>
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<tr>
<td>DT</td>
<td>diphtheria and tetanus toxoid</td>
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<tr>
<td>DTaP</td>
<td>diphtheria and tetanus toxoids and acellular pertussis vaccine</td>
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<tr>
<td>DTP</td>
<td>diphtheria and tetanus toxoids and whole-cell pertussis vaccine</td>
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<tr>
<td>EIA/ELISA</td>
<td>enzyme immunoassay</td>
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<tr>
<td>FDA</td>
<td>Food and Drug Administration</td>
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<tr>
<td>GBS</td>
<td>Guillain-Barré syndrome</td>
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<tr>
<td>HBIG</td>
<td>hepatitis B immune globulin</td>
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<tr>
<td>HbOC</td>
<td>diphtheria CRM&lt;sub&gt;197&lt;/sub&gt; (CRM, cross-reactive material) protein conjugate</td>
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<tr>
<td>HBsAg</td>
<td>hepatitis B surface antigen</td>
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<tr>
<td>Hib</td>
<td><em>Haemophilus influenzae</em> type b</td>
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<tr>
<td>HIV</td>
<td>human immunodeficiency virus</td>
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<tr>
<td>HSCT</td>
<td>hematopoietic stem cell transplant</td>
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<td>IgG</td>
<td>immunoglobulin G</td>
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<tr>
<td>IgIV</td>
<td>intravenous immune globulin</td>
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<tr>
<td>IPV</td>
<td>inactivated poliovirus vaccine</td>
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<tr>
<td>JIs</td>
<td>jet injectors</td>
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<tr>
<td>MMR</td>
<td>measles, mumps, rubella vaccine</td>
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<tr>
<td>OPV</td>
<td>oral poliovirus vaccine</td>
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<tr>
<td>OSHA</td>
<td>Occupational Safety and Health Administration</td>
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<tr>
<td>PCV</td>
<td>pneumococcal conjugate vaccine</td>
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Definitions Used in This Report

**Adverse event.** An untoward event that occurs after a vaccination that might be caused by the vaccine product or vaccination induced: caused by the intrinsic characteristic of the vaccine preparation and the individual response of the vaccinee; these events have a causative relationship to vaccination (e.g., vaccine-associated paralytic poliomyelitis); 2) vaccine-potentiated: would have occurred anyway, but were precipitated by the vaccination (e.g., first febrile seizure in a predisposed child); 3) programmatic error: caused by technical errors in vaccine preparation, handling, or administration of the vaccine by chance or caused by underlying illness. Special studies are needed to determine if an adverse event is a reaction or an effect of another cause (Sources: Chen RT. Special methodological issues in pharmacoepidemiology studies of vaccine safety. In: Strom BL, ed. Pharmacoepidemiology. 3rd ed. Philadelphia: Lippincott-Raven, 1999:287–90).

**Adverse reaction.** An undesirable medical condition that has been demonstrated to be caused by a vaccine. Evidence for the randomized clinical trials, controlled epidemiologic studies, isolation of the vaccine strain from the pathogenic site, or recurrence (i.e., rechallenge); synonyms include side effect and adverse effect.

**Immunobiologic.** Antigenic substances (e.g., vaccines and toxoids) or antibody-containing preparations (e.g., globulins and antitoxins) that are used for active or passive immunization or therapy. The following are examples of immunobiologics:

- **Vaccines.** A suspension of live (usually attenuated or inactivated microorganisms (e.g., bacteria or viruses) or fractions thereof in a sterile solution containing antibodies, which are usually obtained from human blood. It is obtained from large pools of blood plasma and contains 15%–18% protein. Intended for intramuscular administration, immune globulin maintenance of immunity among certain immunodeficient persons and for passive protection against measles and hepatitis B; others have antigens that are complex or incompletely defined (e.g., killed and inactivated B. pertussis or the surface antigen of hepatitis B); others have antigens that are complex or incompletely defined (e.g., killed and inactivated B. pertussis or the surface antigen of hepatitis B).
- **Toxoids.** A modified bacterial toxin that has been made nontoxic, but retains the ability to stimulate the formation of immunity. A sterile solution containing antibodies, which are usually obtained from human blood. It is obtained from large pools of blood plasma and contains 15%–18% protein. Intended for intramuscular administration, immune globulin maintenance of immunity among certain immunodeficient persons and for passive protection against measles and hepatitis B.
- **Intravenous immune globulin.** A product derived from blood plasma from a donor pool similar to the immune globulin pool suitable for intravenous use. Intravenous immune globulin is used primarily for replacement therapy in primary anti-D. pertussis vaccination, immune thrombocytopenic purpura, hypogammaglobulinemia in chronic lymphocytic leukemia immunodeficiency virus infection (Table 2).
- **Hyperimmune globulin (specific).** Special preparations obtained from blood plasma from donor pools preselected for specific antigen (e.g., hepatitis B immune globulin, varicella-zoster immune globulin, rabies immune globulin, tetravalent immune globulin, respiratory syncytial virus immune globulin, botulism immune globulin monoclonal antibody. An antibody product prepared from a single lymphocyte clone, which contains only antibody.
- **Antitoxin.** A solution of antibodies against a toxin. Antitoxin can be derived from either human (e.g., diphtheria and botulism antitoxin). Antitoxins are used to confer passive immunity and for treatment.

**Vaccination and Immunization.** The terms *vaccine* and *vaccination* are derived from *vacca*, the Latin term for cow. *Vaccin* material used (i.e., cowpox virus) to produce immunity to smallpox. The term *vaccination* was used by Louis Pasteur in the 19th century to include the physical act of vaccinating against a disease. *Immunization* was the Latin term for cow. *Vaccination* is a more inclusive term, denoting the process of inducing or providing immunity. *Immunization* can be active or passive. *Active immunization* is the production of antibody or other immune responses through the administration of preformed antibodies. Four types of immunization processes are 1) pooled human immune globulin or intravenous immune globulin, 2) hyperimmune globulin (specific) preparations, 3) monoclonal antibody preparations, and 4) antitoxins from nonhuman sources. Although persons often use the terms *vaccination* and *immunization* interchangeably, they are not synonymous because the administration of an immunobiologic cannot be equated automatically with development of
Table 1