

AMERICAN ACADEMY OF PEDIATRICS

Committee on Infectious Diseases

Immunization of Adolescents: Recommendations of the Advisory Committee on Immunization Practices, the American Academy of Pediatrics, the American Academy of Family Physicians, and the American Medical Association

ABSTRACT. This report, concerning the immunization of adolescents (ie, persons 11 to 21 years old, as defined by the American Medical Association [AMA] and the American Academy of Pediatrics [AAP]), is a supplement to previous publications (ie, *MMWR*. 1994;43 [No. RR-1]1-38; the *AAP 1994 Red Book: Report of the Committee on Infectious Diseases; Summary of Policy Recommendations for Periodic Health Examination*, August 1996 from the American Academy of Family Physicians [AAFP]; and *AMA Guidelines for Adolescent Preventive Services [GAPS]: Recommendations and Rationale*). This report presents a new strategy to improve the delivery of vaccination services to adolescents and to integrate recommendations for vaccination with other preventive services provided to adolescents. This new strategy emphasizes vaccination of adolescents 11 to 12 years old by establishing a routine visit to their health-care providers. Specifically, the purposes of this visit are to a) vaccinate adolescents who have not been previously vaccinated with varicella virus vaccine, hepatitis B vaccine, or the second dose of the measles, mumps, and rubella (MMR) vaccine; b) provide a booster dose of tetanus and diphtheria toxoids; c) administer other vaccines that may be recommended for certain adolescents; and d) provide other recommended preventive services. The recommendations for vaccination of adolescents are based on new or current information for each vaccine. The most recent recommendations from the Advisory Committee on Immunization Practices (ACIP), AAP, AAFP, and AMA concerning specific vaccines and delivery of preventive services should be consulted for details (Exhibit 2).

ABBREVIATIONS. AMA, American Medical Association; AAP, American Academy of Pediatrics; AAFP, American Academy of Family Physicians; MMR, measles, mumps, and rubella (vaccine); ACIP, Advisory Committee on Immunization Practices; Td, tetanus and diphtheria toxoid booster; HRSA, Health Resources and Services Administration; USPSTF, United States Preventive Services Task Force; HBV, hepatitis B virus; CDC, Centers for Disease Control and Prevention; NIS, New Independent States; NHANES, National Health and Nutrition Examination Survey; HIV, human immunodeficiency virus; HAV, hepatitis A virus.

BACKGROUND

In the United States, vaccination programs that focus on infants and children have decreased the

The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

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occurrence of many childhood, vaccine-preventable diseases.¹ However, many adolescents and young adults (ie, persons 22 to 39 years old) continue to be adversely affected by vaccine-preventable diseases (eg, varicella, hepatitis B, measles, and rubella), partially because vaccination programs have not focused on improving vaccination coverage among adolescents.

These recommendations for the immunization of adolescents were developed to improve vaccination coverage among adolescents and focus on establishing a routine visit to health-care providers (ie, providers for adolescents 11 to 12 years old). Such a visit provides the opportunity for a) ensuring vaccination of those adolescents not previously vaccinated with hepatitis B vaccine, varicella virus vaccine (if indicated), or the second dose of the MMR vaccine; b) administering a tetanus and diphtheria toxoid (Td) booster; c) administering other vaccines that may be recommended for certain adolescents; and d) providing other recommended preventive services.

Flexibility in scheduling vaccinations is an important factor for improving vaccination coverage among adolescents. Because multiple-dose vaccines or simultaneous administration of several vaccines may be indicated for adolescents (Table 1), providers may need to be flexible in determining which vaccines to administer during the initial visit and which to administer on return visits.

IMMUNIZATION AS A PREVENTIVE HEALTH SERVICE FOR ADOLESCENTS

Administration of vaccinations should be integrated with other preventive services provided to adolescents. The importance of improving the vaccination levels and of providing other preventive services indicated for adolescents and young adults has been emphasized recently by many national organizations (Exhibit 1). In particular, the AAP has advocated and provided specific recommendations for the vaccination of adolescents.^{2,3} Similarly, the AMA and the Health Resources and Services Administration (HRSA) have proposed comprehensive recommendations that provide a framework for organizing the content and delivery of preventive health services (including vaccinations) for adolescents.^{4,5} The United States Preventive Services Task Force (USP-

TABLE 1.

Recommended Childhood Immunization Schedule United States, January - December 1997

Vaccines¹ are listed under the routinely recommended ages. Bars indicate range of acceptable ages for vaccination. Shaded bars indicate catch-up vaccination: at 11-12 years of age, hepatitis B vaccine should be administered to children not previously vaccinated, and Varicella vaccine should be administered to children not previously vaccinated who lack a reliable history of chickenpox.

Age Vaccine	Birth	1 mo	2 mos	4 mos	6 mos	12 mos	15 mos	18 mos	4-6 yrs	11-12 yrs	14-16 yrs
Hepatitis B ^{2,3}	Hep B-1		Hep B-2		Hep B-3					Hep B ³	
Diphtheria, Tetanus, Pertussis ⁴			DTaP or DTP	DTaP or DTP	DTaP or DTP		DTaP or DTP ⁴	DTaP or DTP ⁴	DTaP or DTP	Td	
<i>H. influenzae</i> type b ⁵			Hib	Hib	Hib ⁵		Hib ⁵				
Polio ⁶			Polio ⁶	Polio			Polio ⁶		Polio		
Measles, Mumps, Rubella ⁷							MMR		MMR ⁷ or	MMR ⁷	
Varicella ⁸							Var			Var ⁸	

Approved by the Advisory Committee on Immunization Practices (ACIP), the American Academy of Pediatrics (AAP),
and the American Academy of Family Physicians (AAFP).

¹ This schedule indicates the recommended age for routine administration of currently licensed childhood vaccines. Some combination vaccines are available and may be used whenever administration of all components of the vaccine is indicated. Providers should consult the manufacturers' package inserts for detailed recommendations.

² **Infants born to HBsAg-negative mothers** should receive 2.5 µg of Merck vaccine (Recombivax HB) or 10 µg of SmithKline Beecham (SB) vaccine (Engerix-B). The 2nd dose should be administered ≥ 1 mo after the 1st dose.

Infants born to HBsAg-positive mothers should receive 0.5 mL hepatitis B immune globulin (HBIG) within 12 hrs of birth, and either 5 µg of Merck vaccine (Recombivax HB) or 10 µg of SB vaccine (Engerix-B) at a separate site. The 2nd dose is recommended at 1-2 mos of age and the 3rd dose at 6 mos of age.

Infants born to mothers whose HBsAg status is unknown should receive either 5 µg of Merck vaccine (Recombivax HB) or 10 µg of SB vaccine (Engerix-B) within 12 hrs of birth. The 2nd dose of vaccine is recommended at 1 mo of age and the 3rd dose at 6 mos of age. Blood should be drawn at the time of delivery to determine the mother's HBsAg status; if it is positive, the infant should receive HBIG as soon as possible (no later than 1 wk of age). The dosage and timing of subsequent vaccine doses should be based upon the mother's HBsAg status.

³ Children and adolescents who have not been vaccinated against hepatitis B in infancy may begin the series during any childhood visit. Those who have not previously received 3 doses of hepatitis B vaccine should initiate or complete the series during the 11-12 year-old visit. The 2nd dose should be administered at least 1 mo after the 1st dose, and the 3rd dose should be administered at least 4 mos after the 1st dose and at least 2 mos after the 2nd dose.

⁴ DTaP (diphtheria and tetanus toxoids and acellular pertussis vaccine) is the preferred vaccine for all doses in the vaccination series, including completion of the series in

children who have received ≥1 dose of whole-cell DTP vaccine. Whole-cell DTP is an acceptable alternative to DTaP. The 4th dose of DTaP may be administered as early as 12 months of age, provided 6 months have elapsed since the 3rd dose, and if the child is considered unlikely to return at 15-18 mos of age. Td (tetanus and diphtheria toxoids, absorbed, for adult use) is recommended at 11-12 years of age if at least 5 years have elapsed since the last dose of DTP, DTaP, or DT. Subsequent routine Td boosters are recommended every 10 years.

⁵ Three *H. influenzae* type b (Hib) conjugate vaccines are licensed for infant use. If PRP-OMP (PedvaxHIB [Merck]) is administered at 2 and 4 mos of age, a dose at 6 mos is not required. After completing the primary series, any Hib conjugate vaccine may be used as a booster.

⁶ Two poliovirus vaccines are currently licensed in the US: inactivated poliovirus vaccine (IPV) and oral poliovirus vaccine (OPV). The following schedules are all acceptable by the ACIP, the AAP, and the AAFP; and parents and providers may choose among them:

1. IPV at 2 and 4 mos; OPV at 12-18 mos and 4-6 yr
2. IPV at 2, 4, 12-18 mos, and 4-6 yr
3. OPV at 2, 4, 6-18 mos, and 4-6 yr

The ACIP routinely recommends schedule 1. IPV is the only poliovirus vaccine recommended for immunocompromised persons and their household contacts.

⁷ The 2nd dose of MMR is routinely recommended at 4-6 yrs of age or at 11-12 yrs of age, but may be administered during any visit, provided at least 1 month has elapsed since receipt of the 1st dose and that both doses are administered at or after 12 months of age.

⁸ Susceptible children may receive Varicella vaccine (Var) at any visit after the first birthday, and those who lack a reliable history of chickenpox should be immunized during the 11-12 year-old visit. Children ≥ 13 years of age should receive 2 doses, at least 1 mos apart.

STF) has advocated specific vaccinations for adolescents that are based on the patient's age and risk factors.⁶ In addition, the AAFP has recommended delivery of preventive services based on reviews by USPSTF and the AAFP Commission on Clinical Policies and Research.⁷ Guidelines recommended by these organizations include the delivery of preventive health services during a series of regular visits by adolescents to providers. These services include specific guidance on health behaviors; screening for biomedical, behavioral, and emotional conditions; and delivery of other health services, including vaccinations. The recommendations for vaccination of adolescents adopted by the ACIP, AAP, AAFP, and AMA are consistent with those of other groups that promote preventive health services for adolescents.

RATIONALE FOR VACCINE ADMINISTRATION DURING AN ADOLESCENT'S VISIT TO PROVIDERS

Hepatitis B Vaccine

In the US, most persons infected with hepatitis B virus (HBV) acquired their infection as young adults or adolescents. HBV is transmitted primarily through sexual contact, injecting-drug use, regular household contact with a chronically infected person, or occupational exposure. However, the source of infection is unknown for approximately one third of persons who have acute hepatitis B.⁸

A comprehensive vaccination strategy to eliminate transmission of HBV through routine vaccination of infants, adolescents ages 11 to 12 years, and adolescents who are at increased risk for HBV infection has been adopted.^{3,7,9,10} Any reduction in HBV-related liver disease resulting from universal vaccination of infants cannot be expected until vaccinated children reach adolescence and adulthood.

Routine vaccination of adolescents 11 to 12 years old who have not been vaccinated previously is an effective strategy for more rapidly lowering the incidence of HBV infection and assisting in the elimination of HBV transmission in the US.^{3,10} An adolescent's visit at ages 11 to 12 years gives the provider an opportunity to initiate protection against HBV before the adolescent begins high-risk behaviors. Unvaccinated adolescents older than 12 years who are at increased risk for HBV infection also should be vaccinated.¹⁰ Such adolescents are at increased risk for HBV infection and should be vaccinated against hepatitis B if they a) have multiple sexual partners (ie, more than one partner in a 6-month period), b) use illegal injection drugs, c) are males who have sex with males, d) have sexual or regular household contact with a person who is positive for hepatitis B surface antigen, e) are health-care or public-safety workers who are occupationally exposed to human blood, f) are undergoing hemodialysis, g) are residents of institutions for the developmentally disabled, h) are administered clotting factors, or i) travel to an area of high or intermediate HBV endemicity for ≥6 months. In addition, the AAP recommends that providers administer hepatitis B

EXHIBIT 1. National Organizations That Advocate Preventive Services for Adolescents

Organization	Publication
Advisory Committee on Immunization Practices (ACIP)	Update on Adult Immunization ³¹
American Academy of Family Physicians (AAFP)	Summary of Policy Recommendations for Periodic Health Examination ⁷
American Academy of Pediatrics (AAP)	Recommendations for Preventive Pediatric Health Care: Committee on Practice and Ambulatory Medicine ²
American College Health Association (ACHA)	Position Statement on Immunization Policy ³²
American College of Physicians (ACP)	Guide for Adult Immunization ³³
American Medical Association (AMA)	AMA Guidelines for Adolescent Preventive Services: Recommendations and Rationale ⁴
Council of State and Territorial Epidemiologists (CSTE)	Position statement approval during Council of State and Territorial Epidemiologists Annual Meeting, Austin, Texas, May 16, 1995
Health Resources and Services Administration (HRSA) and Health Care Financing Administration (HCFA)	Bright Futures: Guidelines for Supervision of Infants, Children, and Adolescents ⁵
National Vaccine Advisory Committee (NVAC)	Adult Immunization ³⁴
United States Preventive Services Task Force (USPSTF)	Guide to Clinical Preventive Services ⁶

EXHIBIT 2. ACIP, AAP, AAFP, and AMA Documents**ACIP**

- CDC. General recommendations on immunization: recommendations of the Advisory Committee on Immunization Practices (ACIP). *MMWR*. 1994;43 (No. RR-1)
- CDC. Measles prevention: recommendations of the Immunization Practices Advisory Committee (ACIP). *MMWR*. 1989;38 (No. S-9)
- CDC. Diphtheria, tetanus, and pertussis: recommendations for vaccine use and other preventive measures: recommendations of the Immunization Practices Advisory Committee (ACIP). *MMWR*. 1991;40(No. RR-10).
- CDC. Prevention of varicella: recommendations of the Advisory Committee on Immunization Practices (ACIP). *MMWR*. 1996;45 (No. RR-11)
- CDC. Pneumococcal polysaccharide vaccine: recommendations of the Immunization Practices Advisory Committee. *MMWR*. 1989;38: 64–68, 73–76
- CDC. Mumps prevention: recommendations of the Immunization Practices Advisory Committee (ACIP). *MMWR*. 1989;38:388–92, 397–400
- CDC. Rubella prevention: recommendations of the Immunization Practices Advisory Committee (ACIP). *MMWR*. 1990;39 (No. RR-15)
- CDC. Prevention and control of influenza: part 1, vaccines—recommendations of the Advisory Committee on Immunization Practices (ACIP). *MMWR*. 1993;42 (No. RR-6)
- CDC. Update on adult immunization: recommendations of the Immunization Practices Advisory Committee (ACIP). *MMWR*. 1991;40 (No. RR-12)
- CDC. Hepatitis B virus: a comprehensive strategy for eliminating transmission in the United States through universal childhood vaccination: recommendations of the Immunization Practices Advisory Committee (ACIP). *MMWR*. 1991;40 (No. RR-13)
- CDC. Recommended childhood immunization schedule—United States, July–December 1996. *MMWR*. 1996;45:635–638
- CDC. Prevention of hepatitis A through active or passive immunization: recommendations of the Advisory Committee on Immunization Practices (ACIP). *MMWR*. 1996. In press

AAP

- American Academy of Pediatrics. In: Peter G, ed. 1994 *Red Book: Report of the Committee on Infectious Diseases*. 23rd ed. Elk Grove Village, IL: American Academy of Pediatrics; 1994
- Recommended childhood immunization schedule—United States, January–December 1997. *Pediatrics*. 1997;99:136–138
- American Academy of Pediatrics, Committee on Practice and Ambulatory Medicine. Recommendations for preventive pediatric health care. *Pediatrics*. 1995;96:373–374
- American Academy of Pediatrics, Committee on Infectious Diseases. Recommendations for the use of live attenuated varicella vaccine. *Pediatrics*. 1995;95:791–796

AAFP

- American Academy of Family Physicians. Summary of policy recommendations for periodic health examination. Kansas City, MO: American Academy of Family Physicians, August 1996. (AAFP order no. 962, reprint no. 510)
- American Academy of Family Physicians. Recommended immunization schedule, United States, July–December 1996. (AAFP order no. 974, reprint no. 520)

AMA

- American Medical Association. Rationale and recommendations: infectious diseases. In: Elster AB, Kuznets NJ, eds. *AMA Guidelines for Adolescent Preventive Services (GAPS): Recommendations and Rationale*. Chicago, IL: Williams & Wilkins; 1994:165–171

Abbreviations: ACIP, Advisory Committee on Immunization Practices; AAP, American Academy of Pediatrics; AAFP, American Academy of Family Physicians; AMA, American Medical Association.

vaccine to all adolescents for whom they provide services.³

Adolescents can be vaccinated against hepatitis B in various settings, including schools and providers' offices. In the US, school-based demonstration projects to vaccinate adolescents against hepatitis B have achieved greater than 70% vaccination coverage.^{11–13}

Adolescents should receive three age-appropriate doses of hepatitis B vaccine (Table 2). Hepatitis B vaccine is highly immunogenic in adolescents and young adults when administered in varying three-dose schedules.^{14,15} A schedule of 0, 1 to 2, and 4 to 6 months is recommended. Flexibility in scheduling is an important factor for achieving high rates of vaccination in adolescents. When the vaccination sched-

TABLE 2. Recommended Schedule of Vaccinations for Adolescents Ages 11 to 12 Years

Immunobiologic	Indications	Name	Dose	Frequency	Route
Hepatitis A vaccine	Adolescents who are at increased risk of hepatitis A infection or its complications	HAVRIX* VAQTA*	720 EL.U./0.5 mL† 25 U/0.5 mL	A total of two doses at 0,§ 6–12 months A total of two doses at 0, 6–18 months	IM
Hepatitis B vaccine	Adolescents not vaccinated previously for hepatitis B	Recombivax HB* Engerix-B*	5 µg/0.5 mL 10 µg/0.5 mL	A total of three doses at 0, 1–2, 4–6 months A total of three doses at 0, 1–2, 4–6 months	IM
Influenza vaccine	Adolescents who are at increased risk for complications caused by influenza or who have contact with persons at increased risk for these complications	Influenza virus vaccine¶	0.5 mL	Annually (September–December)	IM
Measles, mumps, and rubella vaccine (MMR)	Adolescents not vaccinated previously with two doses of measles vaccine at ≥12 months of age	MMR¶ *	0.5 mL	One dose	SC#
Pneumococcal polysaccharide vaccine	Adolescents who are at increased risk for pneumococcal disease or its complications	Pneumococcal polyvalent¶	0.5 mL	One dose	IM or SC
Tetanus and diphtheria toxoids (Td)	Adolescents not vaccinated within the previous 5 years	Tetanus and diphtheria toxoids, absorbed (for adult use)¶	0.5 mL	Every 10 years	IM
Varicella virus vaccine	Adolescents not vaccinated and who have no reliable history of chickenpox	VARIVAX*	0.5 mL	One dose**	SC

* Manufacturer's product name.

† Enzyme-linked immunosorbent assay (ELISA) unit.

‡ Alternative dosage and schedule of 360 EL.U./0.5 mL and a total of three doses administered at 0, 1, and 6–12 months.

§ 0 months represents timing of the initial dose, and subsequent numbers represent months after the initial dose.

|| Intramuscular injection.

¶ Generic name.

Subcutaneous injection.

** Adolescents ≥13 years of age should be administered a total of two doses (0.5 mL/dose) subcutaneously at 0 and 4–8 weeks.

ule is interrupted, the vaccine series does not require reinitiation (Centers for Disease Control and Prevention [CDC], unpublished data¹⁶). Studies of "off-schedule" vaccinations indicate that if the series is interrupted after the first dose, the second dose should be administered as soon as possible, and the second and third doses should be separated by an interval of at least 2 months. If only the third dose is delayed, it should be administered as soon as possible. Intervals of up to 1 year between administration of the first and third doses induce excellent antibody responses,¹⁵ and studies are in progress to evaluate longer intervals.

MMR Vaccine

The sustained decline of measles in the US has been associated with a shift in occurrence from children to infants and young adults. During 1990 to 1994, 47% of reported cases occurred in persons ages ≥ 10 years, compared with only 10% during 1960 to 1964 (CDC, unpublished data¹⁷). During the 1980s, outbreaks of measles occurred among school-age children in schools with measles-vaccination levels of $\geq 98\%$.¹⁸ Primary vaccine failure was considered the principal contributing factor in these outbreaks. As a result, beginning in 1989, a two-dose measles-vaccination schedule for students in primary schools, secondary schools, and colleges and universities was recommended.¹⁸⁻²⁰ This two-dose vaccination schedule provides protection to $\geq 98\%$ of persons vaccinated. Administration of a second dose of MMR at entry to elementary school (ie, at ages 4 to 6 years) or junior high or middle school (ie, at ages 11 to 12 years) is recommended.²¹⁻²³ State policies for implementing the two-dose strategy have varied; some states require the second dose for entry into primary school, and others require it for entry into middle school. Because the recommendation for a second dose of MMR was made in 1989, many children born before 1985 (and some children born after 1985, depending on local policy) may not have received the second vaccine dose. The routine visit to providers at ages 11 to 12 years affords an opportunity to administer a second dose of MMR to adolescents who have not received two doses of MMR at ≥ 12 months old.

MMR should not be given to adolescents who are known to be pregnant or to adolescents who are considering becoming pregnant within 3 months of vaccination. Asking adolescents if they are pregnant, excluding those who say they are, and explaining the theoretical risk of fetal infection to the other female adolescents are recommended precautions.

Td

Although booster doses of Td are recommended at 10-year intervals, no special strategies have been developed to ensure that this recommendation is fully implemented. During 1991 to 1994, 191 (95%) of the 201 reported cases of tetanus in the US occurred in persons ages ≥ 20 years, and 9 (45%) of the 20 reported cases of diphtheria occurred in persons ages ≥ 20 years (CDC, unpublished data). Data from a serosurvey conducted in Minnesota indicated that

62% of persons 18 to 39 years old lacked adequate protection against diphtheria.²⁴

Epidemic diphtheria has reemerged in the New Independent States (NIS) of the former Soviet Union and has resulted in $>47\,000$ cases reported in 1994 and $>50\,000$ in 1995 (CDC, unpublished data²⁵). Although no imported cases were reported in the US during those years, ≥ 20 cases of diphtheria were reported in Europe, and two cases occurred among US citizens who resided or were traveling in the NIS. This threat of infection underscores the importance of maintaining high levels of diphtheria immunity in the US population.

Recent data from CDC's National Health and Nutrition Examination Survey (NHANES III) suggested that immunity to tetanus varied with age.²⁶ Among children 6 to 16 years old, 82% had protective levels of tetanus antitoxin (defined as a serum level greater than .15 IU/mL). Immunity in persons decreased at 9 to 13 years, with 15% to 36% of these persons unprotected (CDC, unpublished data). Immunity also varied inversely with the length of time since the last tetanus vaccination. Among children who were reported as being vaccinated 6 to 10 years before the serologic survey, 28% lacked immunity to tetanus, compared with 14% who were reported as being vaccinated 1 to 5 years before the survey and 5% who were reported as being vaccinated ≤ 1 year before the survey.²⁷ A Td booster is essential to ensure long-lasting immunity against tetanus. Lowering the age for administration of the first Td booster from ages 14 to 16 years to ages 11 to 12 years should increase compliance and thereby reduce the susceptibility of adolescents to tetanus and diphtheria.

Administering the Td booster at ages 11 to 12 years provides a rationale for a routine visit to providers for adolescents, regardless of their need for other vaccines. Data suggest there should be no increased risk for serious side effects to Td when the first booster dose is administered at ages 11 to 12 years rather than at ages 14 to 16 years (CDC, unpublished data).

With the exception of the Td booster at ages 11 to 12 years, routine boosters should be administered every 10 years. If a dose of Td has been administered after receipt of tetanus- and diphtheria-containing vaccine at ages 4 to 6 years and before the routine Td booster at ages 11 to 12 years, the dose at ages 11 to 12 years is not indicated. The next dose should follow the last dose by 10 years, unless specifically indicated because of a tetanus-prone injury (ie, persons who sustain a tetanus-prone injury should be administered a Td booster immediately if >5 years have elapsed since their last Td booster).

Varicella Virus Vaccine

Before varicella virus vaccine became available in 1995, most persons in the US contracted varicella (ie, chickenpox), resulting in an estimated 4 million infections annually. At present, approximately 20% of adolescents 11 to 12 years old remain susceptible to varicella (CDC, unpublished data). The rate of complications, including death, is greater for persons

who contract chickenpox when they are ≥ 15 years old.

Varicella virus vaccine should be administered to adolescents 11 to 12 years old if they have not been vaccinated and do not have a reliable history of chickenpox.^{7,27,28} At ages 11 to 12 years, providers should assess the adolescent's need for varicella virus vaccine and administer the vaccine to those who are eligible. When administered to children < 13 years old, a single dose of vaccine induces protective antibodies in $> 95\%$ of recipients. For susceptible persons ≥ 13 years old, two doses separated by 4 to 8 weeks are recommended.

Varicella vaccine should not be given to adolescents who are known to be pregnant or to adolescents who are considering becoming pregnant within 1 month of vaccination. Asking adolescents if they are pregnant, excluding those who say they are, and explaining the potential effects of the vaccine virus on the fetus to the other female adolescents are recommended precautions.

OTHER VACCINES INDICATED FOR CERTAIN ADOLESCENTS

Influenza Vaccine

More than 8 million children and adolescents in the US, including 2.2 million persons 10 to 18 years old who have asthma (CDC, unpublished data), have at least one medical condition that places them at high risk for complications associated with influenza. Such adolescents should be vaccinated annually for influenza; however, few actually receive the vaccine.

Adolescents at high risk who should be administered influenza vaccine annually are those who a) have chronic disorders of the pulmonary system (including those who have asthma) or the cardiovascular system; b) reside in chronic-care facilities that house persons of any age who have chronic medical conditions; c) have required regular medical follow-up or hospitalization during the preceding year because of chronic metabolic disease(s) (including those who have diabetes mellitus), renal dysfunction, hemoglobinopathy, or immunosuppression (including those who have immunosuppression caused by medication); or d) receive long-term aspirin therapy and, therefore, may be at risk for contracting Reye syndrome after influenza. In addition, adolescents who have close contact (close contact occurs when persons live with, work with, or otherwise are frequently in close physical proximity to other persons) with persons who meet any of these conditions or with persons ≥ 65 years of age should be administered influenza vaccine annually. Students in institutional settings (eg, those residing in dormitories) should be encouraged to receive influenza vaccine annually to minimize any disruption of routine activities during epidemics. In addition, any adolescent may be vaccinated annually to reduce the likelihood of acquiring influenza infection.

Administration of influenza vaccine to adolescents ages 11 to 12 years may assist in establishing the lifetime practice of annual influenza vaccination in

persons for whom it is indicated. Providers should administer influenza vaccine to adolescents who visit them for routine care if vaccination is indicated and if their visit is during the time of year appropriate for influenza vaccination (ie, September through December); such adolescents should be scheduled for an additional visit if they are seen at a time of year when vaccination is not indicated. Adolescents may receive influenza vaccine at the same time they receive other recommended vaccines. Additional strategies are needed to improve delivery of influenza vaccine to adolescents for whom it is indicated.

Pneumococcal Polysaccharide Vaccine

Approximately 340 000 persons 2 to 18 years old have chronic illnesses associated with increased risk for pneumococcal disease or its complications and should receive the 23-valent pneumococcal vaccine. Adolescents who should be vaccinated include those who have a) anatomic or functional asplenia (including sickle cell disease), b) nephrotic syndrome, c) cerebrospinal fluid leaks, or d) conditions associated with immunosuppression (including human immunodeficiency virus [HIV] infection).

Revaccination is recommended for adolescents at highest risk for serious pneumococcal infection and those likely to experience rapid decline in pneumococcal-antibody levels, provided ≥ 5 years have passed since administration of the first dose of pneumococcal vaccine. The possible need for subsequent doses after revaccination requires further study. Persons at highest risk and persons likely to have a rapid decline in pneumococcal-antibody levels include those who have a) splenic dysfunction or anatomic asplenia, b) sickle cell disease, c) HIV infection, d) Hodgkin's disease, e) lymphoma, f) multiple myeloma, g) chronic renal failure, h) nephrotic syndrome, or i) other conditions associated with immunosuppression (eg, undergoing organ transplantation or receiving immunosuppressive chemotherapy).

Hepatitis A Vaccine

Each year, approximately 140 000 persons in the US are infected with hepatitis A virus (HAV). The highest rates of disease occur among persons 5 to 14 years old. Most cases of hepatitis A can be attributed to person-to-person transmission.

Adolescents who plan to travel to or work in a country that has high or intermediate endemicity of HAV infection (this includes countries other than Australia, Canada, Japan, New Zealand and those located in western Europe) should be administered hepatitis A vaccine or immune globulin.²⁹ For adolescents who plan to travel repeatedly to or reside for long periods in such areas, administration of hepatitis A vaccine rather than immune globulin is preferred.²⁹

Unvaccinated adolescents who reside in a community that has a high rate of HAV infection and periodic outbreaks of hepatitis A disease also should be vaccinated. During outbreaks in such a community, age-specific disease rates provide an indirect indication of the age groups in which a large percentage of

the group has prior immunity and, therefore, would benefit little from vaccination. Often the upper-age cut-off for hepatitis A vaccination is between 10 and 15 years old. In addition, adolescents should be vaccinated against hepatitis A if they a) have chronic liver disease, b) are administered clotting factors, c) use illegal injection or noninjection drugs (ie, if local epidemiologic data indicate current or past outbreaks have occurred among persons who have such risk behaviors), or d) are males who have sex with males.

SCHEDULING VACCINATIONS

Simultaneous Administration of Vaccines

Extensive clinical experience and experimental evidence from studies of infants and children have strengthened the scientific basis for administering certain vaccines simultaneously. Although specific studies have not been conducted regarding the simultaneous administration of all vaccines recommended for routine use in adolescents, no evidence has established that this practice is unsafe or ineffective.³⁰

All indicated vaccinations should be administered at the scheduled immunization visit for adolescents who are 11 to 12 years old. However, some adolescents may require multiple (ie, four or more) vaccinations, and the provider may choose not to administer all indicated vaccines during the same visit. In these circumstances, the provider may prioritize which vaccines to administer during the visit and schedule the adolescent for one or more return visits. Factors to consider in this decision include which vaccines require multiple doses, which diseases pose an immediate threat to the adolescent, and whether the adolescent is likely to return for scheduled visits.

Documentation of Previous Vaccinations

Providers may encounter adolescents who do not have documentation of previously received vaccines. In these circumstances, providers should attempt to assess each adolescent's vaccination status through documentation obtained from the parent, previous providers, or school records. If documentation of an adolescent's vaccination status is not available at the time of the visit, the following strategy is recommended while awaiting documentation: a) for those vaccinations required by law or regulation that the adolescent previously was subject to, assume that the adolescent has been vaccinated (unless required vaccinations have not been administered for religious, philosophic, or medical reasons) and withhold those vaccinations; and b) administer those vaccines that the adolescent previously was not subject to by law or regulation.

STATE VACCINATION LAWS AND REGULATIONS

In the US, state vaccination laws and regulations for kindergarten through grade 12 are effective in ensuring high coverage levels among school attendees and have led to a marked decline of overall morbidity and mortality from vaccine-preventable diseases. Additional state laws and regulations re-

quiring documentation of up-to-date immunization of adolescents or a reliable history of disease-related immunity at entry into sixth or seventh grade would ensure implementation of these recommendations and would lead to further reduction in transmission of vaccine-preventable disease.

RECOMMENDATIONS FOR VACCINATION OF ADOLESCENTS

The recommendations for administering each vaccine are consistent with current ACIP, AAP, AAFP, and AMA documents (Exhibit 2). However, the Td recommendation has been changed recently such that the ages at which the first Td booster is administered may be lowered from 14 to 16 years to 11 to 12 years.²¹⁻²³ General recommendations and vaccine-specific recommendations for providers are as follows:

General Recommendations

- Establish a visit to providers for adolescents ages 11 to 12 years to screen for immunization deficiencies, and administer those indicated vaccines that have not been received (Table 1). During the initial visit, schedule appointments to receive needed doses of vaccine that are not administered during the initial visit. Provide other indicated preventive services during this and all other visits.
- Check the vaccination status of adolescents during each subsequent visit to providers and correct any deficiencies, including those associated with the three-dose series of hepatitis B vaccinations.

Vaccine-specific Recommendations

- Hepatitis B vaccine. Vaccinate adolescents 11 to 12 years old who have not been vaccinated previously with the three-dose series of hepatitis B vaccine. Ensure completion of the series by scheduling the vaccinations that are needed and by following up on those adolescents who do not receive these scheduled vaccinations. In addition, adolescents older than 12 years who are at increased risk for HBV infection should be vaccinated.
- MMR (second dose). Administer the second dose of MMR to adolescents who have not received two doses of MMR at ≥ 12 months old.
- Td booster. Administer a booster dose of Td vaccine to adolescents at ages 11 to 12 or 14 to 16 years if they have received the primary series of vaccinations and if no dose has been received during the previous 5 years. All subsequent, routine Td boosters (ie, in the absence of tetanus-prone injury) should be administered at 10-year intervals.
- Varicella virus vaccine. Administer varicella virus vaccine to adolescents ages 11 to 12 years who do not have a reliable history of chickenpox and who have not been vaccinated with varicella virus vaccine.
- Influenza vaccine. Administer influenza vaccine annually to adolescents who, because of an underlying medical condition, are at high risk for complications associated with influenza. If seen at a time of year when vaccination is not indicated,

schedule the adolescent for an influenza vaccination at the appropriate vaccination time (ie, September through December). Vaccinate adolescents who have close contact with persons at high risk for complications associated with influenza. This vaccine also may be administered to adolescents who have no underlying medical condition to reduce their risk for influenza infection.

- Pneumococcal polysaccharide vaccine. Administer pneumococcal vaccine to adolescents who have chronic illnesses associated with increased risk for pneumococcal disease or its complications. Use adolescents' visits to providers to ensure that the vaccine has been administered to persons for whom it is indicated.
- Hepatitis A vaccine. Administer hepatitis A vaccine to unvaccinated adolescents who a) plan to travel to or work in a country that has high or intermediate endemicity of HAV infection (immune globulin is an alternative if a single, short visit is planned); b) reside in a community that has a high rate of HAV infection and periodic outbreaks of hepatitis A disease; c) are administered clotting factors; or d) have any of the following conditions or risk behaviors: chronic liver disease, use of illegal injection or noninjection drugs (ie, if local epidemiologic data indicate current or past outbreaks of hepatitis A disease have occurred among persons who have such risk behaviors), or if they are males who have sex with males.

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