Annals of Internal Medicine

CLINICAL GUIDELINE

Recommended Immunization Schedule for Adults Aged 19 Years or Older, United States, 2017*

David K. Kim, MD, MA; Laura E. Riley, MD; Kathleen H. Harriman, PhD, MPH, RN; Paul Hunter, MD; and Carolyn B. Bridges, MD; on behalf of the Advisory Committee on Immunization Practices†

In October 2016, the Advisory Committee on Immunization Practices (ACIP) voted to approve the Recommended Adult Immunization Schedule for Adults Aged 19 Years or Older, United States, 2017. The 2017 adult immunization schedule summarizes ACIP recommendations in 2 figures, footnotes for the figures, and a table of contraindications and precautions for vaccines recommended for adults (**Figure**). These documents can also be found at www.cdc.gov/vaccines/schedules. The full ACIP recommendations for each vaccine can be found at www.cdc.gov/vaccines/hcp/acip-recs/index.html. The 2017 adult immunization schedule was also reviewed and approved by the American College of Physicians, the American Academy of Family Physicians, the American College of Obstetricians and Gynecologists, and the American College of Nurse-Midwives.

Newly added to the 2017 adult immunization schedule is a cover page that contains information on select general principles pertinent to the adult immunization schedule, additional CDC resources, instructions for reporting adverse events related to vaccination and suspected cases of reportable vaccine-preventable diseases, and an ACIP-approved list of standardized acronyms for vaccines recommended for adults. In addition, the table of contraindications and precautions for vaccines routinely recommended for adults that was formerly a standalone document has been incorporated into the adult immunization schedule. Changes in the 2017 adult immunization schedule from the previous year's schedule include new or revised ACIP recommendations on influenza, human papillomavirus, hepatitis B, and meningococcal vaccinations.

Influenza vaccination (1). Changes are related to concerns regarding low effectiveness of the live attenuated influenza vaccine (LAIV) (FluMist, MedImmune) against influenza A(H1N1)pdm09 in the United States during the 2013–2014 and 2015–2016 influenza seasons and revised recommendations on the use of the influenza vaccine among patients with egg allergy. These changes are reflected in the 2017 adult immunization schedule as:

- LAIV should not be used during the 2016–2017 influenza season.
- Adults with a history of egg allergy who have only hives after exposure to egg should receive age-appropriate inactivated influenza vaccine (IIV) or recombinant influenza vaccine (RIV).
- Adults with a history of egg allergy with symptoms other than hives (e.g., angioedema, respiratory distress, lightheadedness, or recurrent emesis, or who required epinephrine or another emergency medical intervention) may receive age-appropriate IIV or RIV. The selected vaccine should be administered in an inpatient or outpatient medical setting and supervised by a health care provider who is able to recognize and manage severe allergic conditions.

Human papillomavirus vaccination (2). Healthy adolescents who start their human papillomavirus vaccine (HPV) series before age 15 years are recommended to receive 2 doses of HPV. However, the recommendation remains at 3 doses for adults and adolescents who did not start their vaccination series before age 15 years. Changes in recommendations in the adult immunization schedule include updates regarding HPV vaccination for adults who did not complete HPV series as adolescents. These changes are described in the 2017 adult immunization schedule as:

- Women through age 26 years and men through age 21 years who have not received any HPV should receive a 3-dose series of HPV at 0, 1-2, and 6 months. Men aged 22 through 26 years may be vaccinated with a 3-dose series of HPV at 0, 1-2, and 6 months.
- Women through age 26 years and men through age 21 years (and men aged 22 through 26 years who may receive HPV) who initiated HPV series before age 15 years and received 2 doses at least 5 months apart are considered adequately vaccinated and do not need an additional dose of HPV.
- Women through age 26 years and adult males through age 21 years (and men aged 22 through 26 years who may receive HPV) who initiated HPV series before age 15 years and received only 1 dose, or 2 doses less than 5 months apart, are not considered ad-

Ann Intern Med. 2017;166:209-18. doi:10.7326/M16-2936

* The 2017 ACIP Adult Immunization Schedule appeared in *Annals of Internal Medicine* and on the Centers for Disease Control and Prevention Web site at www.cdc.gov/vaccines/schedules. An announcement summarizing changes in the 2017 adult immunization schedule is published concurrently in the *Morbidity and Mortality Weekly Report*. Readers can cite the 2017 adult immunization schedule as follows: Kim DK, Riley LE, Harriman KH, Hunter P, Bridges CB; Advisory Committee on Immunization Practices. Recommended Immunization Schedule for Adults Aged 19 Years or Older, United States, 2017. Ann Intern Med. 2017;166:209-18. doi:10.7326/M16-2936

† The 2017 adult immunization schedule was prepared by the Advisory Committee on Immunization Practices (ACIP); the ACIP Adult Immunization Work Group; David K. Kim, MD, MA, Carolyn B. Bridges, MD, LaDora Woods, and Akiko Wilson (Centers for Disease Control and Prevention, Atlanta, Georgia); Laura E. Riley, MD (Harvard University, Cambridge, Massachusetts); Kathleen H. Harriman, PhD, MPH, RN (California Department of Public Health, Richmond, California); and Paul Hunter, MD (University of Wisconsin, Madison, Wisconsin). For a list of members of the ACIP and the ACIP Adult Immunization Work Group, see **Appendix** (available at Annals.org).

equately vaccinated and should receive 1 additional dose of HPV.

Hepatitis B vaccination (3). The ACIP updated chronic liver disease conditions for which a hepatitis B vaccine (HepB) series is recommended. This change is described in the 2017 adult immunization schedule as:

- Adults with chronic liver disease, including, but not limited to, hepatitis C virus infection, cirrhosis, fatty liver disease, alcoholic liver disease, autoimmune hepatitis, and an alanine aminotransferase (ALT) or aspartate aminotransferase (AST) level greater than twice the upper limit of normal, should receive a HepB series.

Meningococcal vaccination (4, 5). There are 2 changes in meningococcal vaccination recommendations for 2017. First, the ACIP recommended that adults with HIV infection should receive a 2-dose primary series of serogroups A, C, W, and Y meningococcal conjugate vaccine (MenACWY). Second, the ACIP provided updated dosing guidance for one of the serogroup B meningococcal vaccine (MenB)–MenB-FHbp (Trumenba, Pfizer). For adults who are at increased risk for meningococcal disease and for use during serogroup B meningococcal disease outbreaks, 3 doses of MenB-FHbp should be administered at 0, 1-2, and 6 months. When MenB-FHbp is given to healthy adolescents and young adults who are not at increased risk for meningococcal disease, 2 doses of MenB-FHbp should be administered at 0 and 6 months (MenB-FHbp was previously recommended as a 3-dose series at 0, 2, and 6 months, consistent with the original vaccine licensure for this population). Note that the dosing frequency and interval for the other MenB, MenB-4C (Bexsero, GlaxoSmithKline), have not changed; MenB-4C remains a 2-dose series administered at least 1 month apart. Either MenB can be used when indicated. The change in ACIP recommendations on the use of MenB-FHbp does not imply a preference for one MenB over the other. These updates in meningococcal vaccination are reflected in the 2017 adult immunization schedule as:

- Adults with anatomical or functional asplenia or persistent complement component deficiencies should receive a 2-dose primary series of MenACWY at least 2 months apart and revaccinate every 5 years. They should also receive a series of MenB with either a 2-dose series of MenB-4C at least 1 month apart or a 3-dose series of MenB-FHbp at 0, 1-2, and 6 months.
- Adults with HIV infection who have not been previously vaccinated should receive a 2-dose primary series of MenACWY at least 2 months apart and revaccinate every 5 years. Those who previously received 1 dose of MenACWY should receive a second dose at least 2 months after the first dose. Adults with HIV infection are not routinely recommended to receive MenB because meningococcal disease in this population is caused primarily by serogroups C, W, and Y.
- Microbiologists who are routinely exposed to isolates of *Neisseria meningitidis* should receive 1 dose of MenACWY and revaccinate every 5 years if the risk for infection remains, and either a 2-dose series of MenB-4C at least 1 month apart or a 3-dose series of MenB-FHbp at 0, 1-2, and 6 months.
- Adults at risk because of a meningococcal disease outbreak should receive 1 dose of MenACWY if the outbreak is attributable to serogroup A, C, W, or Y, or either a 2-dose series of MenB-4C at least 1 month apart or a 3-dose series of MenB-FHbp at 0, 1-2, and 6 months if the outbreak is attributable to serogroup B.
- Young adults aged 16 through 23 years (preferred age range is 16 through 18 years) who are healthy and not at increased risk for serogroup B meningococcal disease may receive either a 2-dose series of MenB-4C at least 1 month apart or a 2-dose series of MenB-FHbp at 0 and 6 months for short-term protection against most strains of serogroup B meningococcal disease.

Notable changes in **Figures 1** and **2** are:

- In Figures 1 and 2, standardized acronyms for vaccines are used to promote simplicity and consistency, and their listing has been reordered. Ancillary information previously contained in the figures have been consolidated and moved to the cover page. Colored blocks instead of colored bars are used to denote indications. These figures must be read with the footnotes that contain important information for each vaccine and considerations for special populations.
- In **Figure 2**, the columns for medical condition and other indications have been reordered to keep medical conditions together and special populations together. Additional footnotes mark appropriate columns of medical conditions and other indications to refer the reader to view relevant vaccine-specific information.
- In **Figure 2**, the color of the indication block for MenACWY for HIV infection has been changed to yellow (recommended for adults who meet the age requirement, lack documentation of vaccination, or lack evidence of past infection) from purple (recommended for adults with additional medical conditions or other indications).

Significant changes in the 2017 adult immunization schedule footnotes include the following:

- Footnotes are limited to the information that pertains to the vaccines listed in **Figures 1** and **2** and organized by vaccine-specific information and considerations for special populations (e.g., pregnant women and adults with HIV infection). The footnote on "additional information," contained in previous iterations of the adult immunization schedule, has been moved to the cover page. The footnote on "immunocompromising conditions" has been removed but vaccine-specific information on immunocompromising conditions has been added to appropriate footnotes, e.g., the footnote for pneumococcal vaccination.
- The format for the footnotes has been condensed, simplified, and standardized. The format for pneumococcal; human papillomavirus; meningococcal; varicella; and measles, mumps, and rubella vaccination footnotes have undergone significant revision.

Lastly, the table of contraindications and precautions for vaccines routinely recommended for adults, previously a standalone document, has been incorporated into the adult immunization schedule. The content of the table has been consolidated and simplified.

The ACIP-recommended use of each vaccine is developed after in-depth reviews of vaccine-related data, including disease epidemiology, vaccine efficacy and effectiveness, vaccine safety, feasibility of program implementation, and economic aspects of immunization policy (6). As a result, some vaccination recommendations are complex and their implementation can be challenging. The adult immunization schedule summarizes the current ACIP recommendations and is designed to help health care providers implement those recommendations. In preparing the 2017 adult immunization schedule, the ACIP made a concerted effort to simplify, consolidate, and standardize its graphics, language, and format. Additional efforts are under way to continue to improve its usability by health care providers and to evaluate its usefulness.

The utility of the adult immunization schedule is ultimately dependent on the efforts of health care providers and health care systems to apply it in the care of their adult patients and implement the standards for adult immunization practice (7). The incorporation of ACIP recommendations into clinical practice and reducing missed opportunities to vaccinate adult patients remain a challenge (8). Barriers for vaccination for adults cited by health care providers include competing priorities with management of patients' acute and chronic health conditions, lower prioritization of immunization for adults compared with other preventive services, and financial barriers to providing vaccination services to adults (9, 10). These and other challenges (e.g., limited awareness for adult vaccinations by adult patients, difficulties maintaining complete vaccination records for adult patients, and complexities of adult vaccine insurance coverage) contribute to low immunization coverage rates for adults in the United States (9–11).

The 2014 National Health Interview Survey (NHIS) found that influenza vaccination coverage among adults aged ≥19 years was 43.2%; pneumococcal vaccination coverage among adults aged 19 through 64 years who are at high risk for pneumococcal disease was 20.3% and among adults aged ≥65 years was 61.3%; tetanus and diphtheria toxoids and acellular pertussis vaccination (Tdap) coverage among adults aged ≥19 years was 20.1%; and herpes zoster vaccination coverage among adults aged ≥60 years was 27.9% (8). These low immunization coverage rates have generally not changed significantly over the past several years. In addition, racial and ethnic disparities—with whites generally having higher adult immunization coverage than blacks, Hispanics, and Asians—were prevalent across vaccines recommended for adults (8, 12).

Not surprisingly, adults who have health insurance have higher vaccination coverage than those who do not have health insurance (8). Overall, immunization coverage in 2014 was 2 to 5 times higher among adults with public or private health insurance than among those without health insurance for influenza vaccination for adults aged ≥19 years (48.0% vs. 15.9%); pneumococcal vaccination for adults aged 19 through 64 years at high risk (22.5% vs. 11.0%) and adults aged ≥65 years (61.7% vs. 24.3%); Tdap for adults aged ≥19 years (21.5% vs. 11.5%); and herpes zoster vaccine for adults aged ≥60 years (28.7% vs. 5.6%). While adults with health insurance are more likely to receive vaccines than are those without, substantial proportions of adults with health insurance who reported having had at least 10 physician contacts within the past year reported missing vaccinations. For example, 23.8% of adults aged ≥65 years did not report having received influenza vaccination, 61.4% of high-risk adults aged 19 through 64 years did not report having received pneumococcal vaccination, and 64.8% of adults aged 19 through 59 years with diabetes did not report having received hepatitis B vaccination (8).

Missed opportunities for vaccinating adults may result in part from limited familiarity or challenges with the complexity of the adult immunization schedule among health care providers. In a recent survey, 25.3% (149 of 588) of general internists and family physicians reported that the age-based vaccination recommendations for adults were difficult to follow and 29.3% (172 of 587) reported that medical condition–based recommendations were difficult to follow (9). Additional data are needed to assess health care providers' range of familiarity with the adult immunization schedule and identify ways to improve its utility and usability.

To improve overall adult vaccination rates, health care providers and health care systems can use a systematic approach to adult immunization and implement evidence-based strategies, such as use of standing orders, patient reminders, recall for patients with missing vaccinations, and provider reminders through electronic medical record alerts and other means (13). These proven amplifiers for adult vaccination, along with the implementation of the adult immunization practice standards, should help health care providers and health care systems reduce racial and ethnic disparities in vaccination levels for adults and reduce their risk for illness, disability, and death from vaccine-preventable diseases.

Recommended Immunization Schedule for Adults Aged 19 Years or Older, United States, 2017.

In February 2017, the *Recommended Immunization Schedule for Adults Aged 19 Years or Older, United States, 2017* became effective, as recommended by the Advisory Committee on Immunization Practices (ACIP) and approved by the Centers for Disease Control and Prevention (CDC). The 2017 adult immunization schedule was also reviewed and approved by the following professional medical organizations:

- American College of Physicians (www.acponline.org)
- American Academy of Family Physicians (www.aafp.org)
- American College of Obstetricians and Gynecologists (www.acog.org)
- American College of Nurse-Midwives (www.midwife.org)

CDC announced the availability of the 2017 adult immunization schedule at www.cdc.gov/vaccines/schedules/hcp/index.html in the *Morbidity and Mortality Weekly Report* (*MMWR*).[1] The schedule is published in its entirety in the *Annals of Internal Medicine*.[2]

The adult immunization schedule describes the age groups and medical conditions and other indications for which licensed vaccines are recommended. The 2017 adult immunization schedule consists of:

- Figure 1. Recommended immunization schedule for adults by age group
- Figure 2. Recommended immunization schedule for adults by medical condition and other indications
- Footnotes that accompany each vaccine containing important general information and considerations for special populations
- Table. Contraindications and precautions for vaccines routinely recommended for adults

Consider the following information when reviewing the adult immunization schedule:

- The figures in the adult immunization schedule should be read with the footnotes that contain important general information and information about vaccination of special populations.
- When indicated, administer recommended vaccines to adults whose vaccination history is incomplete or unknown.
- Increased interval between doses of a multi dose vaccine does not diminish vaccine effectiveness; therefore, it is not necessary to restart the vaccine series or add doses to the series because of an extended interval between doses.
- Adults with immunocompromising conditions should generally avoid live vaccines, e.g., measles, mumps, and rubella vaccine. Inactivated vaccines, e.g., pneumococcal or inactivated influenza vaccines, are generally acceptable.
- Combination vaccines may be used when any component of the combination is indicated and when the other components of the combination vaccine are not contraindicated.
- The use of trade names in the adult immunization schedule is for identification purposes only and does not imply endorsement by the ACIP or CDC.

Details on vaccines recommended for adults and complete ACIP statements are available at www.cdc.gov/vaccines/hcp/acip-recs/index.html. Listed below are additional CDC resources:

- A summary of information on vaccination recommendations, vaccination of persons with immunodeficiencies, preventing and managing adverse reactions, vaccination contraindications and precautions, and other information can be found in *General Recommendations on Immunization* at www.cdc.gov/mmwr/preview/mmwrhtml/rr6002a1.htm.
- Vaccine Information Statements that explain benefits and risks of vaccines are available at www.cdc.gov/vaccines/hcp/vis/index.html.
- Information and resources regarding vaccination of pregnant women are available at www.cdc.gov/vaccines/adults/rec-vac/pregnant.html.
- Information on travel vaccine requirements and recommendations is available at wwwnc.cdc.gov/travel/destinations/list.
- *CDC Vaccine Schedules App* for clinicians and other immunization service providers to download is available at www.cdc.gov/vaccines/schedules/hcp/schedule-app.html.
- *Recommended Immunization Schedule for Children and Adolescents Aged 18 Years or Younger* is available at www.cdc.gov/vaccines/schedules/hcp/index.html.

Report suspected cases of reportable vaccine-preventable diseases to the local or state health department.

Report all clinically significant post vaccination reactions to the Vaccine Adverse Event Reporting System at www.vaers.hhs.gov or by telephone, 800-822-7967. All vaccines included in the 2017 adult immunization schedule except herpes zoster and 23-valent pneumococcal polysaccharide vaccines are covered by the Vaccine Injury Compensation Program. Information on how to file a vaccine injury claim is available at www.hrsa.gov/vaccinecompensation or by telephone, 800-338-2382.

Submit questions and comments regarding the 2017 adult immunization schedule to CDC through www.cdc.gov/cdc-info or by telephone, 800-CDC-INFO (800-232-4636), in English and Spanish, 8:00am–8:00pm ET, Monday–Friday, excluding holidays.

The following acronyms are used for vaccines recommended for adults:

HepA	hepatitis A vaccine
HepA-HepB	hepatitis A and hepatitis B vaccines
HepB	hepatitis B vaccine
Hib	*Haemophilus influenzae* type b conjugate vaccine
HPV	human papillomavirus vaccine
HZV	herpes zoster vaccine
IIV	inactivated influenza vaccine
LAIV	live attenuated influenza vaccine
MenACWY	serogroups A, C, W, and Y meningococcal conjugate vaccine
MenB	serogroup B meningococcal vaccine
MMR	measles, mumps, and rubella vaccine
MPSV4	serogroups A, C, W, and Y meningococcal polysaccharide vaccine
PCV13	13-valent pneumococcal conjugate vaccine
PPSV23	23-valent pneumococcal polysaccharide vaccine
RIV	recombinant influenza vaccine
Td	tetanus and diphtheria toxoids
Tdap	tetanus toxoid, reduced diphtheria toxoid, and acellular pertussis vaccine
VAR	varicella vaccine

[1]MMWR Morb Mortal Wkly Rep. 2017;66(5). doi:10.15585/mmwr.mm6605e2. Available at http://dx.doi.org/10.15585/mmwr.mm6605e2

[2]Ann Intern Med. 2017;166:209-18. Available at http://annals.org/aim/article/doi/10.7326/M16-2936

U.S. Department of Health and Human Services
Centers for Disease Control and Prevention

Figure 1. Recommended immunization schedule for adults aged 19 years or older by age group, United States, 2017

Figures 1 and 2 must be read with the footnotes that contain important general information and considerations for special populations.

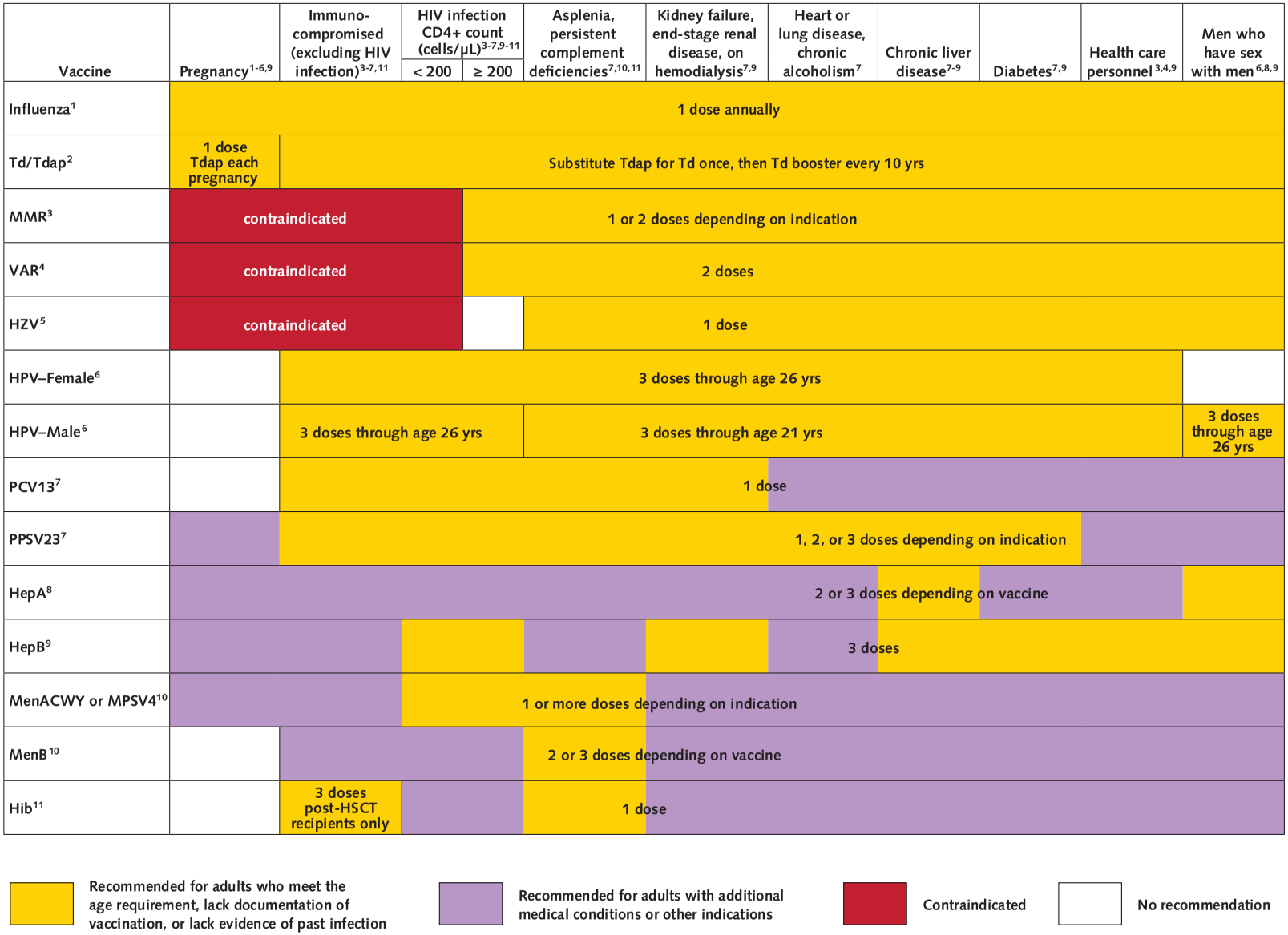
Vaccine	19–21 years	22–26 years	27–59 years	60–64 years	≥65 years
Influenza[1]	1 dose annually				
Td/Tdap[2]	Substitute Tdap for Td once, then Td booster every 10 yrs				
MMR[3]	1 or 2 doses depending on indication				
VAR[4]	2 doses				
HZV[5]				1 dose	
HPV – Female[6]	3 doses				
HPV – Male[6]	3 doses				
PCV13[7]	1 dose				
PPSV23[7]	1 or 2 doses depending on indication				1 dose
HepA[8]	2 or 3 doses depending on vaccine				
HepB[9]	3 doses				
MenACWY or MPSV4[10]	1 or more doses depending on indication				
MenB[10]	2 or 3 doses depending on vaccine				
Hib[11]	1 or 3 doses depending on indication				

Recommended for adults who meet the age requirement, lack documentation of vaccination, or lack evidence of past infection

Recommended for adults with additional medical conditions or other indications

No recommendation

Figure 2. Recommended immunization schedule for adults aged 19 years or older by medical condition and other indications, United States, 2017



Footnotes

Footnotes. Recommended immunization schedule for adults aged 19 years or older, United States, 2017

1. Influenza vaccination

General information

- All persons aged 6 months or older who do not have a contraindication should receive annual influenza vaccination with an age-appropriate formulation of inactivated influenza vaccine (IIV) or recombinant influenza vaccine (RIV).
- In addition to standard-dose IIV, available options for adults in specific age groups include: high-dose or adjuvanted IIV for adults aged 65 years or older, intradermal IIV for adults aged 18 through 64 years, and RIV for adults aged 18 years or older.
- Notes: Live attenuated influenza vaccine (LAIV) should not be used during the 2016–2017 influenza season. A list of currently available influenza vaccines is available at www.cdc.gov/flu/protect/vaccine/vaccines.htm.

Special populations

- Adults with a history of egg allergy who have only hives after exposure to egg should receive age-appropriate IIV or RIV.
- Adults with a history of egg allergy other than hives, e.g., angioedema, respiratory distress, lightheadedness, or recurrent emesis, or who required epinephrine or another emergency medical intervention, may receive age-appropriate IIV or RIV. The selected vaccine should be administered in an inpatient or outpatient medical setting and under the supervision of a health care provider who is able to recognize and manage severe allergic conditions.
- Pregnant women and women who might become pregnant in the upcoming influenza season should receive IIV.

2. Tetanus, diphtheria, and acellular pertussis vaccination

General information

- Adults who have not received tetanus and diphtheria toxoids and acellular pertussis vaccine (Tdap) or for whom pertussis vaccination status is unknown should receive 1 dose of Tdap followed by a tetanus and diphtheria toxoids (Td) booster every 10 years. Tdap should be administered regardless of when a tetanus or diphtheria toxoid-containing vaccine was last received.
- Adults with an unknown or incomplete history of a 3-dose primary series with tetanus and diphtheria toxoid-containing vaccines should complete the primary series that includes 1 dose of Tdap. Unvaccinated adults should receive the first 2 doses at least 4 weeks apart and the third dose 6–12 months after the second dose.
- Note: Information on the use of Td or Tdap as tetanus prophylaxis in wound management is available at www.cdc.gov/mmwr/preview/mmwrhtml/rr5517a1.htm.

Special populations

- Pregnant women should receive 1 dose of Tdap during each pregnancy, preferably during the early part of gestational weeks 27–36, regardless of history of receiving Tdap.

3. Measles, mumps, and rubella vaccination

General information

- Adults born in 1957 or later without acceptable evidence of immunity to measles, mumps, or rubella (defined below) should receive 1 dose of measles, mumps, and rubella vaccine (MMR) unless they have a medical contraindication to the vaccine, e.g., pregnancy or severe immunodeficiency.
- Notes: Acceptable evidence of immunity to measles, mumps, or rubella in adults is: born before 1957, documentation of receipt of MMR, or laboratory evidence of immunity or disease. Documentation of health care provider–diagnosed disease without laboratory confirmation is not acceptable evidence of immunity.

Special populations

- Pregnant women who do not have evidence of immunity to rubella should receive 1 dose of MMR upon completion or termination of pregnancy and before discharge from the health care facility; non-pregnant women of childbearing age without evidence of rubella immunity should receive 1 dose of MMR.
- Adults with primary or acquired immunodeficiency, including malignant condition affecting the bone marrow or lymphatic system, systemic immunosuppressive therapy, or cellular immunodeficiency, should not receive MMR.
- Adults with HIV infection and CD4+T-lymphocyte count ≥200 cells/mL for at least 6 months who do not have evidence of measles, mumps, or rubella immunity should receive 2 doses of MMR at least 28 days apart.Adults with HIV infection and CD4+T-lymphocyte count <200 cells/mL should not receive MMR.
- Adults who work in health care facilities should receive 2 doses of MMR at least 28 days apart; health care personnel born before 1957 who are unvaccinated or lack laboratory evidence of measles, mumps, or rubella immunity, or laboratory confirmation of disease should be considered for vaccination with 2 doses of MMR at least 28 days apart for measles or mumps, or 1 dose of MMR for rubella.
- Adults who are students in postsecondary educational institutions or plan to travel internationally should receive 2 doses of MMR at least 28 days apart.
- Adults who received inactivated (killed) measles vaccine or measles vaccine of unknown type during years 1963–1967 should be revaccinated with 1 or 2 doses of MMR.
- Adults who were vaccinated before 1979 with either inactivated mumps vaccine or mumps vaccine of unknown type who are at high risk for mumps infection, e.g., work in a health care facility, should be considered for revaccination with 2 doses of MMR at least 28 days apart.

Varicella vaccination

4. General information

- Adults without evidence of immunity to varicella (defined below) should receive 2 doses of single-antigen varicella vaccine (VAR) 4–8 weeks apart, or a second dose if they have received only 1 dose.
- Persons without evidence of immunity for whom VAR should be emphasized are: adults who have close contact with persons at high risk for serious complications, e.g., health care personnel and household contacts of immunocompromised persons; adults who live or work in an environment in which transmission of varicella zoster virus is likely, e.g., teachers, childcare workers, and residents and staff in institutional settings; adults who live or work in environments in which varicella transmission has been reported, e.g., college students, residents and staff members of correctional institutions, and military personnel; nonpregnant women of childbearing age; adolescents and adults living in households with children; and international travelers.
- Note: Evidence of immunity to varicella in adults are: U.S.-born before 1980 (for pregnant women and health care personnel, U.S.-born before 1980 is not considered evidence of immunity); documentation of 2 doses of VAR at least 4 weeks apart; history of varicella or herpes zoster diagnosis or verification of varicella or herpes zoster disease by a health care provider; or laboratory evidence of immunity or disease.

Special populations

- Pregnant women should be assessed for evidence of varicella immunity. Pregnant women who do not have evidence of immunity should receive the first dose of VAR upon completion or termination of pregnancy and before discharge from the health care facility, and the second dose 4–8 weeks after the first dose.
- Health care institutions should assess and ensure that all health care personnel have evidence of immunity to varicella.
- Adults with malignant conditions, including those that affect the bone marrow or lymphatic system or who receive systemic immunosuppressive therapy, should not receive VAR.
- Adults with HIV infection and CD4+T-lymphocyte count ≥200 cells/μL may receive 2 doses of VAR3 months apart. Adults with HIV infection and CD4+ T-lymphocyte count <200 cells/μL should not receive VAR

5. Herpes zoster vaccination

General information

- Adults aged 60 years or older should receive 1 dose of herpes zoster vaccine (HZV), regardless of whether they had a prior episode of herpes zoster.

Special populations

- Adults aged 60 years or older with chronic medical conditions may receive HZV unless they have a medical contraindication, e.g., pregnancy or severe immunodeficiency.
- Adults with malignant conditions, including those that affect the bone marrow or lymphatic system or who receive systemic immunosuppressive therapy, should not receive HZV.
- Adults with HIV infection and CD4+ T-lymphocyte count <200 cells/μL should not receive HZV.

6. Human papillomavirus vaccination

General information

- Adult females through age 26 years and adult males through age 21 years who have not received any human papillomavirus vaccine (HPV) should receive a 3-dose series of HPV at 0, 1–2, and 6 months. Males aged 22 through 26 years may be vaccinated with a 3-dose series of HPV at 0, 1–2, and 6 months.
- Adult females through age 26 years and adult males through age 21 years (and males aged 22 through 26 years who may receive HPV) who initiated HPV series before age 15 years and received 2 doses at least 5 months apart are considered adequately vaccinated and do not need an additional dose of HPV.
- Adult females through age 26 years and adult males through age 21 years (and males aged 22 through 26 years who may receive HPV) who initiated HPV series before age 15 years and received only 1 dose, or 2 doses less than 5 months apart, are not considered adequately vaccinated and should receive 1 additional dose of HPV.
- Notes: HPV is routinely recommended for children at age 11 or 12 years. For adults who had initiated but did not complete HPV series, consider their age at first HPV vaccination (described above) and other factors (described below) to determine if they have been adequately vaccinated.

Special populations

- Men who have sex with men through age 26 years who have not received any HPV should receive a 3-dose series of HPV at 0, 1–2, and 6 months.
- Adult females and males through age 26 years with immunocompromising conditions (described below), including those with HIV infection, should receive a 3-dose series of HPV at 0, 1–2, and 6 months.
- Pregnant women are not recommended to receive HPV, although there is no evidence that the vaccine poses harm. If a woman is found to be pregnant after initiating HPV series, delay the remaining doses until after the pregnancy. No other intervention is needed. Pregnancy testing is not needed before administering HPV.
- Note: Immunocompromising conditions for which a 3-dose series of HPV is indicated are those with primary or secondary immunocompromising conditions that might reduce cell-mediated or humoral immunity, e.g., B-lymphocyte antibody deficiencies, complete or partial T-lymphocyte defects, HIV infection, malignant neoplasm, transplantation, autoimmune disease, and immunosuppressive therapy.

7. Pneumococcal vaccination

General information

- Adults who are immunocompetent and aged 65 years or older should receive 13-valent pneumococcal conjugate vaccine (PCV13) followed

Footnotes–Continued

by 23-valent pneumococcal polysaccharide vaccine (PPSV23) at least 1 year after PCV13.

- Notes: Adults are recommended to receive 1 dose of PCV13 and 1, 2, or 3 doses of PPSV23 depending on indication. When both PCV13 and PPSV23 are indicated, PCV13 should be administered first; PCV13 and PPSV23 should not be administered during the same visit. If PPSV23 has previously been administered, PCV13 should be administered at least 1 year after PPSV23. When 2 or more doses of PPSV23 are indicated, the interval between PPSV23 doses should be at least 5 years. Supplemental information on pneumococcal vaccine timing for adults aged 65 years or older and adults aged 19 years or older at high risk for pneumococcal disease (described below) is available at www.cdc.gov/vaccines/vpd-vac/pneumo/downloads/adult-vax-clinician-aid.pdf. No additional doses of PPSV23 are indicated for adults who received PPSV23 at age 65 years or older. When indicated, PCV13 and PPSV23 should be administered to adults whose pneumococcal vaccination history is incomplete or unknown.

Special populations

- Adults aged 19 through 64 years with chronic heart disease, including congestive heart failure and cardiomyopathies (excluding hypertension); chronic lung disease, including chronic obstructive lung disease, emphysema, and asthma; chronic liver disease, including cirrhosis; alcoholism; or diabetes mellitus or those who smoke cigarettes should receive PPSV23. At age 65 years or older, they should receive PCV13 and another dose of PPSV23 at least 1 year after PCV13 and at least 5 years after the most recent dose of PPSV23.
- Adults aged 19 years or older with immunocompromising conditions or anatomical or functional asplenia (described below) should receive PCV13 and a dose of PPSV23 at least 8 weeks after PCV13, followed by a second dose of PPSV23 at least 5 years after the first dose of PPSV23. If the most recent dose of PPSV23 was administered before age 65 years, at age 65 years or older, administer another dose of PPSV23 at least 8 weeks after PCV13 and at least 5 years after the most recent dose of PPSV23.
- Adults aged 19 years or older with cerebrospinal fluid leak or cochlear implant should receive PCV13 followed by PPSV23 at least 8 weeks after PCV13. If the most recent dose of PPSV23 was administered before age 65 years, at age 65 years or older, administer another dose of PPSV23 at least 8 weeks after PCV13 and at least 5 years after the most recent dose of PPSV23.
- Notes: Immunocompromising conditions that are indications for pneumococcal vaccination are congenital or acquired immunodeficiency including B- or T-lymphocyte deficiency, complement deficiencies, and phagocytic disorders excluding chronic granulomatous disease; HIV infection;chronic renal failure and nephrotic syndrome; leukemia, lymphoma, Hodgkin disease, generalized malignancy, and multiple myeloma; solid organ transplant; and iatrogenic immunosuppression including long-term systemic corticosteroid and radiation therapy. Anatomical or functional asplenia that are indications for pneumococcal vaccination are sickle cell disease and other hemoglobinopathies, congenital or acquired asplenia, splenic dysfunction, and splenectomy. Pneumococcal vaccines should be given at least 2 weeks before immunosuppressive therapy or an elective splenectomy, and as soon as possible to adults who are diagnosed with HIV infection.

8. Hepatitis A vaccination

General information

- Adults who seek protection from hepatitis A virus infection may receive a 2-dose series of single antigen hepatitis A vaccine (HepA) at either 0 and 6–12 months (Havrix) or 0 and 6–18 months (Vaqta). Adults may also receive a combined hepatitis A and hepatitis B vaccine (HepA-HepB) (Twinrix) as a 3-dose series at 0, 1, and 6 months. Acknowledgment of a specific risk factor by those who seek protection is not needed.

Special populations

- Adults with any of the following indications should receive a HepA series: have chronic liver disease, receive clotting factor concentrates, men who have sex with men, use injection or non injection drugs, or work with hepatitis A virus–infected primates or in a hepatitis A research laboratory setting.
- Adults who travel in countries with high or intermediate levels of endemic hepatitis A infection or anticipate close personal contact with an international adoptee, e.g., reside in the same household or regularly babysit, from a country with high or intermediate level of endemic hepatitis A infection within the first 60 days of arrival in the United States should receive a HepA series.

9. Hepatitis B vaccination

General information

- Adults who seek protection from hepatitis B virus infection may receive a 3-dose series of single-antigen hepatitis B vaccine (HepB) (Engerix-B, Recombivax HB) at 0, 1, and 6 months. Adults may also receive a combined hepatitis A and hepatitis B vaccine (HepA-HepB) (Twinrix) at 0, 1, and 6 months. Acknowledgment of a specific risk factor by those who seek protection is not needed.

Special populations

- Adults at risk for hepatitis B virus infection by sexual exposure should receive a HepB series, including sex partners of hepatitis B surface antigen (HBsAg)–positive persons, sexually active persons who are not in a mutually monogamous relationship, persons seeking evaluation or treatment of a sexually transmitted infection, and men who have sex with men.
- Adults at risk for hepatitis B virus infection by percutaneous or mucosal exposure to blood should receive a HepB series, including adults who are recent or current users of injection drugs, household contacts of HBsAg-positive persons, residents and staff of facilities for developmentally disabled persons, incarcerated, health care and public safety workers at risk for exposure to blood or blood-contaminated body fluids, younger than age 60 years with diabetes mellitus, and age 60 years or older with diabetes mellitus at the discretion of the treating clinician.
- Adults with chronic liver disease including, but not limited to, hepatitis C virus infection, cirrhosis, fatty liver disease, alcoholic liver disease, autoimmune hepatitis, and an alanine aminotransferase (ALT) or aspartate aminotransferase (AST) level greater than twice the upper limit of normal should receive a HepB series.
- Adults with end-stage renal disease including those on pre dialysis care, hemodialysis, peritoneal dialysis, and home dialysis should receive a HepB series. Adults on hemodialysis should receive a 3-dose series of 40 μg Recombivax HB at 0, 1, and 6 months or a 4-dose series of 40 μg Engerix-B at 0, 1, 2, and 6 months.
- Adults with HIV infection should receive a HepB series.
- Pregnant women who are at risk for hepatitis B virus infection during pregnancy, e.g., having more than 1 sex partner during the previous 6 months, been evaluated or treated for a sexually transmitted infection, recent or current injection drug use, or had an HBsAg-positive sex partner, should receive a HepB series.
- International travelers to regions with high or intermediate levels of endemic hepatitis B virus infection should receive a HepB series.
- Adults in the following settings are assumed to be at risk for hepatitis B virus infection and should receive a HepB series: sexually transmitted disease treatment facilities, HIV testing and treatment facilities, facilities providing drug-abuse treatment and prevention services, health care settings targeting services to persons who inject drugs, correctional facilities, health care settings targeting services to men who have sex with men, hemodialysis facilities and end-stage renal disease programs, and institutions and nonresidential day care facilities for developmentally disabled persons.

10. Meningococcal vaccination

Special populations

- Adults with anatomical or functional asplenia or persistent complement component deficiencies should receive a 2-dose primary series of serogroups A, C, W, and Y meningococcal conjugate vaccine (MenACWY) at least 2 months apart and revaccinate every 5 years. They should also receive a series of serogroup B meningococcal vaccine (MenB) with either a 2-dose series of MenB-4C (Bexsero) at least 1 month apart or a 3-dose series of MenB-FHbp (Trumenba) at 0, 1–2, and 6 months.
- Adults with HIV infection who have not been previously vaccinated should receive a 2-dose primary series of MenACWY at least 2 months apart and revaccinate every 5 years. Those who previously received 1 dose of MenACWY should receive a second dose at least 2 months after the first dose. Adults with HIV infection are not routinely recommended to receive MenB because meningococcal disease in this population is caused primarily by serogroups C, W, and Y.
- Microbiologists who are routinely exposed to isolates of *Neisseria meningitidis* should receive 1 dose of MenACWY and revaccinate every 5 years if the risk for infection remains, and either a 2-dose series of MenB-4C at least 1 month apart or a 3-dose series of MenB-FHbp at 0, 1–2, and 6 months.
- Adults at risk because of a meningococcal disease outbreak should receive 1 dose of MenACWY if the outbreak is attributable to serogroup A, C, W, or Y, or either a 2-dose series of MenB-4C at least 1 month apart or a 3-dose series of MenB-FHbp at 0, 1–2, and 6 months if the outbreak is attributable to serogroup B.
- Adults who travel to or live in countries with hyperendemic or epidemic meningococcal disease should receive 1 dose of MenACWY and revaccinate every 5 years if the risk for infection remains. Men B is not routinely indicated because meningococcal disease in these countries is generally not caused by serogroup B.
- Military recruits should receive 1 dose of MenACWY and revaccinate every 5 years if the increased risk for infection remains.
- First-year college students aged 21 years or younger who live in residence halls should receive 1 dose of MenACWY if they have not received MenACWY at age 16 years or older.
- Young adults aged 16 through 23 years (preferred age range is 16 through 18 years) who are healthy and not at increased risk for serogroup B meningococcal disease (described above) may receive either a 2-dose series of MenB-4C at least 1 month apart or a 2-dose series of MenB-FHbp at 0 and 6 months for short-term protection against most strains of serogroup B meningococcal disease.
- For adults aged 56 years or older who have not previously received serogroups A, C, W, and Y meningococcal vaccine and need only 1 dose, meningococcal polysaccharide serogroups A, C, W, and Y vaccine (MPSV4) is preferred. For adults who previously received MenACWY or anticipate receiving multiple doses of serogroups A, C, W, and Y meningococcal vaccine, MenACWY is preferred.
- Notes: MenB-4C and MenB-FHbp are not interchangeable, i.e., the same vaccine should be used for all doses to complete the series. There is no recommendation for MenB revaccination at this time. MenB may be administered at the same time as MenACWY but at a different anatomical site, if feasible.

11. *Haemophilus influenzae* type b vaccination

Special populations

- Adults who have anatomical or functional asplenia or sickle cell disease, or are undergoing elective splenectomy should receive 1 dose of *Haemophilus influenzae* type b conjugate vaccine (Hib) if they have not previously received Hib. Hib should be administered at least 14 days before splenectomy.
- Adults with a hematopoietic stem cell transplant (HSCT) should receive 3 doses of Hib in at least 4 week intervals 6–12 months after transplant regardless of their Hib history.
- Note: Hib is not routinely recommended for adults with HIV infection because their risk for *Haemophilus influenzae* type b infection is low.

Table. Contraindications and precautions for vaccines recommended for adults aged 19 years or older*

The Advisory Committee on Immunization Practices (ACIP) recommendations and package inserts for vaccines provide information on contraindications and precautions related to vaccines. Contraindications are conditions that increase chances of a serious adverse reaction in vaccine recipients and the vaccine should not be administered when a contraindication is present. Precautions should be reviewed for potential risks and benefits for vaccine recipient. For a person with a severe allergy, e.g., anaphylaxis, to latex, vaccines supplied in vials or syringes that contain natural rubber latex should not be administered unless the benefit of vaccination clearly outweighs the risk for a potential allergic reaction. For latex allergies other than anaphylaxis, vaccines supplied in vials or syringes that contain dry, natural rubber or natural rubber latex may be administered.

Contraindications and precautions for vaccines routinely recommended for adults

Vaccine	Contraindications	Precautions
All vaccines routinely recommended for adults	• Severe reaction, e.g., anaphylaxis, after a previous dose or to a vaccine component	• Moderate or severe acute illness with or without fever

Additional contraindications and precautions for vaccines routinely recommended for adults

Vaccine	Additional Contraindications	Additional Precautions
IIV[1]		• History of Guillain-Barré syndrome within 6 weeks after previous influenza vaccination • Egg allergy other than hives, e.g., angioedema, respiratory distress, lightheadedness, or recurrent emesis; or required epinephrine or another emergency medical intervention (IIV may be administered in an inpatient or outpatient medical setting and under the supervision of a health care provider who is able to recognize and manage severe allergic conditions)
RIV[1]		• History of Guillain-Barré syndrome within 6 weeks after previous influenza vaccination
LAIV[1]	• LAIV should not be used during 2016–2017 influenza season	• LAIV should not be used during 2016–2017 influenza season
Tdap/Td	• For pertussis-containing vaccines: encephalopathy, e.g., coma, decreased level of consciousness, or prolonged seizures, not attributable to another identifiable cause within 7 days of administration of a previous dose of a vaccine containing tetanus or diphtheria toxoid or acellular pertussis	• Guillain-Barré syndrome within 6 weeks after a previous dose of tetanus toxoid-containing vaccine • History of Arthus-type hypersensitivity reactions after a previous dose of tetanus or diphtheria toxoid-containing vaccine. Defer vaccination until at least 10 years have elapsed since the last tetanus toxoid-containing vaccine • For pertussis-containing vaccine, progressive or unstable neurologic disorder, uncontrolled seizures, or progressive encephalopathy (until a treatment regimen has been established and the condition has stabilized)
MMR[2]	• Severe immunodeficiency, e.g., hematologic and solid tumors, chemotherapy, congenital immunodeficiency or long-term immunosuppressive therapy;[3] HIV infection with severe immunocompromise • Pregnancy	• Recent (within 11 months) receipt of antibody-containing blood product (specific interval depends on product)[4] • History of thrombocytopenia or thrombocytopenic purpura • Need for tuberculin skin testing[5]
VAR[2]	• Severe immunodeficiency, e.g., hematologic and solid tumors, chemotherapy, congenital immunodeficiency or long-term immunosuppressive therapy;[3] HIV infection with severe immunocompromise • Pregnancy	• Recent (within 11 months) receipt of antibody-containing blood product (specific interval depends on product)[4] • Receipt of specific antiviral drugs (acyclovir, famciclovir, or valacyclovir) 24 hours before vaccination (avoid use of these antiviral drugs for 14 days after vaccination)
HZV[2]	• Severe immunodeficiency, e.g., hematologic and solid tumors, chemotherapy, congenital immunodeficiency or long-term immunosuppressive therapy;[3] HIV infection with severe immunocompromise • Pregnancy	• Receipt of specific antiviral drugs (acyclovir, famciclovir, or valacyclovir) 24 hours before vaccination (avoid use of these antiviral drugs for 14 days after vaccination)
HPV		• Pregnancy
PCV13	• Severe allergic reaction to any vaccine containing diphtheria toxoid	

1. For additional information on use of influenza vaccines among persons with egg allergy, see: CDC. Prevention and control of seasonal influenza with vaccines: recommendations of the Advisory Committee on Immunization Practices—United States, 2016–17 influenza season. MMWR. 2016;65(RR-5):1-54. Available at www.cdc.gov/mmwr/volumes/65/rr/rr6505a1.htm.
2. MMR may be administered together with VAR or HZV on the same day. If not administered on the same day, separate live vaccines by at least 28 days.
3. Immunosuppressive steroid dose is considered to be daily receipt of 20 mg or more prednisone or equivalent for 2 or more weeks. Vaccination should be deferred for at least 1 month after discontinuation of immunosuppressive steroid therapy. Providers should consult ACIP recommendations for complete information on the use of specific live vaccines among persons on immune-suppressing medications or with immune suppression because of other reasons.
4. Vaccine should be deferred for the appropriate interval if replacement immune globulin products are being administered. See: CDC. General recommendations on immunization: recommendations of the Advisory Committee on Immunization Practices (ACIP). MMWR. 2011;60(No. RR-2). Available at www.cdc.gov/mmwr/preview/mmwrhtml/rr6002a1.htm.
5. Measles vaccination may temporarily suppress tuberculin reactivity. Measles-containing vaccine may be administered on the same day as tuberculin skin testing, or should be postponed for at least 4 weeks after vaccination.

* Adapted from: CDC. Table 6. Contraindications and precautions to commonly used vaccines. General recommendations on immunization: recommendations of the Advisory Committee on Immunization Practices. MMWR. 2011;60(No. RR-2):40-41 and from: Hamborsky J, Kroger A, Wolfe S, eds. Appendix A. Epidemiology and prevention of vaccine preventable diseases. 13th ed. Washington, DC: Public Health Foundation; 2015. Available at www.cdc.gov/vaccines/pubs/pinkbook/index.html

Acronyms of vaccines recommended for adults

HepA	hepatitis A vaccine	LAIV	live attenuated influenza vaccine	PCV13	13-valent pneumococcal conjugate vaccine
HepA-HepB	hepatitis A and hepatitis B vaccines	MenACWY	serogroups A, C, W, and Y meningococcal conjugate vaccine	PPSV23	23-valent pneumococcal polysaccharide vaccine
HepB	hepatitis B vaccine			RIV	recombinant influenza vaccine
Hib	*Haemophilus influenzae* type b conjugate vaccine	MenB	serogroup B meningococcal vaccine	Td	tetanus and diphtheria toxoids
HPV	human papillomavirus vaccine	MMR	measles, mumps, and rubella vaccine	Tdap	tetanus toxoid, reduced diphtheria toxoid, and acellular pertussis vaccine
HZV	herpes zoster vaccine	MPSV4	serogroups A, C, W, and Y meningococcal polysaccharide vaccine		
IIV	inactivated influenza vaccine			VAR	varicella vaccine

From the Centers for Disease Control and Prevention, Atlanta, Georgia.

Disclosures: To assure the integrity of the ACIP, the U.S. Department of Health and Human Services has taken steps to ensure technical adherence to ethics statutes and regulations regarding financial conflicts of interest. Concerns regarding the potential for the appearance of a conflict are addressed, or avoided altogether, through pre- and postappointment considerations. Individuals with particular vaccine-related interests will not be considered for appointment to the committee. Potential nominees are screened for conflicts of interest, and if any are found, they are asked to divest or forgo certain vaccine-related activities. In addition, at the beginning of each ACIP meeting, each member is asked to declare his or her conflicts. Members with conflicts are not permitted to vote if the conflict involves the vaccine or biological being voted on. Details can be found at www.cdc.gov/vaccines/acip/committee/structure-role.html. Conflict of interest disclosures of members of the ACIP are available at www.acponline.org/authors/icmje/ConflictOfInterestForms.do?msNum=M16-2936.

Corresponding Author: David K. Kim, MD, Immunization Services Division, National Center for Immunization and Respiratory Diseases, Centers for Disease Control and Prevention, 1600 Clifton Road NE, Mailstop A-19, Atlanta, GA 30329-4027; e-mail, dkim@cdc.gov.

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Appendix

Recommendations for routine use of vaccines in adults, and children and adolescents are developed by the Advisory Committee on Immunization Practices (ACIP). ACIP is chartered as a federal advisory committee to provide expert external advice and guidance to the Director of the Centers for Disease Control and Prevention (CDC) on use of vaccines and related agents for the control of vaccine-preventable diseases in the civilian population of the United States. Recommendations for routine use of vaccines in adults are harmonized with recommendations of the American College of Physicians (ACP), the American Academy of Family Physicians (AAFP), the American College of Obstetricians and Gynecologists (ACOG), and the American College of Nurse-Midwives (ACNM). Recommendations for routine use of vaccines in children and adolescents are harmonized to the greatest extent possible with recommendations made by the American Academy of Pediatrics (AAP), AAFP, and ACOG. ACIP recommendations adopted by the CDC Director become agency guidelines on the date published in the *Morbidity and Mortality Weekly Report* (MMWR). Additional information on ACIP is available at www.cdc.gov/vaccines/acip.

Members of the ACIP

Nancy Bennett, MD, MS, University of Rochester School of Medicine and Dentistry, Rochester, New York (*Chair*); Amanda Cohn, MD, Centers for Disease Control and Prevention, National Center for Immunization and Respiratory Diseases, Atlanta, Georgia (*Executive Secretary*); Robert L. Atmar, MD, Baylor College of Medicine, Houston, Texas; Edward Belongia, MD, Marshfield Clinic Research Foundation, Marshfield, Wisconsin; Echezona Ezeanolue, MD, MPH, University of Nevada, Las Vegas, Nevada; Paul Hunter, MD, University of Wisconsin School of Medicine and Public Health, Milwaukee, WI; Allison Kempe, MD, MPH, University of Colorado School of Medicine, Denver, Colorado; Grace M. Lee, MD, MPH, Harvard Medical School, Boston, Massachusetts; Kelly Moore, MD, MPH, Tennessee Department of Health, Nashville, Tennessee; Cynthia Pellegrini, March of Dimes, Washington, DC; Arthur L. Reingold, MD, University of California School of Public Health, Berkeley, California; Laura E. Riley, MD, Harvard Medical School, Boston, Massachusetts; José R. Romero, MD, University of Arkansas for Medical Sciences, Little Rock, Arkansas; David Stephens, MD, Emory University School of Medicine, Atlanta, Georgia; Peter Szilagyi, MD, MPH, University of California, Los Angeles, Los Angeles, California; Emmanuel (Chip) Walter Jr., MD, MPH, Duke University School of Medicine, Durham, North Carolina. A list of current ACIP members is available at www.cdc.gov/vaccines/acip/committee/members.html.

ACIP Adult Immunization Work Group

Work Group Chair: Laura E. Riley, MD, Cambridge, Massachusetts.

Work Group Members: John Epling, MD, MSEd, Syracuse, New York; Stephan Foster, Nashville, Tennessee; Sandra Fryhofer, MD, Atlanta, Georgia; Robert H. Hopkins Jr., MD, Little Rock, Arkansas; Paul Hunter, MD, Milwaukee, WI; Jane Kim, MD, Durham, North Carolina; Laura Pinkston Koenigs, MD, Springfield, Massachusetts; Maria Lanzi, ANP, MPH, Hamilton, New Jersey; Marie-Michele Leger, MPH, PA-C, Alexandria, Virginia; Susan M. Lett, MD, Boston, Massachusetts; Robert Palinkas, MD, Urbana, Illinois; Gregory Poland, MD, Rochester, Minnesota; Joni Reynolds, MPH, Denver, Colorado; Charles Rittle, DNP, MPH, RN, Pittsburgh, Pennsylvania; William Schaffner, MD, Nashville, Tennessee; Kenneth Schmader, MD, Durham, North Carolina; Angela Shen, PhD, Washington, DC; Rhoda Sperling, MD, New York, New York.

Work Group Contributors: Carolyn B. Bridges, MD, Atlanta, Georgia; Elizabeth Briere, MD, MPH, Atlanta, Georgia; Lisa Grohskopf, MD, MPH, Atlanta, Georgia; Rafael Harpaz, MD, MPH, Atlanta, Georgia; Charles LeBaron, MD, Atlanta, Georgia; Jennifer L. Liang, DVM, MPVM, Atlanta, Georgia; Jessica MacNeil, MPH, Atlanta, Georgia; Mona Marin, MD, Atlanta, Georgia; Lauri Markowitz, MD, Atlanta, Georgia; Noele Nelson, MD, PhD, Atlanta, Georgia; Tamara Pilishvili, MPH, Atlanta, Georgia; Mona Saraiya, MD, MPH, Atlanta, Georgia; Sarah Schillie, MD, Atlanta, Georgia; Raymond A. Strikas, MD, MPH, Atlanta, Georgia; Walter W. Williams, MD, MPH, Atlanta, Georgia.

Work Group Consultants: Tamera Coyne-Beasley, MD, MPH, Chapel Hill, North Carolina; Kathleen H. Harriman, PhD, MPH, RN, Richmond, California; Molly Howell, MPH, Bismarck, North Dakota; Linda Kinsinger, MD, MPH, Durham, North Carolina; Diane Peterson, St. Paul, Minnesota; Litjen Tan, PhD, Chicago, Illinois.

Work Group Secretariat: David K. Kim, MD, MA, Atlanta, Georgia.