Impact of Adult Immunization

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- No conflicts of interest to disclose.

Objectives

- Overview of burden of illness, effectiveness of vaccines, and vaccine coverage for common vaccine-preventable diseases among adults.
- Update on recent changes or recommendations regarding adult immunizations.
- Describe the Standards for Adult Immunization Practice.
- Summarize results from recent national surveys on implementation of the Standards for Adult Immunization Practice.
- Resources to help with implementation of adult vaccination.

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Background

- Vaccine preventable diseases cause substantial morbidity and mortality among adults.
- Vaccinations have decreased the burden of illness in adults.
- The impact of vaccination, or vaccine effectiveness, varies by vaccine type, the disease outcome being measured, and the age or health of the person vaccinated.

Burden of Disease among U.S. Adults for Selected Diseases with Vaccines Available – Hepatitis B

- Liver infection caused by Hepatitis B virus.
- Estimated 19,200 cases acute Hepatitis B were reported in US in 2014.
- ~95% of new HBV infections occur among adults.
- Persons with diabetes are at twice risk of Hepatitis B.

https://www.fda.gov/ForPatients/Illness/HepatitisBC/ucm20041759.htm

https://www.cdc.gov/vaccines/pubs/pinkbook/hepb.html

Impact of Vaccination – Hepatitis B

- The vaccine is 80% to 100% effective in preventing infection or clinical hepatitis in those who receive the complete vaccine series.

https://phil.cdc.gov/phil/quicksearch.asp

https://www.cdc.gov/vaccines/pubs/pinkbook/hepb.html

Burden of Disease among U.S. Adults for Selected Diseases with Vaccines Available – Herpes Zoster (Shingles) [1]

- About 1 million cases of zoster annually U.S.
  - 10-11/1000 per year in persons ≥60 yrs
  - Lifetime risk: 32%
- Thoracic, cervical, and ophthalmic involvement are most common
- Approximately 10-25% with complication of eye (herpes zoster ophthalmicus)

FIGURE 2. Case of herpes zoster ophthalmicus

Photo/MN Oxman, University of California, San Diego

1. CDC. Prevention of Herpes Zoster. MMWR 2008. 57(RR-5): 1-30.

Impact of Vaccination – Herpes Zoster

- Zoster live attenuated vaccine effectiveness (VE):
  - 51% against shingles
  - 66% against post-herpetic neuralgia (PHN)
  - 80% against most prolonged and extreme cases of PHN[1]

- More effective subunit vaccine was presented at the most recent Advisory Committee Immunization Practices (ACIP) meeting.

1. Oxman MN, et al. NEJM 2005;352:2271-84.

Burden of Disease among U.S. Adults for Selected Diseases with Vaccines Available – Human Papilloma Virus (HPV)

- ~14 million people become infected with HPV each year[1].
- The symptoms resolve without intervention in 9 of 10 people within two years.
- HPV infections can last longer and can cause certain cancers.
- HPV causes 30,700 cancers in men and women annually.

1. https://www.cdc.gov/hpv/parents/cancer.html

Impact of Vaccination – HPV

- HPV vaccination can prevent most of the cancers (~28,000) from occurring.

Burden of Disease among U.S. Adults for Selected Diseases with Vaccines Available – Influenza

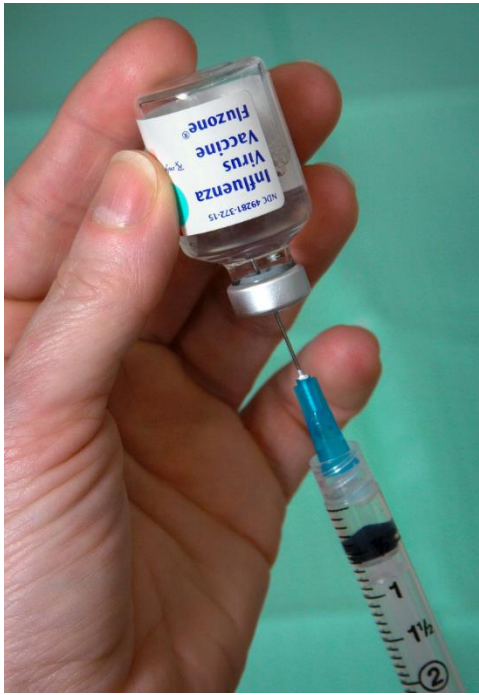
- Influenza disease burden varies year to year
  - — Millions of cases and average of 226,000 hospitalizations annually with >75% among adults[1]
  - — 3,000-49,000 deaths annually, >90% among adults[2]

- Direct medical costs in U.S.: ~$10.4 billion[3]
- Add in loss of work and life: ~$87 billion

1. Thompson WW, et al. Influenza-Associated Hospitalizations in the United States. JAMA 2004; 292: 1333-1340
2. CDC. Estimates of deaths associated with seasonal influenza – United States, 1976-2007. MMWR. 2010;59(33):1057-1062.
3. Molinari, et al. The annual impact of seasonal influenza in the US: Measuring disease burden and costs. *Vaccine* 2007;25 :5086–5096.

Impact of Vaccination - Influenza

- Effectiveness varies based on antigenic match and age and health of person being vaccinated
  - ~60–70% effective in younger adults when good match
  - ~30% in adults ≥65 years against medically attended influenza when good match[1]
  - Reduces antibiotic use, medical visits, loss of work days
- 2016-17 VE estimate: 48% (95% CI = 37%- 57%) against medically-attended influenza[2]



https://phil.cdc.gov/phil/quicksearch.asp

1. CDC. Prevention and Control of Seasonal Influenza: Recommendations of the ACIP – U.S., 2016-17. MMWR 2016
2. https://www.cdc.gov/mmwr/volumes/66/wr/mm6606a3.htm

Burden of Disease Among U.S. Adults for Selected Diseases with Vaccines Available – *Streptococcus pneumoniae*

- Can cause pneumonia, ear infections, sinus infections, meningitis, and bacteremia
- Vaccination recommended to prevent invasive pneumococcal disease (IPD) and other *S. pneumoniae* infections
- Adults with high risk medical conditions and ≥65 year at highest rates of IPD
  - –23 cases per 100,000 in 2015 among adults ≥65 years

1. CDC. Active Bacterial Core Surveillance. http://www.cdc.gov/abcs/reports-findings/survreports/spneu13.pdf
2. CDC. Notifiable Diseases and Mortality Tables. MMWR 2013. 61(51&52): ND-719 – ND 732.
3. CDC. Viral Hepatitis Surveillance United States, 2013. National Center for HIV/AIDS, Viral Hepatitis, STD& TB Prevention/Division of Viral Hepatitis.

Impact of Vaccination – Pneumococcal Vaccines

- PCV13 (pneumococcal conjugate vaccine) among adults aged ≥65 years:
  - 45% effective against vaccine-type pneumococcal pneumonia
  - 75% effective against vaccine-type invasive pneumococcal disease (IPD)

- PPSV23 (pneumococcal polysaccharide):
  - 74% (CI: 55-86%) effective in meta-analysis against IPD
  - Not effective against non-IPD pneumonia

Bonten MJ, et al. NEJM 2015;372:1114-25.
Moberley S, et al. Cochrane Database Syst Rev 2013

Burden of Disease Among U.S. Adults for Selected Diseases with Vaccines Available – Tetanus, Diphtheria, and Acellular Pertussis

- Tetanus and diphtheria are rare in U.S.
- Pertussis: 20,762 cases reported in 2015 (4,650 cases among adults)

https://www.cdc.gov/pertussis/downloads/pertuss-surv-report-2015.pdf

Impact of Vaccination – Td/Tdap

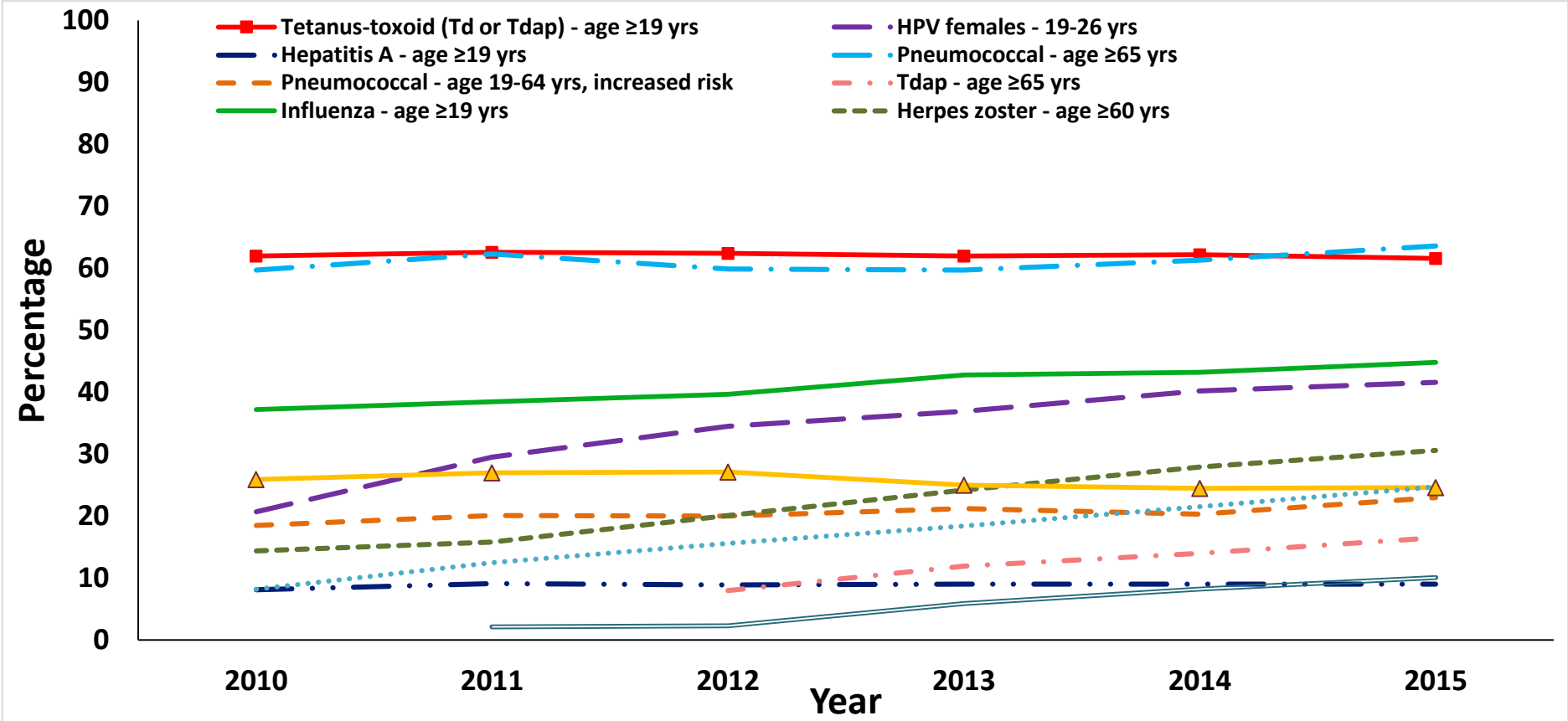
- Tdap is ~70% effective against pertussis in the first year after vaccination.

- Effectiveness decreases each year: 4 years post-vaccination, effectiveness is 30-40%.

- Vaccinated persons who are infected with pertussis are less likely to have a serious infection.

https://www.cdc.gov/pertussis/about/faqs.html

Proportion of Adults Aged ≥19 Years Who Received Selected Vaccines,* by Age Group and Increased Risk Status† — National Health Interview Survey, United States, 2010–2015



Objectives

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Background on Adult Immunization Schedule

- Updated annually
  - Represents current, approved Advisory Committee on Immunization Practices (ACIP) policy
  - Designed for implementation of ACIP recommendations
  - Contains figures for indications by age and medical or other conditions
  - Contains footnotes for each vaccine that should be read with the figures
  - Target audience – healthcare providers and pharmacists

- Published in- *MMWR* (announcement) and *Annals of Internal Medicine*

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. Additional CDC resources include:

- 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 vaccine	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). Available at www.cdc.gov/mmwr/volumes/66/wr/mm6605e2.htm?s_cid=mm6605e2_w.
[2] Ann Intern Med. 2017;166:209-218. Available at annals.org/aim/article/doi/10.7326/M16-2936.

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

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

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

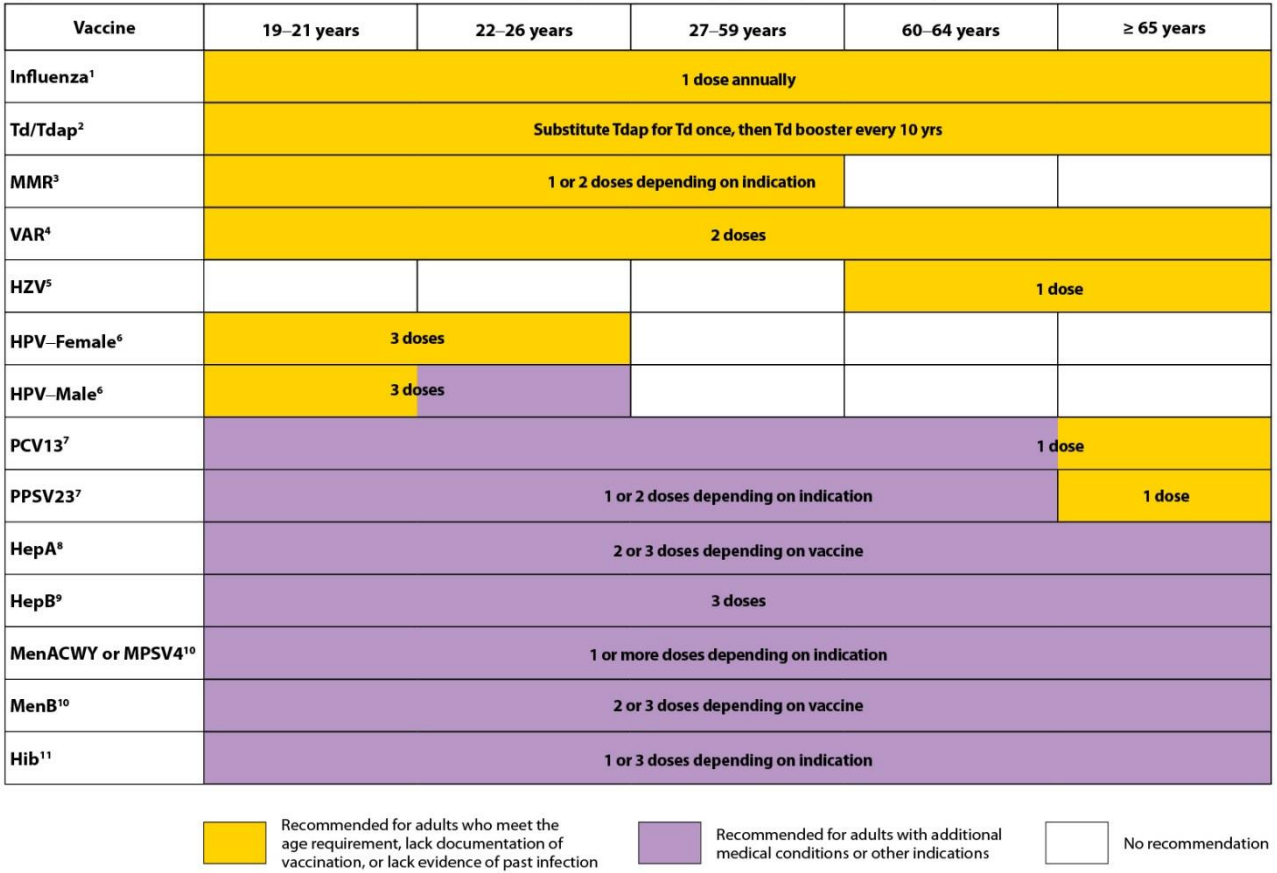

Figure 2. Recommended immunization schedule for adults aged 19 years or older by medical condition and other indications, United States, 2017

Vaccine	Pregnancy[1-6,9]	Immuno-compromised (excluding HIV infection)[3-7,11]	HIV infection CD4+ count (cells/μL)[3-7,9-11]		Asplenia, persistent complement deficiencies[7,10,11]	Kidney failure, end-stage renal disease, on hemodialysis[7,9]	Heart or lung disease, chronic alcoholism[7]	Chronic liver disease[7-9]	Diabetes[7,9]	Healthcare personnel[3,4,9]	Men who have sex with men[6,8,9]
			< 200	≥ 200							
Influenza[1]	1 dose annually										
Td/Tdap[2]	1 dose Tdap each pregnancy	Substitute Tdap for Td once, then Td booster every 10 yrs									
MMR[3]	contraindicated			1 or 2 doses depending on indication							
VAR[4]	contraindicated			2 doses							
HZV[5]	contraindicated				1 dose						
HPV–Female[6]		3 doses through age 26 yrs									
HPV–Male[6]		3 doses through age 26 yrs			3 doses through age 21 yrs						3 doses through age 26 yrs
PCV13[7]		1 dose									
PPSV23[7]		1, 2, or 3 doses depending on indication									
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]	3 doses post-HSCT recipients only	1 dose									

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

Contraindicated

No recommendation

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 healthcare 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.
- Notes: 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 prior 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 healthcare 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 healthcare 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 conditions affecting the bone marrow or lymphatic system, systemic immunosuppressive therapy, or cellular immunodeficiency should not receive MMR.
- Adults with human immunodeficiency virus (HIV) infection and CD4+ T-lymphocyte count ≥200 cells/μl 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/μl should not receive MMR.
- Adults who work in healthcare facilities should receive 2 doses of MMR at least 28 days apart; healthcare 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 healthcare facility, should be considered for revaccination with 2 doses of MMR at least 28 days apart.

4. Varicella vaccination

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., healthcare 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; non-pregnant women of childbearing age; adolescents and adults living in households with children; and international travelers.
- Notes: Evidence of immunity to varicella in adults is: U.S.-born before 1980 (for pregnant women and healthcare 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 healthcare 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 healthcare facility, and the second dose 4–8 weeks after the first dose.
- Healthcare institutions should assess and ensure that all healthcare 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 human immunodeficiency virus (HIV) infection and CD4+ T-lymphocyte count ≥200 cells/μl may receive 2 doses of VAR 3 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 human immunodeficiency virus (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 (HPV) vaccine should receive a 3-dose series of HPV vaccine at 0, 1-2, and 6 months. Males aged 22 through 26 years may be vaccinated with a 3-dose series of HPV vaccine 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 vaccination) who initiated the HPV vaccination 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 vaccine.
- Adult females through age 26 years and adult males through age 21 years (and males aged 22 through 26 years who may receive HPV vaccination) who initiated the HPV vaccination 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 vaccine.
- Notes: HPV vaccination is routinely recommended for children at age 11 or 12 years. For adults who had initiated but did not complete the HPV vaccination 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 vaccine should receive a 3-dose series of HPV vaccine at 0, 1-2, and 6 months.
- Adult females and males through age 26 years with immunocompromising conditions (described below), including those with human immunodeficiency virus (HIV) infection, should receive a 3-dose series of HPV vaccine at 0, 1–2, and 6 months.
- Pregnant women are not recommended to receive HPV vaccine, although there is no evidence that the vaccine poses harm. If a woman is found to be pregnant after initiating the HPV vaccination series, delay the remaining doses until after the pregnancy. No other intervention is needed. Pregnancy testing is not needed before administering HPV vaccine.
- Notes: Immunocompromising conditions for which a 3-dose series of HPV vaccine is indicated are 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 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 two 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 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; human immunodeficiency virus (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 for a sexually transmitted infection, and men who have sex with men (MSM).
- 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, healthcare 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 human immunodeficiency virus (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 one sex partner during the previous six 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, healthcare settings targeting services to persons who inject drugs, correctional facilities, healthcare settings targeting services to MSM, 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 human immunodeficiency virus (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. MenB 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 anatomic 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.
- Notes: Hib is not routinely recommended for adults with human immunodeficiency virus 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 to latex, e.g., anaphylaxis, 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 healthcare 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], human immunodeficiency virus (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 vaccine		• 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 two 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 vaccine	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

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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 healthcare 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.
- Notes: 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 prior 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 healthcare provider-diagnosed disease without laboratory confirmation is not acceptable evidence of immunity.

vaccine or mumps vaccine of unknown type who are at high risk for mumps infection, e.g., work in a healthcare facility, should be considered for revaccination with 2 doses of MMR at least 28 days apart.

4. Varicella vaccination

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., healthcare 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; non-pregnant women of childbearing age; adolescents and adults living in households with children; and international travelers.
- Notes: Evidence of immunity to varicella in adults is: U.S.-born before 1980 (for pregnant women and healthcare 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 healthcare 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 healthcare facility, and the second dose 4–8 weeks after the first dose.
- Healthcare institutions should assess and ensure that all healthcare 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.

- Adult females through age 26 years and adult males through age 21 years (and males aged 22 through 26 years who may receive HPV vaccination) who initiated the HPV vaccination 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 vaccine.
- Adult females through age 26 years and adult males through age 21 years (and males aged 22 through 26 years who may receive HPV vaccination) who initiated the HPV vaccination 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 vaccine.
- Notes: HPV vaccination is routinely recommended for children at age 11 or 12 years. For adults who had initiated but did not complete the HPV vaccination 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 vaccine should receive a 3-dose series of HPV vaccine at 0, 1-2, and 6 months.
- Adult females and males through age 26 years with immunocompromising conditions (described below), including those with human immunodeficiency virus (HIV) infection, should receive a 3-dose series of HPV vaccine at 0, 1–2, and 6 months.
- Pregnant women are not recommended to receive HPV vaccine, although there is no evidence that the vaccine poses harm. If a woman is found to be pregnant after initiating the HPV vaccination series, delay the remaining doses until after the pregnancy. No other intervention is needed. Pregnancy testing is not needed before administering HPV vaccine.
- Notes: Immunocompromising conditions for which a 3-dose series of HPV vaccine is indicated are 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.

LAIV should not be used during the 2016–2017 influenza season

Adults with egg allergy who have only hives should receive age-appropriate IIV or RIV

Adults with egg allergy other than hives, e.g., angioedema or respiratory distress, may receive age-appropriate IIV or RIV… in a medical setting

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 healthcare 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.
- Notes: 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 prior 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 healthcare 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 healthcare 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 conditions affecting the bone marrow or lymphatic system, systemic immunosuppressive therapy, or cellular immunodeficiency should not receive MMR.
- Adults with human immunodeficiency virus (HIV) infection and CD4+ T-lymphocyte count ≥200 cells/μl 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/μl should not receive MMR.
- Adults who work in healthcare facilities should receive 2 doses of MMR at least 28 days apart; healthcare 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

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

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; non-pregnant women of childbearing age; adolescents and adults living in households with children; and international travelers.
- Notes: Evidence of immunity to varicella in adults is: U.S.-born before 1980 (for pregnant women and healthcare 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 healthcare 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 healthcare facility, and the second dose 4–8 weeks after the first dose.
- Healthcare institutions should assess and ensure that all healthcare 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 human immunodeficiency virus (HIV) infection and CD4+ T-lymphocyte count ≥200 cells/μl may receive 2 doses of VAR 3 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 human immunodeficiency virus (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 (HPV) vaccine should receive a 3-dose series of HPV vaccine at 0, 1-2, and 6 months. Males aged 22 through 26 years may be vaccinated with a 3-dose series of HPV vaccine at 0, 1-2, and 6 months

vaccination 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 vaccine should receive a 3-dose series of HPV vaccine at 0, 1-2, and 6 months.
- Adult females and males through age 26 years with immunocompromising conditions (described below), including those with human immunodeficiency virus (HIV) infection, should receive a 3-dose series of HPV vaccine at 0, 1–2, and 6 months.
- Pregnant women are not recommended to receive HPV vaccine, although there is no evidence that the vaccine poses harm. If a woman is found to be pregnant after initiating the HPV vaccination series, delay the remaining doses until after the pregnancy. No other intervention is needed. Pregnancy testing is not needed before administering HPV vaccine.
- Notes: Immunocompromising conditions for which a 3-dose series of HPV vaccine is indicated are 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.

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.,

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 healthcare 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 conditions affecting the bone marrow or lymphatic system, systemic immunosuppressive therapy, or cellular immunodeficiency should not receive MMR.
- Adults with human immunodeficiency virus (HIV) infection and CD4+ T-lymphocyte count ≥200 cells/µl 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/µl should not receive MMR.
- Adults who work in healthcare facilities should receive 2 doses of MMR at least 28 days apart; healthcare 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

- Adults with human immunodeficiency virus (HIV) infection and CD4+ T-lymphocyte count ≥200 cells/µl may receive 2 doses of VAR 3 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 human immunodeficiency virus (HIV) infection and CD4+ T-lymphocyte count <200 cells/µl should not receive HZV.

Adult females through age 26 and adult males through age 21 (and males 22–26 who may receive vaccination) who initiated HPV vaccination series before age 15 and:

- **Received 2 doses at least 5 months apart are considered adequately vaccinated and do not need additional dose of HPV vaccine**
- **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 vaccine**

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 (HPV) vaccine should receive a 3-dose series of HPV vaccine at 0, 1-2, and 6 months. Males aged 22 through 26 years may be vaccinated with a 3-dose series of HPV vaccine 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 vaccination) who initiated the HPV vaccination 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 vaccine.
- Adult females through age 26 years and adult males through age 21 years (and males aged 22 through 26 years who may receive HPV vaccination) who initiated the HPV vaccination 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 vaccine.
- Notes: HPV vaccination is routinely recommended for children at age 11 or 12 years. For adults who had initiated but did not complete the HPV vaccination 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 vaccine should receive a 3-dose series of HPV vaccine at 0, 1-2, and 6 months.
- Adult females and males through age 26 years with immunocompromising conditions (described below), including those with human immunodeficiency virus (HIV) infection, should receive a 3-dose series of HPV vaccine at 0, 1–2, and 6 months.
- Pregnant women are not recommended to receive HPV vaccine, although there is no evidence that the vaccine poses harm. If a woman is found to be pregnant after initiating the HPV vaccination series, delay the remaining doses until after the pregnancy. No other intervention is needed. Pregnancy testing is not needed before administering HPV vaccine.
- Notes: Immunocompromising conditions for which a 3-dose series of HPV vaccine is indicated are 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.

rubella in adults is: born before 1957, documentation of receipt of MMR, or laboratory evidence of immunity or disease. Documentation of healthcare provider-diagnosed disease without laboratory confirmation is not acceptable evidence of immunity.

- Healthcare institutions should assess and ensure that all healthcare 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.

7. Pneumococcal vaccination

General information

- Adults who are immunocompetent and aged 65 years or older should receive 13-valent pneumococcal conjugate vaccine (PCV13) followed 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 two 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; people who smoke cigarettes should receive PPSV23. At age 65 years or
- dose of PPSV23 at least 1 y
- most recent dose of PPSV
- Adults aged 19 years or ol
- anatomical or functional a
- and a dose of PPSV23 at le
- dose of PPSV23 at least 5 y
- recent dose of PPSV23 wa
- years or older, administer
- PCV13 and at least 5 years
- Adults aged 19 years or ol
- implant should receive PC
- PCV13. If the most recent
- 65 years, at age 65 years o
- least 8 weeks after PCV13
- of PPSV23.
- Notes: Immunocompromi
- pneumococcal vaccinatio
- including B- or T-lymphoc
- and phagocytic disorders
- human immunodeficienc
- and nephrotic syndrome;
- generalized malignancy, a
- and iatrogenic immunosu
- corticosteroid and radiatic
- that are indications for pn
- and other hemoglobinop
- dysfunction, and splenect
- at least 2 weeks before im
- splenectomy, and as soon
- HIV infection.

8. Hepatitis A vaccinati

General information

- Adults who seek protectio
- a 2-dose series of single ar
- and 6–12 months (Havrix)
- 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

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 human immunodeficiency virus (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

immunodeficiency virus infection because their risk for *Haemophilus influenzae* type b infection is low.

Recommendations for HepB remain same, examples of chronic liver disease added

- **Anyone who wants protection from hepatitis B virus infection**
- **At risk – percutaneous/mucosal or sexual exposure, close contacts of HBsAg(+), HIV, occupational, travel**
- **End-stage renal disease, dialysis**
- **Chronic liver disease – examples include hepatitis C virus infection, cirrhosis, fatty liver disease, alcoholic liver disease, autoimmune hepatitis, alanine aminotransferase (ALT) or aspartate aminotransferase (AST) level greater than twice the upper limit of normal**

Adults with HIV infection… should receive 2-dose primary series of MenACWY at least 2 months apart…and revaccinate every 5 years

Young adults age 16–23 (preferred age 16–18) healthy and not at increased risk for serogroup B meningococcal disease may receive either 2-dose series of MenB-FHbp at 0 and 6 months or 2-dose series of MenB-4C at least 1 month apart

Adults at risk, e.g., asplenia, complement deficiency, microbiologists, outbreaks, should receive 3-dose series of MenB-FHbp at 0, 1–2, and 6 months… or 2-dose series of MenB-4C at least 1 month apart

and phagocytic disorders excluding chronic granulomatous disease; human immunodeficiency virus (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.

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 human immunodeficiency virus (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 one sex partner during the previous six 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, healthcare settings targeting services to persons who inject drugs, correctional facilities, healthcare settings targeting services to MSM, 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 human immunodeficiency virus (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. MenB 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 anatomic 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.
- Notes: Hib is not routinely recommended for adults with human immunodeficiency virus infection because their risk for *Haemophilus influenzae* type b infection is low.

Plan – 2018 Adult Immunization Schedule

- Update with new or revised ACIP recommendations
- Harmonize further with child and adolescent immunization schedule
- Conduct comprehensive evaluation
  - Usability and usefulness
  - In-depth interviews, graphics design, job aids, product testing
- Continue efforts to simplify and standardize figures and footnotes
  - Language, format, and flow
- Collaborate with
  - ACOG for *Recommended Immunization Schedule for Pregnant Women*
  - HHS for *Recommended Immunization Schedule for Adults and Adolescents with HIV Infection*

Improving Use of the Adult Immunization Schedule

- Many HCP treating adults are not using the adult immunization schedule.
  - Prompts for age-based recommendations built into EHRs
  - No prompts built in for risk-based recommendations

- HCP want to see immunization recommendations from their professional organizations which make these partnerships so important.

Objectives

- Overview of burden of illness, effectiveness of vaccines, and vaccine coverage for common vaccine-preventable diseases among adults.
- Update on recent changes or recommendations regarding adult immunizations.
- Describe the Standards for Adult Immunization Practice.
- Summarize results from recent national surveys on implementation of the Standards for Adult Immunization Practice.
- Include resources to help with implementation of adult vaccination.

Standards for Adult Immunization Practice

In 1990, the National Coalition for Adult Immunization developed the Standards for Adult Immunization Practice (the “Standards”), outlining basic strategies to improve vaccine delivery to adults.

The Standards were revised to emphasize the responsibility of all HCP who treat adults to:

- Conduct routine assessments of a patient’s vaccination needs during every clinical encounter
- Strongly recommend needed vaccines
- Administer needed vaccines or refer patients for vaccination
- Document administered vaccinations in IIS

Objectives

- Overview of burden of illness, effectiveness of vaccines, and vaccine coverage for common vaccine-preventable diseases among adults.
- Update on recent changes or recommendations regarding adult immunizations.
- Describe the Standards for Adult Immunization Practice.
- Summarize results from recent national surveys on implementation of the Standards for Adult Immunization Practice.
- Include resources to help with implementation of adult vaccination.

Surveys to Assess Implementation of the Standards

- General population survey
- Healthcare provider and pharmacist surveys

Objectives: General Population Survey

1) Evaluate responses from adults on whether their HCPs, including pharmacists, implemented the Standards during their most recent healthcare and/or pharmacy visit in the past year.

2) Determine whether Standards were being implemented differently among different types of providers.

Methods: General Population Survey

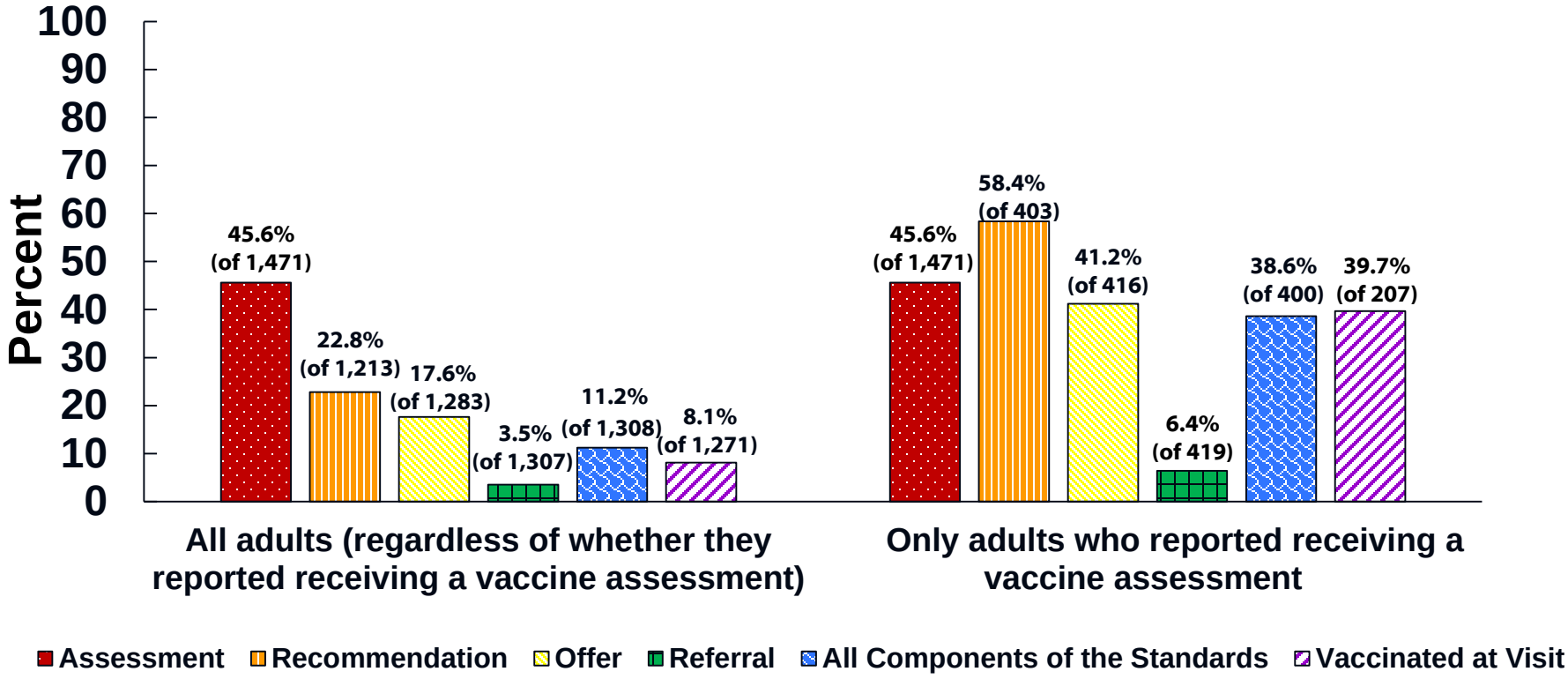
- Conducted a probability-based Internet panel survey during Feb—March 2016.
- Selected a nationally representative sample of U.S. adults aged ≥19 years and oversampled self-reported Hispanics, non-Hispanic blacks, and respondents identified as other/multiple-race.
- Developed sampling weights to produce estimates for the U.S. adult population.
- Questions were asked about the implementation of the Standards from the patient's most recent outpatient HCP/pharmacy visit in last 12 months.

Results: General Population Survey

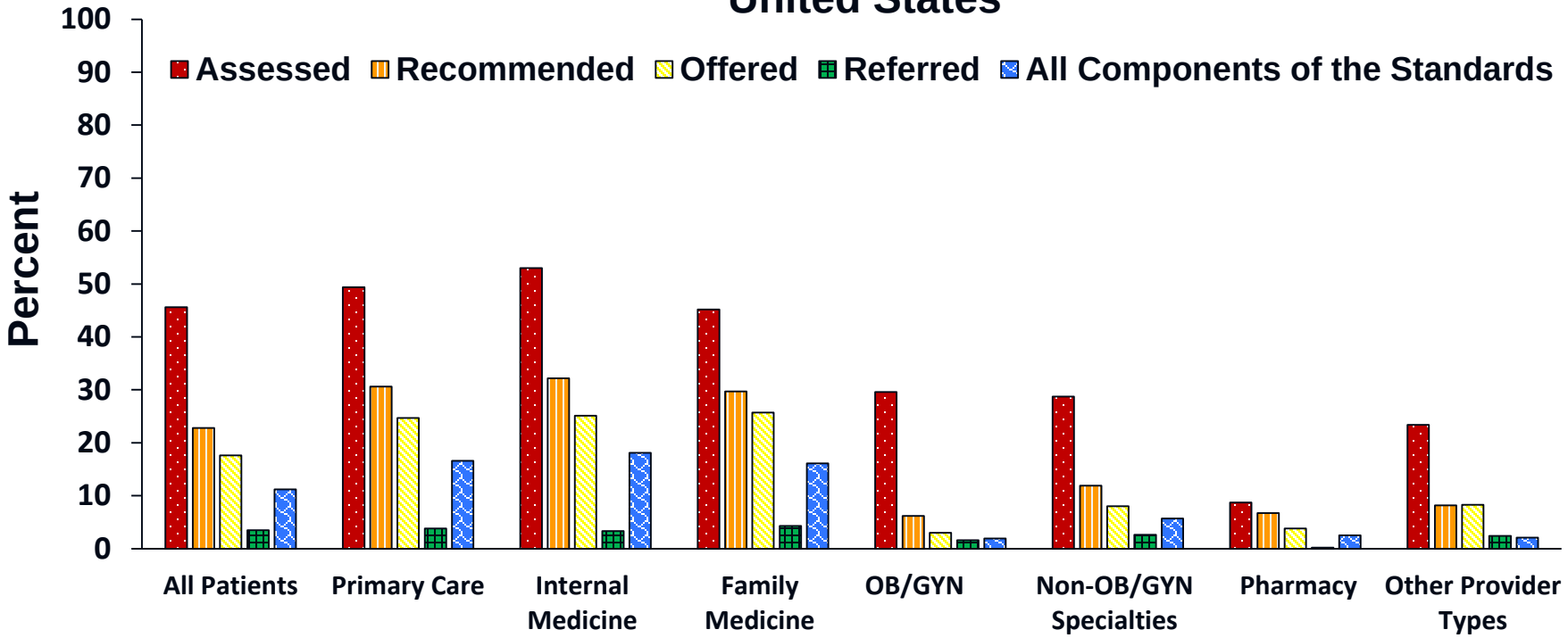
- Of 3,473 panelists invited to take the survey, 2,004 (57.7%) entered the survey site, of whom 1,905 (95.1%) completed the survey with valid answers.

- We analyzed data from 1,476 (77.5%) respondents:
  - 459 (68.3%) were self-reported non-Hispanic white
  - Median age was 55 years (range: 19-92 years)
  - 1,399 (94.7%) were insured
  - 1,203 (59.7%) had at least a college education

Reported Receipt of the Standards for Adult Immunization Practice during Patients' Most Recent Healthcare and/or Pharmacy Visit: All Adults Versus Only Adults Who Reported Receiving a Vaccine Assessment, Internet Panel Survey, United States, February– March, 2016



Percentage of Most Recent Visit(s) to Healthcare Location and/or Pharmacy in Past 12 Months during Which Adults Reported Receiving Each Component of the Standards for Adult Immunization Practice (by Provider Type), Internet Panel Survey, February–March 2016, United States



Strength of Vaccine Recommendation

- Among 333 responses on strength of vaccination:
  - 80 (21.1%) reported a “very strong” recommendation
  - 119 (35.1%) reported a “somewhat strong” recommendation
  - 99 (34.3%) reported a “not too strong” recommendation
  - 35 (9.5%) reported a “not strong at all” recommendation

- Fewer respondents reported receiving a “very strong” or “somewhat strong” recommendation for influenza vaccination (155/175 [49.9%]) compared with non-influenza vaccination (103/143 [75.3%], p=0.0018).

- A strong recommendation correlated with vaccine receipt.

Limitations: General Population Survey

- There were sociodemographic differences between respondents and non-respondents.
- Results were based on self-report and were not verified by review of medical records or other reliable sources.
- Patients may not have been aware of assessments done “behind the scenes”.

Discussion: General Population Survey

- The Standards are not being routinely implemented.

- However, if the patient reported receiving a vaccine assessment:
  - —Nearly 3x more reported receiving a recommendation
  - —2 ½ times more reported receiving either a vaccine offer or referral, of whom 40% reported actually receiving a vaccination

- Primary care practices implemented the Standards more frequently than other types of practices.
  - —However, <17% of respondents who visited a primary care provider reported receiving all components of the Standards.

Healthcare Provider Survey and Pharmacist Survey

Objectives: HCP and Pharmacist Surveys

1) Evaluate responses from HCPs and pharmacists on whether they routinely implement the Standards with their adult patients.

2) Determine whether Standards were being implemented differently among different types of providers.

Methods: HCP and Pharmacist Surveys

- HCP and pharmacist surveys were essentially the same survey, but questions were slightly different because of differences in pharmacy workflow.

- Opt-in Internet panel of physicians, nurse practitioners, physician assistants, pharmacists in outpatient settings (Medscape)
  - Internal medicine, family medicine, OB/GYN, specialty care; pharmacists

- Weighted, probability-based, representative

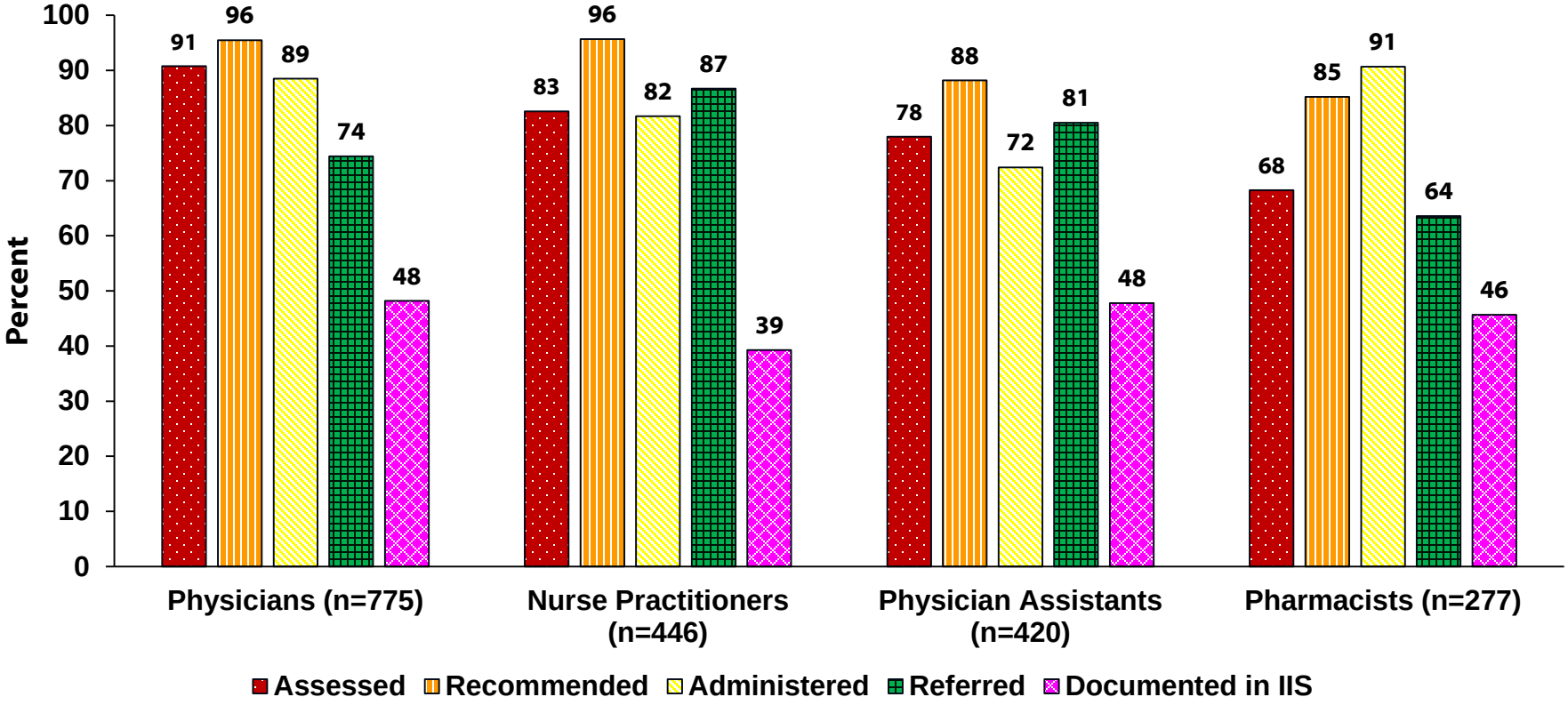
- Administered online Feb–Mar 2016

Results: Healthcare Providers and Pharmacists Surveys

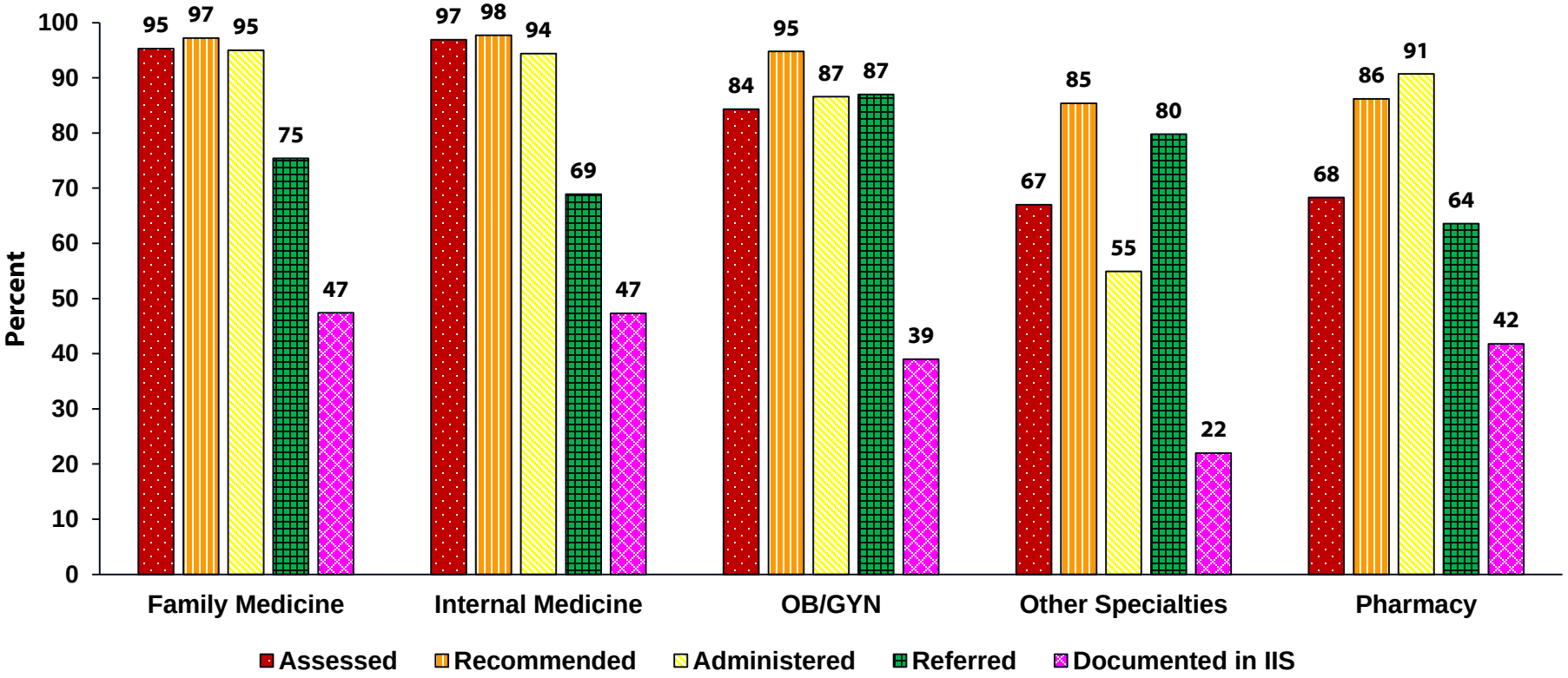
- HCPs: 1,907 started survey → 1,684 (88.3%) completed survey; data analysis on 1,641 eligible
  - 32% family medicine, 28% internal medicine, 21% OB/GYN, 19% other specialties
  - 46% private practice, 38% healthcare system-owned practice
  - 66% non-Hispanic white

- Pharmacists: 320 started survey → 277 (86.6%) completed survey; data analysis on 277 eligible
  - 44% chain drug store pharmacist, 32% retail or grocery store pharmacist, 18% independent
  - 87% employee, 7% contractor, 6% owner
  - 70% non-Hispanic white

Reported Implementation of the Standards for Adult Immunization Practice, as Reported by HCPs and Pharmacists (by Provider Type), Internet Panel Survey, United States, February- March 2016 (N=1,918)



Implementation of the Standards for Adult Immunization Practice, as Reported by HCPs and Pharmacists (by Provider Specialty), Internet Panel Survey, United States, February- March 2016 (N=1,918)



Limitations: HCP and Pharmacist Surveys

- HCPs may have generalized their immunization practices to all patients.
- Sampling bias – self-selected Internet panels of respondents; differences between respondents and non-respondents.
- Results based on self-report and not verified. There was also the potential for recall bias.
- Survey response rate cannot be calculated because opt-in recruitment sample does not permit enumeration of the denominator.

Discussion: HCP and Pharmacist Surveys

- Overall, HCPs and pharmacists reported very high levels of implementation of the Standards.
- Physicians reported implementing the Standards more frequently than other provider types (Nurse practitioners, PAs, pharmacists).
- Primary care providers reported implementing the Standards more frequently than other specialties.
- Limited reporting to IIS among all groups.

Overall Conclusions (from Patient and Provider Surveys)

- Striking gap between patient and provider perceptions of how well the Standards are being implemented:
  - HCPs reported very high levels of implementation of the Standards (reported assessments ranged from 67%- 97%)
  - Adult patients reported low levels of receipt of care that reflects implementation of the Standards (reported assessments ranged from 9%- 53%).

- When obstacles are not overcome for any individual component of the Standards or at the systems-level, the end result is patients not being vaccinated.

Public Health Implications

- The Standards for Adult Immunization Practice should be incorporated into routine clinical practice for every patient, at every visit, regardless of the type of clinical setting.

- Additional vaccine-related quality measures might encourage healthcare system executives to prioritize implementation of the Standards.

- Given the low rates of vaccination of adults in the U.S., the consistent implementation of the Standards is necessary for improving adult vaccination coverage.

Objectives

- Overview of burden of illness, effectiveness of vaccines, and vaccine coverage for common vaccine-preventable diseases among adults.
- Update on recent changes or recommendations regarding adult immunizations.
- Describe the Standards for Adult Immunization Practice.
- Summarize results from recent national surveys on implementation of the Standards for Adult Immunization Practice.
- Include resources to help with implementation of adult vaccination.

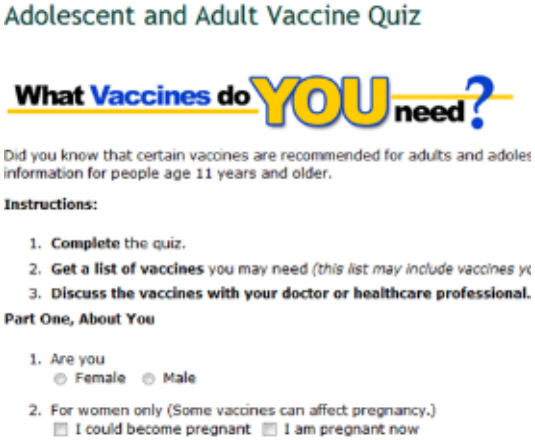
Resources For Implementing Standards

- Patient check-in vaccine questionnaire to be used at clinics: http://www.cdc.gov/vaccines/hcp/patient-ed/adults/downloads/patient-intake-form.pdf.

- H-A-L-O – vaccine needs questionnaire based on your patient's Health condition, Age, Lifestyle, and Occupation at: http://www.immunize.org/catg.d/p3070.pdf.

- Patient on-line quiz – direct patients to complete the quiz before coming to their appointment – gives them and you a starting point for talking about which vaccines they might need. http://www2.cdc.gov/nip/adultimmsched/.

- CDC adult vaccine schedule app at: http://www.cdc.gov/vaccines/schedules/hcp/schedule-app.html.



Adolescent and Adult Vaccine Quiz

What Vaccines do YOU need?

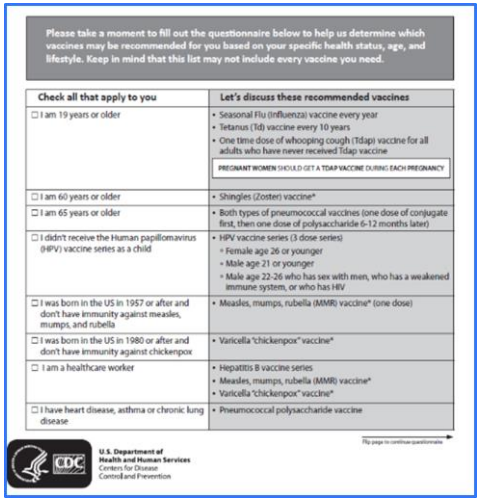
Did you know that certain vaccines are recommended for adults and adoles
information for people age 11 years and older.

Instructions:

1. **Complete** the quiz.
2. **Get a list of vaccines** you may need *(this list may include vaccines yo*
3. **Discuss the vaccines with your doctor or healthcare professional.**

Part One, About You

1. Are you
   ○ Female ○ Male
2. For women only (Some vaccines can affect pregnancy.)
   ☐ I could become pregnant ☐ I am pregnant now



Please take a moment to fill out the questionnaire below to help us determine which vaccines may be recommended for you based on your specific health status, age, and lifestyle. Keep in mind that this list may not include every vaccine you need.

Check all that apply to you	Let's discuss these recommended vaccines
☐ I am 19 years or older	• Seasonal Flu (influenza) vaccine every year • Tetanus (Td) vaccine every 10 years • One time dose of whooping cough (Tdap) vaccine for all adults who have never received Tdap vaccine PREGNANT WOMEN SHOULD GET A TDAP VACCINE DURING EACH PREGNANCY
☐ I am 60 years or older	• Shingles (Zoster) vaccine*
☐ I am 65 years or older	• Both types of pneumococcal vaccines (one dose of conjugate first, then one dose of polysaccharide 6-12 months later)
☐ I didn't receive the Human papillomavirus (HPV) vaccine series as a child	• HPV vaccine series (3 dose series) ◦ Female age 26 or younger ◦ Male age 21 or younger ◦ Male age 22-26 who has sex with men, who has a weakened immune system, or who has HIV
☐ I was born in the US in 1957 or after and don't have immunity against measles, mumps, and rubella	• Measles, mumps, rubella (MMR) vaccine* (one dose)
☐ I was born in the US in 1980 or after and don't have immunity against chickenpox	• Varicella "chickenpox" vaccine*
☐ I am a healthcare worker	• Hepatitis B vaccine series • Measles, mumps, rubella (MMR) vaccine* • Varicella "chickenpox" vaccine*
☐ I have heart disease, asthma or chronic lung disease	• Pneumococcal polysaccharide vaccine

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

Patient Education Materials: Chronic Conditions and Vaccinations

www.cdc.gov/vaccines/AdultPatientEd

Patient Education Materials: General Vaccinations

www.cdc.gov/vaccines/AdultPatientEd

Resources From Professional Provider Organizations on Adult Immunizations

- **American College of Physicians** - http://immunization.acponline.org/ has information about adult vaccinations, quality improvement, resources for practical application, and information on special populations. Download the ACP Immunization Advisor App here: http://bit.ly/ACPapp
- **American Academy of Family Physicians** - http://www.aafp.org/patient-care/immunizations/schedules.html for information on vaccinations plus CME opportunities
- **American Assocation of Nurse Practitioners** - http://www.aanp.org/education/education-toolkits/immunizations. Includes tool kits and other information.
- **American Academy of Physician Assistants –** http://www.aapa.org. has information on professional recommendations for immunization practice.
- **American College of Obstetricians and Gynecologists** - www.immunizationforwomen.org information about vaccines for pregnant and non-pregnant women, vaccine coding and other business practices
- **American Pharmacists Assocation** - http://www.pharmacist.com/immunization-resources. Multiple resources, training and tools for pharmacists on immunizations.
- **Infectious Diseases Society of America** - http://www.idsociety.org/Immunization/. Provides multiple resources and also recommendations specifically for immune compromised persons.

Final Thoughts…

- Substantial burden of disease in adults for which vaccines are recommended.
- Vaccination rates low among adults in U.S., leaving adults unnecessarily vulnerable to illnesses that can be prevented.
  - Do not reflect patient or provider interest in vaccines
  - Efforts needed to close gap
- Routinely implementing the Adult Immunization Practice Standards can help increase adult vaccination coverage.
- Many tools and resources available.

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The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

Back-up Slides

Data Source
National Health Interview Survey, 2015

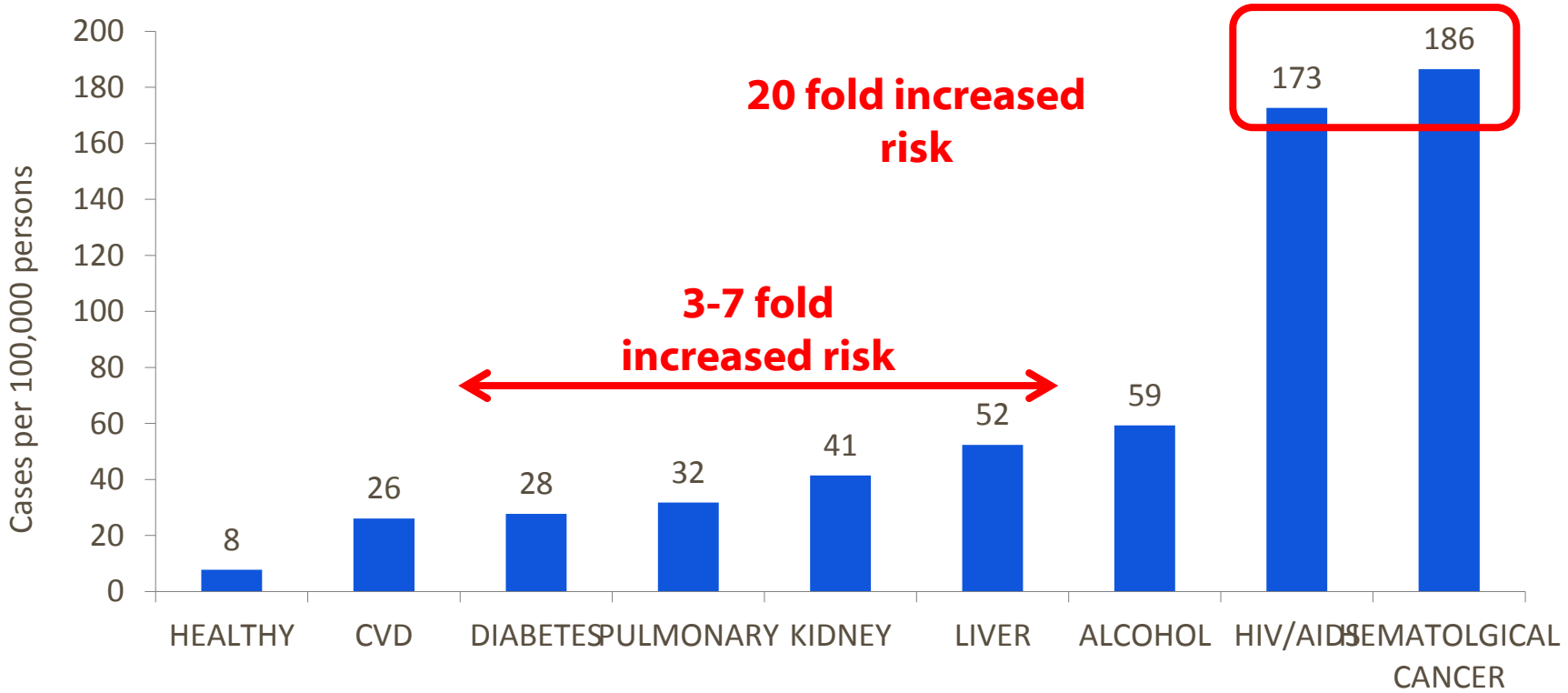
- Annual in-home survey of U.S. non-institutionalized civilian population
- Detailed health survey of one adult per family in each household sampled
- Provides national coverage estimates
- Final sample for estimating adult vaccination coverage:
  - Response rate: 55.2%
  - N = 33,348
- Sample for estimating influenza coverage, 2014-15 season:
  - Response rate: 58.9% (2014); 55.2% (2015)
  - N = 31,897

Adult Vaccination Coverage 2015

- Pneumococcal vaccination for 19–64y high risk: 23.0% (↑2.8%)
- Tdap vaccination for ≥19y: 23.1% (↑3.1%); adults living with infants <1y: 41.9% (↑10.0%)
- Shingles vaccination for ≥60y: 30.6% (↑2.7%)
- Otherwise similar to 2014 estimates; in 2015:
  - Influenza vaccination 2015–2016 for ≥18y: 41.7%
  - Pneumococcal vaccination for ≥65y: 63.6%
  - Hepatitis B vaccination for 19–59y w diabetes: 24.4%
- Racial and ethnic disparities persisted – lower coverage among blacks and Hispanics

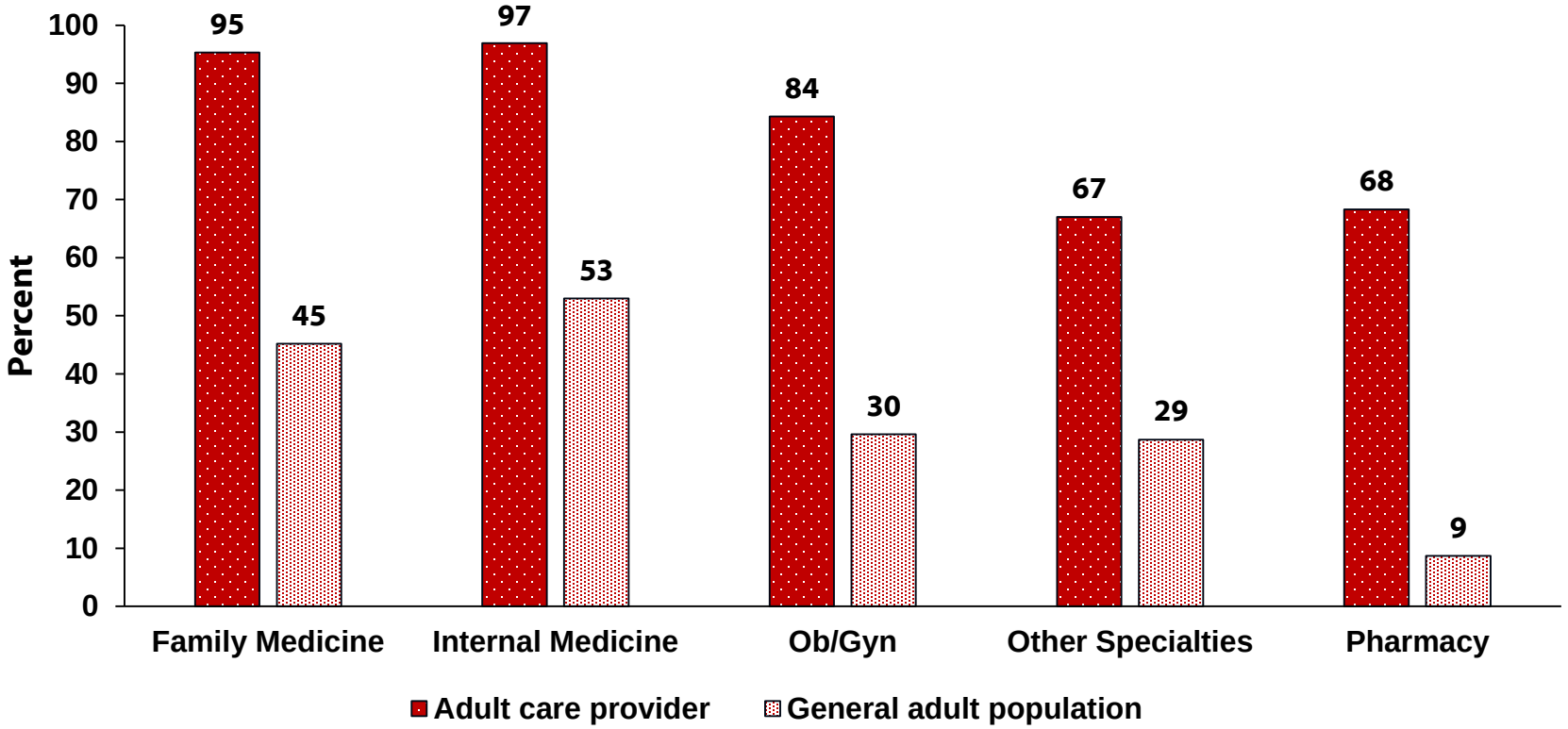
Brief update published online Feb 7 (full article pending publication in MMWR)
Non-influenza vaccination coverage – National Health Interview Survey (NHIS)
Influenza vaccination coverage – Behavioral Risk Factor Surveillance System (BRFSS)
https://www.cdc.gov/vaccines/imz-managers/coverage/adultvaxview/coverage-estimates/2015.html
https://www.cdc.gov/flu/fluvaxview/coverage-1516estimates.htm

Incidence of IPD in adults aged 18--64 years with selected underlying conditions, United States, 2009



Kyaw, JID 2005;192:377-86

Comparison of Adult Vaccination Assessments, Reported by HCPs and Pharmacists Versus General Adult Population, Internet Panel Survey, United States, February- March 2016



Vaccination of Adults 65 Years and Older

- Older adults at greatest risk of severe influenza-related illness, but vaccine effectiveness lower compared to younger persons

- Two newer vaccines approved for adults >65 years
  - Adjuvanted inactivated trivalent influenza vaccine
    - Cohort study in Italy estimated 25% (CI 2-43) lower risk influenza-related hospitalization vs non-adjuvanted
  - High dose
    - RCT efficacy of high-dose relative to standard dose vaccine of 24% (CI 9.7-36.5) against laboratory confirmed influenza

Black S. Safety and effectiveness of MF-59 adjuvanted influenza vaccines in children and adults. Vaccine 2015;335:B3-B5.

Mannino S, et al. Effectiveness of adjuvanted influenza vaccination in elderly subjects in northern Italy. Am J Epidemiol. 2012;176(6):527-33.

HPV VACCINE WORKS AND IT LASTS

HPV Vaccine WORKS

- The HPV vaccine works extremely well
- Clinical trials showed HPV vaccine provided close to 100% protection against precancers that can become cancer
- HPV vaccination has decreased HPV infection in teens

HPV Vaccine LASTS

- Excellent protection lasts at least 10 years
- No sign that protection will decrease
- Made like the Hepatitis B vaccine which gives lifelong protection

Discussion: What Can Be Done To Improve Adult Immunizations?

- Identify barriers in your community and in your practice
  - Usability and access to use of IIS by all vaccine providers
    - Tools to help remind patients and providers
    - Consolidates patients vaccination records in one place
  - Convenience and access to vaccines for patients
  - Improving patients being given strong provider recommendation
  - Reduce barriers for providers to offer vaccine
    - Providers identify payment issues as top barriers
      - In-network barriers, including Medicaid
      - Vaccine and vaccination payments
  - Systems changes to incorporate vaccination into patient flow