Adult Immunization: Schedule, Coverage, and Challenges

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MD Adult Immunization NetConference
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Overview

- Burden of vaccine-preventable diseases among adults
- Impact of vaccination
- Updates in 2017 adult immunization schedule
- Gaps in vaccination coverage for adults
- Strategies to improve adult immunization coverage
Vaccine-preventable diseases disproportionately affect adults, particularly older adults.
Health and Economic Impact of Influenza

- Millions of cases per year, varies year to year
- 226,000 hospitalizations per year, >75% among adults\(^1\)
- 3,000–49,000 deaths per year, >90% among adults\(^2\)
- Direct medical cost – $10.4 billion\(^3\)
- With loss of work and life – $87 billion

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Zoster and post-herpetic neuralgia on health-related quality of life

- 1 million cases per year, lifetime risk 32%
- 10–11/1,000 per year for adults ≥60y

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

Figure 1: Impact of herpes zoster on health-related quality of life. Shown are the percentages of participants (n = 261) who reported problems in the EuroQol EQ-5D domains at the time of recruitment (<14 days after rash onset) and after the pain stopped. Median duration of pain was 32.5 days. Error bars = 95% confidence intervals.

Drolet M et al. CMAJ 2010
Incidence of invasive pneumococcal disease among adults aged 18-64 years with select underlying conditions, United States, 2009

- 33,900 cases, 3,700 deaths in 2013
- 89% cases, almost all deaths occur among adults


Kyaw. JID 2005;192:377–86
Burden of Pertussis

- 21,000 cases in 2015, 22% among adults
- Most severe for infants
- Among hospitalized – apnea (61%), pneumonia (23%), death (1%)

Incidence of acute hepatitis B, by age group, United States, 2000–2013

- 3,050 cases in 2015
- Estimated 19,800 cases

CDC Viral Hepatitis Surveillance United States, 2013. National Center for HIV/AIDS, Viral Hepatitis, STD & TB Prevention/Division of Viral Hepatitis

National Notifiable Diseases Surveillance System (NNDSS)
Numbers of U.S. Cancers and Genital Warts Attributed to HPV Infections

- Penis: 400 (290 Males, 110 Females)
- Vagina: 500 (200 Males, 300 Females)
- Juvenile-Onset RRP: 820 (420 Males, 400 Females)
- Vulva: 1,600 (800 Males, 800 Females)
- Anus: 1,600 (800 Males, 800 Females)
- Oropharynx: 11,500 (5,700 Males, 5,800 Females)
- Cervix: 160,000 (80,000 Males, 80,000 Females)
- Genital Warts: 180,000 (90,000 Males, 90,000 Females)

Includes Males and Females
Vaccination is an important part in preventing serious diseases
Impact of Vaccination – Influenza

- Vaccine effectiveness varies depending on antigenic match, age and health
  - 60–70% in younger adults when good match
  - 30% in adults ≥65y for medically attended illness when good match

- 2016–2017 interim vaccine effectiveness estimate
  - 43% against A(H3N2), similar to years past
  - 61% against A(H1N1)pdm09

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2. Presented at February 2017 ACIP meeting
Impact of Vaccination – Influenza (2)

- Acute respiratory illness or influenza-like illness increases acute MI risk 2x
- Influenza vaccination effectiveness: Meta-analyses\textsuperscript{1–2}
  - 29% (95%CI 9.44) against acute MI in persons with existing CVD
  - 36% (95%CI 14.53) against major cardiac events with existing CVD
- Vaccine effectiveness 29% in acute MI prevention
  - “On par or better than accepted preventive measures [as] statins (36%), anti-hypertensives (15–18%), and smoking cessation (26%)”
  - Recommended by American College of Cardiology and American Heart Association


Cases and Hospitalizations Averted by Vaccination

www.cdc.gov/flu/about/disease/2015-16.htm
Impact of Vaccination – Zoster

- 51% against shingles
- 66% against post-herpetic neuralgia (PHN)
- 80% against most prolonged and extreme cases of PHN
- Inactivated adjuvanted herpes zoster subunit vaccine (HZ/su)
  - Not licensed
  - 17% vaccinated vs. 3% placebo with Grade 3 symptoms
  - 96% (95%CI 93,98) effectiveness among 50-, 60-, 70-year olds
  - Subsequent 90% (95%CI 84,94) effectiveness among ≥70y
  - Immunogenicity persisted through 9y post-vaccination

4. Presented at February 2017 ACIP meeting
Impact of Vaccination – Pneumococcal

- 13-valent pneumococcal conjugate vaccine (PCV13)
  - 45% against vaccine-type pneumococcal pneumonia and 75% against vaccine-type invasive pneumococcal disease (IPD) among adults ≥65y

- 23-valent pneumococcal polysaccharide vaccine (PPSV23)
  - 74% (95%CI 55,86) in meta-analysis against IPD
  - Not effective against non-IPD pneumonia
  - 11 unique serotypes (12 common serotypes with PCV13) caused 38% of IPD among adults ≥65y

Impact of Vaccination – Tdap in Pregnancy

- Vaccinating pregnant women 90% effective in preventing pertussis in infants

Annual number of pertussis prevented among infants ≤12 months-old with maternal Tdap vaccination, United States, 2000–2011

<table>
<thead>
<tr>
<th>Pertussis</th>
<th>Prevented with Tdap after pregnancy</th>
<th>Prevented with Tdap during pregnancy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cases (2746)</td>
<td>549</td>
<td>906</td>
</tr>
<tr>
<td>Hospitalizations (1217)</td>
<td>219</td>
<td>462</td>
</tr>
<tr>
<td>Deaths (18)</td>
<td>3</td>
<td>9</td>
</tr>
</tbody>
</table>

CDC. MMWR 2012;61:ND:719–32
CDC. MMWR 2013;62(07):131–135
Impact of Vaccination – Hepatitis B

- 90% effective after completing 3-dose series
- Effectiveness estimated lower in persons with diabetes and increasing age
  - 90% age <40y
  - 80% age 41–59y
  - 65% age 60–69y
  - <40% age ≥70y

MMWR 2011;60:1709–1711
Vaccines are routinely recommended for adults based on age, medical conditions, and other indications.
General Best Practice Guidelines for Immunization

Best Practices Guidance of the Advisory Committee on Immunization Practices (ACIP)

Kroger AT, Duchin J, Vázquez M

1. Introduction

The Centers for Disease Control and Prevention (CDC) recommends routine vaccination to prevent 17 vaccine-preventable diseases that occur in infants, children, adolescents, or adults. This report provides information for clinicians and other health care providers about concerns that commonly arise when vaccinating persons of various ages.
General Best Practice Guidelines for Immunization

- Replaces *General Recommendations on Immunization* in MMWR last updated in 2011
- Describes recommendations and guidelines on vaccination practice
- Removed most storage and handling information – now in www.cdc.gov/vaccines/hcp/admin/storage/toolkit/index.html
- Incorporates IDSA guidance on vaccinating immunocompromised
- Updates on vaccination record policy, impact of ACA, characterization and protocol for anaphylaxis, definition of precaution; new information on simultaneous vaccination and febrile seizures
Background – Adult Immunization Schedule

- Updated each year
  - Represents current, approved ACIP policy
  - Designed for implementation of ACIP recommendations
  - Contains figures for indications by age and medical or other conditions
  - Contains notes for each vaccine that should be read with the figures
  - Target audience – clinical care providers and pharmacists

- Updates approved by
  - American College of Physicians
  - American Academy of Family Physicians
  - American College of Obstetricians and Gynecologists
  - American College of Nurse-Midwives

- Published in
  - MMWR
  - Annals of Internal Medicine
Immunization Schedules

- **ACIP**
  - Adult Immunization Work Group
  - Child and Adolescent Immunization Work Group
  - Other ACIP Work Groups
    - General Recommendations
    - Evidence-based Recommendations
    - Influenza
    - HPV
    - Meningococcal
    - Pneumococcal
    - Zoster
    - Hepatitis

- **Other**
  - Varicella, Tdap/Td, MMR, Hib
  - Graphics, web design, communications
Updates – 2017 Adult Immunization Schedule

- Influenza vaccination – Jun 2016
  - Not use LAIV in 2016–2017
  - Modified language on egg allergy

- Tdap vaccination – Oct 2016
  - Updated guidance for use during pregnancy

- HPV vaccination – Oct 2016
  - Updated dosing schedule

- Hepatitis B vaccination – Oct 2016
  - Updated definition of chronic liver disease

- Meningococcal vaccination – Jun and Oct 2016
  - Use of MenACWY for adults with HIV infection
  - Updated dosing schedule for MenB-FHbp
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)


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 ACP 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/mm6602a1.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.vaes.cdc.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/dcd-info or by telephone, 800-822-6463. 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
- IPV: inactivated poliovirus vaccine
- LVV: 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
- Tet: tetanus and diphtheria toxoids
- Td: tetanus toxoid, reduced diphtheria toxoid, and acellular pertussis vaccine
- VAR: varicella vaccine

1 MMWR Morb Mortal Wkly Rep. 2017;66(2). Available at www.cdc.gov/mmwr/volumes/66/wr/mm6602a3.htm?s_cid=mm6602a2_w.
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**

<table>
<thead>
<tr>
<th>Vaccine</th>
<th>19-21 years</th>
<th>22-26 years</th>
<th>27-59 years</th>
<th>60-64 years</th>
<th>≥ 65 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Influenza(^1)</td>
<td>1 dose annually</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Td/Tdap(^2)</td>
<td></td>
<td></td>
<td>Substitute Tdap for Td once, then Td booster every 10 yrs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MMR(^3)</td>
<td>1 or 2 doses depending on indication</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VAR(^4)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2 doses</td>
</tr>
<tr>
<td>HZV(^5)</td>
<td></td>
<td>1 dose</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HPV-Female(^6)</td>
<td></td>
<td>3 doses</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HPV-Male(^6)</td>
<td></td>
<td>3 doses</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PCV13(^7)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1 dose</td>
</tr>
<tr>
<td>PPSV23(^7)</td>
<td></td>
<td></td>
<td>1 or 2 doses depending on indication</td>
<td></td>
<td>1 dose</td>
</tr>
<tr>
<td>HepA(^8)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2 or 3 doses depending on vaccine</td>
</tr>
<tr>
<td>HepB(^8)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3 doses</td>
</tr>
<tr>
<td>MenACWY or MPSV4(^9)</td>
<td></td>
<td></td>
<td>1 or more doses depending on indication</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MenB(^9)</td>
<td></td>
<td></td>
<td>2 or 3 doses depending on vaccine</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hib(^11)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1 or 3 doses depending on indication</td>
</tr>
</tbody>
</table>

- **Yellow** Recommended for adults who meet the age requirement, lack documentation of vaccination, or lack evidence of past infection
- **Purple** Recommended for adults with additional medical conditions or other indications
- **White** No recommendation
Figure 2. Recommended immunization schedule for adults aged 19 years or older by medical condition and other indications, United States, 2017

<table>
<thead>
<tr>
<th>Vaccine</th>
<th>Pregnancy4,6,8</th>
<th>Immunocompromised (excluding HIV infection)4,9,11</th>
<th>HIV infection CD4+ count (cells/μL) &lt; 200</th>
<th>≥ 200</th>
<th>Asplenia, persistent complement deficiencies4,11</th>
<th>Kidney failure, end-stage renal disease, on hemodialysis2,9</th>
<th>Heart or lung disease, chronic alcoholism2</th>
<th>Chronic liver disease10</th>
<th>Diabetes10</th>
<th>Healthcare personnel1,4,9</th>
<th>Men who have sex with men4,9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Influenza1</td>
<td>1 dose annually</td>
<td>Substitute Tdap for Td once, then Td booster every 10 yrs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Td/Tdap2</td>
<td>1 dose Tdap each pregnancy</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>MMR2</td>
<td>contraindicated</td>
<td>1 or 2 doses depending on indication</td>
<td></td>
<td></td>
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<tr>
<td>VAR4</td>
<td>contraindicated</td>
<td>2 doses</td>
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<tr>
<td>HZV9</td>
<td>contraindicated</td>
<td>1 dose</td>
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<td></td>
<td></td>
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<tr>
<td>HPV—Female4</td>
<td></td>
<td>3 doses through age 26 yrs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>HPV—Male6</td>
<td></td>
<td>3 doses through age 26 yrs</td>
<td></td>
<td></td>
<td>3 doses through age 21 yrs</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>PCV137</td>
<td></td>
<td>1 dose</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>PPSV237</td>
<td></td>
<td>1, 2, or 3 doses depending on indication</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>HepA4</td>
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<td>2 or 3 doses depending on vaccine</td>
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<tr>
<td>HepB4</td>
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<td>3 doses</td>
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<td></td>
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<tr>
<td>MenACWY or MeningocV47</td>
<td></td>
<td>1 or more doses depending on indication</td>
<td></td>
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<tr>
<td>MenB99</td>
<td></td>
<td>2 or 3 doses depending on vaccine</td>
<td></td>
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<td></td>
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<td></td>
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<tr>
<td>Hib10</td>
<td>3 doses post-HSCT recipients only</td>
<td>1 dose</td>
<td></td>
<td></td>
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<td></td>
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</tbody>
</table>

Legend:
- **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 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.
- Note: 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/professionals/vaccine/evaccines.htm.

Special populations
- Adults with a history of egg allergy who have only hives after exposure to egg should receive IIV.
- 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 reactions.
- Pregnant 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 a tetanus prophylaxis in wound management is available at www.cdc.gov/mmwr/preventive/nms/hr/2005/mm5131a1.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 1967 or later without adequate 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, 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 malignancies 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 may receive 2 doses of MMR; adults with HIV infection and CD4+ T lymphocyte count <200 cells/µL should not receive VCV.
- Adults with human immunodeficiency virus (HIV) infection and CD4+ T lymphocyte count ≥200 cells/µL may 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 in 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 secondary 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 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.
- Adults who were vaccinated before 1989 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) 4–6 weeks apart, or a second dose if they have received only 1 dose.
- Persons without evidence of immunity for whom VARV 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 individuals who are adults who live or work in an environment in which transmission of varicella zoster virus is likely, e.g., consultation with immunocompromised (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 adults living in child care settings (any age). Adults with severe chickenpox illness or residua, varicella or 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 at least 4 weeks prior to 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 malignancy, including those that affect the bone marrow or lymphatic system or who receive systemic immunosuppressive therapy, 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 malignancy, 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
- Adults through age 26 years and adults through age 21 years who have not received any human papillomavirus (HPV) vaccine should receive a 3-dose series of HPV vaccine at 0, 2–6, and 12 months. Males through age 21 years may be vaccinated with a 3-dose series of HPV vaccine at 0, 1–2, and 6 months.

Special populations
- Adults through age 26 years and adults 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.
- Adults through age 26 years and adults 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 1 dose, or 2 doses less than 5 months apart, are considered inadequately 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 before age 15 years and received 1 dose, or 2 doses less than 5 months apart, are considered inadequately vaccinated and should receive 1 additional dose of HPV vaccine.

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, 2–6, and 12 months.
- Adults 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, 2–6, and 12 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 routine 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., blood cell malignancies, solid organ transplant recipients, recipients of T-lymphocyte antibodies, organ transplant recipients, and patients with chronic granulomatous disease.
7. Pneumococcal vaccination

General information
- Adults who are immunocompetent and aged 65 years or older should receive at least 1 pneumococcal conjugate vaccine (PCV) followed by 2-valent pneumococcal polysaccharide vaccine (PPSV23) at least 1 year after PCV1.

Notes: Adults are recommended to receive 1 dose of PCV1 and 2, 3 doses of PPSV23 depending on indication. When PCV1 and PPSV23 are indicated, PCV1 should be administered first; PCV1 and PPSV23 should not be administered during the same visit. PPSV23 has previously been administered, PCV1 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/safe/readpdf_pdf.htm.

Special populations
- Adults aged 65 years or older with chronic lung disease including congestive heart failure and cardiomyopathies (including hypertensive, chronic lung disease including chronic obstructive pulmonary disease, emphysema, and asthma; chronic lung disease including cirrhosis, alcoholism; or diabetes mellitus; or who smoke cigarettes should receive PPSV23. At age 65 years or older, a second dose of PPSV23 at least 1 year after PCV1 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 (as described below) should receive PCV1 and a dose of PPSV23 at least 8 weeks after PCV1, 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, age 65 years or older, administer another dose of PPSV23 at least 8 weeks after PCV1 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 HIV infection; chronic renal failure and nephrotic syndrome; chronic liver disease, generalized malignancy, and multiple myeloma; solan organ transplant; and atrophic immunosuppression including long-term use of corticosteroid and radiation therapy. Anatomical or functional asplenia that are indications for pneumococcal vaccination are sickle cell disease and other hematologic conditions, congenital or acquired asplenia, splenic dysfunction, and splenectomy. Pneumococcal vaccines should be given at least 2 weeks before immunosuppressive therapy or 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 (Havrix (Merck) and Twinrix (Viridian) as a 3-dose series at 1, 2, 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 who have had recent contact with an international adoptee, e.g., reside in the same household or regularly report, from their intermediate level of endemic hepatitis A infection. The vaccination schedule starts with the first dose 60 days before 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 (Heplisav-B (Biogen Idec), Engerix-B (SmithKline), Recombivax HB (Merck), and Twinrix (Viridian) as a 6-month series. A dose of Hepatitis B vaccine should be administered to a specific risk factor by those who seek protection is not needed.

Special populations
- Adults should receive hepatitis B virus infection by sexual exposure should receive a HepB series, including sex partners of hepatitis B surface antigen (HBsAg)-positive persons, sex active persons who are in a mutually monogamous relationship, persons seeking evaluation or treatment for a sexually transmitted infection, and men who have sex with men.

- Adults at risk for hepatitis B virus infection by percutaneous or mucosal exposure to blood should receive a HepB series, including adults who are current or previous users of injection drugs; household contacts of HBsAg-positive persons, residents and staff of facilities for developmentally disabled persons, incarcerated, healthcare institutions and public safety workers at risk to exposure to blood or blood-contaminated body fluids, younger than age 40 years with diabetes mellitus and diabetes insipidus in the discretion of the treating clinician.

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

- Adults with cirrhosis or pre-clinical cirrhosis should receive a pre-diagnosis care, hemodialysis, peritoneal dialysis, and home dialysis should receive a 3-dose series of 45 μg Recombivax HB at 0, 1, and 6 months. None of the dose of 45 μg Engerix-B at 0, 1, 2, and 6 months. None of the dose of 45 μg Engerix-B at 0, 1, 2, and 6 months.

- Adults with HIV and Hepatitis B virus infection should receive a HepB series.

- Pregnant women should not be 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 HBV-A positive sex partner should receive a HepB series.

- International travelers to countries with high or intermediate levels of endemic hepatitis B virus infection should receive a HepB series.

- Adults in any of 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 patients to persons who inject drugs, correctional facilities, healthcare settings targeting services to MSM, hemodialysis facilities and end-stage renal disease programs, and institutions and nontreatment day care facilities for developmentally disabled persons.

10. Meningococcal vaccination

General information
- Adults with anatomical or functional asplenia or sickle cell disease, or an underlying effective splenectomy should receive 1 dose of MenC vaccine (MenACWt) at least 4 weeks intervals 6-12 months after transplant regardless of their Hb status.

Notes: MenC vaccine is not recommended for adults with diabetes mellitus and insulin-dependent diabetes mellitus to the risk for MenC meningococcal meningitis. MenC vaccine is not recommended for adults with diabetes mellitus and insulin-dependent diabetes mellitus to the risk for MenC meningococcal meningitis.
Table. Contraindications and precautions for vaccines recommended for adults aged 19 years or older*

The Advisory Committee on Immunization Practices (ACIP) recommends 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 recipients. 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

<table>
<thead>
<tr>
<th>Vaccine</th>
<th>Contraindications</th>
<th>Precautions</th>
</tr>
</thead>
<tbody>
<tr>
<td>All vaccines routinely recommended for adults</td>
<td>- Severe reaction, e.g., anaphylaxis, after a previous dose or to a vaccine component</td>
<td>- Moderate or severe acute illness with or without fever</td>
</tr>
<tr>
<td>Additional contraindications and precautions for vaccines routinely recommended for adults</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Vaccine</th>
<th>Additional Contraindications</th>
<th>Additional Precautions</th>
</tr>
</thead>
<tbody>
<tr>
<td>IPV*</td>
<td>* - History of Guillain-Barré Syndrome within 6 weeks after previous influenza vaccination</td>
<td>* - History of Guillain-Barré Syndrome within 6 weeks after previous influenza vaccination</td>
</tr>
<tr>
<td>LAIV*</td>
<td>* - LAIV should not be used during 2016-2017 influenza season</td>
<td>* - LAIV should not be used during 2016-2017 influenza season</td>
</tr>
<tr>
<td>Td, Td(a/c), Tdap</td>
<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</td>
<td>* Guillain-Barré Syndrome within 6 weeks after a previous dose of tetanus toxoid-containing vaccine</td>
</tr>
<tr>
<td>MMRV</td>
<td>* Severe immunodeficiency, e.g., hematologic and solid tumors, chemotherapy, congenital immunodeficiency or long-term immunosuppressive therapy, human immunodeficiency virus (HIV) infection with severe immunocompromise</td>
<td>* Guillain-Barré Syndrome within 6 weeks after a previous dose of tetanus toxoid-containing vaccine</td>
</tr>
<tr>
<td>* Pregnancy</td>
<td>* Recent (within 11 months) receipt of antibody-containing blood product (specific interval depends on product)*</td>
<td>* Need for tuberculin skin testing*</td>
</tr>
<tr>
<td>VAR*</td>
<td>* Severe immunodeficiency, e.g., hematologic and solid tumors, chemotherapy, congenital immunodeficiency or long-term immunosuppressive therapy, HIV infection with severe immunocompromise</td>
<td>* Recent (within 11 months) receipt of antibody-containing blood product (specific interval depends on product)*</td>
</tr>
<tr>
<td>* Pregnancy</td>
<td>* Receipt of specific antiviral drugs (acyclovir, famciclovir, or valacyclovir) 24 hours before vaccination</td>
<td>* Need for tuberculin skin testing*</td>
</tr>
<tr>
<td>RV*</td>
<td>* Severe immunodeficiency, e.g., hematologic and solid tumors, chemotherapy, congenital immunodeficiency or long-term immunosuppressive therapy, HIV infection with severe immunocompromise</td>
<td>* Receipt of specific antiviral drugs (acyclovir, famciclovir, or valacyclovir) 24 hours before vaccination</td>
</tr>
<tr>
<td>* Pregnancy</td>
<td>* Recent (within 11 months) receipt of antibody-containing blood product (specific interval depends on product)*</td>
<td></td>
</tr>
<tr>
<td>HPV vaccine</td>
<td>* - Pregnancy</td>
<td></td>
</tr>
</tbody>
</table>

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(5):51-54. Available at www.cdc.gov/mmwr/volumes/65/wr/rr6505a1.htm.

2. MMF may be administered together with VARI or HEV 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(RR-2). Available at www.cdc.gov/mmwr/volumes/60/wr/rr6002.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.


**Acronyms of vaccines recommended for adults**

- HepA: hepatitis A vaccine
- HepA-HepB: hepatitis A and hepatitis B vaccines
- HepB: hepatitis B vaccine
- HFl: Hemophilus influenzae type b conjugate vaccine
- HPV vaccine: human papillomavirus vaccine
- HSV: herpes zoster vaccine
- IPV: inactivated poliovirus vaccine
- LAIV: live attenuated influenza vaccine
- MenACWY: serogroups A, C, W and Y meningococcal conjugate vaccine
- MMR: serogroups B meningococcal vaccine
- MPSV4: serogroups A, C, W and Y meningococcal polysaccharide vaccine
- MMR: serogroups A, C, W and Y meningococcal vaccine
- IPV: live attenuated influenza vaccine
- PCV13: 13-valent pneumococcal conjugate vaccine
- PPVS: 23-valent pneumococcal polysaccharide vaccine
- RV: rotavirus vaccine
- VAR: varicella vaccine

**CS70557-A**
Influenza Vaccination – Background

- Annual influenza vaccination for persons ≥6 mos
- Residual egg protein in influenza vaccine is very rare cause of allergic reaction even in people with severe allergy
  - Ovalbumin in influenza vaccine less than that needed to cause anaphylaxis
  - Anaphylaxis occurs ~1 case per million doses of vaccine
  - 12 cases of anaphylaxis reported after RIV
- Previous severe allergic reaction to influenza vaccine is contraindication

MMWR 2016;65(RR-5):29-30
Influenza Vaccination – Updated Recommendations

- LAIV should not be used in 2016–2017
- If history of egg allergy and hives-only to egg, use any licensed age-appropriate influenza vaccine (IIV or RIV)
- If history of reactions to egg other than hives may use any age-appropriate influenza vaccine (IIV or RIV)
  - Angioedema, respiratory distress, lightheadedness, recurrent vomiting
  - Administer in medical setting supervised by health care provider

MMWR 2016;65(RR-5):29-30
Infants of mothers vaccinated with Tdap were born with significantly higher anti-pertussis antibodies compared to infants of unvaccinated mothers.
- If given within the 27–36 weeks administration window.
- Concentration of anti-pertussis antibodies in infant cord blood higher when mothers vaccinated earlier in this window.
- Longer exposure to vaccine allows higher vaccine-induced antibody levels produced by mother and transferred to infant.
Tdap should be given at every pregnancy during gestation weeks 27–36, preferably early part of this window.
HPV Vaccination – Background

- Adult females through age 26 and adult males through age 21 should receive 3 doses of HPV vaccine at 0, 1–2, 6 mos, if not previously vaccinated; adult males 22–26 may be vaccinated
- Noninferior immunogenicity with 2 doses (0, 6 or 12 mos) in girls and boys age 9–14 compared to 3 doses (0, 2, 6 mos) in females age 16–26
- ≥97.9% seroconversion to all 9 HPV types in 4 wks after first dose
- Similar immunogenicity findings in other studies on 4vHPV and 2vHPV
- Duration of protection expected to be similar for 2- or 3-dose regimen

MMWR 2016;65(49):1405-1408
HPV Vaccination – Updated Recommendations

- 2 doses of HPV vaccine (0, 6–12 mos) should be given if age <15
- 3 doses of HPV vaccine (0, 1–2, 6 mos) should be given if age ≥15
- Young adults who did not complete HPV series before age 15
  - Did not start – give 3 doses of HPV vaccine (0, 1–2, 6 mos)
  - Received 1 dose – give 1 dose HPV vaccine
  - Received 2 doses but <5 mos apart – give 1 dose HPV vaccine
  - Received 2 doses ≥5 mos apart – considered adequately vaccinated

MMWR 2016;65(49):1405-1408
Hepatitis B Vaccination – Background

- “Vaccinate... persons with... chronic liver disease”
Hepatitis B Vaccination – Updated Recommendations

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

- 1980s – MPSV4 recommended for groups at increased risk
- 2005 – MenACWY recommended for persons age 11–55 at risk
- 2010 – MenACWY booster recommended for those who remain at risk
- 2015 – MenB recommended for persons age ≥10 at increased risk; healthy 16–23 (preferred age 16–18) may receive MenB
- 2016 – Evidence indicates HIV infection increases risk of invasive meningococcal disease
- 2016 – MenB-FHbp dosage change approved by FDA (3 doses at 0, 1–2, 6 mos and 2 doses at 0, 6 mos); choice depends on risk
Meningococcal Vaccination – Updated Recommendations

- **MenACWY**
  - Adults with HIV infection recommended to receive MenACWY at least 2 months apart, revaccinate every 5 years

- **MenB**
  - Persons **at increased risk** for meningococcal disease recommended to receive **3 doses** of MenB-FHbp at 0, 1–2, 6 months
  - Healthy persons 16–23 who are **not at increased risk** may receive **2 doses** of MenB-FHbp at 0, 6 months (no preference between MenB-FHbp and MenB-4C)
Case Discussion: Ms. Cali Ann T. Schott

- 35yo accountant, HIV(+) with CD4 = 500
- Nonsmoker, not pregnant, had chickenpox as child
- State vaccine registry shows she had all recommended vaccines as child
- Which vaccines does Ms. Schott need?
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**

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

- **Yellow**: Recommended for adults who meet the age requirement, lack documentation of vaccination, or lack evidence of past infection
- **Purple**: Recommended for adults with additional medical conditions or other indications
- **White**: No recommendation
Figure 2. Recommended immunization schedule for adults aged 19 years or older by medical condition and other indications, United States, 2017

<table>
<thead>
<tr>
<th>Vaccine</th>
<th>Pregnancy</th>
<th>Immuno-compromised (excluding HIV infection)17,18</th>
<th>HIV infection with CD4+ cell count ≤ 200</th>
<th>≥ 200</th>
<th>Asplenia, persistent complement deficiencies19,20</th>
<th>Kidney failure, end-stage renal disease, on hemodialysis1,3</th>
<th>Heart or lung disease, chronic alcoholism5</th>
<th>Chronic liver disease21</th>
<th>Diabetes22</th>
<th>Healthcare personnel18</th>
<th>Men who have sex with men18</th>
</tr>
</thead>
<tbody>
<tr>
<td>Influenza1</td>
<td>1 dose annually</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Td/Tdap2</td>
<td>1 dose</td>
<td>Tdap each pregnancy</td>
<td></td>
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<td></td>
<td></td>
<td></td>
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<td>MMR3</td>
<td>contraindicated</td>
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<tr>
<td>VAR4</td>
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<tr>
<td>HZV5</td>
<td>contraindicated</td>
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<td></td>
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</tr>
<tr>
<td>HPV–Female6</td>
<td>3 doses through age 26 yrs</td>
<td></td>
<td></td>
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<tr>
<td>HPV–Male6</td>
<td>3 doses through age 26 yrs</td>
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<tr>
<td>PCV137</td>
<td>1 dose</td>
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<td></td>
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<td></td>
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<tr>
<td>PPSV237</td>
<td>1, 2, or 3 doses depending on indication</td>
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<tr>
<td>HepA8</td>
<td>2 or 3 doses depending on vaccine</td>
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<tr>
<td>HepB9</td>
<td>3 doses</td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>MenACWY or MPSV410</td>
<td>or more doses depending on indication</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>MenB11</td>
<td>2 or 3 doses depending on vaccine</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hib11</td>
<td>3 doses post-HSCT recipients only</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

- 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
Recommended Vaccines for Ms. Schott

- Vaccines recommended based on age
  - Influenza vaccine
  - Tdap

- Plus vaccines based on HIV with CD4 500
  - Hepatitis B series
  - MenACWY primary series, booster every 5y
  - Pneumococcal vaccinations: PCV13, PPSV23
A Peek Ahead

- **High-dose influenza vaccine**
  - Inactivated, contains 60 µg antigen per vaccine strain (4x standard dose)
  - RCT – Efficacy relative to standard dose 24% (CI 9.7,36.5) against laboratory-confirmed influenza
  - CMS cohort study for claims – 22% (CI 16,27) reduction in influenza-related hospitalizations
  - Use among adults ≥65?

- **Hepatitis A and B updates**

- **MenB booster**

- **Zoster**
  - Phase III efficacy study of HZ/su (ZOE-50 and ZOE-70)
  - Cost effectiveness and considerations for policy, plan for ACIP vote in October 2017

- **Mumps**
  - Outbreaks among highly vaccinated populations, but limited data on third dose MMR
  - ACIP to continue discussion, possible recommendations in 2018?

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2. Lal et al. NEJM 2015; Cunningham et al. NEJM 2016
Millions of adults get diseases for which we have vaccines
Adult Vaccination Coverage, United States, 2015

- Brief update published online in Feb 2017 (full article publication in May)
  - Non-influenza vaccination coverage – National Health Interview Survey (NHIS)
  - Influenza vaccination coverage – Behavioral Risk Factor Surveillance System (BRFSS)

- Key findings
  - Pneumococcal vaccination for 19–64y high risk: 23.0% (↑2.8%)
  - Tdap 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:
    - Pneumococcal vaccination for ≥65y: 63.6%
    - Hepatitis B vaccination for 19–59 years among persons with diabetes: 24.4%
  - Disparities by race and ethnicity, education, income, insurance

www.cdc.gov/vaccines/imz-managers/coverage/adultvaxview/coverage-estimates/2015.html
www.cdc.gov/flu/fluvoxview/coverage-1516estimates.htm

* The Healthy People 2020 target for coverage is 90% for all vaccines with the exception of rotavirus (80%) and HepA (85%).
† DTP (3+) is not a Healthy People 2020 objective. DTaP (4+) is used to assess Healthy People 2020 objectives.
§ Reflects 3+ doses through 2008, and Full Series (3 or 4 doses depending on type of vaccine received) 2009 and later.
Figure 1. Seasonal Flu Vaccination Coverage by Age Group and Season, United States, 2009–2016

Error bars represent 95% confidence intervals around the estimates. The 2009–10 estimates do not include the Influenza A (H1N1) pdm09 monovalent vaccine. Starting with the 2011–12 season, adult estimates reflect changes in BRFSS survey methods, the addition of cellular telephone samples and a new weighting method.

www.cdc.gov/flu

www.cdc.gov/flu
Health Insurance Status and Vaccination Coverage

- 87% reported some type of health insurance
- Vaccination coverage 2–5x higher with health insurance for influenza, Tdap, zoster, and HPV vaccinations
- Among insured persons with ≥10 physician contacts in past 12 months, 24–89% missing recommended vaccine
  - 65% adults with diabetes missing hepatitis B vaccination
  - 61% adults 19–64y at high risk missing pneumococcal vaccine

Williams WW et al. MMWR 2016;65(1):1–36
## Adult Knowledge and Interest in Vaccination

<table>
<thead>
<tr>
<th>Which of the following best describes you?</th>
<th>Tdap (19+)</th>
<th>Pneumo (65+)</th>
<th>Zoster (60+)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I am not aware that I need this vaccine.</td>
<td>52%</td>
<td>22%</td>
<td>18%</td>
</tr>
<tr>
<td>I am aware that I need this vaccine, but haven’t thought about getting it.</td>
<td>6%</td>
<td>3%</td>
<td>6%</td>
</tr>
<tr>
<td>I am considering getting this vaccine, but have not yet decided.</td>
<td>5%</td>
<td>3%</td>
<td>9%</td>
</tr>
<tr>
<td>I have decided to get this vaccine, but have not yet gotten vaccinated.</td>
<td>3%</td>
<td>4%</td>
<td>8%</td>
</tr>
<tr>
<td>I have decided not to get this vaccine.</td>
<td>13%</td>
<td>13%</td>
<td>19%</td>
</tr>
<tr>
<td>I have gotten this vaccine.</td>
<td>22%</td>
<td>56%</td>
<td>39%</td>
</tr>
</tbody>
</table>

Porter Novelli 2015. ConsumerStyles (Fall) unpublished
I’m not aware I need Tdap – 52%
I’ve decided not to get Tdap – 13%

I got Tdap – 22%
I’ve decided to get Tdap – 3%

Porter Novelli 2015. ConsumerStyles (Fall) unpublished
There are evidence-based strategies to address barriers to vaccinating adults
Standards for Adult Immunization Practice

- Developed in 1990 to improve vaccine delivery to adults, most recently updated in 2014 by National Vaccine Advisory Committee
- All HCPs, including those who do not provide vaccine services, have role in ensuring patients up-to-date on vaccines
- Call to action for HCPs for adults to
  - **ASSESS** vaccination status of all patients at every clinical encounter
  - Strongly **RECOMMEND** vaccines that patients need
  - **ADMINISTER** needed vaccines or **REFER** to a vaccine service provider
  - **DOCUMENT** vaccines received by patients in state vaccine registries
- Promoted through National Adult and Influenza Immunization Summit (NAIIS)

Public Health Reports 2014;129:115–123
The Community Guide: The Guide to Community Prevention Services

- Systems changes to incorporate vaccination into patient flow
  - Patient reminder and recall systems
  - Provider reminders
  - Provider assessment and feedback
  - Standing orders
  - Health care system-based interventions
- Community-based interventions
- Immunization information systems

https://www.thecommunityguide.org/
What can be done to improve adult Immunizations?
Role of Coalitions

- Identify and overcome barriers in community
- Increase convenience and access to vaccines
- Promote use of IIS by all vaccine providers
What can be done to improve adult Immunizations? Role of Providers

- Provide strong recommendations to patients
- Incorporate vaccination into patient flow
- Use IIS to document vaccination
  - Tools to remind patients and providers
  - Consolidates patients vaccination records in one place
Vaccination Uptake by Provider Recommendation and Offer

Influenza vaccination before and during pregnancy overall and by provider recommendation and offer for influenza vaccination among women pregnant anytime between October 2012 and January 2013, Internet Panel Survey, 2012-2013 influenza season.

Coverage estimates (%)

- Overall: 50.5% (n = 1,702)
- Reported a provider recommendation and offer: 70.5% (n = 895)
- Reported a provider recommendation but no offer: 46.3% (n = 270)
- Reported no provider recommendation: 16.1% (n = 455)

*Women who didn’t visit a provider since August 2012 (n=27) or women who didn’t know whether they received provider recommendation or offer (n=55) were excluded in the analysis.*
Reported receipt of care reflecting the standards among adults with healthcare or pharmacy visits in the past year, United States, 2016 (N=1,476)
Reported implementation of standards components among HCPs, by provider specialty, United States, 2016 (N=1,918)

Internet panel survey of health care providers on the implementation of adult immunization practice standards, United States, 2016 - unpublished
Comparison of adult vaccination recommendations reported by HCPs and general adult population, United States, 2016

- Family Medicine: 97% HCPs, 30% general population
- Internal Medicine: 98% HCPs, 32% general population
- Ob/Gyn: 95% HCPs, 6% general population
- Other Specialties: 85% HCPs, 12% general population
- Pharmacy: 86% HCPs, 7% general population

CDC Internet panel surveys - unpublished
What can be done to improve adult Immunizations?

System Changes

- Reduce barriers for providers to offer vaccine
  - Providers identify payment issues as top barriers
  - Out-of-network barriers, including Medicaid
  - Vaccine and vaccination payments
Patients ≥65 who Received Tdap at a Large Hospital Network, New Hampshire, July 2015–June 2016

Graph showing the number of visits and Tdap immunizations across different locations. The graph highlights locations A, B, C, D, E, F, G, H, and I.

- Location A: 369 visits, 2% Tdap immunizations
- Location B: 1674 visits, 30% Tdap immunizations
- Location C: 106 visits, 59% Tdap immunizations
- Location D: 701 visits, 48% Tdap immunizations
- Location E: 2041 visits, 24% Tdap immunizations
- Location F: 13 visits, 21% Tdap immunizations
- Location G: 233 visits, 60% Tdap immunizations
- Location H: 183 visits, 37% Tdap immunizations
- Location I: 400 visits, 43% Tdap immunizations

Legend:
- Patient Visits
- Tdap Imm
- Percent Tdap Imm

Key: No champion, High staff turnover, No Standing orders

Courtesy: Immunization Program, New Hampshire Department of Health
Summary

- Burden of vaccine-preventable diseases among adults – High
- Impact of vaccination for adults – High
- Vaccines widely available but underutilized by adults
- Implementation of the standards for adult immunization practice – Talk to adult patients about vaccines
- Implement evidence-based interventions to promote vaccination for adults

Ensure that adults are up-to-date on recommended vaccines to help adults stay healthy and prevent hospitalizations, disability, and premature deaths