Immunizing Older Adults and those less than 65 years with Chronic Illnesses

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Disclosures

- Raymond Strikas is a federal government employee with no financial interest or conflict with the manufacturer of any product named in this presentation.

- I will discuss the off-label use of serogroup meningococcal ACWY and meningococcal B vaccines.
Outline of Presentation

- Recommended Adult Immunization Schedule, United States, 2017

- Burden of vaccine-preventable diseases in selected populations
  - Hepatitis B, zoster, influenza, pneumococcal disease, pertussis, and tetanus, and meningococcal disease in
    - Older adults (65 years and older)
    - Adults with chronic illnesses without immunosuppression
    - Immunosuppressed adults

- Vaccine uptake in older adults and those chronically ill

- Vaccine effectiveness in these populations

- Case studies: what vaccines are recommended for these different populations?
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). The schedule is published in its entirety in the Annals of Internal Medicine. 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:

1. Figure 1. Recommended immunization schedule for adults by age group
2. Figure 2. Recommended immunization schedule for adults by medical condition and other indications
3. Footnotes that accompany each vaccine containing important general information and considerations for special populations
4. 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 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/m6002a1.htm.

- Vaccine Information Statements that explain benefits and risks of vaccines are available at www.cdc.gov/vaccines/hcp/vix/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, 800am–800pm ET, Monday–Friday, excluding holidays.

The following acronyms are used for vaccines recommended for adults:

HepA = hepatitis A vaccine
HepA-HepB = hepatitis A and hepatitis B vaccines
HepB = hepatitis B vaccine
Hib = Haemophilus influenzae type b conjugate vaccine
HPV = human papillomavirus vaccine
HIV = human immunodeficiency virus
HIVLV = live attenuated influenza vaccine
LSA = meningococcal conjugate vaccine
MENACWWY = meningococcal vaccine
MM = measles, mumps, and rubella vaccine
MPV = measles, mumps, and rubella vaccine
MPV4 = meningococcal polysaccharide vaccine
PCV13 = pneumococcal conjugate vaccine
PPV23 = pneumococcal polysaccharide vaccine
RIV = recombinant influenza vaccine
Tet = 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.
Recommended Immunization Schedule for Adults Aged 19 Years or Older, United States, 2017

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- Figure 1. Recommended immunization schedule for adults by age group
- Figure 2. Recommended immunization schedule for adults by medical condition and other indications
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- 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 vaccines. 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.
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Advisory Committee on Immunization Practices
American College of Physicians
American Academy of Family Physicians
American College of Obstetricians and Gynecologists
American College of Nurse-Midwives

1 MMWR Mortal Mortal Wkly Rep. 2017;66(5). Available at www.cdc.gov/mmwr/volumes/66/wk/mm6605a2.htm?c_ cid=mm6605a2_w.
**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></td>
<td>1 dose annually</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></td>
<td></td>
<td>1 or 2 doses depending on indication</td>
</tr>
<tr>
<td>VAR(^4)</td>
<td></td>
<td></td>
<td></td>
<td>2 doses</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></td>
<td>3 doses</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HPV–Male(^6)</td>
<td></td>
<td></td>
<td>3 doses</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></td>
<td>1 dose</td>
<td></td>
</tr>
<tr>
<td>HepA(^8)</td>
<td></td>
<td></td>
<td></td>
<td>2 or 3 doses depending on vaccine</td>
<td></td>
</tr>
<tr>
<td>HepB(^9)</td>
<td></td>
<td></td>
<td></td>
<td>3 doses</td>
<td></td>
</tr>
<tr>
<td>MenACWY or MPSV4(^10)</td>
<td></td>
<td></td>
<td></td>
<td>1 or more doses depending on indication</td>
<td></td>
</tr>
<tr>
<td>MenB(^10)</td>
<td></td>
<td></td>
<td></td>
<td>2 or 3 doses depending on vaccine</td>
<td></td>
</tr>
<tr>
<td>Hib(^11)</td>
<td></td>
<td></td>
<td></td>
<td>1 or 3 doses depending on indication</td>
<td></td>
</tr>
</tbody>
</table>

Legend:
- **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)</th>
<th>HIV infection CD4+ count (cells/μL)</th>
<th>Asplenia, persistent complement deficiencies</th>
<th>Kidney failure, end-stage renal disease, on hemodialysis</th>
<th>Heart or lung disease, chronic alcoholism*</th>
<th>Chronic liver disease*</th>
<th>Diabetes</th>
<th>Healthcare personnel</th>
<th>Men who have sex with men</th>
</tr>
</thead>
<tbody>
<tr>
<td>Influenza</td>
<td></td>
<td></td>
<td>&lt; 200</td>
<td>≥ 200</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Td/Tdap</td>
<td>1 dose</td>
<td>Tdap each pregnancy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MMR</td>
<td>contraindicated</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VAR</td>
<td>contraindicated</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HZV</td>
<td>contraindicated</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HPV-Female</td>
<td>3 doses through age 26 yrs</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>HPV-Male</td>
<td>3 doses through age 26 yrs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>PCV13</td>
<td>1 dose</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PPSV23</td>
<td>1, 2, or 3 doses depending on indication</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HepA</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>
</tr>
<tr>
<td>HepB</td>
<td>3 doses</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MenACWY or MPSV4</td>
<td>1 or more doses depending on indication</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MenB</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>
</tr>
<tr>
<td>Hib</td>
<td>1 dose</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</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
Incidence of acute hepatitis B, by age group, per 100,000 persons—United States, 2000–2014

- Estimated 19,200 cases acute Hepatitis B reported in US in 2014
- Persons with diabetes at twice risk of hepatitis B

Source: National Notifiable Diseases Surveillance System (NNDSS)
Availability of risk exposures/behaviors associated with acute hepatitis B – United States, 2014

- Most commonly reported risks were injection drug use, having multiple sexual partners, and surgery

* Includes case reports indicating the presence of at least one of the following risks 6 weeks to 6 months prior to onset of acute, symptomatic hepatitis B: 1) using injection drugs; 2) having sexual contact with suspected/confirmed hepatitis B patient; 3) being a man who has sex with men; 4) having multiple sex partners concurrently; 5) having household contact with suspected/confirmed hepatitis B patient; 6) occupational exposure to blood; 7) being a hemodialysis patient; 8) having received a blood transfusion; 9) having sustained a percutaneous injury; and 10) having undergone surgery.

Source: National Notifiable Diseases Surveillance System (NNDSS)
Burden of Disease Among U.S. Adults for Selected Diseases with Vaccines Available - Zoster

- **Zoster (shingles)**
  - 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 herpes zoster ophthalmicus (HZO)
  - Risk of severe prolonged pain, post-herpetic neuralgia, increases with age

FIGURE 3. Rate* of zoster and postherpetic neuralgia (PHN)†, by age — United States

*Per 1,000 person-years.
†Defined as ≥30 days of pain.
**Burden of Disease Among U.S. Adults for Selected Diseases with Vaccines Available – *Streptococcus pneumoniae***

- Significant declines of invasive pneumococcal disease (IPD) since pneumococcal conjugate vaccines introduced in United States (PCV7 in 2000 and PCV13 in 2010 for children)
  - 100 cases per 100,000 in 1998 to 9 cases per 100,000 in 2015.
  - IPD caused by PCV13 serotypes decreased from 91 cases per 100,000 in 1998 to 2 cases per 100,000 in 2015.
  - Vaccine impact on carriage likely related to decrease

- Adults ≥65 yrs highest rates of IPD
  - 59 cases per 100,000 in 1998 to 23 cases per 100,000 in 2015
  - Reductions mostly attributable to the conjugate vaccines

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2. [CDC. Notifiable Diseases and Mortality Tables.](http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6151a4.htm#toc)
Incidence of IPD in adults aged 18--64 years with selected underlying conditions, United States, 2009

- Healthy: 8 cases per 100,000 persons
- CVD: 26 cases
- Diabetes: 28 cases
- Pulmonary: 32 cases
- Kidney: 41 cases
- Liver: 52 cases
- Alcohol: 59 cases
- HIV/AIDS: 173 cases
- Hematological Cancer: 186 cases

Older adults, 23

3-7 fold increased risk

20 fold increased risk
Influenza Health Impact

- Influenza disease burden varies year to year
  - Millions of cases and average of 226,000 hospitalizations annually with >75% among adults
  - 3,000-56,000 deaths annually, >90% among adults
  - 54-70% of hospitalizations and 71-85% of deaths occurred among adults aged >65 years.

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

Pertussis (Whooping Cough)

- Caused by *Bordetella pertussis*
- Infection leads to respiratory tract inflammation and difficulty clearing pulmonary secretions
- ~21,000 cases reported in 2015, 22% in adults
- Most severe cases among infants – complications among hospitalized infants: apnea (61%), pneumonia (23%), seizures (1.1%), death (1%), encephalopathy (0.3%)
- Complications in adults: pneumonia (2%), weight loss (33%), urinary incontinence (28%), syncope (6%), rib fractures from severe coughing (4%)
- Pregnant women recommended to get Tdap vaccine 3rd trimester of *each pregnancy* to protect infants
Pertussis cases reported in US by year and age group, 1990-2015

- Source: National Notifiable Disease Surveillance System (NNDSS)
  www.cdc.gov/pertussis/surv-reporting.html
### U.S. Tetanus Surveillance 2001-2008

**TABLE 1.** Number and rate* of tetanus cases, number of known deaths, and case-fatality rate (CFR), by tetanus toxoid--containing vaccination status and age group --- United States, 2001--2008

<table>
<thead>
<tr>
<th>Age group (yrs)</th>
<th>Unknown</th>
<th>0 dose</th>
<th>1 dose</th>
<th>3 doses</th>
<th>≥4 doses</th>
<th>Total</th>
<th>Average annual rate</th>
<th>No. known deaths</th>
<th>CFR (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5--19</td>
<td>6 (27.3)</td>
<td>10 (45.5)</td>
<td>1 (4.6)</td>
<td>1 (4.6)</td>
<td>4 (18.2)</td>
<td>22 (9.4)</td>
<td>0.04</td>
<td>0</td>
<td>---</td>
</tr>
<tr>
<td>20--34</td>
<td>20 (58.8)</td>
<td>3 (8.8)</td>
<td>3 (8.8)</td>
<td>1 (2.9)</td>
<td>7 (20.6)</td>
<td>34 (14.6)</td>
<td>0.07</td>
<td>0</td>
<td>---</td>
</tr>
<tr>
<td>35--49</td>
<td>37 (59.7)</td>
<td>5 (8.1)</td>
<td>9 (14.5)</td>
<td>2 (3.2)</td>
<td>9 (14.5)</td>
<td>62 (26.6)</td>
<td>0.12</td>
<td>4</td>
<td>(7.5)</td>
</tr>
<tr>
<td>50--64</td>
<td>30 (69.8)</td>
<td>4 (9.3)</td>
<td>6 (14.0)</td>
<td>0 (----)</td>
<td>3 (7.0)</td>
<td>43 (18.5)</td>
<td>0.11</td>
<td>2</td>
<td>(5.4)</td>
</tr>
<tr>
<td>≥65</td>
<td>48 (67.6)</td>
<td>14 (19.7)</td>
<td>7 (9.9)</td>
<td>1 (1.4)</td>
<td>1 (1.4)</td>
<td>71 (30.5)</td>
<td>0.23</td>
<td>20</td>
<td>(31.3)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>141 (60.5)</td>
<td>37 (15.9)</td>
<td>26 (11.2)</td>
<td>5 (2.2)</td>
<td>24 (10.3)</td>
<td>233 (100.0)</td>
<td>0.10</td>
<td>26</td>
<td>(13.2)</td>
</tr>
</tbody>
</table>

*Per 1 million population.

† Based on 197 cases with known outcomes.

§ Includes one nonfatal case in a neonatal patient who received no vaccine doses.

[www.cdc.gov/mmwr/preview/mmwrhtml/mm6012a1.htm](http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6012a1.htm)
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<table>
<thead>
<tr>
<th>Age group (yrs)</th>
<th>Previous vaccination with tetanus toxoid–containing vaccine</th>
<th>Total</th>
<th>Average annual rate</th>
<th>No. known deaths</th>
<th>CFR† (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Unknown</td>
<td>0 dose</td>
<td>1 dose</td>
<td>3 doses</td>
<td>≥4 doses</td>
</tr>
<tr>
<td>5--19</td>
<td>6 (27.3)</td>
<td>10 (45.5)</td>
<td>1 (4.6)</td>
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<td>4 (18.2)</td>
</tr>
<tr>
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<td>2 (3.2)</td>
<td>9 (14.5)</td>
</tr>
<tr>
<td>50--64</td>
<td>30 (69.8)</td>
<td>4 (9.3)</td>
<td>6 (14.0)</td>
<td>0</td>
<td>---</td>
</tr>
<tr>
<td>≥65</td>
<td>48 (67.6)</td>
<td>14 (19.7)</td>
<td>7 (9.9)</td>
<td>1 (1.4)</td>
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</tr>
</tbody>
</table>

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† Based on 197 cases with known outcomes.
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[www.cdc.gov/mmwr/preview/mmwrhtml/mm6012a1.htm](www.cdc.gov/mmwr/preview/mmwrhtml/mm6012a1.htm)
Meningococcal Disease Incidence by Age, United States, 2005-2013

SOURCE: CDC. National Notifiable Diseases Surveillance System
Meningococcal Incidence in Adolescents and Young Adults by Serogroup, 2005–2014

Source: National Notifiable Diseases Surveillance System (NNDSS) data with additional serogroup data from Active Bacterial Core surveillance (ABCs) and state health departments. Unknown serogroup (21%) and other serogroups (7%) excluded
### How Many People In Each Meningococcal Risk Group?

<table>
<thead>
<tr>
<th>Group</th>
<th>Estimated Persons in Risk Group</th>
<th>Increased Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complement component deficiencies</td>
<td>Prevalence of 0.03%&lt;sup&gt;1&lt;/sup&gt; ~70,000 persons (adults)</td>
<td>Up to 10,000-fold increased risk and can experience recurrent disease</td>
</tr>
<tr>
<td>Anatomic or Functional Asplenia (including sickle cell)</td>
<td>Sickle cell ~100,000 (all ages)&lt;sup&gt;2&lt;/sup&gt;</td>
<td>Increased risk for invasive disease due to many encapsulated bacteria; higher case-fatality</td>
</tr>
<tr>
<td>Microbiologists</td>
<td>~100,000 clinical; 400 research</td>
<td>Attack rate of 13/100,000; high case-fatality ratio&lt;sup&gt;3&lt;/sup&gt;</td>
</tr>
<tr>
<td>HIV AIDS</td>
<td>1.2 million</td>
<td>Attack rate of 3.4-6.6/100,000&lt;sup&gt;4&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

**Total** ~1.47 million persons

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<sup>2</sup>www.cdc.gov/ncbddd/sicklecell/data.html


<sup>4</sup>MMWR / November 4, 2016 / Vol. 65 / No. 43.
<table>
<thead>
<tr>
<th>Group</th>
<th>Estimated Persons in Risk Group¹</th>
<th>Reported Cases¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outbreak at-risk populations (2008–2016)</td>
<td>~180,000 students identified as at risk during 11 serogroup B university outbreaks</td>
<td>50 cases (3 deaths) (2008–2016)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>~20,000 students per year or ~16,000 students per outbreak</td>
<td></td>
</tr>
</tbody>
</table>

1 Outbreaks where CDC was consulted
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></td>
<td></td>
<td>1 dose annually</td>
</tr>
<tr>
<td>Td/Tdap(^2)</td>
<td></td>
<td></td>
<td></td>
<td>Substitute Tdap for Td once, then Td booster every 10 yrs</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></td>
<td>3 doses</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>1 dose</td>
<td></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(^10)</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>
<td></td>
<td></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.

No recommendation.

Footnotes:
\(^1\) Recommended for adults who meet the age requirement, lack documentation of vaccination, or lack evidence of past infection.
\(^2\) Substitute Tdap for Td once, then Td booster every 10 yrs.
\(^3\) 1 or 2 doses depending on indication.
\(^4\) 2 doses.
\(^5\) 1 dose.
\(^6\) 3 doses.
\(^7\) 1 or 2 doses depending on indication.
\(^8\) 2 or 3 doses depending on vaccine.
\(^9\) 3 doses.
\(^10\) 1 or more doses depending on indication.
\(^11\) 1 or 3 doses depending on indication.
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>Influenza¹</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>1 dose annually</td>
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</tr>
<tr>
<td>Td/Tdap²</td>
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<tr>
<td></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>MMR³</td>
<td></td>
<td></td>
<td></td>
<td>1 or 2 doses depending on indication</td>
<td></td>
</tr>
<tr>
<td>VAR⁴</td>
<td></td>
<td></td>
<td></td>
<td>2 doses</td>
<td></td>
</tr>
<tr>
<td>HZV⁵</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1 dose</td>
</tr>
<tr>
<td>HPV–Female⁶</td>
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<td>3 doses</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>HPV–Male⁶</td>
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<td></td>
<td>3 doses</td>
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</tr>
<tr>
<td>PCV13⁷</td>
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<td></td>
<td></td>
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<td>1 dose</td>
</tr>
<tr>
<td>PPSV23⁷</td>
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<td></td>
<td></td>
<td></td>
<td>1 dose</td>
</tr>
<tr>
<td>HepA⁸</td>
<td></td>
<td></td>
<td></td>
<td>2 or 3 doses depending on vaccine</td>
<td></td>
</tr>
<tr>
<td>HepB⁹</td>
<td></td>
<td></td>
<td></td>
<td>3 doses</td>
<td></td>
</tr>
<tr>
<td>MenACWY or MPSV4¹⁰</td>
<td></td>
<td></td>
<td></td>
<td>1 or more doses depending on indication</td>
<td></td>
</tr>
<tr>
<td>MenB¹⁰</td>
<td></td>
<td></td>
<td></td>
<td>2 or 3 doses depending on vaccine</td>
<td></td>
</tr>
<tr>
<td>Hib¹¹</td>
<td></td>
<td></td>
<td></td>
<td>1 or 3 doses depending on indication</td>
<td></td>
</tr>
</tbody>
</table>

Legend:
- **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 indication, United States, 2017

<table>
<thead>
<tr>
<th>Vaccine</th>
<th>Pregnancy</th>
<th>Immuno-compromised (excluding HIV infection)</th>
<th>HIV infection</th>
<th>Asplenia, persistent complement deficiencies</th>
<th>Kidney failure, end-stage renal disease, on hemodialysis</th>
<th>Heart failure, chronic lung disease, chronic alcoholism</th>
<th>Chronic liver disease</th>
<th>Diabetes</th>
<th>Healthcare personnel</th>
<th>Men who have sex with men</th>
</tr>
</thead>
<tbody>
<tr>
<td>Influenza</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Td/Tdap</td>
<td>1 dose Tdap each pregnancy</td>
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<tr>
<td>MMR</td>
<td>contraindicated</td>
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<tr>
<td>VAR</td>
<td>contraindicated</td>
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<tr>
<td>HZV</td>
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<tr>
<td>HPV-Female</td>
<td></td>
<td>3 doses through age</td>
<td></td>
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<tr>
<td>HPV-Male</td>
<td>3 doses through age</td>
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<tr>
<td>PCV13</td>
<td></td>
<td>3 doses through age</td>
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<tr>
<td>PPSV23</td>
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<tr>
<td>HepA</td>
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<tr>
<td>HepB</td>
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<tr>
<td>MenACWY or MPSV4</td>
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<tr>
<td>MenB</td>
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<td></td>
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</tr>
<tr>
<td>Hib</td>
<td>3 doses post-HSCT recipients only</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**
<table>
<thead>
<tr>
<th>Vaccine</th>
<th>Pregnancy(^1)(^2)(^4)(^5)(^6)(^9)</th>
<th>Immuno-compromised (excluding HIV infection)(^3)(^7)(^11)</th>
<th>HIV infection</th>
<th>Asplenia, persistent complement deficiencies(^8)(^10)(^11)</th>
<th>Kidney failure, end-stage renal disease, on hemodialysis(^7)</th>
<th>Heart or lung disease, chronic alcoholism(^9)</th>
<th>Chronic liver disease(^7)</th>
<th>Diabetes(^7)(^9)</th>
<th>Healthcare personnel(^1)(^3)(^9)</th>
<th>Men who have sex with men(^1)(^3)(^9)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Influenza(^1)(^2)(^6)(^9)</td>
<td></td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Td/Tdap(^2)</td>
<td>1 dose Tdap each pregnancy</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MMR(^8)</td>
<td>contraindicated</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VAR(^4)</td>
<td>contraindicated</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>HZV(^9)</td>
<td>contraindicated</td>
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<tr>
<td>HPV-Female(^6)</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HPV-Male(^6)</td>
<td>3 doses through age 26 yrs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3 doses through age 26 yrs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PCV13(^7)</td>
<td></td>
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</tr>
<tr>
<td>PPSV23(^7)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1, 2, or 3 doses depending on indication</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HepA(^8)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2 or 3 doses depending on vaccine</td>
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</tr>
<tr>
<td>HepB(^9)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3 doses</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MenACWYW or MPSV4(^10)</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td>3 doses depending on indication</td>
<td></td>
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<tr>
<td>MenB(^10)</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>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></td>
<td></td>
<td></td>
<td>3 doses post-HSCT recipients only</td>
<td></td>
<td></td>
</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**
ACIP MenACWY Recommendations for Adults

- Routine recommendations for others at increased risk of meningococcal disease
  
  - First year college students, age 19 through 21 years, living in residence halls
    
    o If no history of prior vaccination with MenACWY, give 1 dose of MenACWY
    
    o If history of 1 dose of MenACWY given when younger than age 16 years, give dose #2 of MenACWY

www.cdc.gov/mmwr/preview/mmwrhtml/rr6202a1.htm
ACIP MenACWY Recommendations for Adults (cont.)

- Risk-based recommendations
  - Travelers to or residents of countries where meningococcal disease is hyperendemic or epidemic*, people present during outbreaks caused by a vaccine serogroup, and other people with prolonged increased risk for exposure (e.g., microbiologists routinely working with Neisseria meningitidis)
    - For ages 19 through 55 years, give 1 dose of MenACWY and boost every 5 years with MenACWY if risk continues
    - For age 56 years and older, if no previous MenACWY dose and either short-term travel or outbreak-related, give 1 dose of MPSV- Men ACWY; all others, give 1 dose of MenACWY and boost every 5 years with MenACWY if risk continues**

*Vaccination in the 3 years before the date of travel is required by the government of Saudi Arabia for all travelers to Mecca during the annual Hajj
**ACIP off-label recommendation

www.cdc.gov/mmwr/preview/mmwrhtml/rr6202a1.htm
ACIP MenACWY Recommendations for Adults (cont.)

**Risk-based recommendations**

- People with persistent complement component deficiencies, HIV infection, or functional or anatomic asplenia (including sickle cell disease)
  - For ages 19 through 55 years, give 2 doses of MenACWY, 8 weeks apart and boost every 5 years with MenACWY
  - For age 56 years and older, give 2 doses of MenACWY, 8 weeks apart and boost every 5 years with MenACWY

www.cdc.gov/mmwr/preview/mmwrhtml/rr6202a1.htm
www.cdc.gov/mmwr/volumes/65/wr/mm6543a3.htm
ACIP MenB Recommendations for Adults

▪ **Routine recommendation**
  • For young adults through 23 years who wish to be vaccinated
    o Give either 2 doses of Bexsero 4 weeks apart, or 2 doses of Trumenba on a 0- and 6-month schedule

▪ **Risk-based recommendations**
  • For people with persistent complement component deficiencies, anatomic or functional asplenia (including sickle cell disease) and
  • For people who are present during outbreaks caused by serogroup B, have prolonged increased risk for exposure (e.g., microbiologists routinely working with *Neisseria meningitidis*)
    o Give either 2 doses of Bexsero 4 weeks apart, or 3 doses of Trumenba on a 0-, 1-2-, and 6-month schedule.

www.cdc.gov/mmwr/preview/mmwrhtml/mm6422a3.htm
www.cdc.gov/mmwr/preview/mmwrhtml/mm6441a3.htm
Vaccination Coverage
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

MMWR Surveillance Summaries / May 5, 2017 / 66(11);1–28
www.cdc.gov/mmwr/volumes/66/ss/ss6611a1.htm?s_cid=ss6611a1_w
National Health Interview Survey, 2015
Vaccination Questions

- Influenza
- PPSV or PCV13, Td/Tdap, HepA, HepB, Zoster, HPV
  - No questions in NHIS to ascertain pneumococcal vaccination by type
- High-risk/increased-risk status
  - Limited information collected for Hep A and Hep B
    - Hep A (travel status & chronic liver disease)
    - Hep B (travel status, chronic liver disease, & diabetes mellitus)
  - PPSV or PCV13
- Health Care Personnel (HCP)
Adult Influenza Vaccination Coverage by Age, 2014-15 season, United States

- Influenza, ≥19 yrs: 45% (+1.6)
- Influenza, 19-49 yrs: 33%
- Influenza, 50-64 yrs: 49%
- Influenza, ≥65 yrs: 74%
- Influenza, ≥19 yrs, HCP: 69%

Data Source: 2014-2015 NHIS
HP2020 Targets: 70% ≥19 years, 90% HCP ≥19 years
HP2020 Targets: 60% PPV IR 19-64 years, 90% PPV ≥65 years, 30% Shingles
Data Source: 2015 NHIS
Adult Immunization Coverage, Selected Vaccines by Age and Increased-risk Status, 2013-2015, United States

Pneumococcal, IR 19-64yrs
- 2013
- 2014
- 2015

Pneumococcal, ≥65 yrs
- 2013
- 2014
- 2015

Zoster, ≥60 yrs
- 2013
- 2014
- 2015

HP2020 Targets: 90% PPV ≥65 yrs, 60% PPV IR 19-64 yrs, 30% zoster ≥60 yrs

Data Source: 2013, 2014 and 2015 NHIS
Adult Tetanus-containing Vaccination Coverage by Age and High-risk Status, United States

Data Source: 2015 NHIS
Hepatitis B Vaccination Coverage by Age and High-risk Status, United States

- HepB (≥3 doses), ≥19 yrs: 25%
- HepB (≥3 doses), Endemic Area Travel: 32%
- HepB (≥3 doses), No Endemic Area Travel: 21%
- HepB (≥3 doses), Chronic Liver Disease: 27%
- HepB (≥3 doses), HCP ≥19 yrs: 65% (+4.1)
- HepB (≥3 doses), 19-49 yrs: 32%
- HepB (≥3 doses), Diabetes 19-59 yrs: 24%
- HepB (≥3 doses), Diabetes ≥60 yrs: 13%

HP2020 Target: 90% HepB Healthcare Personnel (HCP)

Data Source: 2015 NHIS
Racial/Ethnic Vaccination Disparities -- NHIS 2015

Compared with 2014, racial/ethnic differences persisted for all seven and widened for pneumococcal and herpes zoster:

- Non-Hispanic blacks, Hispanics, and Non-Hispanic Asians had lower vaccination coverage than that of non-Hispanic whites for all of the vaccines routinely recommended for adults, except for:
  - Influenza 19+ years -- Asians had coverage similar to whites
  - PPSV/PCV13 19-64 years -IR -- Blacks and Asians had coverage similar to whites
  - HepA 19-49 years – Blacks had coverage similar to whites and Asians had higher coverage than whites
  - HepB 19-49 years – Asians had coverage similar to whites
  - HPV 19-26 years females – Blacks and Asians had coverage similar to whites

- Health Care Personnel (HCP) – Non-Hispanic black HCP and Hispanic HCP had lower coverage than white HCP for influenza, Tdap, and HepB vaccinations.
Limitations of Findings

- NHIS excludes persons in the military and those residing in institutions – results apply to the civilian, non-institutionalized population.
- Response rate 55.2% -- low response rate can result in selection bias if the nonresponse is unequal among participants regarding vaccination.
- Reported vaccination status and high-risk/increased-risk conditions not validated by medical records.
- Self-report of vaccination subject to recall bias.
- Tdap estimates: potential bias due to exclusions.
Conclusions

- **Overall coverage remains below HP2020 targets**
  - 70% for 19+ years for influenza vaccine
  - 90% for 65+ years for pneumococcal vaccine
  - 60% for high risk 19-64 years for pneumococcal vaccine
  - 30% for 60+ years for Zoster vaccine
  - 90% for hepatitis B vaccine for healthcare personnel

- **Some improvement from 2014**
  - Pneumococcal (19-64 years, IR), Tdap (≥19 years), and herpes zoster (≥60 years) vaccines
  - No improvements for other vaccines

- **Racial and ethnic disparities remain**

- **Much remains to be done to increase vaccine utilization among adults and to eliminate disparities**
Collaborators

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- Walter W. Williams, MD

MMWR Surveillance Summaries / May 5, 2017 / 66(11);1–28
- www.cdc.gov/mmwr/volumes/66/ss/ss6611a1.htm?s_cid=ss6611a1_w
For Additional Information:

ACIP Recommendations for Specific Vaccines

- [www.cdc.gov/vaccines/hcp/acip-recs/index.html](http://www.cdc.gov/vaccines/hcp/acip-recs/index.html)

Surveillance of Adult Vaccination Coverage, NHIS 2014

- [www.cdc.gov/mmwr/volumes/65/ss/ss6501a1.htm?s_cid=ss6501a1_w.htm](http://www.cdc.gov/mmwr/volumes/65/ss/ss6501a1.htm?s_cid=ss6501a1_w.htm)

Online Report on Adult Vaccination Coverage, February 2017:


AdultVaxView

- [www.cdc.gov/vaccines/imz-managers/coverage/adultvaxview/index.html](http://www.cdc.gov/vaccines/imz-managers/coverage/adultvaxview/index.html)
Vaccine Effectiveness
Impact of Vaccination – Hepatitis B

• In 2011, added adults with diabetes to those recommended for HepB vaccination

• 90% vaccine effectiveness (VE) after completing 3-dose series

• Effectiveness estimated to be lower in persons with diabetes with increasing age at time of vaccination
  › 90% VE age <40 years
  › 80% VE 41–59 years
  › 65% VE 60–69 years
  › <40% VE if 70 years or older with diabetes

CDC. Use of hepatitis B vaccine for adults with diabetes mellitus. MMWR 2011;60:1709-1711.
Impact of Vaccination - Zoster

- Vaccine effectiveness varies by vaccine type, the disease outcome, and the age or health of the person vaccinated.

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

Impact of Vaccination – Pneumococcal Vaccines

- **PCV13 (pneumococcal conjugate vaccine):**
  - Pneumococcal pneumonia:
    - 45% efficacy against vaccine-type pneumococcal pneumonia – older adults
    - 0% to 13% in immunocompromised adults
  - Invasive Pneumococcal Disease (IPD)
    - 75% efficacy against vaccine-type bacteria in adults aged ≥65 years
    - 25% to 75% in immunocompromised adults

- **PPSV23 (pneumococcal polysaccharide):**
  - Not effective against non-IPD pneumonia
  - Invasive Pneumococcal Disease (IPD)
    - 74% (CI 55-86%) in meta-analysis against IPD for older adults
    - 8% to 25% in immunocompromised adults

MMWR 2012;61(40):816-819
Impact of Vaccination – Influenza in Older Adults

- Vaccine Effectiveness (VE) varies based on antigenic match and age and health of person being vaccinated
  - ~30% VE in adults ≥65 years against medically attended influenza when good match\(^1\)
  - Generally higher VE in younger adults and children compared to older adults when good match
  • Reduces antibiotic use, medical visits, loss work
- Preliminary VE estimate for 2016-17\(^2\):

<table>
<thead>
<tr>
<th>Age Group, influenza A&amp;B</th>
<th>Adjusted Vaccine Effectiveness</th>
</tr>
</thead>
<tbody>
<tr>
<td>18-49 yrs</td>
<td>19 (–17 to 43)</td>
</tr>
<tr>
<td></td>
<td>58 (38 to 72)†</td>
</tr>
<tr>
<td>50-64 yrs</td>
<td></td>
</tr>
<tr>
<td>≥65 yrs</td>
<td>46 (4 to 70)†</td>
</tr>
</tbody>
</table>

\(^1\)CDC. Prevention and Control of Seasonal Influenza: Recommendations of the ACIP – U.S., 2016-17.  
\(^2\)MMWR 2016; MMWR 2017;66:167–171
Impact of Vaccination – Influenza in Adults with Chronic Illness

- Adults <65 years with chronic medical conditions have had lower vaccine effectiveness in some studies than similar adults without conditions:
  - 48% vs. 60% for lab confirmed influenza (LCI)
  - 36% vs 90% for influenza-related hospitalization
  - 76% in adults with chronic lung disease against LCI
  - 44% to 60% in preventing cardiac events in persons with pre-existing heart conditions

- Immunocompromised adults:
  - HIV infected adults - 75% vaccine effectiveness for LCI
  - Variable estimates in other immunocompromised adults, such as transplant recipients

\(^1\) CDC. Prevention and Control of Seasonal Influenza: Recommendations of the ACIP – U.S., 2016-17.
Case Studies
28 year old female comes to your office in October to receive hepatitis A vaccine before a trip to New Zealand. Her medical history is unremarkable except for a splenectomy at age 13 due to a bicycle crash.

You look in the state’s immunization information system, which has a record for the patient of
- MMR, two doses
- Varicella, two doses
- DTaP, five doses
- IPV, four doses
- Hib, four doses
- She also thinks she may have received “pneumonia vaccine” in the past but isn’t sure

What vaccine or vaccines does this person need today?
Immunocompromised Younger Adult

- 28 year old female comes to your office in October to receive hepatitis A vaccine before a trip to New Zealand. Her medical history is unremarkable except for a splenectomy at age 13 due to a bicycle crash.

- You look in the state’s immunization information system, which has a record for the patient of
  - MMR, two doses
  - Varicella, two doses
  - DTaP, five doses
  - IPV, four doses
  - Hib, four doses
  - She also thinks she may have received “pneumonia vaccine” in the past but isn’t sure

- What vaccine or vaccines does this person need today?
  - Hepatitis A, hepatitis B, influenza, Tdap, pneumococcal conjugate, meningococcal conjugate ACWY, meningococcal B
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>Pregnancy¹-⁶,⁹</th>
<th>Immuno-compromised (excluding HIV infection)¹⁰¹¹</th>
<th>HIV infection</th>
<th>HIV infection</th>
<th>Asplenia, persistent complement deficiencies¹⁰¹ⁱ</th>
<th>Kidney failure, end-stage renal disease, on hemodialysis⁷,⁹</th>
<th>Heart or lung disease, chronic alcoholism⁴</th>
<th>Chronic liver disease⁹</th>
<th>Diabetes⁷,⁹</th>
<th>Healthcare personnel⁸,⁹</th>
<th>Men who have sex with men⁸,⁹</th>
</tr>
</thead>
<tbody>
<tr>
<td>Influenza¹</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1 dose annually</td>
<td>For Td once, then Td booster every 10 yrs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Td/Tdap²</td>
<td>1 dose</td>
<td></td>
<td></td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MMR³</td>
<td>contraindicated</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>VAR⁴</td>
<td>contraindicated</td>
<td></td>
<td></td>
<td></td>
<td>1 or 2 doses depending on indication</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>HZV⁵</td>
<td>contraindicated</td>
<td></td>
<td></td>
<td></td>
<td>2 doses</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>HPV–Female⁶</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3 doses through age 26 yrs</td>
<td></td>
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<tr>
<td>HPV–Male⁸</td>
<td>3 doses through age 26 yrs</td>
<td></td>
<td></td>
<td></td>
<td>3 doses through age 21 yrs</td>
<td></td>
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<tr>
<td>PCV13⁷</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1 dose</td>
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<tr>
<td>PPSV23⁹</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1, 2, or 3 doses depending on indication</td>
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<tr>
<td>HepA⁸</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2 or 3 doses depending on vaccine</td>
<td></td>
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<tr>
<td>HepB⁹</td>
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<td></td>
<td></td>
<td></td>
<td>3 doses</td>
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<tr>
<td>MenACWY or MPSV4¹⁰</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1 dose depending on indication</td>
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<tr>
<td>MenB¹⁰</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1 dose depending on vaccine</td>
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<tr>
<td>Hib¹¹</td>
<td>3 doses post-HSCT recipients only</td>
<td></td>
<td></td>
<td></td>
<td>1 dose</td>
<td></td>
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</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
A 60-year-old retired aerospace engineer is beginning a second career as an aide in a children’s hospital. He has a history of psoriatic arthritis diagnosed 6 months ago. The arthritis is being treated with a dose of etanercept (Enbrel®) twice a week.

He reports having had severe varicella at 22 years of age that was complicated by varicella pneumonia and required hospitalization. He also reports a current mumps outbreak in the community served by the hospital where he works, and several children with mumps have recently been admitted to the hospital. His childhood vaccination record was lost in a fire several years ago. Listed below are his only documented vaccine doses.

**Vaccination History**
- Influenza (IIV) – 1 dose 1 month ago
- Hepatitis B – 3rd dose 1 month ago
- Td – 1 dose 1 year ago
- MMR – 1 dose 1 year ago

What vaccine or vaccines can this person receive today?
60 year old adult

- A 60-year-old retired aerospace engineer is beginning a second career as an aide in a children’s hospital. He has a history of psoriatic arthritis diagnosed 6 months ago. The arthritis is being treated with a dose of etanercept (Enbrel®) twice a week.

- He reports having had severe varicella at 22 years of age that was complicated by varicella pneumonia and required hospitalization. He also reports a current mumps outbreak in the community served by the hospital where he works, and several children with mumps have recently been admitted to the hospital. His childhood vaccination record was lost in a fire several years ago. Listed below are his only documented vaccine doses.

- **Vaccination History**
  - Influenza (IIV) – 1 dose 1 month ago
  - Hepatitis B – 3rd dose 1 month ago
  - Td – 1 dose 1 year ago
  - MMR – 1 dose 1 year ago

- **What vaccine or vaccines can this person receive today?**
  - Tdap, pneumococcal conjugate
Older Adult

- Paul is a 65-year-old retired accountant who is an established patient in your practice, with no significant medical history. He is in your office in November for a checkup. He lives with his daughter, who is expecting her first child in a month. Paul wants to know if he is eligible for Tdap vaccine so his grandchild can be protected from pertussis. He reports that he had chickenpox as a child, but his medical records lack a health care provider diagnosis or verification of varicella disease. His vaccination records show that he received valid doses of smallpox, DTP, and IPV in childhood and HepB and MMR as an adult. The state immunization registry shows his recent vaccination records below.
  - Tdap – 1 dose (11 years ago)
  - Td – 2 doses (11 years ago)
  - IIV – 1 dose (1 year ago)
  - Td – 1 dose (1 year ago)

- What vaccine or vaccines does Paul need today?
Paul is a 65-year-old retired accountant who is an established patient in your practice, with no significant medical history. He is in your office in November for a checkup. He lives with his daughter, who is expecting her first child in a month. Paul wants to know if he is eligible for Tdap vaccine so his grandchild can be protected from pertussis. He reports that he had chickenpox as a child, but his medical records lack a health care provider diagnosis or verification of varicella disease. His vaccination records show that he received valid doses of smallpox, DTP, and IPV in childhood and HepB and MMR as an adult. The state immunization registry shows his recent vaccination records below.

- Tdap – 1 dose (11 years ago)
- Td – 2 doses (12 years ago)
- IIV – 1 dose (1 year ago)
- Td – 1 dose (1 year ago)

What vaccine or vaccines does Paul need today?
- HZV, PCV13, and influenza vaccine
Competency-based education for staff is critical

Multiple education products available free through the CDC website:
- Immunization courses (webcasts and online self-study)
- Netconferences
- You Call the Shots self-study modules

Continuing education credits available

www.cdc.gov/vaccines/ed/index.html
Now Available

- Supplemental information regarding:
  - Human Papillomavirus
  - Meningococcal Disease
  - Pneumococcal Disease

www.cdc.gov/vaccines/pubs/pinkbook/supplement.html
www.cdc.gov/vaccines/pubs/pinkbook/index.html
CDC Vaccine and Immunization Resources

Questions? Email CDC

- Providers nipinfo@cdc.gov
- Parents and patients www.cdc.gov/cdcinfo

Website www.cdc.gov/vaccines

Twitter @DrNancyM_CDC

Influenza www.cdc.gov/flu

Vaccine Safety www.cdc.gov/vaccinesafety
Additional Resources

- State Immunization Program
  - http://www........
  - And local public health immunization programs, too!
- Immunization Action Coalition  www.immunize.org
- Vaccine Education Center  www.chop.edu
- American Academy of Pediatrics (AAP)  www.aap.org/immunize
- National Foundation for Infectious Diseases (NFID)  www.nfid.org
- Maryland Department of Health and Mental Hygiene  http://phpa.dhmh.maryland.gov/OIDEOR/IMMUN/Pages/Home.aspx