Adult Immunizations Overview

April 15, 2016

Carolyn B. Bridges, MD
Immunization Services Division
National Center for Immunization and Respiratory Diseases
Centers for Disease Control and Prevention
Disclosure

Dr. Carolyn Bridges has no financial relationships with any entity producing, marketing, re-selling, or distributing health care goods or services, consumed by, or used on, patients.

One unlicensed product will be mentioned and CDC-recommended off-label use of pneumococcal conjugate vaccine will be discussed.
Goals of Presentation

- Provide information on
  - Burden of vaccine-preventable illness, hospitalizations and deaths
  - Recommended adult vaccines and changes to 2016 adult immunization schedule
  - Current adult U.S. vaccination rates

- Review Practice Standards for Adult Immunization

- Provide practice resources for adult immunization
Influenza Health Impact

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

- Direct medical costs in U.S.: ~$10.4 billion

- Add in loss of work and life: ~$87 billion

---

Burden of Disease Among U.S. Adults for Diseases with Vaccines Available

- **Zoster (also known as shingles)**
  - About 1 million cases of zoster annually U.S.

- **Invasive pneumococcal disease (IPD)**
  - 33,900 total cases and 3,700 total deaths in 2013
    - 89% of IPD cases and nearly all IPD deaths among adults

- **Pertussis (also known as whooping cough)**
  - ~28,000 cases per year for 2013 and 2014
    - ~9,000 among adults

- **Hepatitis B**
  - 3,050 acute cases reported 2013
    - 19,800 estimated cases

---

Impact of Vaccination

- Vaccine effectiveness varies by vaccine type, the disease outcome, and the age or health of the person vaccinated.
  - PCV13 (pneumococcal conjugate vaccine):
    - 45% efficacy against vaccine-type pneumococcal pneumonia,
    - 75% efficacy against vaccine-type invasive pneumococcal disease among adults aged ≥ 65 years
  - Zoster (Shingles) vaccine effectiveness:
    - 51% against shingles
    - 66% against post-herpetic neuralgia (PHN),
    - 80% against most prolonged and extreme cases of PHN

References:
Impact of Vaccination – Hepatitis B

- Hepatitis B vaccine:
  - Recently added adults with diabetes to those recommended for vaccination
  - 90% effectiveness after completing 3-dose series
  - Effectiveness estimated to be lower in persons with diabetes with increasing age
    - 90% age <40 years
    - 80% 41–59 years
    - 65% 60–69 years
    - <40% 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 - Influenza

- Effectiveness varies based on antigenic match and age and health of person being vaccinated
  - ~60–70% effective in younger adults when good match
  - ~30% in adults ≥65 years against medically attended influenza when good match

- 2015-16 mid-season estimate:
  - 59% (95% CI = 44 - 70%) effective against medically attended, lab-confirmed influenza

2. Presented at February 2016 ACIP meeting.
Impact of Vaccination - Influenza

- Effective in preventing major cardiac events among persons with existing cardiovascular disease\(^1\)-\(^4\)
  - Meta-analysis of case control studies:\(^3\)
    - Acute respiratory illness/ILI increases acute MI risk by 2-fold
    - Influenza vaccination efficacy (VE) 29% (95% CI=9-44%) against acute MI
  - Meta-analysis of randomized studies of persons with existing CVD:\(^4\) influenza VE 36% (95% CI=14% to 53%)

- Influenza vaccination recommended as secondary prevention by American College of Cardiology and American Heart Association

Unlicensed Vaccine Clinic Recently Presented at Advisory Committee on Immunization Practices (ACIP)

• Inactivated adjuvanted herpes zoster vaccine
  – Not licensed
  – Results of phase III clinical trial among >15,000 persons 50 years and older presented at ACIP in June 2015
  – VE against shingles: 96% (95% CI=93-98%) with VE estimates similar for 50, 60, and 70 year old participants
  – 17% of vaccinated and 3% of placebo with Grade 3 symptoms

• Points to need for improved platform for delivery of current and future adult vaccines

2016 Adult Immunization Schedule

- Voted on by ACIP then approved by ACP, AAFP, ACOG, ACNM

- Published in *Annals of Internal Medicine* and *MMWR*

**Schedule**

- Recommendations by age group, medical and other indications
- Contraindications and precautions

**Available in multiple formats**

- Apps for mobile devices
- Printed laminated versions

[www.cdc.gov/vaccines/schedules/hcp/adult.html](http://www.cdc.gov/vaccines/schedules/hcp/adult.html)
Changes for 2016 Adult Schedule

- **Use of 9-Valent Human Papillomavirus (HPV) Vaccine: Updated HPV Vaccination Recommendations of the Advisory Committee on Immunization Practices**
  - MMWR March 27, 2015 / 64(11);300-304
  - [www.cdc.gov/mmwr/preview/mmwrhtml/mm6411a3.htm](http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6411a3.htm)

- **Use of Serogroup B Meningococcal Vaccines in Persons Aged ≥ 10 Years at Increased Risk for Serogroup B Meningococcal Disease: Recommendations of the Advisory Committee on Immunization Practices, 2015**
  - MMWR June 12, 2015 / 64(22);608-612
  - [www.cdc.gov/mmwr/preview/mmwrhtml/mm6422a3.htm](http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6422a3.htm)

- **Intervals Between PCV13 and PPSV23 Vaccines: Recommendations of the Advisory Committee on Immunization Practices (ACIP)**
  - MMWR September 4, 2015 / 64(34);944-947
  - [www.cdc.gov/mmwr/preview/mmwrhtml/mm6434a4.htm](http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6434a4.htm)
# Recommended Adult Immunization Schedule—United States - 2016

Note: These recommendations must be read with the footnotes that follow containing number of doses, intervals between doses, and other important information.

Figure 1. Recommended immunization schedule for adults aged 19 years or older, by vaccine and age group

<table>
<thead>
<tr>
<th>VACCINE ▼</th>
<th>AGE GROUP ▶</th>
<th>19-21 years</th>
<th>22-26 years</th>
<th>27-49 years</th>
<th>50-59 years</th>
<th>60-64 years</th>
<th>≥ 65 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Influenza*</td>
<td>1 dose annually</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tetanus, diphtheria, pertussis (Td/Tdap)*</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>
</tr>
<tr>
<td>Varicella*</td>
<td>2 doses</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Human papillomavirus (HPV) Female*</td>
<td>3 doses</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Human papillomavirus (HPV) Male*</td>
<td>3 doses</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zoster*</td>
<td>1 dose</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Measles, mumps, rubella (MMR)*</td>
<td>1 or 2 doses depending on indication</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pneumococcal 13-valent conjugate (PCV13)*</td>
<td>1 dose</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pneumococcal 23-valent polysaccharide (PPSV23)*</td>
<td>1 or 2 doses depending on indication</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hepatitis A*</td>
<td>2 or 3 doses depending on vaccine</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hepatitis B*</td>
<td>3 doses</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meningococcal 4-valent conjugate (MenACWY) or polysaccharide (MPSV4)*</td>
<td>1 or more doses depending on indication</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meningococcal B (MenB)*</td>
<td>2 or 3 doses depending on vaccine</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Haemophilus influenzae type b (Hib)*</td>
<td>1 or 3 doses depending on indication</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Covered by the Vaccine Injury Compensation Program

---

Report all clinically significant postvaccination reactions to the Vaccine Adverse Event Reporting System (VAERS). Reporting forms and instructions on filing a VAERS report are available at [www.vaers.hhs.gov](http://www.vaers.hhs.gov) or by telephone, 800-822-7967.

Information on how to file a Vaccine Injury Compensation Program claim is available at [www.hrsa.gov/vaccinecompensation](http://www.hrsa.gov/vaccinecompensation) or by telephone, 800-338-2382. To file a claim for vaccine injury, contact the U.S. Court of Federal Claims, 717 Madison Place, N.W., Washington, D.C. 20005; telephone, 202-357-6400.

Additional information about the vaccines in this schedule, extent of available data, and contraindications for vaccination is also available at [www.cdc.gov/vaccines](http://www.cdc.gov/vaccines) or from the CDC-INFO Contact Center at 800-CDC-INFO (800-232-4636) in English and Spanish, 8:00 a.m. - 8:00 p.m. Eastern Time, Monday - Friday, excluding holidays.

Use of trade names and commercial sources is for identification only and does not imply endorsement by the U.S. Department of Health and Human Services.

The recommendations in this schedule were approved by the Centers for Disease Control and Prevention’s (CDC) Advisory Committee on Immunization Practices (ACIP), the American Academy of Family Physicians (AAFP), the America College of Physicians (ACP), the American College of Obstetricians and Gynecologists (ACOG) and the American College of Nurse-Midwives (ACNM).
**Recommended Adult Immunization Schedule—United States - 2016**

*Note: These recommendations must be read with the footnotes that follow containing number of doses, intervals between doses, and other important information.*

Figure 1. Recommended immunization schedule for adults aged 19 years or older, by vaccine and age group

<table>
<thead>
<tr>
<th>VACCINE</th>
<th>AGE GROUP</th>
<th>19-21 years</th>
<th>22-26 years</th>
<th>27-49 years</th>
<th>50-59 years</th>
<th>60-64 years</th>
<th>≥ 65 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Influenza</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1 dose annually</td>
<td></td>
</tr>
<tr>
<td>Tetanus, diphtheria, pertussis (Td/Tdap)</td>
<td></td>
<td></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>Varicella</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2 doses</td>
<td></td>
</tr>
<tr>
<td>Human papillomavirus (HPV) Female</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3 doses</td>
<td></td>
</tr>
<tr>
<td>Human papillomavirus (HPV) Male</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3 doses</td>
<td></td>
</tr>
<tr>
<td>Zoster</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1 dose</td>
<td></td>
</tr>
<tr>
<td>Measles, mumps, rubella (MMR)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1 or 2 doses depending on indication</td>
<td></td>
</tr>
<tr>
<td>Pneumococcal 13-valent conjugate (PCV13)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1 dose</td>
<td></td>
</tr>
<tr>
<td>Pneumococcal 23-valent polysaccharide (PPSV23)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1 or 2 doses depending on indication</td>
<td></td>
</tr>
<tr>
<td>Hepatitis A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2 or 3 doses depending on vaccine</td>
<td></td>
</tr>
<tr>
<td>Hepatitis B</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3 doses</td>
<td></td>
</tr>
<tr>
<td>Meningococcal 4-valent conjugate (MenACWY) or polysaccharide (MPSV4)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1 or more doses depending on indication</td>
<td></td>
</tr>
<tr>
<td>Meningococcal B (MenB)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2 or 3 doses depending on vaccine</td>
<td></td>
</tr>
<tr>
<td>Haemophilus influenzae type b (Hib)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1 or 3 doses depending on indication</td>
<td></td>
</tr>
</tbody>
</table>

*Covered by the Vaccine Injury Compensation Program

Report all clinically significant postvaccination reactions to the Vaccine Adverse Event Reporting System (VAERS). Reporting forms and instructions on filing a VAERS report are available at [www.vaers.hhs.gov](http://www.vaers.hhs.gov) or by telephone, 800-822-7967.

Information on how to file a Vaccine Injury Compensation Program claim is available at [www.hrsa.gov/vaccinecompensation](http://www.hrsa.gov/vaccinecompensation) or by telephone, 800-338-2382. To file a claim for vaccine injury, contact the U.S. Court of Federal Claims, 717 Madison Place, N.W., Washington, D.C. 20005; telephone, 202-357-6400.

Additional information about the vaccines in this schedule, extent of available data, and contraindications for vaccination is also available at [www.cdc.gov/vaccines](http://www.cdc.gov/vaccines) or from the CDC-INFO Contact Center at 800-CDC-INFO (800-232-4636) in English and Spanish, 8:00 a.m. - 8:00 p.m. Eastern Time, Monday - Friday, excluding holidays.

Use of trade names and commercial sources is for identification only and does not imply endorsement by the U.S. Department of Health and Human Services.

The recommendations in this schedule were approved by the Centers for Disease Control and Prevention's (CDC) Advisory Committee on Immunization Practices (ACIP), the American Academy of Family Physicians (AAFP), the America College of Physicians (ACP), the American College of Obstetricians and Gynecologists (ACOG) and the American College of Nurse-Midwives (ACNM).
Figure 2. Vaccines that might be indicated for adults aged 19 years or older based on medical and other indications

<table>
<thead>
<tr>
<th>VACCINE ▼</th>
<th>INDICATION ▶</th>
<th>Pregnancy</th>
<th>Immuno-compromising conditions (excluding HIV infection) 4,4,7,8,13</th>
<th>HIV infection CD4+ count (cells/µL) 4,6,7,8,13</th>
<th>Men who have sex with men (MSM) 4,4,7,8,13</th>
<th>Kidney failure, end-stage renal disease, on hemodialysis</th>
<th>Heart disease, chronic lung disease, chronic alcoholism</th>
<th>Asplenia and persistent complement deficiencies 9,11,12</th>
<th>Chronic liver disease</th>
<th>Diabetes</th>
<th>Healthcare personnel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Influenza* 2</td>
<td>1 dose annually</td>
<td>1 dose annually</td>
<td>Substitute Tdap for Td once, then Td booster every 10 yrs</td>
<td>Contraindicated</td>
<td>Contraindicated</td>
<td>Contraindicated</td>
<td>Contraindicated</td>
<td>Contraindicated</td>
<td>Contraindicated</td>
<td>Contraindicated</td>
<td></td>
</tr>
<tr>
<td>Tetanus, diphtheria, pertussis (Td/Tdap)* 3</td>
<td>1 dose Tdap each pregnancy</td>
<td>Contraindicated</td>
<td>Contraindicated</td>
<td>Contraindicated</td>
<td>Contraindicated</td>
<td>Contraindicated</td>
<td>Contraindicated</td>
<td>Contraindicated</td>
<td>Contraindicated</td>
<td>Contraindicated</td>
<td></td>
</tr>
<tr>
<td>Varicella* 4</td>
<td>Contraindicated</td>
<td>Contraindicated</td>
<td>Contraindicated</td>
<td>Contraindicated</td>
<td>Contraindicated</td>
<td>Contraindicated</td>
<td>Contraindicated</td>
<td>Contraindicated</td>
<td>Contraindicated</td>
<td>Contraindicated</td>
<td></td>
</tr>
<tr>
<td>Human papillomavirus (HPV) Female* 5</td>
<td>3 doses through age 26 yrs</td>
<td>3 doses through age 26 yrs</td>
<td>3 doses through age 26 yrs</td>
<td>3 doses through age 26 yrs</td>
<td>3 doses through age 26 yrs</td>
<td>3 doses through age 26 yrs</td>
<td>3 doses through age 26 yrs</td>
<td>3 doses through age 26 yrs</td>
<td>3 doses through age 26 yrs</td>
<td>3 doses through age 26 yrs</td>
<td></td>
</tr>
<tr>
<td>Human papillomavirus (HPV) Male* 5</td>
<td>3 doses through age 26 yrs</td>
<td>3 doses through age 26 yrs</td>
<td>3 doses through age 26 yrs</td>
<td>3 doses through age 26 yrs</td>
<td>3 doses through age 26 yrs</td>
<td>3 doses through age 26 yrs</td>
<td>3 doses through age 26 yrs</td>
<td>3 doses through age 26 yrs</td>
<td>3 doses through age 26 yrs</td>
<td>3 doses through age 26 yrs</td>
<td></td>
</tr>
<tr>
<td>Zoster* 6</td>
<td>Contraindicated</td>
<td>Contraindicated</td>
<td>Contraindicated</td>
<td>Contraindicated</td>
<td>Contraindicated</td>
<td>Contraindicated</td>
<td>Contraindicated</td>
<td>Contraindicated</td>
<td>Contraindicated</td>
<td>Contraindicated</td>
<td></td>
</tr>
<tr>
<td>Measles, mumps, rubella (MMR)* 7</td>
<td>Contraindicated</td>
<td>Contraindicated</td>
<td>Contraindicated</td>
<td>Contraindicated</td>
<td>Contraindicated</td>
<td>Contraindicated</td>
<td>Contraindicated</td>
<td>Contraindicated</td>
<td>Contraindicated</td>
<td>Contraindicated</td>
<td></td>
</tr>
<tr>
<td>Pneumococcal 13-valent conjugate (PCV13)* 8</td>
<td>1 dose</td>
<td>1 dose</td>
<td>1 dose</td>
<td>1 dose</td>
<td>1 dose</td>
<td>1 dose</td>
<td>1 dose</td>
<td>1 dose</td>
<td>1 dose</td>
<td>1 dose</td>
<td></td>
</tr>
<tr>
<td>Pneumococcal polysaccharide (PPSV23)* 9</td>
<td>1, 2, or 3 doses depending on indication</td>
<td>1, 2, or 3 doses depending on indication</td>
<td>1, 2, or 3 doses depending on indication</td>
<td>1, 2, or 3 doses depending on indication</td>
<td>1, 2, or 3 doses depending on indication</td>
<td>1, 2, or 3 doses depending on indication</td>
<td>1, 2, or 3 doses depending on indication</td>
<td>1, 2, or 3 doses depending on indication</td>
<td>1, 2, or 3 doses depending on indication</td>
<td>1, 2, or 3 doses depending on indication</td>
<td>1, 2, or 3 doses depending on indication</td>
</tr>
<tr>
<td>Hepatitis A* 7</td>
<td>2 or 3 doses depending on vaccine</td>
<td>2 or 3 doses depending on vaccine</td>
<td>2 or 3 doses depending on vaccine</td>
<td>2 or 3 doses depending on vaccine</td>
<td>2 or 3 doses depending on vaccine</td>
<td>2 or 3 doses depending on vaccine</td>
<td>2 or 3 doses depending on vaccine</td>
<td>2 or 3 doses depending on vaccine</td>
<td>2 or 3 doses depending on vaccine</td>
<td>2 or 3 doses depending on vaccine</td>
<td>2 or 3 doses depending on vaccine</td>
</tr>
<tr>
<td>Hepatitis B* 10</td>
<td>3 doses</td>
<td>3 doses</td>
<td>3 doses</td>
<td>3 doses</td>
<td>3 doses</td>
<td>3 doses</td>
<td>3 doses</td>
<td>3 doses</td>
<td>3 doses</td>
<td>3 doses</td>
<td>3 doses</td>
</tr>
<tr>
<td>Meningococcal 4-valent conjugate (MenACWY) or polysaccharide (MPSV4)* 11</td>
<td>1 or more doses depending on indication</td>
<td>1 or more doses depending on indication</td>
<td>1 or more doses depending on indication</td>
<td>1 or more doses depending on indication</td>
<td>1 or more doses depending on indication</td>
<td>1 or more doses depending on indication</td>
<td>1 or more doses depending on indication</td>
<td>1 or more doses depending on indication</td>
<td>1 or more doses depending on indication</td>
<td>1 or more doses depending on indication</td>
<td>1 or more doses depending on indication</td>
</tr>
<tr>
<td>Meningococcal B (MenB)* 11</td>
<td>2 or 3 doses depending on vaccine</td>
<td>2 or 3 doses depending on vaccine</td>
<td>2 or 3 doses depending on vaccine</td>
<td>2 or 3 doses depending on vaccine</td>
<td>2 or 3 doses depending on vaccine</td>
<td>2 or 3 doses depending on vaccine</td>
<td>2 or 3 doses depending on vaccine</td>
<td>2 or 3 doses depending on vaccine</td>
<td>2 or 3 doses depending on vaccine</td>
<td>2 or 3 doses depending on vaccine</td>
<td>2 or 3 doses depending on vaccine</td>
</tr>
<tr>
<td>Haemophilus influenzae type b (Hib)* 12</td>
<td>3 doses post-HSCT recipients only</td>
<td>3 doses post-HSCT recipients only</td>
<td>3 doses post-HSCT recipients only</td>
<td>3 doses post-HSCT recipients only</td>
<td>3 doses post-HSCT recipients only</td>
<td>3 doses post-HSCT recipients only</td>
<td>3 doses post-HSCT recipients only</td>
<td>3 doses post-HSCT recipients only</td>
<td>3 doses post-HSCT recipients only</td>
<td>3 doses post-HSCT recipients only</td>
<td>3 doses post-HSCT recipients only</td>
</tr>
</tbody>
</table>

*Covered by the Vaccine Injury Compensation Program

Recommended for all persons who meet the age requirement, lack documentation of vaccination, or lack evidence of past infection; zoster vaccine is recommended regardless of past episode of zoster

Recommended for persons with a risk factor (medical, occupational, lifestyle, or other indication)

No recommendation

Contraindicated

These schedules indicate the recommended age groups and medical indications for which administration of currently licensed vaccines is commonly recommended for adults aged ≥ 19 years, as of February 2016. For all vaccines being recommended on the Adult Immunization Schedule: a vaccine series does not need to be restarted, regardless of the time that has elapsed between doses. Licensed combination vaccines may be used whenever any components of the combination are indicated and when the vaccine’s other components are not contraindicated. For detailed recommendations on all vaccines, including those used primarily for travelers or that are issued during the year, consult the manufacturers’ package inserts and the complete statements from the Advisory Committee on Immunization Practices (www.cdc.gov/vaccines/hcp/acip-recs/index.html). Use of trade names and commercial sources is for identification only and does not imply endorsement by the U.S. Department of Health and Human Services.
<table>
<thead>
<tr>
<th>Formulation</th>
<th>Trade name</th>
<th>Manufacturer</th>
<th>Presentation</th>
<th>Age indications</th>
<th>Route</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Inactivated influenza vaccine</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>standard dose (IIV4)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>quadrivalent (IIV4), standard dose</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Immunization</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>IIV4 intradermal</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fluarix</td>
<td>GlaxoSmithKline</td>
<td>0.5 mL single-dose syringe</td>
<td>≥3 yrs</td>
<td>IM</td>
<td></td>
</tr>
<tr>
<td>FluLaval</td>
<td>ID Biomedical</td>
<td>5.0 mL multi-dose vial</td>
<td>≥3 yrs</td>
<td>IM</td>
<td></td>
</tr>
<tr>
<td>Fluzone</td>
<td>Sanofi Pasteur</td>
<td>0.25 mL single-dose syringe</td>
<td>6 - 35 mos</td>
<td>IM</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0.5 mL single-dose syringe</td>
<td>≥36 mos</td>
<td>IM</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0.5 mL single-dose vial</td>
<td>≥36 mos</td>
<td>IM</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5.0 mL multi-dose vial</td>
<td>≥6 mos</td>
<td>IM</td>
</tr>
<tr>
<td><strong>IIV4 trivalent (IIV3), standard dose</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>standard dose</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>IIV3 adjuvant, standard dose</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fluarial</td>
<td>Seqirus</td>
<td>0.5 mL single-dose syringe</td>
<td>≥9 yrs††</td>
<td>IM</td>
<td></td>
</tr>
<tr>
<td>FluLaval</td>
<td>Seqirus</td>
<td>5.0 mL multi-dose vial</td>
<td>≥9 yrs††</td>
<td>IM</td>
<td></td>
</tr>
<tr>
<td>Fluzone</td>
<td>Sanofi Pasteur</td>
<td>0.5 mL single-dose syringe</td>
<td>≥4 yrs</td>
<td>IM</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5.0 mL multi-dose vial</td>
<td>≥4 yrs</td>
<td>IM</td>
</tr>
<tr>
<td><strong>IIV3 cell-culture-based (ccIIV3), standard dose</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>standard dose</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recombinant influenza vaccine (RIV3)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>standard dose</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Live attenuated influenza vaccine</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>vaccine, quadrivalent</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>IIV3 high dose</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fluzone HD</td>
<td>Sanofi Pasteur</td>
<td>0.5 mL single-dose syringe</td>
<td>≥65 yrs</td>
<td>IM</td>
<td></td>
</tr>
<tr>
<td><strong>Recombinant influenza vaccine (RIV3) standard</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>standard dose</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Live attenuated influenza vaccine</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>vaccine, quadrivalent</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Manufacturers</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fluad</td>
<td>Seqirus</td>
<td>0.5 mL single-dose syringe</td>
<td>≥65 yrs</td>
<td>IM</td>
<td></td>
</tr>
<tr>
<td>Fluclavix</td>
<td>Seqirus</td>
<td>0.5 mL single-dose syringe</td>
<td>≥18 yrs</td>
<td>IM</td>
<td></td>
</tr>
<tr>
<td>FluMist IIV4</td>
<td>MedImmune</td>
<td>0.2 mL single-dose IN sprayer</td>
<td>2 - 49 yrs</td>
<td>IN</td>
<td></td>
</tr>
</tbody>
</table>

Note: The table uses standard dose for IIV4 and standard dose for IIV3 formulations.
Vaccination of Pregnant Women
Recommended for All Pregnant Women

- Inactivated
  - Inactivated influenza vaccine
  - Tetanus toxoid, reduced diphtheria toxoid, and acellular pertussis (Tdap)

*Rasmussen et al., Semin Fetal Neonatal Med 19:161-9, 2014*
Influenza Vaccine during Pregnancy Protects Infants < 6 Months of Age from Laboratory-Proven Influenza

Maternal Influenza Vaccine’s Effects on Fetus/Newborn

• Observational study from Georgia PRAMS¹
  – Infants whose mothers who received influenza vaccine prenatally were less likely to be preterm (aOR=0.60, 95% CI 0.38-0.94) and SGA (aOR=0.31, 95% CI 0.13-0.75).

• Observational study from Ontario²
  – Infants whose mothers received H1N1 vaccine prenatally less likely to be SGA (aRR=0.90; 95% CI 0.85, 0.96) or preterm (<32 weeks) (aRR = 0.73; 95% CI = 0.58, 0.91). Fetal loss aRR = 0.66; 95% CI = 0.47, 0.91.

• Observational study: Kaiser Permanente³
  – Infants whose mothers who received H1N1 vaccine prenatally had 37% lower odds of being born preterm (aOR 0.63; 95%CI 0.47-0.84).


SGA=small for gestational age; aOR=adjusted odds ratio; aRR=adjusted relative risk.
Td/Tdap Vaccination of Adults

- Td – give as booster shot every 10 years or after high risk exposure under some circumstances.

- Tdap – also contains protection against pertussis - adolescents (preferably given at age 11-12 years – 2006 recommendation) and adults 19 and older should receive a single dose of Tdap if no prior history Tdap

- Pregnant women recommended to get Tdap vaccine 3rd trimester each pregnancy
Effectiveness of Maternal Pertussis Vaccination -- United Kingdom

• Observational study
• Vaccine effectiveness (VE) calculated by comparing vaccination status for mothers of confirmed cases with estimates of vaccine coverage for national population of pregnant women

<table>
<thead>
<tr>
<th>Vaccine effectiveness</th>
<th>Timing of maternal vaccination</th>
</tr>
</thead>
<tbody>
<tr>
<td>91% (83-95)</td>
<td>At least 28 days before birth</td>
</tr>
<tr>
<td>38% (-95-80)</td>
<td>0-6 days before or 1-13 days after birth</td>
</tr>
</tbody>
</table>

Vaccination Coverage Rates
Adult Influenza Vaccination Coverage by Age, 2013-14 season, United States, 2014 NHIS

- HP2020 Targets: 70% ≥19 years, 90% HCP ≥19 years
- BRFSS estimates for 2013-14: 42.2% (18+), 32.2% (18-49), 45.3% (50-64), 65.0% (65+)
- HCP internet panel survey 2013-14: 75.2%

Adult Vaccination Coverage, Selected Vaccines by Age and High-risk Status, United States

- **Pneumococcal, HR 19-64yrs**: 20%
- **Pneumococcal, ≥65 yrs**: 61%
- **Herpes Zoster (Shingles), ≥60 yrs**: 28% (+3.6)

**HP2020 Targets**: 60% PPV HR 19-64 years, 90% PPV ≥65 years, 30% Shingles

Adult Tetanus-containing Vaccination Coverage by Age and High-risk Status, United States

- Td past 10 yrs, 19-49 yrs: 63%
- Td past 10 yrs, 50-64 yrs: 65%
- Td past 10 yrs, ≥65 yrs: 58%
- Tdap past 9 yrs, ≥19 yrs: 20% (+2.9)
- Tdap past 9 yrs, Living with infant <1 yr, ≥ 19 yrs: 32%
- Tdap past 9 yrs, HCP ≥19 yrs: 42%

Hepatitis B Vaccination Coverage by Age and High-risk Status, United States

- HepB (≥3 doses), ≥19 yrs: 25%
- HepB (≥3 doses), Travel Endemic Area: 31% (-2.6%)
- HepB (≥3 doses), No Endemic Area: 21%
- HepB (≥3 doses), Chronic Liver Disease: 30%
- HepB (≥3 doses), HCP ≥19 yrs: 61%
- HepB (≥3 doses), 19-49 yrs: 32%
- HepB (≥3 doses), Diabetes 19-59 yrs: 24%
- HepB (≥3 doses), Diabetes ≥60 yrs: 14%

HP2020 Target: 90% HepB Healthcare Personnel (HCP)
Data Source: 2014 NHIS

Proportion of HCP ≥19 years of age who received selected vaccines, by direct patient care

<table>
<thead>
<tr>
<th>Group</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Influenza (2013-14 season), ≥19 years, with direct patient care</td>
<td>65</td>
</tr>
<tr>
<td>Influenza (2013-14 season), ≥19 years, without direct patient care</td>
<td>66</td>
</tr>
<tr>
<td>Tdap, ≥19 years, with direct patient care</td>
<td>48</td>
</tr>
<tr>
<td>Tdap, ≥19 years, without direct patient care</td>
<td>32*</td>
</tr>
<tr>
<td>HepB (&gt;3 doses), ≥19 years, with direct patient care</td>
<td>68</td>
</tr>
<tr>
<td>HepB (&gt;3 doses), ≥19 years, without direct patient care</td>
<td>48*</td>
</tr>
</tbody>
</table>

*p < 0.05 by T test for comparisons between HCP with direct patient care responsibilities and HCP without direct patient care responsibilities.

Data Source: 2014 NHIS
Influenza vaccine 2014-15 season coverage by:

a. Work setting

b. Occupation type

http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6436a1.htm
HPV Vaccination Coverage (≥1 dose ever), Adults 19-26 years of age by Sex, United States

<table>
<thead>
<tr>
<th>Group</th>
<th>% Vaccinated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Females 19-26 yrs</td>
<td>40</td>
</tr>
<tr>
<td>Females 19-21 yrs</td>
<td>45 (+5.6)</td>
</tr>
<tr>
<td>Females 22-26 yrs</td>
<td>38 (+5.3)</td>
</tr>
<tr>
<td>Males 19-26 yrs</td>
<td>8</td>
</tr>
<tr>
<td>Males 19-21 yrs</td>
<td>13 (+5.6)</td>
</tr>
<tr>
<td>Males 22-26 yrs</td>
<td>5</td>
</tr>
</tbody>
</table>

Data Source: 2014 NHIS
Association of Health Insurance Status and Usual Place of Health Care with Vaccination Coverage

- 87% reported some type of health insurance

- Coverage 2-5 times higher for persons with health insurance for influenza, Tdap, herpes zoster, and HPV vaccinations

- Even among insured persons with >10 physician contacts in past 12 months, 24% - 89% missing a recommended vaccine
  - Eg. 65% diabetics missing hepatitis B vaccine, 61% high risk persons 18-64 yrs missing pneumococcal vaccine.

Adult Immunization Practice Standards

- **Assess** immunization status of all patients in every clinical encounter.
- Strongly **recommend** vaccines that patients need.
- **Administer** needed vaccines or **Refer** to a provider who can immunize.
- **Document** vaccines received by patients, including entering immunizations into immunization registries where available.

http://www.publichealthreports.org
Percentage of most recent visit(s) to healthcare location or pharmacy* in past 12 months during which adults reported receiving vaccination assessment, Internet Panel Survey, February–March 2015, United States (N=2,349)

- Primary Care (n=1859): 31%
- Internal Medicine (n=866): 32%
- Family Medicine (n=907): 31%
- Ob/Gyn (n=499): 14%
- Other Specialties (n=142): 8%
- Pharmacy (n=1604): 5%

*Visited pharmacy to fill prescription for themselves.
Resources For Implementing Standards


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

- **CDC adult vaccine schedule app** at [http://www.cdc.gov/vaccines/schedules/hcp/schedule-app.html](http://www.cdc.gov/vaccines/schedules/hcp/schedule-app.html).
Challenges to Implementation of Adult Standards

- Busy providers
- Many providers and healthcare systems without vaccine integrated into work flow
  - Limited number of quality measures
- Financial-related barriers for providers and patients,
  - Eg. cost of vaccine stocking, vaccine expiration, vaccination administration payments, Medicare part D vaccines, in-network status, out of pocket costs to patients for Medicare part D vaccines
- Vaccination record keeping
- Immunization Information Systems (IIS) aka Vaccine Registries
  - On-boarding challenges
  - Challenges with connecting EMRs to IIS
Components of Successful Vaccination Programs

- Use combination of approaches

- Strategies shown to improve coverage:
  - Use of standing orders
  - Use of reminder-recall systems
  - Efforts to remove administrative barriers
  - Provider and practice assessment of vaccination and feedback
  - Use of immunization registries
  - Education of both providers and public

www.thecommunityguide.org/vaccines/index.html
# Meta-Analysis of Interventions to Increase Use of Adult Immunization

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Odds Ratio*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organizational change (e.g., standing orders, separate clinics devoted to prevention)</td>
<td>16.0</td>
</tr>
<tr>
<td>Provider reminder</td>
<td>3.8</td>
</tr>
<tr>
<td>Patient financial incentive</td>
<td>3.4</td>
</tr>
<tr>
<td>Provider education</td>
<td>3.2</td>
</tr>
<tr>
<td>Patient reminder</td>
<td>2.5</td>
</tr>
<tr>
<td>Patient education</td>
<td>1.3</td>
</tr>
</tbody>
</table>

*Compared to usual care or control group, adjusted for all remaining interventions

Examples of Assessment Tools

Patient vaccine needs-assessment form from Immunization Action Coalition at immunize.org. Consider Health, Age, Lifestyle and Occupation/Other Factors H-A-L-O

![H-A-L-O checklist of factors that indicate a possible need for adult vaccination](https://www.immunize.org)
Examples of Assessment Tools

Adult patient vaccine needs-assessment form from National Foundation for Infectious Diseases at NFID.org
Conclusions

- Substantial burden of disease in adults for which vaccines are recommended
- Vaccination rates low among adults in U.S., leaving adults unnecessarily vulnerable to illnesses that can be prevented
- Many tools and resources available to help providers implement adult immunization practice standards
Collaborators

- Peng-Jun Lu, MD, PhD
- Alissa O’Halloran, MSPH
- Carolyn B. Bridges, MD
- David K. Kim, MD
- Lisa A. Grohskopf, MD
- Tamara Pilishvili, MPH
- Tami H. Skoff, MS
- Noele P. Nelson, MD, PhD
- Rafael Harpaz, MD
- Lauri E. Markowitz, MD
- Alfonso Rodriguez-Lainz, PhD, DVM
- Walter W. Williams, MD
Thank you!

**Questions?**

cbridges@cdc.gov