Vaccines for the Internist:

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SD Chapter Meeting American College of Physicians

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Adult Immunization Resource Hub

- Developed as part of ACP’s I Raise the Rates initiative.
- Provides updated clinical information, patient education materials, quality improvement guidance and much more.
- For more information, visit: www.acponline.org/ai
ACP Advance QI Curriculum

- Learn core QI skills that empower you to implement practice-changing initiatives to increase adult immunization rates in your practice.
- Additional ACP Advance offerings include a physician-led coaching service and chronic care resources.
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  www.acponline.org/acpadvance
Vaccines for the Internist

- Vaccines are a public health tool to combat illnesses that have effected humanity for generations
- First we need to understand how vaccines work and remember how the body fights illness

https://www.cdc.gov/vaccines/index.html
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- When bacteria or viruses enter the body their job is to multiply.
  - In order to do this they must invade and evade.
    - This is called an infection
    - The immune system uses white blood cells
      - Macrophages: Antigen, "Eaters"
      - B-lymphocytes: Antibody, "Notifiers"
      - T-lymphocyte: Search and Destroy, "Digesters", Memory
        - Bleach and H2O2

https://www.cdc.gov/vaccines/index.html
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- Vaccines did not begin with Jenner’s use of cowpox (1796 CE) to provide protection against smallpox
  - There was an earlier use: Chinese employed smallpox inoculation as early as 1000 CE.
  - Practiced in Africa and Turkey as well, before Europe and the Americas.
- Louis Pasteur’s 1885 rabies vaccine lead to bacteriology and developments of antitoxins and vaccines against diphtheria, tetanus, anthrax, cholera, plague, typhoid, tuberculosis.
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- With the improvement in methods for growing viruses the vaccines for polio, measles, mumps, and rubella have reduced the global disease burden greatly.
- Now recombinant DNA technology and new delivery techniques are leading scientists in new directions.
- The impact on global travel, war and social unrest have direct impact on vaccine-preventable diseases.
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- It is important for your patients to be educated and informed
  - This is harder than it appears in a quantality versus quality pay system
  - ACP, CDC, Merck all have documents to help

[Links]
https://www.cdc.gov/vaccines/index.html
https://www.merckvaccines.com/Professional-Resources/Pages/Home
Vaccines for the Internist

- Vaccines imitate an infection
  - "I always get the Flu after the Flu shot".
  - It causes the immune system to produce T-lymphocytes and antibodies.
  - The job is to create the “memory” T-lymphocytes and B-lymphocytes to fight that disease in the future.
  - It takes a few weeks for the body to produce T-lymphocytes and B-lymphocytes after vaccination.
  - Timing is everything

https://www.cdc.gov/vaccines/index.html
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- The “Overloaded Immune System” Misconception
- Receives multiple vaccines at once
- Expanded immunization schedule
  - studies demonstrated it was not more likely to cause adverse effects when given in an expanded schedule than when they are administered separately.

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Spread out the time to receive vaccinations “just in case” this misconception is inaccurate.

- No scientific evidence to support
- Maintains risk of contracting preventable diseases.

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- The “More Vaccinated Than Unvaccinated People Get Sick” Misconception
- Outbreak of measles in the United States
  - Unvaccinated people aren’t the only ones at risk
  - No vaccination is 100% effective
- Public Health: the more unvaccinated population the greater risk for endemic or ongoing exposure

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- 500 people who have been exposed to an outbreak: 490 have been vaccinated, 10 have not.
  - Different vaccines provide different rates of protection, assume that 98 of every 100 people (98% effective)
    - 10 of the unvaccinated people, 100%
    - Vaccinated 10 people, 2% of the vaccinated
  - Try Flu math with 60% immunity to strains

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https://www.cdc.gov/vaccines/index.html
**Vaccines for the Internist**

### Table 1
**Recommended Adult Immunization Schedule by Age Group**
**United States, 2019**

<table>
<thead>
<tr>
<th>Vaccine</th>
<th>19–21 years</th>
<th>22–26 years</th>
<th>27–49 years</th>
<th>50–64 years</th>
<th>≥65 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Influenza inactivated (IIV) or</td>
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<tr>
<td>Influenza recombinant (RIV)</td>
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<tr>
<td>Influenza live attenuated (LAIV)</td>
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<tr>
<td>Tetanus, diphtheria, pertussis (Tdap or Td)</td>
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<td></td>
<td></td>
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<tr>
<td>Measles, mumps, rubella (MMR)</td>
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<tr>
<td>Varicella (VAR)</td>
<td></td>
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<tr>
<td>Zoster recombinant (RZV) (preferred)</td>
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<tr>
<td>Zoster live (ZVL)</td>
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<td></td>
<td></td>
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<tr>
<td>Human papillomavirus (HPV) Female</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Human papillomavirus (HPV) Male</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Pneumococcal conjugate (PCV13)</td>
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<td></td>
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<tr>
<td>Pneumococcal polysaccharide (PPSV23)</td>
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<tr>
<td>Hepatitis A (HepA)</td>
<td></td>
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<tr>
<td>Hepatitis B (HepB)</td>
<td></td>
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<td></td>
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<tr>
<td>Meningococcal A, C, W,Y (MenACWY)</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Meningococcal B (MenB)</td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td><em>Haemophilus influenzae</em> type b (Hib)</td>
<td></td>
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</tr>
</tbody>
</table>

- **Recommended vaccination for adults who meet age requirement, lack documentation of vaccination, or lack evidence of past infection**
- **Recommended vaccination for adults with an additional risk factor or another indication**
- **No recommendation**

**Note:**
- 1 dose Tdap, then Td booster every 10 yrs
- 1 dose annually
- 2 doses (if born in 1980 or later)
- 2 doses
- 1 dose

**Source:** Centers for Disease Control and Prevention | Recommended Adult Immunization Schedule, United States, 2019 | Page 2
# Vaccines for the Internist

## Table 2

### Recommended Adult Immunization Schedule by Medical Condition and Other Indications

**United States, 2019**

<table>
<thead>
<tr>
<th>Vaccine</th>
<th>Pregnancy</th>
<th>Immuno-compromised (excluding HIV infection)</th>
<th>HIV infection CD4 count</th>
<th>Asplenia, complement deficiencies</th>
<th>End-stage renal disease on hemodialysis</th>
<th>Heart or lung disease, alcoholism</th>
<th>Chronic liver disease</th>
<th>Diabetes</th>
<th>Health care personnel</th>
<th>Men who have sex with men</th>
</tr>
</thead>
<tbody>
<tr>
<td>IV or RIV</td>
<td>CONTRAINDED</td>
<td>1 dose annually</td>
<td>PRECAUTION</td>
<td>1 dose annually</td>
<td>(or)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LAIV</td>
<td>CONTRAINDED</td>
<td>1 dose annually</td>
<td>PRECAUTION</td>
<td>1 dose annually</td>
<td>(or)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tdap or Td</td>
<td>CONTRAINDED</td>
<td>1 dose annually</td>
<td>PRECAUTION</td>
<td>1 dose Tdap, then Td booster every 10 yrs</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MMR</td>
<td>CONTRAINDED</td>
<td>1 dose annually</td>
<td>1 or 2 doses depending on indication</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VAR</td>
<td>CONTRAINDED</td>
<td>1 dose annually</td>
<td>2 doses</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RZV (preferred)</td>
<td>DELAY</td>
<td>2 doses at age ≥50 yrs</td>
<td>(or)</td>
<td>1 dose at age ≥60 yrs</td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>ZVL</td>
<td>CONTRAINDED</td>
<td>1 dose annually</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HPV Female</td>
<td>DELAY</td>
<td>3 doses through age 26 yrs</td>
<td>2 or 3 doses through age 26 yrs</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>HPV Male</td>
<td>DELAY</td>
<td>3 doses through age 26 yrs</td>
<td>2 or 3 doses through age 21 yrs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>PCV13</td>
<td></td>
<td></td>
<td></td>
<td>1 dose</td>
<td></td>
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<tr>
<td>PPSV23</td>
<td></td>
<td></td>
<td></td>
<td>1, 2, or 3 doses depending on age and indication</td>
<td></td>
<td></td>
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<tr>
<td>HepA</td>
<td></td>
<td></td>
<td></td>
<td>2 or 3 doses depending on vaccine</td>
<td></td>
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<tr>
<td>HepB</td>
<td></td>
<td></td>
<td></td>
<td>2 or 3 doses depending on vaccine</td>
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<tr>
<td>MenACWY</td>
<td></td>
<td></td>
<td></td>
<td>1 or 2 doses depending on indication, then booster every 5 yrs if risk remains</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>MenB</td>
<td>PRECAUTION</td>
<td></td>
<td></td>
<td>2 or 3 doses depending on vaccine and indication</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hib</td>
<td>3 doses HCT recipients only</td>
<td>1 dose</td>
<td></td>
<td></td>
<td>(or)</td>
<td></td>
<td></td>
<td></td>
<td>(or)</td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**
1. Precaution for LAIV does not apply to alcoholism.
2. See notes for influenza, hepatitis B, measles, mumps, and rubella and varicella vaccinations.
3. Hematopoietic stem cell transplant.

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

**Recommended vaccination for adults with an additional risk factor or another indication.**

**Precaution—vaccine might be indicated if benefit of protection outweighs risk of adverse reaction.**

**Delay vaccination until after pregnancy if vaccine is indicated.**

**Contraindicated—vaccine should not be administered because of risk for serious adverse reaction.**

**No recommendation.**

02/16/19

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## Vaccines for the Internist

### Recommended Adult Immunization Schedule

#### United States, 2019

### Haemophilus influenzae type b vaccination

**Special situations**
- Anatomical or functional asplenia (including sickle cell disease): 1 dose Hib if previously did not receive Hib; if elective splenectomy, 1 dose Hib, preferably at least 14 days before splenectomy
- Hematopoietic stem cell transplant (HSCT): 3-dose series Hib 4 weeks apart starting 6–12 months after successful transplant, regardless of Hib vaccination history

### Hepatitis A vaccination

**Routine vaccination**
- Not at risk but want protection from hepatitis A (identification of risk factor not required): 2-dose series HepA (Havrix 6–12 months apart or Vaqta 6–18 months apart [minimum interval: 6 months]) or 3-dose series HepA-HepB (Twixiv at 0, 1, 6 months [minimum intervals: 4 weeks between doses 1 and 2, 8 weeks between doses 2 and 3, 16 weeks between doses 1 and 3])

**Special situations**
- At risk for hepatitis A virus infection: 2-dose series HepA or 3-dose series HepA-HepB as above
  - Chronic liver disease
  - Clotting factor disorders
  - Men who have sex with men
  - Injection or non-injection drug use
  - Homelessness
  - Work with hepatitis A virus in research laboratory or nonhuman primates with hepatitis A virus infection
  - Travel in countries with high or intermediate endemic hepatitis A
  - Close personal contact with international adoptee (e.g., household, regular babysitting) in first 60 days after arrival from country with high or intermediate endemic hepatitis A (administer dose 1 as soon as adoption is planned, at least 2 weeks before adoptee’s arrival)

### Hepatitis B vaccination

**Routine vaccination**
- Not at risk but want protection from hepatitis B (identification of risk factor not required): 2- or 3-dose series HepB (2-dose series Heplisav-B at least 4 weeks apart [2-dose series HepB only applies when 2 doses of Heplisav-B are used at least 4 weeks apart]) or 3-dose series Engerix-B or Recombivax HB at 0, 1, 6 months [minimum intervals: 4 weeks between doses 1 and 2, 8 weeks between doses 2 and 3, 16 weeks between doses 1 and 3]) or 3-dose series HepA-HepB (Twixiv at 0, 1, 6 months [minimum intervals: 4 weeks between doses 1 and 2, 5 months between doses 2 and 3])

**Special situations**
- At risk for hepatitis B virus infection: 2-dose (Heplisav-B) or 3-dose (Engerix-B, Recombivax HB) series HepB, or 3-dose series HepA-HepB as above
  - Hepatitis C virus infection
  - Chronic liver disease (e.g., cirrhosis, fatty liver disease, alcoholic liver disease, autoimmune hepatitis, alanine aminotransferase [ALT] or aspartate aminotransferase [AST] level greater than twice upper limit of normal)
  - HIV infection
  - Sexual exposure risk (e.g., sex partners of hepatitis B surface antigen [HBsAg]-positive persons; sexually active persons not in mutually monogamous relationships, persons seeking evaluation or treatment for a sexually transmitted infection, men who have sex with men)
  - Current or recent injection drug use
  - Percutaneous or mucosal risk for exposure to blood (e.g., household contacts of HBsAg-positive persons; residents and staff of facilities for developmentally disabled persons; health care and public safety personnel with reasonably anticipated risk for exposure to blood or blood-contaminated body fluids; hemodialysis, peritoneal dialysis, home dialysis, and predialysis patients; persons with diabetes mellitus age younger than 60 years and, at discretion of treating clinician, those age 60 years or older)
  - Incarcerated persons
  - Travel in countries with high or intermediate endemic hepatitis B

### Human papillomavirus vaccination

**Routine vaccination**
- Females through age 26 years and males through age 21 years: 2- or 3-dose series HPV vaccine depending on age at initial vaccination; males age 22 through 26 years may be vaccinated based on individual clinical decision (HPV vaccination routinely recommended at age 11–12 years)
  - Age 15 years or older at initial vaccination: 3-dose series HPV vaccine at 0, 1–2, 6 months (minimum intervals: 4 weeks between doses 1 and 2, 2, 12 weeks between doses 2 and 3, 5 months between doses 1 and 3; repeat dose if administered too soon)
- Age 9 through 14 years at initial vaccination and received 1 dose, or 2 doses less than 5 months apart: 1 dose HPV vaccine
- Age 9 through 14 years at initial vaccination and received 2 doses at least 5 months apart: HPV vaccination complete, no additional dose needed
- If completed valid vaccination series with any HPV vaccine, no additional doses needed

**Special situations**
- Immunocompromising conditions (including HIV infection) through age 26 years: 3-dose series HPV vaccine at 0, 1–2, 6 months as above
- Men who have sex with men and transgender persons through age 26 years: 2- or 3-dose series HPV vaccine depending on age at initial vaccination as above
- Pregnancy through age 26 years: HPV vaccination not recommended until after pregnancy; no intervention needed if vaccinated while pregnant; pregnancy testing not needed before vaccination

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Recommended Adult Immunization Schedule
United States, 2019

Influenza vaccination

Routine vaccination
- Persons age 6 months or older: 1 dose IIV, RIV, or LAIV appropriate for age and health status annually
- For additional guidance, see www.cdc.gov/flu/professionals/index.htm

Special situations
- Egg allergy, hives only: 1 dose IIV, RIV, or LAIV appropriate for age and health status annually
- Egg allergy more severe than hives (e.g., angioedema, respiratory distress): 1 dose IIV, RIV, or LAIV appropriate for age and health status annually in medical setting under supervision of health care provider who can recognize and manage severe allergic conditions
- Immunocompromising conditions (including HIV infection), anatomical or functional asplenia, pregnant, close contacts and caregivers of severely immunocompromised persons in protected environment, use of influenza antiviral medications in previous 48 hours, with cerebrospinal fluid leak or cochlear implant: 1 dose IIV or RIV annually (LAIV not recommended)
- History of Guillain-Barré syndrome within 6 weeks of previous dose of influenza vaccine: Generally should not be vaccinated

Measles, mumps, and rubella vaccination

Routine vaccination
- No evidence of immunity to measles, mumps, or rubella: 1 dose MMR
- Evidence of immunity: Born before 1957 (except health care personnel [see below]), documentation of receipt of MMR, laboratory evidence of immunity or disease (diagnosis of disease without laboratory confirmation is not evidence of immunity)

Special situations
- Pregnancy with no evidence of immunity to rubella: MMR contraindicated during pregnancy; after pregnancy (before discharge from health care facility), 1 dose MMR
- Non-pregnant women of childbearing age with no evidence of immunity to rubella: 1 dose MMR
- HIV infection with CD4 count ≥200 cells/μL for at least 6 months and no evidence of immunity to measles, mumps, or rubella: 2 dose series MMR at least 4 weeks apart; MMR contraindicated in HIV infection with CD4 count <200 cells/μL
- Severe immunocompromising conditions: MMR contraindicated
- Students in postsecondary educational institutions, international travelers, and household or close personal contacts of immunocompromised persons with no evidence of immunity to measles, mumps, or rubella: 1 dose MMR if previously received 1 dose MMR, or 2 dose series MMR at least 4 weeks apart if previously did not receive any MMR
- Health care personnel born in 1957 or later with no evidence of immunity to measles, mumps, or rubella: 2 dose series MMR at least 4 weeks apart for measles or mumps, or at least 1 dose MMR for rubella; if born before 1957, consider 2 dose series MMR at least 4 weeks apart for measles or mumps, or 1 dose MMR for rubella

Meningococcal vaccination

Special situations for MenACWY
- Anatomical or functional asplenia (including sickle cell disease), HIV infection, persistent complement component deficiency, eculizumab use: 2 dose series MenACWY (Menactra, Menvax) at least 8 weeks apart and revaccinate every 5 years if risk remains
- Travel in countries with hyperendemic or epidemic meningococcal disease, microbiologists routinely exposed to Neisseria meningitidis: 1 dose MenACWY and revaccinate every 5 years if risk remains
- First-year college students who live in residential housing (if not previously vaccinated at age 16 years or older) and military recruits: 1 dose MenACWY

Special situations for MenB
- Anatomical or functional asplenia (including sickle cell disease), persistent complement component deficiency, eculizumab use, microbiologists routinely exposed to Neisseria meningitidis: 2 dose series MenB-4C (Bexsero) at least 1 month apart, or 3 dose series MenB-FHbp (Trumenba) at 0, 1–2, 6 months (if dose 2 was administered at least 6 months after dose 1, dose 3 not needed); MenB-4C and MenB-FHbp are not interchangeable (use same product for all doses in series)
- Pregnancy: Delay MenB until after pregnancy unless at increased risk and vaccination benefit outweighs potential risks
- Healthy adolescents and young adults age 16 through 23 years (age 16 through 18 years preferred) not at increased risk for meningococcal disease: Based on individual clinical decision, may receive 2 dose series MenB-4C at least 1 month apart, or 2 dose series MenB-FHbp at 0, 6 months (if dose 2 was administered less than 6 months after dose 1, administer dose 3 at least 4 months after dose 2); MenB-4C and MenB-FHbp are not interchangeable (use same product for all doses in series)
# Vaccines for the Internist

## Recommended Adult Immunization Schedule
### United States, 2019

### Pneumococcal vaccination

**Routine vaccination**
- Age 65 years or older (immunocompetent): 1 dose PCV13 if previously did not receive PCV13, followed by a dose PPSV23 at least 1 year after PCV13 and at least 5 years after last dose PPSV23.
- Previously received PPSV23 but not PCV13 at age 65 years or older: 1 dose PCV13 at least 1 year after PPSV23.
- When both PCV13 and PPSV23 are indicated, administer PCV13 first (PCV13 and PPSV23 should not be administered during the same visit).

**Special situations**
- Age 19 through 64 years with chronic medical conditions (chronic heart [excluding hypertension], lung, or liver disease; diabetes), alcoholism, or cigarette smoking: 1 dose PPSV23.
- Age 19 years or older with immunocompromising conditions (congenital or acquired immunodeficiency [including B- and T-lymphocyte deficiency, complement deficiencies, phagocytic disorders, HIV infection], chronic renal failure, nephrotic syndrome, leukemia, lymphoma, Hodgkin disease, generalized malignancy, iatrogenic immunosuppression [e.g., drug or radiation therapy], solid organ transplant, multiple myeloma) or anatomical or functional asplenia (including sickle cell disease and other hematoglobinopathies): 1 dose PCV13 followed by 1 dose PPSV23 at least 8 weeks later; then another dose PPSV23 at least 5 years after previous PPSV23; at age 65 years or older, administer 1 dose PPSV23 at least 5 years after most recent PPSV23 (note: only 1 dose PPSV23 recommended at age 65 years or older).
- Age 19 years or older with cerebrospinal fluid leak or cochlear implant: 1 dose PCV13 followed by 1 dose PPSV23 at least 8 weeks later; at age 65 years or older; administer another dose PPSV23 at least 5 years after PPSV23 (note: only 1 dose PPSV23 recommended at age 65 years or older)

### Tetanus, diphtheria, and pertussis vaccination

**Routine vaccination**
- Previously did not receive Tdap at or after age 11 years: 1 dose Tdap, then Td booster every 10 years.

**Special situations**
- Previously did not receive primary vaccination series for tetanus, diphtheria, and pertussis: 1 dose Tdap followed by 1 dose Td at least 4 weeks after Tdap, and another dose Td 6–12 months after last Td (Tdap can be substituted for any Td dose, but preferred as first dose); Td booster every 10 years thereafter.
- Pregnancy: 1 dose Tdap during each pregnancy, preferably in early part of gestational weeks 27–36.
- For information on use of Tdap or Td as tetanus prophylaxis in wound management, see www.cdc.gov/mmwr/volumes/67/wr/wr6702a1.htm

### Varicella vaccination

**Routine vaccination**
- No evidence of immunity to varicella: 2-dose series VAR 4–8 weeks apart if previously did not receive varicella-containing vaccine (VAR) or MMRI (measles-mumps-rubella-varicella vaccine) for children; if previously received 1 dose varicella-containing vaccine 1 dose VAR at least 4 weeks after first dose.

**Special situations**
- Pregnancy: VAR contraindicated during pregnancy; after pregnancy (before discharge from health care facility), 1 dose VAR if previously received 1 dose varicella-containing vaccine, or dose 1 of 2-dose series VAR (dose 2: 4–8 weeks later) if previously did not receive any varicella-containing vaccine, regardless of whether U.S.-born before 1980.

**Zoster vaccination**

**Routine vaccination**
- Age 50 years or older: 2-dose series RZV 2–6 months apart (minimum interval: 4 weeks; repeat dose if administered too soon) regardless of previous herpes zoster or previously received ZVL (administer RZV at least 2 months after ZVL).
- Age 60 years or older: 2-dose series RZV 2–6 months apart (minimum interval: 4 weeks; repeat dose if administered too soon) or 1 dose ZVL if not previously vaccinated (if previously received ZVL administer RZV at least 2 months after ZVL); RZV preferred over ZVL.

**Special situations**
- Pregnancy: ZVL contraindicated; consider delaying RZV until after pregnancy if RZV in otherwise indicated.
- Severe immunocompromising conditions (including HIV infection with CD4 count <200 cells/μL): ZVL contraindicated; recommendation of use of RZV under review.
Vaccines for the Internist

Questions?