Adult Immunizations

Population: Adults, ≥18 years old

Objectives: Implement an evidence-based strategy for routine adult immunizations.

Key Points

Routine immunizations for adults are: hepatitis A, hepatitis B, herpes zoster, human papilloma virus, influenza, measles, mumps, rubella, meningococcal, pneumococcal, tetanus, diphtheria, pertussis and varicella. Below is a summary on priority populations, initial vaccination, and revaccination.

- Use combination vaccines whenever possible to increase the coverage rates for vaccine-preventable diseases: Tetanus-diphtheria (Td), Tetanus-diphtheria-acellular pertussis (Tdap), Measles-Mumps-Rubella (MMR), hepatitis A-hepatitis B (Twinrix®). Single antigen vaccines have no safety advantage.
- Live virus vaccines (Herpes Zoster, Measles-Mumps-Rubella, Varicella and Live Attenuated Influenza Vaccine) are contraindicated in persons who are pregnant or may become pregnant in the next four weeks, or who have immunocompromising conditions. If administering multiple live vaccines, give simultaneously or separate them by 4 weeks. Tuberculosis (PPD) skin test should be administered before or on the same day as a live virus vaccine or they need to be spaced 4-6 weeks apart.

This guideline follows recommendations of the federal Advisory Committee on Immunization Practices:
- These vaccinations should be performed [strength of recommendation] for indicated populations at risk.
- Evidence for each vaccine is based on randomized controlled trials [level of evidence] in general population and some subgroups, with findings extrapolated to some subgroups.

<table>
<thead>
<tr>
<th>Vaccine/ Doses</th>
<th>Priority Populations</th>
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</thead>
<tbody>
<tr>
<td><strong>Hepatitis A vaccine</strong></td>
<td>Note: For combined HAV &amp; HBV, use HAV/HBV Vaccine (Twinrix®) ¹</td>
</tr>
<tr>
<td>Previously</td>
<td></td>
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<tr>
<td>unvaccinated: Two doses at 0 and 6-12 months or 0 and 6-18 months (depending on manufacturer; minimum of 6 months between doses )</td>
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<tr>
<td>Three doses: first two doses separated by no less than 4 weeks and third dose 4-6 months after the second dose. (For immunocompromised patients and hemodialysis patients, increase dose to 40 micrograms.)</td>
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<tr>
<td>No routine booster (immunity is felt to be lifelong)</td>
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</table>

| **Hepatitis B vaccine** | Note: For combined HAV & HBV, use HAV/HBV Vaccine (Twinrix®) ¹ |
| Insurance coverage for Hepatitis B vaccine varies by payer |
| Three doses: | |
| - adults younger than 60 years old with diabetes as soon as possible after diagnosis. For adults greater than 60 years old with diabetes, base decision on: need for assisted blood glucose monitoring, likelihood of acquiring HBV infection and likelihood of immune response. |
| - individuals with multiple sex partners during previous 6 months |
| - men who have sex with men |
| - persons with ESRD, including those receiving hemodialysis |
| - persons with chronic liver disease |
| - current or recent injection drug users |
| - travelers to countries with intermediate or high prevalence of HBV |
| - persons seeking evaluation or treatment for STDs |
| - persons with HIV |
| - healthcare workers/public safety workers/others potentially exposed to blood or other infectious body fluids |
| - clients and staff in institutions and nonresidential daycare facilities for the developmentally disabled and in correctional facilities |
| - persons seeking protection against HBV infection |
| - household & sexual contacts of persons with chronic HBV infection |
| - adults in these settings: facilities for testing and/or treatment and prevention for STD, HIV or drug abuse; health-care settings targeting services to injection-drug users or homosexual men; ESRD programs and facilities for chronic HD patients. |

¹ HAV/HBV (Twinrix®) dosing: three doses at 0, 1, and 6 months. Consider accelerated dosing schedule for emergency first-care responders, individuals preparing to travel to high-risk areas on short notice, those with risk factors for hepatitis A and B such as HIV and STDs: three doses in 3 weeks (0, 7days, 21-30 days); booster at 12 months.
### Vaccine/ Doses

**Herpes zoster vaccine**  
Note: Live virus vaccine. [This vaccine may not be covered by all payers or all Medicare Part D policies. Patients should confirm coverage.]

<table>
<thead>
<tr>
<th>Doses</th>
<th>Priority Populations</th>
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</thead>
<tbody>
<tr>
<td>One dose.</td>
<td>Adults ≥ 60 years old, whether or not they report a prior episode of herpes zoster. Persons with chronic medical conditions may be vaccinated, unless a contraindication precaution exists. Vaccine is now licensed for adults ages 50 and older but adults over age 60 should be prioritized if supply is limited.</td>
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</tbody>
</table>

**Human papilloma virus (HPV) vaccine, Quadrivalent**  
(types 6,11,16 and 18) vaccine (Gardasil®)  
Note: In women of child bearing age, avoid pregnancy for at least 4 weeks after immunization. [*Cervarix®, HPV bivalent vaccine (types 16 and 18) has no proven clinical benefit over Gardasil. Not currently stocked at UMHHC.*]  
(Insurance coverage varies by payer)

<table>
<thead>
<tr>
<th>Previously unvaccinated:</th>
<th>Females 11-26 years old (earliest 9 years old) who have not received the vaccine or completed the series. If a woman turns 27 years old after the first dose is administered but before the third dose is given, complete the series using the recommended intervals between doses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Three doses at 0, 2 and 6 months. Minimum interval of 24 weeks between doses 1 and 3</td>
<td>Males who have not received the vaccine or completed a series:</td>
</tr>
<tr>
<td></td>
<td>• 11–21 years old (earliest 9 years old)</td>
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<tr>
<td></td>
<td>• 22–26 years old:</td>
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<tr>
<td></td>
<td>- if immunocompromised, or who have tested positive for human immunodeficiency virus (HIV) infection, or who have sex with men.</td>
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<tr>
<td></td>
<td>- others may receive the vaccine series.</td>
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</tbody>
</table>

**Influenza vaccines**  
Initial dose:  
Trivalent Inactivated Vaccine (TIV) & Quadrivalent Inactivated Vaccine –  
• intramuscular (age >6 months)  
• intradermal (age 18 – 64 years)

<table>
<thead>
<tr>
<th>Doses</th>
<th>Priority Populations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual influenza vaccine recommended for all individuals 6 months of age and older.</td>
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</tbody>
</table>

**High-dose inactivated (injectable) flu vaccine (≥ age 65)**

<table>
<thead>
<tr>
<th>Doses</th>
<th>Priority Populations</th>
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</thead>
<tbody>
<tr>
<td>Licensed for the use in individuals ≥ 65 years old. Fluzone High-Dose®, made by Sanofi Pasteur, contains four times as much antigen as standard seasonal flu vaccines.</td>
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</table>

**Live attenuated (intranasal) Quadrivalent**

<table>
<thead>
<tr>
<th>Doses</th>
<th>Priority Populations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Note: Live virus vaccine. Licensed for non-pregnant healthy adults &lt; 50 years old, live attenuated vaccine may be used as an alternative to inactivated vaccine.</td>
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</tbody>
</table>

**Measles, mumps, rubella vaccine**  
(use MMR vaccine)  
Note: Live virus vaccine

<table>
<thead>
<tr>
<th>Initial dose</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>• no evidence of immunity to measles, to mumps, and (if woman of childbearing age) to rubella</td>
<td></td>
</tr>
<tr>
<td>• consider giving initial dose to unvaccinated health-care workers born before 1957 who do not have other evidence of mumps immunity.</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Second dose at ≥ 1 month</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>• health care workers (for measles, mumps).</td>
<td></td>
</tr>
<tr>
<td>• college students (for measles, mumps; first dose may be required before start of classes)</td>
<td></td>
</tr>
<tr>
<td>• travelers to foreign countries (for measles, mumps)</td>
<td></td>
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<tr>
<td>• recently exposed to measles or are in an outbreak setting</td>
<td></td>
</tr>
<tr>
<td>• previously vaccinated with killed measles vaccine, or between 1963-1967 with an unknown measles vaccine</td>
<td></td>
</tr>
<tr>
<td>• in age group affected during a mumps outbreak</td>
<td></td>
</tr>
</tbody>
</table>

2 Evidence of immunity: (a) documentation of MMR vaccination requires 2 doses for measles, 1 dose for rubella or mumps (b) laboratory evidence of immunity, (c) documentation of physician diagnosis or (d) born before 1957 (age exceptions: rubella immunity not assumed for women of child-bearing age who could become pregnant; measles and mumps immunity possibly not assumed for health care workers).

(Table continues on next page)
### Meningococcal vaccine

Use meningococcal conjugate MCV4 (Menactra® or Menveo®) for adults ≤ 55 years old and meningococcal polysaccharide MSPV4 (Menomune®) for those 56 years and older.

#### Adolescents
- one dose at 11-12 years and a booster dose at 16 years.
- catch-up: if 1st dose at 13-15 years, booster at 16-18 years (up to 21 years if college freshman living in dormitories); if 1st dose at ≥ 16 years, no booster

#### Previously unvaccinated:
- initial - one dose
- college freshman through age 21 years living in dormitories who are unvaccinated or vaccinated prior to age 16 years
- military recruits
- persons who travel to or reside in countries where the disease is hyperendemic or epidemic
- microbiologists routinely exposed to isolates of Neisseria meningitidis

#### Second dose at 2 months
- persons with functional or anatomic asplenia or persistent complement component deficiencies
- persons with HIV who fall into any of the risk groups listed above
- persons who remain in any of the risk groups listed above

#### Revaccinate: every 5 years
- persons with HIV who fall into any of the risk groups listed above

### Pneumococcal vaccines: polysaccharide vaccine (PPSV23/Pneumovax), conjugate vaccine (PCV13/Prevnar 13)

#### Initial: PCV13 and PPSV23*

**(Very high risk)**
- Immunocompromised (e.g., HIV, chronic renal failure and CKD likely to progress to chronic renal failure, nephrotic syndrome, leukemia, lymphoma, Hodgkin disease, cancer that has spread throughout body, iatrogenic immunosuppression, solid organ transplant, multiple myeloma)
- Functional or anatomic asplenia (e.g., sickle cell disease, other hemoglobinopathy)

#### Revaccinations:
- PPSV23 in 5 years
- PCV13 and PPSV23 at ≥ 5 years ago

**(High risk)**
- Cerebrospinal fluid leak
- Cochlear implant

#### Initial: PCV13 and PPSV23*

- PCV13:
  - age ≥ 65 yrs and if PPSV23 vaccination at < 65 yrs and ≥ 5 yrs ago

**(Elevated risk)**
- Immunocompetent persons: chronic heart disease (e.g., congestive heart failure, cardiomyopathies, but not hypertension), chronic lung disease (e.g., chronic obstructive pulmonary disease, emphysema, asthma), diabetes mellitus, alcoholism, chronic liver disease, cirrhosis, cigarette smoking

#### Revaccination:
- PCV23:
  - age ≥ 65 yrs and if PCV23 vaccination at < 65 yrs and ≥ 5 yrs ago

**(Average risk)**
- Age ≥ 65 years with none of the above conditions

#### Initial PPSV23 or revaccination with PPSV23
- if age ≥ 65 yrs and if PPSV23 vaccination at < 65 yrs and ≥ 5 yrs ago

* Sequence for administering PCV13 and PPSV23 vaccinations
  - If not previously vaccinated with PCV13 or PPSV23: administer PCV13 first, followed by PPSV23 ≥ 8 weeks later.
  - If previously vaccinated with PCV23 and not PCV13: administer PCV13 ≥ 1 year after the last PPSV23 dose
  - If previously vaccinated with PCV13 and not PPSV23: administer PCV13 and PPSV23 ≥ 8 weeks after PCV13

### Tetanus, diphtheria, pertussis vaccines (Td/Tdap) *(primary series assumed)*

**Insurance coverage varies by payer**

#### Revaccinate every 10 years
- All patients
- A one-time dose of Tdap should be given to persons 19 years and older who have not received a prior dose of Tdap, or whose vaccine status is unknown, regardless of the interval since their last Td containing vaccine. (As of 12/31/12 Medicare does not cover Tdap.)
- A dose of Tdap during each pregnancy irrespective of the patient’s prior history of receiving Tdap. Optimal timing is between 27 and 36 weeks gestation to maximize the maternal antibody response and passive antibody transfer to the infant.
- For women not previously vaccinated with Tdap, if Tdap is not administered during pregnancy; Tdap should be administered as soon as possible postpartum.

#### Revaccinate in ≥ 5 years
- Patients with wounds (other than clean or minor wounds) who have never received a dose of Tdap should receive one. If prior dose of Tdap was given, revaccinate with Td. If history of Tdap is unknown, administer 1 dose of Tdap instead of Td.

3 If primary series not given or unknown: 3 doses Td at 0, 4 wks, and 7-12 months, with one dose being Tdap. If primary series not completed: include one dose of Tdap

(Table continues on next page)
Varicella vaccine  Note: Live virus vaccine
Two doses at 0 and ≥ 4 weeks all non-pregnant adults without evidence of immunity to varicella 4 should receive 2 doses of single-antigen varicella vaccine if not previously vaccinated or the second dose if they have received only 1 dose, unless they have a medical contraindication. Special consideration should be given to those who 1) have close contact with persons at high risk for severe disease (e.g., health-care personnel and family contacts of persons with immunocompromising conditions) or 2) are at high risk for exposure or transmission (e.g., teachers; child-care employees; residents and staff members of institutional settings, including correctional institutions; college students; military personnel; adolescents and adults living in households with children; nonpregnant women of childbearing age; and international travelers).

4 Evidence of immunity to varicella in adults includes any of the following: 1) documentation of 2 doses of varicella vaccine at least four weeks apart; 2) U.S.-born before 1980 (although for health-care personnel and pregnant women, birth before 1980 should not be considered evidence of immunity); 3) history of varicella based on diagnosis or verification of varicella by a health-care provider (for a patient reporting a history of or having an atypical case, a mild case, or both, health-care providers should seek either an epidemiologic link with a typical varicella case or to a laboratory-confirmed case or evidence of laboratory confirmation, if it was performed at the time of acute disease); 4) history of herpes zoster based on diagnosis or verification of herpes zoster by a health-care provider; or 5) laboratory evidence of immunity or laboratory confirmation of disease.

Pregnant women should be assessed for evidence of varicella immunity. Women who do not have evidence of immunity should receive the first dose of varicella vaccine upon completion or termination of pregnancy and before discharge from the health-care facility. The second dose should be administered 4-8 weeks after the first dose.

Clinical Background

Hepatitis A

Burden of Suffering

Hepatitis A is one of the most frequently reported vaccine-preventable diseases in the United States. In 2010, the overall incidence rate was the lowest ever recorded, 0.5 cases per 100,000 population. During 2000-2010, rates declined for all age groups. In 2010, a total of 1,670 acute symptomatic cases of hepatitis A were reported to CDC. Adjusting data for underreporting and asymptomatic infections, the National Notifiable Diseases Surveillance System estimated that there were 17,000 new infections that occurred in 2010. People with chronic liver disease (including hepatitis C) are at increased risk for fulminant hepatitis A. Most U.S. cases of hepatitis A result from person-to-person transmission by fecal-oral route or by ingestion of contaminated food or water. Rarely, it has been transmitted through blood or blood product transfusions. Because most children have asymptomatic or unrecognized infections, they serve as a source for transmitting infection to others.

Rationale for Recommendation

Protective antibody levels develop in 95% of adults one month after the first dose is given in a two-dose series. Nearly 100% of all persons studied had protective levels of antibody after the second dose, given 6-12 months after the first. Surveillance data and population-based studies are being conducted to monitor the long-term protective efficacy and to determine the possible need for a booster dose. Persons considered to be at increased risk for hepatitis A or its adverse outcomes who should be routinely vaccinated include all persons with chronic liver disease, persons with clotting-factor disorders, persons traveling to or working in a country with high or intermediate hepatitis A virus (HAV) endemicity, persons who anticipate close personal contact with an international adoptee from a country where there is high or intermediate hepatitis A virus (HAV) endemicity (administer 1st dose as soon as adoption is planned, ideally 2 or more weeks before adoptee’s arrival), men who have sex with men, persons who use injection or non-injection illicit drugs, and persons who work with HAV-infected primates or with the virus in research laboratories. Health care workers and food handlers are not recommended for routine immunization. In addition, anyone who is seeking protection from HAV infection should receive the vaccine. Contraindication to vaccine administration is limited to severe allergic reaction after previous dose or to a vaccine component. Administration precautions include moderate/severe acute illness with or without fever.

Patients previously unvaccinated should receive two doses scheduled at 0, and 6-12 months of single antigen inactivated whole-virus hepatitis A vaccine (Havrix). The minimum interval between the first and second doses is six calendar months, however if the interval exceeds 18 months, repeating the first dose is not necessary. The combination hepatitis A (inactivated) and hepatitis B (recombinant) vaccine (Twinrix®) is available and should be used for persons ≥ 18 years old, having an indication for both hepatitis A and B vaccination. Primary vaccination consists of three doses, given on a 0-, 1-, and 6-month schedule, the same schedule as that used for single antigen hepatitis B vaccine. Ensure appropriate spacing; first and second doses separate by at least 4 weeks while second and third doses by at least 5 months. Note:
Administering two doses of Twinrix® and one dose of hepatitis B vaccine is not sufficient and will not complete a series for both hepatitis A and hepatitis B vaccination. Twinrix® contains less hepatitis A antigen than a single antigen hepatitis A vaccine; therefore, three doses of hepatitis A are needed when using this product.

**Hepatitis B**

**Burden of Suffering**

In 2010, acute hepatitis B incidence declined to the lowest rate ever recorded (1.1 cases per 100,000 population). Further, the incidence of infection declined in all age groups. Universal vaccination of children against hepatitis B has reduced disease incidence substantially among younger age groups. Higher rates of hepatitis B virus (HBV) infection continue among adults, particularly 30-39 years old, reflecting the need to vaccinate adults at risk for HBV infection. In 2010, a total of 3,350 acute, symptomatic cases of hepatitis B were reported nationwide. After asymptomatic infection and underreporting were taken into account, the estimate of new cases for that year reached 35,000. Six to ten percent of infected individuals become a chronic carrier. Twenty five percent of chronic carriers develop chronic active hepatitis, which can progress to cirrhosis or hepatocellular carcinoma resulting in death. Prevention of hepatitis B also prevents infection of hepatitis delta virus, which can also lead to cirrhosis or hepatocellular carcinoma. In the U.S., it is estimated that 804,000 to 1.4 million persons live with chronic hepatitis B infection and most are unaware of their infection status.

**Rationale for Recommendation**

Hepatitis B virus is transmitted by exposure to blood or body fluids of an infected person, most often through injection drug use, sexual contact, or to a newborn during childbirth. In addition, transmission can occur in persons who have prolonged, but nonsexual, interpersonal contact with an infected person.

Hepatitis B vaccination is recommended for adults in high-risk groups including:

- Adults younger than 60 years old with diabetes (vaccinate as soon as possible after diagnosis) due to risk of transmission from use of shared home blood glucose monitoring equipment. For adults over 60 years with diabetes, vaccinate at the discretion of clinician based on: increased need for assisted blood glucose monitoring (e.g. occupants of long term care facilities), likelihood of acquiring hepatitis B infection and likelihood of vaccine immune response.
- Health care workers, public safety workers and others with occupational risk of potential exposure to blood or other infectious body fluids
- Clients and staff of institutions and non-residential day-care facilities for the developmentally disabled
- Clients and staff members of correctional facilities
- Household and sexual contacts of those with chronic HBV infection
- Persons seeking protection from HBV infection
- Individuals with multiple sex partners during the previous 6 months
- Men who have sex with men
- Patients with end stage renal disease (ESRD), including patients on hemodialysis
- Injection drug users
- Persons seeking evaluation or treatment for a sexually transmitted disease (STD)
- Those with HIV infection
- Persons with chronic liver disease
- Travelers to countries with increased prevalence of chronic HBV infection
- Adults in the following settings: STD, HIV testing and treatment, drug abuse prevention and treatment, health care or treatment facilities.
- Adults in health-care settings targeting services to injection-drug users or men who have sex with men; or facilities for chronic hemodialysis patients or those with ESRD

Effective hepatitis B vaccines have been available since the early 1980’s. Recombinant hepatitis B vaccine (Engerix-B) is produced when a plasmid containing the gene for HBsAg is inserted into yeast cells. The yeast cells then produce HBsAg, which is then harvested and purified. When recombinant hepatitis B vaccine is administered in a three-dose series (at 0, 1, and 6 months) over 90% of healthy adults will show an adequate antibody response. Immunologic memory is established after the vaccination series and remains intact for at least 20 years, however, there is an age-specific decline in immunogenicity. Immunocompromised patients and adult hemodialysis patients should receive an increased vaccine dose (40 micrograms). Further, perform booster dose assessment annually for hemodialysis patients. If serum anti-HBs titer falls below 10 mIU/mL, provide booster doses.

Routine post-immunization testing is not necessary, but is recommended 1-2 months after vaccine series completion for the following specific groups:

- chronic hemodialysis patients
- health care workers and public safety workers with occupational risk
- immunocompromised patients and those with HIV infections who are at risk for HBV exposure
- persons with HBsAg-positive sexual partners or infants born to HBsAg-positive mothers

Vaccine recipients who do not seroconvert after a primary vaccine series should be re-immunized with an additional 3-dose series.

Hepatitis B vaccination is currently recommended for all newborns and adolescents not previously immunized. Over time this current practice for children and adolescents will increase the likelihood that adults have been previously vaccinated.
Herpes Zoster Vaccine

Burden of Suffering

Herpes zoster, commonly known as “shingles,” is caused by a reactivation of the varicella zoster virus, which may occur decades after illness with chickenpox. It is estimated that 1 million cases of zoster are diagnosed annually in the U.S. Lifetime risk of developing Herpes Zoster is about 30%. Zoster infection usually is associated with a reduced immune response which may occur with illness, immunosuppressive therapy or normal aging. Other risk factors for Herpes Zoster include female gender, Caucasians greater than African Americans, and trauma or surgery in affected dermatome. The unilateral vesicular rash along a dermatome is the most distinctive feature, but the pain during the prodrome, acute eruptive or postherpetic phase of the infection is the most debilitating. Postherpetic neuralgia can persist for weeks or months after the rash. Serious complications may include scarring, pneumonia, encephalitis, visual impairment, hearing loss, bacterial superinfection, allodynia, cranial and motor neuron palsies and death.

Rationale for Recommendation

Herpes Zoster vaccine, licensed in May 2006, contains the same live attenuated virus as varicella vaccine, but at a much higher titer. In clinical studies, the overall incidence of herpes zoster in those vaccinated was 51% less than those who received placebo, with the highest efficacy in the 60-69 year old subjects. Among individuals who developed herpes zoster, vaccinated subjects reported fewer complications (e.g., 67% reduction in postherpetic neuralgia) compared to those who had not been vaccinated. The most frequently reported adverse events following vaccination were injection site reactions and rashes.

The ACIP recommends a single dose of the vaccine for adults 60 years old and older with varicella immunity, whether or not the patient reported a prior episode of shingles. All individuals older than age 60 can be assumed to be immune and screening for immunity to varicella is not recommended. The potential need for booster doses is unknown. Herpes Zoster vaccine should be offered to eligible persons including those > 80 years old, frail, or with chronic diseases.

Although it is now licensed for adults ages 50-59 as well, the ACIP has not changed the age recommendation because of concern for adequate supply and the burden of complications is highest in individuals aged 60 and older.

Contraindications. Because herpes zoster vaccine is a live attenuated virus the following persons should not get herpes zoster vaccine:

- Those with a life-threatening allergic reaction to gelatin, the antibiotic neomycin, or any other component of shingles vaccine.
- Those who have a weakened immune system because of current:
  - HIV- with CD4 count <200 cells/microL (no recommendation for CD 4 ≥200 cells/microL) or another disease that affects the immune system,
  - treatment with drugs that affect the immune system, such as prolonged use of high dose steroids,
  - cancer treatment such as radiation or chemotherapy,
- cancer affecting the bone marrow or lymphatic system, such as leukemia or lymphoma,
- pregnancy, or might become pregnant. Women should not become pregnant until at least four weeks after getting shingles vaccine.
- moderate to severe illness. Persons should usually wait until they recover before getting the vaccine. This includes anyone with a temperature of 101.3 or higher.

**Human Papilloma Virus Vaccine**

**Burden of Suffering**

Human Papilloma Virus (HPV) infections are the most common type of sexually transmitted infection with a lifetime cumulative incidence in the U.S. reaching 80% and prevalence of 26.8% in people 14-49 years old. Cervical cancer is associated with HPV infection such that the virus is detected in nearly every cervical cancer specimen. More than 100 HPV types have been identified. Most HPV types infect the cutaneous epithelium and cause common skin warts. Of the ~40 types of HPV that infect the genital tract, 70% of cervical cancers are caused by Types HPV-16 and HPV-18. HPV-16 and HPV-18 also cause 80% of high- and low-grade cervical dysplasias, are commonly associated with anal cancers, and are detected in ~10% of head and neck cancers. The low-risk Types HPV-6 and HPV-11 cause 90% of genital warts and recurrent respiratory papillomatosis, as well as low-grade cervical dysplasias.

The quadrivalent HPV vaccine (Gardasil®) targets HPV-16, HPV-18, HPV-6 and HPV-11. The bivalent HPV vaccine (Cervarix®) targets HPV-16 and HPV-18. Cervarix® does not have any proven clinical benefits over Gardasil® and, therefore, is not currently stocked at UMHHC.

**Rationale for Recommendation**

Controlled trials of the quadrivalent HPV vaccine which is derived from yeast, indicate that prophylactic administration decreases the risk HPV-16 and HPV-18 related cervical, vulvar, and vaginal cancer, as well as dysplastic lesions that are precursors to cervical, vulvar, and vaginal cancer. Efficacy was demonstrated to decrease risk for all four HPV types for infection, low-grade dysplastic lesions, and genital warts in 16-26 year old women. The quadrivalent HPV vaccine is indicated for females and males to prevent the following diseases caused by HPV types 6, 11, 16, and 18:
- Cervical cancer (female)
- Genital warts (condyloma acuminata) (male & female)
- Cervical intraepithelial neoplasia (CIN) grade 1, grade 2 and grade 3 (female).
- Cervical adenocarcinoma in situ (female).
- Vulvar intraepithelial neoplasia (VIN) grade 2 and grade 3 (female).
- Vaginal intraepithelial neoplasia (VaIN) grade 2 and grade 3 (female)

ACIP recommendations vary somewhat by gender due to differences in consequences of infection and available data. For individuals who have not received the vaccine or completed the series, vaccine:

**Should be provided to:**
- females 11–26 years old (earliest 9 years old)
- males 11–21 years old (earliest 9 years old)
- males 22–26 years old with human immunodeficiency virus (HIV) infection or those who have sex with men.

**May be provided to:**
- males 22–26 years old without the risk factors above.

In December 2010, the U.S. Food and Drug Administration approved the use of Gardasil® for the prevention of anal cancer and associated precancerous lesions due to human papillomavirus (HPV) types 6, 11, 16, and 18 in people ages 9 through 26 years. HPV is associated with approximately 90 percent of anal cancer. The American Cancer Society estimates that about 5,300 people are diagnosed with anal cancer each year in the United States, with more women diagnosed than men.

Because vaccinees may develop syncope, sometimes resulting in falling with injury, observation for 15 minutes after administration is recommended. Syncope, sometimes associated with tonic-clonic movements and other seizure-like activity, has been reported following vaccination with Gardasil®. When syncope is associated with tonic-clonic movements, the activity is usually transient and typically responds to restoring cerebral perfusion.

**Special situations**

The quadrivalent HPV vaccine can be administered at the same visit when other vaccines are provided, such as Tdap, Td and MCV4.

Cervical cancer screening recommendations are not changed for females who receive the quadrivalent HPV vaccine.

HPV vaccine can be given to females who have an equivocal or abnormal Pap test, a positive HPV test, or genital warts. Data from clinical trials indicate the vaccine will not have any therapeutic effect on existing Pap test abnormalities, HPV infection or genital warts. Vaccination of these females may provide protection against infection with vaccine HPV types not already acquired.

Lactating women can receive the quadrivalent HPV vaccine.

Females who are immunocompromised, either from disease or medication, can receive the HPV vaccine, however,
vaccine effectiveness might be less than in females who are immuno-competent.

**Contraindications.** The quadrivalent HPV vaccine is contraindicated for people with a history of immediate hypersensitivity to yeast or to any vaccine component.

Vaccination of people with moderate or severe acute illnesses should be deferred until after the illness improves.

The HPV vaccine is not recommended for use in pregnancy, although in limited data, vaccination during pregnancy has not been causally associated with adverse outcomes of pregnancy or adverse events to the developing fetus. Any exposure to vaccine during pregnancy should be reported to the vaccine pregnancy registry (1-800-986-8999).

### Influenza

#### Burden of Suffering

Influenza has been estimated to cause over 4 million respiratory illnesses per year and 16-18 million bed or restricted activity days among adults. Elderly persons and those with chronic medical illnesses are at increased risk for complications such as pneumonia. Between 1976 and 2006, estimates of flu-associated deaths in the United States range from a low of about 3,000 to a high of about 49,000 people. Rates of serious illness and death attributable to influenza are highest among persons aged 65 years and older. Influenza vaccines (both inactivated and live attenuated) contain antigens identified by global surveillance to match circulating influenza A and B viruses. Due to antigen shift the vaccine must be manufactured and administered annually. During the 2009 influenza A (H1N1) pandemic, a higher rate of hospitalization and deaths among children and young adults was observed.

#### Rationale for Recommendation

Beginning with the 2010-2011 influenza season, the Advisory Committee on Immunization Practices (ACIP) voted to expand its influenza vaccination recommendations to all people aged 6 months and older, including healthy adults younger than 50 years of age. A major reason for this change in recommendations is that the pandemic H1N1 influenza virus had been more severe in people aged 19 to 49 years than in older adults. In addition, new data shows that some people who are not in a higher-risk group may still be at increased risk for flu-related complications, such as obese people, certain racial and ethnic groups (see below), and post-partum women.

Vaccination programs should begin as soon as the vaccine is made available and should continue throughout the season, because the onset and duration of the influenza season varies, including after influenza infection activity has begun.

Immunity begins approximately 2 weeks after vaccination in the majority of adults.

In vaccine shortage situations, high risk groups for priority vaccination efforts should include:

- adults ≥ 50 years old \( [B^*] \)
- persons with chronic illnesses (e.g., cardiovascular, pulmonary [including asthma], renal, hepatic, neurologic, hematologic, metabolic, (including diabetes mellitus), immunosuppression/HIV
- residents of nursing homes and other chronic care facilities \( [B^*] \)
- \( [B^*] \)
- women who are or will be pregnant during influenza season
- health care workers, including home care and long-term care workers \( [A^*] \)
- American Indians and Alaskan Natives
- morbidly obese (BMI≥40)
- household contacts and caregivers of children less than 6 years old or adults ≥ 50 years old
- household contacts and caregivers of persons with conditions that put them at higher risk of severe complications from influenza

Patients with severe egg allergy or previous allergy/anaphylaxis to influenza vaccine should not receive the flu vaccine. Persons who have had hives following exposure to eggs should receive TIV (not LAIV, which has not been studied) by a healthcare provider who recognizes signs of egg allergy reactions and can observe the patient for 30 minutes following administration. However, if the patient has had more severe egg allergy symptoms, such as angioedema, respiratory distress, lightheadedness or recurring vomiting, should be referred to an allergist or physician with similar expertise in management of allergic conditions.

Caution should be taken in those with a previous history of Guillian-Barre syndrome.

**Inactivated and live vaccines.** Influenza vaccine is available as an inactivated vaccine administered intramuscularly or intradermally (Fluzone Intradermal®, Sanofi Pasteur), and as a live, attenuated vaccine administered as a nasal spray.

The live, attenuated vaccine is currently approved for use only in healthy individuals 2-49 years old. Patients receiving this live virus vaccine should avoid contact with someone who is severely immunocompromised and in a protected environment, such as a patient in a bone marrow transplant unit.

**Trivalent and quadrivalent influenza vaccines.** The inactivated influenza (injectable) vaccines will be produced in both trivalent and quadrivalent and formulations.

Trivalent vaccines contain two strains of influenza A virus and one of influenza B virus. Two distinct lineages of
Measles, Mumps, Rubella

Burden of Suffering

Measles, mumps, and rubella are considered to be viral illnesses of childhood. These diseases are no longer considered to be indigenous diseases in the United States, however, globally represent a significant health risk. From January 1 to May 2011, a total of 118 cases of measles were reported from 23 states. 40% of cases required hospitalization. Mumps: In 2009–2010 approximately 3,000 cases of mumps were reported. Rubella presents the greatest risk to the fetus if contracted by a pregnant woman. Infection within the first 16 weeks of pregnancy may result in miscarriage, stillbirth, or congenital rubella syndrome (CRS): hearing loss, growth retardation, developmental delay and cardiac and ocular defects.

Rationale for Recommendation

Efficacy: A single dose of measles vaccine is 95% effective in producing long term immunity. The Advisory Committee on Immunization Practices (ACIP) recommends that two doses of live measles vaccine be given to children; one dose at 12 to 15 months old, and a second dose when entering school at 4-5 years old. Most persons born before 1957 are likely to have natural immunity.

Mumps vaccine was introduced in 1967 with a 99% reduction in the incidence of mumps demonstrated in the U.S.

Rubella immunity should be documented in women of child bearing age by vaccination history or serologic test. Susceptible non-pregnant women should be offered the vaccine. Pregnancy should be avoided for 4 weeks following immunization as this is a live vaccine. Susceptible pregnant women should be vaccinated after delivery. No documented cases of CRS have resulted from vaccination in early pregnancy, but this practice is not recommended.

The combination vaccine, MMR, should be used unless a patient has a contraindication to an individual component.

Do not give immune globulin products and MMR simultaneously. If unavoidable, give at different sites and revaccinate or test for seroconversion in 3 months. If MMR is given first, do not give IG for 2 weeks. If IG is given first, the interval between IG and measles vaccination depends on the product, the dose, and the indication.

Meningococcal Vaccine

Burden of Suffering

Each year in the United States, 2,000-3,000 cases of meningococcal disease occur with a case-fatality rate of 10-14%. Moreover, 11-19% of survivors have sequelae (e.g., neurologic disability, limb loss, hearing loss). The disease is most common in infants and in people with certain medical conditions. The rate of invasive disease among people age 17–20 years is about twice that of the general U.S. population and has increased in recent years. Neisseria meningitides has at least 13 different subtypes. Five of these subtypes, A, B, C, Y, and W-135, cause almost all invasive disease.

Rationale for Recommendation

Three meningococcal vaccines are currently licensed in the United States for use in adolescents and adults: tetravalent meningococcal conjugated vaccines MCV4 (Menactra™ and Menveo™), and polysaccharide meningococcal vaccine, MPSV4 (Menomune™). Each provides similar efficacy against the same 4 serogroups (A, C, Y, and W-135) which cause the majority of cases in adolescents and adults. However, both MCV4 products are expected to provide a longer duration of protection and are preferred over MPSV4 for persons aged ≤ 55 years. MPSV4 can be given to all others at increased risk.
All adolescents are considered to be at risk:
• at 11-12 years old administer one dose, then a booster at 16-18 years.
• catch-up: if 1st dose is at 13-15 years old, booster at 16-18 years (up to 21 years if college freshman living in dormitories); if 1st dose is at ≥ 16 years old, no booster.

Individuals with certain medical conditions including functional or anatomic asplenia, and complement component deficiencies and HIV do not develop a sufficient immune response to a single dose of meningococcal conjugate vaccine. These individuals should receive a 2-dose primary series administered 2 months apart and then receive a booster dose every 5 years.

All other persons at increased risk for meningococcal disease should receive a single dose of meningococcal vaccine followed by revaccination every 5 years for those who remain in these high risk groups. The increased risk groups include:
• College freshman through age 21 years living in dormitories or residence halls who did not receive a vaccine after age 16 years,
• military recruits,
• microbiologists who are routinely exposed to Neisseria meningitidis
• travelers to an epidemic or highly endemic country

Special situations:
Although HIV by itself is not considered a high risk condition for meningococcal disease, individuals with HIV who fall into any of the other risk groups should receive a 2-dose primary series.

Meningococcal vaccine may be given to pregnant women.

**Pneumococcal Disease**

**Burden of Suffering**

Population based surveillance studies have reported annual pneumococcal disease rates of 15-19/100,000. Higher rates are found among those < 5 years old, > 65 years old, alcoholics, smokers, asthmatics, Native Americans (e.g., Alaskan natives, Apaches and Navajos), African Americans, nursing home residents, and those with chronic underlying medical conditions. Pneumococcal pneumonia is the most common clinical presentation of pneumococcal disease among adults and results in an estimated 175,000 hospitalizations per year in the United States. It accounts for up to 36% of adult community-acquired pneumonia and 50% of hospital acquired pneumonia. Pneumococcal pneumonia is a common bacterial complication of influenza and measles and it has a case fatality rate of 5%-7%. Highest fatality rates occur in elderly persons (30-43%) and those with co-morbid diseases (25-27%). Bacteremia occurs in about 25%-30% of patients with pneumococcal pneumonia and has an overall case fatality rate of 20% but as high as 60% among the elderly. Resistant strains of Streptococcus pneumoniae have emerged, emphasizing the importance of vaccination.

**Streptococcus pneumoniae** (pneumococcus) remains a leading cause of serious illness, including bacteremia, meningitis, and pneumonia among adults in the United States. An estimated 4,000 deaths occur in the United States each year because of S. pneumoniae, primarily among adults. Adults with certain medical conditions also are at increased risk for invasive pneumococcal disease (IPD). For adults aged 18–64 years with hematologic cancer, the rate of IPD in 2010 was 186 per 100,000, and for persons with human immunodeficiency virus (HIV) the rate was 173 per 100,000 (CDC, unpublished data, 2012). The disease rates for adults in these groups can be more than 20 times those for adults without high-risk medical conditions.

**Rationale for Recommendation**

**Characteristics of the vaccines.** Two pneumococcal vaccines are currently available: polysaccharide vaccine (PPSV23/Pneumovax) and conjugate vaccine (PCV13/Prevnar 13). They differ in coverage and long-term efficacy.

**Polysaccharide vaccine – PPSV23.** The current 23-valent vaccine was introduced in 1983. Pneumococcal polysaccharide vaccine (Pneumovax®) contains 23 purified capsular polysaccharide antigens of S. pneumoniae, and is protective against 88% of the strains of S. pneumoniae causing bacteremic pneumococcal disease reported in the United States. The six serotypes that most frequently cause invasive drug-resistant pneumococcal infection in the United States are represented in the 23-valent vaccine. Duration of antibody protection is unknown but elevated titers persist for at least 5 years. Cohort studies suggest that clinical efficacy persists at least 7-10 years.

Pneumococcal polysaccharide’s primary benefit is in preventing invasive disease (bacteremia, meningitis) and death, but does not appear to reduce the incidence of pneumonia. A meta-analysis of nine randomized trials demonstrated significant reductions in definitive and presumptive pneumococcal disease among low risk individuals, including older individuals. Antibody response has been demonstrated to be satisfactory in older subjects (e.g., age > 85 years old). Although, this same reduction was not demonstrated in high risk populations, over the past several years the Advisory Committee on Immunization Practices (ACIP) has expanded the number of medical conditions for which PPSV23 vaccination is recommended due to the increased risk for pneumococcal infection associated with those conditions.

**Conjugate vaccine –PCV13.** PCV7 was licensed for use in children in 2000 and replaced by PCV13 in 2010. For adults, PCV13 is particularly important for those who are immunocompromised. The disease rate of S.
pneumonia in immunocompromised adults can be > 20 times those for adults without high-risk medical conditions. Among immunocompromised adults in 2010, 50% of invasive pneumococcal disease cases were caused by serotypes contained in PCV13; an additional 21% were caused by serotypes only contains in PPSV23.

Comparison of vaccines. Each vaccine has relative strengths and limitations.

- **Strains covered.** PPSV23 covers more strains than PCV13. PCV13 covers 12 of the 13 strains covered by PCV13.
- **Ongoing protection.** PCV13 provides longer-lasting projection. Polysaccharide vaccines such as PPSV23 do not have the same boosting ability that conjugate vaccines have. Also, the efficacy of polysaccharide vaccination wanes and revaccination may be needed.
- **Reduction in carriage.** Due to its superior “boosting ability, PCV13 (conjugate vaccine) may reduce the number of people who carry the bacteria in their nose or throat, decreasing disease spread and increasing “herd immunity.”

Vaccination recommendations. The current (2012) recommendations for pneumococcal vaccination take into consideration coverage, ongoing protection, and risk of pneumococcal infection due to specific medical conditions and older age.

The detailed recommendations and timing for vaccinations are summarized in the Key Points. Patients are categorized into four groups based on risk:

- **Very high risk:** immunocompromised or functional/anatomic asplenia. Administer both vaccines for greater coverage and efficacy, revaccinating with PPSV23 up to two times to maintain its efficacy.
- **High risk:** Cerebrospinal fluid leak, cochlear implant. Administer both vaccines for greater coverage and efficacy, revaccinating with PPSV23 up to one time to maintain its efficacy.
- **Elevated risk:** Immunocompetent due to a variety of chronic medical conditions and practices (e.g., smoking) – see complete list in Key Points. Administer PPSV23, revaccinating up to one time to maintain efficiency.
- **Average risk:** Age ≥ 65. Administer PPSV23 if not previously vaccinated. If previously vaccinated, revaccinate.

Tetanus, Diphtheria and Pertussis

Burden of Suffering

In the mid-1940s, prior to the introduction or routine vaccination in the U.S., approximately 600 cases of tetanus, 9,500 cases of diphtheria, and 175,000 cases of pertussis occurred annually. In 2001, only 27 cases of tetanus were reported in the United States. Respiratory diphtheria has become a rare disease in the U.S. (0-5 cases per year). Pertussis incidence declined with less than 3000 cases reported annually in the 1990s. However, the incidence of pertussis has been increasing since this time with more than 41,000 cases reported in 2012, including deaths of 14 infants < 12 months.

In the United States tetanus is almost exclusively a disease of the elderly or immigrants who either did not complete a primary tetanus/diphtheria (Td) series or did not receive boosters. Serosurveys conducted since 1977 indicate 22-62% of adults 18-39 years old and 41-84% of those 60 years old or older may lack protective antitoxin against diphtheria.

The one-time addition of pertussis toxoid (Tdap) into the vaccination schedule for adults 19-64 occurred in 2005. Adolescents and adults are estimated to make up over 60% of the current cases of pertussis. The disease may be mild in adolescents and adults, but they are important sources of pertussis for infants and young children for whom the disease can be fatal. This rise in cases prompted the introduction of Tdap vaccination.

Over time Tdap recommendations expanded to include adults 65 years and older. In 2010 the recommendation was expanded to include adults 65 and older if they had close contact with an infant < 12 months or if they requested the vaccine. In February 2012 ACIP recommended Tdap for all adults 65 years and older and eliminated a minimum interval between Td and Tdap.

Tdap recommendations also expanded for pregnant women. On October 21, 2011 the ACIP recommended a single dose of Tdap for a woman who had not previously received Tdap, to be given after the 20th week of pregnancy. In October, 2012, ACIP recommended giving Tdap to pregnant women during every pregnancy (preferably during the third trimester – 27-36 weeks gestation), regardless of the prior history of receiving Tdap.

Rationale for Recommendation

Immunity to diphtheria, tetanus and pertussis (DTP) given in childhood wanes in adults. One month after a booster dose, 93% of adults have seroprotective antibody levels to tetanus and diphtheria and 97% to pertussis. The recommendation is for a Td booster every ten years after receiving the full primary series.

Adding the pertussis component in individuals over 7 years old is new, so data are insufficient to predict waning immunity in vaccinated adults. When data are available, the recommendation regarding pertussis may be modified.

Available data do not indicate substantially more adverse reactions to Tdap than to Td vaccine. Available data suggest a short duration of blunting of infant response to DTaP. The ACIP decided that the potential benefit of protection from maternal antibodies in newborn infants outweighs the potential risk for shifting disease burden to later in infancy.
Varicella Vaccine

Burden of Suffering

Adults make up only 5% of varicella cases but account for more than a third of the deaths attributable to this infection. Varicella pneumonia is the most common complication in adults, causing 20-30 hospital admissions/10000 adults. Immunocompromised persons are at high risk for complications. Previously, vaccine was only recommended for adults without evidence of immunity who were at high risk of exposure or exposing others who were immunocompromised or otherwise at risk for severe disease. Now, it is recommended that those without evidence of immunity be vaccinated with two doses to promote individual immunity and for more rapid impact on outbreaks. It is estimated that 70-90% of adults are immune to varicella.

Rational for Recommendation

Patients without evidence of immunity should receive two doses of varicella vaccine, 4-8 weeks apart. Criteria for evidence of immunity to varicella were revised in 2006, and include any of the following:

1. documentation of age-appropriate vaccination;
2. laboratory evidence of immunity or laboratory confirmation of disease;
3. birth in U.S. before 1980 (not considered sufficient evidence in immunocompromised, healthcare workers and pregnant women);
4. a healthcare provider diagnosis of varicella or verification of history of varicella disease (special rules apply to diagnosis of atypical disease); and
5. healthcare provider diagnosis or verification of history of herpes zoster.

Women should be assessed for immunity to varicella prenatally. Because varicella is a live virus vaccine, women who are pregnant or may become pregnant within 4 weeks should not be vaccinated. Following the pregnancy, women without evidence of immunity should be immunized with the first dose immediately, with a second dose in 4-8 weeks.

A second dose of varicella vaccine is recommended for people who have had only one dose of varicella vaccine as a catch-up during routine health care. The second dose should be spaced at least 28 days from the first dose. Following an exposure to varicella, patients without evidence of immunity to varicella who are at high risk of severe disease and complications may be eligible to receive varicella zoster immune globulin under an investigational new drug protocol.

Varicella virus vaccine should not be given for at least 5 months after receipt of blood (except washed red blood cells) or plasma transfusions, immune globulin, or varicella zoster immune globulin. In addition, IG and VZIG should not be administered for 3 weeks after vaccination unless the benefits exceed those of vaccination.

If giving multiple live virus vaccines or administering a PPD skin test, they must be given on the same day or spaced 28 days apart. Live virus vaccines can impair the recipients’ response to the PPD skin test.

Contraindications. Vaccine is contraindicated in:

- Pregnant women
- Immunocompromising conditions including HIV with CD4 \( \leq \) 200, congenital immunodeficiencies, leukemia, lymphoma; generalized malignancies; cerebrospinal fluid leaks; therapy with alkylating agents, antimetabolites, radiation or high dose (> 20 mgs) long term corticosteroids.

Strategy for Literature Search

The U.S. Department of Health and Human Services appoints the Advisory Committee on Immunization Practice (ACIP) to make official U.S. recommendations regarding vaccines and immune globulins. ACIP recommendations are published by the Centers for Disease Control in the Morbidity and Mortality Weekly Report and on the Internet (www.cdc.gov/vaccines/pubs/ACIP-list.htm). This internet site provides the most current recommendations, including detailed recommendations for each of the vaccinations included in this guideline.

The literature search for this update began with the results of a literature search performed in developing the initial version of this guideline. That search on Medline was for literature published from 1/1/95 through 5/1/99. It included the major key words of adults, humans, English; and a number of specific search terms related to immunizations (see specific search terms printed in initial UMHS guideline published March, 2004). Since that search additional literature searches for updates have focused on subsequent ACIP statements regarding immunizations for adults and the supporting literature presented by ACIP. This guideline is based on ACIP statements through February 2013. The “strength of recommendation” for key aspects of care was determined by expert opinion.

Related National Guidelines

This guideline generally conforms to:

ACIP Adult Immunization Schedule – United States, 2013

 Measures of Clinical Performance

National programs that have clinical performance measures of diabetes include the following.

Centers for Medicare & Medicaid Services:
• Physician Quality Reporting Measures for Group Practice Reporting Option (GPRO)
• Clinical Quality Measures for financial incentives for Meaningful Use of certified Electronic Health Record technology (MU)
• Quality measures for Accountable Care Organizations (ACO)

These programs have clinical performance measures for diabetes addressed in this guideline. While specific measurement details vary (e.g., method of data collection, population inclusions and exclusions), the general measures are summarized below.

Influenza immunization for patients ≥ 50 years old. The percentage of patients aged 50 years and older who received an influenza immunization during the flu season (September through February) (MU, ACO, GPRO).

Pneumonia vaccination. The percentage of patients aged 65 years and older who have ever received a pneumococcal vaccination (MU, ACO, GPRO).

Disclosures

The University of Michigan Health System endorses the Guidelines of the Association of American Medical Colleges and the Standards of the Accreditation Council for Continuing Medical Education that the individuals who present educational activities disclose significant relationships with commercial companies whose products or services are discussed. Disclosure of a relationship is not intended to suggest bias in the information presented, but is made to provide readers with information that might be of potential importance to their evaluation of the information.

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Review and Endorsement

This guideline was endorsed by the Executive Committee for Clinical Affairs of the University of Michigan Hospitals and Health Centers. Annual updates are produced through the UMHHC Immunizations Committee.

Acknowledgments

Listed on the first page are members of the team that reviewed the previous version of this guideline and produced this update. The following individuals developed earlier versions of this guideline, parts of which continue to be used in this updated guideline:

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Annotated References

General Information on Vaccines from CKD/ACIP

The most current federal recommendations of the Advisory Committee on Immunization Practice and published in the
CDC Morbidity and Mortality Weekly report are available at http://www.cdc.gov/vaccines/pubs/ACIP-list.htm
Detailed information is available concerning vaccinations in this guideline and other vaccinations.

Current ACIP Adult Immunization Schedule


Relevant ACIP Recommendations in the Past 2 Years

Influenza vaccine

Meningococcal vaccine

Pneumococcal vaccines

Tetanus, diphtheria, pertussis vaccines (Td/Tdap)

Updated recommendations for use of tetanus toxoid, reduced diphtheria toxoid, and acellular pertuss vaccine (Tdap) in pregnant women—Advisory Committee on Immunization Practices (ACIP). MMWR, 2013; 62(7); 131-135. http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6207a4.htm

Other Recent Resources

General vaccination information

Vaccinations for CKD patients