Editorial

Immunization guidelines in the United States: New vaccines and new recommendations for children, adolescents, and adults

When meditating over a disease, I never think of finding a remedy for it, but, instead, a means of preventing it.

– Louis Pasteur

It is increasingly apparent that prevention, rather than treatment, of infectious diseases offers significant health and economic benefits to individuals and populations. Combined with the increasing virulence of some pathogens, and the increasing rates of antimicrobial resistance, as well as the tremendous costs associated with treating disease once it has occurred, vaccines are a highly cost-effective public health strategy.

Despite this, and the widespread availability of vaccines in the US, an estimated annual average of 50,000 Americans die of potentially vaccine-preventable diseases each year, with more than 99% of these deaths occurring in adults. This means that at the start of each year, 1 out of every 7000 Americans will die of a disease that might be prevented by already existing and available vaccines.

Several factors commonly conspire to prevent routine immunization, including cost, lack of knowledge and awareness, missed opportunities, and the lack of a systems-level approach to providing vaccines. Excellent resources are available for setting up an immunization program and are available from the American College of Physicians at http://www.acponline.org/aii/index.html and from the CDC at http://www.cdc.gov/vaccines/. In addition, a free and very helpful smart phone app is available through the iTunes store (ACP Immunization Advisor).

The purpose of the annual immunization guidelines is to provide an evidence-based schedule of routine immunizations demonstrated to be safe and effective, based on age and concurrent medical conditions. This is the approved official schedule for use in the US, and allows all clinicians to provide vaccines in a harmonious manner regardless of geographic location. The schedule is developed by a federal advisory committee (the Advisory Committee on Immunization Practices – ACIP), which consists of experts in vaccinology, public health, infectious diseases, and related disciplines.

These new recommendations describe each vaccine, its use, indications and contraindications, background data, and other information, and can be accessed at http://www.immunize.org/catg.d/p2010.pdf. The full adult immunization schedule is available at http://www.cdc.gov/vaccines/schedules/downloads/adult/adult-schedule-bw.pdf. These schedules can be found in Appendix A.

Below we provide brief commentary on the major changes clinicians should be aware of:

Immunization of persons 0–18 years

New vaccines:

- A new vaccine that provides protection against invasive disease caused by Haemophilus influenzae type B and meningococcal Groups C and Y was licensed for use in infants and children. Finding a role for this combined vaccine has been somewhat challenging because although the ACIP has long recommended universal infant protection against H. influenzae B infections, it has no comparable recommendation for the use of meningococcal vaccine in this age group. Nevertheless, certain infants are at increased risk for meningococcal infections, including those with recognized persistent complement pathway deficiencies and infants who have anatomic or functional asplenia, including sickle cell disease. The ACIP noted that the new vaccine (Hib-MenCY) could be used to vaccinate these infants (a four-dose series at 2, 4, 6 and 12–15 months). The vaccine also could be used in infants ages 2 months through 18 months who are in communities that are experiencing outbreaks of disease caused by meningococcal serogroups C or Y.

- No other new vaccines have been added to the schedule for use in children and adolescents at the present time [January, 2013]; however, quadrivalent LAIV has been approved and is expected to be available for the 2013–2014 influenza vaccination season. Quadrivalent inactivated influenza vaccines are also expected to be available in limited quantities. The nomenclature for inactivated influenza vaccines has been changed in the 2013 schedule to "IIV" from "TIV" to minimize potential confusion for readers as this transition occurs.

New recommendations for existing vaccines:

- The structure of the vaccine schedule for children 0–18 years of age has been modified significantly to place recommendations for all children on a single schedule. The new table highlights recommended vaccine intervals, catch-up and risk-factor based immunization in a single pediatric schedule, and is followed by reformatted and clarified footnotes for each vaccine product.

- Rotavirus vaccines: The vaccine footnote has been revised to detail the recommendations for the RV-1 and RV-5 vaccines separately.

- Hib vaccine: Only one dose of HiB vaccine is recommended after 15 months of age. This vaccine is not routinely recommended in persons older than 5 years; however, one dose should be
administered to unvaccinated or partially vaccinated persons with severe immune compromise, as detailed in the adult recommendations below.

- **Pneumococcal vaccines**: Vaccination recommendations for persons with high-risk conditions have been clarified. Specific guidance for pneumococcal polysaccharide 23 vaccine after age 2 and following completion of a pneumococcal conjugate 13 vaccine series is provided for high risk children. This includes a recommendation for a single booster dose of pneumococcal polysaccharide 23 vaccine five years later.

- **Meningococcal vaccines**: Recommendations for meningococcal vaccines in children with high-risk conditions have been expanded and clarified.

**Immunization of persons 19 and older:**

**New vaccines**

- **Pneumococcal conjugate 13 vaccine**: The traditional pneumococcal polysaccharide 23 vaccine is designed to prevent the invasive complications of pneumococcal infection. Limitations of the vaccine include the uncertain protection against pneumococcal pneumonia and poor induction of long-term immune memory. Nevertheless, it remains the mainstay of protection against invasive pneumococcal disease in adults. This year pneumococcal conjugate 13 vaccine was licensed for use in adults age 50 and older. To date, the ACIP has limited its recommendation for the use of this vaccine in adults to immunocompromised persons, including those with anatomic or functional asplenia, and persons who have CSF leaks or cochlear implants. A single dose of PCV13 is recommended, followed at least eight weeks later with a dose of PPSV23. Depending upon prior receipt of PPSV23, additional doses of PPSV23 at recommended intervals are recommended.

- **Quadrivalent influenza vaccine**: Starting with the 2013–2014 season, quadrivalent live attenuated influenza vaccine (LAIV) will become available in the US, along with limited supplies of quadrivalent inactivated influenza vaccines.

- **Baculovirus-produced influenza vaccine**: In January 2012, a new trivalent inactivated influenza vaccine was granted FDA approval. The vaccine contains 45 micrograms of each influenza strain antigen (3 times the dose contained in other IIV vaccines) and is composed of recombinant hemagglutinin – with no neuraminidase component. The vaccine is licensed for use in adults 18–49 years of age, and has no egg proteins as it is not produced in eggs.

- **Cell-culture derived inactivated influenza vaccine**: In November 2012, a new trivalent inactivated influenza vaccine was granted FDA approval. The vaccine contains 15 micrograms of each influenza strain antigen, and is propagated in a continuous MDCK (Madin Darby Canine Kidney) cell line. As such it does not contain egg proteins, preservatives, or antibiotics. The vaccine is licensed for use in adults age 18 years and older.

**New recommendations for existing vaccines:**

- **Inactivated influenza vaccines**: Persons who experience hives, but not anaphylactic allergic reactions, can receive inactivated influenza vaccines. However, such persons should not receive LAIV. Inactivated influenza vaccine options include both IM and ID preparations.

- **Tdap vaccines**: Recommendations have now been expanded to routinely immunize all adults 65 years of age and older with a single dose of Tdap; and to administer a booster dose of Tdap with each pregnancy, regardless of interval between pregnancies, ideally after the 20th week of gestation.

- **Pneumococcal polysaccharide 23 vaccine (PPSV23)**: Individuals with certain medical conditions (asplenia, chronic renal failure, immunocomprised) have long been recommended to receive two doses of PPSV23 before the age of 65 as long as five or more years have elapsed since the last dose. The ACIP has clarified that, even for these individuals, another dose of PPSV23 is recommended at age 65 years if the last dose received was at least five years earlier.

- **Hepatitis A**: Vaccination is recommended for persons with injection or non-injection illicit drug use and travelers to areas of the world endemic for hepatitis A. Pregnancy is no longer a precaution for use of this vaccine.

- **Hepatitis B**: Due to documented elevated rates of hepatitis B, all individuals with diabetes younger than age 60 were recommended last year to receive the HBV vaccine series. Individuals with diabetes older than age 60 may receive HBV vaccine based on the risk of acquiring HBV through assisted blood glucose monitoring in assisted care type settings or other risk factors. Although not, strictly speaking, a new recommendation, we emphasize it because knowledge of this new recommendation seems not yet to have penetrated very effectively among either those who provide medical care to persons with diabetes or to persons with diabetes themselves.

- **H. influenzae type B vaccine**: A single dose of Hib vaccine can be considered for those individuals with functional or anatomic asplenia, sickle cell anemia, HIV infection, or leukemia.

As VACCINE did last year, we plan to publish these recommendations on an annual basis for readers. We do so with the goals of providing widespread visibility for these schedules, and to insure that our readers have access to the latest recommendations and the rationale for changes in the schedules. In addition, as we stated in a previous editorial, we hope that publishing this schedule might stimulate consideration of global harmonization of immunization schedules, and interest from every country in engaging in a process similar to what the ACIP process entails.

Routine immunization of all persons should be considered a quality of care and patient safety issue. Anywhere medical care is rendered, systems and procedures should be in place to screen patients for needed vaccines, with facilities or policies to administer needed vaccines, or to refer such persons to another facility where vaccines can be administered. No other single medical maneuver is as effective in the prevention of the morbidity and mortality due to infectious diseases. Immunization is an important standard of medical care and it is the duty of every physician, and every nurse, to be both knowledgeable and supportive of the goal to fully immunize the patients for whom we are privileged to care.

**Disclosures:**

- Gregory A. Poland, MD: Dr. Poland is the chair of a Safety Evaluation Committee for novel investigational vaccine trials being conducted by Merck Research Laboratories. Dr. Poland offers consultative advice on vaccine development to Merck & Co, Inc., CSL Biotherapies, Avianax, Sanofi Pasteur, Dynavax, Novartis Vaccines and Therapeutics, and PAXVAX Inc. These activities have been reviewed by the Mayo Clinic Conflict of Interest Review Board and are conducted in compliance with Mayo Clinic Conflict of Interest policies.

- William Schaffner, MD: Dr. Schaffner is a member of a Safety Evaluation Committee for novel investigational vaccine trials by Merck Research Laboratories and has provided consultative advice to Sanofi Pasteur, Pfizer, GlaxoSmithKline and Dynavax.

- Robert H. Hopkins, Jr, MD: Dr. Hopkins reports no disclosures.
Appendix A.

Figure 1. Recommended immunization schedule for persons aged 0 through 18 years – 2013. (For those who fall behind or start late, see the catch-up schedule (Figure 2).)

These recommendations must be read with the footnotes that follow. For those who fail behind or start late, provide catch-up vaccination at the earliest opportunity as indicated by the green bars in Figure 1. To determine minimum intervals between doses, see the catch-up schedule (Figure 2). School entry and adolescent vaccine age groups are in bold.

<table>
<thead>
<tr>
<th>Vaccines</th>
<th>Birth</th>
<th>1 mo</th>
<th>2 mos</th>
<th>4 mos</th>
<th>6 mos</th>
<th>8 mos</th>
<th>12 mos</th>
<th>15 mos</th>
<th>18 mos</th>
<th>19–23 mos</th>
<th>2–3 y</th>
<th>4–6 y</th>
<th>7–10 y</th>
<th>11–12 y</th>
<th>13–15 y</th>
<th>16–18 y</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hepatitis B (HepB)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rotavirus (RV)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></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></td>
<td></td>
<td></td>
<td></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></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diphtheria, tetanus, and acellular pertussis (DTaP)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pertussis (PRP), or diphtheria and tetanus toxoids and acellular pertussis (DTaP)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tetanus, diphtheria, and acellular pertussis (Tdap)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neomycin sulfonamide type 6 (NHS)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pneumococcal conjugate (PCV13)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pneumococcal polysaccharide (PPSV23)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></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></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Haemophilus influenzae type b (Hib)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Haemophilus influenzae type b (Hib) conjugate vaccine</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Haemophilus influenzae type b (Hib)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Measles, mumps, rubella (MMR)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Varicella (VAR)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hepatitis A (HepA)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Human papillomavirus (HPV) 16/18 females</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Merck</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></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></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Range of recommended ages for all children

Range of recommended ages for catch-up immunization

Range of recommended ages for certain high-risk groups

Range of recommended ages during which catch-up is encouraged and for certain high-risk groups

Not routinely recommended

NOTE: The above recommendations must be read along with the footnotes of this schedule.

Footnotes — Recommended immunization schedule for persons aged 0 through 18 years—United States, 2013

For further guidance on the use of the vaccines mentioned below, see: http://www.cdc.gov/vaccines/pubs/acip-list.htm.

1. Hepatitis B (HepB) vaccine. (Minimum age: birth)
   - Routine vaccination: At birth.
   - Administer monovalent HepB vaccine to all newborns before hospital discharge.
   - For infants born to hepatitis B surface antigen (HBsAg)-positive mothers, administer HepB vaccine and 0.5 mL of hepatitis B immune globulin (HBIG) within 12 hours of birth. These infants should be tested for HBsAg and antibody to HBsAg (anti-HBs) 1 to 2 months after completion of the HepB series. If any dose is not administered at the recommended age, it should be administered at a subsequent visit, when indicated and feasible. The use of a combination vaccine generally is preferred over separate injections of its equivalent component vaccines. Vaccination providers should consult the relevant Advisory Committee on Immunization Practices (ACIP) statement and recommendations available online at http://www.cdc.gov/vaccines/pubs/acip-list.htm. Clinically significant adverse events that follow vaccination should be reported to the Vaccine Adverse Event Reporting System (VAERS) online (http://vaers.hhs.gov) or by telephone (800-822-7967). Suspected cases of vaccine-preventable diseases should be reported to the state or local health department. Additional information, including precautions and contraindications for vaccination, is available from CDC online (http://www.cdc.gov/vaccines) or by telephone (800-CDC-INFO [800-232-4636]).

This schedule is approved by the Advisory Committee on Immunization Practices (http://www.cdc.gov/vaccines/acip/index.html), the American Academy of Pediatrics (http://www.aap.org), and the American College of Obstetricians and Gynecologists (http://www.acog.org).

NOTE: The above recommendations must be read along with the footnotes of this schedule.

Footnotes — Recommended immunization schedule for persons aged 0 through 18 years—United States, 2013

For further guidance on the use of the vaccines mentioned below, see: http://www.cdc.gov/vaccines/pubs/acip-list.htm.

1. Hepatitis B (HepB) vaccine. (Minimum age: birth)
   - Routine vaccination: At birth.
   - Administer monovalent HepB vaccine to all newborns before hospital discharge.
   - For infants born to hepatitis B surface antigen (HBsAg)-positive mothers, administer HepB vaccine and 0.5 mL of hepatitis B immune globulin (HBIG) within 12 hours of birth. These infants should be tested for HBsAg and antibody to HBsAg (anti-HBs) 1 to 2 months after completion of the HepB series. If any dose is not administered at the recommended age, it should be administered at a subsequent visit, when indicated and feasible. The use of a combination vaccine generally is preferred over separate injections of its equivalent component vaccines. Vaccination providers should consult the relevant Advisory Committee on Immunization Practices (ACIP) statement and recommendations available online at http://www.cdc.gov/vaccines/pubs/acip-list.htm. Clinically significant adverse events that follow vaccination should be reported to the Vaccine Adverse Event Reporting System (VAERS) online (http://vaers.hhs.gov) or by telephone (800-822-7967). Suspected cases of vaccine-preventable diseases should be reported to the state or local health department. Additional information, including precautions and contraindications for vaccination, is available from CDC online (http://www.cdc.gov/vaccines) or by telephone (800-CDC-INFO [800-232-4636]).

This schedule is approved by the Advisory Committee on Immunization Practices (http://www.cdc.gov/vaccines/acip/index.html), the American Academy of Pediatrics (http://www.aap.org), and the American College of Obstetricians and Gynecologists (http://www.acog.org).

NOTE: The above recommendations must be read along with the footnotes of this schedule.

Footnotes — Recommended immunization schedule for persons aged 0 through 18 years—United States, 2013

For further guidance on the use of the vaccines mentioned below, see: http://www.cdc.gov/vaccines/pubs/acip-list.htm.

1. Hepatitis B (HepB) vaccine. (Minimum age: birth)
   - Routine vaccination: At birth.
   - Administer monovalent HepB vaccine to all newborns before hospital discharge.
   - For infants born to hepatitis B surface antigen (HBsAg)-positive mothers, administer HepB vaccine and 0.5 mL of hepatitis B immune globulin (HBIG) within 12 hours of birth. These infants should be tested for HBsAg and antibody to HBsAg (anti-HBs) 1 to 2 months after completion of the HepB series. If any dose is not administered at the recommended age, it should be administered at a subsequent visit, when indicated and feasible. The use of a combination vaccine generally is preferred over separate injections of its equivalent component vaccines. Vaccination providers should consult the relevant Advisory Committee on Immunization Practices (ACIP) statement and recommendations available online at http://www.cdc.gov/vaccines/pubs/acip-list.htm. Clinically significant adverse events that follow vaccination should be reported to the Vaccine Adverse Event Reporting System (VAERS) online (http://vaers.hhs.gov) or by telephone (800-822-7967). Suspected cases of vaccine-preventable diseases should be reported to the state or local health department. Additional information, including precautions and contraindications for vaccination, is available from CDC online (http://www.cdc.gov/vaccines) or by telephone (800-CDC-INFO [800-232-4636]).
For further guidance on the use of the vaccines mentioned below, see: http://www.cdc.gov/vaccines/pubs/acip-list.htm.

- For other catch-up issues, see Figure 2.
- Vaccination of persons with special risk conditions:

  - HB vaccine is not routinely recommended for persons aged 5 years or older. However, one dose of HB vaccine is recommended to all children who have been unvaccinated or partially vaccinated aged 5 years or older who have leukemia, malignant neoplasms, anatomic or functional asplenia (including sickle cell disease), an immunocompromising condition, HIV infection, or other immunocompromising conditions.

6a. Pneumococcal conjugate vaccine (PCV) (Minimum age: 6 weeks)

Routine vaccination:

- Administer a series of PCV13 vaccine at ages 2, 4, 6 months with a booster at age 12 through 15 months.
- For children aged 14 through 59 months who have received an age appropriate series of 7-valent PCV7, administer a single supplemental dose of 13-valent PCV13.

Catch-up vaccination:

- Administer 1 dose of PCV13 to all healthy children aged 24 through 59 months who are not completely vaccinated for their age.
- For other catch-up issues, see Figure 2.

Vaccination of persons with high-risk conditions:

- For children aged 24 through 71 months with certain underlying medical conditions (see footnote 6), administer 1 dose of PCV13 if 3 doses of PCV were received previously, or administer 2 doses of PCV13 at least 8 weeks apart if fewer than 3 doses of PCV were received previously.
- A single dose of PCV13 may be administered to previously unvaccinated children aged 6 through 18 years who have anatomic or functional asplenia (including sickle cell disease), HIV infection or an immunocompromising condition, chronic renal failure, or congenital or acquired aplastic anemia.

- Children with congenital heart disease or certain chronic medical conditions such as diabetes mellitus; cerebrospinal fluid leaks; or cochlear implant.
- Children with solid organ transplantation, lymphomas and Hodgkin disease; or solid organ transplantation.

6b. Pneumococcal polysaccharide vaccine (PPSV23) (Minimum age: 2 years)

Vaccination of persons with high-risk conditions:

- Administer PPSV23 at least 8 weeks after the last dose of PCV to children aged 2 years or older with certain underlying medical conditions (see footnote 6). A single revaccination with PPSV23 should be administered after 5 years to children with anatomic or functional asplenia (including sickle cell disease) or an immunocompromising condition.

6c. Medical conditions for which PPSV23 is indicated in children aged 2 years and older and for which use of PCV13 is indicated in children aged 24 through 71 months:

- Immunocompromising conditions (particular: opportunistic congenital heart disease and cardiac failure, chronic lung disease including asthma if treated with high-dose oral corticosteroids, diabetes mellitus, or chronic renal failure) or congenital or acquired aplastic anemia.

- Children with HIV or hepatitis C infection or other immunocompromising conditions (including organ transplantation, diabetes mellitus; cerebrospinal fluid leaks; or cochlear implant).

7. Inactivated poliovirus vaccine (IPV) (Minimum age: 6 weeks)

Routine vaccination:

- A series of IPV at age 2, 4, 6–18 months, with a booster at age 4–6 years. The final dose in the series should be administered on or after the fourth birthday and at least 6 months after the previous dose.

Catch-up vaccination:

- In the first 6 months of life, minimum age and minimum intervals are only recommended if the person is at high risk for exposure to circulating poliovirus (i.e., travel to a polio-endemic region or during an outbreak).
- A 4-dose series is administered before age 4 years; an additional dose should be administered at age 4 to 6 years.
- A fourth dose is not necessary if the third dose was administered at age 4 years or older and at least 6 months after the previous dose.
- If both IPV and OPV were administered as part of a series, a total of 4 doses should be administered, regardless of the IPV dose interval.
- IPV is not routinely recommended for U.S. residents aged 18 years or older.
- For other catch-up issues, see Figure 2.

Influenza vaccines. (Minimum age: 6 months for inactivated influenza vaccine [IIV]; 2 years for live, attenuated influenza vaccine [LAIV])

Routine vaccination:

- Administer influenza vaccine annually to all children beginning at age 6 months. For most healthy, nonpregnant persons aged 49 years or younger, LAIV or IIV may be used. However, LAIV should NOT be administered to persons, including 1) those with asthma, 2) children 2 through 4 years who have had bronchiolitis (OR) another illness with respiratory or feeding difficulties after their first dose of PCV (if they have any other underlying medical conditions); 2) those with asthma who are prescribed inhaled corticosteroids, 3) children 2 through 4 years with conditions that predispose them to influenza complications. For other contraindications to use of LAIV see “Vaccine Precautions” in General Recommendations on Immunization (ACIP), available at http://www.cdc.gov/mmwr/pdf/vw/vw5801.pdf.
- Administer 1 dose to persons aged 9 years and older.
- For children aged 6 months through 8 years:
  - Administer 1 dose to persons aged 9 years and older.

- For children aged 6 months through 8 years:
  - For the 2013–14 season, administer 2 doses (separated by at least 4 weeks) to children who are receiving influenza vaccine for the first time. For additional guidance, follow dosing guidelines in the 2013 ACIP Influenza vaccine recommendations. For other catch-up issues, see Figure 2.

- Administer 1 dose of IIV to infants aged 6 through 11 months before departure from the United States for international travel. These children should be revaccinated with 2 doses of IIV vaccine, the first at age 12 through 15 months if the child remains in an area where disease risk is high, and the second dose at 4 weeks later.

- Administer 2 doses of IIV vaccine to children aged 12 months and older, before departure from the United States for international travel. The first dose should be administered on or after age 12 months and the second dose at least 4 weeks later.

Catch-up vaccination:

- Ensure that all school-aged children and adolescents have had 2 doses of IIV vaccine; the minimum interval between the 2 doses is 4 weeks.

10. Varicella (VACC) (Minimum age: 12 months)

Routine vaccination:

- Administer the first dose of VAR vaccine at age 12 through 15 months, and the second dose at age 4 through 6 years. The second dose may be administered before age 4 years, provided at least 3 months have elapsed since the first dose. If the second dose was administered at least 4 weeks after the first dose, it can be accepted as valid.

Catch-up vaccination:

- Ensure that all persons aged 7 through 18 years without evidence of immunity (see MMWR 2007;56 [No. RR-4], available at http://www.cdc.gov/mmwr/pdf/rr/rr5604.pdf) have 2 doses of varicella vaccine. For children aged 7 through 12 years the recommended minimum interval between doses is 3 months if the second dose was administered at least 4 weeks after the first dose, it can be accepted as valid; for persons aged 13 years and older, the minimum interval between doses is 4 weeks.

11. Hepatitis A (HAV) (Minimum age: 12 months)

Routine vaccination:

- Administer 2 doses of HAV vaccine for the first time; the 2 doses may be separated by 2 to 4 months.

Catch-up vaccination:

- For age groups 2 years and older who have not yet received the Hep A vaccine series, 2 doses of HAV should be administered at least 6 months apart to be considered immune to hepatitis A virus infection.

12. Human papillomavirus (HPV) vaccines. (HPV4 [Gardasil®] and HPV2 [Cervarix®]) (Minimum age: 9 years)

Vaccination of persons with high-risk conditions:

1. For children aged 9 years and older.

Routine vaccination:

- Administer 3 doses of HPV vaccine on a schedule of 0, 2, and 6 months for all ages, including girls aged 13 through 18 years.

Catch-up vaccination:

- For children aged 9 years and older with high-risk conditions, below.

For other catch-up issues, see Figure 2.

13. Meningococcal conjugate vaccine (MCV) (Minimum age: 6 weeks for Meningitis C [MCV4-C]), 2 years for MenB-MCV (MCV4-CRM)

Routine vaccination:

- Administer MCV4 vaccine at age 11–12 years, with a booster dose at age 16 years.

Catch-up vaccination:

- For children aged 13 through 18 years who have not previously received MCV vaccine.

Recommended routine dosing intervals (see above) for vaccine catch-up.

Meningococcal conjugate vaccine (MCV) (Minimum age: 6 weeks for Meningitis C [MCV4-C]), 2 years for MenB-MCV (MCV4-CRM)

- For children aged 12 through 15 months
- For children aged 13 through 18 years

Nonpregnant persons aged 15 through 26 years

- For children aged 16 through 26 years

For other catch-up issues, see Figure 2.

Additional information

- For contraindications and precautions to use of a vaccine and for additional information regarding use of a vaccine, vaccine providers should consult the relevant ACIP statement available online at http://www.cdc.gov/vaccines/pubs/acip-list.htm.

- For the purposes of calculating intervals between doses, 4 weeks = 28 days. Intervals of 4 months or greater are determined by calendar months.

- Information on travel vaccine requirements and recommendations is available at http://wwwnc.cdc.gov/travel/.


- For children aged 12 through 15 years with a minimum interval of at least 8 weeks between doses.

- For children aged 16 through 18 years with a minimum interval of at least 8 weeks between doses.

- For other catch-up issues, see Figure 2.

For children who are present during outbreaks caused by a vaccine serogroup, administer or complete an age-appropriate formulation of MenB or MCV4.

For other doses among persons with high-risk conditions refer to http://www.cdc.gov/vaccines/pubs/acip-list.htm.