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NEEDLE TIPS

from the Immunization Action Coalition — www.immunize.org

What's Inside

ACIP adds booster dose to its recommendations for use of MCV4 vaccine in children and teens

In January 2011, CDC published the ACIP's recently updated MCV4 vaccination recommendations in *MMWR*. ACIP's previous recommendations, issued in 2005 and 2007, called for a single dose of MCV4 for adolescents at age 11–12 years, with catch-up vaccination for those ages 13–18 years. At the time it was thought that the dose given at age 11–12 would provide protection that would last through the years when meningococcal disease rates peak (ages 16–21). However, data gathered since indicate many adolescents might not be protected for more than 5 years from the date of vaccination. In January 2011, ACIP issued updated MCV4 vaccination recommendations. The updated recommendations cover the following groups:

Adolescents: Routinely vaccinate adolescents with a first dose of MCV4 at ages 11–12, and follow with a booster dose at age 16. Those who receive the first dose at ages 13 through 15 need a one-time booster at ages 16 through 18. No booster is needed for those who receive the first dose at or after age 16.

College students: Administer 1 dose of MCV4 to unvaccinated incoming college students ages 19 through 21 years, and consider vaccinating currently enrolled unvaccinated college students in this age group. Give a booster dose of MCV4 to students younger than age 22 who are about to enter college if they received their most recent dose more than 5 years earlier, and consider giving booster doses to currently enrolled students who meet these criteria.

People with risk factors: Administer 2 doses of MCV4 at least 8 weeks apart to people younger than age 56 who have the following risk factors: persistent complement component deficiency, or functional or anatomic asplenia. For people with risk factors age 56 years and older, administer 1 dose of MPSV4. Give booster doses every 5 years to people with these risk factors.

People with HIV-infection: HIV-infected people ages 2 through 55 years who are in a group recommended to be vaccinated should be given 2 doses of MCV4 at least 8 weeks apart.

For more complete information on ACIP's meningococcal vaccination recommendations, see the "Ask the Experts" feature below, including the table titled "Summary of meningococcal vaccination recommendations, by risk group." To access the updated recommendations, go to www.cdc.gov/mmwr/PDF/wk/mm6003.pdf and see pages 72–76.

Ask the Experts

IAC extends thanks to our experts, William L. Atkinson, MD, MPH, and Andrew T. Kroger, MD, MPH, medical epidemiologists at the National Center for Immunization and Respiratory Diseases, Centers for Disease Control and Prevention (CDC).

DTaP, Tdap, and Td vaccines

According to the newest ACIP recommendations, which healthcare workers should be vaccinated against pertussis with Tdap vaccine?

On February 23, 2011, ACIP voted to approve the following recommendations for the use of Tdap in healthcare personnel.

- All healthcare personnel (HCP), regardless of age, should receive a single dose of Tdap as soon as feasible if they have not previously received Tdap and regardless of the time since last Td dose.
- Tdap is not currently licensed for multiple administrations. After receipt of Tdap, HCP should receive routine booster immunization against tetanus and diphtheria according to previously published guidelines.
- Hospitals and ambulatory-care facilities should provide Tdap for HCP and use approaches that maximize vaccination rates (e.g., education about the benefits of vaccination, convenient access, and the provision of Tdap at no charge).

To obtain a copy of the provisional ACIP recommendations that reflect these changes, go to: www.cdc.gov/vaccines/recs/provisional.

Meningococcal vaccines

I've heard the recently updated recommendations for the use of meningococcal conjugate vaccines in adolescents now include a booster dose. Would you please tell me more?

ACIP recommends people age 11 or 12 years be routinely vaccinated with quadrivalent meningococcal conjugate vaccine (MCV4) and receive a booster dose at age 16 years. Adolescents who receive the first dose at age 13 through 15 years should receive a one-time booster dose, preferably at ages 16 through 18 years, which are the years before the peak in incidence of meningococcal disease occurs. Teens who receive their first dose of meningococcal conjugate vaccine at or after age 16 years do not need a booster dose, as long as they have no risk factors.

Can you provide a comprehensive overview of the meningococcal conjugate vaccine recommendations, including those for vaccinating younger children and older adults who have risk factors?

The table on page 16 provides a summary of the

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Immunization questions?

- Call the CDC-INFO Contact Center at (800) 232-4636 or (800) CDC-INFO
- Email nipinfo@cdc.gov
- Call your state health dept. (phone numbers at www.immunize.org/coordinators)

Needle Tips

online at www.immunize.org/nt

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IAC, a 501(c)(3) charitable organization, publishes practical immunization information for health professionals to help increase immunization rates and prevent disease.

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IAC maintains strict editorial independence in its publications.

Read Extensive Coverage of Wakefield's MMR Fraud on IAC's Web Section "Talking about Vaccines"

Brian Deer's recent three-part exposé in the British Medical Journal (BMJ) *is a comprehensive examination of the Wakefield-MMR fraud. Deer, a UK investigative journalist, clearly documents how Wakefield's 1998 MMR study was actually an elaborate fraud.*

www.immunize.org/bmj-deer-mmr-wakefield

To provide one-stop access for healthcare professionals to the *BMJ* series and subsequent media coverage, IAC has created a web page on the series. Titled "The Fraud Behind the MMR Scare," IAC's web page summarizes and links to the series, and also supplies links to accompanying *BMJ* editorials, related print news coverage and commentary, and videos of broadcast media coverage.

The Fraud Behind the MMR scare is part of IAC's Talking about Vaccines web section. It provides healthcare professionals with background information and practical resources that will help them discuss immunization with concerned parents and patients. It includes top vaccination resources from trusted sources such as CDC, AAP, IAC, Vaccine Education Center at the Children's Hospital of Philadelphia, and many more.

The Talking about Vaccines web section is divided into two main parts: (1) Resources for healthcare professionals that help them make a compelling case about the safety of vaccines, the importance of vaccination, and the potentially grave consequences of failure to vaccinate. In addition, it includes practical tips for talking with vaccine-hesitant patients and parents. (2) Specific topics that parents and patients have questions about (e.g., Adjuvants, Autism, MMR, Thimerosal, and Dr. Sears' Alternative Schedule).

For a wealth of information to help you communicate more effectively about vaccines with parents and patients, visit: www.immunize.org/concerns.

We also suggest you subscribe to our weekly email news service, *IAC Express*. Once you complete the sign-up form at www.immunize.org/subscribe, you'll start receiving email announcements about important developments related to immunization.

Handouts For Vaccine-Hesitant Parents from IAC

Evidence Shows Vaccines Unrelated to Autism
www.immunize.org/catg.d/p4028.pdf

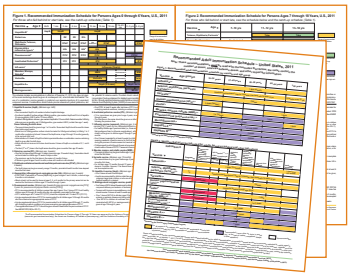
Personal Belief Exemptions for Vaccination Put People at Risk
www.immunize.org/catg.d/p2069.pdf

Need Help Responding to Vaccine-hesitant Parents?
www.immunize.org/catg.d/p2070.pdf

To access the entire collection, go to:
www.immunize.org/handouts/discussing-vaccines-parents.asp

Laminated child and adult immunization schedules
Order one of each for every exam room

Here are the ACIP/AAP/AAFP-approved immunization schedule for people ages 0 through 18 years and the ACIP/AAFP/ACOG/ACP-approved schedule for adults. Both are laminated and washable for heavy-duty use, complete with essential footnotes, and printed in color for easy reading. The cost is $7.50 for each schedule and only $5.50 each for five or more copies.



To order, visit www.immunize.org/shop, or use the order form on page 17.
For 20 or more copies, contact us for discount pricing: admininfo@immunize.org

New DVD! "Immunization Techniques — Best Practices with Infants, Children, and Adults"

The California Department of Public Health, Immunization Branch, updated its award-winning training video, "Immunization Techniques: Best Practices with Infants, Children, and Adults." The 25-minute DVD can be used to train new employees and to refresh the skills of experienced staff on administering injectable, oral, and nasal-spray vaccines to children, teens, and adults. Make sure your healthcare setting has the new 2010 edition!

The cost is $17 each for 1–9 copies; $10.25 each for 10–24 copies; $7 each for 25–49 copies; $5.75 each for 50–99 copies.

To order, visit www.immunize.org/shop, or use the order form on page 17.
For 100 or more copies, contact us for discount pricing: admininfo@immunize.org

For healthcare settings in California, contact your local health department immunization program for a free copy.

Wallet-sized immunization record cards for all ages: For children & teens, for adults, and for a lifetime!

Now you can give any patient a permanent vaccination record card designed specifically for their age group: child & teen, adult, or lifetime. These brightly colored cards are printed on durable rip-, smudge-, and water-proof paper. To view the cards or for more details, go to www.immunize.org/shop and click on the images.

Buy 1 box (250 cards) for $45 (first order of a 250-card box comes with a 30-day, money-back guarantee). Discounts for larger orders: 2 boxes $40 each; 3 boxes $37.50 each; 4 boxes $34.50 each

To order, visit www.immunize.org/shop, or use the order form on page 17.
To receive sample cards, contact us: admininfo@immunize.org

Vaccine Highlights

Recommendations, schedules, and more

Editor's note: The information in Vaccine Highlights is current as of April 20, 2011.

Immunization schedules – U.S.

On Feb. 11, CDC published "Recommended Immunization Schedules for Persons Aged 0 Through 18 Years—U.S., 2011." Issued jointly by ACIP, AAP, and AAFP, it is available at www.cdc.gov/vaccines/recs/schedules/child-schedule.htm. *Needle Tips* includes a reformatted version on pages 6–8.

On Feb. 4, CDC published "Recommended Adult Immunization Schedule—U.S., 2011." Issued jointly by ACIP, AAFP, ACOG, and ACP, it is available at www.cdc.gov/vaccines/recs/schedules/adult-schedule.htm. *Needle Tips* includes a reformatted version on pages 9–11.

IAC has developed laminated 6-page color versions of both immunization schedules, the child and teen as well as the adult. They are available for purchase. For more information visit www.immunize.org/shop/laminated-schedules.asp.

DTaP, Tdap, and Td news

On Jan. 14, CDC published "Updated Recommendations for Use of Tetanus Toxoid, Reduced Diphtheria Toxoid, and Acellular Pertussis (Tdap) Vaccine." The recommendations, which allow expanded use of Tdap vaccine in children ages 7–10 years and in adults age 65 and older, also permit Tdap vaccination regardless of interval since receipt of the last tetanus- or diphtheria-toxoid containing vaccine. To obtain a copy of the recommendations, go to www.cdc.gov/mmwr/pdf/wk/mm6001.pdf and see pages 13–15.

On April 4, CDC issued "ACIP Provisional Recommendations for Health Care Personnel on use of Tetanus Toxoid, Reduced Diphtheria Toxoid and Acellular Pertussis Vaccine (Tdap) and use of Post-exposure Antimicrobial Prophylaxis." The provisional recommendations state that all healthcare personnel (HCP), regardless of age, should receive a single dose of Tdap as soon as feasible if they have not previously received one and regardless of the interval since the last Td dose. After receiving Tdap, HCP should receive routine Td boosters, according to previously published guidelines. In addition, healthcare facilities should provide Tdap for HCP and use approaches that maximize vaccination rates. To obtain a copy of the provisional ACIP recommendations, go to www.cdc.gov/vaccines/recs/provisional.

Also in 2011, the Joint Commission issued a monograph titled *Tdap Vaccination Strategies for Adolescents and Adults, Including Health Care Personnel—Strategies from Research and Practice.* Its goal is to increase Tdap uptake by helping healthcare organizations implement or enhance Tdap vaccination programs for adolescents and adults. To access the monograph, go to www.jointcommission.org/assets/1/6/Tdap_Monograpgh.pdf.

In March, CDC published "Best Practices for Health Care Professionals on the Use of Polymerase Chain Reaction (PCR) for Diagnosing Pertussis." It is a compilation of optimal procedures that can help healthcare professionals avoid common pitfalls that often lead to inaccurate PCR test results. To access the document, go to www.cdc.gov/pertussis/clinical/downloads/diagnosis-pcr-bestpractices.pdf. In addition, two 4-minute videos on how to properly obtain specimens for pertussis testing are available at www.cdc.gov/pertussis/clinical/diagnostic-testing/specimen-collection.html.

On April 4, CDC updated information about the supply of two DTaP-containing vaccines. Sanofi pasteur has discontinued production of Tripedia (DTaP) and TriHIBit (DTaP/Hib): Supplies are expected to last through the first half of 2011. For CDC's continuing vaccine supply information, go to www.cdc.gov/vaccines/vac-gen/shortages.

Meningococcal vaccine news

On Jan. 28, CDC published "Updated Recommendations for Use of Meningococcal Conjugate Vaccines." Changes include (1) routine first-time vaccination of adolescents, preferably at ages 11 or 12 years, followed by a booster dose at age 16 years and (2) a 2-dose primary series administered 2 months apart for people ages 2–55 years with persistent complement component deficiency, or with functional or anatomic asplenia. To obtain a copy of the recommendations, go to www.cdc.gov/mmwr/pdf/wk/mm6003.pdf and see pages 72–76. For additional details, see the editorial on page 1 of this issue. For pertinent Q&As answered by CDC experts and a table summarizing the recommendations, see Ask the Experts in this issue.

On Jan. 28, FDA approved an expanded age indication for use of Menveo meningococcal conjugate vaccine (MCV4; Novartis) to include use in children ages 2–10 years. Previously, Menveo had been approved for use in people ages 11–55 years. To access the package insert, go to www.fda.gov/downloads/BiologicsBloodVaccines/Vaccines/ApprovedProducts/UCM201349.pdf.

No data are available on the interchangeability of Menactra and Menveo MCV4 vaccine products. Whenever feasible, the same brand of vaccine should be used for all doses of the vaccination series. If vaccination providers do not know or have available the type of vaccine product previously administered, any product should be used to continue or complete the series.

Shingles (zoster) vaccine news

On March 24, FDA approved Zostavax vaccine (Merck) for use in adults ages 50 through 59 years. Zostavax received initial FDA approval in 2006 for use in adults age 60 years and older. To access the package insert, go to www.fda.gov/downloads/BiologicsBloodVaccines/Vaccines/ApprovedProducts/UCM132831.pdf.

ACIP General Recs – 2011

On Jan. 28, CDC published "General Recommendations on Immunization." It updates the previous General Recommendations, published in 2006. Revisions include changes made to the table of contraindications and precautions to vaccination, as well as the addition of a separate table of conditions that are commonly misperceived as contraindications and precautions. Information on vaccine storage and handling was also extensively revised. To obtain a copy of the 2011 "General Recom-

(continued on page 5)

mendations on Immunization," go to: www.cdc.gov/mmwr/pdf/rr/rr6002.pdf.

Vaccine safety news

On Feb. 22, the Supreme Court ruled in *Bruesewitz v. Wyeth* that manufacturers of childhood vaccines cannot be sued by individuals who claim they suffered vaccine-related injuries as a result of an alleged "design defect" in the vaccine (i.e., a theory that a manufacturer should have distributed a vaccine designed differently from the one that the child received). To read an *IAC Express* article on the decision, go to www.immunize.org/express/issue917.asp#n1. To read the Supreme Court decision, go to www.supremecourt.gov/opinions/10pdf/09-152.pdf.

In January, the *British Medical Journal (BMJ)* published a three-part series about Dr. Andrew Wakefield's 1998 paper, which fraudulently linked MMR vaccine to the development of autism. Written by investigative journalist Brian Deer, the series received international media attention.

IAC gathered notable media coverage into a web page titled "The Fraud Behind the MMR Scare." It offers website users links to all three parts of the series, accompanying *BMJ* editorials, related print news coverage and commentary, and videos of broadcast media coverage. To access it, go to www.immunize.org/bmj-deer-mmr-wakefield. For more information about the IAC web page on the Wakefield fraud, see page 2 of this issue.

New HHS vaccine information

On March 30, the U.S. Department of Health and Human Services (HHS) announced the launch of a new consumer-focused immunization website—www.vaccines.gov. It is intended to help parents and other consumers learn about immunization and about the most effective way to protect themselves and their children from infectious diseases.

On Feb. 16, HHS released an updated National Vaccine Plan. It addresses issues such as research and development, supply, financing, distribution, safety, global cooperation, and informed decision-making among consumers and healthcare providers. To access the plan, go to www.hhs.gov/nvpo/vacc_plan.

Current VISs and dates

The use of most Vaccine Information Statements (VISs) is mandated by federal law. Listed below are the dates of the most current VISs. Check your stock of VISs against this list. If you have outdated VISs, print current ones from IAC's website at www.immunize.org/vis. You'll find VISs in more than 30 languages.

DTaP/DT/DTP.... 5/17/07	MMR 3/13/08
Hepatitis A 3/21/06	MMRV 5/21/10
Hepatitis B 7/18/07	PCV 4/16/10
Hib 12/16/98	PPSV 10/6/09
HPV (Cervarix)... 3/30/10	Polio 1/1/00
HPV (Gardasil).... 3/30/10	Rabies 10/6/09
Influenza (LAIV)...8/10/10	Rotavirus 12/6/10
Influenza (TIV) 8/10/10	Shingles 10/6/09
Japanese encephalitis	Td/Tdap 11/18/08
Ixiaro.....3/1/10	Typhoid 5/19/04
JE VAX.....3/1/10	Varicella 3/13/08
Meningococcal...1/28/08	Yellow fever 3/30/11

Multi-vaccine VIS 9/18/08
(for 6 vaccines given to infants/children: DTaP, IPV, Hib, HepB, PCV, RV)

Leaders in Medicine and Infectious Disease Have Spoken: Mandatory Influenza Vaccination for All Healthcare Workers Is Imperative

Refer to the position statements of these leading medical organizations to guide you in developing and implementing a mandatory influenza vaccination policy at your healthcare institution or medical setting. Statement titles, URLs, publication dates, and excerpts follow.

American Academy of Pediatrics (AAP)
Policy Statement—Recommendation for Mandatory Influenza Immunization of All Health Care Personnel (October 1, 2010)
http://pediatrics.aappublications.org/cgi/content/abstract/peds.2010-2376v1
"The implementation of mandatory annual influenza immunization programs for HCP nationwide is long overdue. For the prevention and control of influenza, now is the time to put the health and safety of the patient first."

American College of Physicians (ACP)
ACP Policy on Influenza Vaccination of Health Care Workers (October 1, 2010)
www.acponline.org/clinical_information/resources/adult_immunization/flu_hcw.pdf
"Vaccinating HCWs against influenza represents a duty of care, and a standard of quality care, so it should be reasonable that this duty should supersede HCW personal preference."

American Medical Directors Association (AMDA)
Position Statement: Mandatory Immunization for Long Term Care Workers (March 2011)
www.amda.com/governance/resolutions/J11.cfm
"Therefore be it resolved, AMDA - Dedicated to Long Term Care Medicine supports a mandatory annual influenza vaccination for every long-term health care worker who has direct patient contact unless a medical contraindication or religious objection exists."

American Public Health Association (APHA)
APHA Policy Statement: Annual Influenza Vaccination Requirements for Health Workers (April 2011)
www.apha.org/advocacy/policy/policysearch/default.htm?id=1410
"Encourages institutional, employer, and public health policy to require influenza vaccination of all health workers as a precondition of employment and thereafter on an annual basis, unless a medical contraindication recognized in national guidelines is documented in the worker's health record."

Association for Professionals in Infection Control and Epidemiology, Inc. (APIC)
APIC Position Paper: Influenza Vaccination Should Be a Condition of Employment for Healthcare Personnel, Unless Medically Contraindicated (February 1, 2011)
www.apic.org/Content/NavigationMenu/GovernmentAdvocacy/PublicPolicyLibrary/APIC_Influenza_Immunization_of_HCP_12711.PDF
"As a profession that relies on evidence to guide our decisions and actions, we can no longer afford to ignore the compelling evidence that supports requiring influenza vaccine for HCP. This is not only a patient safety imperative, but is a moral and ethical obligation to those who place their trust in our care."

Infectious Diseases Society of America (IDSA)
IDSA Policy on Mandatory Immunization of Health Care Workers Against Seasonal and Pandemic Influenza (rev. July 28, 2010)
www.idsociety.org/redirector.aspx?id=15413
"Physicians and other health care providers must have two special objectives in view when treating patients, namely, 'to do good or to do no harm' (Hippocratic Corpus in Epidemics: Bk. I, Sect. 5, trans. Adams), and have an ethical and moral obligation to prevent transmission of infectious diseases to their patients."

Society for Healthcare Epidemiology of America (SHEA)
Revised (SHEA) Position Paper: Influenza Vaccination of Healthcare Personnel (August 31, 2010) www.journals.uchicago.edu/doi/full/10.1086/656558
"SHEA views influenza vaccination of HCP as a core patient and HCP safety practice with which noncompliance should not be tolerated."

Figure 1. Recommended Immunization Schedule for Persons Ages 0 through 6 Years, U.S., 2011

For those who fall behind or start late, see the catch-up schedule (Table 1).

Vaccine ▼ Age ▶	Birth	1 mo	2 mo	4 mo	6 mo	12 mo	15 mo	18 mo	19–23 mo	2–3 yrs	4–6 yrs
Hepatitis B[1]	HepB	HepB			HepB						
Rotavirus[2]			RV	RV	RV[2]						
Diphtheria, Tetanus, Pertussis[3]			DTaP	DTaP	DTaP	See footnote 3	DTaP				DTaP
Haemophilus influenzae type b[4]			Hib	Hib	Hib[4]	Hib					
Pneumococcal[5]			PCV	PCV	PCV	PCV				PPSV	
Inactivated Poliovirus[6]			IPV	IPV	IPV						IPV
Influenza[7]					Influenza (Yearly)						
Measles, Mumps, Rubella[8]						MMR		See footnote 8			MMR
Varicella[9]						Varicella		See footnote 9			Varicella
Hepatitis A[10]						HepA (2 doses)				HepA Series	
Meningococcal[11]										MCV4	

Range of recommended ages for all children

Range of recommended ages for certain high-risk groups

This schedule includes recommendations in effect as of December 21, 2010. Any dose not given at the recommended age should be given 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. Considerations should include provider assessment, patient preference, and the potential for adverse events. Providers should consult the relevant Advisory Committee on Immunization Practices statement for detailed recommendations: www.cdc.gov/vaccines/pubs/acip-list.htm. Clinically significant adverse events that follow immunization should be reported to the Vaccine Adverse Event Reporting System (VAERS) at www.vaers.hhs.gov or by telephone, 800-822-7967.

1. Hepatitis B vaccine (HepB). *(Minimum age: birth)*

At birth:

- Give monovalent HepB to all newborns before hospital discharge.
- If mother is hepatitis B surface antigen (HBsAg)-positive, give newborn HepB and 0.5 mL of hepatitis B immune globulin (HBIG) within 12 hours of birth.
- If mother's HBsAg status is unknown, give newborn HepB within 12 hours of birth. Determine mother's HBsAg status as soon as possible and, if HBsAg-positive, give newborn HBIG (no later than age 1 week).

Doses following the birth dose:

- The second dose should be given at age 1 or 2 months. Monovalent HepB should be used for doses given before age 6 weeks.
- Infants born to HBsAg-positive mothers should be tested for HBsAg and antibody to HBsAg 1 to 2 months after completion of at least 3 doses of the HepB series, at age 9 through 18 months (generally at the next well-child visit).
- Administration of 4 doses of HepB to infants is permissible when a combination vaccine containing HepB is given after the birth dose.
- Infants who did not receive a birth dose should receive 3 doses of HepB on a schedule of 0, 1, and 6 months.
- The final (3rd or 4th) dose in the HepB series should be given no earlier than age 24 weeks.

2. Rotavirus vaccine (RV). *(Minimum age: 6 weeks)*

- Give the first dose at age 6 through 14 weeks (maximum age: 14 weeks 6 days). Vaccination should not be initiated for infants age 15 weeks 0 days or older.
- The maximum age for the final dose in the series is 8 months 0 days.
- If Rotarix is given at ages 2 and 4 months, a dose at 6 months is not indicated.

3. Diphtheria and tetanus toxoids and acellular pertussis vaccine (DTaP). *(Minimum age: 6 weeks)*

- The fourth dose may be given as early as age 12 months, provided at least 6 months have elapsed since the third dose.

4. *Haemophilus influenzae* type b conjugate vaccine (Hib). *(Minimum age: 6 weeks)*

- If PRP-OMP (PedvaxHIB or Comvax [HepB-Hib]) is given at ages 2 and 4 months, a dose at age 6 months is not indicated.
- Hiberix should not be used for doses at ages 2, 4, or 6 months for the primary series but can be used as the final dose in children ages 12 months through 4 years.

5. Pneumococcal vaccine. *(Minimum age: 6 weeks for pneumococcal conjugate vaccine [PCV]; 2 years for pneumococcal polysaccharide vaccine [PPSV])*

- PCV is recommended for all children younger than age 5 years. Give 1 dose of PCV to all healthy children ages 24 through 59 months who are not completely vaccinated for their age.
- A PCV series begun with 7-valent PCV (PCV7) should be completed with 13-valent PCV (PCV13).
- A single supplemental dose of PCV13 is recommended for all children ages 14 through 59 months who have received an age-appropriate series of PCV7.
- A single supplemental dose of PCV13 is recommended for all children ages 60 through 71 months with underlying medical conditions who have received an age-appropriate series of PCV7.
- The supplemental dose of PCV13 should be given at least 8 weeks after the previous dose of PCV7. See *MMWR* 2010;59(No. RR-11).
- Give PPSV at least 8 weeks after last dose of PCV to children age 2 years or older with certain underlying medical conditions, including a cochlear implant.

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

- If 4 or more doses are given prior to age 4 years, an additional dose should be given at age 4 through 6 years.
- The final dose in the series should be given on or after the fourth birthday and at least 6 months following the previous dose.

7. Influenza vaccine (seasonal). *(Minimum age: 6 months for trivalent inactivated influenza vaccine [TIV]; 2 years for live, attenuated influenza vaccine [LAIV])*

- For healthy children age 2 years and older (i.e., those who do not have underlying medical conditions that predispose them to influenza complications), either LAIV or TIV may be used, except LAIV should not be given to children ages 2 through 4 years who have had wheezing in the past 12 months.
- Give 2 doses (separated by at least 4 weeks) to children ages 6 months through 8 years who are receiving seasonal influenza vaccine for the first time or who were vaccinated for the first time during the previous influenza season but received only 1 dose.
- Children ages 6 months through 8 years who received no doses of monovalent 2009 H1N1 vaccine should receive 2 doses of 2010–11 seasonal influenza vaccine. See *MMWR* 2010;59(RR-8):33–34.

8. Measles, mumps, and rubella vaccine (MMR). *(Minimum age: 12 months)*

- The second dose may be given before age 4 years, provided at least 4 weeks have elapsed since the first dose.

9. Varicella vaccine. *(Minimum age: 12 months)*

- The second dose may be given before age 4 years, provided at least 3 months have elapsed since the first dose.
- For children ages 12 months through 12 years, the recommended minimum interval between doses is 3 months. However, if the second dose was given at least 4 weeks after the first dose, it can be accepted as valid.

10. Hepatitis A vaccine (HepA). *(Minimum age: 12 months)*

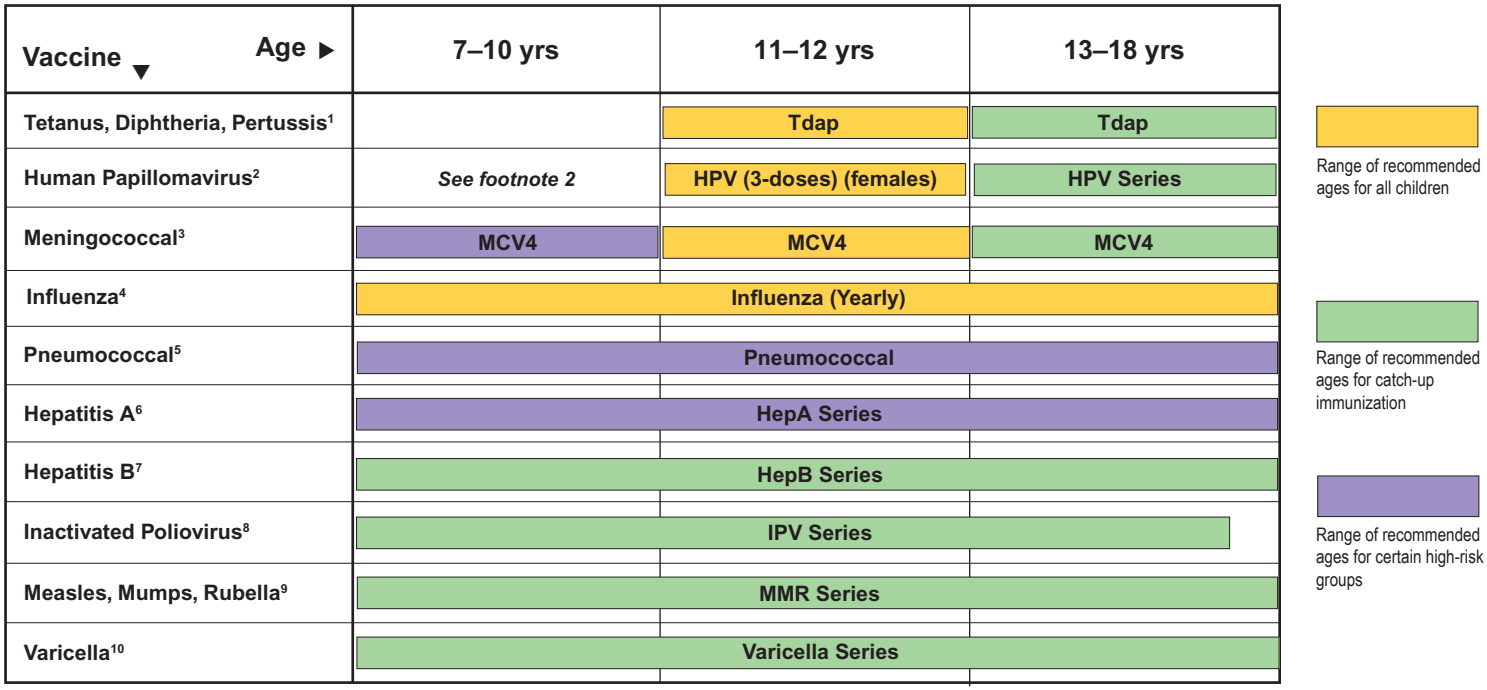
- Give 2 doses at least 6 months apart.
- HepA is recommended for children older than age 23 months who live in areas where vaccination programs target older children, or who are at increased risk for infection, or for whom immunity against hepatitis A is desired.

11. Meningococcal conjugate vaccine, quadrivalent (MCV4). *(Minimum age: 2 years)*

- Give 2 doses of MCV4 at least 8 weeks apart to children ages 2 through 10 years with persistent complement component deficiency and anatomic or functional asplenia, and 1 dose every 5 years thereafter.
- Persons with human immunodeficiency virus (HIV) infection who are vaccinated with MCV4 should receive 2 doses at least 8 weeks apart.
- Give 1 dose of MCV4 to children ages 2 through 10 years who travel to countries with highly endemic or epidemic disease and during outbreaks caused by a vaccine serogroup.
- Give MCV4 to children at continued risk of meningococcal disease who were previously vaccinated with MCV4 or meningococcal polysaccharide vaccine after 3 years if first dose given at age 2 through 6 years.

Figure 2. Recommended Immunization Schedule for Persons Ages 7 through 18 Years, U.S., 2011

For those who fall behind or start late, see the schedule below and the catch-up schedule (Table 1).



This schedule includes recommendations in effect as of December 21, 2010. Any dose not given at the recommended age should be given 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. Considerations should include provider assessment, patient preference, and the potential for adverse events. Providers should consult the relevant Advisory Committee on Immunization Practices statement for detailed recommendations: www.cdc.gov/vaccines/pubs/acip-list.htm. Clinically significant adverse events that follow immunization should be reported to the Vaccine Adverse Event Reporting System (VAERS) at www.vaers.hhs.gov or by telephone, 800-822-7967.

1. Tetanus and diphtheria toxoids and acellular pertussis vaccine (Tdap). *(Minimum age: 10 years for Boostrix and 11 years for Adacel)*

- Persons ages 11 through 18 years who have not received Tdap should receive a dose followed by Td booster doses every 10 years thereafter.
- Persons ages 7 through 10 years who are not fully immunized against pertussis (including those never vaccinated or with unknown pertussis vaccination status) should receive a single dose of Tdap. Refer to the catch-up schedule if additional doses of tetanus and diphtheria toxoid-containing vaccine are needed.
- Tdap can be given regardless of the interval since the last tetanus and diphtheria toxoid-containing vaccine.

2. Human papillomavirus vaccine (HPV). *(Minimum age: 9 years)*

- Quadrivalent HPV vaccine (HPV4) or bivalent HPV vaccine (HPV2) is recommended for the prevention of cervical precancers and cancers in females.
- HPV4 is recommended for prevention of cervical precancers, cancers, and genital warts in females.
- HPV4 may be given in a 3-dose series to males ages 9 through 18 years to reduce their likelihood of acquiring genital warts.
- Give the second dose 1 to 2 months after the first dose and the third dose 6 months after the first dose (at least 24 weeks after the first dose).

3. Meningococcal conjugate vaccine, quadrivalent (MCV4). *(Minimum age: 2 years)*

- Give MCV4 at age 11 through 12 years with a booster dose at age 16 years.
- Give 1 dose at age 13 through 18 years if not previously vaccinated.
- Persons who received their first dose at age 13 through 15 years should receive a booster dose at age 16 through 18 years.
- Give 1 dose to previously unvaccinated college freshmen living in a dormitory.
- Give 2 doses at least 8 weeks apart to children ages 2 through 10 years with persistent complement component deficiency and anatomic or functional asplenia, and 1 dose every 5 years thereafter.
- Persons with HIV infection who are vaccinated with MCV4 should receive 2 doses at least 8 weeks apart.
- Give 1 dose of MCV4 to children ages 2 through 10 years who travel to countries with highly endemic or epidemic disease and during outbreaks caused by a vaccine serogroup.
- Give MCV4 to children at continued risk of meningococcal disease who were previously vaccinated with MCV4 or meningococcal polysaccharide vaccine after 3 years (if first dose given at age 2 through 6 years) or after 5 years (if first dose given at age 7 years or older).

4. Influenza vaccine (seasonal).

- For healthy nonpregnant persons ages 7 through 18 years (i.e., those who do not have underlying medical conditions that predispose them to influenza complications), either LAIV or TIV may be used.
- Give 2 doses (separated by at least 4 weeks) to children ages 6 months through 8 years who are receiving seasonal influenza vaccine for the first time or who were vaccinated for the first time during the previous influenza season but received only 1 dose.
- Children ages 6 months through 8 years who received no doses of monovalent 2009 H1N1 vaccine should receive 2 doses of 2010–11 seasonal influenza vaccine. See *MMWR* 2010;59(RR-8):33-34.

5. Pneumococcal vaccines.

- A single dose of 13-valent pneumococcal conjugate vaccine (PCV13) may be given to children ages 6 through 18 years who have functional or anatomic asplenia, HIV infection or other immunocompromising condition, cochlear implant or CSF leak. See *MMWR* 2010;59(No. RR–11).
- The dose of PCV13 should be given at least 8 weeks after the previous dose of PCV7.
- Give pneumococcal polysaccharide vaccine at least 8 weeks after the last dose of PCV to children age 2 years or older with certain underlying medical conditions, including a cochlear implant. A single revaccination should be given after 5 years to children with functional or anatomic asplenia or an immunocompromising condition.

6. Hepatitis A vaccine (HepA).

- Give 2 doses at least 6 months apart.
- HepA is recommended for children older than age 23 months who live in areas where vaccination programs target older children, or who are at increased risk for infection, or for whom immunity against hepatitis A is desired.

7. Hepatitis B vaccine (HepB).

- Give the 3-dose series to those not previously vaccinated. For those with incomplete vaccination, follow the catch-up schedule (Table 1).
- A 2-dose series (separated by at least 4 months) of adult formulation Recombivax HB is licensed for children ages 11 through 15 years.

8. Inactivated poliovirus vaccine (IPV).

- The final dose in the series should be given on or after the fourth birthday and at least 6 months following the previous dose.
- If both OPV and IPV were given as part of a series, a total of 4 doses should be given, regardless of the child's current age.

9. Measles, mumps, and rubella vaccine (MMR).

- The minimum interval between the 2 doses of MMR is 4 weeks.

10. Varicella vaccine.

- For persons ages 7 through 18 years without evidence of immunity (see *MMWR* 2007;56 [No. RR-4]), give 2 doses if not previously vaccinated or the second dose if only 1 dose has been given.
- For persons ages 7 through 12 years, the minimum interval between doses is 3 months. However, if the second dose was given at least 4 weeks after the first dose, it can be accepted as valid.
- For persons age 13 years and older, the minimum interval between doses is 4 weeks.

Table 1. Catch-up Immunization Schedule for Persons Ages 4 Months through 18 Years Who Start Late or Who Are More Than 1 Month Behind, U. S., 2011

The table below provides catch-up schedules and minimum intervals between doses for children whose vaccinations have been delayed. A vaccine series does not need to be restarted, regardless of the time that has elapsed between doses. Use the section appropriate for the child's age.

Vaccine	Minimum Age for Dose 1	Minimum Interval Between Doses			
		Dose 1 to Dose 2	Dose 2 to Dose 3	Dose 3 to Dose 4	Dose 4 to Dose 5
Catch-up schedule for persons ages 4 months through 6 years					
Hepatitis B[1]	Birth	4 weeks	8 weeks (and at least 16 wks after first dose)		
Rotavirus[2]	6 wks	4 weeks	4 weeks[2]		
Diphtheria, Tetanus, Pertussis[3]	6 wks	4 weeks	4 weeks	6 months	6 months[3]
Haemophilus influenzae type b[4]	6 wks	**4 weeks** if first dose given before age 12 mos **8 weeks (as final dose)** if first dose given at age 12–14 mos **No further doses needed** if first dose given at age 15 mos or older	**4 weeks**[4] if current age is younger than 12 mos **8 weeks (as final dose)**[4] if current age is 12 mos or older and first dose given before age 12 mos and second dose given before age 15 mos **No further doses needed** if previous dose given at age 15 mos or older	**8 weeks (as final dose)** This dose only necessary for children ages 12 mos through 59 mos who received 3 doses before age 12 mos	
Pneumococcal[5]	6 wks	**4 weeks** if first dose given before age 12 mos **8 weeks (as final dose for healthy children)** if first dose given at age 12 mos or older or current age is 24 through 59 mos **No further doses needed** for healthy children if first dose given at age 24 mos or older	**4 weeks** if current age is younger than 12 mos **8 weeks (as final dose for healthy children)** if current age is 12 mos or older **No further doses needed** for healthy children if previous dose given at age 24 mos or older	**8 weeks (as final dose)** This dose only necessary for children ages 12 mos through 59 mos who received 3 doses before age 12 mos or for high-risk children who received 3 doses at any age	
Inactivated Poliovirus[6]	6 wks	4 weeks	4 weeks	6 months[6]	
Measles, Mumps, Rubella[7]	12 mos	4 weeks			
Varicella[8]	12 mos	3 months			
Hepatitis A[9]	12 mos	6 months			
Catch-up schedule for persons ages 7 through 18 years					
Tetanus, Diphtheria/ Tetanus, Diphtheria, Pertussis[10]	7 yrs[10]	4 weeks	**4 weeks** if first dose given before age 12 mos **6 months** if first dose given at age 12 mos or older	**6 months** if first dose given before age 12 mos	
Human Papillomavirus[11]	9 yrs	Routine dosing intervals are recommended (females)[11]			
Hepatitis A[9]	12 mos	6 months			
Hepatitis B[1]	Birth	4 weeks	8 weeks (and at least 16 wks after first dose)		
Inactivated Poliovirus[6]	6 wks	4 weeks	4 weeks[6]	6 months[6]	
Measles, Mumps, Rubella[7]	12 mos	4 weeks			
Varicella[8]	12 mos	**3 months** if person is younger than age 13 yrs **4 weeks** if person is age 13 yrs or older			

1. Hepatitis B vaccine (HepB).
- Give the 3-dose series to those not previously vaccinated.
- The minimum age for the third dose of HepB is 24 weeks.
- A 2-dose series (separated by at least 4 months) of adult formulation Recombivax HB is licensed for children ages 11 through 15 years.

2. Rotavirus vaccine (RV).
- The maximum age for the first dose is 14 weeks 6 days. Vaccination should not be initiated for infants age 15 weeks 0 days or older.
- The maximum age for the final dose in the series is 8 months 0 days.
- If Rotarix was given for the first and second doses, a third dose is not indicated.

3. Diphtheria and tetanus toxoids and acellular pertussis vaccine (DTaP).
- The fifth dose is not necessary if the fourth dose was given at age 4 years or older.

4. *Haemophilus influenzae* type b conjugate vaccine (Hib).
- 1 dose of Hib vaccine should be considered for unvaccinated persons age 5 years or older who have sickle cell disease, leukemia, or HIV infection, or who have had a splenectomy.
- If the first 2 doses were PRP-OMP (PedvaxHIB or Comvax), and given at age 11 months or younger, the third (and final) dose should be given at age 12 through 15 months and at least 8 weeks after the second dose.
- If the first dose was given at age 7 through 11 months, give the second dose at least 4 weeks later and a final dose at age 12 through 15 months.

5. Pneumococcal vaccine.
- Give 1 dose of 13-valent pneumococcal conjugate vaccine (PCV13) to all healthy children ages 24 through 59 months with any incomplete PCV schedule (PCV7 or PCV13).
- For children ages 24 through 71 months with underlying medical conditions, give 1 dose of PCV13 if 3 doses of PCV were received previously or give 2 doses of PCV13 at least 8 weeks apart if fewer than 3 doses of PCV were received previously.
- A single dose of PCV13 is recommended for certain children with underlying medical conditions through age 18 years. See age-specific schedules for details.
- Give pneumococcal polysaccharide vaccine (PPSV) to children age 2 years or older with certain underlying medical conditions, including a cochlear implant, at least 8 weeks after the last dose of PCV. A single revaccination should be given after 5 years to children with functional or anatomic asplenia or an immunocompromising condition. See *MMWR* 2010:59(No. RR-11).

6. Inactivated poliovirus vaccine (IPV).
- The final dose in the series should be given on or after the fourth birthday and at least 6 months following the previous dose.
- A fourth dose is not necessary if the third dose was given at age 4 years or older and at least 6 months following the previous dose.
- In the first 6 months of life, minimum age and minimum intervals are only recommended if the person is at risk for imminent exposure to circulating poliovirus (i.e., travel to a polio-endemic region or during an outbreak).

7. Measles, mumps, and rubella vaccine (MMR).
- Give the second dose routinely at age 4 through 6 years. The minimum interval between the 2 doses of MMR is 4 weeks.

8. Varicella vaccine.
- Give the second dose routinely at age 4 through 6 years.
- If the second dose was given at least 4 weeks after the first dose, it can be accepted as valid.

9. Hepatitis A vaccine (HepA).
- HepA is recommended for children older than age 23 months who live in areas where vaccination programs target older children, or who are at increased risk for infection, or for whom immunity against hepatitis A is desired.

10. Tetanus and diphtheria toxoids (Td) and tetanus and diphtheria toxoids and acellular pertussis vaccine (Tdap).
- Doses of DTaP are counted as part of the Td/Tdap series.
- Tdap should be substituted for a single dose of Td in the catch-up series for children ages 7 through 10 years or as a booster for children ages 11 through 18 years; use Td for other doses.

11. Human papillomavirus vaccine (HPV).
- Give the series to females at age 13 through 18 years if not previously vaccinated or have not completed the vaccine series.
- Quadrivalent HPV vaccine (HPV4) may be given in a 3-dose series to males ages 9 through 18 years to reduce their likelihood of acquiring genital warts.
- Use recommended routine dosing intervals for series catch-up (i.e., the second and third doses should be given at 1-to-2 and 6 months after the first dose). The minimum interval between the first and second doses is 4 weeks. The minimum interval between the second and third doses is 12 weeks, and the third dose should be given at least 24 weeks after the first dose.

Recommended Adult Immunization Schedule – United States, 2011

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

Figure 1. Recommended adult immunization schedule, by vaccine and age group

Vaccine ▼ / Age group ▶	19–26 years	27–49 years	50–59 years	60–64 years	≥65 years
Influenza[1,*]	1 dose annually				
Tetanus, diphtheria, pertussis (Td/Tdap)[2,*]	Substitute one-time dose of Tdap for Td booster; then boost with Td every 10 yrs				Td booster every 10 yrs
Varicella[3,*]	2 doses				
Human papillomavirus (HPV)[4,*]	3 doses (females)				
Zoster[5]				1 dose	
Measles, mumps, rubella (MMR)[6,*]	1 or 2 doses		1 dose		
Pneumococcal (polysaccharide)[7,8]	1 or 2 doses				1 dose
Meningococcal[9,*]	1 or more doses				
Hepatitis A[10,*]	2 doses				
Hepatitis B[11,*]	3 doses				

*Covered by the Vaccine Injury Compensation Program.

Figure 2. Vaccines that might be indicated for adults, based on medical and other indications

Vaccine ▼ / Indication ▶	Pregnancy	Immunocompromising conditions (excluding human immunodeficiency virus [HIV])[3,5,6,13]	HIV infection[3,6,12,13] CD4+ T lymphocyte count <200 cells/μL	HIV infection[3,6,12,13] CD4+ T lymphocyte count ≥200 cells/μL	Diabetes, heart disease, chronic lung disease, chronic alcoholism	Asplenia[12] (including elective splenectomy and persistent complement component deficiencies)	Chronic liver disease	Kidney failure, end-stage renal disease, receipt of hemodialysis	Healthcare personnel
Influenza[1,*]	1 dose TIV annually								1 dose TIV or LAIV annually
Tetanus, diphtheria, pertussis (Td/Tdap)[2,*]	Td	Substitute one-time dose of Tdap for Td booster; then boost with Td every 10 yrs							
Varicella[3,*]	Contraindicated			2 doses					
Human papillomavirus (HPV)[4,*]		3 doses for females through age 26 yrs							
Zoster[5]	Contraindicated				1 dose				
Measles, mumps, rubella (MMR)[6,*]	Contraindicated			1 or 2 doses					
Pneumococcal (polysaccharide)[7,8]		1 or 2 doses							
Meningococcal[9,*]	1 or more doses								
Hepatitis A[10,*]	2 doses								
Hepatitis B[11,*]	3 doses								

*Covered by the Vaccine Injury Compensation Program.

For all persons in this category who meet the age requirements and who lack evidence of immunity (e.g., lack documentation of vaccination or have no evidence of previous infection)

Recommended if some other risk factor is present (e.g., on the basis of medical, occupational, lifestyle, or other indications)

No recommendation

These schedules indicate the recommended age groups and medical indications for which administration of currently licensed vaccines is commonly indicated for adults ages 19 years and older, as of January 1, 2011. For all vaccines being recommended on the adult immunization schedule: a vaccine series does not need to be restarted, regardless of the time that has elapsed between doses. Licensed combination vaccines may be used whenever any components of the combination are indicated and when the vaccine's other components are not contraindicated. For detailed recommendations on all vaccines, including those used primarily for travelers or that are issued during the year, consult the manufacturers' package inserts and the complete statements from the Advisory Committee on Immunization Practices (www.cdc.gov/vaccines/pubs/acip-list.htm).

Footnotes

For complete statements by the Advisory Committee on Immunization Practices (ACIP), visit www.cdc.gov/vaccines/pubs/acip-list.htm

1. Influenza vaccination. Annual vaccination against influenza is recommended for all persons age 6 months and older, including all adults. Healthy, nonpregnant adults younger than age 50 years without high-risk medical conditions can receive either intranasally administered live, attenuated influenza vaccine (FluMist) or inactivated vaccine. Other persons should receive the inactivated vaccine. Adults age 65 years and older can receive the standard influenza vaccine or the high-dose (Fluzone) influenza vaccine. Additional information on influenza vaccination is available at www.cdc.gov/vaccines/vpd-vac/flu/default.htm.

2. Tetanus, diphtheria, and acellular pertussis (Td/Tdap) vaccination. Give a one-time dose of Tdap to adults younger than age 65 years who have not received Tdap previously or for whom vaccine status is unknown to replace one of the 10-year Td boosters, and as soon as feasible to all 1) postpartum women, 2) close contacts of infants younger than age 12 months (e.g., grandparents, child-care providers), and 3) healthcare personnel with direct patient contact. Adults age 65 years and older who have not previously received Tdap and who have close contact with an infant younger than age 12 months also should be vaccinated. Other adults age 65 years and older may receive Tdap. Tdap can be given regardless of interval since the most recent tetanus or diphtheria-containing vaccine.

Adults with uncertain or incomplete history of completing a 3-dose primary vaccination series with Td-containing vaccines should begin or complete a primary vaccination series. For unvaccinated adults, give the first 2 doses at least 4 weeks apart and the third dose 6–12 months after the second. If incompletely vaccinated (i.e., less than 3 doses), give remaining doses. Substitute a one-time dose of Tdap for one of the doses of Td, either in the primary series or for the routine booster, whichever comes first.

If a woman is pregnant and received the most recent Td vaccination 10 or more years previously, give Td during the second or third trimester. If the woman received the most recent Td vaccination less than 10 years previously, give Tdap during the immediate postpartum period. At the clinician's discretion, Td may be deferred during pregnancy and Tdap substituted in the immediate postpartum period, or Tdap may be given instead of Td to a pregnant woman after an informed discussion with the woman.

The ACIP statement for recommendations for giving Td as prophylaxis in wound management is available at www.cdc.gov/vaccines/pubs/acip-list.htm.

3. Varicella vaccination. All adults without evidence of immunity to varicella should receive 2 doses of single-antigen varicella vaccine if not previously vaccinated or a 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., healthcare 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).

Evidence of immunity to varicella in adults includes any of the following: 1) documentation of 2 doses of varicella vaccine at least 4 weeks apart; 2) U.S.-born before 1980 (although for healthcare 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 healthcare provider (for a patient reporting a history of or having an atypical case, a mild case, or both, healthcare 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 healthcare 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 healthcare facility. The second dose should be given 4–8 weeks after the first dose.

4. Human papillomavirus (HPV) vaccination. HPV vaccination with either quadrivalent (HPV4) vaccine or bivalent vaccine (HPV2) is recommended for females at age 11 or 12 years and catch-up vaccination for females ages 13 through 26 years. Ideally, vaccine should be given before potential exposure to HPV through sexual activity; however, females who are sexually active should still be vaccinated consistent with age-based recommendations. Sexually active females who have not been infected with any of the four HPV vaccine types (types 6, 11, 16, and 18, all of which HPV4 prevents) or any of the two HPV vaccine types (types 16 and 18, both of which HPV2 prevents) receive the full benefit of the vaccination. Vaccination is less beneficial for females who have already been infected with one or more of the HPV vaccine types. HPV4 or HPV2 can be given to persons with a history of genital warts, abnormal Papanicolaou test, or positive HPV DNA test, because these conditions are not evidence of previous infection with all vaccine HPV types.

HPV4 may be given to males ages 9 through 26 years to reduce their likelihood of genital warts. HPV4 would be most effective when given before exposure to HPV through sexual contact.

A complete series for either HPV4 or HPV2 consists of 3 doses. The second dose should be given 1 to 2 months after the first dose; the third dose should be given 6 months after the first dose.

Although HPV vaccination is not specifically recommended for persons with the medical indications described in Figure 2, "Vaccines that might be indicated for adults, based on medical and other indications," it may be given to these persons because the HPV vaccine is not a live-virus vaccine. However, the immune response and vaccine efficacy might be less for persons with the medical indications described in Figure 2 than in persons who do not have the medical indications described or who are immunocompetent.

5. Herpes zoster vaccination. A single dose of zoster vaccine is recommended for adults age 60 years and older regardless of whether they report a previous episode of herpes zoster. Persons with chronic medical conditions may be vaccinated unless their condition constitutes a contraindication.

6. Measles, mumps, rubella (MMR) vaccination. Adults born before 1957 generally are considered immune to measles and mumps. All adults born in 1957 or later should have documentation of 1 or more doses of MMR vaccine unless they have a medical contraindication to the vaccine, laboratory evidence of immunity to each of the three diseases, or documentation of provider-diagnosed measles or mumps disease. For rubella, documentation of provider-diagnosed disease is not considered acceptable evidence of immunity.

Measles component: A second dose of MMR vaccine, given a minimum of 28 days after the first dose, is recommended for adults who 1) have been recently exposed to measles or are in an outbreak setting; 2) are students in postsecondary educational institutions; 3) work in a healthcare facility; or 4) plan to travel internationally. Persons who received inactivated (killed) measles vaccine or measles vaccine of unknown type from 1963 to 1967 should be revaccinated with 2 doses of MMR vaccine.

Mumps component: A second dose of MMR vaccine, given a minimum of 28 days after the first dose, is recommended for adults who 1) live in a community experiencing a mumps outbreak and are in an affected age group; 2) are students in postsecondary educational institutions; 3) work in a healthcare facility; or 4) plan to travel internationally. Persons vaccinated before 1979 with either killed mumps vaccine or mumps vaccine of unknown type who are at high risk for mumps infection (e.g., persons who are working in a healthcare facility) should be revaccinated with 2 doses of MMR vaccine.

Rubella component: For women of childbearing age, regardless of birth year, rubella immunity should be determined. If there is no evidence of immunity, women who are not pregnant should be vaccinated. Pregnant women who do not have evidence of immunity should receive MMR vaccine upon completion or termination of pregnancy and before discharge from the healthcare facility.

Healthcare personnel born before 1957: For unvaccinated healthcare personnel born before 1957 who lack laboratory evidence of measles, mumps, and/or rubella immunity or laboratory confirmation of disease, healthcare facilities should 1) consider routinely vaccinating personnel with 2 doses of MMR vaccine at the appropriate interval (for measles and mumps) and 1 dose of MMR vaccine (for rubella), and 2) recommend 2 doses of MMR vaccine at the appropriate interval during an outbreak of measles or mumps, and 1 dose during an outbreak of rubella. Complete information about evidence of immunity is available at www.cdc.gov/vaccines/recs/provisional/default.htm.

(continued)

Footnotes (continued)

7. Pneumococcal polysaccharide (PPSV) vaccination. Vaccinate all persons with the following indications:

Medical: Chronic lung disease (including asthma); chronic cardiovascular diseases; diabetes mellitus; chronic liver diseases, cirrhosis; chronic alcoholism; functional or anatomic asplenia (e.g., sickle cell disease or splenectomy [if elective splenectomy is planned, vaccinate at least 2 weeks before surgery]); immunocompromising conditions (including chronic renal failure or nephrotic syndrome); and cochlear implants and cerebrospinal fluid leaks. Vaccinate as close to HIV diagnosis as possible.

Other: Residents of nursing homes or long-term care facilities and persons who smoke cigarettes. Routine use of PPSV is not recommended for American Indians/Alaska Natives or persons younger than age 65 years unless they have underlying medical conditions that are PPSV indications. However, public health authorities may consider recommending PPSV for American Indians/Alaska Natives and persons ages 50 through 64 years who are living in areas in which the risk for invasive pneumococcal disease is increased.

8. Revaccination with PPSV. One-time revaccination after 5 years is recommended for persons ages 19 through 64 years with chronic renal failure or nephrotic syndrome; functional or anatomic asplenia (e.g., sickle cell disease or splenectomy); and for persons with immunocompromising conditions. For persons age 65 years and older, one-time revaccination is recommended if they were vaccinated 5 or more years previously and were younger than age 65 years at the time of primary vaccination.

9. Meningococcal vaccination. Meningococcal vaccine should be given to persons with the following indications:

Medical: A 2-dose series of meningococcal conjugate vaccine is recommended for adults with anatomic or functional asplenia, or persistent complement component deficiencies. Adults with HIV infection who are vaccinated should also receive a routine 2-dose series. The 2 doses should be given at 0 and 2 months.

Other: A single dose of meningococcal vaccine is recommended for unvaccinated first-year college students living in dormitories; microbiologists routinely exposed to isolates of *Neisseria meningitidis;* military recruits; and persons who travel to or live in countries in which meningococcal disease is hyperendemic or epidemic (e.g., the "meningitis belt" of sub-Saharan Africa during the dry season [December through June]), particularly if their contact with local populations will be prolonged. Vaccination is required by the government of Saudi Arabia for all travelers to Mecca during the annual Hajj.

Meningococcal conjugate vaccine, quadrivalent (MCV4) is preferred for adults with any of the preceding indications who are age 55 years and younger; meningococcal polysaccharide vaccine (MPSV4) is preferred for adults age 56 years and older. Revaccination with MCV4 every 5 years is recommended for adults previously vaccinated with MCV4 or MPSV4 who remain at increased risk for infection (e.g., adults with anatomic or functional asplenia, or persistent complement component deficiencies).

10. Hepatitis A vaccination. Vaccinate persons with any of the following indications and any person seeking protection from hepatitis A virus (HAV) infection:

Behavioral: Men who have sex with men and persons who use injection drugs.

Occupational: Persons working with HAV-infected primates or with HAV in a research laboratory setting.

Medical: Persons with chronic liver disease and persons who receive clotting factor concentrates.

Other: Persons traveling to or working in countries that have high or intermediate endemicity of hepatitis A (a list of countries is available at wwwn.cdc.gov/travel/contentdiseases.aspx).

Unvaccinated persons who anticipate close personal contact (e.g., household or regular babysitting) with an international adoptee during the first 60 days after arrival of the adoptee in the United States from a country of high or intermediate endemicity should be vaccinated. The first dose of the 2-dose hepatitis A vaccine series should be given as soon as adoption is planned, ideally 2 or more weeks before the arrival of the adoptee.

Single-antigen vaccine formulations should be given in a 2-dose schedule at either 0 and 6–12 months (Havrix), or 0 and 6–18 months (Vaqta). If the combined hepatitis A and hepatitis B vaccine (Twinrix) is used, give 3 doses at 0, 1, and 6 months; alternatively, a 4-dose Twinrix schedule may be used, given on days 0, 7, and 21 to 30, followed by a booster dose at month 12.

11. Hepatitis B vaccination. Vaccinate persons with any of the following indications and any person seeking protection from hepatitis B virus (HBV) infection:

Behavioral: Sexually active persons who are not in a long-term, mutually monogamous relationship (e.g., persons with more than one sex partner during the previous 6 months); persons seeking evaluation or treatment for a sexually transmitted disease (STD); current or recent injection-drug users; and men who have sex with men.

Occupational: Healthcare personnel and public-safety workers who are exposed to blood or other potentially infectious body fluids.

Medical: Persons with end-stage renal disease, including patients receiving hemodialysis; persons with HIV infection; and persons with chronic liver disease.

Other: Household contacts and sex partners of persons with chronic HBV infection; clients and staff members of institutions for persons with developmental disabilities; and international travelers to countries with high or intermediate prevalence of chronic HBV infection (a list of countries is available at wwwn.cdc.gov/travel/contentdiseases.aspx).

Hepatitis B vaccination is recommended for all adults in the following settings: STD treatment facilities; HIV testing and treatment facilities; facilities providing drug-abuse treatment and prevention services; healthcare settings targeting services to injection-drug users or men who have sex with men; correctional facilities; end-stage renal disease programs and facilities for chronic hemodialysis patients; and institutions and nonresidential day-care facilities for persons with developmental disabilities.

Give missing doses to complete a 3-dose series of hepatitis B vaccine to those persons not vaccinated or not completely vaccinated. The second dose should be given 1 month after the first dose; the third dose should be given at least 2 months after the second dose (and at least 4 months after the first dose). If the combined hepatitis A and hepatitis B vaccine (Twinrix) is used, give 3 doses at 0, 1, and 6 months; alternatively, a 4-dose Twinrix schedule, given on days 0, 7, and 21 to 30, followed by a booster dose at month 12 may be used.

Adult patients receiving hemodialysis or with other immunocompromising conditions should receive 1 dose of 40 μg/mL (Recombivax HB) given on a 3-dose schedule or 2 doses of 20 μg/mL (Engerix-B) given simultaneously on a 4-dose schedule at 0, 1, 2, and 6 months.

12. Selected conditions for which *Haemophilus influenzae* type b (Hib) vaccine may be used. 1 dose of Hib vaccine should be considered for persons who have sickle cell disease, leukemia, or HIV infection, or who have had a splenectomy, if they have not previously received Hib vaccine.

13. Immunocompromising conditions. Inactivated vaccines generally are acceptable (e.g., pneumococcal, meningococcal, influenza [inactivated influenza vaccine]) and live vaccines generally are avoided in persons with immune deficiencies or immunocompromising conditions. Information on specific conditions is available at www.cdc.gov/vaccines/pubs/acip-list.htm.

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

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

Additional information about the vaccines in this schedule, extent of available data, and contraindications for vaccination also is available at www.cdc.gov/vaccines or from the CDC-INFO Contact Center at 800-CDC-INFO (800-232-4636) in English and Spanish, 24 hours a day, 7 days a week.

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

Guide to Contraindications and Precautions for Vaccines

Consider these contraindications and precautions before administering vaccine to patients of any age

Guide to Contraindications and Precautions[1] to Commonly Used Vaccines* (Page 1 of 2)

Vaccine	Contraindications	Precautions[1]
Hepatitis B (HepB)	• Severe allergic reaction (e.g., anaphylaxis) after a previous dose or to a vaccine component	• Moderate or severe acute illness with or without fever • Infant weighing less than 2000 grams (4 lbs, 6.4 oz)[2]
Rotavirus (RV5 [RotaTeq], RV1 [Rotarix])	• Severe allergic reaction (e.g., anaphylaxis) after a previous dose or to a vaccine component • Severe combined immunodeficiency (SCID)	• Moderate or severe acute illness with or without fever • Altered immunocompetence other than SCID • History of intussusception • Chronic gastrointestinal disease[3] • Spina bifida or bladder exstrophy[3]
Diphtheria, tetanus, pertussis (DTaP) **Tetanus, diphtheria, pertussis (Tdap)**	• Severe allergic reaction (e.g., anaphylaxis) after a previous dose or to a vaccine component • Encephalopathy (e.g., coma, decreased level of consciousness, prolonged seizures) not attributable to another identifiable cause within 7 days of administration of previous dose of DTP or DTaP (for DTaP); or of previous dose of DTP, DTaP, or Tdap (for Tdap)	• Moderate or severe acute illness with or without fever • Guillain-Barré syndrome (GBS) within 6 weeks after a previous dose of tetanus toxoid-containing vaccine • History of arthus-type hypersensitivity reactions after a previous dose of tetanus toxoid-containing vaccine; defer vaccination until at least 10 years have elapsed since the last tetanus-toxoid containing vaccine • Progressive or unstable neurologic disorder (including infantile spasms for DTaP), uncontrolled seizures, or progressive encephalopathy: defer vaccination with DTaP or Tdap until a treatment regimen has been established and the condition has stabilized **For DTaP only:** • Temperature of 105° F or higher (40.5° C or higher) within 48 hours after vaccination with a previous dose of DTP/DTaP • Collapse or shock-like state (i.e., hypotonic hyporesponsive episode) within 48 hours after receiving a previous dose of DTP/DTaP • Seizure within 3 days after receiving a previous dose of DTP/DTaP • Persistent, inconsolable crying lasting 3 or more hours within 48 hours after receiving a previous dose of DTP/DTaP
Tetanus, diphtheria (DT, Td)	• Severe allergic reaction (e.g., anaphylaxis) after a previous dose or to a vaccine component	• Moderate or severe acute illness with or without fever • GBS within 6 weeks after a previous dose of tetanus toxoid-containing vaccine • History of arthus-type hypersensitivity reactions after a previous dose of tetanus toxoid-containing vaccine; defer vaccination until at least 10 years have elapsed since the last tetanus-toxoid containing vaccine
***Haemophilus influenzae* type b (Hib)**	• Severe allergic reaction (e.g., anaphylaxis) after a previous dose or to a vaccine component • Age younger than 6 weeks	• Moderate or severe acute illness with or without fever
Inactivated poliovirus vaccine (IPV)	• Severe allergic reaction (e.g., anaphylaxis) after a previous dose or to a vaccine component	• Moderate or severe acute illness with or without fever • Pregnancy
Pneumococcal (PCV or PPSV)	• For PCV13, severe allergic reaction (e.g., anaphylaxis) after a previous dose (of PCV7, PCV13, or any diphtheria toxoid-containing vaccine) or to a vaccine component (of PCV7, PCV13, or any diphtheria toxoid-containing vaccine) • For PPSV, severe allergic reaction (e.g., anaphylaxis) after a previous dose or to a vaccine component	• Moderate or severe acute illness with or without fever
Measles, mumps, rubella (MMR)[4]	• Severe allergic reaction (e.g., anaphylaxis) after a previous dose or to a vaccine component • Pregnancy • Known severe immunodeficiency (e.g., from hematologic and solid tumors; receiving chemotherapy; congenital immunodeficiency; or long-term immunosuppressive therapy[5]; or patients with HIV infection who are severely immunocompromised)[6]	• Moderate or severe acute illness with or without fever • Recent (within 11 months) receipt of antibody-containing blood product (specific interval depends on product)[7] • History of thrombocytopenia or thrombocytopenic purpura • Need for tuberculin skin testing[8]

Technical content reviewed by the Centers for Disease Control and Prevention, February 2011. www.immunize.org/catg.d/p3072a.pdf • Item #P3072a (2/11)

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...utions[1] to Commonly Used Vaccines* (continued) (Page 2 of 2)

	Precautions[1]
...e.g., anaphylaxis) after a previous dose or ... ...ficiency (e.g., from hematologic and solid ...therapy, congenital immunodeficiency, or ...ssive therapy[5] or patients with HIV infection ...ocompromised)[6]	• Moderate or severe acute illness with or without fever • Recent (within 11 months) receipt of antibody-containing blood product (specific interval depends on product)[7] • Receipt of specific antivirals (i.e., acyclovir, famciclovir, or valacyclovir) 24 hours before vaccination, if possible; delay resumption of these antiviral drugs for 14 days after vaccination.
...e.g., anaphylaxis) after a previous ...ponent	• Moderate or severe acute illness with or without fever • Pregnancy
...e.g., anaphylaxis) after a previous dose or ...including egg protein	• Moderate or severe acute illness with or without fever • History of GBS within 6 weeks of previous influenza vaccine
...e.g., anaphylaxis) after a previous dose or ...including egg protein ... disease in a child age 2 through 4 years ...wheezing or a recent wheezing episode) ...conditions[9]	• Moderate or severe acute illness with or without fever • History of GBS within 6 weeks of previous influenza vaccine • Receipt of specific antivirals (i.e., amantadine, rimantadine, zanamivir, or oseltamivir) 48 hours before vaccination. Avoid use of these antiviral drugs for 14 days after vaccination.
...e.g., anaphylaxis) after a previous dose or ...	• Moderate or severe acute illness with or without fever • Pregnancy
...e.g., anaphylaxis) after a previous dose or ...	• Moderate or severe acute illness with or without fever
...e.g., anaphylaxis) after a previous dose or ... ...of cellular immunity	• Moderate or severe acute illness with or without fever • Receipt of specific antivirals (i.e., acyclovir, famciclovir, or valacyclovir) 24 hours before vaccination, if possible; delay resumption of these antiviral drugs for 14 days after vaccination.

...carefully. Benefits of and ...se circumstances should ...igh the benefit, the vac- ...believed to outweigh the ...administer DTaP to chil- ...should be decided on a ...

...ants and infants weigh- ...patitis B surface antigen ...tion can commence at ...nts born to women who ... are HBsAg-positive, hepatitis B immunoglobulin and hepatitis B vaccine should be administered within 12 hours of birth, regardless of weight.

3. For details, see CDC. "Prevention of Rotavirus Gastroenteritis among Infants and Children: Recommendations of the Advisory Committee on Immunization Practices. (ACIP)" *MMWR* 2009;58(No. RR–2) at www.cdc.gov/vaccines/pubs/acip-list.htm.
4. LAIV, MMR, and varicella vaccines can be administered on the same day. If not administered on the same day, these vaccines should be separated by at least 28 days.
5. Substantially immunosuppressive steroid dose is considered to be 2 weeks or more of daily receipt of 20 mg (or 2 mg/kg body weight) of prednisone or equivalent.
6. HIV-infected children may receive varicella and measles vaccine if CD4+ T-lymphocyte count is >15%. (Source: Adapted from American Academy of Pediatrics. Passive Immunization. In: Pickering LK, ed. *Red Book: 2009 Report of the Committee on Infectious Diseases*. 28th ed. Elk Grove Village, IL: American Academy of Pediatrics: 2009.)
7. Vaccine should be deferred for the appropriate interval if replacement immune globulin products are being administered (see Table 5 in CDC. "General Recommendations on Immunization: Recommendations of the Advisory Committee on Immunization Practices (ACIP)" at www.cdc.gov/vaccines/pubs/acip-list.htm.)
8. Measles vaccination might suppress tuberculin reactivity temporarily. Measles-containing vaccine can be administered on the same day as tuberculin skin testing. If testing cannot be performed until after the day of MMR vaccination, the test should be postponed for at least 4 weeks after the vaccination. If an urgent need exists to skin test, do so with the understanding that reactivity might be reduced by the vaccine.
9. For details, see CDC. "Prevention and Control of Influenza: Recommendations of the Advisory Committee on Immunization Practices (ACIP), 2010" at www.cdc.gov/vaccines/pubs/acip-list.htm.

*Adapted from "Table 6. Contraindications and Precautions to Commonly Used Vaccines" found in: CDC. "General Recommendations on Immunization: Recommendations of the Advisory Committee on Immunization Practices (ACIP)." *MMWR* 2011; 60(No. RR-2), p. 40–41.

For a ready-to-copy 8½" x 11" version of this 2-page piece, visit www.immunize.org/catg.d/p3072a.pdf

Vaccines with Diluents: How to Use Them

The following vaccines must be reconstituted correctly before they are administered. Reconstitution means that the lyophilized (freeze-dried) vaccine powder or wafer in one vial must be reconstituted (mixed) with the diluent (liquid) in another. Only use the diluent provided by the manufacturer for that vaccine as indicated on the chart. ALWAYS check the expiration date on the diluent and vaccine. NEVER use expired diluent or vaccine.

Vaccine product name	Manufacturer	Lyophilized vaccine (powder)	Liquid diluent (may contain vaccine)	Time allowed between reconstitution and use*	Diluent storage environment
ActHIB (Hib)	sanofi pasteur	ActHIB	0.4% sodium chloride	24 hrs	Refrigerator
Hiberix (Hib)	GlaxoSmithKline	Hib	0.9% sodium chloride	24 hrs	Refrigerator or room temp
Imovax (RAB_{HDCV})	sanofi pasteur	Imovax	Sterile water	Immediately	Refrigerator
JE-VAX	sanofi pasteur	JE-VAX	Sterile water	8 hrs	Refrigerator
M-M-R II (MMR)	Merck	MMR	Sterile water	8 hrs	Refrigerator or room temp
Menomune (MPSV4)	sanofi pasteur	MPSV4	Distilled water	30 min (single-dose vial) 35 days (multi-dose vial)	Refrigerator
Menveo (MCV4)	Novartis	MenA	MenCWY	8 hrs	Refrigerator
Pentacel (DTaP-IPV/Hib)	sanofi pasteur	ActHIB	DTaP-IPV	Immediately†	Refrigerator
ProQuad (MMRV)	Merck	MMRV	Sterile water	30 min	Refrigerator or room temp
RabAvert (RAB_{PCECV})	Novartis	RabAvert	Sterile water	Immediately	Refrigerator
Rotarix (RV1)‡	GlaxoSmithKline	RV1	Sterile water, calcium carbonate, and xanthan*	24 hrs	Room temp
Varivax (VAR)	Merck	VAR	Sterile water	30 min	Room temp or refrigerator
YF-VAX (YF)	sanofi pasteur	YF-VAX	0.9% sodium chloride	60 min	Refrigerator
Zostavax (ZOS)	Merck	ZOS	Sterile water	30 min	Room temp or refrigerator

Always refer to package inserts for detailed instructions on reconstituting specific vaccines. In general, follow these steps:

1. For single-dose vaccine products (exceptions are Menomune in the multi-dose vial and Rotarix‡), select a syringe and a needle of proper length to be used for both reconstitution and administration of the vaccine. Following reconstitution, Menomune in a multi-dose vial will require a new needle and syringe for each dose of vaccine to be administered. For Rotarix, see the package insert.‡
2. Before reconstituting, check labels on both the lyophilized vaccine vial and the diluent to verify the following:
   - that they are the correct two products to mix together
   - that the diluent is the correct volume (especially for Menomune in the multi-dose vial)
   - that neither vaccine nor diluent has expired
3. Reconstitute (i.e., mix) vaccine ***just prior to use***‡ by
   - removing the protective caps and wiping each stopper with an alcohol swab
   - inserting needle of syringe into diluent vial and withdrawing entire contents
   - injecting diluent into lyophilized vaccine vial and rotating or agitating to thoroughly dissolve the lyophilized powder
4. Check the appearance of the reconstituted vaccine.
   - Reconstituted vaccine may be used if the color and appearance match the description on the package insert.
   - If there is discoloration, extraneous particulate matter, obvious lack of resuspension, or cannot be thoroughly mixed, mark the vial as "DO NOT USE," return it to proper storage conditions, and contact your state or local health department immunization program or the vaccine manufacturer.
5. If reconstituted vaccine is not used immediately or comes in a multi-dose vial (i.e., multi-dose Menomune),
   - clearly mark the vial with the date and time the vaccine was reconstituted
   - maintain the product at 35°–46°F (2°–8°C); do not freeze
   - protect reconstituted vaccines from light
   - use only within the time indicated on chart above

* If the reconstituted vaccine is not used within this time period, it must be discarded.
† Within 30 minutes or less.
‡ Rotarix vaccine is administered by mouth using the applicator that contains the diluent. It is not administered as an injection.

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Need Help Responding to Parents' Concerns about Vaccines and Autism?

This handout for parents presents science-based evidence that no relationship exists between vaccines and autism

Evidence Shows Vaccines Unrelated to Autism

Many parents have heard claims that vaccines cause autism. The most common and specific claims are that autism stems from the measles-mumps-rubella (MMR) vaccine or from vaccines that contain the preservative thimerosal. Many large studies have been conducted to investigate these specific concerns, but no link has ever been found between vaccines and autism. Still, these unproven claims persist, and they have led some parents to refuse vaccination for their children. The causes of autism are not fully understood, but overwhelmingly, scientific evidence does not point toward vaccines as a possible cause. The information that follows lays out scientific evidence that (1) refutes claims that any relationship exists between vaccines and autism and (2) presents some of the current thinking on the causes of autism.

Medical and legal authorities agree that no evidence exists that vaccines cause autism.
In 2004, the Institute of Medicine—a prestigious group of impartial experts who advise Congress on science issues—stated strongly that the evidence from five large epidemiological studies, three of which involved more than 100,000 children each, did not support a connection between autism and thimerosal-containing vaccines. Similarly, evidence from 14 large epidemiological studies showed no association between measles-mumps-rubella (MMR) vaccine and autism. Since that time, even more studies have reinforced the conclusion that there is no evidence for a connection between vaccines and autism. In 2009, after extensive proceedings that generated 5,000 pages of transcript and included 939 medical articles, the federal court that administers the National Vaccine Injury Compensation Program found the scientific evidence is "overwhelmingly contrary" to the theory that autism is linked to MMR vaccine, thimerosal, or a combination of the two. The World Health Organization, the European Medicines Agency, Health Canada, and other national and international health groups have all dismissed the possibility of a link between vaccines and autism.

The causes of autism are not fully understood, but the evidence does not point toward vaccines.
The influence of vaccines on a child cannot explain the measurable differences in brain structure and brain function that exist between autistic and non-autistic children. Starting in the first six months of life, many autistic children experience unusually rapid growth in areas of the brain that are responsible for the skills typically impaired in autism. Researchers have used "functional" MRI scans to study the connections of nerve cells within the brains of autistic individuals. These scans show—in very young autistic infants and toddlers—abnormal connections in areas of the brain that control language, social, and emotion processes, suggesting that these abnormalities contribute to the development of autism. The results of these and other studies provide promising clues for future research on the causes of autism and emphasize that finding its causes will not be as simple as pointing to vaccines as the cause.

What is known with great certainty is that genetics play a major role in determining whether a child will be autistic. The study of twins bears this out. Identical twins have 100% of their genes in common; fraternal twins have 50% in common (like any other pair of siblings). In more than three out of four cases, when one identical twin has a form of autism, the other one does too. Among fraternal twins, though, this is true for one out of about seven pairs, at most. A child who has one or more older siblings with autism is between 20 and 50 times more likely to be diagnosed with a form of autism, compared with a child who has no autistic older siblings. In addition, in families affected by autism, many parents and non-autistic siblings display mild autistic-like traits. The inherited or spontaneous mutations that seem to be associated with autism are in genes that control the development of the brain—including how brain cells develop and make circuits that operate correctly. This finding agrees with the discovery of abnormalities in the way the brain operates even in very young infants and toddlers with autism.

Autism is present before it becomes apparent to a child's family.
Parents often first notice the behaviors of autism when their child is 18–24 months old—the age by which most childhood vaccines have been given. Because of this, many parents incorrectly associate vaccination with the onset of autism. Developmental specialists, however, can identify early signs of autism in children when they are much younger, before their parents have noticed anything unusual. This research supports the scientific consensus that, in most cases, the precursors of autism are present before a child is born.

A baby's immune system can easily handle the vaccines recommended for infants and toddlers.
Some people worry that receiving too many vaccines early in life can overwhelm a baby's immune system and that this might somehow lead to autism. This doesn't fit with what we know about the remarkable capacity of the immune system. From the moment of a baby's birth, the immune system begins coping with microorganisms in the form or bacteria, viruses, and fungi. Like vaccines, these microorganisms contain foreign antigens—proteins that stimulate the immune system. When you realize that a single bacterium contains a larger variety and number of antigens than are found in all the recommended early childhood vaccines combined, you can see that a baby's immune system, which copes with exposure to countless bacteria each day, can easily withstand exposure to the antigens in vaccines.

Vaccines contain only the components necessary to make them work safely.
Vaccines contain a few components, such as formaldehyde and aluminum, that may sound dangerous until you understand that everything in a vaccine is there either because it helps the vaccine do its job or because it is part of making the vaccine. For instance, some vaccines contain a very small quantity of formaldehyde, which is used in vaccine

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As a precaution, by 2001, all routinely recommended childhood vaccines were changed to single-dose packaging so they wouldn't require thimerosal. At the time, this was thought prudent, but all the evidence that has emerged since then shows that there was never a danger of children being harmed by thimerosal in vaccines. In 2004, the CDC began recommending influenza vaccine for all children 6 to 23 months old; some influenza vaccine formulations come in multi-dose vials that are preserved with thimerosal. Today, influenza vaccine is the only childhood vaccine licensed for use in the U.S. that contains more than a trace of thimerosal, and we know that it is safe for children.

Studies have found no link between autism and MMR vaccine.
Some studies of MMR vaccine compared groups of children who had received MMR vaccine against those who had not. These studies found that neither group was more likely to develop autism. Other studies looked at comparable groups of autistic and non-autistic children. These studies found that autistic children were no more likely to have received MMR vaccine.

Rumors about the safety of MMR vaccine first arose about a decade ago after a British physician (a gastroenterologist, not a person trained in either vaccinology or in neurological disorders) announced he had found virus from measles vaccines lingering in the intestines of 12 autistic children. He believed this accounted for their autism. Other researchers, however, were never able to replicate these results, which implied the gastroenterologist's conclusions were erroneous. Later, a press investigation revealed that the doctor had falsified patient data and relied on laboratory reports that he had been warned were incorrect. The journal that originally published his study took the unusual step of retracting it from the scientific literature on the grounds that it was the product of dishonest and irresponsible research, and British authorities revoked the doctor's license to practice medicine.

The fear that vaccines might cause autism is a dangerous myth. Much scientific research has been devoted to this topic. The result has been an ever-increasing and uniformly reassuring body of evidence that childhood vaccination is, in fact, entirely unrelated to the development of autism. The readings below may be of interest to parents who wish to learn more.

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What's the Impact of Parents Who Use Personal Beliefs to Refuse Vaccines for their Children?

States with personal belief exemptions have experienced outbreaks of diseases traced to unvaccinated children

Personal belief exemptions for vaccination put people at risk. Examine the evidence for yourself.

Enforcement of mandatory immunization requirements for children entering childcare facilities and schools has resulted in high immunization coverage levels. While all states and the District of Columbia allow exemptions from the requirements for medical reasons, and all but two offer exemptions to accommodate religious beliefs, 20 states allow exemptions based on parents' personal beliefs. Several recent outbreaks of measles, pertussis, and varicella (chickenpox) have been traced to pockets of unvaccinated children in states that allow personal belief exemptions. To understand the impact of vaccine refusal, examine the evidence for yourself.

1. ***Measles in the United States during the postelimination era.*** Parker Fiebelkorn A, Redd SB, Gallagher K, et al. *J Infect Dis* 2010; 202(10):1520–28.

   Summary: A descriptive analysis of all cases of measles reported in the United States during 2001–2008.

   Key findings: A total of 557 confirmed cases of measles and 38 outbreaks were reported during 2001–2008. Of these outbreaks, the 3 largest occurred primarily among personal belief exemptors (defined as persons who were vaccine eligible, according to recommendations of the Advisory Committee on Immunization Practices or the World Health Organization, but remained unvaccinated because of personal or parental beliefs). During 2004–2008, a total of 68% of reported measles cases were among unvaccinated U.S. residents, who were age-eligible for vaccination but who claimed a personal belief exemption to state immunization requirements.

   Link: www.ncbi.nlm.nih.gov/pubmed/20929352

2. ***Measles outbreak in a highly vaccinated population, San Diego, 2008: role of the intentionally undervaccinated.*** Sugerman DE, Barskey AE, Delea MG, et al. *Pediatrics* 2010;125(4):747–55.

   Summary: Researchers mapped vaccination-refusal rates by school and school district, analyzed measles-transmission patterns, and conducted discussions and surveys to examine beliefs of parents who decline vaccination for their children.

   Key findings: An intentionally unvaccinated 7-year-old child who was unknowingly infected with measles returned from Switzerland, resulting in 11 additional measles cases and in known measles exposure of more than 800 people. In San Diego, high personal belief exemption (PBE) rates were found in 10 schools (range, 42%–100%); schools and districts with high refusal rates were clustered geographically. Across all surveyed kindergartens, higher PBE rates correlated strongly with lower measles vaccination rates.

   Link: www.ncbi.nlm.nih.gov/pubmed/20308208

3. ***Parental refusal of varicella vaccination and the associated risk of varicella infection in children.*** Glanz JM, McClure DL, Magid DJ, Daley MF, France EK, Hambidge SJ. *Archives of Pediatrics & Adolescent Medicine* 2010; 164(1):66–70.

   Summary: A case-control study of 133 physician-diagnosed cases of varicella among Kaiser Permanente Colorado members between 1998 and 2008; each case was matched with 4 randomly selected controls (i.e., people who did not have varicella disease).

   Key findings: Compared with children of vaccine-accepting parents, children of vaccine-refusing parents had a 9-fold higher risk of varicella illness. Overall, 5% of varicella cases in the study population were attributed to vaccine refusal.

   Link: www.ncbi.nlm.nih.gov/pubmed/20048244

4. ***Parental refusal of pertussis vaccination is associated with an increased risk of pertussis infection in children.*** Glanz JM, McClure DL, Magid DJ, et al. *Pediatrics* 2009;123(6):1446–51.

   Summary: A case-control study of 156 physician-diagnosed cases of pertussis among Kaiser Permanente Colorado members between 1996 and 2007; each case was matched with 4 randomly selected controls (n=595).

   Key findings: Vaccine refusers had a 23-fold higher risk for pertussis when compared with vaccine acceptors, and 11% of pertussis cases in the entire study population were attributed to vaccine refusal.

   Link: www.ncbi.nlm.nih.gov/pubmed/19482753

5. ***Invasive* Haemophilus influenzae *type b disease in five young children — Minnesota, 2008.*** CDC. *Morbidity and Mortality Weekly Report (MMWR)* 2009;58(03):58–60.

   Summary: In 2008, during routine surveillance conducted by public health workers in Minnesota for invasive *H. influenzae* type b (Hib) disease, five children ages 5 months to 3 years were reported with invasive Hib disease; one child died.

   Key findings: Three of the five children with invasive Hib disease had not been vaccinated. One of the children was too young to complete the primary series of Hib vaccine, and another child, who had completed the primary series, was found to have an immune disorder that impairs response to vaccination.

   Link: www.cdc.gov/mmwr/preview/mmwrhtml/mm5803a4.htm

6. ***Geographic clustering of nonmedical exemptions to school immunization requirements and associations with geographic clustering of pertussis.*** Omer SB, Enger KS, Moulton LH, Halsey NA, Stokley S, Salmon DA. *Am J Epidemiol* 2008;168:1389–96.

   Summary: Researchers evaluated the geographic clustering of personal belief exemptions in Michigan (1991–2004: N=4,495 schools) and measured the geographic overlap between exemption clusters and clusters of reported pertussis cases (1993–2004: N=1,109 cases among people18 years and younger).

   Key findings: Researchers reported significant overlap between clusters of exemptions and clusters of pertussis cases. In addition, exemption rates appear to be increasing in Michigan, and nonmedical exemptions tend to be geographically clustered.

   Link: www.ncbi.nlm.nih.gov/pubmed/18922998 *(Page 1 of 2)*

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school entry, 1991–2004, and incidence of pertussis in children ages 18 years and younger, 1986–2004.

Key findings: Exemption rates for states that allowed only religious exemptions remained at about 1% between 1991 and 2004; however, in states that allowed exemptions for personal beliefs, the mean exemption rate increased from 0.99% to 2.54%. The study found associations between increased pertussis incidence and state policies that allowed personal belief exemptions or easily-obtained exemptions in general.

Link: www.ncbi.nlm.nih.gov/pubmed/17032989

11. ***Implications of a 2005 measles outbreak in Indiana for sustained elimination of measles in the United States.*** Parker AA, Staggs W, Dayan GH, et al. *N Engl J Med* 2006;355:447–55.

    Summary: A case-series investigation of the largest documented U.S.-based measles outbreak since 1996; included molecular typing of viral isolates, surveys of vaccination rates, interviews about vaccination attitudes, and cost surveys.

    Key findings: This U.S. measles outbreak was caused when an unvaccinated teenager returned from Romania and introduced measles into a group of children whose parents objected to vaccination. Among people exposed at a church gathering, 50 lacked immunity to measles, 16 (32%) of whom acquired measles. During the 6 weeks after the gathering, a total of 34 cases of measles were confirmed. Of the people with confirmed measles, 97% were members of the church, 94% were unvaccinated, and 82% were children ages 5 to 19 years. In this outbreak, 68% of the containment cost was incurred by a single hospital, where an undervaccinated employee potentially exposed children, immunocompromised patients, and employees to measles.

    Link: www.ncbi.nlm.nih.gov/pubmed/16885548

12. ***The cost of containing one case of measles: the economic impact on the public health infrastructure—Iowa, 2004.*** Dayan GH, Ortega-Sanchez IR, LeBaron CW, Quinlisk MP, Iowa Measles Response Team. *Pediatrics* 2005;116:e1–e4.

    Summary: Measurement of activities performed, personnel time and materials allocated, and direct costs incurred in 2004 U.S. dollars by the Iowa public health infrastructure during the study period of March 5 (date of first contact about possible case) through May 12, 2004 (date of final meeting).

    Key findings: Total estimated cost of one case of measles: $142,452, of which 75% was attributable to personnel costs and overhead.

    Link: www.ncbi.nlm.nih.gov/pubmed/15995008

13. ***Individual and community risk of measles and pertussis associated with personal exemptions to immunizations.*** Feikin DR, Lezotte DC, Hamman RF, Salmon DA, Chen RT, Hoffman RE. *JAMA.* 2000; 284(24):3145–50.

    Summary: A population-based, retrospective cohort study of all reported measles and pertussis cases among children ages 3–18 years in Colorado during 1987–1998.

    Key findings: Exemptors were 22.2 times more likely to acquire measles and 5.9 times more likely to acquire pertussis than were vaccinated children. At least 11% of vaccinated children in measles outbreaks acquired infection through contact with exemptors.

    Link: www.ncbi.nlm.nih.gov/pubmed/11135778

14. ***Health consequences of religious and philosophical exemptions from immunization laws: individual and societal risk of measles.*** Salmon DA, Haber M, Gangarosa EJ, Phillips L, Smith NJ, Chen RT. *JAMA* 1999; 281(2):47–53.

    Summary: A population-based, retrospective cohort study of measles surveillance data collected by the CDC from 1985 through 1992 and a review of annual state immunization program reports on prevalence of exemptors and vaccination coverage. The study group was restricted to school-aged children (5–19 years old).

    Key findings: On average, exemptors were 35 times more likely to contract measles than were vaccinated persons.

    Link: www.ncbi.nlm.nih.gov/pubmed/10404911

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Summary of meningococcal vaccination recommendations, by risk group

Risk Group	Primary series	If and when to give booster
Persons ages 11 through 18 years	Give 1 dose of MCV4, preferably at age 11 or 12 years[1]	Give booster at age 16 years if primary dose given at age 12 years or younger
		Give booster at ages 16 through 18 years if primary dose given at ages 13 through 15 years[2]
Persons ages 19 through 21 years who will be attending college	Give 1 dose of MCV4, if previously unvaccinated[1]	Give booster dose if previous dose given at age younger than 16 years
Persons ages 19 through 21 years who are attending college	*May give* 1 dose of MCV4, if previously unvaccinated[1]	*May give* booster dose if previous dose given at age younger than 16 years
Persons with persistent complement component deficiency (including C5-C9, properdin, factor H, factor D), or functional or anatomic asplenia		
- for ages 2 through 55 years	Give 2 doses of MCV4, 2 months apart	Boost every 5 years with MCV4[3]
- for age 56 years and older	Give 1 dose of MPSV	Boost every 5 years with MPSV[3]
Persons with prolonged increased risk for exposure (e.g., microbiologists routinely working with *Neisseria meningitidis* and travelers to or residents of countries where meningococcal disease is hyperendemic or epidemic)		
- for ages 2 through 55 years	Give 1 dose of MCV4[1]	Boost every 5 years with MCV4[4,5]
- for age 56 years or older	Give 1 dose of MPSV	Boost every 5 years with MPSV[5]

1. If the person is HIV-positive, give 2 doses, 2 months apart.
2. The minimum interval between doses of MCV4 is 8 weeks.
3. If the person received a 1-dose primary series, give booster at the earliest opportunity, then boost every 5 years.
4. If younger than age 7 years, give booster after 3 years.
5. A booster dose is recommended if the person remains at increased risk.

Note: Children ages 2 through 10 years and adults ages 19 years and older without any of the risk factors listed above are not recommended for routine vaccination against meningococcal disease. If an adult patient requests vaccination against meningococcal disease, ACIP states that you can vaccinate them.

Technical content reviewed by the Centers for Disease Control and Prevention, April 2011

ACIP recommendations for use of meningococcal vaccine for people of all ages. It reflects the changes issued by ACIP in October 2010, which were published in early 2011.

Which people are recommended to receive a 2-dose primary series of MCV4?

A 2-dose series of MCV4, spaced 2 months apart, is recommended for people younger than age 56 years who have functional or anatomic asplenia, or persistent complement component deficiency, including C5-C9, properdin, factor H, and factor D. In addition, people in this age group who are HIV-positive who are vaccinated should also receive a 2-dose series of MCV4, spaced 2 months apart.

Are people who are HIV positive in a risk group for meningococcal disease?

Being HIV-positive does *not* put a person into a risk group that necessitates MCV4 vaccination. However, the updated ACIP recommendations for use of MCV4 vaccines state that people "with HIV who are vaccinated should receive a 2-dose primary series administered 2 months apart." Accordingly, the following HIV-positive people should receive 2 initial doses of MCV4 (instead of 1), spaced 2 months apart:

- HIV-positive adolescents ages 11 through 18 who, like other adolescents, are recommended for routine MCV4 vaccination
- HIV-positive people ages 2 through 55 years who are at prolonged increased risk for exposure to meningococcal disease (e.g., travelers to or residents of countries where meningococcal disease is hyperendemic or epidemic and microbiologists who routinely work with *Neisseria meningitidis*)
- Any HIV-positive adult who chooses to be vaccinated.

Which previously unvaccinated college students are recommended to receive MCV4 and how many doses should they be given?

Previously unvaccinated students ages 19 through 21 years who will be in a college or university setting should receive 1 dose of MCV4. Further, students who meet these same criteria who are already attending college *may* be vaccinated. Routine vaccination is not recommended for adults age 22 and older who do not have risk factors. If an adult patient requests vaccination against meningococcal disease, ACIP states that you can vaccinate them.

Which previously vaccinated college students need booster doses?

A booster dose should be given to students age 21 years and younger if the previous dose was given 5 or more years earlier, and if the student is planning to enter college (i.e., is not yet in college). A booster dose *may* be given to college students who meet these same criteria and are currently attending college.

If someone received meningococcal polysaccharide vaccine (MPSV4) at age 5 years (e.g., for pending foreign travel) and a dose of MCV4 at age 11–12 years, will they still need a booster dose of MCV4 vaccine starting at age 16 years?

Yes. Any meningococcal vaccination given prior to the tenth birthday (either with MCV4 or MPSV4) does NOT count toward routinely recommended doses.

(continued on page 18)

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If someone received MPSV4 (or MCV4) at age 10 years and another dose at age 11-12 years, will they still need a booster dose at age 16 years?
No, as long as the first dose was given at age 10 years or older, the second dose was MCV4 (not MPSV4), there was an interval of at least 8 weeks between the two doses, and they are not in a risk group that necessitates ongoing boosters (e.g., due to asplenia). In this scenario, however, the healthcare provider may offer a booster dose if the person is younger than age 22 years and about to enter a college or university setting.

With three licensed meningococcal vaccines, how do I decide which one to use?
Quadrivalent meningococcal conjugate vaccine (MCV4) is the preferred product for people ages 2 through 55 years. Both Menactra (sanofi) and Menveo (Novartis) are licensed for use in this age range. The conjugate vaccines are believed to have several advantages over meningococcal polysaccharide vaccine (MPSV4; Menomune [sanofi]), such as reduction in bacterial carriage in the nose and throat, longer duration of immunity, and better immunologic memory. MPSV4 should be used for adults age 56 and older.

For which patients is MPSV4 the preferential vaccine?
MPSV4 is the only meningococcal vaccine licensed for adults age 56 years and older. MPSV4 can also be used in people ages 2 through 55 years who have a contraindication or precaution to MCV4.

Are the two meningococcal quadrivalent conjugate vaccines (MCV4) interchangeable?
Whenever feasible, the same brand of vaccine should be used when 2 doses are recommended. If the vaccine provider does not know or have available the type of MCV4 vaccine previously administered (Menactra or Menveo), either product can be used to complete the series.

How do I find out if my state has a meningococcal vaccination requirement?
Go to www.immunize.org/laws/#menin.

A 19-year-old student who received 1 dose of MCV4 at age 12 years will be attending a community college this fall. Does she need a booster dose of MCV4?
Yes. Adults ages 19 through 21 years who plan to attend college, and who received the previous dose of MCV4 before age 16 years, need a booster dose. They no longer need to be living in on-campus housing to qualify in a risk group for meningococcal vaccination.

General vaccine questions

How many vaccines can be given during an office visit?
No upper limit exists for the number of vaccines that can be administered during one visit. ACIP and AAP consistently recommend that all needed vaccines be administered during an office visit.

Which vaccines* cannot *be administered at an office visit along with other vaccines?
All routine vaccines can be given during an office visit, as long as a different syringe is used for each vaccine.

If all needed vaccines aren't administered during the same visit, does one need to wait a certain period of time before administering the other needed vaccines?
All inactivated vaccines can be given on the same day, or on any day before or after giving other inactivated or live vaccines. However, if two live vaccines are not given on the same day, they need to be spaced at least 4 weeks apart.

Do we have to check vital signs before giving vaccines?
No. ACIP does not recommend routinely checking a patient's temperature or other vital signs before vaccination. Requiring these extra steps can be a barrier to immunization.

Is it necessary to routinely test young women for pregnancy before administering vaccines?
No. However, females of childbearing age should be asked about the possibility of their being pregnant before they are given any vaccine for which pregnancy is a contraindication or precaution. The patient's answer should be documented in the medical record. If the patient thinks she might be pregnant, a pregnancy test should be performed before administering live virus vaccines.

Which vaccines can be given to breastfeeding women?
All vaccines except smallpox can be given to breastfeeding women. Breastfeeding is a precaution for yellow fever vaccine. Women who are breastfeeding should be advised to postpone travel to yellow fever endemic or epidemic regions; however, if travel cannot be postponed, the woman should receive yellow fever vaccine.

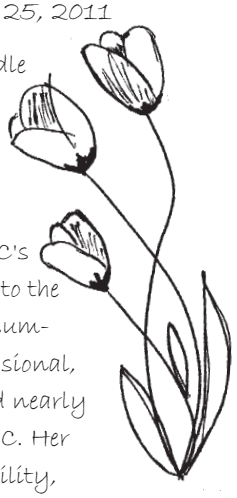
Can I administer vaccine to a child who is taking antibiotics?
Treatment with antibiotics is not a valid reason to defer vaccination. If a child or adult is otherwise well, or has only a minor illness, vaccines should be administered. But if the person has a moderate or severe acute illness (regardless of antibiotic use), one should defer vaccination until the person's condition has improved.

We frequently see patients who have a fever or an acute illness and are due for vaccinations. We're never quite sure if we should withhold the vaccines or not. What do you advise?
A "moderate or severe acute illness" is a precaution for administering any vaccine. A mild acute illness (e.g., mild diarrhea or upper-respiratory tract infection) with or without fever is not.

Should I vaccinate a child who has recently been exposed to an infectious disease? What about a child who is convalescing from illness?
Neither of these situations is a contraindication or precaution to vaccination.

Remembering Becky

January 14, 1953 – March 25, 2011



This issue of Needle Tips is dedicated to the memory of our dear friend and colleague, Becky Payne, IAC's former Assistant to the Director. The consummate office professional, Becky influenced nearly every aspect of IAC. Her hallmarks—humility, wisdom, and generosity—left an indelible mark on all who were privileged to know her. She is dearly missed. (more)