Welcome to the *Epidemiology and Prevention of Vaccine-Preventable Diseases* Course

The “Pink Book” Course

Day 1: Pediatric Track

August 14–15, 2019
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- The use of trade names is for identification only and does not imply endorsement by the Centers for Disease Control and Prevention or the U.S. Department of Health and Human Services
Content will not include any discussion of the unlabeled use of a product or a product under investigational use, with the exception of the discussion of the use of the following vaccines in a manner recommended by the Advisory Committee on Immunization Practices, but not approved by the Food and Drug Administration except for the following vaccines:


CDC does not accept commercial support
The recommendations to be discussed are primarily those of the Advisory Committee on Immunization Practices (ACIP):

- Composed of 15 nongovernment experts in clinical medicine and public health
- Provides guidance on use of vaccines and other biologic products to DHHS, CDC, and the U.S. Public Health Service
Course Text

*Epidemiology and Prevention of Vaccine-Preventable Diseases 13th edition (“Pink Book”)*

- 13th Edition (2017) available online at:

- Supplement available on-line only at:
  - HTML: [www.cdc.gov/vaccines/pubs/pinkbook/supplement.html](http://www.cdc.gov/vaccines/pubs/pinkbook/supplement.html)

- Updated recommendations include:
  - Human papillomavirus vaccine
  - Meningococcal B vaccine
  - Pneumococcal vaccine
Course Objectives

At the end of the course, attendees will be able to:

1. Describe the difference between active and passive immunity.
2. List two characteristics of live, attenuated vaccines.
3. List two characteristics of inactivated vaccines.
4. For each vaccine-preventable disease discussed, identify those for whom routine immunization is recommended.
5. For each vaccine-preventable disease discussed, describe characteristics of vaccine used to prevent the disease.
6. Describe an emerging immunization issue.
7. Locate resources relevant to current immunization practice.
8. Implement disease detection and prevention health care services (e.g., smoking cessation, weight reduction, diabetes screening, blood pressure screening, immunization services) to prevent health problems and maintain health.
Clinical Resources for You and Other Staff

- Course immunization resources list included in your folder
- Additional clinical resources and job aids are highlighted in:
  - The slide show playing before we start and during lunch and breaks
  - Presentations throughout the course

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**Course Resources**

**Epidemiology and Prevention of Vaccine-Preventable Diseases**
- [CDC.gov](https://www.cdc.gov)

**Detailed Resources**
- [Current childhood and adult immunization schedules](https://www.cdc.gov/vaccines/schedules/hcp_ACIP/index.html)
- [CDC Vaccine Schedules App for Healthcare Providers](https://www.cdc.gov/vaccines/schedules/hcp/acip-index.html)
- [Advisory Committee on Immunization Practices (ACIP) recommendations](https://www.cdc.gov/vaccines/acip/index.html)
- [CDC General Best Practice Guidelines for Immunization](https://www.cdc.gov/vaccines/pubs/pinkbook/index.html)
- [PeopleCaring.com](https://www.peoplescaring.com)
- [Healthcare Provider Consultation Line](https://www.cdc.gov/vaccines/hcp/consult/index.html)
- [Vaccines Licensed for Use in the United States Package Inserts](https://www.fda.gov/drugs/development-testing/approved-drugs)

**Course Info and Objectives**
- What is the Advisory Committee on Immunization Practices (ACIP)?
- CDC Immunization Resources for You and Your Patients
- [Vaccine hesitancy](https://www.cdc.gov/vaccines/hcp/immunization-resources/index.html)
- [Practices in Further Limiting Harm](https://www.cdc.gov/vaccines/hcp/immunization-resources/index.html)
- [Understanding How Vaccines Work](https://www.cdc.gov/vaccines/hcp/immunization-resources/index.html)
- [Vaccines Work](https://www.cdc.gov/vaccines/hcp/immunization-resources/index.html)
- [The History of Vaccines](https://www.cdc.gov/vaccines/hcp/immunization-resources/index.html)

**Principles of Vaccination**
- [Immune System Research](https://www.niaid.nih.gov/research/immune-system-research)
- [Understanding How Vaccines Work](https://www.cdc.gov/vaccines/hcp/immunization-resources/index.html)

** Gorski Best Practice Guidelines**
- [Assess the Schedule: Scheduling FAQs](https://www.immunize.org/kids/facts/scheduling-faqs.htm)
- [Assess the Experes: Combination Vaccines FAQs](https://www.immunize.org/kids/facts/combination-faqs.htm)
- [Assess the Experes: Precautions and Contraindications FAQs](https://www.immunize.org/kids/facts/precautions-contraindications-faqs.htm)
- [Foreign Language Vaccine Reassurance Disease Terms](https://www.cdc.gov/vaccines/pubs/pinkbook/downloads/appendix/B/foreign-products-tables.pdf)
- [Interval Between Antibody-Containing Products and Malaria and Venereal Containing Vaccines](https://www.cdc.gov/vaccines/pubs/pinkbook/downloads/appendix/B/foreign-products-tables.pdf)

January 2019
Course Evaluation: Pretest and Post-test

- **Pretest e-mailed August 8th**
  - If you did not receive pretest
    - You may have registered for the course after August 7th
    - Some e-mails on registration list were undeliverable

- **If you completed the pretest, you will receive post-test August 20th**
  - Post-test will not fulfill CE requirements
  - Aid CDC in measuring knowledge gained from course participation
  - Expires August 27th at 11:59pm

- **CDC staff will also e-mail course evaluation August 20th**
  - Expires September 17th
Talking About Vaccines

Day 1: Pediatric Track

August 2019
Vaccines protect children and adults from serious diseases and potential complications

There are record low rates of vaccine-preventable diseases

And yet . . .
Vaccine Hesitancy

- Vaccine hesitancy refers to refusal or delay in acceptance despite the availability of vaccination services.

- Vaccine hesitancy is complex and varies across time, place, and vaccines.

- It includes factors such as complacency, convenience, and confidence.

Image: James Gillray, The Cow-Pock—or—the Wonderful Effects of the New Inoculation! (1802)
Flu vaccine gave me the flu!

Vaccines can make people walk backwards.

Influenza is not a serious illness.

Flu vaccine doesn’t work.

Immunity from disease is better!

The side effects from a vaccine are worse than the disease!

I don’t need a flu shot… I never get the flu.

I’m pregnant so I can’t get vaccinated.

Vaccines weaken your body's immune response.

I am allergic to eggs so I can’t be vaccinated.

Vaccines cause Alzheimer's disease.
You are administering Tdap vaccine today to a patient. You offer a flu shot, too, but she declines flu vaccine. Would you consider her “vaccine-hesitant”?

- Yes
- No
- Maybe
Hesitant Patients?

- Question the value or necessity of the recommended *vaccination schedule or specific vaccines*
- Want information to make the best choice
- BUT may not identify themselves as vaccine-hesitant
Costs of Vaccine Hesitancy

- **Increased levels of undervaccination**
  - Undervaccinated tend to remain undervaccinated
  - Outbreaks of vaccine-preventable diseases
    - Pertussis
    - Varicella
    - Pneumococcal disease
    - MEASLES!!!!
Costs of Vaccine Hesitancy

- Increased pain/trauma for children from multiple visits
  - 84% of pediatricians think it is more painful for children to administer vaccines over multiple visits than to give them simultaneously

- Less time to spend on other preventive health issues
  - Average visit = 18 minutes

- Reports of physician burnout

O’Leary, S. Strategies for Talking to Vaccine-Hesitant Parents. Mar 2017
Vaccine Hesitancy and Health Care Providers

- **National survey among pediatricians shows:**
  - 46% agreed that their job was less satisfying because of the need to discuss vaccines with vaccine-hesitant parents
  - 60% reported spending more than 10 minutes discussing vaccines in visits with vaccine-hesitant parents

- **When talking about vaccines, we want to be effective but also efficient**
Vaccine Conversations

- **Answering questions can be challenging**
  - Staff is not always prepared for questions
  - Inconsistent messages from staff
  - Real-life time constraints
  - Frustrating! Correcting misconceptions can successfully reduce misperceptions, but does not always result in vaccination

Communicating About Vaccines

- There is much research on parents’ knowledge, attitudes, and beliefs about vaccines
- Little research on what communication techniques actually change parents’ behavior
- Research in this area is complicated
- We’ve been focused on the “what” more than the “how”
Conventional Wisdom

- Improve parents’ knowledge and they will make the right decision
- This educational approach assumes human decision-making is rational-but this is often not true
- Behavioral economics: human behavior is influenced by deep-seated cognitive biases and heuristics resistant to rational influence
What Does This Mean?

- Becoming increasingly clear that simply correcting knowledge gaps—whether through informational brochures, community campaigns, or direct provider conversations—often is not enough to address parents’ concerns about vaccines.

- Investigators are now focusing on developing interventions to improve vaccination uptake focused on how people actually think rather than how they ought to think.
  - Remember—correcting misconceptions can successfully reduce misperceptions but does not always result in vaccination.

O’Leary, S. Strategies for Talking to Vaccine-Hesitant Parents. NFID Clinical Vaccinology Course, Mar 2017
Providers are a patient’s most trusted source of information on vaccines.

Research shows a patient who receives a strong recommendation from a provider is 4–5 times more likely to be vaccinated.*

“Bundle” all needed vaccines into the same recommendation.

What You Say Matters AND How You Say It Matters

- Good recommendation = simple, strong, and personalized

“*It’s time to start the HPV series. I recommend he is vaccinated today. I vaccinated my children. It’s the healthy thing to do.*”

VERSUS

“Research suggests that persons vaccinated with HPV vaccine have a decreased chance of contracting HPV diseases such as penile and anogenital cancers or genital warts. Would you like John vaccinated today?”
The best predictor of vaccination was how the provider started the conversation

- For both vaccine-hesitant and nonhesitant patients
Participatory Versus Presumptive Approach

- **Participatory**: provides more decision-making latitude
  - Example: “Have you thought about what shots you’d like today”?

- **Presumptive**: presupposes that parents would get the child vaccinated
  - Example: “We have some vaccines due today”.

Among all parents, a larger proportion resisted vaccine recommendations when providers used a participatory rather than presumptive initiation format (83% vs 26%; \( P < .001 \))

This finding remained true among vaccine-hesitant parents (89% vs 30%; \( P < .001 \))
Why Presumptive Style Might Be Better

- Most patients perceive decisions about vaccination to be complicated.

- As humans, when we make decisions we perceive to be complicated, we tend to have a status quo bias (also called a “default bias”), meaning we go with what is expected or “normal”.

- Using a presumptive approach, patients are made to feel that vaccination is what most people do, and it is the socially acceptable “norm”.

Consistent Messages

- Consistent messages from ALL staff are critical
  - Don’t forget front desk/support staff

- Use talking points to get everyone on the same page
Vaccine Conversations
What Usually Happens When a Patient is Hesitant?

- The provider might ask why the patient does not want the vaccine
- Often patients will state all the reasons they do not want to be vaccinated
  - In the process, the patient strengthens their resolve against the vaccination
- The provider is vulnerable to falling into conversation traps
Communication Traps

Persuasion trap

Data dump trap

Q and A trap

O’Leary, S. Strategies for Talking to Vaccine-Hesitant Parents. NFID Clinical Vaccinology Course, Mar 2017
Persuasion Trap

- When the provider becomes the champion for the vaccine and tries to convince the hesitant or resistant patient of the benefits

- This usually ends up in an argumentative type of “yes, but” cycle
The Lecture (Data Dump) Trap

- The tendency here is to provide the full story about some aspect of the vaccine

- This often ends up putting people off and raising resistance because it implies that they don’t know the full story and you’re going to give it to them

- Also, it can be counterproductive because you end up raising concerns that the patient had not previously considered
The Question and Answer Trap

- When the provider begins asking a series of closed questions that require a yes or no answer and does not invite any additional information or thoughts
In Summary

- Directive patient/provider recommendations followed by a closed question work fine for the patient who is ready to be vaccinated or for the patient who expects the doctor to tell him or her what to do.

- For patients who are unsure or resistant, a closed-ended question following a recommendation can lead to less productive conversations.
Motivational interviewing (MI) is a patient-centered, guiding communication style for enhancing a person’s own motivation for change or behavioral activation

- Engages the patient respectfully and fully in the discussion

- The 4 elements include:
  - Empathy
  - Collaboration
  - Evocation
  - Support for autonomy

O’Leary, S. Strategies for Talking to Vaccine-Hesitant Parents. Mar 2017
Motivational Interviewing

- Motivational interviewing has not been tested and proven effective for convincing those who are hesitant about vaccination

- HOWEVER, it has been shown to be effective in other health interventions, including:
  - Diabetes self-care
  - Smoking cessation
  - Cognitive behavioral therapy

O’Leary, S. Strategies for Talking to Vaccine-Hesitant Parents. NFID Clinical Vaccinology Course, Mar 2017
Using Motivational Interviewing for Vaccine Discussions

- **Motivational interviewing includes:**
  - Open-ended questions
  - Affirmations
  - Reflection
  - Summary

- **Remember to:**
  - Include simple, strong, and personalized recommendation
  - Highlight social norms
Motivational Interviewing and Vaccine Conversations

- HCP asks in a nonthreatening way what are the patient’s concerns
Motivational Interviewing and Vaccine Conversations

- HCP reflects back what the patient is saying to be sure he/she understands (empathy) and summarizes what has been heard before proceeding, again with permission, to make a recommendation.
Motivational Interviewing and Vaccine Conversations

- If possible, put the concern into a perspective the family can relate to
- Examples?
“I think about flu vaccine like a savings account for a rainy day. The immune system has antibodies ‘in the bank’ to use when they are needed. Most of the patients in my practice are vaccinated.”
Now it's time for a simple, strong, and personalized recommendation.
End the conversation with an open-ended question.

“I get vaccinated every year and so does all of the staff that works here. We know it’s the best protection we have against influenza and staying healthy. I recommend you get vaccinated. Having said this, what do you think?”
Motivational Interviewing Summary

- Engage the patient respectfully and fully in the discussion
- The four elements of the MI spirit—empathy, collaboration, evocation, and support for autonomy
- Core MI skills like open-ended questions and reflections
- Use of behavior change principles like emphasizing social norms and focusing on the disease that is prevented rather than negatives (like side effects)
- Don’t forget—a simple, strong, and personalized recommendation
Vaccine Storage and Handling and Vaccine Administration

Chapters 5 and 6
Vaccine Storage and Handling
Vaccine “Cold Chain”
3 Keys to Storing and Handling Vaccines

- Well-trained staff
- Reliable storage and temperature monitoring equipment
- Accurate vaccine inventory management protocols and procedures

https://www2.cdc.gov/vaccines/ed/shvideo/
Staff and Training
Staff Training

- **SOPs**
  - Routine
  - Emergency

- **Complete training:**
  - As part of employee orientation
  - Annually
  - When new vaccines or products are added
  - When recommendations change

Primary and Alternate Coordinator Duties

- **Primary coordinator**
  - Responsible for ensuring all vaccines are stored and handled properly
  - Expert on routine and emergency SOPs
  - Review and update SOPs annually

- **Alternate coordinator**
  - Expert that can assist primary and fulfill duties in their absence

- **All other staff**
  - May delegate duties to trained staff

Vaccine Storage Equipment
Equipment: Vaccine Storage Units

- Purpose-built or pharmaceutical-grade (large or compact)
- Household-grade
  - Do not use freezer

Equipment: Vaccine Storage Units

Compact, purpose-built unit: Yes

Dormitory-style unit: No

CDC Vaccine Storage and Handling Toolkit: www.cdc.gov/vaccines/hcp/admin/storage/toolkit/storage-handling-toolkit.pdf  Accessed 5/21/2019
Equipment: Vaccine Storage Units

Refrigerator
2° C and 8° C
(36° F and 46° F)

Freezer
-50° C and -15° C
(-58° F and +5° F)

Routine Management

- **Storage units and related equipment need regular maintenance**
  - Refer to equipment manuals

- **Storage unit temperatures may require adjustments**
  - These should be made by the vaccine coordinators only
  - Should be done when the unit is not being opened and closed frequently

New or Repaired Vaccine Storage Unit?

- 2–7 days to stabilize refrigerator temperature
- 2–3 days to stabilize freezer temperature
- Check and record temperatures
- 2 consecutive days of temperatures recorded within the recommended ranges = unit ready for use

Equipment: Temperature Monitoring Devices

- Every storage unit must have a temperature monitoring device

- CDC recommends using a specific type of temperature monitoring device—a digital data logger (DDL)
  - DDLs provide the most accurate temperature information, including how long a unit has been operating outside the recommended temperature range

ACIP General Best Practice Guidelines for Immunization: [www.cdc.gov/vaccines/hcp/acip-recs/general-recs/timing.html](http://www.cdc.gov/vaccines/hcp/acip-recs/general-recs/timing.html), Accessed 5/21/2019

CDC Vaccine Storage and Handling Toolkit: [www.cdc.gov/vaccines/hcp/admin/storage/toolkit/storage-handling-toolkit.pdf](http://www.cdc.gov/vaccines/hcp/admin/storage/toolkit/storage-handling-toolkit.pdf), Accessed 5/21/2019
Temperature Monitoring Devices: DDL

DDLs provide the most accurate temperature information 24/7

- **Recommended features**
  - Detachable buffered probe
  - Alarm
  - Low battery indicator
  - Min/max temperature display
  - Uncertainty of +/-0.5°C (+/-1°F)
  - 30-minute reading rate

Certificate of Calibration

Every TMD should have a certificate of calibration

- Certificates should include:
  - Model/device name or number
  - Serial number
  - Date of calibration
  - Confirmation that the instrument passed testing
  - Recommended uncertainty of +/- 0.5°C (+/-1°F) or less

Temperature Monitoring Devices (continued)

- Certain TMD are not recommended, including:
  - Alcohol or mercury thermometers
  - Bimetal stem thermometers
  - Thermometers used for food storage
  - Chart recorders
  - Infrared thermometers
  - Thermometers that do not have a current and valid Certificate of Calibration Testing
Inventory Management: Maintaining the Proper Storage Unit Temperatures

- One unit per electrical outlet
- Use safety-lock plug or cover
- Post “DO NOT UNPLUG” warning sign
- Label fuses and circuit breakers
- Avoid using outlets that can be tripped or switched off (i.e., reset buttons, wall switches, power strips)

Device displays min/max, preferably a DDL with buffered probe:
• Check and record min/max temperature at the start of each workday

Device does not display min/max:
• Check and record current temperature 2 times, at the start and end of the workday

http://www.immunize.org/handouts/temperature-logs.asp
Temperature Monitoring

- Review storage unit temperature readings and review continuous DDL software or website information at least 1 time each week.

- Keep ongoing file of temperature data, including hard copies and electronic data, for 3 years*.

*Or longer if required by the New Jersey immunization program.
Temperature Excursion

- Take immediate action and isolate all vaccine(s) exposed to improper temperatures

- Notify
- Document
- Contact
- Correct

Inventory Management: Vaccine Ordering and Deliveries

- Conduct vaccine and diluent inventory prior to ordering
  - Avoid overstocking

- Arrange deliveries when vaccine coordinator or alternate (backup) coordinator is on duty and notify them when delivery arrives

Inventory Management:
Vaccine Ordering and Deliveries

- Immediately unpack and examine container, contents, and temperature monitors when delivery arrives

- **If you have questions or concerns:**
  - Label vaccines “Do NOT Use”
  - Store under appropriate conditions, isolated from other vaccines
  - Consult immunization program, distributor, and/or vaccine manufacturer for guidance

Inventory Management:
Arranging Vaccines in the Storage Unit

- Store vaccines away from walls, coils, cooling vents, top shelf, ceiling, door, floor, and back of unit
  - Keep refrigerated diluents with corresponding vaccines (these diluents may contain vaccine antigen)
  - Keep vaccines and diluents in original packaging with lids closed

Arranging Vaccines in Your Unit

- Inspect storage unit organization daily
- Place water bottles in refrigerator and freezer in the doors and along the walls
  - Water bottles are not recommended for use with certain pharmaceutical-grade and purpose-built units
    - Follow the manufacturer’s guidance
- If other biologics must be stored in the same unit, store them BELOW the vaccines to avoid contamination
Vaccine and Diluent Placement and Labeling

- Label shelves and containers to clearly identify where each type of vaccine is stored

- Place pediatric, adult, look-alike, and sound-alike vaccines in different shelves or areas of the unit

CDC Vaccine Storage Labels: https://www.cdc.gov/vaccines/hcp/admin/storage/guide/vaccine-storage-labels.pdf  Accessed 4/16/2019

CDC Vaccine Storage and Handling Toolkit: www.cdc.gov/vaccines/hcp/admin/storage/toolkit/storage-handling-toolkit.pdf  Accessed 5/21/2019
Vaccine Storage and Handling “DON’Ts”

- **NEVER store:**
  - Vaccines in the door or the deli, vegetable, and fruit crisper drawers
  - Diluents in the freezer
  - Food and beverages in the unit with vaccines

Expiration Dates

- Arrange stock so doses with the earliest expiration dates are placed in front of those with later expiration dates

- Check expiration dates weekly and when new stock is delivered

- Remove expired vaccine and diluents from the unit immediately

Understanding Vaccine Expiration Dates

Vaccine expiration date: 08/16/19
Note: Use through August 16, 2019.
Do NOT use on or after August 17, 2019.

Vaccine expiration date: 08/19
Note: Use through August 31, 2019.
Do NOT use on or after September 1, 2019.

CDC Vaccine Storage and Handling Toolkit: www.cdc.gov/vaccines/hcp/admin/storage/toolkit/storage-handling-toolkit.pdf  Accessed 5/21/2019
Expiration Date Exceptions: Beyond Use Date (BUD)

- A BUD replaces the manufacturer’s expiration date
- Examples of BUDs include:
  - Some reconstituted vaccines
  - Some multidose vials
  - Manufacturer may determine a BUD when vaccine is exposed to inappropriate storage conditions
- BUD guidance is in the storage section of the specific vaccine’s package insert
- BUD should be written on the vial label along with the initials of the person writing it

Vaccine Disposal

- Contact your immunization program or state environmental agency to ensure that your vaccine disposal procedures and any related documentation comply with state and federal regulations
  - Open vials, activated manufacturer-filled syringes, provider predrawn syringes, and broken vials and syringes should be appropriately discarded

- Contact immunization program and/or vaccine manufacturer(s) for guidance regarding disposition of:
  - Unopened and expired vials
  - Unused doses
  - Potentially compromised vaccine

www.cdc.gov/vaccines/imz-managers/awardee-imz-websites.html
www.hercenter.org/rmw/rmwlocator.cfm
Emergency Vaccine Storage and Handling
Emergency Backup Equipment

- **Alternative storage facility**
  - Even if generator is on-site

- **Additional storage unit(s)**
  - In use or for emergency use

- **Backup generator**
  - May prevent need for transport

- **Backup battery power source**
Keep storage units and containers closed

Use TMDs

Use one of the following containers:
- Qualified containers and packouts
- Portable vaccine unit (if power source available)
- Packing Vaccines for Transport during Emergencies system

Packing Vaccines for Transport during Emergencies

Be ready BEFORE the emergency

Equipment failures, power outages, natural disasters—these and other emergency situations can compromise vaccine storage conditions and damage your vaccine supply. It’s critical to have an up-to-date emergency plan with steps you should take to protect your vaccines. In any emergency situation, you should be prepared to transport your vaccines safely using a portable vaccine refrigerator or qualified pack-out. However, if these options are not available you can follow the emergency packing procedures for refrigerated vaccines below.

1. Gather the Supplies

- Hard-sided cooler or Synoptics™ vaccine-shipping containers
  - Coolers should be large enough for your largest typical supply of refrigerated vaccines.
  - Coolers should be in good working condition. Check them for any damage before use.
  - Do NOT use clothed迷信he containers.

- Portable vaccine unit (if power source available)
  - Packing Vaccines for Transport during Emergencies system

Why do you need cardboard, bubble wrap, and conditioned frozen water bottles?

Conditioned frozen water bottles and corrugated cardboard used along with one inch of insulating cushioning material such as bubble wrap keep refrigerated vaccines at the right temperature and prevent them from freezing. Freezing vaccines destroys vaccines and can make them unsafe for use. Therefore, it is important to use conditioned frozen water bottles and cardboard correctly.

Power Outage

- Record room temperature
- Record min/max storage unit temperatures
  - As soon as the power goes out AND during the outage
- Avoid temperature excursions
  - Shift to transport plan or use alternative containers
- If temp reading can only be obtained by opening door and there is no alternative facility, wait until power is restored
  - Record room and unit temperatures (min/max, if available)
  - Length of time power was off
  - Follow procedures for temperature excursion, if one occurred
Vaccine Transport
Transport Situations

- Off-site or satellite facilities
- Shipping
- Emergency

## Transport Systems

### Transport System Recommendations

<table>
<thead>
<tr>
<th></th>
<th>Emergency Transport</th>
<th>Transport for Off-Site Clinic, Satellite Facility, or Relocation of Stock</th>
</tr>
</thead>
<tbody>
<tr>
<td>Portable Vaccine Refrigerator or Freezer</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Qualified Container and Packout</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Conditioned Water Bottle Transport System</strong>$^+$</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Manufacturer’s Original Shipping Container</td>
<td>Yes (last resort only)</td>
<td>No</td>
</tr>
<tr>
<td>Food/Beverage Coolers</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>
Transport Planning

- **Protocols**
  - Identify trained staff
  - Vehicles
  - Inventory
  - Documentation
  - Contact emergency vaccine storage facility
  - Suspend operations prior to emergency

- **Vehicle considerations**
  - Company or personal vehicle
  - Use passenger compartment
  - Avoid sunlight
  - Monitor vaccine temperature
  - Move vaccines into storage unit upon arrival
Temperature Monitoring during Transport

- **For any type of transport:**
  - Use a temperature monitoring device (DDL preferred)
  - Place buffered probe with vaccines
  - Keep display on top
Before administering vaccines, all personnel who administer vaccines should:
- Receive competency-based training
- Have knowledge and skills validated

Integrate competency-based training into:
- New staff orientation
- Annual education requirements

Ongoing education:
- When vaccine administration recommendations are updated
- When new vaccines are added to the inventory

Skills Checklist for Immunization [Link]
Infection Control

- **Perform hand hygiene:**
  - Before preparing vaccines
  - Between patients
  - Anytime hands become soiled

- **Gloves are not required when administering vaccines unless the person administering the vaccine is likely to come into contact with potentially infectious body fluids or has open lesions on hands:**
  - If gloves are worn, they should be changed between patients
  - Perform hand hygiene between patients even if wearing gloves

- **Equipment disposal:**
  - Puncture-proof biohazard container
  - Empty or expired vaccine vials are medical waste

https://www.cdc.gov/handhygiene/index.html
Vaccine Preparation
Vaccine Preparation “Dos”

**ALWAYS:**

- Use designated, clean preparation area
- Follow aseptic technique:
  - Use a new needle and syringe for each injection
  - Use a single-dose vial for 1 patient ONLY
- Check the expiration date (or BUD, if present) on vaccines and diluents before using them
- Prepare vaccines you administer and only when ready to administer

Predrawing Vaccines

- Generally not recommended, but if you must...
  - Prepare at site or event in clean area
  - Separate administration stations if multiple vaccines
  - One MDV or 10 doses per provider
  - Monitor patient flow
  - Additional guidance for reconstituted vaccines

- Best practice: Use manufacturer prefilled syringes for large vaccination clinics
Vaccine Preparation DON’Ts

- NEVER:
  - Use expired vaccine or diluent
  - Transfer vaccine from one syringe to another
  - Administer improperly stored or prepared vaccine

**Vaccine Preparation: Reconstituting Vaccines**

- Only use the diluent supplied by the manufacturer to reconstitute lyophilized vaccines
- Reconstitute vaccine just prior to administration

**NEVER:**
- Administer vaccine reconstituted with the wrong diluent
- Use a “stock” vial of normal saline or sterile water to reconstitute lyophilized vaccine
- Transfer reconstituted vaccine from a syringe back into the vial for storage
Before Administering Vaccines

- Review the immunization history at every health care visit:
  - Accept only written, dated records (except influenza and PPSV23 self-report)
  - Use recommended schedule to determine vaccines needed based on age, medical conditions, and risk factors
- Screen for contraindications and precautions prior to administering any vaccine(s)
- Discuss vaccine benefits and risks and vaccine-preventable disease risks using VISs and other reliable resources
- Provide after-care instructions
Route and Site

- **Oral (PO):**
  - Administer liquid inside cheek slowly down one side (between cheek and gum) toward the back of infant’s mouth

- **Intranasal (NAS):**
  - LAIV4 is the only vaccine administered by the intranasal route

https://www.cdc.gov/vaccines/hcp/admin/resource-library.html
http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6304a4.htm?s_cid=mm6304a4_w
https://www.cdc.gov/mmwr/volumes/67/wr/mm6722a5.htm?s_cid=mm6722a5_w%20
**Subcutaneous Injection (Subcut) Route**

- **Site:**
  - Thigh for infants < 12 months of age
  - Upper outer triceps of arm for children > 12 months and adults (can be used for infants if necessary)

- **Needle gauge and length:**
  - 23–25 gauge needle, 5/8 inch

- **Technique:**
  - To avoid reaching the muscle, pinch up the fatty tissue, insert the needle at a 45° angle, and inject the vaccine into the tissue
Intramuscular Injection (IM) Route

- Spread the skin of the site taut between the thumb and forefinger, isolating the muscle
- Another technique, acceptable mostly for pediatric and geriatric patients, is to grasp the tissue and “bunch up” the muscle
- Insert the needle fully into the muscle at a 90° angle and inject

Aspiration is NOT required
Intramuscular Injection (IM) Route: Infants <12 Months

- **Site:**
  - Vastus lateralis muscle (anterolateral thigh)

- **Needle gauge and length:**
  - 22–25 gauge
  - Neonates and preterm infants: 5/8 inch (adequate only if the skin is stretched flat between thumb and forefinger)
  - 1 month and older: 1 inch
Intramuscular Injection (IM) Route: 1–2 Years

- **Site:**
  - Vastus lateralis muscle (anterolateral thigh) is preferred
  - Deltoid muscle (upper arm) may be used if the muscle mass is adequate

- **Needle gauge and length:**
  - 22–25 gauge
  - 5/8 to 1 inch (5/8 inch adequate only for the deltoid muscle and only if the skin is stretched flat between thumb and forefinger)
Intramuscular Injection (IM) Route: 3–18 Years

- **Site:**
  - Deltoid muscle (upper arm) is preferred
  - Vastus lateralis muscle (anterolateral thigh) may be used

- **Needle gauge and length:**
  - 22–25 gauge
  - 5/8 to 1 inch

- **Most young children in this age range require a 5/8 or 1 inch needle:**
  - 5/8 inch needle is adequate only for the deltoid muscle and only if the skin is stretched flat between thumb and forefinger

- **Older children and adolescents require a 1 inch needle**
Intramuscular (IM) Route
Adults 19 Years and Older

- **Site:**
  - Deltoid muscle (upper arm) is preferred
  - Vastus lateralis muscle (anterolateral thigh) may be used

- **Needle gauge:** 23–25 gauge

- **Needle length varies with patient weight**
Positioning and Comforting Restraint

- Encourage parent/guardian to hold child
- Sitting rather than lying down (young child)
- Be aware of syncope (fainting):
  - Have patient seated or lying down during vaccination
  - Be aware of symptoms that precede syncope
  - If patient faints, provide supportive care and protect patient from injury
  - Observe patient (seated or lying down) for at least 15 minutes after vaccination
Procedural Pain Management Strategies

- **Pharmacological**
  - Topical anesthetics
  - Sweet-tasting solutions

- **Physical**
  - Breastfeeding
  - Positioning – parent holding the infant or young child
  - Sitting upright rather than lying down
  - Tactile stimulation

Procedural Pain Management Strategies

- **Psychological**
  - Distraction (i.e., games on smart phones)
  - Deep breathing (i.e., young children can blow bubbles)

- **Procedural**
  - Order of injection: Administer the vaccine most painful when injected last
  - Rapid injection without aspiration

- **Process intervention**
  - Educating and training staff; implementing a planned approach to address procedural pain management

Multiple Vaccinations

- Separate injections by at least 1 inch (or more if possible)
- Use a separate limb for most reactive vaccines, if possible
- Use combination vaccines when appropriate to reduce the number of injections

Documentation

- **Federally required documentation:**
  - Date of administration
  - Vaccine manufacturer
  - Vaccine lot number
  - Name and title of person who administered vaccine and address of clinic or facility where permanent record will reside
  - Vaccine information statement (VIS)
    - Date printed on the VIS
    - Date VIS given to patient or parent/guardian

- **Best practice documentation:**
  - Vaccine type (ACIP abbreviation)
  - Route
  - Dosage (volume)
  - Site
Preventing Vaccine Administration Errors
Strategies to Prevent Errors

- Establish an environment that values reporting and investigating errors as part of risk management and quality improvement
- Use best practices for storing, handling, preparing, and administering vaccines
- Take immediate action and isolate affected vaccine(s) if there is a temperature excursion
- Promptly remove expired vaccines from the storage unit
- Use standing orders
Shoulder Injury Related to Vaccine Administration

- Shoulder injury related to vaccine administration (SIRVA) was added to the Vaccine Injury Compensation Table in March 2017
- Shoulder injuries related to vaccine administration are injuries to the musculoskeletal structure of the shoulder, including the ligaments, bursa, and tendons
  - They are thought to occur as a result of the unintended injection of vaccine antigen and/or trauma from the needle going into and around the underlying bursa of the shoulder
  - Symptoms include shoulder pain and limited mobility after the injection
Shoulder Injury Related to Vaccine Administration and Vaccine Administration Best Practices

- When administering a vaccine by intramuscular (IM) injection in the deltoid muscle, use:
  - Proper landmarks and technique to identify the injection site
  - Proper needle length based on the age, patient size, and injection technique
What if a Vaccination Error Occurs?

- Inform the patient/parent of the error
- Determine the status of the patient
- Explain any needed next steps
- Know how to correct the error
  - Contact your state or local health department, vaccine manufacturer, or nipinfo@cdc.gov for guidance
- Record the vaccine as it was given on the medical administration record
Providers are encouraged to report vaccination errors without health events if they believe the error may pose a safety risk.

VAERS encourages reports of clinically significant adverse health events.
Haemophilus influenzae Type b and Hib Vaccine

May 2019

Chapter 8
Disease
Haemophilus influenzae

- Severe bacterial infection, particularly among infants
- Aerobic gram-negative bacteria
- Polysaccharide capsule
- 6 different serotypes (a-f) of polysaccharide capsule
- 95% of invasive disease caused by type b (prevaccine era)
Impact of *Haemophilus influenzae* Type b Disease

- Formerly the leading cause of bacterial meningitis among children younger than 5 years of age
- Approximately 1 in 200 children developed invasive Hib disease
- Almost all infections among children younger than 5 years
Haemophilus influenzae Type b – Clinical Manifestations*

*Prevacine era
Hib facial cellulitis
# Haemophilus influenzae Type b Epidemiology

<table>
<thead>
<tr>
<th>Reservoir</th>
<th>Human asymptomatic carriers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transmission</td>
<td>Respiratory droplets presumed</td>
</tr>
<tr>
<td>Temporal pattern</td>
<td>Peaks in September-December and March-May</td>
</tr>
<tr>
<td>Communicability</td>
<td>Generally limited but higher in some circumstances (e.g., household, child care)</td>
</tr>
</tbody>
</table>
Estimated Annual Incidence (per 100,000) of Invasive *Haemophilus influenzae* Type b (Hib) Disease in Children Aged <5 Years — United States, 1980–2012

Haemophilus influenzae, Invasive Disease
Incidence of Reported Cases (per 100,000), by Serotype
Among Children Aged <5 Years — United States, 2000–2013

Vaccine
**Haemophilus influenzae Type b Polysaccharide Vaccine**

- Available 1985-1988
- Not effective in children younger than 18 months of age
- Efficacy in older children varied
- Age-dependent immune response
- Not consistently immunogenic in children 2 years of age and younger
- No booster response
Haemophilus influenzae Type b Conjugate Vaccines

- Conjugation improves immunogenicity
  - Immune response with booster doses

- Same polysaccharide capsule linked to different carrier proteins

- 3 single-component conjugate vaccines

- 1 combination vaccine available that contains Hib vaccine
<table>
<thead>
<tr>
<th>Vaccine product</th>
<th>Age indications</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRP-T (polysaccharide, tetanus toxoid)</td>
<td></td>
</tr>
<tr>
<td>ActHIB</td>
<td>All doses of primary schedule and booster dose</td>
</tr>
<tr>
<td></td>
<td>2 months through 5 years</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Hiberix</td>
<td>All doses of primary schedule and booster dose</td>
</tr>
<tr>
<td></td>
<td>6 weeks through 4 years</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Pentacel (DTaP, IPV, Hib)</td>
<td>For doses 1 through 4</td>
</tr>
<tr>
<td></td>
<td>6 weeks through 4 years of age</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>PRP-OMP (polysaccharide, outer membrane protein)</td>
<td></td>
</tr>
<tr>
<td>PedvaxHIB</td>
<td>All doses of primary schedule and booster dose</td>
</tr>
<tr>
<td></td>
<td>2 to 71 months of age</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Vaxelis (DTaP, IPV, Hib, HepB)</td>
<td>All doses of primary schedule (2) and booster dose</td>
</tr>
<tr>
<td></td>
<td>6 weeks-4 years</td>
</tr>
</tbody>
</table>
Clinical Considerations
ACIP Hib Vaccine Recommendations: Pediatric

- Recommended interval 8 weeks for primary series
- Minimum interval 4 weeks for primary series
- Minimum age 6 weeks
- Booster dose at 12-15 months
## Hib Vaccine Routine Schedule

<table>
<thead>
<tr>
<th>Vaccine</th>
<th>2 months</th>
<th>4 months</th>
<th>6 months</th>
<th>12-18 months</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRP-T (ActHIB, Hiberix, and Pentacel)</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>PRP-OMP (PedvaxHIB and Vaxelis)</td>
<td>X</td>
<td>X</td>
<td>NA</td>
<td>X</td>
</tr>
</tbody>
</table>
Unvaccinated Children 7 months of Age and Older

- Children starting late may not need entire 3- or 4-dose series

- Number of doses child requires depends on current age

- See detailed schedule p. 128 of Pink Book and 2019 catch-up schedule
Hib Vaccine Use in Older Children and Adolescents

- Generally not recommended for persons older than 59 months of age
- High-risk older children and adolescents may be vaccinated if not vaccinated in childhood
  - Asplenia
  - Elective splenectomy
  - Immunoglobulin deficiency
  - HIV infection
  - Receipt of chemotherapy or radiation therapy
Special Populations

- **Children aged <24 months with invasive Hib disease**
  - Administer complete series as recommended for child’s age
  - Vaccinate during the convalescent phase of the illness

- **American Indian/Alaska Natives**
  - PRP-OMP vaccines specifically recommended for primary series doses
  - Hib disease peaks earlier in infancy
  - PRP-OMP vaccines produce protective antibody after first dose/early protection
Hib Vaccine Interchangeability

- All single-component conjugate Hib vaccines are interchangeable for primary series and booster dose

- 3-dose primary series (4 doses total) if more than one brand of vaccine used at 2 or 4 months of age

- Whenever feasible use same combination vaccine for subsequent doses

- If vaccine used for earlier doses is not known or not available, any brand may be used to complete the series
Contraindications and Precautions

- Severe allergic reaction to vaccine component or following previous dose
- Moderate to severe acute illness
- Age younger than 6 weeks
Vaccine Administration – Hib-containing Vaccines

- **Preparation:**
  - ActHIB and Pentacel must be reconstituted BEFORE administering
  - PedvaxHib: None

- **Route: IM injection**
  - Needle gauge: 22–25 gauge
  - Needle length*: 1–1.5 inch depending on the patient’s age and/or weight

- **Site***:
  - 6 weeks through 11 months: Vastus lateralis muscle
  - 1 through 2 years: Vastus lateralis muscle is preferred; deltoid muscle may be used if the muscle mass is adequate
  - 3 years and older: Deltoid muscle is preferred; vastus lateralis muscle may be used

- **Vaccine administration error:**
  - Preparation error: Wrong diluent used to reconstitute ActHIB or Pentacel

---

*Professional judgement should be used to determine the proper needle length and site. Influencing factors include injection technique, local reaction, number of vaccines to be administered, patient age, size, and muscle mass.
Hib Vaccine Adverse Reactions

- Swelling, redness, or pain in 5%-30% of recipients
- Systemic reactions infrequent
- Serious adverse reactions rare
Vaccine Storage and Handling

- Store Hib-containing vaccines in a refrigerator between 2°C -- 8°C (36°F -- 46°F)

- Store Hib-containing vaccines:
  - In the original packaging with the lids closed
  - In a clearly labeled bin and/or area of the storage unit

- Store Pentacel diluent (DTaP-IPV) in the refrigerator with the ActHIB vaccine

Vaccine storage label examples
Available at www.cdc.gov/vaccines/hcp/admin/storage/guide/vaccine-storage-labels.pdf

Do not freeze vaccine or diluent
4

Resources
Ask the Experts—Hib FAQs:  
www.immunize.org/askexperts/experts_hib.asp

CDC Catch-Up Guidance for Healthy Children 4 Months through 5 Years of Age for HIB Vaccine: ActHIB, Pentacel, Hiberix, or Unknown:  


CDC Haemophilus influenzae Type b Disease and Vaccination:  
www.cdc.gov/hi-disease/index.html

Standing Orders for Hib Vaccine:  
• Children: www.immunize.org/catg.d/p3083a.pdf  
• Adults: www.immunize.org/catg.d/p3083.pdf
What Do You Think?

Callie is a healthy 2-year-old coming for a well-child visit. Her immunization history indicates she has received 2 doses of Hib vaccine—the first at 10 months and a second at 15 months of age. Do you administer Hib vaccine today?

a. Yes

b. No
Hepatitis B and Hepatitis B Vaccine

Day 1: Pediatric Track

August 2019

Chapter 10
Disease
Hepatitis B Virus

- Hepadnaviridae family (DNA)
- Numerous antigenic components
- May retain infectivity for more than 7 days at room temperature
Hepatitis B Virus Infection

257 million chronic infections worldwide

850,000–2.2 million US chronic infections

Causes 50% of hepatocellular carcinomas

786,000 deaths worldwide

https://www.cdc.gov/hepatitis/hbv/bfaq.htm#bFAQb04
Hepatitis B Epidemiology

- **Reservoir**: Human
- **Transmission**: percutaneous (i.e., puncture through the skin) or mucosal contact with infectious blood or body fluids (e.g., semen, saliva)
- **Communicability**: 1-2 months before and after onset of symptoms
  Persons with either acute or chronic HBV infection with HBsAg present in blood
Hepatitis B Clinical Features

- Incubation period 60-150 days (average 90 days)
- Nonspecific prodrome of malaise, fever, headache, myalgia
- Children < 5 years and newly infected immunosuppressed adults generally asymptomatic
  - 30%–50% of persons aged ≥5 years have signs and symptoms
Chronic Hepatitis B Virus Infection

- 80-90% of persons infected during infancy
- 30% of persons infected before age 6 years
- 1-12% of persons infected as an older child or adult
- Approximately 25% of persons chronically infected during childhood and 15% chronically infected after childhood will die prematurely from cirrhosis or liver cancer
Risk of Chronic HBV Infection

J Hepatol. 2008;48(2):335-52
Hepatitis B Perinatal Transmission*

- HBsAg+ & HBeAg+
  - 70-90% infected
- HBsAg+ only
  - 10% infected
- Up to 90% of infected infants become chronically infected

*in the absence of post exposure prophylaxis
Strategy to Eliminate Hepatitis B Virus Transmission—United States

- Prevent perinatal HBV transmission
  - Routine testing of all pregnant women for HBsAg
    - Prophylaxis (HepB vaccine and HBIG) for infants born to HepB surface antigen (HBsAg) positive women
    - HBV DNA testing for HBsAg positive women and antiviral therapy if HBV DNA is >200,000 IU/mL

- Universal vaccination of all infants at birth

- Routine vaccination of previously unvaccinated children and adolescent (<19 years of age)

- Vaccination of adults at risk for HBV infection

https://www.cdc.gov/mmwr/volumes/67/rr/rr6701a1.htm#B2_down
Vaccine
# Hepatitis B-Containing Vaccine Products*

<table>
<thead>
<tr>
<th>Vaccine product</th>
<th>Age indications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Single-component vaccines</strong></td>
<td></td>
</tr>
<tr>
<td>Engerix-B</td>
<td></td>
</tr>
<tr>
<td><strong>Pediatric formulation</strong></td>
<td>Birth–19 years</td>
</tr>
<tr>
<td><strong>Adult formulation</strong></td>
<td>20 years and older</td>
</tr>
<tr>
<td>Recombivax HB</td>
<td></td>
</tr>
<tr>
<td><strong>Pediatric formulation</strong></td>
<td>Birth–19 years</td>
</tr>
<tr>
<td><strong>Adult formulation</strong></td>
<td>20 years and older</td>
</tr>
<tr>
<td>Heplisav-B</td>
<td>18 years and older</td>
</tr>
<tr>
<td><strong>Combination vaccines</strong></td>
<td></td>
</tr>
<tr>
<td>Pediarix–DTaP, IPV and HepB vaccines</td>
<td>6 weeks–6 years</td>
</tr>
<tr>
<td>Twinrix–HepA and HepB vaccines</td>
<td>18 years and older</td>
</tr>
</tbody>
</table>

*ACIP does not state a preference for vaccine product versus another if the patient is eligible for more than 1 product.
Engerix and Recombivax HB

- Composition
  - Recombinant HBsAg

- Efficacy
  - 95% (Range, 80%-100%)

- Duration of Immunity
  - 30 years or more

- Schedule
  - 3 doses

- Booster doses not routinely recommended
Recommended Dosage of HepB Vaccine

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Recombivax HB Dose (mcg)</th>
<th>Engerix-B Dose (mcg)</th>
<th>Heplisav-B (mcg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Children/Adolescents birth through 17 years</td>
<td>0.5 mL (5)</td>
<td>0.5 mL (10)</td>
<td>Not approved</td>
</tr>
<tr>
<td>Adolescents 18 years</td>
<td>0.5 mL (10)</td>
<td>0.5 ml (20)</td>
<td>0.5 mL (20)</td>
</tr>
<tr>
<td>Adults 19 years of age and older</td>
<td>1.0 mL (10)</td>
<td>1.0 mL (20)</td>
<td>0.5 mL (20)</td>
</tr>
</tbody>
</table>
Vaccine Supply: Pediatric
RecombivaxHB

- Merck is not currently distributing hepatitis B vaccine, pediatric and adult formulations, through 2019
- GSK address the gap for pediatric hepatitis B vaccine using a combination of single-component hepatitis B vaccine and DTaP-HepB-IPV (Pediarix)
- CDC anticipates there will be approximately 10% less single component pediatric hepatitis B vaccine than normal during the rest of 2019
- GSK has sufficient supplies of adult hepatitis B vaccine to address these anticipated gaps
  - Preferences for a specific presentation (i.e., vial versus syringe) may not be consistently be met

CDC Current Vaccine Shortages and Delays https://www.cdc.gov/vaccines/hcp/clinical-resources/shortages.html
Clinical Considerations
**ACIP HepB Vaccine Recommendations: Pediatric**

<table>
<thead>
<tr>
<th>Vaccine</th>
<th>Birth</th>
<th>1 mo</th>
<th>2 mos</th>
<th>4 mos</th>
<th>6 mos</th>
<th>9 mos</th>
<th>12 mos</th>
<th>15 mos</th>
<th>18 mos</th>
<th>19-23 mos</th>
<th>2-3 yrs</th>
<th>4-6 yrs</th>
<th>7-10 yrs</th>
<th>11-12 yrs</th>
<th>13-15 yrs</th>
<th>16 yrs</th>
<th>17-18 yrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hepatitis B (HepB)</td>
<td>1st dose</td>
<td>2nd dose</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

- Routinely recommended for all children birth through 18 years of age
- Vaccinate previously unvaccinated children and those missing doses
### HepB Schedule: Routine Infant

<table>
<thead>
<tr>
<th>Dose$^+</th>
<th>Routine Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dose 1</td>
<td>Birth$^§$</td>
</tr>
<tr>
<td>Dose 2</td>
<td>1- 2 months</td>
</tr>
<tr>
<td>Dose 3$^+$</td>
<td>6-18 months$^*$</td>
</tr>
</tbody>
</table>

$^§$The birth dose of single-component Hepatitis B vaccine should be administered within 24 hours of birth for medically stable infants weighing ≥2,000 grams born to hepatitis B surface antigen (HBsAg)-negative mothers.

*Infants whose mothers are HBsAg+ or whose HBsAg status is unknown should receive the third dose at 6 months of age

$^+$An additional dose at 4 months is acceptable if the clinician prefers to use a combination vaccine that contains hepatitis B vaccine
HepB Schedule: Minimum Age and Intervals

DOSE 1

4 weeks

DOSE 2

8 weeks

DOSE 3

6 months = minimum age

16 weeks

4-day grace can be applied to minimum age and intervals
Pediarix Schedule Considerations

Can be given to infants who received HepB at birth = 4 doses*
Do NOT use for the birth dose

*An additional dose at 4 months is acceptable if the clinician prefers to use a combination vaccine that contains hepatitis B vaccine.

6 months is the minimum age for the last dose.
Birth Dose Considerations:
Babies Weighing 2000 grams or more

HBsAg NEGATIVE mother
Administer HepB vaccine within 24 hours of birth

HBsAg POSITIVE mother
Administer HepB vaccine and HBIG* within 12 hours of birth

HBsAg UNKNOWN mother
Administer HepB vaccine within 12 hours of birth and test to determine mother’s status ASAP

*Administer HepB vaccine and HBIG in separate limbs
Birth Dose Considerations: Babies Weighing Less Than 2000 grams

**HBsAg NEGATIVE**

Mother

Administer HepB vaccine at hospital discharge or at 1 month of age

**HBsAg POSITIVE**

Mother

Administer HepB vaccine and HBIG* within 12 hours of birth

**HBsAg UNKNOWN**

Mother

Administer HepB vaccine within 12 hours of birth. Give HBIG, if the mother’s HBsAg status cannot be determined within 12 hours of birth*

*Administer HepB vaccine and HBIG in separate limbs
Medical Considerations: Treating Infants Whose Mother is Hepatitis B Surface Antigen POSITIVE

- Administer HepB vaccine and HBIG within 12 hours of birth
  - HepB vaccine and HBIG can be administered at the same time
  - HepB and HBIG are both IM injections
  - Administer in different limbs

- Complete vaccination series at 6 months of age
  - 1st dose does not count when administered to infants weighing less than 2000 grams

- Test for response after completing a 3-dose series at 9 through 12 months of age
Medical Considerations: Treating Infants Whose Mother is Hepatitis B Surface Antigen \textit{UNKNOWN}

- Infants born to women without HBsAg testing results but other evidence suggests maternal HBV infection exists, administer both HepB and HBIG within 12 hours of birth.

- Test mother for HBsAG status as soon as possible.
  - Infants weighing 2000 grams or more: If mother is determined to be hepatitis B surface antigen positive give HBIG as soon as possible, but no later than age 7 days.
  - Infants weighing less than 2000 grams: If the mother tests positive or HBsAG status can not be determined, administer HBIG within 12 hours of birth.
Serologic Testing and Children

- **Prevaccination serologic testing is:**
  - Not indicated before routine vaccination of infants or children
  - Recommended for all persons born in Africa, Asia, the Pacific Islands, and other regions with HBsAg prevalence of 2% or higher

- **Postvaccination serologic testing is:**
  - Not routinely recommended following vaccination of infants, children, and adolescents
  - Recommended for infants born to HBsAg+ women
Revaccination

- Revaccination is generally not recommended for persons with a normal immune status
- Recommended for the following:
  - HBsAg-negative infants with anti-HBs <10 mIU/mL (born to HBsAg-positive mothers)
  - Hemodialysis patients
  - HIV-infected persons
  - Other immunocompromised persons
Vaccine Administration

- **Route: IM Injection**
  - Needle gauge: 22–25 gauge
  - Needle length*: 5/8 – 1.5 inch depending on the patient’s age and/or weight

- **Site***:
  - Birth–11 months: Vastus lateralis muscle is preferred
  - 1–3 years: Vastus lateralis muscle is preferred; deltoid muscle may be used if the muscle mass is adequate
  - 4 years and older: Deltoid muscle is preferred; vastus lateralis muscle may be used

*Professional judgement should be used to determine the proper needle length and site. Factors influencing site including local reaction, number of vaccine to be administered age and muscle mass
# Vaccine Administration Considerations

- **Route: IM Injection**
  - Administer HepB vaccine and HBIG (if needed) in different limbs

- **Site: NO BUTTS!**

<table>
<thead>
<tr>
<th>Administration Errors</th>
<th>Count the Dose or Revaccinate?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adult formulation administered to a child</td>
<td>Count the dose, if it meets minimum age and interval</td>
</tr>
<tr>
<td>Pediatric formulation administered to an adult</td>
<td>Dose does not count and should be repeated ASAP</td>
</tr>
<tr>
<td>HepA instead of HepB vaccine</td>
<td>Administer HepB vaccine ASAP</td>
</tr>
</tbody>
</table>
HepB Vaccine Contraindications and Precautions

- **Contraindication**
  - Severe allergic reaction to a vaccine component or following a prior dose

- **Precaution**
  - Moderate or severe acute illness
<table>
<thead>
<tr>
<th>Symptom</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pain at injection site</td>
<td>3%-29%</td>
</tr>
<tr>
<td>Erythema</td>
<td>3%</td>
</tr>
<tr>
<td>Swelling</td>
<td>3%</td>
</tr>
<tr>
<td>Fever</td>
<td>1%-6%</td>
</tr>
<tr>
<td>Headache</td>
<td>3%</td>
</tr>
<tr>
<td>Severe systemic reactions</td>
<td>rare</td>
</tr>
</tbody>
</table>
Hepatitis B Vaccine Storage and Handling

- Store HepB-containing vaccines in a refrigerator between 2°C - 8°C (36°F - 46°F)
- DO NOT FREEZE
- Store in the original packaging with the lids closed in a clearly labeled bin and/or area of the storage unit
- Store pediatric and adult formulations separately, away from each other and other look- or sound-alike vaccines; e.g., HepA, Hib, HPV

Vaccine storage label example
Available at www.cdc.gov/vaccines/hcp/admin/storage/guide/vaccine-storage-labels.pdf
Resources
Information for Parents: Hepatitis B and the Vaccine (Shot) to Prevent It

The best way to protect against hepatitis B is by getting the hepatitis B vaccine. Doctors recommend that all children get the vaccine.

Why should my child get the hepatitis B shot?
- Protects your child against hepatitis B, a potentially serious disease.
- Protects other people from the disease because children with hepatitis B usually don’t have symptoms, but they may pass the disease to others without anyone knowing they were infected.
- Protects your child from developing liver disease and cancer from hepatitis B.
- Keep your child from missing school or childcare and keeps you from missing work to care for your sick child.

Is the hepatitis B shot safe?
The hepatitis B vaccine is very safe, and it is effective at preventing hepatitis B. Like any medicine, it can have side effects. But serious side effects caused by the hepatitis B vaccine are extremely rare.

What are the side effects?
Most people who get the hepatitis B vaccine will have no side effects at all. When side effects do occur, they are often very mild, such as a low fever (less than 100 degrees) or a sore arm from the shot.

What is hepatitis B?
Hepatitis B is a contagious liver disease caused by the hepatitis B virus. When a person is first infected with the virus, he or she can develop an "acute" (short-term) infection. Acute hepatitis B refers to the first 6 months after someone is infected with the hepatitis B virus. This infection can range from a very mild illness with few or no symptoms to a serious condition requiring hospitalization. Some people are able to fight the infection and clear the virus.

For others, the infection remains and is "chronic" or lifelong. Chronic hepatitis B refers to the infection when it remains active instead of getting better after 6 months. Over time, the infection can cause serious health problems, and even liver cancer.

Doctors recommend that your child get 3 doses of the hepatitis B shot for best protection. Ask your doctor when your child should get the next shot. Typically, children get one dose at each of the following ages:
- Shortly after birth
- 1 through 2 months
- 6 through 18 months
Your child may get a 4th dose depending on the brand of vaccine the doctor uses.

Hepatitis B Standing Order Templates

Children and Adults

**STANDING ORDERS FOR Administering Hepatitis B Vaccine to Children and Teens**

**Purpose**
To reduce morbidity and mortality from hepatitis B virus (HBV) by vaccinating all children and teens who meet the criteria established by the Centers for Disease Control and Prevention’s Advisory Committee on Immunization Practices (ACIP).

**Policy**
Where allowed by state law, standing orders enable eligible nurses and other healthcare professionals (e.g., pharmacists) to assess the need for and vaccinate children and teens who meet any of the criteria below.

**Procedure**
1. Assess Children and Teens in Need of Vaccination against HBV infection based on the following criteria:
   - Lack of documentation of at least 3 doses of hepatitis B vaccine (HBV) with the third dose given at least 14 weeks after the first dose, at least 6 weeks after the second dose, and when no younger than age 24 weeks.
2. Screen for contraindications and precautions
   - Do not give HepB to a child or teen who has experienced a serious adverse event (e.g., anaphylaxis) to a prior dose of the vaccine or to any of its components. Information on vaccine components, refer to the manufacturer’s package insert (www.immunize.org/package insert) or to go to www.cdc.gov/vaccines/pubs/pinkbook/downloads/appendices/Emc/EmcScheduling2.pdf.
   - Do not give any HepB to a child or teen who has experienced hypersensitivity to yeast.

**Precautions**
- Moderate or severe acute illness with or without fever

**Additional Information**
- Provide Vaccine Information Statements
- Provide patients or parents, or legal representatives, with a copy of the most current federal vaccine information statement (VFC). Provide non-English-speaking patients with a copy of the VFC in their native language. If none is available and desired, these can be found at www.immunize.org. For information about how to download the VFC in English, see section 6.1.1 (Document Vaccination).

**Steps to Administer Vaccine**
- Choose the needle gauge, needle length, and injection site according to the following chart.

<table>
<thead>
<tr>
<th>Vaccine name</th>
<th>Needle gauge</th>
<th>Needle length</th>
<th>Injection site</th>
</tr>
</thead>
<tbody>
<tr>
<td>HBV vaccine</td>
<td>27G</td>
<td>1”</td>
<td>Upper arm</td>
</tr>
<tr>
<td></td>
<td>25G</td>
<td>1/2”</td>
<td>Upper arm</td>
</tr>
<tr>
<td></td>
<td>23G</td>
<td>1/2”</td>
<td>Upper arm</td>
</tr>
<tr>
<td></td>
<td>21G</td>
<td>5/8”</td>
<td>Upper arm</td>
</tr>
<tr>
<td></td>
<td>20G</td>
<td>5/8”</td>
<td>Upper arm</td>
</tr>
<tr>
<td></td>
<td>18G</td>
<td>1”</td>
<td>Upper arm</td>
</tr>
<tr>
<td></td>
<td>16G</td>
<td>1”</td>
<td>Upper arm</td>
</tr>
<tr>
<td></td>
<td>14G</td>
<td>1”</td>
<td>Upper arm</td>
</tr>
<tr>
<td></td>
<td>12G</td>
<td>1”</td>
<td>Upper arm</td>
</tr>
<tr>
<td></td>
<td>10G</td>
<td>1”</td>
<td>Upper arm</td>
</tr>
<tr>
<td></td>
<td>8G</td>
<td>1”</td>
<td>Upper arm</td>
</tr>
</tbody>
</table>

**CONTINUED ON THE NEXT PAGE**

**IMMUNIZATION ACTION COALITION**


**STANDING ORDERS FOR Administering Hepatitis B Vaccine to Adults**

**Purpose**
To reduce morbidity and mortality from hepatitis B virus (HBV) by vaccinating all adults who meet the criteria established by the Centers for Disease Control and Prevention’s Advisory Committee on Immunization Practices.

**Policy**
Where allowed by state law, standing orders enable eligible nurses and other healthcare professionals (e.g., pharmacists) to assess the need for and vaccinate adults who meet any of the criteria below.

**Procedure**
1. Assess Adults in Need of Vaccination against HBV infection according to the following criteria:
   - Any person who wants to be protected from HBV infection.
   - Person with diabetes mellitus. (Note for those age 60 years or older with diabetes mellitus, or at the discretion of the treating clinician.)
   - Person with HIV/AIDS. (Including patients receiving antiretroviral, HBV or, chronic liver disease.
   - Sexually active and not in a long-term, mutually monogamous relationship (e.g., more than 1 sex partner during the previous 6 months).
   - Sexually active and not in a long-term, mutually monogamous relationship (e.g., more than 1 sex partner during the previous 6 months).
   - Person with or at high risk for hepatitis B. (Including those who are currently infected with HBV (HIV patient.) (This includes an infected postive drug user.)
   - Person with or at high risk for hepatitis B. (Including those who are currently infected with HBV (HIV patient.) (This includes an infected postive drug user.)
   - Person with or at high risk for hepatitis B. (Including those who are currently infected with HBV (HIV patient.) (This includes an infected postive drug user.)
   - Person with or at high risk for hepatitis B. (Including those who are currently infected with HBV (HIV patient.) (This includes an infected postive drug user.)
   - Person with or at high risk for hepatitis B. (Including those who are currently infected with HBV (HIV patient.) (This includes an infected postive drug user.)

**Precautions**
- Moderate or severe acute illness with or without fever

**Additional Information**
- Provide Vaccine Information Statements
- Provide patients or parents, or legal representatives, with a copy of the most current federal vaccine information statement (VFC). Provide non-English-speaking patients with a copy of the VFC in their native language. If none is available and desired, these can be found at www.immunize.org. For information about how to download the VFC in English, see section 6.1.1 (Document Vaccination).

**Steps to Administer Vaccine**
- Choose the needle gauge, needle length, and injection site according to the following chart.

<table>
<thead>
<tr>
<th>Vaccine name</th>
<th>Needle gauge</th>
<th>Needle length</th>
<th>Injection site</th>
</tr>
</thead>
<tbody>
<tr>
<td>HBV vaccine</td>
<td>27G</td>
<td>1”</td>
<td>Upper arm</td>
</tr>
<tr>
<td></td>
<td>25G</td>
<td>1/2”</td>
<td>Upper arm</td>
</tr>
<tr>
<td></td>
<td>23G</td>
<td>1/2”</td>
<td>Upper arm</td>
</tr>
<tr>
<td></td>
<td>21G</td>
<td>5/8”</td>
<td>Upper arm</td>
</tr>
<tr>
<td></td>
<td>20G</td>
<td>5/8”</td>
<td>Upper arm</td>
</tr>
<tr>
<td></td>
<td>18G</td>
<td>1”</td>
<td>Upper arm</td>
</tr>
<tr>
<td></td>
<td>16G</td>
<td>1”</td>
<td>Upper arm</td>
</tr>
<tr>
<td></td>
<td>14G</td>
<td>1”</td>
<td>Upper arm</td>
</tr>
<tr>
<td></td>
<td>12G</td>
<td>1”</td>
<td>Upper arm</td>
</tr>
<tr>
<td></td>
<td>10G</td>
<td>1”</td>
<td>Upper arm</td>
</tr>
<tr>
<td></td>
<td>8G</td>
<td>1”</td>
<td>Upper arm</td>
</tr>
</tbody>
</table>

**CONTINUED ON THE NEXT PAGE**

**IMMUNIZATION ACTION COALITION**


- Ask the Experts–Hepatitis B FAQs: www.immunize.org/askexperts/experts_hepb.asp
- CDC Viral Hepatitis–Hepatitis B Information: www.cdc.gov/hepatitis/hbv/index.htm
- CDC Hepatitis B Vaccination: www.cdc.gov/vaccines/vpd/hepb/index.html
- Hepatitis B and the Vaccine (Shot) to Prevent It–Information for Parents: www.cdc.gov/vaccines/parents/diseases/child/hepB-basics-color.pdf
- Preexposure Evaluation for Health Care Personnel Previously Vaccinated with Complete ≥3-Dose HepB Vaccine Series Who Have Not Had Postvaccination Serologic Testing (Figure 3): www.cdc.gov/mmwr/volumes/67/rr/pdfs/rr6701-H.pdf
What Do You Think?

- Hepatitis B vaccine was inadvertently administered subcutaneously instead of the recommended route, intramuscular injection. Does the dose count?
  - Yes
  - No

No. For optimal protection, it is crucial that the vaccine be administered IM, not subcutaneously. ACIP recommends repeating the dose.
Pneumococcal Disease and Pneumococcal Vaccines

Day 1: Pediatric Track

August 2019

Chapter 17
1
Streptococcus pneumoniae

- Gram-positive bacteria
- 92 known serotypes
- Polysaccharide capsule important virulence factor
- Type-specific antibody is protective
- Limited cross-reactivity
Pneumococcal Disease

- Second most common cause of vaccine-preventable death in the U.S.

- Major clinical syndromes
  - Pneumonia
  - Bacteremia
  - Meningitis
Risk Factors for Invasive Pneumococcal Disease

- Functional or anatomic asplenia, including sickle-cell disease
- Altered immunocompetence
- Underlying medical conditions, including chronic renal disease, nephrotic syndrome, and CSF leak
- Cochlear implant
Pneumococcal Disease Epidemiology

- **Reservoir**: Human carriers
- **Transmission**: Respiratory and autoinoculation
- **Temporal pattern**: Winter and early spring
- **Communicability**: Unknown; probably as long as organism in respiratory secretions
Vaccine
Pneumococcal Conjugate Vaccine (PCV13) Characteristics

- Contains 13 serotypes of S. pneumoniae conjugated to nontoxic diphtheria CRM197 carrier protein

- Approval based on demonstration of immunologic noninferiority to PCV7 rather than clinical efficacy
Pneumococcal Conjugate Vaccine (PCV13) Immunogenicity/Efficacy

- Highly immunogenic in infants and young children, including those with high-risk medical conditions

- PCV7 was 97% effective against invasive disease caused by vaccine serotypes (presumably PCV13 as well)
Pneumococcal Polysaccharide Vaccine (PPSV23)
Characteristics

- Purified capsular polysaccharide antigen from 23 types of pneumococcus

- Not effective in children younger than 2 years
Clinical Considerations
PCV13 is recommended for:
- Infants and young children 6 weeks through 4 years of age
- Previously unvaccinated children 6 years of age and older at increased risk

PPSV23 is recommended for children 2 years of age and older who are at increased risk
ACIP Recommendations for PCV13

- Routinely recommended for infants and children 2 through 59 months of age
  - 4–dose schedule: 2, 4, 6, and 12 to 15 months
  - Fewer doses if series started at 7 months of age or older
Pneumococcal Conjugate Vaccine Schedule for Unvaccinated Older Children-Primary Series

<table>
<thead>
<tr>
<th>Age at First Dose</th>
<th># of Doses</th>
<th>Booster</th>
</tr>
</thead>
<tbody>
<tr>
<td>7-11 months</td>
<td>2 doses</td>
<td>Yes</td>
</tr>
<tr>
<td>12-23 months</td>
<td>2 doses*</td>
<td>No</td>
</tr>
<tr>
<td>24-59 months</td>
<td>1 dose</td>
<td>No</td>
</tr>
<tr>
<td>24-71 months,</td>
<td>2 doses*</td>
<td>No</td>
</tr>
<tr>
<td>with medical</td>
<td></td>
<td></td>
</tr>
<tr>
<td>conditions**</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Separated by at least 8 weeks; see MMWR 2010;59(RR-11):1–19

**Chronic heart, lung disease, diabetes, CSF leak, cochlear implant, sickle cell disease, other hemoglobinopathies, functional or anatomic asplenia, HIV infection, immunocompromising conditions
ACIP Recommendations for PCV13 Dose

- A dose of PCV13 should be administered to children 6 through 18 years of age who are at increased risk for invasive pneumococcal disease* (and no prior PCV13 doses)
  - Functional or anatomic asplenia, including sickle cell disease
  - HIV infection and other immunocompromising conditions
  - Cochlear implant
  - CSF leak

- Regardless of previous history of PCV7 or PPSV vaccine

*Off-label recommendation, ACIP vote, February 20, 2013
Pneumococcal Conjugate (PCV13) Vaccine Administration

- **Administer PCV13 vaccine via intramuscular (IM) injection**
  - Needle gauge: 22–25 gauge
  - Needle length*: 5/8 – 1.5 inch depending on the patient’s age and/or weight
  - Site*:
    - Birth–11 months: Vastus lateralis muscle is preferred
    - 1–2 years: Vastus lateralis muscle is preferred; deltoid muscle may be used if the muscle mass is adequate
    - 3 years and older: Deltoid muscle is preferred; vastus lateralis muscle may be used

- **Administer at the same medical visit as other vaccines, except Men ACWY-D in asplenic persons (others, OK to administer)**

*Professional judgement should be used to determine the proper needle length and site. Factors influencing site including local reaction, number of vaccine to be administered age and muscle mass*
**ACIP Pneumococcal Recommendations:**

**Pneumococcal Polysaccharide (PPSV23)**

- Administer PPSV23 to children 2 years of age and older with:

<table>
<thead>
<tr>
<th>Chronic Medical Conditions</th>
<th>Immunocompromising Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiovascular disease</td>
<td>Asplenia (functional or anatomic)</td>
</tr>
<tr>
<td>Pulmonary disease</td>
<td>Chronic renal failure or nephrotic syndrome</td>
</tr>
<tr>
<td>Diabetes</td>
<td>Hodgkin disease</td>
</tr>
<tr>
<td>CSF leak</td>
<td>Lymphoma and leukemia</td>
</tr>
<tr>
<td>Liver disease</td>
<td>Multiple myeloma</td>
</tr>
<tr>
<td>Cochlear implant</td>
<td>Organ transplant</td>
</tr>
<tr>
<td>Alcoholism</td>
<td>HIV infection</td>
</tr>
</tbody>
</table>
Pneumococcal Polysaccharide Vaccine Recommendations

- Administer 1 dose of PPSV23 to children 2 years of age and older with normal immune systems who have a chronic illness including:
  - Cardiovascular or pulmonary disease
  - Diabetes
  - CSF leak
  - Liver disease (6 years old and older)
  - Cochlear implant
  - Alcoholism (6 years old and older)

- Consider for Alaskan Natives/American Indians in environments or settings with increased risk
Pneumococcal Polysaccharide Vaccine Revaccination

- Revaccination recommended for persons 2–64 years of age who are at highest risk of serious pneumococcal infection
  - Immunocompromising conditions
  - Functional or anatomic asplenia

- Separate doses by at least 5 years
- No more than 2 doses are recommended
- Routine revaccination of immunocompetent persons is not recommended
Pneumococcal Polysaccharide Vaccine Recommendations

- Administer 2 doses to those who are immunocompromised (due to disease or treatment), including those with:
  - Asplenia (functional or anatomic)
  - Chronic renal failure
  - Nephrotic syndrome
  - Hodgkin disease
  - Lymphoma and leukemia
  - Multiple myeloma
  - Organ transplant
  - HIV infection
Pneumococcal polysaccharide (PPSV23) Vaccine Administration

- Administer PPSV23 vaccine via intramuscular (IM) or subcutaneous injection
  - Choose needle size based on route and patient considerations – age and/or size
  - IM Site*:
    - 2–3 years: Vastus lateralis muscle is preferred; deltoid muscle may be used if the muscle mass is adequate
    - 4 years and older: Deltoid muscle is preferred; vastus lateralis muscle may be used
  - Subcut site:
    - Subcutaneous tissue over the upper outer triceps of arm

- Administer at the same medical visit as other vaccines

*Professional judgement should be used to determine the proper needle length and site. Factors influencing site including local reaction, number of vaccine to be administered age and muscle mass
Administering PCV13 and PPSV23 Vaccines

General Rules

- PCV13 and PPSV23 should not be administered during the same clinic visit
  - Either vaccine may be administered simultaneously with influenza vaccine
- Administer PCV13 before PPSV23 whenever possible
What Do You Think?

A 6 year-old patient has sickle cell disease. Her immunization history includes a complete PCV13 series, and PPSV23 at 4 years of age. Should PPSV23 be administered today?

• Yes

• No
Vaccine Administration Errors
Pneumococcal Vaccines

- Frequent vaccine administration errors:
  - Wrong vaccine
    - PPSV23 to an infant
  - Schedule error:
    - More than 1 PPSV23 revaccination dose to immunocompetent at-risk persons
# Pneumococcal Vaccines
## Adverse Reactions

<table>
<thead>
<tr>
<th></th>
<th>PPSV23</th>
<th>PCV13</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Local reactions</strong></td>
<td>30%-50%</td>
<td>5%-49%</td>
</tr>
<tr>
<td><strong>Fever, myalgia</strong></td>
<td>&lt;1%</td>
<td>24-35%</td>
</tr>
<tr>
<td><strong>Febrile seizures</strong></td>
<td>---</td>
<td>Rare: 1-14/100,000; with IIV 4 -45/100,000</td>
</tr>
<tr>
<td><strong>Severe adverse reactions</strong></td>
<td>rare</td>
<td>8% (local)</td>
</tr>
</tbody>
</table>
Pneumococcal Vaccines
Contraindications and Precautions

- Severe allergic reaction to vaccine component or following prior dose of vaccine

- Moderate or severe acute illness
Vaccine Storage and Handling

- Store PCV13 and PPSV23 vaccines in a refrigerator between 2°C - 8°C (36°F - 46°F)

- Store:
  - In the original packaging with the lids closed
  - In a clearly labeled bin and/or area of the storage unit – not next to each other

  Do not freeze the vaccine

PCV13 (Prevnar 13)
Ages: All children 6 weeks through 5 years
Increased risk children: 6 years through 18 years
Increased risk adults: 19 years and older
Adults 65 years and older who have never received PCV13
Route: Intramuscular (IM) injection

PPSV23 (Pneumovax 23)
Ages: Healthy adults 65 years and older
Increased risk persons: 2 years through 64 years
Route: Intramuscular (IM) injection OR Subcutaneous (subcut) injection
No more than two doses of PPSV23 recommended before 65th birthday and one dose after 65.

Available at www.cdc.gov/vaccines/hcp/admin/storage/guide/vaccine-storage-labels.pdf
4

Resources
The app incorporates recommendations for all ages

Users simply:
- Enter a patient’s age
- Note if the patient has specific underlying medical conditions
- Answer questions about the patient’s pneumococcal vaccination history

Then the app provides patient-specific guidance consistent...
Pneumococcal Catch-Up Guidance

- Provides guidance for children whose vaccinations have been delayed.
- Start with the child’s age and immunization history.
- Use this table in conjunction with table 2 of the Recommended Child and Adolescent Immunization Schedule for Ages 18 Years or Younger.
Rotavirus

Day 1: Pediatric Track

August 2019
Disease
Rotavirus

- First identified as a cause of diarrhea in 1973
- Leading cause of severe gastroenteritis among U.S. children before introduction of vaccine in 2006
- Nearly universal infection by age 5 years
- Responsible for up to 500,000 diarrheal deaths each year worldwide
Rotavirus

- Two important outer shell proteins—VP7, or G-protein, and VP4, or P-protein define the serotype of the virus
- From 1996–2005, five predominate strains in the U.S. (G1–G4, G9) accounted for 90% of the isolates
- G1 strain accounts for 75% of infections
- Very stable and may remain viable for weeks or months if not disinfected
Rotavirus Immunity

- Antibody against VP7 and VP4 probably important for protection
  - Cell-mediated immunity probably plays a role in recovery and immunity

- First infection usually does not lead to permanent immunity

- Reinfection can occur at any age

- Subsequent infections generally less severe
Rotavirus Clinical Features

- Short incubation period
- First infection after 3 months of age generally most severe
- May be asymptomatic or result in severe, dehydrating diarrhea with fever and vomiting
- Gastrointestinal symptoms generally resolve in 3–7 days
Rotavirus Complications

- Infection can lead to severe diarrhea, dehydration, electrolyte imbalance, and metabolic acidosis
- Immunocompromised children may experience severe prolonged gastroenteritis
- May have abnormalities in multiple organ systems, especially the kidney and liver
Rotavirus Epidemiology

- **World-wide distribution**
  - Similar in developed and developing countries

- **Reservoir**
  - Human–GI tract and stool

- **Transmission**
  - Fecal–oral, fomites

- **Temporal pattern**
  - Fall and winter (temperate areas)

- **Communicability**
  - 2 days before to 10 days after onset of symptoms
Rotavirus Disease in the United States
Prevaccine Era

▪ Annually responsible for:
  • 3 million infections
  • More than 400,000 physician visits
  • 200,000 emergency dept. visits
  • 55,000–70,000 hospitalizations
  • 20–60 deaths

▪ $1 billion in direct and indirect costs

Impact of Rotavirus Vaccine Introduction

FIGURE 1. Total number of rotavirus tests and positive rotavirus tests (A) and percent positivity (B) among the 23 continuously reporting National Respiratory and Enteric Virus Surveillance System (NREVSS) laboratories* — NREVSS, United States, 2000–2018

https://www.cdc.gov/mmwr/volumes/68/wr/mm6824a2.htm?s_cid=mm6824a2_w#F1_down
Rotavirus: What You Should Know

Before a rotavirus vaccine was available, each year in the United States almost 3 million children experienced high fever, persistent vomiting, and diarrhea as a result of rotavirus infections. These illnesses occurred during the winter in the United States and led to hundreds of thousands of doctor visits, tens of thousands of hospitalizations, and a small number of deaths. In other parts of the world where vaccine and medical access are limited, rotavirus still claims the lives of more than 1,000 children every day.

Q&A

1. Q: What is rotavirus?
   A: Rotavirus is a virus that infects the lining of the intestines. Typically, the virus infects children between 6 months of age and 5 years of age. In temperate climates, the disease occurs year-round.

2. Q: What is my child’s risk of getting infected with rotavirus?
   A: Almost everyone in the industrialized world is infected with rotavirus by 5 years of age. Before the vaccine, every year in the United States, rotavirus caused about 3.5 million children. The virus also caused 300,000 doctor visits, 53,000 to 70,000 hospitalizations, and 20 to 60 deaths. About one of every 5 children born in the U.S. was hospitalized with dehydration caused by rotavirus. Since the rotavirus vaccine became widely used, about 90% of children have not fallen ill from rotavirus. Throughout the world, rotavirus kills about 500,000 children 5 years of age and younger each year, more than any other single infection.

3. Q: How do we vaccinate children in the developing world without resources?
   A: In many places, children receive rotavirus vaccines intranasally, meaning the vaccine is sprayed into the nose. This method has been used successfully in areas where resources are limited.

4. Q: Why do we vaccinate children under 5 years of age?
   A: Most children who get rotavirus infections develop symptoms in developing countries, but they’re rare.

5. Q: Are there any side effects from rotavirus vaccines?
   A: Rotavirus causes some temporary symptoms: high fever, vomiting, and diarrhea. These symptoms cause children to be very sick. For this reason, it is crucial that parents keep children hydrated as quickly as possible when they have symptoms.

Throughout the world, rotavirus kills about 500,000 infants and young children every year, more than any other single infectious disease. About 1,400 children die every day from rotavirus.

Children’s Hospital of Philadelphia Vaccine Education Center http://media.chop.edu/data/files/pdfs/vaccine-education-center-rotavirus.pdf
Vaccine
## Rotavirus Vaccines

<table>
<thead>
<tr>
<th>Vaccine product</th>
<th>Age indications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single-component vaccines</td>
<td></td>
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<tr>
<td>RotaTeq (RV5)</td>
<td>6 weeks to 32 weeks of age</td>
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<tr>
<td>Rotarix (RV1)</td>
<td>6 weeks to 24 weeks of age</td>
</tr>
</tbody>
</table>
Rotavirus Vaccine Efficacy

- **Any rotavirus gastroenteritis**
  - 74–87%

- **Severe gastroenteritis**
  - 85–98%

- Both vaccines have significantly reduced physician visits for diarrhea and reduced rotavirus-related hospitalizations

- No ACIP preference for one product (RV5 vs. RV1) over the other
Clinical Considerations
2 RV1 or 3 RV5 oral doses beginning at 2 months of age
  • May be started as early as 6 weeks of age

For both rotavirus vaccines:
  • Maximum age for first dose is 14 weeks, 6 days*
  • Minimum interval between doses is 4 weeks
  • Maximum age for any dose is 8 months, 0 days

*ACIP off-label recommendation for both vaccines because the labeled maximum age for the first dose of RV5 is 12 weeks
Rotavirus Vaccination Schedule

- ACIP did not define a maximum interval between doses
- Doses of rotavirus vaccine should be separated by at least 4 weeks
- No rotavirus vaccine should be administered to infants older than 8 months, 0 days*
- It is not necessary to restart the series or add doses because of a prolonged interval between doses

*ACIP off-label recommendation for both vaccine products because the labeled maximum age for RV1 is 24 weeks, and the labeled maximum age for RV5 is 32 weeks
Rotavirus Vaccine Recommendations

- ACIP recommends that providers do not repeat the dose if the infant spits out or regurgitates the vaccine

- Any remaining doses should be administered on schedule
  - Doses of rotavirus vaccine should be separated by at least 4 weeks

- Complete the series with the same vaccine product whenever possible
Rotavirus Vaccine Recommendations

- If product used for a prior dose or doses is not available or not known, continue or complete the series with the product that is available.

- If any dose in the series was RV5 (RotaTeq) or the vaccine brand used for any prior dose is not known, a total of 3 doses of rotavirus vaccine should be administered.

- Infants documented to have had rotavirus gastroenteritis before receiving the full course of rotavirus vaccinations should still begin or complete the 2- or 3-dose schedule.
Rotavirus Vaccine Administration

- **Preparation:**
  - RV5: None
  - RV1: Must be reconstituted BEFORE administering

- **Route/Site:** Administer ORALLY (PO)
  - The infant may eat or drink immediately following vaccine administration

- May be administered during the same clinical visit as other vaccines
Vaccine Administration Errors

▪ **Route:**
  • RV1 inadvertently injected
    o The dose does NOT count. Re-administer the vaccine ORALLY ASAP

▪ **Schedule errors:**
  • 1st dose was inadvertently given after 14 weeks, 6 days (maximum age)
    o The dose counts
    o Administer the remaining doses of the series at the routinely recommended intervals
    o Timing of the first dose should not affect the safety and efficacy of the remaining doses
  • Any dose after 8 months, 0 days (maximum age)
    o Rotavirus vaccine should not be given after age 8 months, 0 days even if the series is incomplete
Rotavirus Vaccine Contraindications

- Severe allergic reaction to a vaccine component (including latex) or following a prior dose of vaccine
  - RV1 (Rotarix) oral applicator contains latex rubber
- History of intussusception
- Severe combined immunodeficiency (SCID)
Rotavirus Vaccine Precautions*

- **Altered immunocompetence (except SCID, which is a contraindication)**
  - Limited data do not indicate a different safety profile in HIV-infected versus HIV-uninfected infants
  - HIV diagnosis not established in infants due for rotavirus vaccine
  - Vaccine strains of rotavirus are attenuated
  - These considerations support rotavirus vaccination of HIV-exposed or infected infants

*The decision to vaccinate if a precaution is present should be made on a case-by-case risk and benefit basis.
Rotavirus Vaccine Precautions

- Acute, moderate, or severe gastroenteritis or other acute illness
- The decision to vaccinate if a precaution is present should be made on a case-by-case risk and benefit basis
Rotavirus Vaccine Adverse Events

- **Intussusception**
  - RV1 postlicensure evaluation—1 to 3 excess cases per 100,000 first doses, possible risk for RV5 cases too small to confirm
  - Vaccine Adverse Event Reporting System (VAERS) reports show event clusters in 3–6 days following RV5
  - Vaccine Safety Datalink (VSD) shows no increased risk of intussusception (unable to assess RV1)
Rotavirus Vaccine Adverse Reactions

- **RV5 (RotaTeq)**
  - Diarrhea 18.1%
  - Vomiting 11.6%
  - Also greater rates of otitis media, nasopharyngitis, and bronchospasm

- **RV1 (Rotarix)**
  - Irritability 11.4%
  - Cough or runny nose 3.6%
  - Flatulence 2.2%
Vaccine Storage and Handling

- Store rotavirus vaccines in a refrigerator between 2°C–8°C (36°F–46°F)
- Store in the original packaging with the lids closed in a clearly labeled bin and/or area of the storage unit
  - Protect the vaccine from light
- Store RV1 (Rotarix) diluent in the refrigerator with the vaccine or at room temperature up to 25°C (77°F)
- Do not freeze vaccine or diluent
Rotavirus
▪ Ask the Experts–Rotavirus FAQs:  
  www.immunize.org/askexperts/experts_rota.asp

▪ CDC Rotavirus Disease and Vaccination: 
  www.cdc.gov/rotavirus/index.html

▪ Questions and Answers–Rotavirus What You Should Know: 
  https://media.chop.edu/data/files/pdfs/vaccine-education-center-rotavirus.pdf

▪ Standing Orders for Administering Rotavirus Vaccine: 
  www.immunize.org/catg.d/p3087.pdf
Rotavirus Vaccine Standing Orders

**Standing Orders for Administering Rotavirus Vaccine to Infants**

**Purpose:** To reduce morbidity and mortality from rotavirus disease by vaccinating all infants who meet the criteria established by the Centers for Disease Control and Prevention's Advisory Committee on Immunization Practices.

**Policy:** Under these standing orders, eligible nurses and other healthcare professionals (e.g., pharmacists), where allowed by state law, may vaccinate infants who meet the criteria below.

**Procedure:**

1. Identify infants ages 6 weeks through 7 months (not for 8 months or older) who have not completed a rotavirus (RV) vaccination series.

2. Screen all patients for contraindications and precautions to rotavirus vaccine:
   - **Contraindications:**
     - History of a severe allergic reaction (e.g., anaphylaxis) after a previous dose of RV vaccine or to an RV vaccine component (Note: latex rubber is contained in the Rotarix oral applicator). For information on vaccine components, refer to the manufacturer’s package insert (www.immunize.org/packageinserts) or go to www.cdc.gov/vaccines/pubs/pocketguide/downloads/rotavirus_table-2.pdf.
     - Diagnosis of severe combined immunodeficiency (SCID)
     - History of intussusception
   - **Precautions:**
     - Altered immune competence
     - Chronic gastrointestinal disease
     - Sepsis or other septic symptoms
     - Moderate or severe acute illness with or without fever

3. Provide all patients (parent/legal representative) with a copy of the most current Federal Vaccine Information Statement (VIS). You must document, in the patient's medical record or office log, the publication date of the VIS and the date it was given to the patient (parent/legal representative). Provide non-English speaking patients with a copy of the VIS in their native language. If available, these can be found at www.immunize.org/vis.

4. Provide routine vaccination with Rotarix at ages 2 and 4 months OR provide routine vaccination with RotaTeq at ages 2, 4, and 8 months. Administer the full dose (1 mL for Rotarix; 2 mL for RotaTeq) of vaccine by administering the entire contents of the dosing applicator of the liquid vaccine into the infant's mouth toward the inner cheek until empty. Note that Rotarix needs to be reconstituted before administration; RotaTeq does not.

5. For infants who have not received RV vaccine by age 2 months, give the first dose at the earliest opportunity but no later than age 14 weeks. Then schedule subsequent doses by observing minimum intervals of 4 weeks between the remaining one (if Rotarix) or two (if RotaTeq) doses such that the final dose can be administered by age 8 months or 10 days. Do not administer any RV vaccine beyond the age of 8 months or 10 days.

6. Document each patient’s vaccine information and follow up in the following phases:
   - **Medical chart:** Record the date the vaccine was administered, the manufacturer and lot number, the vaccination site and route, and the name and title of the person administering the vaccine. If vaccine was not given, record the reason(s) for non-reciept of the vaccine (e.g., medical contraindication, patient refusal).
   - **Personal Immunization record card:** Record the date of vaccination and the name/location of the administering clinic.
   - **Emergency preparedness:** Prepare for management of a medical emergency related to the administration of vaccine by having a written emergency medical protocol available, as well as equipment and medications.
   - **Adverse reactions:** Report all adverse reactions to rotavirus vaccine to the Federal Vaccine Adverse Event Reporting System (VAERS) at www.vaers.hhs.gov or by phone at 800-822-7967. VAERS report forms are available at www.vaers.hhs.gov.

This policy and procedure shall remain in effect for all patients of the

**Medical Director’s signature:**

**Effective date:**

For standing orders for other vaccines, go to www.immunize.org/standing-orders

Immunization Action Coalition
2920 7th Ave NW
Minneapolis, MN 55411-4436

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2920 7th Ave NW
Minneapolis, MN 55411-4436

4/8/2018
Diphtheria, Tetanus, and Pertussis and DTaP/DT/Tdap Vaccines

Chapters 7, 21 and 16

August, 2019
Disease
Diphtheria

- A toxin-mediated disease caused by Corynebacterium diphtheriae
- Usually produces exudate and pseudomembrane involving pharynx and tonsils
- Complications attributable to toxin – severity generally related to extent of local disease
- Most complications are myocarditis and neuritis
- Death in 5% to 10% of cases
Diphtheria Clinical Features

- Incubation period 2-5 days (range, 1-10 days)
- May involve any mucous membrane
- Classified based on site of disease
  - anterior nasal
  - pharyngeal and tonsillar
  - laryngeal
  - cutaneous
  - ocular
  - genital
Tetanus

- A toxin-mediated disease caused by Clostridium tetani

- Infectious from environment, not contagious

- Most common form is generalized tetanus: descending symptoms of trismus (lockjaw), difficulty swallowing, muscle rigidity, spasms

- Complications caused by spasms, asphyxia, or nosocomial infection
Tetanus Clinical Features

- Incubation period; 8 days (range, 3-21 days)
- Three clinical forms: local (uncommon), cephalic (rare), generalized (most common)
- Generalized tetanus: descending pattern of trismus (lockjaw), stiffness of the neck, difficulty swallowing, rigidity of abdominal muscles
  - spasms continue for 3-4 weeks
  - complete recovery may take months
- Neonatal Tetanus
  - Generalized tetanus in newborn infant
  - Infant born without protective passive immunity
  - 58,000 neonates died in 2010 worldwide
Tetanus

- 233 cases reported (29 cases per year)
- Case-fatality rate 11%
- Median age 49 years (range 5 to 94 years)
  - 49% were among persons 50 years of age or older
- Among the reported tetanus cases
  - 72% reported an acute wound (puncture or contaminated wound)
  - 13% reported a chronic wound (a diabetic ulcer or dental abscess)
Required 57 days of inpatient acute care, including 47 days in the intensive care unit.

The inpatient charges totaled $811,929 (excluding air transportation, inpatient rehabilitation, and ambulatory follow-up costs).
Pertussis

- Highly contagious respiratory infection by Bordetella pertussis
- Incubation period 7-10 days (range 4-21 days)
- Insidious onset, similar to minor upper respiratory infection with nonspecific cough
- Fever usually minimal throughout course
- Catarrhal stage: 1-2 weeks
- Paroxysmal cough stage: 1-6 weeks
- Convalescence: weeks to months
Pertussis

- Pertussis was one of the most common childhood diseases and a major cause of childhood mortality in the United States.
- Before the availability of pertussis vaccine in the 1940s, public health experts reported more than 200,000 cases of pertussis annually.
- Since the 1980s there’s been an increase in the number of reported cases of pertussis.
- In 2012, the last peak year, CDC reported 48,277 cases of pertussis.
Pertussis Deaths in the United States, 2012–2018

<table>
<thead>
<tr>
<th>Age at onset</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 12 months</td>
<td>59 (72%)</td>
</tr>
<tr>
<td>12 months and older</td>
<td></td>
</tr>
</tbody>
</table>

https://www.cdc.gov/pertussis/surv-reporting.html
## DTaP-Containing Vaccines

<table>
<thead>
<tr>
<th>Vaccine product</th>
<th>Age indications</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>DTaP vaccines</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Infanrix</td>
<td>6 weeks to 6 years</td>
<td>Doses 1-5</td>
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<tr>
<td>Daptacel</td>
<td>6 weeks to 6 years</td>
<td>Doses 1-5</td>
</tr>
<tr>
<td>DT vaccines</td>
<td></td>
<td></td>
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<tr>
<td>DT Vaccine (no trade name)</td>
<td>6 weeks to 6 years</td>
<td>3- or 4-dose series</td>
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<tr>
<td>Combination vaccines</td>
<td></td>
<td></td>
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<tr>
<td>Pediarix (DTaP, HepB, IPV)</td>
<td>6 weeks to 6 years</td>
<td>Doses 1-3</td>
</tr>
<tr>
<td>Kinrix (DTaP, IPV)</td>
<td>4-6 years</td>
<td>5th dose only</td>
</tr>
<tr>
<td>Quadracel (DTaP, IPV)</td>
<td>4-6 years</td>
<td>5th dose only</td>
</tr>
<tr>
<td>Pentacel (DTaP, IPV, Hib)</td>
<td>6 weeks-4 years</td>
<td>Doses 1-4</td>
</tr>
<tr>
<td>Vaxelis (DTaP, IPV, Hib, HepB)</td>
<td>6 weeks-4 years</td>
<td>3-dose series</td>
</tr>
</tbody>
</table>
Clinical Considerations
### ACIP DTaP Vaccine Recommendations: Pediatric

<table>
<thead>
<tr>
<th>Vaccine</th>
<th>Birth</th>
<th>1 mo</th>
<th>2 mos</th>
<th>4 mos</th>
<th>6 mos</th>
<th>9 mos</th>
<th>12 mos</th>
<th>15 mos</th>
<th>18 mos</th>
<th>19-23 mos</th>
<th>2-3 yrs</th>
<th>4-6 yrs</th>
<th>7-10 yrs</th>
<th>11-12 yrs</th>
<th>13-15 yrs</th>
<th>16 yrs</th>
<th>17-18 yrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diphtheria, tetanus, &amp; acellular pertussis (DTaP: &lt;7 yrs)</td>
<td>1st dose</td>
<td>2nd dose</td>
<td>3rd dose</td>
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<td></td>
<td>4th dose</td>
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<td>5th dose</td>
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- **Routinely recommended for children at:**
  - 2 months
  - 4 months
  - 6 months
  - 15–18 months
  - 4–6 years
### Primary DTaP Schedule

<table>
<thead>
<tr>
<th>Vaccine</th>
<th>Birth</th>
<th>1 mo</th>
<th>2 mos</th>
<th>4 mos</th>
<th>6 mos</th>
<th>9 mos</th>
<th>12 mos</th>
<th>15 mos</th>
<th>18 mos</th>
<th>19-23 mos</th>
<th>2-3 yrs</th>
<th>4-6 yrs</th>
<th>7-10 yrs</th>
<th>11-12 yrs</th>
<th>13-15 yrs</th>
<th>16 yrs</th>
<th>17-18 yrs</th>
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<tbody>
<tr>
<td>Diphtheria, tetanus, &amp; acellular pertussis (DTaP: &lt;7 yrs)</td>
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<tr>
<td>Dose</td>
<td>Routine Age</td>
<td>Minimum Interval to Next Dose</td>
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<tr>
<td>Primary 1</td>
<td>2 months</td>
<td>4 weeks</td>
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<tr>
<td>Primary 2</td>
<td>4 months</td>
<td>4 weeks</td>
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<tr>
<td>Primary 3</td>
<td>6 months</td>
<td>6 months</td>
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<tr>
<td>Primary 4</td>
<td>15-18 months</td>
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</tbody>
</table>
Fourth Dose of DTaP

- Routinely recommended at 15 through 18 months

- May be given earlier if:
  
  • Child is at least 12 months of age and
  
  • At least 6 months since DTaP dose 3 and
  
  • Child is unlikely to return at 15 through 18 months of age
Administer a 5\textsuperscript{th} dose of DTaP when the 4\textsuperscript{th} dose was given \textit{before} age 4 years

All DTaP products are approved for use for the 5\textsuperscript{th} dose except:

- Pediarix (DTaP-HepB-IPV)
- Pentacel (DTaP-IPV/Hib)
- Vaxelis (DTaP-IPV-Hib-HepB)
Diphtheria and Tetanus Toxoid
DT Vaccine

- Given as a 3- or 4-dose series

- DT should only be used for children with a true contraindication to pertussis vaccine

Use for children 6 weeks through 6 years of age
Pediatric DT Schedule

- First dose of DT at younger than 1 year of age
  - Total of 4 doses

- First dose of DT at 1 year of age or older
  - Total of 3 doses

- Fourth or fifth dose at school entry not needed if pertussis vaccine is not being administered
Vaccine Administration
DTaP-containing Vaccines

- **Route: IM injection**
  - Needle gauge: 22–25 gauge
  - Needle length*: 1–1.5 inch depending on the patient’s age and/or weight

- **Site***:
  - 6 weeks through 11 months: Vastus lateralis muscle is preferred
  - 1 through 3 years: Vastus lateralis muscle is preferred; deltoid muscle may be used if the muscle mass is adequate
  - 4 years and older: Deltoid muscle is preferred; vastus lateralis muscle may be used

- **Vaccine administration error:**
  - Tdap instead of DTaP

*Professional judgement should be used to determine the proper needle length and site. Influencing factors include injection technique, local reaction, number of vaccines to be administered, patient age, size and muscle mass
DTaP Contraindications

- Severe allergic reaction after a previous dose or to a vaccine component

- Encephalopathy not due to another identifiable cause occurring within 7 days after administration of a previous dose of DTP or DTaP
DTaP (and Tdap) Precautions

- Moderate or severe acute illness with or without a fever
- Progressive neurologic disorder, including infantile spasms, uncontrolled epilepsy, progressive encephalopathy; defer DTaP until neurologic status clarified and stabilized
- GBS <6 weeks after previous dose of tetanus-toxoid-containing vaccine
- History of Arthus-type hypersensitivity reactions after a previous dose of diphtheria-toxoid or tetanus-toxoid vaccine; defer vaccination until at least 10 years have elapsed since the last tetanus-toxoid-containing vaccine
Conditions NOT Precautions for DTaP

- Following a dose of DTaP/DTP:
  - Temperature 105°F (40.5°C) or higher
  - Collapse or shock-like state
  - Persistent crying lasting 3 hours or longer
  - Convulsions with or without fever
  - History of an extensive limb swelling reaction
DTaP Adverse Reactions

- Local reactions (pain, redness, swelling) 20%-40%
- Temperature of 101° or higher 3%-5%
- More severe adverse reactions Not common
Tdap/Td Vaccines
Why Adolescents and Adults Need Pertussis Vaccine

- 18,975 pertussis cases reported in the U.S. in 2017, 13,439 cases in 2018
  - >50% of cases in those 11 years and older

- Infection may be asymptomatic, or may present as classic pertussis

- Disease often milder than in infants and children
  - Persons with mild disease may transmit the infection

- Older persons and household contacts often source of infection for infants and children

* Provisional data www.cdc.gov/pertussis
## Tdap Vaccines

<table>
<thead>
<tr>
<th>Vaccine product</th>
<th>Age indications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tdap vaccines</strong></td>
<td></td>
</tr>
<tr>
<td>Boostrix</td>
<td>10 years and older</td>
</tr>
<tr>
<td>Adacel</td>
<td>10-64 years</td>
</tr>
<tr>
<td><strong>Td vaccines</strong></td>
<td></td>
</tr>
<tr>
<td>TDVAX</td>
<td>7 years and older</td>
</tr>
<tr>
<td>Tenivac</td>
<td>7 years and older</td>
</tr>
</tbody>
</table>
Tdap Vaccination Recommendations: Adolescents

- Adolescents 11 through 18 years of age
  - Preferred administration at 11-12 years

*Off-label recommendation  MMWR 2013;62(No. 7):131-5
Use of Tdap Among Children
7 through 10 Years of Age*

- Persons 7 through 10 years of age who are not fully immunized against pertussis (including those never vaccinated or with unknown pertussis vaccination status) should receive a single dose of Tdap

- For those who received Tdap at ages 7 through 10 years as part of the catch-up schedule, they should receive another dose of Tdap at age 11–12 years old **

*Off-label recommendation. MMWR 2011; 60 (No. 1):13-5

“Not Fully Immunized”

- Children 7 through 10 years of age are not fully immunized against pertussis if they have received:
  - Fewer than 4 doses of DTaP OR
  - Four doses of DTaP and last dose before 4 years of age

MMWR 2011; 60 (No. 1):13-5
Tdap For Persons Without History of DTP or DTaP

- All adolescents and adults should have documentation of having received a series of DTaP, DTP, DT, or Td

- Persons without documentation should receive a series of 3 vaccinations

- One dose should be Tdap, preferably the first
# Catch-up Schedules for Children Age 7 Years And Older

**Previously vaccinated WITH a dose BEFORE the 1st birthday**

<table>
<thead>
<tr>
<th>Dose 1 – 2</th>
<th>Dose 2 – 3</th>
<th>Dose 3 – 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 weeks</td>
<td>4 weeks</td>
<td>6 months</td>
</tr>
</tbody>
</table>

**Previously unvaccinated or previously vaccinated WITH 1\textsuperscript{st} dose AT/AFTER the 1\textsuperscript{st} birthday**

<table>
<thead>
<tr>
<th>Dose 1 – 2</th>
<th>Dose 2 – 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 weeks</td>
<td>6 months</td>
</tr>
</tbody>
</table>

FIGURE 2. Catch-up immunization schedule for persons aged 4 months through 18 years who start late or who are more than 1 month behind—United States, 2017

Tdap Contraindications

- Severe allergic reaction to vaccine component or following a prior dose

- Encephalopathy not due to another identifiable cause within 7 days of administration of a pertussis-containing vaccine
Vaccine Administration
DTaP/DT/Tdap Vaccines

- **Route: IM injection**
  - Needle gauge: 22–25 gauge
  - Needle length*: 1–1.5 inch depending on the patient’s age and/or weight

- **Site***:
  - 6 weeks through 11 months: Vastus lateralis muscle is preferred
  - 1 through 3 years: Vastus lateralis muscle is preferred; deltoid muscle may be used if the muscle mass is adequate
  - 4 years and older: Deltoid muscle is preferred; vastus lateralis muscle may be used

*Professional judgement should be used to determine the proper needle length and site. Influencing factors include injection technique, local reaction, number of vaccines to be administered, patient age, size and muscle mass
Tdap/Td Adverse Reactions

- Local reactions (pain, redness, swelling)
  - 21%-66%
- Temp of 100.4°F or higher
  - 1.4%
- Adverse reactions occur at approximately the same rate as Td alone (without acellular pertussis vaccine)
Vaccine Storage and Handling

- Store DTaP-Tdap containing vaccines in a refrigerator between 2°C–8°C (36°F–46°F)
  - Do not freeze the vaccine
- Store DTaP-containing vaccines in:
  - The original packaging with the lids closed
  - A clearly labeled bin and/or area of the storage unit
- Pentacel: Store diluent (DTaP-IPV) and lyophilized component together in the refrigerator

**DTaP (Daptacel)**
- Ages: 6 weeks through 6 years
- Use for: Any dose in the series
- Route: Intramuscular (IM) injection

**DTaP (Infanrix)**
- Ages: 6 weeks through 6 years
- Use for: Any dose in the series
- Route: Intramuscular (IM) injection

Read the package insert that accompanies the product to check for the presence of natural rubber or latex.

Vaccine storage label example
Available at www.cdc.gov/vaccines/hcp/admin/storage/guide/vaccine-storage-labels.pdf
- Ask the Experts—DTaP/DT/Tdap/Td FAQs:  
  [www.immunize.org/askexperts/experts_per.asp](http://www.immunize.org/askexperts/experts_per.asp)
- CDC Diphtheria Disease and Vaccination:  
  [www.cdc.gov/diphtheria/index.html](http://www.cdc.gov/diphtheria/index.html)
- CDC Pertussis Disease and Vaccination:  
  [www.cdc.gov/pertussis/index.html](http://www.cdc.gov/pertussis/index.html)
- CDC Tetanus Disease and Vaccination:  
  [www.cdc.gov/tetanus/index.html](http://www.cdc.gov/tetanus/index.html)
- Tdap/Td Catch-Up Guidance for Children 7 through 18 Years of Age:  
Polio and Polio Vaccine

Day 1: Pediatric Track

Chapter 18

August 2019
Poliomyelitis Disease

- First outbreak described in the U.S. in 1843
- Polio epidemics were reported each summer and fall
- More than 21,000 paralytic cases reported in the U.S. in 1952
Disease
Poliovirus

- Three serotypes of wild poliovirus:
  - WPV1
  - WPV2
  - WPV3
- Minimal heterotypic immunity between serotypes
- Rapidly inactivated by heat, chlorine, formaldehyde, and ultraviolet light
Poliomyelitis Pathogenesis

- Enters into mouth
- Replicates in pharynx and GI tract
- Hematologic spread to lymphatics and central nervous system
- Viral spread along nerve fibers
- Destruction of motor neurons

Racaniello VR. One hundred years of poliovirus pathogenesis. *Virology* 2006;344:9-16
Outcomes of Poliovirus Infection

- Asymptomatic
- Minor non-specific illness
- Aseptic meningitis
- Flaccid paralysis
Asymmetric paralysis
### Poliovirus Epidemiology

<table>
<thead>
<tr>
<th>Reservoir</th>
<th>Human</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transmission</td>
<td>Fecal-oral</td>
</tr>
<tr>
<td></td>
<td>Oral-oral possible</td>
</tr>
<tr>
<td>Communicability</td>
<td>Most infectious: 7–10 days before onset</td>
</tr>
<tr>
<td></td>
<td>Virus present in stool 3–6 weeks</td>
</tr>
</tbody>
</table>
Poliomyelitis—United States, 1950–2011

Source: National Notifiable Disease Surveillance System, CDC
Poliomyelitis—United States, 1980–2010

Vaccine–associated paralytic polio = VAPP
Vaccine
Enhanced Inactivated Polio Vaccine

- Highly effective in producing immunity to poliovirus
  - ≥90% of recipients immune after 2 doses
  - ≥99% of recipients immune after 3 doses

- Duration of immunity not known with certainty
# Polio-Containing Vaccine Products

<table>
<thead>
<tr>
<th>Product</th>
<th>ACIP Abbreviation</th>
<th>Age Indications</th>
<th>IPV Series</th>
</tr>
</thead>
<tbody>
<tr>
<td>IPOL</td>
<td>IPV</td>
<td>6 weeks and older</td>
<td>Any dose in the series</td>
</tr>
<tr>
<td>Pediarix</td>
<td>DTaP-IPV-HepB</td>
<td>6 weeks through 6 years</td>
<td>Doses 1 through 3</td>
</tr>
<tr>
<td>Pentacel</td>
<td>DTaP-IPV/Hib</td>
<td>6 weeks through 4 years</td>
<td>Doses 1 through 4</td>
</tr>
<tr>
<td>Kinrix</td>
<td>DTaP-IPV</td>
<td>4 through 6 years</td>
<td>Dose 4</td>
</tr>
<tr>
<td>Quadracel</td>
<td>DTaP-IPV</td>
<td>4 through 6 years</td>
<td>Dose 4 or 5</td>
</tr>
</tbody>
</table>
Clinical Considerations
## ACIP Polio Immunization Recommendations
### Routine Schedule

<table>
<thead>
<tr>
<th>IPV Dose</th>
<th>Routinely Recommended Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2 months</td>
</tr>
<tr>
<td>2</td>
<td>4 months</td>
</tr>
<tr>
<td>3</td>
<td>6–18 months</td>
</tr>
<tr>
<td>4</td>
<td>4–6 years</td>
</tr>
</tbody>
</table>
ACIP Polio Immunization Recommendations
Catch-Up Schedule

- Infants 6 months of age and younger, follow the recommended schedule intervals
- If accelerated protection is needed (e.g., travel to polio-endemic area), minimum age and intervals may be followed

<table>
<thead>
<tr>
<th>Dose</th>
<th>Minimum Age</th>
<th>Minimum Interval to the Next Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dose 1</td>
<td>6 weeks</td>
<td>4 weeks</td>
</tr>
<tr>
<td>Dose 2</td>
<td>10 weeks</td>
<td>4 weeks</td>
</tr>
<tr>
<td>Dose 3</td>
<td>14 weeks</td>
<td>6 months</td>
</tr>
<tr>
<td>Dose 4</td>
<td>4 years</td>
<td>---------</td>
</tr>
</tbody>
</table>
ACIP Polio Immunization Recommendations
4th Dose and the Catch-Up Schedule

- A 4th dose is not necessary if the 3rd dose was administered:
  - At age 4 years or older AND
  - At least 6 months after the previous dose

- Children who have received 4 doses (or more) before 4 years of age need an additional dose
  - There should be at least 6 months between last and next-to-last dose
Schedules that Include Both IPV and OPV

- Mixed-product series containing both OPV and IPV is acceptable
  - Only trivalent OPV (tOPV) counts toward completing the series

- Children with an incomplete series:
  - Administer IPV to complete a series that includes doses of OPV
  - Ensure doses met minimum ages and intervals

- Administer 1 dose of IPV to children who received 4 doses of OPV (or more) before 4 years of age
  - There should be at least 6 months the last dose of OPV and the IPV dose
OPV Administered Outside the U.S.

- Use the date of administration to make a presumptive determination of what type of OPV was received
- Trivalent OPV was used throughout the world prior to April 2016
- Persons 18 years of age and younger with doses of OPV that do not count towards the U.S. vaccination requirements should receive IPV
ACIP Polio Immunization Recommendations

Adolescents

- Routine vaccination of U.S. residents 18 years of age or older is not necessary or recommended

- May consider vaccination of travelers to polio-endemic countries and selected lab workers
Contraindications and Precautions

- Severe allergic reaction to a vaccine component or following a prior dose of vaccine
- Moderate to severe acute illness
Vaccine Administration

- **Route: IM injection**
  - IPV, DTaP-IPV/Hib, DTaP-IPV-HepB, DTaP-IPV
  - Needle gauge: 22 – 25 gauge
  - Needle length*: 1 – 1.5 inch depending on the patient’s age and/or weight

- **IM injection site**:  
  - 6 weeks–11 months: Vastus lateralis muscle is recommended
  - 1–3 years: Vastus lateralis muscle is preferred; deltoid muscle may be used if the muscle mass is adequate
  - 3 years and older: Deltoid muscle is preferred; vastus lateralis muscle may also be used

- **Note**: IPV single component may also be Subcut injection in the anterolateral thigh or upper outer triceps area of the arm

*Professional judgement should be used to determine the proper needle length and site. Influencing factors include injection technique, local reaction, number of vaccines to be administered, patient age, size and muscle mass*
IPV Adverse Reactions

- Local reactions: 2.8% (pain, redness, swelling)
- Severe reactions: rare
Polio: Vaccine Administration Errors

- **Schedule errors: Dose 4 administered too soon**
  - Doses administered 5 or more days before the minimum age and/or interval do not count and should be repeated when age-appropriate
  - Wait the minimum interval from the invalid dose before giving the repeat dose
  - Minimum age/interval: At/after age 4 AND 6 months after dose 3

- **Age/dose errors: Kinrix or Quadracel for doses 1 through 3**
  - If the minimum age and interval from the last dose of polio vaccine has been met, the dose can count and does not need to be repeated

- **Preparation errors: Wrong diluent to reconstitute DTaP-IPV/Hib (Pentacel)**
  - Do not use Kinrix or Quadracel to reconstitute Pentacel
Storage and Handling

- Store all IPV-containing vaccines in a refrigerator between 2°C and 8°C (36°F and 46°F)
- Store in original packaging with lids closed
- Store DTaP-IPV/Hib (Pentacel) diluent in the refrigerator and lyophilized Hib vaccine
- Do not freeze vaccine or diluent
Disease
Hepatitis A

- Epidemic jaundice described by Hippocrates
- Differentiated from hepatitis B in 1940s
- Serologic tests developed in 1970s
- Vaccines licensed in 1995 and 1996
- Until 2004, hepatitis A was the most frequently reported type of hepatitis in the U.S.
Hepatitis A Clinical Features

- Incubation period 28 days (range 15–50 days)
- Illness not specific for hepatitis A
- Likelihood of symptomatic illness directly related to age
- Children generally asymptomatic, adults symptomatic
<table>
<thead>
<tr>
<th>Reservoir</th>
<th>Human</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transmission</td>
<td>Fecal–oral</td>
</tr>
<tr>
<td>Temporal pattern</td>
<td>None</td>
</tr>
<tr>
<td>Communicability</td>
<td>2 weeks before to 1 week after onset of jaundice</td>
</tr>
</tbody>
</table>
Hepatitis A outbreaks in 10 states have occurred primarily among persons who:

- Use injection and noninjection drugs
- Are homeless
- Are their close, direct contacts

2

Vaccine
Hepatitis A-Containing Vaccines

<table>
<thead>
<tr>
<th>Vaccine product</th>
<th>Age indications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Havrix</td>
<td></td>
</tr>
<tr>
<td>Pediatric</td>
<td>Birth – 18 years</td>
</tr>
<tr>
<td>formulation</td>
<td></td>
</tr>
<tr>
<td>Adult</td>
<td>19 years and older</td>
</tr>
<tr>
<td>formulation</td>
<td></td>
</tr>
<tr>
<td>Vaqta</td>
<td></td>
</tr>
<tr>
<td>Pediatric</td>
<td>Birth – 18 years</td>
</tr>
<tr>
<td>formulation</td>
<td></td>
</tr>
<tr>
<td>Adult</td>
<td>19 years and older</td>
</tr>
<tr>
<td>formulation</td>
<td></td>
</tr>
<tr>
<td>Twinrix</td>
<td></td>
</tr>
<tr>
<td>Adult</td>
<td>18 years and older</td>
</tr>
<tr>
<td>formulation</td>
<td></td>
</tr>
</tbody>
</table>

Administer the appropriate formulation based on the patient’s age.
Hepatitis A Vaccine Efficacy

- **HAVRIX (GSK)**
  - 40,000 Thai children 1 to 16 years of age
  - Vaccine efficacy 94%

- **VAQTA (Merck)**
  - 1,000 New York children 2 to 16 years of age
  - Vaccine efficacy 100%

- **Twinrix (GSK)**
  - 1,551 healthy adults 17 to 70 years of age
  - Vaccine efficacy HepA 99.9% and HepB 98.5%
Clinical Considerations
All children should receive vaccine at 12 through 23 months of age.

Vaccination should be integrated into the routine vaccination schedule.

*Catch-up all unvaccinated children between 2 and 18 years*

*Vaccination of all children 12 months and older with HIV infection*

*Newly voted on recommendations by ACIP. New recommendations will be published soon in MMWR once approved by CDC director.*
Hepatitis A Vaccination of Children

- Existing hepatitis A vaccination programs for children 2–18 years of age should be maintained

- New efforts for routine vaccination of children 12 months of age should enhance, not replace, ongoing vaccination programs for older children

- Areas without an existing hepatitis A vaccination program can consider catch-up vaccination for unvaccinated children 2-18 years of age
Hepatitis A and International Travel

Hepatitis A, countries or areas at risk

http://gamapserver.who.int/mapLibrary/Files/Maps/Global_HepA_ITHRiskMap.png?ua=1.
Hepatitis A Vaccine for International Travelers: Infants

- Administer a single dose of HepA vaccine to infants 6–11 months of age*

- Infants should restart the 2-dose series of HepA vaccine at 12 months of age or older as recommended

https://www.cdc.gov/mmwr/volumes/67/wr/mm6743a5.htm
Hepatitis A Vaccination for International Travelers: Children and Adults

- One dose of a monovalent hepatitis A vaccine protects most healthy people 1–40 years of age

- Administer HepA vaccine to persons 1 year of age and older
  - Start the series as soon as travel is being considered to an area outside the U.S. where protection against hepatitis A is recommended
  - The series should be completed for lifelong protection – even if the trip is over
  - Postvaccination testing is not recommended
## Summary: Hepatitis A Vaccine Recommendations and International Travel

<table>
<thead>
<tr>
<th>Age</th>
<th>Vaccine/Immunoglobulin (IG)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infants less than 6 months of age</td>
<td>Immunoglobulin (IG)</td>
</tr>
<tr>
<td>Infants 6 through 11 months of age</td>
<td>Vaccine&lt;sup&gt;1&lt;/sup&gt; (or IG&lt;sup&gt;2&lt;/sup&gt;)</td>
</tr>
<tr>
<td>Healthy persons 1 year of age or older</td>
<td>Vaccine</td>
</tr>
</tbody>
</table>

### Special Populations

<table>
<thead>
<tr>
<th>Special Populations</th>
<th>Vaccine/Immunoglobulin (IG)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Persons with a vaccine contraindication</td>
<td>IG</td>
</tr>
<tr>
<td>Immunocompromised persons</td>
<td>Vaccine with addition of IG&lt;sup&gt;3&lt;/sup&gt;</td>
</tr>
<tr>
<td>Persons with chronic liver disease</td>
<td>Vaccine</td>
</tr>
<tr>
<td>Pregnant women</td>
<td>Vaccine</td>
</tr>
</tbody>
</table>

<sup>1</sup> https://www.cdc.gov/mmwr/volumes/67/wr/mm6743a5.htm
<sup>2</sup> If measles is not endemic in the region
<sup>3</sup> Based on provider guidance risk assessment and availability of vaccine or IG
Vaccination for Close Contacts of Newly Arriving International Adoptees

- Hepatitis A vaccination for unvaccinated persons who anticipate close, personal contact during the first 60 days after arrival of an international adoptee from a country of high or intermediate endemicity

- Administer dose 1 as soon as adoption is planned, ideally 2 or more weeks before the arrival of the adoptee
Hepatitis A Serologic Testing

- **Prevaccination** serologic testing is not indicated for children
  - Older adolescents: Testing may be cost-effective for certain populations

- **Postvaccination**
  - Not indicated
Hepatitis A Vaccine Administration

- **Route: IM injection**
  - Needle gauge: 22 – 25 gauge
  - Needle length*: 1 – 1.5 inch depending on the patient’s age and/or weight

- **Site***:
  - 1-3 years: Vastus lateralis muscle is preferred; deltoid muscle may be used if the muscle mass is adequate
  - 4 years and older: Deltoid muscle is preferred; vastus lateralis muscle may be used

*Professional judgement should be used to determine the proper needle length and site. Influencing factors include injection technique, local reaction, number of vaccines to be administered, patient age, size and muscle mass
# Hepatitis A

## Vaccine Administration Errors

<table>
<thead>
<tr>
<th>We administered:</th>
<th>Now:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adult formulation to a child</td>
<td>Dose counts, revaccination is not indicated*</td>
</tr>
<tr>
<td>HepB, Hib, or HPV instead of HepA vaccine</td>
<td>Dose does not count toward completion of the HepA series</td>
</tr>
</tbody>
</table>

*If meets minimum age and interval (if applicable)*
Hepatitis A Vaccine
Contraindications and Precautions

- Severe allergic reaction to a vaccine component or following a prior dose

- Moderate or severe acute illness
Hepatitis A Vaccine

Adverse Reactions

- Local reaction  20% - 50%

- Systemic reactions  
  (malaise, fatigue)  Less than 10%

- No serious adverse reactions reported
Vaccine Storage and Handling

- Store hepatitis A vaccine in a refrigerator between 2°C-8°C (36°F-46°F)

- Store pediatric and adult formulations:
  - In the original packaging with the lids closed
  - In a clearly labeled bin and/or area of the storage unit—not next to each other

Vaccine storage label example
Available at [www.cdc.gov/vaccines/hcp/admin/storage/guide/vaccine-storage-labels.pdf](http://www.cdc.gov/vaccines/hcp/admin/storage/guide/vaccine-storage-labels.pdf)
General Recommendations for Persons Vaccinated Outside the U.S.

- Vaccines administered outside the U.S. can be accepted as valid if the schedule is similar to U.S. recommendations

- With the exception of influenza and PPSV23 vaccines, only written documentation should be accepted as evidence of previous vaccination
Determining What to Do Next

- Questions? Health care providers may:
  - Repeat the vaccinations—safe and prevents the need for serologic testing
  - Use serologic testing judiciously—may avoid unnecessary injections
    - But for most vaccines, many serologic tests cannot document protection against infection
    - Cost can be a factor

Child Resources

- Ask the Experts–Hepatitis A FAQs: [www.immunize.org/askexperts/experts_hepa.asp](http://www.immunize.org/askexperts/experts_hepa.asp)
- CDC Hepatitis A Disease: [www.cdc.gov/hepatitis/hav/index.htm](http://www.cdc.gov/hepatitis/hav/index.htm)
- CDC Hepatitis A Vaccination: [www.cdc.gov/vaccines/vpd/hepa/hcp/index.html](http://www.cdc.gov/vaccines/vpd/hepa/hcp/index.html)
### Hepatitis A Vaccine Standing Orders for Children and Adults

**STANDING ORDERS FOR Administering Hepatitis A Vaccine to Children and Teens**

**Purpose**
To reduce morbidity and mortality from Hepatitis A (HAV) by vaccinating all children and teens who meet the criteria established by the Centers for Disease Control and Prevention’s Advisory Committee on Immunization Practices (ACIP).

**Policy**
Where allowed by state law, standing orders enable eligible nurses and other healthcare professionals (e.g., pharmacists) to assess the need for and vaccinate children and teens who meet any of the criteria below.

**Procedure**

1. **Assess Children and Teens in Need of Vaccination against HAV infection based on the following criteria:**
   - Age 12-23 months and lack of documentation of 1 dose of hepatitis A vaccine (HepA)
   - Age 18-19 years or living in a community, region, or state where routine vaccination is recommended (contact your health department for recommendations)
   - Age 19 months and older with anticipated travel to a country with intermediate or high endemicity for hepatitis A (i.e., all except Canada, Japan, Australia, New Zealand, and Western Europe)
   - Anticipated close personal contact with an international adoptee from a country of high or intermediate endemicity during the first 6 months after the arrival of the adoptee in the United States
   - A child who has seen with other males
   - Cases of recent outbreaks (taurine and non-tauro)
   - Diagnosis of proven fecal–oral disease, including hepatitis B and C
   - Diagnosis of clotting factor disorders, such as hemophilia
   - Employment in a research laboratory requiring work with sera or plasma
   - An associated child or teen with recent possible exposure to HAV (e.g., within previous 2 weeks). (Note: Children younger than age 12 months should be given immunoglobulin (IG) instead of vaccine)
   - Any other child or teen who wants to be protected from hepatitis A

2. **Screen for contraindications and precautions:**
   - Do not give HepA to a child or teen who has experienced a serious reaction (e.g., anaphylaxis) to a prior dose of the vaccine or any of its components. For information on vaccine components, refer to the manufacturer’s package insert or go to www.cdc.gov/vaccines/pubs/pinkbook/downloads/appendixk/appendixk2.pdf.
   - Precautions: Moderate or severe acute illness with or without fever

3. **Provide Vaccination Information Statements:**
   - Provide all patients (or, in the case of minors, their parent or legal representative) with a copy of the most current National Vaccine Information Statement (NVIS). Provide non-English speaking patients with a copy of the VIS in their native language. (Visa is available and detailed these can be found at www.cdc.gov/vaccines). (For information about how to document that the VIS was given, see section 6 titled “Document Vaccinations”)

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**STANDING ORDERS FOR Administering Hepatitis A Vaccine to Adults**

**Purpose**
To reduce morbidity and mortality from Hepatitis A (HAV) by vaccinating all adults who meet the criteria established by the Centers for Disease Control and Prevention’s Advisory Committee on Immunization Practices (ACIP).

**Policy**
Where allowed by state law, standing orders enable eligible nurses and other healthcare professionals (e.g., pharmacists) to assess the need for and vaccinate adults who meet any of the criteria below.

**Procedure**

1. **Assess Adults in Need of Vaccination against HAV infection based on the following criteria:**
   - Anticipated travel to a country with intermediate or high endemicity for hepatitis A (i.e., all except Canada, Japan, Australia, New Zealand, and Western Europe)
   - A male who has sex with other males
   - Cases of recent outbreaks (taurine and non-tauro)
   - Diagnosis of proven fecal–oral disease, including hepatitis B and C
   - Diagnosis of clotting factor disorders, such as hemophilia
   - Anticipated close personal contact with an international adoptee from a country of high or intermediate endemicity during the first 6 months after the arrival of the adoptee in the United States
   - Employment in a research laboratory requiring work with sera or plasma
   - An associated child or teen with recent possible exposure to HAV (e.g., within previous 2 weeks). (Note: Children younger than age 12 months should be given immunoglobulin (IG) instead of vaccine)
   - Any other adult who wants to be protected from hepatitis A

2. **Screen for contraindications and precautions:**
   - Do not give HepA to an adult who has experienced a serious reaction (e.g., anaphylaxis) to a prior dose of the vaccine or any of its components. For information on vaccine components, refer to the manufacturer’s package insert or go to www.cdc.gov/vaccines/pubs/pinkbook/downloads/appendixk/appendixk2.pdf.
   - Precautions: Moderate or severe acute illness with or without fever

3. **Provide Vaccination Information Statements:**
   - Provide all patients with a copy of the most current National Vaccine Information Statement (VIS). Provide non-English speaking patients with a copy of the VIS in their native language. (Visa is available and detailed these can be found at www.cdc.gov/vaccines). (For information about how to document that the VIS was given, see section 6 titled “Document Vaccinations”)

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Measles, Mumps, and Rubella

Day 1: Pediatric Track

August 2019

Chapters 13, 15 and 20
Measles

- **Paramyxovirus**
  - Nasopharynx is primary site of infection

- **Incubation period is 10–12 days**

- **Prodrome is 2–4 days**
  - 3 Cs – cough, coryza, and conjunctivitis
  - Stepwise increase in fever up to 103°F–105°F
  - Koplik spots

- **Rash occurs 2–4 days after prodrome, 14 days after exposure, and persists 5–6 days**
  - Begins on face and upper neck
  - Maculopapular, becomes confluent
  - Fades in order of appearance
# Measles Complications

<table>
<thead>
<tr>
<th>Complication</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diarrhea</td>
<td>8%</td>
</tr>
<tr>
<td>Otitis Media</td>
<td>7%</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>6%</td>
</tr>
<tr>
<td>Encephalitis</td>
<td>0.1%</td>
</tr>
<tr>
<td>Seizures</td>
<td>0.6-0.7%</td>
</tr>
<tr>
<td>Death</td>
<td>0.2%</td>
</tr>
</tbody>
</table>
Mumps

- **Paramyxovirus**
  - Nasopharynx and regional lymph nodes are primary sites of infection then can spread to meninges and glands (salivary, pancreas, testes, ovaries)

- **Incubation period is 12–25 days**

- **Prodrome is nonspecific**
  - Myalgia
  - Anorexia
  - Malaise
  - Headache
  - Low-grade fever

- **Parotitis in 9%–94%, typically occurs within 16-18 days**

- **Prevaccine era: 15%–27% of infections were asymptomatic**
<table>
<thead>
<tr>
<th>Complication</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orchititis</td>
<td>12%–66% in postpubertal males (prevaccine)</td>
</tr>
<tr>
<td></td>
<td>3%–10% (postvaccine)</td>
</tr>
<tr>
<td>Pancreatitis</td>
<td>3.5% (prevaccine)</td>
</tr>
<tr>
<td>Unilateral deafness</td>
<td>1/20,000 (prevaccine)</td>
</tr>
<tr>
<td>Death</td>
<td>2/10,000 from 1966–1971</td>
</tr>
</tbody>
</table>
Rubella

- **Togavirus**
- **Incubation period is 14 days (range: 12–23 days)**
- **Prodrome**
  - Rare in children
  - Low-grade fever in adults
- **Maculopapular rash 14–17 days after exposure**
- **Lymphadenopathy occurs before rash and lasts for several weeks**
## Rubella Complications

<table>
<thead>
<tr>
<th>Complication</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arthritis or arthralgia</td>
<td>May occur in up to 70% of adult women, but is rare in children and adult males</td>
</tr>
<tr>
<td>Encephalitis</td>
<td>1/6,000 cases</td>
</tr>
<tr>
<td>Hemorrhagic manifestations (e.g. thrombocytopenic purpura)</td>
<td>1/3,000 cases</td>
</tr>
<tr>
<td>Orchitis, neuritis, progressive panencephalitis</td>
<td>Rare</td>
</tr>
</tbody>
</table>
## Epidemiology

<table>
<thead>
<tr>
<th></th>
<th>Measles</th>
<th>Mumps</th>
<th>Rubella</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Reservoir</strong></td>
<td>Human</td>
<td>Human</td>
<td>Human</td>
</tr>
<tr>
<td><strong>Transmission</strong></td>
<td>Respiratory</td>
<td>Airborne</td>
<td>Respiratory</td>
</tr>
<tr>
<td></td>
<td>Airborne</td>
<td>Direct contact with droplet or saliva</td>
<td></td>
</tr>
<tr>
<td><strong>Temporal Pattern</strong></td>
<td>Peaks in late winter/spring</td>
<td>Peaks in late winter/spring</td>
<td>Peaks in late winter/spring</td>
</tr>
<tr>
<td><strong>Communicability</strong></td>
<td>4 days before to 4 days after rash onset</td>
<td>Several days before and after onset of parotitis</td>
<td>7 days before to 5–7 days after rash onset</td>
</tr>
</tbody>
</table>
Measles Cases by Year

Measles Cases and Outbreaks at [www.cdc.gov/measles/cases-outbreaks.html](http://www.cdc.gov/measles/cases-outbreaks.html) Accessed 8/12/2019
The states that have reported cases to CDC are Alaska, Arizona, California, Colorado, Connecticut, Florida, Georgia, Idaho, Illinois, Indiana, Iowa, Kentucky, Maine, Maryland, Massachusetts, Michigan, Missouri, New Mexico, Nevada, New Hampshire, New Jersey, New York, Ohio, Oklahoma, Oregon, Pennsylvania, Texas, Tennessee, Virginia, and Washington.
Man drove across three states for charity, spreading measles to 39 people as he went

The traveller became Michigan’s Patient Zero, after meeting hundreds of people in homes, synagogues and markets.

A sign warns people of measles in the ultra-Orthodox Jewish community in Williamsburg on April 16, 2019 in New York City. (Spencer Platt/Getty Images)

Last month, a traveller raising money for charity in Brooklyn’s ultra-Orthodox Jewish community drove through the night to Detroit — his next fundraising stop. He felt sick en route and saw a doctor when he got there. But the doctor, who had never seen measles, misdiagnosed the man’s fever and cough as bronchitis.
Guidance for Health Care Personnel

- Be vigilant about measles, mumps and rubella
- Consider measles in patients with febrile rash illness and clinically compatible measles symptoms—cough, coryza, and conjunctivitis
  - Promptly isolate patients with suspected measles
- Ask patients about:
  - Recent international travel
  - Recent travel to domestic venues frequented by international travelers
  - Recent contact with international travelers
  - History of measles in the community
2

Vaccine
MMR Vaccine

- **Composition**: Live, attenuated viruses

- **Efficacy**
  - Measles: 95% at 12 months; 98% at 15 months
  - Mumps: 88% (range: 31%–95%) (2 doses)
  - Rubella: 95% or more (1 dose)

- **Schedule**: 2 doses given subcutaneously (Subcut)
MMRV Vaccine

- **Composition**
  - Live, attenuated measles, mumps, rubella, and varicella vaccines
  - 7 to 8 times as much vaccine virus as monovalent varicella vaccine

- **Efficacy**
  - Inferred from that of MMR vaccine and varicella vaccine on the basis of noninferior immunogenicity

- **Schedule**
  - 2 doses given subcutaneously (Subcut)
Clinical Considerations
Child/Adolescent Schedule

- **Routine administration**

<table>
<thead>
<tr>
<th>Vaccine</th>
<th>Birth</th>
<th>1 mo</th>
<th>2 mos</th>
<th>4 mos</th>
<th>6 mos</th>
<th>9 mos</th>
<th>12 mos</th>
<th>15 mos</th>
<th>18 mos</th>
<th>19-23 mos</th>
<th>2-3 yrs</th>
<th>4-6 yrs</th>
<th>7-10 yrs</th>
<th>11-12 yrs</th>
<th>13-15 yrs</th>
<th>16 yrs</th>
<th>17-18 yrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measles, mumps, rubella</td>
<td>MMR</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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</tr>
</tbody>
</table>

\[1\text{st dose} \rightarrow \text{2nd dose}\]

- **Medical indications**

<table>
<thead>
<tr>
<th>Vaccine</th>
<th>Pregnancy</th>
<th>Immune- compromised status (excluding HIV infection)</th>
<th>HIV Infection CD4+ count</th>
<th>INDICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measles, mumps, rubella</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
MMR Recommendations for Children and Adolescents (Birth through 18 years)

- **First dose at 12–15 months of age**
  - Minimum age is 12 months
  - Doses given before 12 months of age are not counted as valid
    - Infants as young as 6 months should receive MMR before international travel*
    - Revaccinate at 12 months of age or older

- **Second dose at 4–6 years of age**
  - May be administered before age 4 years, provided at least 4 weeks (minimum interval) have elapsed since the first dose (Example: international travel)
  - Intended to produce measles and/or mumps immunity in persons who failed to respond to the first dose and may boost antibody titers in some persons who responded to the first dose
  - People who received 2 doses of MMR vaccine as children according to the U.S. vaccination schedule are considered protected for life

*ACIP off-label recommendation [www.cdc.gov/mmwr/pdf/rr/rr6204.pdf](http://www.cdc.gov/mmwr/pdf/rr/rr6204.pdf)
MMRV Vaccine

First dose at 12–47 months of age
- Minimum age is 12 months
- Can be given as MMR and VAR separately or MMRV
  - Providers considering MMRV for the first dose should discuss benefits/risks of both options with parents or caregivers
  - Unless parent or caregiver expresses preference for MMRV, CDC recommends MMR and VAR be given separately
  - If first dose given at 48 months–12 years of age, MMRV is generally preferred

Second dose at 15 months–12 years of age
- MMRV generally preferred
- May be given any time before 13th birthday at least 3 months (minimum interval) after the first dose
- Not approved for use in persons 13 years of age and older

www.cdc.gov/mmwr/pdf/rr/rr5903.pdf
Mumps: New ACIP Recommendation

Recommendation of the Advisory Committee on Immunization Practices for Use of a Third Dose of Mumps Virus–Containing Vaccine in Persons at Increased Risk for Mumps During an Outbreak

Mona Marie, MD; Martel Marlow, PhD; Kelly L. Moore, MD; Maritza Paul, MD

A substantial increase in the number of mumps outbreaks and outbreak-associated cases has occurred in the United States since late 2015 (1,2). To address this public health problem, the Advisory Committee on Immunization Practices (ACIP) reviewed the available evidence and determined that a third dose of measles, mumps, rubella (MMR) vaccine is safe and effective at preventing mumps. During its October 2017 meeting, ACIP recommended a third dose of a mumps virus–containing vaccine for persons previously vaccinated with 2 doses who are identified by public health authorities as being part of a group or population at increased risk for acquiring mumps because of an outbreak. The purpose of the recommendation is to improve protection of persons in outbreak settings against mumps disease and mumps-related complications. This recommendation supplements the existing ACIP recommendations for mumps vaccination (3).

In 1977, ACIP recommended 1 dose of mumps vaccine for all children aged ≥12 months (4). In response to multiple measles outbreaks in the late 1980s, in 1989 ACIP recom-

Despite this recommendation, mumps outbreaks continued to be reported throughout the United States, particularly in settings where persons have close, prolonged contact (e.g., universities and close-knit communities). To assist state and local health departments in responding to mumps outbreaks, CDC issued guidance on use of a third dose of MMR vaccine in the 2012 Manual for the Surveillance of Vaccine-Preventable Diseases. The guidance was based on limited data and provided criteria for health departments regarding when to consider use of a third dose in specifically identified target populations. Additional evidence on effectiveness and safety of the third dose of MMR vaccine recently became available and was presented to ACIP during 2017. This report summarizes the evidence considered by ACIP regarding use of a third dose of a mumps virus–containing vaccine during outbreaks and provides the recommendation for its use among persons who are at increased risk for acquiring mumps because of an outbreak.

Methods

https://www.cdc.gov/vaccines/hcp/acip-recs/vacc-specific/mmr.html
MMR and MMRV Administration

- **Preparation**
  - MMR-containing vaccines must be reconstituted BEFORE administering
  - Use ONLY the diluent supplied by the manufacturer

- **Route: Subcutaneous (Subcut) injection**
  - Needle gauge: 23 – 25 gauge
  - Needle length: 5/8 inch

- **Site: Upper outer triceps of the arm or the thigh**
MMRV and MMRV Administration Errors

- **Wrong diluent used to reconstitute vaccine**
  - Dose does NOT count and should be repeated ASAP

- **MMRV administered after the age of 12 years**
  - Dose counts if the minimum interval has been met

- **Always remember** – store vaccine according to the manufacturer’s recommendations and use a new needle and syringe for each patient
Measles, Mumps, Rubella Postexposure Prophylaxis

- If given within 72 hours of exposure, MMR vaccine might protect or modify clinical course of measles (preferable to IG for persons >12 months if given within 72 hours of exposure)

- If administered within 6 days of exposure, IG can prevent or modify measles in persons who are nonimmune
  - Not indicated for persons who have received 1 dose of measles-containing vaccine at age ≥12 months, unless they are severely immunocompromised

- Postexposure MMR vaccination or IG not shown to prevent or alter the clinical severity of rubella or mumps and is not recommended
MMR and MMRV Contraindications and Precautions

- History of anaphylactic reaction to neomycin
- History of severe allergic reaction to any component of the vaccine
- Pregnancy
  - Ask if pregnant or likely to become so in next 4 weeks*
  - Exclude those who say “yes”
  - For others, explain theoretical risks and then vaccinate
- Moderate or severe acute illness
- Recent blood product
- Personal or family (i.e., sibling or parent) history of seizures of any etiology
  - Should be vaccinated with separate MMR and varicella vaccines, not MMRV)

*ACIP off-label recommendation; Vaccine package insert states 3 months
MMR Vaccine Contraindications and Precautions

- **Immunosuppression**
  - HIV
    - Prevaccination HIV testing not recommended
    - MMR recommended for persons who do not have evidence of current severe immunosuppression
    - Revaccination recommended for persons with perinatal HIV infection who were vaccinated before establishment of effective antiretroviral therapy (ART) with 2 appropriately spaced doses of MMR vaccine once effective ART has been established
    - MMRV not for use in persons with HIV infection
  - Low-dose steroids – vaccinate anytime
  - Leukemia in remission without chemotherapy for 3 months – vaccinate
  - Hematopoietic cell transplant (HCT) recipient who is immunocompetent
Tuberculin Skin Testing (TST)* or Tuberculosis Interferon-Gamma Release-Assay (IGRA) and MMR or MMRV Vaccines

- Apply TST or IGRA at same visit as MMR or MMRV

- Delay TST or IGRA at least 4 weeks (28 days) if MMR or MMRV given first

- Apply TST first and administer MMR or MMRV when skin test read (least favored option because receipt of MMR or MMRV is delayed)

*Previously called PPD
<table>
<thead>
<tr>
<th>MMR Vaccine Adverse Reactions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fever</td>
</tr>
<tr>
<td>Rash, pruritis, purpura</td>
</tr>
<tr>
<td>Thrombocytopenia</td>
</tr>
<tr>
<td>Lymphadenopathy</td>
</tr>
<tr>
<td>Allergic reactions</td>
</tr>
<tr>
<td>Parotitis</td>
</tr>
<tr>
<td>Deafness</td>
</tr>
<tr>
<td>Encephalopathy</td>
</tr>
</tbody>
</table>
**MMR Storage and Handling**

- **Store in the refrigerator between 2°C and 8°C (36°F and 46°F)**
  - May also be stored in the freezer
  - Protect vaccine from light by keeping in the original packaging with the lid closed

- **Store diluent at room temperature or refrigerate**

- **Discard if not used within 8 hours after reconstitution**
  - Do not fill syringe with reconstituted vaccine until ready to administer
Resources
Measles Outbreak Toolkit for Providers

Measles Outbreak Toolkit for Healthcare Providers

For information about measles for healthcare professionals, visit https://www.cdc.gov/measles/hcp/index.html

If you are looking for resources for you or your staff to learn more about having effective vaccine conversations with parents, these may help:

- Guidance for Talking with Parents about Vaccines
- Tips for Preparing for Questions Parents may Ask about Vaccines
- Vaccine safety fact sheets, such as Understanding Thimerosal, Mercury, and Vaccine Safety
- You Call the Shots module on MMR

Examples of resources for providers to share with parents include:

- Parent-friendly immunization schedule for children ages 0-6
- Fact Sheet: Infant Immunization FAQs
- Fact Sheet: If You Choose Not to Vaccinate Your Child, Understand the Risks and Responsibilities
- Infographic: Measles: It isn't Just a Little Rash
- Fact Sheet: Tips for a Less Stressful Shot Visit
- Infographic: Illustrated list of Six Reasons to Follow CDC's Immunization Schedule
- Fact sheet: Measles and the Vaccine (Shot) to Prevent It
- Fact Sheet: Vaccines When Your Child is Sick

Measles Clinical Features and Diagnosis

Learn the signs and symptoms of measles for quicker diagnosing and share this resource with health care providers in your community.
MMRV Vaccine Adverse Reactions

- Similar to MMR

- Higher risk for fever and febrile seizures 5–12 days after the first dose among children 12–23 months of age
  - 1 additional febrile seizure occurred 5–12 days after vaccination per 2,300–2,600 children compared with children who received first dose as MMR and varicella vaccine separately

- Fever of 102°F or higher
  - 22% of MMRV recipients
  - 15% with separate injections

- Increased risk of febrile seizures has not been observed following use of MMRV as the second dose in the MMR and varicella series
MMR Revaccination Indications

- Vaccinated before the first birthday
- Vaccinated with inactivated (killed) measles vaccine (KMV) or measles vaccine of unknown type from 1963 through 1967
- Vaccinated with immune globulin (IG) in addition to a further attenuated strain or vaccine of unknown type (revaccination not necessary if IG given with Edmonston B vaccine)
- Vaccinated before 1979 with either inactivated mumps vaccine or mumps vaccine of unknown type who are at high risk for mumps infection (e.g., work in a health care facility) should be considered for revaccination with 2 doses of MMR
Meningococcal Disease and Meningococcal Vaccine

Day 1: Pediatric Track

August 2019

Chapter 14
Disease
Neisseria meningitidis

- Aerobic gram-negative bacteria
- At least 13 serogroups based polysaccharide capsule
- Most invasive disease caused by serogroups A, B, C, Y, and W
- Relative importance of serogroups depends on geographic location and other factors (e.g., age)
Meningococcal Disease Pathogenesis

- Organism colonizes nasopharynx
- In some persons organism enters the bloodstream and causes infection at distant site
- Antecedent URI may be a contributing factor
Neisseria meningitidis
Clinical Features

- Incubation period 3-4 days (range 2-10 days)

- Abrupt onset of fever, meningeal symptoms, hypotension, and rash

- Fatality rate 10%-15%, up to 40% in meningococcemia
Meningococcal Meningitis

- Most common presentation of invasive disease

- Results from hematogenous dissemination

- Clinical findings
  - fever
  - headache
  - stiff neck
Meningococcal Sepsis

- Meningococcemia
- Bloodstream infection
- May occur with or without meningitis

Clinical findings

- fever
- petechial or purpuric rash
- hypotension
- shock
- acute adrenal hemorrhage
- multi-organ failure
Meningococcal Disease
Meningococcal Disease
Neisseria meningitidis
Risk Factors for Invasive Disease

- **Host Factors**
  - Deficiencies in the terminal common complement pathways
  - Functional or anatomic asplenia
  - Chronic underlying disease
  - Certain genetic factors (altered genes: mannose-binding lectin and tumor necrosis factor)

- **Environmental factors**
  - Household crowding
  - Active and passive smoking
  - Antecedent viral infection

- **Occupational (microbiologists)**
Neisseria meningitidis
Risk Factors for Invasive Disease

- College Students
  - Studies in 1990s – overall incidence similar to or lower than their counterparts in general population*
  - Case control study of 50 cases and other studies in the 1990s#
    - First-year college students living in residence halls at higher risk

*JAMA 1999;281:1906-10
#Abstracts of the 39th Meeting of the IDSA. Philadelphia, PA: IDSA; 1999:276
Meningococcal Disease Incidence, United States, 1970-2015

Meningococcal Disease Incidence by Age, United States, 2005-2013

SOURCE: CDC. National Notifiable Diseases Surveillance System
Meningococcal Disease Serotypes in the U.S., 2005-2011

Meningococcal Serotypes in the U.S.

- B: 32%
- C: 35%
- Y: 27%
- Other*: 6%

*Includes serogroup W135, nongroupable, and other serogroups.

MMWR, March 22, 2013; Recommendations and Reports / Vol. 62 / No. 2
Meningococcal Outbreaks in the United States

- Outbreaks account for 2%-3% of reported cases
- Most recent outbreaks caused by serogroup C and B
Rates of Meningococcal Disease (C and Y) by Age, 1999–2008

Option 1
Dose at 11–12 years and booster at 16 years

Option 2
Single dose at 16 years

Active Bacterial Core surveillance (ABCs), 1998–2008
Vaccine
<table>
<thead>
<tr>
<th>Vaccine product</th>
<th>Age indications (FDA)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Men A Vaccines</strong></td>
<td></td>
</tr>
<tr>
<td>Menactra</td>
<td>Men A, C, W, Y</td>
</tr>
<tr>
<td></td>
<td>9 months-55 years</td>
</tr>
<tr>
<td>Menveo</td>
<td>Men A, C, W, Y</td>
</tr>
<tr>
<td></td>
<td>2 months–55 years</td>
</tr>
<tr>
<td><strong>Men B Vaccines</strong></td>
<td></td>
</tr>
<tr>
<td>Trumebma</td>
<td>10-25 years</td>
</tr>
<tr>
<td>MenB-FHbp</td>
<td></td>
</tr>
<tr>
<td>Bexsero</td>
<td>10-25 years</td>
</tr>
<tr>
<td>Men B-4C</td>
<td></td>
</tr>
</tbody>
</table>
Meningococcal Conjugate Vaccines

- Meningococcal polysaccharide conjugated to protein carrier
- Elicit both T- and B-cell immunity (T-cell dependent immunity)
- 2 brands currently licensed in the United States
  - Menactra = MenACWY-D (Sanofi Pasteur)
  - Menveo = MenACWY-CRM (GlaxoSmithKline)
Menactra MenACWY Vaccine

- Licensed by FDA in January 2005

- Quadrivalent polysaccharide vaccine conjugated to diphtheria toxoid (MenACWY-D)

- Approved for persons 9 months through 55 years of age

- Intramuscular injection

- Single dose vials
Menveo MenACWY Vaccine

- Licensed by FDA in February 2010
- Lyophilized serogroup A vaccine reconstituted with liquid containing serogroups C, Y, and W135 (MenACWY-CRM)
- May be used for any person 2 months through 55 years of age for whom MCV4 is indicated, including revaccination
- Intermuscular injection
- Single dose vials
Interchangeability of Conjugate Vaccine Brands

- Limited data suggest that different conjugate vaccine products can be used interchangeably.

- 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.
Clinical Considerations
Administer MenACWY at age 11 or 12 years with a booster dose at 16 years of age

Administer 1 dose at age 13 through 15 years if not previously vaccinated

For persons vaccinated at age 13 through 15 years, administer a one-time booster dose, preferably at or after 16 through 18 years of age
  - The minimum interval between doses is 8 weeks
MenACWY Adolescent Vaccination Recommendations

- A booster dose is not recommended for healthy persons if the first dose is administered at or after 16 years of age.

- A booster dose is not recommended for healthy persons after 21 years of age who are not at increased risk of exposure:
  - A booster dose is not recommended for healthy persons 22 years of age and older even if the first dose was administered at 11-15 years of age.
  - Exception: first year students living in a residence hall (irrespective of age).
High-risk Groups: Functional or Anatomic Asplenia or HIV Infection*

- Younger than 19 months
  - Infant series at 2, 4, 6, and 12-15 months with MenACWY-CRM

- 19-23 months who have not received a complete series
  - 2-dose primary series of MenACWY-CRM
  - Interval 12 weeks**

- 24 months or older who have not received a complete series
  - 2-dose primary series of either MenACWY 8-12 weeks apart

*Including sickle-cell disease
** Doses valid if 8 weeks apart
High-risk Groups: Persistent Complement Component Deficiency*

- **Children 2-18 months**
  - Infant series at 2, 4, 6, and 12-15 months with MenACWY-CRM; OR
  - 2-dose primary series of MenACWY-D starting at 9 months at least 12 weeks apart**

- **19-23 months without complete series of either MenACWY**
  - 2-dose primary series of either MenACWY at least 12 weeks apart**

- **24 months or older who have not received a complete series of either MenACWY**
  - 2-dose primary series of either MenACWY at least 12 weeks apart**

* Including persons taking Soliris (eculizumab)
** Doses valid if 8 weeks apart
Meningococcal Vaccine Use in Outbreaks

- MenACWY recommended for use in control of outbreaks caused by A, C, W, and Y

- **Outbreak definition:**
  - at least 3 confirmed or probable primary cases of the same serogroup
  - period of 3 months or less
  - primary attack rate of more than 10 cases per 100,000 population
Meningococcal Vaccine Booster Doses

- **Children who receive primary immunization and remain at increased risk should receive booster doses**
  - if primary immunization complete by 7 years of age first booster should be 3 years after primary immunization and every 5 years thereafter if at continued risk

- **If primary immunization complete on or after 7 years of age**
  - first booster should be 5 years after primary immunization and every 5 years thereafter if at continued risk
### Meningococcal Vaccines Adverse Reactions

<table>
<thead>
<tr>
<th>Reaction</th>
<th>MenACWY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local reactions for 1-2 days</td>
<td>11%-59%</td>
</tr>
<tr>
<td>Low-grade fever</td>
<td>5%-17%</td>
</tr>
<tr>
<td>Systemic reactions (headache, malaise, fatigue)</td>
<td>4%-54%</td>
</tr>
</tbody>
</table>
MenB Vaccine Recommendations
Meningococcal B Vaccines

- **Trumenba (MenB-FHbp)**
  - Licensed by the FDA in October 2014
  - For persons age 10-25 years
  - 3 dose series, administered at 0, 1-2, and 6 months or a 2 dose series, administered at 0, and 6 months

- **Bexsero (MenB-4C)**
  - Licensed by the FDA in January 2015
  - For persons aged 10-25 years
  - 2 dose series at 0, and 1-6 months

- **Same volume (0.5 cc)**
- MenB should be administered as either a 2-dose series of MenB-4C or a 2-dose or 3-dose series of MenB-FHbp
- The same vaccine product should be used for all doses
- MenB-4C and MenB-FHbp may be administered concomitantly with other vaccines indicated for this age, but at a different anatomic site, if feasible
- No product preference to be stated
Meningococcal B Recommendations

- Recommendation for use in individuals ≥10 years of age at increased risk of disease

- Recommendation for use in adolescents and young adults not at increased risk for disease
ACIP MenB Recommendations

- Certain persons aged ≥10 years* who are at increased risk for meningococcal disease should receive MenB vaccine. These persons include:
  - Persons with persistent complement component deficiencies
  - Persons with anatomic or functional asplenia**
  - Microbiologists routinely exposed to isolates of Neisseria meningitides
  - Persons identified as at increased risk because of a serogroup B meningococcal disease outbreak

*ACIP off-label recommendation
**Including sickle cell disease
http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6422a3.htm?s_cid=mm6422a3_w
ACIP MenB Recommendations

- Certain other groups included in MenACWY (MCV4) recommendations for persons at increased risk, are not in this recommendation

- MenB – **NOT currently recommended for**:
  - Children aged 2 months – 9 years of age
  - Persons who travel to or reside in countries where meningococcal disease is hyperendemic or epidemic because risk is generally not caused by serogroup B
  - Routine use in first-year college students living in residence halls, military recruits, or all adolescents

http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6422a3.htm?s_cid=mm6422a3_w
Use of 2- and 3-Dose Schedules of MenB-FHbp (Trumenba) Meningococcal Serogroup B Vaccine

- For persons at increased risk for meningococcal disease and for use during serogroup B outbreaks, 3 doses of MenB-FHbp should be administered at 0, 1-2, 6 months

- When given to healthy adolescents who are not at increased risk for meningococcal disease, 2 doses of MenB-FHbp should be administered at 0 and 6 months
Trumenba Timing and Spacing Errors

- If a patient is recommended for 3 doses of Trumenba, but the second dose is delayed beyond a 6-month interval, a third dose is NOT necessary.

- If a patient is recommended for 2 doses of Trumenba, and the second dose is given less than 6 months after the first dose, then a repeat (3rd) dose must be administered 4 months after the second dose.
MenB for Adolescents and Young Adults

- A MenB vaccine series may be administered to adolescents and young adults aged 16–23 years to provide short-term protection against most strains of serogroup B meningococcal disease*

- The preferred age for MenB vaccination is 16–18 years

* Permissive recommendation (Category B)
MMWR October 23, 2015 / 64(41);1171-6
MenB Vaccine Brand Error

- If a dose of MenB vaccine is administered and found to be a different brand from a dose previously administered:
  - Pick the brand with which you want to continue the series
  - Invalidate the dose of the other brand
  - Continue the series
  - Need a 4 week minimum interval from any invalid doses
  - Need to follow the minimum intervals between doses of the chosen brand
# Meningococcal B Adverse Reactions

<table>
<thead>
<tr>
<th>Adverse Reactions</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pain at injection site, injection site reactions, erythema</td>
<td>45%-85%</td>
</tr>
<tr>
<td>fatigue, headache, chills, nausea, arthralgia</td>
<td>13%-60%</td>
</tr>
</tbody>
</table>
Meningococcal Vaccine
Contraindications and Precautions

- Severe allergic reaction to vaccine component or following prior dose

- Moderate or severe acute illness
Resources
Meningococcal Resources

- ACIP’s Meningococcal Recommendations web page
  www.cdc.gov/vaccines/hcp/acip-recs/vacc-specific/mening.html
- CDC’s Meningococcal Infection web page
  www.cdc.gov/meningococcal/index.html
- CDC’s Meningococcal Vaccination web page
  www.cdc.gov/vaccines/vpd-vac/mening/default.htm
- Immunization Action Coalition Meningococcal web page
  www.immunize.org/meningococcal/
- Children’s Hospital of Philadelphia Vaccine Education Center Meningococcal web page
  http://www.chop.edu/centers-programs/vaccine-education-
Human Papillomavirus and HPV Vaccine

Day 1: Pediatric Track

August, 2019

Chapter 11 = supplemental material
Disease
Human Papillomavirus (HPV) Disease

- Most common sexually transmitted infection in the U.S.
- Small DNA virus
- More than 150 types
- First vaccine was licensed in 2006
Human Papillomavirus Type and Disease Association

- **Mucosal** (~40 types)
  - "High-risk" Types (16, 18, others)
    - Low-grade cervical abnormalities
    - High grade abnormalities/Cancer precursors
    - Anogenital cancers
  - "Low-risk" Types (6, 11, others)
    - Low-grade cervical abnormalities
    - Genital warts
    - Respiratory papillomas

- **Cutaneous** (other types)
  - "Common" Warts (hands/feet)
Natural History of HPV Infection

- *CIN = cervical intraepithelial neoplasia
HPV Clinical Features

- Most HPV infections are asymptomatic and result in no clinical disease

- Clinical manifestations of HPV infection include:
  - Anogenital warts
  - Recurrent respiratory papillomatosis
  - Cervical cancer precursors (cervical intraepithelial neoplasia)
  - Cancer (cervical, anal, vaginal, vulvar, penile, and some oropharyngeal cancers)
HPV Epidemiology

- **Reservoir**: Human
- **Transmission**: Direct contact (usually sexual)
- **Temporal pattern**: None
- **Communicability**: Presumed to be high
Cumulative Incidence of any HPV Infection Months after Sexual Initiation

4 years, >50%

HPV Disease Burden in the U.S.

- Estimated 79 million persons are infected
  - ~14 million new infections annually

- Common among adolescents and young adults
  - 50% of new infections occur in persons 15–24 years of age

- About $8 billion spent annually on management of sequelae of HPV infections
Vaccine
HPV Vaccine Products

<table>
<thead>
<tr>
<th>Vaccine product</th>
<th>Age indications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gardasil (4vHPV)</td>
<td>Girls and women 9–26 years</td>
</tr>
<tr>
<td></td>
<td>Boys and men 9-26 years</td>
</tr>
<tr>
<td>Gardasil 9 (9vHPV)</td>
<td>Girls and women 9–45 years*</td>
</tr>
<tr>
<td></td>
<td>Boys and men 9–45 years*</td>
</tr>
<tr>
<td>Cervarix (2vHPV)</td>
<td>Girls and women 9–25 years</td>
</tr>
</tbody>
</table>

*Gardasil 9 is FDA approved for use in women and men through 45 years, and ACIP recently approved its use for this age range using a shared clinical decision making process.*
Human Papillomavirus Virus Vaccine

- HPV L1 major capsid protein of the virus is antigen used for immunization
- L1 protein produced using recombinant DNA technology
- L1 proteins self-assemble into virus-like particles (VLP)
- VLPs are noninfectious and nononcogenic
Human Papillomavirus Vaccine

Efficacy

- High efficacy among females without evidence of infection with vaccine HPV types (>95%)
- No evidence of efficacy against disease caused by vaccine types participants were infected with at the time of vaccination
- Prior infection with one HPV type did not diminish efficacy of the vaccine against other vaccine HPV types
9vHPV (Gardasil 9)  
Efficacy and Safety

- **Efficacy**
  - ~97% protection against 31-, 33-, 45-, 52-, 58-related outcomes
  - Similar protection against 6-, 11-, 16-, 18-related disease

- **Noninferior immunogenicity to 4vHPV**

- **5 additional types account for 11% of invasive cancers**
  - Differences by gender: 14% for females; 5% for males

- **9vHPV can be administered at the same medical visit with MenACWY and Tdap**

- **Safety profile similar to 4vHPV across age, gender, race, ethnicity groups**
The duration of immunity after a complete 3-dose series is not known

- Available evidence indicates protection for at least 8 years for 4vHPV and at least 9 years for 2vHPV
- Multiple cohort studies are in progress to monitor the duration of immunity
Clinical Considerations
ACIP HPV Vaccine Recommendations: Pediatric

- Routinely recommended for all adolescents age 11–12 years (can start at age 9 years*) and through age 18 years if not previously adequately vaccinated

- 2- or 3-dose series
  - Age 9–14 at initial vaccination: 2-dose series
    - 0, 6–12 months
  - Age 15 and older at initial vaccination: 3-dose series
    - 0, 1–2 months, 6 months

*For children with a history of sexual abuse or assault, ACIP recommends routine HPV vaccination beginning at 9 years
Human Papillomavirus Vaccine
Immunization Schedules

- **Routine 2-dose schedule**: 0, 6–12 months

- **Routine 3-dose schedule**: 0, 1–2, 6 months
  - Dose 2: Administer at least 1 to 2 months after dose 1
  - Dose 3: Administer at least:
    - 12 weeks after dose 2 AND
    - 6 months (24 weeks) after dose 1

- **An accelerated schedule using minimum intervals is not recommended**

*ACIP off-label recommendation, MMWR 2015;64(29):300–4
HPV Immunization Schedule
Unvaccinated Adolescents 9–14 Years of Age

- ACIP recommends following the routine 2-dose schedule (0, 6–12 months) for children 9 through 14 years of age starting the HPV vaccination series

- If a 2nd dose is inadvertently administered prior to 5 months, follow a 3-dose series
HPV Immunization Schedule
Unvaccinated Adolescents 15 Years of Age and Older

- ACIP recommends following the routine 3-dose schedule (0, 1–2, 6 months) for adolescents and adults starting the HPV series on or/after their 15th birthday.
ACIP HPV Immunization Recommendations

Medical Condition Considerations

- ACIP recommends HPV vaccination for immunocompromised females and males age 9 through 26 years with 3 doses of HPV vaccine (0, 1–2, 6 months)

- Administer a 3-dose series to immunocompromised persons, including those with:
  - Primary or secondary immunocompromising conditions that might reduce cell-mediated or humoral immunity, such as B lymphocyte antibody deficiencies, T lymphocyte complete or partial defects, HIV infection, malignant neoplasm, transplantation, autoimmune disease, or immunosuppressive therapy
ACIP HPV Immunization Recommendations

Schedule Considerations

- **Number of recommended doses is based on:**
  - Age at administration of the first dose OR
  - Health status – immunosuppression

- **Series does not need to be restarted if it is delayed or interrupted**
  - There is NO maximum interval between HPV vaccine doses

- **HPV vaccine can be administered during the same clinical visit as other vaccines**

- **No booster doses are recommended—even if the series was completed years ago**

- **No therapeutic effect on HPV infection, genital warts, cervical lesions**
Human Papillomavirus Vaccine
Product Interchangeability

- No data on schedules that include 2vHPV and 4vHPV and/or 9vHPV
- Response to types 16 and 18 likely to be similar when 2vHPV, 4vHPV, or 9vHPV used in the same series
- Protection against other vaccine types is probably reduced if fewer than 3 doses of 4vHPV or 9vHPV received
- Use same vaccine for all doses whenever possible
Starting the vaccine series should be delayed until after the pregnancy.

If a woman becomes pregnant after starting the vaccination series, remaining doses should be delayed until after the pregnancy.

If a vaccine dose has been administered during pregnancy, there is no indication for intervention.

Women vaccinated during pregnancy should be reported to the respective manufacturer:
- Active pregnancy registry for 9vHPV established; others are closed
- Contact information is in the package insert.

*MMWR* 2014;63(No. 5):1–30; *MMWR* 2015;64(29):300–4
<table>
<thead>
<tr>
<th>Age</th>
<th>Previous Vaccines</th>
<th>Followed Schedule</th>
<th>Adequately Vaccinated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before 15th birthday</td>
<td>2 doses of any HPV vaccine</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Before 15th birthday</td>
<td>3 doses of any HPV vaccine</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>After 15th birthday</td>
<td>3 doses of any HPV vaccine</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

*For persons who have been adequately vaccinated with 2vHPV or 4vHPV, no ACIP recommendation regarding additional vaccination with 9vHPV.*
Human Papillomavirus Vaccine
Routine Recommendations

- Catch up those previously unvaccinated or missing doses, including:
  - Females age 13 through 26 years
  - Males age 13 through 26 years*

*ACIP voted in June, 2019 to recommend vaccination of all men 13-26 years of age. Recommendations will be published once approved by the CDC director.
ACIP recommends following the routine 3-dose schedule (0, 1–2, 6 months) for adolescents and adults starting the HPV series on or/after their 15th birthday
Vaccine Administration

- **Route:** intramuscular (IM) injection
  - Needle size: 1 to 1½ inch, 22–25-gauge

- **Site:** Deltoid muscle in the upper arm

- **Administer at the same medical visit as other vaccines**
Human Papillomavirus Vaccine
Contraindications and Precautions

- **Contraindication**
  - Severe allergic reaction to a vaccine component or following a prior dose

- **Precaution**
  - Moderate or severe acute illness (defer until symptoms improve)
## Adverse Events Following Any Dose of HPV Vaccine among Females*

<table>
<thead>
<tr>
<th>Adverse Event</th>
<th>2vHPV</th>
<th>4vHPV</th>
<th>9vHPV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pain</td>
<td>92%</td>
<td>84%</td>
<td>89%</td>
</tr>
<tr>
<td>Swelling</td>
<td>44%</td>
<td>29%</td>
<td>40%</td>
</tr>
<tr>
<td>Erythema</td>
<td>48%</td>
<td>25%</td>
<td>34%</td>
</tr>
<tr>
<td>Fever</td>
<td>13%</td>
<td>13%</td>
<td>5%</td>
</tr>
<tr>
<td>Nausea</td>
<td>7%</td>
<td>GI 28%**</td>
<td>4%</td>
</tr>
<tr>
<td>Headache</td>
<td>12%</td>
<td>55%</td>
<td>11%</td>
</tr>
</tbody>
</table>

*FDA product approval data

**GI = Gastrointestinal symptoms, including nausea, vomiting, diarrhea, and/or abdominal pain
Syncope Following Vaccination

- An increase in the number of reports of syncope has been detected by the Vaccine Adverse Event Reporting System (VAERS)
  - Most of the increase among females 11–18 years
- Serious injuries have resulted
- ACIP recommends providers strongly consider observing patients for 15 minutes after they are vaccinated
Vaccine Storage and Handling

- Store HPV vaccine in a refrigerator between 2°C–8°C (36°F–46°F)

- Store HPV vaccines:
  - In the original packaging with the lids closed
  - In a clearly labeled bin and/or area of the storage unit

- Do not freeze the vaccine

Vaccine storage label example
Available at www.cdc.gov/vaccines/hcp/admin/storage/guide/vaccine-storage-labels.pdf
- Ask the Experts–HPV FAQs: www.immunize.org/askexperts/experts_hpv.asp
- CDC HPV Disease and Vaccination: www.cdc.gov/hpv/hcp/index.html
- HPV and Cancer: www.cdc.gov/cancer/hpv/index.htm
Talking to Parents about HPV Vaccine: 
www.cdc.gov/hpv/hcp/for-hcp-tipsheet-hpv.pdf

National HPV Vaccination Roundtable Resource Library: hpvroundtable.org/resource-library/

Standing Orders for Administering HPV Vaccine:
• Children and Teens: www.immunize.org/catg.d/p3090.pdf
• Adults: www.immunize.org/catg.d/p3091.pdf
Strategies for Increasing HPV Vaccination Coverage in Clinical Practices

- Give a presumptive, bundled recommendation for vaccination!
  - Include HPV vaccine when discussing other recommended vaccines
Same Way
Same Day
Make an Effective Recommendation

- **Same way:**
  - Effective recommendations group all of the adolescent vaccines
  - Recommend HPV vaccination the same way you recommend Tdap and meningococcal vaccines

- **Same day:**
  - Recommend HPV vaccine TODAY with other adolescent vaccines

Your preteen needs three vaccines today to protect against meningitis, HPV cancers, and pertussis.

Keeping All Staff On the Same Page

- Align communication with mission
- Give staff a cancer prevention mission
- All staff needs to be saying the same thing
- Share talking points
- Use the Tip Sheet
- Educate staff about HPV vaccine recommendations, including schedule, administration, storage, and handling

www.cdc.gov/hpv/hcp/for-hcp-tipsheet-hpv.pdf
Influenza and Influenza Vaccines

Day 1: Pediatric/Adolescent Track

August 2019
Influenza

- Highly infectious viral illness
- First pandemic in 1580
- At least 4 pandemics in 19th century
- 3 pandemics in the 20th century
  - Spanish influenza pandemic – 21 million deaths worldwide
  - Pandemics of 1957 and 1968 of lesser severity
- Most recent pandemic (H1N1) in 2009-2010
- Virus first isolated in 1933
Influenza Virus

- Single-stranded RNA virus
- Orthomyxoviridae family
- 3 types: A, B, C
- Subtypes of type A are determined by hemagglutinin and neuraminidase
Influenza Virus Strains

- **Type A**
  - Moderate to severe illness
  - All age groups
  - Humans and other animals

- **Type B**
  - Milder epidemics
  - Primarily affects children
  - Humans only

- **Type C**
  - Rarely reported in humans
  - No epidemics
Influenza Type A Subtypes

Subtypes of type A determined by hemagglutinin (H) and neuraminidase (N)

A/California/7/2009 (H1N1)
Influenza Antigenic Changes

- **Antigenic Drift**
  - Minor change, same subtype
  - Caused by point mutations in gene
  - May result in epidemic

- **Antigenic Shift**
  - Major change, new subtype
  - Caused by exchange of gene segments
  - May result in pandemic
WHO declares first flu pandemic in 41 years

The World Health Organization scaled up its flu warning to its highest level Thursday, declaring the first global influenza pandemic in 41 years as cases of H1N1 continued to mount in the USA, Europe, Latin America and Australia.

"The scientific criteria for a pandemic have been met," said Margaret Chan, director general of the WHO. "The world is now at the start of the 2009 influenza pandemic."

The decision marks the agency's formal recognition of the magnitude of the challenge posed by a novel, H1N1 flu virus now spreading unchecked among people who, because the virus is new, are virtually all susceptible to it.

The WHO is working closely with vaccine makers, who are just wrapping up production of seasonal flu vaccine for fall and gearing up to produce the first doses of an H1N1 vaccine by September. The agency urged member nations to maintain their vigilance to detect ominous changes in the virus.
Influenza Pathogenesis

- Respiratory transmission of virus
- Replication in respiratory epithelium with subsequent destruction of cells
- Viremia rarely documented
- Virus shed in respiratory secretions for 5-10 days
Influenza Clinical Features

- Incubation period: 2 days (range: 1-4 days)

- 50% of infected persons develop classic symptoms

- Abrupt onset of fever (usually 101°F -- 102°F), myalgia, sore throat, nonproductive cough, headache
Influenza Complications

- Pneumonia
  - Primary influenza pneumonia
  - Secondary bacterial pneumonia

- Reye syndrome

- Myocarditis

- Death reported in <1 per 1,000 cases

- Number of influenza-associated deaths varies substantially by year, influenza virus type and subtype, and age group

- Annual influenza-associated deaths ranged from 3,349 (1985-86 season) to 48,614 (2003-04 season), average of 23,607 annual deaths

- Updated estimates from 2010-2011 to 2013-2014, deaths ranged from 12,000 (during 2011-2012) to 56,000 (during 2012-2013).

- Persons 65 years of age and older account for ~90% of deaths

- 3-7 times more deaths during seasons when A(H3N2) viruses were
Impact of Influenza--United States

- Highest rates of complications and hospitalizations among persons 65 years and older, young children, and persons of any age with certain underlying medical conditions

- Average of >200,000 influenza-related excess hospitalizations

- 37% of hospitalizations among persons younger than 65 years of age

- Greater number of hospitalizations during years that A(H3N2) is predominant
Influenza Among School-Age Children

- School-age children
  - Typically have the highest attack rates during community outbreaks of influenza
  - Serve as a major source of transmission of influenza within communities
Influenza Epidemiology

- **Reservoir**
  - Human, animals (type A only)

- **Transmission**
  - Respiratory, probably airborne

- **Temporal pattern**
  - Peak December – March in temperate climate
  - May occur earlier or later
Influenza Diagnosis

- Clinical and epidemiological characteristics

- Isolation of influenza virus from clinical specimen (e.g., throat, nasopharynx, sputum)

- Significant rise in influenza IgG by serologic assay
# Influenza Virus Testing Methods

<table>
<thead>
<tr>
<th>Method</th>
<th>Types Detected</th>
<th>Test Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Viral tissue cell culture</td>
<td>A and B</td>
<td>3-10 days</td>
</tr>
<tr>
<td>Rapid cell culture (shell vials; cell mixtures; yields live virus)</td>
<td>A and B</td>
<td>1-3 days</td>
</tr>
<tr>
<td>Immunofluorescence, Direct (DFA) or Indirect (IFA) Fluorescent Antibody Staining</td>
<td>A and B</td>
<td>1-4 hours</td>
</tr>
<tr>
<td>Reverse transcriptase polymerase chain reaction (RT-PCR) and other molecular assays (influenza viral RNA or nucleic acid detection)</td>
<td>A and B</td>
<td>Varies by assay (generally 60-80 minutes and 4-8 hours)</td>
</tr>
<tr>
<td>Rapid molecular assay (influenza viral RNA or nucleic acid detection)</td>
<td>A and B</td>
<td>Approximately 20 minutes</td>
</tr>
<tr>
<td>Rapid influenza diagnostic tests (antigen detection)</td>
<td>A and B</td>
<td>&lt;15 minutes</td>
</tr>
</tbody>
</table>

Adapted from [http://www.cdc.gov/flu/professionals/diagnosis/rapidclin.htm#table](http://www.cdc.gov/flu/professionals/diagnosis/rapidclin.htm#table)
Influenza Positive Tests Reported to CDC by U.S. Public Health Laboratories, National Summary, 2018-2019 Season

- A (subtyping not performed)
- A (H1N1)pdm09
- A (H3N2)
- H3N2v
- B (lineage not performed)
- B (Victoria Lineage)
- B (Yamagata Lineage)
Vaccine
Inactivated Influenza Vaccine Efficacy

- About 47% effective among all persons

- 60% effective in preventing medically attended illness in children
There are Still Many Different Vaccines

- **ACIP Statement, Table 1**
- 13 distinct products
- More than one might be appropriate for any given recipient
  - ACIP/CDC express no preferences for any one type of influenza vaccine over another, where more than one is appropriate and available
  - Vaccination should not be delayed in order to obtain a specific product.
Abbreviations

- IIV = Inactivated influenza vaccine
- LAIV = Live, attenuated influenza vaccine
- RIV = Recombinant influenza vaccine
- Prefixes:  SD = standard dose
  HD = high dose
  a = adjuvanted
  cc = cell-culture-based
- Numeric suffixes (e.g., RIV3, IIV4) indicate trivalent or quadrivalent, respectively
Influenza Vaccines

- **IIV:**
  - Contain inactivated virus, split or subunit
    - High dose or standard dose
    - Trivalent or quadrivalent
    - Unadjuvanted or adjuvanted
    - Egg- or cell-culture-based
  - Many brands, some approved for those as young as 6 months of age

- **LAIV**
  - Live, attenuated virus
  - Intranasal spray
2019-2020 Influenza Vaccine Composition

- **Trivalent vaccines:**
  - An A/Brisbane/2/2018 (H1N1)pdm09-like virus *(updated)*
  - An A/Kansas/14/2017 (H3N2)-like virus *(updated)*
  - B/Colorado/06/2017-like virus

- **Quadrivalent vaccines:**
  - The above three viruses
  - A B/Phuket/3073/2013-like virus
Quick Aside about Influenza Vaccines for 6 Months – 35 Months of Age

- Two potential points of confusion
  - Four licensed products, but the dose volume differs
    - Afluria Quadrivalent: 0.25 mL – newly licensed down to 6 months
    - Fluarix Quadrivalent: 0.5 mL
    - FluLaval Quadrivalent: 0.5 mL
    - Fluzone Quadrivalent: 0.25 mL
  - Fluzone Quadrivalent: 0.5 mL – newly licensed formulation

- Dose volume is distinct from number of doses needed
  - A child 6 months through 35 months who is recommended for two doses of influenza vaccine and receives FluLaval Quadrivalent 0.5 mL still needs the second dose of vaccine 4 weeks later
Clinical Considerations
Groups Recommended for Vaccination

- Routine annual influenza vaccination is recommended for all persons \( \geq 6 \) months of age who do not have contraindications

- While vaccination is recommended for everyone in this age group, there are some for whom it is particularly important:
  - People age \( \geq 6 \) months who are at high risk of complications and severe illness
  - Contacts and caregivers of these people, and of infants under age 6 months (because there is no vaccine approved for children this age)
Groups at Increased Risk for Influenza Complications and Severe Illness

- Children age 6 through 59 months and adults age ≥50 years (children under 6 months of age are also at high risk, but cannot be vaccinated)
- Persons with chronic pulmonary (including asthma) or cardiovascular (except isolated hypertension), renal, hepatic, neurologic, hematologic, or metabolic disorders (including diabetes mellitus)
- Immunocompromised persons
- Women who are or will be pregnant during the influenza season
- Children and adolescents (age 6 months–18 years) who are receiving aspirin therapy and who might be at risk for experiencing Reye syndrome after influenza virus infection
- Residents of nursing homes and other long-term care facilities
- American Indians/Alaska Natives
- Persons who are extremely obese (BMI ≥40)
Influenza Vaccination of Persons with Egg Allergy

- Mostly unchanged from last few seasons
  - Main change is that LAIV4 is an option

- Egg allergic persons can receive any licensed, recommended vaccine that is otherwise appropriate (IIV, RIV4, or LAIV4)
  - However, RIV not licensed for persons under 18 years of age

- For persons with a history of severe allergic reaction to egg (i.e., any symptom other than hives)
  - “The selected vaccine should be administered in an inpatient or outpatient medical setting (including but not necessarily limited to hospitals, clinics, health departments, and physician offices). Vaccine administration should be supervised by a health care provider who is able to recognize and manage severe allergic conditions.”

- No specific post-vaccination observation period recommended
  - However, per the ACIP General Best Practices guidelines, providers should consider...
Egg Allergy Algorithm

- No longer printed in the MMWR
## Inactivated Influenza Vaccination Schedule

<table>
<thead>
<tr>
<th>Group Age</th>
<th>Dose</th>
<th>No. Doses</th>
</tr>
</thead>
<tbody>
<tr>
<td>6–35 mos</td>
<td>0.25 mL or 0.50 mL*</td>
<td>1 or 2</td>
</tr>
<tr>
<td>3–8 yrs</td>
<td>0.50 mL</td>
<td>1 or 2</td>
</tr>
<tr>
<td>9 yrs and older</td>
<td>0.50 mL</td>
<td>1</td>
</tr>
</tbody>
</table>

*Depending on vaccine product
Dosing Algorithm for Children Age 6 Months Through 8 Years, 2019–2020

- Similar to past two seasons
- If 2 cumulative doses received prior to July 1, 2019, only 1 dose needed for 2019-2020
- Only 1 dose needed after the 9th birthday

Has the child received ≥2 total doses of trivalent or quadrivalent influenza vaccine before July 1, 2017? (Doses need not have been received during the same season or consecutive seasons.)

- Yes
  - 1 dose of 2017–18 influenza vaccine

- No or don’t know
  - 2 doses of 2017–18 influenza vaccine (administered ≥4 weeks apart)
Inactivated Influenza Vaccine (IIV) and RIV
Contraindications and Precautions

- Severe allergic reaction (e.g., anaphylaxis) to a vaccine component or following a prior dose of inactivated influenza vaccine

- Moderate or severe acute illness

- History of Guillain-Barré syndrome (GBS) within 6 weeks following a previous dose of influenza vaccine
# LAIV Contraindications and Precautions

<table>
<thead>
<tr>
<th>Contraindications</th>
<th>Precautions</th>
</tr>
</thead>
<tbody>
<tr>
<td>• History of severe allergic reaction to any component of the vaccine† or after a previous dose of any influenza vaccine</td>
<td>• Moderate-to-severe acute illness with or without fever</td>
</tr>
<tr>
<td>• Concomitant aspirin or salicylate-containing therapy in children and adolescents</td>
<td>• History of Guillain-Barré syndrome within 6 weeks of receipt of influenza vaccine</td>
</tr>
<tr>
<td>• Children aged 2 through 4 years who have received a diagnosis of asthma or whose parents or caregivers report that a health care provider has told them during the preceding 12 months that their child had wheezing or asthma or whose medical record indicates a wheezing episode has occurred during the preceding 12 months</td>
<td>• Asthma in persons aged ≥5 years</td>
</tr>
<tr>
<td>• Children and adults who are immunocompromised due to any cause (including immunosuppression caused by medications or by HIV infection)</td>
<td>• Other underlying medical conditions that might predispose to complications after wild-type influenza infection (e.g., chronic pulmonary, cardiovascular [except isolated hypertension], renal, hepatic, neurologic, hematologic, or metabolic disorders [including diabetes mellitus])</td>
</tr>
<tr>
<td>• Close contacts and caregivers of severely immunosuppressed persons who require a protected environment</td>
<td></td>
</tr>
<tr>
<td>• Pregnancy</td>
<td></td>
</tr>
<tr>
<td>• Receipt of influenza antiviral medication within the previous 48 hours</td>
<td></td>
</tr>
</tbody>
</table>
Influenza Vaccine Adverse Events

- **IIV**
  - Local reactions — common
  - Guillain-Barré syndrome (GBS) - expected to be greater among persons with a history of GBS than among persons with no history of GBS

- **LAIV**
  - Nonspecific systemic symptoms - common
Inactivated Influenza Vaccine (IIV) Adverse Reactions

- **Local reactions (soreness, redness)**
  - 15%—20%

- **Fever, malaise, myalgia**
  - Less than 1%

- **Allergic reactions (hives, angioedema, anaphylaxis)**
  - Rare
Live, Attenuated Influenza Vaccine (LAIV) Adverse Reactions

- Children
  - No significant increase in URI symptoms, fever, or other systemic symptoms
  - Increased risk of wheezing in children 6-23 months of age

- No serious adverse reactions identified
Timing of Vaccination

- Vaccination should occur before onset of influenza activity. Health care providers should offer vaccination by the end of October, if possible.

- Children aged 6 months through 8 years who require 2 doses should receive their first dose as soon as possible after vaccine becomes available, and the second dose ≥4 weeks later.

- Vaccination should continue to be offered as long as influenza viruses are circulating and unexpired vaccine is available.

To avoid missed opportunities for vaccination, providers should offer vaccination during routine health care visits and hospitalizations when possible.
Vaccine Administration
Inactivated Influenza Vaccine (IIV)

- **Route: IM injection**
  - Needle gauge: 22 – 25 gauge
  - Needle length*: 1 – 1.5 inch depending on the patient’s age and/or weight

- **IM injection Site:**
  - 6 months through 11 months: Vastus lateralis muscle
  - 1 through 2 years: Vastus lateralis muscle is preferred; deltoid muscle may be used if the muscle mass is adequate
  - 3 years and older: Deltoid muscle is preferred; vastus lateralis muscle may be used

- **Vaccine administration error:**
  - Wrong dosage
  - Wrong product – outside of age indications
CDC website on influenza:
https://www.cdc.gov/flu/index.htm
Vaccine Storage and Handling

- Store influenza vaccines in a refrigerator between 2°C – 8°C (36°F – 46°F)

- Do not freeze the vaccine

- Store influenza vaccines in:
  - The original packaging with the lids closed
  - A clearly labeled bin and/or area of the storage unit

Vaccine storage label examples
Available at www.cdc.gov/vaccines/hcp/admin/storage/guide/vaccine-storage-labels.pdf
...and get a flu vaccination!
What Do You Think?

An 8-year-old child is being vaccinated for the first time. When the child returns for the second dose, he/she is now 9 years old. Should the second dose of influenza vaccine be given?

a. Yes

b. No
Influenza Resources

- ACIP’s influenza recommendations web page
  www.cdc.gov/vaccines/hcp/acip-recs/vacc-specific/flu.html

- CDC’s influenza web page
  www.cdc.gov/flu/index.htm

- Immunization Action Coalition influenza web page
  www.immunize.org/influenza/

- Children’s Hospital of Philadelphia Vaccine Education Center influenza web page
  http://www.chop.edu/centers-programs/vaccine-education-center/vaccine-details/influenza-vaccine#.VgHMa3YpCAU
Varicella (Chickenpox) and Varicella Vaccine

Day 1: Pediatric Track

Chapter 22

August 2019
Varicella Zoster Virus

- Herpes virus (DNA)
- Primary infection results in varicella (chickenpox)
- Recurrent infection results in herpes zoster (shingles)
- Short survival in environment
Varicella Pathogenesis

- Respiratory transmission of virus
- Replication in nasopharynx and regional lymph nodes
- Primary viremia 4 to 6 days after infection
- Multiple tissues, including sensory ganglia, infected during viremia
Varicella Clinical Features

- Incubation period: 14 to 16 days (range: 10 to 21 days)
- Mild prodrome for 1 to 2 days (adults)
- Rash generally appears first on the head; most concentrated on the trunk
- Successive crops over several days with lesions present in several stages of development
Varicella Complications

- Bacterial infection of lesions
- Hemorrhagic varicella
- CNS manifestations
- Pneumonia (primary viral or secondary bacterial)
- Congenital varicella
- Perinatal varicella
- Prevaccine era:
  - Hospitalization ~3 per 1,000 cases or 11,000/year
  - Death ~ 1 per 60,000 cases or 100/year
Varicella with secondary bacterial infection
Increased Risk for Complications of Varicella

- Persons older than 15 years
- Infants younger than 1 year
- Immunocompromised persons
- Newborns of women with rash onset within 5 days before to 48 hours after delivery
Varicella Epidemiology

- **Reservoir**
  - Human

- **Transmission**
  - Person to person – respiratory tract secretions
  - Direct contact with lesions

- **Temporal Pattern**
  - Peak in late winter and spring (U.S.)

- **Communicability**
  - 1 to 2 days before until lesions have formed crusts
  - May be longer in immunocompromised
Acceptable Evidence of Varicella Immunity

- Written documentation of age-appropriate vaccination
- Laboratory evidence of immunity or laboratory confirmation of varicella disease
- Health care provider diagnosis or verification of varicella disease
- History of herpes zoster based on health care provider diagnosis

*Birth year immunity criterion does not apply to health care personnel or pregnant women

MMWR 2007;56(RR-4):16-17
Chickenpox Vaccine Means:

- 90% fewer deaths mean less than 20 persons die because of chickenpox each year

- 84% fewer hospitalizations means fewer than 1,700 persons are hospitalized because of chickenpox every year

- 92% fewer cases mean fewer than 350,000 people contract chickenpox each year

CDC chicken pox vaccine infographic [https://www.cdc.gov/chickenpox/vaccine-infographic.pdf](https://www.cdc.gov/chickenpox/vaccine-infographic.pdf)
Clinical Considerations
Routine recommendations:
- Dose 1 at 12–15 months of age
- Dose 2 at 4–6 years of age

Minimum interval between doses is 3 months for children 12 years of age and younger
ACIP Varicella Recommendations: Adolescents

- All persons 13 years of age and older without evidence of varicella immunity
  - 2 doses separated by at least 4 weeks

- Do not repeat 1\textsuperscript{st} dose because of extended interval between doses
- 2\textsuperscript{nd} dose recommended for persons of any age who have only received 1 dose
Can varicella vaccine be given to infants before age 1 year if they are traveling internationally?

- Yes
- No

No. ACIP recommends giving a dose of MMR to infants age 6 through 11 months before international travel, but not varicella vaccine. Varicella vaccine is neither approved nor recommended for children younger than age 12 months in any situation.
VAR and MMRV Administration

- **Preparation:**
  - Varicella-containing vaccines must be reconstituted BEFORE administering
  - Use the diluent supplied by the manufacturer

- **Route: Subcutaneous injection**
  - Needle gauge: 23–25 gauge
  - Needle length: 5/8 inch

- **Site:** Upper outer triceps of the arm or the thigh may be used if necessary
Vaccine Administration Errors

- **Live, attenuated zoster vaccine administered to a child or adult instead of varicella vaccine**
  - MORE antigen (15X antigen in varicella vaccine) than the recommended dose was administered
  - If the dose meets minimum age and interval, it may be counted

- **Wrong diluent used to reconstitute the vaccine**
  - Dose does NOT count and should be repeated ASAP
Varicella-Containing Vaccine Contraindications

- Severe allergic reaction to a vaccine component or following a prior dose
- Pregnancy or planned pregnancy within 4 weeks*
- Immunosuppression

*ACIP off-label recommendation
Varicella-Containing Vaccines
Immunocompromised Persons

- Single-antigen varicella vaccine may be administered to persons with isolated humoral immunodeficiency

- Consider varicella vaccination for:
  - HIV-infected children with CD4 count of 15% or higher
  - HIV-infected with CD4 count of 200 or higher
Varicella-Containing Vaccines

Precautions

- Moderate or severe acute illness

- Recent blood product
  - Varicella or MMRV vaccine should not be administered for 3–11 months after receipt of antibody-containing blood products
Adverse Reactions

- **Local reactions (pain, erythema)**
  - 19% (children)
  - 24% (adolescents and adults)

- **Rash: varicella recipients (3%–4%)**
  - May be maculopapular rather than vesicular
  - Average 5 lesions

- **Systemic reactions not common**
MMRV Vaccine

- For the first dose of measles, mumps, rubella, and varicella vaccines at age 12 through 47 months, either MMR vaccine and varicella vaccine or MMRV vaccine may be used.

- Providers who are considering administering MMRV vaccine should discuss the benefits and risks of both vaccination options with the parents or caregivers.
Unless the parent or caregiver expresses a preference for MMRV vaccine, CDC recommends that separate MMR vaccine and varicella vaccine should be administered for the first dose for children 12–47 months of age.
MMRV Vaccine

- **Administer MMRV:**
  - For the second dose of measles, mumps, rubella, and varicella vaccines at age 15 months through 12 years
    - Do not administer to persons 13 years of age or older
  - For the first dose at age 48 months or older
Adverse Reactions: MMRV

- **Fever**
  - 21.5% with MMRV
    - Compared with 14.9% of MMR and varicella recipients

- **Febrile seizure**
  - Among children 12–23 months of age, one additional febrile seizure occurred 5–12 days after vaccination per 2,300–2,600 children compared with children who received the first dose of MMR and varicella vaccine separately
  - Data do not suggest that children 4–6 years of age who received the second dose had an increased risk
Storage and Handling: Varicella-Containing Vaccines

- Store varicella-containing vaccines in a freezer between -50°C and -15°C (-58°F and +5°F) *
  - Protect from light
- Store vaccines in the original packaging with the lids closed in a clearly labeled bin and/or area of the storage unit
- Store diluent in a refrigerator or at room temperature
  - Do not freeze diluent
- Use ONLY the manufacturer-supplied diluent to reconstitute the lyophilized vaccine

*Vaccine may be stored in the refrigerator between 2°C and 8°C (36°F and 46°F) for up to 72 continuous hours after removal from freezer. Discard unused vaccine after 72 hours.

Vaccine storage label examples www.cdc.gov/vaccines/hcp/admin/storage/guide/vaccine-storage-labels.pdf
4

Resources
You Call the Shots

- An interactive, web-based immunization training course consisting of a series of modules that discuss vaccine-preventable diseases and explain the latest recommendations for vaccine use
Resources and CE Information

Day 1: Pediatric Track

Portland, Oregon
August 2019

Almost there...
Advisory Committee on Immunization Practices

Vaccine Recommendations and Guidelines of the ACIP

ACIP Vaccine Recommendations and Guidelines

Vaccine-Specific ACIP Recommendations

- Anthrax
- BCG
- Cholera
- DTaP
- Hepatitis A
- Hepatitis B
- Hib
- HPV
- Influenza
- Japanese Encephalitis
- Measles, Mumps and Rubella
- MMR

ACIP Abbreviations

These abbreviations provide a uniform approach to vaccine references used in ACIP Recommendations that are published in the MMWR, the ACIP core, and the U.S. immunization schedule for children, adolescents, and adults.

Comprehensive ACIP Recommendations and Guidelines

- General Best Practice Guidelines on Immunization

Immunization Schedules

For Health Care Professionals

2018 Immunization Schedules and Resources

- Children and Adolescents Aged 18 Years or Younger
  - Immunization Schedule
  - Vaccines based on medical indications
  - Catch-Up Immunization Schedule
  - Changes to this year’s schedule
  - Additional immunization resource tool (United States/Mexico)
  - Use the CDC Vaccine Schedules app for immediate access to the schedule

- Resources for patients: easy-to-read schedules, personalized vaccination creators and a vaccine quiz

Adults Aged 19 Years or Older

Immunization Schedules

For Parents & Adults

2018 Recommended Immunizations

- For Infants and Children (Birth through 18 Years):
  - Recommended immunizations and when to get them (English/Español)
  - Create a personalized immunization schedule for your child
  - Take the quiz for a personalized list of recommended vaccines for your child (English/Español)

- For Preschoolers and Teens (7 through 18 Years):
  - Recommended immunizations and when to get them (English/Español)
  - Create a personalized catch-up or accelerated immunization schedule for your child
  - Take the quiz for a personalized list of recommended vaccines for your child (English/Español)

ACIP Vaccine Recommendations

www.cdc.gov/vaccines/hcp/acip-recs/index.html

Immunization Schedules

www.cdc.gov/vaccines/schedules/index.html
Advisory Committee on Immunizations Practices Meetings

- Watch the live webcast
- Register at
  - https://www.cdc.gov/vaccines/acip/meetings/webcast-instructions.html

Next ACIP meeting
October 23-24, 2019
Multiple education products available free through the CDC website:

- Immunization courses (webcasts and online self-study)
- Netconferences
- You Call the Shots self-study modules

Continuing education available

CDC Resources for Staff Education

Immunization Education and Training: www.cdc.gov/vaccines/ed/index.html
Clinical Issues in Immunization Netconferences (CIINCs)

- CIINCs provide clinicians with the most up-to-date information on immunization
  - Live, 1-hour webinars
  - Conducted 4 to 5 times a year
  - Topics announced prior to each one
  - Webinars are archived
  - CE available

- Sign up for e-mail alerts at [www.cdc.gov/vaccines/ed/ciinc/index.html](http://www.cdc.gov/vaccines/ed/ciinc/index.html)
YCTS is a series of modules on each vaccine-preventable disease and ACIP recommendations.

Each module provides learning opportunities, self-test practice questions, reference and resource materials, and an extensive glossary.

CE available.

You Call the Shots: www.cdc.gov/vaccines/ed/youcalltheshots.html
Vaccine Administration Resources for Health Care Personnel

- CDC vaccine administration materials for health care personnel include:
  - Printable clinical job aids
  - Demonstration videos
  - Vaccine administration e-Learn

CDC Vaccine Administration: [www.cdc.gov/vaccines/hcp/admin/admin-protocols.html](http://www.cdc.gov/vaccines/hcp/admin/admin-protocols.html)
Staying Up To Date

- Bookmark web resources for staff such as:
  - State and/or local health department
  - Immunization Action Coalition
  - Every Child By Two
  - Vaccine Education Center at Children’s Hospital of Philadelphia

- Sign up for e-mail alerts and/or newsletters if available
Immunization Questions?

- Questions? E-mail CDC
  - nipinfo@cdc.gov or www.cdc.gov/cdcinfo

- Vaccines and Immunizations website
  - www.cdc.gov/vaccines

- HCP education
  - www.cdc.gov/vaccines/hcp.htm

- Twitter
  - @DrNancyM_CDC

- Influenza
  - www.cdc.gov/flu

- Vaccine Safety
  - www.cdc.gov/vaccinesafety
Do You Need CE?

- NOTE: Complete the CE process for each day
  - For CE credit, go to www.cdc.gov/GetCE
  - Search course number provided by CDC Speaker
  - CE credit expires: September 16, 2019

- For help with CE, contact:
  - Call 1-800-41TRAIN or email ce@cdc.gov
  - Melissa Barnett at MBarnett2@cdc.gov
CE Summary

- Follow the instructions in your packet
- Additional guidance is on the CDC website at www.cdc.gov/vaccines/ed/ce-credit-how-to.html
Course Evaluation: Pretest and Post-test

- **Pretest e-mailed August 8th**
  - If you did not receive pretest
    - You may have registered for the course after August 7\textsuperscript{th}
    - Some emails on registration list were undeliverable

- **If you completed the pretest, you will receive post-test August 20\textsuperscript{th}**
  - **Post-test will not fulfill CE requirements**
  - Aid CDC in measuring knowledge gained from course participation
  - Expires August 27\textsuperscript{th}, 11:59pm

- **CDC staff will also e-mail course evaluation August 20\textsuperscript{th}**
  - Expires September 17th
See You In the Morning!

SO EXCITED TO SEE YOU

TOMORROW MORNING!