Vaccine Overview

Quick and Dirty Version
Key Points

• Random Facts
• Vaccine Schedule
• Types of Vaccines
• 7 Rules of vaccinations
• Vaccine Updates
VACCINATIONS ARE IMPORTANT

Never miss an opportunity to vaccinate!!!
Antipyretics

• Evidence does not support use of antipyretics before or at the time of vaccination
  — Possibly reduces immune response
• They can be used for the treatment of fever and local discomfort that might occur following vaccination.
• Studies of children with previous febrile seizures have not demonstrated antipyretics to be effective in the prevention of febrile seizures.
There's An App for That

• Shots Medical App

• http://www.cdc.gov/vaccines/schedules/hcp/index.html
Types of Vaccines

• Live Attenuated

• Inactivated Vaccine
Live Attenuated

• Need to be able to replicated in order to produce an immune response
Live Attenuated Vaccines

• **Viral:**
  – measles, mumps, rubella (MMR)
  – yellow fever
  – vaccinia (smallpox)
  – Rotavirus (Oral)
  – Live attenuated influenza vaccine (LAIV)-Flumist
  – varicella, and zoster (shingles)
  – Live oral polio vaccine is no longer used in the United States.

• **Bacterial**
  – Oral typhoid
  – Bacillus Calmette-Guérin (BCG)
Inactivated Vaccines

• Whole Virus- Polio, rabies, hepatitis A, Influenza

• Fractional
  – Toxoid- Diphtheria and Tetanus
  – Polysachride- pneumococcal, meningococcal, typhoid Vi
  – Conjugated- *Haemophilus influenzae* type b, meningococcal, and pneumococcal
7 General Rules of Vaccines

- Rule 1: The more similar a vaccine is to the natural disease, the better the immune response to the vaccine.
- Rule 2: Circulating antibody has more effect on the immune response to live attenuated vaccines than on the immune response to inactivated vaccines.
- Rule 3: All vaccines can be administered at the same visit as all other vaccines.
- Rule 4: Live attenuated vaccines generally produce long-lasting immunity with one or two doses. Inactivated vaccines generally require three or more doses and may require periodic boosting to maintain immunity.
- Rule 5: Increasing the interval between doses of a multidose vaccine does not diminish the effectiveness of the vaccine. Decreasing the interval between doses of a multidose vaccine may interfere with the antibody response and protection.
- Rule 6: Adverse reactions following live attenuated vaccines are similar to a mild form of the natural disease. Adverse reactions following inactivated vaccines are mostly local, and may occur with or without fever.
- Rule 7: There are only three permanent contraindications to vaccination:
  - Severe allergic reaction to a vaccine component or following a prior dose of vaccine (Do not give another dose of that vaccine.)
  - Encephalopathy without a known cause occurring within 7 days of a dose of a pertussis-containing vaccine (Do not give another dose of a pertussis-containing vaccine.)
  - Rotavirus vaccine (both RV5 and RV1) in infants diagnosed with Severe Combined Immunodeficiency Disease (SCID)
RULE 1:
The more similar a vaccine is to the natural disease, the better the immune response to the vaccine.
Rule 1

• Live attenuated vaccines (except oral vaccines) are generally effective with one dose.
• In contrast to live vaccines, the first dose of an inactivated vaccine does not produce protective immunity.
• Inactivated vaccines require multiple doses and often require boosters due to waning immunity.
## Median MMR Vaccine Effectiveness

<table>
<thead>
<tr>
<th>Disease</th>
<th>1-dose</th>
<th>2-doses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measles</td>
<td>93%</td>
<td>97%</td>
</tr>
<tr>
<td>Mumps</td>
<td>78%</td>
<td>88%</td>
</tr>
<tr>
<td>Rubella</td>
<td>97%</td>
<td>N/A</td>
</tr>
</tbody>
</table>
RULE 2:

Circulating antibody has more effect on the immune response to live attenuated vaccines than on the immune response to inactivated vaccines
Rule 2

- Antibodies from any source (e.g., from the mother before birth, from blood transfusions, from immune globulin administration) can interfere with replication of the live attenuated viruses or bacteria in the vaccine, specifically MMR, varicella, and MMRV vaccines.
  - Can result in vaccine failure

- Inactivated vaccines do not need to replicate to produce an immune response so circulating antibodies do not substantially affect the immune response

- If the live vaccine is given first, it is necessary to wait at least 2 weeks before giving the antibody.
  - If the interval between the vaccine and antibody is less than 2 weeks, the recipient should be tested for immunity or the vaccine dose should be repeated after the antibody decreases.
  - If antibodies have already been given must wait anywhere from 3-10 months to administer MMR depending on the type of antibody given.
  - http://www.cdc.gov/vaccines/pubs/pinkbook/downloads/appendices/A/mmr_ig.pdf
RULE 3

All vaccines can be administered at the same visit as all other vaccines.
Rule 3

- Live vaccines must be given 4 weeks apart
  - If live vaccines are not given simultaneously, they must be separated by at least 4 weeks (28 days).
  - Why? Because the live vaccine given first can interfere with the second vaccine, and the person may not develop active immunity to the second vaccine.

- If 2 live vaccines are given less than 4 weeks apart, the second vaccine should be repeated in four weeks or test for immunity

- Injected and intranasal live vaccines are not believed to have an effect on live oral vaccines (rotavirus and oral typhoid vaccines). Live oral vaccines may be given at any time before or after live injected or intranasal vaccines.
Rule 3 and TST/IGRA

- Inactivated vaccines can be given at anytime.

- A TST/IGRA can be done before or on the same day of a live vaccine.

- TST/IGRA must be delayed by 4 weeks if patient is given a live vaccine prior to TB testing.

- Live vaccines can suppress the immune response and result in a false negative.
  - NOTE: This timing issue does not apply to oral polio vaccine (OPV), oral rotavirus vaccine, and oral typhoid vaccine.
RULE 4

Live attenuated vaccines generally produce long-lasting immunity with 1 or 2 doses. Inactivated vaccines generally require 3 or more doses and may require periodic boosting to maintain immunity.
RULE 4

• The first dose does not provide full protection.  
  – "priming the immune system."

• Then, the second or third dose results in a protective immune response.

• Antibody levels can decrease with time and booster doses may be needed to maintain protective antibody levels.
RULE 5

Increasing the interval between doses of a multi-dose vaccine does not diminish the effectiveness of the vaccine.

Decreasing the interval between doses of a multi-dose vaccine or giving before a minimum age may interfere with antibody response and production.
Rule 5

• In general, doses of the same vaccine need to be separated by at least 4 weeks.

• Catch up vaccine schedules tend to be based on minimum separation periods of vaccines
Exceptions to Minimum Age

- Although vaccine doses should not be given before the minimum age, there are exceptions:
- Travelers aged 6 months and older who do not have acceptable evidence of measles, mumps, and rubella immunity should be vaccinated with MMR vaccine.
- During measles outbreaks involving infants aged less than 12 months with ongoing risk for exposure, infants aged 6 months and older can be vaccinated.
- Doses administered before 12 months of age are not counted in the 2 recommended doses. Any dose administered before 12 months of age should be repeated when the child is 12 months or older and a second dose administered at least 28 days later or between the ages of 4 and 6 years.
RULE 6

Adverse reactions following live attenuated vaccines are similar to a mild form of the natural disease.

Adverse reactions following inactivated vaccines are mostly local and may occur with or without fever.
Rule 6-Local Reactions

• Occur at the injection site and include: pain, swelling, and redness.

• Local reactions can occur in up to 80% of vaccine doses

• Usually are mild

• Are more common after inactivated vaccines

• Usually occur within a few hours of the injection
Rule 6-Systemic Reactions

• They occur near the middle to end of the natural disease's usual incubation period, at 7 to 21 days after vaccination
  – Fever in an infant one week after MMR vaccine

• Systemic reactions tend to be generalized and include:
  – Fever
  – Malaise
  – Muscle pain
  – Headache
  – Loss of appetite
Reporting Adverse Reactions to Vaccines

• When certain adverse reactions occur, they should be reported to the Vaccine Adverse Event Reporting System (VAERS).

• VAERS is a cooperative program for vaccine safety of the Centers for Disease Control and Prevention (CDC) and the Food and Drug Administration (FDA).

• Anyone can send a report to VAERS
  – most reports are sent by vaccine manufacturers or healthcare providers.

• Reports should be sent for any clinically significant adverse event that occurs after the administration of any vaccine licensed in the United States. Report such events even if you are unsure whether a vaccine caused them.
  – Reports can be made online or by sending in a printed form.
RULE 7

There are only three permanent contraindications to vaccination.
Rule 7-Sever Allergic Reaction

- Severe allergic reaction (also called anaphylactic reaction) to a vaccine component or after a prior dose of vaccine is a contraindication to vaccination.

- Persons who have had only mild allergic reactions can be vaccinated.

- A severe allergic reaction is one that resulted in:
  - hives all over the body,
  - difficulty breathing,
  - swelling of the mouth and throat,
  - low blood pressure, or shock.
Rule 7- Ecephalopathy

• Encephalopathy without a known cause occurring within 7 days of a dose of pertussis vaccine is a contraindication to more doses of pertussis-containing vaccine.

• If encephalopathy occurs after pertussis vaccination, you can give other vaccines, but you cannot give pertussis-containing vaccine again.
  – Must use DT and Td vaccines for tetnus and diptheria
Rule 7- SCID

• Severe combined immunodeficiency disease (SCID) is a contraindication to receiving rotavirus vaccine.

• Infants with SCID are at increased risk for development of vaccine-acquired rotavirus infection, which can be very harmful in infants with SCID.
Precautions

• There are several conditions that are considered permanent precautions to further doses of pediatric pertussis-containing vaccine (DTaP). They include:
  – Temperature of 105°F or higher within 48 hours of a dose of DTaP
  – Collapse or shock-like state within 48 hours of a dose of DTaP
  – Persistent inconsolable crying lasting 3 or more hours occurring within 48 hours of a dose of DTaP
  – Seizure, with or without fever, occurring within 3 days of a dose of DTaP

• The occurrence of one of these events in a child following DTaP vaccine is not a precaution to later vaccination with the adolescent/adult formulation of pertussis vaccine (Tdap).
Pregnancy

• Pregnancy is a temporary contraindication for live attenuated vaccines.
  – Rubella non-immune patients should receive their vaccine post partum

• Theoretical risk that the vaccine could pose a danger to the fetus.

• Inactivated vaccines can be given to pregnant women.
Illness

• Moderate or severe illness is a temporary precaution for all vaccines because an adverse reaction to a vaccine could complicate the care of someone who is ill.
Immunosuppression

- Immunosuppression is a temporary contraindication for live attenuated vaccines.
  - Replication may be unchecked and cause actual illness.

- You can give inactivated vaccines because they do not replicate.
  - However the immune response may be stunted/insufficient

- The immune system can be suppressed by:
  - Congenital immunodeficiency
  - Cancer
  - HIV infection with low cd-4 count
  - Chemotherapy
  - Radiation therapy
  - Large doses of corticosteroids
Things that are NOT contraindications

• Minor Illness
• Antimicrobial Therapy
• Disease exposure or convalescence
• Breastfeeding mothers
• Pregnancy in the household
• Preterm birth
• Non-specific allergies
• Non-sever allergic reactions to a vaccine or vaccine component
• Family history of illness, seizure or SIDS
Tetanus, Diphtheria, Pertussis

- DTap is for children less than 7 years of age
- Tdап is for older children and adults

- DT is for children younger than 7
- Td is for children 7 years of age and older through adulthood
Natural Immunity

• Having diphtheria, tetanus, or pertussis disease does **NOT** result in long-term active immunity.

• Persons who recover from any of these diseases should begin or complete the age-appropriate vaccine series and receive booster doses as appropriate.
Duration of Immunity

• Efficacy of tetanus toxoid has never been studied in a vaccine trial, but it can be inferred from protective antitoxin levels that a complete tetanus toxoid series has a clinical efficacy of virtually 100%.
  – Cases of tetanus occurring in fully immunized persons whose most recent dose was within the last 10 years are extremely rare.

• After a primary series of diphtheria toxoid-containing vaccine, a protective level of antitoxin is reached in more than 95% of vaccinated persons.
  – Diphtheria toxoid has been estimated to have a clinical efficacy of 97%.

• Most people have antitoxin levels that only approach the minimal protective level by the time they reach 10 years following their most recent dose.
  – As a result, routine boosters are recommended every 10 years.
  – This is currently being studied as less frequent vaccinations may be needed for tetanus.
Pertussis Immunity

• Tdap vaccination protects against pertussis in about 7 out of 10 people within the first year of vaccination.

• By two or more years after Tdap vaccination, only about 3 out of 10 people are protected.
  – Investigators are working to understand how best to protect against pertussis
  – Pertussis vaccines continue to be the best way to protect adolescents and adults from pertussis and its complications.

• There is no vaccine that only contains pertussis
Tdap Immunization

- ACIP recommends a single Tdap dose for persons aged 11 through 18 years who have completed the recommended childhood diphtheria and tetanus toxoids and pertussis (DTP or DTaP) vaccination series.

- Adults 19 years of age and older who have not received Tdap previously should receive a single dose of Tdap to help protect against pertussis and reduce the likelihood of transmission.
  - For adults 19-64 years of age, either brand of Tdap may be used.
  - Adults 65 years or older should be vaccinated with Boostrix if feasible.
    - However, either vaccine administered to a person 65 years or older is immunogenic and will provide protection. A dose of either vaccine would be considered valid.
Pregnancy and Tdap

• ACIP recommends that providers of prenatal care implement a Tdap immunization program for all pregnant women.

• Tdap should be given during each pregnancy, regardless of patient’s history of receiving Tdap
  – To maximize the maternal antibody response and passive antibody transfer to the infant, optimal timing for Tdap administration is between 27 and 36 weeks’ gestation,
  – Tdap may be given at any time during pregnancy.

• Women not vaccinated with Tdap during pregnancy should receive a dose of Tdap immediately postpartum

• Adults who will come into contact with infants and have not had a Tdap as an adult should get vaccinated with Tdap at least 2 weeks prior to contact with infant
Guillain-Barre

• A few cases of (GBS) have been associated with tetanus toxoid administration.

• When there is a history of a neurologic reaction after a prior dose of a tetanus toxoid-containing vaccine, the decision to administer further doses of tetanus toxoid-containing vaccines should be made on a case-by-case basis, weighing the benefits of vaccination against the risk that the reaction might occur again. This discussion should take place with the healthcare provider.
Neurologic Disorders

- If a child has any progressive neurologic disorder (infantile spasms, uncontrolled epilepsy, or progressive encephalopathy), defer DTaP until the child is evaluated, treated, and stabilized.

- If the child has a stable neurologic condition, such as controlled idiopathic epilepsy, cerebral palsy, or developmental delay, DTaP vaccine should be given.

- A history of seizures or neurologic disease in a family member is not a contraindication to vaccination with DTaP.
Arthus-Type Reaction

- Exaggerated local reactions are rare following receipt of a diphtheria- or tetanus-containing vaccine.
- These reactions present as extensive painful swelling, often from shoulder to elbow.
- They generally begin 2 to 8 hours after injections and are reported most often in adults, particularly those who have received frequent doses of diphtheria or tetanus toxoid.
- Persons experiencing these severe reactions usually have very high serum antitoxin levels; they should not be given further routine or emergency booster doses of Td more frequently than every 10 years.
- Less severe local reactions may occur in persons who have had multiple boosters.
Tetanus Wound Management

• Vaccinated
  – Clean: Tdap/Td if >10 years
  – Dirty: Tdap/TD if >5 years

• 3 Doses or Less
  – Clean: Tdap/Td only
  – Dirty: Tdap/Td and TIG
Quiz Time

A 22-year-old woman received 1 dose of DTaP when she was 2 years old. What is recommended to complete her series?

A) 1 dose of Tdap and 1 dose of Td.

B) 2 doses of Tdap.

C) 1 dose of Tdap and 2 doses of Td.

D) 1 dose of Tdap and 3 doses of Td.
A is correct

• A total of 3 doses are needed. She has already received 1 dose.
• A single Tdap dose is recommended for persons 10 years of age and older who have not previously received a dose of Tdap.
• The remaining dose should be Td.
• A routine Td booster should be given every 10 years thereafter.
A child received DTaP-5 at age 5 years. At what age should this child receive a dose of Tdap vaccine?

A) Age 9
B) Age 11 or 12
C) Age 15
D) Age 20 to 21
B is Correct

• A dose of Tdap vaccine should be given at 11 or 12 years of age.
• Td is then given every 10 years thereafter.
Quiz Time

• An 18-year-old man received a 5-dose primary DTaP series as a child and a Tdap dose at age 17. At what age is his next booster dose of Td recommended?
A) Never, since she has already received 6 doses.
B) Age 20.
C) Age 22.
D) Age 27.
Adults should receive a routine Td booster every 10 years throughout life.

Because the man received a dose of Tdap at 17 years of age, his next Td booster is recommended at 27 years of age.
A 28-year-old woman sustained a puncture wound while tearing down an old shed. The puncture wound is deep and dirty. Her records indicate that she completed a primary series of DTaP as a child and her last tetanus booster was 9 years ago. She has never received Tdap. After the wound is cleaned and dressed, what would be the correct action to take?
Quiz Time

A) Nothing. She has had a Td booster within the last 10 years.

B) Administer a dose of Tdap today.

C) Administer TIG today.

D) Administer TIG and a Td booster today.
B is Correct

• The woman should receive a Tdap dose today.
• She has had more than 3 doses of a vaccine that contained tetanus toxoid, so TIG is not indicated. However, her wound is neither minor nor clean, so a tetanus booster is recommended because it has been more than 5 years since her last booster.
• Also, because she has never received Tdap, a single dose is indicated.
Quiz Time

A 65-year-old man cut himself on a piece of farm machinery. The wound is contaminated with manure. He does not know if he ever received a tetanus shot. After the wound is cleaned and dressed, what would be the correct action to take?
Quiz Time

A) No action. He probably received Td vaccine as a child.

B) Administer a Td booster dose today and monitor for infection.

C) Start the primary series of Td vaccine, including a Tdap dose.

D) Administer TIG and give a dose of Tdap vaccine
D is Correct

- This man has an unknown vaccination history and a wound that is neither minor nor clean, so TIG is indicated.
- He also should be started on the primary series of Td vaccine, with the first dose given today as Tdap.
- He will need 2 more doses of Td to complete the tetanus vaccination series.
- He should be instructed on the importance of completing the entire series.
A 15-year-old boy got a deep cut in his leg while climbing over rusty barbed wire. Pieces of rust and dirt are in the wound. He received 3 doses of DTP as a child and received a dose of Tdap vaccine at age 11. After the wound is cleaned and dressed, what would be the correct action to take?
Quiz Time

A) No action. He has had a Tdap booster within 5 years.
B) Administer a Td booster.
C) Administer TIG.
D) Administer TIG and a Td booster.
A is correct

• This boy has received more than 3 doses of vaccine that contain tetanus toxoid, so TIG is not indicated.

• He received a Tdap less than 5 years ago, so neither Td nor Tdap is indicated as part of wound management.
A 36-year-old woman has an ear infection and low-grade fever. Can Td vaccine be administered today?

Yes
No
YES!

This is a minor illness. Moderate or severe acute illnesses are a precaution to vaccination. Td vaccine can be given today.
Quiz Time

A women is 30 weeks pregnant. Can Tdap vaccine be administered today?

Yes

No
Pregnant women should receive Tdap during EVERY pregnancy, preferably between 27 and 36 weeks’ gestation.
Quiz Time

• A 36-year-old woman just delivered a baby and will be discharged in the morning. She received a 3-dose Td series as an adult with the last dose given 18 months ago. Should this new mother receive Tdap today to provide protection from pertussis?

YES

NO
Infants are at highest risk for complications and death from pertussis. It is critical that anyone who has contact with an infant – particularly the parents – receive age-appropriate pertussis vaccination to help protect the infant from exposure to pertussis.

Tdap can be administered at any interval since the last dose of Td. Since this woman did not receive Tdap during her pregnancy and has never received Tdap, she should receive a dose before being discharged from the hospital.

Other family members who have not received Tdap should also receive a dose, preferably at least 2 weeks before coming into close contact with the infant.
Influenza

- ALL persons must receive influenza vaccine each year
- Immunity following influenza vaccination usually lasts more than 1 year,
- The virus strains likely to cause illness can change from year to year.
- It takes about 2 weeks after influenza vaccination for the body to develop protective antibodies.
- Healthcare providers should offer vaccination by October, if possible.
- Providers should continue to offer influenza vaccine in December and throughout influenza season even after influenza activity has been documented in the community.
Who Needs Two Doses of Influenza

- Children aged 6 months through 8 years who have never been vaccinated against influenza or for whom vaccination history is unknown;

- Children who have not received at least two doses of seasonal influenza vaccine (trivalent or quadrivalent) before July 1, 2015.

- Administer the second dose at least 4 weeks after the first
Types of Influenza Vaccines

• **Live attenuated influenza vaccine (LAIV)**
  – Quadrivalent
  – Does contain egg product

• **Recombinant influenza vaccine (RIV)**
  – Does NOT contain egg, thimerosal, antibiotics, and preservatives
  – Trivalent
  – Must be 18 years or older

• **Inactivated influenza vaccines (IIVs)**
  – Can contain egg, thimerosal, antibiotics, and preservatives
  – Read the package for each brand as ingredients vary
  – Trivalent and quadrivalent options
IIV-Who Responds?

• Inactivated vaccines are effective in protecting about 60% of healthy vaccinees younger than 65 years of age from illness when the vaccine strain is similar to the circulating strain.

• Influenza vaccination might reduce the frequency of secondary complications and might reduce the risk for influenza-related hospitalization and death among community-dwelling adults 65 years of age and older with and without high-risk medical conditions. However, some of these studies have not measured reductions in laboratory-confirmed influenza illness.

• Although the vaccine is not highly effective in preventing clinical illness among the elderly, it is effective in preventing complications and death.
Live Attenuated Influenza Vaccine

- Flumist

- Analysis of data from three observational studies of quadrivalent LAIV (LAIV4) vaccine effectiveness for the 2013–14 season (the first season in which LAIV4 was available) revealed poor effectiveness of LAIV4 against influenza A (H1N1) among children aged 2 through 17 years. The reasons for the lack of effectiveness of LAIV4 against influenza A (H1N1) are still under investigation.

  - LAIV is **NOT** currently recommended
Vaccine Rationing

• When vaccine supply is limited, vaccination efforts should focus on delivering vaccination to persons who:
  • Are aged 6 months through 4 years (59 months)
  • Are aged 50 years and older
  • Have chronic pulmonary (including asthma), cardiovascular (except isolated hypertension), renal, hepatic, neurologic, hematologic, or metabolic disorders (including diabetes mellitus)
  • Are immunosuppressed (including immunosuppression caused by medications or by human immunodeficiency virus [HIV] infection)
  • Are or will be pregnant during the influenza season
  • Are aged 6 months through 18 years and receiving long-term aspirin therapy and who, therefore, might be at risk for experiencing Reye syndrome after influenza virus infection
  • Are residents of nursing homes and other chronic-care facilities
  • Are American Indians/Alaska Natives
  • Are morbidly obese (body-mass index [BMI] of 40 or higher)
  • Are healthcare personnel
  • Are household contacts (including children) and caregivers of children age younger than 5 years and adults aged 50 years or older, with particular emphasis on vaccinating contacts of children less than 6 months of age
  • Are household contacts (including children) and caregivers of persons with medical conditions that put them at higher risk for severe complications from influenza
Pregnancy and Influenza

• Pregnant and postpartum women are at higher risk for severe illness and complications from influenza than women who are not pregnant because of changes in the immune system, heart, and lungs during pregnancy.

• Vaccination of pregnant women protects women and newborns as well.

• Pregnant and postpartum women do not need to avoid contact with persons recently vaccinated with LAIV.

• Breastfeeding does not affect the immune response adversely and is not a contraindication for vaccination. Unless contraindicated because of other medical conditions, women who are breastfeeding can receive either IIV or LAIV.
Egg Allergy Algorithm

1. Can the patient eat lightly cooked egg (e.g., scrambled egg) without reaction?
   - Yes: Administer vaccine per usual protocol
   - No:
     2. After eating eggs or egg-containing foods, does the patient experience only hives?
        - Yes: Administer RIV3 if patient aged ≥ 18 years OR administer IV; observe for reaction for at least 30 minutes after vaccination.
        - No:
          3. After eating eggs or egg-containing foods, does the patient experience symptoms such as:
             - cardiovascular changes (e.g., hypotension)
             - respiratory distress (e.g., wheezing)
             - gastrointestinal symptoms (e.g., nausea or vomiting)
             - reaction recurring epinephrine
             - reaction recurring emergency medical attention?
                - Yes: Administer RIV3, if patient aged ≥ 18 years OR if RIV3 is not available, or if patient is aged < 18 years, IV should be administered by a physician with experience in the recognition and management of severe allergic conditions. Observe for reaction for at least 30 minutes after vaccination.
                - No: Proceed with usual protocol.


GBS and Flu

- The incidence of Guillain-Barré syndrome (GBS) among the general population is low, but persons with a history of GBS have a substantially greater likelihood of subsequently experiencing GBS than persons without such a history.
- The likelihood of coincidentally experiencing GBS after influenza vaccination is expected to be greater among persons with a history of GBS than among persons with no history of this syndrome. Whether influenza vaccination specifically might increase the risk for recurrence of GBS is unknown.
- As a precaution, persons who are not at high risk for severe influenza complications and who are known to have experienced GBS within 6 weeks of receipt of an influenza vaccine generally should not be vaccinated with IIV or LAIV.
- As an alternative, physicians might consider using influenza antiviral chemoprophylaxis for these persons. Although data are limited, the established benefit of influenza vaccination might outweigh the risks for many persons who have a history of GBS and who also are at high risk for severe complications from influenza. This requires a medical decision based on the risks and benefit to the individual patient.
In 1976, swine influenza vaccine was associated with cases of Guillain-Barré syndrome (GBS). Newer influenza vaccines have not been clearly associated with an increased frequency of GBS. However, obtaining a precise estimate of a small increase in risk is difficult for a rare condition such as GBS, which has an annual background incidence of only one to two cases per 100,000 adult population. Among persons who received the swine influenza vaccine in 1976, the rate of GBS exceeded the background rate by less than one case per 100,000 vaccinations. Even if GBS were a true adverse reaction in subsequent years, the estimated risk for GBS was much lower than one per 100,000. Further, the risk is substantially less than that for severe influenza or its complications, which could be prevented by vaccination, especially for persons aged 65 years or older and those with a medical indication for influenza vaccine.
Pneumonia Vaccines

- Pneumococcal polysaccharide vaccine (PPSV23)

- Pneumococcal conjugate vaccine (PCV13)
PPSV23

- All adults who are 65 years of age and older.

- Persons 2 through 64 years of age with certain medical conditions that put them at high risk for invasive pneumococcal disease.

- PPSV23 is also recommended for use in adults 19 through 64 years of age who smoke cigarettes or who have asthma.
PPSV23

• Elevated antibody levels persist for at least 5 years in healthy adults but decline more quickly in persons with certain underlying illnesses.

• 60% to 70% effective in preventing invasive disease caused by serotypes included in the vaccine.

• Despite the vaccine's reduced effectiveness among immunocompromised persons, PPSV23 is still recommended for such persons because they are at high risk of developing severe disease
PPSV23 Additional Indications

- A single dose of PPSV23 is also indicated for persons 2 years of age and older with a normal immune system who have a chronic illness, including
  - cardiovascular disease,
  - pulmonary disease,
  - diabetes,
  - alcoholism,
  - chronic liver disease,
  - cirrhosis,
  - cerebrospinal fluid leak,
  - or a cochlear implant

- A single dose of PPSV23 is also recommended for use in adults 19 through 64 years of age who smoke cigarettes or who have asthma.
PPSV23-Immunocompromised

• Immunocompromised persons 2 years of age and older who are at highest risk of pneumococcal disease or its complications should also be vaccinated. This group includes persons with:
  – Splenic dysfunction or absence (either from disease or surgical removal).
  – Cancer, including Hodgkin disease, lymphoma, and multiple myeloma.
  – Chronic renal failure or nephrotic syndrome.
  – Asymptomatic or symptomatic HIV infection.
  – Conditions such as organ transplant associated with immunosuppression.
  – Immunosuppression from chemotherapy or high-dose corticosteroid therapy (14 days or longer).

• PPSV23 might be considered for persons living in special environments or social settings with an identified increased risk of pneumococcal disease or its complications, such as certain Native American (i.e., Alaska Native, Navajo, and Apache) populations.
PCV13

• All children younger than 5 years of age.
  – The primary series is 3 doses given at 2, 4, and 6 months of age, with a fourth (booster) dose at 12–15 months of age.

• All adults 65 years of age or older who have not previously received PCV13.

• Persons 6 years of age or older with certain medical conditions.
PCV13 in persons 65 and older

- 45.6% efficacy of PCV13 against vaccine-type pneumococcal pneumonia,

- 45% efficacy against vaccine-type nonbacteremic pneumococcal pneumonia, and;

- 75% efficacy of PCV13 against vaccine-type invasive pneumococcal disease
PCV13 Additional Indications

- A single dose of PCV13 should be administered to children 6 through 18 years of age who are at increased risk for invasive pneumococcal disease because of:
  - Chronic heart and lung disease.
  - Diabetes.
  - CSF leak.
  - Cochlear implant.
  - Sickle cell disease and other hemoglobinopathies.
  - Functional or anatomic asplenia.
  - HIV infection.
  - Immunocompromising conditions resulting from disease or treatment of a disease.

- When elective splenectomy, immunocompromising therapy, or cochlear implant placement is being planned, PCV13 and/or PPSV23 vaccination should be completed at least 2 weeks before surgery or initiation of therapy.
Adults PCV13

- A single lifetime dose of PCV13 is recommended for all PCV13-naïve adults 19 years and older with:
  - Functional or anatomic asplenia (e.g., from sickle cell disease or splenectomy).
  - HIV infection.
  - Leukemia or lymphoma, Hodgkin disease, multiple myeloma, or generalized malignancy.
  - Chronic renal failure or nephrotic syndrome.
  - Other conditions associated with immunosuppression (e.g., organ or bone marrow transplant).
  - Immunosuppressive chemotherapy, including long-term corticosteroids.
  - Cerebrospinal fluid (CSF) leak.
  - Cochlear implants.
PNA Vaccine And Elective Procedures

• If elective splenectomy or cochlear implant is being considered, PPSV23 should be given at least 2 weeks before the procedure.

• If vaccination prior to the procedure is not feasible, the vaccine should be given as soon as possible after surgery.

• Similarly, there should also be a 2-week interval between vaccination and initiation of cancer chemotherapy or other immunosuppressive therapy, if possible.
How to space vaccine before 65

| Adults 19-64 who have not received pneumococcal vaccine and who have/are: | When to vaccinate, and with which vaccine: |
|---|---|---|---|---|
| | Now | At least 8 weeks after PCV13 | At least 5 years after most recent PPSV23, and before 65 years of age | At 65 years of age or older and at least 5 years after the most recent PPSV23 |
| Immunocompromised, Asplenic, Sickle cell, Other hemoglobinopathies | PCV13 | PPSV23 | PPSV23 | PPSV23 |
| CSF leak or Cochlear implant | PCV13 | PPSV23 | Not indicated | PPSV23 |
How to space vaccines before 65

<table>
<thead>
<tr>
<th>Adults 19-64 who have previously received 1 dose of pneumococcal vaccine (PPSV23) and who have/are:</th>
<th>When to vaccinate, and with which vaccine:</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Previously administered)</td>
<td>At least 1 year after the most recent PPSV23</td>
</tr>
<tr>
<td>Immunocompromised, Asplenic, Sickle cell, Other hemoglobinopathies</td>
<td>PPSV23</td>
</tr>
<tr>
<td>CSF leak or Cochlear implant</td>
<td>PPSV23</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Adults 19-64 who have previously received 2 doses of pneumococcal vaccine (PPSV23) who have/are:</th>
<th>When to vaccinate, and with which vaccine:</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Previously administered)</td>
<td>At least 1 year after the most recent PPSV23</td>
</tr>
<tr>
<td>Immunocompromised, Asplenic, Sickle cell, Other hemoglobinopathies</td>
<td>PPSV23</td>
</tr>
<tr>
<td>Adult 65 years and older who:</td>
<td>When to vaccinate, and with which vaccine:</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>------------------------------------------</td>
</tr>
<tr>
<td></td>
<td>First</td>
</tr>
<tr>
<td>Has not received any pneumococcal vaccine</td>
<td>PCV13</td>
</tr>
<tr>
<td>Has received PPSV23 at age 65 or older</td>
<td>PCV13</td>
</tr>
<tr>
<td>Has received PPSV23 prior to 65 years of age</td>
<td>PCV13</td>
</tr>
</tbody>
</table>

*Note: the recommended interval is at least 8 weeks for adults 65 years and older with CSF leak, cochlear implant, functional/anatomic asplenia, or who are immunocompromised.*
<table>
<thead>
<tr>
<th>Risk Group</th>
<th>Medical Condition</th>
<th>PCV13</th>
<th>PPSV23</th>
<th>PPSV23 Revaccination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Immuno Competent</td>
<td>Chronic heart, lung, or liver disease, diabetes, alcoholism, cigarette smoking, asthma</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Immuno Competent</td>
<td>CSF leaks, cochlear implants</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>functional or anatomic asplenia</td>
<td>Sickle cell disease or other hemoglobinopathies, asplenia</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Immuno-Compromised</td>
<td>Immunodeficiency, HIV infection, certain cancers, solid organ transplant</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>
Quiz Time

• Which vaccine is indicated for a healthy 2-month-old boy?
  A) PCV13
  B) PPSV23
  C) Both PCV13 and PPSV23
  D) Neither vaccine is recommended
A is Correct

PCV13 should be administered to all children 2 to 59 months of age. PPSV23 is not indicated in children younger than 2 years of age.
• Which vaccine is indicated for a 19-year-old woman with symptomatic HIV who has never received pneumococcal vaccine?

A) PCV13  
B) PPSV23  
C) Both PCV13 and PPSV23  
D) Neither vaccine is recommended
C is Correct.

- PCV13 is recommended for persons of any age with HIV infection. PPSV23 should be administered 8 weeks or more after PCV13.
- A second dose of PPSV23 should be given 5 or more years after the first PPSV23 dose.
- No further PPSV23 doses are indicated before 65 years of age.

NOTE: If the patient had already received a dose of PPSV23, PCV13 should be given 1 year or more after the PPSV23 dose.
Quiz Time

• Which vaccine is indicated for a 5-year-old boy with sickle cell disease who completed a PCV7 series?
  A) PCV13
  B) PPSV23
  C) Both PCV13 and PPSV23
  D) Neither vaccine is recommended
Both PCV13 and PPSV23 are indicated for a child who received PCV7 and who has sickle cell disease.

Give the PPSV23 dose at least 8 weeks after the PCV 13 dose.
Quiz Time

• Which vaccine is indicated now for a 38-year-old woman who received a cochlear implant and a dose of PPSV23 at 36 years of age?

A) PCV13
B) PPSV23
C) Both PCV13 and PPSV23
D) Neither vaccine is recommended
A is correct

A single dose of PCV13 should be administered now since more than a year has elapsed since the dose of PPSV23. This woman does not need a second dose of PPSV23 now, but she will need a dose at 65 years of age.
Which vaccine is indicated for a healthy 60-year-old man who smokes cigarettes?

A) PCV13  
B) PPSV23  
C) Both PCV13 and PPSV23  
D) Neither vaccine is recommended
B is Correct

PPSV23 is recommended for adults 19 through 64 years of age who smoke cigarettes.

PCV13 would only be indicated if the man was immunocompromised or asplenic, or had sickle cell disease, another hemoglobinopathy, a cerebrospinal fluid leak, or a cochlear implant.
Quiz Time

Which vaccine is indicated for a 28-year-old woman who has been diagnosed with breast cancer and will be undergoing surgery, followed by radiation and chemotherapy in a few weeks?

A) PCV13
B) PPSV23
C) Both PCV13 and PPSV23
D) Neither vaccine is recommended
C is Correct

• Both PCV13 and PPSV23 are recommended for adults 19 years and older with immunocompromising conditions, including those resulting from cancer or cancer chemotherapy.

• A dose of PCV13 should be administered first, followed by a dose of PPSV23 8 weeks later.

• When possible, administer these vaccines at least 2 weeks before a patient starts chemotherapy or other therapies that can suppress the immune system.
Quiz Time

• Which vaccine is indicated for a 4-year-old girl who has a cochlear implant and 3 prior doses of PCV13?

A) PCV13
B) PPSV23
C) Both PCV13 and PPSV23
D) Neither vaccine is recommended
Answer Is C

• Both PCV13 and PPSV23 are indicated. A fourth dose of PCV13 is indicated for a 4-year-old child who is at high risk for pneumococcal disease because of the cochlear implant.

• A dose of PPSV23 is also indicated for persons with cochlear implants.

• Give the PPSV23 at least 8 weeks after the dose of PCV13.
Quiz Time

• Which vaccine is indicated for a healthy 66-year-old man?

A) PCV13  
B) PPSV23  
C) Both PCV13 and PPSV23  
D) Neither vaccine is recommended
C is Correct

- Both PCV13 and PPSV23 are recommended for healthy adults aged 65 years and older who have not received pneumococcal vaccine previously.

- A single dose of PCV13 should be administered first, followed by a single dose of PPSV23 at least 1 year after the PCV13 dose.
Quiz Time

• Which vaccine is indicated for a 33-year-old woman who works in a child care center?

A) PCV13
B) PPSV23
C) Both PCV13 and PPSV23
D) Neither vaccine is recommended
D is Correct

• PCV13 is not recommended for healthy adults

• PPSV23 is not indicated for persons who work in child care centers or long-term care facilities.
Quiz Time

• The pneumococcal immunization history of a healthy 70-year-old man is 1 dose of PPSV23 at 65 years of age. Should he receive a 2nd dose of PPSV23 today?

Yes
No
No!

- This gentleman should receive a single dose of PCV13 vaccine today, since at least 1 year has passed since his PPSV23 dose.

- He will not need any further pneumococcal vaccines after this dose.
A 9-year-old girl who is on immunosuppressive therapy for a heart transplant received the full PCV7 series, followed by a dose of PPSV23 at 3 years of age. Should she receive a second dose of PPSV23 today?

Yes

No
• This child is at high risk for pneumococcal disease due to immunosuppressive therapy. The recommendation is to administer 1 revaccination dose of PPSV23 to persons 2 years of age and older who are at high risk for pneumococcal disease.

• In these cases of high risk, revaccination should be considered 5 years after the initial dose of PPSV23. However, a single supplemental dose of PCV13 is also indicated for high-risk children.

• Therefore, this child should receive a dose of PCV13 now and the second dose of PPSV23 8 weeks later.
Zoster

- Advisory Committee on Immunization Practices (ACIP) in 2008 for prevention of herpes zoster (shingles) and its complications among adults aged ≥60 years
  - ACIP is the CDC vaccine advisory group
  - CDC vaccine recommendations are derived from this groups recommendations
- FDA approved the use of Zostavax in 2011 for adults aged 50 through 59 years based on a large study of safety and short term efficacy in this age group
Why the Difference in Recs?

- Efficacy of the vaccine wanes and appears to be ineffective 6 or more years after vaccination.

- While safe to give to 50 years olds may not protect against zosters and zoster complications later in life when the disease is more common.
Why the Difference

• Modelling given the possibility of waning immunity suggest the most cases/complications of zoster will be prevented if given at age 60
  – Giving the vaccine at age 70 prevents the second most cases/complications
  – Giving the vaccine at age 50 prevents the least amount cases/complications

• There are no long term studies out yet on actual vaccine effectiveness past 7 years in persons 60 years and older, and no long term studies in persons vaccinated at age 50.
Conclusion on Zosters

- CDC recommends a **single dose of herpes zoster vaccine for people 60 years of age or older**
  - Whether or not the person reported a prior episode of zoster.
  - Do **NOT** do serologic testing. Vaccinate regardless of serologic results.

- Zostavax packaging states it is for persons age 60 years and older
- FDA Approved for age 50 and up based on safety and short term follow up
- CDC/ACIP is actively following this in post marketing studies
  - Will evaluate optimal age
  - Possible need for re-vaccination
What this means for patients

• Anyone age 60 and up can get a Zostavax vaccine without a script
  – Covered by insurance

• Those younger than 60 need a script from the doctor
  – May not be covered by insurance
References


• [http://www.cdc.gov/vaccines/vpd-vac/shingles/hcp-vax-recs.html#routine](http://www.cdc.gov/vaccines/vpd-vac/shingles/hcp-vax-recs.html#routine)

• [http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6333a3.htm](http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6333a3.htm)