Lifespan Cardiovascular Institute
Rhode Island Hospital • The Miriam Hospital
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Vaccines for Pulmonary Patients

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Background

- A substance made from organisms – dead, or alive & attenuated – administered via injection to provide immunity to a disease
- Purpose
  - To prevent and eventually cure diseases which would otherwise be fatal
  - To protect those w/little to no immunity
  - To curb the spread of disease
- Discovered by Edward Jenner when he realized the milkmaids milking cows never seemed to contract smallpox

Background

- Advisory Committee on Immunization Practices (ACIP)
  - Works under the Centers for Disease Control and Prevention (CDC)
  - Responsible for creating vaccine schedules and recommendations
  - Release or update guidelines regularly
    - Annually for influenza
    - Less frequently for other vaccinations

Background

Live, attenuated (LAIV)

- Alive
- Attenuated (weakened)
- Whole bacteria or virus
- Can replicate (theoretically)
- Only healthy people
  - Ages 2-64

Inactivated (TIV)

- Dead
- Piece of bacteria or virus
- Cannot replicate
- Everyone
  - Healthy (all ages)
  - <2 or >65 years old
  - Chronic conditions

Pneumococcal vaccine

- *Streptococcus pneumoniae*
  - The most common cause of bacterial pneumonia
- Two versions
  - PCV13 – Child (0 to 2 years old)
  - PPSV23 – Adult (>2 years)
- 13 vs. 23
  - Number of strains
  - 13 – Covers 60 to 80% of all infections in this group
  - 23 – Covers 85 to 90% of the strains in the US
    - Includes the 13 strains of the PCV13 vaccine
- Both are given intramuscularly or subcutaneously

Pneumococcal Vaccine

- PPSV23 indicated for –
  - People ≥65 years of age
  - People btw 19 & 64 years of age w/:
    - Cancer
      - Lymphoma, leukemia, multiple myeloma, generalized malignancy
    - HIV
    - Solid organ transplant recipients
    - Use of immunosuppressives (high dose steroids)
    - Diabetes
    - COPD/asthma/smokers
    - Cirrhosis/alcoholic
    - Chronic renal failure/nephrotic syndrome
    - Cochlear implants
    - CSF leaks
    - Cardiovascular disease (HF, cardiomyopathy)
    - Residents of nursing homes/long-term care facilities
  - People w/asplenia
    - Sickle cell anemia
    - S/p splenectomy/asplenia/splenic dysfunction

Pneumococcal Vaccine

- PCV13 indicated for –
  - People ≥65 years of age
  - People btw 19 & 64 years of age w/:
    - Cancer
      - Lymphoma, leukemia, multiple myeloma, generalized malignancy
    - HIV
    - Solid organ transplant recipients
    - Use of immunosuppressives (high dose steroids)
    - Chronic renal failure/nephrotic syndrome
    - Cochlear implants
    - CSF leaks
  - People w/asplenia
    - Sickle cell anemia
    - S/p splenectomy/asplenia/splenic dysfunction

Pneumococcal Vaccine

- PCV13 is NOT indicated for –
  - People btw 19 & 64 years of age w/:
    - Diabetes
    - COPD/asthma/smokers
    - Cirrhosis/alcoholic
    - Chronic renal failure/nephrotic syndrome
    - Cardiovascular disease (HF, cardiomyopathy)

Pneumococcal Vaccine

- Dose schedule (vaccine naïve)
  - ≥65 years old –
    - Single dose of PCV 13
    - Single dose of PPSV 23 in 6 to 12 mos
  - 19 to 64 years old w/intermediate risk chronic conditions –
    - Upon diagnosis, single dose of PPSV23
  - 19 to 64 years old w/high risk chronic conditions –
    - Upon diagnosis, single dose of PCV 13
    - Single dose of PPSV 23 after ≥8 weeks
  - Asplenia –

Pneumococcal Vaccine

- Revaccination w/PPSV23
  - 19 to 64 years old w/intermediate risk chronic conditions –
    - Single 2nd dose if 1st dose was ≥5 years ago + pt is now ≥65 yo
  - 19 to 64 years old w/high risk chronic conditions –
    - 2nd dose if it has been ≥5 years since 1st dose
    - 3rd dose if 2nd dose was ≥5 years ago + pt is ≥65 yo
  - Asplenia –

Pneumococcal Vaccine

- Revaccination w/PCV13 (i.e., catch-up)
  - ≥65 years old & previous PPSV23 –
    - Single dose of PCV13 ≥1 year after PPSV23
  - 19 to 64 years old w/intermediate risk chronic conditions –
    - Single dose of PCV13 ≥1 year after PPSV23
    - 2nd PPSV23 dose 6 to 12 mos after PCV13 (if 1st dose of PPSV23 was ≥5 years ago)
  - 19 to 64 years old w/high risk chronic conditions –
    - Single dose of PCV13 ≥1 year after PPSV23
    - 2nd PPSV23 dose 6 to 12 mos after PCV13 (if 1st dose of PPSV23 was ≥5 years ago)
  - Asplenia

Influenza Vaccine

- Respiratory illness caused by influenza virus
- Presents as –
  - Sore throat
  - Fever
  - Chills
  - Muscle aches & headaches
  - Non-productive cough
  - Fatigue
- Transmitted by respiratory droplets in the air
  - W/i 6 ft of infected pts

Influenza Vaccine

- Influenza characteristics
  - Spreads rapidly
  - Mutates frequently → Requires annual revaccination
- Vaccine characteristics
  - 3 strains of influenza
    - 2 strains of influenza A (H1N1, H3N2)
    - 1 strain of influenza B
  - A strains mutate frequently & widely, + have many types (H1, H2, H3 + N1, N2)
    - Passes between birds, pigs, and humans

Influenza Vaccine

- Indicated for –
  - Everyone!
  - Native Americans/Alaskans
  - Chronic conditions
  - Age <2 or >65 years of age
  - Nursing home residents
  - Household contacts of the above
  - Healthcare workers
- Contagiousness
  - Very contagious!
  - 1 day **before** symptoms + up to 5 to 7 days

Influenza Vaccine

- Complications
  - Bacterial pneumonia
  - Sinus and ear infections
  - Dehydration
  - Worsening of chronic conditions
- Myths!
  - "The flu vaccine can give you the flu" – FALSE!
  - May have been exposed to influenza virus prior to vaccination (ex: w/i 2 weeks)
  - May have a non-influenza virus (ex: rhinovirus) (similar symptoms)

Live attenuated influenza vaccine (LAIV) compared with inactivated influenza vaccine (TIV) for seasonal influenza, United States formulations

Factor	LAIV	TIV
Route of administration	Intranasal spray	Intramuscular injection
Type of vaccine	Live virus	Killed virus
Number of included virus strains	Three (two influenza A, one influenza B)	Three (two influenza A, one influenza B)
Vaccine virus strains updated	Annually*	Annually*
Frequency of administration	Annually•	Annually•
Approved age	Persons aged 2 to 49 years[Δ]	Persons aged ≥6 months[◇]
Interval between two doses recommended for children aged ≥6 months to 8 years who require two doses•	≥4 weeks	≥4 weeks
Can be given to persons with medical risk factors for influenza-related complications[Δ]	No	Yes
Can be given to children with asthma or children aged 2 to 4 years with wheezing in the past year[§]	No	Yes
Can be administered to family members or close contacts of immunosuppressed persons not requiring a protected environment	Yes	Yes
Can be administered to family members or close contacts of immunosuppressed persons requiring a protected environment (eg, hematopoietic stem cell transplant recipient)	No	Yes
Can be administered to family members or close contacts of persons at higher risk including pregnant women, but not severely immunosuppressed	Yes	Yes
Can be administered simultaneously with other vaccines	Yes[¥]	Yes[‡]
If not administered simultaneously, can be administered within 4 weeks of another live vaccine	Prudent to space ≥4 weeks apart	Yes
If not administered simultaneously, can be administered within 4 weeks of an inactivated vaccine	Yes	Yes

* A decision is made annually regarding which virus strains will be targeted in the vaccine for the upcoming influenza season. Even in years in which the vaccine composition is the same as the previous season, annual vaccination is necessary since immunity wanes.

• Children aged six months through eight years who did not receive seasonal influenza vaccine during the 2010-11 influenza season should receive two doses at least four weeks apart for the 2011-12 season. Those children aged six months through eight years who received ≥1 dose of the 2010-11 seasonal vaccine require one dose for the 2011-12 season.

Δ Persons at higher risk for complications of influenza infection because of underlying medical conditions should not receive LAIV. Such persons include those who have chronic pulmonary (including asthma), cardiovascular (except hypertension), renal, hepatic, neurologic, neuromuscular, and neurodevelopmental disorders (including disorders of the brain, spinal cord, peripheral nerve and muscle such as cerebral palsy, epilepsy, stroke, intellectual disability [mental retardation], moderate to severe developmental delay, muscular dystrophy, or spinal cord injury), hematologic, or metabolic (including diabetes mellitus) disorders; those who are immunosuppressed (including immunosuppression caused by medications or by human immunodeficiency virus); those who are or will be pregnant during the influenza season; those aged 6 months to 18 years and receiving long-term aspirin therapy and who therefore might be at risk for experiencing Reye syndrome after influenza virus infection; and residents of nursing homes and other chronic-care facilities.

◇ Approval varies by formulation. Please see table "Influenza vaccines summary."

§ Clinicians and vaccination programs should screen for possible reactive airways diseases when considering use of LAIV for children aged two to four years and should avoid use of this vaccine in children with asthma or a recent wheezing episode. Health-care providers should consult the medical record, when available, to identify children aged two to four years with asthma or recurrent wheezing that might indicate asthma. In addition, to identify children who might be at greater risk for asthma and possibly at increased risk for wheezing after receiving LAIV, parents or caregivers of children aged two to four years should be asked: "In the past 12 months, has a health-care provider ever told you that your child had wheezing or asthma?" Children whose parents or caregivers answer "yes" to this question and children who have asthma or who had a wheezing episode noted in the medical record within the preceding 12 months should not receive LAIV.

¥ LAIV coadministration has been evaluated systematically only among children aged 12 to15 months who received with measles, mumps and rubella vaccine or varicella vaccine.

‡ Inactivated influenza vaccine coadministration has been evaluated systematically only among adults who received pneumococcal polysaccharide or zoster vaccine.

Data from:

1. *Fiore AE, Uyeki TM, Broder K, et al. Prevention and control of influenza with vaccines: recommendations of the Advisory Committee on Immunization Practices (ACIP), 2010. MMWR Recomm Rep 2010; 59:1.*
2. *Centers for Disease Control and Prevention (CDC). Prevention and Control of Influenza with Vaccines: Recommendations of the Advisory Committee on Immunization Practices (ACIP), 2011. MMWR Morb Mortal Wkly Rep 2011; 60:1128.*

UpToDate

Herpes Zoster (“Shingles”) Vaccine

- Herpes Zoster (“Shingles”)
  - “Adult” Chickenpox
  - Caused by Varicella-Zoster Virus (VZV)
  - Reactivation of chickenpox virus
  - Located in a nerve → Presents one-sided
  - Localized pain, itching, rash
  - Contagious (to babies, others, etc.)
  - Effects can be permanent

Herpes Zoster ("Shingles") Vaccine

- Indicated for patients ≥50 years of age
  - ACIP recommends for patients ≥60 years of age
  - Hx of previous shingles episode not a contraindication
  - Especially important for pts w/chronic conditions
    - Diabetes, CKD, COPD, RA
- Live vaccine
  - Contraindicated in immunocompromised pts or pregnant women
  - Immunocompromised includes HIV/AIDs, high-dose steroids, monoclonal anti-bodies, stem cell

Herpes Zoster ("Shingles") Vaccine

- Covered by Medicare Part D
  - Can get at most pharmacies or MD office
- Not the same as Varicella ("Chickenpox")
  - Prevent chickenpox in children or in adults <60 yrs of age w/no hx of chickenpox
- If you have received the two-dose Varicella series, you are NOT eligible for Herpes Zoster vaccine

Tetanus Vaccine

- "Tetanus" vaccine covers:
  - Tetanus
  - Diphtheria
  - Pertussis ("Whooping Cough")

- Tetanus
  - Pts >60 yrs old account for 60% of tetanus cases every yr
  - "Lock Jaw" –
    - Characterized by muscle spasms, sweating, increased heart rate, restlessness
  - Neuromuscular infection by *Clostridium*

Tetanus Vaccine

- Diphtheria
  - Spread via respiratory droplets
  - D/t waning immunity, 20 to 60% of cases are adults
  - Caused by gram (+) *Corynebacterium diphtheriae*
    - Infection caused by toxin secreted from bacteria
  - Initial symptoms similar to common cold
    - Sore throat, loss of appetite, fever
  - “Diphtheria” = “Leather” in Greek
    - “Pseudomembrane” covers throat → Obstructs breathing

Tetanus Vaccine

- Pertussis ("Whooping Cough")
  - Spread via respiratory droplets
  - EXTREMELY contagious
  - Infection cause by toxin secreted by gram (-) bacterium *Bordetella pertussis*
  - Lasts weeks to months
    - Phase 1 – Similar to the common cold (runny nose, sneezing mild cough)
    - Phase 2 – Rapid coughing followed by "whooping" – Pts turn blue
  - > danger for infants & children than adults
  - Complications

Tetanus Vaccine

- DTaP
  - Primary vaccination
  - Given to children 0 to 10 years of age
  - Diphtheria toxoid + Tetanus toxoid + Acellular pertussis
- Td
  - Booster given children 11 to 12 years of age
  - Given every 10 yrs as a “booster” to original DTaP (children) + Tdap (adults)
  - Tetanus toxoid + Reduced diphtheria toxoid
- Tdap

Tetanus Vaccine

- Recommendations –
  - Given intramuscularly
  - Td booster every 10 yrs if already vaccinated w/Tdap
  - Uncertain primary vaccination – Repeat 3-dose series
- Adults aged 19 to 64 & uncertain vaccine status, age <64
  - One-time Tdap w/Td boosters every 10 yrs thereafter
- Uncertain vaccine status, ≥65
  - If close contact w/infants –
    - One-time Tdap w/Td boosters every 10 yrs thereafter

True contraindications to vaccine administration

Safety concern	Reason for contraindication and recommended action
Previous anaphylactic reaction to a specific vaccine	Avoid revaccination with the specific vaccine because of risk of recurrence
History of anaphylaxis to eggs or egg-protein	Avoid measles, mumps, influenza and yellow-fever vaccine because these vaccines are prepared in embryonated chicken eggs or cultures and vaccines may contain residual egg protein
Previous anaphylactic reaction to neomycin or streptomycin	Avoid measles, mumps, rubella (MMR) vaccine because the MMR vaccine contains trace amounts of neomycin
History of severe systemic reactions to the cholera, typhoid or plague vaccine	Avoid revaccination with the specific vaccine because of risk of recurrence
Adults who are immunocompromised as a result of disease or its treatment	Avoid live virus vaccines because there is an increased risk of viral replication in immunocompromised individual [See related card]
Household members of immunocompromised patients	Avoid oral polio because vaccine induced disease (if it occurs) could be transmitted to the immunocompromised individual. This concern does not apply to the MMR vaccine because infection with vaccine strain measles, mumps or rubella is not transmitted to others [See related card]
Pregnant women	Avoid all live virus vaccines because of the potential risk to the fetus [See related card]

Data from: American College Physicians Task Force on Adult Immunization and Infectious Diseases Society of America. Guide for adult immunization. Philadelphia. American College of Physicians, 1994; Centers for Disease Control and Prevention. MMWR Morb Mortal Wkly Rep 1994; 43:1; and Gershon, AA, Gardner, P, Peter, G, et al. Clin Infect Dis 1997; 25:782.

UpToDate

Administering vaccines to adults: Dose, route, site, needle size, and preparation

Vaccine	Dose	Route	Site	Needle size	Vaccine preparation
Tetanus, Diphtheria (Td) with Pertussis (Tdap)	0.5 mL	IM	Deltoid muscle	22-25 g, 1-1½"*	Shake vial vigorously to obtain a uniform suspension prior to withdrawing each dose. Whenever solution and container permit, inspect vaccine visually for particulate matter and/or discoloration prior to administration. If problems are noted (eg, vaccine cannot be resuspended), the vaccine should not be administered.
Hepatitis A (HepA)	≤18 yrs.:0.5 mL ≤19 yrs.:1.0 mL	IM	Deltoid muscle	22-25 g, 1-1½"*	
Hepatitis B (HepB)	≤19 yrs.:0.5 mL ≥20 yrs.:1.0 mL	IM	Deltoid muscle	22-25 g, 1-1½"*	
HepA+HepB (Twinrix)	≥18 yrs.:1.0 mL	IM	Deltoid muscle	22-25 g, 1-1½"*	
Human papillomavirus (HPV)	0.5 mL	IM	Deltoid muscle	22-25 g, 1-1½"*	
Influenza, trivalent inactivated (TIV)	0.5 mL	IM	Deltoid muscle	22-25 g, 1-1½"*	
Pneumococcal polysaccharide (PPSV)	0.5 mL	IM	Deltoid muscle	22-25 g, 1-1½"*	
		SC	Fatty tissue over triceps	23-25 g, ⅝"	
Meningococcal, conjugated (MCV)	0.5 mL	IM	Deltoid muscle	22-25 g, 1-1½"*	
Meningococcal, polysaccharide (MPSV)	0.5 mL	SC	Fatty tissue over triceps	23-25 g, ⅝"	Reconstitute just before using. Use only the diluent supplied with the vaccine. Inject the volume of the diluent shown on the diluent label into the vial of lyophilized vaccine and gently agitate to mix thoroughly. Withdraw the entire contents and administer immediately after reconstitution. Discard single dose MPSV, varicella, and zoster vaccines if not used within 30 minutes after reconstitution. **Note:** Unused reconstituted MMR vaccine and multidose MPSV vaccine may be stored at 35° 46°F (2°8°C) for a limited time. The reconstituted MPSV vaccine must be used within 35 days; the reconstituted MMR vaccine must be used within 8 hours. Do not freeze either reconstituted vaccine.
Measles, mumps, rubella (MMR)	0.5 mL	SC	Fatty tissue over triceps	23-25 g, ⅝"	
Zoster (Zos)	0.65 mL	SC	Fatty tissue over triceps	23-25 g, ⅝"	
Varicella (Var)	0.5 mL	SC	Fatty tissue over triceps	23-25 g, ⅝"	
Influenza, live, attenuated (LAIV)	0.2 mL (0.1 mL into each nostril)	Intranasal spray	Intranasal	NA	Consult package insert

Please note: Always refer to the package insert included with each biologic for complete vaccine administration information. CDC's Advisory Committee on Immunization Practices (ACIP) recommendations for the particular vaccine should be reviewed as well. Access the ACIP recommendations at www.immunize.org/acip.

* When giving intramuscular injections, a ⅝" needle is sufficient in adults weighing <130 lbs (<60 kg); a 1" needle is sufficient in adults weighing 130 to 152 lbs (60 to 70 kg); a 1 to 1½" needle is recommended in women weighing 152 to 200 lbs (70 to 90 kg) and men weighing 152 to 260 lbs (70 to 118 kg); a 1½" needle is recommended in women weighing >200 lbs (>90 kg) or men weighing >260 lbs (>118 kg). A ⅝" (16 mm) needle may be used only if the skin is stretched tight, the subcutaneous tissue is not bunched, and injection is made at a 90-degree angle.

Acquired from: http://www.immunize.org/catg.d/p3084.pdf on January 12, 2012. We thank the Immunization Action Coalition.

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