**Principles of Vaccination**

A. **Immunization**
   1. vaccine
   2. toxoid
   3. immune sera

B. Immunity- ability of the human body to tolerate the presence of material indigenous to the body (“self”), and to eliminate foreign (“non-self”) material
   1. Active- protection that is produced by the person’s own immune system; usually permanent
   2. Passive- protection by products produced by an animal or human, and transferred to another human, usually by injection; protection is only temporary

C. Antigen- A live or inactivated substance (e.g. protein, polysaccharide) capable of producing an immune response

D. Antibody- Protein molecules (immunoglobulin) produced by B lymphocytes to help eliminate an antigen

**Immunization References**

“The Pink Book”: Epidemiology and Prevention of Vaccine-Preventable Diseases, 8th edition.  
[www.cdc.gov/nip/publications/pink](http://www.cdc.gov/nip/publications/pink)

[www.immunize.org](http://www.immunize.org)

Morbidity and Mortality Weekly Report [www.cdc.gov/mmwr](http://www.cdc.gov/mmwr)

**Classification of Vaccines**

A. Live vs. Inactivated Vaccines
   1. Live attenuated vaccines
      a. Produced by modifying a disease producing (“wild”) virus or bacteria in a laboratory
      b. Replicates and produces immunity, but usually does not cause illness
      c. Examples: MMR, Varicella
         -Induce immunologic response more consistent with natural disease
         -Permanent immunity, usually with one dose
2. Inactivated vaccines
   a. Produced by growing the bacteria or virus in culture media, then inactivating it with heat and/or chemicals (usually formalin)
   b. Not alive and cannot replicate; cannot cause disease from infection, even in an immunodeficient person
   c. Always require multiple dosing
   d. Examples: Hep A, Pneumococcal

B. Primary vs. Booster Responses
   1. Primary-original series; usually given every 4 weeks
   2. Booster- additional doses to help induce immunity

**General Principles of Vaccine Scheduling**

**A. Interval Between Doses of the Same Vaccine**

*General Rule*

1. Increasing the interval between doses of a multi-dose vaccine does not diminish the effectiveness of the vaccine.
   a. It is not necessary to restart the series of any vaccine due to extended intervals between doses. (Exception: Manufacturer of oral typhoid recommends repeating series if the 4 dose series is extended to more than 10 days)
   b. If given ≥ 5 days before minimum interval or age, the repeat dose should be spaced from the invalid dose by the recommended minimum interval.
2. Decreasing the interval between doses of a multi-dose vaccine may interfere with antibody response and protection.
   a. Vaccine doses administered up to four days before the minimum interval or age can be counted as valid. (Exception: rabies vaccine)

**B. Simultaneous and Non-Simultaneous Administration**

*General Rule*

1. There is no contraindication to the simultaneous administration of any vaccines.

**Non-Simultaneous Administration of Different Vaccines**

1. Live injected vaccines (MMR, varicella, and yellow fever) that are not administered simultaneously should be separated by at least 4 weeks.
   a. If two live parenteral vaccines are given < 28 days apart the vaccine given second should be repeated in ≥ 4 weeks.
   b. Exception is yellow fever vaccine given < 28 days after measles vaccine.
2. Live non-parenteral vaccines (oral typhoid, intranasal flu) may be given at any time before or after live injected vaccines (MMR, Yellow Fever, Varicella).
3. All other combinations of two inactivated vaccines, or live (injected, oral, or intranasal) and inactivated vaccines may be given at any time before or after each other.
SB is a 23 year old StLCOP student who comes to your clinic for his 2nd Hepatitis B vaccine. It has been three weeks since he received his first vaccine. He is supposed to receive his 2nd vaccine 4 weeks after the first one.

**Question 1:**
Can SB get his Hepatitis B vaccine one week early?

**No, it will not count**

SB comes back for his 2nd hepatitis B vaccine and asks if he can start his Hepatitis A series the same day that he gets his second Hepatitis B vaccine.

**Question 2:**
Can 2 killed vaccines be given on the same day?

Yes, there are no contraindications to simultaneous administration of any vaccines

- Can get two killed or two live or combination (one live, one killed) on the same day

**Question 3:**
If the clinic is out of Hepatitis A vaccine, how long must SB wait after receiving his Hepatitis B vaccine before receiving his Hepatitis A shot (i.e. How long must one wait to receive an inactivated vaccine after receiving an inactivated vaccine?)

No time limit because two killed vaccines
(live vaccines → if not given on same day, must wait 4 weeks before giving the 2nd one)

MC is a 23 year old college student who has never had chicken pox, but was exposed to chicken pox by his little sister while he was home from school over the weekend. He comes to your clinic today requesting the chicken pox vaccine. While looking through his record, you see that he never received his second dose of MMR while he was in high school.

**Question 1:**
Can MC receive two live vaccines simultaneously?

**Yes**

**Question 2:**
What if the clinic is out of the MMR vaccine temporarily, how long should MC wait after receiving the varicella vaccine before receiving his 2nd MMR?

4 weeks

**Question 3**
MC is supposed to get his 2nd varicella vaccine 4-8 weeks after his first injection. Matt forgets and doesn’t come in until 12 weeks after the first vaccine. Does Matt have to start the series over again or can he finish off the series today?

No, he can finish the series today.

- It is not necessary to restart the series of any vaccine due to extended intervals between doses.

*Exception: Oral typhoid under some circumstances*
C. Antibody Vaccine Interactions

General Rule
1. Inactivated vaccines generally are not affected by circulating antibody to the antigen.
2. Live attenuated vaccines may be affected by circulating antibody to the antigen.
   a. If live vaccine given first, wait at least 2 weeks before giving antibody (e.g. blood, immune globulin, etc. NOT antibiotics)
   b. If antibody given before MMR or varicella wait until antibody has waned (3-11 months depending on type of antibody and dose)
   c. Oral typhoid and yellow fever not affected by the administration of immune globulin or blood products

D. Unknown or Uncertain Vaccination Status
1. Provider should only accept written, dated records as evidence of vaccination (exception, pneumococcal polysaccharide vaccine)
2. If records cannot be located, persons should be revaccinated. Serologic testing for immunity is alternative (e.g., measles, mumps, rubella, varicella, tetanus, diphtheria, hepatitis A, hepatitis B, poliovirus)

Special Situations
B. PPD and MMR
1. Measles illness may cause anergic state and give a false negative response to a PPD test
2. Guidelines for PPD and MMR
   a. Give both simultaneously. No interference
   b. If MMR given first, wait 4 weeks to give PPD
   c. Do PPD first. Give MMR after reading PPD. Least preferred because delaying someone from getting the vaccination

B. Vaccination of Premature Infants
1. General Rule: Do not delay, divide, or decrease dose of vaccine for infants born prematurely.
2. Exception: Hepatitis B- If infant weighs < 2 kg- wait until chronological age 1 mo before giving first dose, regardless of weight

C. Vaccination During Pregnancy
1. No evidence exists of risk from vaccinating pregnant women with inactivated virus or bacterial vaccines or toxoids
   a. Indicated in ALL pregnant women: Td, Inactivated Influenza
   b. Indicated if patient at risk: Hepatitis A and B, IPV, pneumococcal polysaccharide, meningococcal polysaccharide
2. Do NOT vaccinate pregnant women with LIVE vaccines because of theoretical risk

D. Breast-feeding
1. Not a contraindication for mother or child for ANY vaccine
   Exception: Small Pox
   routine

Immunization 4
E. Asplenia (either anatomic or functional)
   1. Need Hib, Meningococcal, Pneumococcal

F. Altered Immunocompetence
   1. If indicated, all inactivated vaccines are recommended in usual doses and schedules although response might be suboptimal
   2. LIVE vaccines should NOT be given to immunocompromised persons EXCEPT in certain circumstances: Refer to current recommendations when this occurs
   3. MMR and varicella vaccines should be given to household and other close contacts of immunocompromised persons

Adverse Reactions Following Vaccination

AF comes to your clinic after receiving the influenza vaccine (inactivated). She is complaining of pain at the injection site.

Question 1
Is this a common ADR of inactivated vaccines? Yes

Question 2
What can be used to prevent this? Give kids Tylenol (want to get ok from physician before giving it)
Adults get ibuprofen

Adverse Reaction- any untoward effect caused by a vaccine that is extraneous to the vaccine's primary purpose of production of immunity

Adverse Event- refers to any adverse event that occurs following vaccination; could be true vaccine reaction or coincidental event

Local Reactions
- Pain, swelling, and redness at site of infection
- Most common with inactivated vaccine
- Usually occur within a few hours of the injection

Systemic Adverse Reactions
- More generalized, fever, malaise, myalgias, headaches, loss of appetite
- More common following live vaccines- mimics the disease
Allergic Reaction

- May be life threatening
- Urticaria, swelling of the mouth and throat, difficulty breathing, wheezing, hypotension, or shock
- Rare
- May be caused by vaccine antigen itself, or other component of vaccine such as cell culture material, stabilizer, preservatives, or antibiotic used to inhibit bacterial growth
- Anaphylactic response to:
  - Eggs- Avoid yellow fever, influenza vaccines
  - Gelatin- Avoid MMR, varicella vaccines
  - Neomycin- Avoid IPV, MMR, varicella
  - Latex- Do not administered vaccines supplied in vials or syringes that contain natural rubber, unless benefit outweighs risk
- Risk is minimized by screening prior to vaccination

Reporting Vaccine Adverse Events

- VAERS- Vaccine Adverse Events Reporting System

Review of Diseases and Microbes

A. Diphtheria
   Organism: Corynebacterium diphtheriae
   Clinical Features: fever, sore throat, hoarseness, cough, tough pharyngeal membrane formation

B. Tetanus
   Organism: Clostridium tetani
   Clinical Features: trismus (lockjaw), muscle rigidity/spasms, death

C. Pertussis (or whooping cough)
   Organism: Bordetella pertussis- aerobic gram-negative rod
   Clinical Features: fever, lacrimation, malaise, dry productive cough

Vaccines for Diphtheria, Tetanus, and Pertussis

1. DTaP (diphtheria and tetanus toxoids and acellular pertussis vaccine)
   - Vaccine of choice for children 6 weeks through 6 years of age
   - Primary series schedule- 4 doses; 2, 4, 6, 15-18 months; Booster- 4 to 6 years of age
   - If child has valid contraindication (i.e. severe allergic reaction to a prior dose of vaccine, encephalopathy not due to another identifiable cause within 7 days of vaccination) to pertussis vaccine, pediatric DT should be used
   - D= pediatric (higher) strength diphtheria toxoid
2. **Td**
   - Vaccine of choice for children 7 years old and older, and adults
   - Booster dose- every 10 years
   - d= adult (lower) strength; contains 1/3 amount of pediatric toxoid

**D. Poliomyelitis**

Organism: poliovirus types 1,2,3
Clinical Features: myalgia, fever, progressive muscle weakness, paralysis

Vaccine Schedule: 4 doses of IPV at 2, 4, 6 to 18 months of age, and age 4 to 6 years

**Inactivated Poliovirus Vaccine (IPV)**
- IPOL® (Aventis Pasteur)- contains all three serotypes of polio vaccine virus

**Oral Poliovirus Vaccine (OPV)**
- No longer recommended by ACIP in 1999
- Vaccine-Associated Paralytic Poliomyelitis (VAPP)
- Exclusive use of inactivated polio vaccine eliminated the shedding of live vaccine virus, and eliminated any risk of vaccine associated poliomyelitis

**E. Haemophilus influenzae type B**

Organism: *Haemophilus influenzae*- gram-negative coccobacillus
Clinical Features: fever, decreased mental status, meningitis

Vaccine Schedule: 3 doses- age 2, 4, 6 months of age and booster at 12-15 months
(PedvaxHIB®- do not have to give dose at 6 months)
Hib vaccines: ProHIBIT, Hibtiter, ActHIB, OmniHIB, PedvaxHIB,

Miscellaneous: Do not give to child less than 6 weeks of age because may induce immunological tolerance to additional doses.

Vaccination of older children and adults:
- In general, not needed in children > 59 months of age
- Previously unvaccinated at high risk need at least one dose of Hib conjugate vaccine
  - High risk- functional or anatomic asplenia, immunodeficiency, immunosupression from cancer chemotherapy, HIV

**Combination Vaccines containing Hib**
1. TriHIBit® (Aventis Pasteur)- DTaP-Hib
   - Only approved for fourth dose of DTaP and Hib series
2. COMVAX® (Merck)- Hepatitis B-Hib
   a. PedvaxHIB® plus 5 ug hepatitis B vaccine
   b. > 6 weeks of age
F. Measles
   Organism: measles virus
   Clinical Features: cough, coryza, fever, maculopapular rash

G. Mumps
   Organism: mumps virus
   Clinical Features: swelling of salivary/parotid glands, meningitis

H. Rubella
   Organism: rubella virus
   Clinical Features: rash, fever, lymphadenopathy
   Infection in pregnant women → congenital abnormalities or fetal death
   - Congenital Rubella Syndrome (CRS): deafness, eye defects, cardiac defects, neurologic abnormalities
   - Vaccine in Pregnancy (VIP) Registry (1971-1989): No evidence of CRS occurred in offspring of the 321 susceptible women who received the rubella vaccine and who continued pregnancy to term; Routine termination of pregnancy is not recommended.

Measles, Mumps, Rubella vaccine
Vaccine Schedule: 2 doses of MMR (Dose 1 at 12 months of age or after; Dose 2 at age 4-6)

Miscellaneous:
Avoid pregnancy for one month following vaccine
To date, there is no convincing evidence that the MMR or any other vaccine causes autism.

I. Varicella
   Organism: varicella zoster virus
   Clinical Features: fever, malaise, exanthemous rash, pruritis, meningitis
   Virus may reactivate in adults to cause “shingles”

Vaccine Schedule:
- One dose 12-18 months of age;
- >13 years of age without prior vaccination or chickenpox infection should receive 2 doses, separated by 4-8 weeks
- Post-exposure prophylaxis - effective in preventing illness or modifying severity of illness if used within 3 days and possibly up to 5 days after exposure

Miscellaneous: Avoid pregnancy for one month following vaccine
J. Hepatitis A
Organism: HAV, a non-enveloped RNA virus that is classified as a picornavirus
Clinical Features: malaise, jaundice, hepatic failure, hepatocellular carcinoma

- Groups at increased risk: international travelers, men who have sex with men, illegal drug users

Vaccine Schedule: 0, 6-12 months (Given > age 2)

Miscellaneous: Not recommended for children < 2 years of age

K. Hepatitis B
Organism: small, double-shelled virus in the family Hepadnaviridae
Clinical Features: malaise, jaundice, hepatic failure, hepatocellular carcinoma

Vaccine Schedule:
- Infants: 0, 1, 6 months;
- Adolescents and Adults: 0, 1, 5 months
- For infants- 3rd dose should not be given prior to 6 months of age

Adolescents- should be vaccinated at 11-12 years of age if not previously vaccinated
  - Alternative 2 dose schedule; only for ages 11-15, must be completed by age 16, only for Merck's hepatitis B vaccine (Recombivax HB- two 10 mcg doses separated by 4-6 months)

Adults: High risk
  - men who have sex with other men, heterosexuals with multiple sex partners, persons diagnosed with a recently acquired sexually transmitted disease, prostitutes, injection drug users, long-term male prison inmates, persons on hemodialysis, health care workers

Miscellaneous: NO association between hepatitis B vaccine causing or exacerbating multiple sclerosis

COMVAX®- (Hib and Hepatitis B)- licensed for use at 2, 4, and 12-15 months of age; cannot be used less than 6 weeks of age; cannot be used for doses at birth or one month of age for a child on a 0-1-6 months hepatitis B vaccine schedule

Twinrix®- (Hepatitis A and Hepatitis B)- 0, 1, 6 month schedule; only for ages > 18

Pediarrx® (DTaP, Hepatitis B, IPV)
  - 3 doses- 2, 4, 6 months
  - May be given starting at six weeks of age with 8 week intervals
  - Will need to complete DTaP series at 15-18 months and 4-6 years of age and IPV series at 4-6 years old
L. Influenza

Organism: single-stranded, helically shaped, RNA virus of the orthomyxovirus family

Clinical Features:
- Incubation period - usually 2 days
- Only 50% of infected persons will develop classic clinical symptoms
- "Classic" influenza - abrupt onset of fever, myalgia, sore throat, nonproductive cough

Vaccine Composition 2004-2005: A/Fujian/411/2002 (H3N2)-like, A/New Caledonia/20/99 (H1N1)-like, B/Shanghai/361/2002-like antigens

Vaccine Schedule: Only get 1 dose/year except if < 9 years old. If < 9 years old and getting it for the first time, get 2 shots (1 now, 1 four weeks later).

Recommended for following increased risk groups:
- persons aged ≥ 65 years
- residents of nursing homes and other chronic-care facilities
- adults and children who have chronic disorders of the pulmonary or cardiovascular systems, including asthma
- adults and children who have required regular medical follow-up or hospitalization during the preceding year because of chronic metabolic diseases (including diabetes mellitus), renal dysfunction, hemoglobinopathies, or immunosuppression (including immunosuppression caused by medications or HIV)
- children and adolescents (aged 6 months to 18 years) who are receiving long-term aspirin therapy and therefore, might be at risk for developing Reye Syndrome after influenza infection
- women who will be pregnant during the influenza season
- Children aged 6 to 23 months

Other recommended populations:
- Persons aged 50-64
- Persons who can transmit influenza to those at high risk
  - Physicians, nurses, and other personnel in both hospital and outpatient-care settings including medical emergency response workers
  - Employees of nursing homes and chronic-care facilities who have contact with patients or residents
  - Employees of assisted living and other residences for persons in groups at high risk
  - Persons who provide home care to persons in groups at high risk
  - Household members (including children) of persons in groups at high risk
  - Household members and out of home caretakers of children aged 0-23 months, particularly for children aged 0-5 months

Timing of Annual vaccination

High risk patients need to get it in October.
FluMist- intranasal live attenuated influenza virus vaccine (LAIV)
- Only indicated for healthy people age 5-49 years of age
- Same dosing schedule as inactivated vaccine
- Contraindications: same as inactivated PLUS
  - Pregnant women
  - Persons with asthma, reactive airways disease or other chronic disorders of the pulmonary or cardiovascular system
  - Persons with underlying medical conditions such as metabolic diseases as diabetes, renal dysfunction, and hemoglobinopathies
  - Immunocompromised
  - Children or adolescents receiving ASA or other salicylates
  - Persons with a history of GBS

Miscellaneous-
- Inactivated vaccine preferred for close contacts of SEVERELY immunosuppressed persons who require care in a protective environment
- No preference for HCW and close contacts of patients with lesser degrees of immunosuppression, and all other high-risk groups
- Persons receiving LAIV, including HCW, should refrain from contact with severely immunosuppressed persons for 7 days after vaccination
- Persons who receive LAIV need not be excluded from visitation of patients who are not severely immunocompromised

LE comes to your pharmacy claiming that you gave her the flu by giving her the flu shot. She received the flu shot three days ago, and started having symptoms of the flu this morning.

What is your response?
- The vaccine can not give you the flu.
- Takes 2 weeks for flu shot to take effect. However, it has an incubation period of 2 days, so if get exposed during the incubation period, person is going to get the flu.
- The composition of the flu vaccine and the flu changes every year. The composition of the flu vaccine may not be right.

M. Pneumococcal
Organism: streptococcus pneumoniae
Most frequent cause of pneumonia, bacteremia, sinusitis, acute otitis media

Vaccine Schedule:
Pneumococcal Conjugate Vaccine (PCV7)
- Composition: 7 serotypes
- Indication: children < 24 months of age and children age 24-59 months with high risk medical conditions
- 2,4,6 months of age, 12-15 months (booster)
- Not routinely recommended for persons > 59 months of age
Pneumococcal Polysaccharide Vaccine (Pneumovax®)

- Composition: 23 serotypes
- Indications:
  - ≥ 65 years of age
  - 2-64 years of age with normal immune systems who have chronic illness
    - cardiovascular disease (CHF, cardiomyopathies), pulmonary disease (COPD, emphysema, but not asthma), diabetes, alcoholism, chronic liver disease (cirrhosis), or CSF leaks
  - 2-64 years of age who have functional or anatomic asplenia
  - age 2 to 64 years of age who are living in special environments or social settings (certain Native American populations)
  - Immunocompromised persons ages 2 to 64
    - Hodgkin's disease, lymphoma, multiple myeloma, chronic renal failure, nephrotic syndrome, other conditions associated with immunosuppression (organ transplantation), immunosuppression for corticosteroids or chemotherapy, HIV
- Revaccination
  - Only one PPV23 revaccination dose is recommended for high-risk persons
  - Second dose should be administered five or more years after the first dose
  - If ≥ 65 should receive second dose if were <65 at age of first vaccine and it has been 5 years

LM is a 64 yo diabetic who is f/u in your clinic for DM education. You notice he has never received his pneumococcal vaccine.

Question 1: When should he receive the vaccine?
Now (b/c diabetic)

Question 2: Should he get a second pneumococcal vaccine and if so, at what age?
Yes, at age 69

Question 3: His 44 year old son is also diabetic. He wants to know when he should receive his pneumococcal vaccine
Now

Question 4: At what age should he get his second pneumococcal vaccine?
Age 65
N. Meningococcal

Organism: *Neisseria meningitidis*, 5 subtypes- A,B,C,Y,W-135

Clinical Features:
- High fever, chills, lethargy, rash
- 10-15% with meningococcal disease die
- 10-15% will suffer permanent hearing loss, limb loss, brain damage or other serious after effects

Recommendations:
- Routine vaccination in US is NOT recommended
- Recommended for following groups
  - College Freshman living in dormitories
  - US military recruits
  - Anyone ≥ 2 years old who might be exposed during a meningococcal disease outbreak
  - Individuals with certain medical conditions, specifically a damaged or missing spleen or certain blood disorders
  - Persons working with meningococcus bacteria in laboratories
  - Travelers to certain countries in sub-Saharan Africa as well to other countries for which meningococcal vaccine is recommended

Miscellaneous:
- Does not protect against subtype B

Contraindications and Precautions

Contraindication: condition in a recipient that increases the risk for a serious adverse reaction
- Permanent Contraindications- For any vaccine
  - Severe (anaphylactic) allergy to a vaccine component or following a prior dose of a vaccine
  - Encephalopathy within 7 days of pertussis vaccination
- Temporary Contraindications- For LIVE vaccines
  - Pregnancy
  - Immunosuppression

Precaution: condition in a recipient that may increase the risk for a serious adverse reaction or that may compromise the ability of the vaccine to produce immunity
- Temporary Precautions
  - Moderate or severe acute illness (all vaccines)
  - Recent receipt of an antibody-containing blood product (MMR and varicella)

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Polio Vaccine Contraindications
- Anaphylactic reaction to streptomycin, polymyxin B, neomycin

MMR AND Varicella Vaccine Contraindications
- Pregnancy
- Immunosuppression
- Anaphylactic reaction to neomycin, gelatin

Influenza Vaccine Contraindications
- Severe allergy to vaccine component (e.g., egg, thimerosal)

Influenza Vaccine Contraindications (Live)
- Pregnancy
- Asthma, chronic pulm or cardiac disease
- Diabetes
- Immunocompromised
- Children receiving ASA
- Hx of GBS (Guillain-Barré syndrome)
Incorrect Contraindications

- Mild acute illness with or without fever
- Mild to moderate local reaction (i.e. swelling, redness, soreness); low-grade or moderate fever after previous dose
- Lack of previous physical examination in well-appeared person
- Current antimicrobial therapy
- Convalescent phase of illness
- Premature birth (hepatitis B vaccine is an exception under certain circumstances)
- Recent exposure to an infectious disease
- History of penicillin allergy, other nonvaccine allergies, relatives with allergies, receiving allergen extract immunotherapy

Refer to following websites for contraindications and precautions tables. (FYI: You may prefer one over the other for your peripheral brain)

www.cdc.gov/mmwr/preview/mmwrhtml/rr5102a1.htm#tab5 (Table 5 only)

Bioterrorism Threats

Smallpox

Organism: variola virus; genus Orthopoxvirus, family Poxviridae

Clinical Features:
- Rash, fever

Vaccine Schedule:
- Currently only recommended for laboratory workers who directly handle cultures or animals contaminated or infected with non-highly attenuated vaccinia viruses
- Intentional Release: exposure to initial release, contacts of people with smallpox, and others at risk for exposure
- ACIP Pre-Release Recommendations (as of April 2003)
  - General Population- not recommended
  - Select Groups to Enhance Smallpox Readiness
    - Smallpox Response Teams
    - Designated Smallpox Healthcare Personnel at Designated Hospitals
- Schedule: 1 successful dose

Vaccine ADRs: swelling and tenderness of axillary and other regional lymph nodes, fever, autoinoculation, erythematous or urticarial rashes, eczema vaccinatum, generalized vaccinia, progressive vaccinia, postvaccinal encephalitis, fetal vaccinia, death

- Dryvax® - made from live vaccinia virus. This is not the smallpox virus, but is another “pox” type virus. It is related to smallpox, but milder. You cannot get smallpox from the smallpox vaccine, but can get vaccinia from the smallpox vaccine

Contraindications for potential vacinees and their household
- History or presence of eczema or atopic dermatitis in recipient or household contact
- Have acute, chronic, or exfoliative skin conditions (until improved or resolved) in recipient or household contact
• Immunosuppression in recipient or household contact
• Pregnant in recipient or household contact

**Contraindications for potential vaccinees only**
• breastfeeding
• <1 year of age
• underlying heart disease with or without symptoms (CAD, CHF, cardiomyopathy, TIA, stroke, etc) OR have three or more known major cardiac risk factors (HTN, DM, hyperlipidemia, smoking, first degree relative with heart condition before age 50)
• serious allergy to vaccine component (polymyxin B, streptomycin, chlortetracycline, neomycin, phenol) OR previous anaphylactic reaction to vaccine
• Moderate or severe acute illness
• Inflammatory eye diseases (defer until condition resolves or therapy is complete)

**NOTE:** During smallpox outbreak - Contraindications should be reconsidered
• Administer 4 weeks apart from varicella vaccine
• Varicella immune globulin (VIG) or cidofovir may be of benefit to persons with progressive vaccinia, eczema vaccinatum, and generalized vaccinia or inadvertent inoculation
• Vaccinees are infectious from 3rd day until scab falls off (approx. 3-4 weeks)
• From January through July 2003 more than 38,000 US civilians and more than 450,000 U.S. military personnel received smallpox vaccine
• No reports of eczema vaccinatum, fetal vaccinia, or progressive vaccinia
• 17 cardiac related deaths following vaccine (12 myopericarditis, 5 CAD)

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**Anthrax**
*Organism: Bacillus anthracis*

**Clinical Features:**
- **Cutaneous**
  - Small papule-vesicle-necrotic ulcer with characteristic black center; swelling of adjacent lymph nodes, fever, malaise, headache
- **Gastrointestinal**
  - Pharynx involvement- Lesions on base of tongue or tonsils with sore throat, dysphagia, fever, regional lymphadenopathy
  - Lower intestine involvement- acute inflammation of the bowel, nausea, loss of appetite, vomiting, fever, abdominal pain, vomiting of blood, bloody diarrhea
- **Inhalation**
  - Initial: Nonproductive cough, myalgia, fatigue, fever
  - Rapid deterioration- high fever, dyspnea, cyanosis, shock, chest x-ray- pleural effusion and mediastinal widening, meningitis often hemorrhagic

Vaccine Schedule: 0, 2, and 4 weeks followed by doses at 6, 12, and 18 months; manufacturer recommends an annual booster shot
• **Preexposure**
  - Persons engaged in work involving production quantities or concentrations of *B. anthracis* cultures and in activities with a high potential for aerosol production
  - Certain military personnel and other select groups who may be exposed to an intentional release of *B. anthracis*
• Not currently recommended for emergency first responders, federal responders, medical practitioners, or private citizens

• Postexposure

• Limited data available

• Studies in nonhuman primates indicate that postexposure vaccination alone is not protective. However, studies have shown that antibiotics in combination with postexposure vaccination are effective at preventing disease in animals after exposure to *B. anthracis* spores.

• Need to treat with antibiotics for 60 days because antibiotics will only be effective against the germinated spores, not the spore form.

• Current vaccine only approved for preexposure vaccination

**Travel Vaccines**

**A. Yellow Fever**

*Transmission:* mosquitoes (*Ae.aegypti*)

*Vaccine schedule:* Live vaccine- one dose every 10 years

*Indications:* ≥ 9 months of age who are traveling or living in areas of South America or Africa where yellow fever is reported.

*Contraindications:* egg allergy, < 6 months of age

**B. Typhoid**

*Organism:* Salmonella typhi

*Transmission:* fecal-oral route

*Clinical illness:* headaches, abdominal discomfort, malaise, myalgia, and anorexia

*Indications:* travel to Africa, Asia, Central America, and South America

*Available Vaccines*

1. *Injectable:* Typhim Vi®
   a. Inactivated
   b. *One dose every 2 years*
   c. ≥ 2 years old
   d. Give 2 weeks prior to exposure

2. *Oral:* Vivotif®
   a. *Live*
   b. *Primary- 4 doses: 1 capsule every other day on days 0,2,4, and 6*
   c. *Booster- 4 dose series every 5 years*
   d. ≥ 6 years old
   e. Give one dose prior to exposure

**A. Rabies**

*Disease:* viral infections of CNS characterized by convulsions, coma, and encephalitis usually leading to death

*Transmission:* via bites by rabid animals

*Vaccine:* Inactivated

*Dosing Schedule:* 3 injection series, on days 0,7, and 21 or 28

*Postexposure:* 5 dose series +/- immunoglobulin
B. Japanese Encephalitis
Transmission: mosquitoes
Endemic areas: Asia- leading cause of encephalitis in Asia, occurring with highest frequency in China, Korean peninsula, Indian subcontinent, and Southeast Asia
Vaccine: Inactivated
Schedule: 3 doses, on days 0, 7, and 30
Last dose should be given a minimum of 10 days prior to travel to ensure adequate immune response and access to medical care in case of delayed adverse reactions (anaphylaxis, urticaria, angioedema, respiratory distress)

Reading an Immunization Schedule

Case #1
BB N is 8 months old. His vaccine records indicate he has received DTaP #1, IPV #1, Hib #1, PCV #1 and HepB #2 at 2 months of age. He is still breast feeding and on his third day of a course of amoxicillin to treat otitis media. He has no known allergies. His family is healthy, but his pregnant aunt is staying in the house temporarily.

Question 1
What vaccines does BB need today? DtaP #2
Hib #2
IPV #2
PCV #2
HepB #2
Influenza

Question 2
What contraindications does BB have for getting immunizations today?

None
Case #2

MW Jr is a 12 month old baby boy (DOB: 10/13/01) here for his one-year old check-up. He has NKDA. The following is his vaccination schedule:

<table>
<thead>
<tr>
<th>Vaccine</th>
<th>Date</th>
<th>Vaccine</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>DTaP #1</td>
<td>12/15/01</td>
<td>Hib #1</td>
<td>12/15/01</td>
</tr>
<tr>
<td>DTaP #2</td>
<td>2/15/02</td>
<td>Hib #2</td>
<td>2/15/02</td>
</tr>
<tr>
<td>DTaP #3</td>
<td>4/15/02</td>
<td>Hib #3</td>
<td>4/15/02</td>
</tr>
<tr>
<td>IPV #1</td>
<td>12/15/01</td>
<td>Hep B #1</td>
<td>10/15/01</td>
</tr>
<tr>
<td>IPV #2</td>
<td>2/15/02</td>
<td>Hep B #2</td>
<td>11/15/01</td>
</tr>
<tr>
<td>IPV #3</td>
<td>4/15/02</td>
<td>Hep B #3</td>
<td>4/15/02</td>
</tr>
<tr>
<td>PCV #1</td>
<td>12/15/01</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PCV #2</td>
<td>2/15/02</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PCV #3</td>
<td>4/15/02</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

What vaccines does MW Jr need today?

- Hib #4
- MMR #1
- Varicella
- PCV #4
- Influenza

When does MW Jr need to return for his next vaccinations?

- In 3 months for DTaP (age 15 mo.)
- In 4 weeks for influenza
Case #3

SB is a 18 yo female getting ready to start STLCOP this fall. She will be living in the dorm. She had no known allergies. SB wants to know what vaccinations she needs. She had chickenpox when she was 11. The following is a copy of her immunization card:

<table>
<thead>
<tr>
<th>Vaccine</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>DTaP #1</td>
<td>6/13/84</td>
</tr>
<tr>
<td>Polio #1</td>
<td>6/13/84</td>
</tr>
<tr>
<td>DTaP #2</td>
<td>8/14/84</td>
</tr>
<tr>
<td>Polio #2</td>
<td>8/14/84</td>
</tr>
<tr>
<td>DTaP #3</td>
<td>10/14/84</td>
</tr>
<tr>
<td>Polio #3</td>
<td>10/14/84</td>
</tr>
<tr>
<td>DTaP #4</td>
<td>8/15/85</td>
</tr>
<tr>
<td>Polio #4</td>
<td>4/14/88</td>
</tr>
<tr>
<td>DTaP #5</td>
<td>4/15/88</td>
</tr>
<tr>
<td>Td</td>
<td>4/15/96</td>
</tr>
<tr>
<td>MMR#1</td>
<td>5/15/85</td>
</tr>
<tr>
<td>MMR#2</td>
<td>4/15/98</td>
</tr>
</tbody>
</table>

What vaccines does SB need?
- Meningococcal
- Hep B #1

When should SB return to continue her vaccination series? (Hep B.)
One month

Hep. B schedule:
Now, 1 month later, 4 months after 2nd one

Case #4

NF is a 57 yo male who presents to your pharmacy to pick up his diabetes and HTN meds. He is allergic to penicillin (rash). He notices that you give immunizations in your pharmacy. He wants to know which ones he needs today.

Which vaccines does NF need?
- Td (if > 10 years)
- Influenza
- Pneumococcal

When will NF need these vaccines again?
- Td - 10 yrs
- Influenza - next fall
- Pneumococcal - age 65
Case #5

LK is a 29 year old female who brings you a new Rx for Vicoden. She was in an automobile accident 2 weeks ago and had her spleen removed. She has been your patient for 6 years and her only chronic medication is an OCP. She has not taken her OCP in 2 weeks and would like to become pregnant as soon as she recovers from surgery.

Allergies: Neomycin-rash, Eggs-nauseated

Question 1:
Now that LK doesn’t have a spleen, what vaccines should she receive?

- Pneumococcal
- Meningococcal

Question 2:
What contraindications does she have to vaccination?

- None

Question 3:
What advice do you give LK concerning vaccines and pregnancy?

- Make sure up to date on Td and influenza
- No live vaccines - must wait 4 weeks