Childhood Immunizations

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Kentucky Public Health
Prevent. Promote. Protect.

Developed for AFMRD by

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2010

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Objectives

- Increased knowledge of vaccine-preventable diseases
- Describe routine vaccine schedules for common childhood vaccines
- Utilize resources to find vaccine recommendations
- Describe how a child qualifies for the Vaccines for Children program

Name some vaccine preventable diseases

Vaccine Preventable Diseases (ACIP Recommended Vaccines)

- Tetanus
- Diphtheria
- Pertussis (Whooping Cough)
- Hemophilis influenza type b (Hib)
- Polio
- Hepatitis A
- Hepatitis B
- Rotavirus
- Mumps
- Measles
- Rubella (German Measles)
- Varicella (Chickenpox)
- Pneumococcus
- Meningococcus
- Influenza
- Human Papilloma Virus (HPV)

Vaccine Preventable Diseases

- Herd immunity plus aggressive immunization has made most of these diseases rare

Herd Immunity

- Most of population immunized
- Disease itself still exists, but spread prevented by lack of available hosts
- Unimmunized person less likely to come in contact with infected person

Vaccine Preventable Diseases

- To comprehend why we immunize, you need to have basic childhood disease knowledge.

Diphtheria

- Caused by Corynebacterium diphtheriae
- Incubation 2-5 days
- Early – malaise, sore throat, difficulty in swallowing, loss of appetite, hoarseness, mild fever
- Within 2-3 days, adherent, gray membrane on oral mucous membranes
  - Extensive membrane - life-threatening airway obstruction.
- Toxin – serious systemic complications including myocarditis
- Death rate 5%-10%

Photo from www.cdc.gov. Image in public domain.

Tetanus

- Spread by contact with soil containing bacterium Clostridium tetani
- Most infections from contaminated wounds
- Incubation 1-2 weeks
- Not contagious
- Produces exotoxin

Tetanus

- 1-2 weeks after infection – progressive muscle tightening, descending pattern
  - Trismus (lockjaw)
  - Neck stiffness
  - Difficulty swallowing
  - Abdominal muscle rigidity
- Neonatal tetanus due to no maternal immunity and cutting the umbilical cord with
  a contaminated instrument (e.g. bamboo in Haiti)

Tetanus

Child with painful muscle contractions from tetanus

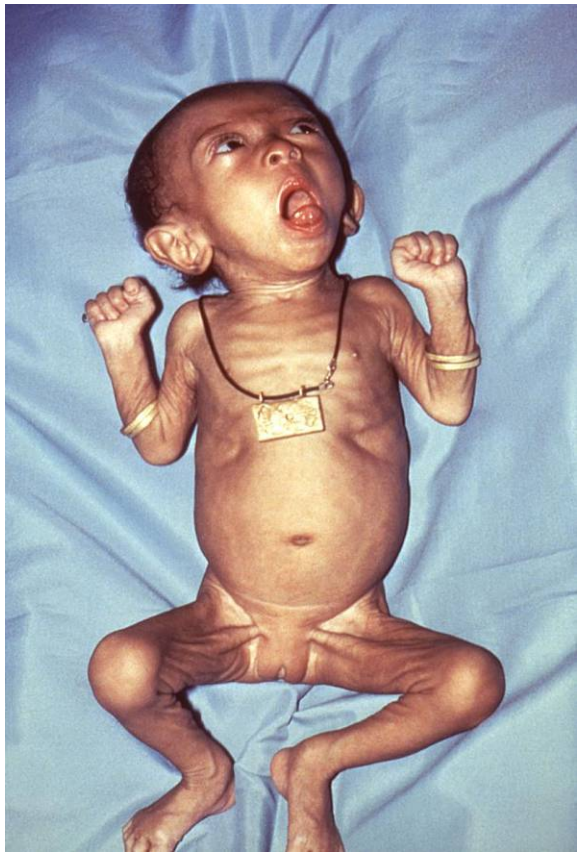
This patient is displaying a bodily posture known as "opisthotonos" due to tetanus.

Neonatal tetanus

Photos from www.cdc.gov. Images in public domain.

Pertussis

- Caused by Bordetella pertussis
- Highly contagious
- 90% of household contacts will acquire
- Starts as URI
- After 1-2 weeks – paroxysms of severe coughing followed by “whoop” with loud inspiration
- Worse for very young



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Pertussis

Pertussis

- Symptoms can last several weeks
  - Severe coughing
  - Whooping
  - Post-tussive vomiting
- 1 in 10 cases develop pneumonia
- 1 in 50 cases develop convulsions
- 1 in 250 cases develop encephalopathy

DTaP

- Capital letter denotes full dose vaccine
- Small “a” for acellular
- Compared to Td or Tdap
  - Small letter denotes half dose vaccine for booster effect
- Diphtheria and Pertussis vaccines only given as combination with Tetanus

DTaP

- Diphtheria
- Tetanus
- Acellular pertussis
- Primary series
  - 2, 4, 6 months
  - 15-18 months (at least 6 months from the 3rd dose)
  - 4-6 years
  - 11-12 years Tdap
  - Then Td boosters every 10 years

Polio

- Very infectious virus
- Up to 95% of people infected with polio have no symptoms
- 4-8% minor symptoms – fatigue, myalgias, stiffness
- <1% have paralysis from virus attacking motor neurons

Photo from www.cdc.gov. Image in public domain.

IPV

- Inactivated polio vaccine
- 4 dose series
  - 2, 4, 6-18 months
  - Booster at 4 years
- Dose 4 must be 6 months after 3rd dose
- If dose 3 is after 4 years old and >6 months from dose 2, a 4th dose is not needed
- If 4 doses received **prior to** 4 years old, a 5th dose **is** required

Hepatitis B

- Viral infection can be transmitted perinatally from Hepatitis B infected mothers
- Symptoms range from none to severe hepatitis & liver failure
- Up to 90% of infected neonates become chronic carriers

Ascites and jaundice due to liver failure.

Photo by Charle Goldberg, M.D. http://meded.ucsd.edu/clinicalmed/abdomen.htm

Hepatitis B Vaccine

- Dose should be given shortly after birth
- If mom HBsAg positive
  - Give HBV and Hepatitis B immunoglobulin (HBIG) within 12 hours of birth
  - Test for HbsAg and HbsAb 1-2 months after completed vaccine series at age 9-18 months

Hemophilus Influenza B (Hib)

- Prior to vaccine, Hib was leading cause of childhood
  - Bacterial meningitis
  - Epiglottitis
  - Pneumonia
  - Empyema
  - Pericarditis
  - Bacteremia
  - Septic arthritis

Photo courtesy of Children's Immunization Project, St. Paul, Minnesota

Hemophilus Influenza B (Hib)

- 2 vaccines available
  - 1 is 3-dose series (PedvaxHIB®)
  - 1 is 4-dose series (ActHIB®)
- Vaccines are interchangeable
  - If changed at 2 or 4 months of age, need a 6-month dose of either vaccine
  - Either vaccine may be given for the 12-month booster dose

Pneumococcal Disease

- Streptococcus pneumoniae
  - Common cause of community acquired pneumonia and otitis media
- Can cause invasive disease
  - Bacteremia
  - Meningitis
  - Sepsis
- Invasive risk related to serotype present

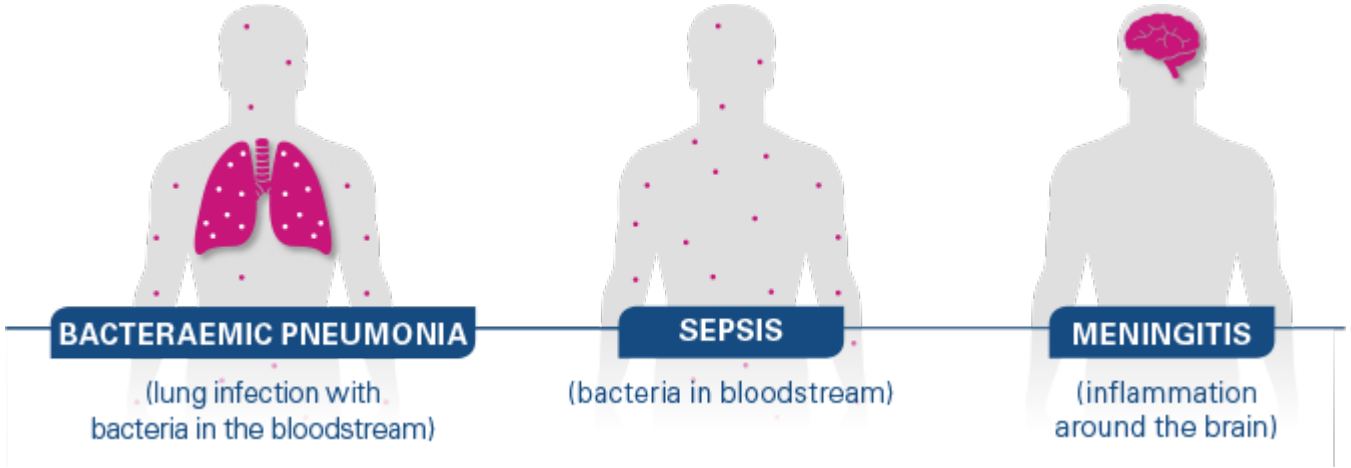

Image from prevnar.ca

PCV-13

- Protects against 13 strains
- Given at 2, 4, 6 months with booster at 12-15 months

PCV-13

- High risk children include
  - Immunocompetent children with
    - Cyanotic congenital heart defects
    - Chronic lung disease
    - Asthma needing oral steroid treatment
    - Diabetes
    - CSF leaks
    - Cochlear implants
    - Asplenia (congenital or acquired)
    - Sickle cell and other hemoglobinopathies

PCV-13

- High risk children include
  - Immunocompromised children
    - HIV
    - Chronic renal failure
    - Nephrotic syndrome
    - Lymphoma and leukemia
    - Chemotherapy
    - Organ transplant
    - Congenital immunodeficiencies

Rotavirus

- Most common cause of gastroenteritis worldwide
- Can cause severe dehydration
- Prior to vaccine introduction in 2006
  - 80% of U.S. children had disease by age 5
  - 410,000 physician visits
  - 205,000 to 272,000 ER visits
  - 55,000 to 70,000 hospitalizations
  - $1 Billion direct/indirect costs

Rotavirus Vaccine

- 2 currently available are interchangeable for dosing
- Narrow administration window
  - **First dose *must*** be before **15 weeks**
  - **Last dose *must*** be before **8 months**

Measles (Rubeola)

- Acute, highly infectious
- Prodrome
  - Fever, conjunctivitis, coryza, cough, Koplik spots
- Day 3: red, blotchy rash develops, face, then generalizes

Koplik spots on the buccal mucosa.

Photos from www.cdc.gov. Images in public domain.

Mumps

- Highly infectious
- Transmitted by respiratory droplets, direct contact or fomites
- Incubation 14-18 days
- Fever, malaise, headache, myalgias
- 48 hours later: parotitis (parotid gland inflammation)

Photo from www.cdc.gov. Image in public domain.

Mumps

- Prior to vaccine in 1967
  - 100,000 to 200,000 cases/year in U.S.
- After routine vaccination 1980-90
  - Incidence declined to 5,000 cases/year in U.S.
- 304 cases in 2018; over 700 in 2019.

Rubella (German Measles)

- Rash and fever for 2-5 days
- If acquired while pregnant, severe congenital defects
  - Cataracts
  - Heart defects
  - Deafness
  - Intellectual disabilities

Photo from www.cdc.gov. Image in public domain.

MMR

- Measles, Mumps, Rubella
- Individual components no longer available
- Live attenuated vaccine
- Give after 12 months old
- Booster at 4-6 years, but may give
  4 weeks after 1st dose during outbreaks

Varicella (Chickenpox)

- Fever occurs just before or at start of blister-like rash
- Usually more concentrated on face, trunk and scalp
- Pneumonia or meningitis can occur, especially if acquired as an adolescent or adult

Photo from immune.org.nz. Image in public domain.

Varicella Vaccine

- Live-attenuated varicella vaccine
- Dose after 12 months old
- Give with MMR or separated by 4 weeks
- Booster at 4-6 years

Hepatitis A

- Caused by Hepatitis A virus
- Fecal/oral transmission
- Contaminated food or water
- Self-limited
- Incubation 28 days (range 15-50 days)
- Viral shedding 2 weeks before to 1 week after symptoms
- Young children often asymptomatic

Hepatitis A

- Symptoms
  - Jaundice
  - Fatigue
  - Abdominal pain
  - Anorexia
  - Nausea

Photo from www.cdc.gov. Image in public domain.

Hepatitis A Vaccine

- Effective 2005, all children should receive vaccine
- 2-dose series, 6 month minimum interval
- Start at 12 months old
- Catch-up vaccination for older children

Influenza

- "Influence of the stars"
  - 1st Pandemic documented in Italy in 1590
- 3 pandemics in 20th century
- "Spanish" influenza 1918-1919
  - 21 million deaths world wide
  - 500,000 deaths in U.S.
- 2009 H1N1 pandemic influenza

Makeshift hospital during 1918 Influenza epidemic at Camp Funston, Kansas.

Photo courtesy of the National Museum of Health and Medicine, Armed Forces Institute of Pathology, Washington, D.C.

Influenza

- Pandemic occurs when unpredicted antigenic shift occurs
  - Genetic recombination between Influenza A viruses
  - Usually involves viruses that affect humans and birds
- Influenza A & B virus isolated in 1930's
- Vaccine developed in 1950's

Influenza

- Causes more deaths than any other vaccine-preventable disease
- 36,000 deaths per year in U.S.
  - Most among elderly
  - Some among children
- High hospitalization rates among children <12 months old

Influenza

- Spread by coughing, sneezing, breathing
- Abrupt onset of fever, sore throat, cough, headache, chills, muscle aches
- Virus changes seasonally
- Requires yearly vaccine updates
- School-aged children
  - Major source of disease transmission
  - Highest attack rates in a community
  - Contagious prior to symptoms and up to 10 days total

Severe Influenza Complications

- Pneumonia
- Reye Syndrome
- Myocarditis
- Death rate 0.5-1/1000 cases

Influenza Vaccine

- The ACIP and CDC recommend universal influenza vaccine for ALL people >6 months of age

Tdap

- Ages 10-64 years or 11-64, dependent upon presentation
- Give as booster at 11-12 years in place of Td
- Follow up boosters of Td every 10 years
- Pertussis epidemics occur periodically
- Routine Tdap boosters instituted in 2006

Meningococcal Disease: Neisseria Meningitis

- Leading cause of bacterial meningitis in children and young adults
- Overall mortality rate 13%
- Sudden onset
  - Fever
  - Severe myalgias
  - Nausea/vomiting
- Rash and meningeal signs
  12-15 hours after onset of symptoms

Photo from bbc.com. Image from public domain.

Meningococcal Vaccines

- Protects against A, C, Y, and W-135 strains
  - 2 vaccines available, 2-dose series
    - Routine recommendation at 11-12 years and 16 years

- Protects against B strain
  - 2 vaccines available, 2-dose series
    - Recommendation at 16-18 years

- Teens need both vaccines for full protection!

Human Papillomavirus (HPV)

- Passed through skin to skin contact
- Very common
- Can cause CANCERS in men and women
- Can cause other infections

- Kentucky has the highest rate of HPV-related cancers in the US

HPV Vaccine

- Recommended for ages 9 to 45 years
- 2-dose series if administered before 15 years old

Vaccine Safety

Vaccination never been proven associated with autism

- In 2010, Lancet retracted the 1998 article
  - Was initial paper linking MMR with autism
- There are multiple web-based sites that have false information regarding vaccine risks

Vaccine Safety

- Safe to administer to young infants – their immune systems are ready to respond to environmental antigens and antigens in vaccines
- Safe to administer more than one vaccine in a visit – combination vaccines reduce number of sticks; vaccines administered in different limbs
- Advisory Committee on Immunization Practices – panel of experts determine recommended vaccine schedule
- Clinical trials and postlicensure studies carried out by FDA
- www.cdc.gov/vaccinesafety

Foreign-Born Children

- Foreign-received vaccine valid if
  - Same age and dosing intervals as U.S.
  - Written documentation
- If not valid, 2 options:
  - Repeat series
  - Serology testing
    - May not predict disease protection
    - Requires accurate interpretation

Combination Vaccines

- Many vaccines come in combinations
- However, different manufacturers make different components
  - Multiple different combinations
  - Vaccination schedule may vary based on which vaccines given or available

Vaccines For Children Program (VFC)

- Federally funded
- Provides free vaccines to doctors who serve eligible children
  - Medicaid-eligible or uninsured
  - American Indian/Alaskan Native
  - Underinsured

http://www.sanantonio.gov/health/images/immunizations/Immunizations-VFC_clip_image002.jpg

Vaccine For Children Program (VFC)

- Office can charge an administration fee to give vaccine
  - $19.93 max in Kentucky
- Vaccines cannot be denied to eligible children
- Covers all ACIP recommended vaccines

Resources

- www.cdc.gov/vaccines
  - (National Immunization Program)
- www.immunize.org
  - (Immunization Action Coalition)
- Epidemiology and Prevention of Vaccine-Preventable Diseases. The Pink Book: Course Textbook 13th Edition
- Kentucky Immunization Branch (502) 564-4478
- www.EnviroHealthLink.org